Introduction to Circuit Troubleshooting

ET 150

Troubleshooting Learning Objectives

- In this lesson you will:
- define troubleshooting
- learn a six step process for successful troubleshooting
- identify typical faults that occur in projects and experiments
- learn to locate faulty components and wiring errors
Troubleshooting

What is troubleshooting?

Troubleshooting – finding and repairing malfunctions and errors in circuits and equipment by using systematic analysis and tests.

Most newly constructed circuits do not work properly due to minor wiring error rather than defective components.

Effective troubleshooting requires a systematic method.

Six-Step Method for Troubleshooting

- **Step 1: Recognize the Symptoms**
  - What is the circuit or system suppose to do according to theory or design?
  - Are measurements being taken properly?
    - Check DVM and Scope against known sources to verify their operation
  - Circuit malfunction verses operator error
    - bad readings could be due to instrument miss-use.
    - Check signal sources and power supplies (Is it on?)
Six-Step Method for Troubleshooting

• **Step 2: Determine Possible Faults**
  - Use circuit schematic or block diagram to determine location of possible fault
    - Inspect all connections—have others review

**Typical Errors**
- Battery or Power Supply Connections
- Incorrect Input Signal Level or Frequency
- Output Not Connected
- Wiring Error

• **Step 3: Locate Possible Faults**

For complex circuits use “Half-Split Method”

1. Stage 1
2. Stage 2
3. Stage 3
4. Stage 4

For each stage:
- **Input**
- **Test Reading**
  - **Good**
  - **Bad**

If first reading is good, split stages 3-4.

Stage 1 likely faulted
Six-Step Method for Troubleshooting

- **Step 4: Find Fault in Stage**
  
  - Input
  - Stage
  - Output

  - Check for correct power supply values
  - Check actual circuit against schematic
  - Check component values

  - Faulted

  - Power Supplies

  - Replace IC or Transistor
  - Check all connections
  - Re-solder, tighten

- **Step 5: Find and Replace Component**

  **Level of Replacement**

  - **Board-level Substitution**
    
    Replace entire subsystems of Electronic devices – Example personal computer repair

  - **Component-level Substitution**
    
    Replace individual devices to such as IC’s transistors, diodes

  - Small prototypes require component level substitution
Six-Step Method for Troubleshooting

- **Step 6: Replace/correct and Document**

  Replace defective part and/or correct wiring error

  Carefully replace IC’s in SEB to prevent mechanical and electrical damage

  Un-solder and re-solder devices Use Heat Sinks

  Dispose of defective devices

  Update design schematic as necessary
  
  Always work from schematic and keep it current as designs change

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COMING NEXT:

**ELECTRONIC WAVEFORMS AND THE FUNCTION GENERATOR**