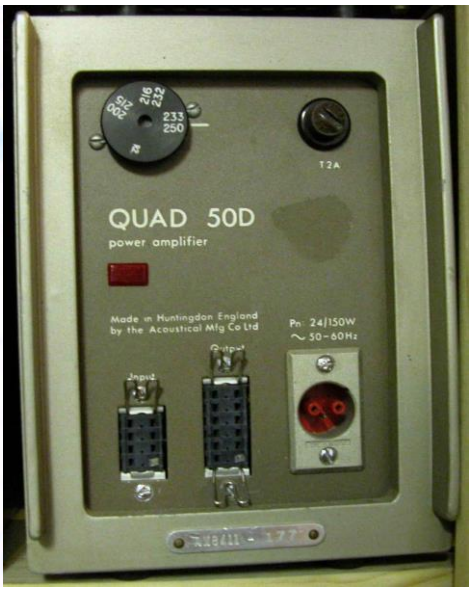
The 50E and D mono amplifier upgrade manual V 1.3

Introduction



The 50E was produced from 1966 to 1983. The quantity that was sold counts up to 12.000. Although it shares the looks of a 303 it is a totally different amplifier. The 50E was the second transistor amplifier from Quad; the Quad 40 was the first (I think!).

The 303 was built from 1967 to 1985 in large numbers; 94.000 units were produced. I own an early and a late version of the 50E, the only visible difference on the outside is the fuse holder! Internally there are a few things that have changed during the production run. The early type has its own heath sink; the later versions share their heat sink with the 303.

Of course components changed during the production years, but as far as I known there are no important modifications to the schematics. Quad added a heat sink to the voltage regulator transistor, and changed the rectifier diodes at a certain point in time, by replacing it with a rectifier bridge, that's it.

Buying advice

Most of the 50E and D's where used professionally, in studios, lab's and PA systems (e.g. British Rail "The train for Oxford is entering the station on rail 2"), so it is difficult to buy an unmolested matched pair. From an electronic point of view almost all units can be restored to pristine order. In some cases the printed circuits are burnt and tracks got lose. The connectors are difficult to obtain, DaDa Electronics is out of stock as well by now. Although a 50E in restored form is still a high quality amplifier, don't buy them if you are searching for the best Quad amplifier. But in a contemporary setup with a 33 pre amplifier they are gorgeous.

Circuit description

The 50E is not a better version of the 303, in fact it's a pity Quad didn't develop a 50E with the famous Triplet output configuration. The setup is more like a tube amplifier (as we see more often in early Quad transistor amplifiers), an input stage, a phase splitter and a symmetrical output stage with an output transformer in some sort of push pull mode.

The 50E has a regulated power supply for the input and phase splitter stages and a different voltage rated, well filtered, supply for the output stages. A choke is deleting HF rubbish. This as well is a technique from the tube era.

An optional 600 ohm balanced input transformer exists, today a rare special and expensive option! An input potentiometer to cope with high voltage input signals is available as well (50E).

Professional amplifiers like the 50 D/E and the 510 have high-voltage – high impedance outputs to allow for long cables and several speakers in series like in churches or railway stations.

The output of the 50E consists of eight (4 x 17V and 4 x 8.5V) independent transformer secondary windings, you can combine those outputs in any way, as long as you keep Ohm's law and the polarity of the windings in mind. The combinations are set by connecting the right pins in the output connector. See the user manual for details. In most cases you will use the 50E with the 17V output configuration. This means in fact six 17V windings in parallel (four standard 17V windings and two 17V windings built up by two 8.5V windings in series).

The 50D has a different output combination; it has only the four 25,5V windings (17V and 8,5v in series)! So compared to a 50E one would miss the important 17V (6 Ohm) option but it is possible to rewire the 50D to this specification. In the 50D there is no possibility to use an input transformer and the power supply voltage has to be minimum 200V AC. The power supply connector is an odd Cannon XLR-like connector. The amplifier output connector is an 11 pin version of the 19 pin 50E connector.

The gain is set with Tr1, it also applies feedback and implements a high pass filter. The protection of the 50E (and 50D) is based on a current limiter circuit around Tr10. This circuit is triggered by two parameters: the current flowing through the emitter resistors of Tr8 and Tr9 and the temperature of the heat sink sensed by R18.

Check this first!

The first thing to do when buying vintage audio equipment is finding information about it. So read and digest the user manual from our download page .

Never connect the amplifier to the mains supply in the first place; there will be an expensive noise in most cases! Start by cleaning the unit, 40 or 50 years of dust-collection will cause problems.

As Quad used standard components, replacing the electrolytes and trimmer pots is easy. Check for suspect looking solder joints as well.

The large resistor and the high power zener in the open spaces of the printed circuit board are the first things to look at.

So the upgrade/revision activities:

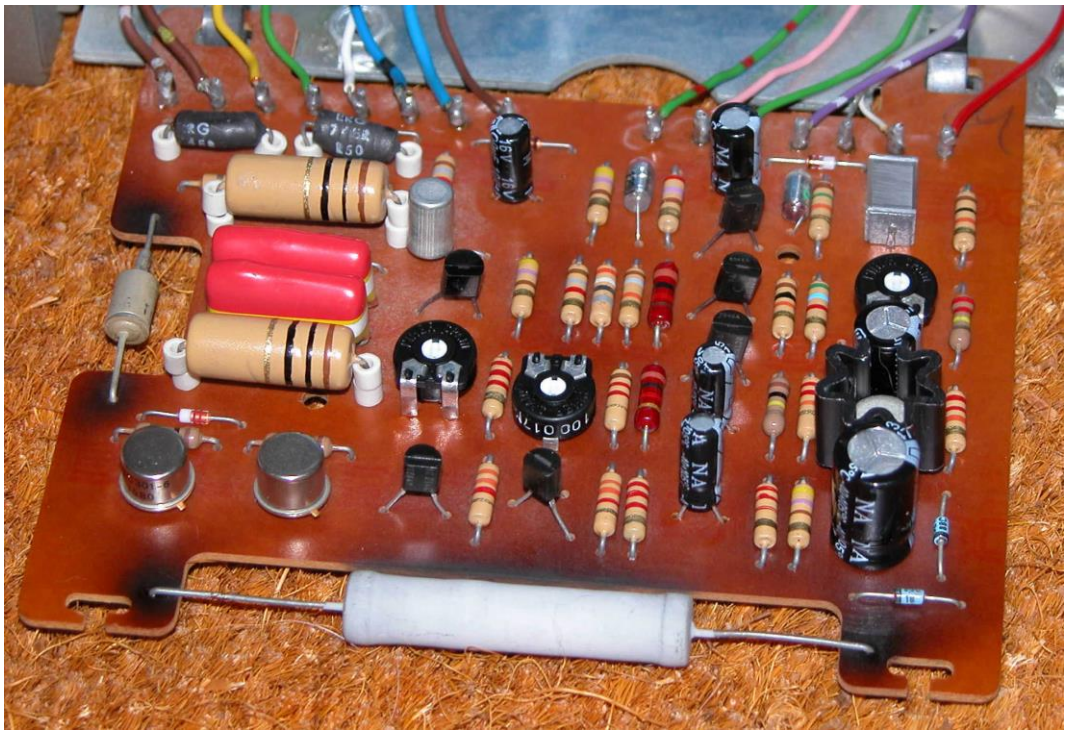
Replace:

(Watch the polarity!)

C1 12u 50V by 22u 35V Electrolyte
C6 50u 12V by 47u 50V Electrolyte
C7 4u 50V by 4u7 100V Electrolyte
C8 4u 50V by 4u7 100V Electrolyte

C9 50u 25V by 47u 50V Electrolyte
C12 5000u 50V by 6800u 63V Electrolyte
C13 100u 12V by 100u 16V Electrolyte

Rv1 2.2K by 2k2 top trimmer one turn
Rv2 & RV3 100 Ohm by 100R top trimmer one turn



Necessary adjustments
First we set the Emitter voltage of Tr3 to 5.5 volts with trimmer Rv1, then the bias currents of Tr8 and Tr9. Instead of breaking the transformer links as mentioned in the manual, we measure the voltage across R30 and R31. The bias current should be 30-40 mA. This means the voltage across R30 or R31 is 0.5 x 30-40mA = 15-20mV. Set this voltage with pot Rv2 and Rv3. Purists would say that I made a mistake; I forgot the base current of Tr8 and Tr9 flowing through R30 and R31 indeed, but that is just a minor error.

Compatible Transistors check pin layout from the data sheets!
BC109= BC184= BC451
BC154= BC560= BC214
BC142= 2N3020
BC125= BC301-6
40411= MJ15003
40408= BC142
IS922= 1N4148
IS920= 1N4004
AA129= no replacement! 200mV reference diode (Limited availability - don’t damage those!)

Joost Plugge & Stefaan Verdonckt @ Dada Electronics, February 2015

Appendix I

Color coding of resistors.

To distinguish left from right there is a larger gap between the D and E bands.

- band **A** is the first significant figure of component value (left side)
- band **B** is the second significant figure
- band **C** is the third significant figure
- band **D** is the decimal multiplier
- band **E** indicates tolerance of value in percent

Color	**A** First figure	**B** Second figure	**C** Third figure	**D** Multiplier		**E** Tolerance
Black	0	0	0	×1		–
Brown	1	1	1	×10		±1%
Red	2	2	2	×100		±2%
Orange	3	3	3	×1K		–
Yellow	4	4	4	×10K		–
Green	5	5	5	×100K		±0.5%
Blue	6	6	6	×1M		±0.25%
Violet	7	7	7	×10M		±0.1%
Gray	8	8	8	×100M		±0.05%
White	9	9	9	×1G		–
Gold	–	–	–	×0.1		±5%
Silver	–	–	–	×0.01		±10%
None	–	–	–	–		±20%

Example: Red, Red, Black, Red, Brown
220 X 100 = 22Kohm and 1% tolerance

The identification of the plus and minus of electrolyte capacitors.
In almost all cases the minus is indicated with a long stripe with symbols at the side of the can in the color of the printed text.

Also if the capacitor has wires, the minus wire is the shortest one!
Capacitors with screw terminals will have sometimes the stripe indication or have indications on top of the capacitor, if any doubts, contact us! Connecting capacitors in the wrong way could give a lot of damage.

With axial capacitors there is an extra arrow indicating the minus wire, or there is a printed small ring around the body indicating the minus wire. Also the minus wire is direct connected to the aluminum body. The plus wire is sticking through the black plastic cap.
Indication of the cathode of diodes and zener diodes

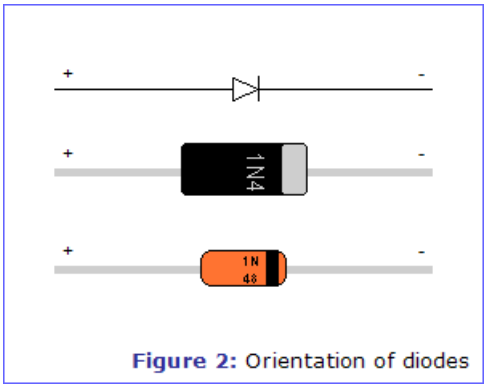


Figure 2: Orientation of diodes

The cathode will be indicated by a white, silver or black line on the body of the diode.