



FERROGRAPH SERIES 7 STEREO
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Source "the tape recorder Sept-1970

BEFORE we can find a fault, we must find our way around the equipment. Ferrograph are kind enough to issue what is about the best user manual on the market; one with each machine. But human nature being what it is, by the time this article is ferreted out from the bottom of a dusty pile to check one or two possibly relevant details, the book issued by the makers, despite its hard covers and tough pages, will have been used as a doorstop or a source of paper aeroplanes for the nipper.

One or two drawings might have saved a few words here, but we could easily fill the entire magazine with layout diagrams, so let's imagine first that the Series Seven is removed from its cabinet and is standing upright with its rear toward us so that we can see the printed circuit panels.

The layout differs in the mono and stereo machines – and, obviously, in the deck and full models. In a previous article we showed the circuit of the mono version, the 713, and in this one we should be able to fill in the gaps with a diagram of the 724 stereo model complete with power amplifiers. (The deck only version is the 702/704.) On these drawings you will note that the individual sections of the circuitry are dotted in. These sections are each contained on an individual printed circuit board, wired to studs along the edge from a common harness.

Perhaps the biggest job of the lot is tracing out wiring with a system like this, and any owner with nothing but the operators handbook for reference may find life a little difficult when he comes to delve into the circuitry. So I propose to dispense with a circuit diagram in the next article and publish instead the layout pin connections of the principle boards, with colour coding of the wires, and their destination where such information may be helpful.

The electronics

Looking at the rear of the uncased mono machine, we have all the electronics at the bottom. Three boards lie horizontally. These are, left to right, the replay, pre-emphasis, and meter and tone control boards. The oscillator board stands vertically facing us and the record board is also vertical, but at the right-hand side. Power unit parts are on the vertical struts; large black heat sinks with the output board spaced off from them, and face us above the main amplifier.

The stereo versions have a slightly changed layout and are not merely mono construction with the second channel added. Instead, we now find the meter board and the replay board of each channel in a neat sandwich on one side. Again looking at the uncased machine with its rear facing us, the boards for the upper track are all at the right side, and the relevant parts of the common boards are also oriented to the

same side. So the pre-emphasis board, with twice as many components this time, is again at the bottom centre, the oscillator board again standing vertically with its print side facing us. Of the two sandwiches, the upper layer is in each case the meter board and the replay board fetches up on the bottom.

FIG. 2. Rear view of uncased mono Series Seven. Note oscillator board and adjustment knob (something Ferrograph had not thought of!), also phono plugs and multiplug positions.

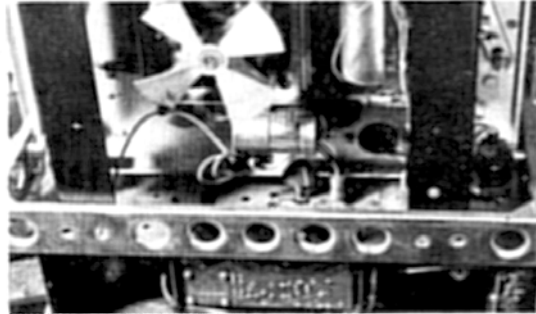


FIG. 3. Close-up of the record amplifier board at the chassis side.

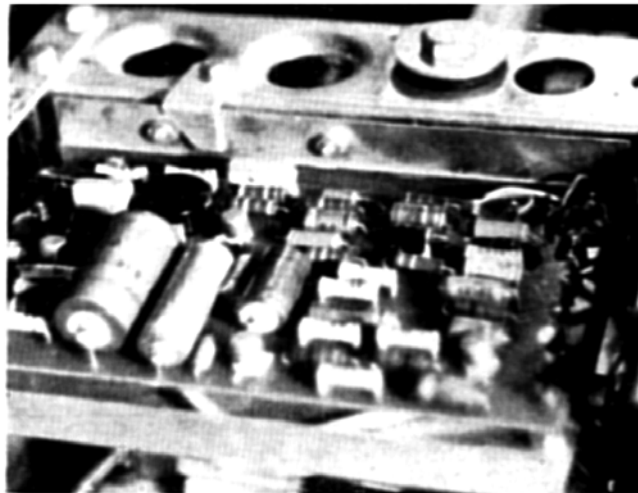
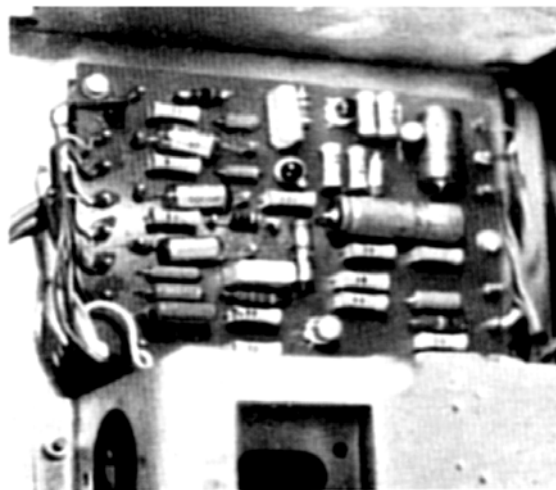


FIG. 4. Replay amplifier board. Note tag fixing of feedback network components.



It is possible to remove the complete amplifier section, to separate it from the mechanism and its power section, but before doing so beware! Although plug and socket connections make life easy, you will find that the usual Ferrograph scrupulousness has made life for the service man a bit more difficult: the head

connections, with their screening, are soldered to the record and replay boards directly. This is, of course, to beat the bogey of hum loops. To identify these connections (which will be given in detail in the next article), remember that the red sleeved cables, as used in the mono machines are 'equivalent mono', i.e., upper channel, in the stereo models. The lower replay connection of the stereo version is white sleeved and the connection to the stereo record lower channel has a black sleeve. After disconnecting these, it is only necessary to unplug the phono connections from the oscillator located along the top of each section, and the nine and fourteen pin plugs for the sockets at top left of the amplifier back. Then the removal of three screws at each side completes the separation.

The power unit section can be completely removed also, and in this case we have only plugs and sockets to contend with: the 14 pin one and the rectangular one at the top of the chassis. But it is a fiddling business, needs great care if the switch by the speed control is to be safeguarded, and requires also that the line sockets be removed.

It is easier to slack off the securing nuts and let the sockets dangle than to try to unsolder and resolder in this location, but take care to retain and replace the spacer washers. A funny thing about these jack sockets, I have many times cursed the necessity to hold panel washers, barrel and nut in position when replacing jacks in difficult positions, yet retain my loyalty to the old GPO jack. I deplore the remark at the end of a review of the Series Seven in the American magazine *Audio* (June 1970) that their only objection to the machine was the use of jacks. For my part, I dislike the phono plug and socket, having seen so many melted inners and rusted outers when machines came in for service. But then, I admit to my prejudice, just as David Kirk must when he slates the versatile DIN plug.

And now, before I stick my neck out any farther, let us take a brief look at the circuit. From the playback head the signal is taken to the base of a low-noise n-p-n transistor, BC154. The capacitor across the base-emitter circuit and the series 100 ohm resistor are for RF suppression. Readers who suffer from TV broadcast pickup in the replay mode, especially noticeable on some cheaper models, might care to experiment along these lines, remembering that positioning is important. The components must be mounted as near the transistor as possible and must have no stray leads floating around. Even a spare centimetre or so of clumsy wiring here can spoil the suppression.

The signal is coupled capacitively to the second BC154 and feedback from the collector of this second transistor to the emitter of the first provides the required correction. In our diagram, the speed selection is indicated, and with reference to this, we need only describe one network. Taking the lower leg, which is the highest speed, and supposing that this is the 19 cm/s machine, we find the treble response determined by C316. This capacitor is 1.5 kpF on earlier models, 2 kpF later and 4 kpF on 'H' versions. The extreme bass is affected by the value of R317, which is 120 K on the earlier models and also on the high-speed version, while later models of the M series had a 150 K in this position.

The phase-shift network across the output of the second stage, (C305 corresponding to our high-speed switching) gives a small treble lift and then a fairly sharp cut-off slightly beyond the required response. This is designed to give protection against RF

bias breakthrough and also to reduce the hiss. This component is 0.022 microfarad in the M versions, 0.015 microfarad in the H versions.

We have deliberately left the equalisation network components unqualified in last articles drawing and again here, because the differences between versions and between earlier and later models were nearly all centred on this part of the circuit. Including all the alternative component values would have cluttered the drawing up hopelessly.

Filter network

A couple more components need explaining before we tackle the adjustment of the replay circuits. These are the filter network, R313, C312, across the output of the third stage; at the point where the signal is taken to the replay level control (this is one of the presets under the hinged flap). The end remote from the amplifier appears to go nowhere – or at least to end at pin five of the nine-pin socket. Looking up and to the left we can see the associated plug and note that the connection from pin five goes through the fast wind position of the selector switch to pin two of the rectangular plug, which then goes (eyes right this time) via the corresponding socket to the earth line of the power supply. In other words, this network shunts the higher frequencies from the output when we are fast winding, leaving enough sound for intelligence, but cutting out the screech.

Adjusting and checking the replay channel requires the use of the correct test tapes. It is presumed that head alignment has been done at this stage. Not much purpose carrying out electrical checks until the scene is properly set, the machine running truly, the heads adjusted, the instruments coupled... Test tapes suitable for the Ferrograph should be recorded to 32 mM/mm at 38 and 19 cm/s.

I have always found the Series Seven to be better than its written specification anyway. Table 1 gives details of the response figures, with the relevant time constants and also the components which affect the high and low frequencies.

Now the catch is that these are not adjustable components. They are factory chosen: in the parts lists they are described as 'average value'. If you want to make changes, you have to solder new components across the tags of the replay board. The components are easily identified, being the only ones affixed to stand-off tags. If you are going to insist on that lowest speed, then the component that needs special attention is C313.

A warning is given by Ferrograph about misinterpretation of results on ¼ track machines when replaying a full-track test tape. Fringing flux from the part of the tape between tracks will cause a bass rise. At 40 Hz this can be +2 dB on the upper track and + 3 dB on the lower track. Compensating for this will of course lead to low frequency loss when the machine is once again used in the correct track mode.

The response checks lead us on to the output level tests, and again we have some special precautions. Testing at the highest speed and with the millivolt meter across the 600 ohms output, using the 32 mM/mm tape at reference frequency of 1 kHz, we should get a reading of 2 V, and can adjust by the 'A' preset under the hinged flap.

But- this is when using a European test tape. There are some other folks across the seas; I am told who have slightly different standards. Using an American test tape, we must first find the part of the tape that contains the recorded level 4 dB to 6 dB below peak. So, as this corresponds to 0 VU, we now run this section of tape through and correct with 'A' to get, not +4 VU, (i.e. 2 V at the 600 ohms output) but 0 VU as indicated on the Ferrograph meter.

The obvious snag there is, of course, that we have to rely on the correct setting of the meter, and this is one of the things we shall be concerned with in the next article, along with bias adjustments, overall response checks (and the recording channel is very important in these models), noise and distortion measurements.