

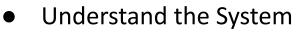
Troubleshooting John R. Leeman GEARS 2023



Image: DeviantArt

# DEBUGGING

The 9 Indispensable Rules for Finding Even the Most Elusive Software and Hardware Problems



- Make it Fail
- Quit Thinking and Look
- Divide and Conquer
- Change One Thing at a Time
- Keep an Audit Trail
- Check the Plug
- Get a Fresh View
- If You Didn't Fix it, It Ain't Fixed



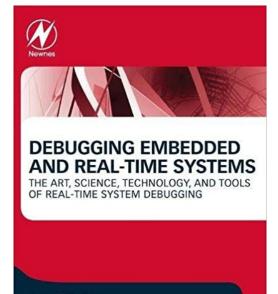
**DAVID J. AGANS** 

#### ROBERT A. PEASE

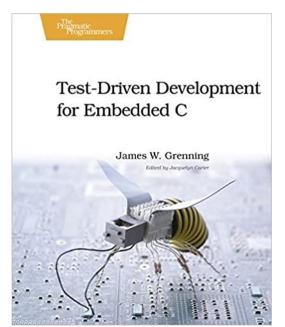
# Troubleshooting Analog Circuits

EDM SERIES FOR DESIGN ENGINEERS





Arnold S. Berger





### Look at the fuses, power source, and batteries







Image: Arrow, Rockwell, Grainger

#### Look/listen - anything loose, burned, etc?

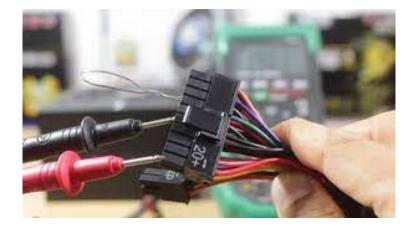






Image: epectech, eeweb

#### Check voltages - start with the power supply inputs/outputs







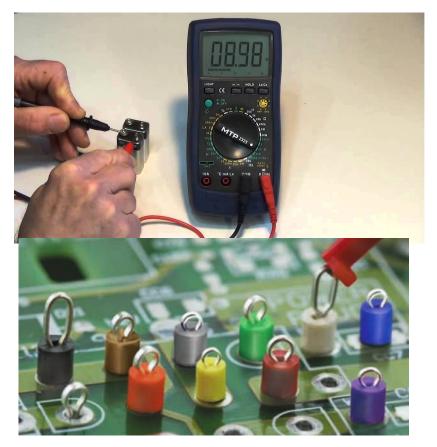
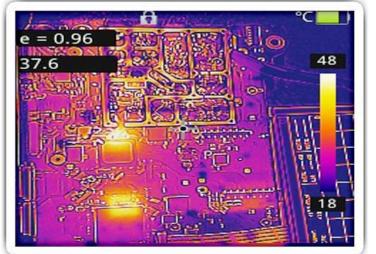


Image: YouTube, StackExchange, Tower Fasteners

#### Look for thermal anomalies



**EEMAN**GEOPHYSICAI

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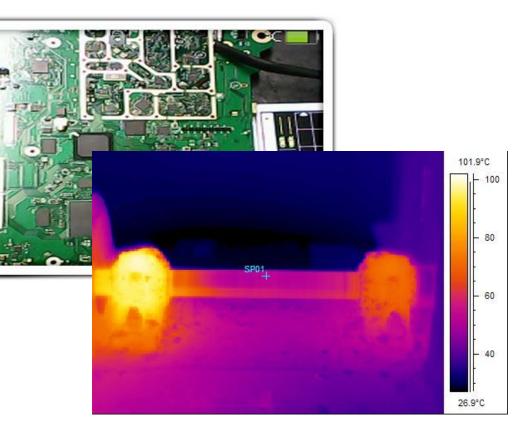
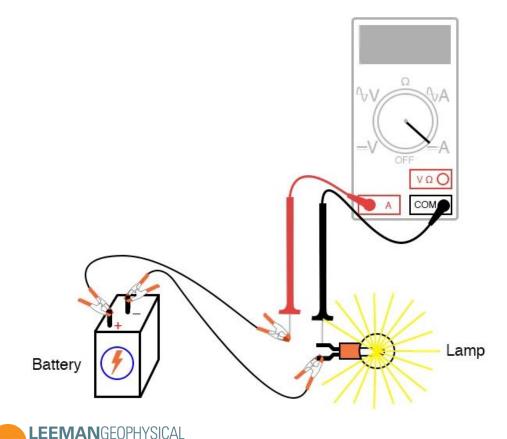


Image: ProMax Electronics, RMS, DigiKey

## Look at the device current draw

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#### Look for loose, dirty, corroded connections

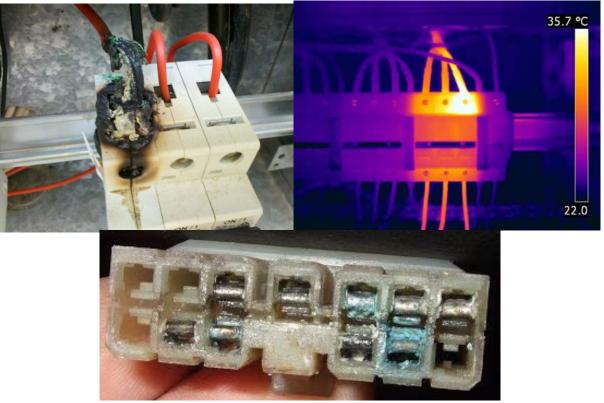




Image: Mance, ElectricalEquipment.org, focusst.org

#### Follow signals or power rails with a binary search approach

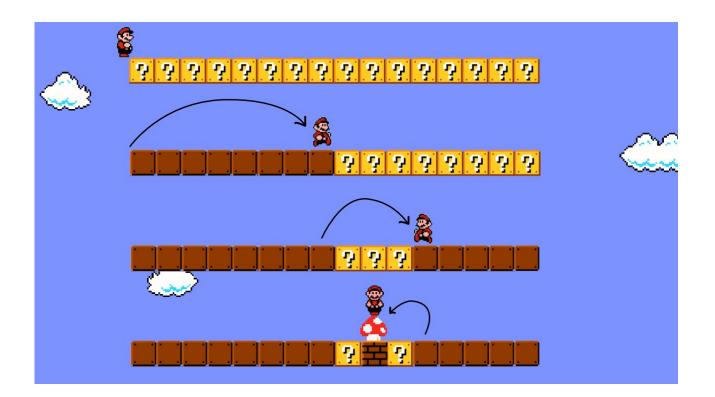




Image: TopCoder

Be wary of in-circuit component checks

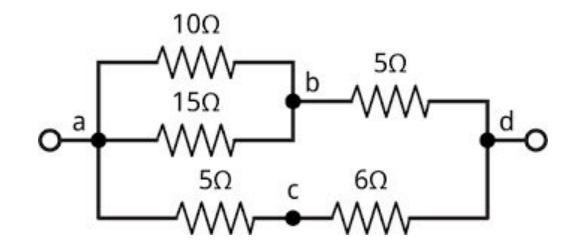




Image: lispology

#### **Common failures**

- Loose connections
- Failed power supply
- Failed capacitors
- Ground loops/issues
- Leaking air/hydraulics
- Failed conductors
- Improper operation
- Lack of lubrication
- Loose set screws/pulleys

