Instructions for Setting up the MKR WIFI 1010 with Grove Connector Base, Loadcell, and Matlab Arduino object for ME20.

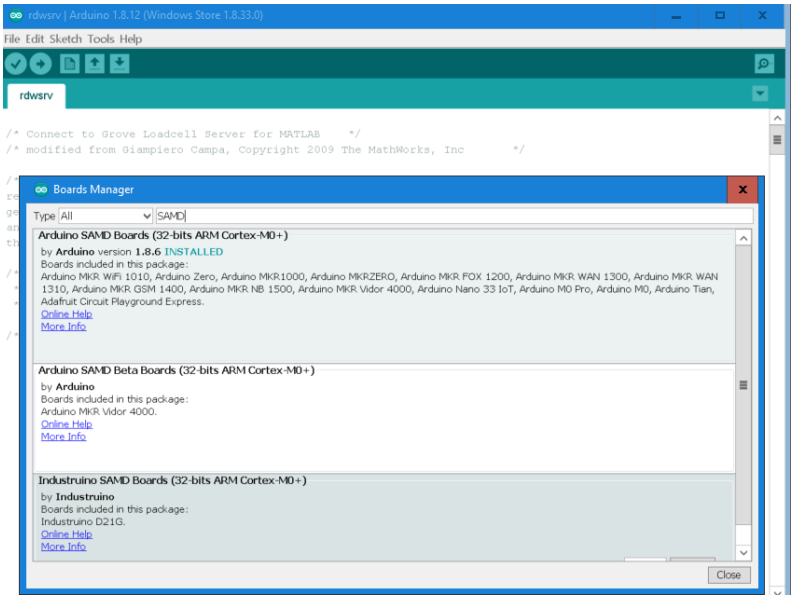
R White 6/3/2020

1. Install the Arduino IDE:

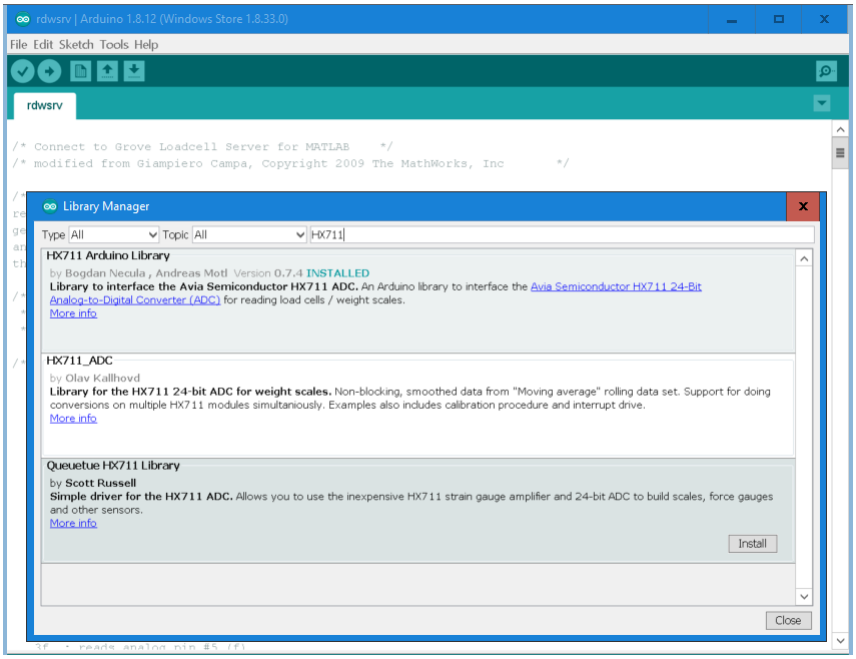
   https://www.arduino.cc/en/main/software

   I got 1.8.12 6/2/2020 (the "Windows App")

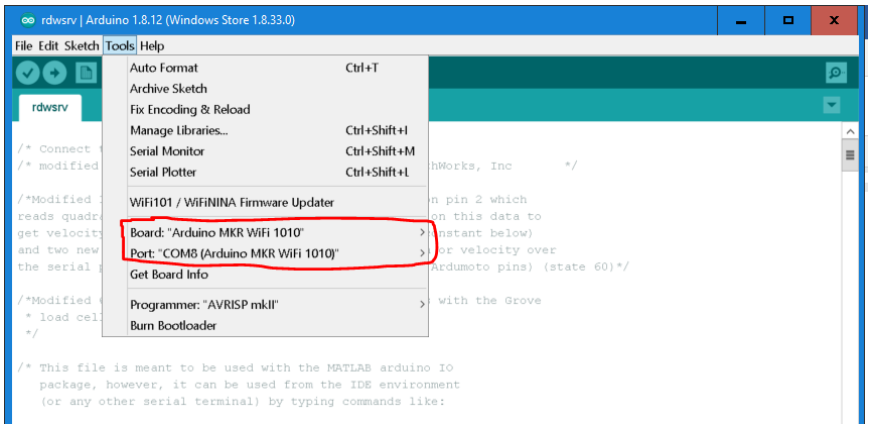
2. Add Arduino SAMD21 Core.
   a. Open Tools Menu
   b. Select "Board | Boards Manager…"
   c. Type "SAMD21" into the search bar
   d. Find "Arduino SAMD Boards (32-bits ARM Cortex-M0+) and select "Install". I got version 1.8.6 (6/3/2020)



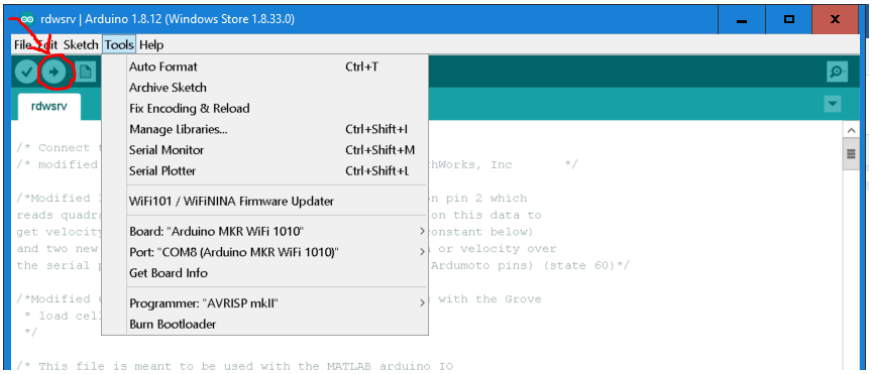
3. Add HX711 (bridge amplifier) support library.
    a. Under Tools Menu, select “Manage libraries…”
    b. Type “HX711” into the search bar
    c. Click the Install button for the library written by Bogdan Necula (I got version 0.7.4 on 6/3/2020)



4. Install the ME20 firmware to the MKR WIFI1010.
    a. Open “rdwsrv.ino” in the Arduino IDE.
    b. Plug in the MKR WIFI1010 using a USB cable. Wait for the drivers to install. Should happen automatically.
    c. Select the “Arduino MKR WIFI1010” under the Tools | Boards menu.
    d. Select the COM port for this board … under the Tools | Port menu. If the board is plugged in, you should see a COM port labeled “MKR WIFI1010”. For me it was COM8 but it could be another one for you. Remember what COM port you are on! You will need this later.



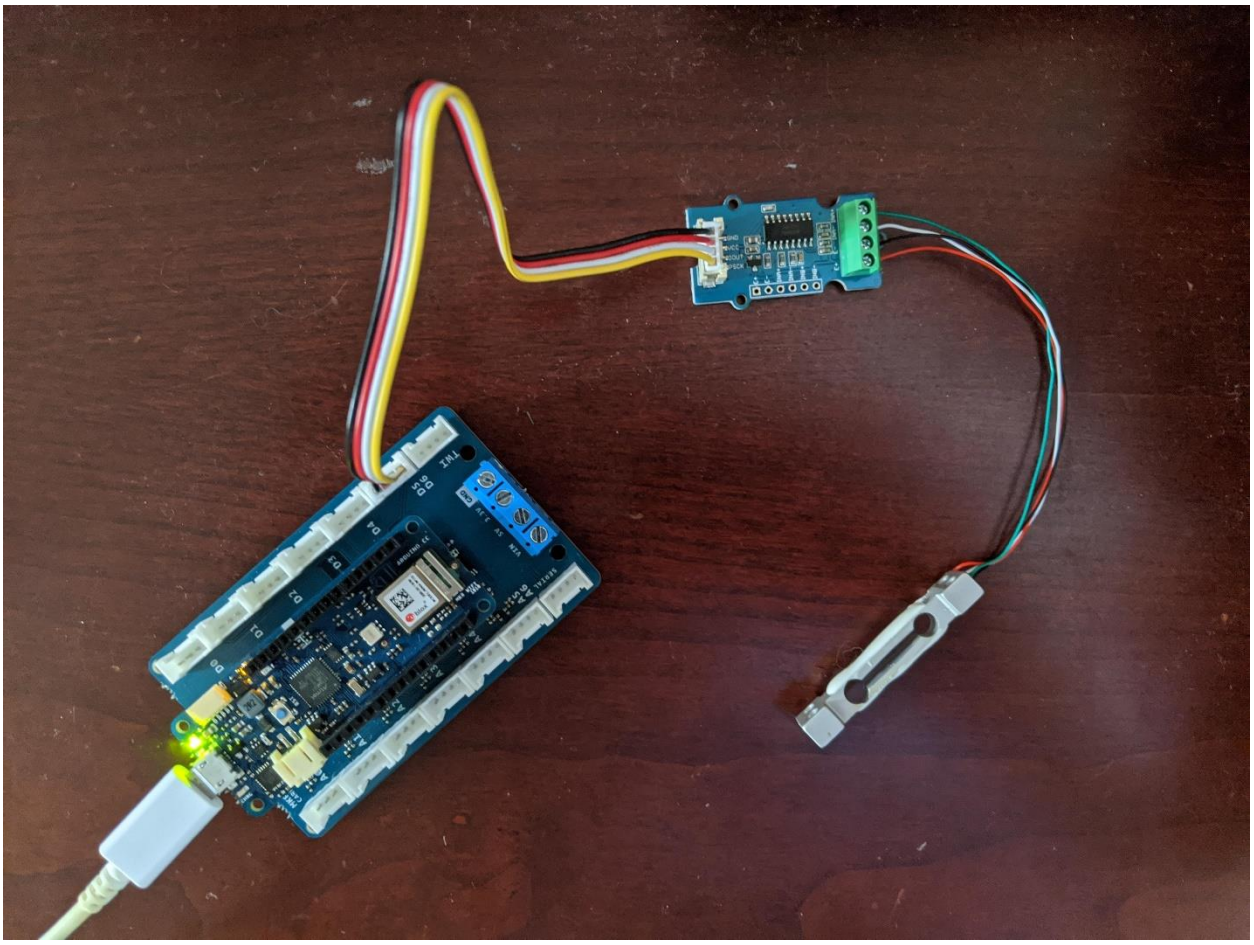
    e. Click the “Upload” arrow, the sketch should compile and upload to the board. It will take a minute. You should see a message at the bottom saying “Done uploading. Verify successful. CPU reset.” if everything worked (see below)!



5. Wire up the sensor and board.
    a. Connect the 4 colored wires on the loadcell to the HX711 screw terminals:

red=E+ black=E- White=INA- Green=INA+

    b. Plug the grove cable into the HX711 board and into the D5/D6 connector on the grove shield.
    c. Plug the MKR WIFI1010 into the grove shield, make sure to put it the right way around!!! Line up the pins with the same names
    d. Plug the USB cable into the MKR WIFI 1010 and into the computer (it should be already from step 4 above).



6. Create a Matlab ME20 Arduino object.

NOTE: When you plug in the Arduino, you may see a note appear in Matlab:

Arduino detected.
To use this device with MATLAB, install MATLAB Support Package for Arduino Hardware.
To use this device with Simulink, install Simulink Support Package for Arduino Hardware.

Please IGNORE this. You DO NOT need the Matlab support packages. We have our own! ☺

a. Put the file "arduino.m" into the directory you are working in Matlab. This defines the Arduino object and works with the code we just uploaded to the Arduino.
b. Create an Arduino object at the Matlab prompt (you can name it whatever you want, I named my myArduino). IMPORTANT: Make sure you use the same COM port number that you found out the Arduino was connected to in step 4.d above! If successful, you should see output similar to below:

```
>> myArduino=arduino('COM8');
Attempting connection ........
ME20 Script detected!
Arduino successfully connected !
```

c. To see all methods available, just type the name of the Arduino object. Some of these methods (such as the motor methods) require the Ardumoto motor shield.

   You can click on the hyperlink for each method to get additional help. Digital pins 05 and 06 are currently in use for the HX711 on the MKR WIFI1010 with the Grove connector base.

```
>> myArduino

myArduino =

arduino object connected to COM8 port
ME20 Server running on the arduino board

Digital Pin 02 is currently set as INPUT
Digital Pin 03 is currently set as OUTPUT
Digital Pin 04 is currently set as INPUT
Digital Pin 05 is currently set as OUTPUT
Digital Pin 06 is currently set as OUTPUT
Digital Pin 07 is currently UNASSIGNED
Digital Pin 08 is currently UNASSIGNED
Digital Pin 09 is currently UNASSIGNED
Digital Pin 10 is currently UNASSIGNED
Digital Pin 11 is currently set as OUTPUT
Digital Pin 12 is currently set as OUTPUT
Digital Pin 13 is currently set as OUTPUT
Digital Pin 14 is currently UNASSIGNED
Digital Pin 15 is currently UNASSIGNED
Digital Pin 16 is currently UNASSIGNED
Digital Pin 17 is currently UNASSIGNED
Digital Pin 18 is currently UNASSIGNED
Digital Pin 19 is currently UNASSIGNED

Pin IO Methods: pinMode digitalRead digitalWrite analogRead analogWrite encoderRead motorDrive loadcellRead
```

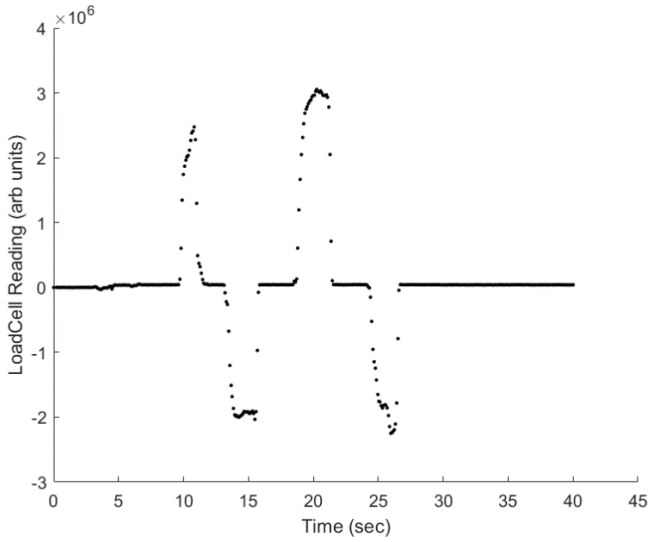
d. You can read the loadcell (in arbitrary integer units) right from the prompt:

```
>> myArduino.loadcellRead()

ans =

       -1802

fx >>
```

e. Here is some code that reads the loadcell and time and plots them in a graph.

```
%R White 6/3/2020
%Works with rdwsrv.ino version 6/3/2020
%MKR WiFi1010 on COM8, plugged into Grove base.
%Grove HX711 on D5/D6.
%Load cell wired up to HX711 screw terminals
%red=E+ black=E- White=INA- Green=INA+

%I get about 10 samples per second plotted using Matlab 2018A on my Win10
%laptop

%Create the arduino object
myArduino=arduino('COM8');
pause(1)

%Create a figure for plotting in
figure
hold on
xlabel('Time (sec)')
ylabel('LoadCell Reading (arb units)')

%Initialize first value in time and data:
t(1)=0;
x(1)=myArduino.loadcellRead();
n=2; %A counter
timer1=tic; %Start a timer
while(t(n-1)<40) %Run for 40 seconds
    t(n)=toc(timer1); %Recall the current time elapsed
    x(n)=myArduino.loadcellRead(); %Get the measurement from the loadcell

    %Plot the point:
    plot(t(n),x(n),'k.')
    drawnow
    n=n+1; %Increment the counter
end

%When you are done delete the arduino object to release the COM port
delete(myArduino)
```

Here is the resulting plot. In this data set I pushed on the beam in one direction, then the other, twice.



Troubleshooting

Check the connections on the loadcell wires. It is very easy to not make a good connection with the screw terminal. Make sure the wire does not tug out … if it tugs out easily the screw missed the wire or it is too loose. It is also possible to stick the wire too far in and have the screw touch the insulation instead of the metal core. Try stripping a bit more insulation off the wires to make it easier, but be careful, the wires are thin.

The loadcell wires are thin and break easily. Be careful not to bend them back and forth. Consdier including some strain relief in the physical setup (such as taping the wires down to the table at either end near the connections, and screwing the HX711 board and loadcell into a baseplate so they don't move relative to eachother.

I found that after being connected for a few minutes, the whole system would slow way down or lose connection. Restart the board by pushing the reset button.

Unplug and replug the USB cable.

Restart the Arduino IDE software.

Reboot Windows.

Some more links:

https://www.seeedstudio.com/blog/2019/11/26/10-things-you-can-do-with-your-hx711-and-load-cell/

The HX711 library is available here: https://github.com/bogde/HX711