# OPERATING INSTRUCTIONS FOR AMECO 2-METER CONVERTER MODEL CB-2

The Ameco 2-meter Converter, Model CB-2, is a crystal-controlled broadband converter. When used in conjunction with a receiver, it will provide reception of the 2-meter amateur band - 144 Mc. to 148 Mc. The converter uses a type 6ES8 tube as a cascode first RF amplifier, a 6U8A pentode section as the second RF amplifier and the triode section as the mixer. A 6J6 serves as the crystal controlled oscillator and multiplier.

The circuitry used, together with considerable internal shielding and bypassing, provide high sensitivity to the desired signals and maximum rejection of spurious, undesired signals. A novel feature of this unit is the fact that the output frequency may be changed by simply changing the crystal. This feature prevents the converter from becoming obsolete when the receiver is changed to a different type. The MARS and CAP frequencies near the 2-meter band are also covered with this converter.

## POWER REQUIREMENTS

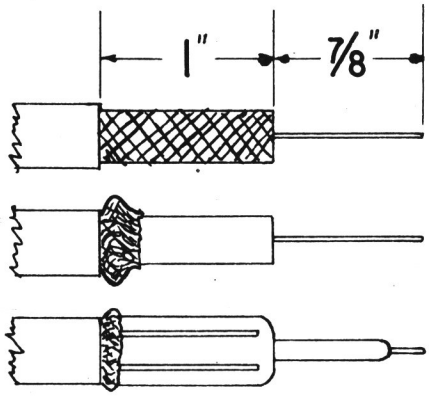
The converter requires 6.3 V. at 1.265 Amps. for the filaments and 100 to 150 V. DC at 30 Ma. for the plates and screens. This power may be obtained from some receivers or from the Ameco Power Supply, Model PS-1. The receiver should be a good quality commercial receiver. Do not attempt to take power from an AC-DC receiver. If the Ameco Power Supply, Model PS-1, is used, merely plug the converter into the power supply. The socket of the power supply mates with the plug of the converter. The power supply socket is wired to apply the correct voltages to the converter. In the event that power for the converter is taken from the receiver or some other source, wire the socket that will mate with the converter plug so that the receiver chassis is connected to pin 2, the hot side of the 6.3 volt filament to pin 7, and B+ (100 to 150 V.) to pin 8. (See the schematic at the end of the instructions).

If the receiver B+ is over 150 volts, add a resistor in series with the B+ lead. With 250 volts B+, use a 4000 ohm, 5 or 10 watt resistor, with 200 volts, use a 2500 ohm, 5 watt resistor. Use Ohms law and the power formula to figure out the resistor specifications for other voltages. Do not use a supply over 300 volts.

## CABLE REQUIREMENTS

The connections to the in put and output of the converter should be made with 50 ohm coaxial cable (RG8/U or RG58/U) terminated with auto radio antenna plugs (Ameco #AP-1 or Cinch #1320). The cable is connected to the plug in the manner shown in figures 1-A and 1-B.

Remove outer vinyl covering for 1-7/8".
Strip braid and inner insulation off center conductor for 7/8".
Push braid back to form a bead all around.
Insert center conductor through pin until braid is against end of plug.
Bend center conductor to hold plug in place.
Roll braid between fingers to roll it over the end of the plug for about 1/16".
Solder the braid to the four tabs of the plug.
Solder the center conductor to the pin and cut off excess wire.




The coaxial cable from the output of the converter to the receiver can be up to a maximum of about three feet. If some undesirable IF signals are getting through, the chances are that it is due to the long ground wire (at the antenna terminal strip) inside most receivers. A short jumper wire (1 or 2 inches) between the converter chassis and the receiver chassis will usually correct this.

## ANTENNA REQUIREMENTS

Any type of 2-meter antenna may be used with this converter. A rotating beam is preferred; however, a quarter wave whip, a ground plane, a beam or a halo type may be used. While the input and output impedance is not critical, it is nominally 50 ohms and 50 ohm coaxial cable should be used between the antenna and the converter. If the antenna terminates at 300 ohms and 300 ohm transmission line is used, then a matching balun* should be used between the line and the converter.

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*The Ameco Model VB-1 balun is recommended for this purpose. It matches a 300 ohm balanced line to a 50 to 75 ohm unbalanced converter input.

## ALIGNMENT

All wired and tested converters have been carefully aligned and their performance measured with laboratory test equipment. Then they are checked on the air. If your antenna is close to 50 ohms, no adjustments are needed. In some cases, adjustment of C1 will improve the noise figure. See paragraph 16 for details.

### INSTRUMENTS REQUIRED:

1. Vacuum tube voltmeter or sensitive voltohmmeter.
2. Signal generator or other signal source in the 144-148 Mc. range such as a VFO, a heterodyne frequency meter or a transmitter.
3. Receiver with S meter.
4. 100,000 ohm, 1/2 watt resistor.
5. 1,000 ohm, 1/2 watt resistor fastened to the end of a four-inch plastic rod.

### COIL ADJUSTMENT:

To simplify alignment, the following is a typical coil adjustment:
L1 - the turns are squeezed to about 2/3 of the space between terminals.
L2, L3, L4 - the turns are spread to full space between terminals.
L5, L7 - squeezed to about 1/2 the space between terminals.
Where L7 is to be "squeezed" make winding as tight as possible without shorting turns.
L6 is not to be adjusted.

### ALIGNMENT PROCEDURE:

1. After the tubes, shields and crystal are in place, connect the converter to the power supply.
2. Connect the positive lead of the voltmeter to the chassis of the converter. Attach one lead of a 100,000 ohm carbon resistor to the negative lead of the voltmeter. Cut the other lead of the 100,000 ohm resistor short and bend it so that it forms a small hook. Hook this lead on to the terminal of the crystal socket nearest the side of the chassis.
3. Turn C18 (see fig. 2) ALL the way up (counterclockwise). Then adjust C18 for maximum reading on the voltmeter. If C18 is properly adjusted, another turn or two clockwise beyond the correct point will cause the voltmeter reading to drop to a very low value. A simple method of checking to see whether the oscillator is functioning properly is to remove the crystal from its socket several times. Each time the crystal is put back in its socket, the voltage should IMMEDIATELY rise to maximum. If this does not occur, the trimmer should be turned slightly (counterclockwise) until the voltage does rise IMMEDIATELY to maximum when the crystal is put into its socket. The maximum DC voltage reading across the crystal should be over 5 volts on a vacuum tube voltmeter.

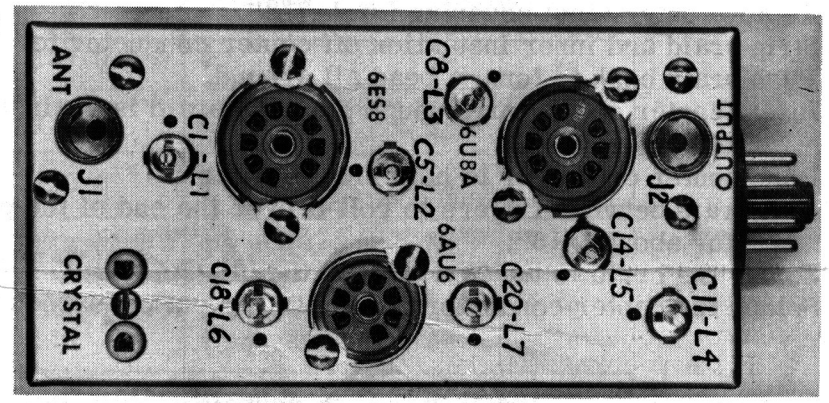


Fig. 2 - Top view of converter.

4. Transfer the negative lead with the 100,000 ohm resistor to pin 9 of the 6U8A tube and do NOT disconnect it until item 15 is completed. Place the loading resistor (a 1000 ohm, 1/2 watt resistor at the end of a four inch plastic rod) across the terminals of L5 and tune C20 for maximum reading on the voltmeter. Keep fingers away from the coils while tuning.
5. Adjust trimmers C11, C14, C6 and C8 so that the trimmer screws are about 10 turns out of the trimmer housings (approximately 3/8 inch of screw should be visible).
6. Connect the output of the converter (J2) to the antenna terminals of the receiver (using coaxial cable). Then connect a signal generator to J1 and feed in a strong signal of 146 Mc. Tune the receiver to this signal. If a 7-11 Mc. IF is used, the signal will come in at 9 Mc., if a 14-18 Mc. IF is used, the signal will come in at 16 Mc. etc.
7. Reduce the signal to a low enough level to read approximately S5 on the receiver S meter. Tune C1, C5, C8, C11 and C14 for maximum S reading, keeping the output of the signal generator down so that the S meter needle does not go too far up the scale. If a transmitter is used in place of the signal generator, it should be connected to a dummy load such as a bulb. There should be no direct connection between the transmitter and the converter. A small single-turn loop, 1 to 2 inches in diameter, connected to the plug which goes into J1, can be used to couple the transmitter to the converter.

# PHOTOGRAPHS OF AMECO CB-2 CONVERTER KIT

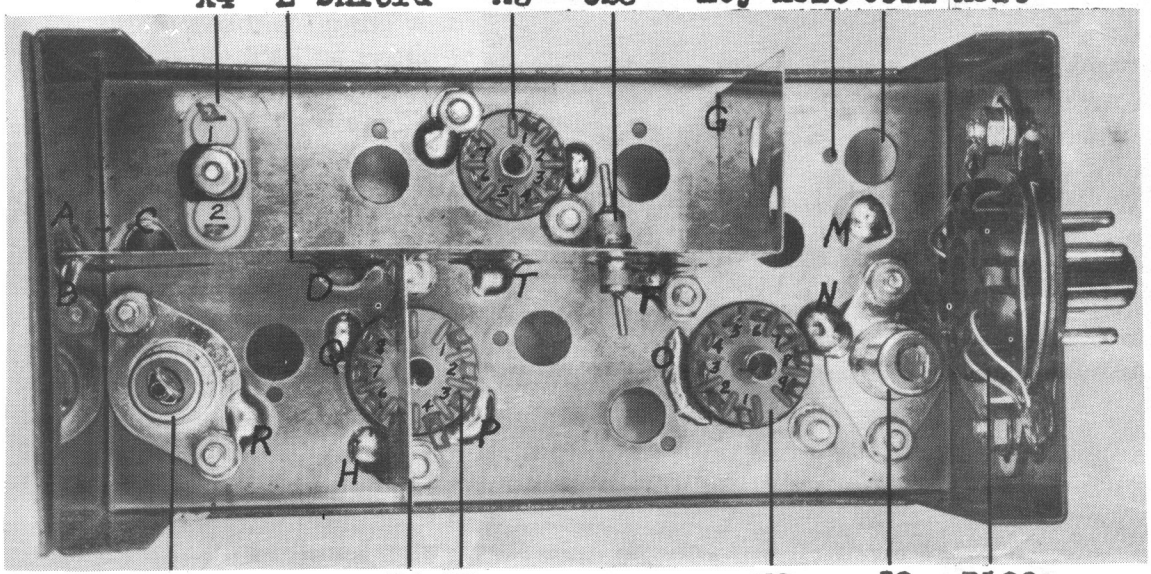


Figure B

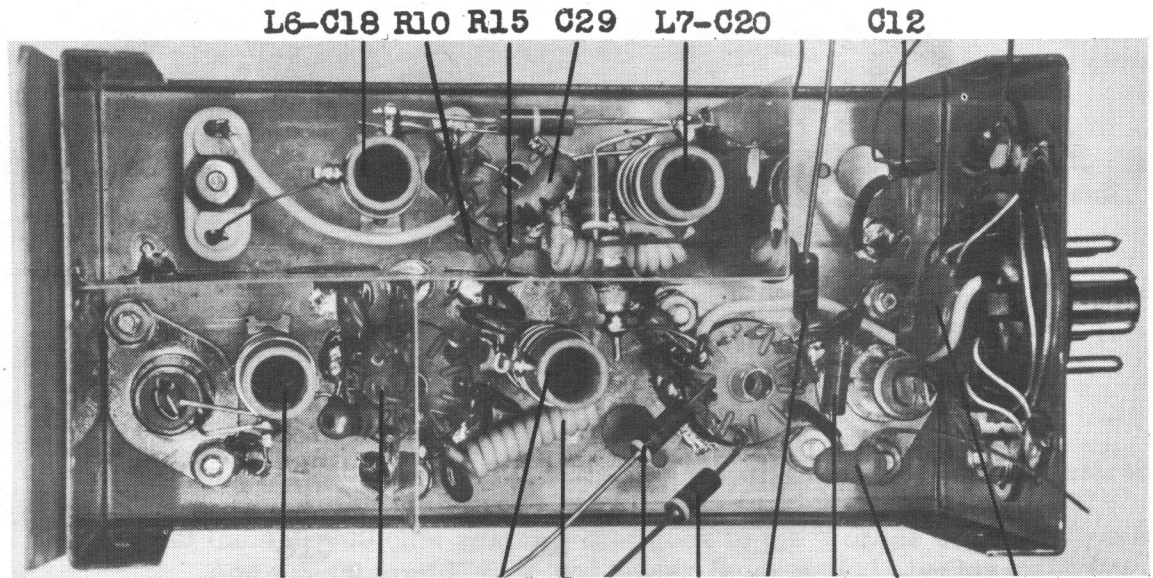


Figure C

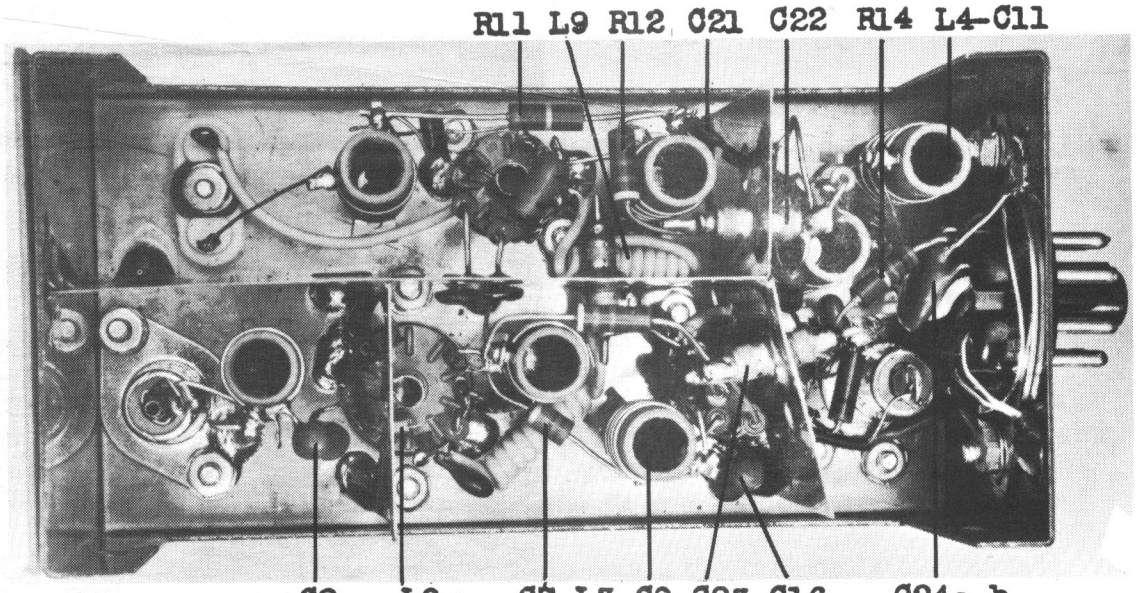


Figure D

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# PHOTOGRAPHS OF AMECO CB-2 CONVERTER KIT

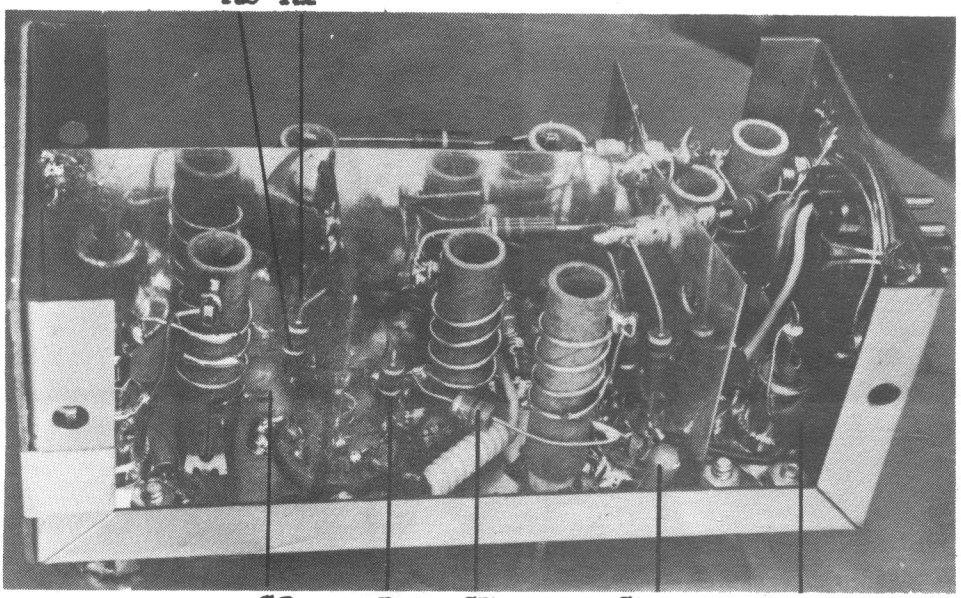



Figure E

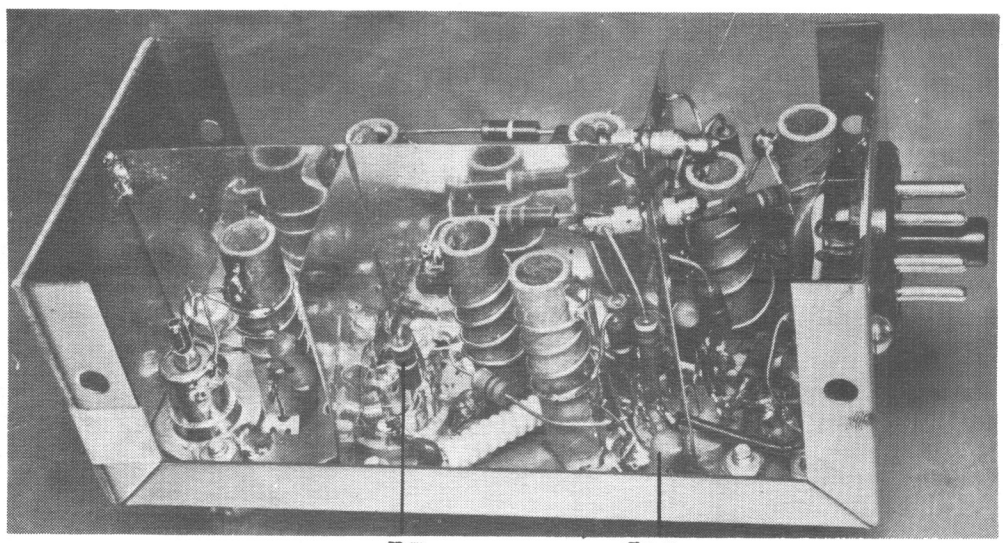



Figure F

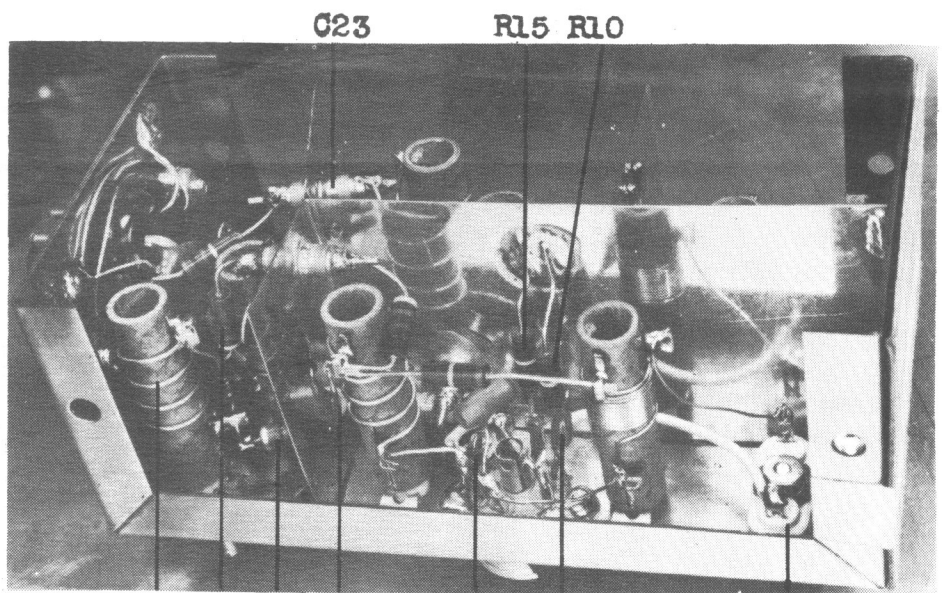



Figure G

8. Step 7 provides a rough alignment which may sound quite good on the air. However, the alignment should be completed as follows: Remove the crystal and turn the converter on its right side (6J6 down). Place the loading resistor across the terminals of L3 and tune C5 for maximum reading on the voltmeter.
9. Place the loading resistor across L2 and tune C8 for maximum reading on the meter.
10. Repeat steps 8 and 9. In so doing, you will note that the adjustment of one trimmer affects the peak of the other. Repeat steps 8 and 9 until each trimmer requires less than 1/2 turn to repeak. If a trimmer approaches but does not reach a peak as the screw is turned all the way out, turn the power off and spread the turns of the coil apart and retune. If the opposite is true, the trimmer approaches but cannot reach a peak as the screw is turned all the way in, squeeze the turns of the coil together and retune.
11. Using the same procedure as in steps 8, 9 and 10, load L4 and tune C14; then load L5 and tune C11.
12. Reduce the signal or disconnect the antenna plug. Insert the crystal. With the loading resistor across L5, adjust C20 for maximum.
13. Remove the crystal. Bring up the signal strength again and repeat step 11.
14. Repeat step 9.
15. Readjust C18 to obtain over 1.3 volts. Best value is 2.0 to 2.5 volts. When OK, disconnect voltmeter.
16. C1 should be tuned up with the regular antenna after the converter has been installed. One way of adjusting C1 is to tune in a STEADY BUT WEAK signal (turn your beam to a null on a local station) and tune C1 for maximum signal strength. Then detune C1 three turns clockwise. At this point, the signal to noise ratio is better than at the maximum point. Note that under certain antenna conditions, a good sharp peak for C1 may not be possible. This should not cause concern since the adjustment of C1 is not critical.
    Another way to align C1 is to tune the receiver on and off a weak, steady, unmodulated signal and adjust C1 for the greatest DIFFERENCE in noise with and without the signal. Be careful not to lose too much converter sensitivity by extreme detuning of the C1-L1 circuit.

## 12 VOLT OPERATION

If it is desired to use 12 volts instead of 6 volts for the filaments of the converter, a 5.0 ohm, 25 watt, wire-wound resistor must be added between the 12 volt source and pin 7 of the converter power plug.

## ADDING AGC TO THE CONVERTER

In strong signal areas - near TV transmitters, police or taxi stations - it may be desirable to add automatic gain control to the converter. This may be done as follows:

Lift the grounded end of the 470,000 ohm resistor that goes to pin 7 of the 6ES8 tube socket and connect it to a new tie-point. Add a 5000 mmfd. disc condenser from chassis to this tie-point. Run a 100K resistor from the tie-point to pin 3 of the power plug. For use with NC-300 or NC-303 receivers, the wiring is now complete. The converter can be plugged directly into the power socket. For other receivers, run a wire from pin 3 of the socket that mates with the converter to the AGC line in the receiver.

If the receiver has very high AGC voltage on strong signals, a divider should be added to reduce the maximum AGC voltage to the 6ES8 to -10 volts. The divider can be made by using a 2.2 megohm resistor instead of the 100K above, then connect another resistor of 470K to 4.7 megohms from the new tie-point to the chassis.

## SELECTING THE OUTPUT IF FREQUENCY

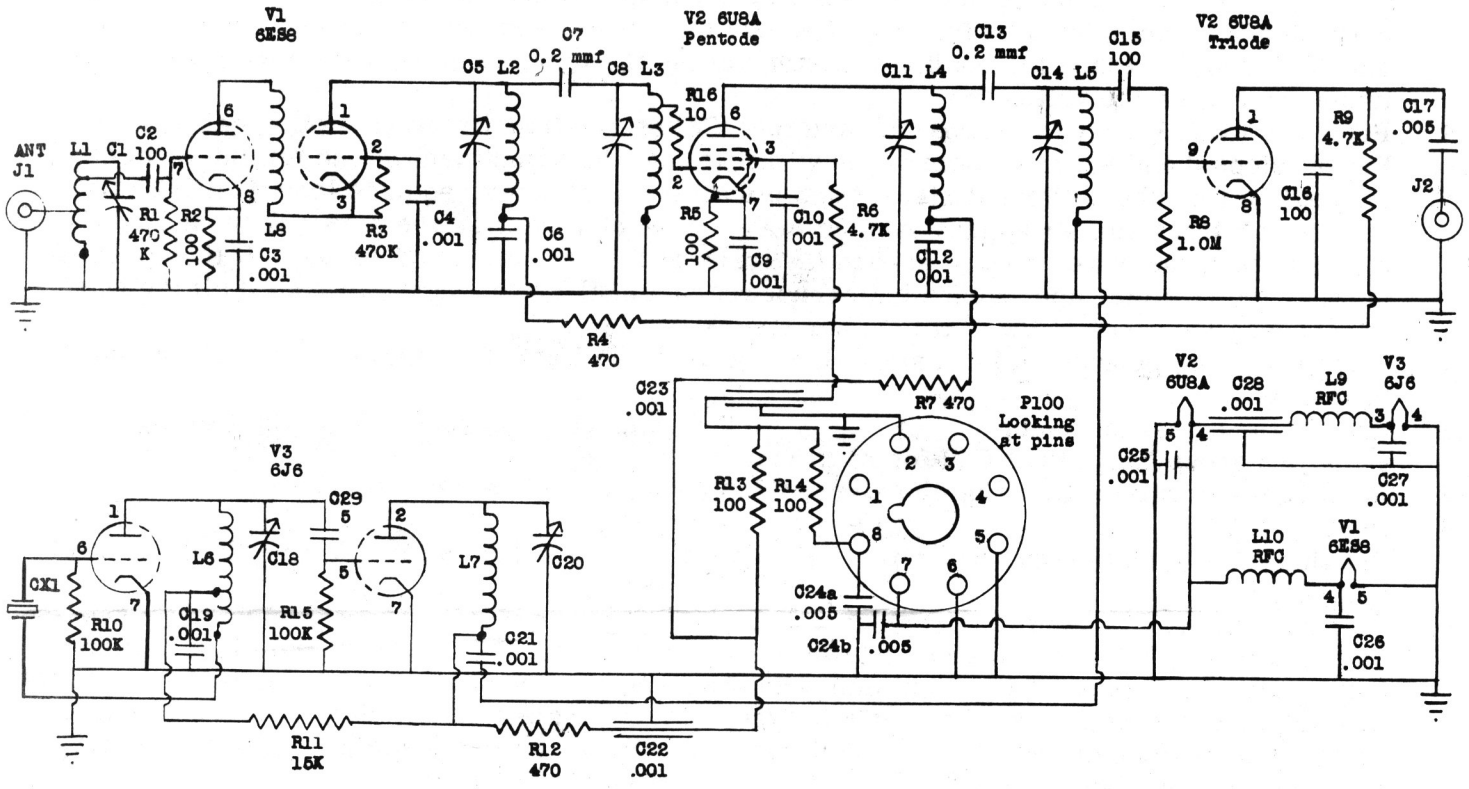
This converter may be adjusted so that it will provide any output frequency between .5 Mc. and 54 Mc. This feature of the converter will prevent it from becoming obsolete should the receiver be changed to a different type.

If there is a choice as to what output frequency to use, it is recommended that a low output IF be used - preferably 7-11 Mc. This is because most receivers perform best in this range. Their oscillator stability (drift), image and spurious rejection become progressively poorer as the frequency goes up.

On receivers covering ham bands only, the 28-30 Mc. band gives the most coverage for use with a 2-meter converter.

The following table shows the crystal frequencies to be used to obtain the various IF outputs from the converter and any other changes required.

# Schematic of AMECO Model CB-2 2-Meter Converter




Condensers in mmf below 1000
in mf .001 and above

Resistor values in ohms
K = 1000
M = 1,000,000

Chassis: ⏚

TABLE

| I-F (Mc.) | CRYSTAL (Mc.) | OSC. OUTPUT (Mc.) | L7 (turns) | ADD CAPACITY ACROSS | |
|---|---|---|---|---|---|
| | | | | L6 | C29 |
| 7-11 | 45.66667 | 137.0 | 4 | -- | -- |
| 10-14 | 44.66667 | 134.0 | 4 | -- | -- |
| 14-18 | 43.33333 | 130.0 | 4 | -- | -- |
| 26-30 | 39.33333 | 118.0 | 4 squeezed | 5* | 10 |
| 27-30 | 39.0 (144-147)<br>39.66667 (146-149) | 117<br>119 | 4 squeezed<br>4 squeezed | 5*<br>5* | 10<br>10 |
| 28-30 | 38.66667 (144-146)<br>39.33333 (146-148) | 116.0<br>118.0 | 4 squeezed | 5*<br>5* | 10<br>10 |
| 30.5-34.5 | 37.83333 | 113.5 | 4 squeezed | 5* | 10 |
| 50-54** | 31.33333 | 94.0 | 6 | 10 | 15 |
| Broadcast 600-1600 KC. | 47.8 (144-145)<br>48.13333 (145-146)<br>48.46667 (146-147)<br>48.8 (147-148) | 143.4<br>144.4<br>145.4<br>146.4 | 4 | -- | -- |

*ONLY if necessary to get oscillator to work.
**Connect C21, 1 turn away from cold end of L5. Spread L5 out.

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