OPERATING INSTRUCTIONS

for the

TC114

Mighty Mite II Tube Tester

SENCORE

Instruction Manual For The Mighty Mite II Tube Tester

You have purchased one of the finest instruments that the electronics in-industry has to offer. This tester 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.

WHY THE NAME MIGHTY MITE II?

The TC114 has been named the Mighty Mite II because it supercedes the popular TC109 Mighty Mite tube tester. Physically it is slightly larger since it has the 4 extra sockets required to check the new compactrons, novar, nuvistor and 10 pin tubes. Electrically it is very similar to the TC109 with some slight circuit improvements.

WHAT THE MIGHTY MITE II TESTS . . . . .

The Mighty Mite II will test virtually 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 2000 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 tube set-up booklets are printed each year. You will automatically receive these new set-up booklets if you sign and return your warranty card that is packed with this unit. You will be invoiced a moderate charge for each book sent.

WHAT THE MIGHTY MITE II 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 120,000 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 all other testers did not find; even expensive dynamic testers.

WHAT IS THE GRID LEAKAGE SENSITIVITY? The control grid leakage sensitivity is over 100 megohms in the Mighty Mite II. This is the same sensitivity that has made the TC109 Mighty Mite Tube Tester so popular. 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 II CHECKS EMISSION . . . The Mighty Mite II tests *all* tubes for Cathode emission near their operating current level. For example, a 5U4 is tested at 150 Ma. This is very important as many testers do not test at operating levels and may test the tube good, but it will not work satisfactory in circuit.

HOW THE MIGHTY MITE II CHECKS FOR SHORTS . . . The Mighty Mite II uses a unique circuit to test shorts between each and every element. This is especially important to a technician who wants to make a complete shorts test

before proceeding with quality checks. Shorts tests are made by merely rotating switch D through all positions.

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 mechanical disturbance. 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 to check emission. Then, set switch B to "J" and set switch D to "K". If 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 has a number of mechanical features to make your tube testing job easier and faster. The "Speedy Set-Up Chart" in the cover was installed by popular demand to avoid spending time hunting the tube set-up information in the set-up booklet. Nearly 9 out of 10 tubes that are found in normal day to day servicing are listed in this handy chart. Note the friction hold on the cover to prevent the cover from shuting and accidentally breaking a tube or pinching your fingers. The burn out proof meter is especially equipped with a background light to assist in reading behind the TV set and also to act as a pilot light. The all steel carrying case insures maximum protection to your tube tester.

TO ACQUAINT YOURSELF WITH THE MIGHTY MITE II . . . 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. Directly under the meter is the FUNCTION switch. This is set to the desired test. Locate the grid cap lead. This will be used on all tubes having grid or plate caps.

OPERATE THE TC114 MIGHTY MITE II AS FOLLOWS:

1. Plug line cord into 110 or 120 volts AC, 60 cycle receptacle.

2. Locate tube in set-up booklet. 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.

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 black adjustment marked CAL. You do not need to make this adjustment every time the tester is used but before rejecting a tube because it reads in the questionable area, check to see that the meter is calibrated with the tube in the socket. Note that meter "zero" is about ¼ inch from left side of meter scale.

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 120,000 ohms or less exists between heater and cathode in any tube.

c. While the FUNCTION switch is in the SHORT TEST position, rotate switch D through all settings from H-K to A. Watch the SHORT IND. lamp to see if it glows at any setting of the D switch. The lamp may flicker and glow dimly on one electrode. This does not indicate a short. The lamp should glow bright and on both electrodes. If the lamp glows on any setting of the D switch, a short or leakage between elements is indicated. Normal shorts are listed in the tube set-up charts. These normal shorts are due to internal connections in the tube and are permissable. Do not reject the tube if the SHORT IND. light does not glow on the positions listed as normal or permissable in the tube set-up manual as some manufacturers do not make the internal connections shown in standard tube manuals.

d. If short check is OK, switch FUNCTION switch to GRID LEAKAGE. Also, reset switch D to setting indicated in chart. Note the lower meter scaled GOOD-BAD and questionable (?). This important check will locate many faulty 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 troublesome 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.

e. Set the FUNCTION switch to EMISSION if all checks to this point have been satisfactory. Read the tube emission quality on the top scale on the meter.

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. If in doubt, look up the filament voltage in a tube manual and set switch A accordingly. 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 indicates 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 BURN OUT. Most tube testers have cautions about burning out the meter. The meter in the MIGHTY MITE II has built-in circuit protection so that you cannot burn out the meter even with a dead short in the tube under test.

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.

CIRCUIT DESCRIPTION

A complete schematic of the TC114 is shown in Figure 5. Note that the layout of this schematic is very similar to the TC 114 panel layout. This, we find, helps one to understand the electrical function of each control in the circuit.

The three major tests that determine the quality of a vacuum tube are selected with the FUNCTION Control (S-3). There are cathode emission, grid leakage, and shorts between elements. Each of these functions is described in detail below. The FUNCTION control also is used to turn the unit off (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 following circuit descriptions will help you to find the defect and get your tester back into operation.

A. BASIC CIRCUIT

A simplified schematic of the basic indicating circuit is shown in Figure 1. This circuit is essentially a single ended vacuum tube voltmeter using ½ 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 Eg Ip 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 O.lma. As voltage is applied and gradually increased, the meter current will rise linearly until it reaches approximately O.75ma with +6 volts applied to the grid circuit. At this point, bias on the 12AU7 is almost zero and any additional voltage applied to grid

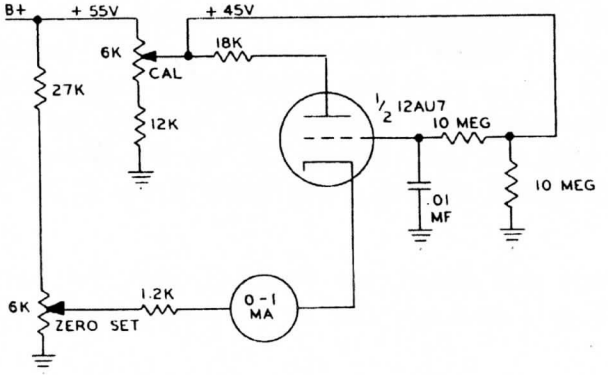

Figure 1. BASIC INDICATOR CIRCUIT

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.Oma). This broad response feature is used to advantage in both the emission and grid leakage tests as will be described later in this section.

The circuit, Figure 1, is shown 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. See figure 2. 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, a short test can be made between the grid and plate and tests turn out the same as if the plate were connected.

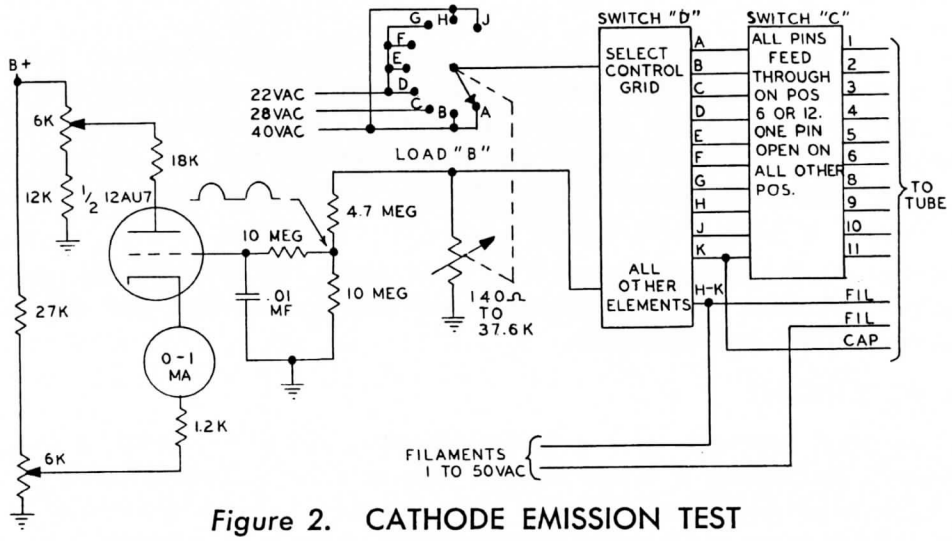

Figure 2. CATHODE EMISSION TEST

The pulsating DC on the cathode of the tube under test is reduced in the voltage divider 4.7 meg. and 10 meg. and applied to the grid of the indicator circuit through 10 meg. and .01 μf. 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 O to .75ma).

GRID LEAKAGE

The grid leakage test circuit, see figure 3, 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.

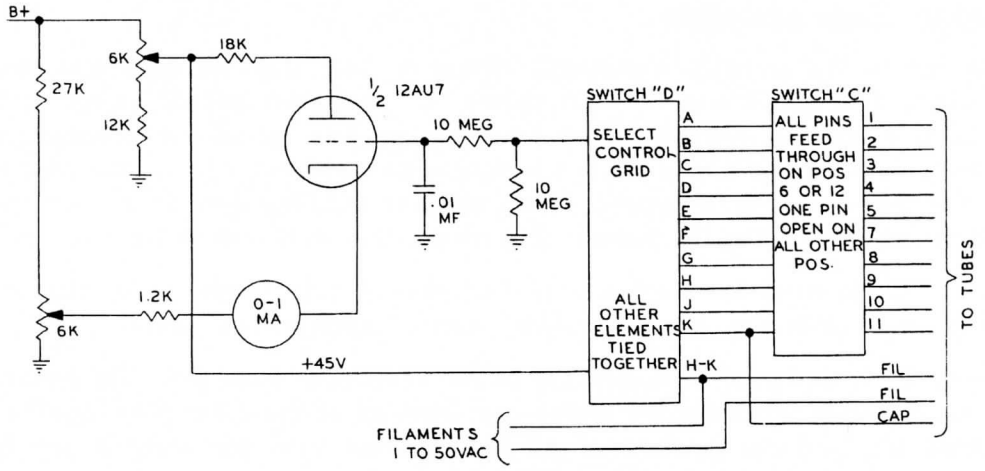

Figure 3. GRID LEAKAGE CIRCUIT

In use, the control grid of a tube under test is connected through 10 megohms to ground. All other elements are connected to +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 120,000 ohms or less are indicated by a simple neon indicator operated from line voltage. See figure 4. As switch "D" is rotated, each pin or element is check against all of the other pins for shorts, gas, or leakage up to 120,000 ohms. In the H-K position of switch "D", heater to cathode leakage will be indicated.

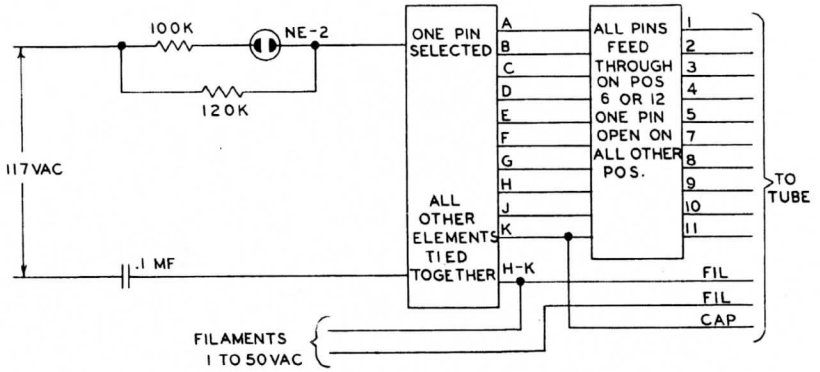

Figure 4. SHORTS TEST CIRCUIT

The 0.1μf 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 brightly.

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 5, 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 schemetic 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 ADJUSTMENTS ON TC114 MIGHTY MITE

The TC114 is calibrated at 115 volts at the factory. The TC114 is automatically compensated for line voltage changes at the high end of the meter so that tubes will be rejected at the same point as line voltages vary. In order to attain this compensation, the meter varies off zero (near left side of scale) with line voltage changes. Therefore, if the meter should not read on zero, this does not indicate that the TC114 is inaccurate, but merely indicates that the line voltage is not 115 volts. To check meter zero, or to readjust for zero, be sure that the line voltage is exactly at 115 volts.

TC114 TROUBLE CHART

Symptom	Probable Cause	Corrective Measure
No meter indication on any position of function switch (meter lamp lights).	Defective 12AU7	Check tube and replace if bad.
	Defective meter.	Check meter, if bad replace.
	Loose connection at meter terminals.	Check connections.
	Defective potentiometer (R11)	Check potentiometer and replace if defective.
	Defective electrolytic	Check electrolytic and replace if defective.
Meter indicates but will not calibrate.	Defective 12AU7	Check tube and replace if defective.
	Defective CAL potentiometer	Check pot. & replace if defective.
Meter can be calibrated but will not indicate emission or leakage on some sockets.	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 TC114 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 O K, but grid leakage will not indicate.	Function switch	Check switch & connections to switch.
Grid leakage measurements OK, but emission will not indicate.	Function switch	Check switch & connections to switch.
	Load switch "B"	Check switch
	Transformer	Check transformer for opens.
Short ind. glows on one anode when testing tube for shorts	Defective 0.1μf cond.	Check for shorted or leaky capacitor
Meter reads high (above O on emission scale) with no tube in socket.	Defective 12AU7 Zero adj. pot. misadjusted or defective	Check 12AU7 & replace if defective Check pot; re-adjust pot.

PARTS LIST

Reference #	Part #	Description	Reference #	Part #	Description
C1	24G27	.1μf200V	6	26G23	Socket 5 pin Nuvistor
C2	24G38	20μf70V			
C3	24G14	.01μf600V	1, 2	26G4	Socket, Octal
I-1	20G3	#51 bulb	R11, R15	15S15	6K potentiometer
I-2	20G1	NE2 bulb	R17	14G85	10 meg.½w5%
M1	23S6	O-1MA moving coil	R21	14G84	4.7 meg.½w5%
			S1	25S42	2P9P switch
R4, R5	14G129	300Ω 10w tapped @140Ω	S2	25S22	1P12P switch
			S3	25S40	4P5P switch
R9	14G130	120K½w10%	T1	28S10	Fil. trans.
10	26G21	Socket compactron	S5	25S43	2P11P switch
3	26G22	Socket, 10 pin	S4	25S41	11P12P switch
5	26G20	Socket, Novar	V1	18G3	12AU7

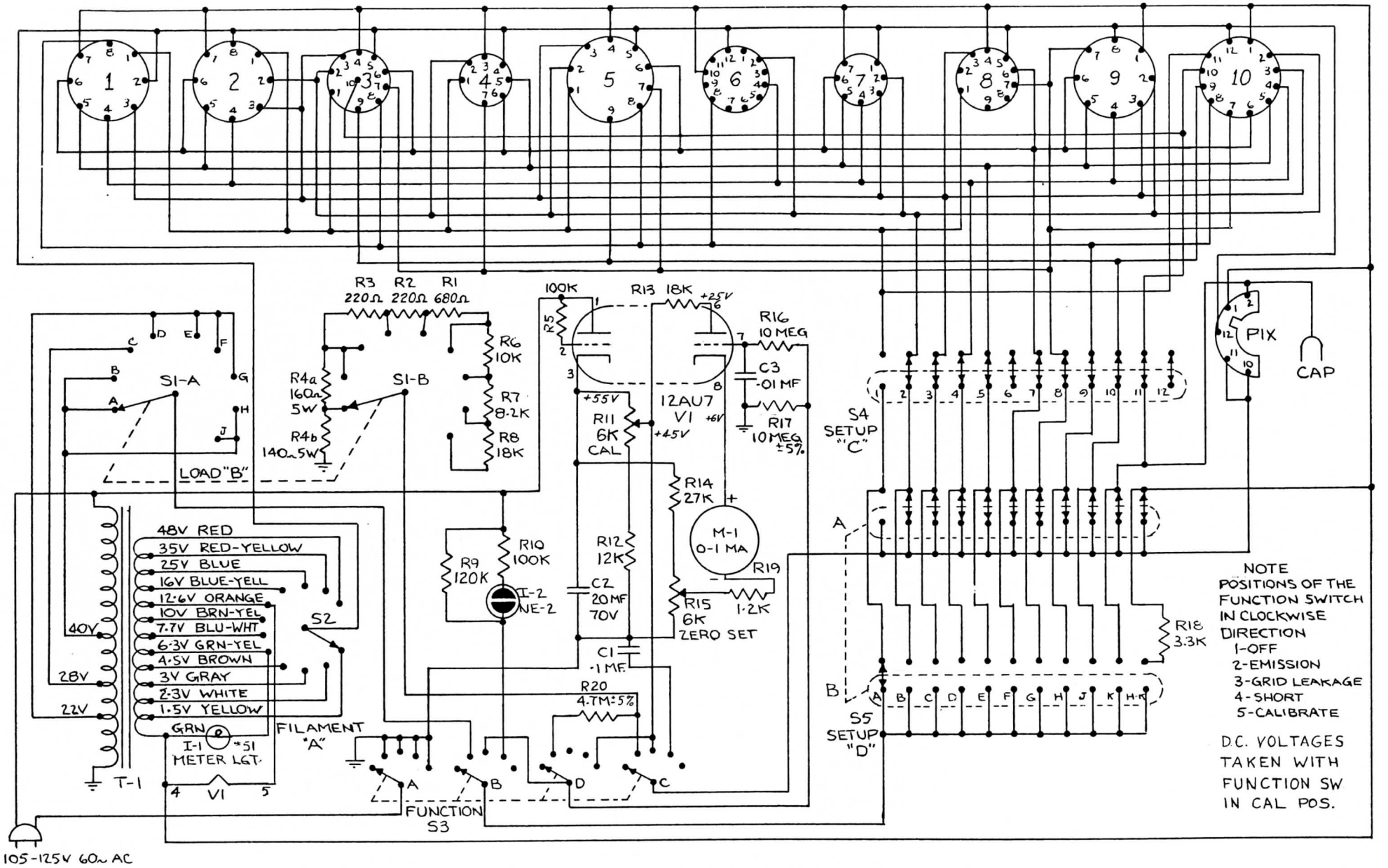

Figure 5. TC114 COMPLETE SCHEMATIC