• *Beginner and Novice*

The Mox-Box

A Simple Monitoring and Control Unit

BY LEWIS G. McCOY,* W1ICP

The Mox-Box (manual operating control box) consolidates your operating controls to a single switch. In addition, a built-in code monitor enables you to monitor your own sending.

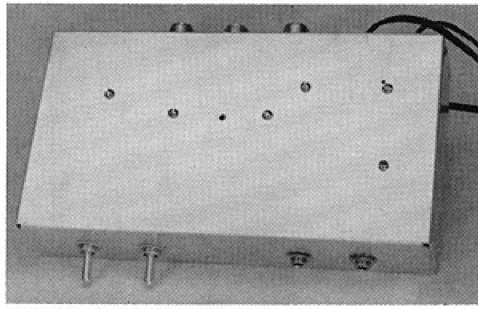
A PROBLEM that bothers the ham just getting started on the air is that of connecting all his equipment together so that he doesn't have to throw a dozen switches to go from receive to transmit. If a single antenna is used it usually involves switching the antenna from the receiver to the transmitter, plus muting or switching the receiver to standby. In case of the Novice, he has the additional problem of monitoring his sending. Because he is crystal-controlled, the ham he is working will probably be on a different frequency, so the receiver cannot be used to monitor his fist.

This article describes a control unit, the Mox-Box, that integrates all the switching controls to a single switch, plus a monitor which permits the user to monitor his sending regardless of where the receiver is tuned.

Fig. 2 is the circuit diagram of the unit. The Mox-Box has a built-in transistor tone oscillator plus a relay, K_1, which is used to transfer the antenna from the receiver to the transmitter and vice versa. One arm of a double-pole relay is used for this function. The other arm is used to transfer the headphones from the receiver to the tone-oscillator monitor. The relay is controlled by S_1. In the receive position, the antenna is connected to the receiver and the headphones to the receiver audio. When S_1 is thrown to the position that energizes the relay, the antenna is switched to the transmitter and the headphones to the monitor output.

We've talked about the control box but actually this article describes the construction of two units. The other one is a code-practice oscillator. The reason for describing two units is quite simple. Nearly all the parts from the practice oscillator can be used in the control box. Many readers will be working toward a license, and a code-practice oscillator can be incorporated into the control box. Both units are excellent items for radio-club projects for beginners. The practice oscillator is something the student can build and make good use of, and none of his investment will be wasted because the parts can be used when he is ready to go on the air.

* Technical Assistant, *QST*.



The switch at the left is the operate-standby switch. Next to it is the switch used to turn off the oscillator when the unit is not in use. At the far right is the key jack. Although it isn't mentioned in the text, you can reduce the cost of the unit by using phono type jacks for your coax leads instead of the more expensive coax type fittings.

Circuit Details

The code-practice oscillator, shown in the photograph on page 24 and Fig. 1, is a simple audio oscillator using a single transistor. Power for the unit is obtained from a 9-volt transistor radio battery. Current drain from the battery is small and it should last for a long time in this type of use. The oscillator is designed to be used with

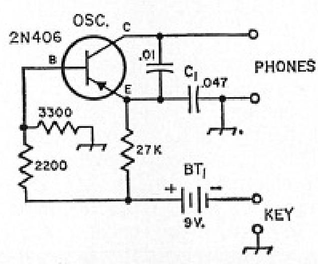


Fig. 1—Circuit diagram of code-practice oscillator. Component values are the same as Fig. 1.

magnetic-type headphones in the 2000- to 3000-ohm impedance range. There are some surplus headphones around that run about 200 ohms impedance, and if this type is used C_1 must be changed to a lower value (see Fig. 2).

Using high-impedance phones and a value of 0.047 μf. for C_1, the audio pitch or tone is about 1000 cycles. The pitch can be lowered by adding capacitance in parallel with C_1. A 0.047 μf. added in parallel to C_1 will lower the pitch appreciably.

The standard-type telegraph key has only one set of contacts. This presents a problem if any equipment in addition to the transmitter is

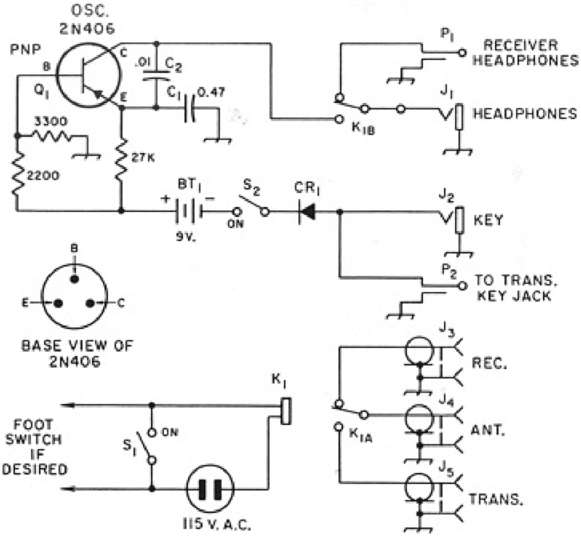
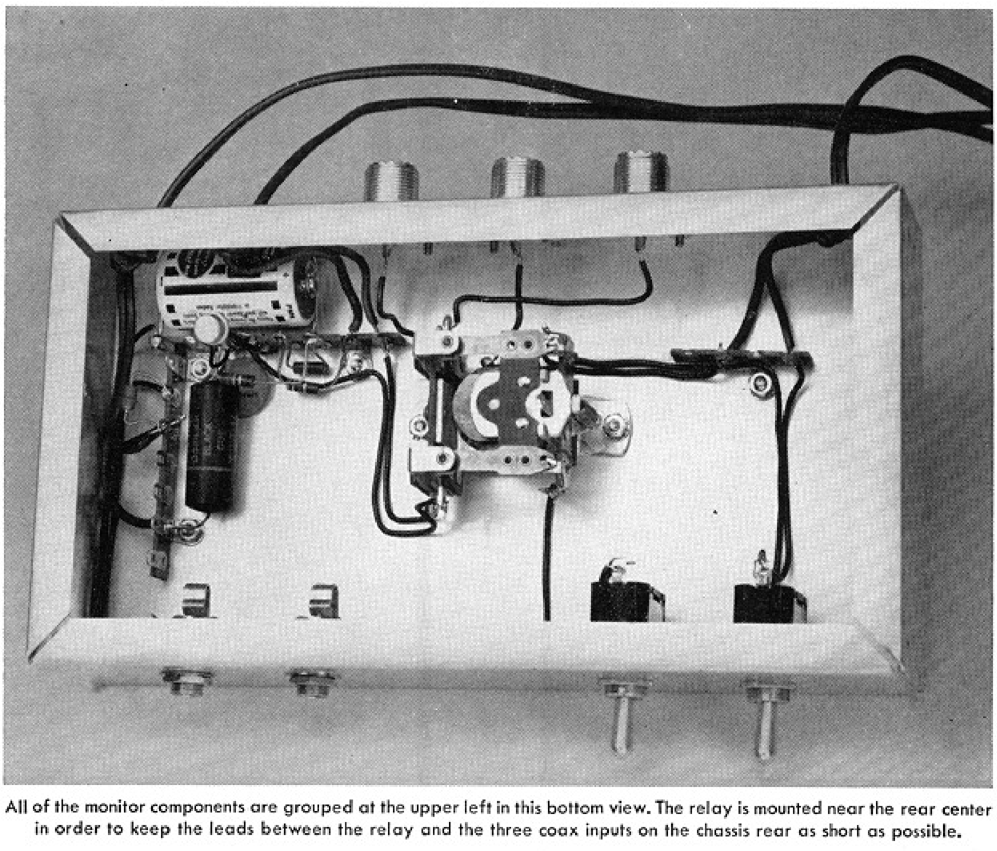


Fig. 2—Circuit diagram of the Mox-Box. The letters C, B, and E on Q1 indicate the base (B), collector (C), and emitter (E). For transmitters having negative voltage at the key, use a p.n.p.-type transistor; for positive voltage, n.p.n. Also, for transmitters with positive voltage at the key the battery and diode polarities should be reversed, compared with what is shown here. Resistances are in ohms, resistors are ½ watt.

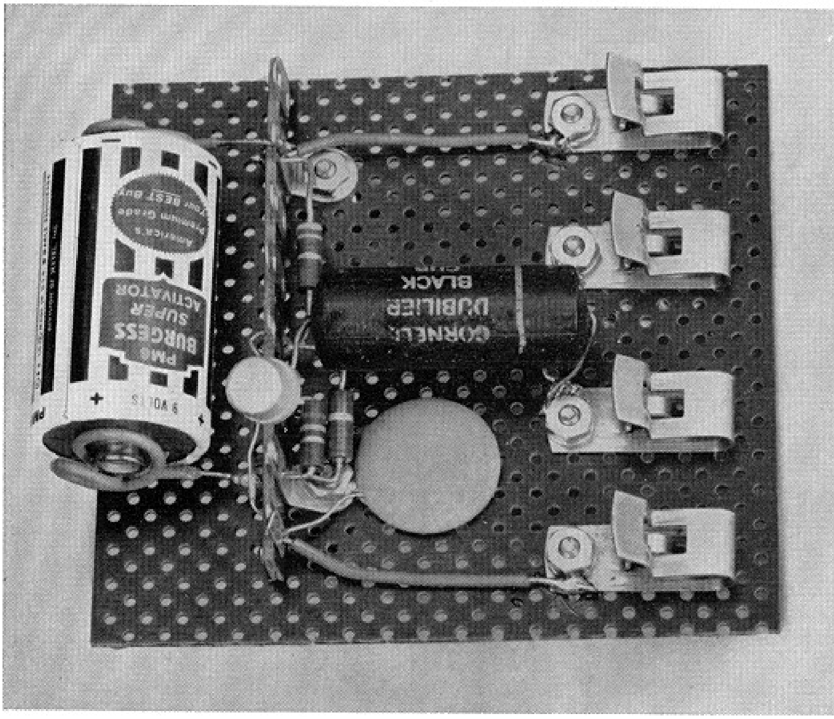
BT1—9-volt transistor battery.
C_1—0.047-μf. paper for high impedance phones (2000 ohms), 0.15 μf. for low-impedance phones (200 ohms). Any working voltage rating over 10 volts is suitable.
C_2—0.01-μf. disk ceramic.
CR_1—Silicon rectifier, any p.i.v. rating over 250 volts (Barry Electronics 600/750).
J_1, J_2—Phone jack, open circuit.
J_3, J_4, J_5—Coax chassis receptacle type (SO-239).
K_1—Double-pole double-throw relay, 115 v. a.c. (Advance GHA/2C/115 VA, Guardian 900-2C-115 VAC, Potter & Brumfield MR 11A 115-volt coil.)
P_1, P_2—Phone plug.
Q_1—P.n.p. type 2N406, n.p.n. type 2N647.
S_1, S_2—Single-pole single-throw toggle switch.

keyed, as it is in our case with keying a monitor and transmitter, using the one set of contacts on a key. If you compare the oscillator circuits of Figs. 1 and 2 you'll notice there is only one difference — the addition of CR_1, a silicon rectifier. The rectifier makes it possible to key both the monitor and a transmitter with a single set of key contacts. A silicon rectifier has a very high resistance in one direction, while very low resistance in the other direction.

In any transmitter, there is a voltage, either positive or negative with respect to chassis, across



All of the monitor components are grouped at the upper left in this bottom view. The relay is mounted near the rear center in order to keep the leads between the relay and the three coax inputs on the chassis rear as short as possible.



Here is a photo of the code practice oscillator. The two clips at the bottom are for the headphones and the two at the top for the key.

the key terminals. In a cathode-keyed transmitter, a common type, the cathodes of the keyed stages are opened between cathodes and chassis by the key. When the key is open, a positive voltage appears on the ungrounded key terminal. If this voltage were allowed to get into the code-monitor circuit it could mess things up. However, this is prevented because of the high resistance of CR_1 when the key is open. In other words, with the key up, CR_1 blocks any voltage from reaching the monitor. When the key is closed, the cathodes of the keyed stages are brought to chassis ground via the key, and at the same time the low-resistance path through CR_1 is closed, permitting the code monitor to come on.

When the transmitter has a negative voltage at the key, with respect to chassis, a p.n.p.-type transistor must be used for Q_1 and the battery and diode polarities are as shown in Fig. 2. If the transmitter key voltage is positive with respect to chassis, then an n.p.n.-type transistor must be used and the battery and diode polarities connected just opposite to what is shown in Fig. 2.

In order to determine which polarity your transmitter has, connect the negative lead (black or −) from a voltmeter to chassis ground and touch the positive lead (red or +) to the ungrounded key terminal. The voltmeter should be set on the 250-volt range for this test. If the pointer reads up, then the transmitter has a positive voltage on the key. If the pointer swings to the left past zero, then the transmitter has a negative voltage on the key. If you are good at reading circuit diagrams you can check the circuit diagram of your rig to determine the voltage polarity on the key. However, some manufacturers seem to delight in making confusing circuit diagrams, so if you are not sure, use the voltmeter check.

As mentioned earlier, one arm of K_1 is used to transfer the antenna from receive to transmit. For some obscure reason, amateurs who use coaxial feed line think they must have a coaxial-type relay for switching their antennas. This isn't true. Coaxial relays are expensive, and while it is a good type for the purpose if you can afford one, any ordinary relay will do the job, particularly at Novice power levels. As long as the leads from the coax fittings, J_3, J_4, and J_5 in our case, are kept reasonably short, there won't be any appreciable mismatch in the feed line.

Getting the Parts

If you are just getting started in ham radio you probably haven't had a chance to collect a junk box of parts. One way to get a good supply of resistors and capacitors is from an old TV set. Many TV repairmen or dealers are happy to sell old sets for just a few dollars, or even give them away. All of the capacitors and resistors shown in the units described here can usually be found in an old TV set.

Write to the various parts distributors and obtain their current catalogues and at the same

(Continued on page 144)

The Mox-Box

(Continued from page 24)

time ask for any sales flyers. Some excellent bargains can be obtained in this manner. In Fig. 1, we specify a certain type of relay for K_1. However, almost any double-pole double-throw relay can be used. Also, the relay doesn't have to have a 115-volt a.c. coil. If you find a bargain in a relay with a 6.3-volt a.c. coil, you can power it by taking the 6.3 volts from the tube heater transformer winding in either your receiver or transmitter.

It is also possible to substitute other types of transistors in the circuit. We tried about a dozen different types and they all worked.

Construction Details

The Mox-Box was built into a 2 × 5 × 9-inch chassis. However, the layout is not at all critical and any convenient-size enclosure can be used. The relay should be mounted close to J_3, J_4 and J_5 in order to keep the leads short. Also, as S_1 is your station operating switch, it should be mounted so that it is clear of any obstructions. Some hams like to use a foot switch mounted on the floor under the operating bench. To go from receive to transmit, they merely step on the switch. If this type of operation is desired, two leads can be connected in parallel with S_1 to the foot switch.

The components for the monitor are mounted on terminal strips. The battery is supported by leads of solid wire soldered directly between the battery terminals and the tie points on the terminal strip. When wiring P_1 and P_2, be sure that the chassis ground leads are connected to the ground portion of the plugs. The purpose of S_2 is to turn off the monitor when the station is not in use. Leaving the key open might accomplish the same thing, but having the switch is a good reminder to turn the unit off when going off the air.

On CR_1, the arrow on the diagram indicates the anode and the bar, the cathode. The cathode end of a silicon rectifier is indicated either by a raised rim, a colored ring, a dot of paint, or a positive sign (+).

The code-practice-oscillator components were mounted on a piece of mounting board, but it just as easily could have been a piece of wood. Fahnestock clips were used for the headphone and key terminals.

Using the Mox-Box is quite simple. Insert the key plug, P_2, into the transmitter key jack, the headphone plug, P_1, into the receiver headphone jack, and connect up the a.c. to the unit. Your key should be plugged into J_2 and the headphones into J_1. The antenna is connected to J_4 and the receiver and transmitter to J_3 and J_4. Your station is now controlled by S_1. QST
