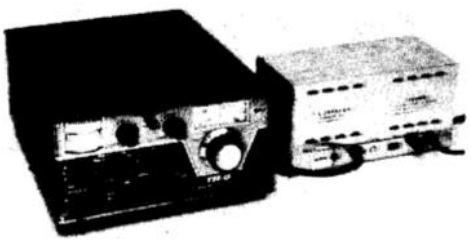
Recent Equipment

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

Drake TR-6 5O-MHz Transceiver



W. E TEND to think of a sideband transceiver as an isolated piece of ham gear, useful mainly on its own, or perhaps as a driver for a linear amplifier. The Drake TR-6 has just about every imaginable operating feature. either built-in or available as an extra-cost option, and it also makes provision for use with other units of a multiband amateur station. Thus. the vhf-oriented amateur can use this major item of his station is the nucleus of a plan for the future. adding accessories and optional operating conveniences as his needs and personal finances dictate. Of course Drake has its own gear in mind for much of this, but the fellow who likes to do some of his own building will Iind attractions in the TR-6 versatility as well.

He can start with the "basic" TR-6, with or without its power supply, speaker and other primary operating accessories. For home-station work he will probably want the Drake AC4 Power Supply. He mav already have it, as it is used with other Drake items. For mobiIe operation he can add the DC-4 supply. to work from the car battery. (Drake's AC-3, DC-3 and DC-24 supplies. the last for 24-volt service. are also suitable with the TR-6.)

At this point our hero has a 50-MHz transceiver capable of 300 watts PEP input on ssb or a-m. and 260 watts on cw or fsk His receiver sensitivity is all he could ask for. and the selectivity is optimum for 50-MHz ssb. If he expects to work a-m or cw extensively, his next step will probably be plug-in filters for optimum selectivity for these modes. 6 kHz for a-m. 2.4 kHz for ssb. and 0.3 kHz for cw. A special filter is needed for lower-sideband operation, but since nearly all 6-meter work is upper-sideband. this is a lower-priority option.

Frequency coverage of the TR-6 in this form is 49.9 to 51.0 MHz. Other overlapping 600-kHz tuning ranges can be provided for a total of nine 500-kHz segments from 49.5 to 54 MHz, with plug-in crystals available as extra-cost options. Activity is concentrated mainly near the low end of the band, so these can wit for more urgent acquisitions. to be described later.

One difficulty with most ssb transceivers, for vhf operation at least. is being limited to working stations on one's own frequency. The transceiver has been a major cause of QRM problems in the vhf bands. These bands are wide enough to support an enormous amount of activity without serious interference, were it not for the channellization that the transceiver encourages. The TR-6 system offers a way out of this. With the Drake RV-6. or your own remote VFO. you can control either the transmitting or receiving frequency. or you can switch the VFO off and go over to normal transceiver operation, when it is desirable. Similarly, the Drake Model FF-1 Fixed-Frequency Adapter allows crystal-controlled operation of either the transmitter or receiver.

A 14-MHz input-output jack on the TR-6 opens up options such as external vhf or uhf receiving converters. external receivers. and heterodyning units for using the TR-6 features on other bands, from hf to uhf. The equipment can be used with 2-meter transverters. Drake- designed or otherwise.

If mobile operation with the TR-6 is planned. the Drake Model 9-NB Noise Blanker is a must. This mounts inside the cabinet bv merely plugging in. and Its operation is provided for on the front panel. The MMK-3 Mobile Mount will very likely be needed. as well. A simple but handy option for the home-station operator is an assortment of mounting feet. permitting horizontal positioning. or two setting of upward tilt.

How It Works

In this writer's opinion the TR-6 is a complex piece of equipment. and the purchaser may have some difficulty understanding its basic functions when reading the instruction book. Its 57 pages of text are not readily digested. even by the experienced reader, and its block and schematic diagrams are understandable only after intensive study. To the uniniated. the complex schematic presentation is likely to remain a mass of long parallel lines, and innumerable cross-overs.

Admittedly a simple description of this sort of equipment is not easy. and the block-diagram approach may leave its user open to charges of over-simpfification. The TR-6 book does have the information. which is more than can be said from some manuals, even if it is not in the most easily-read form. In our block diagram. Fig. 1. we have tried to clarify stage functions and signal paths by separating the transmitting and receiving elements, insofar as possible. When the same stage or component is used for both purposes. it is shown twice in our diagram, or drawn in broken lines, or both. We have deliberately left off type numbers of tubes and transistors. since they tend to be of minor importance to the casual reader.

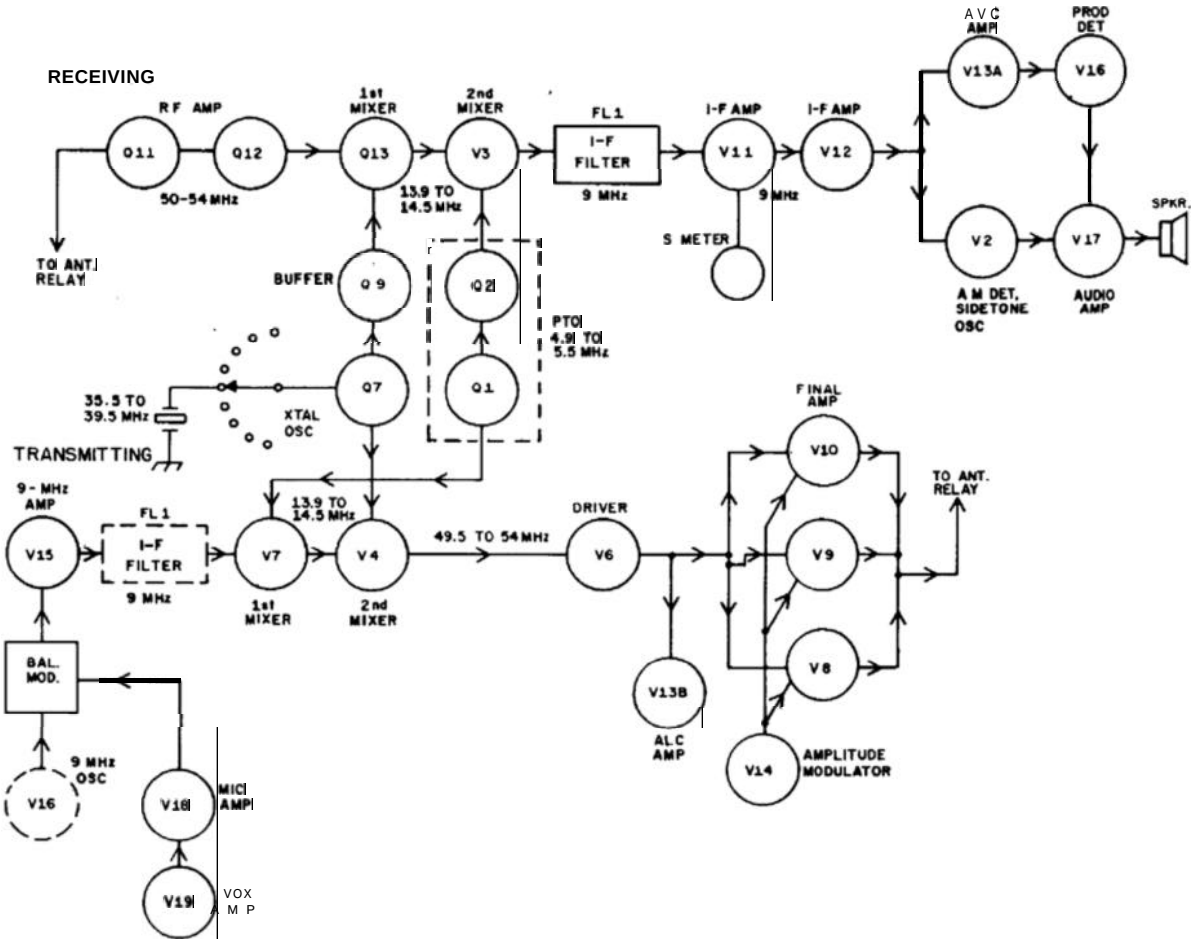


Fig. 1 – Block diagram of the Drake TR-6 transceiver, showing principal receiving and transmitting functions. Several of the 19 vacuum tubes, 13 transistors and 12 diodes are not shown herein, in the interest of clarity for major functions. Similarly, the component type numbers are omitted from the drawing.

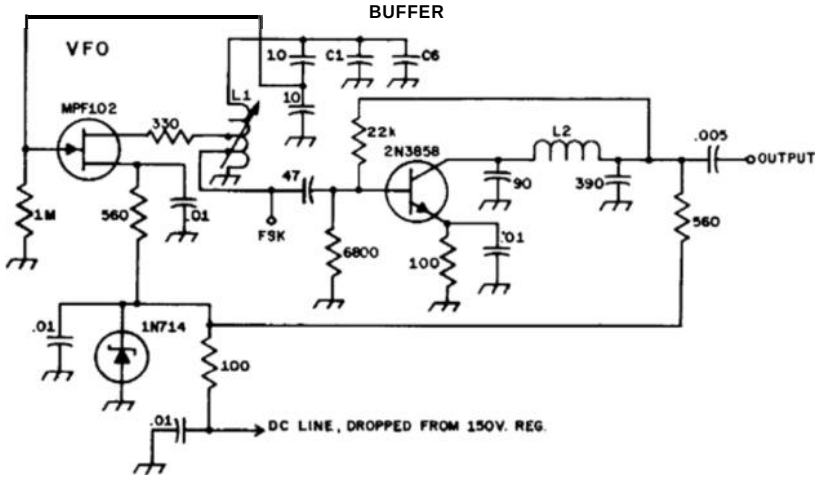


Fig. 2 – Principal details of the PTO and buffer on the Drake TR-6. Values of Cl and C6 are selected during production, to achieve the best possible dial calibration with a given tuning assembly. The PTO covers 4.9 to 5.5 MHz, and is driven by the main dial. Its frequency is shifted automatically in changing modes, with external circuitry not shown here. An fsk voltage can be fed into the jack so marked, for transmission of RTTY information. Note the low-pass filter in the buffer collector circuit, to keep harmonics out of the following circuits.

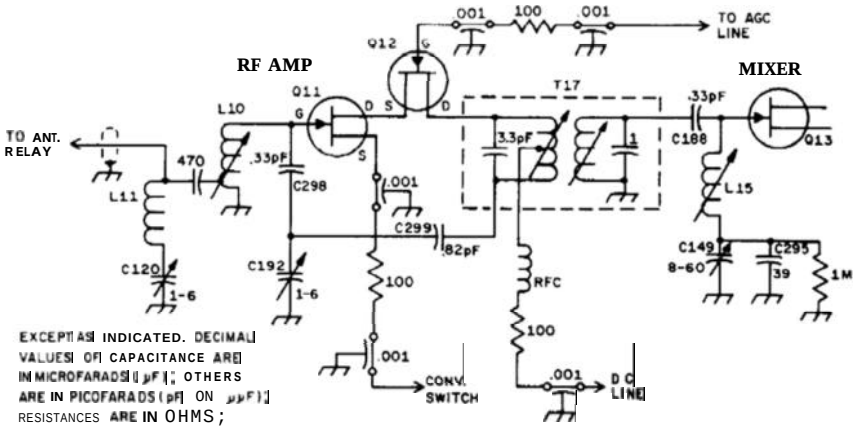


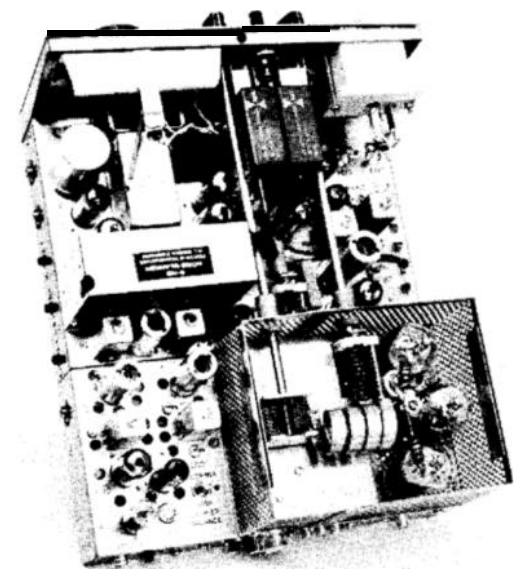
Fig. 3– The receiver front end of the TR-6 uses a cascade rf amplifier circuit. Parts labelling is the same as in the Drake manual. Note the impedance matching in the input circuit, the fixed capacitive-bridge neutralization, and the bandpass interstage coupling. External control and power circuits were omitted in the interest of clarity.

The TR-6 can be thought of as a 14-MHz ssb rig, with transverting circuitry to make it work on the 50-MHz band. To generate a 14-MHz ssb signal it uses the popular 5 + 9 system, the central clement of which is the transistorized permeability-tuned oscillator (PTO) covering 4.9 to 5.5 MHz. This is driven by a smooth-working and well-calibrated main dial. Permeability tuning has advantages, but it has not been used extensively by home-builders of ham gear. A look at the simple schematic of the PTO in the TR-6, Fig. 2, may encourage gadgeteers to attack the not-too-formidable problem of moving a core into and out of a coil.

If you decide to try it, use this hookup, not the one shown in the TR-6 manual. The draftsman responsible for theirs made the classic error of grounding the high **side** of the dc supply for the PTO.

The cascade rf circuits of the receiver front end are **shown** in Fig. 3. It has elements of interest to the vhf converter builder. Note particularly the impedance-matching front end, L10, L11 and C120, and the neutralization by means of the fixed capacitive-bridge network, C299, Cl92 and C298. Details of the agc and switching circuits are omitted in this diagram in the interest of clarity. The interstage coupling circuit consists of T17, a shielded rf assembly, C188, L15, and its series capacitors, Cl49 and C295.

The injection oscillator, Q7, has nine crystal positions (two crystals supplied) for frequencies in 500-kHz increments, from 35.5 to 39.5 MHz. (13.9 MHz below the low ends of the nine overlapping tuning ranges, each covering 600 kHz.) The first-intermediate-frequency signal, 13.9 to 14.5 Mhz, is then fed to a second mixer, V3, which is the first vaccuum tube in the receiver lineup. The tunable-oscillator energy beats with the signal to produce a 9-MHZ output, which then goes through the i-f filter, labelled FL1 in Fig. 1. The actual frequency of this filter depends on whether it is to be for a-m, usb, lsb, or cw. Two 9-MHz i-f amplifier stages, V1 1 and V12, feed either a product detector, V16, or the a-m detector, V2. The audio output of either is then amplified in V17. The PTO is the primary frequency-control element of the transmitter portion as well, the heterodyning operations taking place in reverse order when transmitting. At the lower left of Fig. I, we start with the VOX system and the speech amplifier. The audio voltage and the energy from the 9-MHZ oscillator, V16, are combined in the balanced modulator (4 diodes). The resulting double-sideband signal is amplified in V15 and then fed through the previously-mentioned i-f filter. Output of the filter is in the final form that



Interior of the TR-6, with the Noise Blanker installed. Transmitter output stage, with three 6JB6 sweep tubes in parallel, is at the lower right. The PTO, driven by the vernier dial, is in the upper left corner, with the noise blanker directly below it. The plug-in filters for a-m and cw bandwidths are in the upper center.

the on-the-air signal will takeexcept that it is on 9 MHz. The PTO, the 9-frequency crystal oscillator, and two mixers, V7 and V4, convert the signal to the 50-MHz band, whereupon it passes to the driver, V6, and final amplifier. The output stage uses three sweep tubes, V8, V9 and VIO, in parallel. Amplitude modulation, when used, is supplied to the screens of the sweep tubes from VI 4, resulting in controlledcarrier operation.

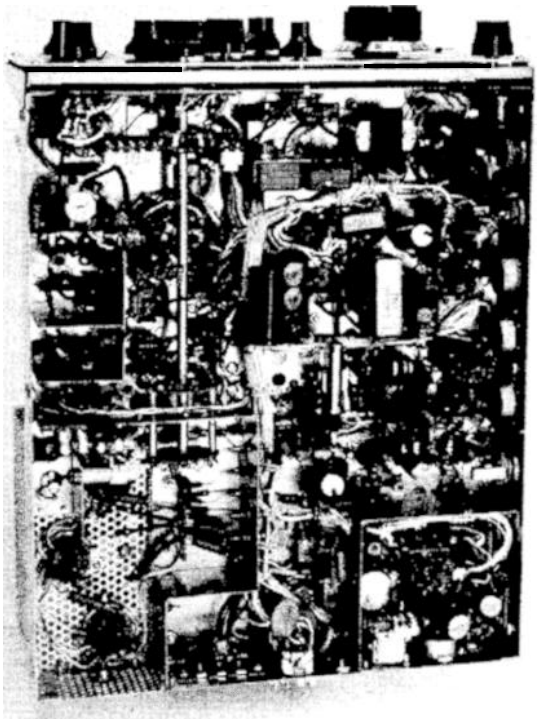
Operation

For all its complexity, and to some extent because of it, the TR-6 is surprisingly easy to operate. Adjustments usually made in sideband rigs when changing modes are taken care of automatically. The operator can easily switch between ssb, cw and a-m, and be tuned up for optimum results on each mode. This is a far cry from the procedure that must be followed with some ssb layouts, including the writer's. If the initial tuneup is done according to the very simple step-by-step procedure given in the manual, signal quality will be good in all positions, and voice levels will he close to optimum for best readability.

In considerable operating experience with the TR-6, we have found only two points which require careful attention. One is that the load the transmitter "sees" must he close to 50 ohms, or you can run into trouble quickly with final-tube deterioration. Sweep tubes are relatively inexpensive, and they work well in linear-amplifier service, but they are not tolerant, if operated near their maximum ratings. for extended periods of time. With the TR-6, you watch your SWR - or,else. And you don't just run to the nearest radio or TV store and buy three new tubes if you damage the originals. With three in parallel, the tubes must be of nearly identical characteristics, or you're in for trou hies.

The other point concerns carrier suppression. The manual says "The carrier balance control is factory adjusted, and should not require resetting under most conditions." At least two TR-6s we've encountered make this statement seem a hit on the optimistic side. A little carrier is not important in weaksignal ssh work, and it may even help some fellows you work to tune the signal in properly, but appreciable deterioration in carrier balance can bring on undesirable signal characteristics with the TR-6. Especially if you're working locals, your carrier becomes very obvious in the form of a hummy background on your signal, if the balancing adjustment is not "right on." The automatic level control in the TR-6 is effective in holding peaks down, and average level of audio up, hut with appreciable carrier the modulation caused by noise and hum can be objectionable, over high-signal paths.

The cure is careful attention to the carrier-balance adjustments, not only the control so labeiled (R185, at the rear of the chassis) hut also C127, alongside it. The book cautions against nulling the carrier before at least a half-hour warmup. We found this point to be deserving of emphasis. Though the TR-6 is very stable as to frequency, there is a marked change in carrier



Bottom of the TR-6, with the final amplifier stage in the lower left corner. Jacks for phones, key and microphone are along the right side of the chassis, as are controls for VOX, antivox and Smeter zero adjustment. The power source plugs onto a fitting on the rear wall. The socket in the upper right-center is for connecting the remote vfo, if used. Plug-in crystals and their range-selector switch are in the upper left-center.

rejection in the early minutes after turn-on. We'd recommend the half-hour warmup beforeoperating, wherever possible, as well as before adjustment.

From the standpoint of operating convenience and effectiveness in making contacts, using the TR-6 is a very pleasant business. The quick and easy mode switching is expecialiy nice, and the cw performance should do much to encourage the newcomer to the 50-MHz hand to make use of this much-neglected mode. The shaped keying results in a fine cw signal on the air, and the automatic sidetone gives the inexperienced cw operator great assurance and helps mightily to improve his fist. This is a feature long overdue in 50-MHz stations!

The writer used the TR-6 extensively in various kinds of operating, and found its versatility and almost foolproof adjustment provided a new measure of satisfaction and pleasure **in** 50-MHz multi-mode work. Its effectiveness in the heat of the 1970 ARRL. VHF Sweepstakes was particularly noteworthy.

There's always at least one "hut," it seems. The writer's one gripe regarding operational aspects of the TR-6 is that in going from sideband to a-m, you have to go through the cw position on the mode switch. in order for the TR-6 to operate in the other modes the keying jack must be closed, either by its own normally-closed contacts, or hy those of a key plugged into the jack. With the

mode switch in the cw position, the signal goes on the air when the jack is closed. Thus you cannot switch from ssb to a-m, or back again, without putting a burst of cw on the frequency. During the VHF SS, for some hours we wondered about the beeps we often heard when we snagged some of the more difficult Sections, until WC suddenly realized that they were produced by some of our TR-6-using competitors, moving in for a shot at the new multiplidr, and switching modes!

The description of the TR-6 given here is by no means complete. Rather, we have mentioned mainly those items in which this equipment is unusual or unique. Just about every other feature normally found in hf sideband gear is included in the TR-6. Operators who have had experience with other Drake equipment will find much of the TR-6 familiar. – WIHDQ

Drake TR-6 50-MHz Transceiver

Height: 5 7/16 inches.
Width: 10 3/4 inches.
Depth: 14 l/4 inches.
Weight: 15 3/4 pounds.
Power Requirements: 650 volts dc at 500 mA. 250 volts dc at 175 mA, 60 volts adjsutable into 30,000-ohm load, 12.6 volts at 5.5 A. These voltages are furnished by the Drake AC-3, AC-4, DC-3, DC4 and DC-24 power supplies.
Price Class: $600, less power supply, speaker and other optional
Manufacturer: R. L. Drake Co., Miamisburg Ohio 45 324.