SURPLUS

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If I were asked which piece of surplus gave you the most for your money I would be forced to say the ARC-5 command sets, but right on the heels of the ARC-5 would be the BC-221 frequency meter. It's hard to find a secondary frequency standard with as much versatility as the 221 for under five hundred dollars, yet that's exactly what the commercial models go for. I've seen a BC-221 go for as little as forty dollars with the calibration book, and in perfect condition. Nowadays, they are still under a hundred and worth every cent.

The BC-221 (and the Navy LM counterpart) is a portable frequency meter of the heterodyne type cable of accuracies of 25 cycles at 20 *mc*, to the nearest kilocycle. The 221 covers two bands, namely 125 *kc* to 2000 *kc* and 2000 *kc* to 20,000 *kc*. Essentially it is a highly stable, well calibrated oscillator with a low frequency range of 125 to 250 *kc* and a high frequency range of 2000 to 4000 *kc*. By means of harmonics, the complete range is covered. The companion calibration book is individually calibrated for its own BC-221 and carries the same serial number as the frequency meter itself. The slight error which may occur due to temperature changes, aging of tubes etc, is accounted for by checking the calibration against the 1000 *kc* standard built into the equipment, and compensating the calibration by a fine trimmer known as the corrector. Many frequency check points occur over the band, and errors can be reduced to as low as 0.02 percent.

In use, the frequency meter is turned on and, in the case of an oscilaltor or transmitter, beat against the unknown signal. The frequency meter has a detector and an audio amplifier so that the beat is heard in a pair of high impedance earphones. The calibration of receiver is very simple. The 221 is set to a particular frequency and the receiver tuned so as to receive the 221's signal. In some models of the frequency meter a modulated signal is available so the *bfo* of the receiver need not be turned on, but this is only in the later models.

The *rf* signal required to operate the BC-221 is relatively small, and only a short length wire for pickup is needed. As a special note, don't connect it directly to the antenna or to a transmitter. Near the antenna is close enough. Likewise when testing a receiver, don't couple the frequency meter directly, but instead connect a short piece of wire to the 221 antenna post and just bring it near enough to allow the receiver's antenna to pick up a signal.

The output of the frequency meter is high enough to allow its use as a fine *vfo*. A cathode follower may be necessary in some cases to prevent loading of the output.

Conversion of the BC-221 is practically negligible except for the power supply to take the place of the batteries and a modulator. We're indebted to DL4VG (W9YUE) who came up with the modulator last year for us. I'm sure that he thought we forgot all about it, but it's well worth passing on and requires very few parts. It is shown in fig. 1. It will allow you to tune up that receiver, under AM conditions, to the exact frequency and be right on when that sked is due. It also allows you to use the 221 as a signal generator for accurate alignment.

The power supply is simple. The original power supply used for 1½ volt large cells for fila-

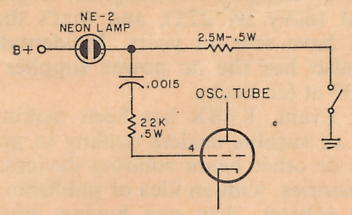


Fig. 1—Simple neon lamp modulator circuit for a 400 cycle tone.

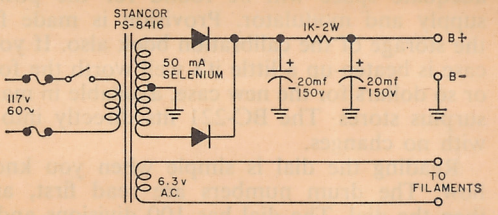
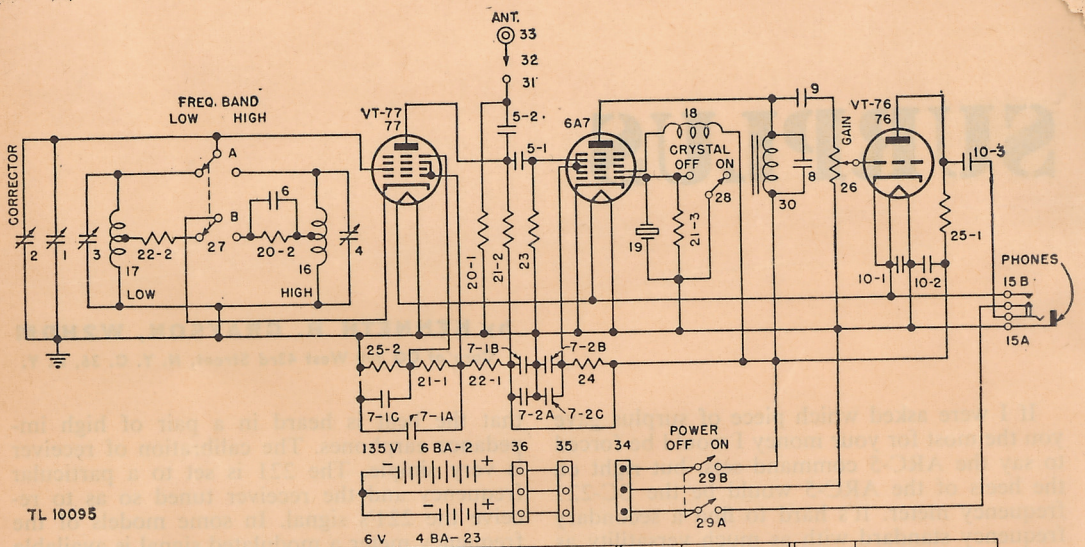


Fig. 2—Full wave power supply to operate BC-221 from the ac line



REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
1	150 μμf	7–1C	0.1 μf	15B	FIL. SWITCH	23	1 MEGOHM	31	ANT. PLUG
2	2 μμf	7–2A	0.1 μf	16	HIGH FREQ. COIL	24	30,000 OHM	32	CONTACT SPRING
3	10 μμf	7–2B	0.1 μf	17	LOW FREQ. COIL	25–1&2	15,000 OHM	33	BINDING POST
4	10 μμf	7–2C	0.1 μf	18	1.7 MILLIHY	26	0.5 MEGOHM	34	POWER PLUGS
5–1&2	10 μμf	8	.001 μf	19	CRYSTAL	27	SWITCH	35	POWER JACKS
6	250 μμf	9	.02 μf	20–1&2	5,000 OHM	28	SWITCH	36	BATTERY TERM
7–1A	0.1 μf	10–1,2,3	0.5 μf	21–1,2,3	50,000 OHM	29	SWITCH		
7–1B	0.1 μf	15A	JACK	22–1&2	10,000 OHM	30	450 HENRYS		

Fig. 3—Circuit diagram of the BC-221 frequency meter.

ments and six 22½ volt cells for plate supply.

This adds up to a few bucks worth of batteries every year. True you don't use the 221 that much, but the power supply shown in fig. 2 can be built for the price of one set of batteries, and you will always have it working when you need it. The power supply is a full wave using selenium rectifiers and good filtering. Rather than drill a switch hole in the front panel the audio gain control potentiometer was removed and a similar one megohm switch type was substituted. By this means, no possible chance of calibration change can occur.

The BC-221 originally came with two different cases, namely the wooden, khaki colored, and the metal, black crackled. In recent months a new case has found itself on the surplus market. Originally used in aircraft, it included a regulated filament supply for use from 24 volts in the plane, and makes use of the plane's communication's receiver for a B+ source. By removing these parts from their compartment, adequate space will be found for the power supply and modulator. Provision is made for the storage of the calibration book also. If your case is beaten-up a little it's well worth the four or so dollars for the new case, available in many surplus stores. The BC-221 fits directly into it with no changes.

Reading the dial is simple when you know how. The drum numbers are read first, and then the dial. The dial has 100 divisions and a vernier which allows reading to one-tenth of a division. Vernier dials are fairly simple in theory. They consist of a second fixed dial marked from 0 to 10 which is eleven divisions. This just covers ten divisions of the main dial. Therefore only the first and the last lines line up with the main dial at zero. Each line is off by 1/10 a division so that line two is 2/10ths off, line three is off 3/10ths etc. If our main dial has a line which lines up with line seven of our vernier then it is 7/10ths past the number on the dial, and we can read that number to a very fine accuracy.

By checking in our calibration book we can tell exactly what frequency we are on, provided we know approximately what our frequency is to start with.

The 1000 kc (1 mc) oscillator also has a correction trimmer (located behind the nameplate). By setting the output knobs to XTAL ONLY and using a receiver to tune in WWV at 5 mc we can zero beat the crystal against WWV. All in all, the heterodyne frequency meter is a good buy at $37.50 less power supply, which is the price J. J. Glass in Los Angeles, is getting for the LM (navy BC-221), and that's the lowest price I have seen in years. Incidentally, J. J. Glass also has the *ac* power supplies for the BC-1335 at ten bucks.

Cliff Evans, K6BX has been making a survey of all surplus dealers dealing in prop-pitch motors or other beam rotating devices, as well as accessories, with an idea of publishing a book on the subject. Any one having info of any kind of this type of device should get in touch

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