

Voltage Controller Manual

Alexander Fogal

For Professor Jim Martin
University of Waterloo
August 9th, 2021

Contents

1	Setup	2
1.1	Raspberry Pi	2
1.2	Remote Setup	2
2	Interface	4

1 Setup

1.1 Raspberry Pi

To setup the Raspberry Pi:

1. Unplug Ethernet and Power from RPi if plugged in, and move to desired location
2. If the DAC/ADC board was unplugged, plug it in now. Make sure the wire with the red striping is aligned with pin 1 on the RPi. Make sure the plug is aligned with the pins properly and BEFORE powering the RPi (or else the control software will fail since the i2c isn't connected)
3. Plug in ethernet and power to RPi and allow it about a minute to finish booting

1.2 Remote Setup

To setup your personal computer or a lab computer:

1. This is only necessary in theory or as a check since I have setup the RPi to use the static IP `192.168.1.4` and I have `mosquitto` running on the Pi at boot.
 - (a) On a laptop/desktop (or even the Pi itself if plugged into a display), run `ip addr` to find your IP address as pictured (see Figure 1 at the end of the document). Then run `nmap` as pictured as well. Note that the Pi and control computer must be plugged into the same router. Make sure the address in the `nmap` command is the same as your IP address but with a zero in the final entry (and leave the `/24`).
 - (b) The IP of the RPi will be labelled as in the picture
 - (c) Change the IP in the `defaultSettings` dictionary in `server/server.py` to the IP of the RPi found in `nmap`.
2. Now you should be able to run `python3 server.py` and have everything connect! It will take a moment, but it should not take more than 30 seconds.
3. If not, the relevant ssh command is:

```
ssh -l jddmartin RPi_IP_Here
```

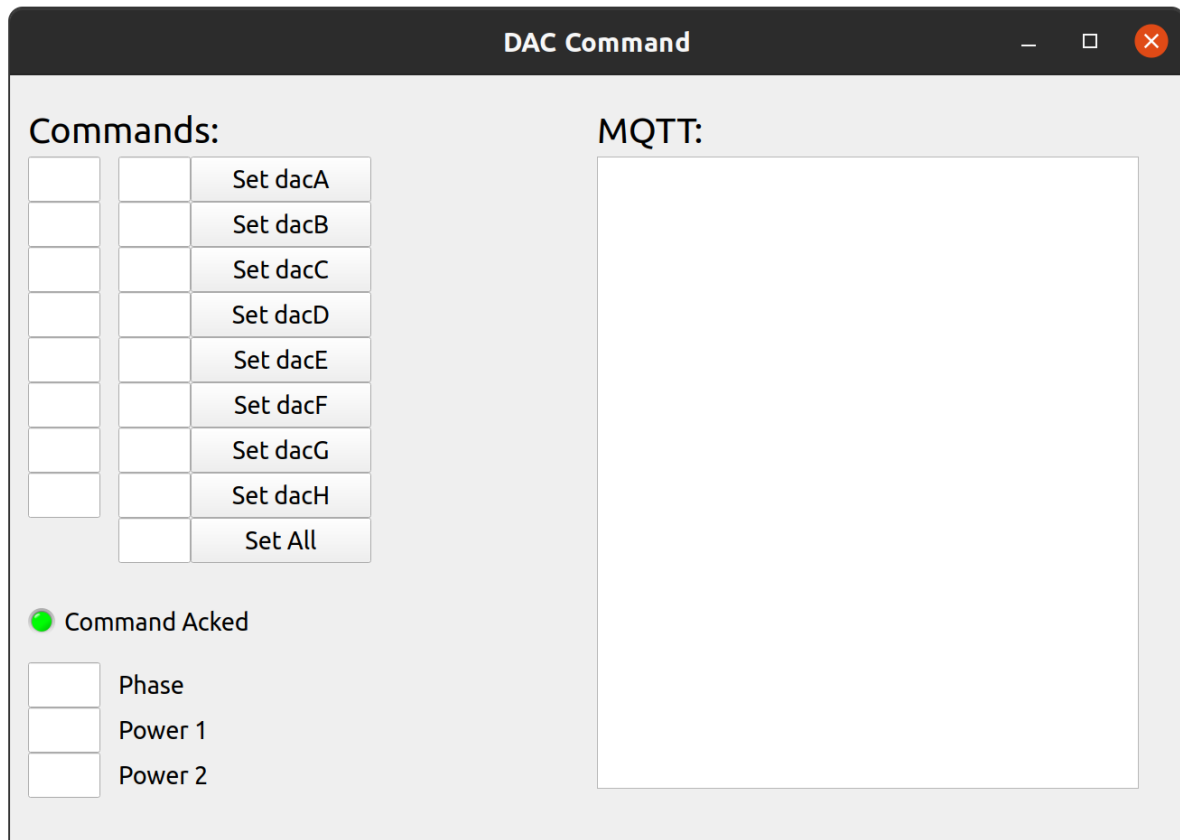
Ask Jim or I for the password. Feel free to message me if it isn't working as expected!

```
alex@imladris: ~  
alex@imladris:~$ ip addr  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host  
        valid_lft forever preferred_lft forever  
2: enx000ec6a62623: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 3e:7b:19:6a:f2:23 brd ff:ff:ff:ff:ff:ff permaddr 00:0e:c6:a6:26:23  
3  
    inet 192.168.1.100/24 brd 192.168.1.255 scope global dynamic noprefixroute enx000ec6a62623  
        valid_lft 80435sec preferred_lft 80435sec  
    inet6 fe80::4105:d14f:7fff:4f5e/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
4: wlp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000  
    link/ether bc:83:85:28:b1:5b brd ff:ff:ff:ff:ff:ff  
    inet 10.36.10.111/17 brd 10.36.127.255 scope global dynamic noprefixroute wlp2s0  
        valid_lft 14036sec preferred_lft 14036sec  
    inet6 fe80::67a2:ace9:83e1:71e4/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
alex@imladris:~$ sudo nmap -sn 192.168.1.0/24  
Starting Nmap 7.91 ( https://nmap.org ) at 2021-08-09 15:49 EDT  
Nmap scan report for _gateway (192.168.1.1)  
Host is up (0.0043s latency).  
MAC Address: 00:14:BF:A9:E4:69 (Cisco-Linksys)  
Nmap scan report for 192.168.1.54  
Host is up (0.0081s latency).  
MAC Address: 30:05:5C:E4:9C:BA (Brother industries)  
Nmap scan report for 192.168.1.103  
Host is up (0.00062s latency).  
MAC Address: DC:A6:32:D8:73:E1 (Raspberry Pi Trading)  
Nmap scan report for imladris (192.168.1.100)  
Host is up.  
Nmap done: 256 IP addresses (4 hosts up) scanned in 1.90 seconds  
alex@imladris:~$
```

Figure 1: Commands to check your IP and find the IP of the RPi. If you are using ethernet, the relevant interface will be either enx... or eth0. Otherwise, for WiFi it will be either wlp... or wlan0. In this case, I am using ethernet and so my IP can be read (next to inet) as 192.168.1.100. Further, note that the relevant IP for a name is *above* it, i.e., the IP for the RPi in this picture is 192.168.1.103.

2 Interface

The interface is rather simple:



The image shows a software window titled "DAC Command". It has a dark grey title bar with standard window controls (minimize, maximize, close). The main content area is light grey and divided into two sections. On the left, under the heading "Commands:", there is a table with two columns of text boxes and a column of buttons. The buttons are labeled "Set dacA" through "Set dacH" and "Set All". Below this table, there is a green status indicator and the text "Command Acked". At the bottom left, there are three more text boxes labeled "Phase", "Power 1", and "Power 2". On the right, under the heading "MQTT:", there is a large, empty rectangular box for displaying MQTT messages.

Commands:		
<input type="text"/>	<input type="text"/>	Set dacA
<input type="text"/>	<input type="text"/>	Set dacB
<input type="text"/>	<input type="text"/>	Set dacC
<input type="text"/>	<input type="text"/>	Set dacD
<input type="text"/>	<input type="text"/>	Set dacE
<input type="text"/>	<input type="text"/>	Set dacF
<input type="text"/>	<input type="text"/>	Set dacG
<input type="text"/>	<input type="text"/>	Set dacH
<input type="text"/>	<input type="text"/>	Set All

☒ Command Acked

<input type="text"/>	Phase
<input type="text"/>	Power 1
<input type="text"/>	Power 2

MQTT:

Figure 2: Command UI for the DAC/ADC board. The left column of text boxes report the current state of the DACs, the right column is for setting the DACs. The bottom section are ADC readouts. MQTT messages will appear in the box to the right.

In order to set the DACs, one can simply enter a value and click the relevant set button. Errors will occur if there was trouble converting the string to a float value, which will be reported in the MQTT box as well. Values should be between 0 and 5V. The board looks like this:

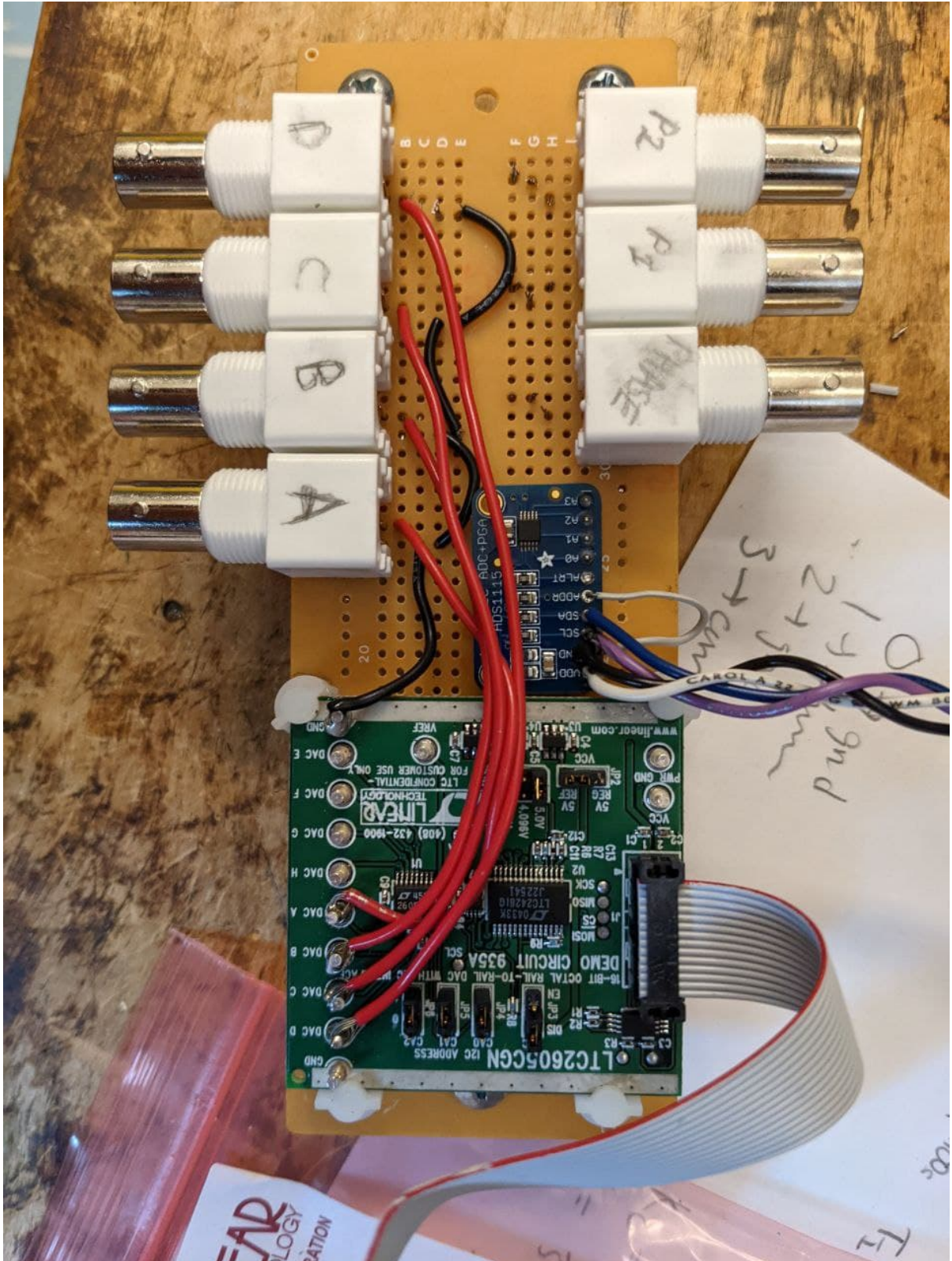


Figure 3: DAC/ADC board, DAC BNCs are labelled and ADC BNCs are labelled, both done rather crudely.