Jochen Dreier, DH6SBN

Individual Indication of Reasons for Cut-Out by Protective Circuits of a High-Power

If part of a transmitter/receiver system breaks down, it usually happens in the most inconvenient situations. So it is important to obtain clear information on where the malfunction is located.

It has happened several times that one of the standard built-in protective circuits in the PA of our club station has responded, for reasons which can no longer be traced, thus cutting out the PA and protecting it from destruction. So the protective circuits have certainly done their job reliably, but the actual reason for the cut-out is still not clear.

Things can be considerably simplified here by the kind of individual indication described in the following article.

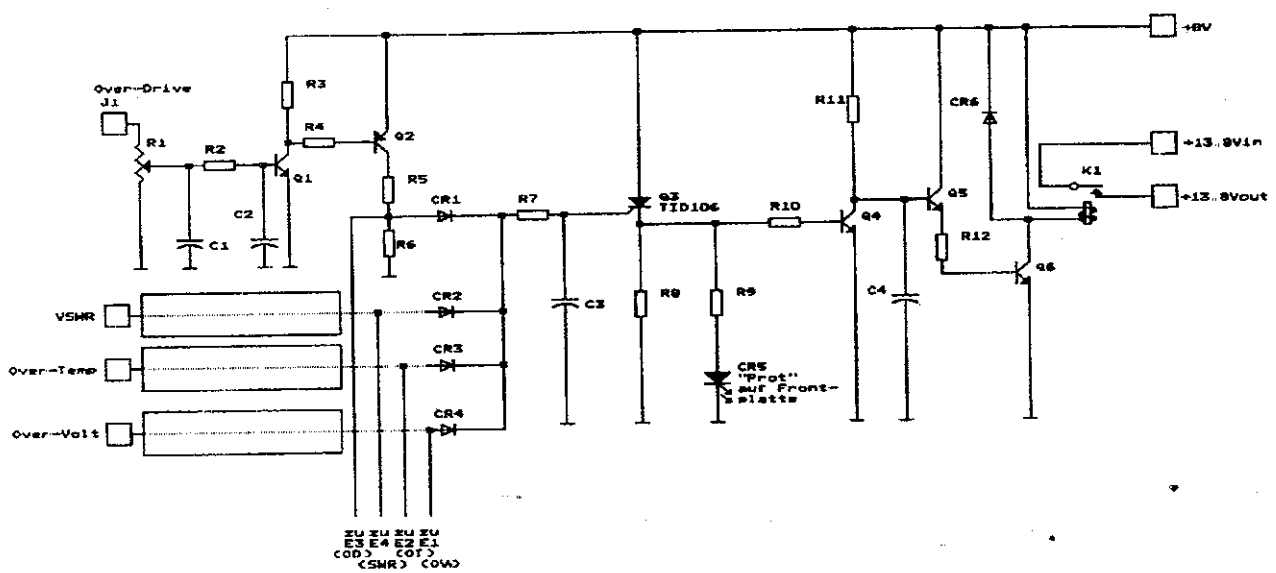

Fig. 1: Circuit Diagram Extract for BEKO Protective Circuits
***Auf Frontplatte* = On front plate**

1. INTRODUCTION

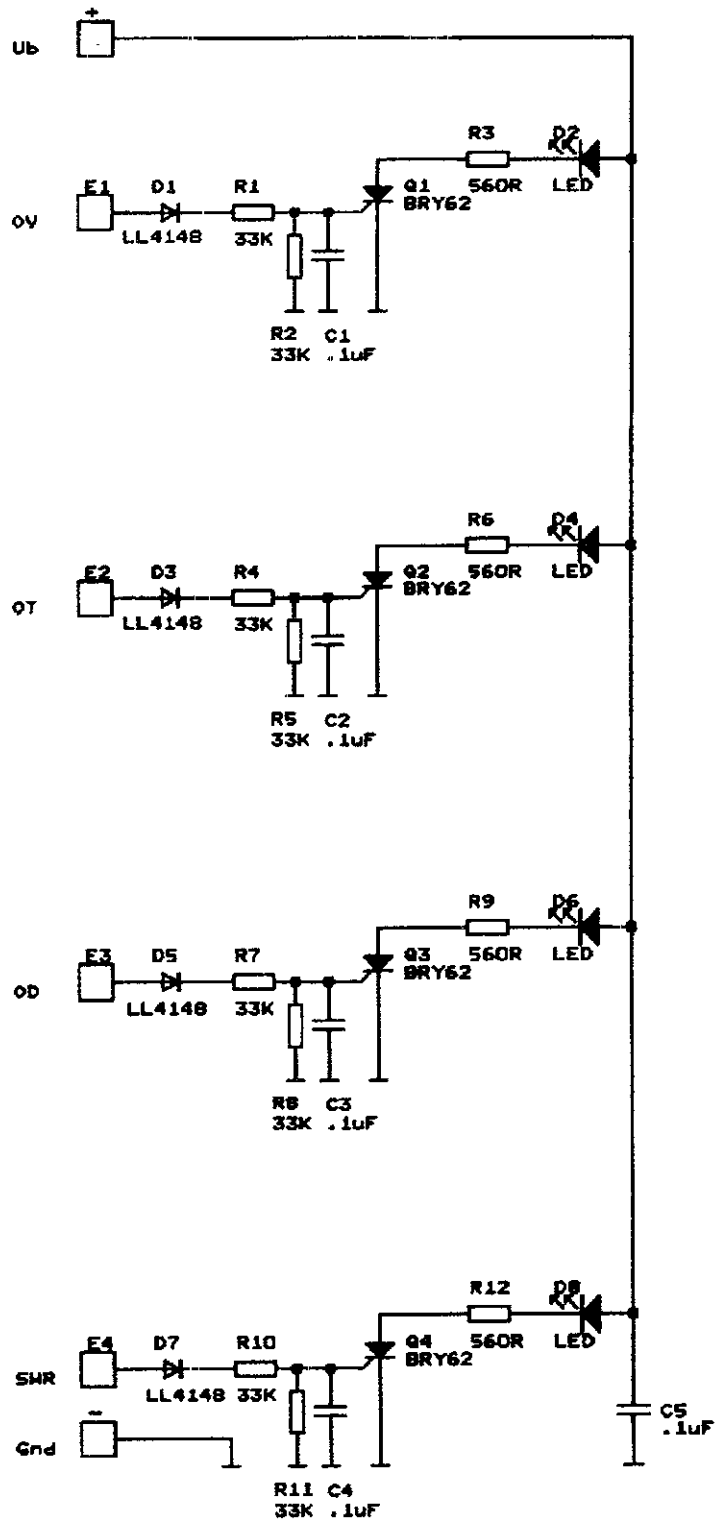

Fig. 2: Individual Fault Display Circuits

The function and assembly of equipment for the individual indication of faults is explained here, using the example of a type HLV120 BEKO transmission amplifier, with an output power of 100 Watts for the 70cm band.

This individual indication system can certainly be incorporated into other BEKO amplifiers which are fitted with similar protective circuits.

The protective circuits are:

- Overvoltage (OV)
- Overtemperature (OT)
- Standing Wave Ratio (SWR)
- Overdrive (OD)

In the original format, the signals from the four monitoring devices, which protect the transmission amplifier from impermissible operating conditions during its operation, are connected to an alarm system totalling all the faults, by-pass the power section and cause the "Protection" LED to light.

The PA is also protected against any reversal of the operating voltage terminals, but no indication takes place.

To narrow down the reason for the cut-out more easily in the case of a fault, it makes sense to have the output signal from each individual protective circuit indicated

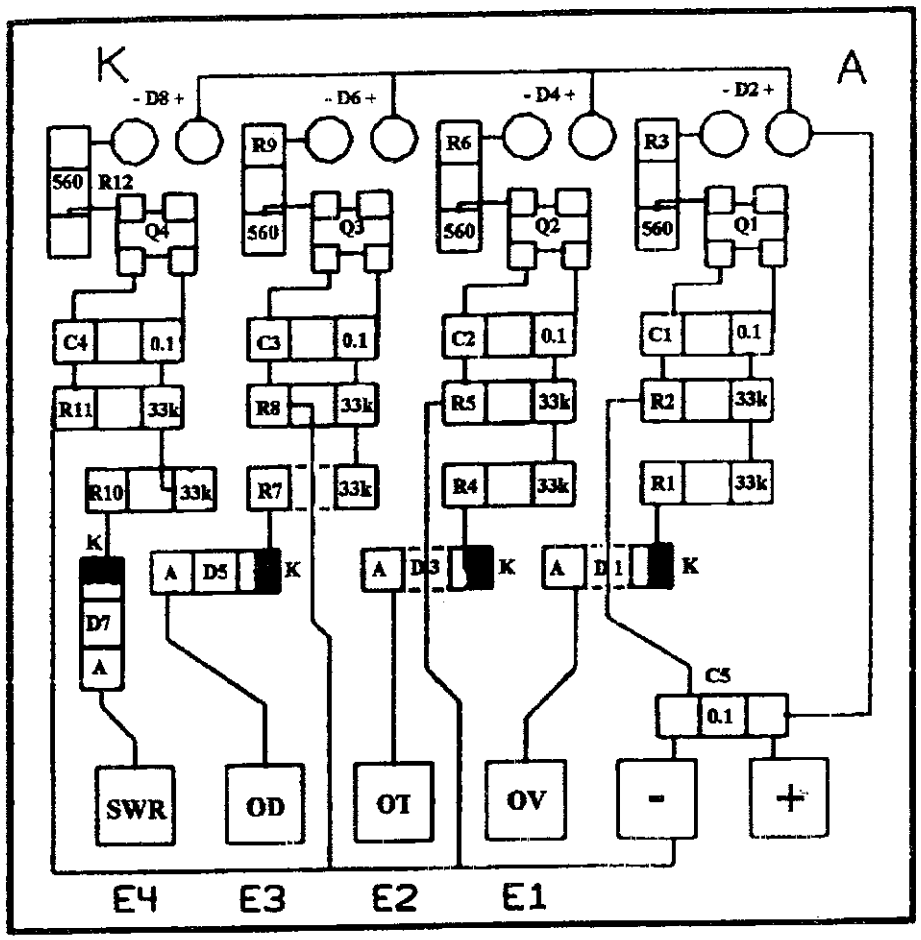

Fig. 3:
SMD Board
Component Overlay

separately. To bring this about, the four signals from the individual faults are measured before they are even combined, and are displayed, each with a separate LED, with the aid of the circuit described here.

The LED's can be mounted directly on circuit boards, behind or into the front plate. A suitable proposal for mounting follows below.

2. CIRCUIT DESCRIPTION

Starting from the standard protective circuits of the transmitter amplifier, the "status" signal is measured in each case, and is processed further for the individual fault display.

The different protective circuits all operate in a similar way: thus, for example, "Input Overdrive" works as follows (Fig. 1):

If the limiting value is exceeded in the PA, this causes the output of the switching transistor to go to the logical "High". The thyristor Q3 is triggered through the diode CR1.

The cathode of Q3 goes to "H", the "Protection" LED CR5 on the front plate lights.

Q4 is also switched through, which makes the Darlington stage - consisting of Q5 and Q6 - currentless, and the relay K1 opens, and the end stage is by-passed.

The four new supplementary circuits also all operate the same way (Fig. 2):

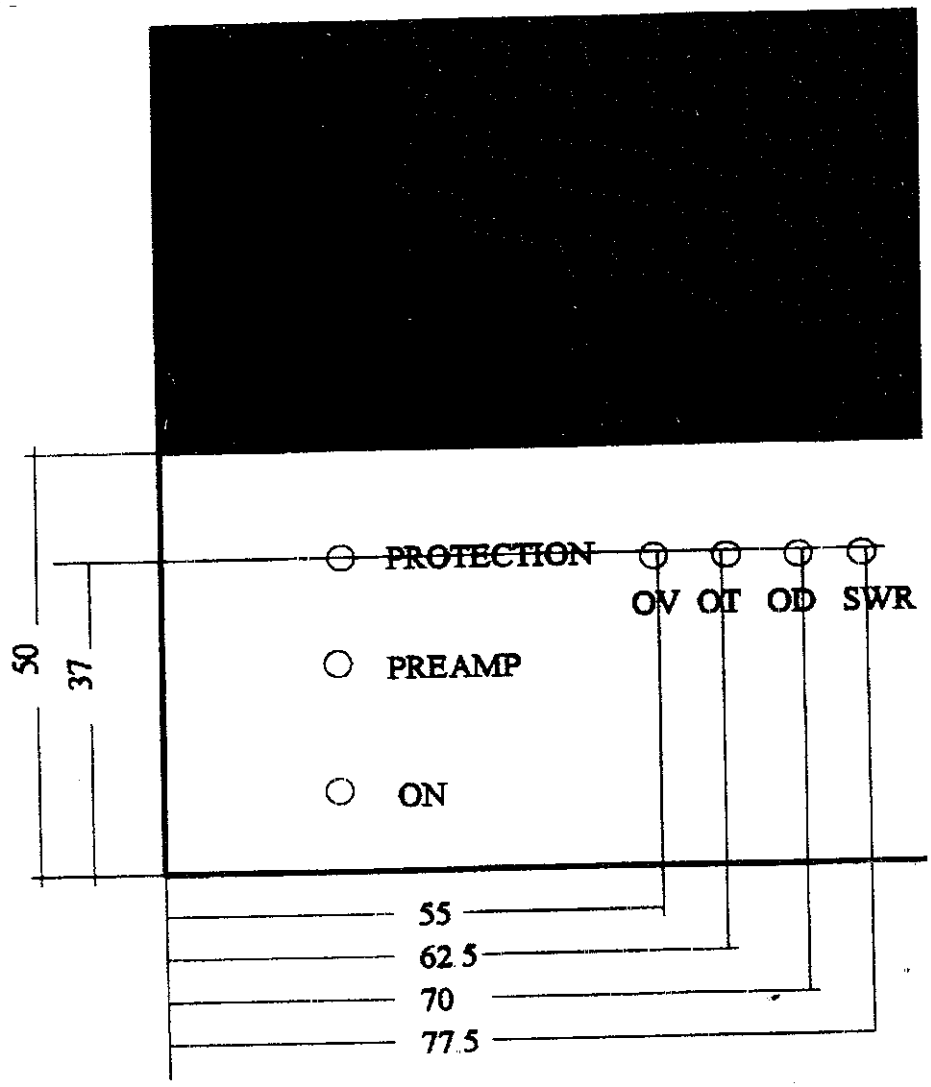

Fig. 4:
Hole dimensions for Additional LED's

In each case, at the point where the signals are connected together through a diode, the corresponding status signal is now measured, and goes through a diode and a voltage divider to the gate of a small thyristor.

Parallel to the gate, a block-off capacitor is connected to earth. Then, in the anode circuit of the thyristor, there is the LED, in series with a resistor to limit the current.

If one of the protective circuits now responds, the corresponding small thyristor is switched through and the LED lights.

The thyristors continue to be switched through until the operating voltage is switched off, which undershoots the holding current.

3. ASSEMBLY

So that as small a printed circuit board as possible could be used, it was decided to assemble the unit in SMD format. The display board can thus be positioned at a free location behind the front plate.

Only the standard tools for SMD placement are needed for assembly.

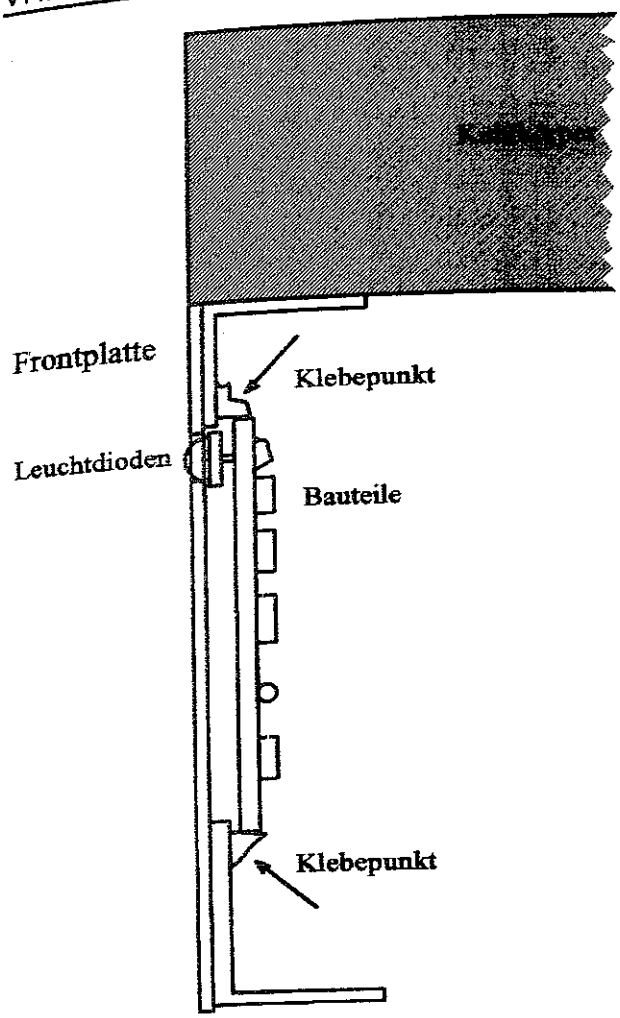

Fig. 5: Side View of Fitted Additional Boards
***Kühlkörper* = Heat sink, *Frontplatte* = Front plate, *Leuchtdioden* = LED's, *Klebepunkt* = Glue point, *Bauteile* = Components**

3.1 Placement

The SMD components are positioned on the foil side in accordance with Fig. 3.

Parts list:

1 x printed circuit board DH6SBN001
4 x SMD diode LL4148 (Mini-Melf)
4 x LED 3 mm., red
4 x BRY 62, thyristor, SOT 143
8 x 33kΩ, SMD 1206
4 x 560Ω, SMD 1206
5 x 0.1µF, 50V, SMD 1206

The "fitting" of the thyristors is not critical. First we tin-plate a speck of solder, then we lay the thyristor onto the printed circuit board, with the somewhat wider connection coming onto the unconnected soldering point, and then we solder up the previously tin-plated speck of solder. Then the remaining connections of the thyristor are soldered on. These are followed by the capacitors, resistors and diodes. The LED's are left to the very end, because these are inserted from the other end and are then soldered on the foil side.

3.2 Checking

Following the placement, the printed circuit board, the position of the components and their soldering joints are given a careful visual check with the aid of a magnifying glass.

If the assembly is correct, the operating voltage of + 8 Volts is applied. None of the LED's should light.

If an additional voltage of app. +3 to +8 volts is applied to each of inputs E1 to E4 in turn, then the corresponding LED should light in each case. It should not go out even when the control voltage is switched off again. The LED's should not go out until the operating voltage is taken out of the circuit.

If the circuit does not function as described, the following sources of error may be present:

LED terminals reversed; triggering voltage to thyristor interrupted or short-circuited; one of soldering joints not in order or - the least likely explanation - a faulty component has been fitted.

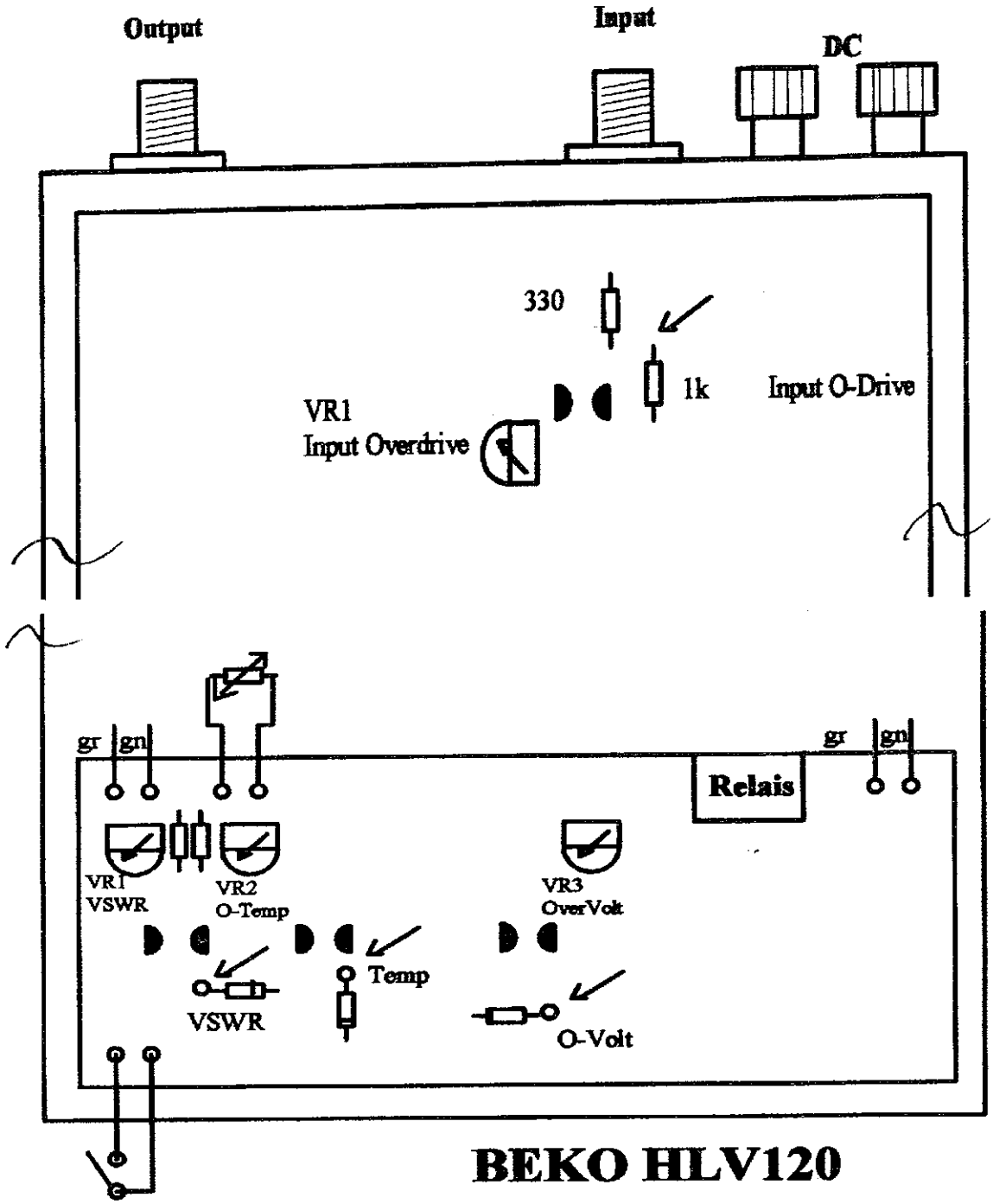

Fig. 6: Connecting Points for Individual Display in PA; View from below; ***Relais*** **= Relay**

3.3 Fitting the display unit

Attention! The display unit has to be fitted extremely carefully, to ensure that the PA operates just as well afterwards as it did before.

Any interference with new appliances during the guarantee period renders the manufacturer's guarantee null and void!

The equipment is unscrewed. To do this, the four screws in the baseplate, and one screw each in the centre and below the front and rear plates are removed.

First the lines leading to the two switches ("On/Off", W) are taken to the front plate, marked and unsoldered.

The feeds from the LED's, which are

Fig. 7: Modified Standard Equipment HLV 120 from BEKO

permanently connected to the front plate, are also unsoldered.

The front plate can now be screwed off, bored as per Fig.4, and then labelled.

The lettering can be done, for example, using transfer letters or laser-printed self-adhesive film.

The modified front plate is re-fitted, and the LED's for the display board are inserted into the front plate from behind, until they are visible and project uniformly through the front plate (Fig.5).

If the front plate holding angle is too great, file out at the appropriate places.

The display board is then mechanically fixed using hot melt or silicone.

3.4 Wiring

The operating voltage and control voltage for the display board are wired up as per Fig's.1, 2 and 6.

A screened line should be used to connect up the "Input Overdrive" signal, since this goes directly past the power unit of the PA.

Finally, the feed lines for the switches and the LED's are soldered on again.

The fitting is now complete. The high-level stage is re-assembled complete (Fig.7) and a functional test is carried out.