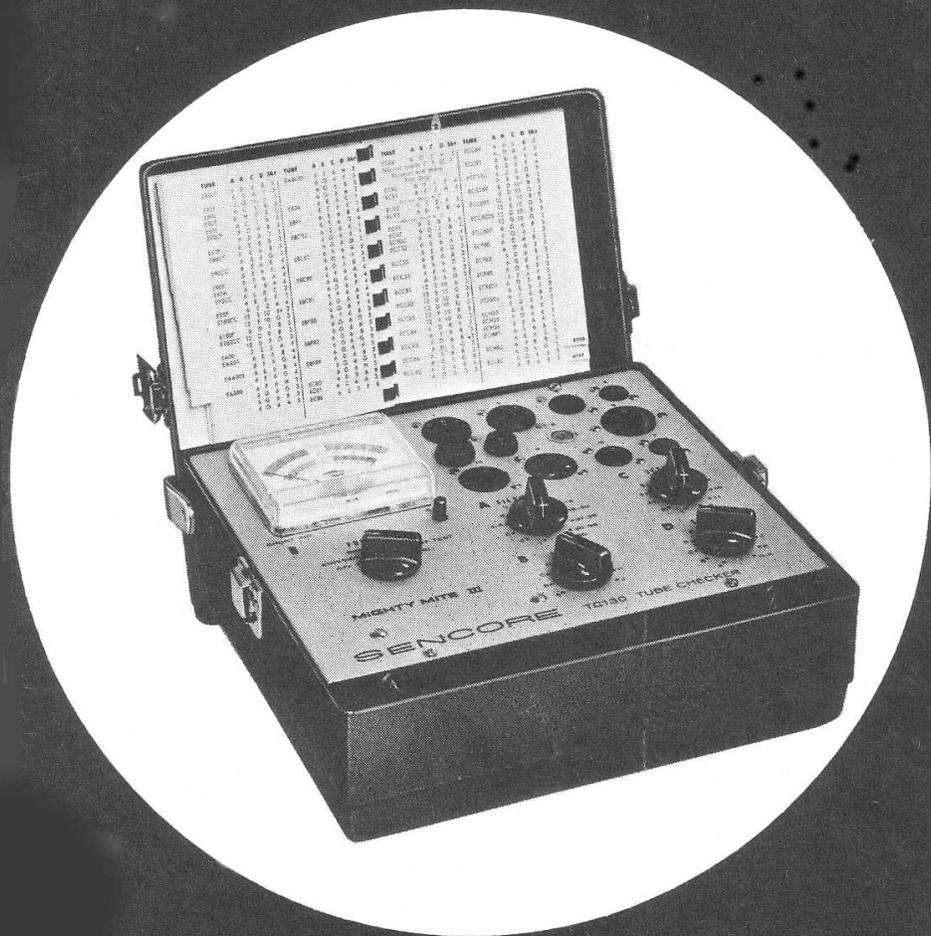


TC 130

MIGHTY MITE
TUBE CHECKER

SENCORE



SENCORE SERVICE MANUAL

426 S. WESTGATE DRIVE, ADDISON, ILLINOIS

You have purchased one of the finest instruments that the electronics industry has to offer. The TC130 is completely hand wired with no printed circuits. It has been tested completely by a competent technician and inspected twice. We know that there are many reasons why you have purchased this unit but we would like to cover all of its benefits so that you can fully appreciate them.

WHAT THE MIGHTY MITE III TESTS . . . The Mighty Mite III will test all tubes used in portable radios, auto radios, Hi-Fi sets, TV sets, and also the newest 9, 10 and 12 pin tubes recently released. It will check over 2500 tubes in addition to picture tubes. This is more tubes than any other tester in this price range and as many tubes as laboratory testers test. New listings will be sent to you for a nominal charge of \$2.00 each booklet as new charts are available, upon receipt of your signed warranty card.

WHAT THE MIGHTY MITE III TESTS TUBES FOR. . . A new unique principle is used in this tester that will enable you to test for leakage and gas between control grid and other elements, shorts between all elements, leakage between cathode and heater of 180,000 ohms plus the all important cathode emission test. Cathode emission has a special significance here because it serves as a positive quality check if leakage tests have been made first. In other words, it tests tubes completely. In test after test, we found that these checks have revealed troublesome tubes that other testers did not find; even expensive dynamic testers.

WHAT IS THE GRID LEAKAGE SENSITIVITY?. . . The control grid leakage sensitivity is over 100 megohms. The high sensitivity is realized by using an expensive moving coil meter. Most testers use lower cost moving iron movements. This high sensitivity is especially important in circuits controlled by AGC voltage. A lower sensitivity of 2 to 5 megohms as found in many tube testers, may eventually reject the tube but not during the time that it is being tested because tube heat causes the leakage to increase with time. On some tubes, leakage may not reach this low level and the checkers with lower sensitivity will not find the "tough dog" tube.

HOW THE MIGHTY MITE III CHECKS EMISSION . . . The Mighty Mite III tests all tubes for cathode emission near their operating current level (See page 7). This is very important as many testers do not test at operating levels and may test the tube good, but it will not work satisfactorily in circuit.

HOW THE MIGHTY MITE III CHECKS FOR SHORTS . . . The Mighty Mite III contains a new unique circuit to test for shorts between each and every element in a tube. This circuit checks tubes for interelement shorts at a very low voltage. The newer "frame grid" type tubes requiring a low test voltage can be tested safely and accurately. Shorts tests are made by merely rotating Switch D through all positions while observing SHORT IND.

HOW TO CHECK HORIZONTAL OUTPUT TUBE PLATES . . . The plate of any tube picks up very little current when measuring cathode emission. Likewise, plates or screens seldom open up. However, the horizontal output tubes with plate caps can open because of excess heat. So, it is a good idea to check the plate current separately after making the emission test. Here is how you do it:

Leave the tester set up for emission. Then, set switch B to "J" and set switch D to "K". If the plate is O.K., the meter will read. The amount of current indicated by the reading is not important as this does not change with age. It is either good or bad; open or connected. Tap the plate cap to be sure that the reading stays constant.

NEW MECHANICAL FEATURES The Mighty Mite III has a number of mechanical features not found on other tube testers. First, note the four additional tube sockets to check the latest tubes. Sockets have phosphor-bronze contacts for long life. The set-up chart on the inside cover is another handy feature. The all steel carrying case not only insures maximum protection but adds a modern appearance to the instrument.

TO ACQUAINT YOURSELF WITH THE MIGHTY MITE III First, note the four controls marked A, B, C and D. These are the four controls that you will be setting up from the chart. Next, note the ten sockets numbered one through ten. You will be inserting the tube in one of these sockets as indicated in the chart. Locate the picture tube socket; you will be using this for all picture tube tests. Locate the grid cap lead. This will be used on all tubes having grid or plate caps.

OPERATE THE TC130 MIGHTY MITE III AS FOLLOWS:

1. Plug line cord into 105 to 125 volts 50 to 60 cycle AC receptacle.
2. Locate tube in set-up chart in cover. Tubes are listed numerically and alphabetically. Looking to the right of the tube listing, note the set-up information for controls A, B, C and D and the tube socket number. Some tubes have more than one listing. This is for tubes that effectively have more than one tube in an envelope. Each section is tested independently.
3. Set the controls as indicated and insert the tube in the socket indicated. Where more than one listing is shown, make complete checks using each listing. "Short" test need be made only once, on most tubes.
4. Set the FUNCTION switch to CAL and set the meter to the line marked CAL on the extreme right hand side of the meter by adjusting the small shaft marked CAL. You need not make this adjustment every time the tester is used, however, before rejecting a tube that is questionable, check to see that the meter is calibrated with the tube in the socket.
5. Next, switch the FUNCTION switch to the test desired. You will find some ways to short cut these tests but for a complete check, proceed as follows:
 - a. Set FUNCTION switch to SHORT TEST and switch D to H-K position.
 - b. SHORT IND. lamp will glow if leakage of 180,000 ohms or less exists between heater and cathode in any tube.
 - c. While in the SHORT TEST position, rotate switch D through all settings from H-K to A. Watch the SHORT IND. lamp for additional shorts or leakages between elements. If the lamp glows, be sure that it glows on both electrodes. Dimly lit electrodes indicate leakage or gas in a tube. Before rejecting tube, note whether or not this tube is marked with an asterisk (*) in the tube chart. If it is, this means that there are extra internal connections that will show up as a short and the tube should not be rejected if it lights on these settings only. Certain dual section tubes have the cathode of one section tied to the suppressor of the other section. These tubes may indicate a short on "one position only" of the "D" switch. If short is on more than one position of "D" switch, the tube has a short (unless otherwise indicated in set up booklet) and should be rejected. NOTE: A few tubes marked with an asterisk may not show shorts. This is because some tube manufacturers use the spare base pins for extra internal connections, whereas other manufacturers of the same tube type do not.

d. Set the FUNCTION switch to EMISSION if SHORTS TEST was satisfactory. Set switch D to setting indicated in chart. Read the tube emission quality on the top scale on the meter.

e. If emission check is OK, set FUNCTION switch to GRID LEAKAGE. Note the lower meter scaled GOOD-BAD and questionable (?). This important check will locate many tubes that may otherwise be passed. If the meter reads in the GOOD area but is slowly moving into the questionable area, wait for a minute or so to see if the meter will finally move into the BAD area. This is the type of tube that is hard to find on many other testers. These particular tubes may not give serious trouble in power output or rectifier stages but should be rejected immediately if operating in high impedance circuits.

If all tests have been satisfactory, the tube is in excellent condition and should not be replaced.

Please note the cap lead which should be placed on all tubes having caps.

TO CHECK PICTURE TUBES

Use the same procedure as above with the following in mind. Use the picture tube socket provided. For 110 degree tubes, it will be necessary to use an adapter socket which is readily available at your parts distributor. Set the filament voltage, switch A, to 6 for most picture tubes. A few new tubes have filaments as low as 2 volts, so it is a good idea to start at 2 volts and switch up to 6 to be sure that the filament does not burn out. Watch the picture tube neck for brilliance. The settings for the other controls are as follows:

TO TEST PICTURE TUBES:

Set SWITCH B to G
Set SWITCH C to 6
Set SWITCH D to K

TUBE LIFE EXPECTANCY TEST

If the meter needle climbs very slowly into the GOOD or questionable area on emission test, the life expectancy can be considered to be much less than if the meter indicated GOOD in a shorter time. Also, if the needle should climb to the GOOD area and then "fall off", life expectancy can be considered much less. This is also true of picture tubes. We cannot recommend that you replace these tubes. This decision is up to you or your customer.

METER PROTECTION: Most tube testers have cautions about burning out the meter. The meter in the TCI30 has built-in circuit protection so that you cannot burn out the meter. With the FUNCTION SWITCH set to the "OFF" position, the meter is electrically damped. This protects it from damage due to jarring.

REJUVENATION: If you wish to rejuvenate a small tube or a picture tube, merely increase the filament voltage by setting switch A to one setting higher for ten or fifteen seconds. You will also find that this will accelerate gas and leakage conditions when on the GRID LEAKAGE test. If you get a grid leakage reading in the BAD area with a slight increase in filament voltage, reduce the filament setting to normal. If the leakage reading returns to GOOD, the tube is a good tube and should not be rejected. If the meter remains in the BAD area, replace the tube.

A complete schematic of the TC130 is shown in Figure 1.

The three major tests that determine the quality of a vacuum tube are selected with the FUNCTION control (S-5). These are cathode emission, grid leakage, and shorts between elements. The FUNCTION control also is used to turn the unit off and place a short across the meter (position 1) and to check calibration of the unit (position 5). Calibration could be compared to "Line Adjust" in some older testers.

If some trouble should develop in your tester, a few minutes spent in studying the circuit will help you to find the defect and get your tester back into operation.

A. BASIC CIRCUIT

The basic indicating circuit is essentially a single ended vacuum tube voltmeter using 1/2 of a 12AU7 tube as an amplifier. Although only one tube is used, the circuit is ultra sensitive and has many outstanding features. One of the main features is the EgIp response. With zero volts on the grid (input to the 10 meg. resistor) the meter in the cathode circuit will read very low, less than 0.1 ma. As voltage is applied and gradually increased, the meter current will rise linearly until it reaches approximately 0.75 ma with +5 volts applied to the grid circuit. At this point, bias on the 12AU7 is almost zero and any additional voltage applied to grid is dropped across the 10 meg. resistor due to grid current flow. Consequently, approximately 40 volts is required to make the meter read full scale (1.0 ma). This broad response feature is used to advantage in both the emission and grid leakage tests as will be described in this section.

With the FUNCTION switch in the CAL position, i. e. , approximately 40 volts at the arm of the CAL potentiometer is fed directly into the 12AU7 grid circuit. The CAL potentiometer is adjusted for full scale meter current with the tester set up and the tube to be tested in its socket.

B. CATHODE EMISSION TEST

Cathode emission of a vacuum tube is tested by applying an AC voltage to the grid, or plate if the tube is a rectifier or diode, and measuring the amplitude of the pulsating DC present on the cathode. All tubes are tested at or near normal operating current levels.

The grid is used as a "pick-up" of cathode current because it was learned that nearly all current flows to the grid in testers where grid and plate are tied together. By leaving the plate open, an emission test can be made between the grid and cathode and tests turn out the same as if the plate were connected.

The pulsating DC on the cathode of the tube under test is reduced in the voltage divider 5.6 meg. and 10 meg. and applied to the grid of the indicator circuit through 10 meg. and .01 mf. to ground. This network filters the signal so that pure DC is present on the grid of the 12AU7. A tube with normal emission will cause the meter to indicate at approximately .78 ma or 100 on the EMISSION-QUALITY scale of the meter. If emission is lower than normal, a proportionately lower meter reading will result. At 50% of normal, the meter will read in the BAD area. If emission is higher than normal, the meter indication will be compressed as described above such that it will never exceed full scale. This is an important feature, because (1) it is impossible to burn out the meter even with a shorted tube or with the load setting "B" on the wrong position and (2) it permits more usable range on the meter scale (from 0 to .75 ma).

GRID LEAKAGE

The grid leakage test circuit uses the same basic indicating circuit. Actually, the grid leakage test circuit could be considered as an ultra sensitive ohmmeter. The break between the good and the questionable areas on the grid leakage scale represents approximately 200 megohms and the break between the questionable and the bad areas represents approximately 100 megohms.

In use, the control grid of a tube under test is connected through 10 megohms to ground. All other elements are connected to approximately +40 volts, the arm of the Calibrate adjustment control. If a tube has grid leakage or emission, a positive voltage will be developed across the 10 megohm resistor (with respect to ground) which is then fed to the 12AU7 grid and causes the meter to indicate. The more leakage there is, the higher the meter will read (towards and then into the bad area) until finally a dead short would cause the meter to read full scale. Leakage of 100 meg. or a grid emission current of approximately 0.5 microamp would produce a leakage indication just into the bad area.

SHORT TEST

Shorts between elements of 180,000 ohms or less are indicated by a simple neon indicator. A capacitive voltage divider allows less than 35 volts to reach a tube under test. This is important, especially in the newer frame grid tubes, where breakdown can occur with higher voltages.

As switch "D" is rotated, each pin or element is checked against all of the other pins for shorts, gas, or leakage up to 180,000 ohms. In the H-K position of switch "D", heater to cathode leakage will be indicated. A dull glow indicates some leakage in a tube.

The 0.1 mf. condenser in series with the neon indicating circuit reduces the effect of normal tube conduction lighting the bulb on one anode. A "true" short will light both anodes of the bulb. Disregard dim flashes in the shorts indicator.

Note: Some tubes have internal connections between pins. These tubes will show shorts, and are indicated on the tube chart with an asterisk.

SWITCHING AND SOCKETS

Referring to the complete schematic, Figure 1, note that all tube pins, except filaments, first go through SET-UP switch "C" and then SET-UP switch "D". Switch "C" is a special switch that has been designed to let all pin connections feed through in positions 6 and 12 but in any other position, one of the pins is opened. For example, the schematic shows all pins feeding through except the first position which is open. In number 2 position, this lead would be open, etc.

Switch "C" is used to reject one of two control grid leads, or a filament center tap that otherwise would prevent normal testing procedure.

Switch "D" is designed to select one of the remaining tube pins (the control grid, or on rectifiers or diodes the plate) and short all of the other pins together. The selected pin and the junction of all of the other pins are used in testing emission, grid leakage and shorts as discussed above.

ZERO ADJUSTMENT ON THE TC130 MIGHTY MITE TESTER

It may be noted that the zero on the TC130 is not at the extreme left as it is on most meters but rather about a quarter of an inch up the scale. This is because the circuit employed is an unbalanced VTVM to accomplish the high sensitivity on grid checks.

Line voltage changes may cause the zero to fall above or below that marked on the meter. The zero potentiometer is the potentiometer located under the front panel. It is the potentiometer nearest the 12AU7A tube. If you are operating the TC130 in an area where the line voltage is far off 115 volts (where the TC130 was factory calibrated), you may suspect that the TC130 is inaccurate because the meter does not come to rest at zero. If so, check for zero and make adjustments if necessary as follows:

- (a) Set the line voltage at exactly 115 volts. Set the Function Switch on CAL and adjust the CAL adjustment on the front panel until the meter reads on the CAL on the meter. This is located on the far right side of the meter.
- (b) Switch the function switch to the "short test" position and note the meter reading in relation to Zero. The zero is located about one-quarter of an inch from the left side of the meter. If the meter does not read zero, adjust the internal zero adjust potentiometer under the front panel (located next to the 12AU7A tube) until the meter reads on zero. The CAL control and the zero adjust control may interact with each other. If so, it may be necessary to repeat the adjustments two or three times until both fall into calibration as you switch back and forth.

HOW TO DETERMINE CONTROL SETTINGS FOR A NEW TUBE (Use Tube Manual)

1. Determine correct octal socket to use by checking if tube filament pins are 2 and 7 or 7 and 8. If 2 and 7, use socket 1 and if 7 and 8, use socket 2. If it is a 9 or 10 pin miniature, use socket 3, unless tube has internal connections which must be isolated. Switch C will isolate one pin and use of socket 8 will in most cases isolate other unnecessary pins. For example, a type 1X2 tube is checked in socket 8 because the filament pins are 1, 4, 6 and 9. Switch C isolates pin 6. Pins 1 and 9 are isolated in the socket. A 12AU7 can be checked in socket 3 since the C switch will isolate the filament center tap. Note that there are two 7 pin miniature sockets. Socket 4 is used for tubes whose filament pins are 3 and 4. Socket 7 is used for tubes whose filament pins are 1 and 7, such as portable radio tubes.

2. Find filament voltage required. Set A switch to correct voltage. If filament has a tap, isolate it with switch C before inserting tube in socket.

3. Find average cathode current with normal bias from tube manual. Set Load Switch according to chart below.

CATHODE CURRENT	SWITCH B SETTING
50 ma+	A
20-50 ma	B
15-30 ma	C
10-16 ma	D
6-12 ma	E
2- 7 ma	F
.7- 2 ma	G
.5- .8 ma	H
.5 or less	J

4. If tube has two Grid pins or Plate pins etc. isolate one pin with switch C. Refer to schematic, Figure 1, for connections between C switch and sockets. If pin isolation is not required, set C switch to 6.

5. Find control grid pin and set switch D to pick up this pin. If tube is a rectifier, set switch D to plate pin. Refer to Schematic, Figure 1, for connections between tube pin and D switch.

SERVICE AND WARRANTY

All Sencore products are guaranteed to be free of defects due to workmanship when purchased. Any defective unit returned to the factory service department at 426 S. Westgate, Addison, Ill., within 90 days after purchase will be serviced free of charge. In no case will a unit be replaced with a new unit. All Warranty Cards must be in the factory office within 10 days after purchase of the unit.

Any unit that has been mishandled or misused will receive a charge for both parts and labor regardless of date of purchase.

No unit will be serviced without charge for either parts or labor after one year of manufacture regardless of circumstances. Run numbers are stamped on chassis to denote date of manufacture.

Please tell us what you think is wrong with the unit when you send it in for repair.

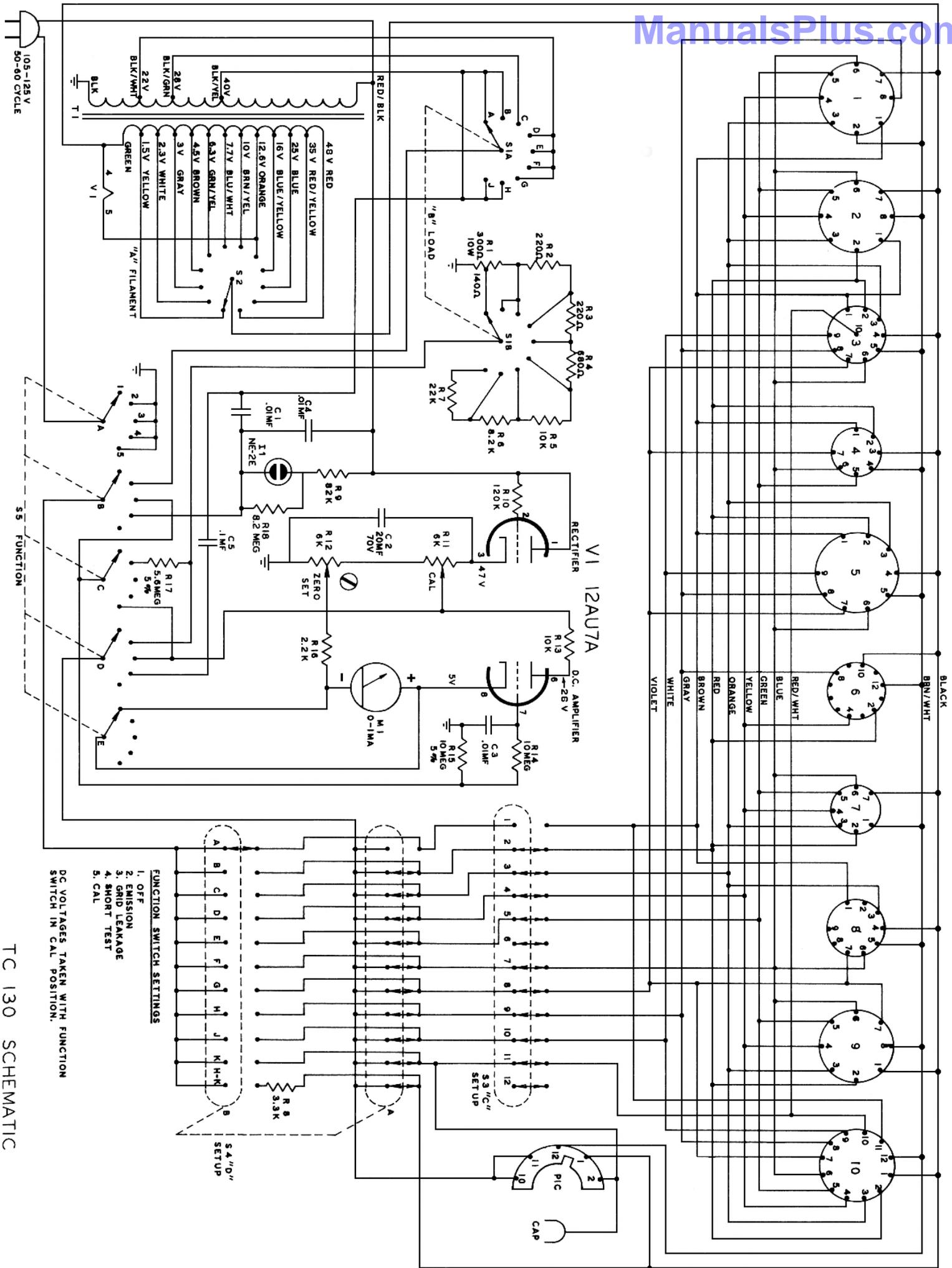
If you wish to repair your own TC130, we have included a schematic and a parts list of the most needed parts. A voltage check compared to the voltages on the schematic should locate most malfunctions.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE MEASURE
No meter indication on any position of function switch.	Defective 12AU7.	Check tube and replace if bad.
	Defective meter.	Check meter, if bad, replace.
	Loose connection at meter terminals.	Check connections.
	Defective potentiometer.	Check potentiometer and replace if defective.
Meter indicates but will not calibrate.	Defective electrolytic.	Check electrolytic and replace if defective.
	Defective 12AU7.	Check tube and replace if defective.
Meter can be calibrated but will not indicate emission or leakage on some sockets.	Defective CAL potentiometer.	Check pot. and replace if defective.
	Loose connection at tube socket or at switch C or D.	Check tube socket in use and wires which feed thru each terminal on both wafers of switch C. If switch C is OK check wires connecting between switch C and switch D for a poor connection.
Short indicator glows without tube in socket in some positions of switch D when Function Switch is in "SHORTS" position.	Wire at tube sockets touching.	Check wiring at tube sockets. To locate short, turn TC130 on and set FUNCTION Switch in "SHORTS" position. Then move wires with a non-metallic probe until light goes out. This will locate shorted wires.
	"C" switch improperly set.	Center "C" switch properly in each position.
Emission measurements OK, but grid leakage will not indicate. Grid leakage measurements OK, but emission will not indicate.	Function switch.	Check switch and connections to switch.
	Function switch.	Check switch and connections to switch.
	Load switch "B".	Check switch.
Short ind. glows on one anode when testing tube for shorts.	Transformer.	Check transformer for opens.
	Defective 0.1 mf. condenser.	Check for shorted or leaky capacitor.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE MEASURE
Meter reads high (above 0 on emission scale) with no tube in socket.	Defective 12AU7.	Check 12AU7 and replace if defective.
	Zero adj. pot. mis-adjusted or defective.	Check pot; re-adjust pot.
	Line voltage very low.	
Bad tubes indicate very good (full scale).	Open resistor on load switch. Open connection at load switch or function switch.	Locate open resistor and replace. Locate open connection.

PARTS LIST

Reference	Part Number	Description
C1, C4	24G130	.01 mf + 10% 200V
C2	24G38	20 mf 70V
C3	24G14	.01 mf 600V
C5	24G27	.1 mf 200V
I2	20G1 (early models)	NE2 bulb
	20G6 (later models)	NE2E (with holder)
M1	23S12	0-1 MA moving coil
R1	14G129	300 ohm 10W tapped @ 140 ohms
R11, R12	15S15A	6K potentiometer
R15	14G85	10 meg. 1/2W \pm 5%
S1	25S42A	2P9P switch
S3	25S41A	11P12P switch
S4	25S43A	2P11P switch
T1	28S10A	Fil. trans.
S2	25S22A	1P12P switch
S5	25S40B	5P5P switch
V1	18G4	12AU7A
1, 2	26G4	Socket, Octal
3	26G22	Socket, 10 pin
4, 7	26G2	Socket, 7 pin min.
5	26G20 (early models)	Socket, Novar
	26G56 (later models)	Socket, Novar
6	26G23	Socket, 5 pin Nuvistor
8	26G3	Socket, 9 pin min.
9	26G15	Socket, Loctal
10	26G21	Socket, compactron



- FUNCTION SWITCH SETTINGS**
1. OFF
 2. EMISSION
 3. GRID LEAKAGE
 4. SHORT TEST
 5. CAL

DC VOLTAGES TAKEN WITH FUNCTION SWITCH IN CAL POSITION.

TC 130 SCHEMATIC