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Title: Solid-State BC-221 Frequency Meter
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Solid-State BC-221 Frequency Meter

Modernize that fine old BC-221 of yours with FETs and a 9-volt battery! These complete instructions show you how.†

By R. S. N. Rau,* VU2CX

The tubes used in the BC-221 frequency meters long ago became obsolete and are now difficult to obtain — especially the older non-octal types — and as all models of the meter have excellent accuracy it would be a pity if the instruments have to be junked for want of tubes. However, with very little effort these instruments may be modernized with FETs, with no sacrifice of accuracy, by changing and adding a few components. In the author's model no recalibration was required, and the instrument now operates from a small 9-V battery.

Modifications

The only description of replacing tubes with FETs in the BC-221 known to the author is by Charles Landhal (*73 Magazine*, May, 1971, p. 61), and using this as a guide, he has modified his BC-221-1. The modifications given below specially concern this model, particularly regarding part numbers and base diagrams. However, all BC-221s and LM counterparts are basically similar and hence the modifications apply to most, if not all models.

The three tubes used are replaced by four N-channel JFETs, type 2N3819, but BFW10 or BFW11 may also be used. The only new components required in addition to the FETs are three octal plugs, five resistors, one capacitor and a 9-V transistor radio battery.

†Adapted from *Radio Comm.*, Aug., 1976.

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The tube used for the VFO is a VT116-B (6SJ7-Y), which is replaced by the N-channel JFET, Q1 (2N3819), mounted inside an octal plug as shown in Figs. 1A and B. Fig. 1C shows the modifications to the anode load resistor of 56 kΩ (part no. 19). The value of R1 will depend on the particular sample of the FET used and ranges from 1 to 6800 Ω.

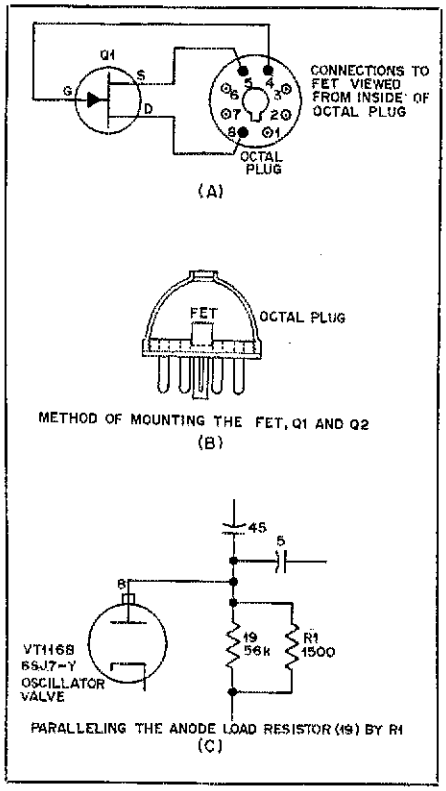

Fig. 1 — Modifications to the VFO circuit.

Mixer and Crystal Oscillator

The tube used for the mixer-oscillator is a VT167 (6K8), which is replaced by two 2N3819 JFETs, Q2 and Q3, one for the mixer and the other for the crystal oscillator. Fig. 2 shows the necessary connections. The two FETs, together with the associated components R2, R3 and C1, are mounted inside the octal plug. R2 and R3 may need some experimentation in the vicinity of the values given (6800 Ω and 3300 Ω, respectively).

It is important to note that the original leads going to pin numbers 2, 7 (heater) and 4 (screen grid) should be cut and insulated. The top-cap clip of the mixer valve should be connected to pin 4.

A short stiff wire of appropriate length is soldered to pin 4 and the other end of the wire is soldered to a small grid cap obtained from a defunct tube. The lead bearing the clip formerly going to the top cap of the mixer tube now goes to the new cap.

Beat-Frequency Amplifier

The tube for this is a VT116 (6SJ7), generally connected as a triode in all models using this tube. This again is replaced by a 2N3819 FET (Q4) mounted and connected inside an octal plug exactly as in the case of Q1 (Fig.

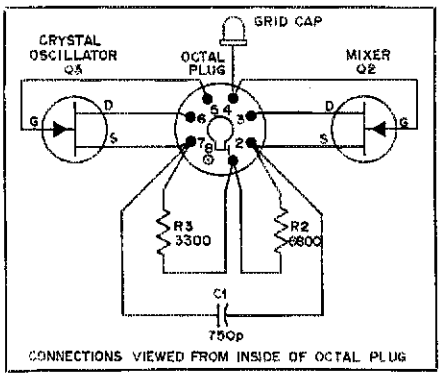

Fig. 2 — Modifications to the mixer and crystal-oscillator circuit.

1A and B). Parallel the 15-kΩ anode load resistor (part no. 24-2) by a 4.7-Ω, 1/4-watt resistor. Remove the original 300-Ω cathode resistor (part no. 41) and replace with one that gives a source current of approximately 1 mA; typically this is in the range 1000 Ω to 3300 Ω.

The power supply is shown in Fig. 3 and is self explanatory. A small 9-V transistor radio battery fastened by a clip to the side of the instrument now powers it. The total current drain is approximately 3 mA, which assures almost shelf life for the battery. The instrument can also be operated from the mains via a filtered low-voltage dc supply stabilized by a 9-V Zener diode.

Performance

All the checkpoints listed in the calibration book for low and high ranges could be clearly located and brought to settings noted in the book using the corrector. No recalibration was found to be necessary. The beats were sufficiently loud, although not as loud as the tube version. From the instant of switching on, there was practically no drift. QST

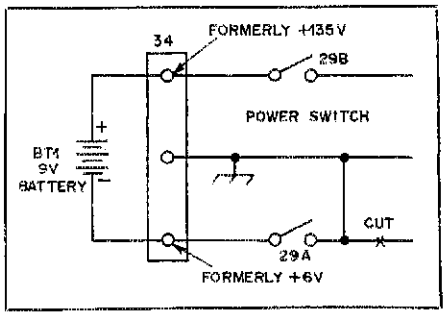

Fig. 3 — Battery connections.

Strays

NEW POST FOR W3ASK

□ George Jacobs, W3ASK, chief of the Voice of America's Frequency Division for the past 23 years, moved into the newly created post of Director of Research and Engineering at the Board for International Broadcasting, effective November 21, 1976. The five-person board is appointed by the president; it supervises grants of money from Congress to Radio Free Europe and Radio Liberty, and oversees their operations.

At Voice of America George had played a leading role in the development of VOA's present worldwide broadcasting system. His new job will entail research, scientific, engineering and regulatory aspects of broadcasting and telecommunications, and their relationship with political considerations that often influence international broadcasting.

George is well-known to the amateur fraternity as a propagation expert, having been the propagation columnist for *CQ Magazine* for many years. He holds a BSEE degree from Pratt Institute, MSEE from the University of Maryland, and is a Fellow of the Institute of Electrical and Electronics Engineers.

□ Here's an idea for a club outing — hold a QRP competition like the Denton County (TX) Radio Club did on one Saturday in October. Each entrant's basic goal was to make a single contact during a 20-minute period while using a club-provided receiver, dc supply and antenna. The judges based their scoring on a miles-per-watt figure with a 500-milliwatt maximum input power limit. Though no other design criteria was specified, all five entries were of the Tuna-Tin 2 style (*QST*, May, 1976).

Band conditions prevented any contacts outside of Denton, so the main prize went to Jack Deines, WB5MST. He had the strongest across-town signal. All who built the rigs had good luck and fun on QRP, many for the first time.

Participating in the Denton County Amateur Radio Club QRP contest were (left to right) WB5MST, W5SAN, WB5RQZ, W5FXQ and WB5WDS. *(Larry Reese photo)*

Fred Stevens, WA5LIE, really tries to dig one out of the band. Below the bug and alongside the HW-101 is the Tuna-Tin 2 transmitter. *(Larry Reese photo)*