

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

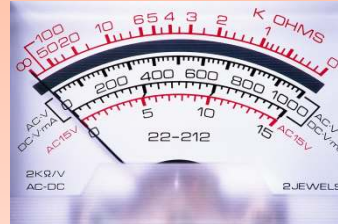
Questions to ask:

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:

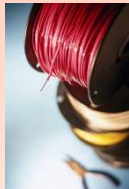


Did you use the test instruments correctly?

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

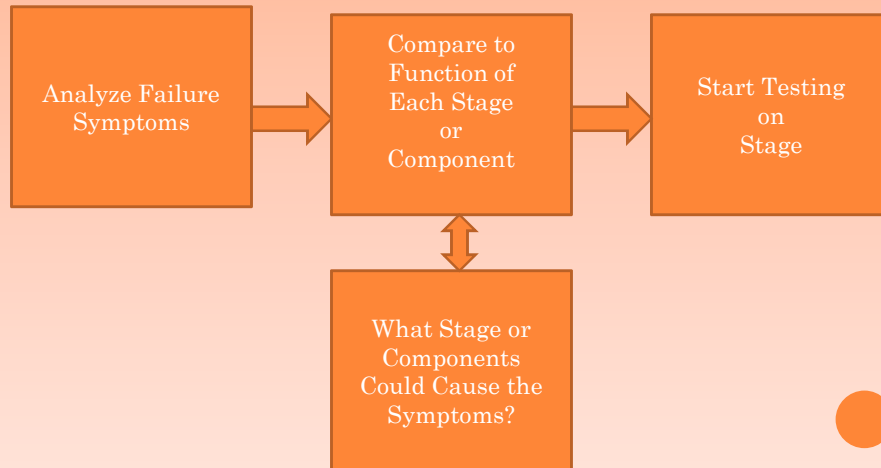
Make quick sketches in lab

Keep revising schematic to reflect work



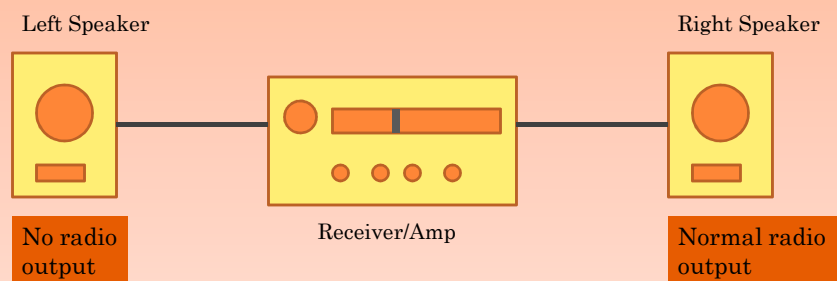
SIX BASIC TROUBLESHOOTING TECHNIQUES

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

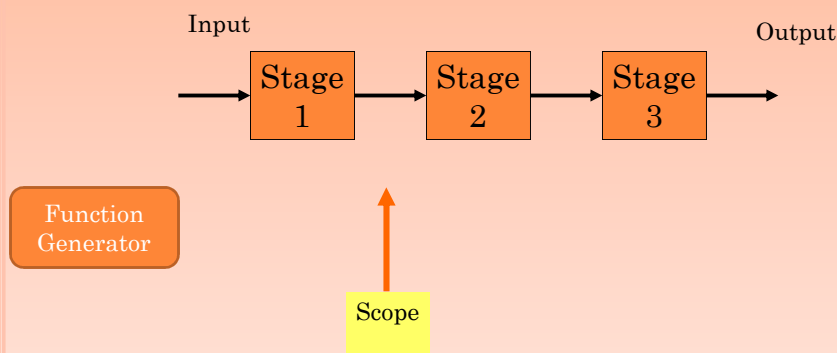


Use Caution: burn and/or shock hazard



TECHNIQUE 3: SIGNAL INJECTION/TRACING

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



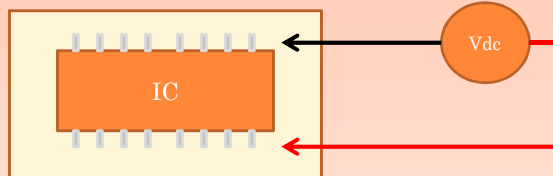
TECHNIQUE 4: VOLTAGE AND RESISTANCE MEASUREMENTS

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

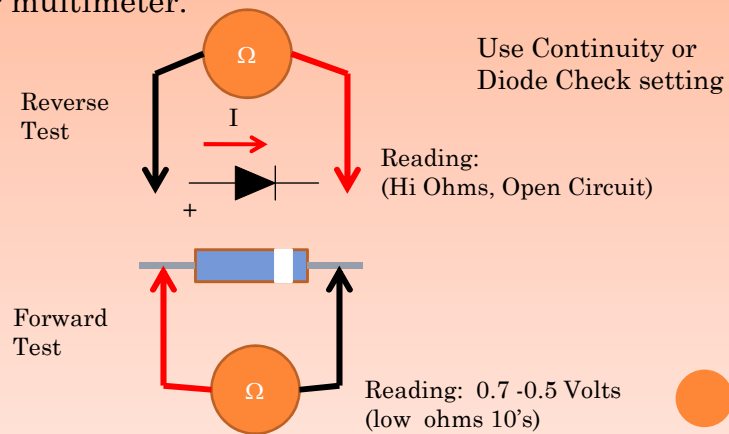
Safety First: power must be off to make resistance measurements

Remove components from circuit for accurate measurements



TECHNIQUE 4: VOLTAGE AND RESISTANCE MEASUREMENTS

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



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**

ET 150

