V12 and probably V9-V10 DEAD BEEF SYNDROME

v.0.95

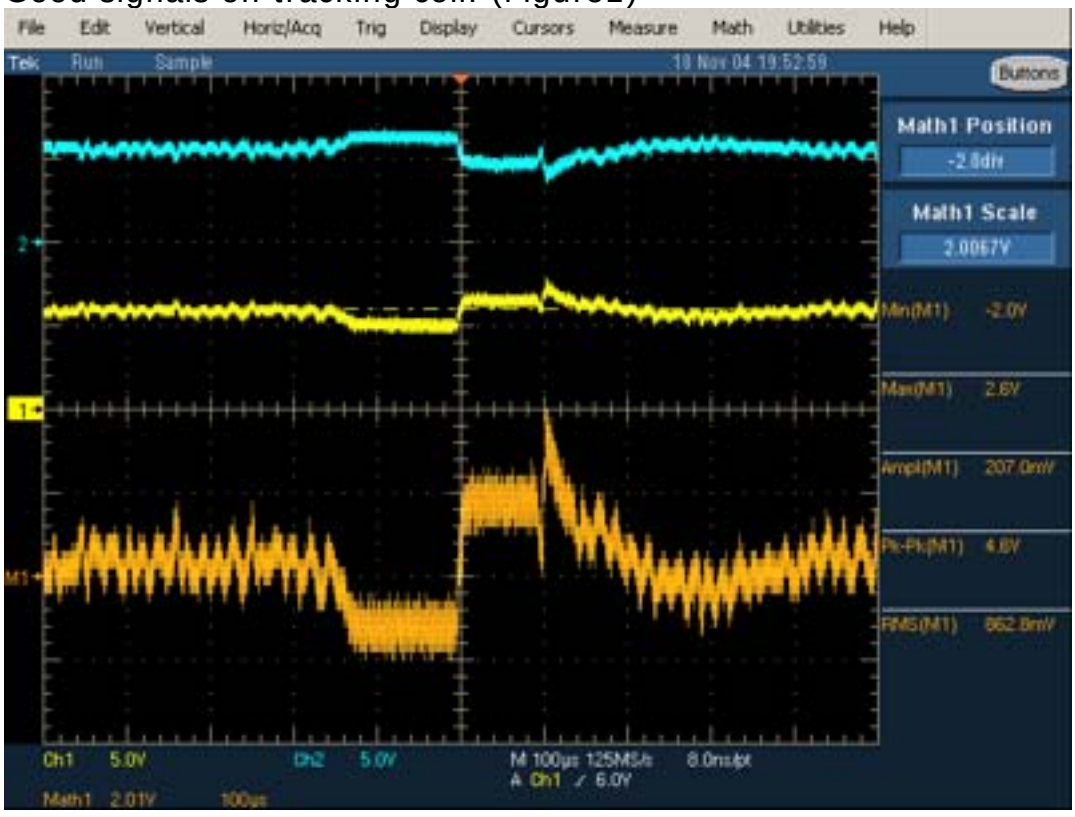
As you probably remember, Ripper Team described V9 dead syndrome at the beginning of 2004. Just looking from the perspective of several months we found that we were wrong in one simple thing. We were not able to identify what should be blamed for short circuit in laser coils. Poor manufacturing was the case rather then external influence of other circuits. Facts were very common. New, never used consoles had shorted coils in their laser units.
Now we can say that coils got shorted probably in the factory during testing process and Sony didn't realize it happened. Some coils survived first factory tests and failed in hands of customers.

As you can see one integrated circuit is missing in all v9 and above. Syscon chip is missing. Syscon was a processor for power management and reset purposes.

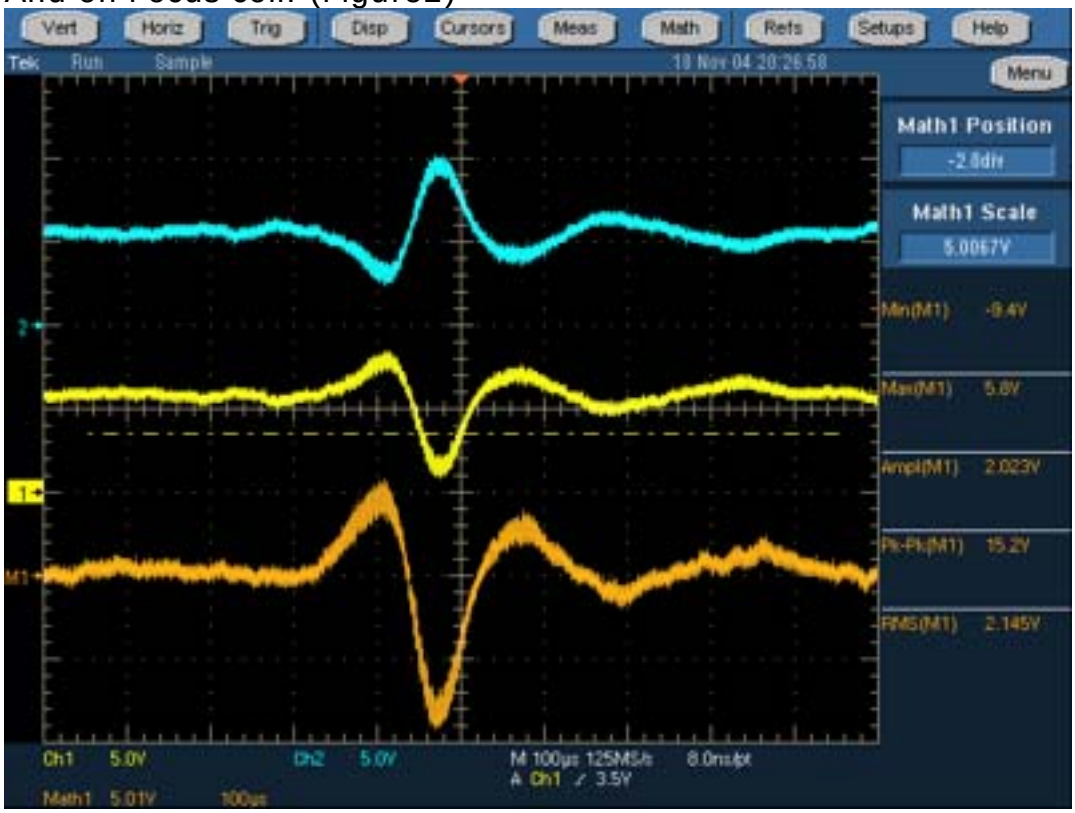
In our opinion the cause of all failures starting from V9 and ending up with V12 is CD/DVD DSP processor lockup! CD/DVD DSP simply fails to start executing code from the beginning or it is locked up later during normal operation when the boot process takes place.

Applying diode circuit or changing gain of LA chip will do nothing special. It will only reduce reading ability of PStwo nothing more.
Of course reducing gain or lowering power supply voltage to LA/BA will have effect like Romeo mod but in PStwo it will reduce ability to read CD/DVD media. Diodes will rather do nothing special. High voltage swing is OK when the swing is present or the swing is not present but both coil's ends get constant the same value measured in respect to ground. The op-amp in BA/LA chips amplifies only the differential signal – it amplifies the difference between rails and clamping inputs to approx. 1.2V by diodes will not make a big difference since the difference of voltages is amplified, not maximum levels. It is called differential amplifier or subtracting amplifier.

Good signals on tracking coil. (Figure1)

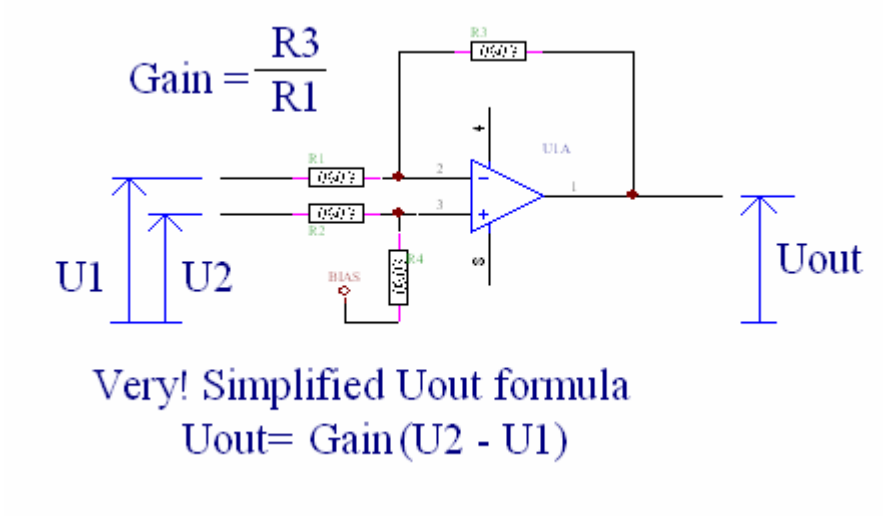


And on Focus coil. (Figure2)



As you can see on above images the LA/BA chip amplifies only the difference what is shown on math M1 waveform from the scope. Very simplified formula for such circuit is shown below. We said Very simplified because we omitted bias value and we assume that ratio R3/R1=R4/R2 (what is not off course true in PStwo circuit but it is only approximation for the next analysis). Let's assume that Uout = Gain * (U2 – U1).

Op-amp circuit (Figure3)

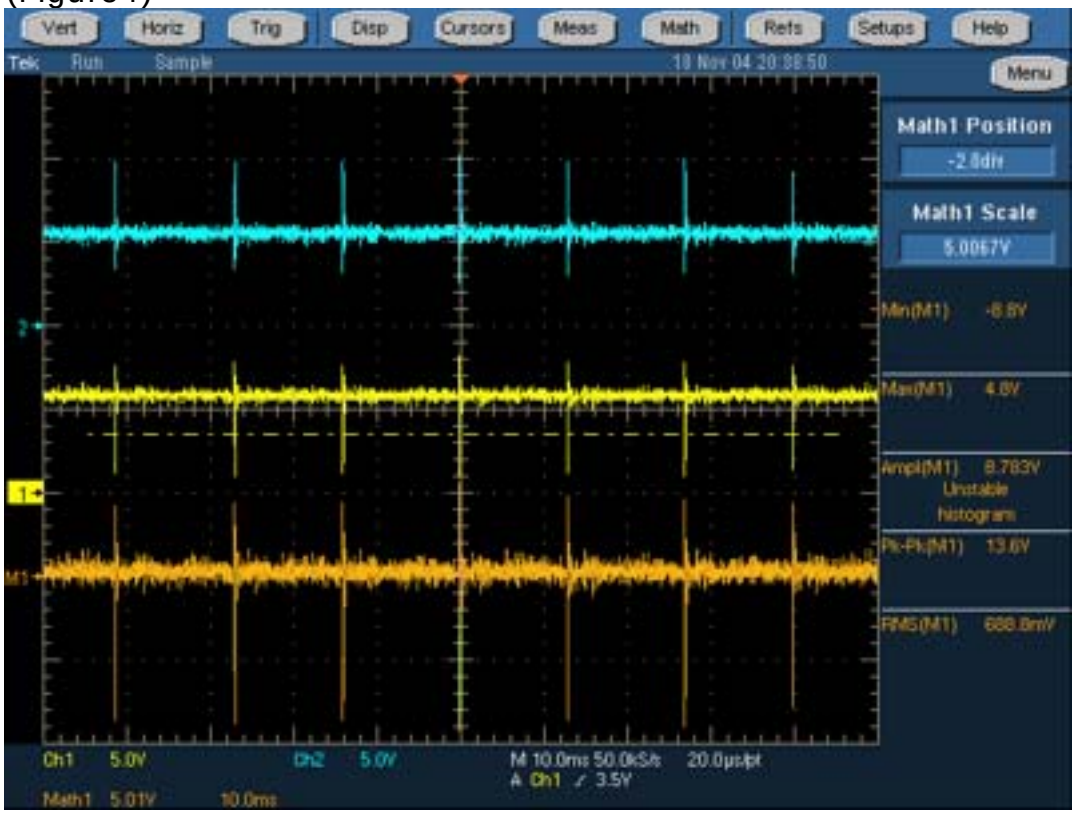


What you can see above it amplifies the difference and if on one rail there will be very small value and on the second rail there will be something around 1.2V then on the output you will get 1,2V multiplied by around 2x. (Sign is omitted for clarification but remember it is inverting amplifier circuit) So limiting the value using diodes will have almost no effect. The gain of this circuit in the first stage of BA/LA is around 2x. Adding diodes will clamp the swinging signals and reduce focusing and tracking ability of laser unit. Until incoming signals are symmetric with even big swing then total power applied to coils is very small. Please look at MATH M1 on the scope. Left and

right side of coil get the same constant 6V almost all the time so the current is not flowing. Only pulses seen on CH1 and CH2 are in opposite phase producing currents in the coil to move it up and down. This “base” level of 6V is the same on both coil’s wires. It can be 3V or it could be 10V but the current is not flowing.
Above circuit amplifies AC and DC signals, remember it.

This image illustrates the same pulses on focus coil but it is presented at slower time base of the scope.

(Figure4)



What happens in your PS2 and PStwo.

1. CD/DVD controller and maybe Mechacon fails to initialize during power on, it locks up during normal operation by strong electromagnetic field produced by spindle motor or by spikes on power lines caused by the motor, or it locks up during the patching of CD/DVD bus by a modchip. We will explain later how important is the proper patching of CD/DVD bus and patching in general. We will show examples of some modchip behaviors. Stay tuned… In general all 5V Scenix based chips are nor suitable for V9..V12. 5V patching is very noisy and producing many unwanted spikes.
2. DSP outputs of digital to analog converter get crazy outputting random and CONSTANT voltages. These voltages applied to both rails of the first stage of the op-amp inside LA/BA differ strong enough causing op-amp in LA/BA to amplify very big voltage difference of the constant value. It starts to amplify DC.
3. And then big difference of DC voltages supplied to the first stage of LA/BA are giving constant DC output of 12V on one side of the coil and almost zero on the other of the lens. Now your coil burns!

We think that poor design of PStwo made it very sensitive on power quality applied to integrated circuits and Mechacon + DSP in particular.

The size of PStwo was reduced, laser and driving circuits are very close to each other and the motherboard became very sensitive. New, not modified console can fail during pressing reset button when internal voltage regulators starting supply noisy power to DSP. It can happen when your bulbs in the house start dimming or when you turn on vacuum cleaner or washing machine connected to the same power line in your house. It can happen if you unplug PStwo power plug from console or when you plug it again and you want to start machine too fast. It can happen when you install poorly designed modchip or 5V modchip.
We don't say that modchips kill consoles. We try to tell you that in such sensitive, poorly designed device, the modchip can add it's 5% to the DEAD BEEF syndrome. Of course modchip is not the main problem but it adds some cents to our case. If PStwo is so sensitive then even spark from your finger to the plastic enclosure, video cable or joypad can lock-up DSP and burn your laser.
We must live with it and we must find the solution how to secure motherboard from lock-ups.

Ladies and Gentleman, We need watchdog, current limiter or mute circuit on DSP lock-up and/or power good circuit to keep DSP in the reset state long enough for power supply to stabilize.
Diodes will not help, don't buy them, it is waste of money.
Yes, they will reduce syndrome a little bit but finally when some bad factors will coincide, your laser will be dead anyway.
It's like a lottery. We got fried coils without reason, no modchip was fitted. It happened in new console powered only once before opening. We took the second laser from another console, we put to that console and PStwo was working again. Probably it will be working to the next lottery event. Now it is chipped and tests are under way. Diodes are not installed.

The best solution
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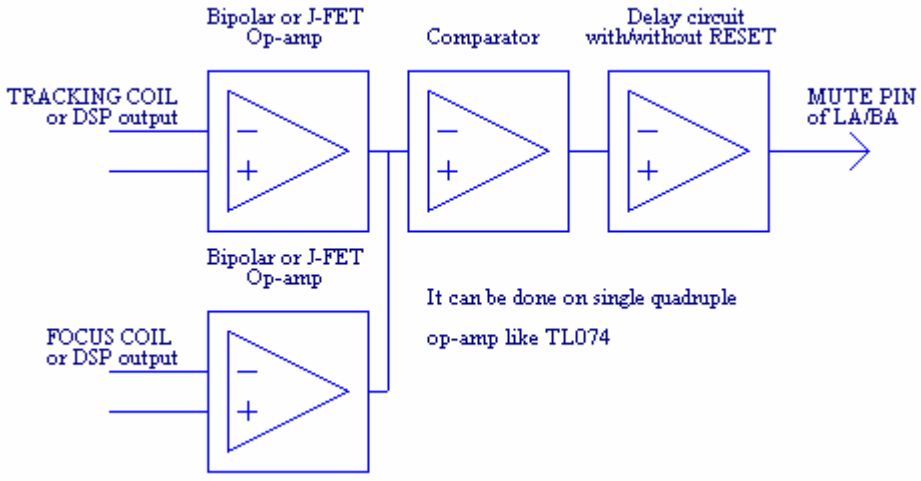
It is probably not complicated circuit. We could make something like that:



We can make independent monitoring of both differential signals applied to LA/BA from DSP or we can measure high voltage signals applied to coils directly. Simply we don't know for certain what part of DSP stops responding and it would be the best idea to monitor faulty signals near the coils. We don't know if reset of DSP will cure the situation, probably not. If DSP is locked then it will require total power OFF and power ON. Normally simple reset will not help. (If your cell phone gets locked, you must remove battery). The best idea (as we think now) is to disable power circuit

(LA/BA) driving coils directly by asserting MUTE signal or by disconnecting power from it.

First we will amplify signals as it is done inside LA/BA. Then we will compare the output to the certain level, probably adjusted by potentiometer and then we will wait a little bit, let's say several milliseconds. If the cause is still present then delay circuit will switch MUTE signal of LA/BA and it will disable LA/BA. User will have to turn of and turn on console.
It is only the block diagram. We will build the circuit today and will test it.

Remember that we have at least two cases of lockups. First during power-on, when you press reset and second when console is operating. Power-ON failure is very easy to cure but lockup during normal operation or boot process is not.

We have also another solution… About it… later…

THE SECOND CASE – DEAD DVD LASER DIODE

Using RW media is causing DVD laser to emit more light and it seems that laser diode is being overheated.
We have small assumption that RW media can be used as DVD Video only because DVD Video is read using single speed DVD. When you insert DVD-RW with PS2 backup the drive will start to spin much faster. Faster speed requires more light and more current to the laser diode. It simply burns. The light of DVD laser will be visible but the light is no more coherent.
Do not use RW media at all until you have laser replacements :-)
We think it is the case and no further discussion is required.

BAD CD/DVD controller PATCHING can cause motherboard failure or DSP lockup

OK, let's start to talk about patching techniques used by some chip manufacturers. First please answer yourself if you have found such symptoms:

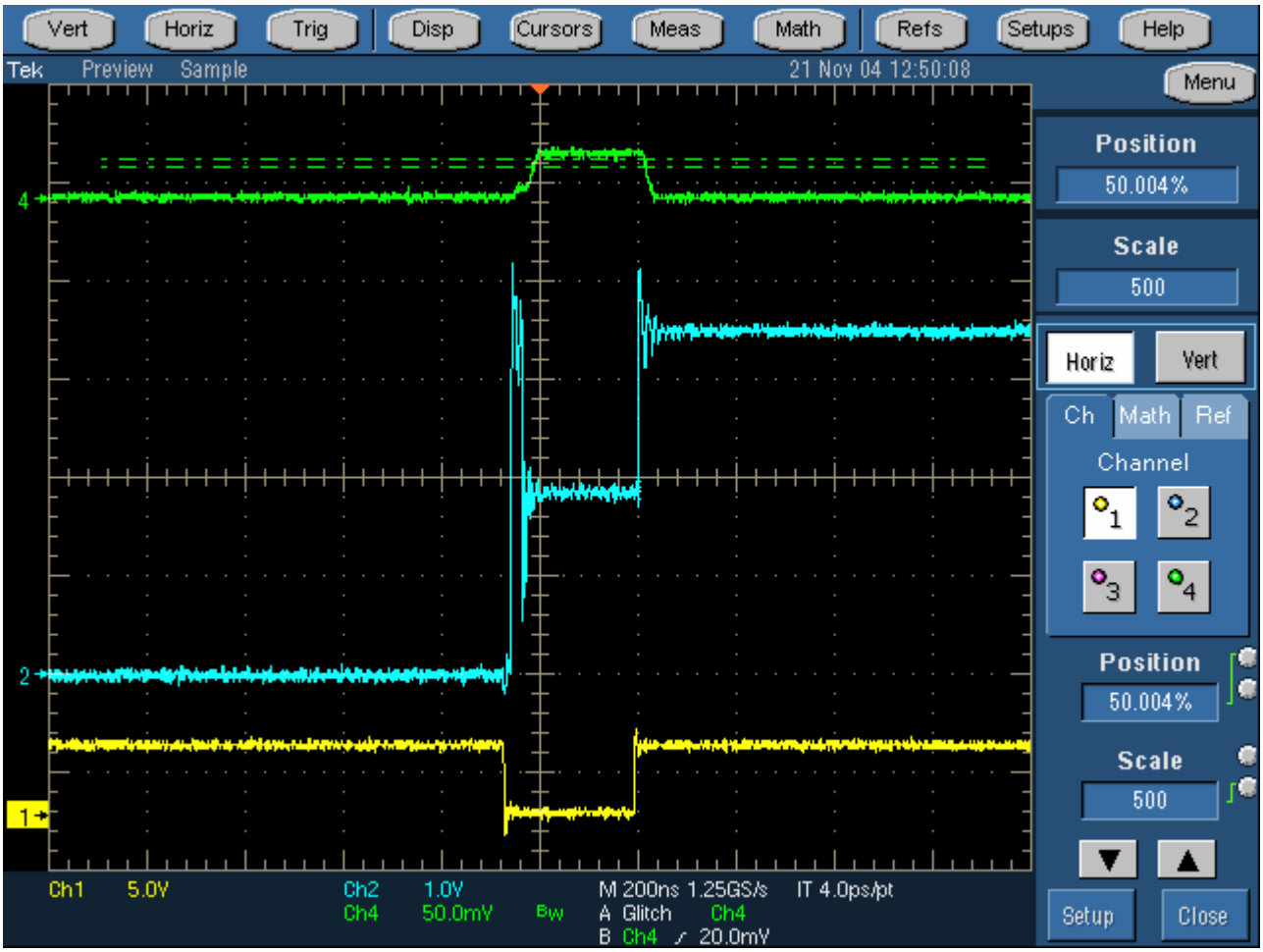
1. I installed the chip to V12 and dev. mode works, other features looks they are working but the PS2 game does not boot while DVD video has proper green fix, PS2 CD and DVD don't start spinning as after normal CD/DVD patching by A, B, G, H, I wires. No way to make it working. Did you have that ?

2. I installed the chip to V12 and dev. mode works, other features looks they are working but the PS2 game does not boot while DVD video has proper green fix, PS2 CD and DVD don't start spinning as after normal CD/DVD patching by A, B, G, H, I wires. After shortening 3,3V wire, Ground wire and after shortening A,B,G,H,I the chip started to work but boot ratio is poor. Did you have that ?

3. I installed the chip to V12 and dev. mode works, other features looks they are working, PS2 CD and DVD seem to work but sometimes I get total lockup of console such that I can't reset it and I need to unplug power from my console. Sometimes console becomes dead without reason, removing chip does not help and console does not want to read anything or it reads only DVD video. Sometimes in rare situations there is only black screen. Did you have that ?

Remember it is NOT lame ground bounce, it is something more dangerous.

Do you know what it is ? It is this !



First we need to describe an image from the scope.

GREEN channel 4 is the current probe output used to trigger the scope on the impulse where the patched byte on CD/DVD bus takes place. It is current, not voltage! Two horizontal lines above that are Glitch advanced triggering levels combined with other triggering features of the scope and used to pin point the patching moment. We are using an AC current probe without TEK-probe interface, so readout is in mV. Probe attenuator is set to 2mA/mV, channel setup is 50mV/div.

YELLOW channel 1 is “A” strobe, scope is set to 5V/div.

BLUE channel 2 is “B” data line and scope is set to 1V/div. ***Signal FAILED to cross 2V LOGIC level.***

Now let’s analyze what has happened here. “One of V12 compatible chip” wanted to patch the CD/DVD bus pin “B” by brute force, changing the voltage on bin “B” from 0V, from ground to 3,3V, to HIGH LOGIC level state. ***AND it FAILED, The Console has FROZEN up!***

As you know logic levels in TTL and LVTTL circuits are described as:

1. input LOW logic LEVEL = when voltage is lower then 0.8V

2. input HIGH logic LEVEL = when voltage is higher then 2.0V (output 2.4V)

Let's use www.google.com and search for "TTL logic levels" and read website of your choice if you don't believe us.

The chip under testing did not meet this standard and simply injected NOT allowed logic level which can cause overheating of internal logic stages of CD/DVD and MECHACON integrated circuits. In the worst situation it can cause permanent damage to the driven circuit or it can cause the PS2 to freeze and then BA/LA problem or it can cause injecting undefined state resulting in poor booting ratio.

Using such chips is dangerous to your console, all of them should be removed and sent for replacement.

It requires total redesign of PCB and code inside the FPGA and extensive testing witch can take a month before the first next sale.

It happened because designers of hardware didn't learn the lesson properly. They are using single pin to make over current and bus congestion as patching the bus. They simply failed to design electronics properly and it is an **inexcusable hardware design error! Check it yourself, if you still don't believe us.**

If you have access to the scope but you don't have the current probe you can use Runt triggering mode to achieve pint point triggering. It is harder but still possible.

Unsolder FPGA IC from the modchip, follow traces from B, G, H, I and check if you see two FPGA pins connected to particular B, G, H, I. Check it visually when you desolder FPGA or simply use multimeter to check it out.

To achieve good patching effect the modchip should drive almost all it's pins with 2 FPGA pins in parallel or it should use what we call LPPT (Low Power Patching Technique). LPPT can be for BIOS patching and for CD/DVD patching but approach is different. Only Ripper3 and Ripper3.1 and one other chip (competitor) use LPPT technology developed by Ripper Team. This second V12 compatible chip took almost all text from our website but engineers of that chip really learned the lesson and they are using our LPPT properly. We examined it.
We don't want to describe LPPT, let's other manufacturers learn the lesson to :-)

5V patching is the same dangerous. Scenix processor can't use 2 pins to over current the bus properly because it is the nature of microprocessor. SCENIX/UBICOM based chips are using higher voltage instead what is ridiculous. Maybe in older consoles it was acceptable but not on V12. Patching by processor gives more very dangerous issues like very serious timing problems which can lead to DSP lockup.

If you want to know what chips we are describing now, please guess or answer our 3 questions above and make visual inspection of the chip after desoldering FPGA or use multimeter to check if B, G, H, I are driven by one or two pins of FPGA.

Of course the choice in using chips is yours.
It is not attack or any war. **It is free contribution to the scene and only information.**

It is not only one potential cause of laser failure. It is only these 5% as we mentioned some pages before.

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Added in rev. 0.95
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Now we are sure. There are 2 SEPARATE causes of our DEAD BEEF SYNDROM !!!

1. MECHACON/DSP lockup during power ON moment when you PLUG the power cord to the console. Not even when you press reset.

2. Poor designed chips. We examined four very famous chips. Only one our competitor is good and properly designed, three others looks like their design engineers simply borrowed schematic and PCB layout from each other LOLLLLLLL :-) All three chips have serious design flows described above and it cause MECHACON/DSP lockup during normal operation during boot, during patching CD/DVD bus! Yes guys yes :-) Only Ripper saga and one other competitor doing it right and using LPPT :-) All 5V chips will do the same bad thing.

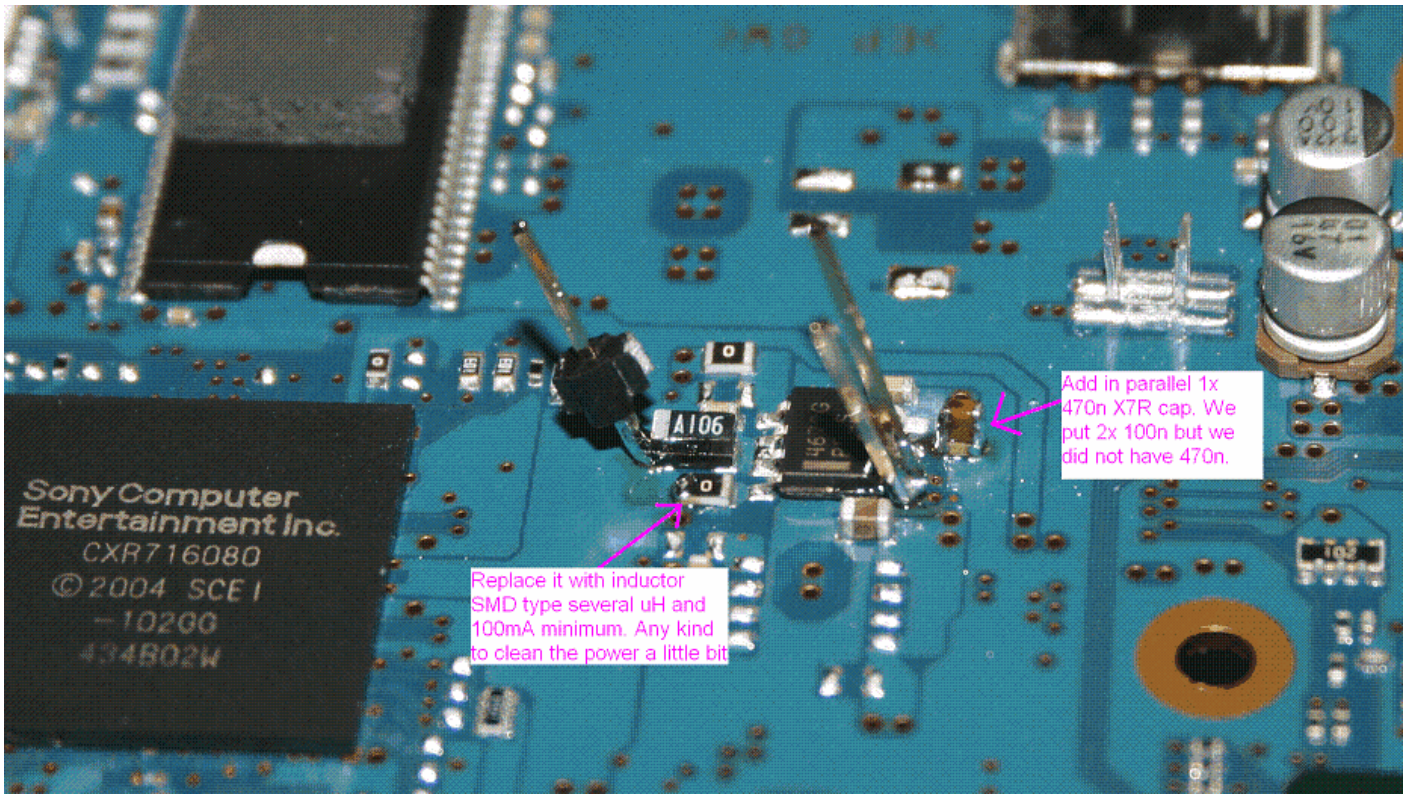
Ok lets start from the point number 1.

Syscon is missing in V12 as we said before. Probably there is no separate watchdog in the system. Reset switch and led diode is connected directly to Mechacon.
Mechacon is powered and _running_ just after you plug the power cord and red light comes on. During plugging the power to the back of your console you produce a lot of glitches on the power making Mechacon to lock up. Again! Mechacon starts running from the moment you plug the power to the back.
There is a power regulator and supervisor circuit shown in the image below. It has a delay of 113ms from plugging power cord to the RESET release.
Suggested adding inductor as a filter plus additional capacitors to increase the time when the Mechacon is in the RESET state will probably almost eliminate Mechacon lockup during POWER ON moment !
If you want to kill not chipped PS2 try to play with power plug and then rapidly press reset to power on the console to the green light :-) No disc inside :-)

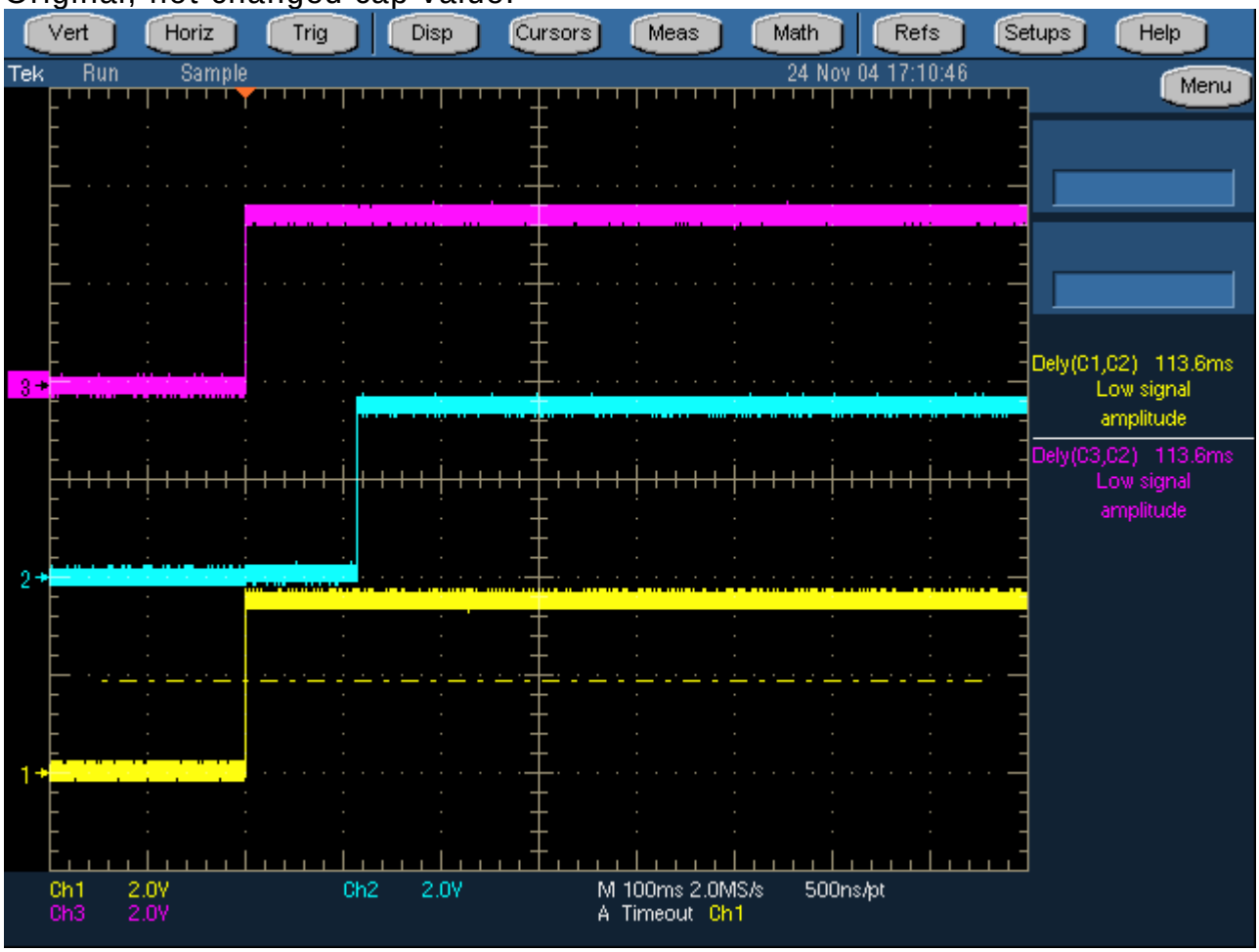
Ladies and Gentleman, putting PIC will not change too much because it happens BEFORE the PIC is powered on and it is only buying your time with corrupted HEX code without explanation what that PIC really does :-) It's only buying time to sell the stock of bad chips. I assume that PIC will work when the poorly design chip will cause the CD/DVD buss to freeze but only after powering on the console :-)

We did not have any suitable inductor today but we think it is a good idea to remove 0 ohm marked with arrow and replace it with inductor. Maybe adding the second tantalum capacitor of 10uF-22uF could help too. It must be low ESR cap and only tantalum cap is suitable but you must solder it very close between power plane after regulator and a ground without any wires. Normal caps will not help and you have opportunity to install additional tantalum cap or do not install any cap.

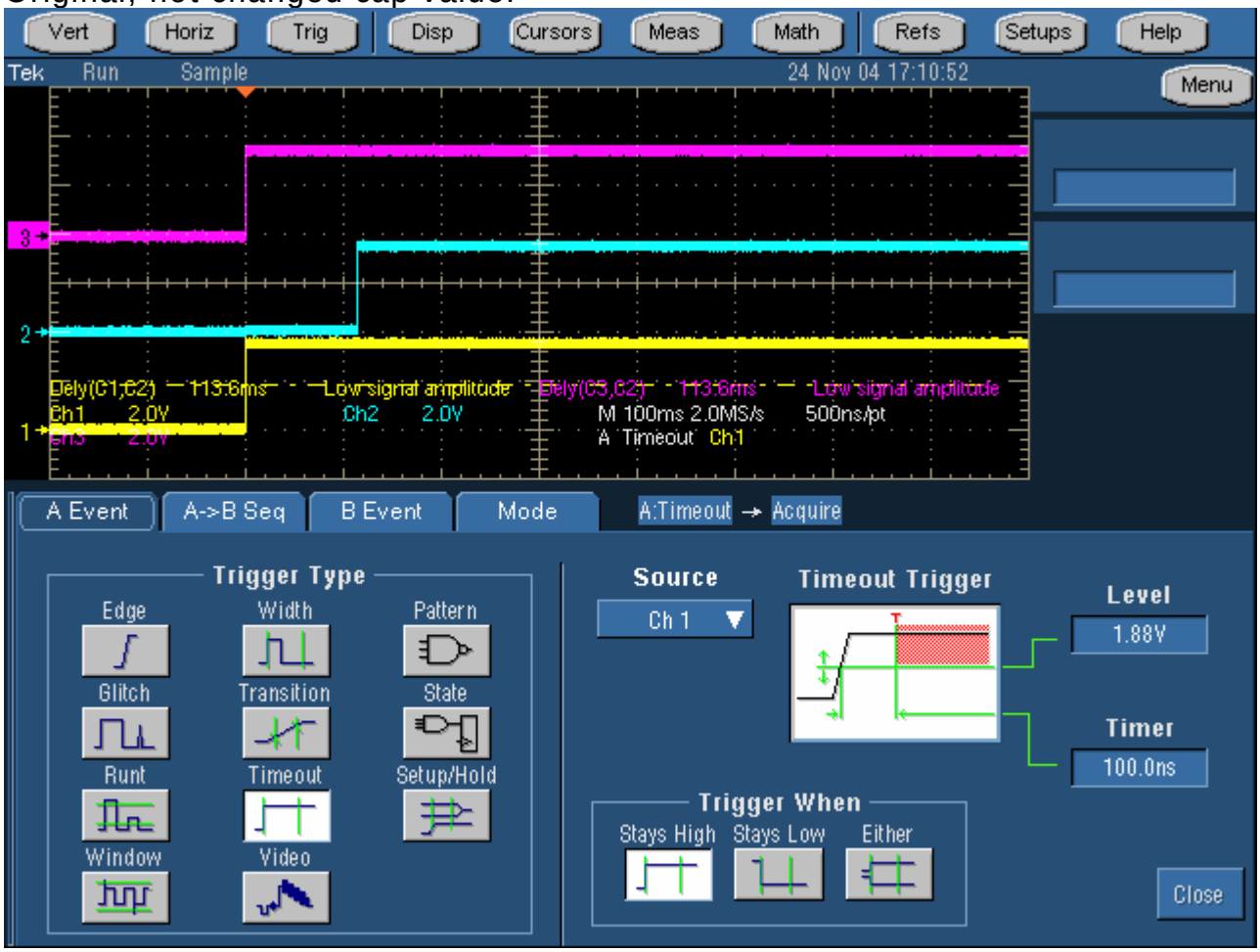
For inceasing time of the reset circuit use only 470nF or more X7R dielectric cap. Remember X7R because other dielectrics have poor temperature coefficients and they are loosing capacitance in increased temperature.



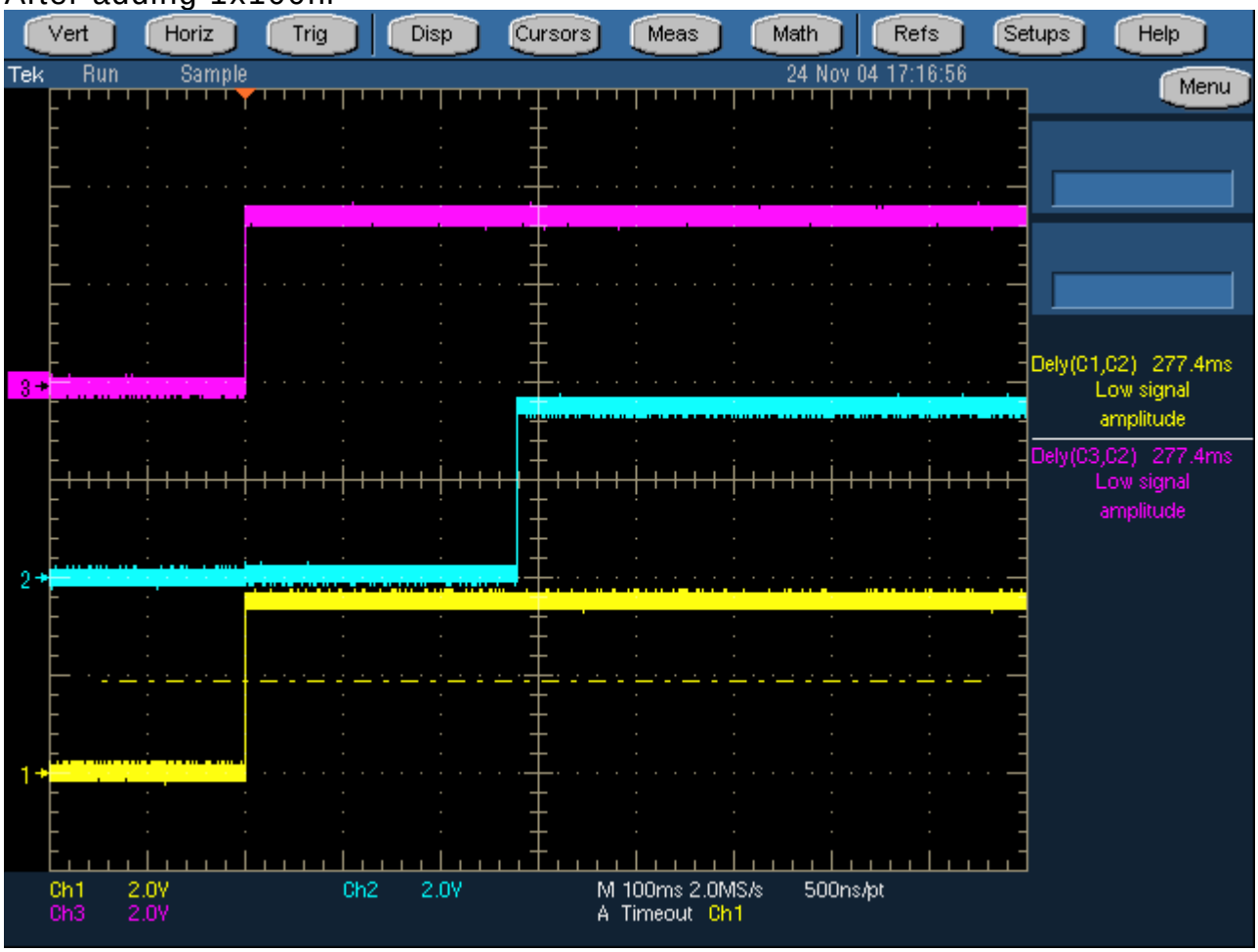
CH1 is INPUT Voltage, CH2 is RESET output, CH3 is OUTPUT Voltage
Original, not changed cap value.



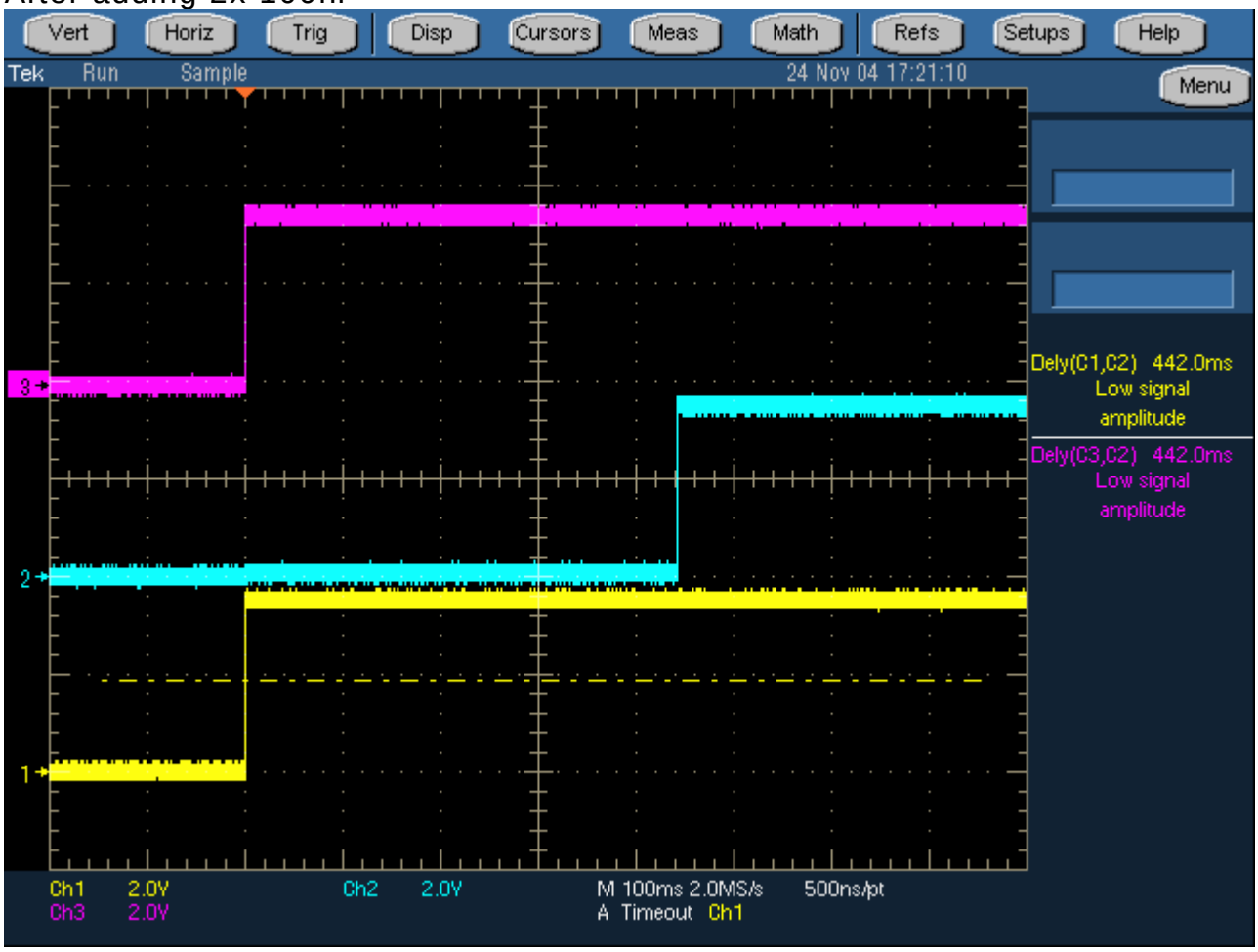
Original, not changed cap value.



After adding 1x100nF



After adding 2x 100nF



The idea is to extend the RESET time of the Mechacon during the time you are manipulating with the power plug. You will notice that the red light will appear around 1 second later then before adding 470n. It is very good. Remember to filter power replacing 0 ohm by inductor. Add tantalum cap somewhere close to the regulator and you can add some 100n caps somewhere around but for decoupling use Z5U dielectric because it has lower ESR then X7R.

Now let's start talking about poorly designed chips.

The second possible cause of Mechacon/DSP lockup is bad chip. If you noticed freezing of your console during PS2 boot you have the problem number 2 :-) Please read again our three points we wrote some pages before :-)
Simply ask your chip manufacturer about timings and logic levels during CD/DVD patching and measure B,G,H,I if they are driven from one or two pins :-) Simply ask :-) they must be driven by two pins :-)
Get multimeter and check it yourself :-)
Again measure B like BEEF and higher wires because A is a clock.

Could somebody test it independently and publish it on ps2-scene ? Come on guys :-)

Console can fail during powering up after that lottery event which we were not able to identify previously and it can be burned by a poorly designed chip. Lottery event is plugging power cord !

What we noticed measuring chips of some competitors. We have found they have something wrong with internal logic of FPGA. Of course their software is great, we know it but the rest is not :-)
For example you can make Mechacon/DSP of V12 to freeze when you make soldering error by shortening wires going to CD/DVD bus. Ha ! Some chips do the same for the short moment when you press reset and until valid clock starts running. Until these chips don't get clock signals from console they make permanent grounding of CD/DVD bus for some miliseconds LOL :-) We will not say more :-)

In the Ripper/// chips we have already PIC on board and our FPGA waits for internal Brown-Out detector inside the PIC to wake up and then we start operation of FPGA when the PIC is running and internal 3state buffers are kept in reset until good power condition is achieved :-) We guarantee that no signals and no current is flowing until our PIC is operating.

In general it is complicated thing when console is running. Lack of reliable watchdog in the console is additional problem too. We will try to propose something more reliable in the next day or two.

If you read ps2-scene board, you can make additional small modification proposed by the user summ0ne by adding 1 or two parallel resistors. Credit to him :-)

The third case of freezing can be simple power filtering problem during normal operation and the lack of watchdog circuit. Noise can come from spindle motor, power line or electromagnetic field and it is **not** chip related. We must find proper solution for that also :-)

Stay tuned.. We are still working…