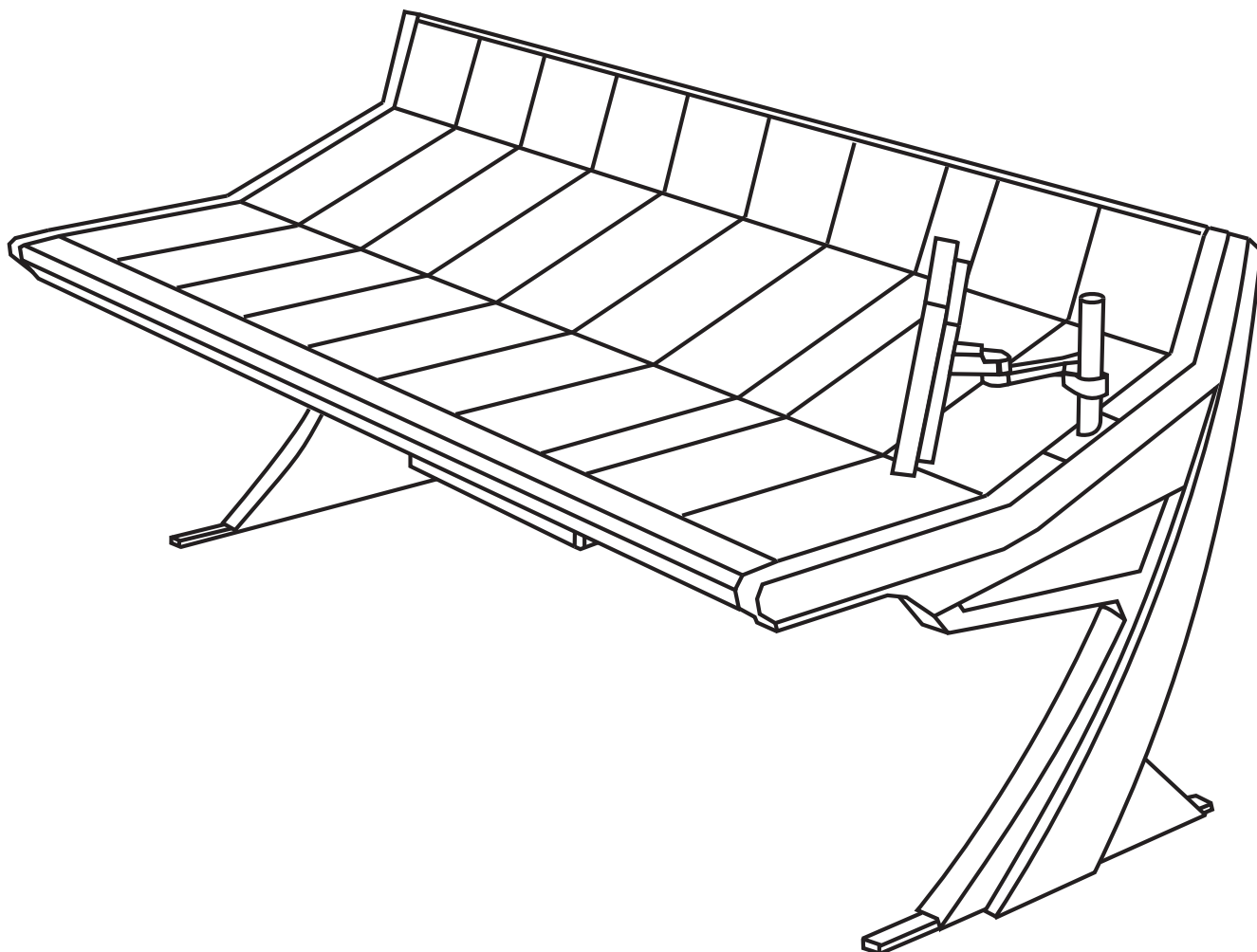


APOLLO INSTALLATION & TECHNICAL MANUAL



Digital Broadcast Production Console



Calrec Audio Ltd

Nutclough Mill
Hebden Bridge
West Yorkshire
England UK
HX7 8EZ

Tel: +44 (0)1422 842159
Fax: +44 (0)1422 845244
Email: enquiries@calrec.com

calrec.com

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APOLLO

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APOLLO INFORMATION

IMPORTANT INFORMATION

After Sales Modifications

Please be aware that any modifications other than those made or approved by Calrec Audio Limited or their agents, may invalidate the console's warranty. This includes changes to cabling provided by Calrec and variations to the recommended installation as detailed in Calrec documentation.

Modifications to this equipment by any party other than Calrec Audio Limited may invalidate EMC and safety features designed into this equipment. Calrec Audio Limited can not be liable for any legal proceedings or problems that may arise relating to such modifications.

If in doubt, please contact Calrec Audio Limited for guidance prior to commencing any modification work.

Third Party Equipment

Integrating third party equipment into a Calrec system may compromise the product's ability to comply with the Class B radiated emission limits set in the EMC (Electro Magnetic Compatibility) standard EN55022.

Calrec Audio Limited can not be responsible for any non-conformities due to use of third party equipment. If in doubt, please contact Calrec Audio Limited for guidance prior to integrating any third party equipment.

Installation

In many installations the AC power connectors will not be readily accessible, effectively making the equipment permanently connected. The installation should be carried out in accordance with all applicable installation rules and regulations.

Service Personnel

The AC power disconnect devices are the 2 x IEC (IEC60320-1 C13/C14) couplers located at the rear of each unit. **WARNING:** The apparatus has a dual power system. It is essential that BOTH AC power IEC couplers are disconnected to prevent exposure to hazardous voltage within the unit.

ESD (Static) Handling Procedures

In its completed form, this equipment has been designed to have a high level of immunity to static discharges. However, when handling individual boards and modules, many highly static sensitive parts are exposed. In order to protect these devices from damage and to protect your warranty, please observe static handling procedures, for example, use an appropriately grounded anti-static wrist band. Calrec will supply an electrostatic cord and wrist strap with all of its digital products.

All modules and cards should be returned to Calrec Audio Limited in anti-static wrapping. Calrec Audio Limited can supply these items upon request, should you require assistance.

This applies particularly to digital products due to the types of devices and very small geometries used in their fabrication, analog parts can however still be affected.

FIGURE 1 - LEAD FREE



RoHS Legislation

In order to comply with European RoHS (Reduction of Hazardous Substances) legislation, Calrec PCB and cable assemblies are produced with lead-free (tin/copper/silver) solder instead of tin/lead solder. See Figure 1.

In the unlikely event of a customer having to carry out any re-soldering on Apollo, Artemis or Hydra2 hardware, it is imperative that lead-free solder is used; contaminating lead-free solder with leaded solder is likely to have an adverse effect on the long-term reliability of the product. Circuit boards assembled with lead-free solder can be identified (in accordance with IPC/JEDEC standards)

FIGURE 2 - LEAD FREE STICKER



by a small oval logo (see Figure 2) on the top-side of the circuit board near the PCB reference number (8xx-xxx). The same logo is used on the connector hoods of soldered cable assemblies.

If in doubt, please check with a Calrec customer support engineer before carrying out any form of re-soldering.

ISO 9001 and RAB Registered

Calrec Audio Ltd has been issued the ISO9001: 2008 standard by the Governing Board of ISOQAR.

The award, for both UKAS (Figure 3) and RAB (Figure 4) registration, is the most comprehensive of the ISO9000 international standards. Granted in recognition of excellence across design, development, manufacture and after-sales support, the certification follows a rigorous and thorough review of Calrec's internal and external communication and business procedures.

FIGURE 3 - UKAS REGISTRATION



FIGURE 4 - RAB REGISTRATION



HEALTH AND SAFETY

Important Safety Instructions:

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Protect the power cord from being walked on or pinched particularly at the plugs, convenience receptacles, and the point where they exit from the apparatus.
- Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operator normally, or has been dropped.
- Warning: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
- Not intended for outdoor use.
- This equipment must be EARTHED.
- Before starting any servicing operation, equipment must be isolated from the AC power supply. The disconnect devices are the 2 x IEC connectors (IEC 60320-1 C13/C14 couplers).
- Do not allow ventilation slots to be blocked. Do not leave the equipment powered up with the dust cover fitted.

Cleaning

For cleaning the front panels of the equipment we recommend using a soft anti-static cloth, lightly dampened with water if required.

Explanation of Warning Symbols

Triangular warning symbols contain a black symbol on a yellow background, surrounded by a black border.

The lightning flash with arrow head symbol within an equilateral triangle, as shown on this page, is intended to alert the user to the presence of dangerous voltages and energy levels within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock or injury.

The exclamation mark within an equilateral triangle, as shown on this page, is intended to prompt the user to refer to important operating or maintenance instructions in the documentation supplied with the product.

Earthing

This is a Class I product. An Earth connection **MUST** be provided in each AC power cord.

The Earth Bolt connection at the rear of the console should be connected to Earth using Earth cable at least 6mm² in cross section (10 AWG).

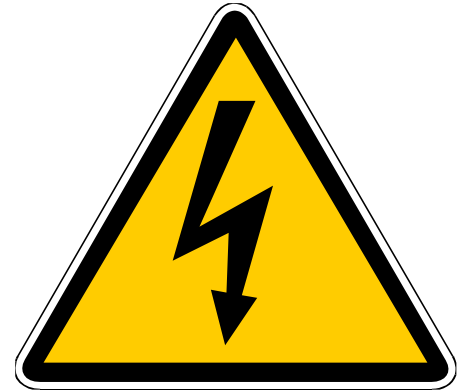
Lithium Battery Replacement

Caution: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type. Batteries must not be exposed to excessive heat such as sunshine, fire or the like

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

DANGEROUS VOLTAGES



IMPORTANT INSTRUCTIONS



TECHNICAL SUPPORT

Telephone: (9:00am-5:30pm)	+44 (0) 1422 842159
Email - Technical:	support@calrec.com
Email - General:	enquiries@calrec.com
Postal address:	Calrec Audio Ltd. Nutclough Mill, Hebden Bridge, West Yorkshire, HX7 8EZ, U.K.
Fax:	+44 (0) 1422 842159
Website:	www.calrec.com

Should you require any technical assistance with your Calrec product then please contact your regional Calrec distributor. Customers within the UK or Ireland should contact Calrec directly.

For a complete list of worldwide distributors by region, go to www.calrec.com or contact us for more information.

For pre-delivery technical enquiries, UK and Ireland customers should contact the Calrec project manager assigned to their order. Post delivery, the Calrec Customer Support team will take care of your technical enquiries.

Our UK customer support team work closely with our global distributor network to provide the highest level of after sales support. Your distributor should be your first point of contact and will often be able to provide an instant solution, be it technical advice, spares or a site visit by an engineer.

Calrec UK customer support and our global technical team provide free of charge technical support and advice by phone or email to all customers.

Once your console is installed we can provide an engineer on site to carry out

system commissioning. Commissioning ensures the equipment is correctly installed and fully functioning before it goes into use. During commissioning, our engineers can also help and advise with configuration and setup.

Calrec after sales support includes:

- Free of charge comprehensive technical advice and support by phone and email.
- Software and hardware upgrades.
- Repairs.
- Quick supply of replacement or loan hardware in the event of a failure.
- Providing export documentation for the return of faulty parts.
- On site commissioning visits.
- On site service and health check visits.
- Emergency engineer visits.
- On site on-air support, for complete peace of mind - providing operational guidance, and technical engineering support for new installations or high profile events.
- Operational training.
- Maintenance / technical training.
- Supply of replacement components
- Supply of documentation

Service contracts

We offer a range service contracts to our UK and Ireland customers, offering 24/7 telephone support, regular health checks and extended warranty amongst other benefits. Please contact our customer support team for more information on service contracts.

Product Warranty

A full list of our conditions & warranties relating to Goods & Services is contained in the Company's standard Terms and Conditions. A copy of this is available on request.

Repairs

If you need to return goods to Calrec, for whatever reason, please contact your regional distributor or Calrec customer support beforehand for guidance, as well as to log the details of the problem and receive a reference number. For customers outside the UK and Ireland, shipping via the distributor saves customers from dealing with exportation paperwork. If there is a need to send direct to Calrec, contact us beforehand to log the incoming repair and for assistance with exportation documents.

Standard of Service

Ensuring the highest standards is a priority, if you have any comments on the level of service, product quality or documentation offered to you by Calrec, please contact the Calrec Customer Support team in the UK who will endeavour to address the issues. Calrec welcomes all customer feedback.

For feedback specific to this document, please contact enquiries@calrec.com.

APOLLO CONTROL SURFACE

SURFACE DIMENSIONS AND ASSEMBLY

The Apollo control surface can be customized in terms of width and fader count and can be provided with various stand and trim options.

Desk-top mounting

The control surface can be supplied without a floor stand to allow for desktop mounting, or for mounting into a custom stand or control room furniture. Figure 1 shows the end elevation with no stand fitted.

Floor stand options

The standard height stand sits the surface of the fader panels at a height of 740mm [29.13"] above the floor. A reduced height stand is also available, positioning the surface of the fader panels at 700mm [27.56"], the overall height being reduced by 40mm [1.57"]. Both versions of the stand have inline fixing holes to allow the stand to be secured to the floor without affecting the footprint, typically when being used in mobile or 'Outside Broadcast' units. The standard height stand fixing holes are 10mm in diameter. The reduced height fixing holes are 8.5mm, designed to be used with M10 tapping screws, or alternatively adjustable feet can be added here to bring the fader height up to 720mm [28.35"]

FIGURE 1 - END ELEVATION, NO FLOOR STAND FITTED

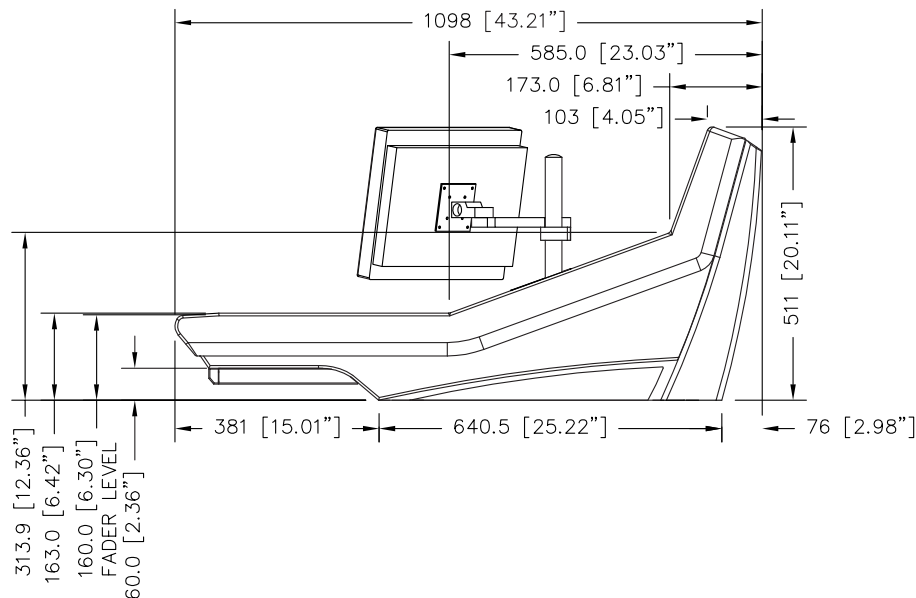


FIGURE 2 - END ELEVATION, STANDARD HEIGHT FLOOR STAND FITTED

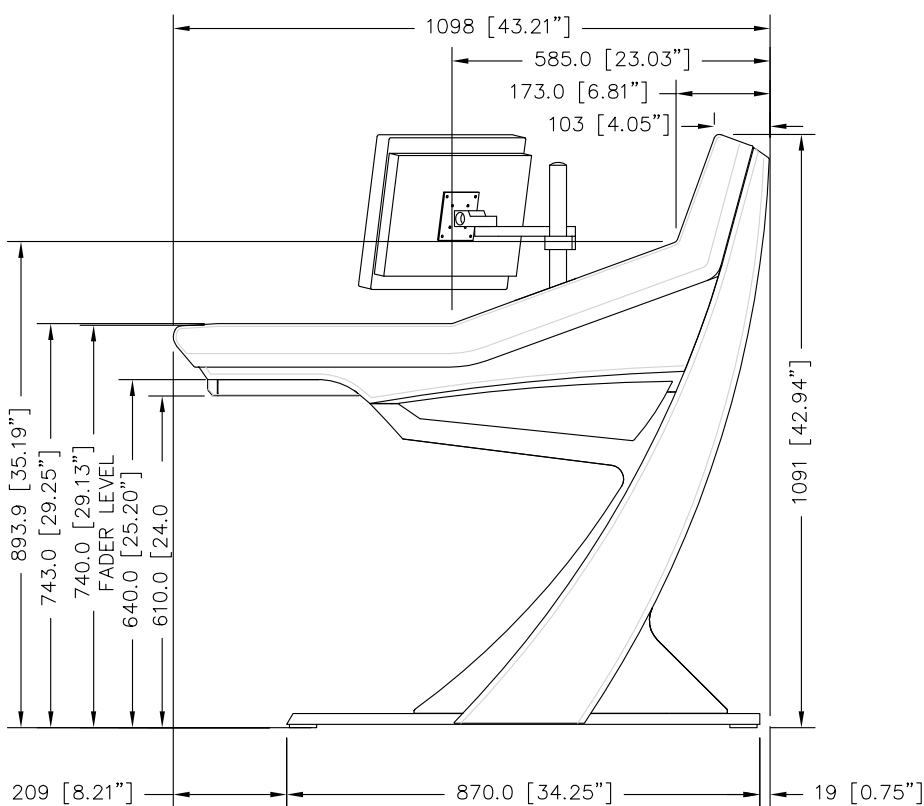


FIGURE 3 - STANDARD HEIGHT, INLINE BOLT-DOWN FIXINGS

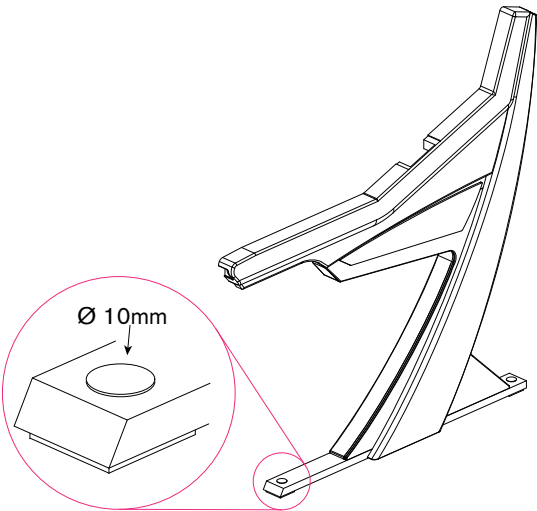


FIGURE 5- REDUCED HEIGHT FLOOR STAND, INLINE BOLT-DOWN FIXINGS

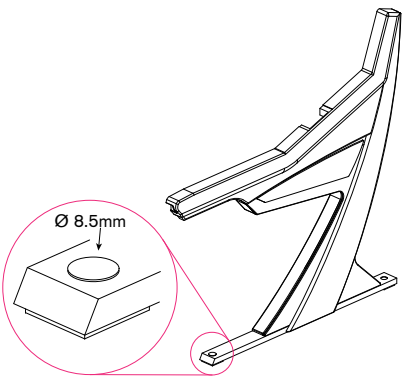
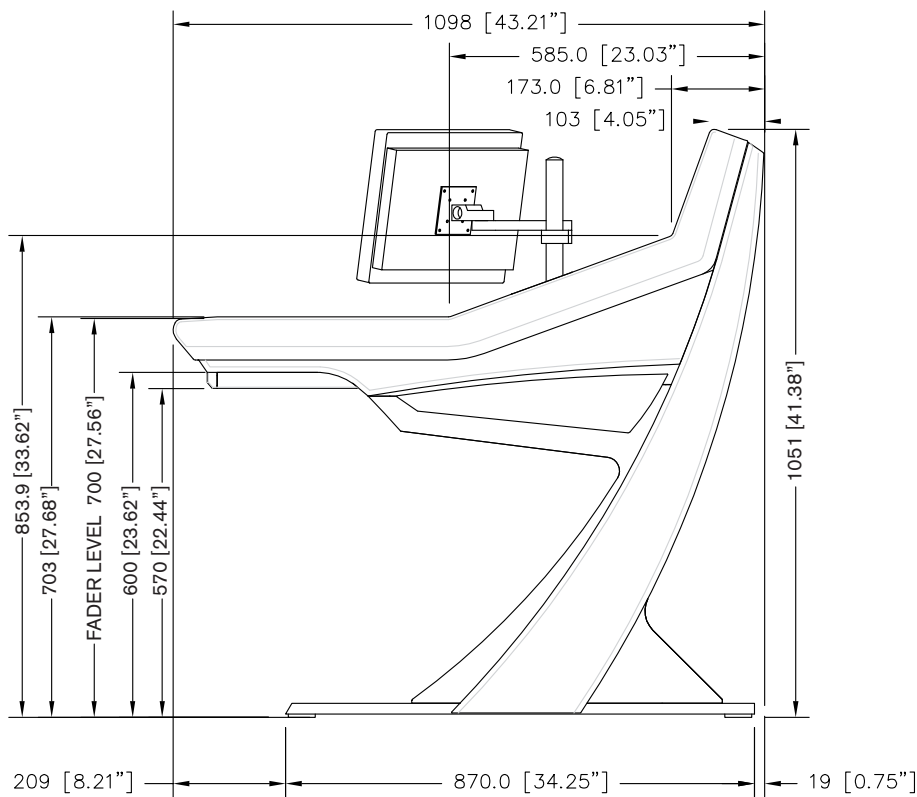
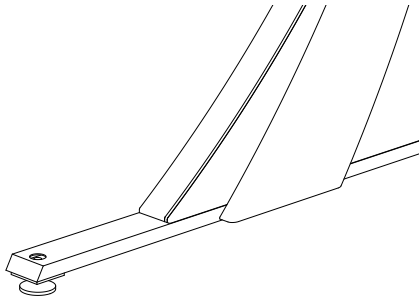


FIGURE 6 - ADJUSTABLE FEET



Surface sizes

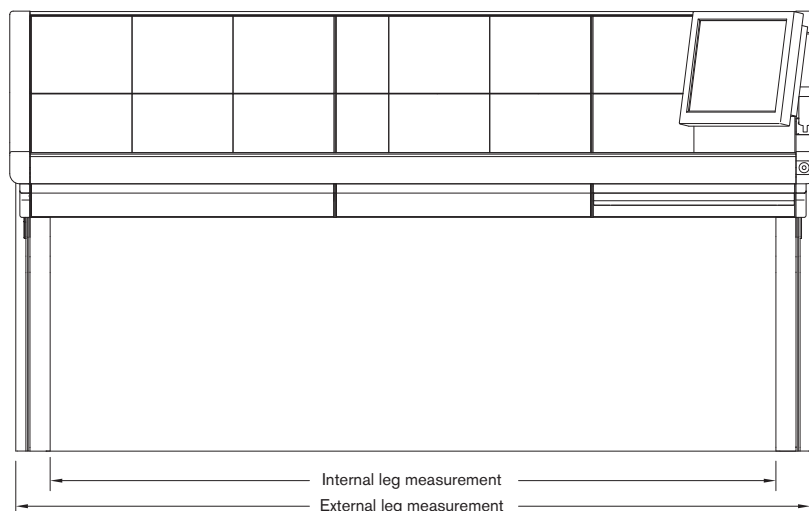
Surface sizes are stated in the number of faders they can contain. A number of chassis sections are fitted together to provide a control surface of a suitable width to contain the number of faders required, or to fit the physical space available. Often chassis' are ordered to be larger than is required at the time to allow for a future increase in the quantity of faders.

Chassis sections come in a variety of widths and are defined by the number of control panels that they can contain across their width. Chassis sections currently available are "2", "2.5", "3" & "3+".

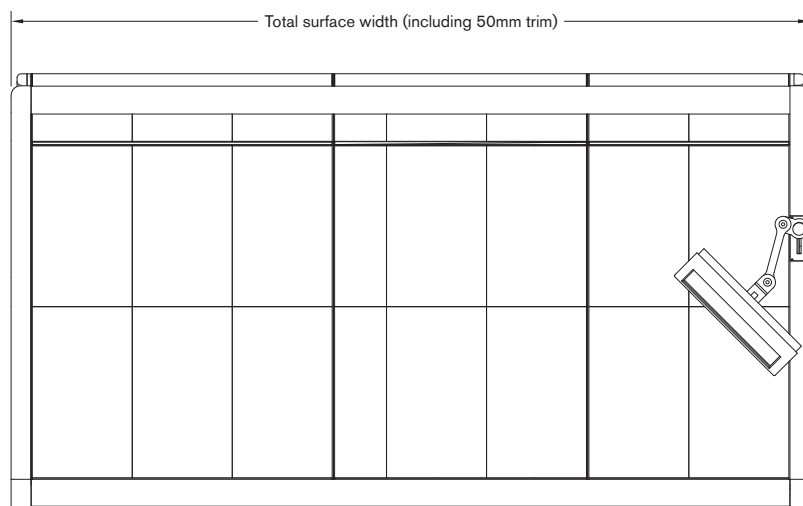
Each section contains two rows of panels in the control bed. A standard Apollo layout consists of a number of fader panels and a dedicated monitor panel fitted in the bottom row, and a number of assignable panels along with a joystick panel in the upper row. Both control bed panel rows are the same height and panels can be fitted in either. Standard panels are 250mm [9.84"] wide, these include the assignable panels and fader panels. The dedicated monitor and joystick panels are 130mm [5.12"] wide and loosely termed as "half-width".

Therefore, for example, a 2.5 section would generally be fitted with 2 fader panels and a "half-width" monitor panel in the bottom row, and 2 assign panels and a "half-width" joystick panel in the upper row. A 3+ section allows for a joystick and monitor panel to be fitted in the same row as each other alongside 2 standard panels. 3 standard panels can be fitted in the other row which would then also be fitted with a 10mm blank panel to fill the remaining space.

INTERNAL / EXTERNAL LEG MEASUREMENTS



OVERALL SURFACE WIDTH



Each frame section is as wide as the modules it can contain, (2 section - 500mm, 2.5 section - 630mm, 3 section - 750mm, 3+ section - 760mm) plus a 3mm wide bulkhead at either end. Once assembled, the overall chassis is fitted with a side trim at each end. The standard trim is 50mm, adding 100mm [3.94"] to the overall width of the control surface.

Consoles without a floor stand can be supplied with optional 10mm [0.39"] wide side trims instead if physical space is limited. Note however that the PC monitor mount cannot be fitted to the 10mm wide trim, therefore a suitable alternative will need to be provided by the installers to give the operator a conveniently located PC monitor display.

A standard chassis build is fitted with a PC monitor and keyboard tray at the right hand side of the control surface. As an option, these can be fitted at the left hand side. If required, monitor mounts and keyboard trays can be fitted at both ends of the console. One of these would typically be used as a convenient location to control / display other equipment such as playout devices.

TYPICAL CONTROL SURFACE WIDTH DIMENSIONS

Fader Count	Section Make-up	Max Surface Width, including 50mm trim at each end	Max Surface Width, including 10mm trim at each end (no monitor mount)	Internal Leg*	External Leg*
32	2/2.5	1242mm [48.90"]	1162mm [45.75"]	1042mm [41.02"]	1212mm [47.72"]
48	2/2.5/2	1748mm [68.82"]	1668mm [65.67"]	1548mm [60.04"]	1718mm [67.64"]
56	3/2.5/2	1998mm [78.66"]	1918mm [75.51"]	1798mm [70.79"]	1968mm [77.48"]
64	3/2.5/3	2248mm [88.50"]	2168mm [85.35"]	2048mm [80.63"]	2218mm [87.32"]
72	3/3+/3	2378mm [93.62"]	2298mm [90.47"]	2178mm [85.75"]	2348mm [92.44"]
72	2/3/2.5/2	2504mm [95.58"]	2424mm [95.43"]	2304mm [90.71"]	2474mm [97.40"]
80	3/2/2.5/3	2754mm [108.43"]	2674mm [105.28"]	2554mm [100.55"]	2724mm [107.24"]

*Internal / external leg widths do not include the floor fixing plates fitted on OB version.

REAR CONNECTION INTERFACE AND COVERS

Access to surface connections

Data connections from the control surface to the processing rack are made to the back interface panel, located next to the left hand leg when viewed from the back, as shown below.

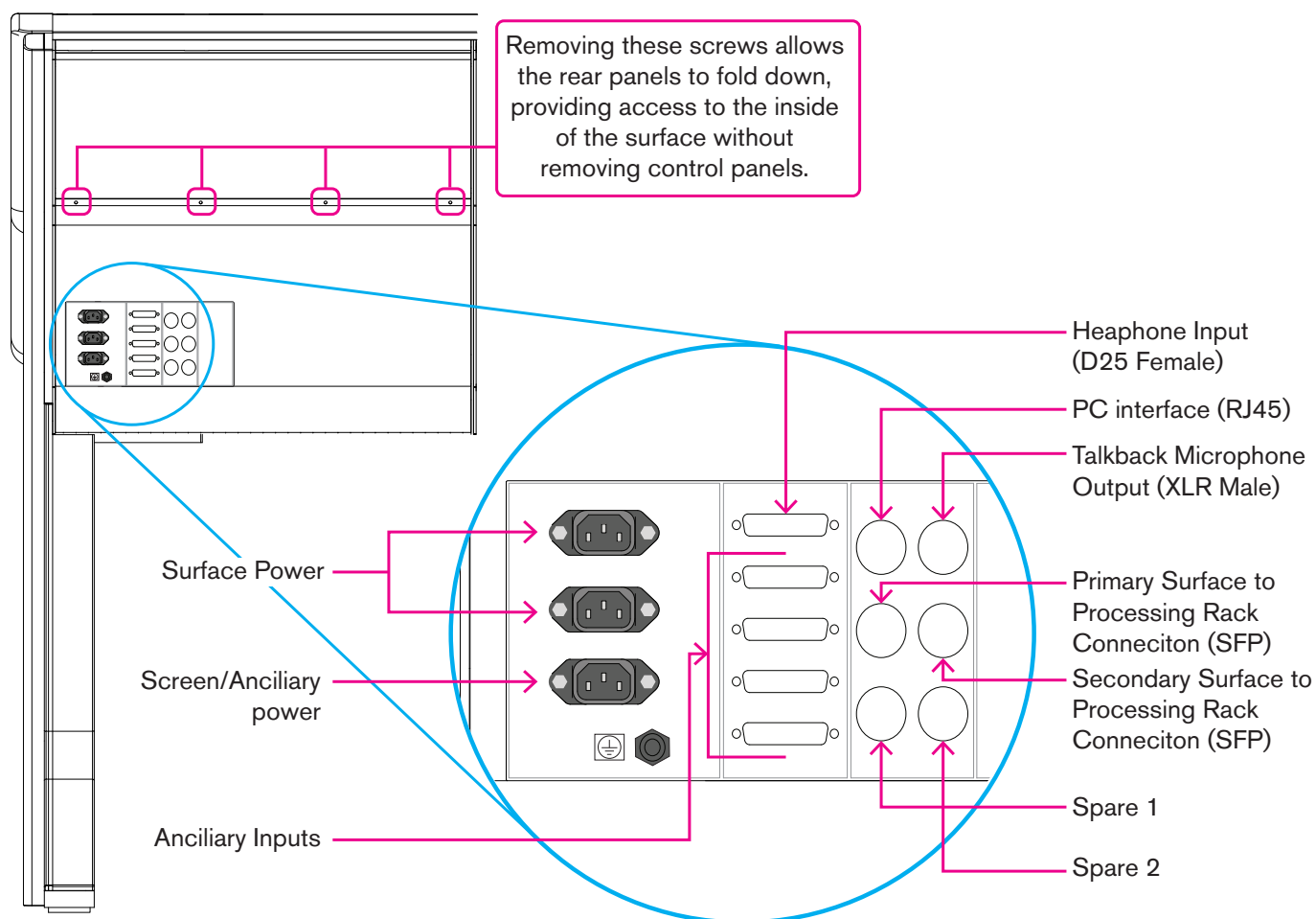
Two fibers or Cat5e cables (depending on connection SFP type ordered) should be connected to the back panel from where they are routed internally to the two Surface Switches.

The rear interface panel provides power connections on three IECs along with a connection point for earthing the chassis.

Audio and data connections are provided for interfacing to audio driven devices along with ancillary data connections.

The format of the interface plate may vary depending on the optional hardware fitted within the surface. Connector and pin-out information is provided in the Connection Information section of this document.

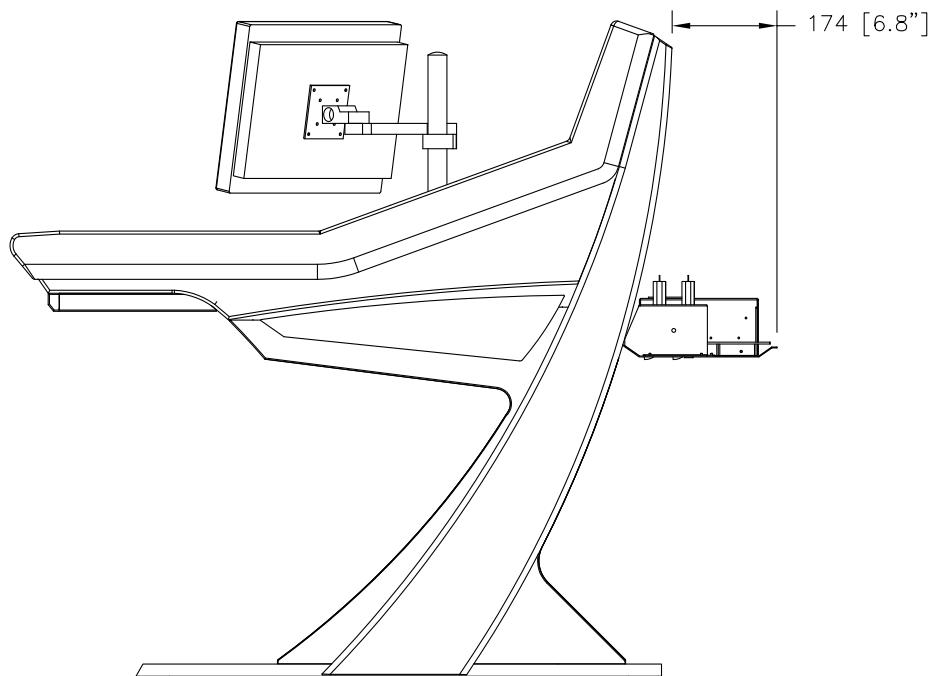
REAR OF APOLLO CONTROL SURFACE



Access to internal surface components

The rear cover of the surface is hinged to provide access to internal surface components. The hinged panels are fixed by screws along their upper edges as shown above right. Once unscrewed they can be carefully lowered. They will support their own weight at the end of their travel and require a certain amount of space at the rear of the surface for access as shown on the right. Alternatively, the internal components can be accessed from the front by removing control surface panels.

FIGURE 7 - ACCESS SPACE REQUIRED BEHIND SURFACE



FLOOR STAND LEG ASSEMBLY

The floor stand legs are made up of a number of structural components and external trims.

Figure 1 illustrates each component that makes up the left and right surface floor stands. The same colors and labels are used in the assembly procedure shown in Figures 2-10.

FIGURE 2 - STAND ASSEMBLY STEP 1

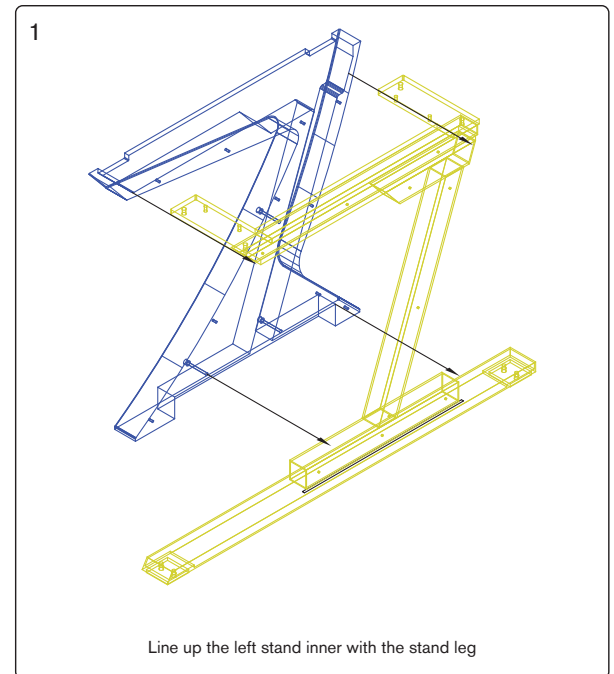


FIGURE 1 - STAND COMPONENTS

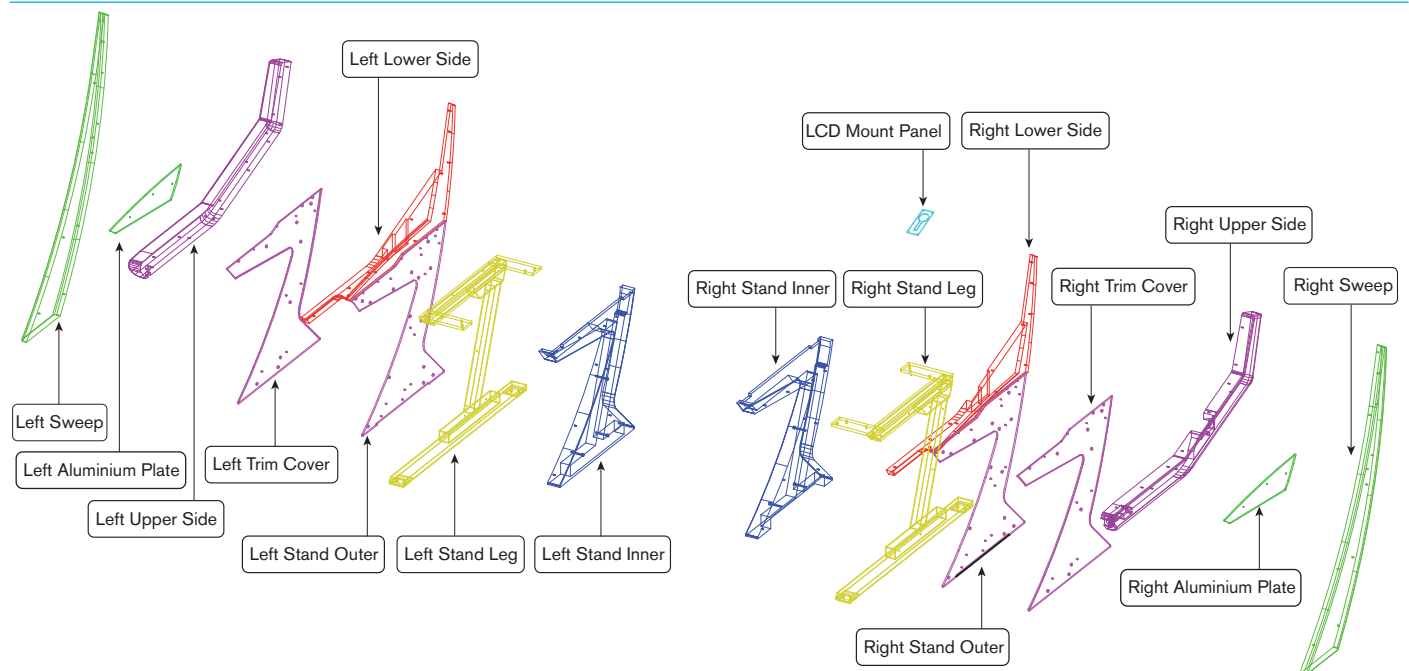


FIGURE 3 - STAND ASSEMBLY STEP 2

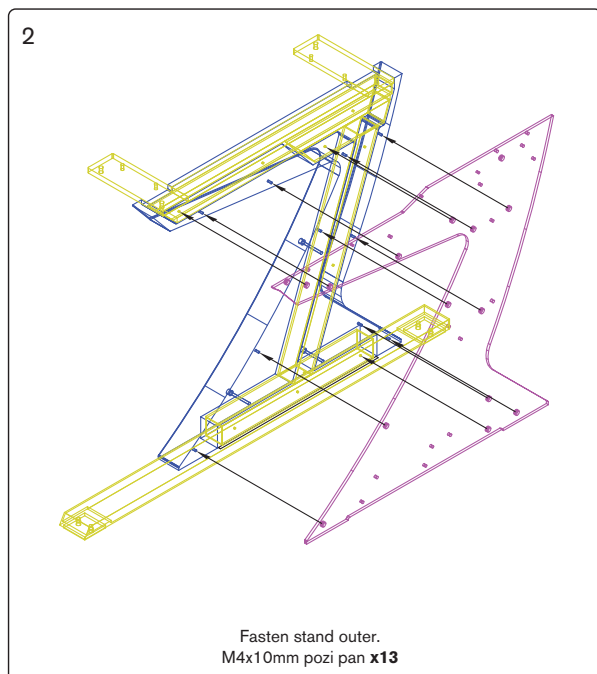


FIGURE 4 - STAND ASSEMBLY STEP 3

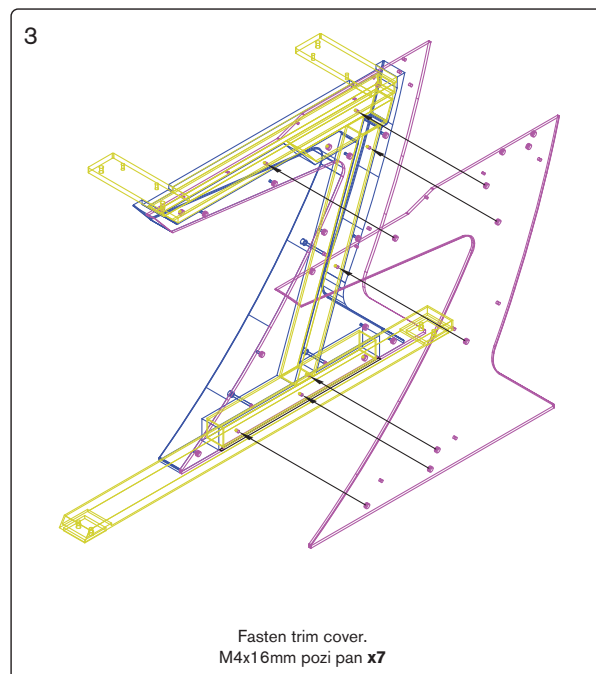


FIGURE 5 - STAND ASSEMBLY STEP 4

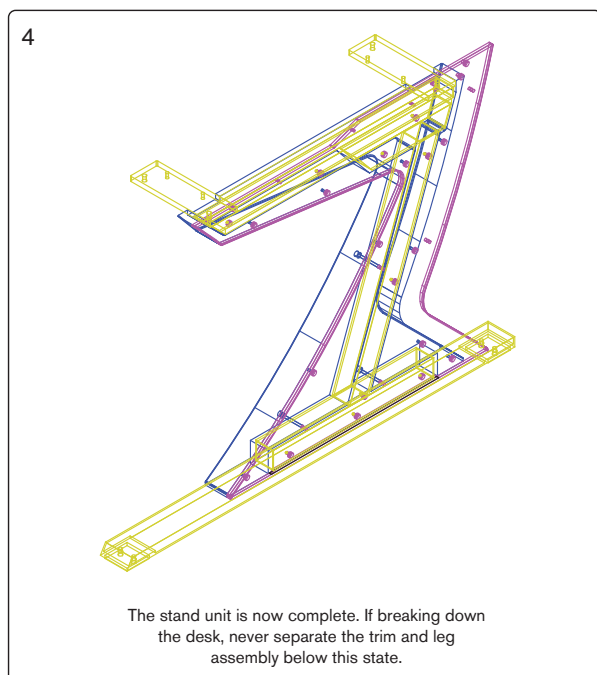


FIGURE 6 - STAND ASSEMBLY STEP 5

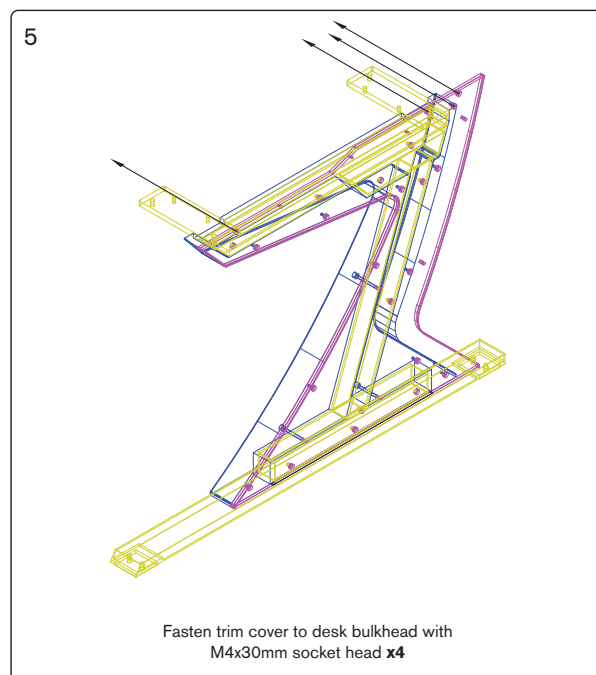


FIGURE 7 - STAND ASSEMBLY STEP 6

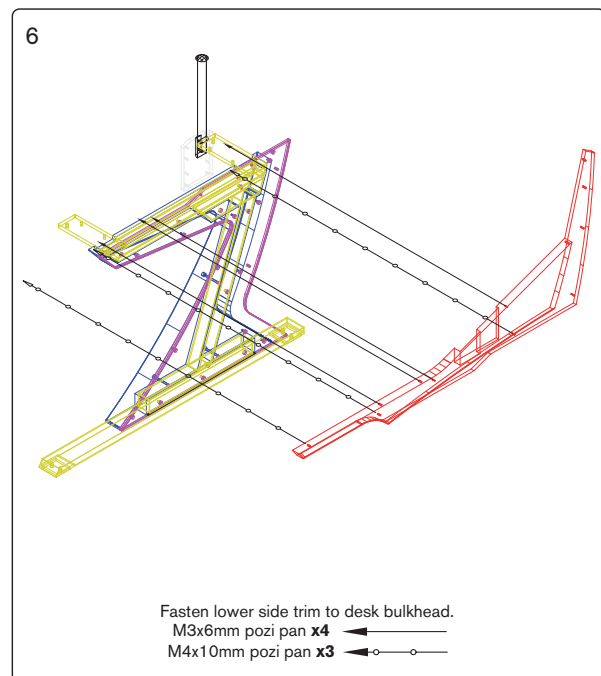


FIGURE 8 - STAND ASSEMBLY STEP 7

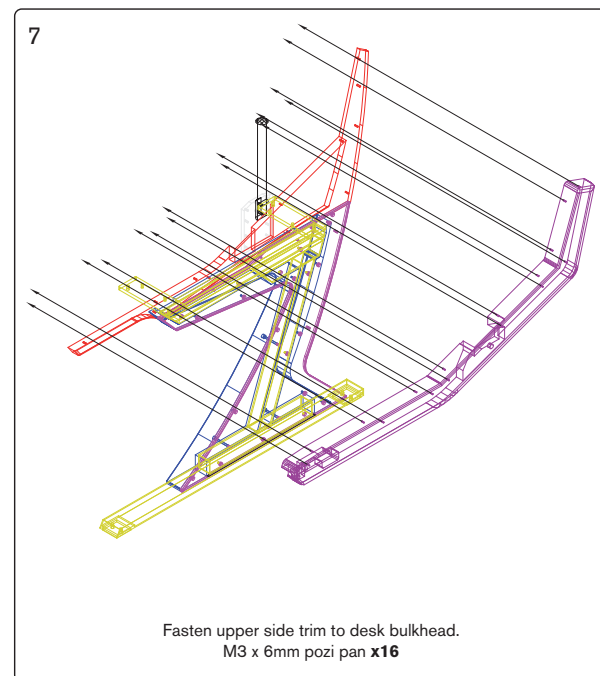


FIGURE 9 - STAND ASSEMBLY STEP 8

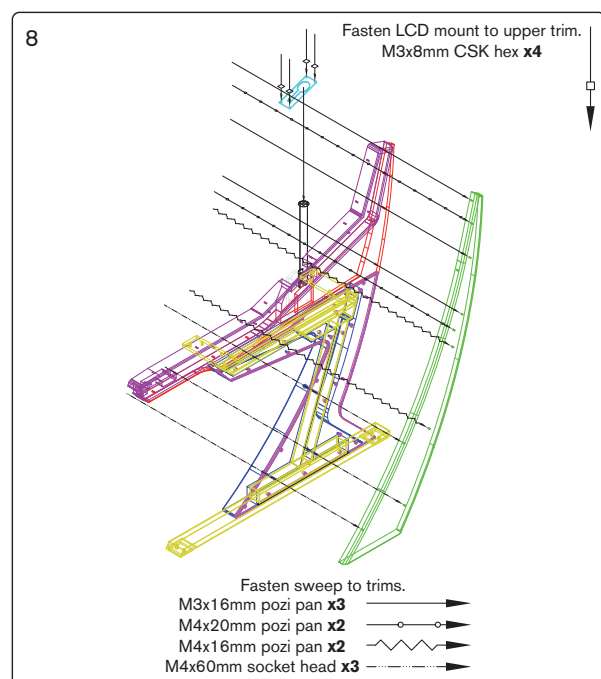
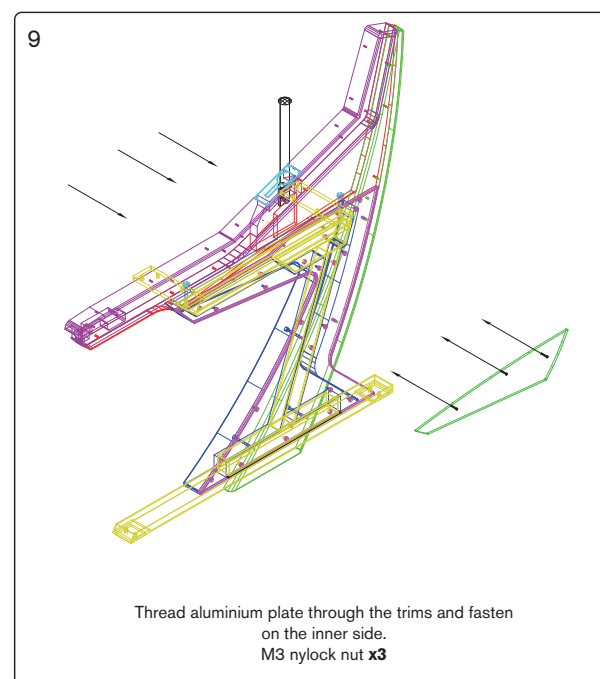


FIGURE 10 - STAND ASSEMBLY STEP 9



SURFACE COMPONENTS

There are a range of components within the surface. This section explains how these components are connected, receive power and communicate with each another.

POE (Power Over Ethernet) switch

Control panels in the surface have a single connection that carries all data and power via an RJ45 connector from a POE switch. The number of POE switches fitted in a control surface is determined by the number of panels fitted. Each POE switch can connect to up to six control panels.

POE switches are mounted to the inside of the rear cover and are accessible by removing control panels, or by opening the rear covers as shown in the Rear Connection Interface and Covers section of this document.

Each POE switch has two AC mains inputs and two PSU's to provide internal and external power redundancy. "Power Good" LED's 1 & 2 indicate each power supply is receiving mains and active. A PSU failure or loss of a mains input will generate an AWACS error message.

Each POE switch has 16 RJ45 connections, split into two groups - A & B. The A group of connectors are full POE - carrying both data and power. Status LED's are provided for these ports which should display a steady, regular flashing pattern once the system is booted and comms have been established.

Connections P1 to P6 are used to connect to control panels. Control panels must be connected to the correct POE unit and port, as defined by the Surface Layout page in the Main PC application. The Surface Layout page, and other utility software refers to these ports simply as POE ports 1 - 6.

When a surface reset command is received by a POE switch it momentarily cuts the power on ports P1 – P6. Control surface panels are "reset" by cycling power to them.

Each POE switch requires a connection to both the primary and secondary Surface Switches. POE connector S1 connects to the primary Surface Switch and connector S2 connects to the secondary Surface Switch. Although S1 and S2 are full POE, power and data, Surface Switches do not use the power from this feed.

Ports SPR1 and SPR2 are uninterrupted during reset and are used to provide power to the Surface Switches, PC and any other items that may need to remain powered during reset, such as ancillary audio feeds. The SPR connections also

contain the reset lines from the upstand reset panel for the surface, control and DSP which the active Surface Switch acts upon accordingly. All other hardware, such as the PC will ignore the reset lines in the SPR feed.

The B group of connectors do not pass data. Ports AP1 – AP4 are ancillary power, used to power "non-intelligent" units with no control processor or data connection, such as moving coil meters. AP connections drop power during surface reset.

Upstand TFT panels do not have a direct data connection from a POE. They have a connection to a fader panel which carries out the processing and passes on the data to the display.

FIGURE 1 - POE SWITCH

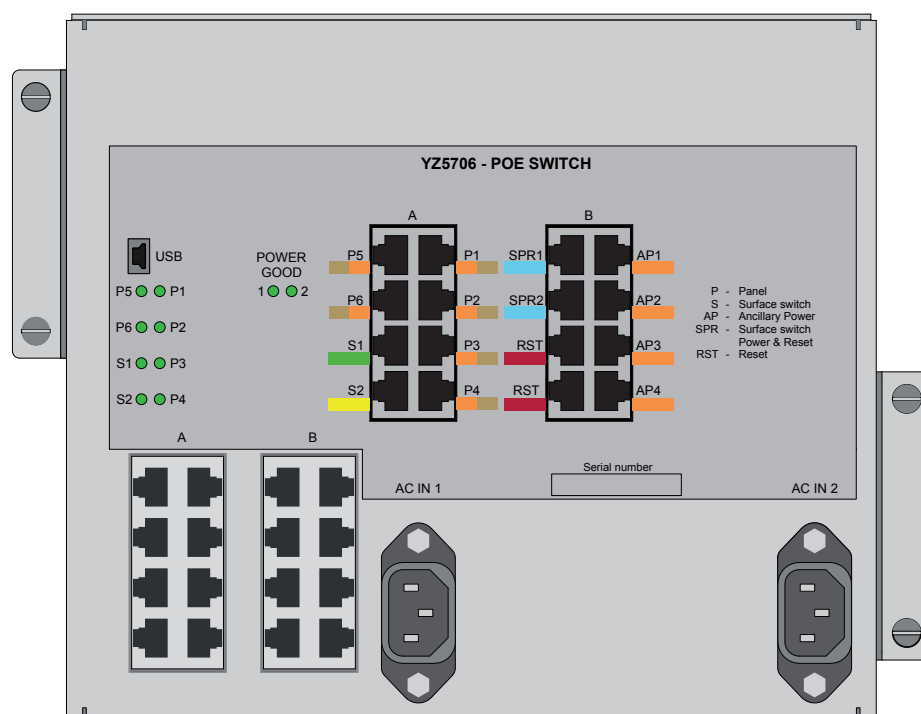
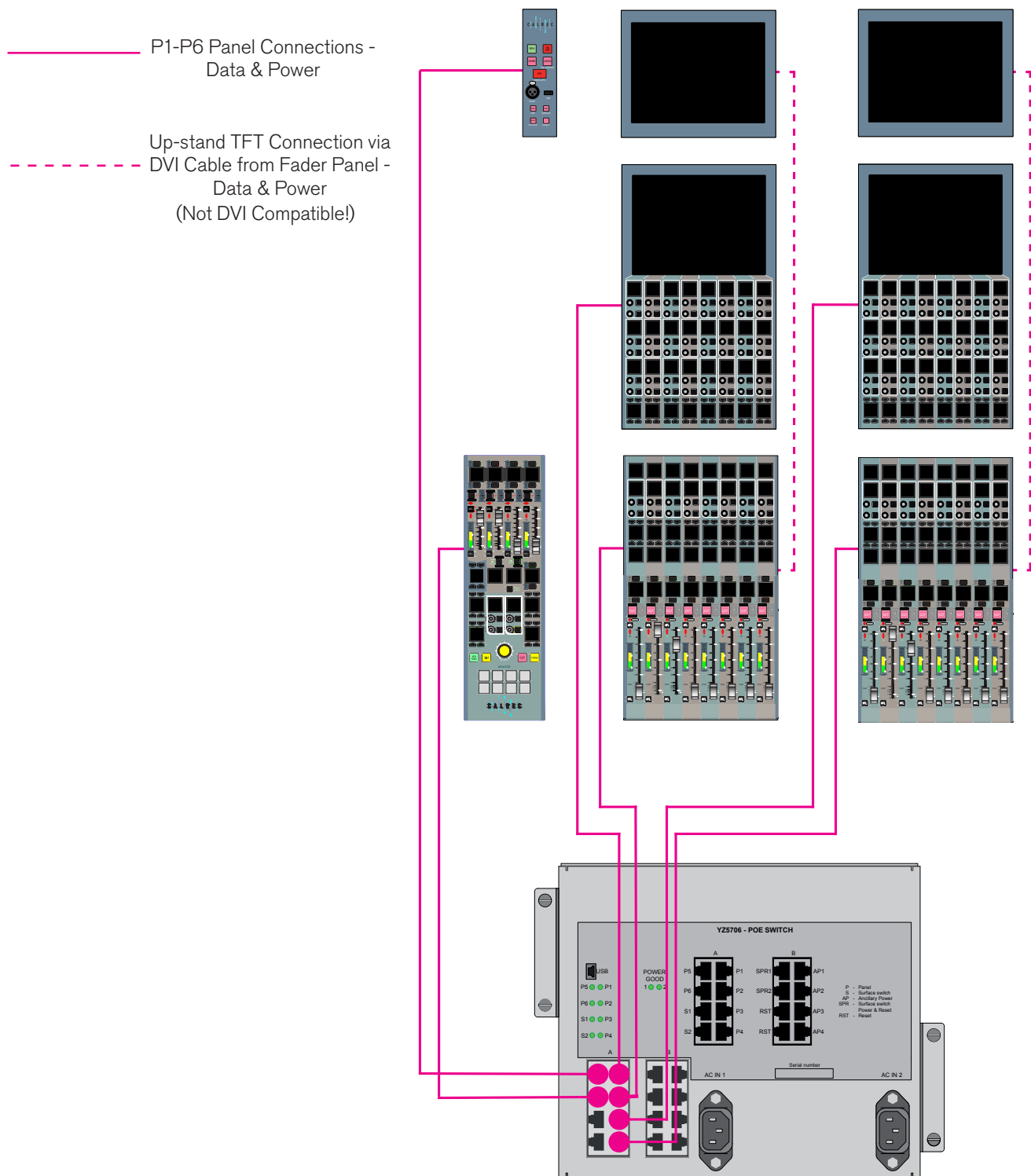


FIGURE 2 - POE TO PANEL CONNECTIONS, DATA AND POWER



POE Reset connections

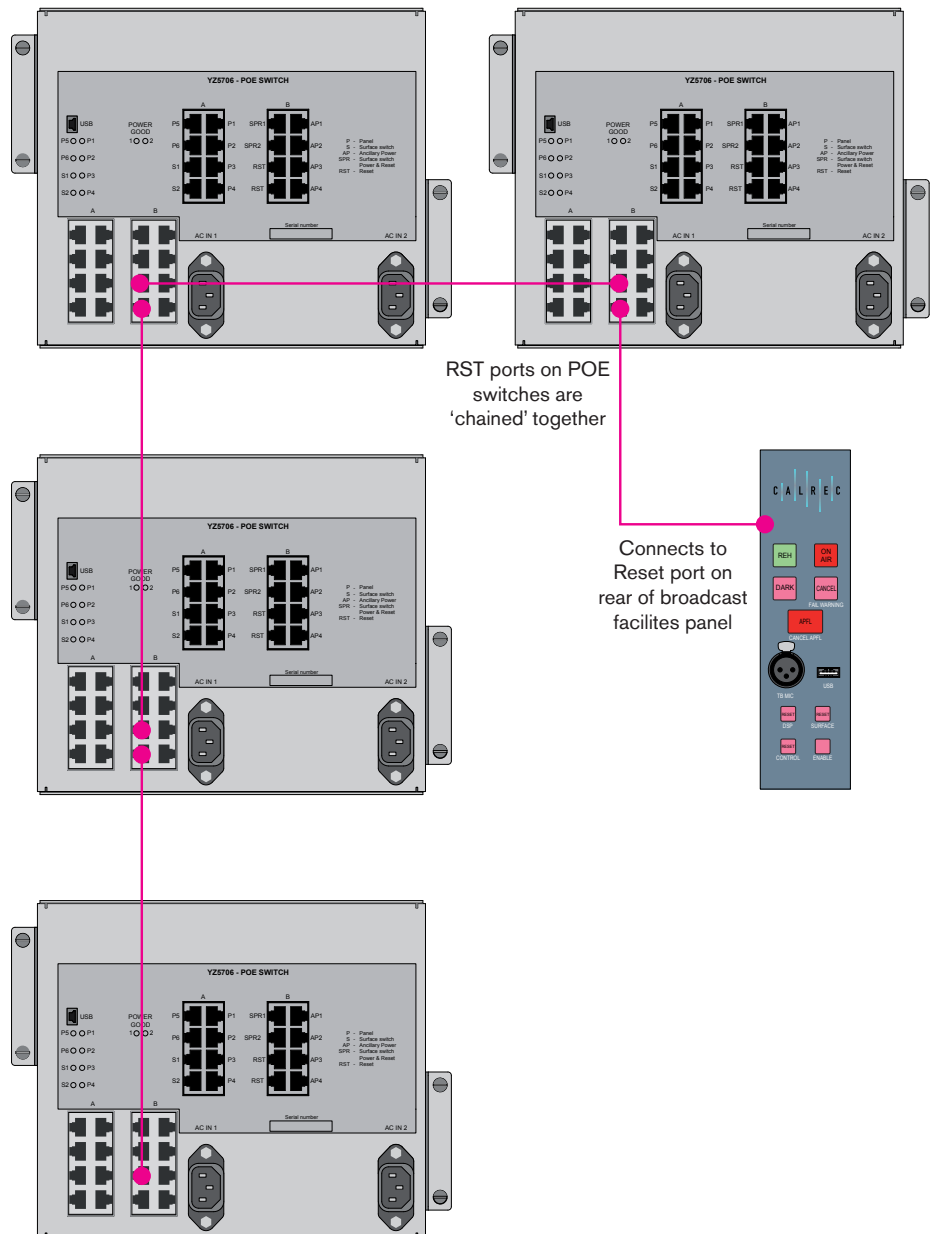
The up-stand reset / broadcast facilities panel has two RJ45 ports - a power and data connection and a reset connection which carries hard logic lines from the reset switches. The reset port should be connected to one of the RST ports on one of the POE switches. The other RST port on that switch is then connected to an RST port on another POE switch and so on, daisy-chaining the reset lines through all the POE switches in the system.

It does not matter which RST is used for "in" & "out" or in what order the POEs are connected. These are hard logic lines rather than data, ensuring reset commands can be passed throughout the system irrespective of the functioning state of each piece of hardware.

During surface reset, all POEs & Surface Switches reboot and power is momentarily dropped to all panels forcing them to reboot. DSP and control resets are passed on to the processing rack via the active Surface Switch.

All Calrec fitted Cat5e cables conform to standard Ethernet pairings and are wired "straight-through" or "pin to pin" as shown in the Category 5e Cables section of this document. Panel cables and I/O to Router cables can be either straight-through or cross-over, however POE RST and SPR cables MUST be wired straight-through.

RESET CONNECTIONS



Surface Switches

The Surface Switch is the interface between the control surface and the processing rack. To provide redundancy, two Surface switches are fitted, primary and secondary. The system will always attempt to boot and run on the primary, however if there is a problem with the primary or its connections, the secondary will automatically take over.

Like POE's, the Surface Switches are mounted to the inside of the rear cover, usually in the same section as the IEC inlets. Access is gained by removing control panels or the rear cover as shown in the Rear Connection Interface and Covers section of this document. When viewed from the front, the primary Surface Switch is always the left hand unit.

To communicate with all the control panels and PC, each Surface Switch requires a direct connection to each POE switch. POE switches MUST be connected to specific ports in the correct order - POE

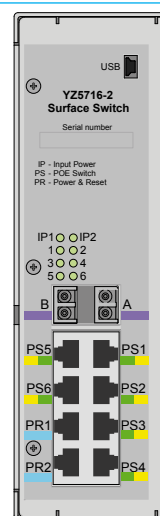
#1 connects to surface switch port PS1, POE#2 to PS2, POE #3 to PS3 etc. POE's are numbered by location from left to right across the console. Figure 6 shows the correct data connections for a 3 x POE system. On each POE, port S1 connects to the primary Surface switch, port S2 to the secondary. LEDs 1 - 6 show activity on these ports and should display a regular flashing pattern once booted and comms established. Although the POE sends power down these lines, the Surface Switches do not use it.

Any POE SPR ports can be used to feed Surface Switch PR1 / PR2 ports to power the Surface Switch as well as passing on the reset signals. LEDs I/P1 and I/P2 indicate if power is present on these ports.

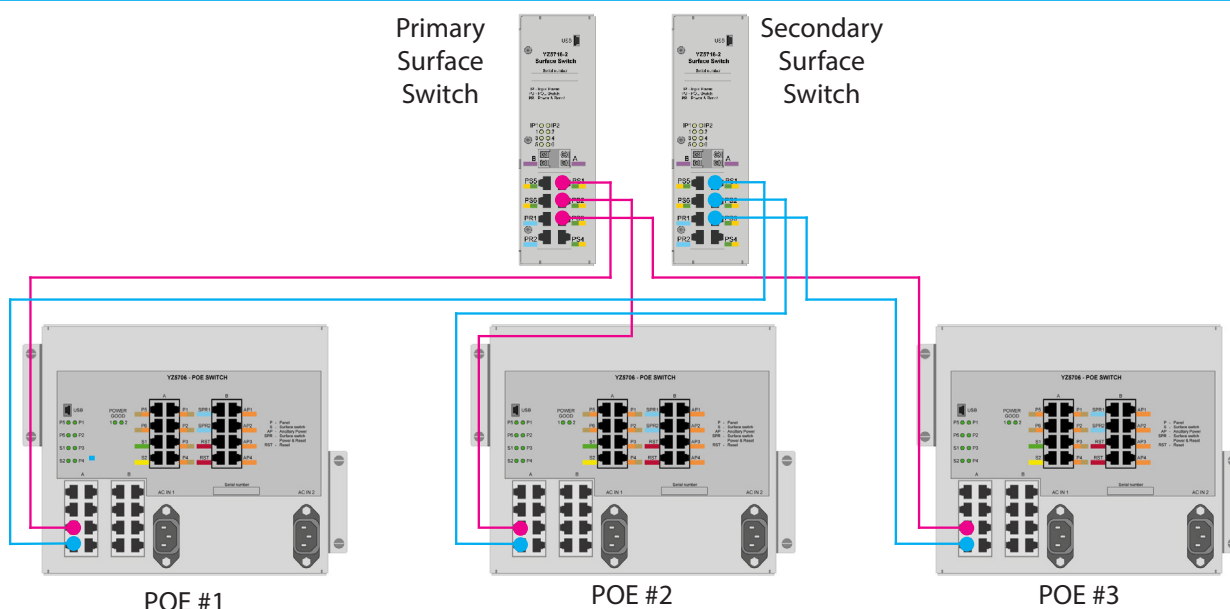
Ports A & B are SFP slots. Port A is used to interface with the control processor in the processing rack, port B is currently unused. The primary Surface Switch should connect to the primary Control processor's MAC7 connector. The

secondary Surface Switch should connect to MAC7 on the secondary Control processor. These connections are NOT supplied by Calrec and need to be made by the installer. Please see the Surface to Rack Connection section of this document for more details.

SURFACE SWITCH



POE TO SURFACE SWITCH DATA CONNECTIONS



SURFACE POWER – AC

Apollo control surfaces have 3 x IEC AC mains inputs requiring 100 - 240V AC.

The AC power inlets are wired internally to three distribution blocks mounted to the base of the inside of the control surface.

The POE switches have dual power supplies for redundancy and take two AC inputs, one from each of the first two mains sources. The majority of the remaining hardware in the control surface,

including the PC is DC powered via POE connections.

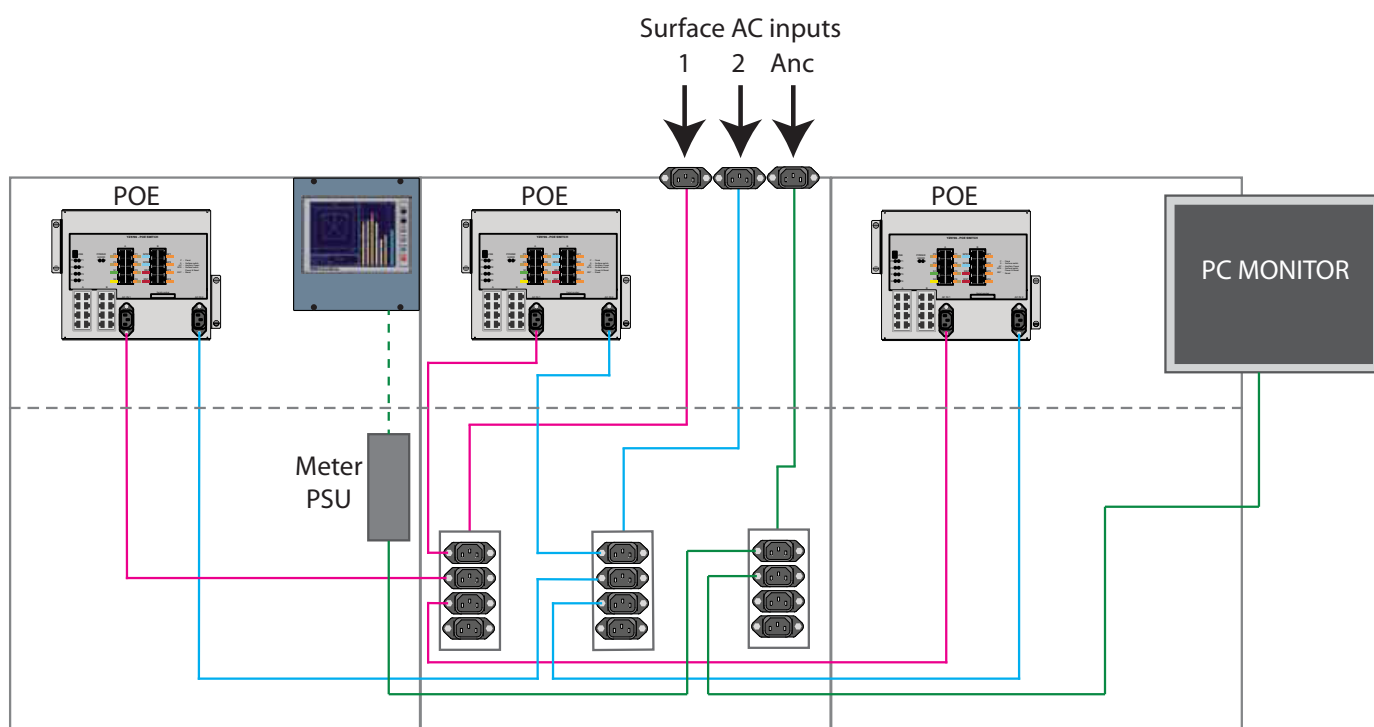
The third IEC input and distribution block is used to power ancillary or third party items with a single mains input, such as DK/RTW meters and PC monitors.

To ensure all equipment is powered and redundancy is applied where available, all three IEC inputs to the control surface need to be fed with 100-240V AC. If only one of the first two inputs is fed, AWACS error messages will be generated by each

POE indicating they are not receiving power on both inputs.

It is recommended that these two mains inputs are fed from two separate AC supplies where possible to provide redundancy against external power failure.

FIGURE 7 - SURFACE AC POWER CONNECTIONS



SURFACE POWER – DC

The surface switches and configuration PC take DC power via RJ45 connectors. These should be fed from SPR connections on POE switches. These connections are for power only - no data is carried over the POE SPR connections. SPR connections do not drop power during surface reset.

The power input connectors on the surface switches are labelled PR1 and PR2. Only one input needs to be connected for full functionality and redundancy. If power to the primary surface switch is lost, or the switch fails, data is automatically routed via the secondary Surface Switch. Therefore the two surface switches should be powered from two different POE units to maintain overall console functionality in the event of a failure of a POE feeding power.

The PC is powered via a DC convertor unit. This unit has two power inputs on RJ45s for the PC. Only one of these is required for operation, the second is provided for power redundancy. These connections should be fed from two different POE's. SPR connections on POE's should be used so the PC power is maintained during surface reset. The PC power convertor outputs 12V DC via a 9 way D-type connector. This wires via a momentary switch in the keyboard tray to the PC's DC input jack. The switch acts as a PC reset by interrupting the power. The PC has 2 DC input jack sockets, either can be used. Only one DC connection to the PC itself is provided as the redundancy is catered for by the power convertor unit.

The PC power convertor box also contains the headphone driver circuitry and has a 3rd RJ45 power input for this, situated in the bottom row of connectors. The headphone driver can be powered from an

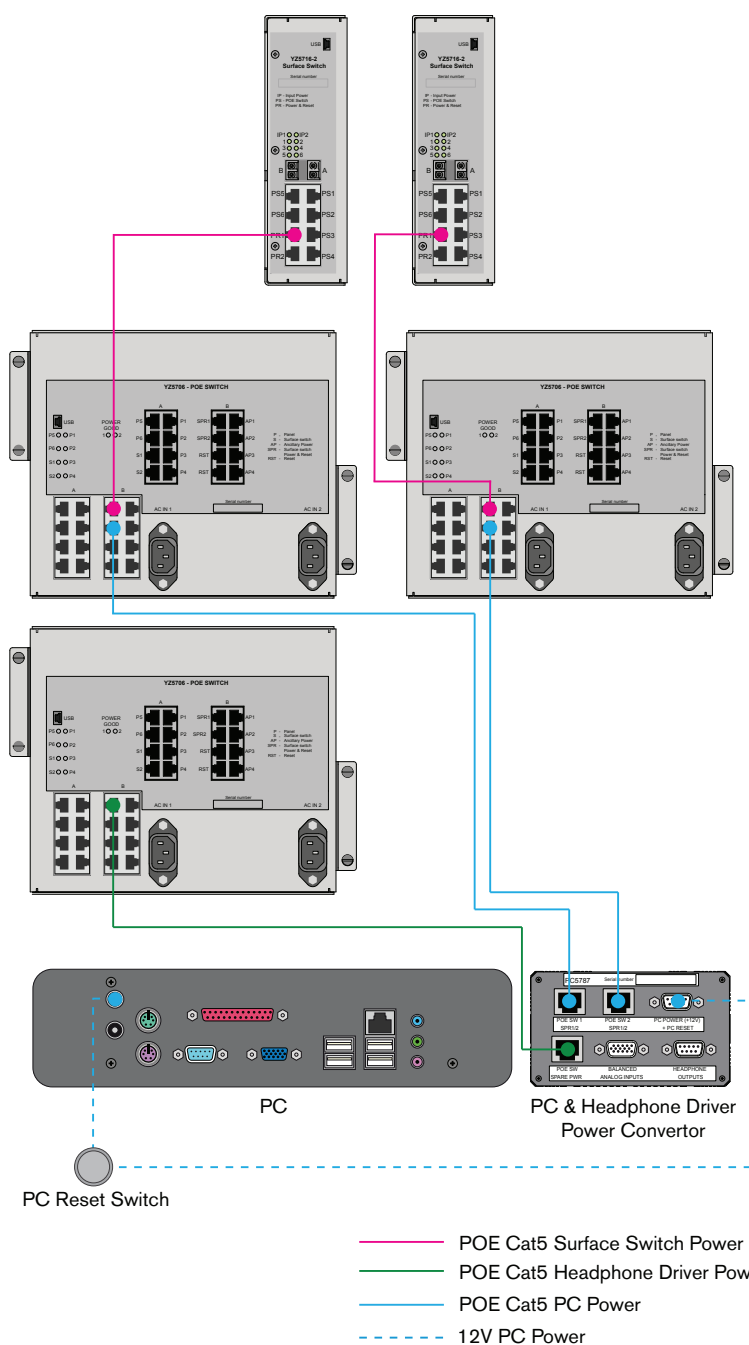
SPR port or an AP depending on whether or not power needs to be maintained during surface reset.

Control panels take power and data on the same RJ45 connection and therefore

need to be connected from a P1 - P6 POE port.

Upright TFT meter panels, moving coil meters and miscellaneous optional panels take power via POE AP ports.

SURFACE SWITCH, PC AND HEADPHONE DRIVER POWER



CONTROL SURFACE CAT5 CABLE CODING

Cat5e network cabling inside the control surface is ID coded at both ends with a number of cable markers.

One marker is used on each to ID the function of the cable by color, matching the color key used for the connector labelling on the POE switch - for example the data connection to the primary surface switch has a green marker and the one to the secondary has a yellow one.

Depending on the function of the cable, some have a prefix and/or suffix to the function marker.

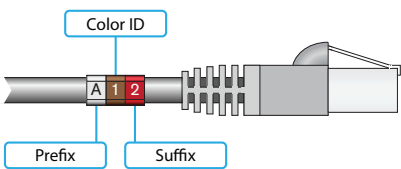
Prefixes are used to identify the control surface section the related POE is fitted in. Viewing the console from left to right, the first frame section is "A", second is "B", third is "C" etc. Where there is more than one POE switch fitted in a section, two letters are used to prefix the label, for example "AA" & "AB" where AA is the first POE in the first section and AB is the second POE in the first section.

Panel connection cables use a suffix to ID the POE port. For example, if a cable is labelled "A11" - The prefix "A" refers to the POE switch in section 1. The next character "1" is a color marker (brown) to identify the cable as a panel connection, and the last character, or suffix - "1" refers to port P1.

Blue SPR connections use a suffix to identify the device being powered by the POE switch.

The table to the right lists the functions with prefix and suffix by color ID. Figures 2 & 3 give examples of the cable labels that would be used for the first POE's A & B group of ports.

FIGURE 1 - ID CODED NETWORK CABLE



Color ID	Function	Prefix	Suffix
A 1 1	Control panel connection, data & power	Section ID	1-6, relates to POE P1-P6 port ID
2	Reset connection (RST)	None	None
A 3	Ancillary power (AP1-4)	Section ID	None
A 4	Secondary Surface Switch (S2), data	Section ID	None
A 5	Primary Surface Switch (S1), data	Section ID	None
6 1	Uninterrupted power + reset (SPR1-2)	None	1 = Primary Surface Switch 2 = Secondary Surface Switch 3 = PC Power 1 4 = PC Power 2

FIGURE 2 - POE "A" CONNECTIONS

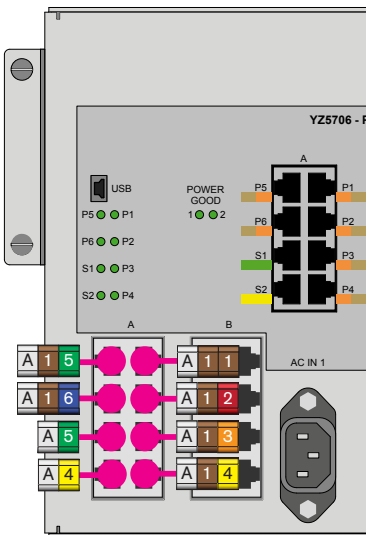
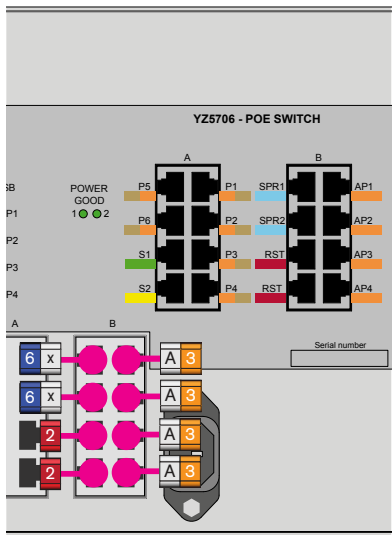


FIGURE 3 - POE "B" CONNECTIONS



SYSTEM PC

A high quality, low power fanless PC is mounted to the baseplate inside the control surface. The design of the PC used ensures reliability alongside minimal heat and acoustic noise.

The PC is supplied as standard with a traditional magnetic hard drive (HDD) or as an option can be supplied with a solid state drive (SSD). SSDs have no moving parts and are therefore quieter and more shock-resistant than traditional HDD's.

The system PC is not relied upon - it does not carry out any audio or control processing. The control surface, control and audio processors all boot and are fully functional irrespective of whether the PC is on or connected.

The PC is used as an interface, providing a comprehensive GUI for control as well as being used for configuration and diagnostics.

The PC monitor and keyboard tray are fitted at the right hand side of the control surface as standard. As an option, consoles can be ordered with keyboard and monitor at the left side of the surface. The keyboard tray slides out from

underneath the fader bed. If required, 2 PC monitors and / or keyboard trays can be fitted, one at each end of the control surface. The second set would typically be used as a convenient location for the operator to display / control other, non-Calrec PC's. Consoles can also be supplied without the monitor mount and / or keyboard tray, this is usually done when space is restrictive. In such a case, the installer should provide a suitable alternative to view and control the system PC.

PC power and reset

The PC should start up automatically when the control surface is powered. The Windows shutdown procedure should be followed whenever possible before removing power to the control surface. A reset switch for the PC is located at the back of the keyboard tray.

The power supply for the PC is located in the adjacent unit which also contains the headphone drivers. The PC power supply inputs POE DC voltage via RJ45s and outputs 12V DC on a 9 pin D-type connector. Two input connections provide redundancy against power loss and should be fed from two different POE switches,

using their SPR feeds to maintain power to the PC during surface reset. The 9 pin connector also contains a reset line for the PC which wires out to a switch in the back of the keyboard tray. The power input to the PC itself is via a DC jack socket.

System network data connection

The PC connects to the system in the same way as a control panel. The RJ45 Ethernet port on the PC itself is its data connection to the system and can connect to any available POE switch port P1 – P6.

Note that P1 – P6 ports are full POE and contain power. The PC's supplied do not take power from this connection, however they are designed to be protected from damage by POE voltage. Connecting other PC's or equipment to a POE switch may damage them. The Ethernet-USB adaptors supplied with the console (as shown in Figure 2) are POE protected and can be used to connect a replacement or backup PC via the backup / replacements USB port if required. One of these adaptors is supplied loose along with the miscellaneous items such as the backup discs and hex screwdrivers. As an option, the console can be supplied with an additional accessible USB port,

FIGURE 1 - PC POWER AND RESET

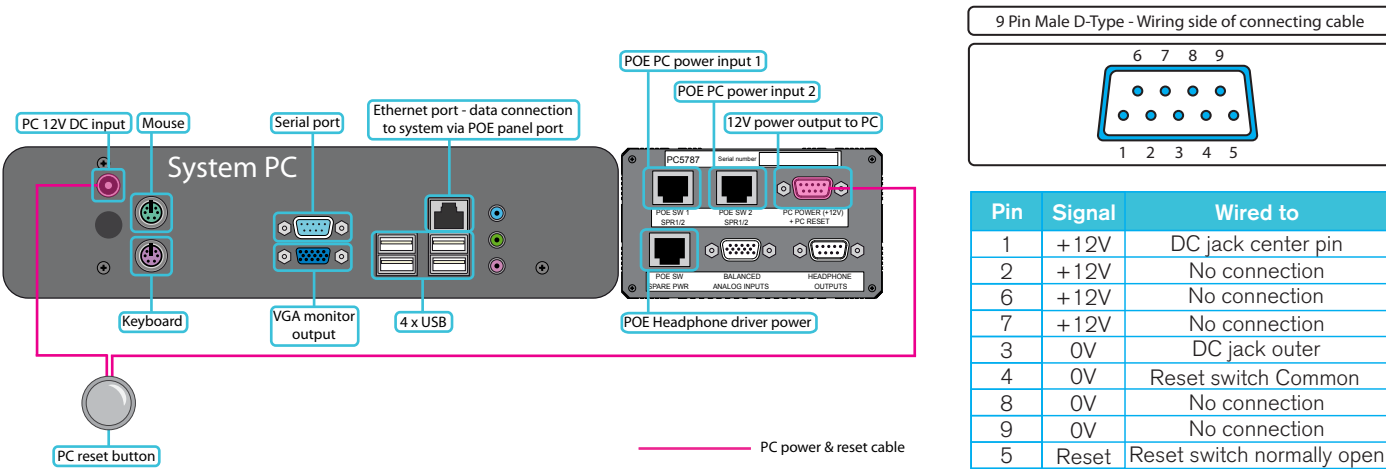


FIGURE 2 - USB TO ETHERNET



wired internally via an adaptor to a POE panel port, allowing for a backup PC to be connected quickly.

LAN connection

An RJ45 socket on the rear interface panel labelled "PC I/F" provides a second network connection to the PC. Internally, this wires via a USB-Ethernet adaptor which is fitted into a USB port on the PC. If connecting to a LAN or the internet, the security / firewall settings can be selected per connection. Security / firewall settings should NOT be changed for the main system network port - "CalrecDeskConnection".

Providing an internet connection to the PC allows Calrec engineers access for diagnostics by agreement using a secure connection.

Keyboard and mouse

As standard, a keyboard with trackball is located in the pull-out keyboard tray under the fader bed. The keyboard has two color coded PS2 connectors which fit directly in the PS2 ports on the PC. UK and US keyboard layouts are available.

Touchscreen monitor

The PC monitor is AC mains powered (100-240V) by a single IEC input, wired via the ancillary AC input to the control

surface. The graphics output from the PC to the monitor is a direct VGA connection. Touch data from the monitor is connected by USB. To correctly display all the Calrec PC applications, a minimum resolution of 1280 x 1024 is required.

Accessible PC USB port

The USB port on the upstand reset panel is connected internally to a PC USB port providing easy access for USB devices, for example for making backups of shows / user memories to a USB memory stick.

Operating system

Calrec system PCs are supplied with Microsoft Windows 7 Professional installed. Calrec software is currently only tested using the Windows 7 Professional platform and we cannot guarantee functionality using any other operating system.

3rd Party software

Even though the PC is not required for operation of the system, Calrec does recommend that the PC is regarded as an integral control device for the system. It should not be used as a general purpose PC. If 3rd party software is installed on the PC, care must always be taken to ensure that it does not interfere with the normal performance of the PC. The installation of inappropriate software on the PC may invalidate the console warranty.

Serial port

The current specification PC has one external serial port. This is connected to the DK meter serial port when fitted to allow convenient access for DK configuration in the factory.

Antivirus Protection

Antivirus protection is not pre-installed on console and router core PCs as standard but if you wish to protect your PC you can install a package of your choice. .

Exceptions will need to be configured within the antivirus software to allow the following to communicate with the Calrec system:

- C:\Calrec\WindowsService\DeskPcWs.exe
- C:\Calrec\ProgramUpdater\Calrec.ProgramUpdater.exe

BACKUP PC

Any standard specification modern PC running Windows XP Professional can be used as a backup or replacement to connect to the console and run the various Calrec applications.

Connection by the PC's USB port, via the supplied USB-Ethernet adaptor into a spare POE switch P1 – P6 port ensures the PC's network port is not damaged by POE power. Note, not all available USB-Ethernet adaptors have protection against POE power, please refer to the manufacturers specification if not using ones supplied by Calrec.

Starting the Calrec Main PC Application on a second PC will disable it on the first PC.

If using a laptop, or a different monitor screen to the one supplied, a minimum screen resolution of 1280 x 1024 is required to display the Calrec software correctly. Currently, such pixel height is not widely supported by budget range laptops.

Calrec can supply pre-configured laptops and replacement PC's ready to work out of the box. The setup instructions on this page can be used to configure a non-Calrec supplied PC. Minimum requirements for the PC are listed below.

MINIMUM PC SPEC

OS	Windows XP Pro
CPU	1.6 GHz Dual Core
RAM	1GB
HDD	160 GB
Ports	1 x USB or 1 x POE protected Ethernet port

APOLLO BACKUP PC SETUP

1. Download the latest version of Java Runtime Environment from www.java.com and install it on the Backup PC.
2. Download the latest version of .net Framework from www.microsoft.com/net and install it on the Backup PC.
3. Copy folder **C:\Calrec** from the Console PC onto the **C:** drive of the Backup PC.
4. Copy the folder **Drivers\WINXP\32 BIT** from the DUB E-100 Ethernet to USB adaptor installation CD onto the **C:** drive of the Backup PC
5. Plug the USB connection of the DUB E-100 USB network adapter into the Backup PC. Windows will automatically detect and start to install it. When prompted, select **Install from a specific location** and browse to the location the drivers were copied to in the previous step. Follow the on-screen prompts to complete the installation
6. Once the DUB E-100 has been successfully installed, go to **Start>Control Panel>Network Connections**, right click on the connection which uses the DUB E-100 and choose Rename. Rename the connection to **CalrecDeskConnection** (case sensitive) and click **OK**.
7. Right click on **CalrecDeskConnection** and select **Properties**, this will open the **Network Properties** window. Scroll down the list to find **Internet Protocol (TCP/IP)** and double click on it. Select **Use the following IP address**. In the IP address field enter **xxx.yyy.135.0** (where xxx.yyy match the first two bytes of the console IP address. If uncertain, open the Calrec program updater application which will list all the IP's in the system. They all have the same first two bytes). In the **Subnet Mask** field enter **255.255.0.0**, leave all other fields blank. Click on **OK**. You will be returned to the Network Properties window
8. Select the **Advanced** tab and click on the **Windows Firewall Settings** button. Turn the firewall off and click **OK** to confirm, then **OK** again to exit Network Properties.
9. Navigate to **C:\Calrec\WindowsService** on the Backup PC and double click on **install.bat**.
10. Go to **Start>Control Panel>Administrative Tools>Services**. Right click on **CalrecService** and click **Start**.
11. Go to **Start>Control Panel>System** and open the Computer Name tab and make a note of the full computer name. Go to **Start>Run** and type **cmd** then press **<enter>**. This will open a DOS command prompt. At the prompt type **c:** and press **<enter>**, then type **Calrec\Utils\setcacis** then press **<enter>**. When prompted enter the full computer name and press **<enter>**.
12. Connect the DUB E-100 to the console using a spare panel port (P1-P6) on one of the POE switches.
13. Navigate to **C:\Calrec\ConsolePC** on the Backup PC and double click on **run.bat**. This will open the Main Application. Note that the Main Application and Program Updater should not be running on the Console PC whilst the Backup PC is in use.

APOLLO PROCESSING RACK

RACK DIMENSIONS AND MOUNTING

The Apollo processing rack is an 8U 19" rack mount enclosure designed for installation in standard 19" equipment bays.

Airflow

The rack is cooled by fan assisted convection. Air is drawn in from the front into the cable-tray and up through the base of the card frame. Fans mounted in the top of the rack pull air through the card frame which then exits through vents across the top of the rear of the rack. All fans are speed monitored and AWACS error message are generated for any failures. To ensure air can flow through the card frame freely, the air vents at the rear of the rack should be left clear and unobstructed. Also, the cable-tray should not be overfilled, leaving space at the base of the card-frame by using the cable-tidy clips in the cable tray. No clearance is required above or below the rack for cooling.

Acoustic Noise

A fully populated rack has been measured to produce <40dB acoustic noise (A-weighted at 1 metre from front).

Support

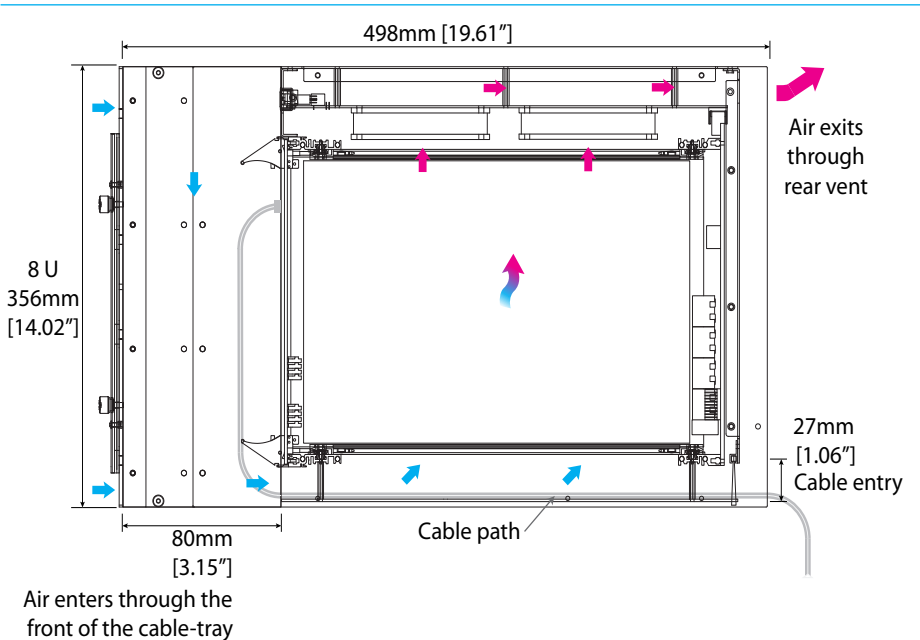
The weight at the rear of the rack should be adequately supported to prevent stress on the front racking angles. This is particularly important when the units are mounted in mobile installations. Calrec will not accept liability for damage caused by insufficient support.

Connections

All connections, including power are made to the front of the rack which is recessed from the racking angles to allow cable clearance within the bay.

A cable tray in the base of the rack allows for cables to be routed from the rear of the bay to the front of the rack. Cable tidy

SIDE PROFILE VIEW - DIMENSIONS & AIR FLOW



RACK SPECIFICATIONS

ED5708 Rack	
Height	8U (356mm)
Depth	498mm
Width	19" rack
Weight	17kg (max)
Heat Dissipation	300W (max)

clips in the cable tray keep cables at the base ensuring airflow into the cardframe is not restricted.

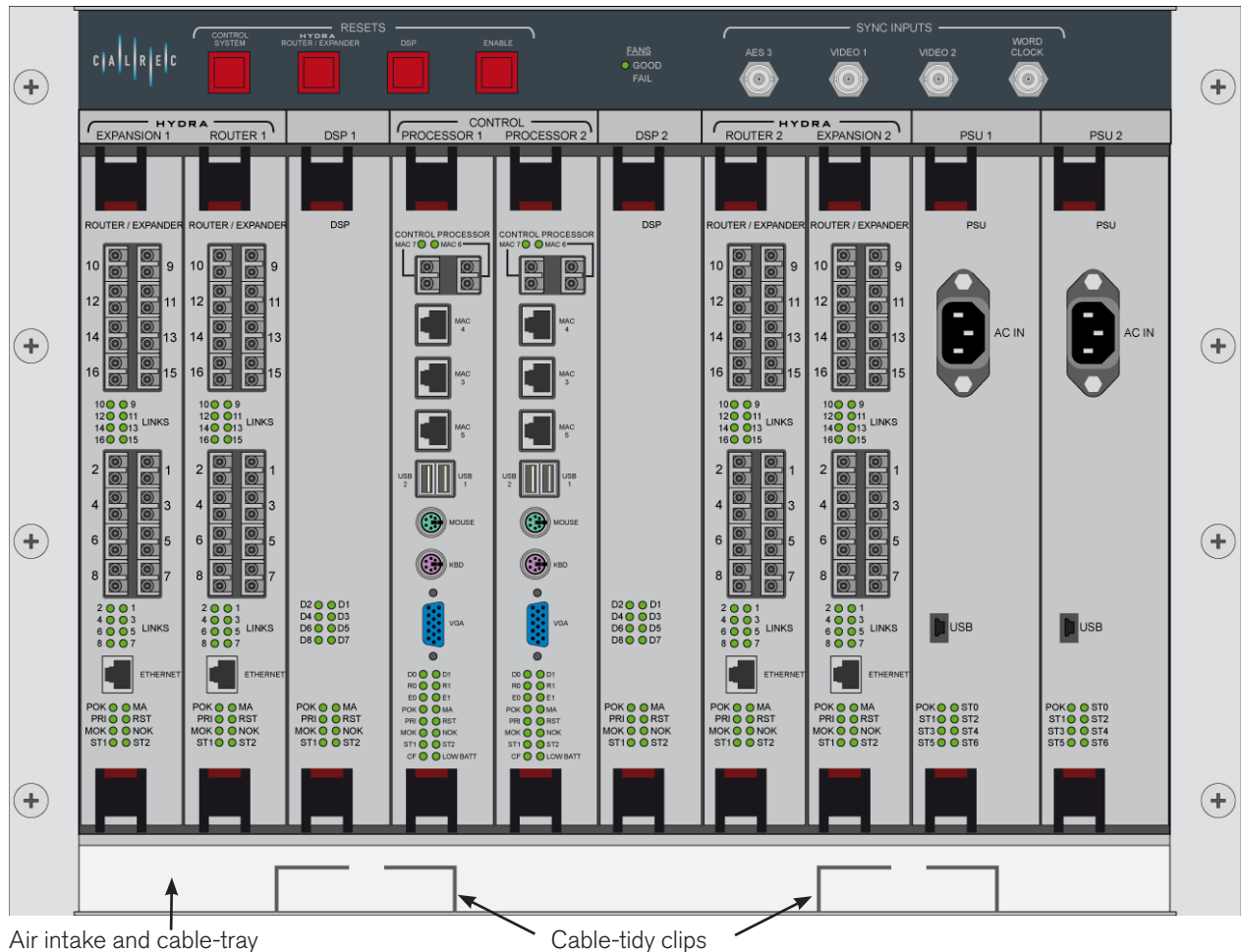
When routing cables through the cable tray and up to front panel connectors, observe the minimum bend radii recommended by the cable manufacturers. This is especially important for fibers and high speed data conductors.

Take care also to "dress" cables neatly so that they cause minimal restriction to the air flow.

Please refer to the Hydra2 installation manual for detail regarding specific router connections.

CARD TYPES AND LAYOUT

FRONT VIEW - FULLY POPULATED 8U APOLLO RACK



Card layout

The Apollo rack has 10 module / card slots. A slot should only be fitted with a module of the correct type for the slot. Slots are labelled for their type across the top.

Two of each type of processing card are fitted to provide comprehensive redundancy. The left hand card of each pair, labelled #1 is the primary / normally active card. The right hand of each pair,

labelled #2 is the secondary, hot-spare card.

A second pair of router cards can be fitted in the expansion slots if required to double the number of Hydra2 I/O ports available.

Both PSU cards when fitted are active and share the load of the whole rack. Only one PSU is required to power the rack however we recommend that both are fitted and fed to provide redundancy.

Reset, sync interface & fan status

Across the top of the card frame are the resets and sync interface. Three buttons can individually reset the control, router and DSP cards within the rack. A fourth button is the enable which must be pressed at the same time as any of the resets as a safety precaution. Be cautious if resetting the routers/expanders, other consoles on the same Hydra2 network may be using I/O connected to the routers in the rack being reset.

4 x BNC connectors provide sync inputs, allowing for redundancy and a range of formats. Two inputs are for SD / HD video sync signals, one for AES DARS and one for TTL wordclock.

The upper section of the rack also contains LED indication to show the status of the fans fitted within. Failures are also reported by the console's AWACS system.

Installing / removing cards

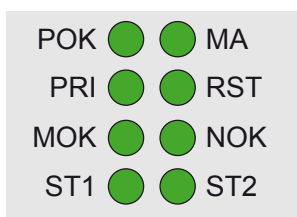
To remove a module from the rack, take hold of both top and bottom card handles, press both of the red latches and open the card handles outwards to lever the module away from the backplane connectors. The module can then be slid out of the rack. Avoid touching any exposed parts of the circuit board unless observing ESD precautions.

To install a module, line up the card edges with the card guides in the rack slot and gently slide it in. Ensure the handles are in the open position and push the card

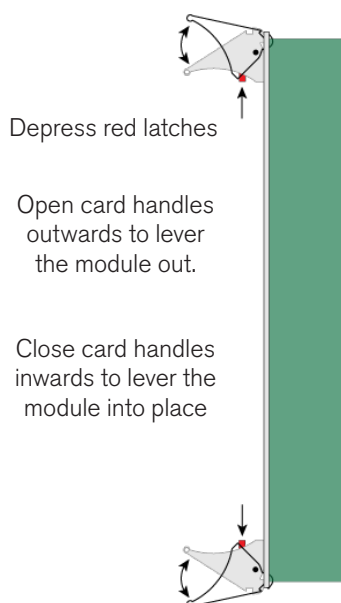
fully into the rack whilst closing the card handles to lever the module into place. A click should be heard when the module is seated fully.

Standard Status LEDs

Control, DSP and router cards have a standard set of front panel status LED's.



- POK - Power OK, module is receiving power.
- MA - Module active. Indicates which of the primary / secondary pair is actively in control.
- PRI - Indicates if the module is fitted in a primary slot.
- RST - Illuminates when the module receives a reset command.
- MOK - Module OK. Indicates the module has booted and is running, either actively or as a hot-spare.
- NOK - Neighbor OK. Indicates the presence and status of the alternate card of the same type. Neighbors are primary / secondary counterparts, rather than physically adjacent modules.
- ST1 & ST2 are Calrec engineering status LED's, the function of which varies by card type and can be subject to change with software version.



Master Control processor

Slots 4 & 5 are for control processor modules, slot 4 for the primary / normally active card, slot 5 for the secondary / hot-spare. The active Control processor is the central processor in the system, handling all control parameters and directing data between control surface, DSP and router.

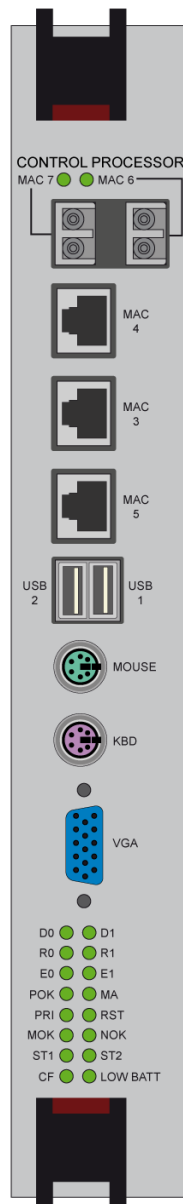
At the top of the module are two SFP slots that can be fitted with copper or fiber SFPs for interfacing with the control surface. The left hand "MAC7" SFP on the primary Control processor connects to the primary surface switch, MAC7 on the secondary Control processor connects to the secondary surface switch. MAC6 connectors are only used for very large control surfaces fitted with a second pair of surface switches, or to connect a sidecar containing its own pair of surface switches.

If the rack is configured as a Master Router, RJ45 port MAC5 should be used to connect standalone (outside of a console) PCs for accessing H20; the network administrator user interface. Ports MAC4 and MAC3 are for use by Calrec engineers only.

USB ports, keyboard, mouse and VGA connections are for use only by, or under the guidance of Calrec engineers.

As well as the standard status indicators, front panel LEDs are also provided to show the status of other cards in the rack - D0 for the primary DSP card, D1 for the secondary, R0 for the primary router, R1 for the secondary, E0 for the primary expansion card, and E1 for the secondary. The CF LED indicates write activity to the module's compact flash card and LOW BATT is a low battery warning for the module's BIOS. The Control processor's ST1 & ST2 LEDs indicate heartbeats from the module's two processing cores.

MASTER CONTROL PROCESSOR



DSP

The primary, normally active DSP card fits in slot 3, the secondary, hot-spare in slot 6. DSP cards are not required in standalone router racks without a control surface.

This audio processing module has no front panel connectors. All audio and data is passed to / from the Control processor and router cards via the rack backplane.

As well as the standard status LEDs, LEDs D1-D8 indicate the status of the signal processing cores within the module.

DSP MODULE



Router / Expander

The primary, normally active router card fits in slot 2, the secondary in slot 7. As an option, slots 1 and 8 can be fitted with additional router modules of the same type to double the number Hydra2 I/O ports in the rack.

The Apollo router card has 16 SFP ports that can be fitted with copper or fiber SFP's to allow connection of Hydra2 I/O boxes and connections to other consoles' routers and standalone router racks. A single RJ45 port labelled Ethernet allows for the connection of 3rd party equipment supporting the SW-P-08 or Ember protocols for remote control.

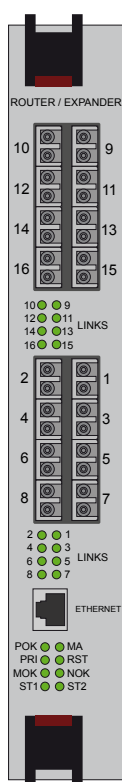
As well as standard status LED's there are front panel LED indicators to show activity on each port.

Power Supply

Card slots 9 & 10 are for PSU modules. Both slots share the power load for the whole rack. One PSU module is sufficient to power the whole rack, two are fitted to provide redundancy.

Each card has an IEC AC mains input connector, requiring 100-240V AC.

ROUTER / EXPANDER MODULE



PSU MODULE



APOLLO CONNECTION INFORMATION

SFP - OVERVIEW

The connections between control surface and processing rack, as well as all Hydra2 network connections - connections between I/O boxes and routers, and router to router connections between different racks, are made via SFP modules (Small Form-factor Pluggable Gigabit Interface Converters).

SFPs can be provided for RJ45 copper connections, as well as for singlemode or multimode fiber on duplex LC connectors. This allows for each port's connection type to be chosen depending on the distance of the run or to match the infrastructure present. SFPs can easily be changed on a port by port basis as and when required.

The correct quantity of SFPs are supplied pre-fitted. The type of each connection - copper, singlemode fiber or multimode fiber, should be specified at the time of order to ensure the correct SFP type's are supplied. Additional SFP modules can be ordered if required. If a system is to be connected to an existing Hydra2 network, please discuss this with your

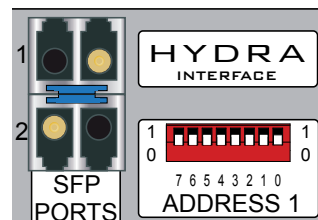
Calrec project leader, sales person or local distributor to ensure that SFPs are provided and ports provisioned for the additional router to router connections.

SFP slot orientation

SFP modules plug into front panel slots on router and modular I/O controller cards, and rear panel slots on fixed format I/O boxes. The modules can be fitted or removed whilst the system is powered and without removing or opening any card or box cases.

Note the orientation of the SFP modules, as shown in the illustrations on this page - modules fitted in even numbered router ports (left hand column) are fitted the opposite way around to those in the odd numbered router ports (right hand column). Likewise for fixed format I/O boxes, the primary SFP module is the opposite way around to the secondary SFP module. The modules are orientated so that the release catch for the RJ45 / LC connector plugs once inserted are on the outside edge.

FIXED FORMAT I/O BOX SFPs



- I/O box shown with singlemode fiber SFPs (button release) fitted.

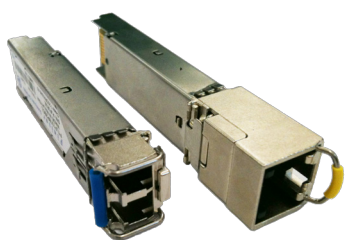
For modular I/O box controller cards, both SFP slots are orientated so that the release catch on the cable / fiber connector are on the right-hand side.

MODULAR I/O BOX SFPs



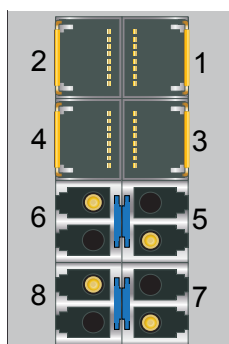
- Modular I/O controller card SFPs are both orientated the same way around (Button release singlemode fiber SFPs shown).

SFP MODULES



- Both SFP types above have a handle latching mechanism, shown in the locked position. The unit on the left is a singlemode duplex LC fiber module. The unit on the right is a copper RJ45 module.

ROUTER CARD SFP ORIENTATION



- Router card shown with copper SFPs fitted in ports 1-4, singlemode fiber (button release) in ports 5-8.

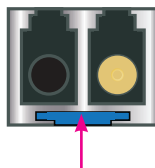
SFP latching and extraction

Calrec source SFP modules from various manufacturers. All types used conform to the same specification, however the latching mechanism on them can vary slightly.

The standard copper SFPs and some fiber SFPs as shown in the photograph on the previous page have latch / extraction handles. On insertion, the handles should be set against the outer edge (the same side as the release catch on the RJ45 / LC connector plug that fits into the SFP) to lock it into place and prevent accidental removal if cables are pulled.

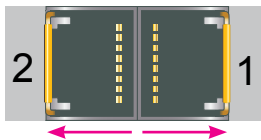
Other SFPs automatically latch into place when they are inserted fully and have a release button on their inside edge. The fiber SFPs shown in the orientation diagrams and below are of this type and have blue release buttons. To remove, depress the button using a small flat blade screwdriver or similar tool. The SFP module will then be free to be removed.

AUTO-LATCHING SFP



- Depress the release button to remove.

SFPS WITH HANDLES - LATCHED



- Both SFPs shown are locked in place - Latch / extraction handles in outer position (or "down" position for fiber).

To remove this style of SFP, remove the cable / fiber and slide the handle (copper) or lift the handle out (fiber) to the inside edge position as shown in the diagram below. The module can then be removed by pulling on the handle.

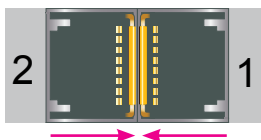
SFP slot covers

Dust covers should be fitted to all SFP slots that do not have SFP modules fitted in them in order to maintain plug-in connection reliability.

Loose SFP storage

SFP modules are small, yet reasonably expensive devices. When removing or changing SFPs, take care to keep track of them and store loose modules in a clean, dry, and anti-static environment. Fiber SFPs should always have a dust cover fitted into their optical transceiver end when no fiber is connected to them.

SFPS WITH HANDLES - UNLATCHED



- Both SFPs free to remove - Latch / extraction handles in inner (or "Lifted" for fiber) position.

COPPER SFP CONNECTIVITY

Hydra 2 network connections and control surface to processing rack connections made via copper SFP modules require shielded F/UTP Category 5e or Category 6 cables with shielded RJ45 mating connectors.

Calrec do not supply these cables as it is often preferable to terminate them after they have been run through cable ducting to avoid damaging the terminations, and to be able to cut them to the precise length required.

Shielded cables and connectors

Shielded cabling and connectors are required in order to meet EMC (Electro-magnetic compatibility) standards to comply with the Class B radiated emission limits set in the standard EN55022, as well as to guarantee performance in electrically noisy environments.

F/UTP Cat5e/Cat6 cable has an overall foil shield around the conductor cores. Shielded RJ45 connector plugs have a metallic shield around them which should be clamped / bonded to the shield within the cable. The shield on the connector mates with the chassis of the RJ45 socket that it is plugged into, providing an earth to the cable shield.

The method of attaching the connector shield to the cable shield can vary. Please refer to the connector manufacturer's information for further guidance.

SHIELDED RJ45 CONNECTOR



Conductive connector mating screen clamped / bonded to cable shield

Maximum cable length

The maximum length of Cat5e/Cat6 cables is 100m / 328ft. This is the absolute maximum and needs to include any patch points and cables that may be in the path. Hydra2 cable runs can NOT be extended using Ethernet switches, hubs or repeaters. If a run between Hydra2 hardware exceeds the maximum recommended distance for copper cabling, fiber and optical SFPs should be used instead.

Cable routing considerations

The layout and twist rate of the data cores within Cat5e/Cat6 cables are integral to their performance at high speed over distance. Poor installation practise can seriously impact upon this. The following are general good rules of practise, please refer to the cable manufacturer's information for comprehensive installation rules.

When running Cat5e / Cat6 network cabling, it is important to avoid kinking the cable. Kinks can seriously impair performance. Cable manufacturers advise that kinked cables should be discarded and replaced as the damage caused cannot be addressed simply by straightening the outer appearance.

Cables should not be bent in tight angles, this too can seriously impair performance. Please refer to the cable manufacturer's specification on minimum bend radii.

Excessive pulling force when routing cables can deform the twist rate of the cable cores, causing irreparable damage. Cable manufacturers specify a maximum pulling tension.

Cable-ties should not be over-tightened as this also deforms the internal structure of the cable. Cable ties should be tight enough only to support the cable weight

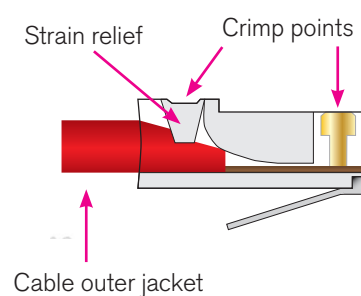
but not so tight as to cause any visible deformation to the cable's outer jacket. Large, heavy bundles of cables can be difficult to support using cable-ties without causing damage. "Velcro" style hook-and-loop cable straps can be a good alternative to plastic cable-ties.

Whilst neatly bundled parallel cable runs are tidy and aesthetically pleasing, they decrease cross-talk immunity which can impact on performance. Avoid neat bundling of network cables over any kind of distance - the majority of a cables length is normally unseen, running under floor or through ducting where they should be loosely laid rather than neatly bundled.

Termination - strain relief

Poor termination and lack of strain relief is one of the most common causes of high speed network cable problems. To properly strain relief the data cores, the outer jacket of the cable should be inserted into the RJ45 housing and held in place once crimped by the strain-relief point, as shown in the following diagram. This also maintains the integrity of the twist rate and shield into the termination,

STRAIN RELIEVED RJ45 TERMINATION



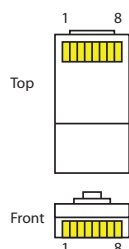
- Note, this is a simplified diagram that does not include the shield.

and therefore the full length of the cable conforms to its' intended specification. Slide on outer boots offer additional strain-relief protection but are not sufficient on their own. In order to be able to crimp the cable jacket inside the RJ45 and land the data cores on the terminals, the amount that the jacket is stripped back in relation to the cores needs to be quite accurate. Cables with exposed data cores should not be used as they will be unreliable.

Termination - pin-out

Hydra2 network cables use the standard gigabit Ethernet pin-out. Performance relies on the positive and negative leg of each signal pair using cores that are twisted together. Calrec recommends that "straight-through" or "pin-for-pin" cables are used. "Cross-over" style cables can be used, however they must be gigabit standard cross-over. Older pin-outs, designed for use with slower Ethernet standards only use two of the four pairs, even though all four pairs are terminated. Cross-over variants of this style only cross the pairs that are used (A & B). Gigabit cross-over cables require that the blue (C) pair is crossed with the brown (D) pair as well as the orange (A) pair being crossed with the blue (B) pair.

STANDARD HYDRA2 RJ45 PIN-OUT



RJ45 PIN NUMBERING

Pin	Color	Signal
1	Orange-White	A+
2	Orange	A -
3	Green-White	B+
4	Blue	C+
5	Blue-White	C -
6	Green	B -
7	Brown-White	D+
8	Brown	D -

- For standard wiring, both ends of the cable should be terminated as above

Testing / certification

Calrec strongly recommend that all Hydra2 network cabling is properly tested or certified prior to on-site commissioning of the system. Simple test devices that only check the pin-out of the terminations are not sufficient to prove the performance and reliability of high speed data cabling. Certification level test equipment can give a simple pass / fail response but in doing so will test various important factors as well as pin-out. Certification type tests include determining cable length, measuring skew (timing differences between pairings due to variations in length caused by intentional differences in twist rate), measuring for loss, signal to noise ratio and BERT error checking on data.

Cables that fail certification tests or fail to perform, may appear to function fine

in other applications, such as a PC LAN connection where errors leading to retries and therefore delays are acceptable and often unnoticed.

Temporary / reusable cables

Cabling that is not part of a permanent infrastructure, such as temporary runs used for outside broadcasts should be carefully coiled and uncoiled to avoid kinking and they should be regularly tested. Cables showing any sign of damage should be replaced.

FIBER SFP CONNECTIVITY

Optical SFP modules for fiber connectivity can be used for console to processing rack, router to router, and router to I/O connections.

Fiber connectivity is required when the cable run between units exceeds the maximum permissible length for Cat5e/ Cat6 copper cabling. Fiber can also be used for shorter runs if it is simply the preferred medium.

Note that this section only concerns fiber connections made via SFPs. Like all I/O boxes, MADI units have pluggable SFPs for their Hydra2 connections to routers, but they also have fiber connectors that pass the actual MADI audio format in and out of the system. The MADI I/O format fiber connectors are of a fixed type which has no relation to SFP choice. Different build types of MADI I/O box are available to provide various types of MADI fiber interface. Please refer to the Hydra2 installation manual for more details on MADI I/O options.

Singlemode vs multimode

The core within multimode fiber is relatively thick when compared to singlemode. Light travels through multimode fiber at multiple angles, “bouncing” of the sides of the core as it travels through it, taking multiple paths, or “modes” of varying length from one end to the other, resulting in pulses being lengthened as they travel. Singlemode fiber has a very fine core and light travels in a single, direct path from one end to the other without affecting pulse length. The result is that singlemode fiber has a higher bandwidth capacity and importantly, low signal loss allowing much greater distances to be achieved. Light can be transmitted into multimode fiber using LED’s or low powered lasers whilst singlemode requires a higher powered laser.

Calrec recommend the use of singlemode fiber whenever possible in order to maximize the flexibility in the location of hardware and maintain uniformity across the system by using a single type. If a multimode infrastructure is in place, fiber length, the number of inter-connects and equipment location become more important.

SFP modules are available for both singlemode and multimode fiber types. It is important to select the correct SFP for the type of fiber being used in the installation. If using a mixture of singlemode and multimode fiber, it is important to ensure the correct SFPs are matched to the correct fiber type.

Identification

The release button / handles of fiber SFPs are color coded - Blue for singlemode, Black for multimode. Blue LC connectors, as shown below should be used to terminate singlemode fiber, and beige colored ones for multimode.

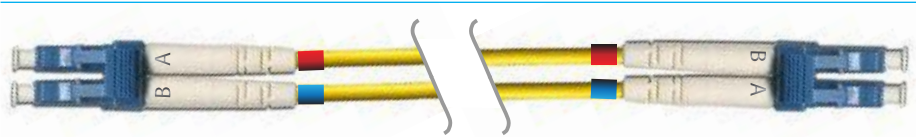
Connectors / terminations

All Calrec fiber SFPs, multimode and singlemode use duplex LC connectors. The duplex termination requires two fibers per connection, one is a send path, the other is a receive path. When terminating the fiber, the send from one end should connect to the receive of the other and therefore they are “cross-over”, terminated A to B and B to A.

SFP / fiber specifications

Specifications are shown in the table below. The maximum distances shown assume a single point to point connection with no intermediary interconnections. Losses should be measured across the total signal path including interconnects - between points of transceiver connection. Losses need to be less than the optical power budget of the SFP transceivers being used.

DUPLEX LC FIBERS CORRECTLY TERMINATED A TO B & B TO A



SFP COPPER / FIBER SPECIFICATIONS

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	LC Duplex	SX	7.5dB
Fiber 50/125µm Multimode	550m	LC Duplex	SX	7.5dB
Fiber 8/125µm Singlemode	10km	LC Duplex	LX	8dB
Fiber 8/125µm Singlemode	70km	LC Duplex	LH	23dB

FIBER – GENERAL RULES

Testing / certification

Calrec strongly recommends that all fibers are properly tested or certified prior to onsite commissioning of the system. A certain amount of signal loss occurs over the length of a fiber path. If the total loss of a path exceeds the optical power budget of the SFPs in use, the system will be unreliable.

Areas of loss

Signal loss occurs in various areas. Splice loss occurs in terminations - at the point where the fiber meets the connector. Typically splice loss should be <0.3dB per termination. Poor termination results in higher loss.

Connector loss occurs at the point where the connector meets the SFP / optical transceiver, or another connector, such as extension interconnects or patch-points. Connector loss should typically be <0.5dB per interconnect. Dust or other contamination between interconnects and scratches on the end surface contact point of the fiber will substantially increase the amount of loss. As such, dust covers should always be fitted to optical transceivers such as SFPs when no fiber is connected and to fiber connectors that are not landed.

As well as splice and connector loss, the fiber itself has inherent loss over distance, typically fiber loss will vary from 3.5dB per Km for multimode down to 0.4dB per Km for singlemode. Poor installation practise and lack of care can damage the fiber and result in substantially increased losses.

Fiber handling practise

It is important to follow the fiber manufacturer's guidelines when handling fiber and installing fiber runs. Some of the main points of concern are:

- Minimum bend radii - fiber should not be bent through too tight an angle. Tight angles can cause significant losses and permanent damage to the fiber. Fibers may pass initial installation testing but can fail at a later date due to stresses on the core of the fiber caused by tight bends.
- Twists, snags and kinks - Twists in fiber runs add stresses to the core which can cause damage over time. Avoid snagging on other cables or conduit which will cause excessive tensions when pulling and can cause kinks and excessive bends in the fiber. When routing through angled conduit, provide enough clearance around corners to avoid the fibers being pulled sharply around the inside of the angle.
- Pulling - observe the manufacturers maximum pulling tension specification. Use pulling tools and lubrication where appropriate. Never pull on the connector.
- Strain relief - fibers should be adequately strain relieved to prevent tension on terminations, however use of plastic cable ties can crush the internal construction of the cable. Hook-and-loop "Velcro" straps are harder to over-tighten, offer more gentle support and a greater surface area to dissipate the pressure.
- Crushing - never place heavy items on top of unprotected fiber.

Ruggedized fiber

For temporary / re-usable fiber runs, or runs unprotected by conduit, fiber that is likely to be exposed to the elements, snagging or to being stood on, should always be of a ruggedized / armored type to protect the internal construction of the core.



WARNING

Never look into the end of an optical transceiver or fiber when in use. Laser radiation can be harmful to the human eye and should be avoided.

Remember that when disconnecting a fiber, the transmitting device at the other end may still be active.

Cleaning and preventative maintenance

Contamination of transceiver and fiber mating contact points causes signal loss and can cause permanent damage by scratching.

Dust covers should be fitted to all fiber connectors and SFP optical transceivers when they are not mated. It is also important to ensure that dust covers themselves are kept clean.

When handling fibers without dust covers, do not allow the ends to come into contact with any surface, including fingers.

Specialist materials should be used for the cleaning of mating contact points to avoid further contamination or scratching. The following items are low cost and readily available from camera shops and laboratory suppliers:

- Canned compressed air - it is important to use specialist filtered, clean, dry air, free of contaminants and moisture.
- Isopropyl alcohol. Use with cotton swabs or lint-free wipes to ensure no residue is left.
- Lint free wipes / long fiber, low ash lens paper - needs to be free from chemical additives. Ensure wipes

and swabs are stored in a clean environment and are not reused.

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 SFP 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.

SYNCHRONIZATION

The Apollo processing rack has 4 inputs to allow connection of external sync. If no external sync is connected and selected, the console will free-run on its own synchronization clock, generated by the active router card.

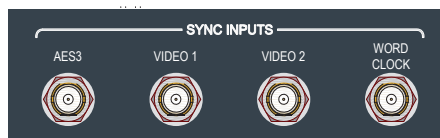
General rules of good practice require that all equipment connected to the audio console's digital inputs and outputs are all locked to the same referenced sync source as the console to ensure clean audio.

In systems with multiple Calrec processing racks; i.e. where more than one Apollo/Artemis consoles are connected together, or where standalone Calrec router racks are used, it is of paramount importance that all connected processing racks are locked to the same referenced sync source.

One or more racks receiving a sync signal that is not locked from the same clock reference as other racks will cause interruptions to both audio and data carried by the routers. This can lead to false error warnings and I/O boxes going offline. Therefore it is essential to consider a robust sync distribution design for the facility and to ensure all points in the chain are correctly configured to lock to the appropriate input and no elements such as sync regenerators are changing the reference source or free-running.

It is also recommended that backup sync sources and paths are considered to maintain full functionality in the event of the loss of any part of the facilities' sync distribution system.

FIGURE 1 - SYNC INPUTS



External sync sources can be fed to the BNC connectors at the top of the processing rack (Figure 1). Two inputs are available for video formats, as well as an input for TTL Wordclock and an input for AES3 digital audio reference.

Sync source selection

The sync sources to be used have to be selected from the Console PC's Main Application, Fixed Options>Sync page, or by the Hydra2 Organizer.

The Main Application must be in technician mode (enter username and password on the Tech page) to change sync settings.

Only one sync source is active and locked to at any given time. Multiple sources can be selected by priority to determine the next choice to use in the event of the active source failing.

The Sync page shows the available sources on the left and the selected sources on the right. The last of the "selectable" sources is actually fixed as Internal to ensure that console will run on its own clock when no external sync is present.

On boot up or reset, the console attempts to lock to the first sync source in the selection list. If it cannot lock to the first choice, it will move down the list in order until a choice can be locked to.

The source currently locked to is displayed on the screen. Any sync failures to the local rack will be reported by AWACS. If

a failed sync input becomes good, the console will NOT automatically re-lock to it as any changeover in sync could affect audio. Switching back to the primary sync choice is done manually by clicking "Reset to 1st" on the sync page, or automatically after the next boot / reset.

To change the sync sources selected, click on the desired source on the left, the desired destination on the right and then click "Patch".

The video inputs can be fed with analogue or digital video in NTSC, PAL or a variety of HD / tri-level formats. The correct video format for each video input being used needs to be specified from the Sync page.

SURFACE TO RACK CONNECTION

A connection is required between the Control processors in the processing rack and the Surface Switches inside the control surface.

These connections are via SFPs, the SFP type will be either fiber or copper, as requested at order depending on the distances and infrastructure involved.

Calrec do not provide these interconnecting fibers / cables as the length, type and quality will vary depending on the specific requirements of each installation.

Copper connections should be made using screened Cat5e or Cat6 cable. For more information on copper connections, SFPs and fibers, please see the Connection Types and Cat5e Cables sections.

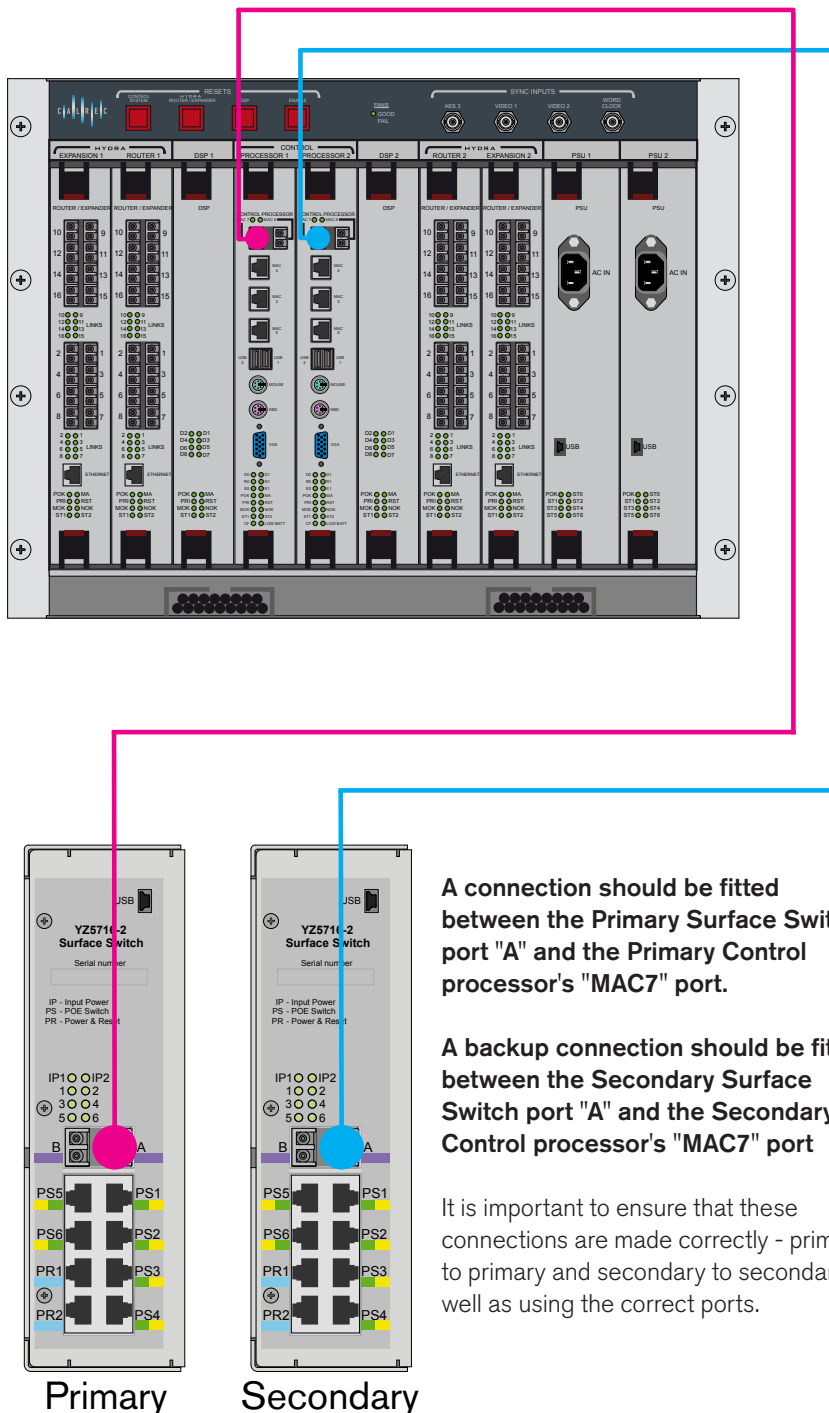
The illustration to the right shows the location of the connections on the rack and surface switches.

The two surface switches are located inside the control surface, mounted to the rear cover of the section containing the IEC mains power inlets. These can be accessed by removing the control surface panels and upstand meter panels in that area of the console.

The two surface switches should be easily identifiable on the rear cover.. The left hand unit, when viewed from the front is the primary Surface Switch, the right hand unit is the secondary Surface Switch.

In the processing rack, the card labelled "Control Processor 1", in slot 4 is the Primary Control processor, whilst slot 5 "Control Processor 2" is the secondary Control processor.

RACK TO CONSOLE CONNECTIONS



A connection should be fitted between the Primary Surface Switch port "A" and the Primary Control processor's "MAC7" port.

A backup connection should be fitted between the Secondary Surface Switch port "A" and the Secondary Control processor's "MAC7" port

It is important to ensure that these connections are made correctly - primary to primary and secondary to secondary, as well as using the correct ports.

CONTROL SURFACE SIDECAR CONNECTION

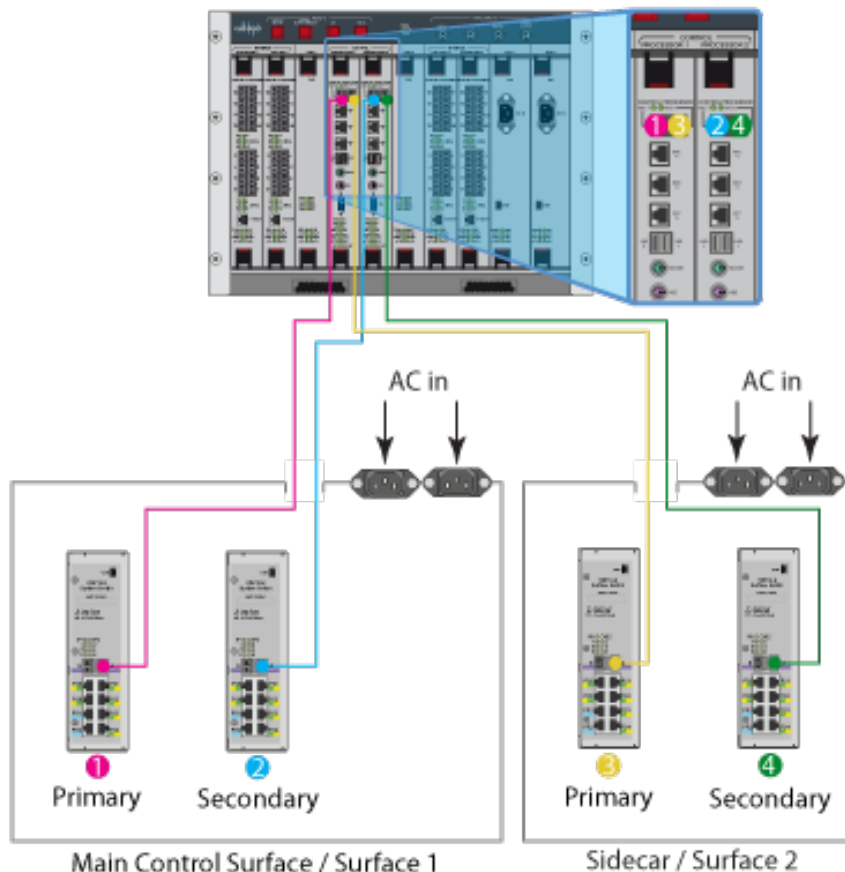
The processing rack supports an additional connection for a second control surface known as a sidecar.

A sidecar surface, unlike a surface extension is fitted with its own pair of surface switches and connects to the MAC6 SFP ports on the Control processor cards in the processing rack, as shown in the adjacent diagram. The primary surface switch needs to be connected to the primary controller card, and secondary switch to secondary card to provide redundancy.

The Calrec Main PC Application, Fixed Options>Surface Layout page defines the control surface panels that are fitted. The layout shown on the "Surface 1" tab relates to the main control surface, connected to the control processor MAC7 ports. The layout shown on the "Surface 2" tab relates to a sidecar surface connected to MAC6. The surface layout numbers the POE switches starting from #1 for both surface 1 and surface 2. The surface layout page allows for different console layouts to be created, edited, saved and loaded onto the control surface(s). For systems that have temporary sidecars it is advisable to have two surface layouts saved, one with a sidecar/surface 2 and one without. Loading a surface layout with a surface 2 sidecar enables the sidecar control panels. Loading a surface layout without a surface 2 configuration prevents error messages being generated for panels that are not present when the sidecar is removed or not powered, as well as preventing paths being placed on faders that are not currently present.

As with the main surface, the sidecar can be supplied with copper or fiber connections depending on the distance required between the processing rack and the control surface.

MAIN SURFACE / SURFACE 1 & SIDECAR / SURFACE2 CONNECTIONS



Both control surfaces have full access to the DSP within the processing rack as well as to all of the I/O that the processing rack has been given access to. To prevent control conflicts, user splits can be put in place between the two surfaces and different monitoring outputs can be set up for each one. Please refer to the console operator manual for further information on user splits and monitoring.

Both the main surface 1, and the sidecar surface 2 can be physically split further using extended control surface's if required.

Extremely large control surface's would require 2 pairs of surface switches fitting in the single chassis surface in order to be able to communicate with the high number of control panels. In such a case, the single chassis would connect to both MAC6 & MAC7. The surface layout for the single control surface would be split across the surface 1 and surface 2 screens. In such a case, a separate sidecar cannot be added, though surface extensions may be.

EXTENDED CONTROL SURFACE CONNECTIONS

In addition to sidecars, console chassis' can also be split using extended control surfaces.

This can be to allow multiple operators the comfort of more space, to create a "wrap around" surface for small rooms or large consoles to bring faders closer, or to provide control from a different location.

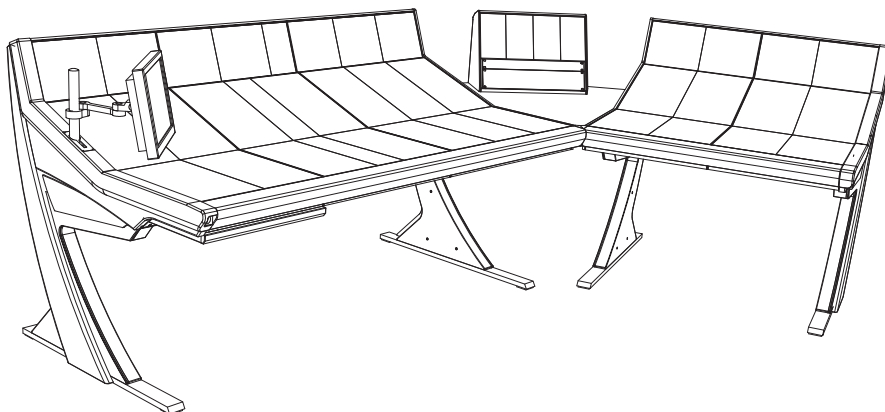
Unlike a sidecar, a control surface extension is not fitted with its own surface switches and therefore does not connect directly to the processing rack. Instead, console extensions connect to the main control surface via its' surface switches. Multiple surface extensions can be added, limited only by the maximum number of POE's that can be connected to the surface switches. Surface extensions can also be used in conjunction with sidecar surfaces.

Using surface extensions and / or sidecars in conjunction with user splits and multiple monitor or headphone outputs, along with the huge resources of both input channels and output buses allows multiple operators to work independently on a single rack system.

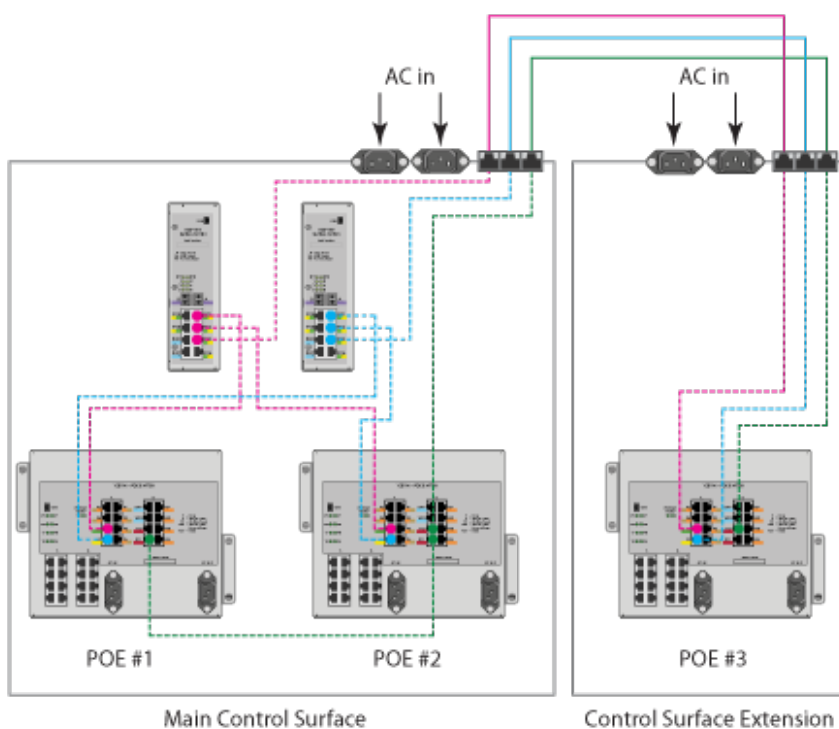
Consoles built with the intention of connecting to extensions will have RJ45's mounted and labelled in the rear interface for this purpose. A primary and secondary data connection between the surface and the extension are required. A third RJ45-RJ45 connection, carrying the reset lines is optional, depending on whether the extension is fitted with its own reset button or not.

Screened Cat5e cable should be used to guarantee performance. These connections use standard Ethernet pin-outs and pairings. The reset cable, if used needs to be a "straight-through" pin out, NOT a "cross-over". See Category 5e

CONTROL SURFACE EXTENSION USED TO CREATE "WRAP-AROUND" CONSOLE



SURFACE EXTENSION CONNECTIONS



Cable section for further info. As these are copper only connections, the cable distance between surfaces is 90m [295 ft] maximum.

AUDIO I/O CONNECTIONS

All audio inputs and outputs to / from the console signal processing engine are Hydra2 based.

Audio Formats

Hydra2 I/O units come in a variety of formats and connector types including MAD1 and SDI embedders / de-embedders as well as standard AES digital and analog mic/line formats with a variety of connector types. Please refer to the Hydra2 installation manual for full details on I/O.

Power

All Hydra2 I/O units are fitted with dual power supplies & IEC mains input connectors operating from 100-240VAC. Both power inputs should be fed, preferably from two separate AC sources to provide full redundancy. IEC "Y" cords are supplied to allow both inputs to be fed from a single cable source in the event that this is all that is available, ensuring both PSU's can always be fed.

ID configuration

Each I/O box in a system needs to be given a unique ID, set by a DIP switch accessible from the rear of a fixed format box, or on the side of the controller card within a modular I/O box.

Box ID's, as well as system IP addresses are factory pre-configured and recorded prior to despatch. When ordering additional Hydra2 I/O, please discuss with your sales person or Calrec project engineer to select suitable ID's for the system it is to be used with.

If fitting a replacement I/O box, settings its ID to the same as the unit it is replacing allows it to function as a drop in replacement with existing user memories and requiring no further configuration (as long as the box types are the same).

Care should be taken when setting HID's to avoid accidentally duplicating the same ID on more than one box. Duplicate box ID's can cause network conflicts. I/O boxes should be disconnected from the network before changing their HID, and reset or power cycled once the DIP switch is set to ensure the new HID is active before reconnecting to the network.

Do not change I/O box ID's or add extra I/O to the system unless you are confident it will not cause a conflict on the network.

Fixed format I/O box ID's

The 8 way DIP switch is set as an 8 bit binary representation of the HID value with the left hand switch used for the most significant bit, and the right hand switch for the least significant bit. A switch in the down / off position represents a binary 0 and a switch set in the up / on position representing a binary 1. Each switch / binary bit equates to a decimal

value, starting at 1 for the least significant bit. The remaining switches are double the value of their less significant neighbor, making the 8th / most significant bit equate to a decimal value of 128.

All fixed format I/O box ID switches are orientated the same way, though some boxes, such as MAD1 units, use a different style switch with more pronounced labelling. Ignore any labels on the switch itself and always refer to the Calrec labelling on the surrounding panel which will show the most significant bit switch on the left and the binary 1 position as up.

Address 2

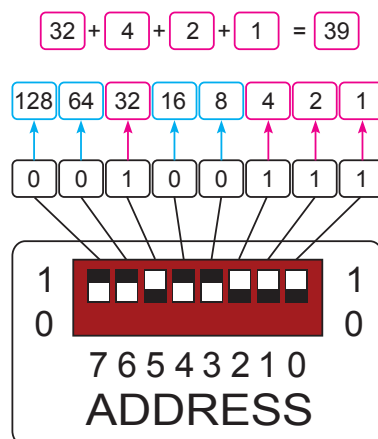
Some I/O boxes, such as MAD1 units are fitted with 2 banks of DIP switches - Address 1 and Address 2, to provide a 16 bit ID and therefore a greater range of values. Please note that only ID values between 0 and 255 are currently supported. Any DIP switches labelled Address 2 should all be set to the off position.

Modular I/O box ID setting

The ID for modular I/O boxes is set by a DIP switch on the controller card and is only accessible by removing the card. Please refer to the Hydra2 installation manual and ensure ESD precautions are observed before removing any modular I/O box cards.

ID switches on modular I/O controller cards are orientated differently. Ignore any labelling on the switch itself and refer to the Calrec labelling printed on the circuit board around the switch to clarify its' orientation. When viewing the card from the side, the most significant bit is on the left and the least significant bit on the right. Pulling a switch towards you sets it as a binary 1, away from you as a binary 0. The following illustrations show the ID switch on the modular I/O controller

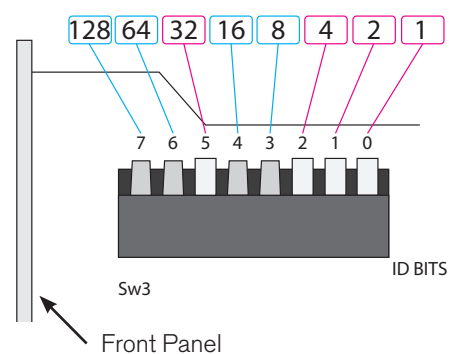
STANDARD SWITCH FOR HID SETTING



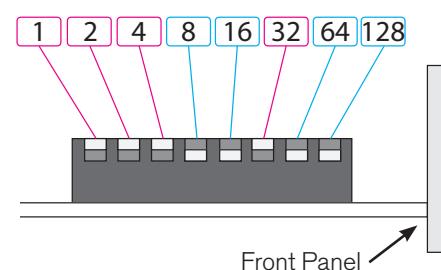
- The above diagram shows how each switch relates to a decimal value. The setting shown in the example provides a decimal HID value of 39

card from the side and top views. Again the decimal value of 39 is used for the example.

MODULAR I/O CONTROLLER - SIDE



MODULAR I/O - VIEWED FROM TOP



Modular I/O card slots

Please note that changing the card type fitted in a modular I/O box slot requires a change to the network configuration. If the order that cards are fitted in a modular frame matters, please discuss this with your Calrec project engineer prior to delivery. If for any reason the card order needs to be changed post delivery, please contact our Customer Support team or your local distributor for guidance. Cards of the same type can be interchanged with no configuration change being required. Additional cards can be fitted in previously empty slots without further configuration.

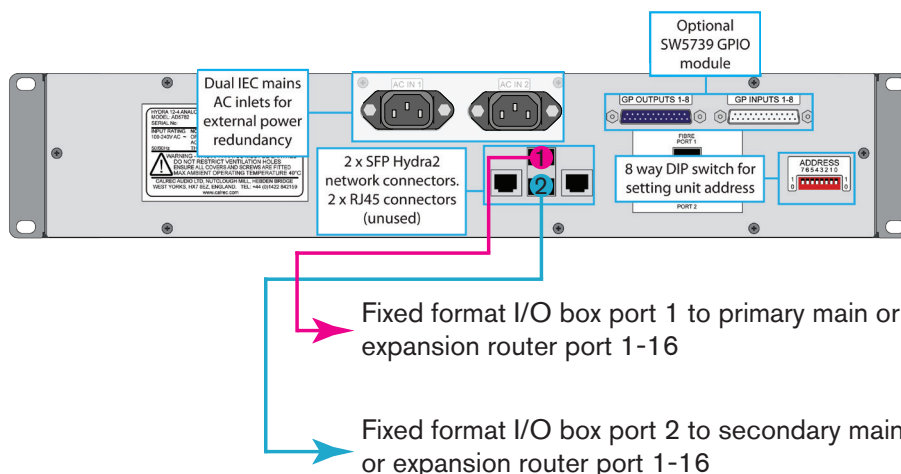
Like the Hydra2 ports on the router card, Hydra2 connections on I/O boxes are made via SFPs and therefore the connection type required (copper / single mode fiber / multimode fiber) needs to be specified at the time of order. Note that any fixed RJ45s on the rear of Hydra2 I/O boxes are not functional, if copper connections are required, copper SFPs should be specified.

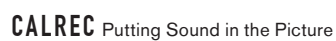
Please refer to the Hydra2 installation manual and H20 user guide for more comprehensive details on Hydra2 I/O options and connectivity.

Hydra2 connection

I/O boxes require a direct connection to a front panel Hydra2 port on the main router card, or the expansion router card if fitted. Each I/O box has two Hydra2 ports to provide redundancy. Port 1 should always connect to a primary main or expansion router, port 2 to the secondary main or expansion router located in the same rack.

FIXED FORMAT (NON-MADI) HYDRA2 I/O, REAR INTERFACE





GPIO CONNECTIONS

GPIO in Apollo and Artemis systems is a Hydra2 option. GPIO cards provide logic inputs and outputs that can be assigned to various functions on the control surface; allowing console functions to trigger external devices such as fader starts for playback devices and for external devices to trigger console functions, for example auto-fades controlled by a video switcher.

If GPIO is required, please discuss this with your sales person or Calrec project engineer. Optional GPIO cards can be fitted in modular Hydra2 I/O frames, or any fixed format Hydra2 box with a height of 2U or greater. Multiple boxes can be fitted with GPIO cards to make up the required quantity. The physical location of I/O boxes within the installation should be considered when choosing which to fit with GPIO cards.

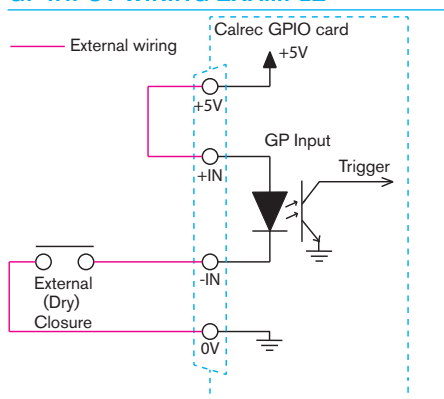
A fixed format I/O box fitted with a GPIO card has two D25 connectors on the rear, female for inputs, male for outputs. GPIO cards for modular frames have a single D50 connector on the front for both inputs and outputs. Two versions of modular card are available, one with 8 changeover relay outputs and one with 16 normally open relay closures.

GP inputs

Each GPIO card type has 8 opto-isolated inputs allowing for remote triggering of console functions. Applying DC or AC voltage across the positive and negative pins of an input will trigger it. A common way to trigger a GP input is by providing a dry closure from a relay with no voltage on it. If using a dry closure, it should not simply be wired across the +/- terminals of the opto input - one half of the closure should be connected to a ground on the GPIO card, the other half of the closure to an opto input, and the other input should be linked in the connector hood to a GPIO card +5V pin, as shown below. This

prevents potential problems in connecting power between different manufacturers' hardware.

GP INPUT WIRING EXAMPLE



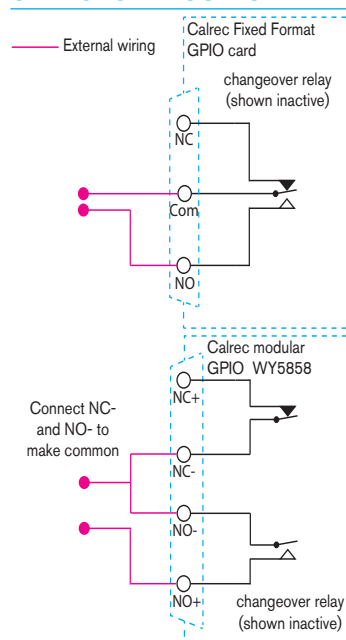
GP outputs

The fixed format I/O box GPIO card, and the WY5858 modular GPIO card both have 8 changeover relays each with access to the normally open, normally closed and either common relay pins or normally open/closed negative pins to provide flexibility in use. If required, these contacts can be used to switch audio. If being used to trigger external equipment expecting a ground, the relay common should be connected to a ground from the external equipment and either the normally open or normally closed contact used as the trigger line.

If a dry closure is required by the external equipment, this can be achieved by wiring one leg to either the normally open or normally closed contact and the other leg to the common or normally open/closed negative contact.

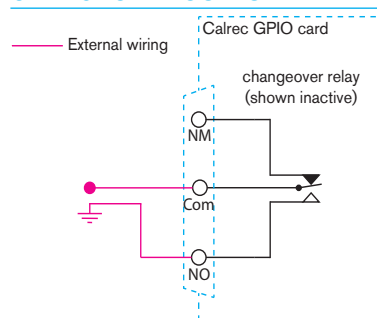
Normally open (NO) contacts short to the common or negative pin when the relay is activated by the selected function. Normally closed (NC) contacts are shorted to common or negative when the function is NOT active.

CHANGEOVER OUTPUT EXAMPLE #1



- Changeover relay shown wired to provide a dry closure when activated. For WY5859 treat NO- as common

CHANGEOVER OUTPUT EXAMPLE #2



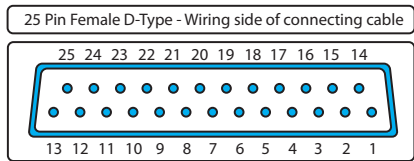
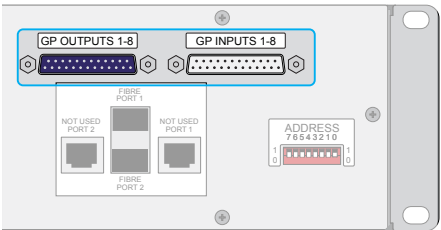
- Changeover relay shown wired to provide a ground when activated. The ground can come from a 0V pin in the GPIO card connector itself as long as the receiving equipment has the same ground reference. For WY5858 and WY5859 common setup see above.

Dry closure only outputs

The WY5859 version of modular I/O card provides the same 8 inputs along with 16 dry closure only relay connections that short when activated (NO+ & NO-).

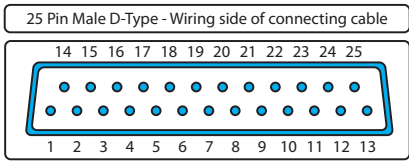
Pin-outs for all GPIO card types are shown on the following pages.

FIXED FORMAT GPIO CONNECTIONS - 8 IN, 8 OUT



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

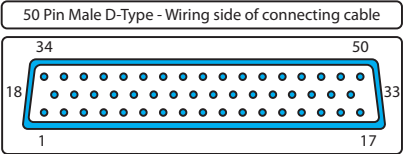
- Calrec connector is male, requiring female terminated cable



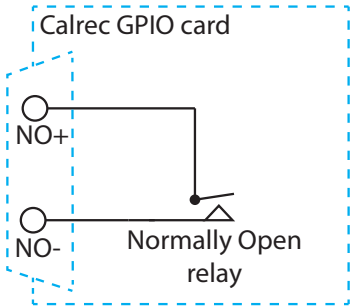
Function		Pin
Opto 1	+	1
	-	14
Opto 2	+	15
	-	3
Opto 3	+	4
	-	17
Opto 4	+	18
	-	6
Opto 5	+	7
	-	20
Opto 6	+	21
	-	9
Opto 7	+	10
	-	23
Opto 8	+	24
	-	12
+5V		2
		5
		8
		11
Ground		16
		19
		22
		25
		13

- Calrec connector is female, requiring male terminated cable

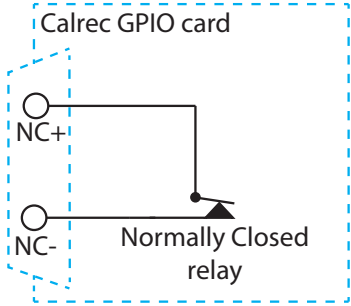
WY5858 - MODULAR GPIO 8 IN + 8 OUT



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	+5V	17
Supply	0V	50
GPO 1	NO+	39
	NO-	23
	NC+	7
	NC-	40
GPO 2	NO+	24
	NO-	8
	NC+	41
	NC-	25
GPO 3	NO+	9
	NO-	42
	NC+	26
	NC-	10
GPO 4	NO+	43
	NO-	27
	NC+	11
	NC-	44
GPO 5	NO+	28
	NO-	12
	NC+	45
	NC-	29
GPO 6	NO+	13
	NO-	46
	NC+	30
	NC-	14
GPO 7	NO+	47
	NO-	31
	NC+	15
	NC-	48
GPO 8	NO+	32
	NO-	16
	NC+	49
	NC-	33

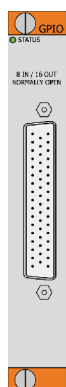


- Closes when activated

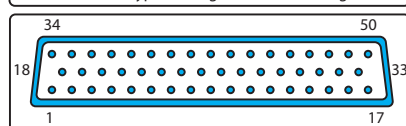


- Opens when activated

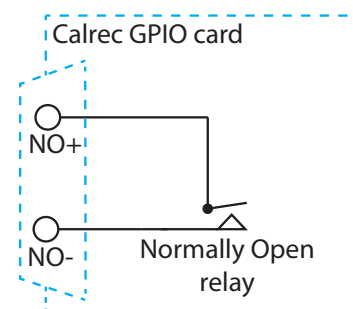
WY5859 - MODULAR GPIO, 8 IN + 16 CLOSURE OUTPUT



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



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	+5V	17
Supply	0V	50
GPO 1	NO+	39
	NO-	23
GPO 2	NO+	7
	NO-	40
GPO 3	NO+	24
	NO-	8
GPO 4	NO+	41
	NO-	25
GPO 5	NO+	9
	NO-	42
GPO 6	NO+	26
	NO-	10
GPO 7	NO+	43
	NO-	27
GPO 8	NO+	11
	NO-	44
GPO 9	NO+	28
	NO-	12
GPO 10	NO+	45
	NO-	29
GPO 11	NO+	13
	NO-	46
GPO 12	NO+	30
	NO-	14
GPO 13	NO+	47
	NO-	31
GPO 14	NO+	15
	NO-	48
GPO 15	NO+	32
	NO-	16
GPO 16	NO+	49
	NO-	33



- Closes when activated

CONNECTING TO OTHER CONSOLES/ROUTERS

Multiple Apollo and Artemis consoles can be connected together and to standalone Calrec Hydra2 routers, allowing them to share each others I/O resources.

Before connecting a console to an active Hydra2 network it is essential to be aware of IP address compatibility and the master router status. Please refer to the Hydra2 installation manual for more comprehensive details on all aspects of Hydra2 networks and I/O.

A single, standalone console with its processing rack and I/O forms a basic Hydra2 network. All Hydra2 networks require that one, and only one of the processing racks is configured as the Master Router. Therefore, consoles specified at order to be standalone have their processing rack pre-configured as a master router. It is vital that this is changed before connecting to an active network.

Consoles are joined together by any of their 16 main primary router I/O ports. Current software supports a single path between any two main routers giving a bandwidth of 512 channels of audio in each direction.

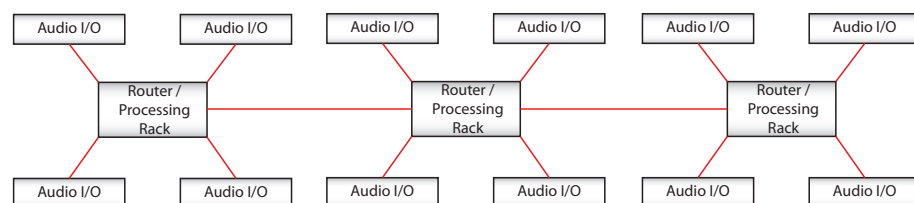
Note, it is important to ensure that when Hydra2 routers are networked together, they are on separate VLANs.

Router to router connections are not currently supported by expansion router ports.

For large systems, network topology should be considered to manage bandwidth. Using a processing rack as a central point to connect others, rather than daisy-chaining several or more together minimizes the number of racks a signal has to pass through to get from I/O port to console, optimizing the available bandwidth on each router to router link.

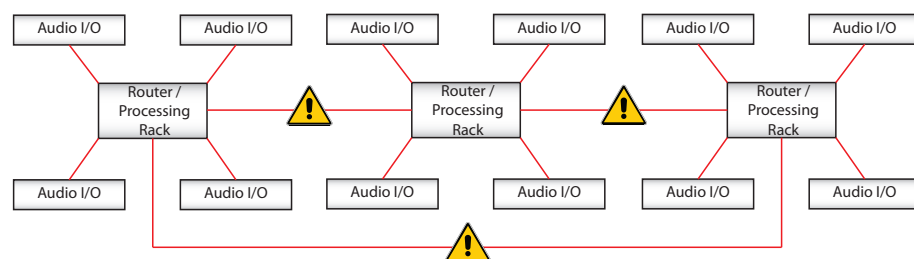
It is important that there is only one path (not counting dedicated secondary paths) between any two points on the network.

FIGURE 1 - CORRECT CONNECTION OF A THREE CONSOLE NETWORK



✓ Three router racks connected with no duplicate paths.

FIGURE 2 - INCORRECT CONNECTION OF A THREE CONSOLE NETWORK



✗ Incorrect connection! The additional link creates a duplicate path.

The path between I/O port and console router may pass through other routers. Figure 2 shows an incorrectly connected network - the addition of a third router to router links creates a duplicate path. This will cause network collisions as data can take two paths between any two routers - one path is direct, the other is via the third router. Removing any one of the router to router links corrects this, effectively changing the topology to match that in Figure 1.

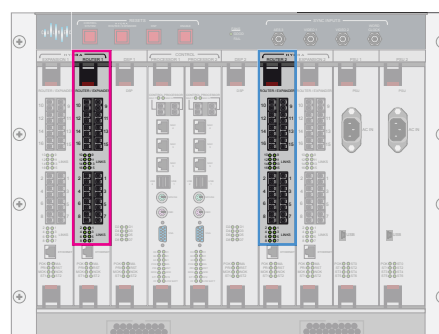
Figure 3 shows the 16 full bandwidth router ports available on both the primary and secondary main routers (as oppose to expansion routers). Any of the 16 ports can be used to connect to another Hydra2 router. Connections should always be made from primary router to primary router. To provide redundancy, a backup connection should be made from secondary router to secondary router.

When multiple racks are networked, it is essential that they are all receiving and are locked to the same derived sync source.

From software version 1.16 onwards Auto Promote can be used to specify which routers in a Hydra2 network can automatically take over the master router status in the very unlikely event of a master router failure. See the Master Router section of the Hydra2 installation manual for more information.

Please refer to the Hydra2 installation manual and H20 user guide for more information regarding Hydra2 and I/O.

FIGURE 3 - MAIN ROUTER PORTS



SURFACE REAR CONNECTOR PIN-OUTS

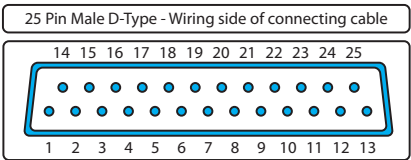
All audio is processed within the rack, the system does not pass audio to or from the control surface on its own. Calrec TFT and LED metering in the control surface functions on proprietary meter data which is not decoded for listening and cannot be used by 3rd party or ancillary hardware.

Ancillary audio items such as moving coil meters, 3rd party meters such as DK or RTW, headphones, talkback mics, optional loudspeaker panels etc all require an audio connection to the rear interface panel of the control surface if they are to be used.

If these items are to be fed directly from console I/O, they should be provisioned for in the quantity of Hydra2 I/O ordered.

Loudspeaker and some moving coil meter panels are fitted with DIP switches that can disable inputs and set levels. Please refer to the Panel Options section of this document for more detail on each panel type.

All D-type audio connectors on the interface panel are all 25 pin female, requiring male terminated cabling.



Moving coil meters

Important notes on moving coil meter wiring:

- If feeding unbalanced AES digital, BOTH signal pins and BOTH ground pins shown for each leg need to be connected.
- Input 2 not used for twin single needle VU meter, or single dual needle meter panels.
- One D25 connector per single / dual or quad meter panel (multiple panels are not combined onto a single rear connector)
- 6 way VU panels require a second D25 connection for meters 5 & 6, pinned out as per the Left1/ Right1 / AES1 inputs shown.
- Analog and digital inputs are both active, not switched. Therefore only one format should be fed to the meter at any given time.
- Refer to Panel Options section for DIP switch setup information about moving coil meters.

MOVING COIL METER INPUTS

Analog Inputs		Pins
Left 1	+	1
	-	14
	Ground	2
Right 1	+	15
	-	3
	Ground	4
Left 2	+	7
	-	20
	Ground	22
Right 2	+	21
	-	9
	Ground	23
Balanced Digital Inputs		Pins
AES 1	+	18
	-	6
	Ground	5
AES 2	+	24
	-	12
	Ground	25
Unbalanced Digital Inputs		Pins
AES 1	Signal	4 + 18
	Ground	5 + 6
AES 2	Signal	10 + 24
	Ground	11 + 12

RTW meters

RTW meters can be supplied with either balanced or unbalanced AES I/O. Unbalanced versions are wired out to BNC connectors on the rear interface. Balanced versions are wired to a D25 connector pinned out as below:

RTW METER DIGITAL I/O

Digital Inputs		Pins
1	+	24
	-	12
	Ground	25
2	+	10
	-	23
	Ground	11
3	+	21
	-	9
	Ground	22
4	+	7
	-	20
	Ground	8

Digital Outputs		Pins
1	+	18
	-	6
	Ground	19
2	+	4
	-	17
	Ground	5
3	+	15
	-	3
	Ground	16
4	+	1
	-	14
	Ground	2

All RTW meters have 8 analog inputs as well as digital I/O.

RTW METER ANALOG INPUTS

Analog Inputs		Pins
1	+	24
	-	12
	Ground	25
2	+	10
	-	23
	Ground	11
3	+	21
	-	9
	Ground	22
4	+	7
	-	20
	Ground	8
5	+	18
	-	6
	Ground	19
6	+	4
	-	17
	Ground	5
7	+	15
	-	3
	Ground	16
8	+	1
	-	14
	Ground	2

DK meters

DK meters can be fitted with up to 4 input cards. Card types available from Calrec are:

- Unbalanced digital only, providing 4 AES3id inputs per card, wired out to BNC connectors on the console's rear interface.
- Balanced digital only, providing 4 AES inputs per card, wired to female D25 connectors on the console's rear interface
- Unbalanced digital and balanced analog mixed, providing 2 analog inputs and 1 AES3id input per card. Analog inputs are wired to female D25s, digital to BNC's, both on the console rear interface.
- Balanced digital and balanced analog mixed, providing 2 analog inputs and one AES input per card, wired to female D25 connectors on the console's rear interface.
- Analog only, providing 8 balanced analog inputs per card, wired to a female D25 connector on the rear console's interface.

The input card types required affect the internal wiring of the control surface and should be specified at the time of order.

BALANCED AES ONLY DK INPUTS

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

- Quantity of inputs available dependant on the number of input cards ordered.
- If more than two cards ordered, an additional D25 connector is fitted in the rear interface for inputs above #8, pinned out the same as inputs 1-8.

MIXED AES & ANALOG DK INPUTS

Input		Pins
AES 1 (3)*	+	1
	-	14
	Ground	2
Analog 1 (3) L	+	4
	-	17
	Ground	5
Analog 1 (3) R	+	18
	-	6
	Ground	19
AES 2 (4)*	+	7
	-	20
	Ground	8
Analog 2 (4) L	+	10
	-	23
	Ground	11
Analog 2 (4) R	+	24
	-	12
	Ground	25

- Quantity of inputs available dependant on the number of input cards ordered.
- If more than two cards ordered, an additional D25 connector is fitted in the rear interface for inputs above 3 & 4.
- If unbalanced digital inputs are specified for this card type, only the analog inputs are on D25s, the digital inputs are on BNC connectors.

BALANCED ANALOG ONLY DK INPUTS

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

- Quantity of inputs available dependant on the number of input cards ordered.
- Each analog only input card has a female D25 connector on the console rear interface, pinned out as above.

Headphone sockets

The headphone driver unit in the control surface has capacity for 3 stereo balanced analog inputs. The actual quantity in use is dependant on the number of headphone jack sockets fitted / requested at order.

HEADPHONE INPUTS

Input		Pins
1 Left	+	1
	-	14
	Ground	2
1 Right	+	15
	-	3
	Ground	16
2 Left	+	18
	-	6
	Ground	19
2 Right	+	7
	-	20
	Ground	8
3 Left	+	21
	-	9
	Ground	22
3 Right	+	24
	-	12
	Ground	25

Loudspeaker panels

Each loudspeaker panel fitted has 4 stereo balanced analog inputs.

LOUD SPEAKER INPUTS

Input		Pins
1 Left	+	1
	-	14
	Ground	3
1 Right	+	2
	-	15
	Ground	3
2 Left	+	16
	-	4
	Ground	18
2 Right	+	17
	-	5
	Ground	18
3 Left	+	6
	-	19
	Ground	8
3 Right	+	7
	-	20
	Ground	8
4 Left	+	21
	-	9
	Ground	23
4 Right	+	22
	-	10
	Ground	23
Logic	Ext Cut	11
	Ext Dim	24
	Ground	13

- Refer to the panel options section for LS panel DIP switch input enabling information.

APOLLO EXTERNAL CONTROL

SW-P-08 REMOTE CONTROL

The Hydra2 router allows for cross-point matrix routing of Hydra inputs direct to Hydra outputs without using console DSP or control surface space. Control over input to output cross-point routing can be from the console PC, a standalone PC running the Hydra2 Organizer or via 3rd party controllers supporting the SW-P-08 protocol.

As well as physical Hydra2 I/O ports, the H2O application and SW-P-08 controllers also have access to Hydra Patchbays, enabling them to change sources on console DSP inputs and access to console DSP outputs.

The following 3rd party SW-P-08 systems have been proven with, and are supported by Calrec:

- L-S-B VSM
- Colledia BNCS
- Grass Valley Jupiter
- Evertz
- NVision
- Axon Cortex
- Harris Edge

Please refer to the relevant manufacturer's guidance for specific information relating to their products.

Connection

The 3rd party SW-P-08 controller should be connected to the single front panel RJ45 "Ethernet" on the main (not expansion) router card. A secondary, backup connection can be made to the secondary main router card. Systems requiring both SW-P-08 and Ember control need to use the same single Ethernet port and therefore an Ethernet switch is required. The two control systems are separated by using different TCP socket port settings.

On Hydra2 networks with more than one processing rack, the SW-P-08 connections should be made to the router cards in the processing rack configured as the Master Router. Slaved processing racks do not support SW-P-08 connections. Connections made to the Master Router can be given access to any I/O on the network, irrespective of which processing rack the I/O is connected to.

The Ethernet port on the router cards is a 100MHz connection which uses standard Ethernet straight-through or cross-over pin-outs and pairings. Screened Cat5e cable should be used to guarantee performance.

The default IP address of the SW-P-08 ports are the same as that of the router cards themselves - xxx.yyy.5.0 for the primary and xxx.yyy.6.0 for the secondary. xxx.yyy is different for each processing rack and can be checked using the Calrec Program Updater application on the PC associated with the rack in question. The user must be logged into Windows as **CalrecAdmin** with the password **calrec** in order to run the Calrec Program Updater which can be found in the Calrec folder in the Windows Start menu. Upon launch, the application checks for the presence of local hardware and reports back with IP addresses. All hardware associated with the same processing rack has the same first two bytes of IP address. The router cards themselves can be identified in the list by their unit number being prefixed with "RY". IP addresses for the SW-P-08 connections can be aliased if required to make them more suitable for use with the 3rd party network, however this will require a Calrec Engineer to carry out and as such should be discussed prior to commissioning.

Note, as well as addressing the routers by IP, the SW-P-08 controller

needs to be configured to use the TCP socket port of 61000

Configuration

SW-P-08 configuration requires the use of the Hydra2 Organizer GUI. Please refer to the H2O user guide for information

EMBER REMOTE CONTROL

The EMBER protocol is a sophisticated data exchange mechanism that has potential for controlling many functions across varied equipment types.

EMBER control has been incorporated into Calrec's Apollo, Artemis and Hydra2 range to allow various remote control functionality, both over consoles and the wider Hydra2 network.

Currently, Calrec support the use of the following EMBER controllers:

- L-S-B VSM
- Colledia BNCS

Please refer to the relevant manufacturer's guidance for specific information relating to their products.

Currently, EMBER has the ability to control the following features when connected to a Calrec Apollo / Artemis / Hydra2 network:

- Loading of shows and user memories onto control surfaces.
- Loading / removing alias files used by consoles, instructing them to use different pre-defined sets of I/O ports. Please refer to the console operator manual for more information on the use of alias files.
- EMBER controllers can view and edit the H20 based Hydra2 I/O box and port labels.
- Inserting SMPTE2020 metadata into Hydra2 SDI embedder outputs - Metadata sets can be uploaded and edited using the H20 application. EMBER controllers can select any of the available metadata sets for insertion to, or removal from any of the SDI embedder outputs on the network.

- EMBER controllers can selectively mute any of the audio channels within the SDI output of Hydra2 embedders.

Connection

The 3rd party EMBER client should be connected to the single front panel RJ45 labelled "Ethernet" on the main (not expansion) router card. A backup secondary connection can be made to the secondary main router card. Systems using both EMBER and SW-P-08 control require the use of an external Ethernet switch to allow both control systems to connect to the same Ethernet port. The two control systems are separated by using different TCP socket port settings.

On Hydra2 networks with more than one processing rack, the EMBER connections should be made to the router cards in the processing rack configured as the Master Router. Slaved processing racks do not support EMBER connections. Connections made to the Master Router can be given access to any console and I/O on the network, irrespective of which processing rack they are connected to.

The Ethernet port on the router cards is a 100MHz connection which uses standard Ethernet straight-through or cross-over pin-outs and pairings. Screened Cat5e cable should be used to guarantee performance.

The default IP address of the Ethernet ports are the same as that of the router cards themselves - xxx.yyy.5.0 for the primary and xxx.yyy.6.0 for the secondary. xxx.yyy is different for each processing rack and can be checked using the Calrec Program Updater application on the PC associated with the rack in question. The user must be logged into Windows as **CalrecAdmin** with the password **calrec** in order to run the Calrec Program Updater which can be found in the Calrec

folder in the Windows Start menu. Upon launch, the application checks for the presence of local hardware and reports back with IP addresses. All hardware associated with the same processing rack has the same first two bytes of IP address. The router cards themselves can be identified in the list by their unit number being prefixed with "RY". IP addresses for the SW-P-08 connections can be aliased if required to make them more suitable for use with the 3rd party network, however this will require a Calrec Engineer to carry out and as such should be discussed prior to commissioning.

As well as addressing the routers by IP, the EMBER controller needs to be configured to use the TCP socket port of 61000.

CALREC SERIAL CONTROL PROTOCOL

The Calrec Serial Control Protocol, CSCP, allows for remote control over mixing console operational functions by 3rd party systems such as video switchers and production automation systems.

Several broadcast equipment manufacturers provide serial control protocols that are compatible with CSCP. The following systems are currently in use around the world, actively controlling Calrec audio mixing consoles for live on-air applications:

- Ross Overdrive (Automated Production Control system) & Ross video switchers.
- Sony ELC.
- Snell Kahuna.
- Mosart.
- Grass Valley Ignite.
- L-S-B VSM

Please refer to the manufacturer's guidance for specific information relating to their products.

CSCP versions

Additional controls have been made accessible via CSCP since it was first introduced, requiring new commands be added to the protocol, and new versions released. If 3rd party equipment receives CSCP data it does not understand, it should simply ignore it, however Calrec cannot guarantee the operation of third parties, and as such makes all CSCP versions available for use on Apollo and Artemis consoles.

Faders controlled by CSCP

Third party systems with a CSCP connection to an Apollo or Artemis console have access to control and read back the status of 192 path faders. Starting with the lowest numbered fader (usually #1) on layer 1A, up to the highest

consecutively numbered fader, followed by the same fader numbers on layer 1B, then layer 2A, 2B, 3A, 3B etc. up to a total of 192 faders.

If required, the faders exposed to CSCP control can be zoned, preventing remote control over the entire surface width by intentionally inserting gaps in fader numbering. The 8 faders within a panel are always consecutively numbered, but they do not need to be so between panels. Under technician level access to the console's Main PC Application, the surface layout page allows a number to be chosen for the first fader on each panel. If for example, the first panel is numbered 1-8, but the second panel, instead of starting with fader 9, is actually set to start at 10 (or any higher number), CSCP would only have access to faders on the first panel, ensuring faders in the remaining surface area cannot be remotely controlled by third parties. Using this example of exposing only one fader panel to CSCP control, all layers of that panel can be accessed by the protocol (12 layers x 2 A/B sub-layers x 8 faders on a single panel = 192 faders total). It is also worth noting, that the lowest numbered faders in a control surface do not have to physically be at the left hand side.

Controls available via CSCP

CSCP V1.0 allows third party controllers:

- Control over and read back of the position of 192 path faders.
- Read back of the 192 faders' path / port labels.
- Control over and read back of the Cut / On status for the same 192 faders.
- Control over and read back of the PFL status for the same 192 faders.
- Control over and read back of Main output bus levels and PFL status.

- Read back of the console's name / ID.

CSCP V2.0 provides the same functionality as V1.0 with the following additional features being made available:

- Control over and status read back of the same 192 faders' routing to the first 20 Auxiliary output busses.
- Control over and read back of the first 20 Aux bus output levels.
- Read back of the path types allocated to the 192 faders.

CSCP V2.1 provides all the functionality of V1.0 & V2.0 along with the following additional features:

- Control and status read back over the 192 faders' routing to Main output busses.
- Control and status read back over Left to Both & Right to Both input controls for stereo paths on the same 192 faders.

Connection

Although the protocol is based on and passes serial data, the Calrec connection is made via TCP/IP. If interfacing to third party systems who only support point to point RS232/422 serial connections, TCP/IP conversion will be required. For this purpose, Calrec support the use of, and can supply Perle IOLAN units.

The CSCP connection should be made to the MAC5 RJ45 front panel port on the primary Controller card fitted in the Calrec processing rack associated with the console being controlled (Unlike H2O / SW-P-08 / EMBER connections which are always made to the Hydra2 network's Master Router rack). If multiple consoles are to be controlled, each will require its own CSCP connection.

To enhance redundancy, and minimize the amount of change-over required in the event of a failure, both the primary and secondary Calrec controller cards can communicate over each others front panel ports - in the event of a primary controller card failing, the secondary would automatically become active, but would still send and receive CSCP data over the connection made to the primary card.

Secondary connections

Third party CSCP controllers that support redundant secondary connections should be connected to one of the MAC5 ports on both the primary and secondary Calrec controller cards to provide complete redundancy, protecting against cable / port failure and card removal. If required, this connection can be via an Ethernet switch, e.g. to allow a single RJ45 port on a 3rd party controller to connect to both primary and secondary Calrec ports.

Multiple consoles

If CSCP connections from multiple Calrec console's are to be networked together, the consoles need to connect via a layer3 (IP) Ethernet switch in order to prevent MAC address conflicts.

Connecting via corporate LAN

DHCP servers run on the Calrec control processor cards to allow easy connection of H2O access PCs and configuration PCs via the MAC5 port. If a CSCP or other connection is to be made to these ports via a corporate LAN, it is important that the Calrec DHCP servers are disabled and the connections are manually configured as appropriate.

Configuration

Please discuss your installation requirements with your Calrec sales representative or distributor prior to delivery. CSCP connections should be configured and tested by, or under the

guidance of a Calrec approved engineer. The following points should be noted when communicating your requirements:

The default Calrec IP addresses are xxx.yyy.1.0 for the primary, and xxx.yyy.2.0 for the secondary control processor cards. xxx.yyy is unique for each Apollo / Artemis / Standalone Router processing rack and can be confirmed by running the Program Updater GUI. If the default addresses are not suitable, please supply alternative IP addresses and a subnet mask which can be configured pre-delivery or during commissioning.

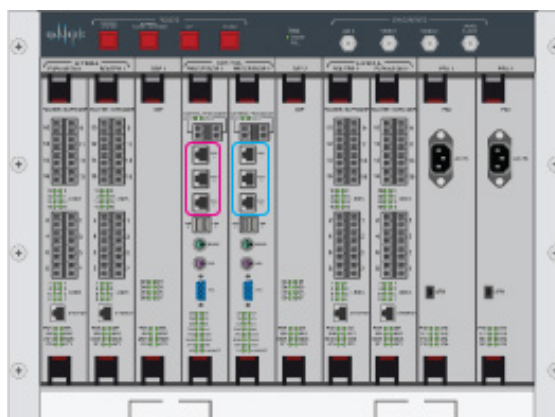
If required, the Calrec system can be configured to connect via an IP gateway.

In addition to connecting by IP address, both the Calrec system and the 3rd party require configuring to use the same TCP socket port. **The default TCP socket port for CSCP is 49200.**

User & boot up enable / disable

Once configured, CSCP can be enabled or disabled from the console's Main PC Application, Fixed Options>Ext Control screen. Being part of the Fixed Options, the enabled / disabled selection is automatically saved for recall after a reset or power cycle. Fixed Options settings are not saved as part of the show or user memory and will therefore not change when different shows / memories are loaded onto the control surface.

PORTS AVAILABLE FOR CSCP CONNECTIONS



- Standard 8U processing rack

- Primary Calrec controller ports
- Secondary Calrec controller ports

AWACS OVER SNMP

All Calrec consoles feature AWACS (Advanced Warning And Correction System). AWACS messages can be managed centrally using an SNMP (Simple Network Management Protocol) server.

All Calrec console and Master Router PCs provide an SNMP agent to forward error and warning messages to a central SNMP server, allowing equipment faults to be monitored and managed from a central location. A connection can also be made to a second SNMP server if required for redundancy.

Connecting to the SNMP server

A USB to ethernet adapter is provided with each console PC for connecting to your central SNMP server. If multiple SNMP servers are used this connection should be made to a network switch to allow multiple onwads connections.

Router cores are provided with a rack mount PC which has a spare ethernet port to be used for connecting to your central SNMP server.

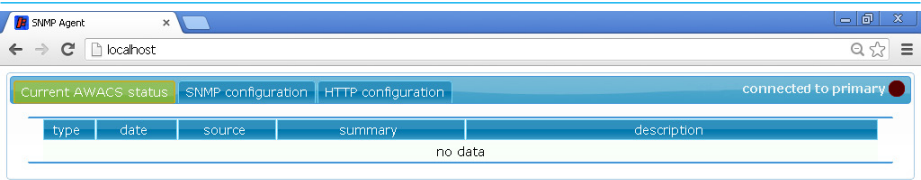
In both cases the ethernet ports used must be configured to be in range of your central SNMP server before configuration can continue.

Configuring the SNMP Agent

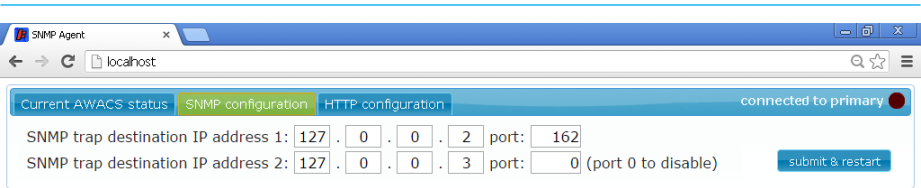
Each console/router core PC's SNMP agent must be configured individually. This can be done from the local PC by opening Google Chrome and entering 'localhost' in the address bar as shown here. SNMP agents can also be configured remotely by entering the IP address of the PC where the SNMP agent is running, including the port number (default: 80).

The SNMP Agent interface has 3 tabs. The Current AWACS Status tab shows a list of the current AWACS errors and

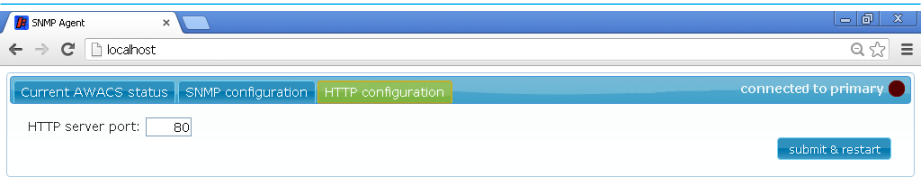
SNMP AGENT - CURRENT AWACS STATUS TAB



SNMP AGENT - SNMP CONFIGURATION TAB



SNMP AGENT - HTTP CONFIGURATION TAB



warnings for the console or router that you are accessing.

Enter the IP address of the facility's main SNMP server within the SNMP configuration tab under 'address 1'; this is where the SNMP agent and SNMP server are connected together. If a second SNMP server is used enter it's IP address under 'address 2'. After making any changes, click SUBMIT & RESTART.

The HTTP configuration tab allows you to set the port number for access to the SNMP agent configuration interface, the default is port 80. If changes are

made here, the port will need to be specified when accessing the SNMP agent interface, for example, if the port is changed to 10, type 'localhost:10' in Chrome's address bar to access the SNMP agent interface. After making any changes, click SUBMIT & RESTART.

Scope of AWACS over SNMP

Only AWACS error and warning messages are sent via SNMP, information messages are not sent. When errors are corrected, the relevant AWACS messages are cleared from the PC Main application and are simultaneously cleared from the SNMP server.

WIRELESS ROUTER CONFIGURATION – ASSIST

Calrec's Assist apps are connected to the console via a wireless router. The setup options provided by different router manufacturers can differ substantially so this setup guide should be used along with the manufacturers instructions for your particular router configuration application. Also, some basic networking knowledge is assumed.

Calrec serial control protocol (CSCP) allows communication with Calrec consoles using the TCP/IP protocol at a pre-determined TCP port number.

Assist apps run on iPad devices which connect to the Calrec system through a wireless router, through which console functions can be controlled using CSCP.

Console Configuration

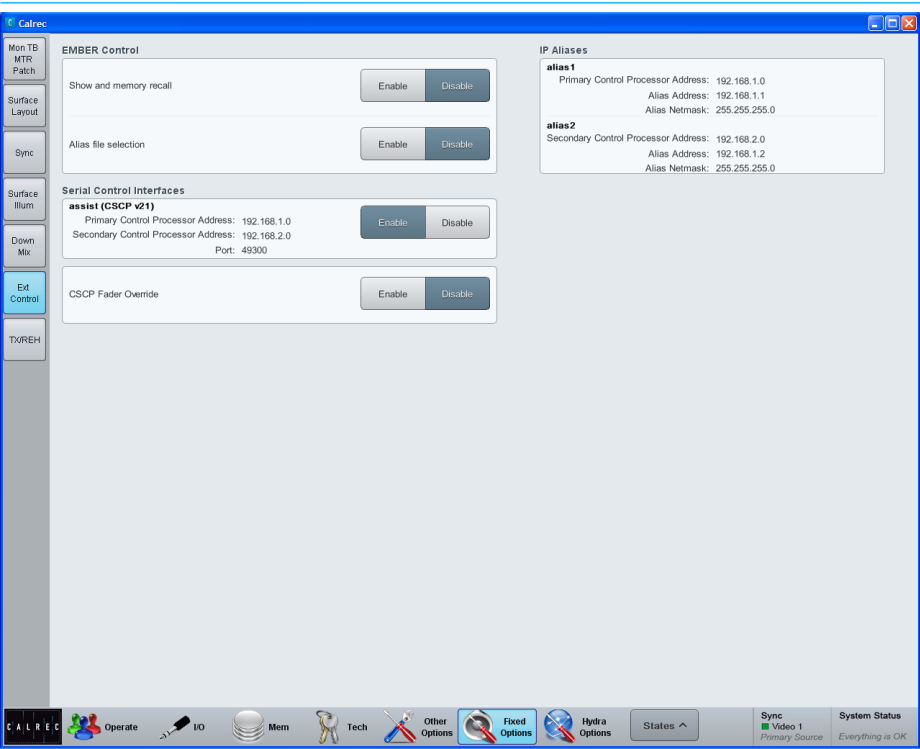
From software version 1.14.7 onwards, Calrec consoles are pre-configured with a basic 'Assist' CSCP configuration which is disabled by default.

This basic configuration assumes a simple, point to point connection with a wireless router on a 192.168.1/24 subnet. This basic setup is unlikely to be suitable for connection to a more complex corporate network.

To enable the basic Assist connection, select **FIXED OPTIONS** from the menu along the bottom of the main application, then select **EXT CONTROL** from the left hand menu and click to **ENABLE 'assist(CSCP v21)'**.

The console will now be providing the CSCP connections shown in this table.

ASSIST CSCP ENABLE



	IP Address	Subnet Mask	Port Number
Primary Control Processor	192.168.1.1	255.255.255.0	49300
Secondary Control Processor	192.168.1.2	255.255.255.0	49300

Wireless Router Configuration

When the basic 'Assist' configuration has been enabled the console provides CSCP connections on the 192.168.1/24 subnet so the wireless router LAN connection must be configured to be part of this subnet. We advise that the wireless router is configured with a LAN IP address of 192.168.1.3 and an IP subnet mask of 255.255.255.0

DHCP Configuration

To connect hand held wireless devices, such as the iPad, the wireless router should be configured to provide a DHCP (Dynamic Host Configuration Protocol) server to distribute IP addresses to these hand-held devices.

The wireless router should be configured as a **DHCP server**: The **IP Start address** or **IP Pool address** should be configured to be **192.168.1.100** and the **IP** or **DHCP pool size** should be set to **4**.

This allows up to four wireless devices to be connected to the console simultaneously. They will be allocated IP addresses in the range: 192.168.1.100 to 192.168.1.103.

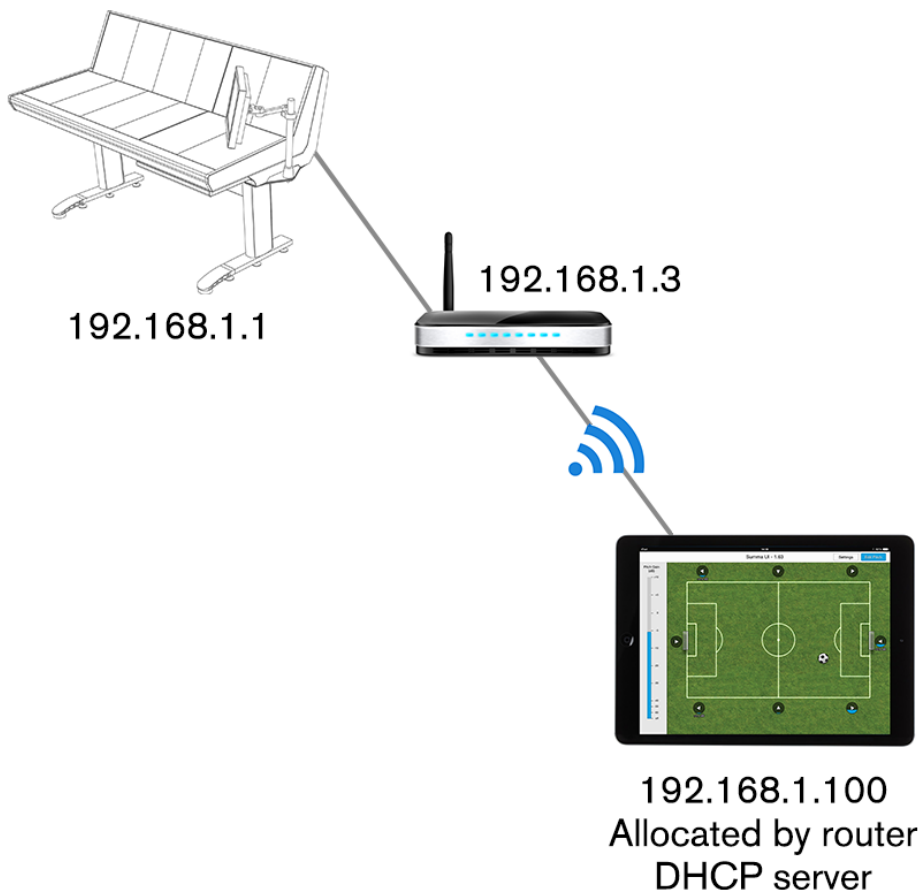
DNS (Domain Name System) parameters are not required for this setup.

Other Configuration Parameters

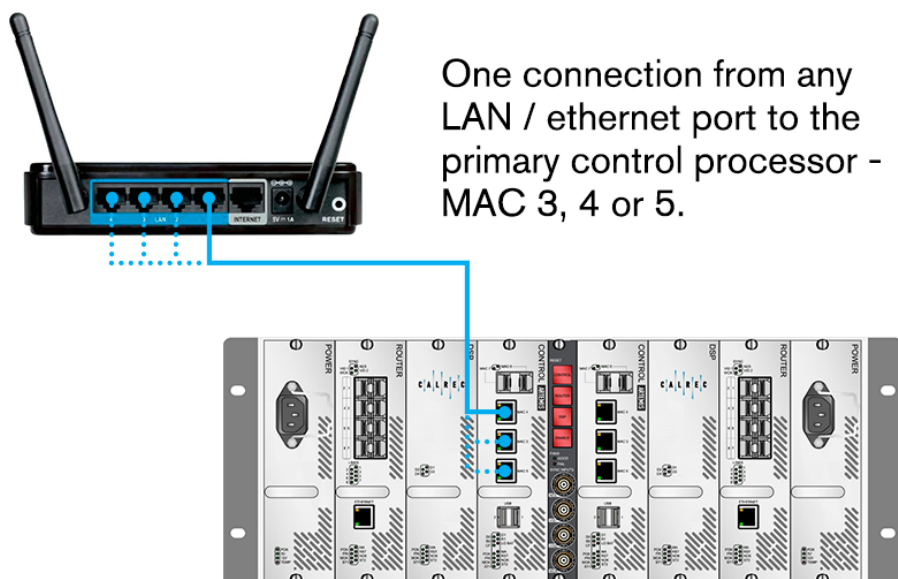
Wireless routers provide many different services and it is not possible to cover all setup permutations in this document. Some common considerations are:

- Firewalls should be disabled if possible. If not then the firewall should be configured to enable TCP/IP traffic in both directions on port 49300.
- NAT (Network Address Translation) should be avoided.
- Packet filtering and MAC address filtering should be avoided.

IPAD, CONSOLE AND WIRELESS ROUTER CONNECTIONS



WIRELESS ROUTER TO CONTROL PROCESSOR CONNECTION



Security Considerations

The wireless LAN (and therefore the console) is open to any devices that can discover the wireless network and have access to the encryption keys. It is strongly recommended that the wireless LAN is configured to use some method of encryption. WEP is considered to be insecure so as a minimum you should select WPA(2)-PSK. This requires both communicating parties to agree on the same keyword or passphrase before access is allowed.

Assist Application Configuration

Assist applications should be configured with a CSCP IP address of 192.168.1.1 to connect to the primary control processor or 192.168.1.2 to connect to the secondary control processor. The CSCP port number should be set to 49300.

To access these settings, launch one of the Assist apps on an iPad and tap **NEW** in the top right hand corner to add a new connection. Enter your settings, as shown here, then press **DONE**. (The number of faders should reflect the number of faders on your desk and the 'Connection Label' can be customized to reflect your particular connection.)

ASSIST APP CONFIGURATION

The screenshot displays the 'ASSIST APP CONFIGURATION' screen on an iPad. The interface includes a 'Cancel' button at the top left and a 'Done' button at the top right. The configuration fields are as follows:

Field	Value
Connection Label	Apollo MCS
CSCP Address	192.168.1.1
CSCP Port	49300
Number of Faders	32

The bottom of the screen shows the iPad's on-screen keyboard, which includes numeric keys, punctuation, and standard QWERTY keys.

RS232/422 CONVERSION

Remote control connections to Calrec Apollo, Artemis and Hydra2 systems are made via TCP/IP. 3rd party controllers that use point to point true RS232/422 serial will require converters to connect to the Calrec system.

Various options are available for serial to TCP/IP conversion, Calrec recommend the use of, and can supply dual PSU Perle IOLAN SCS8's. Calrec chose this unit specifically for its dual power supply option, its 1U rack mount enclosure, and its flexible data routing options.

Fitted with 8 x RS232 serial ports and 2 x Ethernet ports. Data can be routed from a single serial port controller to both primary and secondary Calrec connections. Controllers with a backup port, or systems with backup controllers can route the normally active port to the Calrec primary card, and the backup to the secondary.

For 3rd party controllers that operate on RS422, Calrec can also supply in-line RS232-422 cable converters (Calrec stock code 312-269) to use in conjunction with the Perle SCS8.

The Perle unit needs to be configured to connect to the Calrec Hydra2 network's Master Router card/s (SW-P-08 / EMBER) or each console's Controller card/s (CSCP) by their IP addresses. In cases where the default Calrec card IP addresses are not suitable, as can be the case if data is being passed over a shared Ethernet infrastructure, the Calrec hardware can be configured to be accessed by alternative IP addresses.

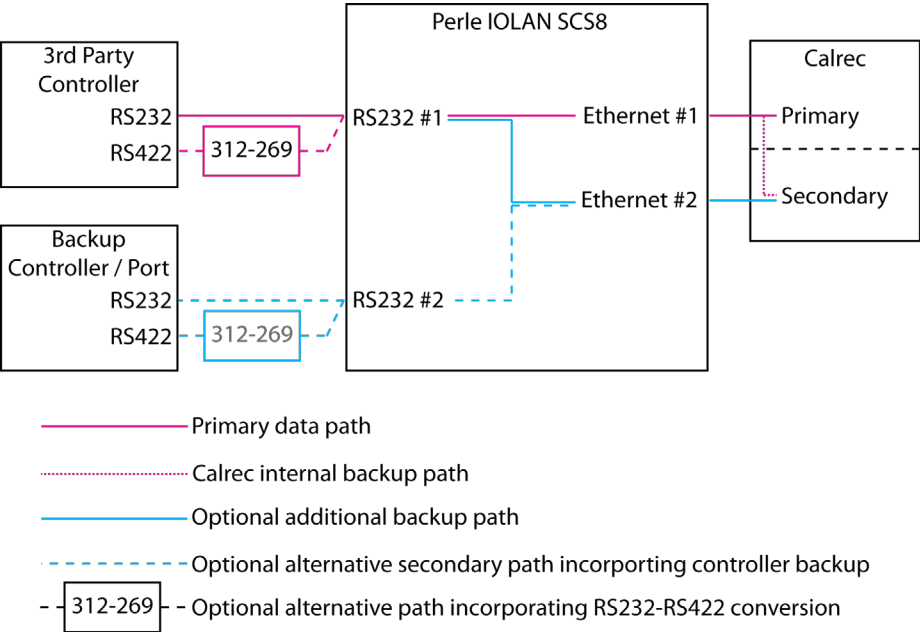
PERLE IOLAN SCS8 - FRONT



PERLE IOLAN SCS8 - REAR



CONNECTIVITY EXAMPLES



PERLE RS232 SERIAL RJ45 PIN-OUT

Perle RJ45 pins	Signal (Perle I/O)	Standard D9 pins
1	DCD (in)	1
2	RTS (out)	7
3	DSR (in)	6
4	TxD (out)	3
5	RxD (in)	2
6	Gnd	5
7	CTS (in)	8
8	DTR (out)	4

PERLE IOLAN CONFIGURATION

Perle units supplied by Calrec can be pre-configured if the connectivity requirements are communicated prior to delivery. Please discuss 3rd party control integration with your Calrec sales representative or assigned project leader.

Configuration requires that the IP addresses of the Perle unit itself are known. If the addresses are not known, or have yet to be configured, the first stage requires a serial Telnet connection to the front panel console port, labelled Admin.

Telnet IP configuration

The front panel Admin console port, like the rear panel serial ports is RS232 on an RJ45 connector.

Perle supply the units with a number of various cable adaptors. Use the female D9 to RJ45 socket adaptor, along with an Ethernet cable, to connect a PC serial port to the Perle front panel Admin console port (the RJ45 plug to RJ45 socket cable adaptor, labelled "Console Port" is not required).

Launch a Telnet application on the PC. The following instructions are based around using HyperTerminal, which is normally pre-installed on Windows PC's. HyperTerminal can be found under **Windows Start>All Programs>Accessories>Communications**.

On starting a new HyperTerminal session, you are required to enter a name of your choice and select an icon. On the following page, select **COM1** (or the PC port being used if different) from the **Connect Using** drop-down menu.

Enter the port settings on the following page as follows; **bits per second: 9600**,

data bits: 8, parity: none, stop bits: 1, flow control: none.

Once the connection is configured, the main HyperTerminal window should be in view. Ensure the connection is active by clicking the **Call** icon (telephone with handset down) at the top of the HyperTerminal window. If the icon is greyed out, it is already connected.



Call (connect) icon



Disconnect icon

Once HyperTerminal is connected, power up the Perle unit. On boot up, messaging from the Perle unit should be displayed in the HyperTerminal window. Once booted, you should be greeted with a login prompt.

To login, enter **admin** , for the password, enter **superuser** . A successful login is greeted with the unit's model number (SCS8#).

Enter the following to set the IP address for the Perle Ethernet port 1: **set server internet eth1 xxx.xxx.xxx.xxx** (substituting xxx.xxx.xxx.xxx with the desired IP address). Enter the following to set port 2: **set server internet eth2 xxx.xxx.xxx.xxx** Enter **save** then **y** to confirm and retain the changes.

Note, the IP addresses chosen for the Perle unit need to be in a range compatible with those of the Calrec cards being connected to (or their alternate, aliased IP addresses).

Cycle the power to the Perle unit to reboot and view the startup messaging to confirm the IP addresses have been set correctly. Note, in the boot up messaging, port 1 is displayed as "eth0" and port 2

"eth1" - this is contrary to the commands required to set the IP's.

Main configuration - Web Manager

Once the IP addresses of the Perle unit are known, the main configuration can be carried out.

Connect an Ethernet cable from a PC Ethernet port to one of the two Ethernet ports on the rear of the Perle unit. Configure the network connection of the PC to be in a compatible IP address range with the Perle unit. Launch a web browser on the PC and enter the IP address of the Perle's port 1 into the browser's address field to bring up the Perle Web Manager application.

Enter **admin** for the username and **superuser** for the password to log in.

Select the **Configuration>Network>IP Address / IP Settings** page, either from the tree on the left, or by the selection buttons in the main screen (screenshot shown overleaf). The addresses of both Perle ports are shown on the IPv4 settings page. If required, the subnet mask for each port can be changed, and also the IP addresses themselves can be changed. Click **Apply** if any changes are made.

Note, that Web Manager page changes can be slow and do not always fully display the content. If content is missing, change away from the page and back, rather than just refreshing. Check the browser's progress bar to see when pages have finished loading.

Select the **Network>Advanced** page (Not the Network>IP Address>advanced page). Click **Add** to add a new host to the host table. Enter a name, eg "Calrec-Primary" and the IP address (or alternate, aliased IP address) of the primary Calrec

card that the Perle will connect to. Repeat to add the secondary Calrec card as another host. Click **Apply** to save the changes.

Select the **Serial>Serial Port** page. Select port 1 and click **Edit** to view the details for the serial port. At the top of the page, below the port label, click **Change** to select the **TCP sockets profile**, click **Apply** and then **Return to Serial 1**.

Select the **Hardware** tab and enter serial port settings that match that of the 3rd party controller. Common settings are; **Serial Interface: EIA-232, Speed: 115200, Data Bits: 8, Parity: Odd, Stop Bits: 1, Flow Control: None**. Click **Apply**.

If a backup controller serial connection is being used, repeat the above for serial port 2.

Select the **General** tab for serial port 1. Check **Connect To**, and select the primary Calrec card from the **Host** drop-down list (as was previously defined from the Network>Advanced page). Enter a **TCP Port** number to match the protocol being setup (61000 for SW-P-08, 62000 for EMBER. The CSCP port is selectable, as defined by Calrec StudioSetup, the default value being 49200).

Select **Initiate Connection Automatically**, and check **Send Name On Connect**.

If Ethernet cable and port redundancy is required from a single serial port controller, check **Connect To Multiple Hosts**, then click **Define Additional Hosts**. Click **Add** and select the Calrec secondary card from the Host list, and enter the TCP port number required for the protocol being used. Click **OK**. Ensure that **Define primary and backup hosts**

PERLE WEB MANAGER - NETWORK>IP ADDRESS PAGE

perle WebManager

Logged in as: admin

Logout
EasyPortWeb

System Name: IOLAN-1062C9
Model: IOLAN SCS8
Firmware Version: 4.2
MAC Address: 00-80-04-10-62-c9
IP Address: 192.168.1.10

Note
⚠ Config Changed!
Reboot Required
Reboot IOLAN

IPv4 Settings

System Name: IOLAN-1062C9
Domain:

Ethernet Interface Settings

Interface 1

☐ Obtain IP Address automatically using DHCP/BOOTP
☒ Use the following IP Address:
IP Address: 192.168.1.10
Subnet Mask: 255.255.0.0

Interface 2

☐ Obtain IP Address automatically using DHCP/BOOTP
☒ Use the following IP Address:
IP Address: 192.168.2.10
Subnet Mask: 255.255.0.0

Default Gateway: 0.0.0.0
DNS Server: 0.0.0.0
WINS Server: 0.0.0.0

Apply

PERLE WEB MANAGER - NETWORK>ADVANCED PAGE

perle WebManager

Logged in as: admin

Logout
EasyPortWeb

System Name: IOLAN-1062C9
Model: IOLAN SCS8
Firmware Version: 4.2
MAC Address: 00-80-04-10-62-c9
IP Address: 192.168.1.10

Note
⚠ Config Changed!
Reboot Required
Reboot IOLAN

Hosts Routes DNS/WINS RIP Dynamic DNS IPv6 Tunnels

Host Table

Name	IP Address/FQDN
Calrec-Primary	192.168.1.0
Calrec-Backup	192.168.2.0

Add Edit Delete

IP Filtering

☒ Allow all traffic
☐ Allow traffic only to/from hosts defined with IP addresses

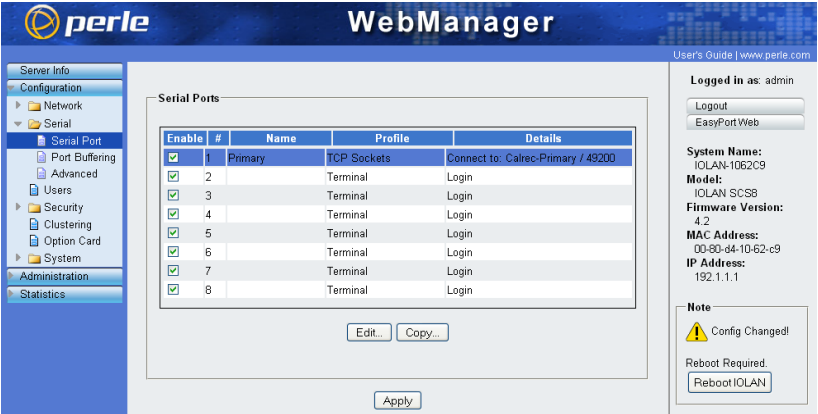
Apply

to connect to is **NOT** selected, and then **Apply**.

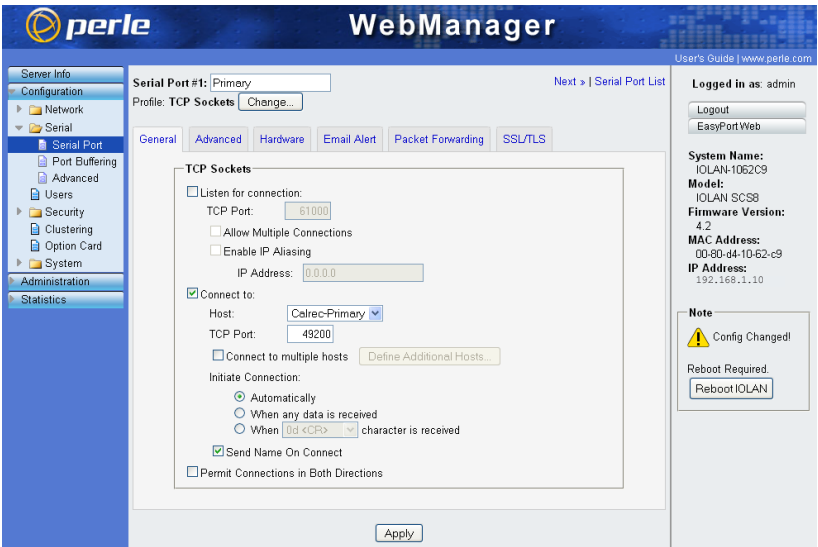
If there is a backup 3rd party controller serial connection, do not select serial port 1 to connect to multiple hosts. Instead, Configure serial port 2 to connect to the Calrec secondary card.

Once completed, click **Reboot IOLAN** or cycle the power to the unit for the configuration changes to take.

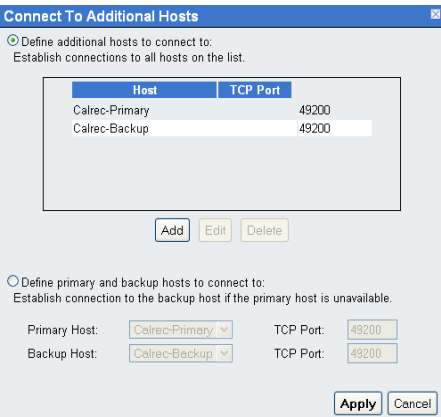
PERLE WEB MANAGER - SERIAL>SERIAL PORT PAGE



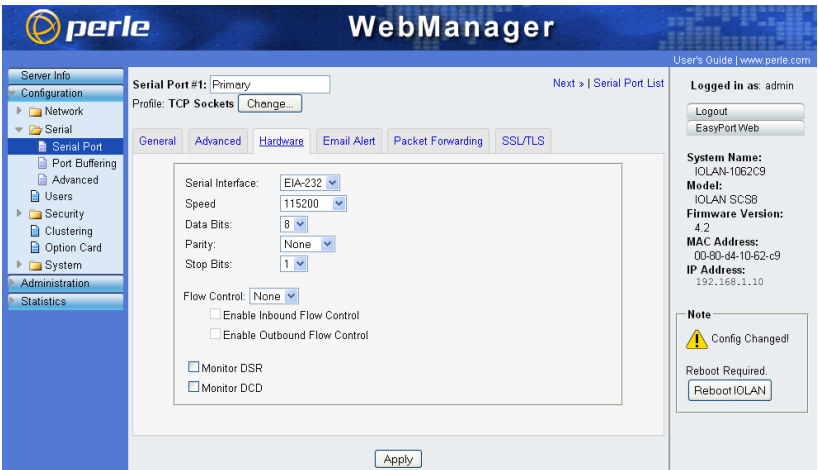
PERLE WEB MANAGER - SERIAL>SERIAL PORT, PORT 1, GENERAL PAGE



ADDITIONAL HOSTS



PERLE WEB MANAGER - SERIAL>SERIAL PORT, PORT 1, HARDWARE PAGE



APOLLO SETUP AND CONFIGURATION

OVERVIEW AND GUI ACCESS

This section covers areas often required by installation engineers to carry out the initial setup and configuration that is required to test the installation and provide a starting template for operators to work with.

Please refer to the console operator manual and the H20 user guide for more comprehensive information on user functionality.

The console PC should boot from power on, the default Windows user is "calrec" and requires no password. Once logged in, the Calrec Main PC Application should start up. If the Main PC Application is closed, it can be restarted from the Windows Start menu. Once open, the main pages can be selected by clicking on their icons across the bottom of the GUI. Most pages have sub-pages which can be accessed by the menu buttons at the left hand side of each main page. Some settings within the Main PC Application are protected and to make changes the user must be logged in as a Technician. Technician access is gained from the **Tech** page by clicking on **Technician**. If no users have been setup, the system allows the creation of a supervisor login. Supervisors are able to create and delete other technician user logins.

H20 - Hydra2 Organizer is an administrator level GUI that provides control over the whole network. H20 can be accessed via a web browser running on a PC connected to the Master Router. This can be a console PC (if the master router rack has a console directly attached to it), or a PC connected directly to a spare RJ45 on the front of the active Control processor card in the Master Router rack. H20 is fully supported by Google Chrome which is pre-installed on Calrec supplied PC's with a bookmark

to the H20 address (IP address of the Control processor)

Once open, H20 screens are accessed using the menu across the top of the GUI window.

Some features, such as accessing the Calrec program updater and admin level Windows settings require the user to log into Windows as an administrator. The user **CalrecAdmin** is setup up with the password **calrec**.

CREATING A CLEAN STARTING POINT

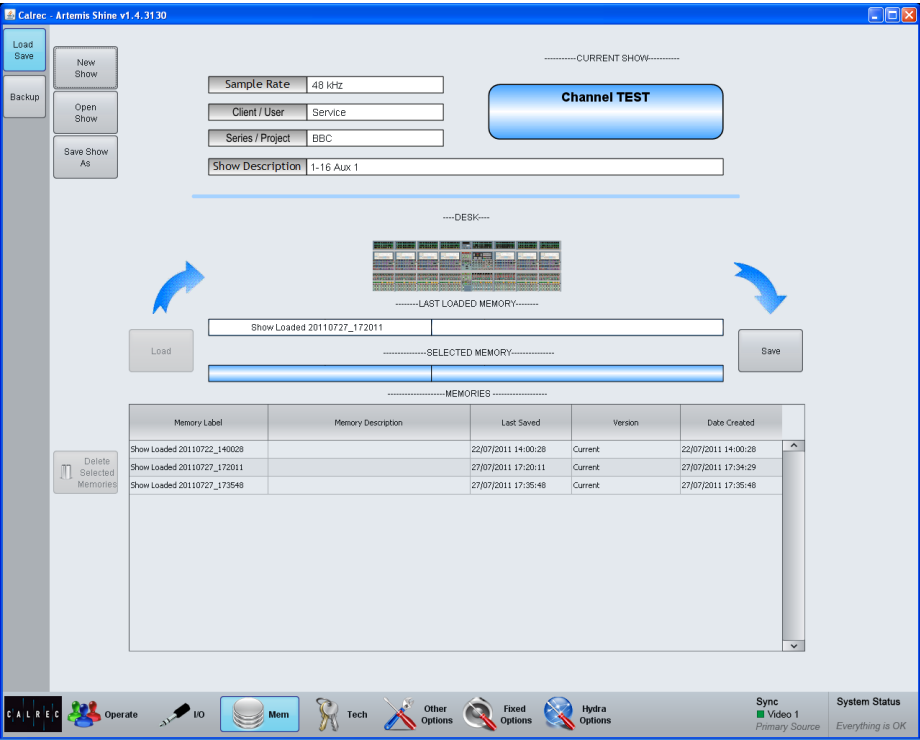
To ensure you are starting from a clean setup, before beginning configuration it is a good idea to create a new show.

Shows contain default settings for the console, including monitor patching, GPI patching and port labelling. Shows can contain multiple user memories which save normal I/O patching, fader assignment and path parameter settings.

To create a new show, go to the **Mem** page and select **New Show**. Choose the Calrec Default as the starting template, enter the details as prompted and click **Next** to load the new, clean show onto the console.

The same Mem page allows changes to the show to be saved, as well as other shows to be loaded, and for user memories within shows to be loaded and saved.

MAIN PC APPLICATION - MEM SCREEN



SCREENSAVER TIMEOUT – 'DARK MODE'

The control surface display brightness can be adjusted and the surface enters a screen saver / "Dark Mode" after a period of inactivity.

During dark mode, the displays are switched off, but all control and audio processing continues. The displays will instantly switch on if any control is changed. Touching a fader knob (without even moving the fader) will activate its touch sensor and bring the surface out of dark mode straight away, without changing control parameters. A "Dark" button/LED on the monitor panel flashes to indicate when the console is in this mode.

Pressing the Dark button on the monitor panel will also put the console into this mode, without waiting for the timeout.

The above settings can be accessed from the Main PC Application, **Fixed Options>Surface Illum page**. Note that the maximum dark mode timeout is 1 hour and cannot be disabled.

SYNC SETUP

The Apollo processing rack is capable of running on its own internally generated synchronization clock, however where more than one rack is networked together, it is essential that they are all fed and locked to the same derived sync source to ensure clean audio and seamless system data transmission.

Even with a single console, general rules of good practise dictate that the audio console should be locked to the same derived sync source as the surrounding digital equipment for clean transfer of audio between devices.

Physically, sync inputs are on BNC connectors located across the top of the processing rack, as described in the Connection Information section.

By default, the system will choose to lock to its internal clock. On initial setup, each console's external sync input priority should be setup.

Sync input priority can be set locally on each console's Main PC Application, or it can be set via H20. Neither GUI has priority over sync choice. Changes made on either user interface are reflected by the other.

Where standalone router racks (without a control surface attached) are used to expand the network, it is essential that the same sync source(s) are connected and selected as the other racks on the network. Sync settings for standalone racks can only be accessed via H20.

Main PC Application Sync

Using the local user interface on each console, sync is set from the **Fixed Options>Sync** page. To make any changes to this page, the user must be logged in as a technician (see overview and GUI access).

The Sync page displays the available sync sources on the left hand side, and the priority list on the right hand side. The priority list displays six sources, the last of which is fixed as internal. The first 5 sources can be selected by highlighting the chosen source on the left, highlighting the chosen priority list entry on the right and clicking **patch**. When selecting a video source, the user should also select the specific video format being used from the central list.

On startup, the system attempts to lock to the first entry in the priority list. If there is a problem with this source, the system moves down the list until a source is found that can be locked to. The "current" column shows which of the sources the system is locked to. AWACS error messages are generated for any sources that fail when the system attempts to lock to them. Once running and locked, the system will not automatically go back to a higher priority source if it becomes available. Clicking **Reset to first** instructs the system to go back through the list attempting to lock to the highest priority source it can find. This can be an important requirement for systems that get powered down as a whole, such as outside broadcast units, as sync generators can often take longer than the console to boot up.

H20 Sync

The **Sync Sources** page displays the sync settings for all consoles and router racks that have been added to H20's client database. If the console being configured does not exist in the client list on the left of the screen it should be added to the client database from the **Manage Clients** page (See H20 User Guide for more information). On the sync page, select any console or rack from the clients list on the left to view their sync settings on the right. The right hand side of the screen acts the same as the Main PC Application, displaying the currently locked source, allowing the sources in the sync priority list to be changed and providing a "reset to first" function. Changes made via H20 are reflected in the Main PC Application on the console they affect. Likewise, any subsequent changes made locally will be reflected by H20.

I/O CONFIGURATION

The Hydra Options>Edit Network screen in the Main PC Application displays the available I/O boxes on the network.

The left hand side of the screen shows all the I/O boxes that are online - powered, connected and functioning.

I/O boxes that are required for use by the console should be added to the network config of that console by highlighting the required box on the left and clicking the **Add>>** button in the central area.

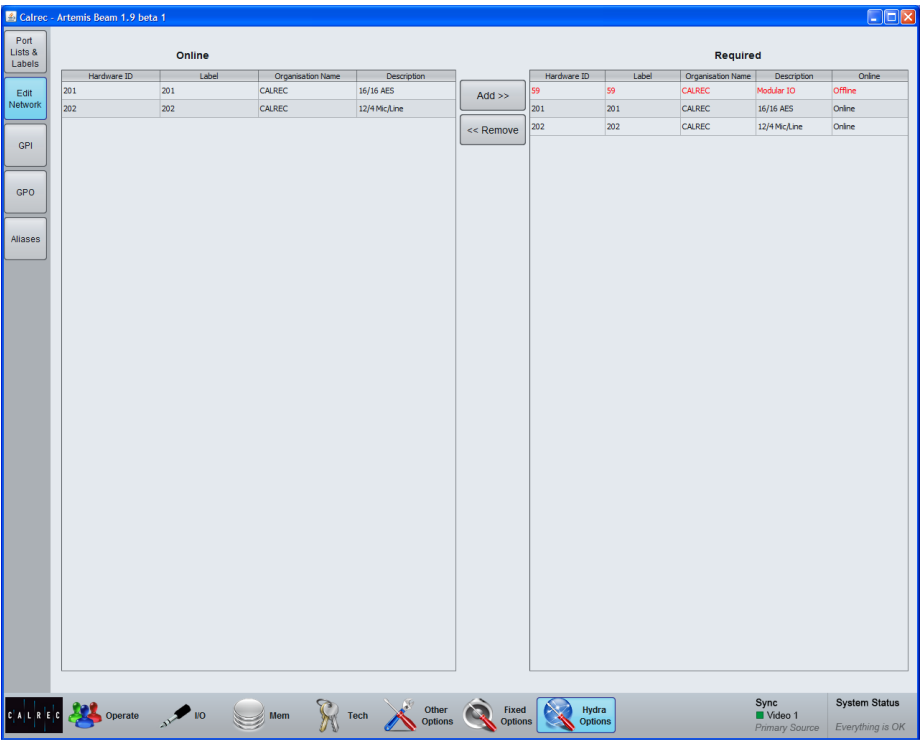
The right hand side of the screen shows all the I/O boxes that have been added to that console's configuration. If a box that has been added is offline, it is displayed in the list in red font and denoted as "Offline".

I/O boxes no longer required, or added by mistake can be removed by highlighting them in the right hand required list and clicking the **<<Remove** button in the central area.

Ports from I/O boxes in the required list are displayed in I/O patching and port list organization screens. If a box is offline, the I/O patching screens will highlight its ports as such, however patches can be "pre-made". Patches made to offline boxes will be displayed "[port label]!". When the box comes online, all such patches are automatically completed and audio is passed.

If access to I/O ports has been restricted by the Hydra2 Organizer, they will appear in I/O patching lists with a "No-Entry" icon and their patching is disabled.

MAIN PC APPLICATION, HYDRA OPTIONS > EDIT NETWORK SCREEN



ASSIGNING PATHS TO FADERS

Assignable faders

Each fader has an A and B sub-layer, which can be switched between by pressing the assign buttons above and below the fader's label display. The two sub-layers, A & B are not related by default and can control two distinct, unrelated audio paths. The upper half of the fader label display is green and refers to the A layer, the lower half is yellow and refers to the B layer. An open fader will remain open and passing audio after the layer is changed.

Pressing the assign button above (A layer) or below (B layer) the label display makes it the currently assigned path and highlights it blue. Only one path (unless user splits are in place) can be the currently assigned path at any given time. Path specific changes are applied to the currently assigned path. For example, adjusting settings on an assignable panel in IP-EQ-DYN or SEND-ROUTE mode will affect the currently assigned (highlighted blue) path.

In addition to A & B sub-layers, there are in fact a total of 12 fader layers, each with an A & B sub-layer. All layers and A/B sub-layers are active irrespective of which is currently visible. Fader layer is selected from the row of touch sensitive displays above the fader label row of any fader panel.

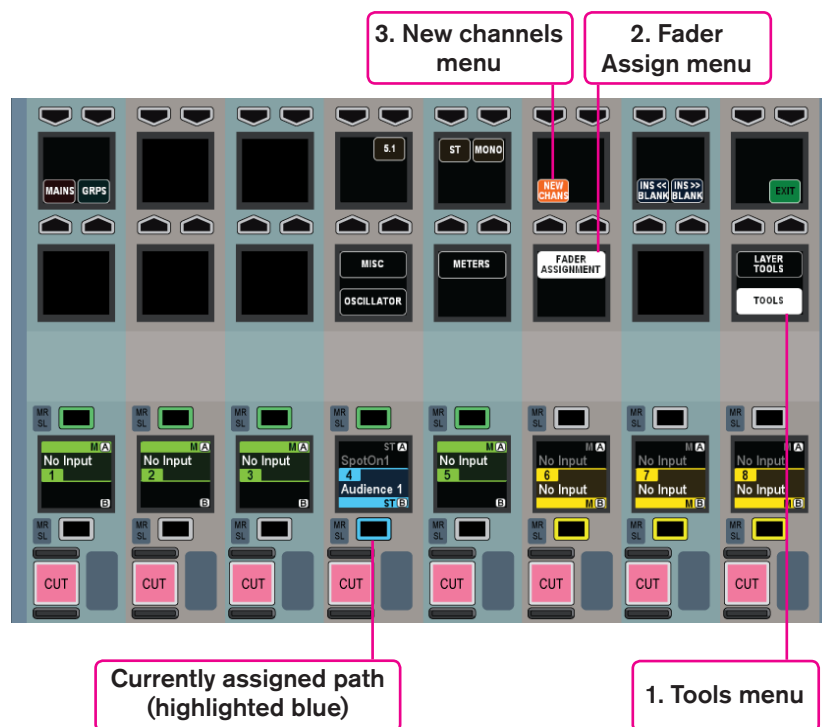
Assigning paths

A or B layer faders with a blank label field have no DSP path assigned. Path assignment is achieved from the **Tools>Fader Assignment** menu (see the highlighted drawing to the right). Select **New Channels** to assign input channels. Three channel widths are currently supported - Mono, Stereo and 5.1. Pressing one of these buttons will assign that channel type to the currently assigned fader (as long as no path is

already assigned on that fader). To assign the same channel type to multiple faders, press and hold the channel type button whilst selecting the faders you wish to be assigned.

To clear a path from a fader, select the **Layer Tools** menu (touch sensitive display above Tools). Press **Remove / Delete Path** from the row above then **Exec** to clear the currently assigned path. To clear

multiple paths, press and hold Clear Path whilst selecting the faders to clear before confirming by pressing Exec.



USING TONE

Use of the console's internal oscillator helps to verify connectivity and configuration during installation.

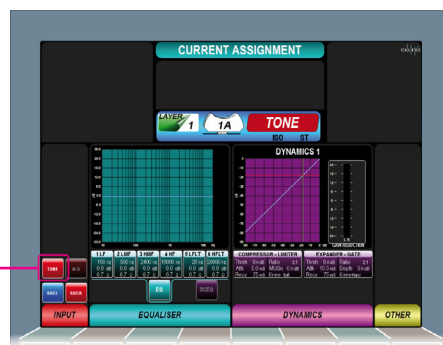
Tone can be selected to path inputs from the **IP-EQ-DYN** panel mode. The tone to input select button is located on the left side of the TFT screen. Selecting this switches tone onto the currently assigned path's input.

Selecting the **Tools>Oscillator** menu on any fader panel brings up oscillator controls on the row above to allow adjustment of tone level, frequency and idents. The **Tone Clear** button in this menu will cancel all tone to path selections across the console.

Select the **Send / Route** panel mode to route the currently assigned fader to bus outputs from the TFT touch screen above.

Note, tone can only be selected to faders that have a DSP path assigned (see previous page).

Select tone to currently assigned path input



****Select IP-EQ-DYN mode****



Currently assigned path (highlighted blue)

MONITORING OUTPUT SETUP

Apollo does not have dedicated outputs for feeding monitors. Monitor outputs can be patched to any Hydra2 audio output port on the network.

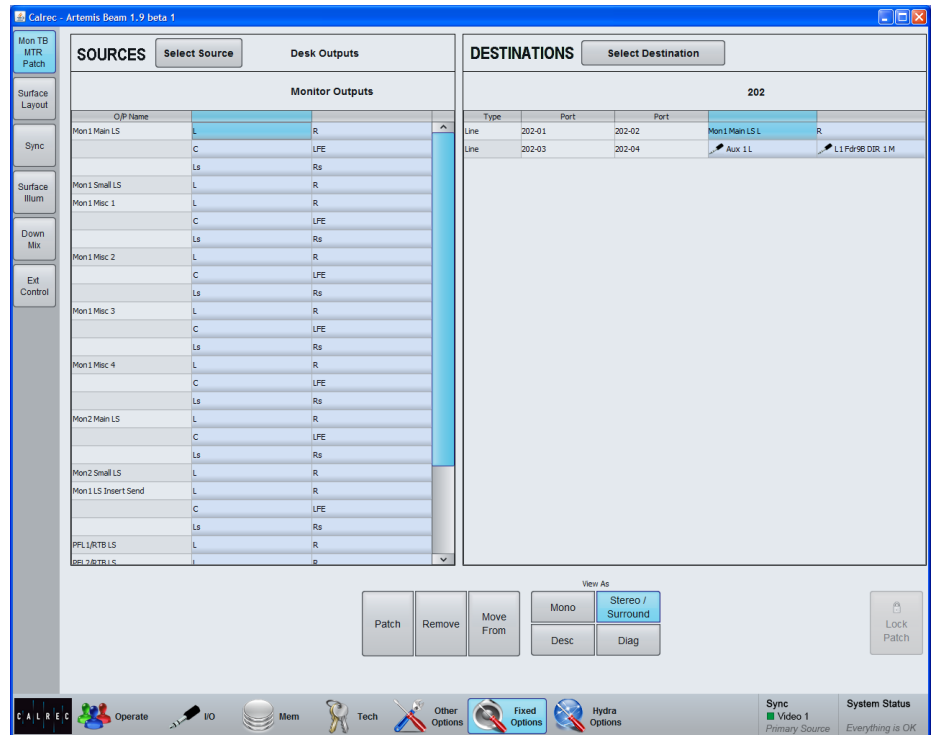
Monitor output patching is separated from other I/O patching as it generally remains fixed irrespective of operators and the shows being worked on. Patches made from the fixed options pages are saved as part of the show.

Monitor outputs can be found on the **Fixed Options>Mon TB Mtr Patch** screen.

Click on the **Sources** button at the top left of the screen to bring up the source lists available and select **Monitor Outputs** from the **My Desk Outputs** group to display the monitor output sources in the left hand list. The normal default monitor output is at the top of the list, labelled **Mon1 Main LS**. Other monitor sources that are likely to be of interest for initial setup are PFL1/RTB LS and Mon1 Small LS. PFL1/RTB LS outputs carry the pre-fader listen bus mixed with any reverse talkback inputs that have been enabled. Mon1 Small LS is often a preferable way to monitor PFL which is routed to the small LS output by default. In changeover mode, the main monitor output is muted and instead sent to the small LS.

Patching monitor outputs is similar to normal I/O patching - click on the **destinations** button above the right hand list and select the list containing the I/O ports that the monitor speakers are physically connected to from the **Output Ports** group. Select the specific port a speaker is connected to within that list by highlighting it on the blue column as shown in the adjacent screenshot. Select the required monitor output source on

MAIN PC APPLICATION, FIXED OPTIONS > MON TB MTR PATCH



the left, again by highlighting in the blue column (as shown in the screenshot) and click patch. Once patched, the destination list should display the patched audio source.

As well as the standard Main Mon LS1 and PFL outputs there are also Mon2 and APFL2 outputs that are independent for when multiple operators are using the same system simultaneously. A number of Misc Monitor outputs are also available and can be used to feed anywhere that needs an independent selector with a level control. One potential use for these can be to feed the analog headphone inputs to the control surface.

Speaker configuration

The detailed setup of monitor systems should always follow the recommendations of the loudspeaker manufacturer. When surround monitor

systems and others with a separate LFE or sub-bass channel are in use, it is often good practice to use a bass management system. Such controllers frequently provide not only for their primary function of optimizing the speaker performance, but also individual level trim functions. The Calrec system itself does not provide level adjustments or delay for adjusting the individual channels within the monitor output.

METERING SETUP

Calrec TFT meters

The high resolution upstand TFT metering can display fader input audio, bus output audio as well as external meters that display audio fed to chosen Hydra2 input ports. As well as audio, upstand meters can display dynamics' gain reduction. Audio data for the TFT meters (and fader bed bargraphs) is generated by DSP and sent to the control surface via the Control processor to console Surface Switch link.

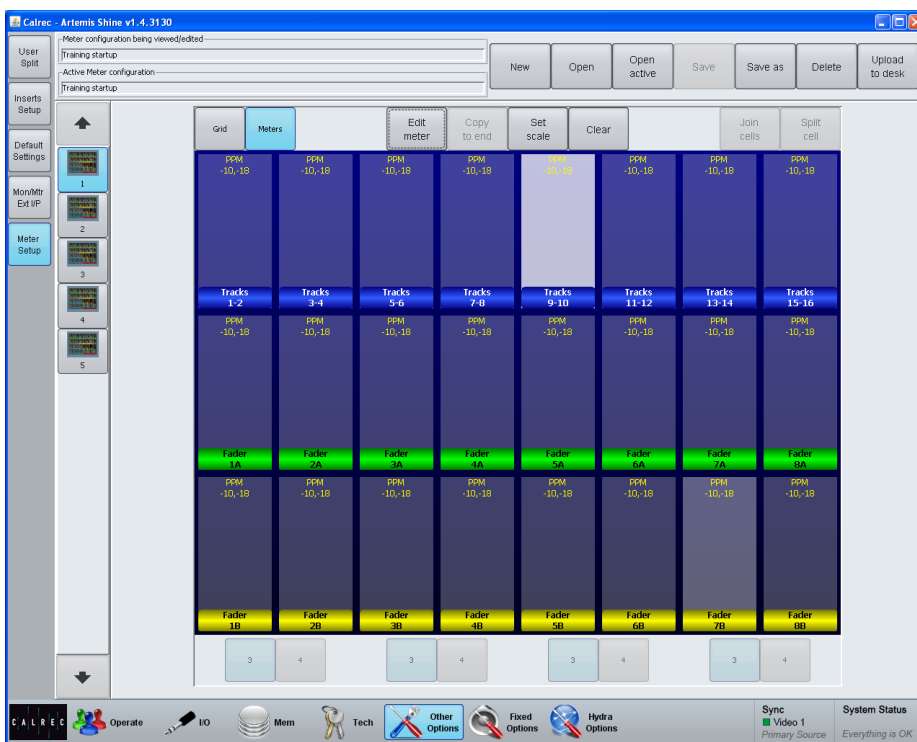
TFT metering is customizable from the Main PC Application **Other Options>Meter Setup** screen. This screen shows one TFT meter panel at a time, different panels can be selected from the column on the left hand side of the screen. Selecting **Grid** allows the layout to be changed. Highlighting a meter cell and selecting **Edit Meter** brings up a choice of meters that can be displayed. **Set Scale** provides a choice of VU or PPM meter ballistics and scales. Once happy with the meter setup, it is transferred to the console by clicking **Upload to Desk** at the top right of the screen. To retain the meter configuration, ensure it is saved using the **Save**, or **Save As** button to create a new config without overwriting the current. Saved meter configs can be viewed and edited by loading them and the sent to the surface using the **upload to desk** button.

Moving coil and third party meters

Traditional PPM / VU moving coil meters and 3rd party meters such as RTW / DK surround scopes cannot access DSP meter data and need to be fed audio via the control surface rear interface. If required, this audio can be fed from Hydra2 output ports. This may be a fixed feed, such as Main1 Line, patched from the regular I/O page, or it can be a changeable source, patched from **Fixed Options>Mon TB MTR patch**. Under the sources>desk outputs group, as well as

monitor outputs, there are also **External Meter Outputs**. Various sources are available in this list, including **Mon LS Pre** which outputs / follows the same audio as being monitored by the Main LS but pre the LS listening level control. Also available are Meter selectors 1-4. These are four selectors without level controls accessible on the monitor panel which have access to all the sources that the monitor LS does but independent of the LS selection. Meter selector outputs can also be displayed on Calrec TFT meters without patching them to Hydra2 outputs.

MAIN PC APPLICATION - OTHER OPTIONS > METER SETUP SCREEN



MONITOR / METER SOURCE SELECTION

The dedicated monitor panel on the control surface provides access to the commonly used monitoring controls. Access to the full set of monitor controls can be gained from any assignable panel by selecting Monitor mode.

The following page shows a panel in Monitor mode with important areas highlighted

Assignable panel mode selection is chosen from the row of touch sensitive displays at the top of the fader panel below.

Ensure the panel is controlling the required output - Monitor 1 or Monitor 2 (control cell highlighted on the following page).

Four pre-selectors determine the audio being monitored. Switch between the pre-selector sources by pressing the "Hear" buttons. To select a different source on a pre-selector, press its "Sel" button to make it the focus of the selector panel on the TFT screen above. Selectable sources are separated into categories, chosen from the "Selector Type" menu at the bottom of the TFT screen.

A control cell on the dedicated monitor panel, to the left of the large yellow level control, shows the sources on each pre-selector and allows for switching between them without accessing the full monitor panel.

In the full monitor panel mode, to the left of the 4 monitor pre-selectors are the 4 meter selectors. Press "Sel" on the appropriate meter selector to change the source in the same way as for the monitor selectors.

To the left of the Main monitor LS level control, on both the dedicated and full monitor panel is a Small LS control cell. By default, the Small LS outputs PFL audio. If Small LS C/O (Change-over) is selected, it will kill the main monitor output and instead send the selected audio to the small LS outputs, irrespective of whether the small LS is patched to physical output ports / speakers.

Another control cell sets the listening level of PFL and AFL audio.

Individual LS channel cuts provide a convenient way to check patching and connectivity.

ASSIGNABLE MONITOR MODE

MEMORIES

Sample Rate: 48 kHz
CURRENT SHOW: BETA 8
Client / User: Culture Test
Series / Project: Tst
Show Description: BETA 8

DESK
LAST LOADED MEMORY
Patching from big apollo AES +

SELECTED MEMORY
LOAD SAVE

MEMORIES

Memory Label	Memory Description
1	
1st sept	
2	
3	
BlueLink Test	Master
Iva On	
Patching from big apollo AES +	

MONITOR

MON1 CRLS PRESEL 3

Source Selection

Source Type Selection

MONITOR SELECTOR TYPE
Mains Groups Auxes Tracks MISC MORE

Individual LS channel cuts

Select to control Mon1 or Mon2 output

LS output level control and cut

LS pre-selectors 1-4
Press "Hear" to listen, press "Sel" to select a different source

****Select Monitor mode****

INPUT & OUTPUT PORT PATCHING

Regular Input and output port patching is similar to that of patching monitor outputs but done from the I/O screen of the Main PC Application and the patches are saved as part of the user memory.

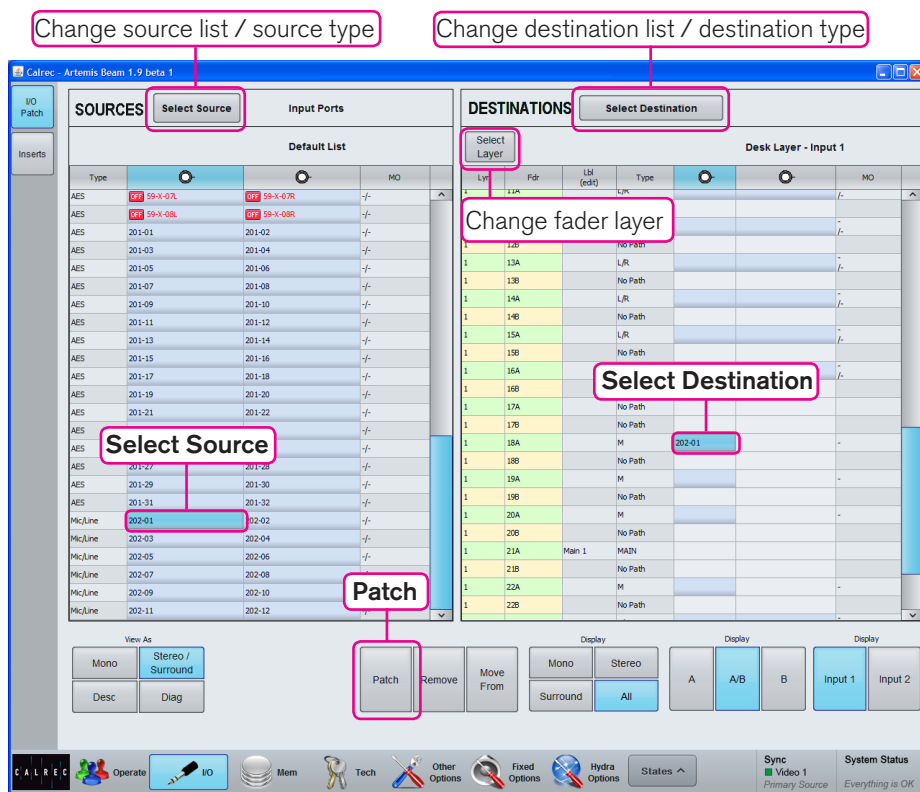
Note that the same input and output ports are available on the I/O screens as the Fixed Options screens. Patches made from the Fixed Options screen are visible on the I/O screens and denoted by the Fixed Options page icon. Likewise when viewing the Fixed Options screen, patches made to ports from the I/O screen are visible and denoted by the jack icon used for the I/O page.

The I/O screen shows sources on the left, and destinations on the right. To patch input ports to channel paths on faders, press **Select Destination**, then select **Channel I/P's** from the **My Desk Inputs** group. The destinations field now displays the faders on the console.

From the **Select Source** button, the **Input Ports** contains the input port lists. If the port lists have not yet been edited, there will be a default list containing all ports, and a list for each I/O box labelled with the box ID.

Highlight the chosen input port/s on the left by clicking on the blue cell. Highlight the chosen fader by selecting the blue cell/s and click patch to put the input port on the fader. Faders with no DSP path assigned cannot be patched to.

To patch console output audio to Hydra2 output ports, press **Select Source** and choose **My Desk Outputs**. Select the required output port list from the **Output Ports** group of the **Select Destination** menu. Again, patching is achieved by highlighting the blue source cell, the blue destination cell and clicking patch.



TALKBACK AND EXTERNAL TONE

All Calrec consoles have a comprehensive talkback system to allow operators to talk over output busses and channel direct outputs / mix-minus outputs.

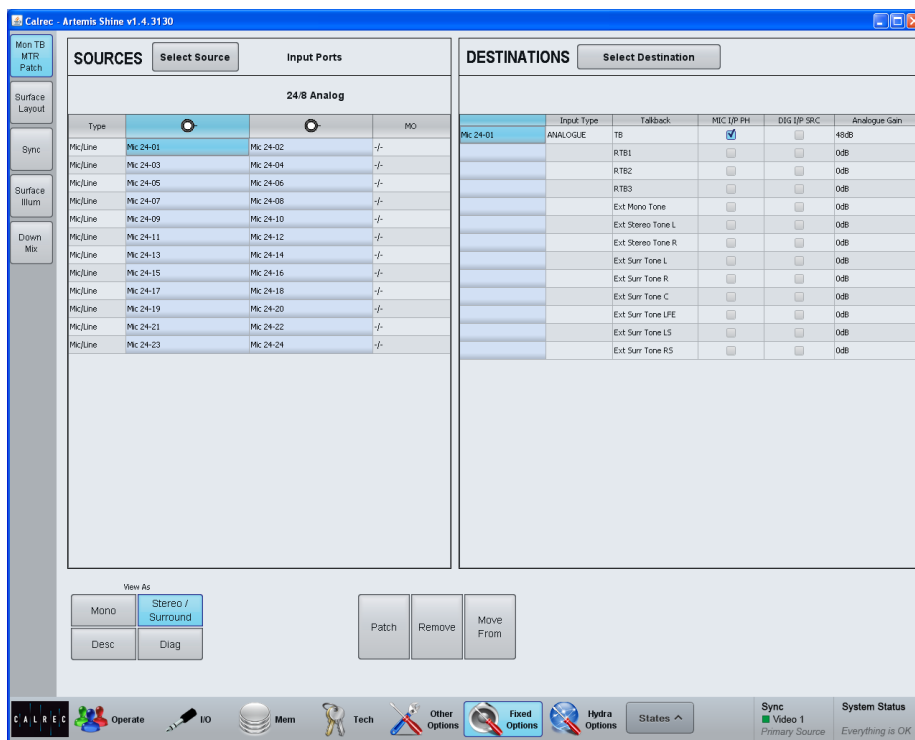
An XLR on the upstand reset panel provides a convenient location to mount the supplied gooseneck microphone. This is wired internally to an XLR on the console rear interface. To use this as part of the console's talkback system it should be connected to a Hydra2 mic input. If the console talkback system is not going to be used, the mic can be wired into an external comms system if it is convenient, i.e. for use as a hot-mic or in conjunction with a foot switch, or an assignable monitor panel button patched to GPO.

The Hydra2 input port with the mic connected should be patched to the talkback input from the Fixed Options > MON TB MTR Patch screen - Select Destinations>My Desk Inputs>Tone & TB. The top entry in this list is the Talkback mic input.

The same screen allows for patching of reverse talkback and external tone inputs. Audio from Hydra2 inputs patched as reverse talkback is sent to the PFL/RTB LS outputs. Ports patched as external tone inputs replace the consoles internal tone generator when the oscillator controls from panel tools mode are set to external.

Ports are patched in the same way as normal I/O - View the appropriate port list using the select source button, then select the required source on the left by highlighting the blue cell. Select the destination on the right, again by selecting the blue cell, and then click patch from the central area. Additional fields on the right allow the switching of SRC, phantom power and analog input gain, dependant on the type of input port patched.

MAIN PC APPLICATION - FIXED OPTIONS > MON TB MTR PATCH



ASSIGNING GPIO

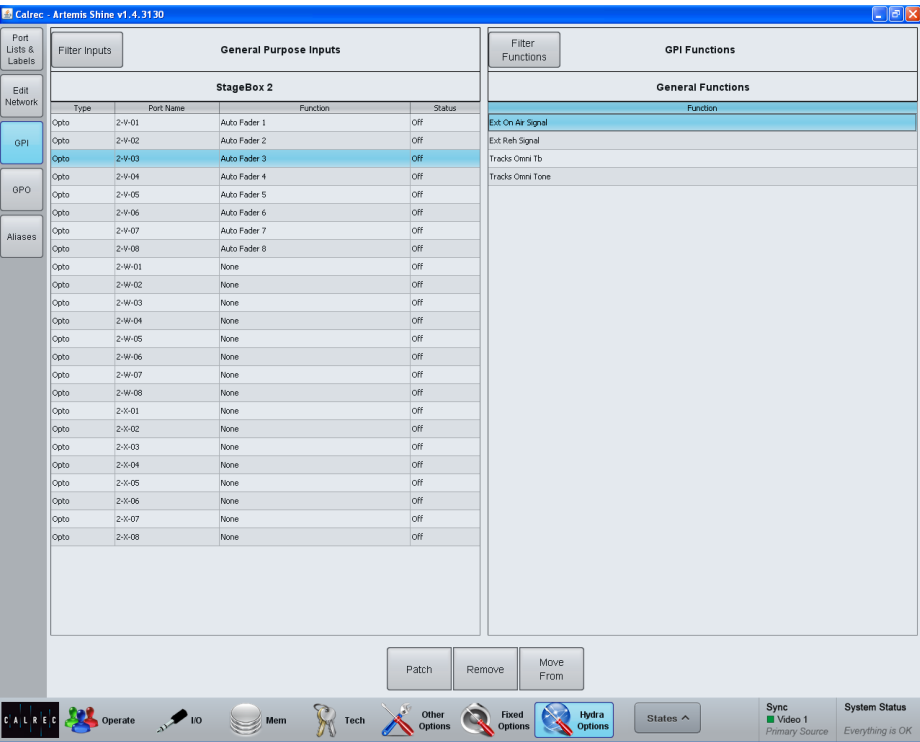
GPIO assignment is achieved from the Hydra Options > GPI & GPO pages.

Select the GPO page to patch functions to GP output relays. The lefthand side of the screen shows the functions available to patch. Click on the functions button at the top of the list to view different function types by group. The relay outputs are shown on the right and the list can be filtered by I/O box using the Filter button. To make an assignment, highlight the function and the relay, and then click patch. The Test button allows each relay to be triggered to check wiring.

GP inputs are assigned from the GPI screen in a similar way. The inputs are shown on the left and can be filtered by I/O box. The functions to be triggered are on the right and are split in to groups by function type, selectable from the Filter Functions button.

GPIO patching is saved as part of the show, rather than in each user memory.

MAIN PC APPLICATION - HYDRA OPTIONS > GPI PATCHING SCREEN



APOLLO PANEL OPTIONS

FADER PANEL – IC5701

Fader panels take up a large portion of the control surface, multiple panels being fitted to make up the required fader quantity.

Usually, fader panels are fitted in the bottom row of the control bed, though if required can be fitted in the upper row as well.

The IC5701 is fitted with 8 x 100mm throw faders.

As standard, the panel is fitted with "Cut" buttons to mute fader paths. As an option, "On" buttons can be fitted and the software configured for reverse functionality - the fader path is active when On is lit and muted when it is not. If On buttons are required, this should be specified at the time of order.

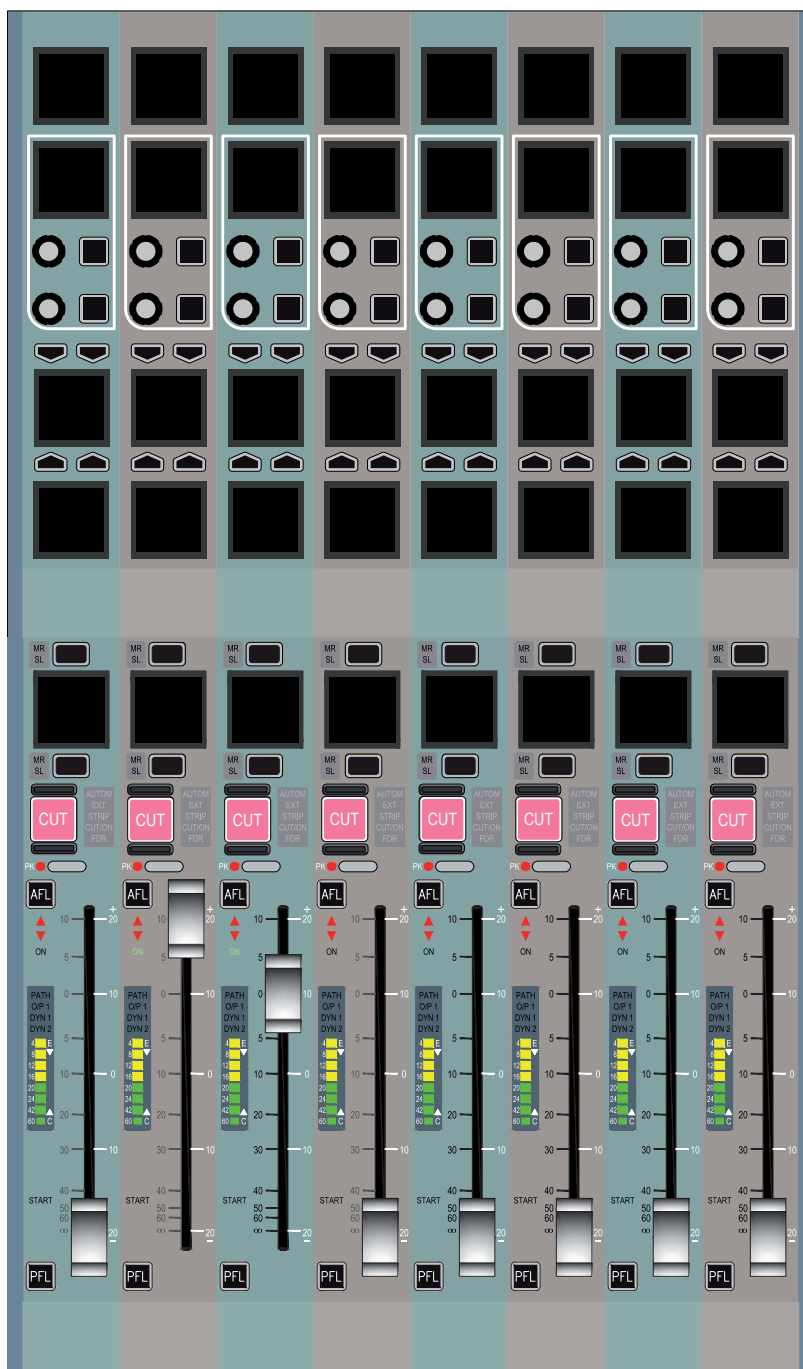
Connections

This panel has a single RJ45 POE connection for its data and power. Fader panels connect to specific POE switches / ports, as defined by the surface layout configuration set in the Main PC Application.

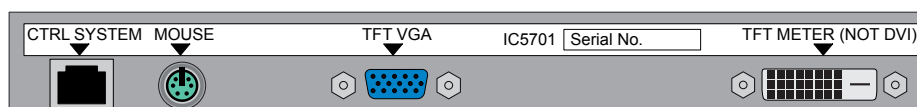
A (NOT*) DVI connector is used to send data to the associated up-stand TFT screen above the fader panel, if fitted.

*Note, the connector type is DVI, but the format is not DVI - This should not be connected to anything other than Calrec TFT panels, doing so may damage the equipment.

Mouse and TFT VGA connections are used for factory configuration only.



CONNECTOR LAYOUT



DUAL FADER PANEL – IC5717

The IC5717 is a dual fader panel, fitted with 8 x 100mm throw faders and a second row above of 8 x 60mm faders.

The panel is the same physical size as the IC5701 with some strip functionality removed to make space for the second row of faders. The dual fader panel gives physical access to both A & B layers simultaneously.

Control surfaces can be fitted with a mixture of single and dual fader panels if required.

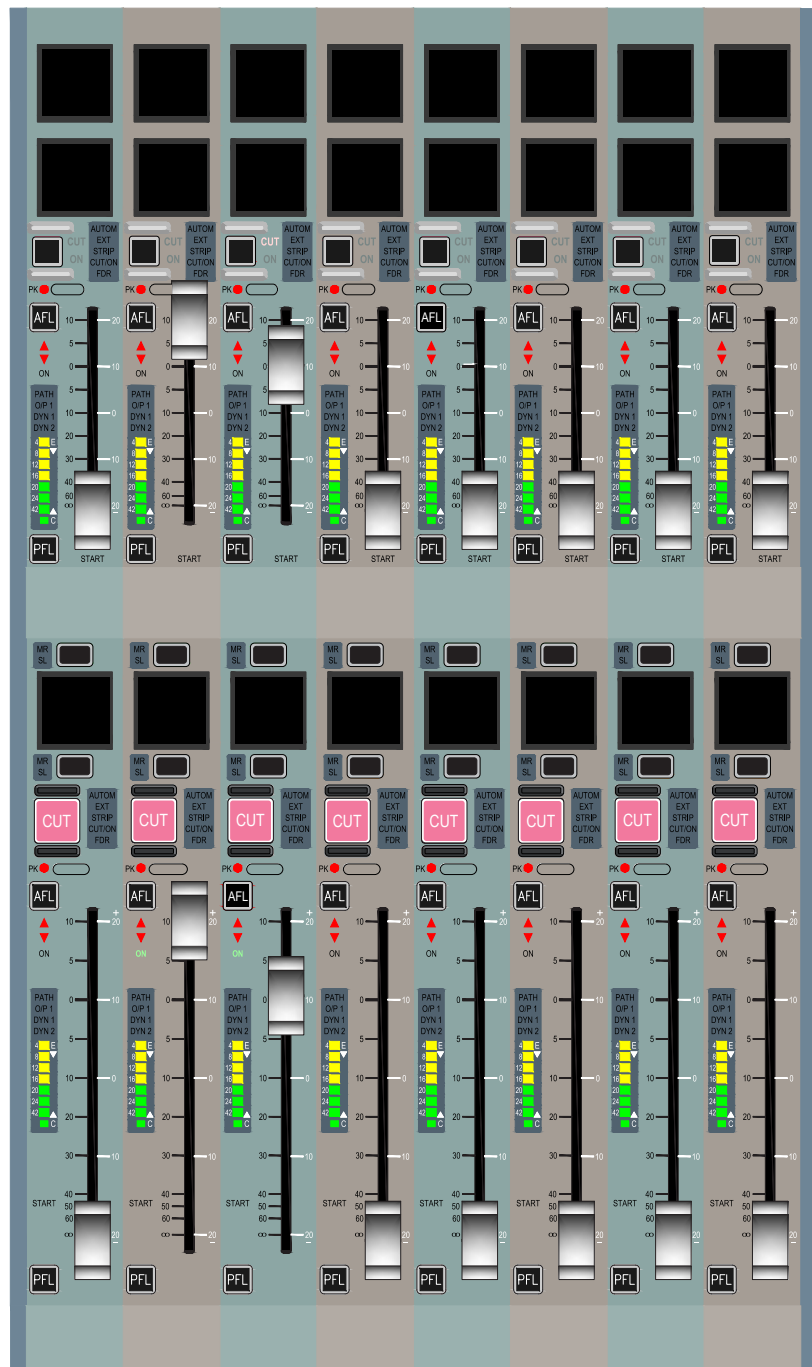
As standard, the panel is fitted with "Cut" buttons to mute fader paths. As an option, "On" buttons can be fitted and the software configured for reverse functionality - the fader path is active when On is lit and muted when it is not. If On buttons are required, this should be specified at the time of order.

Connections

The additional faders require extra power that cannot be delivered by a single POE connection, therefore this panel has 2 x RJ45 ports. CTRL SYSTEM is the main data and power connection from a POE switch panel port, AUX POWER provides the additional power required and connects to a POE switch ancillary power port. As with all intelligent surface control panels, the data connection needs to be connected to the POE switch / port as defined by the console layout in the Main PC Application.

A (NOT*) DVI connector is used to send data to the associated up-stand TFT screen above the fader panel, if fitted.

*Note, the connector type is DVI, but the format is not DVI - This should not be connected to anything other than Calrec TFT panels, doing so may damage the equipment.



CONNECTOR LAYOUT



ASSIGNABLE CONTROL PANEL – CA5700

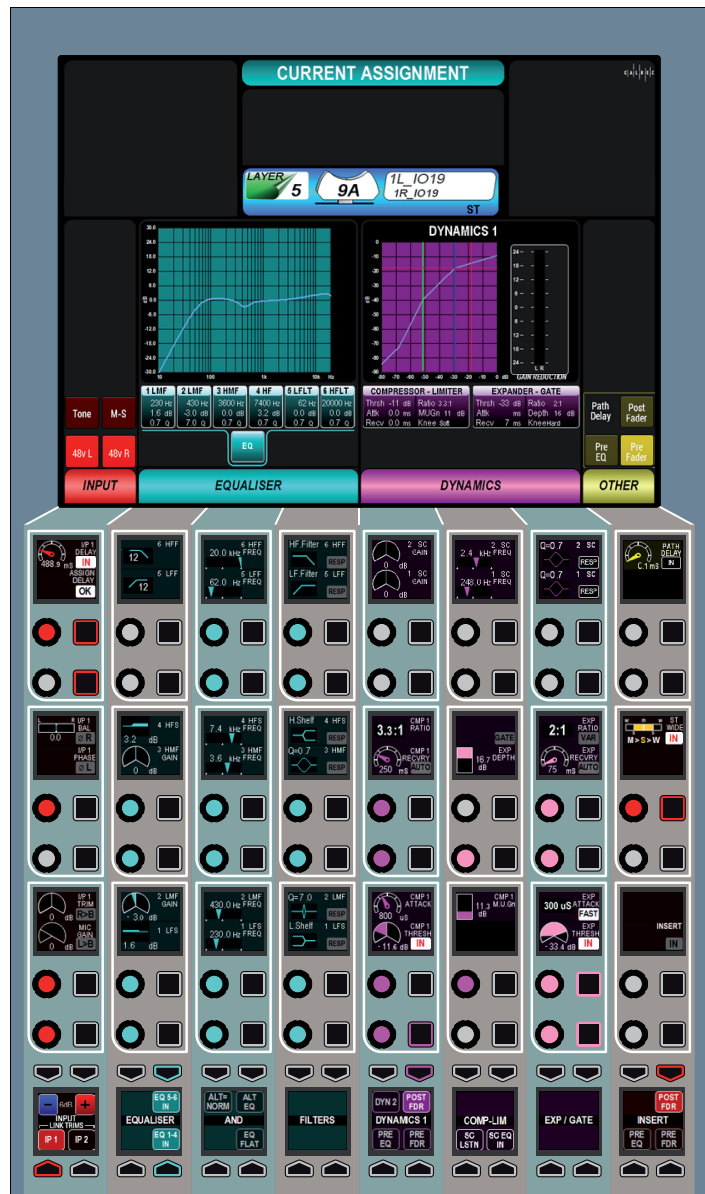
Assignable control panels can quickly switch between 4 main operating modes, giving access to the majority of operational functionality and can also be used in "wilds" mode to provide inline control functions for the fader directly below each strip.

An assignable panel needs to be located above a fader panel in order for it to be fully functional and for mode selection to be performed. Multiple assignable panels can be fitted in order to provide multiple modes of control parameters at the same time, as well as giving control to all functions from various physical locations across the console and also to provide control to multiple operators working on the same console at the same time.

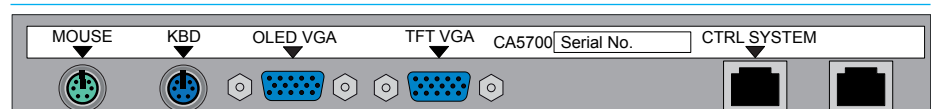
Connections

A single RJ45 connection labelled CTRL SYSTEM provides all data and power for this panel type.

A second, unlabeled RJ45 is unused. Keyboard, Mouse and VGA connectors are for factory configuration.



CONNECTOR LAYOUT



MONITOR PANEL – IM5705

The monitor panel fits in either row of the control bed, providing a dedicated set of the main monitoring controls.

As well as monitoring controls, this panel provides surround spill and downmix faders for in-depth control over surround paths. The faders on this panel can also be used to control Main Output bus levels if required.

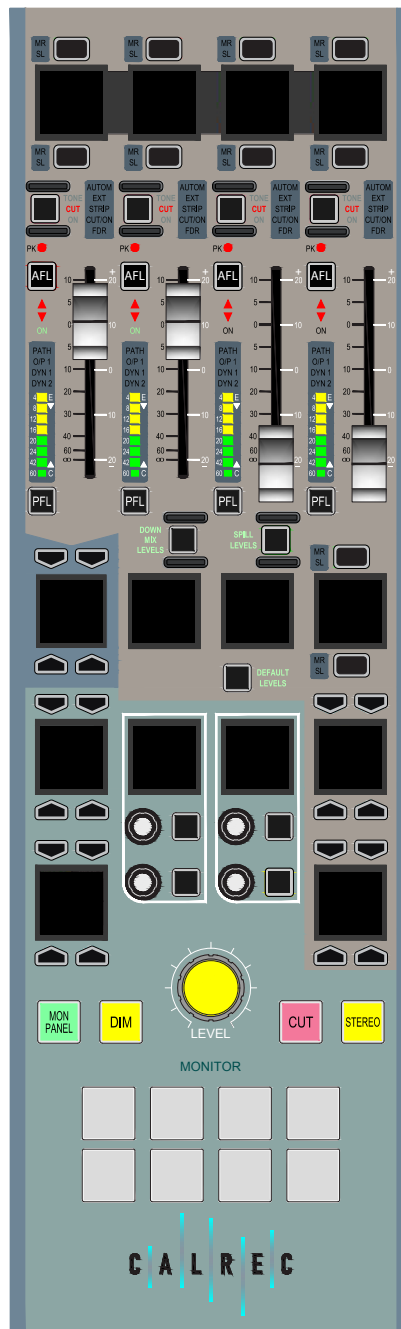
Eight buttons with LED tallies are fitted at the bottom of the panel that can be assigned to GPIO for the triggering of external devices, for example for talkback or remote start of playout devices.

If required, for example on a large console, or for multiple operators, multiple monitor panels can be fitted in the same control surface. Each can switch between controlling monitor 1 or monitor 2 outputs as well as having access to miscellaneous monitor and headphone outputs.

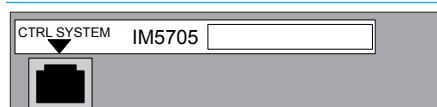
Connections

A single RJ45 carries all data and power for this panel type and should be connected to a POE switch panel port, as determined by the console layout settings in the Main PC Application.

"Half width" Apollo panels such as this require a fader or assignable control panel to carry out their main processing functions. Any fader or assign panel in the surface can be allocated as the master to a half-width panel from the console layout screen of the Main PC Application. As standard, the panel to the left of the half-width panel is configured to be its master. The master panel must be fitted and functional for the slaved half-width panel to be functional.



CONNECTOR LAYOUT



JOYSTICK PANEL – IW5718

The joystick panel, like the monitor panel is "half-width" and can fit in either row of the control bed. Typically it would be located above the monitor panel.

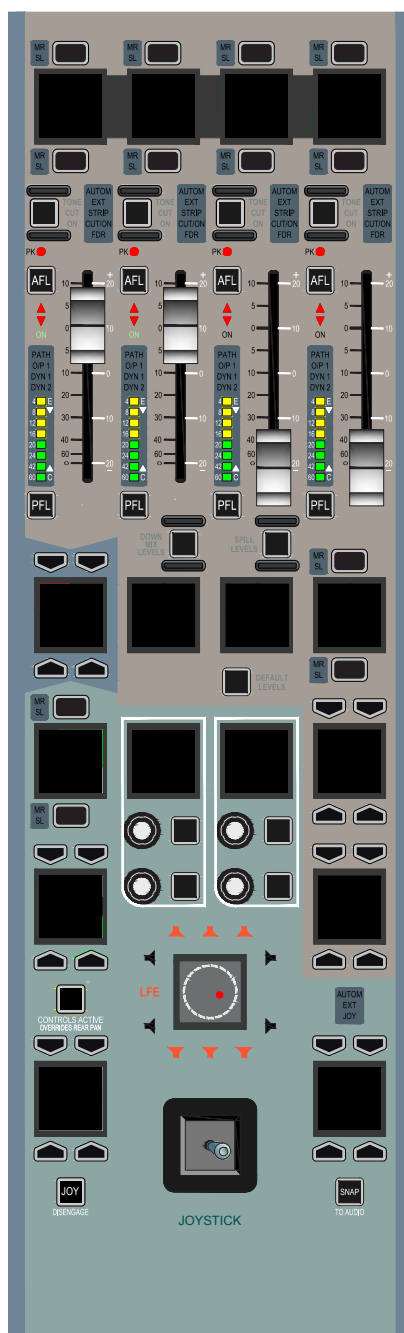
This panel provides joystick control over surround panning / output positioning from mono and stereo paths.

Like the monitor panel, the joystick panel also provides assignable control over surround paths spill and downmix settings, as well as allowing its faders to be assigned to Main output busses if required.

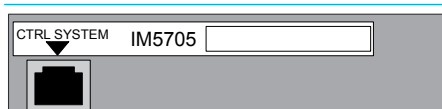
Connections

A single RJ45 carries all data and power for this panel type and should be connected to a POE switch panel port, as determined by the console layout settings in the Main PC Application.

"Half width" Apollo panels such as this require a fader or assignable control panel to carry out their main processing functions. Any fader or assign panel in the surface can be allocated as the master to a half-width panel from the console layout screen of the Main PC Application. As standard, the panel to the left of the half-width panel is configured to be its master. The master panel must be fitted and functional for the slaved half-width panel to be functional.



CONNECTOR LAYOUT



TFT METER PANEL – MD5702

A number of TFT meter panels can be fitted in the control surface up-stand to display input and output audio metering and dynamics gain reduction.

Each up-stand meter panel requires a fader panel to carry out its processing and therefore the maximum number of up-stand meter panels fitted in a console is the same as the number of fader panels fitted.

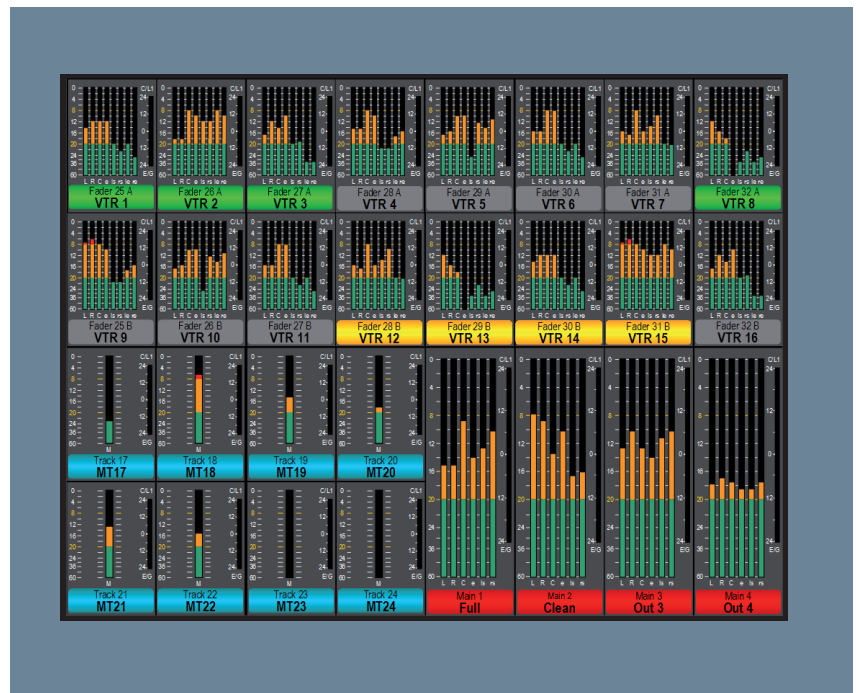
Each panel can display numerous meters, the size and sources displayed are user configurable from the Main PC Application. TFT meter panels are the same width as fader and assignable panels, and as such are often configured to display 8 meters across the width in the bottom row, to line up with the faders beneath them and to display fader input signals.

As well as all fader inputs and all bus outputs, meters can be set to follow monitoring, console meter selectors and external inputs.

Connections

Each TFT meter panel receives its data and power via a single (*NOT) DVI connection, direct from a fader panel.

*Note, the connector type is DVI, but the format is not DVI - This should not be connected to anything other than Calrec fader panels, doing so may damage the equipment.



RTW TM7 METER – MU5993

The MU5993 console up-stand panel is fitted with an RTW TM7 meter, providing a visual surround field representation along with comprehensive surround phase monitoring and other features such as loudness metering and optional moving coil meter emulation.

Multiple types of metering instruments can be displayed simultaneously on each TM7 meter, the layout and sizing of each element is configurable. The images on this page show examples of meter types and layouts available. For full details on TM7 functions, please refer to the RTW website. Multiple meter panels can be fitted into a control surface if required.

The TM7 is supplied with 8 balanced analog inputs, 8 AES digital inputs and 8 digital outputs. Digital I/O can be supplied as either 75 Ohm unbalanced AES3id on a BNC connector interface, or as 110 Ohm balanced AES3 on a D-type connector interface. Digital I/O format for the TM7 should be specified at the time of order.

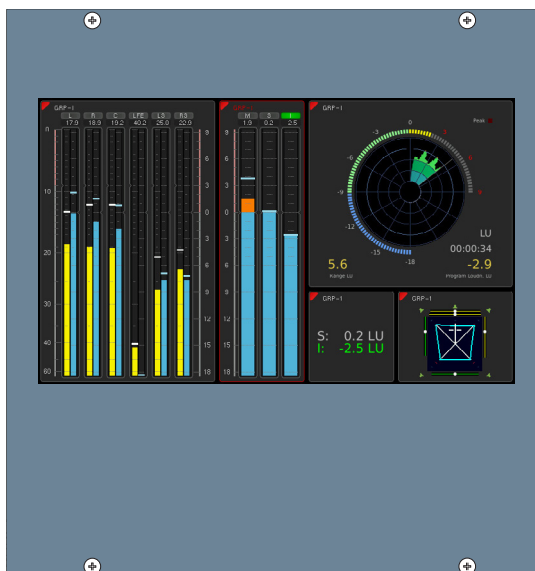
The TM7 does not access Calrec meter data, it requires audio feeds via the console's rear interface panel. If the meter is to be fed directly from console outputs, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Being 195mm [7.68"] wide, this panel is often located next to the RT5707 reset / facilities panel, the two panels having a combined width of 250mm [9.84"] - the same as standard panels such as faders, assignable's and up-stand TFT panels.

Connections

Analogue inputs are on a 25 pin female D-Type, AES I/O is either on a 25 pin female D-Type if balanced, or on BNC's if unbalanced, depending on the type

MU5993 - EXAMPLE 1 OF METER TYPES AND LAYOUT AVAILABLE



MU5993 - EXAMPLE 2 OF METER TYPES AND LAYOUT AVAILABLE



ordered. See the Surface Rear Connector Interface Pin-Outs section for wiring detail.

The RTW meter is powered from a single RTW PSU located within the

control surface and fed from the ancillary AC mains input on the rear connector interface.

DK MSD600++ METER – MU5799

The MU5799 console up-stand panel is fitted with a DK Audio MSD600++ surround meter, providing a visual surround field representation along with comprehensive surround phase monitoring and other features such as loudness metering.

The MSD600++ has 4 I/O slots that can be fitted with various formats of card:

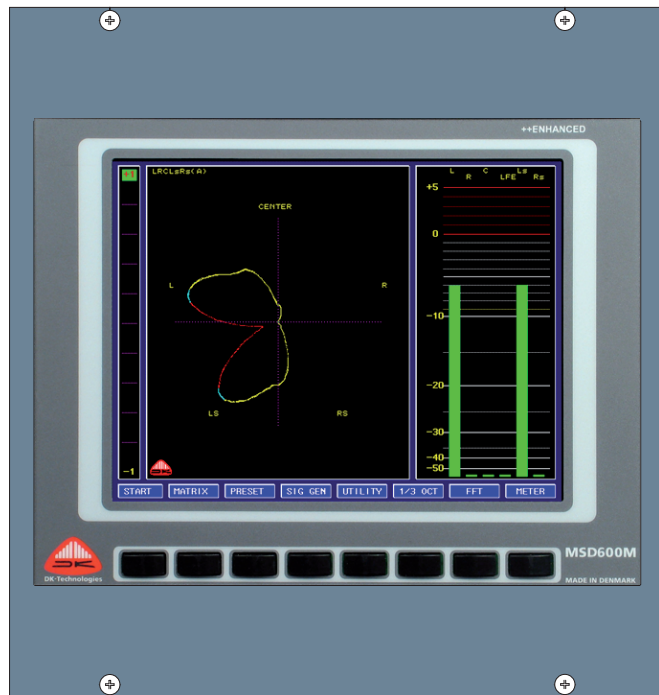
- AES & Analog - Each card has 1 x digital stereo input and a pair of analog inputs. Fully populating the meter with this card type provides 4 stereo digital and 8 analog inputs.
- AES only - Each card having 4 stereo digital inputs.
- Analog only - Each card having 8 analog inputs.

DK's digital inputs are available either as AES3id unbalanced 75 Ohm on BNC connectors, or AES3 balanced 110 Ohms on D-type connectors.

Card types required should be specified at the time of order as it affects the internal wiring and rear interface plate layout of the console. Multiple RTW meters can be fitted in the same control surface if required.

This meter does not access Calrec meter data, it requires dedicated audio feeds. If it is to be fed directly from console outputs, these should be provisioned for in the quantity of Hydra2 output ports being ordered.

Being 195mm [7.68"] wide, this panel is often located next to the RT5707 reset / facilities panel, the two panels having a combined width of 250mm [9.84"] - the same as standard panels such as faders, assignable's and up-stand TFT panels.



Connections

Analogue inputs are on a 25 pin female D-Type, AES I/O is either on a 25 pin female D-Type if balanced, or on BNC's if unbalanced, depending on the type ordered. See the Surface Rear Connector Interface Pin-Outs section for wiring detail.

The DK meter is powered from a single DK PSU located within the control surface and fed from the ancillary AC mains input on the rear connector interface.

LOUDSPEAKER PANEL – LS5930

The LS5930 is an optional loud speaker panel for the Apollo up-stand. Multiple panels can be fitted in each control surface if required.

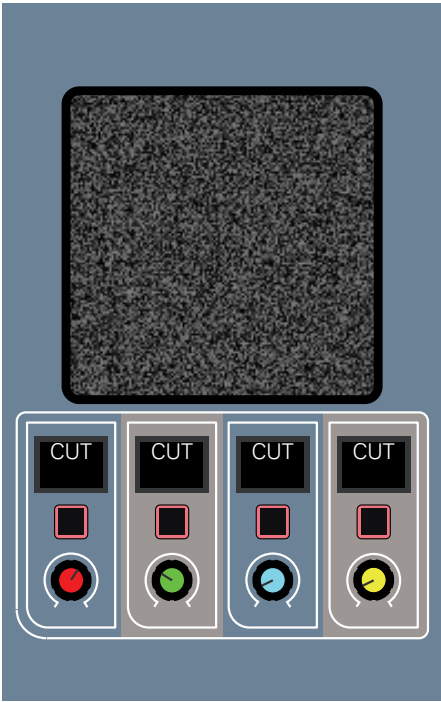
The panel is fitted with a single (mono) loudspeaker, fed by 4 balanced stereo analog inputs, accessible on the rear interface panel (pin-outs shown in the Connection Information section). DIP switches accessible from the rear of the panel enable or disable each leg of each input. From each of the 4 inputs, the loudspeaker can output left, right, both or neither. If inputs are wired but unused / left unterminated, they should be disabled to eliminate noise picked up by the cable run.

Each pair of stereo inputs has a front panel level control, the range of which is set by DIP switch to be either ∞ to +10dB, or -20 to +10dB.

Each level control knob is illuminated to aid identification, the color of each can be set independently using PCB mounted rotary switches, accessible from the rear of the panel.

A front panel button, located above each level control functions as a Cut or an On switch. DIP switches accessible from the rear of the panel set this functionality, which is shown in the front panel display above the button, and also sets the button LED to light appropriately for the chosen function. Another DIP switch is used to set the cut / on status at power up. All four inputs can simultaneously be remotely cut or dimmed by applying a ground to the relevant pin on the console's rear interface (see Connection Information section).

DIP switches are also used to set the frequency response of the signal feeding the speaker. The flat response is +/- 0.5dB 20Hz-20KHz. A high frequency



filter (4k7Hz) and / or a low frequency filter (215Hz) can be switched in.

Connections

This panel receives POE power from a POE switch ancillary power (AP) or SPR port. The audio interface and external cut / dim lines are on a 25 pin D-type connector wired internally to the rear interface panel of the control surface.

SWITCH 1-4 - INPUT ENABLE/DISABLE

Switch	Function
DIP switch 1/1	Input 1 Left disable
DIP switch 1/2	Input 1 Right disable
DIP switch 2/1	Input 2 Left disable
DIP switch 2/2	Input 2 Right disable
DIP switch 3/1	Input 3 Left disable
DIP switch 3/2	Input 3 Right disable
DIP switch 4/1	Input 4 Left disable
DIP switch 4/2	Input 4 Right disable

- Set switch **on (1)** to disable, **off (0)** to enable.

SWITCH 9/1 - BUTTON FUNCTION

Sw 9/1	Function
0	Button = CUT
1	Button = ON

SWITCH 9/2 - MINIMUM POT LEVEL

Sw 9/2	Function
0	Min pot level = -20
1	Min pot level = ∞

ROTARY SET - LEVEL CONTROL COLOR

Rotary Switch	Input knob
5	Input 1
6	Input 2
7	Input 3
8	Input 4

- Turn the appropriate switch to cycle through the colors available.

SWITCH 14 - BOOT STATUS

Switch	Boot-up status
14/1	Input 1
14/2	Input 2
14/3	Input 3
14/4	Input 4

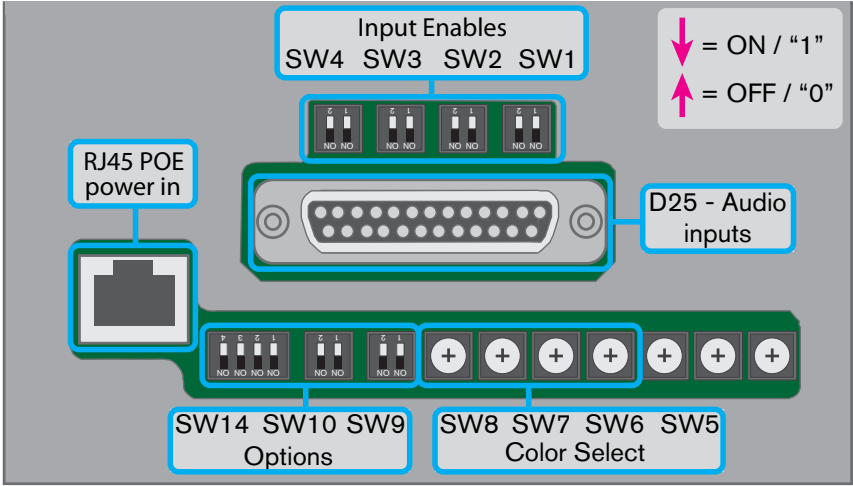
SWITCH 10/1 - LOW FREQ FILTER

Sw 10/1	LF filter status
0	LF filter active
1	LF filter bypassed

SWITCH 10/2 - HIGH FREQ FILTER

Sw 10/2	HF filter status
0	HF filter active
1	HF filter bypassed

REAR OF PANEL - CONNECTOR AND DIP SWITCH LOCATIONS



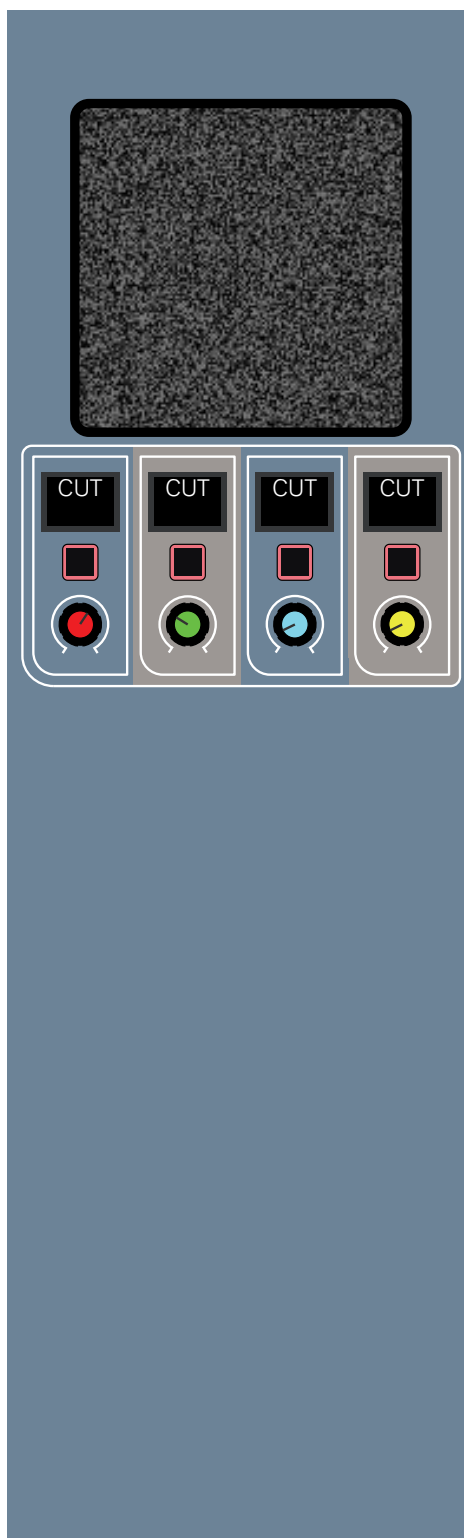
D25 - REAR OF PANEL AND REAR INTERFACE LS CONNECTOR PIN-OUT

Analog input		Pin
1 Left	+	1
	-	14
	Ground	3
1 Right	+	2
	-	15
	Ground	3
2 Left	+	16
	-	4
	Ground	18
2 Right	+	17
	-	5
	Ground	4
3 Left	+	6
	-	19
	Ground	8
3 Right	+	7
	-	20
	Ground	8
4 Left	+	21
	-	9
	Ground	23
4 Right	+	22
	-	10
	Ground	23
Logic	Ext Cut	11
	Ext Dim	24
	Ground	13

LOUDSPEAKER PANEL – LS5957

The LS5957 is an optional loud speaker panel designed to fit in either row of the Apollo control bed.

This panel is identical in functionality and connectivity to the LS5930 up-stand mounting version. Please refer to the LS5930 information for detail.



LOUDSPEAKER PANEL – LS6053

The LS6053 provides the same functionality as the LS5930, with the addition of a level control for an external analog audio path.

The level control is a dual gang potentiometer, allowing for a balanced analog mono audio feed to be passed through it. Typically, this would be used to control the audio level to an ancillary control room loudspeaker, such as a "hot-mic" or communications output, that does not have its own level control, or is not within the physical reach of the audio operator.

Like the LS5957, the LS6053 will fit in either row of the Apollo control bed.

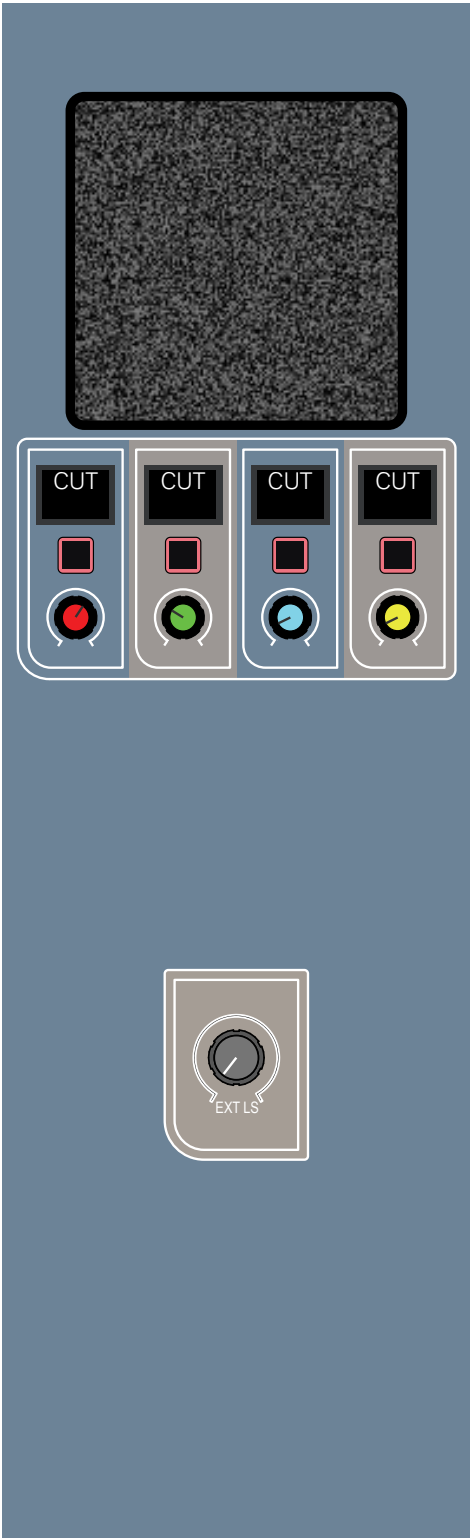
Please refer to the LS5930 information for details on the standard functionality and connectivity of this panel.

Additional level control connection

The analog audio feed to be passed via the central level control should be connected to the female D9 connector on the rear of the control panel itself. Cabling should be routed via the surface cable entry point by the rear connector interface panel.

Connection	Pin
Input +	1
Input -	6
Output +	3
Output -	9
Ground	2 / 4 / 7 / 8

- Cable requires MALE D9 termination



FACILITIES PANEL RT5707

Each control surface requires that a Broadcast Facilities panel is fitted in the upstand.

This panel is 55mm [2.17"] wide and as such is ideally fitted alongside a 3rd party surround meter, or twin/quad moving coil VU meters to take up the same width as a standard panel.

The Broadcast Facilities panel provides the following:

Resets

Three reset buttons along with an enable button are located at the bottom of this panel. As a safety precaution, to activate a reset, the enable button must also be pressed as well as the desired reset button. The resets are split into three areas -

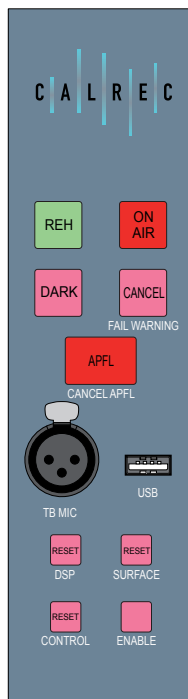
- "DSP" resets the audio signal processing cards in the processing rack.
- "Control" resets the Master Control processors in the processing rack.
- "Surface" resets the control surface panels.

Talkback mic

A female XLR is provided to connect the supplied goose-neck microphone. This connects directly to an XLR on the rear interface panel (no gain or power is applied in the console). The microphone can be connected into an external talkback system, or the console's own talkback system via a Hydra2 input. Please refer to the console configuration section for details on console talkback setup.

USB port

The USB port on this panel connects directly to a USB port on the console PC, providing convenient access for file transfer, such as memory backups. The



spare USB-Ethernet adaptor can also be connected to this USB port to provide a temporary second network connection to the PC if the rear interface panel is not as convenient to access.

Facilities buttons / indicators

A large red button in the center of the panel illuminates to indicate when the selected monitoring source is overruled by an AFL or PFL. Pressing this button will cancel any selected AFL or PFL, returning the monitor to its selected source.

The "Dark" button, when pressed turns off all displays on the control surface and illuminates to indicate the console is in dark mode.

An AWACS warning indicator flashes to alert the user of any console errors,

pressing this button acknowledges the errors and stops it flashing.

The on-air and rehearse buttons can be used to set the mode of the desk and disable functions such as tone

Connections

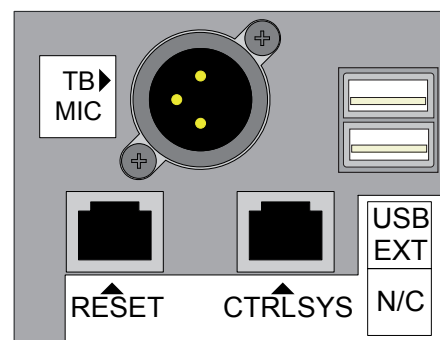
Power and data is fed via an RJ45 labelled CTRL SYS, connected from a POE switch panel port.

An RJ45 labelled RESET connects to a POE switch RST port (which is then daisy-chained through the rest of the POE switches)

The front panel USB port connects inside the panel to one of the ones on the rear which is in turn connected to a USB port on the system PC. The other USB on the rear of this panel is unused.

The front panel XLR connects inside the panel to the XLR on the rear which is in turn connected inside the console chassis to an XLR on the rear interface panel.

REAR CONNECTORS



APOLLO MOVING COIL METERS*

* High quality moving coil meters are no longer being manufactured. With a lack of supply, Calrec has regretfully had to withdraw them from the product range. Users who still prefer to use this style of meter should order up-stand mounting RTW TM7 / TM9 meter panel/s (see previous Panel Options section), specifying that moving coil emulation software is enabled. This package provides accurate VU and PPM response with appropriate scaling on a clear, wide viewing-angle display using graphics and sizing that compares well with true mechanical versions.

The following section is included only in order to provide information to support the many customers using existing moving coil meter panels.



STEREO MOVING COIL METERS

The MV5778 has VU scaling and ballistics, the MU5775 has PPM scaling and ballistics. Both are dual needle, stereo moving coil meters.

These panels are 130mm [5.12"] wide, and as such are often fitted above the monitor or joysticks panels which are the same width.

Moving coil meters do not access the meter data system and require an audio feed via the console's rear connector interface. If the meter is to be fed directly from console outputs, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Moving coil meters can be fed with either digital or analog audio signals. The inputs are mixed rather than switched however so only one format should be fed at any given time.

Connections

Audio is received via a female D25 connector on the console's rear interface panel. This wires internally to a female D9 on the back of the meter panel itself. See the Surface Rear Connector Pin-outs section for wiring detail.

The meter panels are powered via a single RJ45 connection fed from a POE switch ancillary power port.

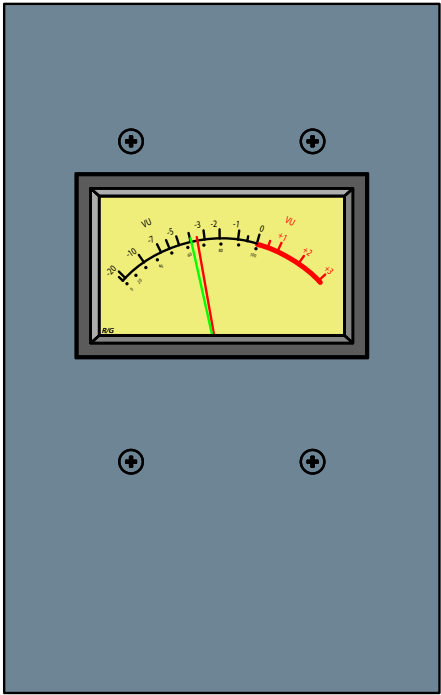
DIP switch configuration

PCB mounted DIP switches provide some configuration options for moving coil meters. To access these switches, the panel needs to be removed from the control surface. Once removed, the drive card for the meters is accessible from the rear.

Level

A bank of 4 switches is used on each audio leg to set the level to be displayed

MV5778 - STEREO VU METER

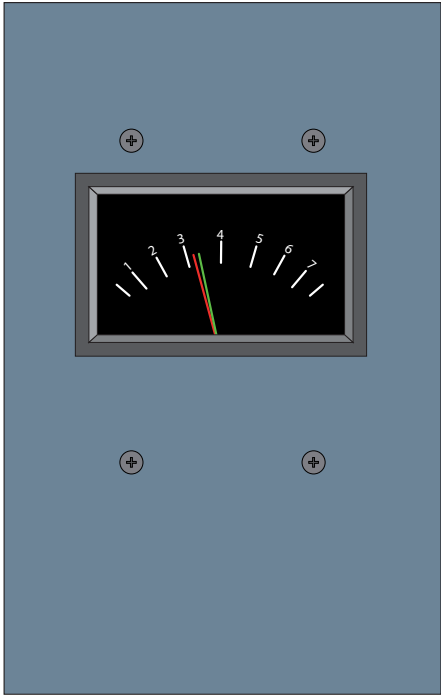


on the meters at line-up. These are adjusted to compensate for the meter type fitted and operating level. The table below shows which bank of switches is used for each audio channel.

CHANNEL LEVEL SWITCHES

Audio Path	Switch
Left	SW 2
Right	SW 3

MU5775 - STEREO PPM METER



Each bank of four switches should be set as per the table below for the required line-up level.

LEVEL SWITCH SETTINGS

1	2	3	4	Level
0	0	0	0	0
0	0	0	1	-2
1	0	0	1	-4
1	1	0	1	-6
1	1	1	1	-15

TWIN STEREO MOVING COIL METER

The MU5891 is fitted with two dual needle moving coil meters with PPM scaling and ballistics. The left hand meter has red / green needles for displaying stereo audio. The right hand meter has white / orange needles, intended to display the M/S content of the stereo signal fed.

This panel type is a standard 250mm [9.84"] wide, the same as fader panels, assignable panels and up-stand meter panels.

As with all moving coil and 3rd party meters, this panel does not access meter data and requires an audio feed via the console's rear interface. If it is to be fed directly from the console, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Moving coil meters can be fed with either digital or analog audio signals. The inputs are mixed rather than switched however so only one format should be fed at any given time.

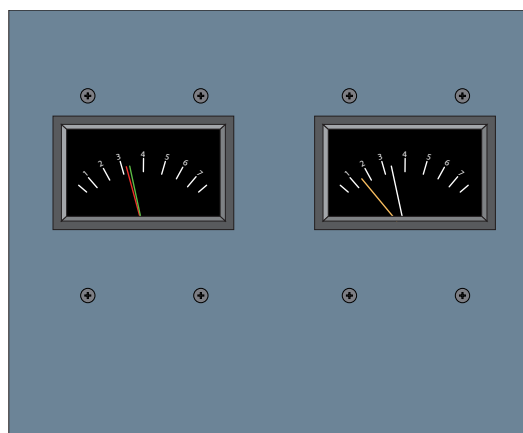
Connections

Audio is received via a female D25 connector on the console's rear interface panel. This wires internally to a female D25 on the back of the meter panel itself. See the Surface Rear Connector Pin-outs section for wiring detail.

The panel is powered via a single RJ45 connection fed from a POE switch ancillary power port.

DIP switch configuration

PCB mounted DIP switches provide some configuration options for moving coil meters. To access these switches, the panel needs to be removed from the control surface. Once removed, the drive card for the meters is accessible from the rear.



Level

A bank of 4 switches is used on each audio leg to set the level to be displayed on the meters at line-up. These are adjusted to compensate for the meter type and operating level. The table below shows which bank of switches is used for each audio channel.

CHANNEL LEVEL SWITCHES

Audio Path	Switch
1 Left	SW 2
1 Right	SW 3
2 Left	SW 1
2 Right	SW 4

Each bank of four switches should be set as per the table below for the required line-up level:

LEVEL SWITCH SETTINGS

1	2	3	4	Level
0	0	0	0	0
0	0	0	1	-2
1	0	0	1	-4
0	1	0	1	-6
0	0	1	1	-9

L/R or M/S

The right hand meter can be set to display left / right stereo, or M/S (mid/side / sum/difference). DIP switch 5 should be set accordingly as shown in the following table. In M/S mode, the mono sum can be a standard A+B-6, or it can be set to A+B-3, using DIP switch 6.

SWITCH 5 - L/R / M/S

1	2	3	4	Operation
1	0	1	0	L/R
0	1	0	1	M/S

SWITCH 6 - A+B-6/-3

1	2	Operation
1	1	A+B-3
0	0	A+B-6

TWIN VU MOVING COIL METER – MV5943

The MV5943 is fitted with two, single needle moving coil meters with VU scaling and ballistics.

This panel type is 195mm [7.68"] wide, the same width as a 3rd party surround meter and is therefore ideally suited to be located next to the reset / facilities panel, or a 55mm blank panel to give a combined width of 250mm [9.84"] - that of a standard panel such as faders, assignables and up-stand TFTs.

Moving coil meters do not access the meter data system and require an audio feed via the console's rear connector interface. If the meter is to be fed directly from console outputs, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Moving coil meters can be fed with either digital or analog audio signals. The inputs are mixed rather than switched however so only one format should be fed at any given time.

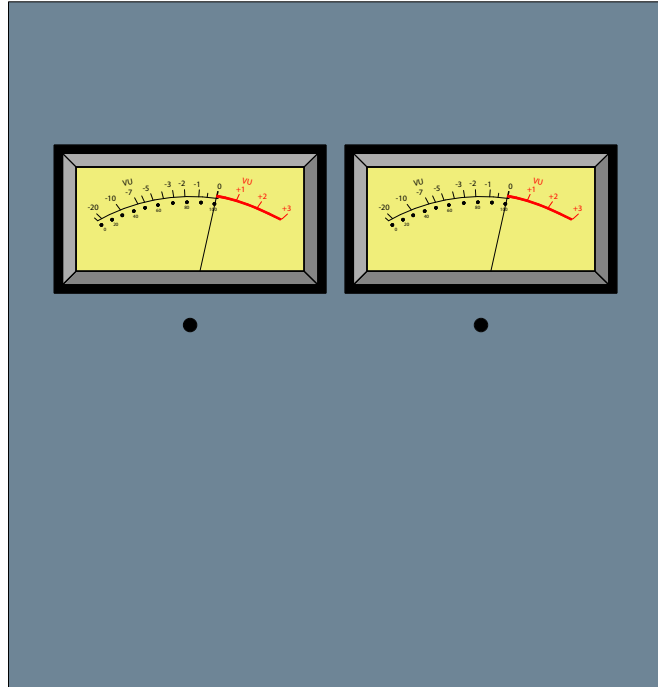
Connections

Audio is received via a female D25 connector on the console's rear interface panel. This wires internally to a female D37 on the back of the meter panel itself. See the Surface Rear Connector Pin-outs section for wiring detail.

Meter panels are powered via a single RJ45 connection fed from a POE switch ancillary power port.

DIP switch configuration

The drive card for this panel type is designed to work only with VU meters and as such has no DIP switch configuration options.



QUAD VU MOVING COIL METER – MV5889

The quad moving coil option is fitted with four, single needle moving coil meters with VU scaling and ballistics.

This panel type is 195mm [7.68"] wide, the same width as a 3rd party surround meter and is therefore ideally suited to be located next to the reset / facilities panel, or a 55mm blank panel to give a combined width of 250mm [9.84"] - that of a standard panel such as faders, assignables and up-stand TFT's.

The same panel is also available as an MV5970 which is slightly narrower at 185mm [7.28"], designed specifically to sit in a 3+ chassis section alongside a 6 way VU panel, a reset / facilities panel and a standard TFT meter panel.

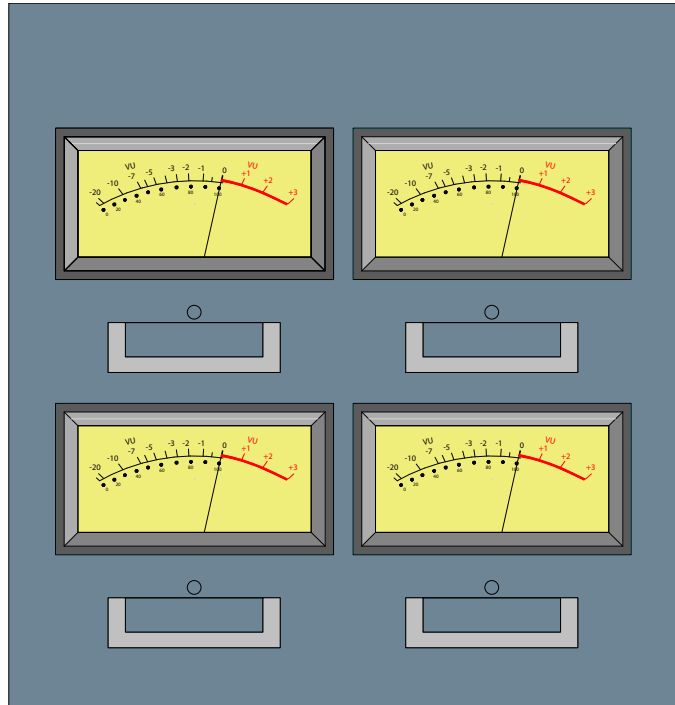
Moving coil meters do not access the meter data system and require an audio feed via the console's rear connector interface. If the meter is to be fed directly from console outputs, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Moving coil meters can be fed with either digital or analog audio signals. The inputs are mixed rather than switched however so only one format should be fed at any given time.

Connections

Audio is received via a female D25 connector on the console's rear interface panel. This wires internally to a female D37 on the back of the meter panel itself. See the Surface Rear Connector Pin-outs section for wiring detail.

Meter panels are powered via a single RJ45 connection fed from a POE switch ancillary power port.



DIP switch configuration

The drive card for this panel type is designed to work only with VU meters and as such has no DIP switch configuration options.

6 WAY VU MOVING COIL METER – MV5916

The MV5916 is fitted with six, single needle moving coil meters with VU scaling and ballistics.

This panel type is unusual at 270mm [10.63"] wide, 20mm wider than standard control panels and would therefore need to be fitted along with blank panels in many chassis configurations. It does however fit perfectly alongside the reduced width MV5970 4 way VU panel in a 3+ chassis section along with a standard TFT meter panel and the reset / facilities panel.

Moving coil meters do not access the meter data system and require an audio feed via the console's rear connector interface. If the meter is to be fed directly from console outputs, this should be provisioned for in the quantity of Hydra2 output ports ordered.

Moving coil meters can be fed with either digital or analog audio signals. The inputs are mixed rather than switched however so only one format should be fed at any given time.

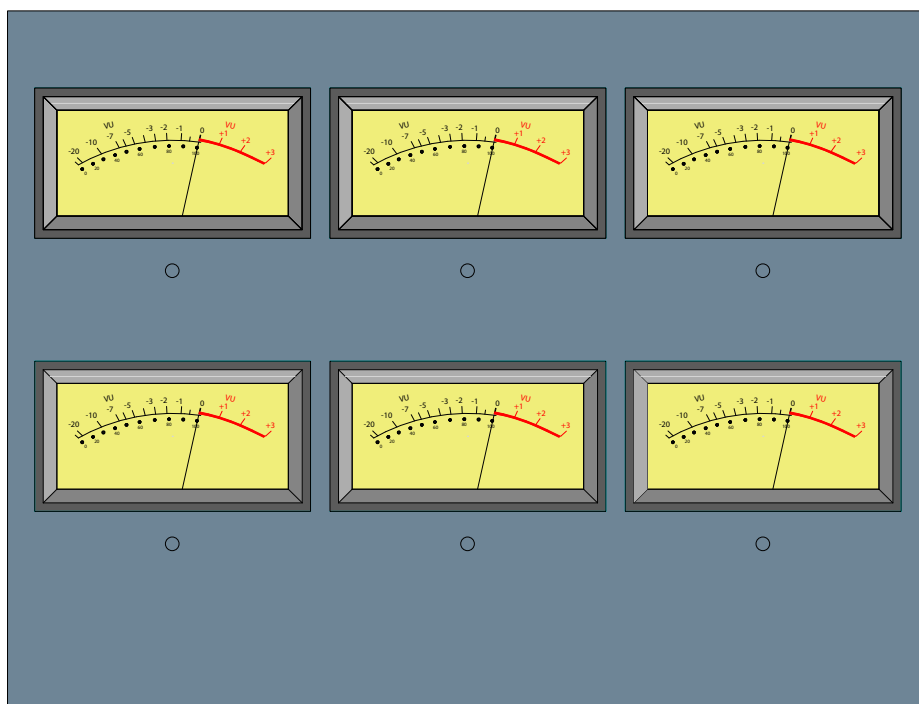
Connections

Audio is received via female D25 connectors on the console's rear interface panel. These wire internally to a female D37 on the back of the meter panel itself. See the Surface Rear Connector Pin-outs section for wiring detail.

Meter panels are powered via a single RJ45 connection fed from a POE switch ancillary power port.

DIP switch configuration

The drive card for this panel type is designed to work only with VU meters and as such has no DIP switch configuration options.



APOLLO SPECIFICATIONS

POWER / ENVIRONMENTAL SPECIFICATION

CONTROL SURFACE

AC Power	<p>The operating AC voltage is 100-240V +/-10%, 50-60Hz.</p> <p>Two IEC AC power inlets on the rear of the control surface are internally distributed to twin PSU POE switches located within the surface chassis which in turn power the main surface components. Feeding either of these IEC connectors with mains power is sufficient for console operation, however it is recommended that both are fed, and where possible from separate sources to provide full redundancy in the event of an internal PSU or external power source failure.</p> <p>The inrush current is actively limited to 13A peak at 230 VAC (6.5A at 115VAC) per internal PSU (Total number of internal PSU's is dependant on the number of POE switches fitted, typically between 2 and 5 depending on the size of the control surface. Each switch contains two PSU's, separately fed from the two IEC inputs). Limiting the inrush current reduces the chances of a nuisance trip or blown fuse from brown-out conditions or black-out recovery. The peak operating current is when all fader motors are active simultaneously, max 5W per fader for less than 120mS.</p> <p>The internal PSU's are high efficiency and employ active PFC (Power Factor Correction). The power factor is > 0.9 under all operating conditions.</p> <p>A third IEC AC power inlet powers third party manufactured hardware in the control surface, such as RTW / DK meters and the PC monitor screen).</p>
DC Power	<p>Internal AC-DC power supplies output 56V DC via POE (power over Ethernet) to the main control surface components. DC power and data is shared over a common RJ45 connection. All components can safely be "hot-plugged", are self initializing and sync with the system on receiving power. Each module locally performs isolated DC-DC conversion, operating over a wide input range of 36-75V to provide a high level of immunity against surges, transients and dips in supply.</p>
Heat Output & Efficiency	<p>The heat output from the console is typically 0.9 x total RMS VA.</p> <p>PSU efficiency is typically > 85% under all operating conditions, depending on the control surface size.</p>
Cooling	<p>The control surface is cooled by natural convection. Air intakes are located on the underside of the chassis, outlet vents are located across the top of the rear. At least 50mm (2") clearance should be maintained around the intakes and outlets to ensure airflow is unimpeded.</p>
Operating Ambient Air Temperature	<p>Short term: 5°C - 35°C.</p> <p>Long term: 15°C - 30°C.</p>
Relative Humidity	<p>5% - 80% non-condensing.</p>

PROCESSING RACK

AC Power	<p>The operating AC voltage is 100-240V +/-10%, 50-60Hz.</p> <p>The processing rack has 2 slots for AC fed PSU modules. The rack will be fully functional on one PSU, however both should be fitted and fed where possible from separate sources to provide redundancy against both PSU failure and external power loss.</p> <p>The inrush current is actively limited to 13A peak at 230V (6.5A at 115V) per power supply module, reducing the chances of a nuisance trip or blown fuse from brown-out conditions or black-out recovery.</p> <p>The PSU modules are high efficiency and employ active PFC (Power Factor Correction) The power factor is > 0.9 under all operating conditions.</p>
DC Power	<p>The rack PSU modules share the load of the whole rack, their DC outputs being combined and tracked across the rack backplane to each card slot. All rack module type's, including the PSU's are hot-pluggable and self-initializing.</p> <p>Rack PSUs output 56V DC. Each processing module within the rack performs local isolated DC-DC conversion, operating over a wide input range of 36-75V to provide a high level of immunity against surges, dips and transients in supply.</p>
Heat Output & Efficiency	<p>The heat output from the rack is nominally 0.93 x total RMS VA.</p> <p>The maximum possible heat output in a fully populated rack is 320W.</p>
Cooling	<p>The rack is cooled by fan assisted convection. Fan speed is monitored and warnings generated if any fan slows or stops.</p> <p>6 x 120mm low power, low speed and low noise fans are mounted inside the top of the rack. Air is drawn in from the cable-tray and up through the bottom of the cardframe. Air is vented out of the top of the rear of the rack.</p> <p>No clearance is required above or below the rack for cooling or airflow.</p> <p>At least 50mm (2") clearance must be maintained at the top of the rear of the racks to allow the fans / vents to dissipate air. The cable tray should not be blocked and should be allowed sufficient clearance to maintain cooling.</p> <p>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 an air conditioned bay providing the air pressure is negative. Consult factory for positive air pressure systems.</p>
Acoustic Noise	A fully populated rack produces <40dB acoustic noise (A-weighted, 1m from front).
Operating Ambient Air Temperature	0°C - 35°C.
Relative Humidity	5% - 80% non-condensing.

HYDRA2 FIXED FORMAT I/O

Power	<p>The operating AC voltage is 100-240V +/-10%, 50-60Hz.</p> <p>All fixed format Hydra2 I/O units have two IEC AC power inlets and are fitted with dual power supplies. Units will be fully functional on one PSU, however both should be fed, and where possible from separate sources to provide redundancy against both PSU failure and external power loss.</p> <p>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.</p> <p>All fixed format Hydra2 I/O units require 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.</p>
Heat Output & Efficiency	<p>The Heat output from fixed format Hydra2 I/O units 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. Heat output figures are available for all types of I/O racks.</p> <p>The low power PSU efficiency is again dependant on supply voltage and loading, generally >70%.</p>
Cooling	<p>All fixed format Hydra2 I/O units of 2U or greater are cooled 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 to the right hand side panel of each unit venting air. Fan speed is monitored and AWACS warnings generated if fans slow or fail. Air is drawn in through the left hand side panel.</p> <p>1U Hydra2 I/O racks do not require fan assistance having sufficient surface area to radiate heat adequately.</p> <p>The side panels of all fixed format Hydra2 I/O units should be unobstructed with at least 50mm (2") clearance to allow airflow. No clearance is required above or below the unit.</p> <p>I/O units may be mounted in an open bay providing the ambient air temperature is within limits (see below). The units may also be housed in any air conditioned bay.</p>
Acoustic Noise	<27 dB SPL (A-weighted, 1m from front).
Operating Ambient Air Temperature	0°C - 35°C.
Relative Humidity	5% - 80% non-condensing.

HYDRA2 MODULAR I/O

Power	<p>The operating AC voltage is 100-240V +/-10%, 50-60Hz.</p> <p>Modular Hydra2 I/O frames are fitted with dual power supplies and have 2 IEC mains input connectors. Units will be fully functional on one PSU, however both should be fed where possible from separate sources to provide redundancy against both PSU failure and external power loss.</p> <p>The peak inrush current is limited (cold start). This reduces the chance of a nuisance trip or fuse blow from power up. The RMS quiescent and peak inrush current figures are dependant upon the quantity and type of I/O cards fitted. Please refer to the Hydra2 installation manual for more details on modular I/O.</p>
Heat Output & Efficiency	<p>The Heat output from modular Hydra2 I/O units depends upon the quantity and card types fitted, please refer to the Hydra2 installation manual for more detail on modular I/O.</p>
Cooling	<p>Fans mounted to the PSU's at the back of the rack draw air through the PSU's and the rack itself. Air is drawn up through the base of the rack which is recessed to allow air to enter through the side, and for the units to be mounted with no clearance above or below. The bottom of the sides of the modular I/O rack should be unobstructed with at least 50mm (2") clearance to allow airflow. The same amount of clearance should be provided at the rear of the rack to allow the fans to vent adequately. Both fans will continue to run (and therefore cool the card-frame) in the event that one of the PSU's fails or loses its' AC mains source.</p> <p>Modular I/O units may be mounted in an open bay providing the ambient air temperature is within limits (see below). The units may also be housed in air conditioned bays.</p>
Acoustic Noise	<p>Dependant on loading, typically <28 dB SPL (A-weighted, 1m from front).</p>
Operating Ambient Air Temperature	<p>0°C - 35°C.</p>
Relative Humidity	<p>5% - 80% non-condensing.</p>

AUDIO PERFORMANCE SPECIFICATION

HYDRA2 AES3ID UNBALANCED DIGITAL INPUTS

Format	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	24-Bit switchable on all AES inputs
SRC THD+N	-117dB @ 1kHz, 0.00014%

HYDRA2 AES3ID UNBALANCED DIGITAL OUTPUTS

Format	AES/EBU (AES3) 24-bit
Interface	75 Ohm unbalanced 1V Pk-Pk (nominal) into 75 Ohm load (BNC)

HYDRA2 AES3 BALANCED DIGITAL INPUTS (MODULAR I/O ONLY)

Format	AES/EBU (AES3) 24-bit.
Interface	110 Ohm balanced (XLR or D-Type).
Sample Rate Conversion	24-Bit switchable on all AES inputs
SRC THD+N	-117dB @ 1kHz, 0.00014%

HYDRA2 AES3 BALANCED DIGITAL OUTPUTS (MODULAR I/O ONLY)

Format	AES/EBU (AES3) 24-bit
Interface	110 Ohm balanced (XLR or D-Type)

HYDRA2 ANALOG INPUT SPECS

Analog - Digital Conversion	24 Bit
Input	Electronically Balanced
Input Impedance	2k Ohms at mic level gain settings 10k Ohms at line level gain settings
Sensitivity	+18 / -78dB for 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

HYDRA2 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	+18 / -78dB for Mic/Line Inputs
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)

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 (Analog Input to Output)	20Hz to 20kHz +/- 0.5dB

SYNCHRONIZATION INPUTS

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

Nutclough Mill
Hebden Bridge
West Yorkshire
England UK
HX7 8EZ

Tel +44 (0)1422 842159
Fax +44 (0)1422 845244
Email Enquiries@calrec.com

calrec.com

(926-136 Iss.20)