

VARIABLE FREQUENCY OSCILLATOR

TRIO

VFO-5D



OPERATING MANUAL

1. SPECIAL FEATURES

1. This VFO has been designed to match its parent components the TS-510 transceiver and PS-510 power supply. Lined together, the three components will dress up any ham shack, giving it a neat, efficient looking appearance.
2. Superb stability is assured through the use of two FETs (Field Effect Transistors), plus two other transistors in the VFO unit which contribute to drift-free QSOs for hours-on-end.
3. This VFO is equipped with the same precision type, double-gear dial which tunes a 25 kHz range with one complete revolution. It is easy-to-read and facilitates SSB demodulation. Fine frequency calibration can be accomplished by utilizing the calibrator of the parent transceiver.
4. Spot channel communication is possible through the use of crystal controlled operation.
5. Use of this VFO-5D increases the versatility of your communications system far more than ordinary external Variable Frequency Oscillators.
6. This unit has a built-in RIT (Receiver Incremental Tuning) circuit which permits slight shifting of receive/transmit frequencies when desired.
7. This VFO is equipped with an Operation Indicator which shows how it is operating, and eliminates operational errors.
8. Connection to an AC supply source is unnecessary as power is received from the parent component.
9. An extra relay connection socket is available which can be used for controlling a preselector or linear amplifier that may be used.
10. High and low legs are available which permit height and panel angle adjustments.
11. Operation of this VFO-5D is not limited to working in conjunction with the TS-510. It can also be used as a remote VFO with various SSB equipment which are scheduled to be marketed.

2. CIRCUIT EXPLANATION

Figure 1 shows the Block Diagram.

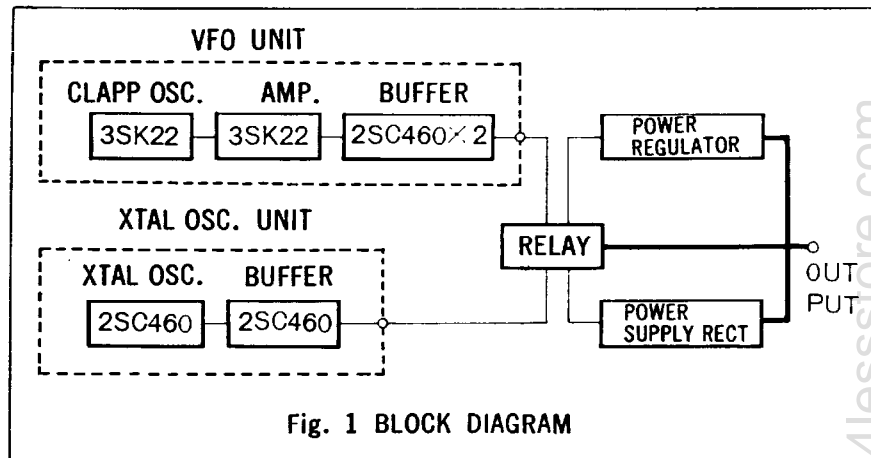
(a) VFO OSCILLATOR UNIT

A Clapp oscillator circuit utilizing a 3SK22 Field Effect Transistor is used. This transistor has superior frequency holding characteristics against temperature changes, as well as load changes. Another 3SK22 FET is used in the buffer amplifier to further ensure frequency adherence qualities. In the Power Amplifier, a pair of 2SC460s have been used in a Darlington circuit which has resulted in low output impedance and minimum output cable losses.

The entire unit is sealed in an aluminum housing which gives complete protection against external temperature changes. Moreover, an effective Harmonic Filter circuit has giving this VFO superior characteristics as against emanation of spurious signals.

(b) CRYSTAL OSCILLATOR UNIT

The crystal oscillator circuit utilizes a Pierce CB oscillator. An emitter follower Q2 serves as a buffer. The trimmer T1



permits correction of the oscillating frequency.

This crystal oscillator circuit is used for spot communications and ensures stable oscillation within the frequency range of this VFO from 4.9 to 5.5 MHz.

When ordering crystals, we recommend that the schematic diagram of the crystal oscillator circuit is attached with your order. This will assure your getting a good oscillating crystal.

CIRCUIT EXPLANATION

(c) THE RELAY AND OTHER CIRCUITS

The built-in relay circuit has been designed to work in coordination with the Standby Relay of the parent transceiver TS-510, etc. The silicon diode D2 and condenser C1 filters the AC 12.6V received from the parent component and this voltage is used to power the relay. The unfiltered portion of this AC12.6V is used to illuminate the pilot lamp.

A REMOTE socket, as shown in Figure 2, is available. It can be used to control a Preselector or a Linear Amplifier. Terminals 2, 4 and 5 are used for relay connections. It should be remembered that the maximum current capacity at these relay terminals is 1 ampere. They should normally be operated at less than one half of this maximum current capacity.

Output cord connections are shown in Figure 3 as seen from the pin side.

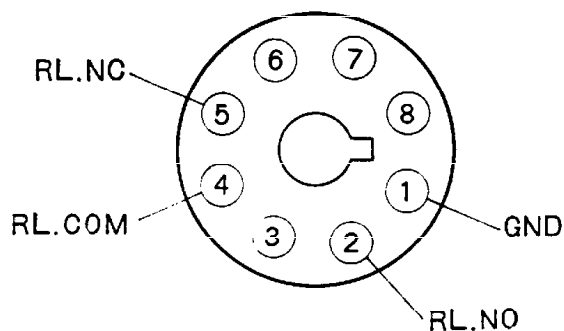


Fig. 2 REMOTE SOCKET

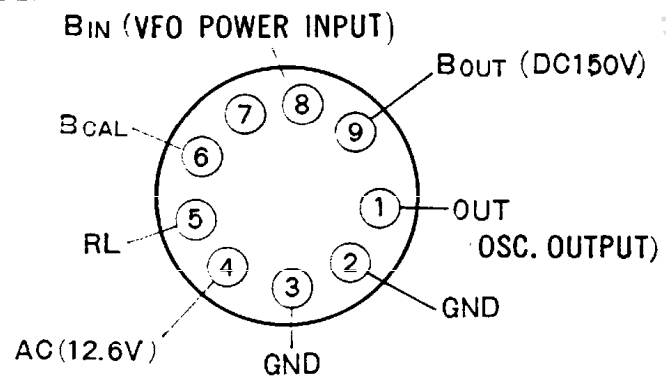


Fig. 3 OUTPUT SOCKET

3. CONTROLS AND THEIR FUNCTIONS

(1) VFO-XTAL SELECTOR SWITCH

This Selector Switch permits selection of either the Variable Frequency Oscillator unit or the Crystal Controlled Oscillator unit.

(2) FUNCTION

Table 1 shows the different operations of this VFO at various FUNCTION positions.

(a) DURING VFO OPERATION

(when (1) is switched to VFO)

At OFF position the VFO of this unit does not operate, and receiver/transmit frequencies are controlled only by the VFO of the parent transceiver. In other words, it would be the same as if this unit was disconnected.

At REC position, the receiving frequency is controlled by this VFO-5D, while the transmitting frequency is determined by the VFO of the parent component.

At REC/XMIT position, both transmission and receiving frequencies are controlled by this VFO-5D, the parent component VFO being inoperative.

At XMIT position, the transmitting,

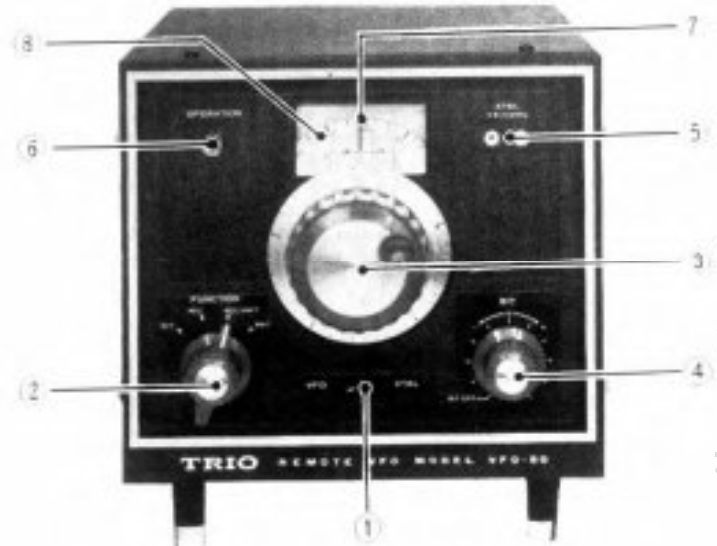


Photo 1 Front Panel Side

Table 1 Operation of FUNCTION Switched

FUNCTION position	VFO of TS-510	VFO-5D
OFF	Controls Transmit/Receive	Inoperative
REC	Controls Transmit only	Controls Receive only
REC/XMIT	Inoperative	Controls Transmit/Receive
XMIT	Controls Receive only	Controls Transmit only

CONTROLS AND THEIR FUNCTIONS

frequency is controlled by this VFO-5D, and receiving frequency by the VFO of the parent transceiver.

(b) DURING XTAL OPERATION

(When (1) is switched to XTAL)

At OFF position, this VFO-5D is inoperative.

At REC position, transmission frequency is controlled by the VFO of the parent transceiver, while receiving frequency is crystal controlled by the VFO-5D.

At REC/XMIT position, both transmitting and receiving frequencies are crystal controlled by this unit.

At XMIT position, the transmitting frequency is crystal controlled by this VFO-5D, and receiving frequency is tuned by the VFO of the parent transceiver.

(3) MAIN DIAL

One complete revolution of this main tuning dial covers a frequency range of 25 kHz. Its outer circular flange can be "slip-adjusted" after pushing it down and turning to correct the calibrating settings. Thus the dial can be calibrated by utilizing the 25 kHz marker of the parent trans-

ceiver (when it is equipped with a 100 kHz calibration crystal.)

(4) RIT (Receiver Incremental Tuning)

When this RIT knob is set at OFF or when it is positioned at "O", the transmitting and receiving frequencies during transceiver communication will be exactly identical and calibration is unnecessary. This RIT control can be used in case it is desired to shift your transmitting or receiving frequencies slightly when the frequency of the station being worked has drifted or when communication is being carried out with FUNCTION set at REC/XMIT. This RIT control enables a frequency shift over a range of about ± 3 kHz. Frequency is lowered when the knob is turned toward (-), and increased when it is turned toward (+) directions.

(5) XTAL

These are jacks which will accept HC-6U type crystals for crystal controlled operation. Crystals can be kept inserted at all times. They may be of any frequency desired between 4.9 and 5.5 MHz. Table 2 shows crystal frequencies and their re-

CONTROLS AND THEIR FUNCTIONS

lation to Amateur bands.

(6) OPERATION

This is the Operation Indicator which shows how this VFO is operating.

(7) DIAL GAUGE

Three Gauge lines are available on the acryl plate. The center Red line is for CW, the left hand black line is for LSB and the right hand black line is for USB use. There is a 1.5 kHz differential between these lines. Accurate frequency readings should be made against the indications on the main dial (3).

(8) SUB DIAL PLATE

This revolves as the Main Dial (3) is turned. Indications are marked off in 25 kHz graduations, points between being calculated by the "plus alpha" method. For example a frequency of 14.170 kHz is obtained by a dial setting of 14.150 kHz plus alpha.

REAR CHASSIS

(1) REMOTE

This REMOTE socket is an auxiliary relay connecting point when it is desired to control a linear amplifier or preselector

which may be added to your transceiver-VFO setup. Connections are shown in Figure 2.

(2) OUTPUT

This is the connecting socket for the Output Cable extending from the parent transceiver's VFO OUT.

Photo 2
Rear Panel
Side

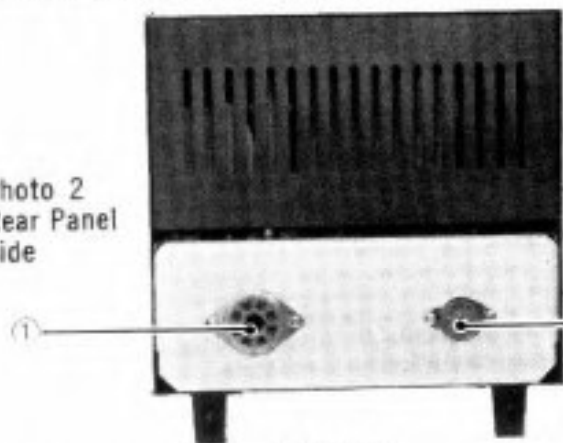


Table 2

Transmit Receive Frequency (MHz)	Crystal Osc. Freq. (MHz)	Transmit Receive Frequency (MHz)	Crystal Osc. Freq. (MHz)
3.5~3.575	5.5~5.425	28.0~28.6	5.5~4.9
7.0~7.1	5.5~5.4	28.5~29.1	5.5~4.9
14.0~14.35	5.5~5.15	29.1~29.7	5.5~4.9
21.0~21.45	5.5~5.05		

4. OPERATING INSTRUCTIONS

1. **ACCESSORIES** included are as follows:

One Output Cord with two connecting plugs. Two Hyzex legs.

2. **WHERE TO INSTALL THE VFO**

High humidity and high temperature locations should be avoided as they can have damaging effects on all electronic equipment. A dry place which is not subject to direct sunlight and which is dust-free should be selected for installing the VFO-5D.

3. **CONNECTING THE VFO**

Connect the Output Cord between the **OUTPUT** socket of this unit and the **VFO OUT** of the parent transceiver. The **REMOTE** socket may be left unconnected if it is not used.

4. **OPERATION**

Although some details of operation have already been explained under "Controls and Their Functions," review of the following will help you get better acquainted with the VFO-5D.

Table 3 shows the relation of control switch positions and operation. The follow-

ing is an explanation of this table.

(1) **FUNCTION at OFF**

At this position the VFO-5D is inoperative. Communication is controlled by the VFO of the parent transceiver. However, this unit has been so designed that a relay connected to **REMOTE** will continue to permit control of a linear amplifier if one is employed.

(2) **FUNCTION at REC**

Transmission is controlled by the parent transceiver, reception by the VFO-5D. The Operation Indicator will light up during receive, indicating that the VFO-5D is operating. **RIT** can be used only during receive.

(3) **FUNCTION at REC/XMIT**

In this position the VFO-5D controls both transmitting and receiving frequencies, the VFO of the parent transceiver becoming inoperative. The Operation Indicator will light up for both transmit and receive. **RIT** will operate only when receive-

OPERATING INSTRUCTIONS

ing, and when VFO-XTAL is at VFO.

(4) **FUNCTION at XMIT**

Receiving frequency is controlled by the parent transceiver, and transmitting frequency by the VFO-5D. Operation Indicator lights up when transmitting. RIT is inoperative.

(5) **CALIBRATION OF THE VFO**

When the parent transceiver is the TS-510, calibration of the VFO can be carried out as follows. Set **FUNCTION** to **REC** or **REC/XMIT**. Set the Calibration Switch of the TS-510 to **CAL/25 kHz**. As the Main Dial is tuned, a beat response will be heard at 25 kHz intervals. At zero beat, slip-adjust the outer flange of the main dial to "O" reading, as was explained under (3) in "Controls and Their Functions."

Adjustment of the subdial is made at "O." When this correction is made, turn the Main Dial around slowly to check its accuracy. If a

calibration check is made at 100 kHz intervals accuracy should be within ± 2 kHz. This is close enough for all practical purposes. If, however, greater precision is required, the dial should be corrected against the zero beat response which is closest to the desired operating frequency.

Table 3

FUNCTION	VFO-XTAL Selector Switch	RIT	OPERATION
OFF	VFO	/	Inoperative
	XTAL		Inoperative
REC	VFO	Operates	Controls receive
	XTAL	Inoperative	Controls receive
REC / XMIT	VFO	Operates	Controls Transmit/Receive
	XTAL	Inoperative	Controls Transmit/Receive
XMIT	VFO	/	Controls Transmit
	XTAL		Controls Transmit

OPERATING INSTRUCTIONS

5. ALIGNMENT . MAINTENANCE

(6) HYZEX LEGS

Two auxiliary, long Hyzex legs are supplied along with the VFO-5D. When it is desired to have the front panel in an inclined position, these can be used to replace the two frontside shorter legs that come attached to the unit. At the same time, remove the rearside metal legs, turn 90 degrees, and reattach them.

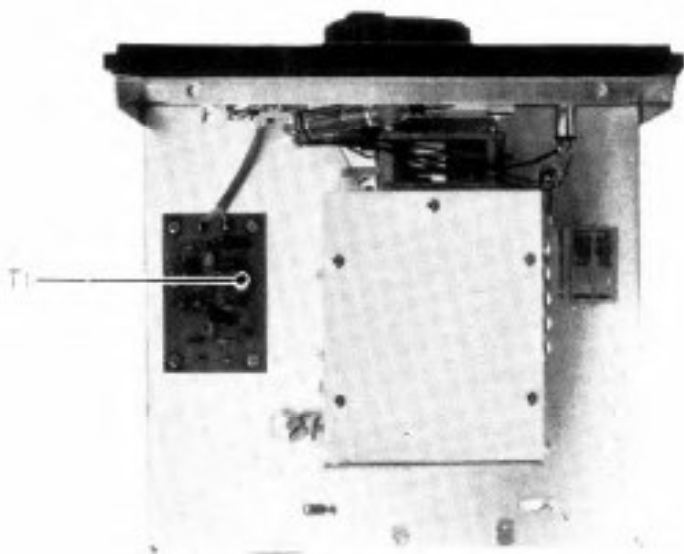


Photo 3 Alignment Point

5. ALIGNMENT AND MAINTENANCE

The VFO-5D is a complete, factory checked component and requires no alignment prior to installation. The following alignment and maintenance tips are presented only for your future reference.

1. CRYSTAL OSCILLATION ADJUSTMENT

When a 4.9 to 5.5 MHz crystal is inserted into the XTAL socket and it fails to oscillate, adjust the ceramic trimmer T1. Oscillation can be confirmed by switching the parent transceiver to transmitting mode and watching for a deflection of the RF Meter. A dummy load should always be connected when making this adjustment.

If oscillation is still unobtainable, the cause is most likely due to a defective crystal, or one that is not suited for the circuit. As previously mentioned, details of the crystal oscillator circuit should always accompany your order for crystals.

ALIGNMENT MAINTENANCE

6. VFO-5D SPECIFICATIONS

2. ADJUSTING FREQUENCY

Frequency tracking is accomplished by aligning the core in the VFO box and the variable condenser. This work which requires alternate alignment of core and trimmer requires a high degree of experience, and it is recommended that these alignment points be left untouched.

3. MAINTENANCE

(1) REMOVING THE CHASSIS FROM THE ENCLOSURE

The chassis can be removed toward the front after unscrewing 2 flat screws from the top, 4 each from both the right and left sides, and 4 bolts from the bottom. It is unnecessary to remove the legs.

A word of caution. The chassis should not be removed unless it is absolutely necessary to do so, because it may give rise to later frequency drift and error problems.

(2) A drop of machine oil placed on the dial double-gear system once a year will help to reduce friction and keep the mechanism operating smoothly.

FREQUENCY RANGE:

<i>Band</i>	<i>Frequency</i>
80 m	3.5 — 4.1 MHz
40 m	7.0 — 7.6 MHz
20 m	14.0 — 14.6 MHz
15 m	21.0 — 21.6 MHz
10 mA	28.0 — 28.6 MHz
10 mB	28.5 — 29.1 MHz
10 mC	29.1 — 29.7 MHz

OSCILLATION FREQUENCY:

4.9 — 5.5 MHz

OSCILLATION METHOD:

VFO Unit — Clapp Osc. circuit

Xtal Osc. Unit — Pierce C - B circuit

OUTPUT VOLTAGE: 1.0 V

FREQUENCY DEVIATION:

Within 100 Hz for 30 minute period three minutes after switching in AC power (at normal temperatures)

TRANSISTORS & DIODES USED:

6 transistors, 6 diodes

POWER:

AC — 12.6 V 180 mA

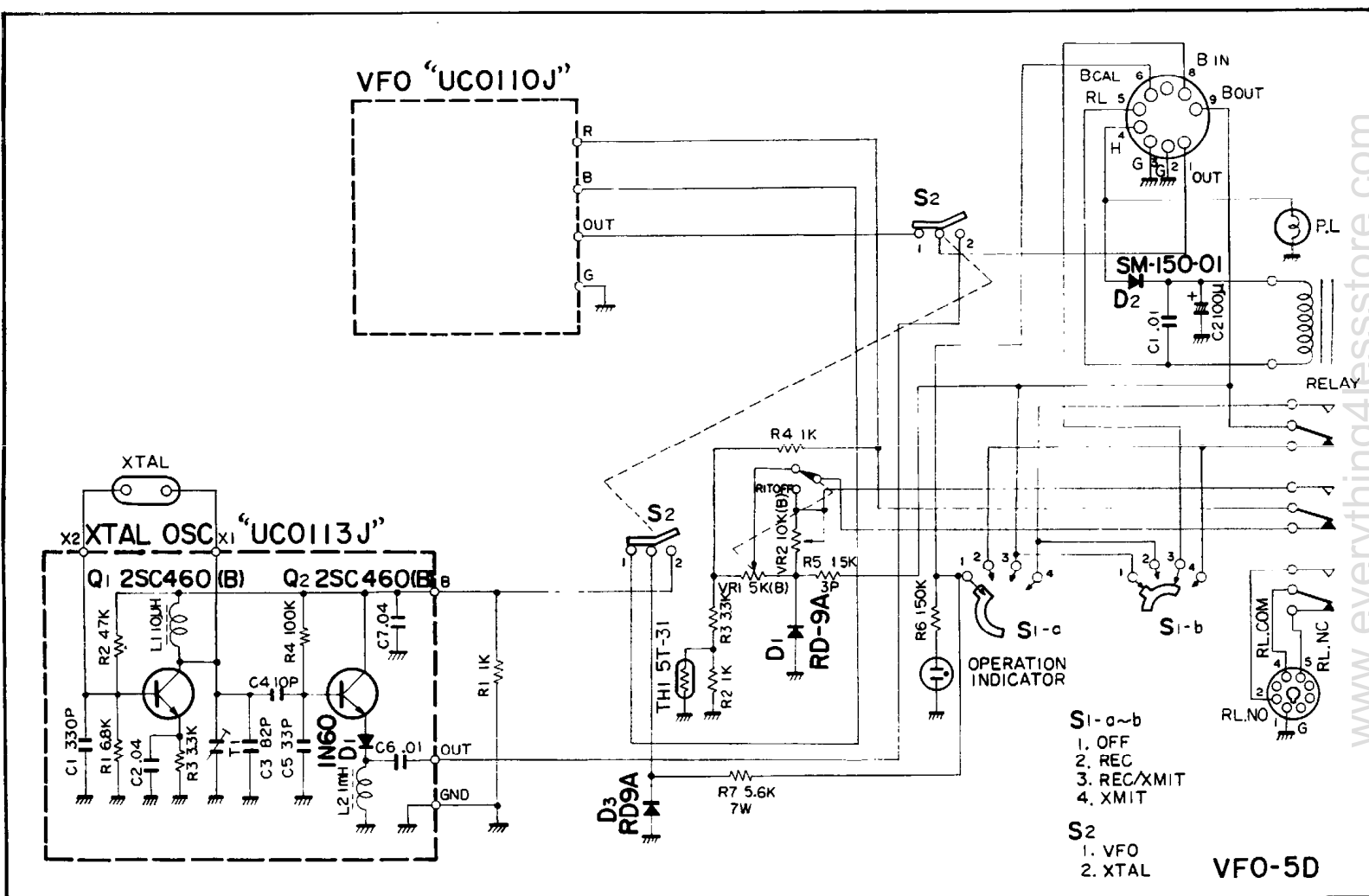
DC — 150 V 30 mA

DIMENSIONS:

W. 7-7/8", H. 8-21/32", D. 7-9/16"

WEIGHT: 7.3 Lbs

7. SCHEMATIC DIAGRAM



We reserve the right to make modifications in this model in accordance with technical developments.