Level One Troubleshooting (Visual Inspection and Swap Testing)

1) Inspect for Damaged or Burned Components

Before attempting to do any troubleshooting, we need to state an obvious fact: ***if any part of the computer board is smoking or appears burnt, STOP! Turn off power immediately, and do not power up the board again.***

Embedded circuit boards generally use low voltages, but a short circuit condition can still allow large amounts of current to pass through the board. Even if the short circuit is limited to a single chip, the excess heat can still damage the pads and fiberglass directly underneath the component. If you see any signs of a short circuit; do not power-up the board again!

Signs of a short circuit:

- Components or connectors that become too hot to touch (+100C) within seconds of applying power.
- Smoke, burn marks, or the smell of burnt components.
- Components with small holes in them that appear “popped” or burst.
- Melted plastic on the top of a chip.
- Melted plastic shroud around the base of an I/O or power connectors.
- Conformal coating that is melting, dripping, or bubbling away from a component.
- Power supplies that trip or reset when connected to a suspect board.
- Warning LEDs or popped fuses on a power supply.

Here are some examples of damaged components:

Figure 1) Burned component

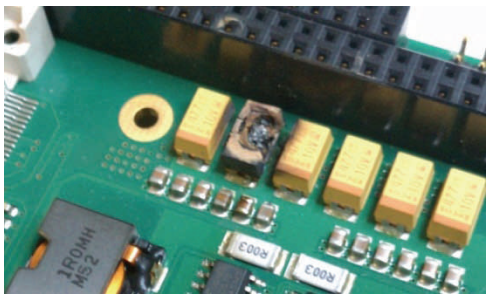

Figure 2) Plastic melted from short circuit

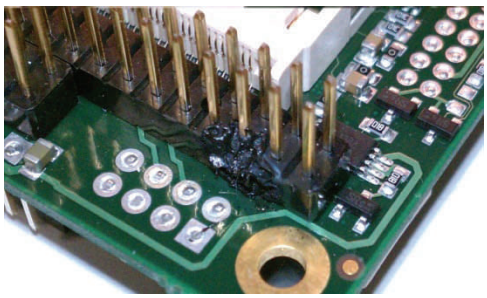

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Figure 3) Burnt fiberglass at connector base

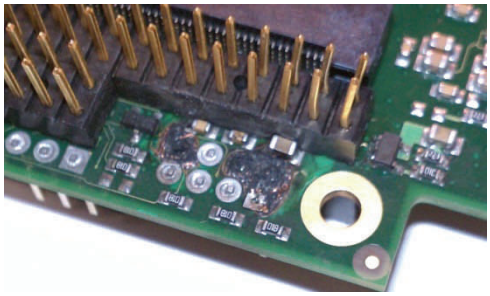
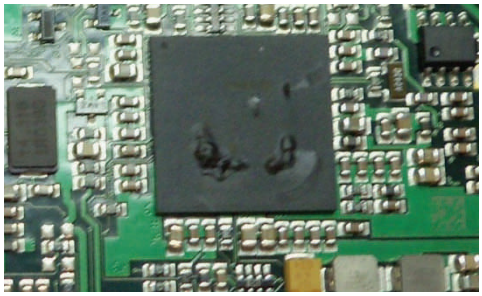


Figure 4) Blisters or bubbles on top of a chip



If you see anything similar to these photographs, **STOP!** Do not power-up the board again! If there is no visible damage, excess heat, or blown power fuses, you can proceed to Step 2.

2) Inspect RAM, Cables, and Stack-through Connectors

Before taking the CPU board away to a separate test bench, quickly inspect the main components of the CPU board for simple problems that can cause boot errors:

LOOSE DDR-RAM? Check that the DDR-RAM memory module has not come loose in the socket (this is especially common on systems that undergo severe vibration). Reinstall if necessary.

CONNECTORS INSTALLED OFF ONE PIN OR BACKWARD CABLES? One very common reason a board will not boot is because the stacking connectors have been installed "off-by-one-row." This is a dangerous condition that can seriously damage both the board and peripheral devices.

Figure 5) DDR-RAM loose but still in socket

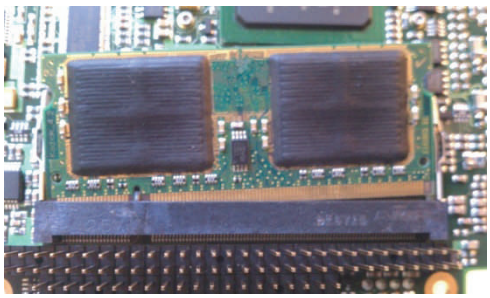
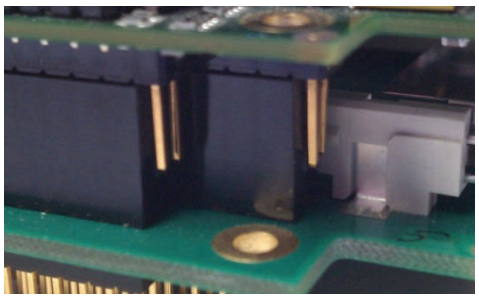


Figure 6) Stack through connector "off-by-one-pin"



BENT PINS OR CABLES NOT PROPERLY INSTALLED? Remove all the I/O cables and inspect for any bent pins at the connectors. Pins may be bent out from the connector or crushed inside the housing or bent inwards so that they are in contact with another pin. Cables can also be installed backwards or forced into slots incorrectly.

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Figure 7) Example of a bent PCI bus pin

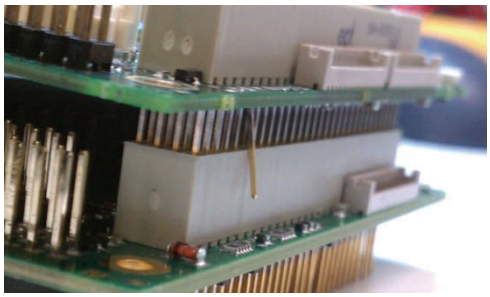


Figure 8) Example of crushed pin inside a cable header

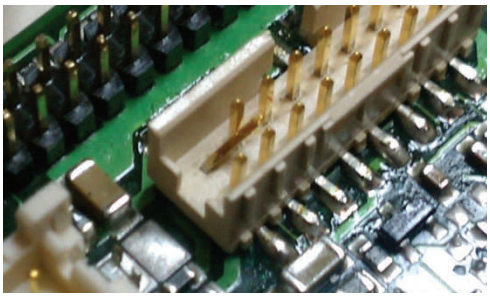


Figure 9) Cable key correctly installed backwards

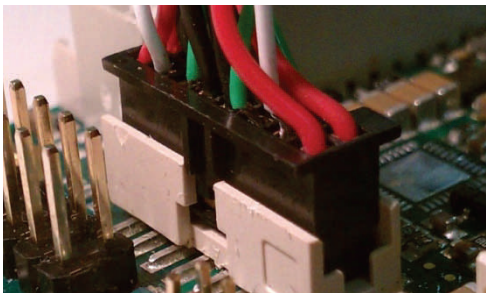
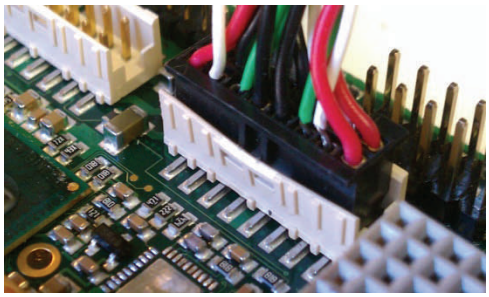


Figure 10) Keyed connector installed wrong



3) Checking Power

3.1 Power Cables and Connectors; Power Cables should be thick enough to handle the current demand for the CPU board, the I/O cards in the stack, and all attached peripherals. They should also be firmly connected at both the board and the power supply. Any exposed metal in the cables should be shielded or shrink wrapped to protect against a short circuit. DC power supplies should be able to provide enough current to start the board and all devices in the stack (consult the user manual for the specific power requirements for each board).

3.2 Main Power Input; ADL CPU boards all require a regulated 5V DC power supply for the main power input. **The tolerance for the 5V input voltage is +/- 5%.** If the Main power input drops below 4.75 volts (even momentarily) the CPU board will not boot.

3.3 Cable Resistance: Extremely long or thin power cables are not recommended. Long thin power wires will have more resistance compared to a short thick cable. In some situations, the extra resistance can cause the input voltage at the CPU to fall below the 5% tolerance; this can cause the board to fail during startup, or reboot under heavy load conditions. **ADL recommends that power cables are a minimum of 22AWG and less than 12 inches long.**

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Figure 11) GOOD power cable: use at least 22AWG wire, and connect all power/ground

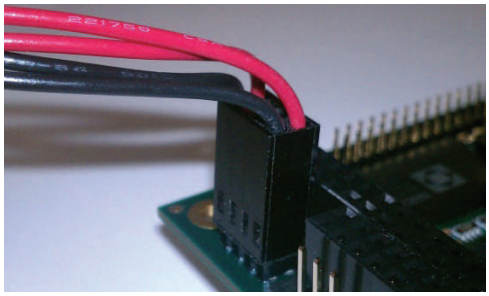
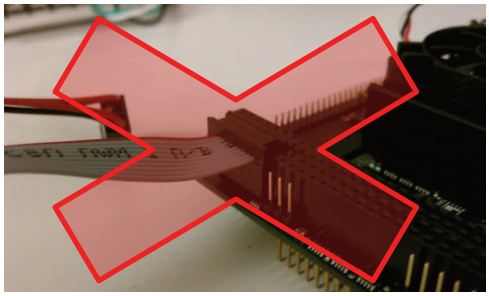
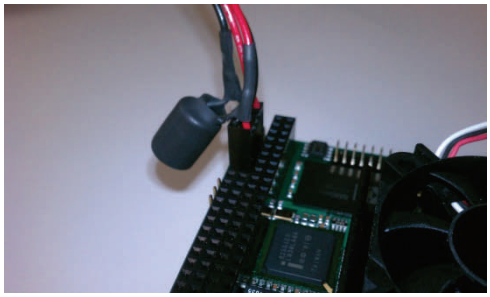


Figure 12) BAD power cable: IDC connectors are not recommended; and 28 AWG ribbon cable is too thin!



3.4 Cable Inductance: Depending on the CPU and the power source, the Main Power Cables may also require a bypass capacitor to filter out voltage spikes caused by inductance in the cable during startup. Capacitors can also help block EMI noise feeding in through the power supply cables. ADL power cables can be ordered with the proper capacitor to eliminate voltage spikes.

Figure 13) Example of a Capacitor installed across the main power input lines



3.5 ACPI (suspend) support. Although some older boards can boot using a simple 5V DC power supply, newer CPU boards may require additional 5V and 12V power inputs. Consult your user manual. **CPU boards with ACPI power management features will not boot at all unless the 5-Suspend and 12V power inputs are also connected.**

Quick check list for power supplies:

- Does the Main 5V DC Power supply provide enough current to start the board?
- Is the "5V-Suspend" power input connected? *(only applies to ACPI style power inputs)*
- Is the 12V power input connected? *(only applies to ACPI style power inputs)*
- Will the System boot after all peripherals and I/O devices are removed?

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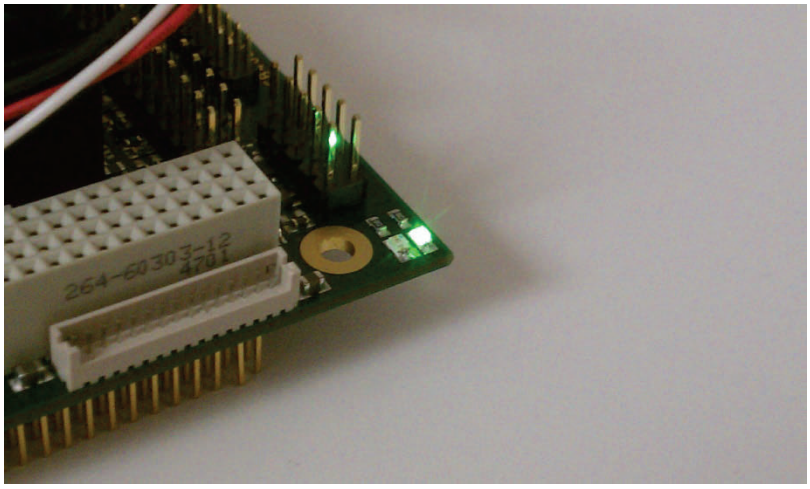
Quick checklist for power cables:

- Are all power cables are at least **22-gauge wire?**
- Is the power cable **less than 12 inches long**?
- Are the power cables installed with correct polarity? (i.e. not backwards)
- Are ALL power and ground wires connected between the board and power supply?
- Inspect the power cable for frayed wires, loose crimps or cold solder joints.
- Is a bypass capacitor required to cancel-out Inductance or ESD at the main power input?
- Check for loose or damaged crimps inside the headers. (*This is especially common on test benches where the same power cable is used over and over to test equipment).*

3.6 Status LEDs: Look for a GREEN LED located on the top side of the CPU board near the edge. This LED indicates "power good." This LED will not turn on until the Main 5V input is within tolerance and stable. A RED LED to indicates power problems (consult the user manual for specific list of LED status codes).

- No color — Board does not have proper 5V power
- GREEN (Solid) — Main power (5V) is Good and board is attempting to boot
- RED (Solid) — Short circuit at main power input, or CPU is stuck in Reset
- RED (Flashing) — CPU is rebooting in a constant loop, from low power or I/O short circuit
- OTHER — Power monitor firmware is being updated (see user manual)

Figure 13) "Power Good" LED at the corner of the CPU board



TIP: *If you see the Green LED for power, but no video, check for other LEDs in your system that might indicate power and status. LAN hubs, USB devices, and Keyboards may have LEDs that will blink or change when they are active and in use. If there is no video but the Keyboard, LAN and USB LEDs are all acting normal, check the video cable or video monitor.*

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4) Swap Testing with "Known Good" Components

Although you may not be able to identify the root cause of the failure without extra bench tools, it's often possible to narrow down the range of possible failures by swap-testing with "known-good" components.

Swapping the DDR-RAM memory stick with a known good unit? Memory modules very seldom go bad (it's more common for them to come loose in the socket), but it is very simple to remove the memory and preform a quick boot test using it in another system.

Swap monitors? Swap video cables? Video cables are just like any other I/O cable; they can be plugged in incorrectly, and wear out from too much hot plugging.

Can you install the CPU board into another system? If are building multiple systems, try installing the CPU board into an identical stack (hint: when swap testing modular systems, the problem usually follows the bad component when it moves to a new system).

Can you install a fresh CPU board into the failing system? If you have additional CPU boards, try installing a 2nd CPU board into the system and see if it boots properly (If a second CPU fails to boot just like the first it's very likely the problem is with something else in the assembly).

Swap testing with another CPU board is the quickest way to isolate the problem. If the problem is isolated within a single component of the system (the CPU board for example), it should display the same error when it's installed on another system. If the CPU board boots and behaves correctly when it's installed on a completely new system, it's most likely an assembly error or problem somewhere in another part of the original assembly.

5) Boot Testing a CPU Board Separately From the Stack

Provided they have enough power to boot properly, all ADL embedded PC/104 boards can boot up to the BIOS with just a power cord, keyboard, DDR-RAM and VGA Video Monitor. This bare-minimum configuration is the easiest way to troubleshoot the CPU board.

To boot in the bare minimum configuration:

- Remove the CPU board from the full assembly
- Make sure the DDR-RAM is properly installed
- Install the Power cable
- Install the VGA video cable
- Install the Keyboard *(note: ADL embedded boards can detect both PS2 or USB style keyboards, and enter the BIOS with either one.*
- **At the first sign of Video, press <DELETE> key to enter the system BIOS.**

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Figure 11) Bare minimum configuration: CPU board, DDR-RAM, 5V DC power supply, power cable, keyboard cable, keyboard, VGA cable, VGA monitor

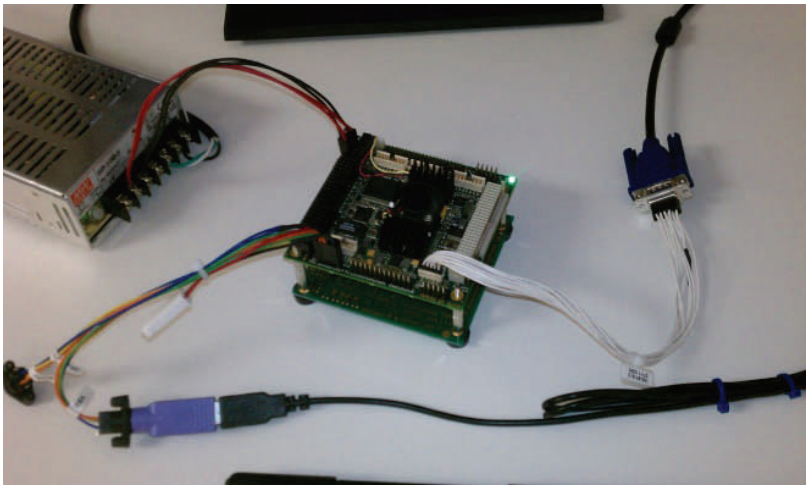
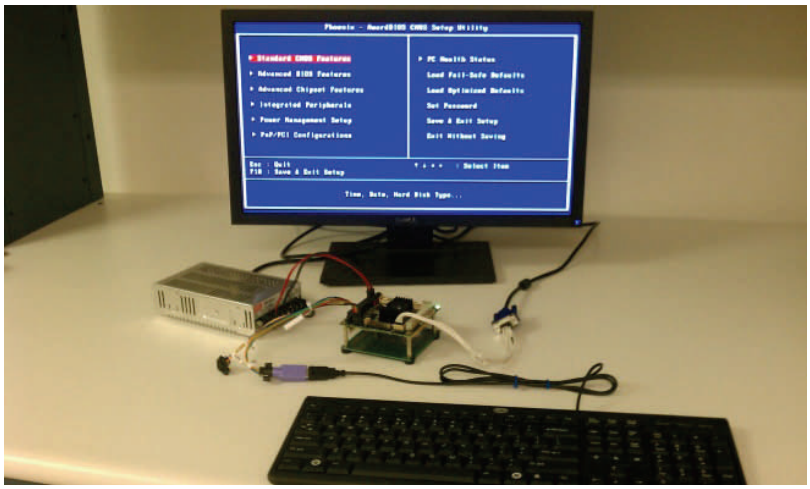


Figure 12) Booting into the BIOS screen from the Bare minimum configuration



6) Have Video, But Still Not Booting

In most modern computers, the main video splash screen comes up after the hardware has been initialized, but before control is handed over to the Operating System. Boot failures at this point are most often due to bad boot media, bad bios settings, or missing I/O devices that are needed at startup.

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A quick check list for common boot errors:

- Is the hard drive properly connected? (double check for loose cables)
- Does the hard drive require a separate power cable? (check SATA power cables)
- Is the board booting to the proper hard drive? (check boot order in the bios)
- Does the CD-ROM or DVD-ROM require external power (check external power cables)
- Is the Operating System properly installed on the Hard drive? ("OS not found" ?)
- Can the CPU boot from another media device? (possible corrupted or bad HDD)

Once the BIOS summary screen is gone and the OS boot logo appears, the system BIOS has handed over control to the operating system and has started loading the OS from the boot media into the system memory. Errors at this point are usually due to OS corruption or device driver issues.

7) How to Locate the Board and BIOS Versions for an RMA

The Serial Number and Hardware Version are both located on the bar-code label.
The serial number label is approximately 1cm x 2cm. It is located on the underside of the board:

In this example:

The serial number is: **08274811110021**

And the Hardware is version **5.6**

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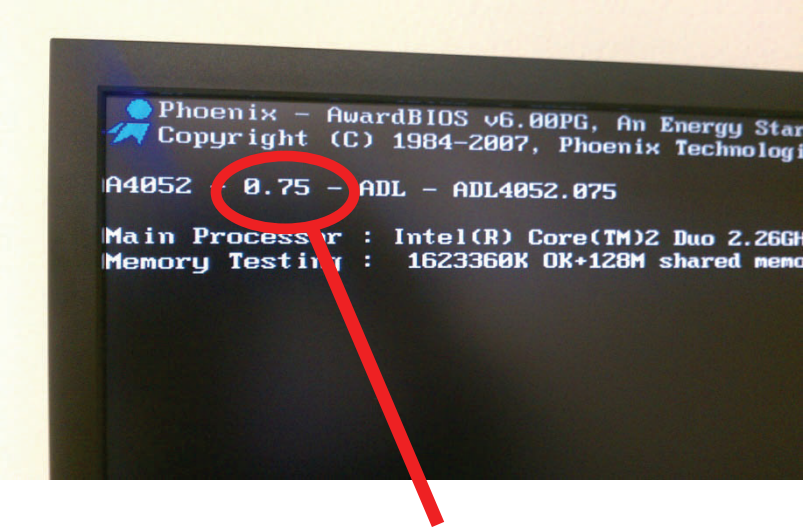
The Bios Version is located in the BIOS Splash Screen at first boot.
TIP: You must disable the splash-screen boot logo in the BIOS to see the BIOS version.
The BIOS version is located in the upper right corner of the Screen at first power up.



In this example, the BIOS is version **0.75**

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