IN CASE OF DIFFICULTY

This section of the Manual is divided into four parts. The first part, "General Troubleshooting Information," outlines possible causes that are the most often sources of trouble in newly assembled kits. Go through this part very carefully and apply these checks to your kit.

The second part "Troubleshooting Precautions and Notes," outlines precautions you should take when troubleshooting your Oscilloscope. Read this part carefully so you do not damage your oscilloscope while searching for the difficulty.

The third part, the "Troubleshooting Charts," is really two parts. The first part of this section consists of various tests to localize the trouble. You will then be directed to the second part, where you will pinpoint the trouble within the local area or circuit board.

If the "Troubleshooting Chart" does not help you locate the problem, read the "Circuit Description" and refer to the Schematic Diagram (fold-in) to help you determine where the trouble is.

The fourth part, "Checking Components," shows you how to use an ohmmeter to determine if a suspected component is faulty.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

GENERAL TROUBLESHOOTING INFORMATION

The following paragraphs deal with the types of difficulties that may show up right after a kit is assembled. These difficulties are most likely to be caused by assembly errors or poor soldering.

1. Recheck the wiring. Trace each wire lead in colored pencil on the Pictorial where it is installed, as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you consistently overlooked.

2. About 90% of the kits that are returned for repair do not work properly due to poor solder connections. Therefore, you can eliminate many troubles by reheating all connections to make sure that they are soldered as described in the "Soldering Instructions," at the front of this Manual.

3. Check to make sure that all transistors are in their proper locations. Make sure that each transistor lead is connected to the proper point and that the transistor flats are properly positioned.

4. Check the values of the parts. Be sure that the proper part has been wired into the circuit as shown in the Pictorials and called out in the wiring instructions. For example, it would be easy to install a 200 Ω (red-black-brown) resistor for a 1000 Ω (brown-black-red) resistor.

5. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring. Check for solder bridges between circuit board foils. Compare your foil pattern against the "Circuit Board X-Ray Views" (Illustration Booklet, Pages 36, 37, and 38).

TROUBLESHOOTING PRECAUTION AND NOTES

WARNING: The full AC line voltage and high DC voltage is present at several places in the Oscilloscope. See Pictorials 9-1 and 9-2 (Illustration Booklet, Page 26). Be careful to avoid electrical shock when you work on the Oscilloscope.

1. Be cautious when you test transistors and integrated circuits. Although they have almost unlimited life when used properly, they are easily damaged by excessive voltage and current.

2. Be careful so you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it may damage one or more components.

3. DO NOT remove any components while the Oscilloscope is turned on.

4. When you make repairs to the Oscilloscope, make sure you eliminate the cause as well as the effect of the trouble. If, for example, you should find a damaged resistor, be sure you find out what caused the resistor to become damaged. If the cause is not eliminated, the replacement resistor may also become damaged when the Oscilloscope is turned on again.

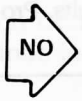
5. Refer to the "Circuit Board X-Ray Views," and the "Schematic Diagram," to locate various components.

6. When the oscilloscope Trigger Selector is in the "LINE" position, a trace may not be visible on the CRT above 20 μsec. The oscilloscope will still be triggered, but the writing speed will be too fast to light the CRT.

TROUBLESHOOTING CHARTS

The "Troubleshooting Charts" are designed to pinpoint a trouble through a series of tests. The following symbols and procedures are used in the charts.

Follow the "YES" arrow when you obtain the correct measurement or condition.



Follow the "NO" arrow when you do not obtain the correct measurement or condition.

Components are listed in the order in which failure or a problem is most likely to occur.

All voltage measurements were made with a high impedance voltmeter, a nominal line voltage of 120 volts AC, and can vary ±20%.

Set the front panel controls and switches as follows:

INTENSITY: Center of rotation.

FOCUS: Center of rotation.

TRIG LEVEL: Center of rotation.

HORIZ POS: Center of rotation.

TIME/CM: X10 (full clockwise).

SWEEP VAR/HORIZ GAIN: CAL (fully clockwise).

Y1-Y2-EXT-LINE (trigger source switch): Y1.

AC-DC-TV (trigger coupling switch): AC.

POSITIVE (+)-NEGATIVE (−) (slope switch): Positive (+).

AUTO-NORMAL (trigger mode switch): NORMAL.

Y1-Y2-AC-GND-DC: GND.

Y1-Y2-VOLTS/CM: 0.05.

Y1 VARIABLE: CAL (fully clockwise).

Y2 VARIABLE: CAL (fully clockwise).

Y1 POS: Center of rotation.

Y2 POS: Center of rotation.

Y1-Y2-CHOP-ALT: Y1. (vertical mode switch).

OFF-ON: OFF.

Do not change the position of any control or switch unless you are instructed in a step to do so.

Connect the line cord to an AC outlet and turn the Oscilloscope on.

Perform the ±9 and +5 volt power supply test (Test #1) on Page 28 in the Illustration Booklet to verify the operation of the power supplies before you proceed. These power supplies must operate properly before you attempt any further troubleshooting. After you have completed Test #1, proceed to the "Trouble Locator Chart " on Page 100.

Trouble Locator Chart

Set the Y1-Y2-CHOP-ALT switch to Y1. Then alternately measure the collector voltages of Q115 and Q116. Adjust the Y1 POS control (on the front panel) until these voltages are 95 volts DC. 77-95

Set the Y1-Y2-CHOP-ALT switch to Y2. Then alternately measure the collector voltages of Q115 and Q116. Adjust the Y2 POS control (on the front panel) until these voltages are 95 volts DC.

NO → A problem exists in the vertical deflection circuits. Proceed to Test #2.

YES

Alternately measure the collector voltages of Q214 and Q215. Adjust the HORIZ POS control until these voltages are equal at 110 volts DC.

NO → A problem exists in the horizontal amplifier circuits. Proceed to Test #3.

YES

Turn the INTENSITY control fully clockwise and counterclockwise. A spot of light should be visible on the CRT and the intensity of the spot should vary as you turn the control.

NO → A problem exists in the blanking and/or CRT circuits. Proceed to Tests #4 and #5.

YES

Set the Y1-Y2-EXT-LINE switch to LINE. Then turn the TIME/CM selector through all of its positions. A trace should appear on all positions except X1 and X10. Then turn the selector to the 200 μS position. NOTE: The trace may not be possible on the CRT at the higher sweep speed settings. If this is the case, set the Y1-Y2-EXT-LINE switch to Y1 or Y2.

NO → A problem exists in the trigger or sweep circuits. Proceed to Tests #6 and #7.

YES

The major Oscilloscope circuits are operating properly. If a problem still exists, proceed to the test that most closely associates with the particular problem.

NOTE: Dual trace operation will only occur in the CHOP mode when the TIME/CM selector is set to the EXT IN position. If the Y1-Y2-CHOP-ALT switch is set to the ALT position, however, only one of the two channels will be displayed. This selection will be random.

CHECKING COMPONENTS

INTRODUCTION

To check a transistor accurately, you should use a transistor checker. However, if one is not available, you can use an ohmmeter to determine the general condition of any of the bipolar transistors (or diodes) in this kit. The ohmmeter used must have at least 1 volt DC at the probe tip to exeed the threshold of the diode junctions in the transistor being tested.

Set your ohmmeter to its low range for the following tests.

HOW TO CHECK TRANSISTORS AND DIODES

A. Unsolder and remove the component.

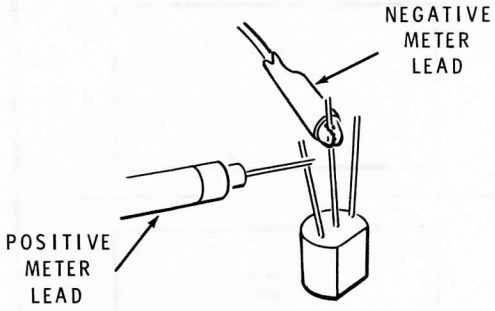
B. Connect the ohmmeter leads to the component as shown in the example illustration for transistors and diodes.

Example:

TRANSISTORS

Connect the positive meter lead to one lead as directed in the chart.

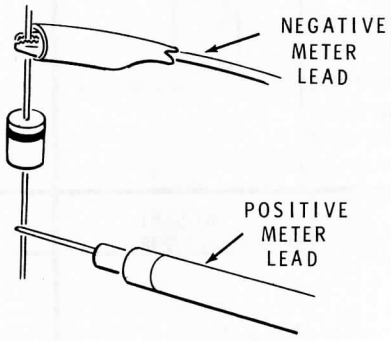
Connect the negative meter lead to another lead, as directed in the chart.



DIODES

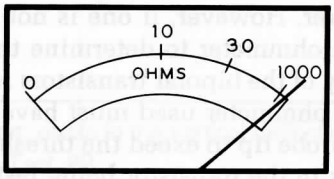
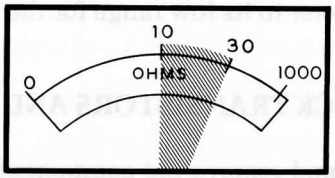
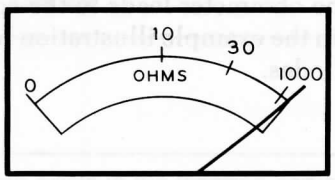
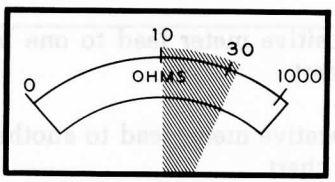
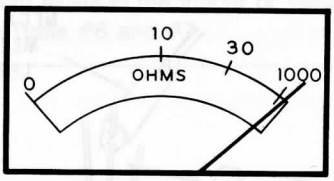
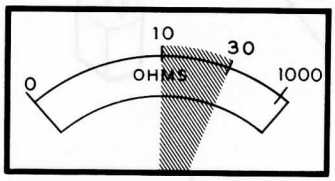
Connect the negative meter lead to one lead as directed in the chart.

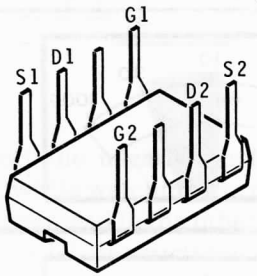
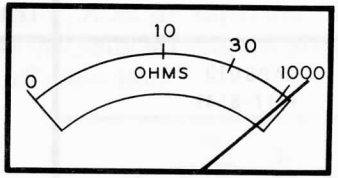
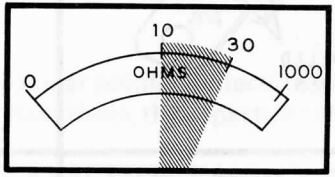
Connect the positive meter lead to the other lead, as directed in the chart.

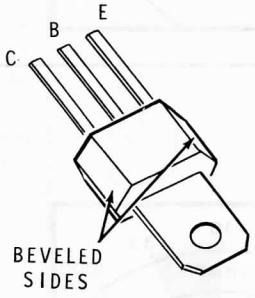
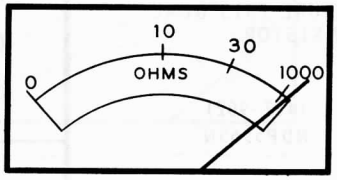
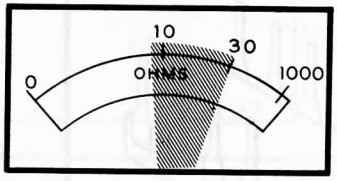
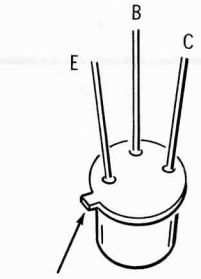
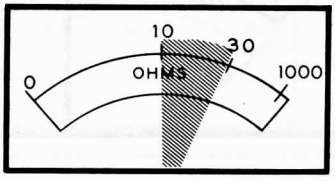
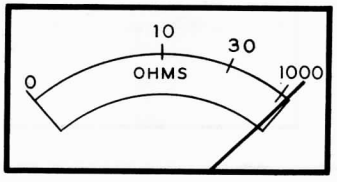
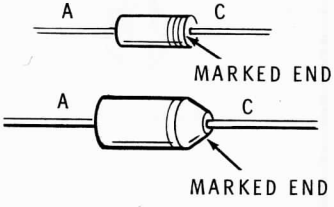
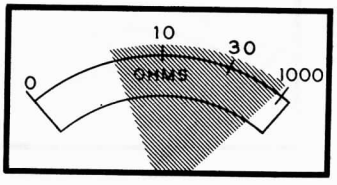
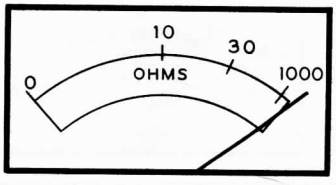


Proceed to the following chart and connect the ohmmeter leads to the component as indicated in the columns titled "Connect Positive Lead To," and "Connect Negative Lead To." The indicated meter reading in the last column is only a nominal reading. Your meter may read slightly different.

NOTE: The polarity of all ohmmeters is not the same. Therefore, if you do not get the indicated results, reverse your meter leads and try again. If you do get the correct results now, cross out the word "negative" in the heading in the second column and write in "positive." Also cross out the word "positive" in the heading in the third column and write in "negative."

TRANSISTOR	CONNECT NEGATIVE LEAD TO	CONNECT POSITIVE LEAD TO	METER READING
MPS6520 (417-134) SE6020 (417-237) 2N5770 (417-293) MPSA20 (417-801) MPSL01 (417-811) 	B B E	C E C	
	C E	B B	
2N4121 (417-235) MPSL51 (417-295) 	C E C	B B E	
	B B	C E	
2N4258A (417-260)  FLAT	C E C	B B E	
	B B	C E	

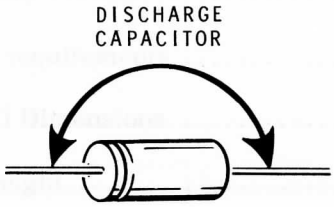
TRANSISTOR	CONNECT NEGATIVE LEAD TO:	CONNECT POSITIVE LEAD TO:	METER READING
NOTE: YOU MAY HAVE TO SET YOUR OHMMETER TO A HIGHER RANGE TO MEASURE THIS DUAL TRANSISTOR (417-902) NDP5565N  	G1 G1 G2 G2	D1 S1 D2 S2	
	D1 S1 D1 S1 D2 S2 D2 S2	G1 G1 S1 D1 G2 G2 S2 D2	

TRANSISTOR	CONNECT NEGATIVE LEAD TO	CONNECT POSITIVE LEAD TO	METER READING
MPSU10 (417-834)  	B	E	
	B	C	
	E	C	
	C	B	
	E	B	
2N2369 (417-154)  	C	B	
	E	B	
	B	E	
	B	C	
	C	E	
DIODES 56-26, 56-56 56-59, 56-67 56-89, 56-634 57-27, 57-52  	C	A	
	A	C	

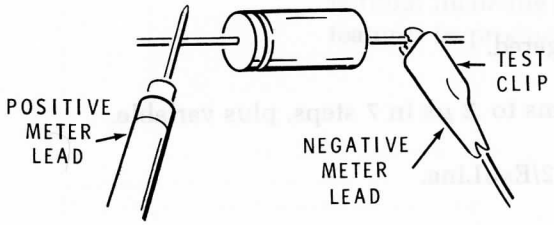
HOW TO CHECK CAPACITORS

A. Unsolder and remove the capacitor.

B. Discharge the capacitor by touching the leads together.



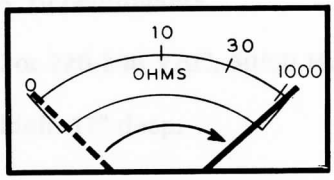
C. Connect the negative meter lead to one lead. Then, while watching the meter, touch the positive meter lead to the other capacitor lead. (Note the special instructions for the electrolytic capacitors.)



How to Connect Electrolytic Capacitors to the Meter and Chassis

Each electrolytic capacitor has a positive (+) mark at one end. When checking one of these capacitors, connect the positive (+) lead to the positive meter lead and the other lead to the negative lead.

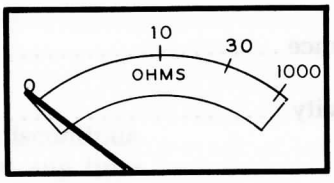
1. If the meter pointer deflects to the low ohms side quickly, and then gradually returns to the high ohms side, the capacitor is not faulty. NOTE: The time it takes for the pointer to return to the high ohms side depends upon the value of the capacitor. A 50 μF capacitor for example, will cause the pointer to return more rapidly than a 500 μF capacitor.



CAPACITY OK
#4

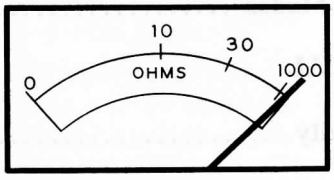
2. If the meter pointer deflects to the low ohms side and stays there, the capacitor is faulty (shorted).

CAPACITOR FAULTY (Short)



3. If the meter pointer does not deflect at all, but stays at the high ohms side, the capacitor is faulty (open).

CAPACITOR FAULTY (Open)



4. Recheck the capacitor, BUT FIRST DISCHARGE IT BY TOUCHING THE LEADS TOGETHER.

Because of the small capacitance of capacitors below the value of 50 μF, it is very difficult to determine if the capacitor is faulty (open). If your meter needle does not move at all when you are checking a small value capacitor, it does not mean that the capacitor is open.