

## **S2Bot App QuickStart Introduction**

*S2Bot is available in two variants – Chrome App or Native Executable. Robots supported include:*

| <b>Device</b>    | <b>Connection</b> | <b>S2Bot Chrome App</b> | <b>S2Bot Native</b> |
|------------------|-------------------|-------------------------|---------------------|
| LEGO WeDo 2.0    | BLE               | ✓                       | ✓                   |
| LEGO WeDo 1.0    | USB HID           | ✓                       | ✓                   |
| LEGO NXT         | classic bluetooth | –                       | ✓                   |
| LEGO EV3         | classic bluetooth | –                       | ✓                   |
| Vengit SBrick    | BLE               | ✓                       | ✓                   |
| Orbotix Sphero   | classic bluetooth | ✓                       | ✓                   |
| Orbotix BB8      | BLE               | ✓                       | ✓                   |
| Orbotix Ollie    | BLE               | ✓                       | ✓                   |
| PicoBoard        | USB VCP           | ✓                       | ✓                   |
| Vernier GoTemp   | USB HID           | ✓                       | –                   |
| Vernier GoMotion | USB HID           | ✓                       | –                   |

This manual is available in two formats:

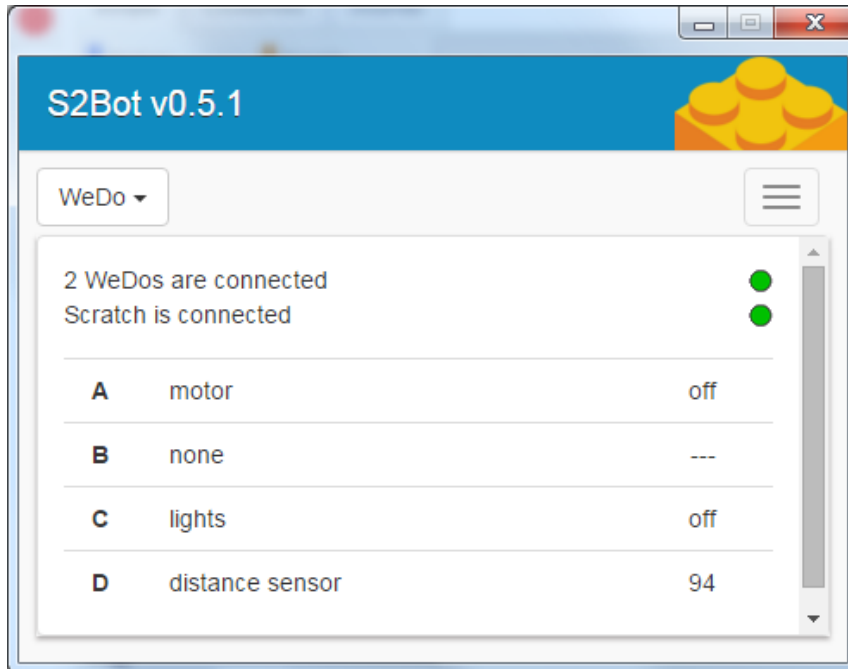
S2Bot Native Version                      please see [www.picaxe.coms/docs/s2bot.pdf](http://www.picaxe.coms/docs/s2bot.pdf)

S2Bot Chrome Version                      *(this document)*

### **S2Bot - Chrome App Version:**

The Chrome app version is primarily designed for use on Chromebooks, but will also run as a Chrome app on Windows, Mac and Linux. It is installed from the Chrome app store.

It requires a Chrome version greater than v41.

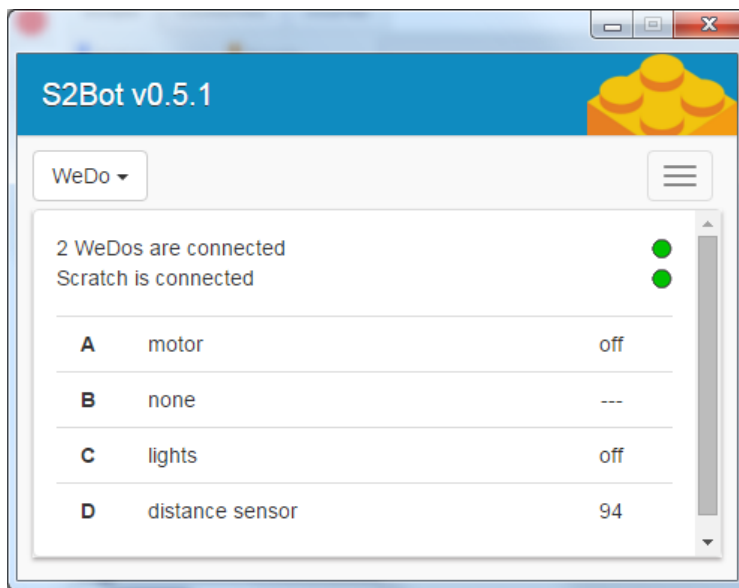


Note that any firewall must allow localhost http communication on ports 17300 to 17320. This is to allow Scratch to 'talk' to S2Bot on the local computer

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## 1.0 Quick Start Notes (Chrome App)



S2Bot is a free helper app to allow control of robotics systems from Scratch 2 (both the online and offline versions of Scratch are supported). It is a free download from <http://www.picaxe.com/s2bot>

After installing the S2Bot chrome app double click on the 'brick' icon to run it.

Select the desired interface type (and communications port, if required). For instructions on how to connect to a BLE device (WeDo 2.0, SBrick, Ollie, BB8) see section 1.2 overleaf.

*If using more than one WeDo make sure they are all now connected and recognised.*

**Click the 'menu' icon (top right) to generate and save a template .sb2 file to use within Scratch.**

The menu is only enabled when the device(s) are already connected (note that the template file changes depending, for instance, on how many WeDo devices are connected).

Start Scratch 2 (either online or offline version – make sure you have the latest version).

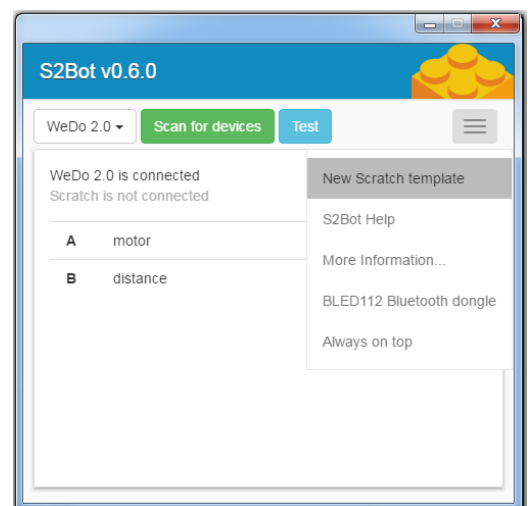
Open the appropriate .sb2 template file for the interface you are using.

In the Offline version select

File > Open

In the Online version select

File > Upload from my computer



The special extra interface blocks will now be immediately available in the 'Other Blocks' palette. If Scratch is 'talking' correctly to S2Bot the dot beside the extension name in 'Other Blocks' will turn green.

**DO NOT USE THE 'ADD AN EXTENSION' BUTTON IN SCRATCH. This is not required as the special blocks come from the template file instead.**

Sensor values can be easily tested by checking the checkbox beside the reporter block on the 'Other Blocks' tab. When checked the values will be constantly displayed/updated on the Stage.

That's it - have fun and be creative!

## **1.1 Sharing Projects**

Unfortunately you cannot currently share projects that use hardware extensions on the Scratch website. Therefore please keep all extension based projects private.

## **1.2 Install the BLED112 Dongle (if required)**

Make sure the BLED112 dongle is installed (if required).

*On Windows, the very first time the BLED112 dongle is used a driver will install (see appendix A) and then the computer must be restarted.*

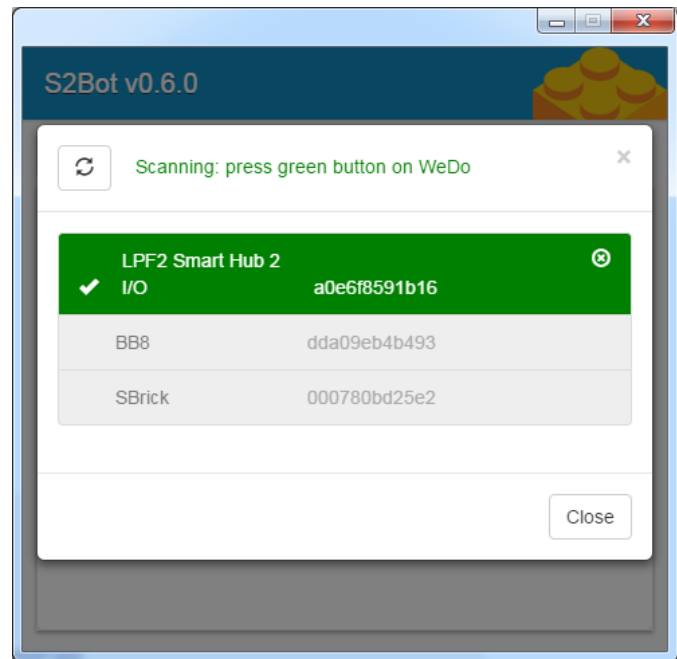
*On Mac OSX no driver is required.*

*On Chromebooks the BLED112 is optional, if not inserted the internal bluetooth adapter will be used instead - in this case make sure the internal bluetooth adapter bluetooth is enabled under Chrome settings.*

### 1.3 Connecting a BLE Device

1. Insert the BLE112 dongle
2. Start the S2Bot app
3. Select the robot device from the S2Bot drop down list
4. Click the 'Scan for devices' button
5. A list of available robots will be shown.
6. Click on the desired robot and wait until it turns to the green 'connected' status
7. Close the connection dialog

The robot is now ready for use. If desired it can be tested using the buttons within the 'Test' dialog.



Now:

1. Save the .sb2 template file (available from the S2Bot menu button top right) onto your desktop.
2. Start Scratch 2.0 and open this new template file. Opening the template file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the **Offline** version select

File > Open

In the **Online** version select

File > Upload from my computer



*S2Bot should now show the robot device and Scratch as both being connected. The system is now ready for use.*

## 2.0 Notes on using the Lego WeDo 2.0 (Bluetooth LE) with S2Bot App



A BLED112 dongle is **always** required for Windows or Mac use, even if you have bluetooth inside your computer. See further details below.

WeDo 2.0 is a bluetooth smart / bluetooth low energy (BLE) device.

**See section 1.3 for details on how to connect the WeDo 2.0 via a bluetooth low energy connection.**

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right), as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

### **Input/Output Devices Currently Supported by WeDo 2.0**

- WeDo 2.0 Tilt Sensor
- WeDo 2.0 Distance Sensor
- WeDo 2.0 'M' Motor
- Push button (on top of WeDo 2.0)
- RGB LED Light (inside WeDo 2.0)
- Sounder (inside WeDo 2.0)

*WeDo 1.0 sensors are not supported.*

*WeDo 1.0 motors and lights **are** supported, however you must manufacture a simple adapter cable as Lego do not currently sell an 'official' adapter cable.*

## 2.1 Windows / Mac

You **must** use an **external** BLED112 'BLE to serial' smart dongle. This is due to the Chrome app development system not currently supporting 'internal bluetooth LE' on any platform apart from Chromebooks. The BLED112 smart USB adapter overcomes this app limitation via communicating with the operating system as a 'virtual RS232 Com Port' instead of as 'native BLE'.

However one great advantage of this system is that, as the BLED112 is a smart 'bluetooth to serial COM port' adapter, it can also be used on older operating systems such as Windows XP or Windows 7 which do not normally support BLE technology. All versions of Windows from XP up to 10 are therefore supported.

You do not need to manually configure any bluetooth stack or 'pair' the bluetooth device. The S2Bot app and BLED112 dongle handle all the pairing and communication automatically.

For more details on purchasing and installing a BLED112 dongle please see:

[www.picaxe.com/bled112](http://www.picaxe.com/bled112)

Do not try to use a cheaper (non-Smart) bluetooth USB dongle from auction sites such as eBay. These will simply not work with the S2Bot system.

## 2. 2 Chromebook

S2Bot connects to the robot using the internal bluetooth connection of the Chromebook or via a BLED112 dongle.

If you cannot get your Chromebook to connect to the robot via the internal adapter then

1. restart the Chromebook
2. check that bluetooth is enabled



### **3.0 Notes on using the Lego WeDo 1.0 (USB) with S2Bot**



The WeDo 1.0 connects to the computer via a USB cable. There are no drivers to install on Windows or Mac, so WeDo should work straight away. For Linux please see the appendix.

The WeDo can only be used by one piece of software at a time (e.g. do not try to use Scratch 1.4 at the same time as Scratch 2/S2Bot).

The Chrome App version of S2Bot supports up to 13 WeDos (motor/sensor A to Z)

The WeDo sometime resets its USB connection (and so disconnects from S2Bot) when a new motor/sensor is snapped onto it. If this occurs you will need to click the S2Bot 'Connect' button again.

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right) , as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

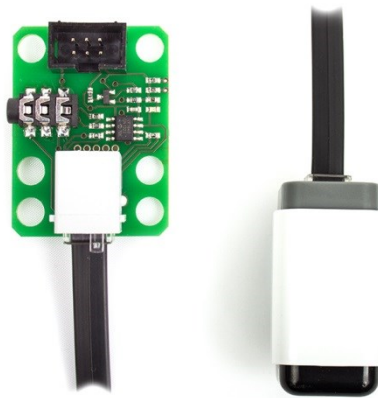
In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

#### **3.1 Lego Input/Output Devices Currently Supported by WeDo 1.0**

- WeDo Tilt Sensor
- WeDo Distance Sensor
- Power Functions 'M' Motor (or RCX style motor via Power Functions extension cable)
- Power Functions Lights
- Power Functions Servo
- Custom Home Made Sensors

### 3.2 Advanced WeDo 1.0 use only - custom sensor block



As we have also made our own 'home-made' sensors and NXT/Wedo adapters to allow NXT sensors to work with WeDo 1.0 you will also see an extra 'custom' reporter block available beside the normal tilt and distance reporters. This allows Scratch to display/use the raw ADC reading from any home-made sensor (as opposed to the scaled tilt/distance values). If you also want to make your own sensors that use the custom reporter block then simply use a 10k resistor from ID to 0V to get S2Bot to recognise this type of custom sensor.

The 4 wires of a cut in half Power Functions cable are: 5V      ADC      ID      0V

Note also that the ADC already has an internal 10k/200k potential divider inside the WeDo, so the ADC values displayed by the custom block will be the reading of the internal potential divider and your external sensor circuit in parallel.

## **4.0 Notes on using the Orbotix Sphero with S2Bot**



The Sphero can be changed colour or moved in various directions at various speeds. The direction is always relative to the current 'heading'. The only way to see the current heading is to switch the blue tail light on, the current heading (0 degrees) is then directly opposite the tail light position.

Note that the Sphero can move very quickly, so a slow speed is recommended. Also remember that you can use the Scratch Stage red 'Stop' button to quickly stop the Sphero if it tries to escape!

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right) , as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

### **4.1 Classic Bluetooth**

Before using the Sphero it must be bluetooth 'paired' with your computer. Classic bluetooth instructions can be found in the appendix at the end of this document. The Sphero does not require a PIN, but simply accept 1234 if your bluetooth pairing software still insists on using a PIN!

The Sphero cannot be paired/used when it is still in the charging cradle. Take out of the cradle and tap twice to wake it up before pairing.

The correct bluetooth port to use within S2Bot should be shown within the properties of the Bluetooth Wizard connection. If two ports are shown use the 'outgoing' COM port.

### **4.2 Chromebook**

Note that Chromebooks use the internal bluetooth adapter, so this must be enabled under Chrome settings. The Sphero must also be paired using the key 1234 in Bluetooth settings before use.

### 4.3 Recommended Classic Bluetooth USB Adapter (if required)



Not all bluetooth adapters are the same, some very cheap models can be quite unreliable and hence frustrating to use.

We use a Kensington branded EDR v2.1 miniature bluetooth USB dongle, based on the Cambridge Silicon radio chipset. This cost about £5 (\$US 8) from eBay and works very reliably with Windows, Linux and Mac.

For bluetooth LE devices use the BLED112 instead.

See the appendices at [www.picaxe.coms/docs/s2bot.pdf](http://www.picaxe.coms/docs/s2bot.pdf) for setup instruction.

### 4.4 Sphero Firmware

S2Bot expects the Sphero to be running the normal default firmware.

## 5.0 Notes on using the Orbotix Ollie or BB8 with S2Bot



*The Ollie and BB8 robots both use an identical bluetooth low energy communication protocol and have the same features, so have identical instructions for use.*

A BLE112 dongle is **always** required for Windows or Mac use, even if you have bluetooth inside your computer. See further details below.

The Ollie/BB8 can be changed colour or moved in various directions at various speeds. The direction is always relative to the current 'heading'. The only way to see the current heading is to switch the blue tail light on, the current heading (0 degrees) is then directly opposite the tail light position.

Note that the Ollie/BB8 can move very quickly, so a slow speed is recommended. Also remember that you can use the Scratch Stage red 'Stop' button to quickly stop the Ollie/BB8 if it tries to escape!

**See section 1.3 for details on how to connect the robot via a bluetooth low energy connection.**

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right) , as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

***Note that the robot will not move when the charging cable is connected!***

## 5.1 Windows / Mac

You **must** use an **external** BLED112 'BLE to serial' smart dongle. This is due to the Chrome app development system not currently supporting 'internal bluetooth LE' on any platform apart from Chromebooks. The BLED112 smart USB adapter overcomes this app limitation via communicating with the operating system as a 'virtual RS232 Com Port' instead of as 'native BLE'.

However one great advantage of this system is that, as the BLED112 is a smart 'bluetooth to serial COM port' adapter, it can also be used on older operating systems such as Windows XP or Windows 7 which do not normally support BLE technology. All versions of Windows from XP up to 10 are therefore supported.

You do not need to manually configure any bluetooth stack or 'pair' the bluetooth device. The S2Bot app and BLED112 dongle handle all the pairing and communication automatically.

For more details on purchasing and installing a BLED112 dongle please see:

[www.picaxe.com/bled112](http://www.picaxe.com/bled112)

Do not try to use a cheaper (non-Smart) bluetooth USB dongle from auction sites such as eBay. These will simply not work with the S2Bot system.

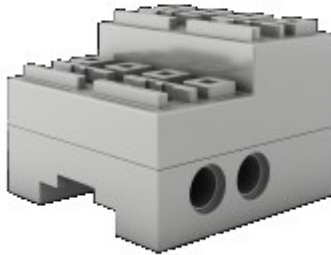
## 5.2 Chromebook

S2Bot connects to the robot using the internal bluetooth connection of the Chromebook or via a BLED112 dongle.

If you cannot get your Chromebook to connect to the robot via the internal adapter then

1. restart the Chromebook
2. check that bluetooth is enabled

## **6.0 Notes on using the Vengit SBrick with S2Bot**



A BLED112 dongle is **always** required for Windows or Mac use, even if you have bluetooth inside your computer. See further details below.

The SBrick can control up to 4 Lego motors.

**See section 1.3 for details on how to connect the SBrick via a bluetooth low energy connection.**

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right) , as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

## 6.1 Windows / Mac

You **must** use an **external** BLED112 'BLE to serial' smart dongle. This is due to the Chrome app development system not currently supporting 'internal bluetooth LE' on any platform apart from Chromebooks. The BLED112 smart USB adapter overcomes this app limitation via communicating with the operating system as a 'virtual RS232 Com Port' instead of as 'native BLE'.

However one great advantage of this system is that, as the BLED112 is a smart 'bluetooth to serial COM port' adapter, it can also be used on older operating systems such as Windows XP or Windows 7 which do not normally support BLE technology. All versions of Windows from XP up to 10 are therefore supported.

You do not need to manually configure any bluetooth stack or 'pair' the bluetooth device. The S2Bot app and BLED112 dongle handle all the pairing and communication automatically.

For more details on purchasing and installing a BLED112 dongle please see:

[www.picaxe.com/bled112](http://www.picaxe.com/bled112)

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## 6.2 Chromebook

S2Bot connects to the robot using the internal bluetooth connection of the Chromebook or via a BLED112 dongle.

If you cannot get your Chromebook to connect to the robot via the internal adapter then

1. restart the Chromebook
2. check that bluetooth is enabled



## **7.0 Notes on using the PicoBoard with S2Bot App**



The Picoboard normally has a USB connector and connects to the computer via a USB cable. Installation of the USB driver is described in the appendix at the end of this document.

If you have a very old ScratchBoard with a 9 pin D connector you can either use a USB<>Serial Convertor cable (e.g. [USB010](#)) or even a traditional 9 pin D serial port if your computer has one.

The PicoBoard can only be used by one piece of software at a time (e.g. do not try to use Scratch 1.4 at the same time as Scratch 2/S2Bot).

The Picoboard does not have any outputs, so the S2Bot 'Test' button is not enabled.

The S2Bot software does not use the in-built 'Add Extensions' feature of Scratch 2, so do not use the 'Add Extensions' button. Instead simply open the .sb2 template file (available from the menu button top right) , as opening this file will automatically configure Scratch correctly and add the extra sensor/motor blocks to the 'More Blocks' palette.

In the Offline version select      File > Open

In the Online version select      File > Upload from my computer

## **Appendix A – BLED112 Driver Installation**

### **Installing BLED112 Driver for Windows**

Windows 7, 8, 10 and later should automatically download and install the BLED112 driver the very first time the BLED112 is inserted via the 'New Hardware Wizard'. For XP / Vista (or if the driver installation failed on 7/8/10) the driver must be installed manually from [this link](#).

When the driver is correctly installed you will see an entry within Device manager in the 'Ports (COM & LPT)' section that states 'Bluegiga Bluetooth Low Energy'. This entry gives you the correct COM port number to use within S2Bot.

The computer **MUST be restarted** after the driver has been installed.

### **Other operating systems**

No driver installation is required for Mac, Linux or Chromebook.

## **Appendix B – PicoBoard Driver Installation**

### **Installing FTDI Driver for Windows**

Windows 7, 8, 10 and later should automatically download and install the PicoBoard driver the very first time the PicoBoard is inserted via the 'New Hardware Wizard'. For XP / Vista (or if the driver installation failed on 7/8/10) the driver must be installed manually from [this link](#).

When the driver is correctly installed you will see an entry within Device manager in the 'Ports (COM & LPT)' section that states 'USB Serial Port'. This entry gives you the correct COM port number to use within S2Bot.

As long as you always plug the PicoBoard into the same USB socket on your computer the COM port number will remain the same.

### **Installing FTDI Driver For Mac OS X (Intel)**

OS X Mavericks and later already have the AppleFTDI driver for the PicoBoard installed, so nothing needs to be installed. For older versions of OS X the FTDI driver is available and must be installed manually from [this link](#).

The COM port symbolic link name to use within S2Bot will look like this

```
/dev/tty.usbserial-ABCD1234
```

where ABCD1234 will be a unique number for your particular PicoBoard. Connect your USB cable and then click the 'Scan' link in S2Bot to find this unique number.

### **Installing Driver for Linux or Chromebook**

There are no drivers to install on Linux, so the PicoBoard should automatically appear as device `/dev/ttyUSB0` (or `/dev/ttyS0` for a traditional serial port (very old style ScratchBoard)).

When using USB, you can use `ls -l` to check which group `ttyUSB0` is allocated to

```
ls -l /dev/ttyUSB0
```

The group will probably be `dialout`, in which case you must make sure that you are also a member of the `dialout` group (you probably won't be by default). To add yourself to the `dialout` group:

```
sudo adduser your_user_name dialout
sudo reboot
```