Recent Equipment

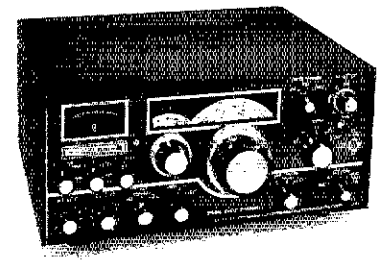
To acquaint you with the technical features of current amateur gear.

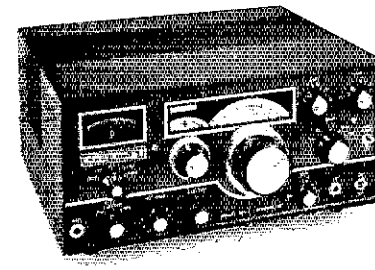
Swan Twins (600-T and 600-R)

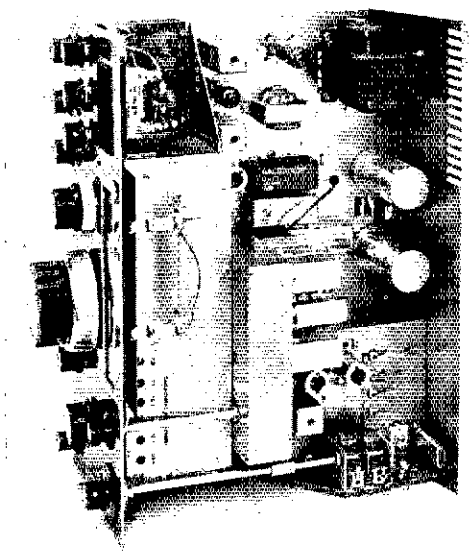
A DOZEN OR SO years ago the name Swan helped spell the beginning of the end for a-m operation. It was the small single-band transceiver that added impetus to the growing number of sideband signals on the air at that time. Swan has marketed a number of five-band transceivers; however, until recently there was a void for the amateur who wanted a separate receiver and transmitter combination. The 600-R and 600-T fill this need. Either unit may be used independently, or both as a compatible pair. The receiver may also be used as an adjunct to one of the Swan transceivers such as the 500-CX.

The 600-R and 600-T are designed for use on amateur frequencies from 3.5 to 29.7 MHz. Generous additional coverage is provided for MARS frequencies. Adapters are available for transmitter crystal control, and for receiver general coverage from 3 to 30 MHz. Like the Swan transceivers, the 600-R and 600-T are both single-conversion units using a 5500-kHz i-f. They are designed for use on ssb, cw, fsk, and SSTV modes.

The 600-R and 600-T have an interesting band changing arrangement. The usual system is to mix the VFO output with a crystal oscillator, then heterodyne this energy with the signal from the rf amplifier stage. Instead, Swan uses a single VFO with two variable capacitors. A 12-pF capacitor provides 200 kHz coverage on all bands except 10 meters, where the range is 500 kHz. Adjacent to the MAIN-TUNING control on the front panel is a knob designated DIAL SET. The skirt is calibrated from +400 through zero to −400 in 100-kHz increments. When the DIAL SET is placed on zero, the unit (either transmitter or receiver) is set up for operation in the phone portion of each ht band. When going from phone band to phone band it is necessary only to activate the built-in crystal calibrator, set the MAIN TUNING to any convenient 25-kHz spot on the dial, and tweak the DIAL SET for zero beat. Going from the phone segment of one band to the cw segment of another band, however, is a chore. For example, if the units are set for operation on 75 meters, the DIAL SET is on zero and the band switch is on 3.8. To go to 40 cw, the band switch is placed on 7.2. However, 7.0 MHz is 200 kHz below 7.2 MHz and the DIAL SET must be adjusted to the −200 increment. The same procedure is followed with the transmitter. For operation on 21.0 MHz, the band switch is placed at 21.3 MHz and the dial is set for −300. The DIAL SET control can be mechanically locked in position on any band. This must be done carefully since it is possible to "bump" the DIAL SET out of alignment.







The 600-R Custom receiver. The optional IC audio Notcher/Peaker is located under the S meter. The noise limiter is mounted above the PRESELECTOR control.

Adjusting the carrier oscillators of the transmitter and receiver for transceive operation is a simple matter. A wire is connected between the test jacks on both units and the 5500-kHz oscillator trimmer (located on the side of the unit) is adjusted for zero beat. This is repeated for the 5503-kHz trimmer.

So much for the common denominators in both the transmitter and receiver. Now for the description of the individual units.

The 600-R Custom Receiver

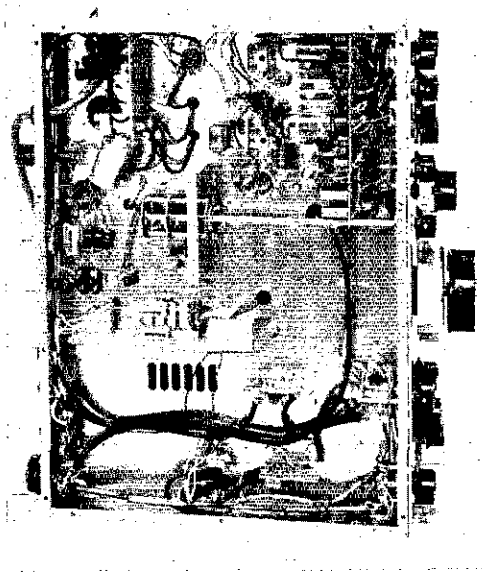
The only difference between the 600-R and the 600-R Custom is the addition of an IC audio filter and noise blanker in the latter unit.

Sensitivity tests indicate that the receiver is well within the manufacturer's specifications. Sensitivity measured 0.17 μV, or less, for 10 dB signal-plus-noise to noise ratio. Sensitivity is controlled by an age circuit having two separate time constants selectable by a front-panel switch. The author's unit tended to "pump" in both SLOW and FAST age positions when tuned to a strong signal. Age recovery is slow for full break-in cw operation.

Selectivity is nominally 2.7 kHz and is determined by a crystal-lattice filter having a 1.7 shape factor. An optional 16-pole crystal-lattice filter, with the same bandwidth as the standard filter, is available. Other optional filters are a 0.6-kHz cw filter and a 6-kHz a-m filter.

The "Custom" comes with an IC audio notcher-peaker. This solid-state device is inserted between the product detector and first audio stage providing a notch approximately 40 dB in depth. In the PEAK mode the filter acts like a *Q* multiplier. The audio filter, when used in conjunction with the 0.6-kHz cw filter, provides excellent selectivity.

When the i-f noise blanker is activated, both the signal and the noise from the mixer are amplified by two 12BA6s and applied to a diode limiter where noise peaks are clipped. From there the



Bottom view of the Swan receiver.

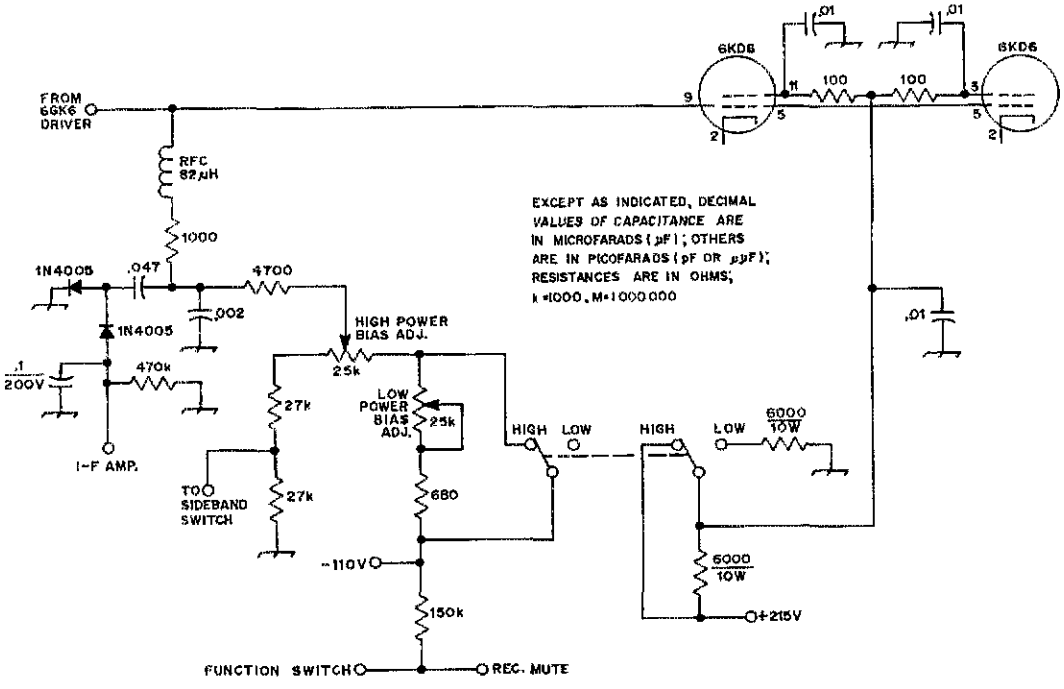
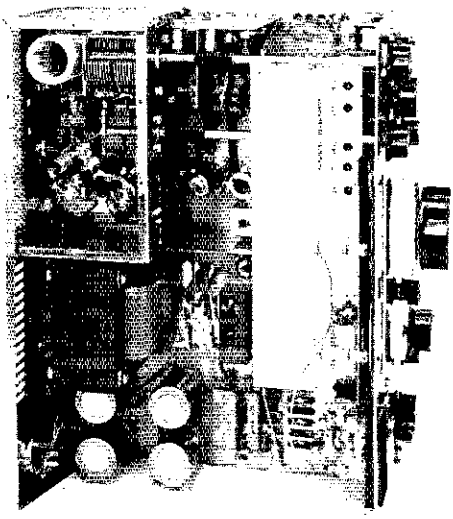


Fig. 1 — High/low power switching for the 600-T final amplifier.

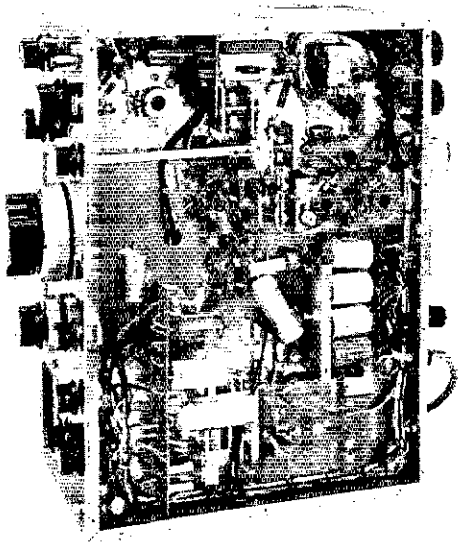


Top view of the 600-T. The tuning eye is behind the lower dial light. The crystal-lattice filter is located between the power transformer and the VFO.

TABLE I – SWAN VFO STABILITY

TIME MINUTES	*VFO FREQUENCY IN kHz*		
	*80-Meters**	*20-Meters*	*15-Meters*
1	9306.767	8706.989	15,807.838
2	9306.784	8706.990	15,807.839
3	9306.829	8706.986	15,807.839
4	9306.877	8706.985	15,807.839
5	9306.931	8706.985	15,807.840
10	9307.031	8706.976	15,807.844
15	9307.027	8706.973	15,807.845
20	9307.055	8706.971	15,807.846
25	9307.097	8706.971	15,807.846
30	9307.120	8706.970	15,807.849
45	9307.195	8706.972	15,807.860
60	9307.208	8706.977	15,807.863

*80-meter measurements were taken from a cold start, 20- and 15-meter measurements were not.



Bottom view of the 600-T. The power supply circuit board is at the lower right below the protective Plexiglas plate. The crystal-lattice filter is mounted on top of the chassis.

signal is attenuated to approximately the same level as the input signal to the blanker. There is a tendency for the noise blanker to overload when there are many strong signals on the band. Swan designed the noise blanker for two levels of gain (adjustable from the front panel). In the MED position, the output level is approximately the same as the input level to the blanker. The MAX position provides better noise reduction, but cross modulation problems introduced by the blanker make it almost unusable, especially during weak-signal reception periods.

VFO stability is quite good. The VFO is solid state and is isolated by a buffer stage to prevent "pulling." A Zener diode provides regulated voltage to the oscillator and buffer. The receiver and transmitter VFO are nearly identical. Table I gives VFO stability measurements made during a three-hour period. The measurements were taken from a "cold start" on 80 meters. Both 20- and 15-meter data were obtained after the receiver had been turned on for an hour.

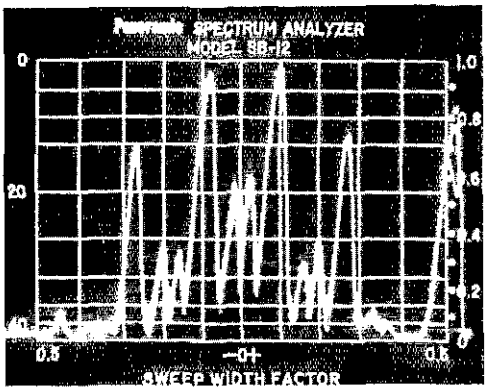
The 600-T Transmitter

The 600-T is a self-contained 600-watt ssb transmitter using a pair of 6KD6 sweep tubes in the final amplifier. The 600-T can be used on cw at 500 watts, a-m at 150 watts, and RTTY/SSTV at 100 watts, dc input.

Each 6KD6 has a plate-dissipation rating of 33 watts. Care must be taken to prevent damaging these tubes when tuning the rig. The instruction manual warns many times that PA resonance adjustments must be performed quickly to preserve tube life. A front-panel HIGH/LOW power switch is provided to aid tune-up and extend tube life. As shown in Fig. 1 the HIGH position applies +215 volts to the screens of the final amplifier tubes. In the LOW position this value is reduced by approximately 30 percent. Although the final tune-up of the rig needs to be accomplished with the switch in the HIGH position, the operator may obtain "ballpark" settings for the drive, tuning, and loading controls in the LOW position.

Swan has provided an interesting tuning aid. A tuning eye, as used in many broadcast-band fm receivers, is used to allow constant monitoring of transmitted relative power output. As shown in Fig. 2, a small amount of rectified voltage from the 1N34A is applied to the grid of the tuning eye; the greater the rf power output, the greater the rectified voltage, and the more the tuning eye closes.

On cw, the 600-T may be operated full or semibreak-in. For the latter, the VOX accessory, VX-2, must be incorporated. Switching func-



Spectral analysis of the 600-T output under two-tone test conditions. The third-order distortion products are only 16 dB below the two-tone output. (The Panoramic scale is calibrated in dB below a single tone. To convert this scale for a two-tone test, subtract 6 dB from figures indicated at the left side of the scale. The line directly above 20 is equal to 10.)

tions from receiving to transmitting are automatic when the key is depressed. VOX-relay drop out may be delayed by varying a potentiometer. Full break-in does not require the use of the VX-2, but an external T-R switch or separate antennas for the receiver and transmitter are required. The 600-T can be operated manually by placing the front-panel function switch in the TRANS position. Receiver muting is accomplished either by an internal relay (in the semibreak-in mode) or a transistor (in the full break-in position). The 600-T uses grid-block keying.

For phone operation, the transmitter must be operated push-to-talk unless the optional VOX accessory is added. A front-panel switch allows the operator to use the opposite sideband (such as usb on 40 meters) if desired. The 600-T has a built-in power supply which surprisingly does not crowd components on the chassis. The final amplifier tubes get quite warm during periods of operation. The only station accessory items needed to put the 600-T on the air are a 117-volt power source, an antenna, and a mike (or key).

Other Comments

The Swan twins may be operated transceive using either the transmitter or the receiver VFO or they may be operated as separate units. VFO selection is accomplished by a front-panel switch on the receiver. Cw transceive operation on either VFO is possible. The cw carrier frequency is shifted 800 Hz above the receiver frequency,

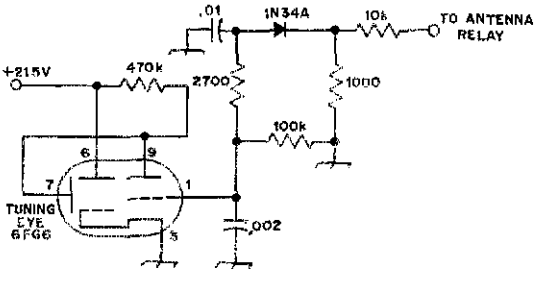


Fig. 2 – 600-T tuning eye circuit.

Swan 600-R Receiver and 600-T Transmitter

600-R:

Sensitivity (for 10 dB Signal-to-Noise plus noise): 3.8 MHz – 0.1 μV; 7.1 MHz – 0.17 μV; 14.2 MHz – 0.1 μV; 21.3 MHz – 0.12 μV; 28.0 MHz – 0.1 μV.*

Selectivity: 2.7 kHz. Optional filters available for a-m and cw.*

Stability: See Table I.*

Image rejection: Better than 50 dB.*

Dial Calibration: Every 2 kHz for 80 through 15 meters; for 10 meters every 5 kHz.

Dial backlash: Unnoticeable.*

Dimensions (HWD) and Weight: 6-1/2 × 15 × 12 inches, 23 pounds.

Power requirements: 117 V ac, 120 watts.

Price class: $440.

600-T:

Power output: 3.7 MHz – 250 watts; 7.1 MHz – 310 watts; 14.1 MHz – 270 watts; 21.2 MHz – 280 watts; 29.0 MHz – 150 watts. (Key-down operating conditions.)*

Plate Voltage: Key up – 930 volts; key down – approx. 800 volts.*

Intermodulation Distortion Products: Approx. – 16 dB for third-order products. (See photograph of analyzer display in text.)*

Carrier Suppression: Better than 50 dB.*

Keying: Grid block.

DC Power Input to PA: 600 watts PEP for ssb, 500 watts for cw, 150 watts for a-m, 100 watts for RTTY/SSTV.*[1]

Amplifier Output Circuit: Pi network.

VFO Stability: Approx. the same as the receiver.*

Dial Calibration: Same as the receiver.

Power Amplifier Tubes: Pair of 6KD6s operated in parallel.

Meter Functions: Cathode current (relative output indicated by a tuning eye).

Dimensions (HWD) and Weight: 6-1/2 × 15 × 12 inches, 32 pounds.

Power Requirements: 117 V ac, 6.2 amperes (key down). Power supply is built in.

Price Class: $590.

Manufacturer: Swan Electronics, Oceanside, California.

*Test measurements made in the ARRL Lab.

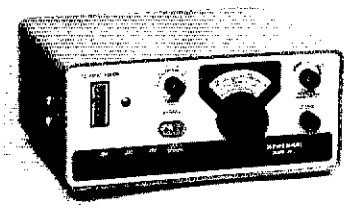
[1]Ten meter input measured at 400 watts.

allowing the operator to cw transceive without having to listen to an uncomfortably high beat note.

Both transmitter and receiver use dual-ratio main-tuning knobs. The inner knob is used for fast frequency excursions and the outer one provides fine tuning. In the author's opinion, VFO accuracy leaves something to be desired. An inaccuracy of one or two kHz per 25 kHz on the cw bands is not uncommon. Accuracy is greatest on the phone bands. Changing from cw band to cw band is, at best, a time-consuming chore. Although the 600-T instruction manual is complete and informative, the receiver manual lacks a circuit diagram. It is assumed this is a simple oversight by Swan! – *W1GNC and WA1PID*

QST —— QST —— QST

Heath HW-7 CW QRP Transceiver



PRACTICES OF PAST eras seem to return and tantalize the radio amateur from time to time. The remarkable curtain call for fm as a mode of communication is a sparkling example. Still another, and one that stirs nostalgia, is "straight key night," held each year. It would be difficult to pinpoint the stimulus that has incited so many radio amateurs into activity in the once-necessary QRP field, but testimony to the popularity of low-power operation is evident when listening to the phone and cw portions of our hf bands. Perhaps the QRP enthusiast is motivated in part by one philosophy of the day, . . . a retreat from material wealth and status. The trend is toward a less complicated way of life, or so it seems, where simplicity is the life style. The application of personal skills seems to be of greater value to some than is the need to acquire recognition through affluence and showmanship. Certainly the QRP operator must exhibit unusual operating skill if he is to compete successfully with his QRO fellows. A QRP rig isn't likely to be regarded as a status symbol in one's shack; the size and the cost (both modest) negate such a possibility. For some, things have become too easy with respect to working WAS, WAC, or DXCC. Big antennas and high power will get the job done quickly if the operator is skilled and courteous, but the challenge does not sharpen one's appetite quite so markedly as when operating in the QRP class.

Heath Company has put QRP operation within the reach of anyone willing to invest less than $75, and their HW-7 provides for operation on 40, 20, and 15 meters. The package is small enough to be tucked under the owner's arm and carried to a camp site, picnic spot, or friend's home. The transceiver can be powered by batteries (12 V) or an ac-operated dc supply. Maximum current taken by the unit is approximately 400 mA during transmit periods. Because of the low duty cycle of cw operation the camper should be able to do plenty of operating with a lantern battery or similar source. Rf power output is in the 2-watt class on all three bands. Shades of the 01A vacuum tube! We *are* being haunted by our past!

Some Early Problems

The specific unit treated in this review came in kit form and was assembled by the writer. Some significant problems with the performance of the transmitter and receiver sections became manifest during initial testing. It was possible to tune the PA in such a manner as to obtain spurious output at 28, 14, 12, and 7 MHz during 15-meter operation. The peak in relative rf-output reading was so poorly defined that it was not possible to tell which peak was the desired one (21 MHz).

While testing the receiver it was observed that strong hf-band commercial stations tended to blanket the amateur band being listened to, despite careful peaking of the front end. Similarly, blanketing from nearby bc-band stations occurred when using antennas other than beams or resonant verticals.

A number of circuit modifications were made by the writer, and the difficulties were cleared up one at a time. The matter was called to the attention of the engineering staff at Heath. After considerable dialogue with the Heath engineers by phone and letter, three of them came to Newington to consult with the ARRL technical staff in an effort to investigate and resolve the problems.

The flaw in the transmitter turned out simply to be a defective component (Zener-diode clamp in the collector circuit of the PA stage). Once it was replaced, the instability and spurious-output problems were resolved. Some of the circuit changes recommended were adopted by Heath and are being offered to early-model owners in a modification kit. The ARRL Hq. staff was much impressed with Heath's concern over the questions raised, and with the dispatch in which they came east to resolve the problem. The remainder of this report deals with performance after the circuit modifications were made.

Circuit Features

Reception is provided by a direct-conversion receiver that has a dual-gate MOSFET product detector as a front end. A single-tuned circuit