

improved frequency readout for the Collins S-line

Two paper dials
added to your
S-line or KWM-2
allow frequency
to be read
within ten Hz

A casual glance at the accompanying photos shows what looks like an ordinary KWM-2 transceiver. Closer inspection, however, reveals that something has been done to the main tuning dial. The graduated scales shown mounted to the main tuning control allow frequency to be read to 10 Hz on a unit designed to read out in kHz. All this was done with just two pieces of paper.

You might say, "I've a good eye and can estimate frequency to 100 Hz on my Collins." Perhaps. But you'd be estimating to one-tenth of a 0.1-inch (2.5mm) space. The reliability of such an estimate is certainly questionable.

preliminary checks

Before adding the frequency dials to your Collins equipment, the first step is to determine the amount of

frequency readout error that exists. After you've accurately set the vfo dial to eliminate end spread in accordance with Collins instructions, check the 100-kHz point on the dial. You'll probably notice an error of between 100 and 400 Hz. A recheck then should be made.

Put a reference mark on the desk. To avoid parallax, align the reference mark, using a magnifying glass, with the 100-kHz point. Offset the hairline 1 kHz so you're using the thinner and more precise dial marks. You'll probably find the frequency is still off at the 100-kHz check point.

If you have an accurate marker generator that goes to 5 or 10 kHz, you can check across the entire 200-kHz range. If you plot the data you'll most likely find an error curve that's somewhat sinusoidal. However, you'll seldom see more than 50-Hz error between any adjacent 5-kHz marks, even though the total error across the 200-kHz range may be as much as 400 to 600 Hz. If you had accurate 5-kHz markers and some way to read the dial to 10 Hz or so, you could plot an error curve, and by using it, be fairly sure of the frequency of any signal to within 25 Hz or better.

applying some leverage

What's needed is a bigger dial with marks, say, every 100 Hz instead of only every kHz. If you could set the dial accurately, you could also use a vernier to read to 10 Hz (and even estimate to 5 Hz).

The Collins knob turns nearly 9 revolutions to cover the 200-kHz range. The knob has a skirt circumference of about 8 inches (203mm), so if the knob skirt is appropriately marked, you would have nearly a 6-foot (1.8m) dial. If a second dial, also appropriately marked, were added to provide a vernier measurement then you would have the equivalent of a 60-foot (18.3m) dial.

And that's exactly what was done. The dials, shown in fig. 1, were made as described below and installed on my KWM-2. The dials will also work, with slight error, on the Heath SB-301, 303, and 401. The large dial is graduated in kilohertz from -10 through zero to +10. It is mounted to the Collins transceiver main tuning shaft

By Bob Gilson, W1GFC, Muhlthaler Str. 5, 8131 Starnberg-Hanfeld, West Germany

that it doesn't move (press fit). The center hole of this dial must be cut as accurately as possible so that no play exists between it and the tuning shaft.* The small dial is graduated with 10 marks for each 0.9 kilohertz and is, therefore, a 10:1 vernier. The small dial is marked from 1 to 26 for reference. This dial is cemented to the back of the Collins tuning knob.

resetability checks

Before you decide to install the dials, here are a few words of advice — learned the hard way: make a check for resetability and backlash in your unit.

Mark a reference line on the knob skirt and on the front of the transceiver (white adhesive tape works well). Carefully align the hairline at 200 on the dial and count the number of revolutions of the knob to near zero. You'll find nearly 9 revolutions will be required. Now tune from zero to 200 and see if you get the same reading. In my case I read 8 turns from 200 to 12 and 8 turns from zero to 188.5. That's an accumulative error of 0.5 kHz across the tuning range, and if linear, would be 12 Hz between any two 5-kHz marks, or 6 Hz from the nearest mark.

If you find that one full knob revolution covers about 23.5 kHz, the dials are for you. If you find the knob covers less than 22 or more than 25 kHz, the dials are not recommended.

making the dials

I used heavy printer's stock and mounted it on a Bridgeport milling machine table. Then I learned that graduating 3-inch (76mm) diameter dials with marks every 1 degree, 22.5 minutes was a chore. Finally I used a 15-inch (381mm) diameter dial. The circular table of the milling machine is readable to one degree of arc, and the crank reads to one minute and can be interpolated to 30 seconds. On a 15-inch (381mm) diameter dial, the

*The dials may be cut using a pair of dividers. Easy does it: rotate the dividers, using moderate pressure, until the dials start to separate from the paper. Then gently separate by bending back and forth. Clean the edges with fine-grit sandpaper. Editor

Closeup of Collins KWM-2 with frequency dials mounted. The equipment indicates a frequency of 14,211,220 Hz.

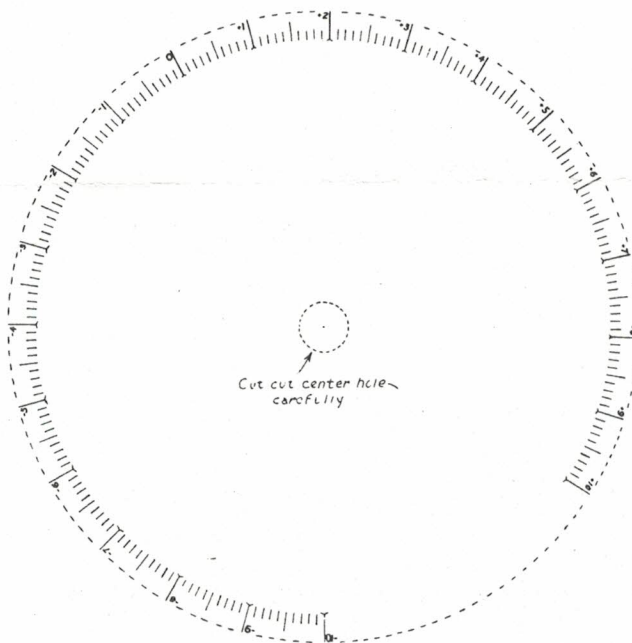
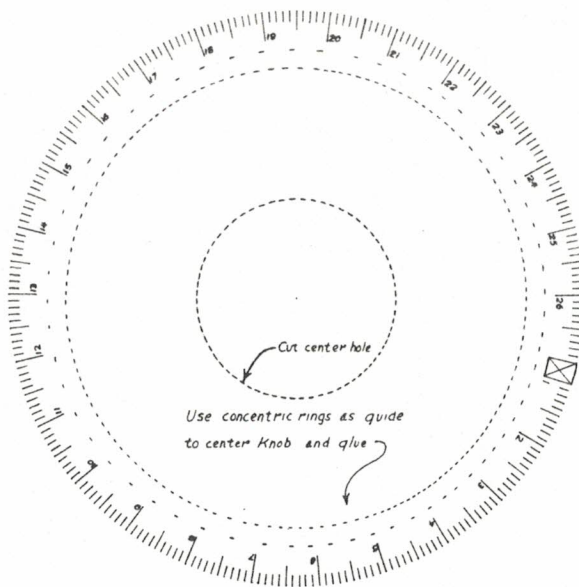
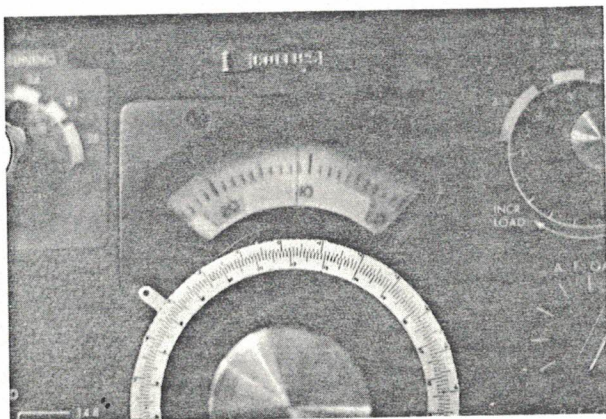


fig. 1. Frequency dials for use with Collins S-line equipment. These dials have been photo reduced from the original upsize masters, which were made on a milling machine table.

lines are 0.01 inch (0.25mm) thick. So even though the Bridgeport machine provides about 0.6 Hz resolution (in terms of frequency), the lines are 7 to 8 Hz thick. This inaccuracy, combined with occasional drafting errors, means that the average accuracy is 10 Hz or so.

The large dials were photo reduced and printed on stiff paper to 3 inches (76mm) diameter for the KWM-2. The printer did a good job — I measured 3.0010 inches (76.225mm) diameter on dial A and 3.0012 inches

(76.230mm) on dial B, using the shadowgraph method. The main thing, however, is uniformity rather than exact dimensions of the dials.

installation and use

The dials should be cut out as indicated in fig. 1. Use care with the small center hole on the large dial because it should make a snug fit on the Collins tuning shaft. Also use care in cutting the circumference of the small dial, but before mounting, check to determine correct alignment of the two scales. If, for example, you align 15 on dial B with 0 on dial A, then 10 and 20 on dial B should line up with -4.5 and +4.5, respectively, on dial A; otherwise the dials haven't been cut and centered correctly.

Remove the tuning knob (two set screws) from the shaft and slide the large dial onto the shaft. Unless you've had experience, do not remove the nut on the shaft, even though the dial isn't flush. Center the knob skirt over the small dial, using the concentric circles as a guide, then cement the dial to the back of the knob with the numbers facing out. Re-install the knob onto the shaft.

Use any accurate marker generator (10 kHz or 5 kHz if you have it) and tune to the nearest marker in the part of the band where you want to measure frequency. Tune for zero beat (or offset if you have an audio oscillator), and set the large dial to line up with one of the numbered marks (1 to 26) on the small dial. You can use 0 kHz, for example, on the large dial. In this case, the large dial would be used much like the hairline on the regular Collins dial.

Hold the large dial and rotate the knob to the signal of interest (either zero-beat or audio offset), and read kilohertz and tenths of kilohertz on the large dial. You can read hundredths of kHz on the smaller dial where the lines line up. The correct vernier lineup is the first one beyond (in the direction you moved from reference) the tenth of a kHz.

The KWM-2 in the closeup photo is indicating 14,211,220 Hz. The first number (2) of the last three digits is read from the position of reference 12 on the small dial to the right of zero on the large dial. The last two numbers (20) are shown where the vernier lines up with the large dial (two lines to the right of the 12 on the small dial).

After you've used the dials for awhile, it's suggested that you cement a tab to the back of the large dial to use as a holding tab when you turn the knob (and the other dial). If you're right-handed you may find that mounting the tab near -3 kHz will be most comfortable.

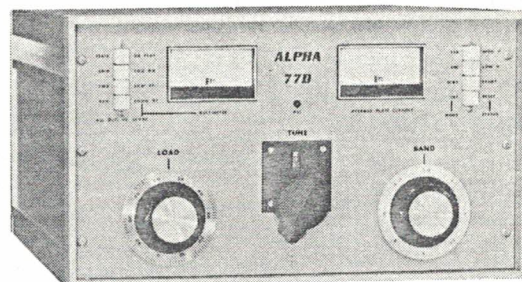
final remarks

With the dials installed I can read frequency to 10 Hz and estimate to 5 Hz. With an accurate 5-kHz marker, I feel confident that I know the frequency to 20 Hz. My objective was to read frequency accurately without a counter. I succeeded, but I had to use a counter to verify my success.

ham radio

GREAT PUNCH LINE

Any **ALPHA** Linear Will Give Your Signal Maximum Legal Power "Punch" ...



The Ultimate — ALPHA 77D

- Ultra-conservative, super-rugged design
- 1.8 through 30 MHz
- 8877 Eimac Triode
- Full QSK break-in
- Vacuum tuning and T/R
- Whisper quiet
- Full year warranty

\$2995 amateur net.

So Just Choose The Model Best Suited ...

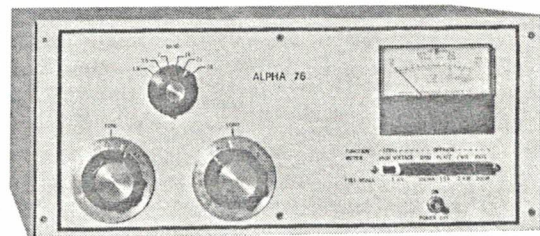


No-Tune-Up — ALPHA 374

- Bandpass or manual tuning 10-80 meters
- Maximum legal power continuous duty all modes
- Three Eimac 8874's
- Proven dependability
- Full year warranty

Immediate delivery at \$1395.

To YOUR Operating Interests And Budget!



Practically Perfect — ALPHA 76

- 2+ Kilowatts SSB PEP
- Full KW CW/FSK/SSTV
- 10-160M Standard
- Two EIMAC 8874's
- Fully self-contained
- Full year warranty

Now available for prompt factory delivery at a practical \$895.00



**EHRHORN TECHNOLOGICAL
OPERATIONS, INC.**
BROOKSVILLE, FLORIDA 33512
(904) 796-1428