DIY TROUBLESHOOTING

Even if you have worked carefully, accurately and patiently on your DIY project, it is possible that it still won't work properly when you flip the switch. Hopefully fixing it is as simple as replacing a missing fuse or plugging the other end of the power cord in. But if it isn't that, please read on.

Building things correctly so they work right off the bat is a skill that is usually acquired over time. For the first few projects you may not yet have the ability to detect issues as they occur. But once you've experienced failure it might be hard to shake that feeling of apprehension when you first flick the switch.

Probably the biggest hurdle you'll encounter is your own mindset when troubleshooting. It's easy to think there is a problem with the printed circuit board, the components, the instructions, the design itself – anything but your own work. When checking something try to approach the task as if someone else built it and you're trying to catch their mistakes. This subtle shift in approach will pay dividends when troubleshooting.

New components are seldom faulty. If a component is ever found to be the cause of a fault it is most likely to be because it was damaged by heat (soldering), static electricity, or the wrong component was fitted in that spot or with the wrong orientation rather than an inherent fault of the new component itself. After all, the idiot who built it tested each component before soldering them on the board, didn't they?

Keep an open mind and don't assume anything. While fixing things based on someone else's similar fault may work some of the time, there are many problems that can create the same symptoms but have completely different causes. As a colleague likes to say, *every fault must be evaluated on its merits.*

Another thing to remember when you are chasing an issue is that you may be experiencing multiple faults. Don't get discouraged if you find an issue, fix it, yet the unit still doesn't work as expected. This is especially true for a new DIY project. Carefully note any change to the unit's behavior after each issue is rectified. Each change is another clue as to what problems might remain and a reminder that progress is being made.

If you've read most build guides you would know that it makes sense to put the power supply section together first and test it. But if you've skipped that step and now find you have a problem the power supply is still the first place to look. Are the voltages correct? If you've done it properly and the voltages were OK before you populated the rest of the circuit but now they are wrong then you can suspect something other than the power supply itself.

But let's say you did not check your power supply first. Then you will have to determine whether the supply is faulty or something being powered by it is dragging the supply low. Anything drawing enough current to drag the voltage(s) low will probably be getting hot. See if you can detect any abnormal thermal events happening. It may be obvious like a resistor starting to heat up or a capacitor that suddenly pops (due to incorrect polarity or overvoltage).

If the power supply itself is working yet the unit is still not, check the schematic for the build that show typical voltages expected at various point of the circuit. For the discrete FET compressors the expected voltages around each bipolar transistor is shown. With the FET compressors, when working properly each transistor is expected to be turned on when powered up with no signal applied.

This means that each transistor should show approximately 0.7 volts drop across the base and emitter terminals. With the new FET/RACK series, the transistor pin assignments are marked on both sides of the PCB. Put your multimeter on the DC voltage setting and measure between B and E for each bipolar transistor. If you do not see approximately 0.7 volts at each transistor then your problem is located near that area and is not usually the transistor itself (though it might be). Remember that not all transistors have the same pinouts! Don't blindly check pins without referring to the marked legends on the PCB or the datasheet.

Look for one or more of the following conditions around the troublesome part of the circuit. Though the transistor itself might be faulty, more often it is one or more of the components surrounding it.

1. Incorrect component(s)
2. Incorrect orientation of polarized components
3. Poor soldering
4. Faulty component(s)
5. Incorrect wiring

Check resistor color codes carefully making sure they match the required value. Pay particular attention to the second last band called the multiplier. It's easy to mistake a 1k and 10k resistor since red and orange look similar. Though the person who built it should have measured them before installation, if you have an issue after the unit has been built you may have to lift one lead of the resistor to measure accurately due to parallel resistance.

Check electrolytic polarity – the new FET/RACK has electrolytic footprints with both the positive and negative marked. The wide line indicates negative. Electrolytic capacitors that are installed with their polarity reversed seldom survive for long and sometimes will go short before they fail completely.

Make sure you've used the correct transistor. NPN and PNP devices are not interchangeable nor are devices that have different pin assignments. If you've purchased transistors from a questionable source it may pay to verify the pinout using a transistor tester.

Soldering joints should show a smooth fillet between the pad and component lead. Blobs, spatters and overheated or lifted pads may point to something more sinister going on under the solder. You can use the continuity setting on your meter to check solder joints. Measure between two component leads known to show continuity in the circuit.

Incorrect wiring is unlikely with the new FET/RACK as the connectors and wiring harnesses make it difficult to accomplish. But if the pins have been overheated they can collapse inside the housing and fail to make contact with the connector. Visually inspect them to ensure that the pins are straight and symmetrical.

Finally, if you have built two of something and one works but the other doesn't, remember that you can pull assemblies or ICs from the good unit to compare with the faulty one. Swap op amps (you used sockets, right?) or pull the meter board from a working unit to see if it changes the symptom in the bad one.
A DIY project will never fail to work for no reason at all. You just have to work to find the error(s)!

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