

# get on 6 meters — the inexpensive way

## Converting the CRT-1/CPRC-26

The CRT-1/CPRC-26 radio set shown in fig. 1 is an ideal unit for low cost, multichannel 6-meter FM operation. A Canadian-designed and manufactured six-channel, crystal-controlled receiver-transmitter, it covers the 47.0 to 55.4 MHz frequency range with a power output of 300 milliwatts. The receiver's sensitivity is 2 microvolts; its deviation is approximately 15 kHz. All that's necessary to make the CRT-1/CPRC-26 operational is a power supply and the Canadian version of the U.S. Military H-33/PT Handset. You can even modify the basic unit described in this article to include

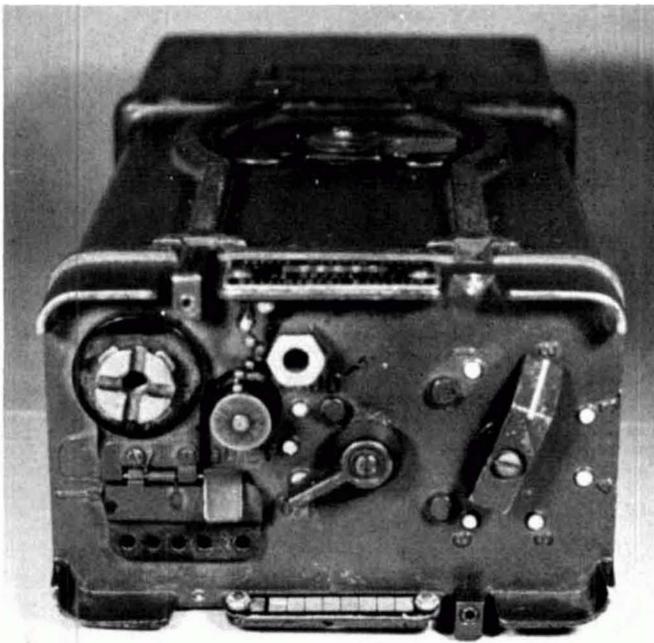


fig. 1. The CRT-1/CPRC-26 radio set represents an easy way of "getting on" 6 meters.

speech limiting, squelch circuitry, and provisions for loudspeaker operation.

### theory of operation

Figure 2 shows a block diagram of the radio set. Incoming signals are amplified in the RF amplifier, V7, and applied to the mixer, V8, along with the output of the crystal oscillator, V4, to produce an IF of 4.3 MHz. The crystal frequency equals the frequency of operation minus 4.3 MHz. The IF signal is then amplified through four identical IF amplifier stages and fed to the limiter, V10. The signal is then routed through the audio discriminator to the audio amplifier, V6, and to the earphone element of the handset via the output transformer, T1.

Audio input from the microphone element of the handset is applied through the microphone transformer, T2, to the modulator, V3. The amplified audio is next fed to the master oscillator, V2, via the master oscillator coil. The audio input varies the frequency of the master oscillator to produce direct FM. The output from the master oscillator, V2, is then applied to the power amplifier, V1, and routed to the antenna via the output tuning network.

Because the master oscillator is essentially a VFO, some method is needed to ensure that the transmitter frequency tracks the receiver frequency. Therefore, the output from the mixer, V8, is fed to the AFC amplifier, V5, during transmit, through the AFC discriminator to the master oscillator, V2, via voltage dividers R5 and R6. In effect, output from the crystal oscillator, V4, provides transmitter frequency control.

### power supply

The power supply for the radio set consists of an inverter for high and low B+ and a simple +1.4-volt

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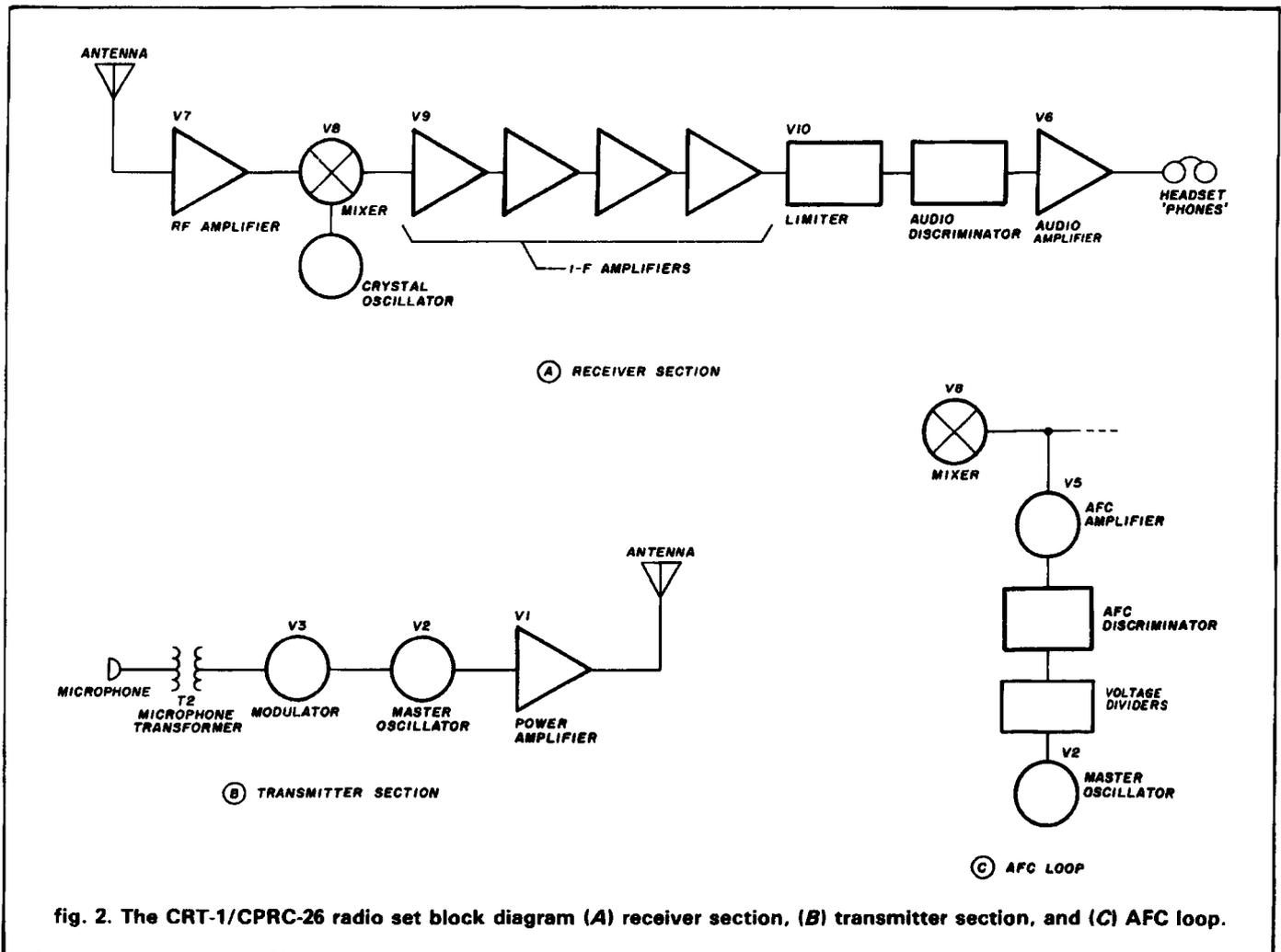


fig. 2. The CRT-1/CPRC-26 radio set block diagram (A) receiver section, (B) transmitter section, and (C) AFC loop.

filament regulator board. Bias is supplied by two +1.5-volt N cells connected in series and mounted on the filament regulator board. Both the inverter and the filament regulator board fit inside the battery box, which attaches to the rear of the radio set. A schematic of the filament regulator circuit is shown in fig. 3.

The inverter can be either bought or built. A surplus transistorized inverter module, P/N 522-1091-004, is available from Fair Radio Sales Company, Inc., (see fig. 4). The only disadvantage of this choice is that unless the inverter is modified, a +24-volt DC power source will be needed. This might prove to be a problem for anyone operating from a typical automobile. A schematic diagram for this circuit is shown in fig. 5. With +13.8 volts power applied to U1, the input regulator circuit, R1, is adjusted until the output voltage present at C3 is +140 volts maximum. This occurs when Q1 and Q2 are biased into oscillation by R3 and R4, which produces high-voltage AC at the secondary of transformer T1. This AC voltage is rectified by CR1, filtered by C3, and applied to the input of the U2 output regulator circuit. Note that the LM317 is capable of high-voltage regulation provided the input voltage does not exceed the output voltage

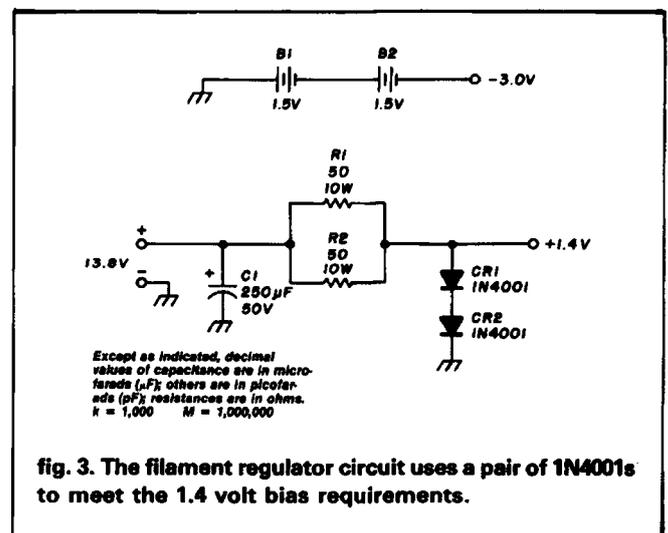


fig. 3. The filament regulator circuit uses a pair of 1N4001s to meet the 1.4 volt bias requirements.

by more than 40 volts. Therefore, I recommend that the input regulator be set to produce approximately 130 volts at the input of U2 (approximately +5 volts to the transistors). CR2 is a 40-volt zener diode that protects U2 if the input regulator circuit fails. Note that a simple voltage divider, consisting of R6 and R7, provides approximately +45 volts for the receiver and transmitter.

The +1.4 volt filament regulator board consists of a series dropping resistor (two 50-ohm, 10-watt resistors in parallel), two 1N4001 diodes shunted to ground, and a filter capacitor. Although there are alternatives that will provide +1.4 volts for the filaments, this circuit is especially simple.

The two N cells are another way to provide needed voltage — in this case, the bias voltage for the receiver

audio amplifier. The N cells are mounted inside a standard 9-volt battery holder and secured to the battery holder with nylon ties. The battery holder is then mounted on the filament regulator board. Transistors Q1 and Q2 are mounted on the top of the battery box. Their placement is not critical; almost any convenient location on the battery box will probably work satisfactorily. The transformer is mounted inside the battery box on either the left or right side. The filament regulator board is also mounted inside the battery box on the side opposite the transformer. Connections from the power supply to the radio set are made with hookup wire wrapped around and soldered to the pins on the rear panel of the radio set. Heat-shrink tubing is then placed over these connections. In addition, a power cable was fabricated using a Radio Shack two-pin plug and matching jack (P/N 274-201 and 274-202), 12-gauge wire, and battery clips (Radio Shack P/N 270-344). Figure 6 shows the power supply mounted in the battery box with the power cable attached. The dimensions of the filament regulator board are 1 inch

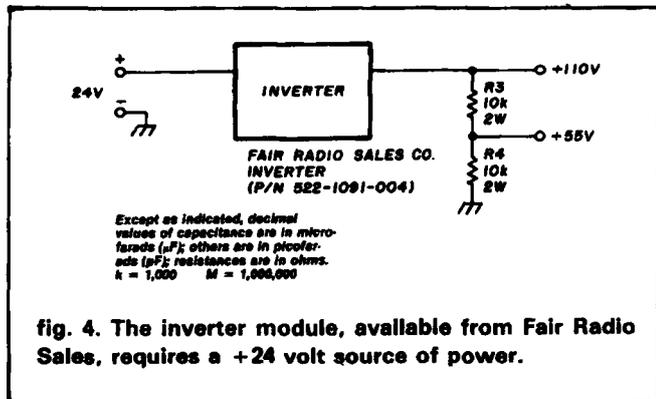


fig. 4. The inverter module, available from Fair Radio Sales, requires a +24 volt source of power.

table 1. Alignment procedure.

VTVM	channel	adjust	indication
2-volt scale, - DC position	1-6	C3-C8 C29-C34	maximum - 1 volt
(Insert the probe into pin 3 of the test socket.)			
10-volt scale, + DC position	1-6	C19-C24	zero indication between positive and negative peaks
(Insert probe into pin 4 of test socket.)			
Press PTT (push-to-talk) switch on handset.)			

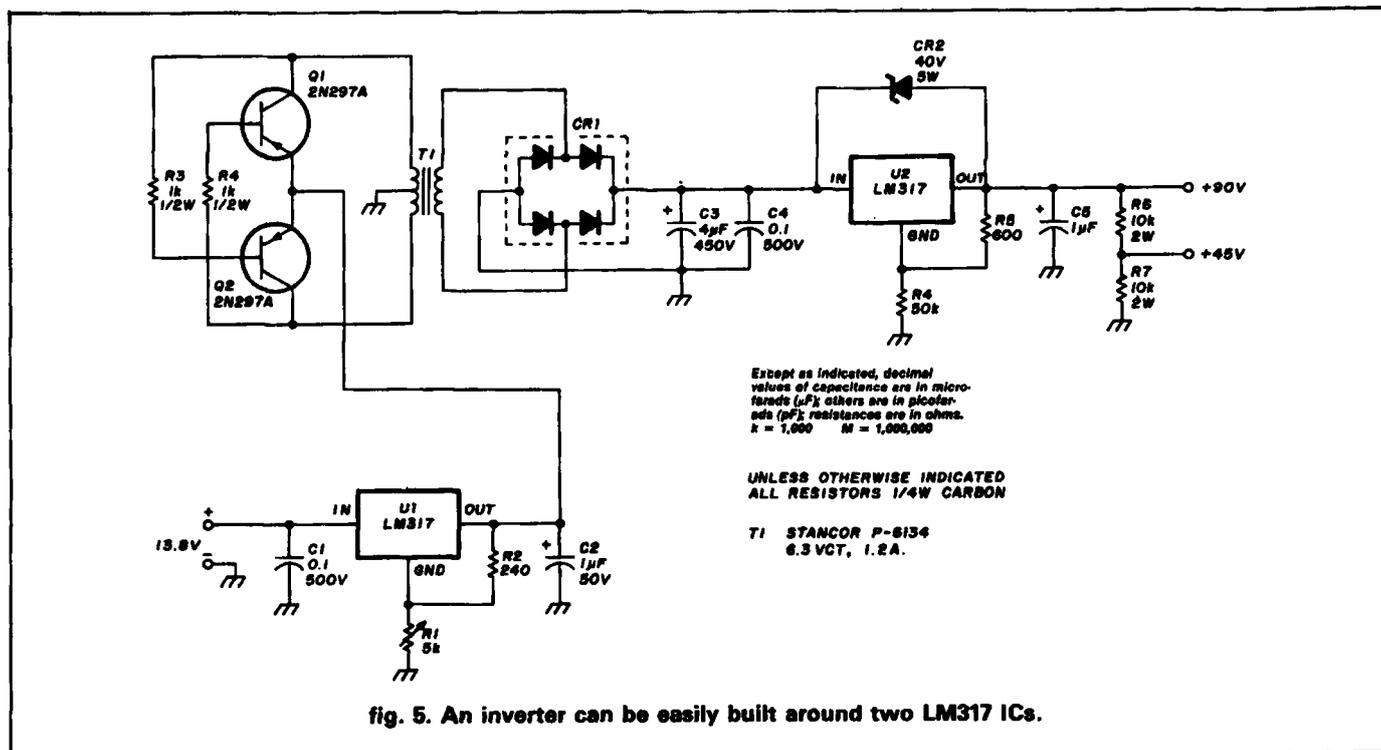


fig. 5. An inverter can be easily built around two LM317 ICs.



fig. 6. The complete radio set, shown with power supply and cable, measures 3 × 4.75 × 10.34 inches (7.62 × 12.07 × 26.26 cm).

(25.4 mm) by 2 inches (50.8 mm). The set's power requirements are as follows:

receiver:	+ 1.5 volts, 550 mA;
	+ 45 volts, 12 mA;
	+ 90 volts, 30 mA;
	- 3 volts bias
transmitter:	+ 1.5 volts, 850 mA;
	+ 45 volts, 8 mA;
	+ 90 volts, 30 mA.

## alignment

The alignment procedure for the radio set is easy and does not require elaborate test equipment. A VTVM and a 5/32-inch color TV tuning wand are necessary.

First remove the battery box from the rear of the radio set. Then remove the cover from the receiver-transmitter chassis. Apply +90, +45, +1.5, and -3.0 volts to the radio set. (Don't forget to connect a dummy load to the antenna connector on the front panel.) Install the appropriate crystals for the desired operating frequencies. Set the OFF/QUIET/LOUD switch to either the QUIET or LOUD position. **Figure 7** shows the radio set adjustment locations. **Figure 8** shows the major component locations. **Table 1** identifies the controls and proper indications to be observed during the alignment procedure.

## obtaining materials

The primary source of the CRT-1/CPRC-26 Radio Set is Fair Radio Sales Co., 1016 East Eureka, Box 1105, Lima, Ohio 45802-1105. Their 1984 catalog price for the radio set — described as "used" — is \$12.95. (The "used" radio set we bought appeared to be in

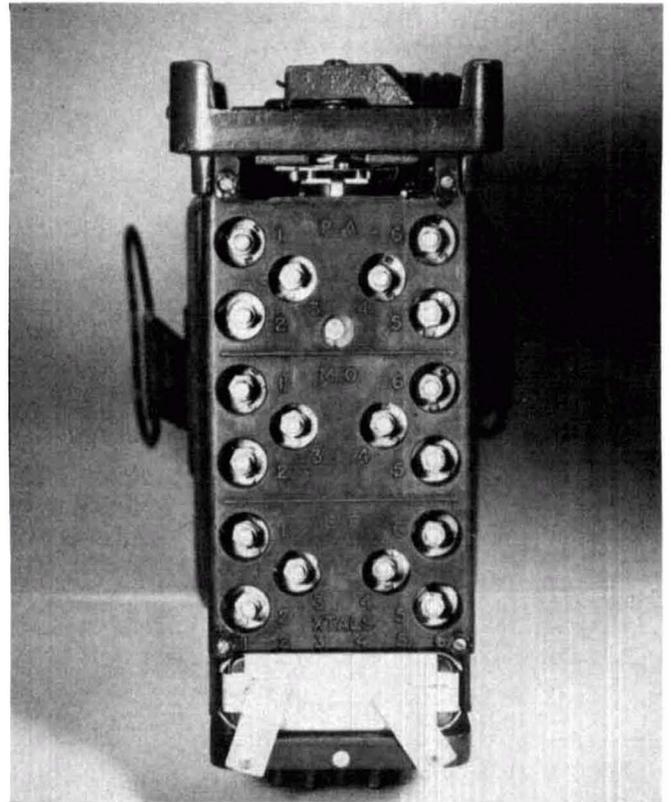


fig. 7. Alignment proceeds smoothly with easy access to the adjustable components.

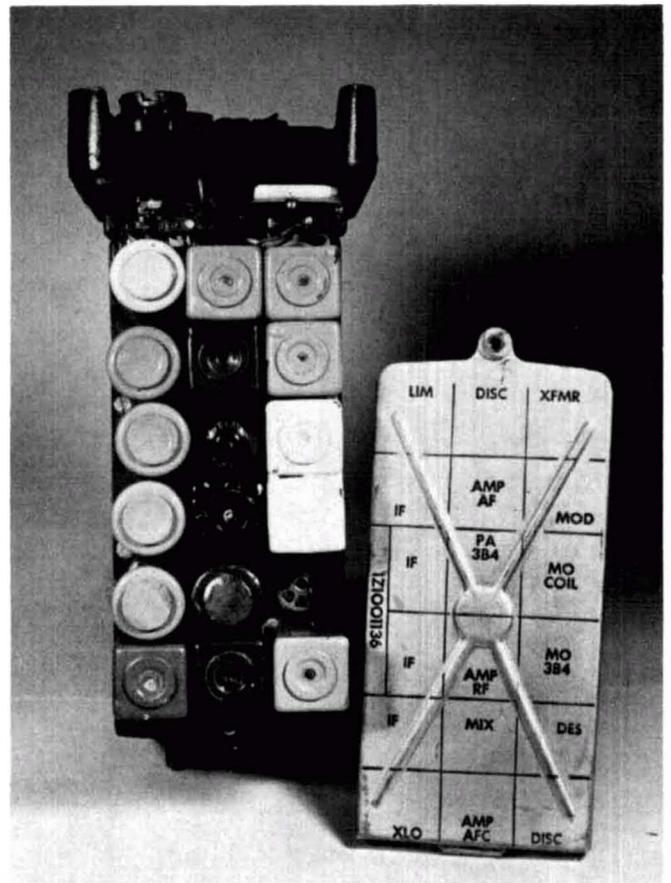


fig. 8. Exposed view of radio set with cover removed shows the location of the major components.

table 2. Spare module color codes and availability.

module name	color	availability (1984)
RF amplifier	black	no
mixer	brown	no
IF amplifier	orange	yes
limiter	yellow	no
audio discriminator	light green	no
audio amplifier	dark green	yes
crystal oscillator	red	yes*
AFC amplifier	dark blue	no
AFC discriminator	light green	no
mo coil	white	no
modulator	grey	yes
transformers	light blue	no

\*"RF oscillator" is stamped on the module housing.

like-new condition.) The handset is also available at \$8.95 and the schematic at \$1.50. Fair Radio also sells spare modules at \$1.50 each or 10 for \$10 (you mix and match them). The inverter module is available from Fair Radio Sales for \$9.95. Table 2 shows the color codes for the various spare modules and whether they were available from Fair Radio in 1984.

Crystals for the radio set are normally CR-52A/U types that are not currently sold by Fair Radio. We were fortunate to obtain a complete CK-6/PRC-6 quartz crystal unit set for an AN/PRC-6 that saved us the expense of buying individual crystals. (This crystal

pack occasionally shows up at flea markets.) However, third overtone crystals (Type EX, available from International Crystal Manufacturing) should also work, although we haven't tried them.

### operation

After installing the power supply, connect +13.8 volts to the battery box rear connection, an antenna to the front panel mounted BNC connector, and the handset to the audio connector on the front panel. Set the OFF/QUIET/LOUD switch to either QUIET or LOUD. (Note that there is no deviation or microphone gain control on the radio set.) Because most of your contacts will probably be with stations operating narrowband equipment, back away from the microphone element on the handset when transmitting; this will help to minimize over-deviation.

Any antenna — from a quarter-wave whip to a multi-element Yagi or quad — can be used with this radio set. Although the 300 milliwatt output is definitely in the QRP category, a decent base station or mobile antenna will provide this little rig with a reasonable line-of-sight range.

### acknowledgement

The author wishes to express his appreciation to Hal Weinstein, K3HW, Rich Royer, W1HZN, and Gene Balinski, WA1UXA, for their contributions to this article.

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