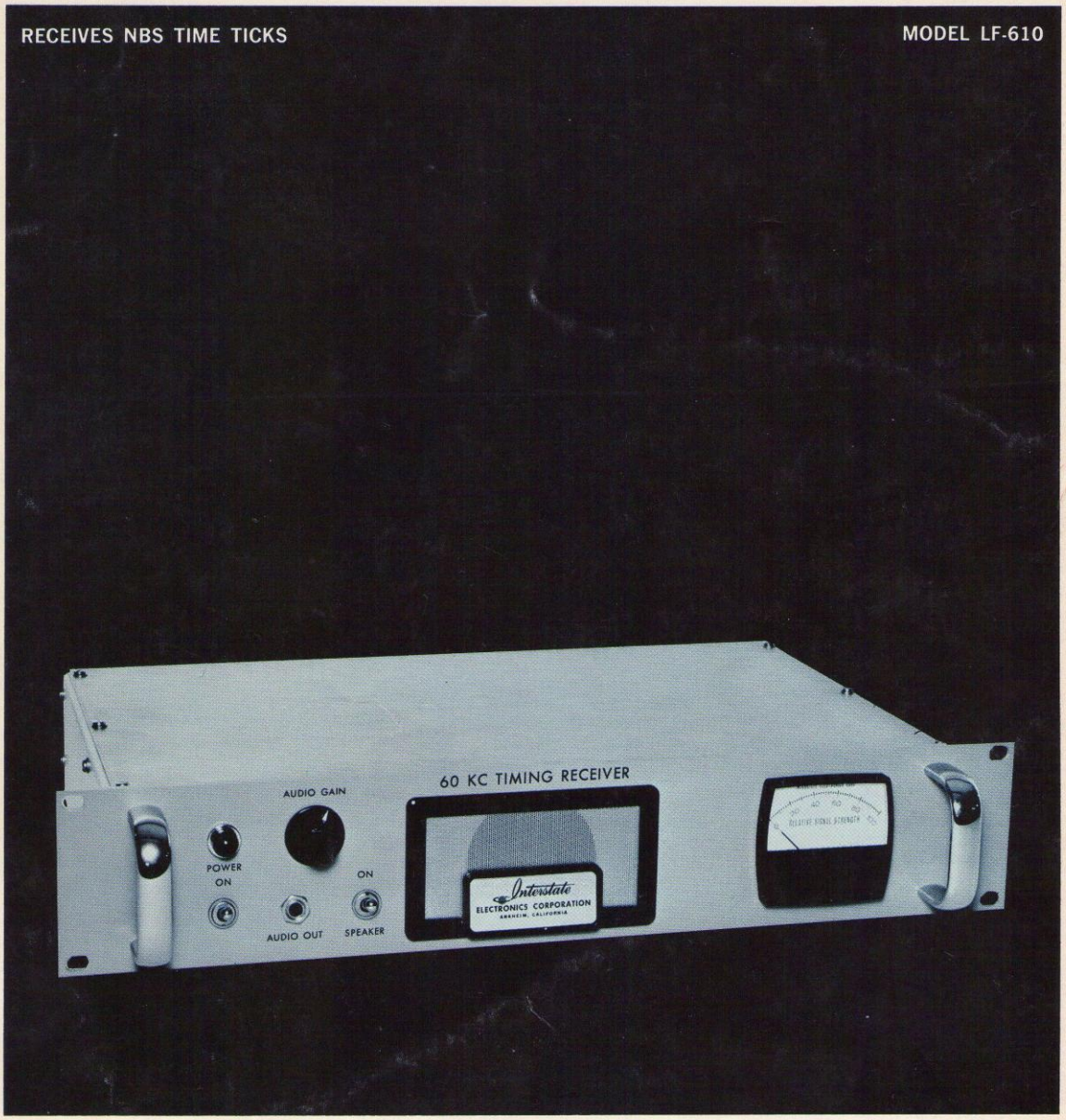
60 KC WWVB TIMING RECEIVER

RECEIVES NBS TIME TICKS

MODEL LF-610



ANOTHER *Interstate* SOLID – *state* INSTRUMENT

THE LF-610 RECEIVER
All Solid State
Self-contained power supply

MODEL LF-610 60 KC TIMING RECEIVER IS ALL THAT IS NEEDED TO PROVIDE U.S. NATIONAL BUREAU OF STANDARDS TIMING SIGNALS AT ANY TIME, DAY OR NIGHT, ANYWHERE IN THE CONTINENTAL UNITED STATES.

Designed specifically to receive the once-per-second precision time ticks broadcast continuously on a carrier frequency of 60 KC, the LF-610 is a direct rf link to the National Bureau of Standards. It receives the radiation transmitted by NBS from Ft. Collins, Colorado. Because of the nature of propagation of this 7KW low frequency carrier, reception is dependable 24 hours a day year around, with precisely known propagation delay, anywhere in the continental United States (in contrast to the variant nature of HF and VHF receptability).

TIMING SIGNALS

The time ticks transmitted by WWVB consist of five cycles of 1KC carrier modulation each second. Minutes and hours are identified by additional 1KC modulation. Accuracy of these timing modulations is precisely controlled by NBS.

When used for time-of-day correlation, in conjunction with a precision clock or time code generator, time can be determined to an accuracy of 0.1 to 0.5 milliseconds. The same techniques are used with the LF-610 as have been previously used with time signals broadcast from WWV and WWVH.

The time delay in the arrival of the signal is easily calculated to a higher degree of accuracy than those transmitted by high frequency stations for the region beyond the high frequency ground wave.

FREQUENCY CALIBRATION

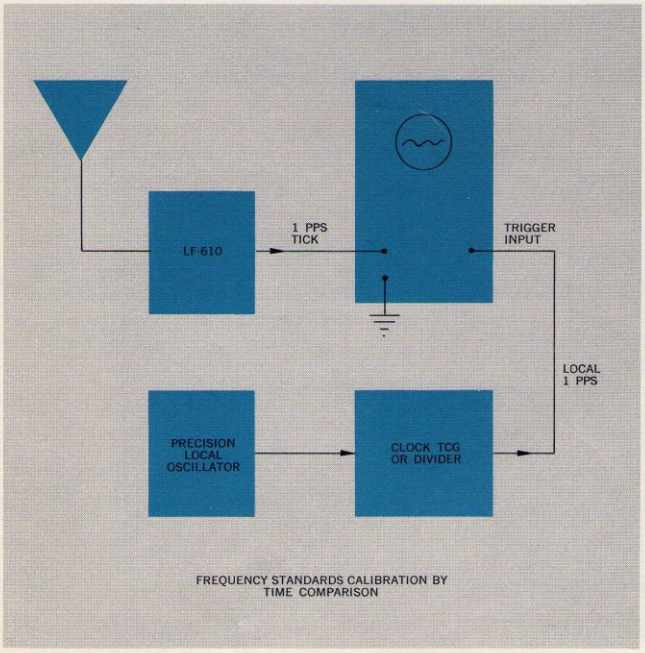
Frequency standards may be calibrated and monitored, using standard techniques, as shown in the diagram. The "time tick" output of the LF 610 is connected to the vertical input of a triggered oscilloscope with a calibrated time base. The one pulse per second output of a precision clock, time code generator, or other frequency divider is used to trigger the oscilloscope. At the start of a test, the "time ticks" and local 1 PPS may be as much as one half second apart. By successive adjustment of the local tick generator phasing and the oscilloscope sweep speed, a condition is established where the two ticks are at or near time coincidence. The amount of local phase shift necessary to re-establish this condition in later tests, or the amount of drift of the local 1 PPS indicates the time drift of the local oscillator. By plotting the data obtained over a period of time, drift rate and frequency offset of the oscillator may be determined very accurately.

Frequency comparison to a few parts in 10^{10} can be made in 24 hours, instead of several days as required when HF, WWV or WWVH transmissions are used.

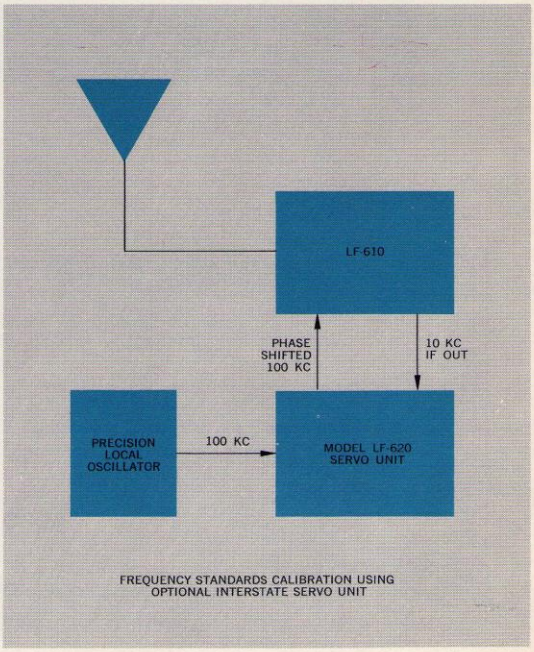
Another method of frequency calibration requires the use of an Interstate Model LF-620 Phase Tracking Servo Unit in conjunction with the LF-610 (See diagram). This technique automatically plots the relative phase of the 60 KC carrier and the local frequency source.

SPECIFICATIONS

Input Frequency	60 KC, Fixed Tuned	Antenna	50 ohms unbalanced
IF	3-stage 10 KC	Sensitivity	0.3 microvolt for time ticks 0.1 microvolt for frequency
Local Oscillator	100 KC crystal-controlled; Internal Divider to 50 KC	RF Bandwidth	2.2 KC
Power Input	115 VAC, 50 / 60 cps, 12 Watts	Image Rejection	50 db min at 40 KC
		AGC Range	80 db
Outputs		Environment	0 to 50° Operating −40 to +80°C Non-Operating 0 to 95% RH
Loudspeaker	0.2 Watt switched		
Phones	High Impedance		
Time Ticks	Rear BNC 0-20 V p-p	Physical Size	3½" x 19" Rack panel, 11 inches deep not including connectors
IF	10 KC, 0.1 rms (for use with optional servo unit)		



FREQUENCY STANDARDS CALIBRATION BY
TIME COMPARISON

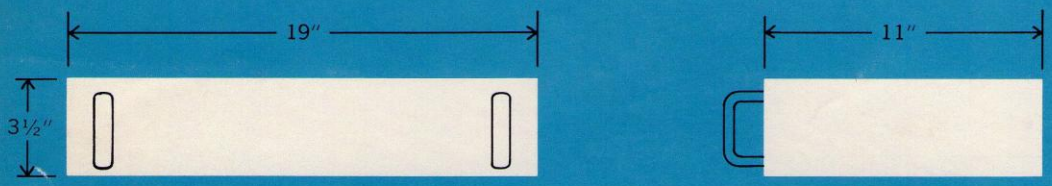


FREQUENCY STANDARDS CALIBRATION USING
OPTIONAL INTERSTATE SERVO UNIT

THE 60KC RECEIVER LF-610

In contrast to time correlation from WWV, signals from WWVB offer a higher degree of accuracy obtainable in a shorter period of time. Time signals from WWVB at 60 KC are propagated in a groundwave mode, therefore, the ionospheric jitter and propagation errors are virtually eliminated. The transmission delay between the transmitter and the receiver is easily calculated.

DIMENSIONS



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