

# **The Ultimate Truck Hacking Platform**

## **Hardware Testing and Verification Manual**

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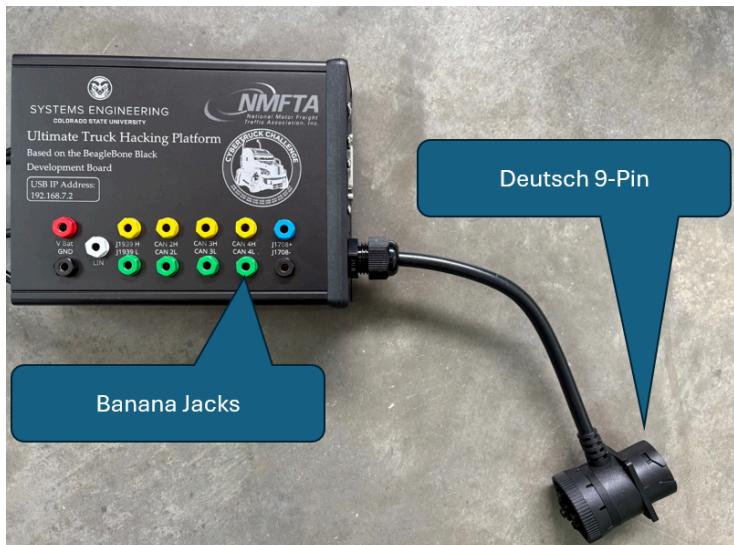


## Summary

This document is a testing plan for the Ultimate Truck Hacking Platform (UTHP) hardware design. It includes:

- **Multimeter Tests:** a set of continuity tests for verifying CAN channels 1-3 and +12V / GND through both the banana jacks and the Deutsch 9-Pin connector.
- **Bitmagic Basic Tests:** A checklist for verifying the built-in logic analyzer and CAN 4.
- **LIN Testing:** A brief test for verifying LIN communication between 2 UTHP devices.

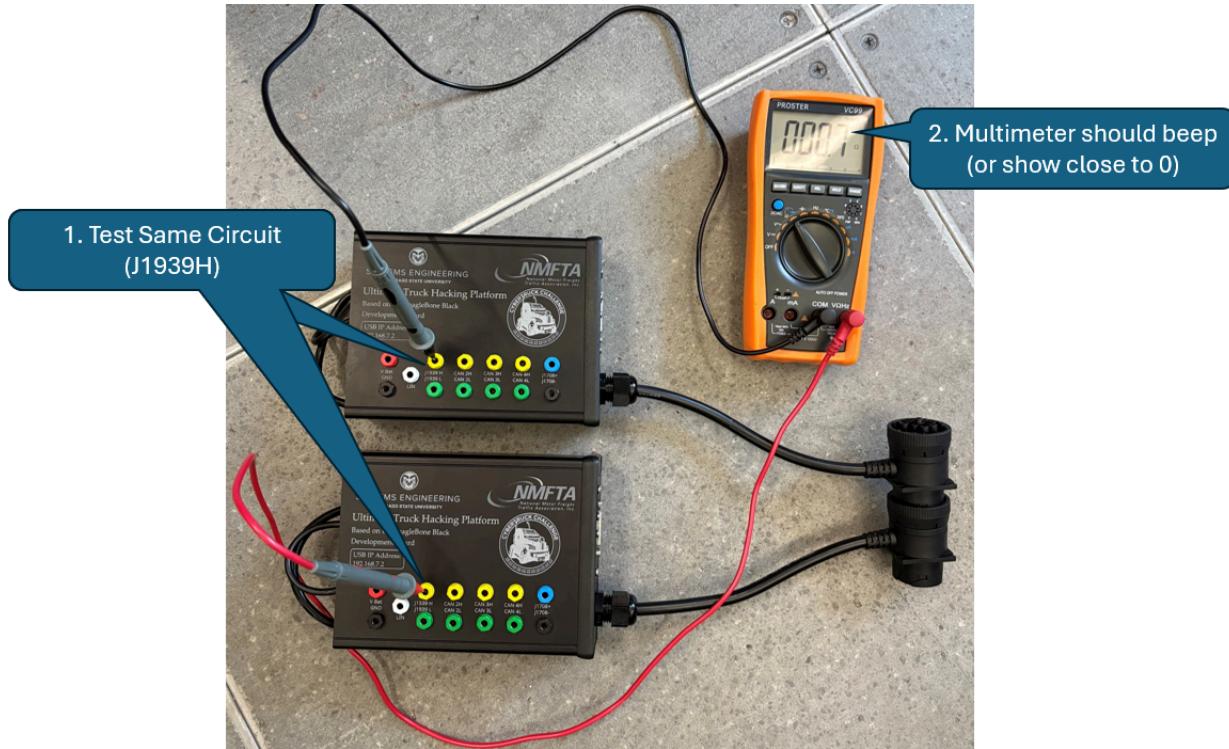
## Continuity Testing



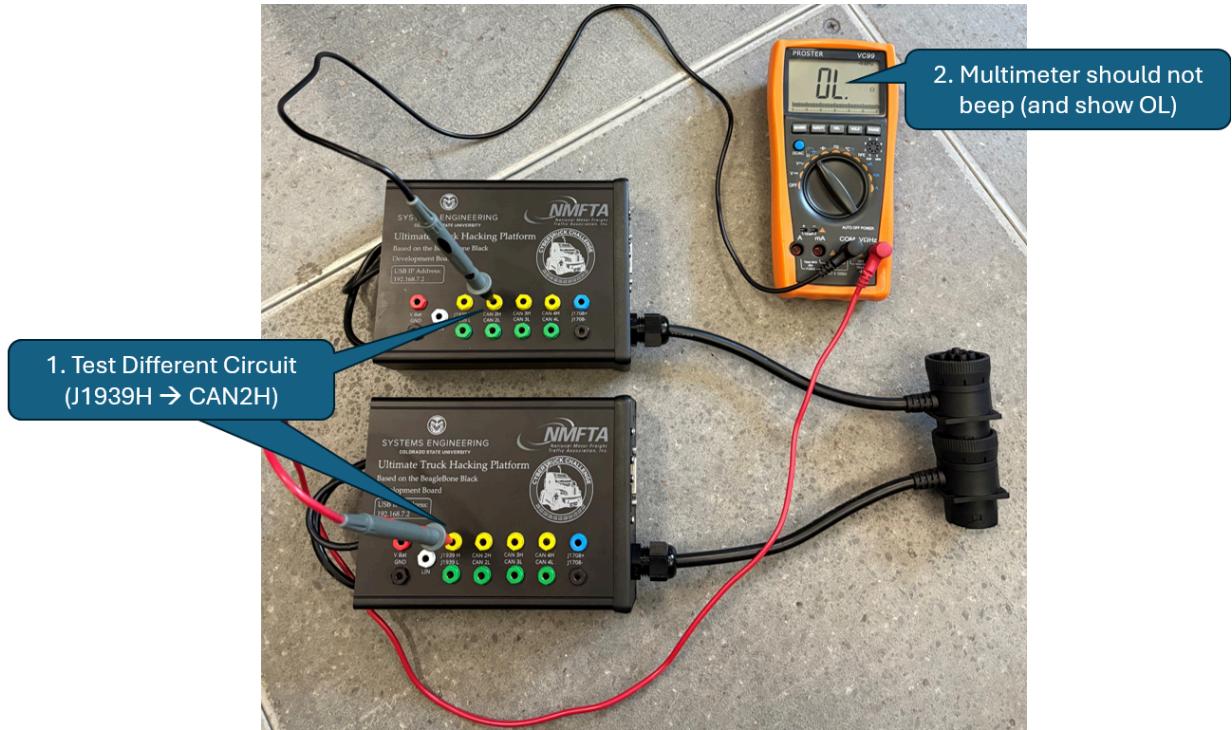
In order to verify each UTHP, connect 2x UTHPs together using the Deutsch 9-Pin connectors. These plug in directly to each other, with a rotating lock. This will connect both UTHP devices by their corresponding CAN channels: J1939 → J1939, CAN2 → CAN2, CAN3 → CAN3, GND → GND, and +12V → +12V.



For the multimeter, rotate the main selector to place it into resistance mode (1), and press the blue button (2) until the mode is selected for continuity (3). This mode beeps when circuits are shorted together, signaling that they are connected properly if testing the same circuit.



In the image above, both probes of the multimeter are connected to the J1939H banana jack (1). Upon connection, the multimeter should beep (and show a value of close to 0 Ohms) indicating that the circuits are connected properly. This verifies that from UTHP 1 J1939H, through the Deutsch 9-pin connection, to UTHP2, the circuits are connected.



In the image above, the red multimeter probe is connected to UTHP1 CAN2, whereas the black probe is connected to UTHP2 J1939H (1). These circuits should not be connected, and therefore the multimeter should not beep (2) and show OL.

The continuity test should be done for the two connected UTHP devices for each of the banana jack circuits below:

1. Test VBat → VBat (red to red)
2. Test GND → GND (black to black)
3. Test J1939H → J1939H (yellow to yellow)
4. Test J1939L → J1939L (green to green)
5. Test CAN2H → CAN2H (yellow to yellow)
6. Test CAN2L → CAN2L (green to green)
7. Test CAN3H → CAN3H (yellow to yellow)
8. Test CAN3L → CAN3L (green to green)

Additional tests can be done (for example: from CAN2H to CAN4H) that should not beep. If this occurs, there is a short somewhere → contact Carson via Slack or email. LIN, J1708+ and J1708- are not pinned out to the Deutsch 9-Pin, and therefore will not beep (or be connected) if tested at this point.

## Bitmagic Testing

If the above tests pass, you can now move onto testing the functionality of the Bitmagic Basic. The Bitmagic is a Logic Analyzer (LA), allowing the UTHP user to view the raw signals of connected networks for low-level analysis.

To start, make sure that you have a Linux operating system. Gather a USB-C cable to connect to the Bitmagic USB port on the end cap of the UTHP. Also connect banana jack cables from J1939H→CAN4H and J1939L→CAN4L. Connect the USB cable to your laptop, and follow the installation instructions found at the links below to download, install, and start Pulseview:  
(Note: you will need both Pulseview and sigrok-cli programs)

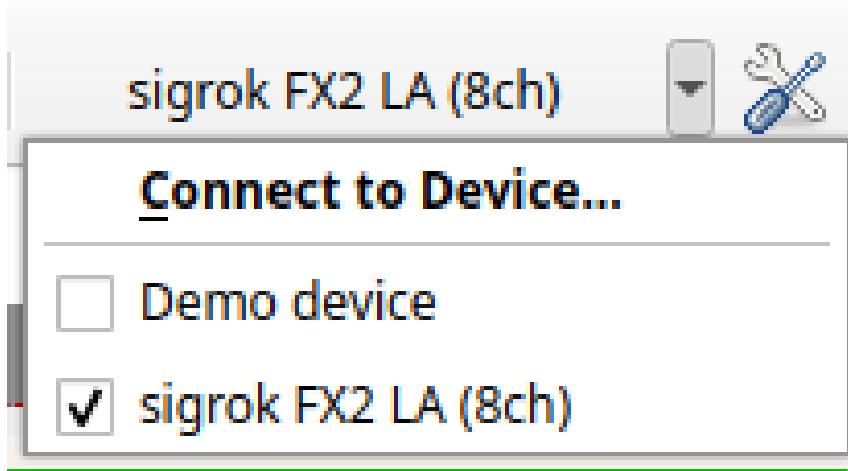
[https://sigrok.org/wiki/Downloads#Binaries\\_and\\_distribution\\_packages](https://sigrok.org/wiki/Downloads#Binaries_and_distribution_packages)

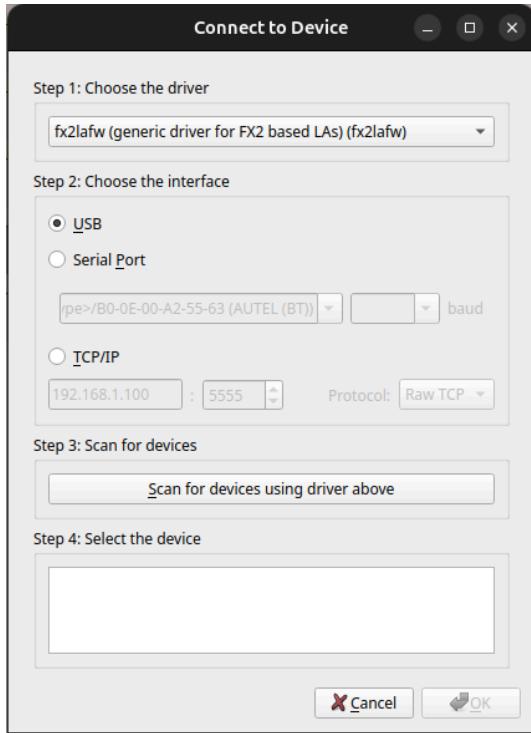
Run the following commands from the "Downloads" folder:

```
chmod +x pulseview-NIGHTLY-x86_64-debug.AppImage  
./pulseview-NIGHTLY-x86_64-debug.AppImage
```

<https://sigrok.org/wiki/PulseView>

select device → fx2lafw → scan → run





Pulseview provides a nice Graphical User Interface (GUI) for viewing the signals passed to the Bitmagic Basic LA. To fully test the Bitmagic, please connect the UTHP to both the Brake Board and Freightliner Cascadia, as if you were to do software testing. Upon setting up Pulseview, you can press "run" and should see similar output to the below image:



The black trace is J1939, the brown is J1708, and the blue is CAN4.

## LIN Testing

To test the Local Interconnect Network (LIN), please connect a jumper wire from one UTHP LIN banana jack port to the other as seen below:



Have one tester SSH into one UTHP via “ssh UTHP@192.168.7.2”, and the other tester follow the same command but for the other UTHP. Once connected, follow the commands below to verify transmission and reception of LIN:

- On one UTHPs:  
“sudo cat /dev/ttys5” (to exit press Ctrl+A, then K, then Y)

```
Windows PowerShell
X Command Prompt - ssh uthp X

UTHP-R1-0008:~$ sudo cat /dev/ttys5
lin test|
```

- On other UTHP:  
“sudo screen /dev/ttys5 19200” →  
“LIN Test” and press enter

This should show “LIN Test” on the other UTHP. If this occurs, you are all done! Nice work.

## **Failed Tests / Issues / Debugging**

Contact Spencer Beer or Carson Green for assistance if you are unable to diagnose and solve an issue when doing the testing above. We are happy to help, but also encourage you to try some things first. There are some listed starting points below:

- Continuity Issues:
  - Check the multimeter is in the correct mode
  - Ensure both Deutsch 9-Pin connectors are connected properly
  - Double check the probes are connected to the correct areas you want to test
  - Try another multimeter
  - Check the wiring of the Molex 10-Pin (white plug on printed circuit board (PCB) of UTHP. It is possible these were wired incorrectly, or the Deutsch 9-Pin had a manufacturing issue
- Bitmagic Issues:
  - Try another BitMagic Basic board, if possible. Carson has noticed not all of them work properly
  - In the downloads folder where you installed pulseview and sigrok-cli, run `./sigrok-cli-NIGHTLY-x86_64-release-installer.AppImage -scan`. This should output a demo device AND the fx2lafw device. If only the demo device pops up, check USB connections then try another bitmagic.
  - New to Linux? Use ChatGPT or this link to quickly learn how to navigate directories, how to run commands, etc...  
<https://www.geeksforgeeks.org/basic-linux-commands/>
- LIN Issues:
  - Double check you are SSH'ed into two separate UTHP devices (they should have different usernames: UTHP-R1-000X) and that they are both connected via the LIN banana jacks.
  - ChatGPT or contact Spencer/Carson