



DRIVER DANGER

AN INTERACTIVE ADVENTURE
INTO THE WORLD OF DRIVER
TROUBLESHOOTING

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The Guide

Welcome to the not at all comprehensive guide to testing and troubleshooting an A2071 driver. While this guide is written with the A2071E (ethernet type) in mind, most of it can be adapted to the A2071A (VME type) as well in theory (I hope). The biggest differences between the two (in the troubleshooting department at least) is the nature in which the driver draws power and the use of a Rabbit module on the ethernet driver.

This guide should cover most the basic/common problems that could prevent a driver from functioning fully, however drivers being as complex as they are many problems can be very unique and hence not covered here. In such cases the oscilloscope and schematics are your best friends. The appendix has tips for testing and working with such drivers.

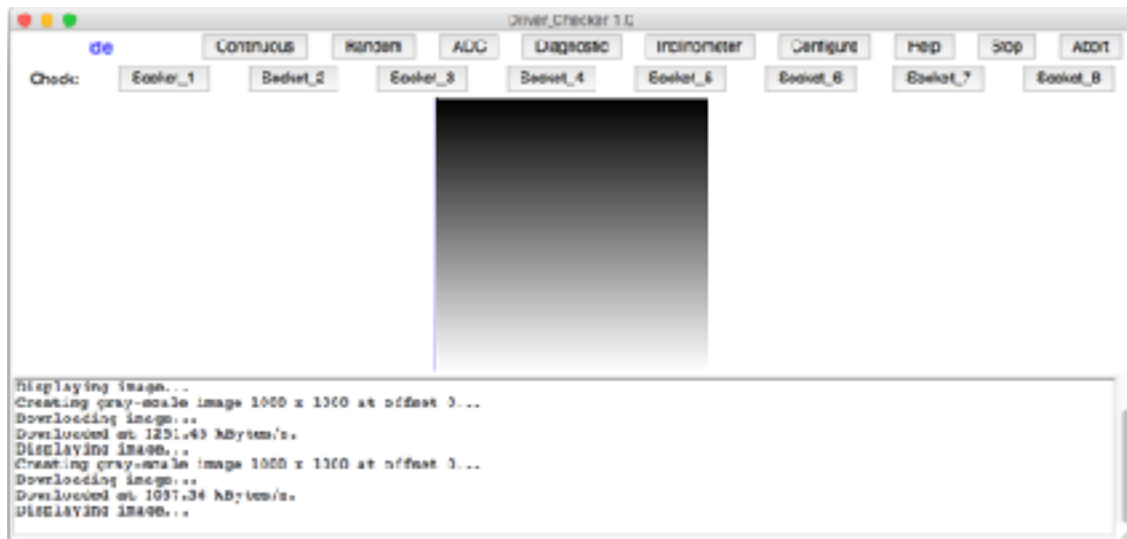
That said, lets dive in!

1. Plug the driver into power and a computer via its ethernet port. If it turns on, as indicated by the green status lights, go to step 5. If not proceed to step 2.
2. Make sure you turned on the power pack supposedly supplying power to the driver and that it is set to $\sim 24V$. If that wasn't the issue proceed to step 3, if it was your issue, don't feel bad, it happens enough for me to put it in here, and proceed to step 5.
3. The next thing to check would be the bridge rectifier located at U8. It's currently the DF01S and is a chip easily mis-oriented. If correctly placed, the plus symbol should be in the top left corner. If not, correct it, and it should turn on. If it was your issue, proceed to step 5.
4. Check the packages on L1, L2, and L3. These are hard (impossible) to misalign, however ensure that L2 and L3 haven't been interchanged (they look slightly similar). If your board still refuses to power up you are now in the "very unique and hence not covered here" territory. In the appendix are some tips for testing and working with stubborn drivers. Click here.
5. If your board now turns on, program it and proceed to step 7. If it doesn't program go to step 6.
6. Chances are if your logic chip isn't programming you have dry pins on it. The usual suspects are first few pins at the bottom of the left and right face of the chip. If your Rabbit Module isn't programming you probably have dry pins on your Rabbit connector. The Rabbit programming software is a little finicky so confirm that it's working on another driver before assuming your board has an issue. Once your board is programmed move to the next step.
7. Launch LWDAQ on the computer connected to your driver and open the "Configurator" tool. Additionally, through "Run Tool" launch the "Driver Checker" tool. You can download it here.

- In Configurator, attempt to contact the driver. You should get something that looks like this in the window:

```
Attempting to open socket...success.  
Attempting login...success.  
Relay Software Version: 15  
Relay MAC Address: 0090c2ef9f17  
Controller Hardware ID: 71  
Controller Hardware Version: 2  
Controller Firmware Version: 7  
Closing socket...closed.
```

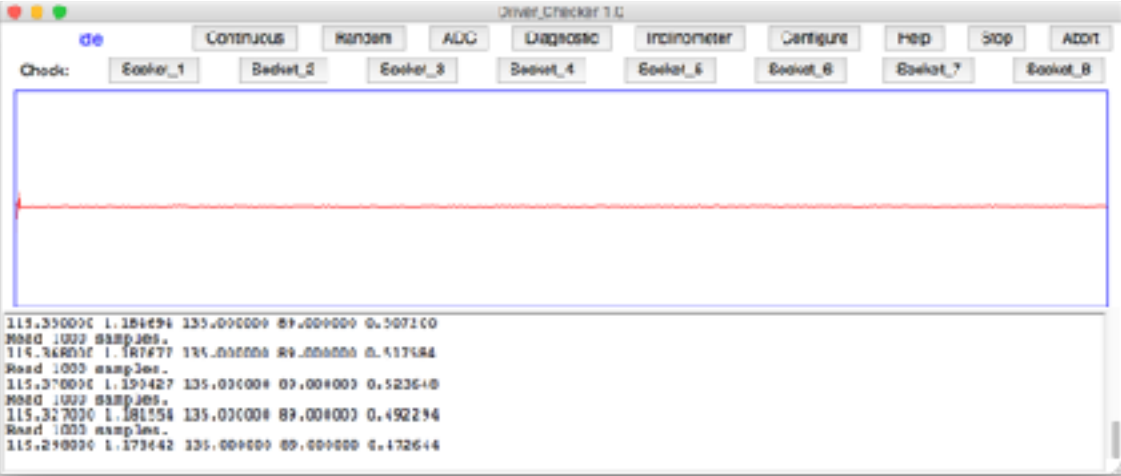
- If the Hardware Version is something other than 2, simply remove R13 from your board and leave it open. Version 2 is what we are using for our current build. The small table printed on the board next to R12 and R13 can help you set your board to any other hardware version we may use in the future.
- If any of the other numbers don't line up the next few tests should help indicate a course of action. (Note: The MAC Address is unique to every driver and will change)
- Now switch to the Driver Checker tool. Start by running the "Continuous" function. It should look like the image below. If it is blank, or solid, or has bars, or has static, or any imperfections go to step 18. Else proceed to the next step.



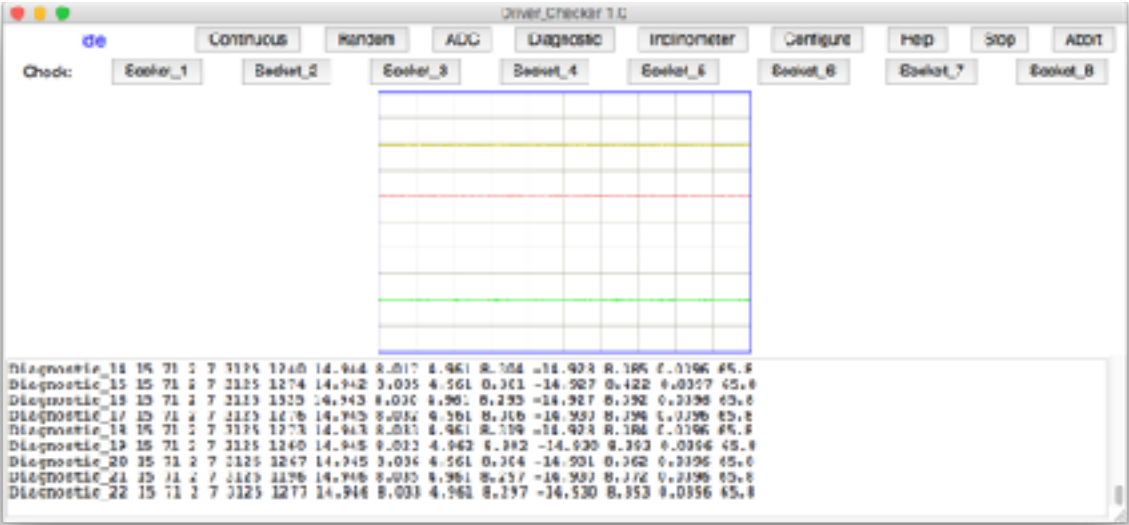
- Now run the "Random" function. If the window does not print the result below, step 18 would be helpful for this issue as well. Else proceed to the next step.

```
SCORE: 1000 out of 1000  
Testing 1000 locations...  
SCORE: 1000 out of 1000  
Testing 1000 locations...  
SCORE: 1000 out of 1000  
Testing 1000 locations...  
SCORE: 1000 out of 1000  
Testing 1000 locations...  
SCORE: 1000 out of 1000
```

13. Now run the “ADC” function. It should look like the image below, in which case proceed to the next step. However, if it is blank, or the level of the signal is either higher or lower go to step 19.



14. Next run the “Diagnostic” function. It should look like the image below, in which case proceed to the next step. However, if it is blank, or the levels of the signals are either higher, lower, nonexistent or whacky go to step 20.



15. Finally, sequentially connect a camera to the sockets on the driver, selecting the respective channel on the Driver Checker. If all the channels present the same problem or don’t work, go to step 21. If most of the channels but a few work go to step 22 to troubleshoot these individual problems.

16. If your driver has passed all the tests above, well done! Go to step 17. If the driver didn’t pass the tests but the subsequent steps to which the above steps link to helped you fix your driver and then pass the test, well done! Go to step 17. If your driver hasn’t passed these tests and this guide failed to help you you are now in the “very

unique and hence not covered here” territory. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).

17. Switch back to the Configurator tool and press “Read” and then “Copy.” In the column on the right enter all the relevant information. If the driver is not going on the network just enter the Driver ID and the Operator name for now to see if this is working. Once entered hit Write, then Reboot, and then Read. If this fails make sure you’ve reset the EEPROM on the driver. If it still doesn't work step 18 will help you here as well. If it did work, well done! Your driver is now complete, put it in a box ASAP so that it doesn't get damaged lying around in the lab.
18. Chances are that if you’ve landed on this step you have a dry pin or a short on your RAM chips or the pins that they connect to on the logic chip. Start by inspecting the RAM chips: U3, U4, U5, and U6. If you locate no dry pins or shorts here check the top face of the logic chip next, this is where most of the RAM signals run to. If you locate no dry pins or shorts here either, check the pins on the bottom face of the logic chip and the pins on the Rabbit connector. It is less likely that these symptoms would emerge from an error here, but it is possible. If you do locate such an issue, fix it and return to the step that brought you here and proceed from there. Else, you are now probably in the “very unique and hence not covered here” territory. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).
19. Chances are that if you’ve landed on this step you have a dry pin or a short on your ADC chips or the pins that they connect to on the logic chip. Start by inspecting the ADC chips: U22 and U23. If you locate no dry pins or shorts here check the right face of the logic chip next, this is where most of the ADC signals run to. If you do locate such an issue, fix it and return to the step that brought you here and proceed from there. Else, you are now probably in the “very unique and hence not covered here” territory. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).
20. If your driver’s power levels aren't what they should be investigate the SOT-23 packages Q2-Q6 at the bottom of your board along with the resistors surrounding them. Ensure that there are no dry pads and that none of the transistors have been switched with neighboring ones. Whacky (you’ll know it when you see it) levels may be caused by an incorrectly oriented oscillator, U7. The big dot should be in the top left corner. If you do locate such an issue, fix it and return to the step that brought you here and proceed from there. Else, you are now probably in the “very unique and hence not covered here” territory. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).
21. If your driver has passed all the tests up to this point but refuses to take images, there is a laundry list of errors that could be the culprit. Unfortunately, most would fall into the “very unique and hence not covered here” category, however, some common soldering errors causing this can be found on chips U28, U19, U18, U20, U21, and U26 checked in that order. If you have images but they’re just distorted in one specific manner and your RAM tests came up clean you’re probably looking for a short on one of these chips. If you do locate such an issue, fix it and return to the step that

brought you here and proceed from there. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).

22. If most of your sockets are taking images with the exception of a few to one, chances are that you have dry pins or a short on the faulty channel's DG411DY chip. If this is not the case inspect the connector pins on the underside of the board. If neither of these is the case check to see you haven't mistakenly transposed the resistors on that channel. If you do locate such an issue, fix it and return to the step that brought you here and proceed from there. Else, you are now probably in the "very unique and hence not covered here" territory. In the appendix are some tips for testing and working with stubborn drivers. [Click here](#).

The Appendix

Welcome to the appendix. If you have been sent here it probably means your driver is misbehaving and my super generic solutions did nothing to help you. Well fret not for with the tips below and the excellent [schematics](#) and oscilloscope you should be able to get your driver up and running in no time!

If the appendix helps you solve the problem the guide sent you down here for, return to the step you came from and resume following the steps and testing your driver.

If you're still hitting a wall and your driver refuses to function as designed it is now time to [contact](#) the [wizard](#). If he can't help you, no one can.

The tips:

- a. Always make sure your scope is connected to ground. Ground on this board are test pins 11 and 12. The GND pad next to the power jack is not actually a ground. If you see a 60Hz signal on your scope you're probably not grounded.
- b. Work on scales appropriate to the board, typically 100ns and 5V, but this may vary.
- c. Have a working driver handy to compare your broken one to.
- d. It is not inconceivable for chips to be transposed with others or incorrectly oriented, it is worth inspecting suspect regions under a loupe.
- e. Chips U24, U30, and U31 are notorious for dry pins and or shorts and can cause a whole host of problems. Inspect them closely.
- f. A fine dental pick can be very handy in tapping suspect pins that look fine but may be dry. Be very careful when doing this because being as tiny as these pins are if bent back and forth too much they are liable to break.
- g. It is common for a drivers issues to be caused by a faulty Rabbit module. Switch it out with another drivers module and re-run the tests to eliminate this possibility.
- h. Feeding a signal into the driver via the connector on P5 using a signal generator and then tracing it to the potentially faulty circuit can sometimes be a useful way of uncovering problems in a board, albeit tricky.
- i. Don't get too frustrated, it is a really good feeling when your board finally starts working, trust me.