

## TYPE 130

# FACTORY CALIBRATION PROCEDURE S/N 5001-up

### RECOMMENDED EQUIPMENT

500 series Tektronix scope. "L" or "B" plug-in.  
10X probe.  
180 Time Mark Generator.  
S30 Delta Standard.

### PRELIMINARY INSPECTION

Check for unsoldered joints, rosin joints, wire dress, loose hardware, and check resistance to ground of transformer primaries and power supplies. (approximately 15 K for both +270 and +150) Fuse 0.8 amp slo. Preset all internal adjustments (potentiometers and capacitors) to mid-scale.

#### 1. ZERO SET FRONT PANEL METER

Set the slotted adjustment on the front-panel meter so that the pointer indicates zero.

#### 2. CHECK POWER SUPPLY OPERATION

Turn the RANGE SELECTOR switch away from the off position. Check the +150 volt for its rated voltage  $\pm 5$  volts. If this falls outside of tolerance, try a different OA2 regulator tube.

Check the +270 volt supply for approximate voltage. The +150 volt supply will have approximately 0.3 volts of ripple and the +270 will be about 8 volts. The +150 should regulate from 105 to 125 line volts.

#### 3. ADJUST THE FREQUENCY OF THE FIXED OSCILLATOR

Connect the 10X probe to either end of C47 and set the scope Time/CM switch to  $\frac{5}{10}$   $\mu\text{sec}/\text{CM}$ . Adjust the frequency of the fixed oscillator for 7 cycles across the 10 division graticule. Now sync the scope externally from a 180 at a 100  $\mu\text{sec}$  rate. Adjust the frequency of the fixed oscillator for the same presentation as obtained on internal sync except that it will not probably be possible to stop the slow drift one direction or the other. The frequency will, however, be well within tolerance. Switch the output of the 180 from 50  $\mu\text{sec}$  through 1 millisecond. If the frequency is correct, the presentation will stay the same except for the brilliance of the trace due to the changing trigger rate. Now re-check with internal sync to see that there are exactly 7 cycles across the 10 divisions of graticule. It is possible to set the frequency incorrectly --- but checking with the other trigger speeds and with the scope calibration will eliminate this. The 140 kc fixed oscillator can also be set by comparison with an LM, an LR or any accurate frequency meter.

#### 4. SET ADJ. 1 and ADJ. 2

Turn ADJ. 1 until a meter reading is obtained. Set coarse zero to about 20 degrees from CW end. Adjust T1 for minimum reading. Connect the S-30 to the unknown jack on the 130. Set the S-30 to 0  $\mu\text{pfd}$ . Turn the 130 to the 3  $\mu\text{pfd}$  range and use the COARSE and FINE ZERO on the 130 to zero the meter. Switch to the 300  $\mu\text{pfd}$  range on the 130 and the S-30. Set ADJ. 2 for full scale (300  $\mu\text{pfd}$ ) reading. If the meter is erratic, generally a slight adjustment of ADJ. 1 will remedy this. Connect a voltmeter across R74. (20,000  $\Omega/\text{volt}$  or more) Adjust ADJ 1 to one extreme. The voltage will read in the vicinity of 50 volts. Note this reading and set ADJ. 1 for one half of this reading, approximately 25 volts. This sets the symmetry of the multivibrator. Now reset ADJ. 2 for full scale (300  $\mu\text{pfd}$ ) reading if it has drifted.

5. ADJUST FREQUENCY OF T1 FOR CORRECT RANGE

Set the RANGE SELECTOR to the 30- $\mu$ h range and set the type S-30 to the short-circuit position. Adjust the COARSE ZERO and the FINE ZERO controls for zero deflection of the meter. Now set the RANGE SELECTOR to the 300  $\mu$ h position and the Type S-30 to the +300  $\mu$ h position. Observe the error in the reading of the meter---the difference between the meter reading and 300  $\mu$ h. Adjust T1 for an error three times as great as that just observed in the meter reading. Next set the S-30 to 0  $\mu$ pf and the RANGE SELECTOR to the 3  $\mu$ pf position. Reset the COARSE ZERO and the FINE ZERO controls for a meter reading of zero. Set both the S-30 and the 130 to 300  $\mu$ pf. If there is any error here, reset ADJ. 2. Now switch the S-30 to short circuit and zero the meter on the 10  $\mu$ h range. Switch the S-30 and the 130 to 300  $\mu$ h. If there is any error here, adjust for three times the error again and re-check on the  $\mu$ pf ranges again. It may be necessary to go through these adjustments three or four times to get both the 300  $\mu$ h and 300  $\mu$ pf ranges on.

6. SET ADJ. 3, 4, 5, and 6

Set the type S-30 to 0  $\mu$ pf. Adjust COARSE ZERO and FINE ZERO controls for zero reading on the meter. (130 on 3  $\mu$ pf range.) Now adjust ADJ. 3 so that turning of the S-30 control to either the +3  $\mu$ pf or the -3  $\mu$ pf position results in a deflection of 3 on the 3  $\mu$ pf range of the meter. If the two deflections are not identical, they can be made so by a small adjustment of the FINE ZERO control. (The average of deflections can be made zero, if preferred.)

Now set the S-30 to 10  $\mu$ pf and the 130 to 10  $\mu$ pf. Set ADJ. 4 to obtain a meter reading of 10  $\mu$ pf. Next set both S-30 and 130 to 30  $\mu$ pf. Set ADJ. 5 for 30  $\mu$ pf. Set both to 100  $\mu$ pf. Set ADJ. 6 for 100  $\mu$ pf reading. Check all  $\mu$ h ranges for operation.

7. CHECK LINEARITY OF METER

Zero meter on 3  $\mu$ pf range and then switch the S-30 to 100  $\mu$ pf and the 130 to 300  $\mu$ pf. The meter error must be less than 3% of full scale.

8. SET RESIST. COMP.

Switch the S-30 to 100k. Set the 130 for mid scale deflection on the 10  $\mu$ pf range. Switch the S-30 to 1 meg. Adjust the RESIST. COMP. for minimum deflection while switching between 100k and 1 meg. If the adjustment is at the end of the range of the capacitor, it may be necessary to change V4.

9. SET THE RANGE OF THE ZERO CONTROLS

Turn the COARSE ZERO and FINE ZERO controls to maximum capacitance settings. (The maximum setting of the Coarse Zero control may not occur at the maximum CW position.) Set the RANGE SELECTOR to 10  $\mu$ pf. Disconnect the S-30 from the Unknown jack. Set C2 for a meter indication of 7.5  $\mu$ pf. Check to see that it is still possible to zero the meter by turning the COARSE ZERO in a CCW direction.

10. CHECK THE ACCURACY OF THE GUARD VOLTAGE

With no external devices or leads connected to the UNKNOWN connector, set the RANGE SELECTOR to 3  $\mu$ pf. Adjust the COARSE and FINE ZERO controls for a meter indication of  $1\frac{1}{2}$   $\mu$ pf. Touch the UNKNOWN connector with the finger, and note the direction of the meter deflection. Connect a capacitor of 100  $\mu$ pf  $\pm 5\%$  between the UNKNOWN connector and the GUARD VOLTAGE terminal. (To avoid disturbing capacitance value, hold capacitor in plastic tongs or other suitable device.) If the meter deflection is in the same direction as that obtained in the operation above, the guard voltage is low. If the change is in the opposite direction, the guard voltage is high. The percentage error in the guard voltage is indicated by the change in meter indication in  $\mu$ pf.

10. (continued)

The guard voltage tolerance is from -0.5% to +1.0%. If the guard voltage is out of tolerance, try replacing V110 (6BH6), check the values of R112 and R113, and consider replacing T1.