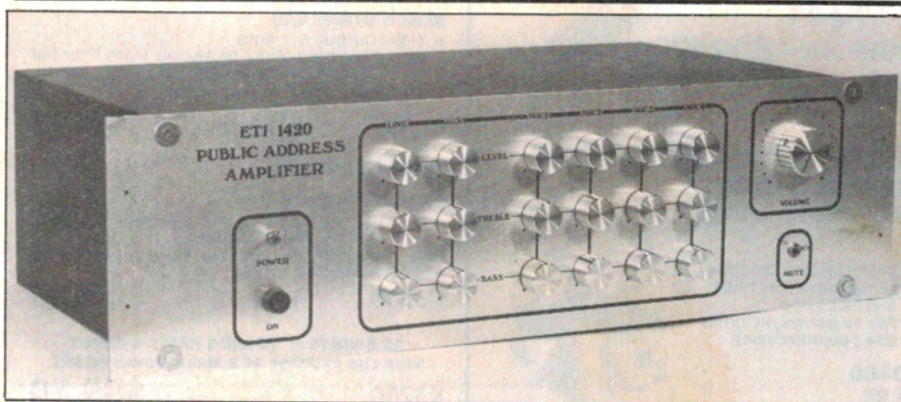


Modular paging amplifier/sound system

Geoff Nicholls

This project utilizes the preamp described in May and the ETI-499 150 W MOSFET power amplifier to implement a cost effective and sophisticated paging system for clubs and large halls.



THE DESIGN philosophy of the ETI-1420 has centred largely on not reinventing the wheel. We have used, with slight modifications, two existing projects that fulfil all the necessary requirements to build a first rate paging system. The only re-design necessary has been associated with making the two projects work together.

This project was conceived as a high quality public address amplifier offering six inputs with independent level, bass and treble controls. It should be suitable for use as a paging amplifier in a club or hotel installa-

tion or as a sound reinforcement amplifier for a small band or a church hall.

The prototype was constructed using a 5¼ by 19 inch rack case which produces a very professional looking unit, although the electronics may be fitted into a cheaper case if desired. The amplifier has a balanced output which can be used to connect other slave amplifiers or to send to a mixer. It should also be possible to use the balanced output to bridge two ETI-499 MOSFET power amps to produce 300W into 8 ohms, although we haven't tried it.

SPECIFICATIONS ETI-1420 PAGING AMPLIFIER

Measured from preamp inputs to power amp input

Sensitivity

Input levels required to drive the power amp to full power output. Tone controls 'flat'.

Line input 200 mV RMS balanced

Aux. input 70 mV RMS

Mic. input 600 μ V RMS balanced

Signal/Noise Ratios

Line/Aux. inputs -72 dB, hum and noise

Mic. Inputs

open -57 dB

560R load -54 dB

Line output 2 V RMS (nom.)
balanced

Six ETI-1421 preamps provide the front end of the amplifier. With slight modifications it proved possible to provide a variety of input characteristics. Four of the inputs provide a balanced input for 500 μ V signals, one provides a balanced input for 70 mV signals and the sixth one has an unbalanced input for 200 mV. All the inputs are individually controllable with separate level, bass and treble controls. There is also a master volume control to set the gain of the mixer stage.

The '1421 modules are suitable for low impedance balanced microphones only. In order to provide a balanced line input it is necessary to reduce the gain in one of the preamps to unity. This is achieved by changing R3 and R4 to 1k 1% and substituting a 22 pF ceramic capacitor for C3.

To use the '1421 as an unbalanced amplifier it is necessary to delete IC1 and its associated components (R1-R4, C2, C3, C12, C13) and connect the input signal straight across RV1. If more gain is required then R6 may be increased as required.

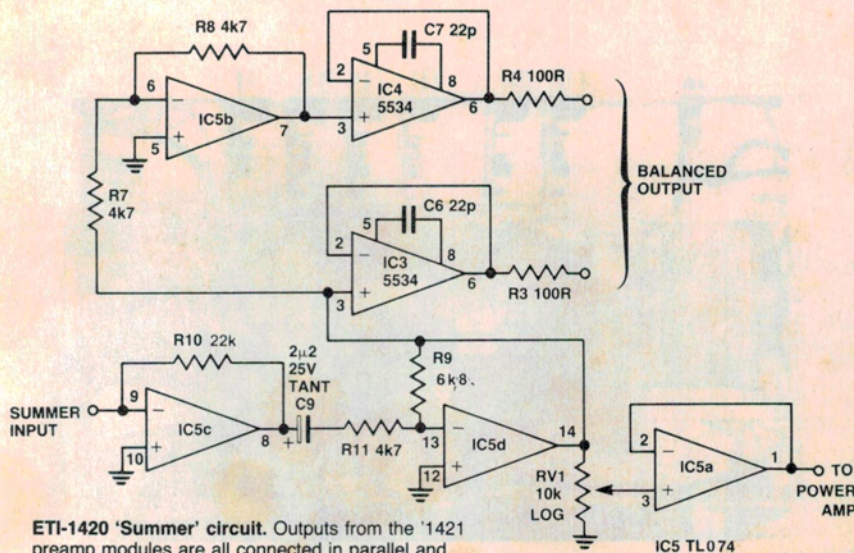
We have included a mute facility on the amplifier to allow the controller to shut down all except one channel. This would allow priority calls to override other inputs. Paging for telephone calls is a case in point.

The power amp is the ETI-499 MOSFET amp first described in March 1982. In this application it is used to drive an OP597 output transformer. This is used to step the output voltage up to 100 V. The OP597 is made for Auditek Australia of Sydney by Ferguson Transformers. Supplies should be available in most capital cities. In the event of problems, contact their Sydney offices (see Shoparound column this issue).

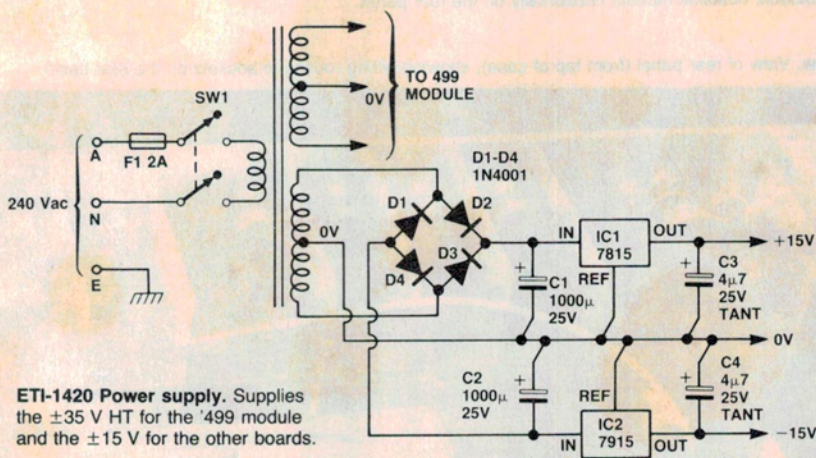
The previous P.A. amp (the ETI-498) used the OP590 which is inferior to the OP597 in that it is an autotransformer and thus does not isolate the line output from the power amp or provide a balanced output.

Construction

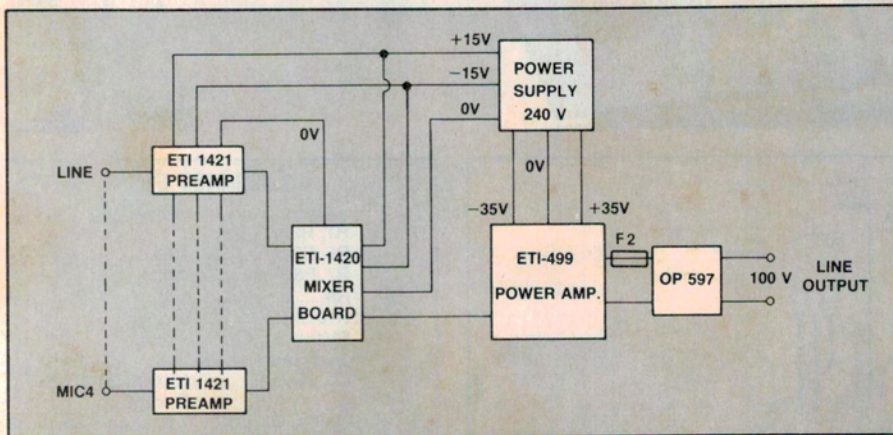
The most difficult aspect of the project is the metalwork, which will take several hours to mark out and fabricate. It is important to get all the dimensions correct, especially with the front panel since the input boards are mounted by the pc-mount pots so any errors are likely to make it difficult to fit them properly. The 19" rack cases are expensive, so take care! Before any holes are made I suggest you try putting all the



ETI-1420 'Summer' circuit. Outputs from the '1421 preamp modules are all connected in parallel and summed at the '1420 input.



ETI-1420 Power supply. Supplies the ± 35 V HT for the '499 module and the ± 15 V for the other boards.



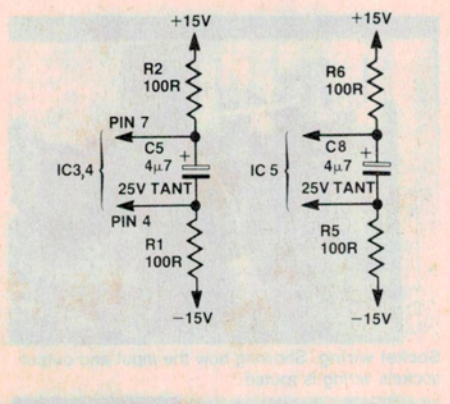
ETI-1420 Block diagram

modules and transformers in the box to see if any clearance problems occur. Read through the rest of the construction before removing any metal and you'll avoid problems later.

The prototype was fitted into a rack that has corner bars and a light gauge cover, so it was necessary to make up brackets to mount the transformers along the sides so

the unit is well balanced and easy to carry. Other styles of cases will require other mounting techniques, so be prepared to improvise here.

Mark out and drill the front panel. I used one of the ETI-1421 PCBs as a template while drilling the input pot shaft holes to ensure the pots would fit properly. I suggest everyone do this. Don't drill through the



HOW IT WORKS ETI-1420

The project consists of six input preamplifiers, a mixing stage with a balanced output, the MOSFET power amplifier, the 100 V line output transformer and the power supply transformer.

MICROPHONE PREAMPLIFIERS

ETI-1421 modules are used for the six preamplifiers. Four of them are wired for low impedance balanced microphones as in the ETI-1421 article in May 84, except that coupling capacitors C7, C12 and C13 are not needed, and should be replaced by links. The other two input preamps are wired to provide a balanced high level input and an unbalanced high level input.

The balanced high level input (the LINE input) has the differential amplifier gain set to unity by changing R3 and R4 in the ETI-1421 to 1k0 1% and by adding C3, a 22 pF ceramic capacitor, to compensate the 5534 for unity gain. Once again C7, C12 and C13 should be replaced by links.

The unbalanced high level input (the AUX input) is implemented by deleting the differential amplifier stage and connecting the input signal directly across RV1 in the ETI-1421 preamp. The gain of this input may be adjusted by varying R6. Again, C7 should be deleted.

The muting is arranged so that all inputs except MIC1 are disabled when the mute switch is operated. This is done by paralleling the mute inputs on the five boards and wiring them to the front panel switch.

MIXER STAGE

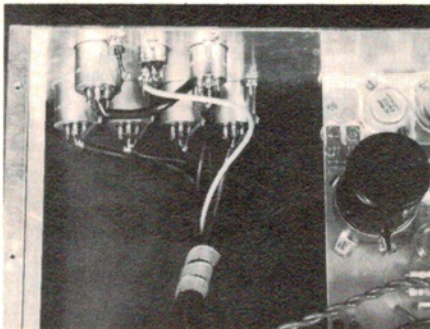
Each of the preamplifier boards has output resistors (R14, R15) to feed the current-summing virtual-earth mixer IC5c on the ETI-1420 board. The mixer stage is ac coupled to the inverting op-amp stage IC5d which drives the master volume pot. and the balanced driver. IC5b inverts the signal for the out of phase driver IC4. The balanced output could be used in a bridging amplifier if desired.

The ETI-1420 pcb also carries the power supply components for all the preamplifiers. The standard 3-terminal regulators deliver + and -15 V from the two 15 Vac windings on the PF4361/1 transformer.

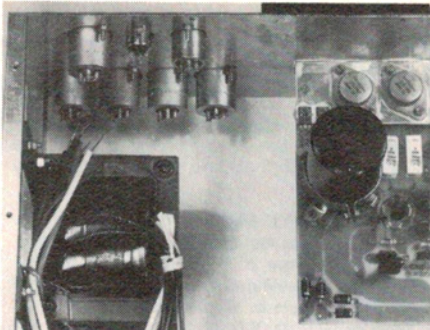
POWER AMP

the ETI-499 MOSFET power amp module was described in ETI March 1982 and is used in this project. It will deliver 150 W RMS into 4 ohms when used with the PF4361/1 transformer. The output from the '499 drives the primary of the OP597 line output transformer to step the voltage up to 100 V, and provide a balanced and isolated output.

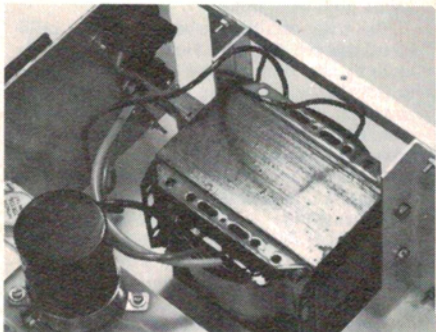
Project 1420



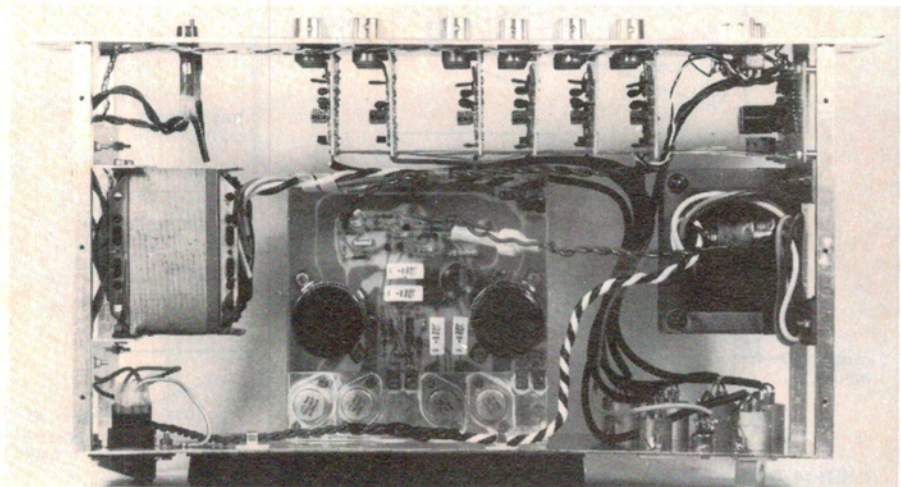
Socket wiring. Showing how the input and output sockets wiring is routed.



Output tranny mount. Two pieces of flat metal strip are used to mount the OP597 100 V line output transformer.

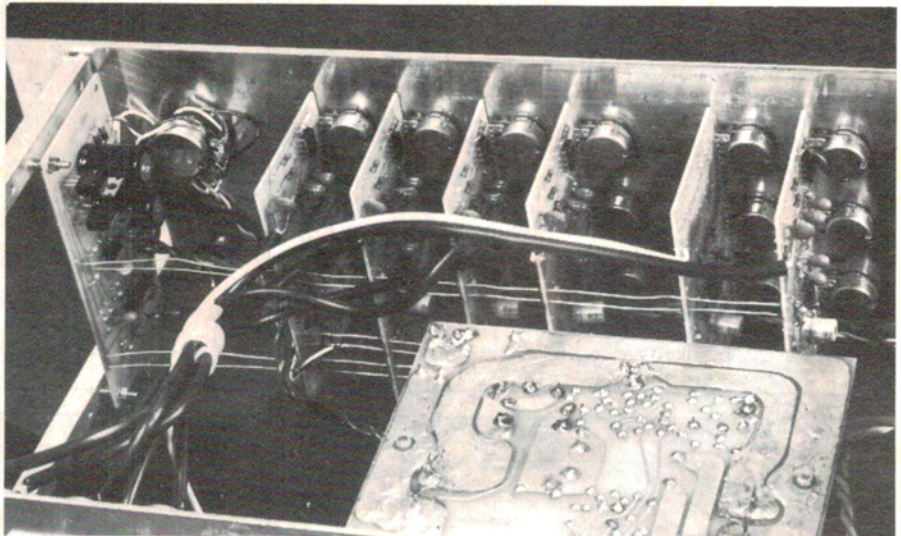


Power tranny mount. Two pieces of 13 mm aluminium angle are used to mount the PF4361/1.

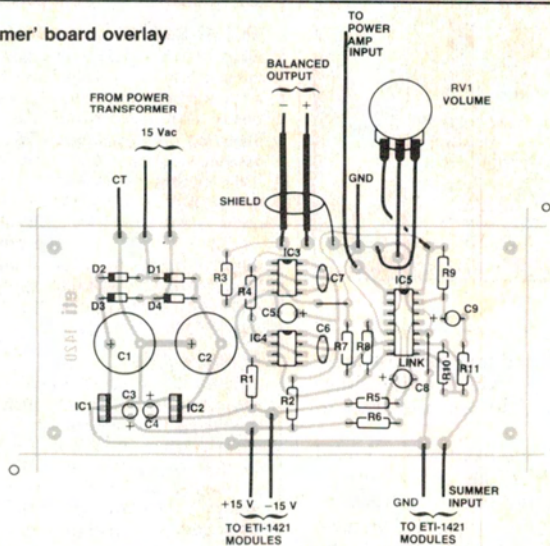


Above. Internal view of the completed project (from the bottom) showing general routing of wiring. A twisted-pair of heavy duty hookup wire is used on the '499 input; likewise the output (note line fuse). The '499 module heatsink mounts horizontally on the rear panel.

Below. View of rear panel (from top of case), showing wiring routing to sockets on the rear panel.

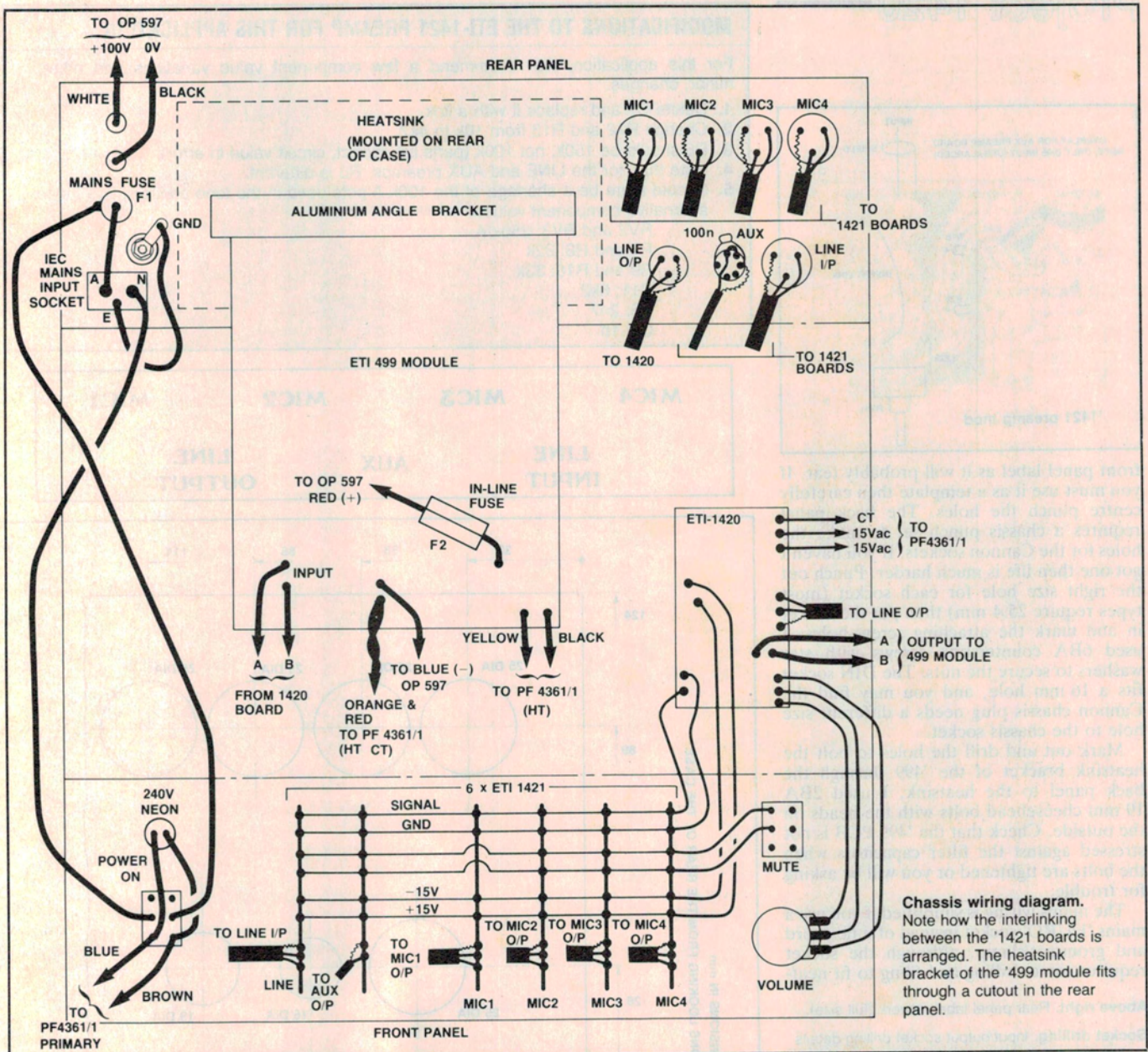


ETI-1420 'summer' board overlay



PARTS LIST ETI-1420

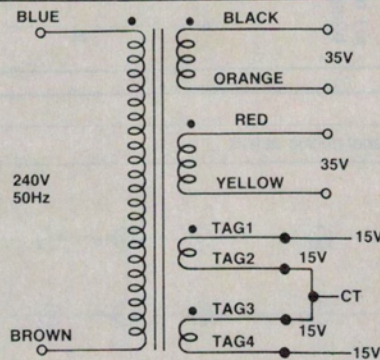
- Resistors**.....all 1/2W, 5%
 R1, R2, R3, R4,
 R5, R6 100R
 R7, R8, R11 4K7
 R9 15k
 R10 6K8
 RV1 10k Log
- Capacitors**
 C1, C2 1000μF 25 VW RB
 Electro
 C3, C4, C5, C8 4μ7 25 VW Tantalum
 C6, C7 22 pF Ceramic
 C9 2μ2 25 VW Tantalum
- Semiconductors**
 IC1 7815
 IC2 7915
 IC3, IC4 NE5534, LM5534
 IC5 TL074, μA774
 D1-D4 1N4001, 1N4002
- Miscellaneous**
 4 ETI-1421 Low Z balanced mic preamps
 1 ETI-1421 Balanced line preamp
 1 ETI-1421 Unbalanced aux. preamp
 1 ETI-499 MOSFET power amp module



Chassis wiring diagram.

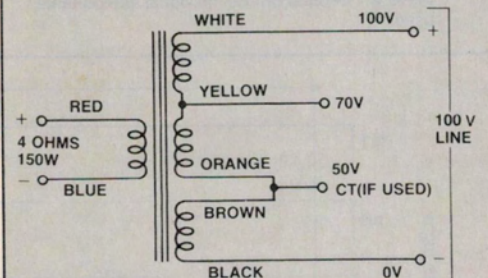
Note how the interlinking between the '1421 boards is arranged. The heatsink bracket of the '499 module fits through a cutout in the rear panel.

- 1 power transformer PF4361/1
 - 1 line output transformer OP 597 (see text)
 - 5 3-pin Cannon chassis sockets
 - 1 3-pin Cannon chassis plug
 - 1 5-pin DIN chassis socket
 - Radial fin heatsink, 225mm x 105mm (DSE H-3426)
 - 1 chassis fuse holder 3AG
 - 1 2A fuse
 - 1 in-line fuse holder
 - 1 8A fuse
 - 2 toggle switches DPDT 250 Vac
 - 1 Euroconnector 3-pin mains male chassis socket
 - 1 250 Vac neon in bezel
 - 18 small knobs
 - 1 large knob
 - 19" by 5" rack box
 - ETI-1420 Front panel
 - Brackets to mount transformers, etc.
 - Heavy duty hook-up wire
 - 2 screw terminals (for 100 V line)
 - Balanced microphone cable
- Price estimate: \$200-\$220**



PF4361/1 CONNECTIONS

The lead-out wires from the power transformer are colour-coded as shown here. This should help you identify where the wires terminate on the '499 and '1420 modules. The high tension centre-tap (HT CT) is formed by joining the orange and red leads at the '499 pc board.



OP597 CONNECTIONS

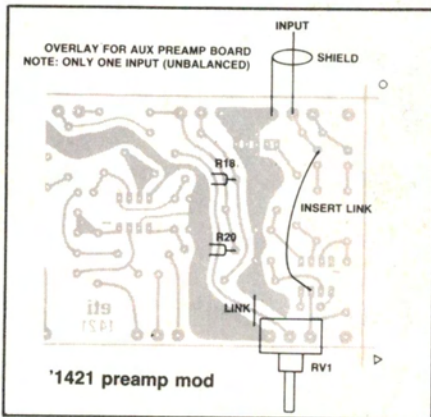
Colour-coding for the lead-out wires on the 100 V line output transformer. The orange and brown wires must be joined. Note that this transformer gives a true balanced 100 V line output, unlike an autotransformer (as used on the ETI-498 Outdoor PA). The white and black wires go to the output terminals on the rear panel, above the mains fuse.

MODIFICATIONS TO THE ETI-1421 PREAMP FOR THIS APPLICATION

For this application, we recommend a few component value variations and other, minor, changes.

1. Delete C7 and replace it with a link.
2. Change R12 and R13 from 10k to 4k7.
3. R6 should be 150k, not 100k (parts list correct, circuit value in error).
4. Note that, for the LINE and AUX preamps, R6 is different.
5. Should there be a shortage of the 100k/A pots used in the tone controls, use these alternative component values.

RV2 and RV3: 250k/A
 R7 and R8: 82k
 R9 and R10: 33k
 R11: 8k2
 C5: 2n7
 C6: 1n



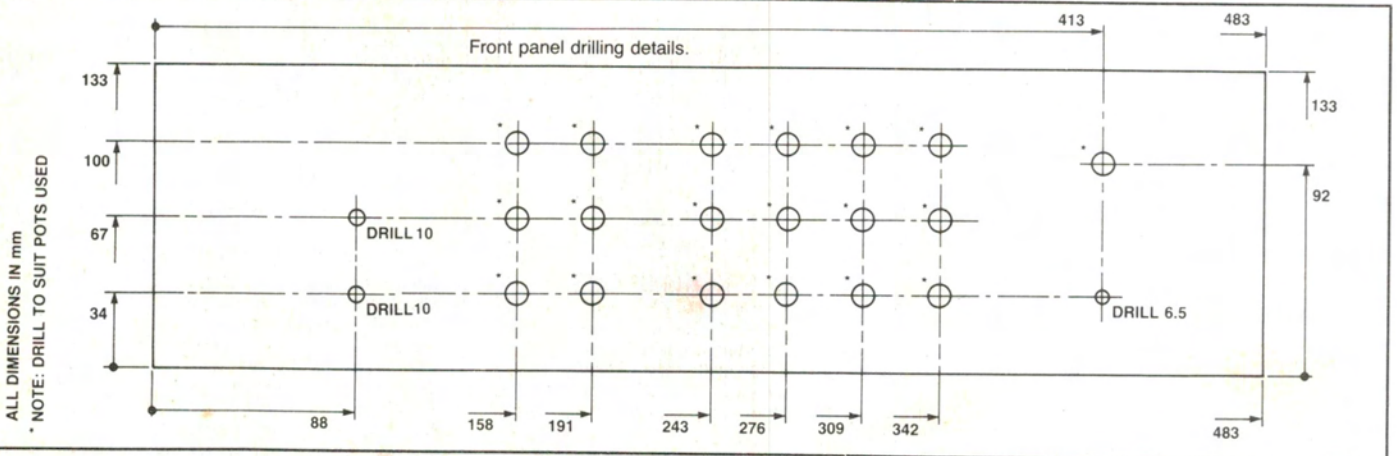
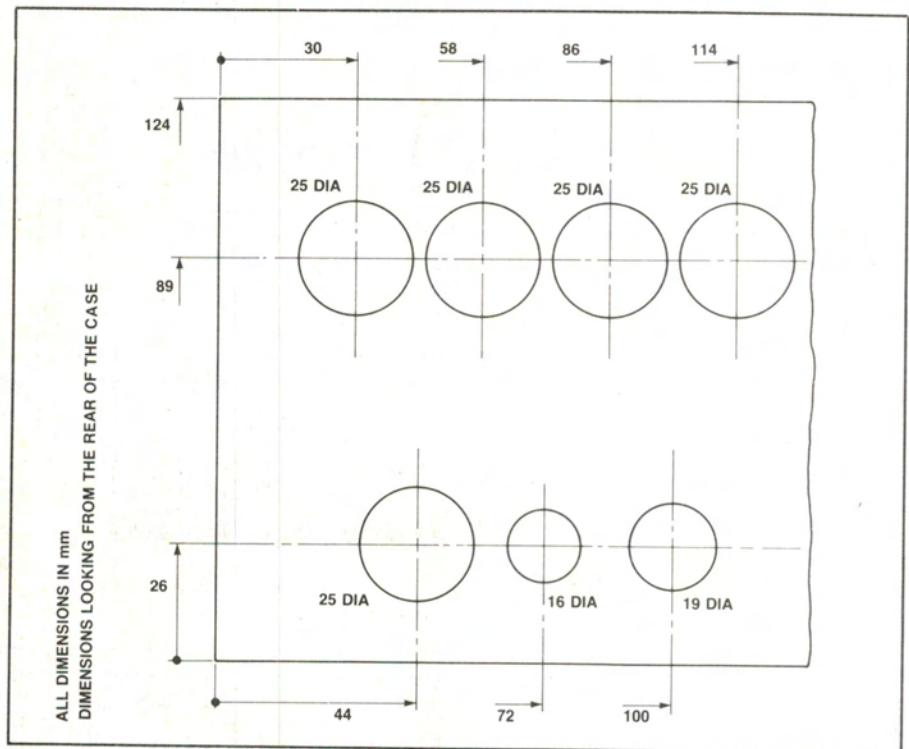
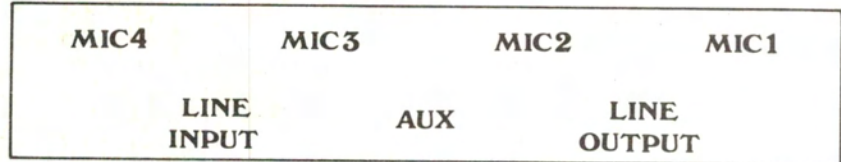
front panel label as it will probably tear. If you must use it as a template then carefully centre punch the holes. The back panel requires a chassis punch set to make the holes for the Cannon sockets. If you haven't got one then life is much harder. Punch out the right size hole for each socket (most types require 25.4 mm) then put the socket in and mark the attaching screw holes. I used 6BA countersunk screws with star washers to secure the nuts. The DIN socket fits a 16 mm hole, and you may find the Cannon chassis plug needs a different size hole to the chassis socket.

Mark out and drill the holes to bolt the heatsink bracket of the '499 through the back panel to the heatsink, I used 2BA 19 mm cheesehead bolts with the heads on the outside. Check that the '499 PCB is not stressed against the filter capacitors when the bolts are tightened or you will be asking for trouble.

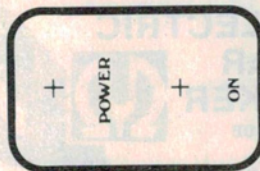
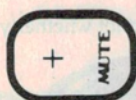
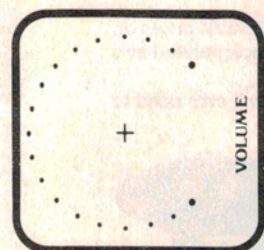
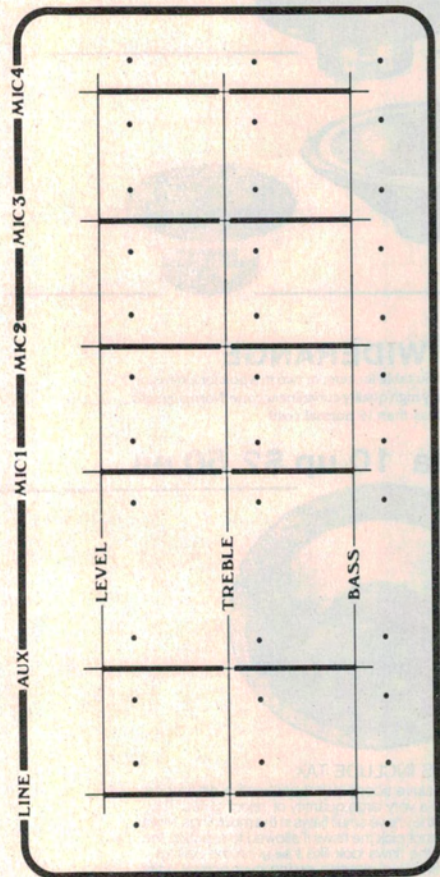
The mains wiring is simplified if you use a mains 'EURO' socket instead of a flex cord and grommet/clamp, although the socket requires some drilling and filing to fit neat-

Above right. Rear panel label artwork (full size).

Socket drilling. Input/output socket drilling details on the rear panel. Mounting details for the '499 and its heatsink, plus the power input socket, mains fuse holder and output terminals are not given as these will depend on the individual components used.



**ETI 1420
PUBLIC ADDRESS
AMPLIFIER**



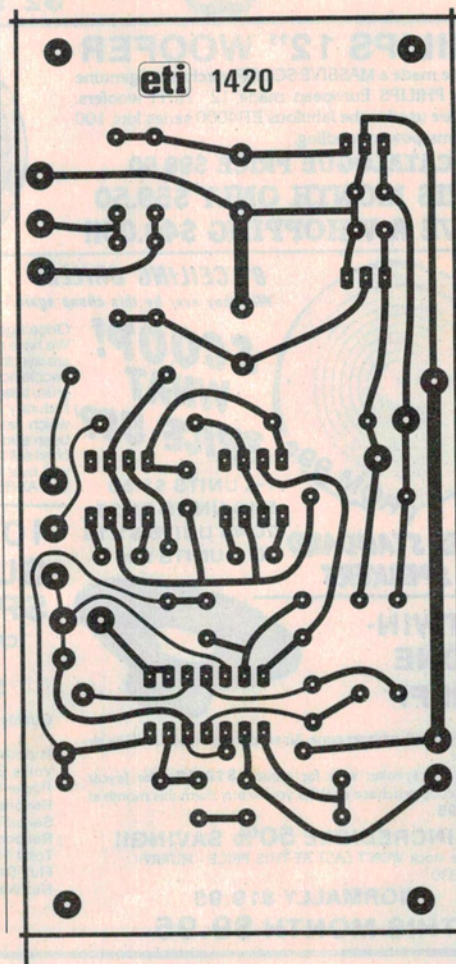
ly. The main advantage is that the cord may be completely removed and the amplifier carried without any trailing wires. The 'EURO' socket uses crimp style pins which are fixed to the wires and then pushed into the plastic moulded case where they catch. Whatever mains cord you use it is imperative that the metal case is connected to the earth pin through heavy duty green/yellow wire.

The back panel is completed by mounting the mains fuseholder near the 'EURO' socket and the terminals for the 100V line. The ETI-1420 pcb mounts on the side of the case near the volume control pot between the front panel and the OP597 transformer. I used 6BA screws and 6 mm spacers to support the board.

The OP597 is wound with an isolated primary winding designed for a 150 W into 4 ohms power amp — ideal for the ETI-499 module. Three separate secondary windings are provided to allow 50, 70 or 100 V outputs: the black-brown pair deliver 50 V, the orange-yellow pair deliver 20 V while the yellow-white pair deliver 30 V. Note that the two wires marked yellow are brought out in one plastic sleeve. The yellow wires should be soldered together and insulated. Then do the same to the orange and brown wires. The 100 V output then comes from the black and white wires, white to positive. The primary positive is the red wire.

An in-line fuse holder is used in the power amp output wire to the OP597 to protect the power amp.

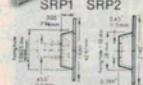
Left. Front panel artwork, 50% actual size.



AUSTRALIAN IMPORTERS



CLIFF
CH-1
CABINET HANDLE
102 x 48mm



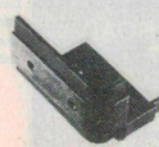
SRP



PF-1
CABINET FEET
37mm



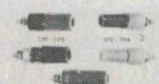
CH-2
LARGE
CABINET HANDLE
165 x 210mm



CF-1
CABINET CORNER



PCB SPACERS
12.5mm 19mm 25.4mm 31.7mm



TPI TERMINAL
4mm, SCREW, 15A, 250V.A.C.



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