The PTO test fixture was built by the R. L. Drake Co. Engineering Department solely to test the tracking and calibration of each PTO assembly, prior to installation in a product.

The fixture was originally built for PTO's going into the 4-line products and for the TR-4 transceiver. It was modified through out the years to coincide with the current production models, as well as older units serviced by the Service Department. The four position switch in the lower left corner allowed the selection of the product destined by the PTO being tested. The toggle switch in the lower left corner allowed the operator to select his/her task, dial calibration or tracking.

The audio could be switched on or off with a toggle switch, left of the speaker grille. The center section measured the audio frequency, the left hand control adjusted the audio gain and the right hand switch provided an expanded scale if needed. However, the 0-2000 scale was the primary scale. The top section measured the RF output and the zener voltage of the PTO under test. An R-4 receiver was used as a monitor receiver, it was rarely, if ever turned off.

The PTO's were basically all the same, with exception to the tracking and dial accuracy. The 4-line permitted a 1 kHz error between each 100 kHz point, however the total error end to end could only be 3 kHz. The RF output was to be between .4 and .6 volts. In addition there was to be at least 55 kHz travel between each end and the stop pin. The 4-line PTO's that didn't quite make the calibration error were tagged for the SW-4A receiver.

The TR-4 transceiver PTO was permitted to have 1 ½ kHz error at the first and last 100 kHz point, 1 kHz error in the middle and a total end to end error of 3 kHz. The RF output was also to be higher, .4 to .7 volts. The end travel was 7 kHz before hitting the stop pin.

The TR-4 PTO's with the highest RF output were tagged for the RV-4, as the additional output was needed to make up for any loss in the inter-connecting cable to the TR-4. The TR-6 used the same PTO as the TR-4, with a different dial.

The C-line PTO had the same specifications as the older 4-line PTO. The dials were changed to a dual dial configuration with 5 gears, all plastic. The dial mounting technique and gears were changed several times in an effort to reduce the problems caused by inconsistency of the plastic gears. Resulting in dial drag, backlash, and improper gear mesh.

Some of the gears were changed to anti-backlash metal gears at some point during production of the TR-4CW transceiver. Spring-loaded gears were also used, as well as the same spring-loaded gears without the springs. Early into the production of the TR-7 transceiver the metal gears were abandoned completely and plastic gears were once again used.

The calibration error of the 7-line was the same as that of the 4-line PTO. The 10 volt zener diode was omitted in the 7-line PTO and the RF output was .18 to .25 volts. The tuning fork was changed to a single prong and grounded with a small piece of ground braid to the PTO frame.

The PTO Assembly Procedure read as follows:

1. **Due to hysteresis characteristics of components, the complete PC board and components should be submitted to the temperature box at +50 degrees C for at least 4 hours before assembling coil.**

2. **The coils should be wound as tight as possible (tension tight enough that about 1 in 20 breaks the wire).**

3. **After winding the coils they should be submitted to the temperature box at +60 degrees C for at least 4 hours.**

4. **Brush a thin coating of Humiseal on the finished coil while still warm.**

5. **Let the Humiseal air dry (12 hours) on the coils before testing.**

6. **Track the PTO over its frequency range by adding appropriate tracking capacitor and test for temperature compensation.**

7. **Place PTO in drift box at room temperature and adjust frequency for a 1500 Hz beat against monitor receiver.**

8. **Turn on the drift box heaters and blowers allowing the internal temperature to come up to + 50 degrees C.**

9. **Leave in temperature box at elevated temperature for one hour and recheck frequency beat note.**

10. **Determine drift by noting error from original 1500 Hz beat note.**

11. **If error exceeds 500 Hz, change temperature-compensating capacitor and repeat steps after 6.**

12. **If error is less than 500 Hz, install appropriate dial and calibrate.**

13. **Needless to say, there were always several PTO's in the various stages of assembly and testing to keep the production lines going.**

Bill Frost