ADVANCED TROUBLESHOOTING TECHNIQUES-A LOGICAL APPROACH

Lesson 19

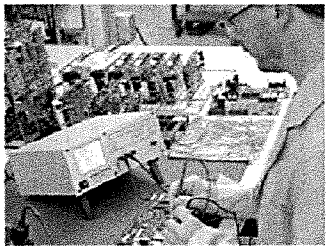
EET 150

Learning Objectives

- In this lesson you will:
- learn how to use logical methods to troubleshoot circuits
- learn to gather information useful in troubleshooting
- see six troubleshooting methods

ADVANCED TROUBLESHOOTING

Creating and testing circuit designs and projects requires troubleshooting skill



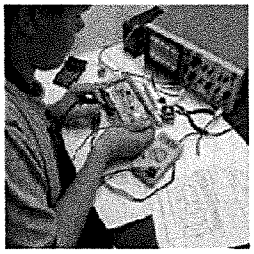
Efficient troubleshooting saves time (and money on the job)

Logical methods promote efficient troubleshooting

Experience builds troubleshooting skills

Systematic techniques more productive

LOGICAL VS "SHOTGUN" TROUBLESHOOTING



Troubleshooting is a trial and error process

"Shotgun" Method – replace parts with little regard to symptoms of circuit/system faults.

Eventually, maybe, the fault disappears

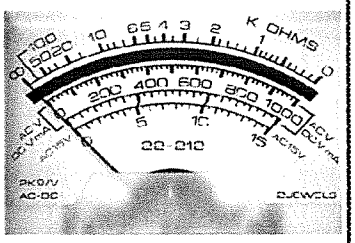
Logical Method – use knowledge of circuit or system operation/theory to identify likely failure points. Gather information on symptoms to help.

STEPS TO LOGICAL TROUBLESHOOTING

Gather information about problem before testing and substituting components

Questions to ask:

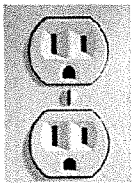
- How is the circuit or system suppose to work?
- Is the problem continuous or intermittent?
- Did the defect occur suddenly or gradually?
- Did the defect occur when the system of circuit was in operation?



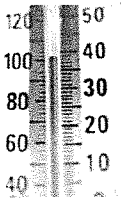
STEPS TO LOGICAL TROUBLESHOOTING

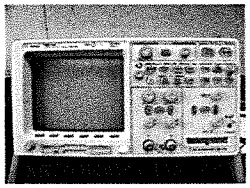
Gather information about problem

Look for additional details like:



- Did you use the test instruments correctly?
- Is the power supply on and set correctly?
- Are there any wiring errors?
- Does time or temperature have an effect?



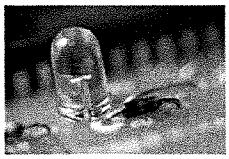


STEPS TO LOGICAL TROUBLESHOOTING

Gather information about problem

Has any other person worked on the circuit or system?

Check for proper component installation
- Diodes
- IC's
- LED's
- Polarized Capacitors

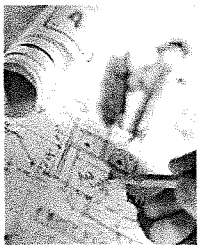


STEPS TO LOGICAL TROUBLESHOOTING

Collect and use documentation

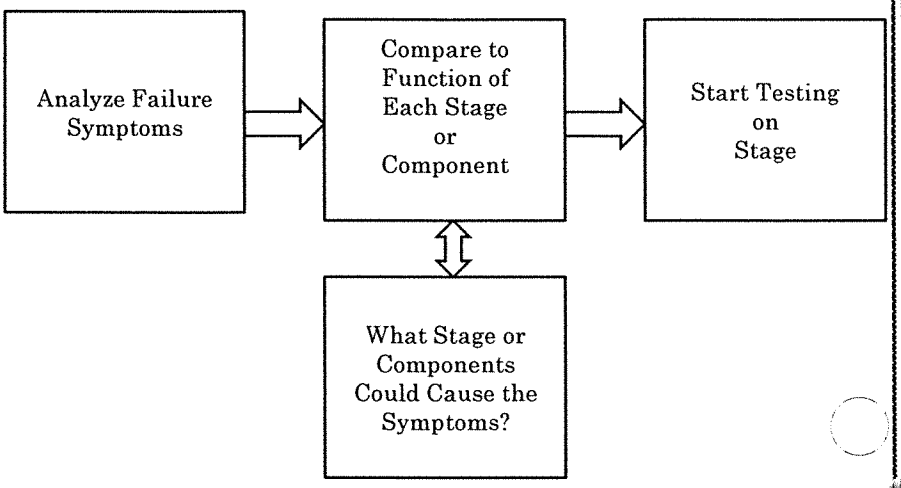
Do you have any circuit or system documentation?

Always work from a schematic
- Make quick sketches in lab
- Keep revising schematic to reflect work



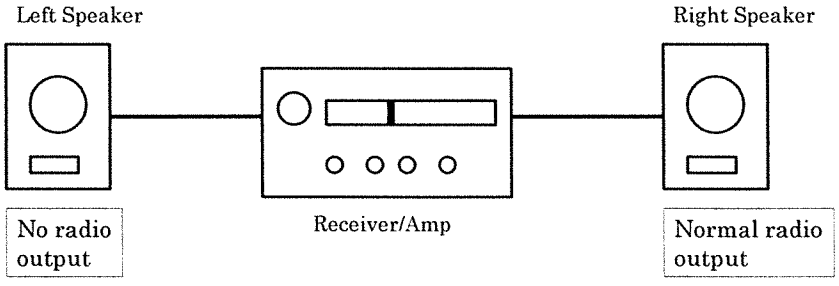

Six Basic Troubleshooting Techniques

Technique 1: Symptom-Function Analysis



Symptom-Function Analysis

Example: Stereo AM/FM radio



Use knowledge of system to identify possible faulted stage

Possible Fault: bad left channel amplifier

TECHNIQUE 2: PHYSICAL OBSERVATION

Use Symptom-Function to guide senses: sight, smell, hearing, touch

Look for catastrophic failures-signs of heat, burned components, broken/loose components or wires/PCB traces.

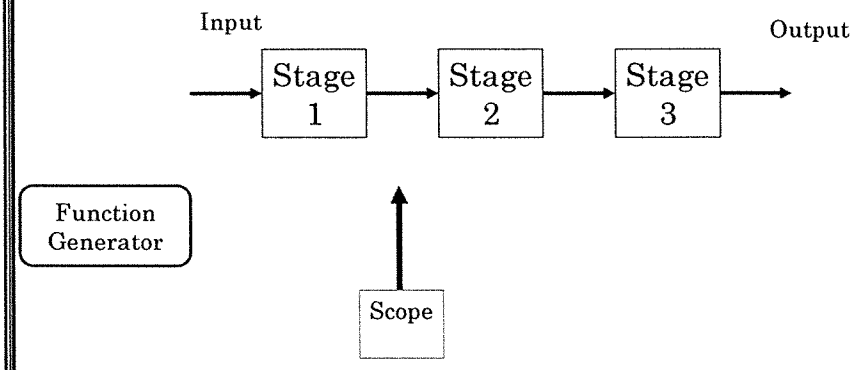
Check for excessive heating using "Five Second Rule". Should be able to touch most components for five seconds or more without discomfort.

Try to find fault cause before re-energizing

Use Caution: burn and/or shock hazard

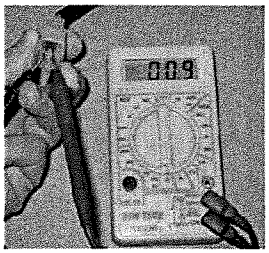
TECHNIQUE 3: SIGNAL INJECTION/TRACING

Use function generator/voltage source and scope/multimeter to inject and measure signals



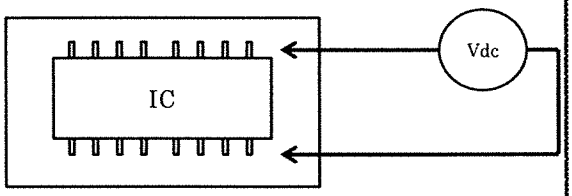
TECHNIQUE 4: VOLTAGE AND RESISTANCE MEASUREMENTS

Use DVM to measure critical AC and DC voltage values and component resistances



Test power supply values

Test IC power supplies on the chip pins when working with SEB's



Test AC supplies on both sides of transformer
Use caution with "wall power"

TECHNIQUE 4: VOLTAGE AND RESISTANCE MEASUREMENTS

Resistance Measurements

Some electronic components have characteristic resistance values

Diodes and Transistors

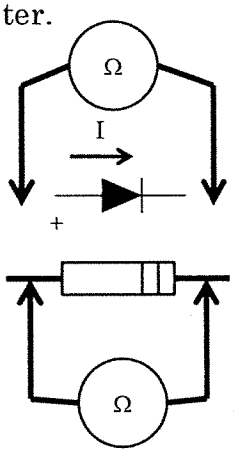
Different meters give different values due to meter internal circuits

Safety First: power must be off to make resistance measurements

Remove components from circuit for accurate measurements

TECHNIQUE 4: VOLTAGE AND RESISTANCE MEASUREMENTS

Resistance Measurements – Checking a diode using a DVM or multimeter.



Reverse Test

Use Continuity or Diode Check setting

Reading: (Hi Ohms, Open Circuit)

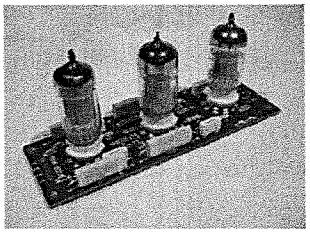
Forward Test

Reading: 0.7 -0.5 Volts (low ohms 10's)

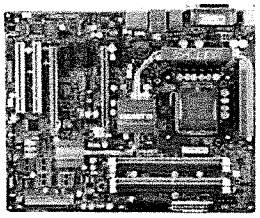
TECHNIQUE 5: SUBSTITUTION

Replace questionable parts with new or known good parts

Easier to implement with socketed devices such as vacuum tubes Ics and daughter boards (board swapping)



Use this technique when fault is isolated or you are stumped (Shot gunning)



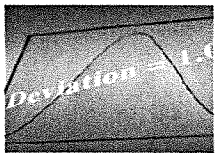
TECHNIQUE 6: STATISTICAL METHODS

Use historical record of repairs and maintenance to determine possible faults and problems

Must create and maintain repair record for circuits and systems

Record experiences with circuits and devices

Not applicable to design and prototyping, no historical record of circuit



COMING NEXT: POWER AND POWER MEASUREMENT

End Lesson 19

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