



By Rob Fowler

Connecting Atlas Scientific Stamps to the Controller

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Introduction

To be able to read the standard probes used in Freshwater and Reef systems, requires a suitable interface to be able to interpret the data coming from the probe, and pass it onto the controller.

Q. Whose probes can I use?

A. Any manufacturers' probe that has a standard BNC connector.

Atlas-Scientific provides the appropriate stamps or circuits, which can be used on Arduino systems, to read and process the data from pH, ORP, DO and EC probes.

To use the Atlas stamps, you need to purchase both the required stamp, and either a 'Full Isolation' carrier board, to mount it on, or, one of two 'Tentacle Shields' manufactured by Whitebox Labs, before you can safely use them with the controller.

Q. Why do you need a 'Full Isolation' Carrier board or Shield?

A. They provide fully isolated power and data, and proper grounding, as well as isolation from any interference from other stamps, that you might add.

Many other manufacturers solve the 'grounding' problem, which can cause interference problems between probes by using an additional 'grounding probe' mounted in the aquarium itself. Atlas has eliminated this, with the design of their isolation carrier boards.

Whitebox Labs, makes two 'Tentacle Shields', one will handle 2 stamps (I2C mode only), and the other will handle 4. With these shields, you do not require a carrier board, simply mount the stamp(s), you are going to use directly onto the shield, and they will provide full isolation and grounding, in compliance with Atlas' specifications.

The Atlas Stamps (Circuits)

You can connect the following Atlas Scientific stamps to the controller:



2 x pH (potential Hydrogen) Stamps



1 ORP (Oxygen Reduction Potential) Stamp



1 DO (Dissolved Oxygen) Stamp



1 EC (Electrical Conductivity) Stamp

You can connect any one, or all of them, to the controller at the same time.

A Stamp Needs a Carrier Board or Shield

To use an Atlas stamp with the controller, they must be mounted in a 'carrier board' or shield. When getting an Atlas 'carrier board' always get the 'Full Isolation' version, The Whitebox Labs shields are fully isolated.



FULL ISOLATION

**An Atlas Single Full Isolation Carrier board (with an EC Stamp)*



FULL ISOLATION

**A Whitebox Labs Tentacle-Mini (2 Channel) Shield (with a pH and EC Circuit)*



FULL ISOLATION

**A Whitebox Labs Tentacle (4 Channel) Shield (with pH, ORP, DO and EC Stamps)*

You can connect these shields internally or mount them in an external case and plug into "Plug 2" on the controller. If you're using more than one shield you can connect them all together by connecting the grounds, +5v, SCL and SDA together coming from the different shields. They can all be connected to the same header pins on the board or "Plug 2". You can do this because each circuit has a unique 'address'.

Note: *If you connect the shields internally the cable connecting them to "Plug 2" shouldn't be longer than 3ft (1m).*

Changing the Stamps Operating Mode to I2C

Unfortunately the EZO Atlas-Scientific stamps aren't plug and play.

After choosing a stamp, but before you can use them with Robo-Tank, new stamps are set in UART mode as a default, you need to put the stamp in I2C mode.

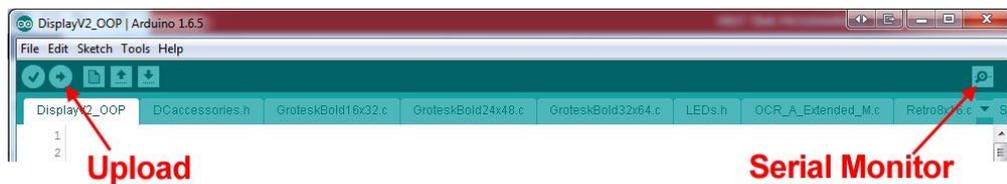
The reason we want I2C, is it allows better control of the data, because each stamp is called using a separate address.

I've setup some sketches to make this process a little easier using Robo-Tank, this is the recommended method as it also locks the circuit in I2C mode, but other methods are listed below.

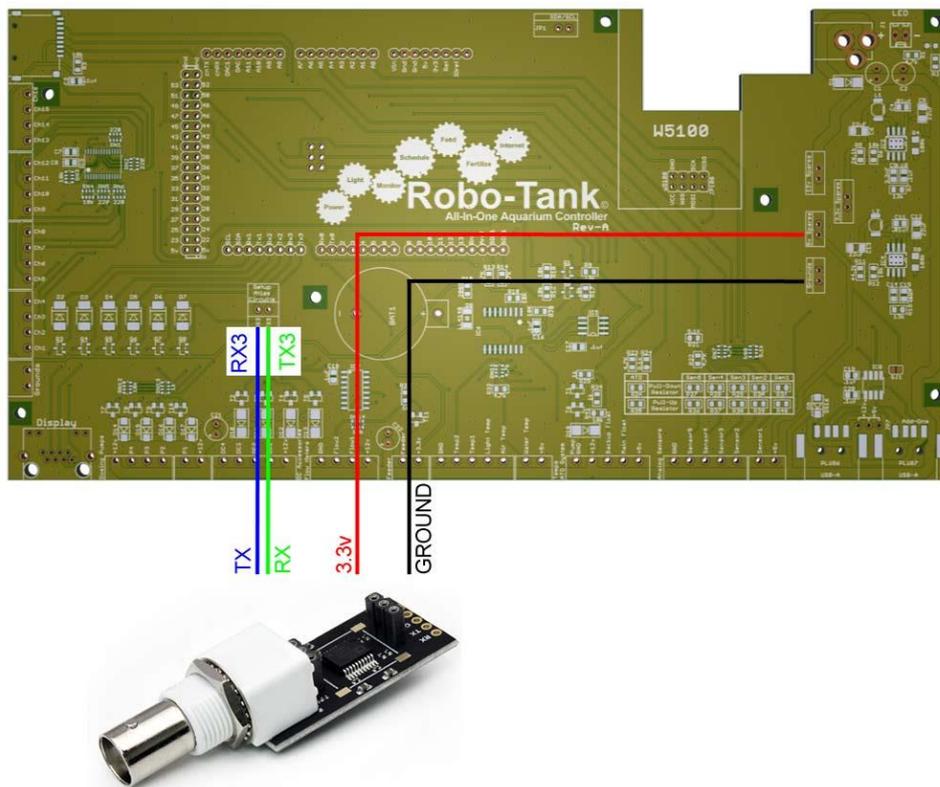
Using Robo-Tank Controller

**Using a pH Stamp as an Example*

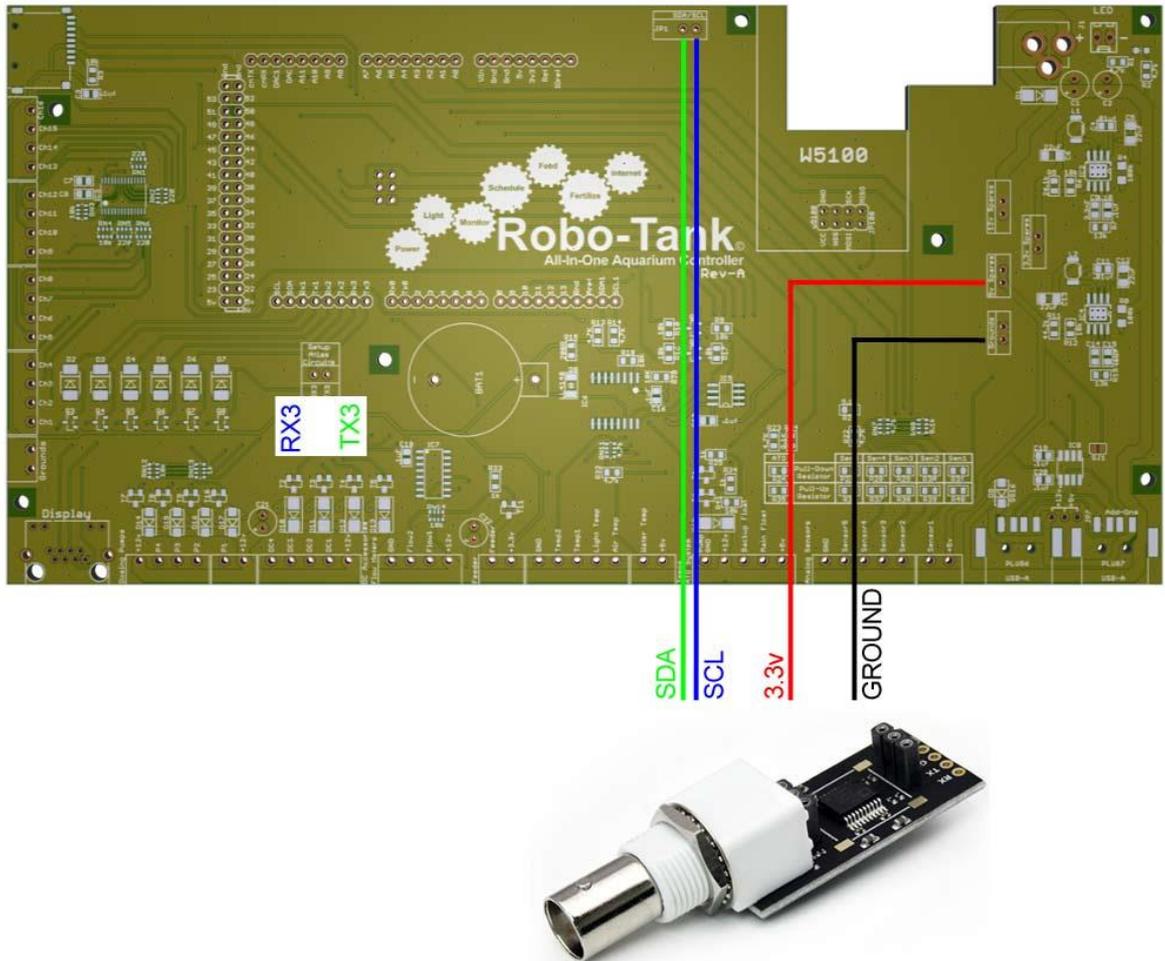
1. [Download the following sketches](#), there are 5 sketches in total, one for each circuit that can be connected to the controller.
2. Disconnect any sensors and equipment you have connected to the controller and upload the respected sketch for the circuit you're setting up to the controller.
3. After uploading sketch open **serial monitor** on controller using the button in the following image.



4. A small window will open, at the bottom right corner you'll see a drop down menu that might say "9600 baud", change that to "115200 baud". Once you do that you should see some text show up in the serial monitor saying "Beginning Setup...". Once you see that you are ready to setup the circuit.
5. Close the Serial Monitor and power down the controller.
6. Connect the circuit as the diagram below shows. RX3 header on controller goes to TX header on circuit, this is backward but correct.



7. After connecting circuit as above power up the controller and wait for LED to change from **Green** to **Blue** on the Atlas circuit. Once that happens the circuit switched to I2C mode.
8. Power down the controller.
9. Now unplug the "TX3 and RX3" jumper on the controller PCB and plug into the SCL and SDA headers on controller PCB as the image below.



10. Power up the controller and watch the circuit. You should see the LED flash from **Green** to **Blue** every 4 seconds. When this happens you are set and can move on to the next circuit. All circuits are done the same way however you need to upload the sketch to match the circuit.
11. You could leave the circuits connected to the pins in step 9 or preferably, you can use the "Plug 2" on the front, (when assembled in the case), of the controller.

Using an Arduino – UNO, Mega or Due.

**Using a pH Stamp as an Example*

1. Go to the following page: <https://www.atlas-scientific.com/files/code/ph-i2c.pdf>, and download the sketch (code), required to change to I2C, then follow the instructions, to change the shield from UART mode to I2C mode.
2. Upload the sketch to an Arduino Due 2560 as an example, do this **BEFORE** connecting your shield.
3. After uploading the code connect your shield as shown in the diagram in the above pdf.
4. Power up the Arduino Due and open the "serial monitor"
5. You should see a pH reading being displayed every second
6. At the top type:
i2c,99 <Enter> or click <Send>
***Refer above: Manually Switching an Atlas Stamp from UART to I2C Mode, Section 8 - Note.**
7. The small light on your stamp should have turned blue and the pH readings stop showing up.

If you get to step 6 you have successfully put the pH stamp in I2C mode. It's now safe to connect it to the controller.

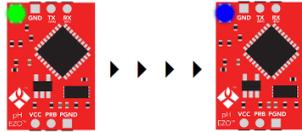
You can use this same process, above, to assign the default or a non-default ID to any of the stamps, but a specific sketch (code), is required for each one, below are the links to the individual instructions and code:

- **ORP stamp:** <https://www.atlas-scientific.com/files/...e-Code.pdf>
- **DO stamp:** <https://www.atlas-scientific.com/files/...e-Code.pdf>
- **EC stamp:** <https://www.atlas-scientific.com/files/...e-Code.pdf>

Manually Switching from UART to I2C Mode Using a Jumper Wire

This procedure switches the circuit between UART/serial and I2C. If the device is in UART mode, the LED lights up **Green**, this procedure will switch it to I2C, and the LED changes to **Blue**.

1. Put the stamp into a breadboard
2. For **pH, DO, ORP and EC**: Short the **PGND** pin to the **TX** pin using a jumper wire
3. Power the device (GND, +5V)
4. Wait for LED to change from **Green** to **Blue** (UART->I2C).



**using the pH stamp, as an example*

5. Remove the jumper wire from the **PGND** (or **PRB** respectively) pin to the **TX** pin (**Do this before removing power!**)
6. Remove power (5V)
7. Apply power (5V) & confirm the LED is **Blue**
8. The device is now in I2C mode

The default I2C IDs for Atlas stamps are:

- **DO = 97**
- **ORP = 98**
- **pH = 99**
- **EC = 100**

Note: *if you are connecting a second pH stamp, you will have change the ID to 101 as the controller is setup to search this address.*

To manually change the address of a stamp, refer to Pg. 9

9. Mount stamp in your Carrier Board or Whitebox Shield.

***NOTE:** *There is a good YouTube video (by Carl Recktenwald Jr.), showing you exactly how to do this. In the video a breadboard and a Whitebox Labs Tentacle shield mounted on an UNO (to supply power), are used, but you can just as easily use a Due, with a standard 12V supply connected. The important stuff starts at 8:20 and finishes at 9:58. Link:*

<https://www.youtube.com/watch?v=GkPVoDmxZs4&feature=autoshare>

Manually Switching from UART to I2C Mode Using a USB Carrier Board & a Terminal Emulator

The second method, comes from the Atlas Scientific site, and is to use a USB Carrier Board from Atlas, and a terminal emulator.

The new USB carrier boards offer a very simple way to switch from UART to I2C mode, without the need for jumpers, breadboards or an Arduino. You will need to download Virtual COM Port drivers for USB, so you can access your carrier board via USB, and a Terminal Emulator program.

- First download the Virtual COM Port drivers from here: <http://www.ftdichip.com/Drivers/VCP.htm> *this link comes from the Atlas web site. And install the drivers.
- Now download this Terminal Emulator software, (Termiter 3.3), for windows and install it on your PC. http://www.compuphase.com/software_termite.htm *this link comes from the Atlas web site.
- Now mount your stamp in the USB carrier board and connect it to your PC using a standard USB to micro-USB cable, the USB will provide the necessary power.
- Now run the terminal emulator, and select the correct COM port, and set it to 9600 baud.
- Issue the following command, (using a pH stamp as an example), to confirm you are connected:

```
i <Enter>
Response should be: ?1,pH,1.98
                    OK
```

- Now type in the following command (select the one specific to your stamp):

```
I2C,n <Enter> or click <Send> *Where n = the ID for the stamp
Response should be: *OK (then reboot into I2C mode)
```

The default I2C IDs for Atlas stamps are:

- DO = 97
- ORP = 98
- pH = 99
- EC = 100
- pH2 = 101

Note: if you are connecting a second pH stamp, you will have change the ID to a custom value, so as not to interfere with other Atlas stamp defaults, (i.e. Temperature stamp = 102), **change it to 101, as the controller software is already set to look for a second pH on that ID.**

Tentacle Mini (2 Channel)



The Whitebox Labs Tentacle-Mini Shield, supports only I2C mode, so before using your circuits with the Tentacle Mini, you have to switch them to I2C manually.

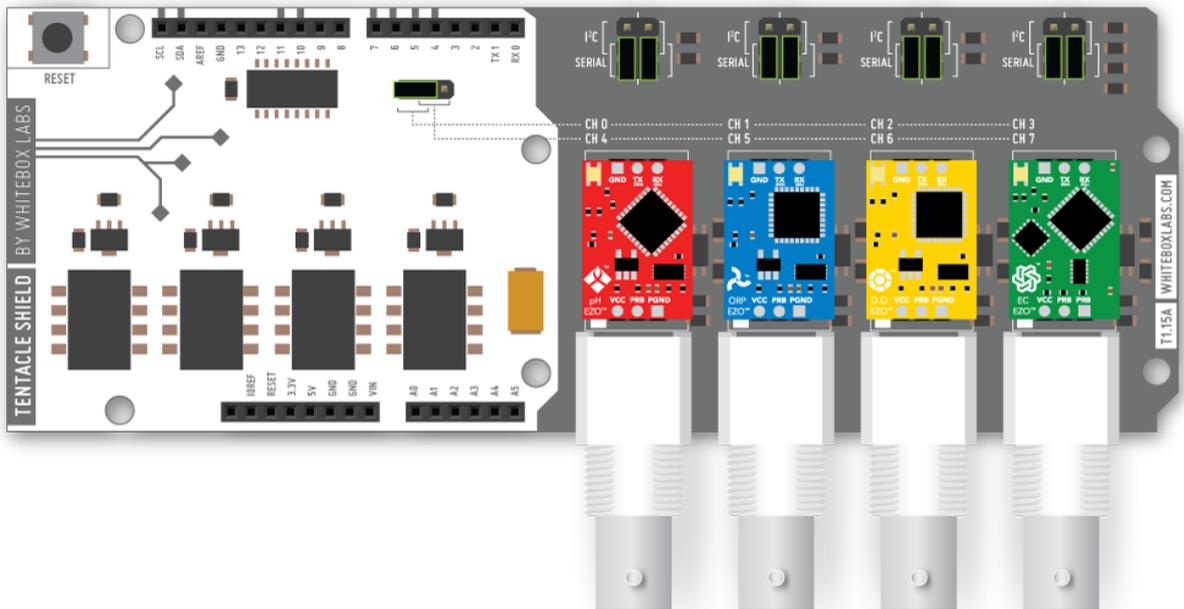
***Refer to: Manually Switching an Atlas Stamp from UART to I2C Mode Pg. 6
Using a USB Carrier Board & a Terminal Emulator – Pg. 7
OR Using an Arduino – UNO, Mega or Due – Pg. 7**

Once you have done that, you can mount the stamp or stamps onto the shield.

Switching Between Bus Types on a Tentacle Shield (4 Channels)



This only works if you have a T1 Tentacle Shield (with 4 channels).



1. Download the [Tentacle Setup sketch](#) from GitHub
2. Load the sketch onto your Arduino and connect to it via the serial monitor @9600
3. Type the Number of the channel (CH), you have mounted your stamp on, and press enter. Referring to the diagram above. The Channel number (CH), for the stamp you have mounted, is easily identified, as it's written immediately above the position you mounted the stamp in. In this case, using the diagram above, we'll change the pH stamp on CH0, type:

0 <Enter> or click <Send>

4. Switch to I2C mode, type:

i2c,n <Enter> or click <Send>

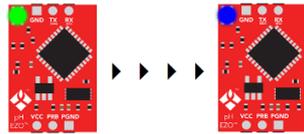
*where n is the ID and must match the ID's below.

- **DO = 97**
- **ORP = 98**
- **pH = 99**
- **EC = 100**
- **pH2 = 101**

So to change the selected Channel to I2C mode, type:

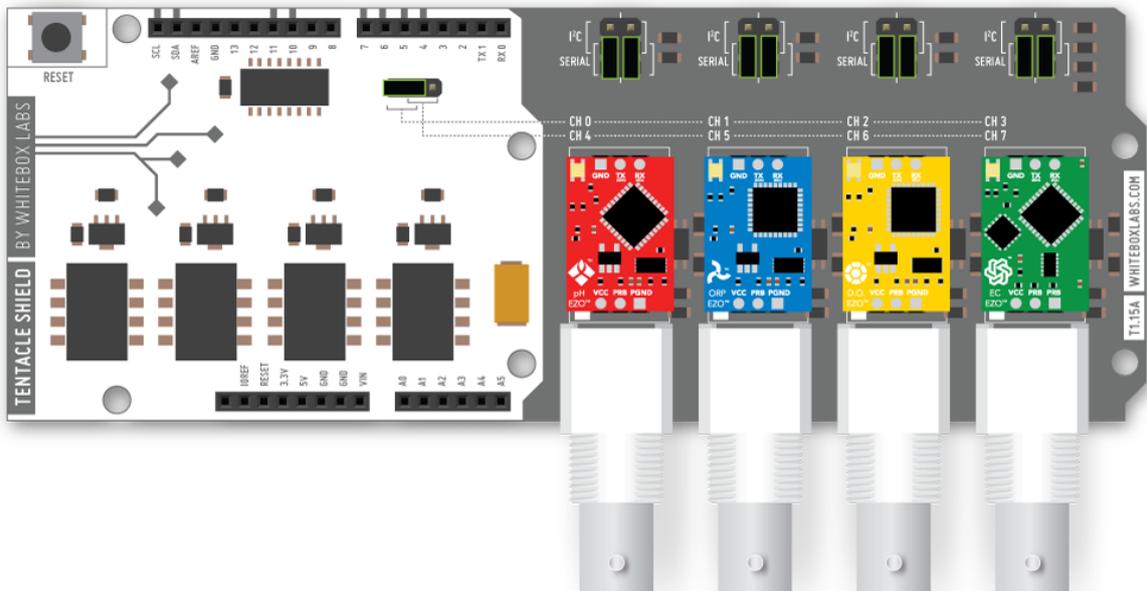
i2c,99 <Enter> **default for a pH stamp*

You should see the stamp's LED change from **Green** to **Blue**



5. Repeat this process for each stamp you are using,
 - enter the Channel number (1, 2 or 3)
 - then switch to I2C mode, (as above), using the appropriate default Atlas ID number
6. **Tentacle Shield (4-channel):** Next we must change both bus type jumpers from UART (Serial) to I2C.
 - *Refer to: Changing Bus Jumpers from UART to I2C Mode in the next section.***
7. you are able to connect to the new channel ID immediately, no need to restart the Arduino

Changing Bus Jumpers from UART to I2C Mode



Each of the 4 channels on the Tentacle Shield must have its bus type select jumpers set. Each channel needs **two** jumpers, one for each communication line (RX/TX or SDL/SCL).

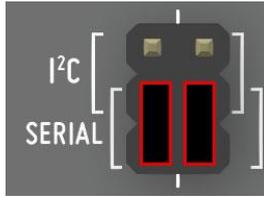
***Note: just changing the jumpers will not change the mode of the circuit.**

These jumpers must be set manually to the bus type which is configured in the circuit itself. If you want to change the bus type of a circuit, configure the circuit accordingly. Then, set the jumpers to match the circuit's configuration, but not before!

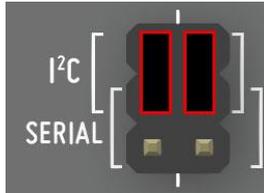
There are 9 Jumpers that have to be changed on the Tentacle Shields altogether. On the image above, they are highlighted with a **Green** outline.

- One jumper is a little left of the center, in the white area
- 8 more jumpers (4 sets of 2), are situated on the top right in the gray area, a set of 2 above each Channel/Stamp location.

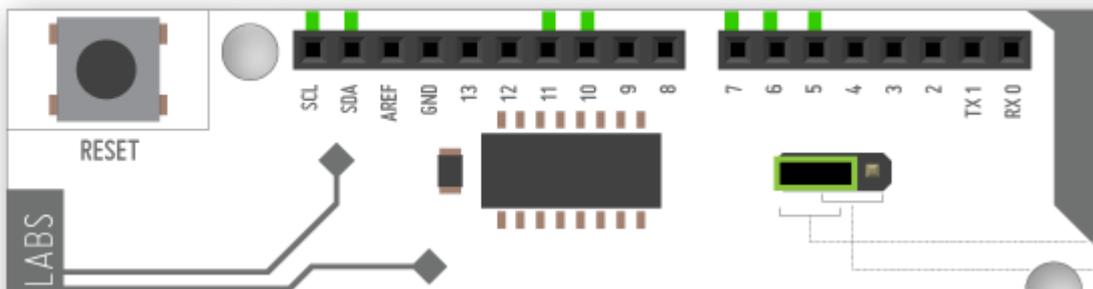
The default jumper configuration for the channels (CH), is UART, and the jumpers look like this:



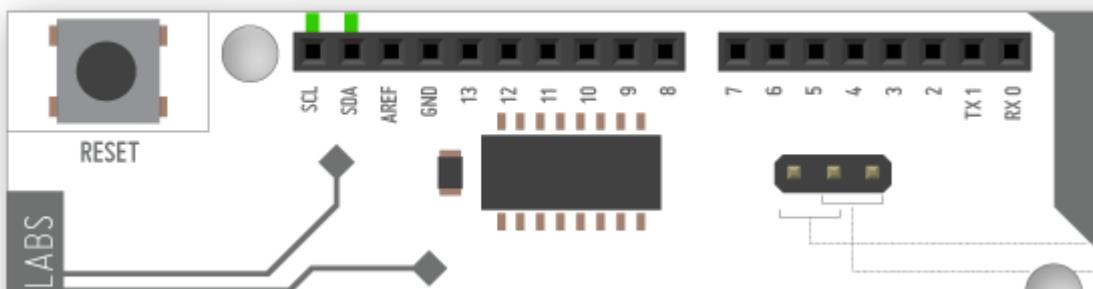
To set the channel to I2C, set your jumpers to look like this:



The default jumper configuration for the Tentacle's, channels 0-3 is UART, this is the single jumper (green outline), in the white area:



Remove this jumper completely, as we will only be using the shield in I2C mode:



Connecting a Carrier Board or Tentacle Shield to Robo-Tank

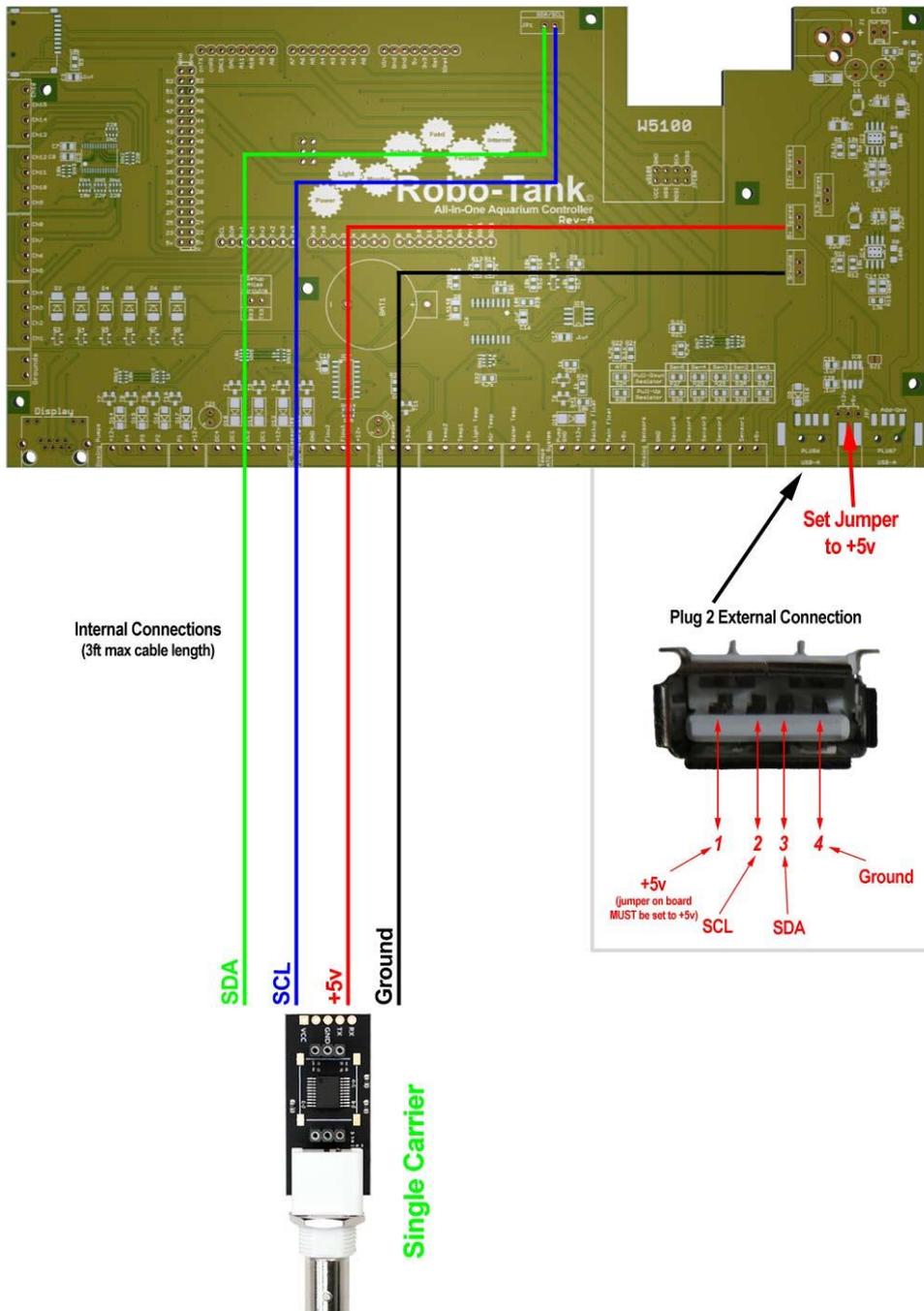
Connecting an Atlas Carrier Board (1 Probe)

The board below is for a single Atlas circuit, you can connect up to 5 to run all the circuits, (if you want to upgrade slowly).

https://www.atlas-scientific.com/product_pages/components/single_carrier_iso.html

The Atlas circuit plugs into this board which connects directly to the controller using 4 wires. You can connect internally as shown below or you can connect to "Plug 2" on the controller (set onboard jumper to +5v). (**Refer: Robo-Tank Gen3 Connecting the Equipment, for pinouts**).

Connecting Atlas Circuits using Single Circuit Shield



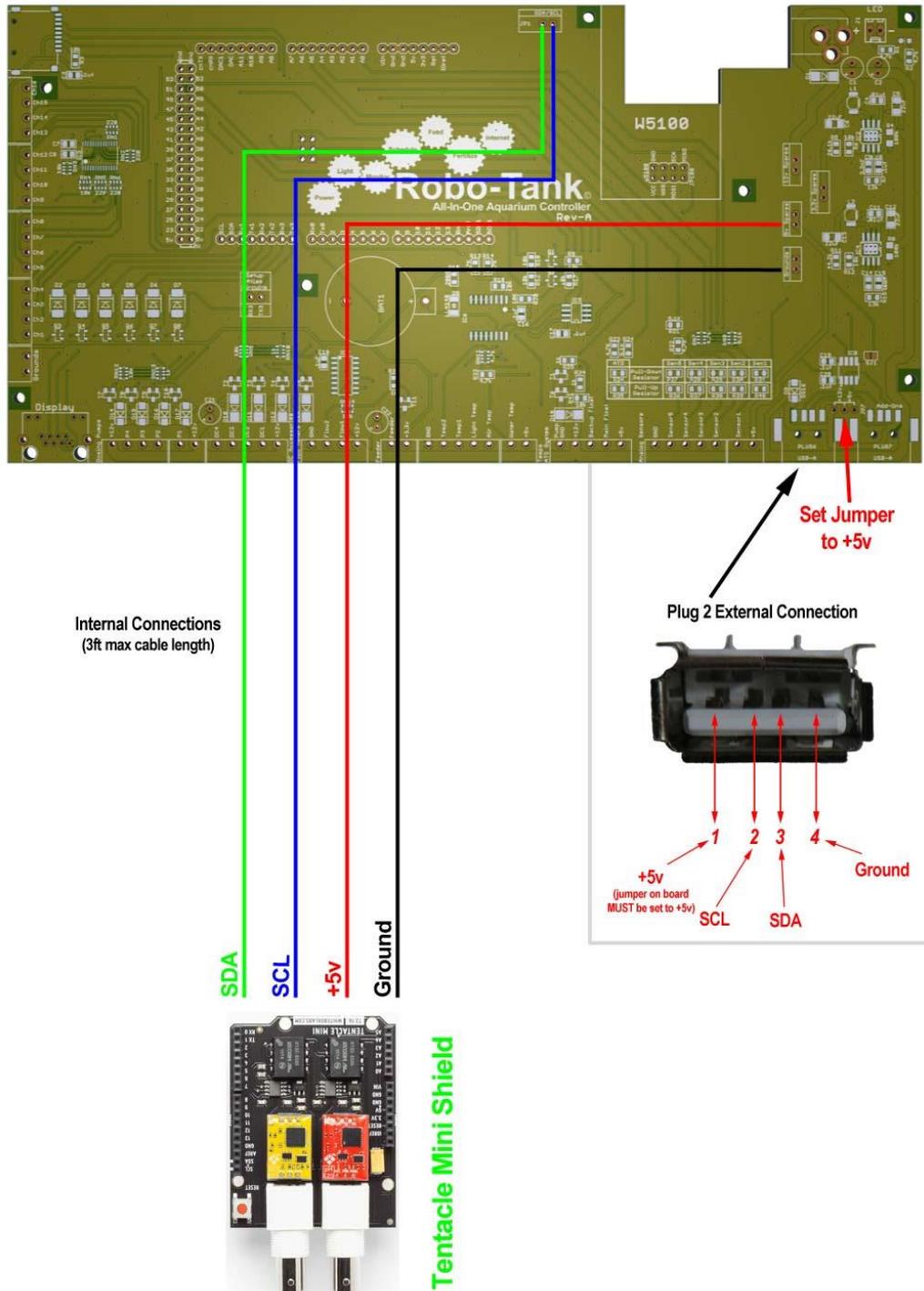
Connecting a Tentacle-Mini Shield (2 Probes)

The board below is for two circuits, you can connect up to 3, to run all the circuits if you want to upgrade slowly.

Any 2 Atlas stamps plug into this board which connects directly to the controller using 4 wires. You can connect internally as shown below or you can connect to “Plug 2” on the controller (set onboard jumper to +5v). (**Refer: Robo-Tank Gen3 Connecting the Equipment, for pinouts**).

https://www.atlas-scientific.com/product_pages/components/tentacle-shield-mini.html

Connecting Atlas Circuits using Tentacle Mini Shield



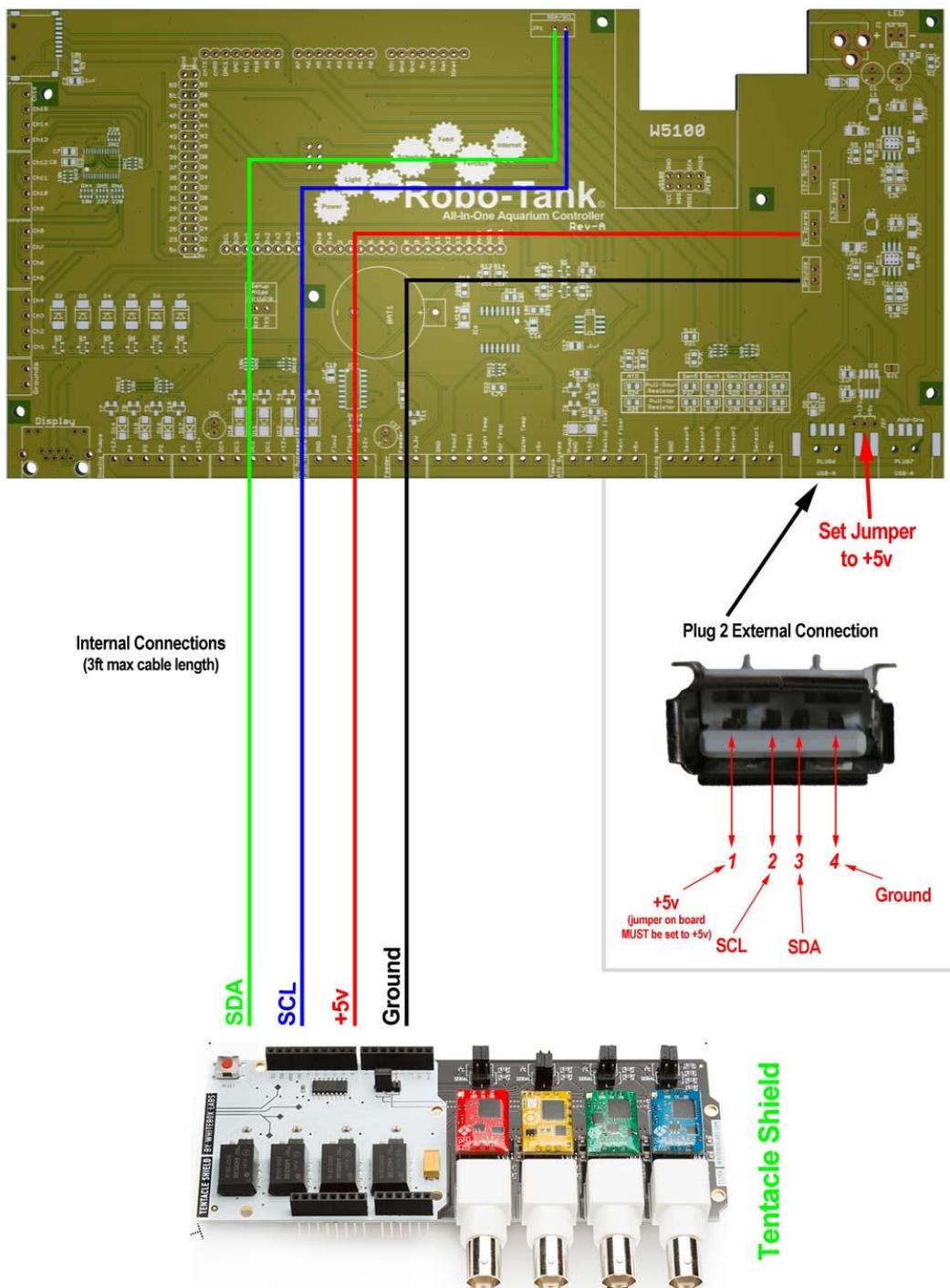
Connecting a Tentacle Shield (4 Probes)

The Tentacle Shield takes up to 4 stamps, (4 probes), and you can connect up to 2 of these to run all the stamps, but since the maximum number of probes that will work with the controller is only 5, 3 spaces on the second shield, would be unused. A better and cheaper option would be one Whitebox Labs Tentacle Shield, plus one Atlas Carrier board, for a total of 5.

You can connect this shield internally as shown below, or you can connect to "Plug 2" on the controller (set onboard jumper to +5v). (**Refer: Robo-Tank Connecting the Equipment to the Controller, for pinouts**).

https://www.atlas-scientific.com/product_pages/components/tentacle-shield.html

Connecting Atlas Scientific Circuits using Tentacle Shield



Where to Get Them?

Carrier Boards & Tentacle Shields

Best price for Carrier boards is both Atlas Scientific and Whitebox Labs, who sell them for the same price, but the best price for the Tentacle Shields, is Whitebox Labs themselves, who sell the 'fully assembled' shields for a little less than Atlas, but also sell them as a kit, saving you around another \$US10. The assembly required on the kit, is simply soldering the headers into place.

Probes

Probes can be sourced from several manufacturers, ranging from very expensive to super cheap. Just remember that cheaper probes may not be as accurate and may have a shorter useful life, though many aquarists are using them without issues. The following is a sample of sources for probes:

Atlas Scientific – mid-range price

- pH
- ORP
- DO
- EC

American Marine Pinpoint – mid-range to slightly higher price

- pH
- ORP
- DO

Neptune Systems Apex – mid-range to expensive

- pH
- ORP
- DO (short, bulky & expensive!)
- EC

Bulk Reef Supplies (BRS) – cheaper to mid-range price

- pH
- ORP
- DO (short, bulky, expensive!)
- EC

Vertex – cheaper to mid-range price

- pH
- ORP
- DO

Digital Aquatics – mid-range price

- EC

eBay – super cheap to expensive

- pH
- ORP
- DO
- EC