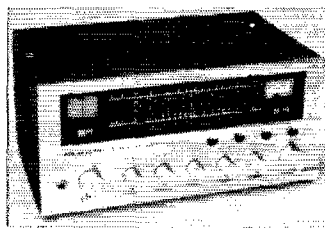


Recent Equipment



To acquaint you with the technical features of current amateur gear.

The Realistic DX-150



THE DX-150 is a solid-state receiver with continuous coverage from 535 kc. to 30 Mc. in four bands. Nineteen bipolar transistors and thirteen diodes are used in a single-conversion superheterodyne. Among the receiver's features are a product detector, an a.g.c. circuit with selectable time constants, an i.f. noise limiter, an a.f. noise limiter, and electrical bandspread. Included in the set are a b.f.o. pitch control, r.f. and audio gain controls, an antenna trimmer, an a.g.c. time-constant switch, a receive-standby switch, a loudspeaker, a headphone jack, and an S meter. The receiver can be operated from either 115 volts a.c. or 12 volts d.c.

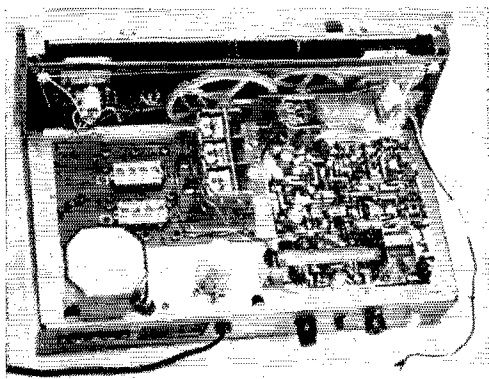
Circuit Details

A block diagram of the DX-150 is shown in Fig. 1. Q_1 and Q_2 form a cascode r.f. amplifier. CR_1 , a 1S73 diode across the base-to-emitter junction of Q_1 , prevents the reverse emitter-base voltage rating of Q_1 from being exceeded if, for example, an overly large signal from an adjacent transmitter is developed across the receiver's input circuit. The 535-kc. to 30-Mc. output of Q_2 is fed to the mixer, Q_3 , where it combines with the v.f.o. signal to produce an i.f. of 455 kc. A buffer amplifier, Q_7 , is used to isolate

the v.f.o., Q_6 , from the mixer. Depending on the band in use, the v.f.o., a Hartley circuit, operates 455 kc. above or 455 kc. below the frequency of the signal to be received. CR_2 is used to stabilize the oscillator.

The mixer is followed by two 455-kc. i.f. stages, Q_4 and Q_5 . C_1 , CR_3 and R_1 in the collector circuit of Q_5 (Fig. 2) form an i.f. noise limiter which is basically of the Bishop type,¹ although in this case unsymmetrical. C_1 is kept charged to the peak signal level through CR_3 , which is therefore back-biased and essentially nonconducting until a short-duration noise pulse momentarily exceeds the bias voltage stored in C_1 . The excess pulse voltage is short-circuited through CR_3 and C_1 , thus eliminating the noise peak. The a.f. limiter, to the right of C_2 , is the conventional carrier-operated a.n.l. circuit for a.m. reception. The two limiters are switched in or out simultaneously by the two sections of S_1 .

CR_4 is used as both an a.m. detector and an a.g.c. rectifier. In the latter application (Fig. 3) a signal appearing across the secondary of the last i.f. transformer is rectified by CR_4 and a negative d.c. voltage is developed from the top of C_2 to ground. This voltage forward-biases Q_9 , causing the transistor to draw collector current through R_8 and R_9 . As the voltage drop across these two resistors increases, the voltage drop across R_{10} and R_{11} decreases because all four resistors are in series across the supply voltage. Since the forward base-bias voltage for Q_1 , Q_4 and Q_5 is taken from the arm of R_{11} (the manual gain control) the gain of the controlled stages is reduced. Two a.g.c. release times, slow and fast, are available. For slow release, C_6 , a 200- μ f. capacitor, is switched from the collector of Q_9 to ground. Additional a.g.c. action is obtained from Q_8 ; the forward bias for this transistor is the voltage drop across R_8 ; and as the drop increases, Q_8 's collector current also increases. This results in a larger negative voltage drop from the top of R_{12} to ground, higher emitter bias (reverse bias) for Q_1 and Q_4 , and reduced gain for the two stages. The apparent reason for this dual a.g.c. system is that the circuit permits the receiver to



Top view of the receiver. The two wires at the right go to a small loudspeaker mounted on one of the sides of the cabinet.

¹ Stiles, "I. F. Noise Limiter," *QST*, June, 1960.

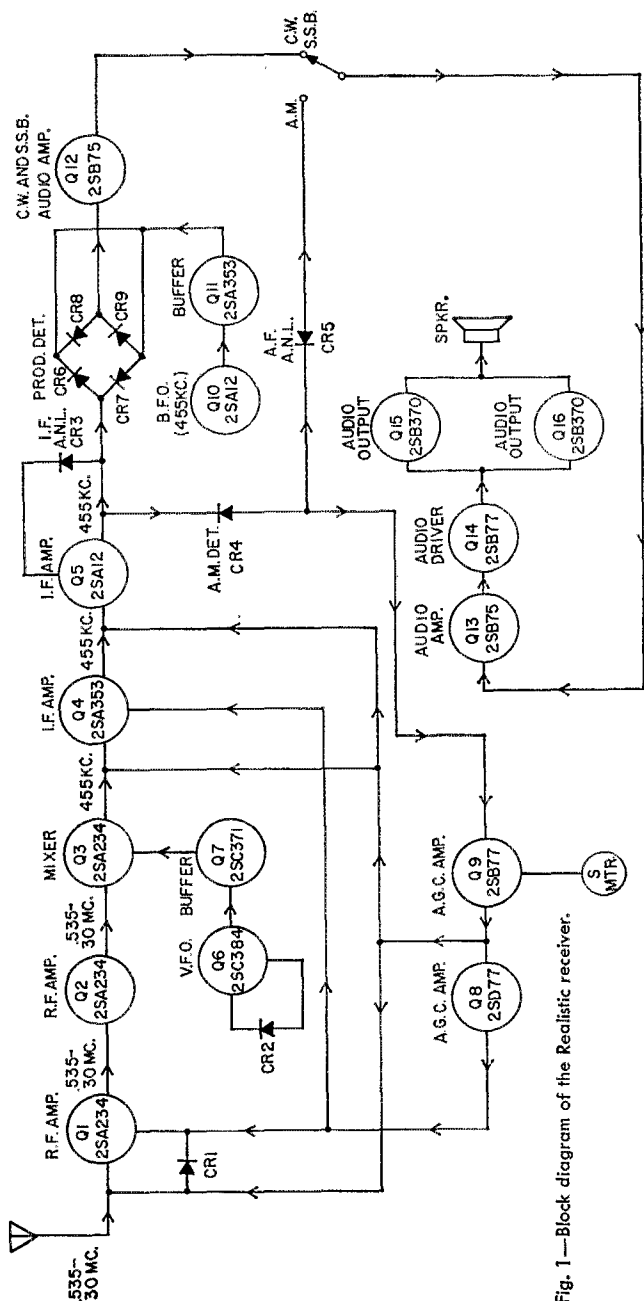


Fig. 1—Block diagram of the Realistic receiver.

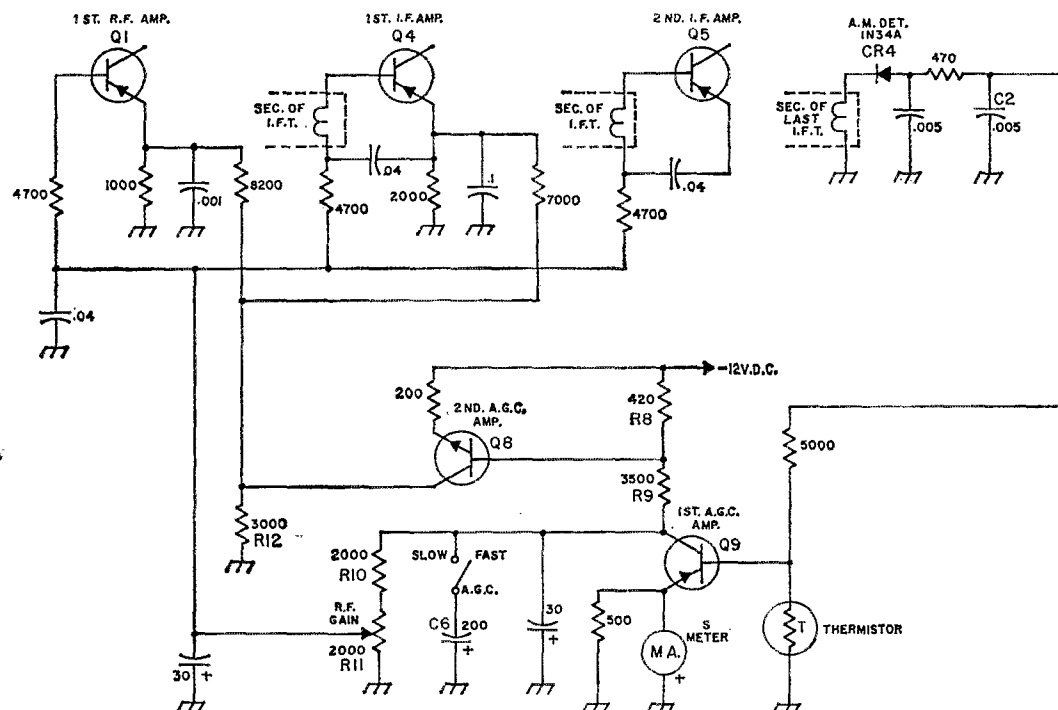
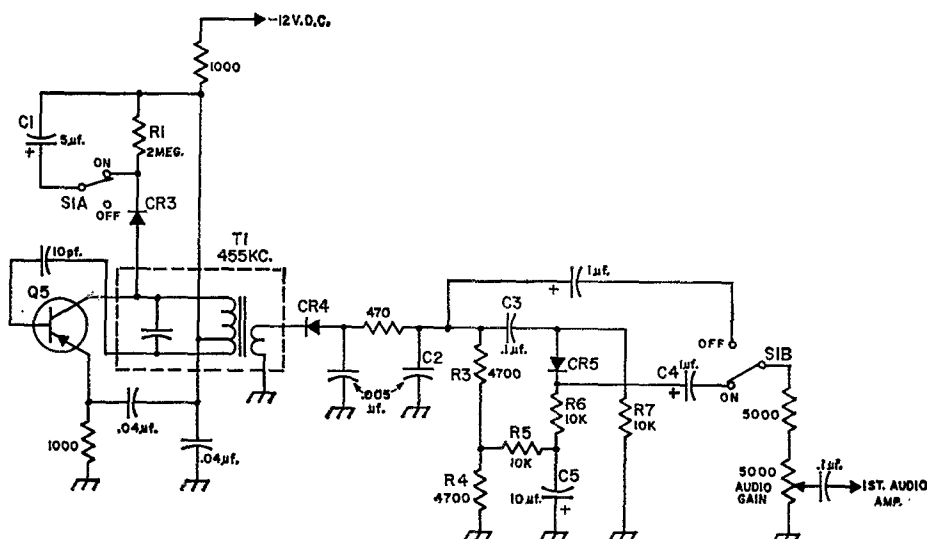
handle a wider range of signal strengths without overloading than the usual a.g.c. circuit which only controls base bias. The a.g.c. circuit is left on all the time.

Because Q_9 's collector current, and therefore its emitter current, increases with the signal level the emitter line of Q_9 is a good spot for an S meter.

Once the audio from a detected a.m. signal reaches S_{1B} , it is fed through the audio channel, Q_{13} , Q_{14} , Q_{15} and Q_{16} , to the loudspeaker. Only one transformer is used in the string, the output stage being a single-ended Class B circuit. A 200- μ f. capacitor is used to couple Q_{15} and Q_{16} to the speaker in the set or to an external speaker or set of headphones via the PHONES jack. The jack disconnects the set's speaker when a phone plug is inserted.

For c.w. and s.s.b. detection, i.f. and b.f.o. signals are fed to a bridge-type product detector consisting of four diodes, CR_6 through CR_9 . A buffer amplifier, Q_{11} , is used between the product detector and a Hartley type b.f.o., Q_{10} . Either u.s.b. or l.s.b. signals can be copied by turning the b.f.o. pitch control to the proper setting. Since the gain of the product detector is less than the gain of the a.m. detector, an extra audio amplifier stage, Q_{12} , is used between the product detector and the receiver's audio channel.

For a.c. operation of the receiver, a step-down transformer is used to feed a full-wave rectifier. This is followed by a capacitor-input filter, a transistor series regulator with a Zener diode reference element, a series dropping resistor, and another Zener. D.c. for the audio stages is taken from the capacitor-input filter while d.c. for the rest of the set is taken from the second Zener mentioned above.



For battery operation of the set, a power switch on the back of the receiver is used to bypass the transformer and rectifiers and to permit the d.c. to be fed directly into the capacitor-input filter. Connection to an external battery or batteries is made through a three-prong socket on the rear of the receiver. To extend the life of the batteries, the power switch is wired so that it disconnects the dial lights when battery power is being used.

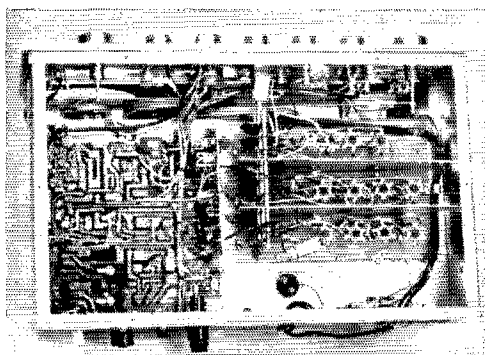
When thrown to STD BY, a REC-STD BY switch on the front panel removes voltage from all the stages in the set except the audio channel. This switch is wired in parallel with a connector on the back of the receiver. By wiring the connector to the transmitter send-receive relay or switch, the user can control the receiver with the transmitter.

Performance

The sensitivity of the DX-150 is as good as most of today's sets; when the short-wave bands are open, it should be possible for the listener to copy a multitude of signals even with a small random-wire antenna. However, strong signals on the DX-150 have a tendency to cross-modulate the signals adjacent to them. This is especially noticeable on the broadcast band; backing off the r.f. gain control does little to clear it up. After a short warm-up, the receiver exhibits little drift. The receiver does change frequency when it is bounced up and down to simulate mobile operation.

The r.f. gain-control and antenna-trimmer settings affect the receiver tuning; this is particularly annoying on the 10-meter band. S.s.b. signals that vary widely in strength (QSB) sound a little bit distorted. The noise limiters, which cut down noise at the expense of some audio distortion, are helpful for a.m. reception, but do not seem to be useful for c.w. or s.s.b. Depending upon the frequency, it takes a signal of 10 μ v. or less to get a meter reading of S9. The meter is easily pinned.

Image rejection was found to be 46 db. at 3.5 Mc., 43 db. at 7 Mc., 18 db. at 14 Mc., 13 db. at 21 Mc., and 0 db. at 28 Mc. These figures are quite in line with what is to be expected from



Bottom view of the receiver. The r.f. coils are at the right and the bandswitch is in the center. Most of the rest of the components are mounted on the circuit boards at the left.

Realistic DX-150 Receiver

Height: 6½ inches.

Width: 14⅞ inches.

Depth: 9¼ inches.

Weight: 14 pounds.

Power Requirements: 6 watts, 105-125 volts a.c., 50-60 cycles, or 12 volts d.c.

Price Class: \$120 less accessories.

Manufacturer: Radio Shack, 730 Commonwealth Ave., Boston, Mass. 02215.

a single-conversion receiver having a 455-kc. i.f. While checking the image rejection of the DX-150 on Band D (13 to 30 Mc.), we found the image to be on the low side of the signal when the set was tested at 14 and 21 Mc.; however, it appeared that the image shifted to the high side when we checked the receiver at 28 Mc. Since it is not possible for the image frequency to move from one side of the signal to the other, what happened? Apparently the manufacturer mistakenly aligned the high end of Band D at the image frequency—something that's easy to do because the image and the desired signal are both about the same strength.

Mechanical Details

The receiver is attractive in appearance; the front panel, an extrusion of brushed aluminum, is contrasted by a dark gray cabinet. Good-sized solid aluminum knobs are attached to the controls. Two string-driven dials that have negligible backlash are used to tune the DX-150: a multicolor slide-rule dial for general coverage, and a circular bandspread dial for the Citizens Band and the five amateur bands between 3.5 and 29.7. It takes one turn of the bandspread knob to tune between 40 and 60 kc. of the 3.5-, 7- and 14-Mc. bands, 150 kc. of the 21-Mc. band and 430 kc. of the 28- Mc. band.

As can be seen from the photographs, the wiring is very neat, and the parts are easy to reach if servicing is necessary. Most of the components in the set are mounted on either of two printed-circuit boards.

The instruction manual, written primarily for the short-wave listener, contains little information that is of interest to hams. It does, however, include a tiny but useful schematic of the receiver.

Among the accessories available for the DX-150 are an external communications-type speaker (SP-150) and a 12-volt d.c. portable power pack. The latter includes all the necessary plugs and cords for operation of the receiver from eight D cells (supplied) or from the outlet for an automobile cigarette lighter. There is sufficient space in the pack for storing a complete set of spare batteries. Eight D cells are said to be capable of operating the receiver for 100 continuous hours.

—WYDS