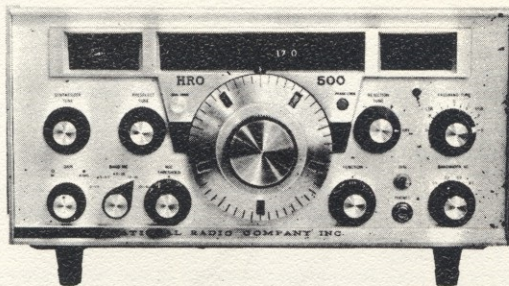


NATIONAL RADIO COMPANY, INC.



HRO-500 SOLID STATE HF/VLF COMMUNICATIONS RECEIVER

The National Radio Company HRO-500 is a completely solid state communications receiver with a frequency range greater than that of any other unit available today. All facilities are incorporated for AM, CW, and SSB reception between five kilohertz and 30 megahertz, with unusually accurate dial calibration, high frequency stability, and ease of operation. The HRO-500 is currently in use by every major government agency in the United States for HF/VLF point-to-point communications, monitoring, and for laboratory instrumentation applications, and has rapidly become accepted as the finest and most versatile commercial receiver available for such use.

Complete transistorization provides a very high MTBF, together with minimal heat generation and power requirements, and allows the HRO-500 to be used in portable or field applications barred to existing vacuum tube equipment. Ease of operation, accuracy of dial calibration, short and long-term stability and sensitivity are demonstrably superior to competitive tube equipment, and offer a performance combination unequalled by any other commercial receiver.

The HRO-500 is remarkably compact in size and weight, and may be either table or rack mounted. In addition, a fully portable version is available with self-contained power, loudspeaker, and waterproof carrying case.

SUPERIOR FEATURES OF THE HRO-500 RECEIVER

- Complete coverage of the entire VLF/HF spectrum between five kilohertz and 30 MHz, with the same superb dial calibration, stability, and tuning rate throughout.
- Total transistorization for maximum reliability and versatility with minimum heat generation and power requirements.
- MTBF per NAV-SHIPS 93820 of 3820 hours results from conservative circuit design and proper de-rating of all components.
- Operates (with no need for accessory supplies) from 117/234 V.A.C. or 11-16 V.D.C. sources. Current drain at 12.6 V.D.C. is only 200 mA.
- Complete SSB, AM, MCW, and CW facilities, including both product and diode detectors; *Passband Tuning* of filter for true selectable sideband reception; fast attack, slow decay AGC; and four discrete bandwidths from 500 Hz to 8 kHz.
- Dial calibration accurate to one kilohertz over the entire frequency range, with bandspread of $\frac{1}{4}$ " per kilohertz and 24 feet per megahertz.
- Selectable tuning ratio of either 10 kHz or 50 kHz per revolution of main tuning control for choice of rapid band-scanning or fine tuning at will.
- "Instant-on" operation with no warm-up period required.
- Superb short and long term stability — nominal stability, including $\pm 27\%$ change in A.C. input voltage, better than 100 Hz per day and 50 Hz per °C.
- Frequency determination by means of phase-locked crystal frequency synthesizer assures maximum stability and elimination of band-to-band recalibration.
- Sensitivity and image rejection (averages 80 dB, minimum 50 dB) superior to the previous standard of comparison — the earlier HRO receivers.
- Unusually flat audio response — 100 Hz to 5500 Hz within 6 dB, with over 2 watts of available audio output.
- Complete remote control provisions including AF and RF gain, BFO on-off, receiver mute, and power on-off.
- All necessary oscillator, AGC, I.F. and detector outputs provided for use with accessory equipment.
- May be either table or rack-mounted (with accessory RMK-5 rack mounting kit).
- Compact size and light weight — $7\frac{1}{8}$ " H, $16\frac{1}{2}$ " W, $12\frac{3}{4}$ " D. Weight only 32 lbs.

SPECIFICATIONS

HRO-500 SPECIFICATIONS

FREQUENCY RANGE: Five kilohertz to 30 MHz in sixty 500 kHz bands, continuous coverage.

MODES: Selectable upper or lower sideband, MCW, FSK, AM, CW.

POWER REQUIREMENTS:

A. Pilot lamps switched off

1. 117/234 V.A.C. 50-60 Hz; 10 watts at 50 mW audio output, 15 watts at 1.5 watts audio output.
2. 12.6 V.D.C.; 2.5 watts (200mA) at 50 mW audio output, 6.5 watts (525mA) at 1.5 watts audio output.

B. Pilot lamps switched on

1. 117/234 V.A.C. requires additional 7 watts
2. 12.6 V.D.C. requires additional 590 mA.

CALIBRATION ACCURACY: Within one kHz over any 500 kHz band.

SYNTHESIZER ACCURACY: Within 250 Hz over entire tuning range when zeroed at 10 MHz.

RESET ACCURACY (Including Visual Error): Within 250 Hz.

TUNING DIAL BACKLASH: Less than 50 Hz.

TUNABILITY: Within 2 Hz.

MAIN TUNING RATIO: Two-speed; 50 kHz/revolution (flywheel) or 10 kHz/revolution.

MAIN TUNING BANDSPREAD: $\frac{1}{4}$ " per kilohertz; 12 feet per 500 kHz band.

CALIBRATOR: 50 kHz crystal controlled.

FREQUENCY STABILITY (Nominal):

A. In room ambients: 300 Hz per hour from point of turn-on to two hours after turn-on; better than 100 Hz per day thereafter.

B. With respect to temperature: 50 Hz per °C.

C. With respect to A.C. supply variation: essentially none for $\pm 27\%$ change.

R.F. INPUT IMPEDANCE: 50 ohm unbalanced (nominal); also separate high impedance unbalanced input for use with random antennas.

SENSITIVITY (500 kHz-30 MHz):

A. AM (Nominal): Better than $2.0 \mu\text{V}$ for 10 dB S+N/N

B. SSB/CW (Nominal): Better than $1.0 \mu\text{V}$ for 10 dB S+N/N.

SENSITIVITY (Five kHz-500 kHz): 25-200 μV for 10 dB S+N/N without LF-10 preselector; equal to HF sensitivity when LF-10 preselector is used.

SELECTIVITY:

A. 6 dB bandwidths available; 500 Hz; 2.5 kHz; 5.0 kHz; 8.0 kHz.

B. Filter Design: six-pole LC type operating at 230 kHz; tunable through 6 kHz range in 500 Hz and 2.5 kHz bandwidths.

C. Filter shape factor (Nominal): 2.5:1 (6-60 dB) in 2.5 kHz bandwidth.

D. Audio filtering provisions incorporated in LF-10 preselector.

HETERODYNE REJECTION FACILITIES: 230 kHz bi-filar notch (REJECTION TUNE control) with ± 10 kHz range around IF passband; minimum rejection capability of 50 dB. Also, PASSBAND TUNE control (of tunable six-pole filter) permits rejection of adjacent channel interference without change in frequency of desired signal.

IMAGE REJECTION (500 kHz-30 MHz): Averages 80 dB; minimum 45 dB.

INTERNALLY GENERATED SPURIOUS SIGNALS: Between 500 kHz and 30 MHz, all less than 1.0 μV equivalent except for two discrete high-amplitude responses at 2.75 and 3.0 MHz. A spurious signal between 0.5 μV and 2.0 μV equivalent amplitude may exist at 500 kHz, and spurious signals up to 2.0 μV equivalent may exist at a maximum of 3 of the following frequencies: 2990 kHz, 3240 kHz, 1.0 MHz, 28.5 MHz, or 29.5 MHz.

AGC: Time constant; 60 millisecond attack, 3 sec. delay. AGC merit; average 5 dB output change for input increase from 10 to 100,000 μV .

AUDIO FREQUENCY RESPONSE: 100 Hz-5500 Hz within 6 dB.

AUDIO OUTPUT DISTORTION: Less than 10% at 2.0 watts.

AUDIO HUM: Better than 60 dB below maximum output.

AUDIO OUTPUTS: 3.2 ohms to rear panel and front panel headphone jack; 600 ohms balanced with center tap (ground reference or floating) to rear panel.

REMOTE CONTROL PROVISIONS: R.F. Gain; A.F. Gain; Receiver Mute; BFO On-Off; Power On-Off.

METERING: Front panel meter calibrated in dB above 1.0 μV and from 0 to S-9 between no-signal and 40 dB above 1.0 μV .

AGC THRESHOLD CONTROL: R.F. input attenuator; 0-30 dB in nominal 10 dB steps.

FRONT PANEL CONTROLS: SYNTHESIZER TUNE (MHz); PRESELECTOR TUNE; PASSBAND TUNE; REJECTION TUNE; MAIN TUNING (kHz); R.F. GAIN; A.F. GAIN; BANDSWITCH; AGC On-Off-Threshold Control (to 30 dB); FUNCTION Off-Standby-SSB-AM-Calibrate; DIAL LAMPS On-Off; BANDWIDTH 500 Hz-2.5 kHz-5.0 kHz-8.0 kHz; DIAL LOCK; PHASE LOCK Warning.

REAR PANEL CONTROLS: S-Meter Zero; Rejection Tune Balance; 117/234 V.A.C.-12.6 V.D.C. Selector Switch.

REAR PANEL OUTPUTS: BFO (230 kHz, 47 ohm, 100 mV); VFO (2980-3480 kHz, 100 ohm, 100 mV); synthesizer (500 kHz increments between 7.25 MHz and 32.75 MHz, 330 ohm, 100 mV); 26 MHz oscillator (50 ohm, 100 mV); I.F. 1K ohm, output dependent upon signal level); detector (10,000 ohm, output dependent upon signal level); audio; two spare connectors.

REAR PANEL INPUTS: 50 ohm unbalanced H.F. antenna; high impedance unbalanced H.F. antenna; low frequency; 117/234 V.A.C.; 12.6 V.D.C.; sidetone oscillator or external audio.

REAR PANEL VOLTAGE OUTPUTS: +12 V.D.C., +11 V.D.C., +10 V.D.C., +7.5 V.D.C. regulated, +5 V.D.C. regulated, +1.5 V NPN A.G.C., +9 V PNP A.G.C.

ENVIRONMENTAL CONDITIONS:

A. Ambient operating temperatures: -20°C to $+45^{\circ}\text{C}$.

B. Humidity: to 90%.

MTBF: 3820 hours per NAVSHIPS 93820.

SIZE: 7 $\frac{1}{2}$ " H, 16 $\frac{1}{2}$ " W, 12 $\frac{3}{4}$ " D.

WEIGHT: 32 pounds.

ALTERNATE CONFIGURATIONS: RMK-5 rack mounting kit for HRO-500 installation (per Mil-Std. 189) in 8 $\frac{3}{4}$ " H x 19" W rack space.