



## TESTS AND ADJUSTMENTS

This section of the Manual is divided into three main sections: "Resistance Measurements," "Voltage Measurements," and "Adjustments." Each section consists of charts which list meter connecting points, the results to be obtained, and the area of the kit to be checked if proper results are not obtained.

The following "Troubleshooting Hints" deal with the types of difficulties that may show up right after a kit is assembled, before you can put it into operation. These difficulties are most likely to be caused by assembly errors or faulty soldering.

NOTE: The "Operation Manual" includes an "In Case of Difficulty" section, "Circuit Board X-Ray Views," and the "Circuit Description." Although the "In Case of Difficulty" section deals mainly with problems that may occur after the kit has been in operation for some time, it could, along with the other Manual sections, be helpful in locating other problems.

### TROUBLESHOOTING HINTS

The following checks will help you locate problems that can exist right after the kit is completed.

1. First, make a good visual check of the whole unit to make sure there are no obvious difficulties, such as unsoldered connections, burned or overheated parts, bare wires touching each other, obviously faulty solder connections, etc. Make sure there are no bits of solder, wire ends, or other foreign matter lodged in the wiring. Carefully check all terminals that have several wires attached to make sure that all wires, especially the lower ones, are soldered.
2. Then check all wires to make sure they are connected to the right places. Usually, it is quite helpful to have a friend help you check your work. Often, someone not familiar with the unit will notice an error that you have overlooked consistently.
3. Check to make sure that each transistor, *each* diode, tantalum and electrolytic capacitor, and IC is installed properly and in the proper location.
4. Check all solder connections to make sure they are bright and shiny. About 90% of the kits that are returned to the Heath Company for repair do not operate properly due to poor solder connections. Reheat and, if necessary, melt a little more solder on all questionable connections to make sure they are properly soldered.
5. Check the values of resistors and capacitors to make sure the proper part is wired into the circuit in each position. It is sometimes easy to misread the third color band on a resistor. For example, if a 22 k $\Omega$  (red-red-orange) resistor were installed instead of a 220 k $\Omega$  (red-red-yellow) resistor, the circuit would not operate properly.
6. Before you try to locate the cause of a difficulty, be sure to check the operation of the controls. Difficulties may also be due to improper adjustments of the front panel and circuit board controls. A recheck of these adjustments as outlined in the "Adjustments" section may help to locate the source of trouble.



7. When you are instructed to check a specific component, Q103 for example, also check any components associated with Q103 to be sure they are the proper value and are installed correctly.
8. In the event that you cannot correct a malfunction in your kit, make every effort to pinpoint the problem to its circuit board. Use the information in the "Test and Adjustments" section of this Manual and the "In Case of Difficulty" section of the Operation Handbook. You can easily remove the suspected circuit board from the kit and

return it by itself to the Heath Company Service Department, rather than returning the complete kit.

**WARNING: Since high voltages are present at many points throughout the kit, caution should be taken to avoid personal shock. See DANGER areas on Pictorial 14-1 (Illustration Booklet, Page 18).**

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

## RESISTANCE MEASUREMENTS

**IMPORTANT: ALL RESISTANCE AND VOLTAGE MEASUREMENTS WERE TAKEN WITH A HEATH VTVM. THEREFORE, YOUR READINGS MAY BE DIFFERENT IF A DIFFERENT METER IS USED.**

The following resistance measurements should be performed if at all possible. These simple measurements can prevent damage to expensive parts due to their being installed or wired incorrectly.

If an ohmmeter is not available, proceed to "Voltage Measurements" on Page 101.

Power to make the measurements is usually supplied by the battery contained in the ohmmeter. If the equipment being measured is turned on, you will either get inaccurate readings or damage components in the ohmmeter.

### NOTES:

1. All ohmmeters do not indicate the same. Therefore, the following meter indications are approximate.
2. Some of the circuits being tested have large-value capacitors in them. In these cases, the

ohmmeter will start at or near zero and then climb slowly. When this happens, keep the ohmmeter lead connected until the meter stops moving; then check the meter indication.

3. In a number of steps, you will be instructed to connect one of the ohmmeter leads to ground. This ground can be the center lug on either of the 5-lug terminal strips or the bare wire connected between the two large capacitors (C1 and C2).
4. Not all ohmmeters have the positive battery terminal connected to the red meter lead. Therefore, you may find that your ohmmeter leads will have to be connected in reverse to the chart directions in order to obtain the correct readings.

Refer to Pictorial 14-1 (Illustration Booklet, Page 18) for the test point locations.

- ( ) Tip the chassis up so it is sitting on its power transformer (T1) end.
- ( ) Place the ohmmeter in the  $\times 100$  ohms position.



CAUTION: When you measure resistance, always have the line cord of the kit unplugged and all circuit boards connected.

METER CONNECTIONS		METER INDICATION	POSSIBLE CAUSE OF TROUBLE
TEST PROBE	GROUND LEAD		
(✓) 1. Round prong of line plug.	Chassis ground	0	A. Line cord. B. Solder lug C.
(✓) 2. Either flat prong of line plug.	Round prong of line plug.	INFINITE with Power switch ON or OFF.	A. Terminal strip D wiring. B. T1.
(✓) 3. Other flat prong of line plug.	Round prong of line plug.	INFINITE with POWER switch ON or OFF.	A. Terminal strip D wiring. B. T1.
(✓) 4. Mounting screw of Q506H.	Ground	Greater than 100.	A. D114 or D115. B. C2. C. R10. D. +35 V line.
(✓) 5. Mounting screw of Q507H.	Ground	Greater than 100.	A. D114 or D115. B. C2. C. R10. D. +35 V line.
(✓) 6. Mounting screw of Q506V.	Ground	Greater than 100.	A. D114 or D115. B. C2. C. R10. D. +35 V line.
(✓) 7. Mounting screw of Q507V.	Ground	Greater than 100.	A. D114 or D115. B. C2. C. R10. D. +35 V line.
(✓) 8. Mounting screw of Q402.	Ground	Greater than 100.	A. D401-D403. B. Q402. C. R401-R406. D. C401 or 402. E. L401. F. Socket S2 wiring.



The following tests are at plug P101 on the power supply circuit board.

METER CONNECTIONS		METER INDICATION	POSSIBLE CAUSE OF TROUBLE
TEST PROBE	GROUND LEAD		
(✓) 8. Pin 1	Ground	Greater than 3000.	A. R101. B. R313. C. D302 or D303.
(✓) 9. Pin 2	Ground	0	A. Board foil broken at P101-2.
(✓) 10. Pin 3	Ground	0-100,000. Varies with setting of Intensity control.	A. R1 B. D101. C. Q101.
(✓) 11. Pin 4	Ground	Greater than 10,000.	A. R1. B. D101. C. Q101.
(✓) 12. Pin 5	Ground	0	A. Board foil broken at P101-5.
(✓) 13. Pin 6	Ground	Less than 1 but not 0.	A. T1.
(✓) 14. Ground	Pin 1	Greater than 3000.	A. Same as 8A, B, and C.
(✓) 15. Ground	Pin 2	0	A. Same as 9A.
(✓) 16. Ground	Pin 3	0-35,000. Varies with setting of Intensity control.	A. Same as 10A, B, and C.
(✓) 17. Ground	Pin 4	Greater than 5000.	A. Same as 11A, B, and C.
(✓) 18. Ground	Pin 5	0	A. Same as 12A.
(✓) 19. Ground	Pin 6	Less than 1 but not 0.	A. Same as 13A.



The following tests are at plug P102 on the power supply circuit board.

	METER CONNECTIONS		METER INDICATION	POSSIBLE CAUSE OF TROUBLE
	TEST PROBE	GROUND LEAD		
(✓)	20. Pins 1 & 2	Ground	Greater than 500.	A. C114 or C118 B. IC 105. C. D107 or D108. D. -15V line.
(✓)	21. Pins 3 & 4	Ground	Greater than 500.	A. D109 or D111. B. C115 or C116. C. +15 V line. D. IC103. E. +15 V line.
(✓)	22. Pin 5	Ground	Greater than 1000.	A. D109 or D111. B. C115. C. Socket S3 wiring.
(✓)	23. Pin 6	Ground	Greater than 100,000.	A. C112 or C113. B. D105 or D106. C. Socket S104 wiring. D. T1. E. Socket S3 wiring.
(✓)	24. Pins 7 & 8	Ground	0	A. Broken foil at P102-7 or P102-8.
(✓)	25. Pin 9	Ground	Greater than 100.	A. D114 or D115. B. Socket S103 wiring. C. T1. D. +35 V line E. C2. F. R10.
(✓)	26. Pin 10	Ground	Greater than 100.	A. D112 or D113. B. Socket S103 wiring. C. T1. D. -35 V line. E. C1. F. R9.
(✓)	27. Ground	Pins 1 & 2	Greater than 1000.	A. Same as 20A, B, C, and D.
(✓)	28. Ground	Pins 3 & 4	Greater than 400.	A. Same as 21A, B, C, D, and E.
(✓)	29. Ground	Pin 5	Greater than 400.	A. Same as 22A, B, and C.
(✓)	30. Ground	Pin 6	Greater than 1000.	A. Same as 23A, B, C, D, and E.
(✓)	31. Ground	Pins 7 & 8	0.	A. Same as 24A.
(✓)	32. Ground	Pin 9	Greater than 100.	A. Same as 25A, B, C, D, E, and F.
(✓)	33. Ground	Pin 10	Greater than 100.	A. Same as 26A, B, C, D, E, and F.



The following tests are at plug P103 on the power supply circuit board.

METER CONNECTIONS		METER INDICATION	POSSIBLE CAUSE OF TROUBLE
TEST PROBE	GROUND LEAD		
(✓) 34. Pin 1	Ground	Less than 1 but not 0.	A. S107-1 wiring. B. T1.
(✓) 35. Pin 3	Ground	Less than 1 but not 0.	A. S103-3 wiring. B. T1.
(✓) 36. Ground	Pin 1	Less than 1 but not 0.	A. S103-1 wiring. B. T1.
(✓) 37. Ground	Pin 3	Less than 1 but not 0.	A. S103-3 wiring. B. T1.
(✓) 38. Pin 1	Pin 3	Less than 1 but not 0.	A. S103-1 wiring. B. T1. C. S103-3 wiring. D. T1.



The following tests are at plug P104 on the power supply circuit board.

METER CONNECTIONS		METER INDICATION	POSSIBLE CAUSE OF TROUBLE
TEST PROBE	GROUND LEAD		
(✓) 39. Pin 1	Ground	Less than 1 but not 0.	A. S104-1 wiring. B. T1.
(✓) 40. Pin 2	Ground	Less than 1 but not 0.	A. S104-2 wiring. B. T1.
(✓) 41. Pin 3	Ground	0	A. S104-3 wiring. B. T1.
(✓) 42. Pin 4	Ground	Less than 1 but not 0.	A. S104-4 wiring. B. T1.
(✓) 43. Pin 5	Ground	Less than 1 but not 0.	A. S104-5 wiring. B. T1.
(✓) 44. Pin 6	Ground	0	A. S104-6 wiring. B. T1.
(✓) 45. Pin 7	Ground	0	A. S104-7 wiring. B. T1.
(✓) 46. Pin 8	Ground	Greater than 50.	A. S104-8 wiring. B. T1.
(✓) 47. Ground	Pin 1	Less than 1 but not 0.	A. S104-1 wiring. B. T1.
(✓) 48. Ground	Pin 2	Less than 1 but not 0.	A. S104-2 wiring. B. T1.
(✓) 49. Ground	Pin 4	Less than 1 but not 0.	A. S104-4 wiring. B. T1.
(✓) 50. Ground	Pin 5	Less than 1 but not 0.	A. S104-5 wiring. B. T1.

This completes the "Resistance Measurements." If all tests were satisfactory, proceed to the "Voltage Measurements" section. If any of the tests were not correct, you must make any corrections necessary and obtain the correct indications before you continue.



## VOLTAGE MEASUREMENTS

IMPORTANT: ALL VOLTAGES WERE TAKEN WITH A HIGH INPUT IMPEDANCE METER.

In this section of the Manual, you will make voltage measurements on the power supplies to see that they are working properly.

Refer to Pictorial 14-1 (Illustration Booklet, Page 18) for the control and test point locations.

( ✓ ) Set the chassis down on its feet.

In the following steps, you will be instructed to preset the various controls and switches. Once set, they should not be changed unless you are instructed to do so in a step. Otherwise, the test may not be correct.

Set the front panel switches as follows:

( ✓ ) SW1: POWER — OFF.

( ✓ ) SW301: SUPERIMPOSE — ON (pushed-in).

( ✓ ) SW301: CANCEL — Press to release any cylinder button (1 through 8) that may be ON (pushed-in). The Cancel button will **not** remain pushed-in.

( ✓ ) SW201: SEC 25 KV (SEC) — ON (pushed-in)

( ✓ ) SW201: VOLTS 20V — ON (pushed-in).

Set the front panel controls as follows:

( ✓ ) R1: Intensity (ITENS) — Full CCW (counterclockwise).

( ✓ ) R2: Vertical Position (VERT POS) — Center of rotation.

( ✓ ) R3: Vertical Gain (VERT GAIN) — Full CCW.

( ✓ ) R4: Horizontal Position (HORIZ POS) — Center of rotation.

( ✓ ) R5: TRACE LENGTH — Full CCW.

( ✓ ) Set the meter mechanical zero adjust screw so the meter pointer is directly over the "O" at the left side of the meter.

Set the controls on the tac/volts circuit board as follows (when viewed from the foil side):

( ✓ ) R242: Tachometer Calibrate (TAC CAL) — Full CCW.

( ✓ ) R259: Secondary Calibrate (SEC CAL) — Center of rotation.

( ✓ ) R255: Primary Calibrate (PRI CAL) — Center of rotation.

( ✓ ) R245, R246, R247: 4 CYL, 6 CYL, and 8 CYL DWELL — Full CCW.

( ✓ ) Tip the chassis up on its right (power transformer T1) end.

( ✓ ) R109: Set the High Voltage Adjust (HV ADJ) control on the power supply circuit board to the center of rotation.

( ✓ ) Connect the pattern cable assembly to the PATTERN socket (S2) on the front panel.

( ✓ ) Keep the red secondary lead (with T-clip), and the black ground lead away from the Analyzer while you make the following voltage checks. If they touch the Analyzer, it could be damaged.

### NOTES:

1. The red primary lead (with alligator clip) of the pattern cable assembly will be used as the test probe to make the following voltage checks. Always clip this lead to the metal blade of a screwdriver and hold the screwdriver by its insulated handle, as there are high voltages present at some of the test points. Touch the metal tip of the screwdriver to the test point. CAUTION: Be very careful to touch the screwdriver blade to the designated test point only. Some of the test points are the foil on a circuit board. If the tip slips and shorts two foils together the circuit component could be damaged.
2. The resulting voltage of a test will be indicated on the meter of the Analyzer. All readings will be read from the 20V (bottom) scale on the meter.



3. When the Analyzer is first turned on, the red pilot lamp should light and the filament in the neck of the cathode ray tube should light up with an orange glow. If any sign of malfunction appears in the following steps, turn the POWER switch off and unplug the line cord immediately. Then check the Possible Cause column of the chart that follows the steps for a clue to the area of the Analyzer to be checked.

**WARNING: Extremely high voltage (up to 10,000 volts) is present in the high voltage assembly (metal box on the power supply circuit board) and at the second anode socket on the CRT. Use extreme care that you do not touch any of the circuit board foils in this area or the second anode lead to the CRT. A safe rule to remember when making voltage measurements is to hold the test lead by its insulated handle in one hand and keep your other hand behind you. This helps prevent your body from becoming part of an electrical circuit by being connected between a voltage source and ground. Note the DANGER areas marked on Pictorial 14-1.**

4. Capacitance between the inner and outer coatings of the CRT allows a high voltage charge to be stored at the second anode socket of the cathode ray tube. Always discharge the second

anode socket in the following manner before you disconnect or connect the second anode lead:

- A. With the line cord of the Analyzer unplugged, clip the black ground lead of the pattern cable assembly to the blade of a screwdriver.
- B. Be sure the pattern cable assembly is connected to the Pattern socket (S2) of the Analyzer; then push the blade of the screwdriver under the rubber cup on the second anode lead while you hold the insulated handle of the screwdriver.

- ( / ) Be sure the unconnected leads of the deflection yoke are not touching any circuit components.
- ( ) Plug the line cord of the Analyzer into a wall outlet that has the line voltage for which the Analyzer was wired (110/130 VAC or 220/260 VAC, 50/60 Hz.).

NOTE: If a dot appears on the face of the CRT when the Analyzer is first turned on, check transistor Q101 and its associated circuitry.



POWER SWITCH		TEST LEAD CONNECTION	METER INDICATION	POSSIBLE CAUSE OF TROUBLE
(✓)	1. ON	P102-3	13.5 to 16.5.	A. IC103. B. D109 or D111. C. C115.
(✓)	2. ON	P102-4	13.5 to 16.5.	A. IC103. B. D109 or D111. C. C115.
(✓)	3. OFF			
(✓)	4. Reverse the red and black meter lead connections on the tac/volts circuit board at A and B.			
(✓)	5. ON	P102-1	13.5 to 16.5.	A. IC105. B. D107 or D108. C. C114 or C118.
(✓)	6. ON	P102-2	13.5 to 16.5.	A. IC105. B. D107 or D108. C. C114 or C118.
(✓)	7. OFF			
(✓)	8. Reverse the red and black meter lead connections on the tac/volts circuit board at A and B.			

This completes the voltage measurements. Proceed to the "Adjustments" section of this Manual.



## ADJUSTMENTS

In the following steps, you will be instructed to make a number of adjustments. Always allow a few minutes for the Analyzer to warm up before making the adjustment.

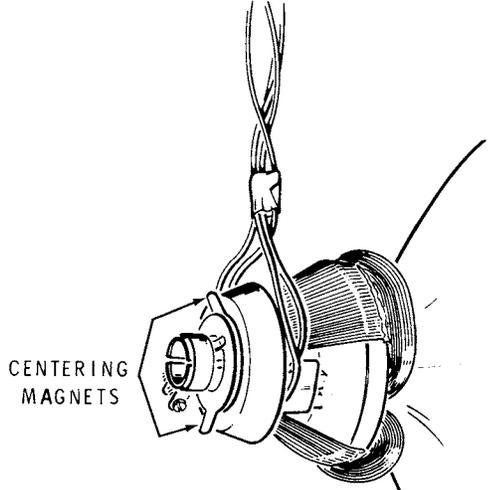
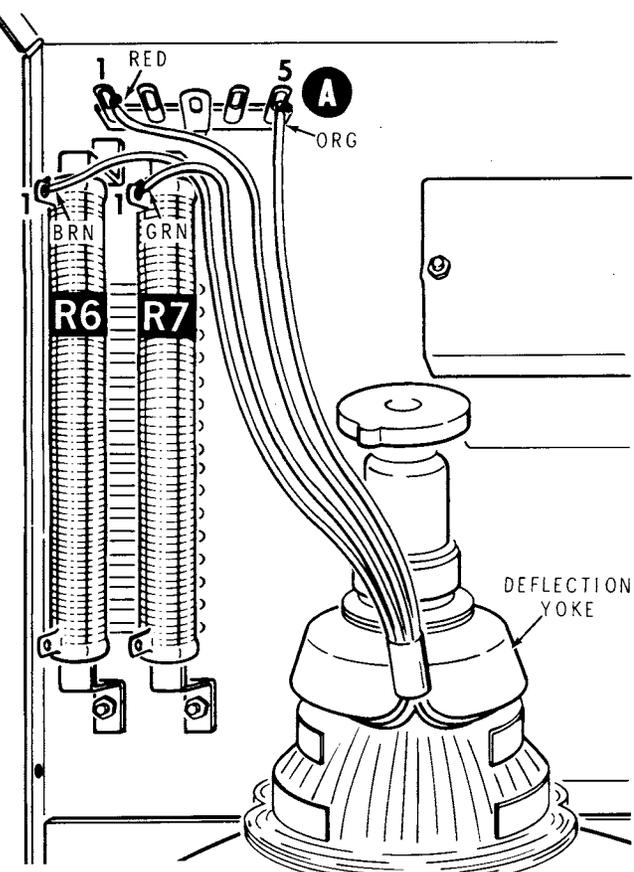
Always use the red primary lead of the pattern cable assembly as the test probe unless you are specifically instructed otherwise in a step. The pattern cable assembly must be connected to the Pattern socket (S2) on the Analyzer.

Perform the operation described in the "Instruction-Result" column of the following chart. The results will be a meter indication or a particular display on the face of the CRT. If you do not get the correct result in a step, turn the Power switch to OFF. Then refer to the "Possible Cause of Trouble" column and check the components or areas described for a possible assembly error.

Refer to Pictorial 14-1 (Illustration Booklet, Page 18) for the control and test point (TP) locations.

INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
(✓) 1. POWER switch to ON.	
(✓) 2. Test probe to TP1 (upper right-hand corner of chassis).	
(✓) 3. Adjust the VERTICAL POSITION control (R2) for as near a 0 indication as possible. (Turn the control slowly, as this adjustment is difficult to make.)	No effect: A. Q211 through Q214. Meter indicates almost 0 with S501V disconnected: A. 211 through Q214. Meter does not indicate almost 0 with S501V disconnected: A. Vertical output amplifier circuit board.
(✓) 4. Move the test probe to TP2 (upper right-hand corner of chassis).	
(✓) 5. Adjust the HORIZONTAL POSITION control (R4) for as near a 0 indication as possible.	No effect: A. Q326 through Q329. TP1 indicates almost 0 with S501H disconnected: A. Q326 through Q329. TP1 does not indicate almost 0 with S501H disconnected: A. Horizontal output amplifier circuit board.
(✓) 6. Disconnect the test probe.	
(✓) 7. Turn the INTENSITY control CW (clockwise) just until a dot appears on the face of the CRT.	No dot: A. Q101. B. Q103 and circuitry inside high voltage shield.



INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
<p>(✓) 8. Refer to Detail 14-1A and rotate the centering magnets on the deflection yoke. First adjust one magnet and then the other until the dot is centered on the face of the CRT. NOTE: Use a straight edge and a grease pencil or crayon to mark an "X" on the graticule at the center of the CRT. See Pictorial 14-1. Wipe off the "X" after the dot is centered.</p>	 <p style="text-align: center;">CENTERING MAGNETS</p> <p style="text-align: center;"><b>Detail 14-1A</b></p>
<p>(✓) 9. POWER switch to OFF.</p>	
<p>(✓) 10. Unplug the line cord and tip the chassis down on its feet.</p>	
<p>(✓) 11. Refer to Detail 14-1B and connect the leads from the deflection yoke as follows:</p> <p>Orange to terminal strip A lug 5 (S-2).</p> <p>Red to terminal strip A lug 1 (S-2).</p> <p>Green to resistor R7 lug 1 (S-3).</p> <p>Brown to resistor R6 lug 1 (S-2).</p>	 <p style="text-align: center;"><b>Detail 14-1B</b></p>



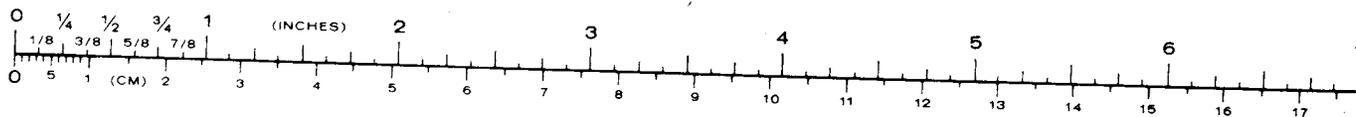
INSTRUCTION-RESULT		POSSIBLE CAUSE OF TROUBLE
(✓)	12. Plug the line cord into a wall outlet.	
(✓)	13. Power switch to ON.	
(✓)	<p>14. Readjust the INTENSITY control, if necessary, for a line on the CRT. See Detail 14-1C. NOTE: It is alright if the line is not straight across the CRT.</p> <p>Adjust the VERTICAL POSITION control to center the line vertically on the CRT.</p>	<p>No line:                      A. IC305.                      B. D302 through D308.                      C. Q303 through Q307.                      D. R4.                      E. R5.</p> <p style="text-align: center;"><b>Detail 14-1C</b></p>
(✓)	<p>15. Adjust the HORIZONTAL POSITION control so the left end of the line is at the left vertical line on the graticule and then adjust the TRACE LENGTH control until the line reaches the right vertical line on the graticule. Readjust these controls until the line touches the vertical sidelines of the graticule. See Detail 14-1 D. Disregard any bow that may appear in the line.</p>	<p>A. R4.                      B. R5.</p> <p style="text-align: center;"><b>Detail 14-1D</b></p>



INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
<p>16. Loosen the deflection yoke clamp screw. Rotate the deflection yoke so the horizontal line is perfectly horizontal across the face of the CRT. See Detail 14-1E.</p>	<p style="text-align: center;"><b>Detail 14-1E</b></p>
<p>17. Retighten the deflection yoke clamp screw.</p>	
<p>18. POWER switch to OFF.</p>	
<p>19. Test probe to TP pin on the power supply circuit board.</p>	
<p>20. POWER switch to ON.</p>	
<p><b>WARNING: When you adjust a circuit board control, as in the next step, use a small blade screwdriver and hold it by its insulated handle.</b></p>	
<p>21. Adjust the HV ADJ control on the power supply circuit board for a .9 (9kV) indication on the top scale of the meter. See Detail 14-1F.</p>	<p>A. Q102 or Q103.                  B. IC101.                  C. T101.                  D. C109.                  E. R121.                  F. D103, D109, or D116.</p> <p style="text-align: center;"><b>Detail 14-1F</b></p>
<p>22. POWER switch to OFF.</p>	



INSTRUCTION-RESULT		POSSIBLE CAUSE OF TROUBLE
(✓) 23.	Move test probe to TP on special functions circuit board.	
(✓) 24.	Press the following pushbuttons to on (in position): PRI 50V RPM 1000 CYLINDERS 8	
(✓) 25.	POWER switch to ON.	
NOTE: Perform only the part of step 26 that pertains to the line voltage frequency in your area. Use step 26A for a 60 Hz line frequency OR step 26B for a 50Hz line frequency. Then proceed to step 27.		
(✓) 26.	A. 60 Hz: Adjust the TAC CAL control (R242) on the tac/volts circuit board for a .9 RPM (900) indication on the top meter scale.	A. Q303 through Q307. B. IC305. C. Q201 through Q208. D. D201.
	B. 50Hz: Press the CYLINDERS 6 pushbutton to on (in position) and adjust the TAC CAL control (R242) on the tac/volts circuit board for a 1000 RPM (1) indication on the top scale of the meter. Then press the CYLINDERS 8 pushbutton to on (in position.)	A. Same as A, B, C, and D.
(✓) 27.	Adjust the PRI CAL control (R255) on the tac/volts circuit board for a 14V indication on the graticule (right-hand scale). See Detail 14-1G.	A. Q211 through Q214.
<p style="text-align: center;"><b>Detail 14-1G</b></p>		
(✓) 28.	Move the test probe to a ground connection.	
(✓) 29.	Press the DWELL pushbutton to on (in position).	

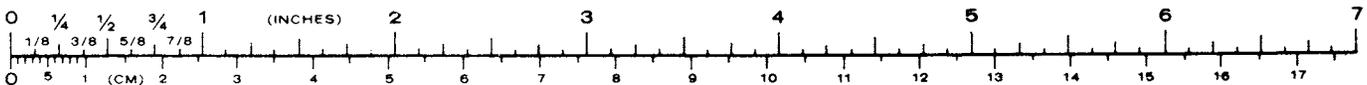




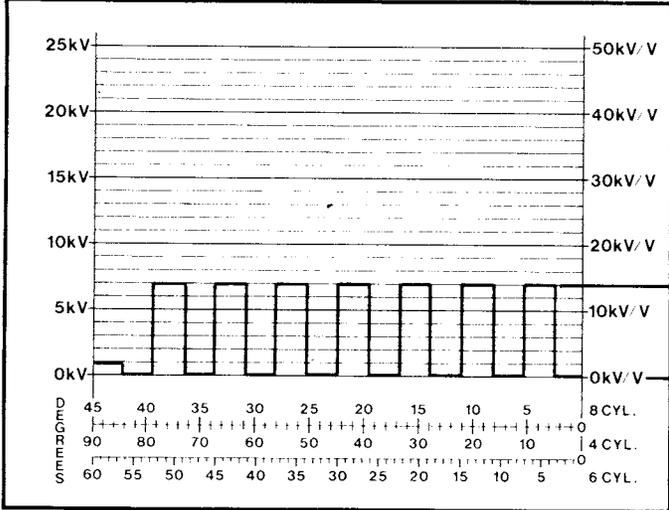
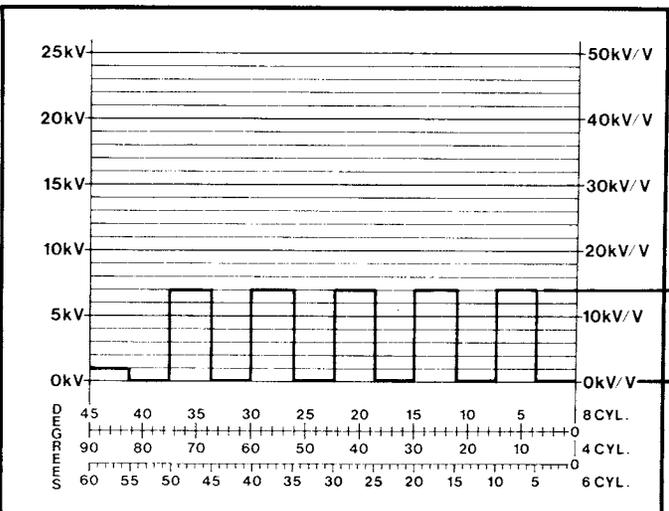
INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
<p>30. Adjust the DWELL 8 CYL control (R245) on the tac/volts circuit board for a 45° indication on the DWELL scale on the meter. See Detail 14-1H.</p>	<p>A. R206, R209, or R213.</p> <p style="text-align: center;"><b>Detail 14-1H</b></p>
<p>31. Press the CYLINDERS 6 pushbutton to on (in position).</p>	
<p>32. Adjust the DWELL 6 CYL control (R246) on the tac/volts circuit board for a 60° indication on the DWELL scale on the meter. See Detail 14-1H.</p>	<p>A. R207, R211, or R214.</p>
<p>33. Press the CYLINDERS 4 pushbutton to on (in position).</p>	
<p>34. Adjust the DWELL 4 CYL control (R247) on the tac/volts circuit board for a 90° indication on the DWELL scale on the meter. See Detail 14-1H.</p>	<p>A. R208, R212, or R215.</p>
<p>35. POWER switch to OFF and unplug the line cord.</p>	
<p>36. Disconnect test probe.</p>	
<p>37. Tip the chassis up on its right (power transformer) end.</p>	
<p>38. Prepare one end of the 24" high-tension wire.</p>	
<p>39. Solder the prepared end of this wire to the "600V" foil on the power supply circuit board. Keep the insulation 1/8" away from the board so you can make a good solder connection.</p>	
<p>40. Install the T-clip around this wire about 1' from the end of the high-tension wire. CAUTION: Be sure the free end of the high tension wire does not touch the chassis or any other part of the Analyzer, as there is 600 VAC present at the ends of this wire.</p>	
<p>41. R262: Temporarily replace the 220 kΩ (red-red-yellow) resistor installed in the pins in the foil side of the tac/volts circuit board with a 2.2 MΩ (red-red-green) resistor. Cut both resistor leads to 3/8" and bend them to fit the pins.</p>	
<p>42. Press the SEC 25KV pushbutton switch to on (in position).</p>	
<p>43. Plug the line cord into a wall outlet.</p>	
<p>44. POWER switch to ON.</p>	



INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
<p>45. After the light appears on the CRT, adjust the SEC CAL control (R259) for a 12KV indication on the graticule (left-hand scale). See Detail 14-1J.</p>	<p>A. D105 or D106.                      B. C112 or C113.                      C. T1 (red and red-yellow winding).</p> <div data-bbox="769 406 1442 917" style="text-align: center;"> <p>12KV ON 25KV SCALE</p> </div> <p style="text-align: center;"><b>Detail 14-1J</b></p>
<p>46. POWER switch to OFF.</p>	
<p>47. Unplug the line cord.</p>	
<p>48. Disconnect the T-clip from the high-tension wire.</p>	
<p>49. Unsolder the high-tension wire from the power supply circuit board.</p>	
<p>50. R262: Replace the 2.2 MΩ resistor in the pins in the foil side of the tac/volts circuit board with the 220 kΩ (red-red-yellow) resistor removed earlier.</p>	
<p>51. Move the test probe to TP on special functions circuit board.</p>	
<p>52. Press the following pushbuttons to on (in position).</p> <p>PARADE                      SINGLE CYL 1                      PRI 50V                      RPM 1000                      SPEC                      CYLINDERS 8</p>	
<p>53. Plug in the line cord.</p>	
<p>54. POWER switch to ON.</p>	





INSTRUCTION-RESULT	POSSIBLE CAUSE OF TROUBLE
<p>(✓) 55. After the Analyzer is warmed up, the following pattern should appear on the CRT.</p>	<p>A. IC306 or IC307.                      B. SW2.                      C. Connector P303 or S303.</p> 
<p>(✓) 56. Meter should indicate:</p> <p>A. 900 RPM if calibrated on 60 Hz line.</p> <p>( ) B. 720-780 RPM (if calibrated on 50 Hz line).</p>	<p>A. See step 26A.</p> <p>A. R206.                      B. SW2.                      C. Connector P203 or S203.</p>
<p>(✓) 57. Press the CYLINDERS 6 pushbutton to on (in position).</p>	
<p>(✓) 58. The following pattern should appear on the CRT.</p>	<p>A. IC306 or IC307.                      B. SW2.                      C. Connector P303 or S303.</p> 



INSTRUCTION-RESULT		POSSIBLE CAUSE OF TROUBLE
<p>(✓) 59. Meter should indicate:</p> <p>( ) A. Against full scale stop (right side) if calibrated on 60 Hz line.</p> <p>( ) B. 1000 RPM if calibrated on 50 Hz line.</p>		<p>A. R207.</p> <p>B. SW2.</p> <p>A. See step 26B.</p> <p>B. Connector P203 or S203.</p>
<p>(✓) 60. Press the CYLINDERS 4 pushbutton to on (in position).</p>		
<p>(✓) 61. The following pattern should appear on the CRT.</p>		<p>A. IC306 or IC307.</p> <p>B. SW2.</p> <p>C. Connector P303 or S303.</p>
<p>(✓) 62. Meter should indicate against full scale stop (right side).</p>		<p>A. R208.</p> <p>B. SW2.</p> <p>C. Connector P203 or S203.</p>
<p>(✓) 63. Press the CYLINDERS 8 and RPM 3000 push-buttons to on (in position).</p>		
<p>64. Meter should indicate:</p> <p>(✓) A. 810-990 RPM if calibrated on 60 Hz line.</p> <p>( ) B. 660-840 RPM if calibrated on 50 Hz line.</p>		<p>A. 209.</p>
<p>(✓) 65. Press the RPM 6000 pushbutton to on (in position).</p>		



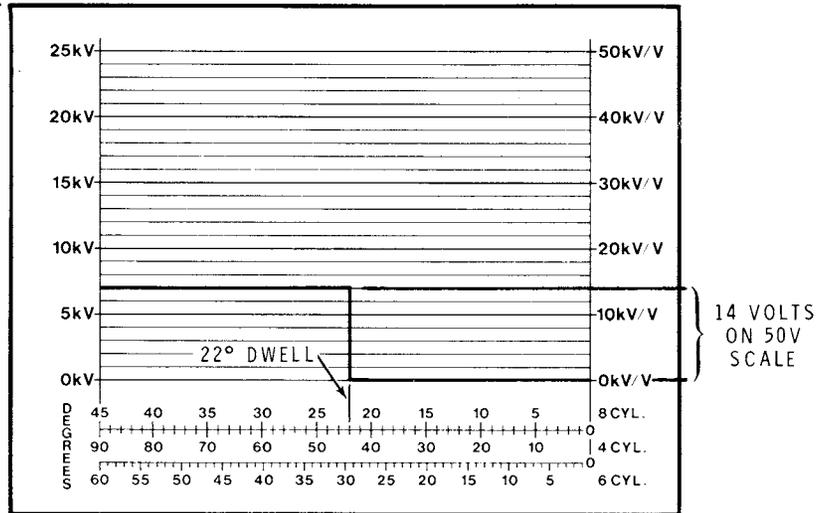
(✓)	66. Meter should indicate: A. 720-1080 RPM if calibrated on 60 Hz line. B. 570-930 RPM if calibrated on 50 Hz line.	A. R213.
( )		
(✓)	67. Press the CYLINDERS 6 and RPM 3000 pushbuttons to on (in position).	
(✓)	68. Meter should indicate: A. 1110-1290 RPM if calibrated on 60 Hz line voltage. B. 910-1090 RPM if calibrated on 50 Hz line.	A. R211.
( )		
(✓)	69. Press the RPM 6000 pushbutton to on (in position).	
(✓)	70. Meter should indicate: A. 1020-1380 RPM if calibrated on 60 Hz line. B. 820-1180 RPM if calibrated on 50 Hz line.	A. R214.
( )		
(✓)	71. Press the CYLINDERS 4 and RPM 3000 push buttons to on (in position).	
(✓)	72. Meter should indicate: A. 1710-1890 RPM if calibrated on 60 Hz line. B. 1410-1590 RPM if calibrated on 50 Hz line.	A. R212.
( )		
(✓)	73. Press the RPM 6000 pushbutton to on (in position).	
(✓)	74. Meter should indicate: A. 1620-1980 RPM if calibrated on 60 Hz line. B. 1320-1680 RPM if calibrated on 50 Hz line.	A. R215.
( )		
( )	75. Press the SUPERIMPOSE pushbutton to on (in position).	
( )	76. Press the CANCEL pushbutton to release the SINGLE CYL 1 pushbutton.	
(✓)	77. The pattern in step 27 should appear on the CRT.	A. See step 27.
(✓)	78. Clip the PARADE cable inductive pickup over the red deflection yoke wire.	



(✓)

79. The following pattern should appear on the CRT. The dwell line should be at approximately 22° on the 8 CYL scale.

- A. Q301, Q303, Q304, or Q305.
- B. IC304, IC305, or IC306.
- C. Connector P1 or S1, P304 or S304.



(-)

80. POWER switch to OFF.

(✓)

81. Disconnect the PARADE inductive pickup and the test probe from inside the Analyzer.

(✓)

82. Unplug the line cord.

This completes the adjustments of the Analyzer.

NOTE: If you have purchased the Accessory Timing Light, it should be assembled and tested at this time before you complete the final assembly of the Analyzer. If you do not have the Timing Light, proceed to "Final Assembly."



## IN CASE OF DIFFICULTY

The following information will most often be used to deal with the type of difficulties that occur after the Analyzer has been in operation for some time. This type of difficulty is usually caused by transistor failure or other parts breakdown.

Troubleshooting your Analyzer means the process of searching through it to find out why it is not operating properly. First, you must determine what general area the trouble is in; then you must find the trouble itself and correct it.

### FINDING THE AREA

Studying a faulty Analyzer is like a detective trying to solve a crime; you must locate the source of the trouble by analyzing the symptoms, or clues, that are shown by the Analyzer. The Block Diagram (Illustration Booklet, Page 6) shows the major sections of your Analyzer. It is provided to help you find out what part of the Analyzer your trouble is in. Careful reading of the "Circuit Description" section of this Manual may also help you to analyze the problem.

Carefully study the symptoms shown by your Analyzer and try to determine which section could cause the type of trouble you are having. A case where you have no dot on the screen of the CRT could be used as an example of the troubleshooting process. The Block Diagram shows that the high voltage circuits cause the dot to appear, so the trouble may well be in the circuit of Q101 and the components inside the high voltage shield.

### FINDING THE TROUBLE

When you have determined the section the trouble is most likely to be in, search through the area carefully to find the exact cause of the trouble. Start by making more complete visual checks in this area, as listed.

1. Search through the trouble area carefully for damaged or burned components.
2. Check the transistors in this section by substituting transistors of the same types that are known to be good, or by using a transistor tester. Substituting good transistors is always the best method.

### REPAIRING THE ANALYZER

In repairing your Analyzer, make sure you eliminate both the **cause** and **effects** of your trouble. For example, suppose you found a burned-up resistor and a shorted transistor. If you only replace the resistor, the shorted transistor will also cause the new resistor to burn up.

Since an ignition analyzer is a complex device, a case may sometimes arise where you cannot find the trouble, even after making the checks listed above. If this condition occurs, you can use the help provided by the Heath Technical Consultation or Service Departments, as described inside the rear cover of this Manual.

In extreme cases where you are unable to resolve a difficulty, you should make every effort to pinpoint the problem to a circuit board. You can then remove the circuit board and return it by itself to the Heath Company Service Department, rather than return the complete unit. See the "Customer Service" information inside the rear cover. Your "Warranty" is located inside the front cover.

**NOTE:** When writing to the Heath Company, be sure to include the following information: Model Number, Series Number (refer to the blue and white label), and purchase date.



## TROUBLESHOOTING CHART

This "Troubleshooting Chart" lists some possible difficulties that might arise in the adjustment and operation of your Analyzer. It may be necessary to refer to more than one trouble listed in the Chart to help locate the difficulty. The suggested corrective measures are given primarily to direct your attention to the areas most likely to be faulty; they do not definitely rule out other possibilities.

TROUBLE	POSSIBLE CAUSE
Fuse blows.	<ol style="list-style-type: none"> <li>1. T1 primary.</li> <li>2. +35 V supply; D114, D115, C2, or R11.</li> <li>3. -35 V supply; D112, D113, C1, or R9.</li> <li>4. Horizontal or vertical sweep amplifier. NOTE: Unplug the harness from either circuit board. If the new fuse blows, the sweep amplifier is OK. Try with the other sweep amplifier. If the fuse does not blow with a sweep amplifier board unplugged, that board is faulty. If the fuse blows with both amplifiers unplugged, the problem is in the +35 V or -35 V power supply.</li> </ol>
No display on CRT, all other functions OK.	<ol style="list-style-type: none"> <li>1. Q102, Q103, IC101, or T101.</li> <li>2. Q101.</li> <li>3. C101, C113, D105, D106, or R108.</li> <li>4. R7 very hot; vertical output amplifier.</li> <li>5. R6 very hot; horizontal output amplifier.</li> </ol>
No meter RPM, volts, or dwell indication. All other functions OK.	<ol style="list-style-type: none"> <li>1. Meter M1.</li> <li>2. C201, D201, or R218.</li> <li>3. SW201.</li> <li>4. Black lead not connected to good vehicle ground point.</li> </ol>
No meter RPM or volts, and CRT will not lock on Superimpose or Parade.	<ol style="list-style-type: none"> <li>1. Red primary pickup assembly wire.</li> <li>2. Pin 4 of socket S1.</li> <li>3. Q201-Q204.</li> </ol>
No horizontal deflection on CRT with or without external input signal. Vertical deflection OK (Vert Pos).	<ol style="list-style-type: none"> <li>1. Q313-Q329.</li> <li>2. Horizontal output amplifier.</li> </ol>
No sync with external input signal. Horizontal base line OK.	<ol style="list-style-type: none"> <li>1. IC304.</li> <li>2. D304.</li> <li>3. Q301.</li> </ol>
No horizontal base line. Horizontal deflection with external input signal.	<ol style="list-style-type: none"> <li>1. Q305-Q307.</li> </ol>
No cylinder shorting.	<ol style="list-style-type: none"> <li>1. D401.</li> <li>2. Q401 or Q402.</li> </ol>
Tachometer (RPM) inoperative.	<ol style="list-style-type: none"> <li>1. Q205-Q208.</li> </ol>
CRT will not lock on external signal, Timing Light erratic or inoperative.	<ol style="list-style-type: none"> <li>1. Slider on pickup assembly not closed tight around spark plug wire.</li> <li>2. Q301.</li> <li>3. IC304.</li> </ol>
No meter RPM, volts erratic, no dwell, cylinder shorting does not work, parade OK but superimpose does not work.	<ol style="list-style-type: none"> <li>1. Black lead not connected to good vehicle ground point.</li> </ol>