

# The National NC-105 Receiver

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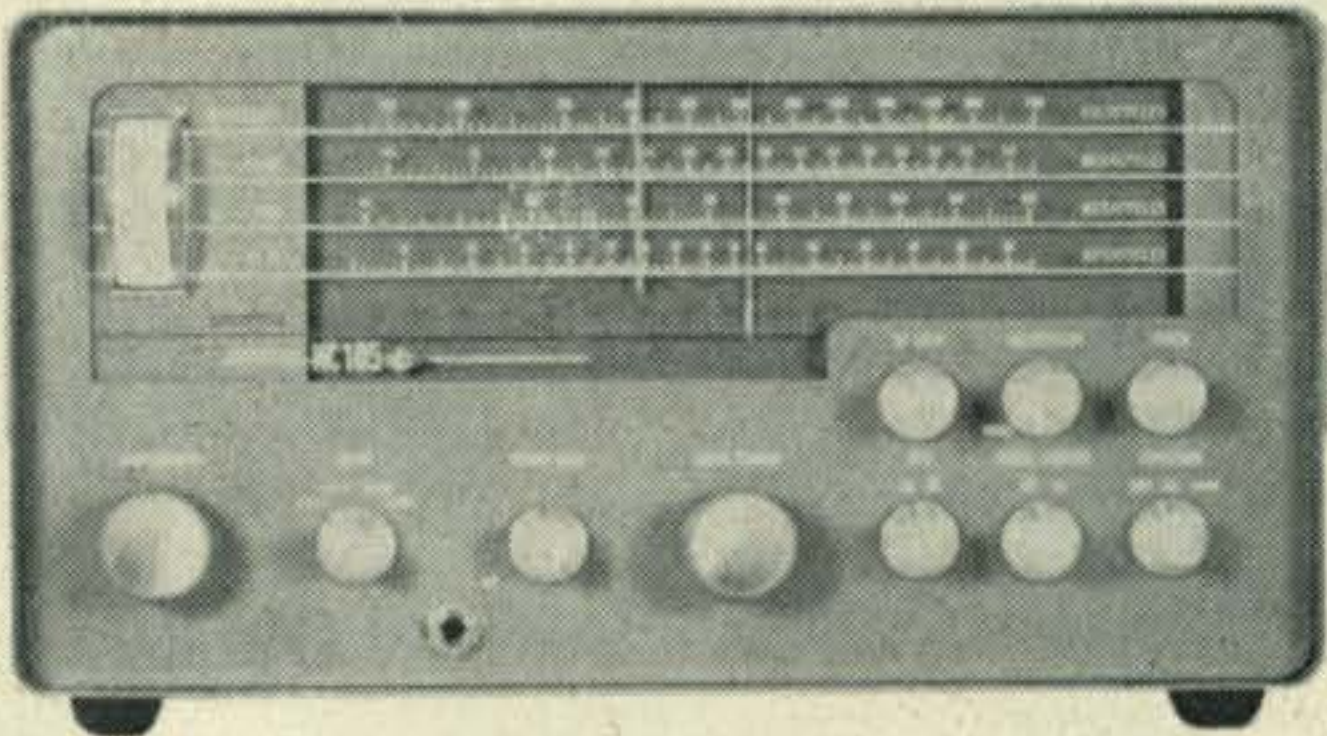
NATIONAL RADIO COMPANY has brought out a new general coverage receiver, the NC-105, which is intended for the beginning ham and the short-wave listener. Its 0.55 mc to 31 mc frequency range is covered in 4 bands, and a 0-100 logging dial provides bandspread for the amateur and short-wave bands. The set is transformer operated and employs six tubes (including a rectifier) in a single conversion (i.f. is 455 kc) circuit. A.m., c.w., and s.s.b. reception are provided for, and selectivity control is achieved by a peaking-type Q-multiplier. A five-inch speaker is mounted on the top underside of the blue-gray metal cabinet and an S-meter is located on the front panel. A complete tabulation of the receiver's specifications is given in Table I.

### Detailed Circuit Description

A block diagram of the NC-105 is shown in fig. 1. A 6BE6 pentagrid converter is used for the local oscillator and mixer functions. The oscillator section consists of a series-fed Hartley; for the 11 mc to 31 mc band, a plate tickler circuit is employed. The oscillator tunes at a higher frequency (455 kc higher) on all bands except the 11-31 mc range.

A 6BA6 is used for each of the i.f. stages.

An R.F. GAIN control is incorporated in the cathode circuit of the first i.f. The secondary winding of the 2nd i.f. transformer is employed as a tank circuit for a regenerative type Q-



Front view of the NC-105. The controls are, bottom row, l. to r.: Bandspread, Band, Audio Gain, Main Tuning, BFO, Noise Limiter, and Function. For the upper row, the controls are l. to r.: RF Gain, Selectivity, and Pitch. The phone jack is mounted between and below the Band and Audio Gain controls.

multiplier. Regeneration is controlled by a pot (SELECTIVITY) in the cathode circuit of the second i.f. stage. As more regeneration is introduced the "Q" increases and the receiver is thereby made more selective. The selectivity can be varied from 5 kc to 500 cps.

The output of the 2nd i.f. stage is fed to one diode portion of a 6T8 (triple-diode triode) which serves as an a.m. detector and furnishes the a.g.c. voltage. The a.g.c. is returned to the 1st i.f. (and converter *only* on the standard broadcast band). Audio output from the detector goes through the AUDIO GAIN control to the triode amplifier section of the 6T8. It is then coupled to the pentode half of a 6AW8 (pentode-triode) which acts as the power amplifier for the five-inch speaker. A front panel-

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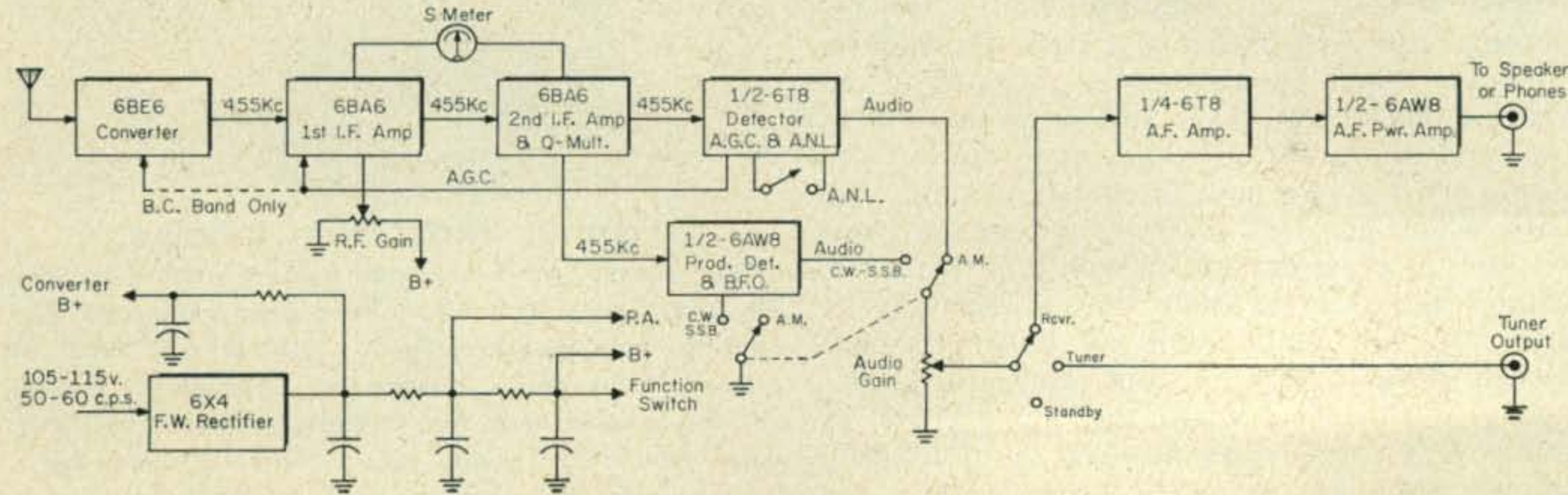


Fig. 1—Block Diagram of the NC-105 receiver.

Rear view of the NC-105. The jack to the right of the linecord is used for the "tuner" output. To the right of this, is the setting pot for the S-meter. Speaker is permanently mounted in the cabinet and is disconnected from the chassis by pin jacks.

mounted phone jack may be used for headset operation.

The triode portion of the 6AW8 is employed as a Hartley b.f.o. and as a product detector. Tuning of the shunt-fed Hartley b.f.o. circuit is accomplished by a slug-tuned coil (PITCH control). The input of the product detector is derived from the 2nd i.f. stage. The product detector is utilized for c.w. and s.s.b. operation; the diode detector is employed for a.m. reception.

Automatic noise limiting (ANL) is obtained from another diode portion of the 6T8, which is used in a series gated circuit. A front panel switch, ANL, turns the automatic noise limiting function ON or OFF.

The transformer operated power supply employs a 6X4 full-wave rectifier circuit. Filtering is accomplished by a 2-section R-C pi-filter and a separate filter is used for the converter stage (see fig. 1).

The S-meter circuit is an interesting one. Referring to fig. 2, the S-meter is connected between plate decoupling resistors  $R_1$  and  $R_2$  of the first and second i.f. stages, respectively. Because the a.g.c. voltage is applied to the 1st i.f., this changes the voltage drop across decoupling resistor  $R_1$ , and causes the S-meter to indicate relative signal strengths. Resistor  $R_1$  is a rear-mounted screw driver adjusted pot which is also used for "setting" the meter.

The receiver may be used as a tuner for an external audio system, such as hi-fi, tape recorder, etc. For this operation, the FUNCTION control is set to TUNER position and the audio is obtained from a rear-mounted jack.

### A.G.C. Action

This test was performed on the 80 meter band. Using a 400 cps, 30% modulated carrier, the input voltage to the receiver was varied by -80 db (from 100,000  $\mu$ V to 10  $\mu$ V). Variation in output voltage (measured across the speaker) was found to be -34 db. This performance is typical for this kind of receiver.

### Receiver Operation

Considering the price range (\$119.95), the performance of the NC-105 is quite satis-

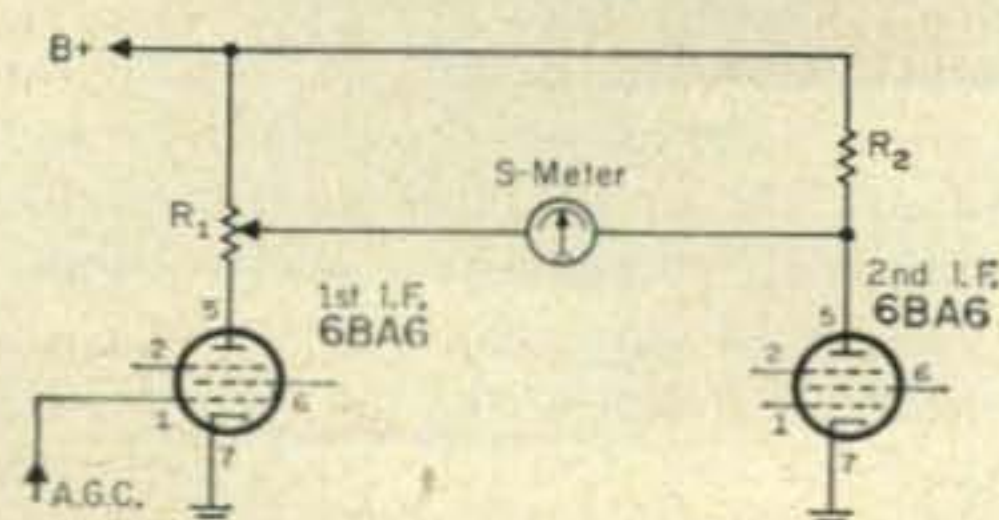
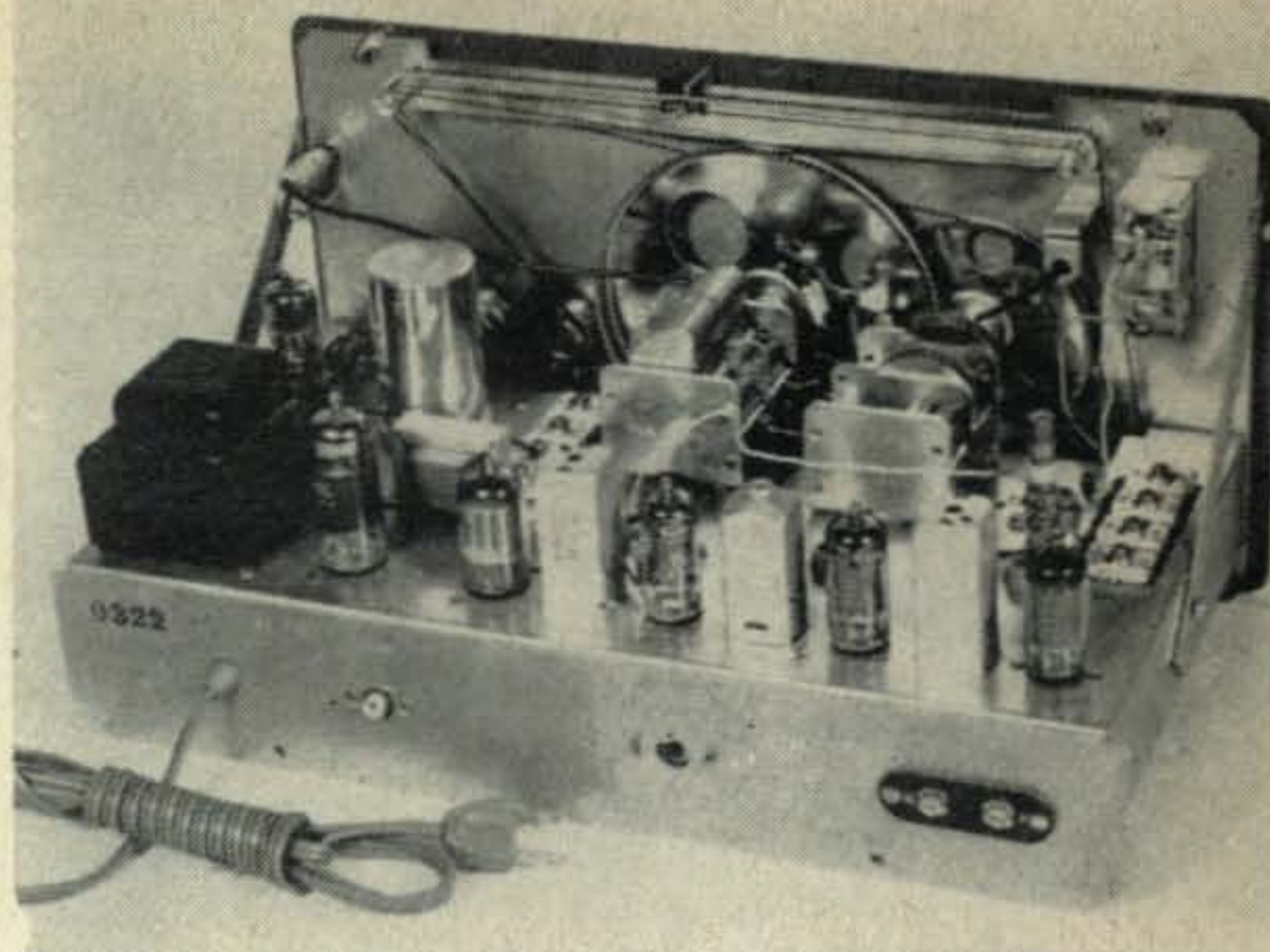


Fig. 2—Circuit of the S-meter as used in the NC-105.



factory. Using a 15 foot length of wire tacked to the wall for the antenna, the receiver pulled in many commercial short-wave and amateur stations. The set is "peppy" and the Q-multiplier aids in reducing QRM. The instruction book contains approximate dial calibration charts which can be used with the 0-100 logging scale. Chassis construction and wiring of the NC-105 are neat. The cabinet styling, in blue-gray or walnut finish, should please most people.

As would be expected, a single conversion receiver (455 kc) with no r.f. stage allows images to get through at the higher frequencies. The NC-105 receiver is no exception. It was also noted that the power transformer ran very warm after a couple of hours of use.

When moderately strong signals were tuned in, the S-meter usually pinned itself. With the receiver set to "tuner" output, some audio feedthrough was heard in the receiver's speaker. This is deliberate and serves as a monitor.

To aid in troubleshooting, it would have been nice if a tube-pin voltage chart were included in the otherwise fine instruction manual.

TABLE I: NC-105 SPECIFICATIONS

|                    |                                                                                                                |
|--------------------|----------------------------------------------------------------------------------------------------------------|
| Main Tuning Ranges | 550-1600 kc (Broadcast Band), 1.6-4.5 mc, 4.0-12.0 mc, 11.0-31.0 mc.                                           |
| Bandsread          | 0-100 logging scale. Calibration charts included in manual.                                                    |
| Circuit            | 6 tube (including rectifier) single-conversion superhet. I.f. = 455 kc.                                        |
| Antenna Input      | 50-300 ohms, unbal.                                                                                            |
| Q-Multiplier       | ON: 5 kc to 500 c.p.s., OFF: 7 kc.                                                                             |
| S-Meter            | Calibrated to S-9 and in db above 9. Operates on all modes (a.m., c.w., s.s.b.).                               |
| Noise Limiter      | Automatic, in series gated circuit. Can be turned off.                                                         |
| Detector           | For a.m.: diode; for c.w. & s.s.b.: product detector.                                                          |
| Audio              | 5-inch, 3.2 ohms built-in speaker. Output available for phones or external speaker. Tuner output available.    |
| Power Requirements | 49 watts, 105-125 volts, 50-60 c.p.s.                                                                          |
| Dimensions         | 7 $\frac{5}{8}$ high $\times$ 13 $\frac{1}{2}$ wide $\times$ 8 $\frac{5}{8}$ deep. (Shipping weight = 32 lbs.) |
| Price              | \$119.95 in blue-gray metal cabinet. \$139.95 in walnut cabinet (Model No. NC-105W).                           |