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Title: README Dual UART Loopback Testing on Jetson Nano 4GB

Document Number: nnn-nn

CTI One Corporation

Table 1a. Document History

2023-07-05	Introduced steps of implementing loopback tests for both J41 UART and J50 UART.	YZ
2023-07-10	Updated according to the meeting note.	YZ

Table 1b. Testing and Release Approval Form

2023-07-05	Loopback tested in Python by YZ	Pending for approval
2023-07-10	Added loopback tests in PuTTY by YZ	Pending for approval

Table 2. References

Number	Name and URL	Note
1.	pySerial Documentation https://pyserial.readthedocs.io/en/latest/index.html	
2.	Jetson Nano Developer Kit	

	https://developer.nvidia.com/embedded/jetson-nano-developer-kit	
3.	Rover System on a Jetson Nano Dev Kit https://www.codeinsideout.com/projects/lidar-mapping-poc/rover/#installation	
4.	PuTTY https://www.putty.org/	

Table 3. Prerequisite

Software Prerequisite No.	Description and Version	Note
1.	Ubuntu 18.04 (Note: the SD card flash was prepared by the host running 18.04)	Host OS
2.	Visual Studio Code	Coding in Python
3.	NoMachine	Access to Jetson Nano
Hardware Prerequisite No.	Description and Version	
1.	Jetson Nano 4GB Core Module Number: 945-13450-0000-100	
2.	microSD Card 64 GB with CTI One preinstalled system	2023-07-04

3.	AC/DC Power Adapter (5V-5A) https://www.amazon.com/gp/product/B078RT3ZPS/ref=ppx_yo_dt_b_asin_title_o00_s01?ie=UTF8&th=1	Depends on using USB devices such as keyboards, mice, WiFi modules
4.	Dupont Female to Female Jumper Wire	To connect UART TX RX pins on Jetson Nano
5.	HDMI or DP cable	For setting up the resolution on NoMachine for Jetson Nano

Setup loopback tests for J50 UART and J41 UART on Jetson Nano

Section 1. Prerequisites

1. Insert the SD card and Power On the Jetson Nano with Power Jack

1.1. Insert the SD card to the Jetson Nano ;

1.2. Let the 2-pin jumper short the 2 pins on the J48 connector ;

1.3. Connect Ethernet port, HDMI or DP port, keyboard and mouse ;

1.4 Connect the power jack to the Jetson Nano to power it on.

2. Setup Ethernet Based Network Connections

In this UART loopback test, the Host computer is connected to Internet through WiFi. To provide both the Internet connection and NoMachine connection to Jetson Nano, simply use Ethernet cables to connect the Jetson Nano and the Host computer either in a direct way or through a network switch. Then share the WiFi network to the Ethernet port on the Host computer. Once the Jetson Nano gains the Internet connection and IP address, the NoMachine will automatically find it.

3. Install Nomachine and Connect to the Jetson Nano through it

3.1. For host OS;

https://downloads.nomachine.com/linux/?id=1

Download “NoMachine for Linux DEB amd64”

Execute the below command;

```
$ sudo dpkg -i nomachine_xxxx_amd64.deb
```

3.2. For Jetson Nano.

https://downloads.nomachine.com/linux/?id=30&distro=Arm

Downlaod “NoMachine for ARM ARMv8 DEB”,

Execute the below command;

```
$ sudo dpkg -i nomachine_xxxx_arm64.deb
```

Restart Jetson Nano

Section 2. UART Configuration for Loopback Tests

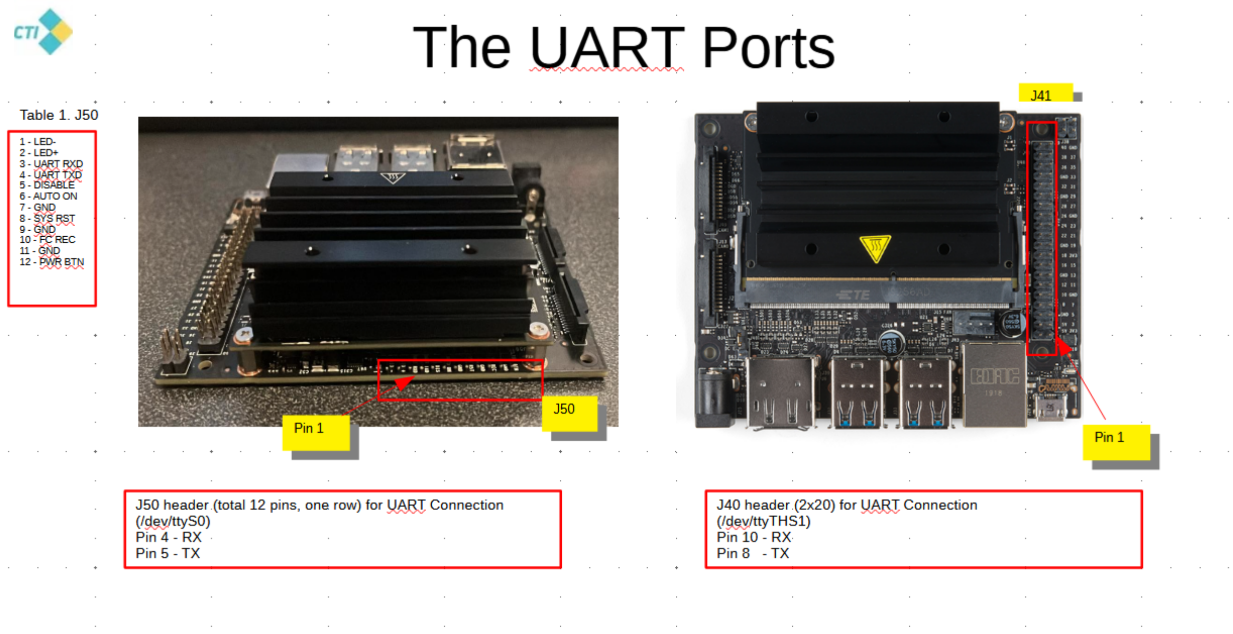
1. Setup UART Config on the Jetson Nano

Jetson Nano has 3 **physical UART** ports:

UART0 at the **M2** Slot for WiFi/BT card

UART1 at the **J41** Header (40-pin connector) for System Console after boot up (run by a service), Pin **8 - TX**, Pin **10 – RX** **(Port = /dev/ttyTHS1)**

UART2 at the **J50** header for debug (early access during boot from bootloader), Pin **4 - RX**, Pin **5 – TX** **(Port = /dev/ttyS0)**



The UART Ports

Table 1. J50

1	LED-
2	LED+
3	UART RXD
4	UART TXD
5	DISABLE
6	AUTO ON
7	GND
8	SYS RST
9	GND
10	FC REC
11	GND
12	PWR BTN

J50 header (total 12 pins, one row) for UART Connection (/dev/ttyS0)
Pin 4 - RX
Pin 5 - TX

J40 header (2x20) for UART Connection (/dev/ttyTHS1)
Pin 10 - RX
Pin 8 - TX

Figure 1. The Location of UART Ports

The M2 slot is not usable for dupont jump wires. Hence the J41 UART and J50 UART are selected.

https://www.codeinsideout.com/projects/lidar-mapping-poc/rover/#enable-spi

1.1. Disable the serial console for the J41 UART port ;

There is a default serial console for J41 UART port. By disabling it, the UART mode will be set to “dialout” for free use.

1.1.1. To disable the console, type the following commands in the terminal:

```
sudo systemctl stop nvgetty && \
```

sudo systemctl disable nvgetty && \

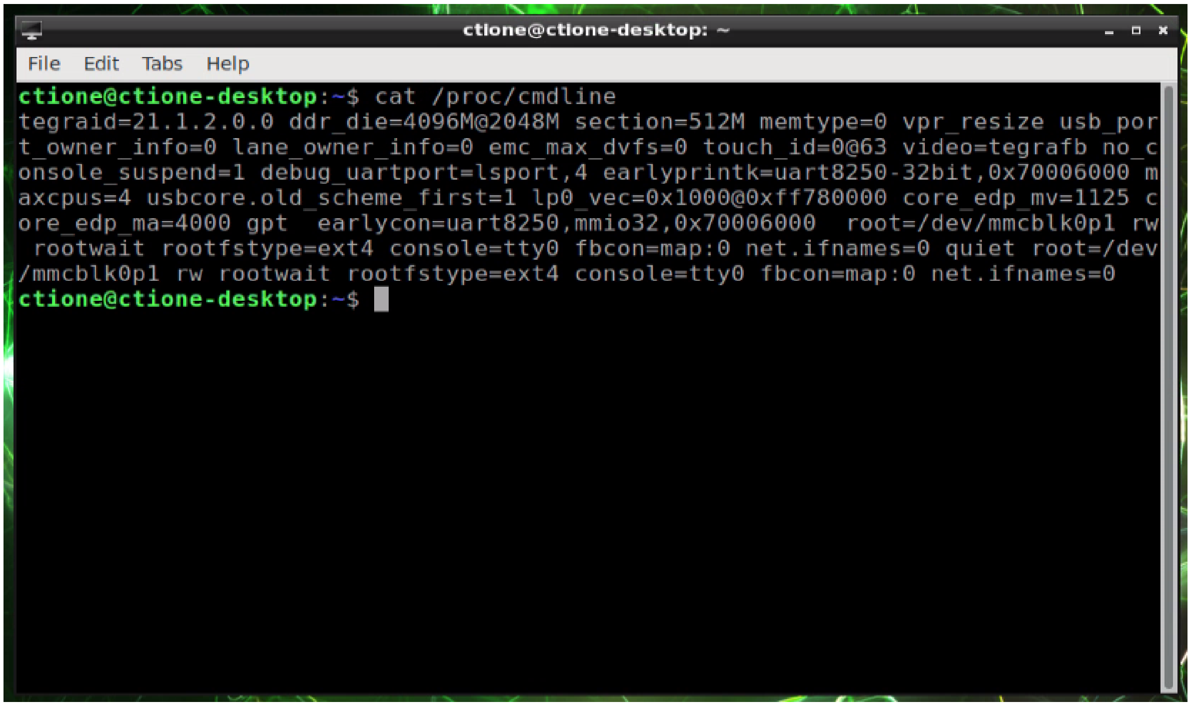
sudo udevadm trigger

1.1.2. Reboot the Jetson Nano.

1.2. Disable the debug serial for the J50 UART port.

The debug serial interface is chosen at the startup of kernel. The J50 UART port **CANNOT** be used freely unless the debug serial interface is disabled.

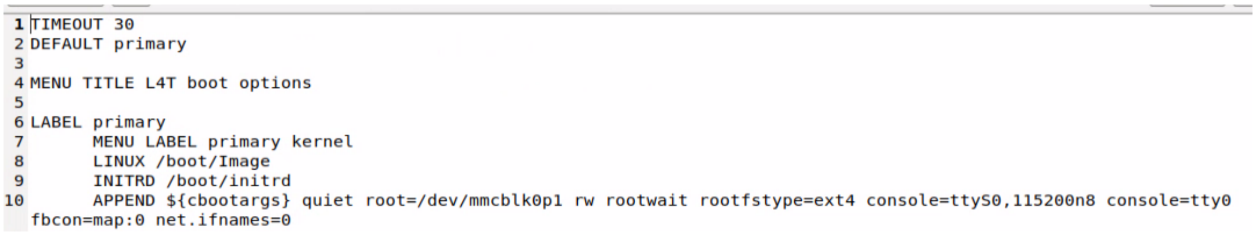
1.2.1. Type "cat /proc/cmdline" command to print the command line options ;



```
ctione@ctione-desktop:~$ cat /proc/cmdline
tegraid=21.1.2.0.0 ddr_die=4096M@2048M section=512M memtype=0 vpr_resize usb_por
t_owner_info=0 lane_owner_info=0 emc_max_dvfs=0 touch_id=0@63 video=tegrafb no_c
onsole_suspend=1 debug_uartport=lsport,4 earlyprintk=uart8250-32bit,0x70006000 m
axcpus=4 usbcore.old_scheme_first=1 lp0_vec=0x1000@0xff780000 core_edp_mv=1125 c
ore_edp_ma=4000 gpt  earlycon=uart8250,mmio32,0x70006000  root=/dev/mmcblk0p1 rw
 rootwait rootfstype=ext4 console=tty0 fbcon=map:0 net.ifnames=0 quiet root=/dev
/mmcblk0p1 rw rootwait rootfstype=ext4 console=tty0 fbcon=map:0 net.ifnames=0
ctione@ctione-desktop:~$ 
```

Figure 2. The Content Of cmdline File

1.2.2. Type "sudo gedit /boot/extlinux/extlinux.conf" command to examine and edit it ;

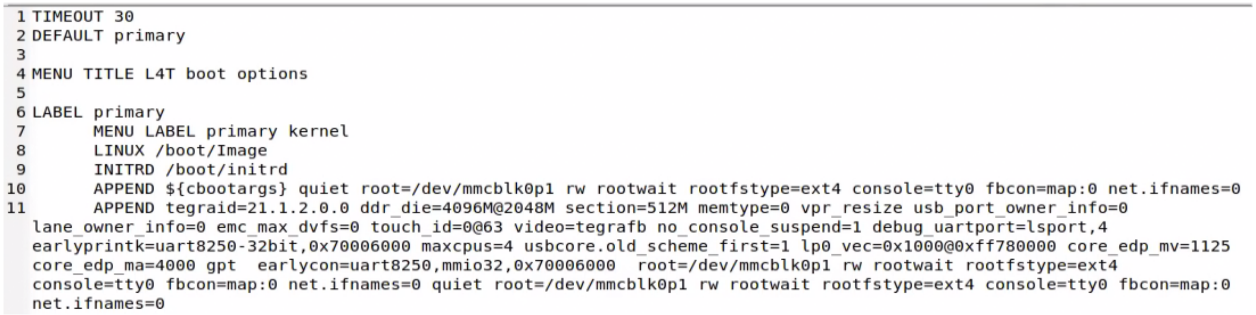


```
TIMEOUT 30
DEFAULT primary

MENU TITLE L4T boot options

LABEL primary
      MENU LABEL primary kernel
      LINUX /boot/Image
      INITRD /boot/initrd
      APPEND ${cbootargs} quiet root=/dev/mmcblk0p1 rw rootwait rootfstype=ext4 console=ttyS0,115200n8 console=tty0
fbcon=map:0 net.ifnames=0
```

Figure 3. extlinux.conf File

1.2.3. Copy the content of the cmdline file. And then write “APPEND” at Line 11 in the extlinux.conf file. Add a tabspace before “APPEND” and a space after “APPEND”, and then paste the content the cmdline file ;

1.2.4. Delete all the “console=ttyS0,115200n8” content in both the Line 10 and Line 11. Save it.



```
 1 TIMEOUT 30
 2 DEFAULT primary
 3
 4 MENU TITLE L4T boot options
 5
 6 LABEL primary
 7       MENU LABEL primary kernel
 8       LINUX /boot/Image
 9       INITRD /boot/initrd
10       APPEND ${cbootargs} quiet root=/dev/mmcblk0p1 rw rootwait rootfstype=ext4 console=tty0 fbcon=map:0 net.ifnames=0
11       APPEND tegraid=21.1.2.0.0 ddr_die=4096M@2048M section=512M memtype=0 vpr_resize usb_port_owner_info=0
   lane_owner_info=0 emc_max_dvfs=0 touch_id=0@63 video=tegrafb no_console_suspend=1 debug_uartport=lsport,4
   earlyprintk=uart8250-32bit,0x70006000 maxcpus=4 usbcore.old_scheme_first=1 lp0_vec=0x1000@0xff780000 core_edp_mv=1125
   core_edp_ma=4000 gpt  earlycon=uart8250,mmio32,0x70006000  root=/dev/mmcblk0p1 rw rootwait rootfstype=ext4
   console=tty0 fbcon=map:0 net.ifnames=0 quiet root=/dev/mmcblk0p1 rw rootwait rootfstype=ext4 console=tty0 fbcon=map:0
   net.ifnames=0
```

Figure 4. The New extlinux.conf File

1.2.5. Reboot the Jetson Nano. Open the the terminal and type “ls -l /dev/ttyS* /dev/ttyTHS*”. It should show that all of them belong to the “dialout” instead of “tty” group now.

1.3. Give the permission to the current user to access J41 and J50 UART ports without “sudo”.

Type these commands in the terminal:

sudo usermod -a -G tty,dialout,gpio $USER

sudo reboot

Note: The serial console and debug serial console will be turned off. They will not be accessible.

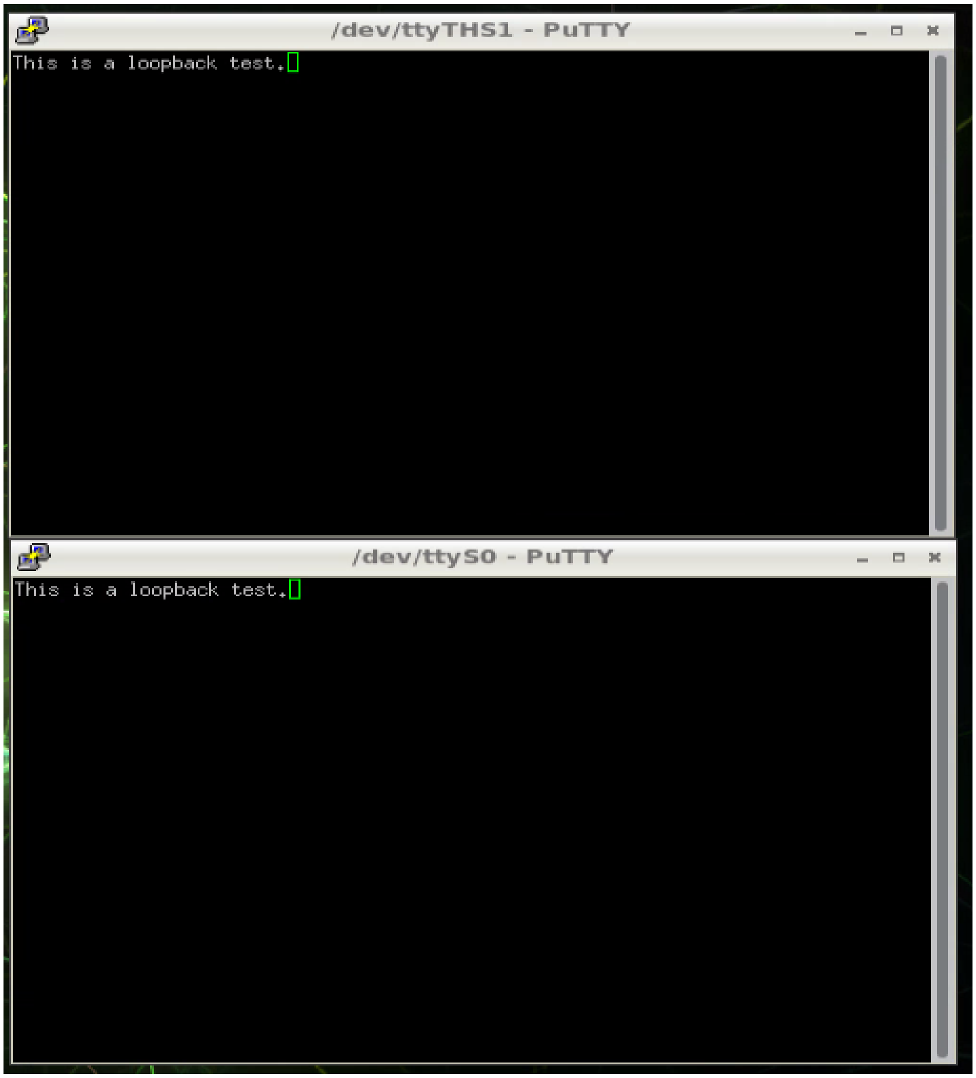
2. Use PuTTY for loopback tests

2.1. Input “sudo apt-get install putty” in the terminal on Jetson Nano to install PuTTY.

2.2. Type “putty” in the terminal to open the PuTTY. Chosse “Serial” in “Connecntion type”. Then type “/dev/ttyTHS1” in the “Serial line” for J41 UART loopback test. Click “Open” at the bottom.

2.3. The PuTTY terminal should be blank at first, since the serial console has been disabled. Type anything in the PuTTY terminal. It should show exactly what has been typed into. If the TX and RX pins are disconnected, then the PuTTY terminal should have no response to what it has been typed into.

2.4. Open PuTTY again and change the “Serial line” to “/dev/ttyS0” for J50 UART loopback test. Repeat the process in 2.3. The results should be the same.



```
This is a loopback test.
```

```
This is a loopback test.
```

Figure 5. Test Results from PuTTY

Section 3. Python Loopback Tests

1. Write the UART Loopback Test Program in Python3

1.1. Write the loopback test code for J41 UART in Visual Studio Code:

```
 1 #!/usr/bin/python3
 2 print 'hello world!'
 3 import time
 4 import serial
 5
 6 ser = serial.Serial(
 7     port="/dev/ttyTHS1",
 8     baudrate=115200,
 9     bytesize=serial.EIGHTBITS,
10     parity=serial.PARITY_NONE,
11     stopbits=serial.STOPBITS_ONE,
12     timeout=1
13 )
14 # Wait a second to let the port initialize
15 time.sleep(1)
16
17 try:
18     print("This is a simple loopback test for J41 UART.\n")
19     while True:
20         wt = input("Write: ") + "\n"
21         ser.write(wt.encode())
22
23         rd = ser.readline()
24         rd = str(rd, 'UTF-8')
25         print("Read: " + rd)
26
27 except KeyboardInterrupt:
28     print("Exiting Program")
29
30 except Exception as exception_error:
31     print("Error occurred. Exiting Program")
32     print("Error: " + str(exception_error))
33
34 finally:
35     ser.close()
36     pass
```

Save the code file as “loopback_j41.py” and then import it into the Jetson Nano through Nomachine.

1.2. To write the loop back test code for J50 UART, simply change:

Line 7 --> “/dev/ttyS0”

Line 18 --> “print("This is a simple loopback test for J50 UART.\n")”.

Save the file as “loopback_j50.py” and then import it into the Jetson Nano through Nomachine.

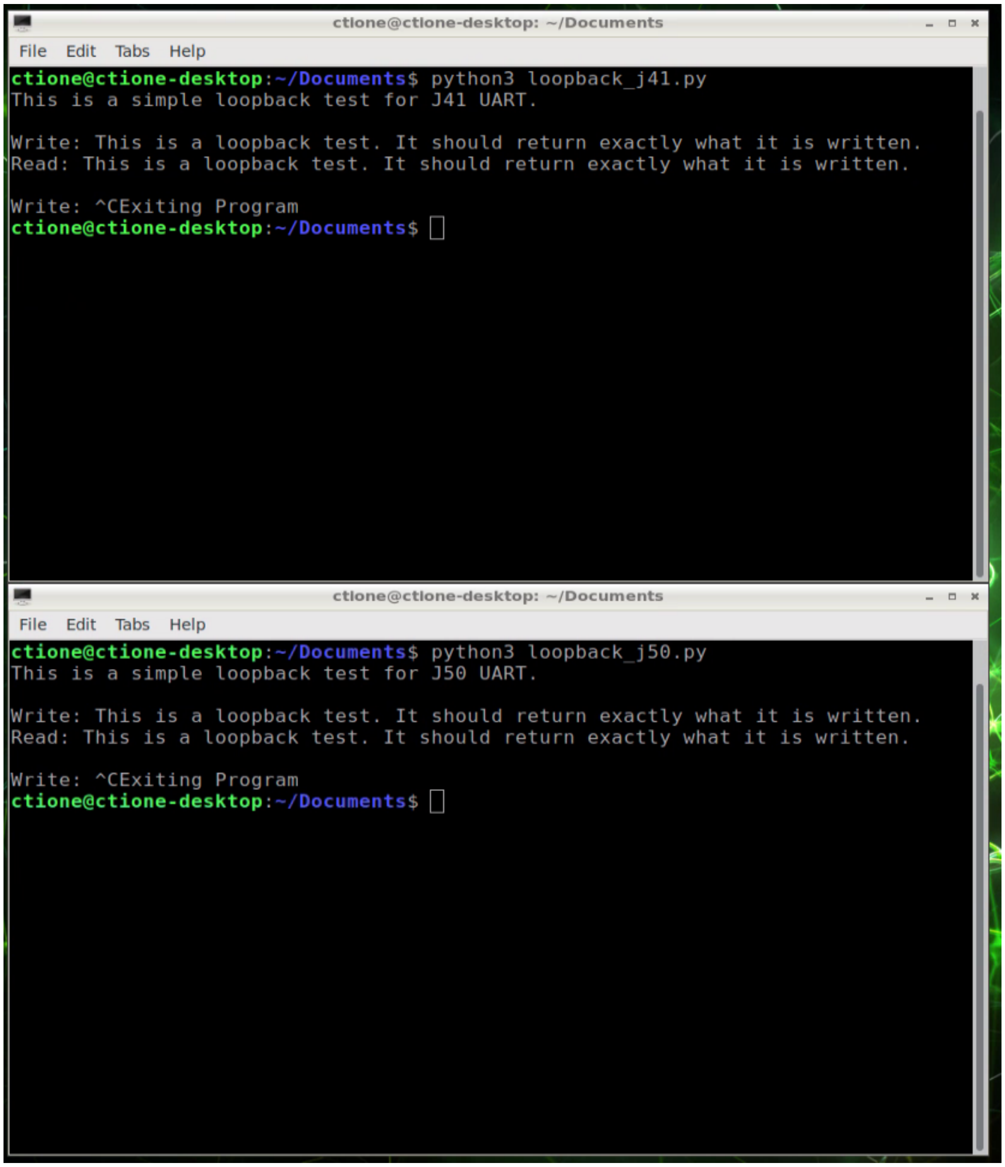
2. Perform the UART Loopback Tests

2.1. Use a dupont jump wire to connect J41 UART TX pin (pin 8) and RX pin (pin 10) ;

2.2. Use a dupont jump wire to connect J50 UART TX pin (pin 4) and RX pin (pin 3) ;

2.3. Change to the directory where the code files are saved and open 2 terminals to type “python3 ./loopback_j41.py”, “python3 ./loopback_j50.py” respectively ;

2.4. Input anything and press Enter key. It should show exactly what has been inputed. Use Ctrl + C“ to exit the program.


ctione@ctione-desktop: ~/Documents
File Edit Tabs Help

```
ctione@ctione-desktop:~/Documents$ python3 loopback_j41.py
This is a simple loopback test for J41 UART.

Write: This is a loopback test. It should return exactly what it is written.
Read: This is a loopback test. It should return exactly what it is written.

Write: ^CExiting Program
ctione@ctione-desktop:~/Documents$
```

ctione@ctione-desktop: ~/Documents
File Edit Tabs Help

```
ctione@ctione-desktop:~/Documents$ python3 loopback_j50.py
This is a simple loopback test for J50 UART.

Write: This is a loopback test. It should return exactly what it is written.
Read: This is a loopback test. It should return exactly what it is written.

Write: ^CExiting Program
ctione@ctione-desktop:~/Documents$
```

Figure 6. The UART Loopback Tests

(END)