

MULTIPHASE EXCITER

MODEL 10-B

INSTRUCTION

MANUAL



*Central Electronics, Inc.*

RESEARCH — DEVELOPMENT — MANUFACTURING  
AUDIO — COMMUNICATIONS — MEDICAL ELECTRONICS

MULTIPHASE EXCITER  
MODEL 10-E

INSTRUCTION MANUAL

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## CONDENSED OPERATING INSTRUCTIONS FOR MULTIPHASE EXCITER MODEL 10B

Connect an antenna or a linear amplifier to the 52 ohm RF output. Plug in proper coils and set the VFO-KTAL switch on the proper position. Turn CARRIER knob fully clockwise. Turn OPERATION selector to MANUAL and tune the MIXER and AMPLIFIER for maximum output as shown on an oscilloscope or an antenna meter.

### TO OPERATE SINGLE SIDEBAND

Set the MODULATION selector to one of the sideband positions (SB1 or SB2). Turn the OPERATION selector to MANUAL. With the carrier knob set at "0" adjust the CARRIER NULL controls A and B for minimum RF indication. Adjust the SPEECH LEVEL control between 9 and 12 o'clock, depending upon microphone gain. Talk into the microphone and you're on SSB!

### TO OPERATE AM

Place the MODULATION selector in the AM position. Leave the CARRIER NULL knobs in the balanced-out condition. Advance the CARRIER knob until maximum output is obtained. Then reduce the CARRIER level to one half of the maximum value on the scope or to one half the maximum antenna current. Adjust the SPEECH LEVEL until the modulation peaks just reach the maximum output value on the scope. Too little or too much carrier will make the AM transmission sound distorted.

### TO OPERATE FM (Narrow band phase modulation)

Turn the MODULATION selector to FM position. Leave the CARRIER NULL knobs on the balanced-out condition. Advance the CARRIER knob to nearly full output. Adjust the SPEECH LEVEL control so that the modulation peaks do not exceed the carrier.

### TO OPERATE CW

Turn the MODULATION selector to CW. Place the OPERATION selector on MANUAL. Advance the CARRIER control to nearly full output. Plug key into jack on rear of chassis.

### TO USE THE VOICE CONTROL CIRCUIT (VOX)

Connect the receiver speaker to the Exciter as shown in the circuit diagram. The resistor across 1 and 2 on the rear terminal strip should be about two to three times the speaker voice coil impedance and rated at twice the power output. The extra contacts on 8, 9 and 10 may be used to operate an antenna relay, additional receiver silencing circuits, etc. With the OPERATION selector in VOX position talk into the microphone and adjust the VOX sensitivity control on the rear of the chassis for proper operation.

### CALIBRATION LEVEL CONTROL

When the OPERATION selector is in the CALIBRATE position the CAL LEVEL control will vary the output of the Exciter for frequency "spotting".

### EXTERNAL BLOCKING BIAS

In the standby position, -100 volts DC appears at terminal 7 on the rear terminal strip. If a bias supply is used for a linear amplifier the positive should be returned to this terminal of the Exciter. All positive components in the bias supply must be "floating" from ground and connected only to the positive lead.

When zero bias tubes are used, the amplifier grid return lead should be by-passed and then connected to terminal 7. A secure ground connection should be made between the Exciter, linear amplifier, linear amplifier power supply and the bias supply.

If an antenna relay with auxiliary contacts is used, these auxiliary "make" contacts can be used to key the blocking bias by connecting them to #6 and #7 on the rear terminal strip. Proper keying sequence is required so that the antenna circuit makes before the blocking bias is removed.

When the auxiliary contacts on an antenna relay are not used to key the transmitter, the jumper should remain between terminals 6 and 7 on the strip.

### RESISTIVE LOADING OR "SWAMPING"

If the Exciter is used to feed an antenna directly, the junction between the two 4700 ohm 2 watt carbon resistors located inside the 5 prong Amplifier plate tank coil (19) should be unsoldered.

When driving a linear amplifier, this resistive loading should remain in the circuit. If additional resistive loading is desired, it may be added at the amplifier grid circuit, or else at the two terminal screw strip at the rear of the Exciter. The amount of resistive loading will depend on the type of tubes used in the amplifier. Pentodes, tetrodes and zero bias triodes require only a small amount; while medium and low mu triodes will require heavier swamping for low distortion.

12BH7  
6BA7

## PRELIMINARY ALIGNMENT INSTRUCTIONS

### THE FOLLOWING IS RECOMMENDED FOR UNITS CONSTRUCTED FROM KITS

Check for "B" shorts with an ohmmeter before power is applied.

Before plate voltage is applied, the 6AG7 grid bias should be checked. This should be done by removing the 5U4G rectifier tube. With the relay in the normal position, the reading at Pin #4 of the 6AG7 should be -100V DC plus or minus 10% measured with a VTVM. When the relay is operated by hand, there should be approximately -11V DC at this point. After the 5U4G is inserted, the operating bias should be -10.5V DC obtained from the voltage divider R47 and R48.

Insert the 5U4G rectifier and apply power. Check "B" voltages in accordance with the chart on the circuit diagram, with the OPERATION switch on MANUAL.

Preliminary rough alignment of the slug-tuned coils: If a grid dipper is available the coils should be aligned to the frequencies indicated on the Alignment Data Chart (Fig. B). If no dipper is available they should be set as follows BEFORE POWER IS APPLIED:

- |                  |                 |                       |
|------------------|-----------------|-----------------------|
| No. 1            | Red             | <del>3/16</del> 3/16" |
| No. 2            | Green           | <del>1/8</del> 1/8"   |
| No. 3            | White           | 1/2"                  |
| No. 4            | Black           | 1/2"                  |
| No. 5            | Blue            | 1/2"                  |
| No. 6            | Orange          | 5/16"                 |
| No. 7            | Yellow          | 5/16"                 |
| <del>No. 8</del> | <del>Blue</del> | <del>1/8"</del>       |



The Audio Balance controls should be set in approximately mid-position.

During alignment, a slight amount of tension should be kept on the adjusting screws by proper adjustment of the locking nut to prevent erratic operation.

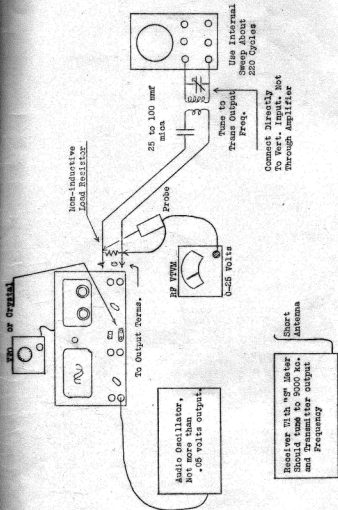


FIG. A

## 10B GENERAL ALIGNMENT PROCEDURE

Plug in the proper coils.

The front panel controls should be set as follows:

OPERATION SWITCH, in MANUAL  
SPEECH LEVEL, completely counter-clockwise  
MODULATION SWITCH, Sideband 1  
CARRIER NULL A, middle position  
CARRIER NULL B, 80% clockwise  
CARRIER, completely counter-clockwise  
VFO-XTAL SWITCH, in correct position  
TUNING CONTROLS, to output frequency

Refer to Fig. A. Connect a non-inductive load resistor of about 50 ohms, 10 watts to the Exciter output terminals. This resistive load may consist of several one or two watt composition resistors in parallel or series-parallel to provide the proper resistance and dissipation.

Connect an oscilloscope, lightly coupled, to the RF output.

If available, a RF vacuum tube voltmeter with a 25 to 50 volt RMS range should be connected to the RF output.

In Exciters that are constructed from kits and are being aligned for the first time, it is recommended that the initial 9 MC alignment of L1 through L5 be made with the red lead removed from the center arm of CARRIER NULL pot A (R23). This will prevent interlocking of the adjustments. After peaking these circuits twice, connect the red wire back to the pot. This procedure will not be required on units previously aligned.

Tune the crystal oscillator plate circuit (L1) until the signal is heard in a receiver tuned to 9 MC. Oscillation should occur with nearly the entire length of the thread outside the form. If a receiver at this frequency is not available, a lightly coupled grid dipper should be used. L1 should be tuned for about 90% of maximum output, for reliable oscillation.

At this time it should be possible to hear a signal on the output frequency with the receiver operating near full sensitivity (AVC on) provided the VFO or frequency conversion crystal is operating. The receiver should be coupled lightly to the Exciter RF output terminal. Refer to Fig. B. Adjust L2, L3, L4, L5 and the MIXER AND AMPLIFIER tuning capacitors for maximum output. As maximum output is reached, it will become necessary to reduce the carrier output by adjusting CARRIER NULL pot B. Now adjust CARRIER NULL knobs for minimum carrier output. If you have removed the red lead from R23, it must be connected at this time. Next, unbalance CARRIER NULL pot B a slight amount and peak L2 through L5 again. Now adjust both CARRIER NULL controls for minimum output. Minimum output will not necessarily occur at the center of the rotation due to stray capacities, etc. Turn CARRIER NULL knob

Be completely clockwise to see if the crystal remains in oscillation. This places an additional load on the oscillator and may pull it out of oscillation. If this occurs, it will be necessary to turn the screw of L1 counter-clockwise until reliable operation is assured.

Then L2 (green) is mounted approximately  $3/4$ " (center to center) away from L1 (red), the RF voltage from the arm of each CARRIER NULL pot to ground will be equal when the carrier is balanced out. If desired, this may be checked with an RF vacuum tube voltmeter.

#### ADJUSTMENT OF L6 and L7

When operating on the 20 meter band, these trap circuits reduce the radiation of the third harmonic generated in the mixer by the heterodyning crystal or VFO operating in the range of 5 to 5.3 MC. With the 20 meter coils plugged in, the SPEECH LEVEL turned off, carrier balanced out, and OPERATION switch in the MANUAL position, RF output will be found when the Mixer and Amplifier tuning controls are set at about 15.5 MC. Adjust both these traps for minimum 15,450 kc. output while using a crystal at approximately 5,150 kc. If no crystal in this range is available, one at approximately 3,850 kc. will supply sufficient 4th harmonic output for this purpose. If you do not intend to operate 14 MC crystal controlled, it will not be necessary to adjust L7 (yellow). When only VFO operation is contemplated in this band, L6 (the orange coil) should be tuned for minimum 15,450 kc. output with the VFO set at 5,150 kc.

Although the 3rd harmonic output may be only a few percent of the total, it can be amplified by the Mixer and Amplifier stages and result in considerable output. With the trap circuits properly aligned, the power output at 15,450 kc. will be less than 10% of that normally obtained at 14 MC., even though the Mixer and Amplifier are peaked at 15,450 kc. When the Mixer and Amplifier are peaked at 14 MC. the other signal will be down in excess of 50 db. in the Exciter. The addition of a properly tuned linear amplifier stage will increase the rejection of the 15 MC. signal to at least 70 to 80 db. down.

The VFO output should be advanced to the point where additional coupling will not increase the Exciter output. Over-injection to the Mixer can cause unnecessary spurious radiation.

#### SIDEBAND SUPPRESSION ADJUSTMENT

Before proceeding with the Single Sideband adjustments, it is recommended that the operator familiarize himself with the illustrations of the oscilloscope patterns shown in this manual. The ultimate objective in the single sideband alignment is to obtain a pattern containing a minimum amount of ripple when a pure sine wave is applied to the microphone input. These adjustments should preferably be made at less than full output, to prevent amplifier overloading, which might "wipe off" the small modulation ripple.

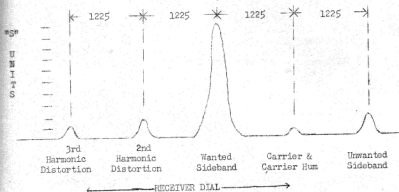


A low distortion audio oscillator (less than 1%) set to approx. 1,225 cycles, cycles, with an output level between .005 and .05 volts should be connected to the microphone jack. CAUTION: If a voltage in excess of .075 is applied to the Mic. input the speech amplifier will overload and it will be impossible to adjust the Exciter properly.

Adjust both CARRIER NULL pots for minimum carrier output. Advance the SPEECH LEVEL control until about half of maximum output is obtained on the oscilloscope. At this point a fair amount of ripple will be observed on the output wave. Adjust the Audio Balance controls for minimum ripple. Now switch from Sideband 1 to Sideband 2 and observe the ripple in each. If the amount of ripple is not equal, vary the adjustment slightly on I2 until the displays are identical in either sideband position. However, each time I2 is tuned, it will be necessary to rebalance both carrier null controls for minimum. It will also be necessary to readjust the Audio Balance controls again. Now loosen the set screws on the CARRIER NULL knobs and set the pointers on the lines when carrier is balanced out.

It is possible to make these sideband suppression adjustments using a receiver in place of an oscilloscope. Turn the AVC on, the BFO off, and remove the antenna to prevent receiver overload. Now tune in the signal. Minimum modulation heard in the loudspeaker corresponds to minimum modulation of the R.F. envelope. Adjust as described in the previous paragraph.

After the alignment has been completed, an analysis of the emitted wave may be made if the receiver has a sharp crystal filter and a calibrated "S" meter. The following illustration is an example of the "S" meter levels as the receiver dial is tuned through the signal with a 1225 cycle tone input to the Exciter.



It is possible to obtain an almost ripple-free pattern in one sideband at the expense of degradation of the other. Under this condition the suppression of the better sideband will be about 45 db., while the other is only 35 db. down. The object is to have them both equal, approximately 40 db. down.

If a deep modulation ripple is noticed on both sideband positions (with carrier balanced out), one side of the audio phase shift circuit is probably operating improperly. Check the Audio Balance controls adjustment, the 12AT7(B) modulator tube, sideband switching circuit, or the phase shift network.

After the alignment has been completed, be sure to tighten the #6 lock-nuts on the iron core slugs.



Good SSB Signal  
Pure Tone Input



- SSB signal, Tone Input
1. Carrier leakage
  2. Improper RF phasing (I2)
  3. Improper AF balance (R18-15A)
  4. Balanced Mod detuned (I3)
  5. Poor sideband rejection