

Hydra

AUDIO NETWORKING SYSTEM

TECHNICAL SALES DATA (PROVISIONAL)

ISSUE 4

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INTRODUCTION

The Hydra Audio Networking system provides a powerful network for sharing of I/O resources and control data between Calrec digital mixing consoles. In addition, remote I/O units, with up to 96 inputs/outputs, analogue or digital, may be connected onto the same network, providing remotely located sources and destinations that can be used by any or all mixing consoles. The system is designed for use in television and radio production studios and outside broadcast vehicles where the devices connected to the network may be fixed or variable.

Gigabit Ethernet fabric is used as it is by far the highest speed network fabric commonly available and offers a clear evolutionary path. Very high bandwidth and scalable, flexible architecture allows the networking system to be tailored precisely to the requirements of each installation.

The Hydra Audio Networking system is highly-reliable because of its use of proven technology and scope for 100% redundancy. Control of the network is remarkably user-friendly, as it is a natural and logical extension of the existing operational screens used by Alpha 100, Sigma 100 and Zeta 100.

Calrec has a world-wide customer base which includes many of the world's most prestigious broadcasters. By consistently focusing upon purely broadcast products, Calrec offers products with the most comprehensive combination of performance and features available. The high level of reliability of all Calrec products, many of which are still in daily use after 20 years service, reflects a clear awareness of the critical nature of the operating environment.

This understanding of the real issues of broadcast operations is one of the many reasons why operators and management alike prefer Calrec. The Hydra Audio Networking system is designed to ensure this level of confidence will continue in the digital era.

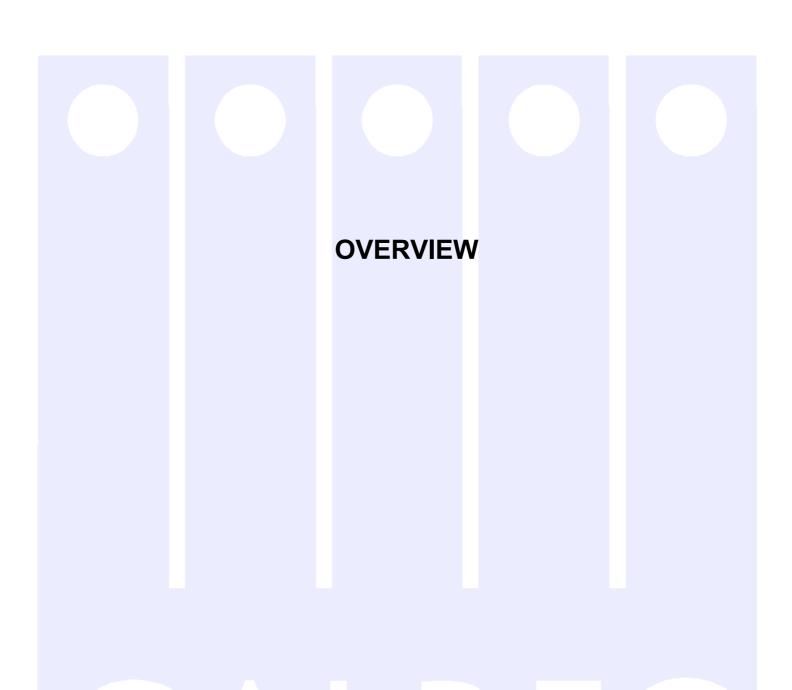


ISO 9001 AND RAB REGISTERED

Calrec Audio Ltd has been issued the ISO9001: 2000 standard by the Governing Board of ISOQAR.

The award, for both UKAS and RAB 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.





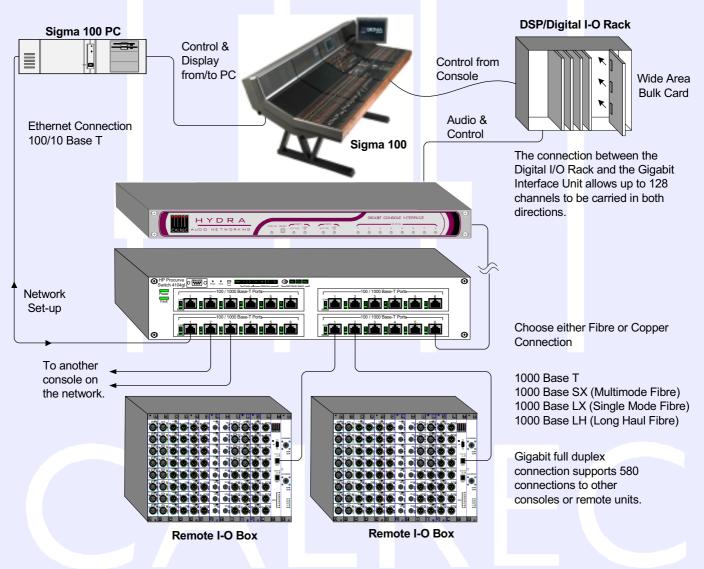


TECHNOLOGY

Gigabit Ethernet is founded on key principles of preceding Ethernet technologies and provides a data rate of 1000 Mbps over copper or optical fibre. Data is transferred using the Ethernet frame format over switched media in a network constructed from standardised structured cabling.

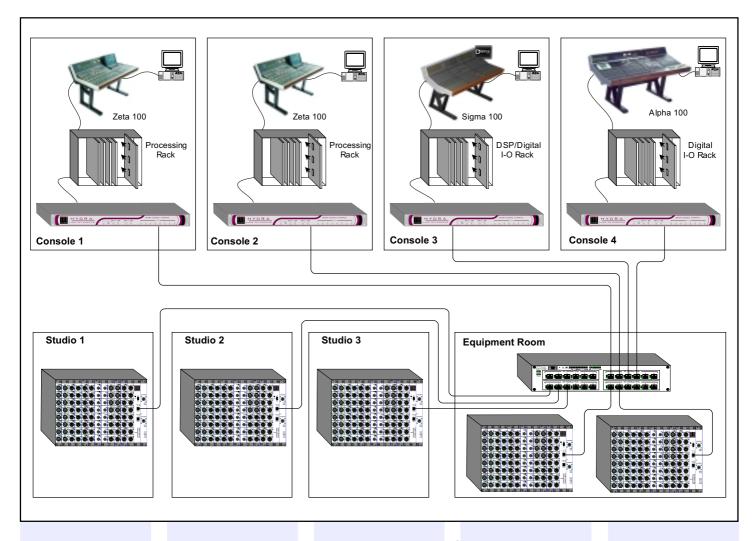
The Hydra Audio Network fabric is constructed using low-cost off-the-shelf hardware. The network topology is similar to that of an office LAN, being created out of a central switch with connections to each mixing console, in a star formation. Connections may be made with Category 5e UTP, up to 90 metres, or with optical fibre, to several kilometres.

There are many commercially available Gigabit switches, repeaters and media converters that can be used to build the network, however some proprietary hardware is required to interface the consoles and Remote I/O boxes to the network. The diagram below shows a Sigma 100 console and racks connected to a network via a Wide Area Bulk Card and Hydra Gigabit Interface Unit. 2 Remote I/O Boxes are also shown, each with up to 96 inputs/outputs available to any console on the network.





TYPICAL NETWORK EXAMPLE



The above diagram shows 4 control rooms, each with a Calrec digital console. The Hydra Gigabit interface unit for each console transmits and receives audio data to and from the Remote I/O boxes, via a Gigabit switch located in the Equipment Room. The console racks and Hydra Gigabit interface unit could also be in the Equipment Room if this was more suitable.

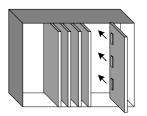
The network supports sample rates of 44.1kHz and 48kHz. However, consoles sharing sources must be running at the same sample rate and must be synchronised (e.g. to station sync or video). A Remote I/O box can only run at one rate.

In order to guarantee fully deterministic performance, it is necessary to apply the further restriction that the network must be kept private. This means that it must not be made to carry any data other than that generated by the audio network.

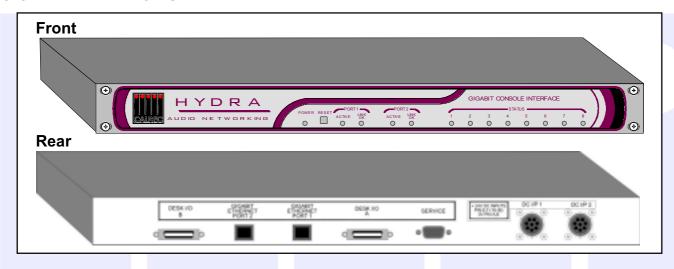


WIDE AREA BULK CARD

A Wide Area Bulk (WAB) card is inserted into the the digital I/O rack of an Alpha 100, Sigma 100 or Zeta 100. The function of the WAB is to transfer digital audio samples and control data between the backplane in the console and the gigabit interface unit. 128 inputs and outputs are carried between the WAB card and the Gigabit interface unit via 36 way SCSI-style cabling.



GIGABIT INTERFACE UNIT



The Hydra Gigabit Interface Unit provides the Alpha 100, Sigma 100 or Zeta 100 console with a connection to the network. It drives a full-duplex connection to the Gigabit switch. A second Gigabit port allows for redundancy. Each port on the Hydra Gigabit Interface Unit runs at Gigabit speed all the time, and may not be connected to switch ports that run at lower speeds.

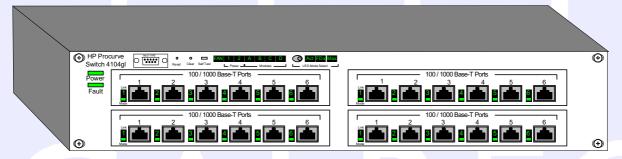
Dimensions = $1U \times 19$ "

Depth = 195mm (7.7 inches) behind the front panel (not including mating connectors)

265mm (10.4 inches) behind the front panel (including mating connectors)

Weight = 2.6 Kg (5.5125 lb)

GIGABIT SWITCH

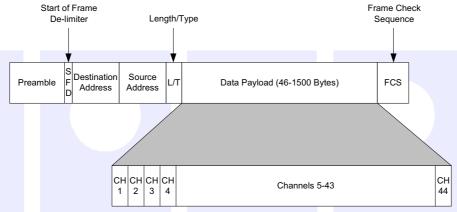


A commercially available Gigabit switch is used to network consoles and Remote I/O boxes together. The switch serves to route traffic directly from source to destination. It is capable of continuously receiving data at one port and routing it to another at the maximum data rate, irrespective of what traffic other ports are handling.



PACKETISATION

In any scheme for moving digital audio over a packet-based network, some amount of audio data has to be packed into a frame, transmitted and then unpacked into its original form. To make best use of the bandwidth, the ratio of payload data to header data is maximised by abandoning much of the protocol baggage of standard networks, making available the largest possible payload of 1500 bytes.

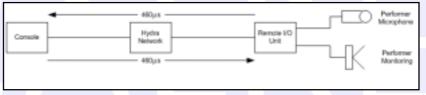


As in the case of networked mixing consoles, groups of signals are routed together, rather than individual ly. Therefore, multiple audio signals can be grouped into the same packet, maximising the payload data and minimising latency. The Hydra network uses a variable frame size into which are packed eight 32-bit samples of anything from 1 to 44 audio channels, depending on network demand. It follows that it should be possible for a single Gigabit Ethernet connection to transport in excess of 600 channels of 48kHz digital audio. In practise, a somewhat lower maximum load is prudent, to allow for some non-audio communication. The Hydra network can successfully manage loads of 585 audio channels, in the presence of heavy control [non-audio] traffic.

In order to guarantee fully deterministic performance, it is necessary to apply the further restriction that the network must be kept private. This means that it must not be made to carry any data other than that generated by the audio network.

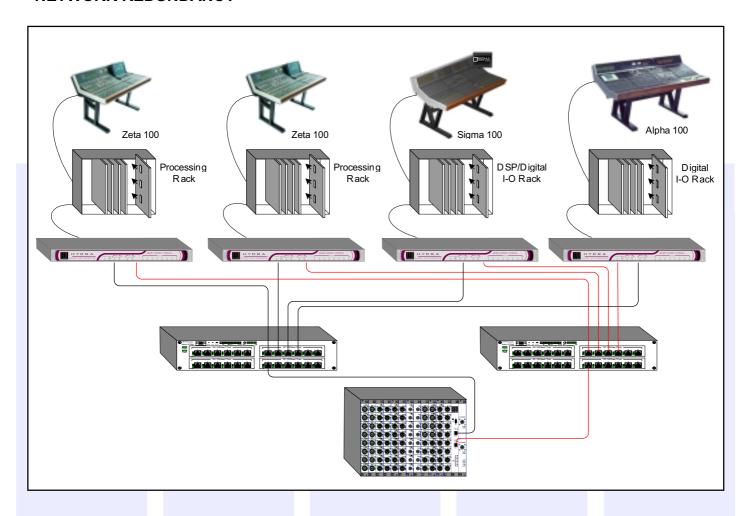
LATENCY

Low network latency is crucial, especially where a performer is listening to a mix which includes their own contribution. The network latency across the Hydra network is equal to two lots of frame buffering delays, one at the transmitting end and one at the receiving end, amounting to $360\mu S$. In addition to this, delays from the network interface circuit to the console audio backplane must be taken into consideration. Experimental measurements have show the total latency from a remote I/O unit to a console to be around $460\mu S$. In the case shown below, the signal makes two trips across the network, one from the remote I/O unit to the console, and one from the console to the remote I/O unit as part of a foldback mix. The net additional delay will be less than 1ms.





NETWORK REDUNDANCY



The second port on the Hydra Gigabit interface unit and Remote I/O box provides for redundancy.

A second Gigabit switch and set of cables creates a secondary network, providing 100% duplication. The system is therefore protected in case of failure of any connector, cable, or even a switch. The control system becomes aware of a failure and will re-route the signals automatically. This will happen quickly but there will be a brief interruption in audio.

The cost of redundancy is relatively low since it requires only the duplication of low cost infrastructure.

It is possible to perform maintenance on one half of the system while the other is operating.

An additional Wide Area Bulk card and Hydra Gigabit interface unit can be fitted to a console to provide further redundancy which is automatically deployed in the event of the network software detecting any failures.

In addition, Gigabit switches are available with redundant power supplies.

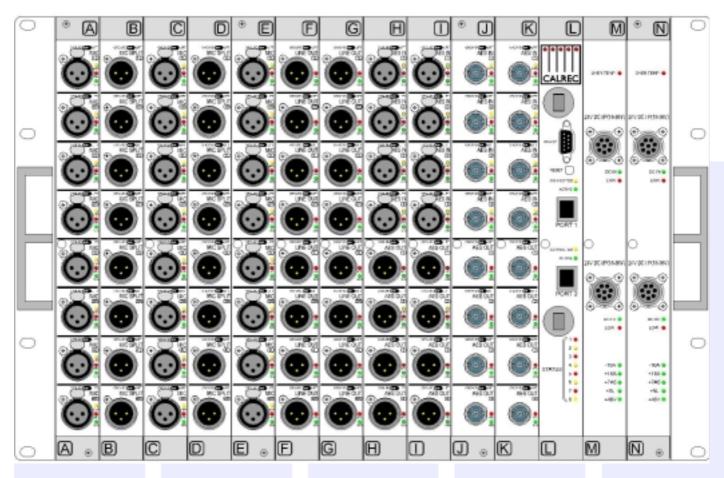


REMOTE I/O UNIT

CALRE



REMOTE I/O BOX



The Remote I/O box offers the ability to carry mic/line input and line output circuits; and digital inputs and outputs via the networking system to one or more Calrec digital consoles.

Modular Structure

There are 14 modular slots across the width of the box, labelled A to N. Input, output, processor and DC PSU modules fit into these slots, in accordance with the requirements of the installation. Input & Output modules receive & transmit either analogue or digital audio signals, dependant on type, to the gigabit interface processor via a 32 bit TDM buss.

All 14 slots may be used by any of the modules in any combination. However, it is advised that the three slots at the right hand side of the box are best occupied by a processor control unit and provision for two DC PSU modules, the second of which would be the optional hot-spare. If no spare DC PSU is present, either a blank panel must be fitted or the processor unit could move into slot M allowing a twelfth input or output module to be fitted into slot L.

Dimensions = $7U \times 19$ "

Depth = 10.4 inches (265mm)

Each modular unit is 1.2 inches (30.48 mm) wide.

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Module Extraction

In some applications, it is envisaged that modules could occasionally be changed according to changing requirements. To aid this operation, a module extraction hole is located on the module front panels. The module slides into the box on two runners, one each at the top & bottom of the box. The rear interface connector on the module then locates into the appropriate connector located on the backplane. To aid accurate plugging-up, some guide strips are located between the three interface connectors on the backplane.

External Connections

All external connections are located on the front face of the box. Space must be allowed in excess of the box dimensions to feed cables to the front interface from any rear access routes.

Mounting

The box is mounted in place using 4 fixing screws on each side angle bracket. No additional support is necessary.

Fan Operation

The box contains 3 low-noise fans to dissipate the heat. The box rear panel has venting holes which must not be obstructed in any way. The fans are located in the rear of the Remote I/O Rack and are controlled from the DC Power Supply unit.

If the ambient temperature within the rack is below 50°C (122°F) the fans are inactive. Between 50°C (122°F) and 55°C (131°F) they are operating at slow speed. Between 55°C (131°F) & 60°C (140°F) the speed increases to fast.

When the internal ambient temperature reaches 60°C (140°F), the box sends a message to all the consoles on the network to indicate a potential overheating problem. Locally the OVER TEMP red LED on the rack DC PSU will also be lit.

Over 70°C (158°F) the DC PSU is disabled, but the fans will continue to function.

Earthing

The box is fitted with an external earth stud on the rear, for connection to an external earthing system. No AC mains power is contained within the rack. All power connections should be unplugged prior to removing the earth connection.

Optional Rack-Mounted AC Power Supply Unit

A 2U rack-mounted Power Supply is available to provide the DC power for the Remote I/O box. This holds up to four AC PSU modules. One module could provide power for a fully populated Remote I/O box, with a second providing redundancy. Two other modules could be fitted to power a second Remote I/O box.

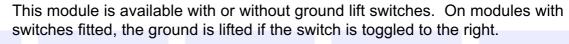


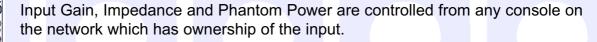
MIC/LINE ADC MODULE



This module is designed to carry either 4 stereo mic/line or 8 mono mic/line circuits. There are 8 XLR-3 pin sockets (female) on the front of the module.

To maintain compatibility with AES inputs and the displays on the console, labels are 1L, 1R, 2L through to 4R running down the module which are back lit.





Input Gain is adjustable from -18dB to +78dB in 0.2dB steps. Impedance switches from line to mic above 18, 20, 22 or 24dB of gain, selectable on the console screens.



Status LEDs

Adjacent to each connector are three LEDs which are:

YELLOW = 48V - Phantom power.

RED = PEAK - Signal within 3dB of clipping.

GREEN = SIG - Signal present.













MIC/LINE SPLITTER MODULE



This module is designed to carry 8 split outputs which are at the same level as the mic/line input being split. The panel must be situated adjacent to the right hand side of the mic/line input panel that it is splitting. If extra splits are required of the mic/line input more splitter modules can be placed to the right of the first splitter, up to a maximum of 11 splitter units.

The front panel has eight XLR 3 pin plugs (male).



To maintain compatibility with the mic/line input module, labels are 1L, 1R, 2L through to 4R running down the module which are back lit.



This module is available with or without ground lift switches. On modules with switches fitted, the ground is lifted if the switch is toggled to the right.



The splitter outputs can drive a level of +27dBu into $10k\Omega$, and +25dBu into $1k\Omega$. Output impedance is 200Ω and the minimum load is $1k\Omega$.



This module is protected against being accidentally plugged into a phantom powered input.





DAC MODULE



This module is designed to carry either 4 stereo or 8 mono output circuits. There are 8 XLR-3 pin plugs (male) on the front of the module.

To maintain compatibility with AES outputs and the displays on the console, labels are 1L, 1R, 2L through to 4R running down the module which are back lit.

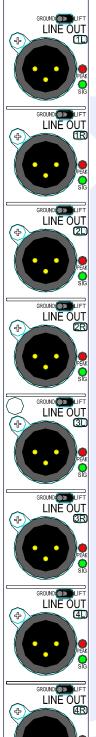
This module is available with or without ground lift switches. On modules with switches fitted, the ground is lifted if the switch is toggled to the right.

Status LEDs

Adjacent to each connector are two LEDs which are:

RED PEAK - Signal within 3dB of clipping.

GREEN SIG - Signal present.



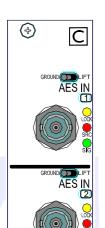


DA5091

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AES BNC INPUT/OUTPUT MODULE



This module is designed to have 4 AES inputs & 4 AES outputs.

It has eight 75Ω BNC insulated sockets (female) down the front panel for all the Inputs 1-4, followed by Outputs 1-4.

Labels are AES IN 1-4, AES OUT 1-4 running down the module which are backlit.

This module is available with or without ground lift switches. On modules with switches fitted, the ground is lifted if the switch is toggled to the right.

Each input has a Sample Rate Converter. It is switched in and out by any console on the network which has ownership of the input.

Status LEDs

Adjacent to each Input connector are three LEDs which are:

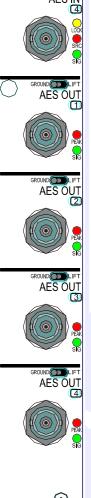
YELLOW = LOCK - Signal locked (lit)

RED = SRC - Sample Rate Converter in circuit (lit)

GREEN = SIG - Audio content present (lit).

Adjacent to each Output connector are two LEDs which are:

RED = PEAK - High level audio content (lit).
GREEN = SIG - Audio content present (lit).





AES XLR INPUT/OUTPUT MODULE

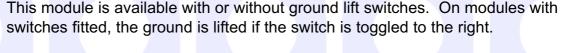
 \bigoplus C This module is designed to have 4 AES inputs and 4 AES output circuits.



It has 8 XLR 3 pin sockets down the front panel. The first four from the top are inputs 1-4 these are XLR 3 pin sockets (female), followed by Outputs 1-4, which are XLR 3 pin plugs (male).



Labels are AES IN 1-4, AES OUT 1-4 running down the module which are back



Each input has a Sample Rate Converter. It is switched in and out by any console on the network which has ownership of the input.



Status LEDs

Adjacent to each Input connector are three LEDs which are:



YELLOW LOCK - Signal locked (lit).

SRC - Sample Rate Converter in circuit (lit). RED

GREEN SIG -Audio content present (lit).



Adjacent to each Output connector are two LEDs which are:



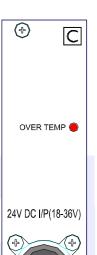
RED PEAK - High level audio content (lit). **GREEN** SIG - Audio content present (lit).







DC POWER SUPPLY UNIT



LOW 🥮

This module is the primary DC power supply for the box. It has two input connectors, which offer partial redundancy. However for full redundancy and greater security, a second DC PSU would be fitted into the rack adjacent to the primary DC PSU and an input connection wired to each module.

There are two DC Input connectors on the module front panel which are 8 way plugs (male) with 4 contacts fitted in each connector. The power inputs are isolated from ground and internal ORing diodes are fitted.

This module is designed to function with voltages in the range of 18 to 36 volts. Any input(s) can be powered externally from a battery source, possibly as a back up feed.

Status LEDs

The LEDs shown adjacent to each input connector are:

GREEN = DC IN - DC input power present, not necessarily within the

required 18-36V range (lit).

RED = LOW - Indicates an input voltage of 20V or below (flashing).

The other LEDs shown are:

RED = OVER TEMP - Indicates when internal box temperature has

reached >60°C (140°F) (flashing).

GREEN = -16A Power output present (lit).

GREEN = +16A Power output present (lit).
GREEN = +5A Power output present (lit).

GREEN = +5L Power output present (lit).

GREEN = +48V Power output present (lit).

24V DC I/P(18-36V)

DC IN LOW 16A 16A 16A 17A5 15L 148V 1

(+)

ZN5231



PROCESSOR UNIT WITH COPPER INTERFACE



This module is designed to be the network interface & processing unit within the remote I/O box.



The RS232 connector is a 9-way D-Type plug (male). This is a computer connection port to allow box identification programming.



A recessed RESET switch is located below the RS232 connector.



The RJ45 connector sockets are used for the networking connections. There are two on the front panel. This allows one for the main primary connection and a secondary for a back up connection via a second Gigabit switch.



The RJ45 connectors are 8 contact, modular single port jacks with integrated 1000 Base T magnetics, side-entry with full shielding.

Status LEDs



The LEDs shown adjacent to each network connector are:



YELLOW = CONNECTED - Indicates a valid connection.

YELLOW

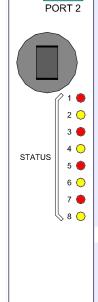
ACTIVE - Indicates bi-directional data being passed (lit).



Status LEDs 1-8 are for diagnostic purposes & have no operational function.

Address Labels

IP address and friendly name labels for both of the network connections will be located on the box rack angle label holders.



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UC5339



SET UP AND OPERATION

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NETWORK EDITOR



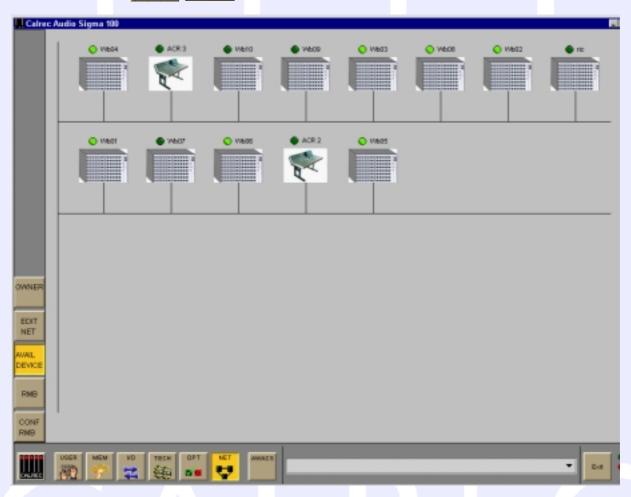
For a network to be truly useful, it must be easy to use and maintain. This has required the development of control software that constantly monitors the network, performing essential administration functions, leaving the user free to creatively exploit network resources as easily as if they were locally connected. The Network Editor consists of a set of screens for :

- v Configuration of Remote I/O Boxes
- v Utility for forcing ownership to be dropped
- v Graphical Representation of the devices on the network
- v Offline editing of Remote I/O and Audio Network

The Network Editor can be run independently of the Front End (console application), allowing the Remote I/O boxes and Network to be configured offline. During this time, any operations which require a console are disabled.

NETWORK STATUS



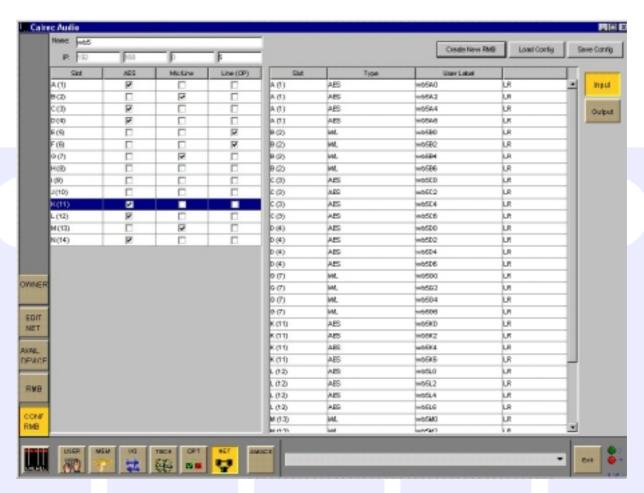


The Available Devices screen provides a graphical overview of the status of all available devices on the network. Each units green LED will "heartbeat" to indicate that the unit is running. If the device is not "heartbeating" then the graphic is greyed out.



REMOTE I/O UNIT CONFIGURATION



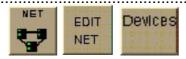


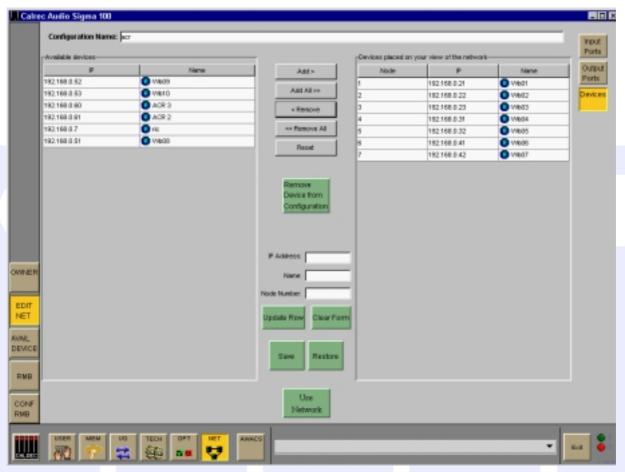
This screen allows the user to manually setup the type of Input/Output modules for each slot in a Remote I/O unit. In some situations, it may be necessary to frequently reconfigure remote I/O units to meet the requirements of each program. This can be done offline, and the configurations can be saved and loaded, just like console memories. Configurations can be loaded from floppy disk, so they can be shared between consoles.

The remote sources can be grouped into lists to make them easier to access either on the front end application or on the I/O Matrix on the console (if fitted).



NETWORK CONFIGURATION





This screen allows configuration of the Network. The Available devices window on the left side of the screen shows all the devices on the network that your console could have access to. This is a list of all devices which have been loaded via the Conf RMB screen. The window on the right side of the screen shows those devices you have selected to use for this session. The Add, Remove, Add All and Remove All buttons are used to add or remove devices from your session.

Network configurations can be saved and restored, to allow use on a job by job basis. This allows multiple setups to be configured offline, and stored for later use.

Changes made to the network configuration only become active when "Use Network" is selected, "Use Network" must also be selected to activate a restored network configuration.

When all the devices to be on the Network have been added then the input and output lists may be setup.



NETWORK OPERATION







Once set up, remote sources are selectable on the I/O screens just like local sources, and can then be patched to faders on the console in the same way. A Remote I/O unit or console can be selected from the list selector buttons, just like local lists. When selected, the remote sources will be displayed on the left side of the screen. These sources can then be patched to faders on the console on the right side of the screen.

Sources have icons to denote their type, they are as follows:

- (House) Source is local to the Console
- (World) Source is on a Remote Device which is heartbeating
- (World with a red cross) Source is on a Remote Device which is not heartbeating
- (Green Padlock) Source is owned by you
- (Grey Padlock) Source is owned by someone else

The network has a system for source control prioritisation, to prevent several consoles gaining control over the same source at the same time.

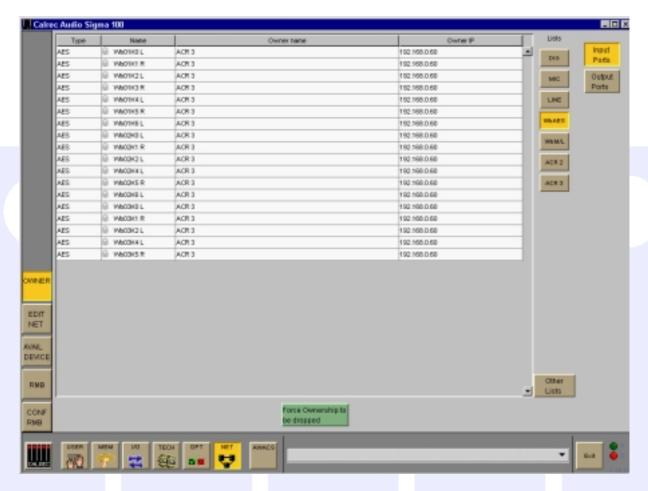
Like local sources, networked sources and their settings are saved with the memories.

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OWNERSHIP

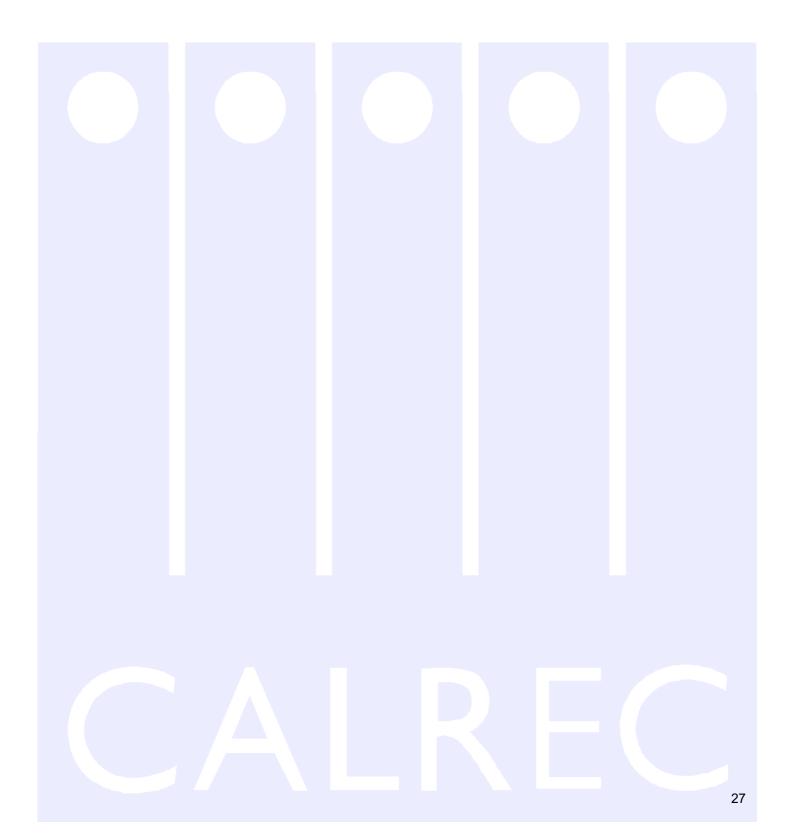




When a port is patched ownership is assigned to the desk. The console that connects to the source first will be given control (ownership) over that source. Other consoles that subsequently connect the same source will not be able to control it.

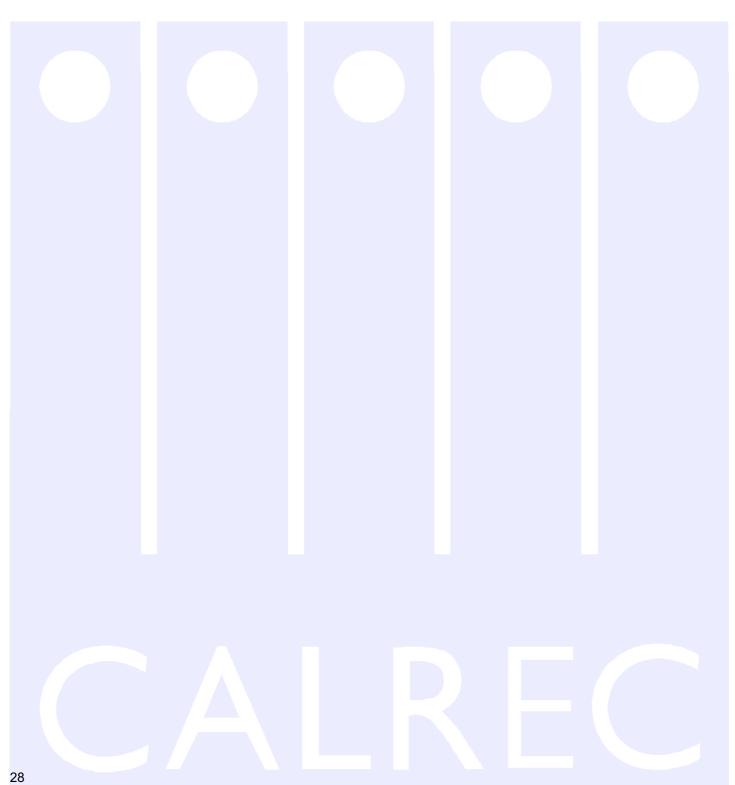
There are circumstances when the ownership needs to be overridden, (ie when a microphone is need for the next shown but has not be release from the previous show). The Force Ownership to be dropped functions allows this.



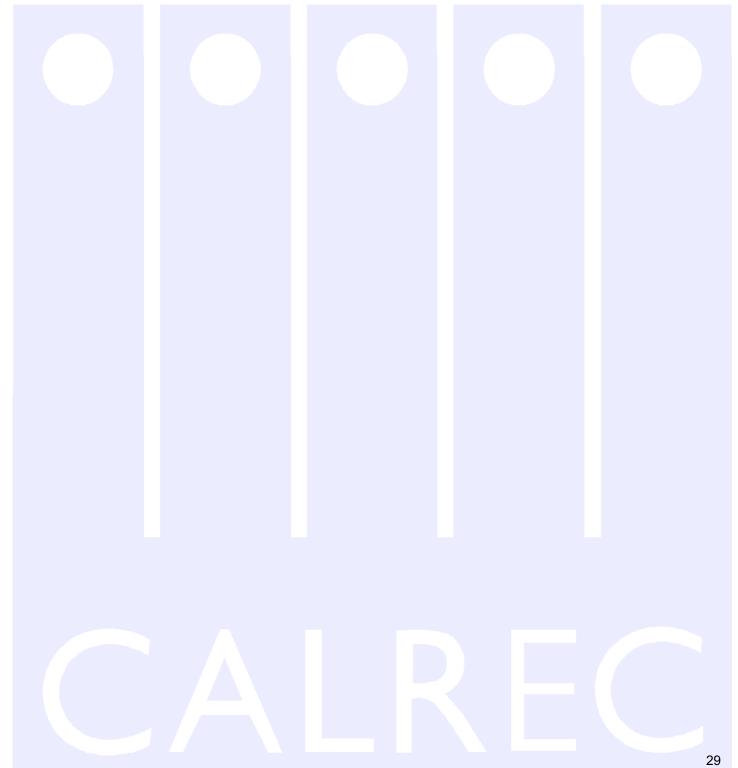




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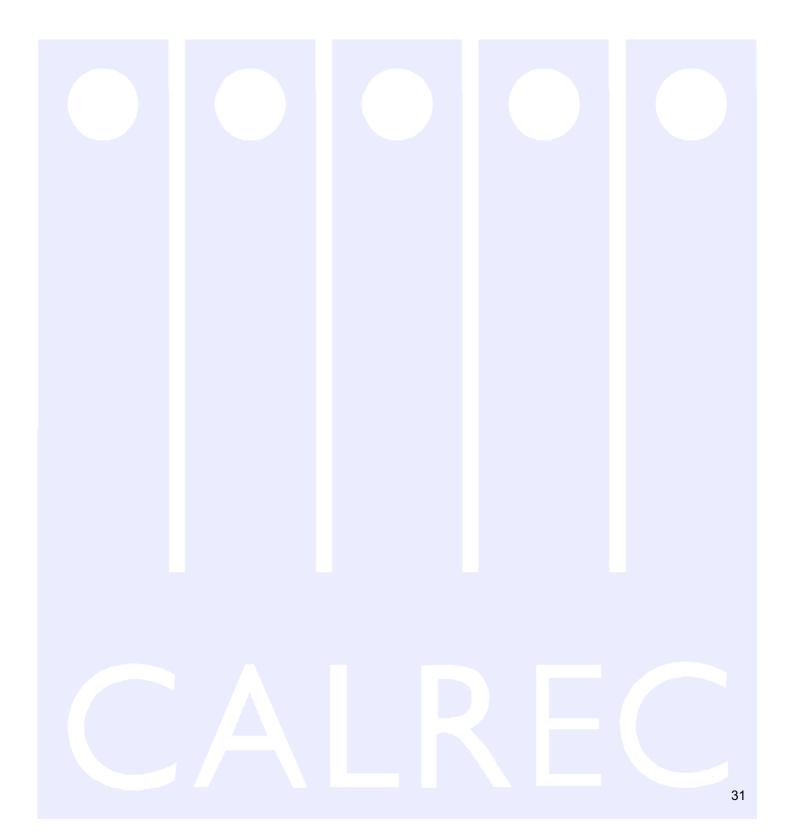














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