S2Bot App QuickStart Introduction

S2Bot is available in two variants –App or Native Executable.

To check for updates and new device support please see http://www.picaxe.com/s2bot

Robots currently supported include:

Device	Connection	S2Bot App	S2Bot Native
LEGO BOOST	BLE	✓	–
LEGO PoweredUp	BLE	✓	–
LEGO WeDo 2.0	BLE	✓	✓
LEGO WeDo 1.0	USB HID	✓	✓
LEGO NXT	classic bluetooth	–	✓
LEGO EV3	classic bluetooth	–	✓
Vengit SBrick	BLE	✓	✓
Vengit SBrick+	BLE	✓	–
Sphero 1/2.0/SPRK	classic bluetooth	✓	✓
Sphero SPRK+	BLE	✓	–
Sphero BB8	BLE	✓	✓
Sphero Ollie	BLE	✓	✓
PicoBoard	USB VCP	✓	✓
Vernier GoTemp	USB HID	✓	–
Vernier GoMotion	USB HID	✓	–
BBC micro:bit	BLE	✓	–
SensorTag 2	BLE	✓	–
Thunderboard	BLE	✓	–

This manual is available in two formats:

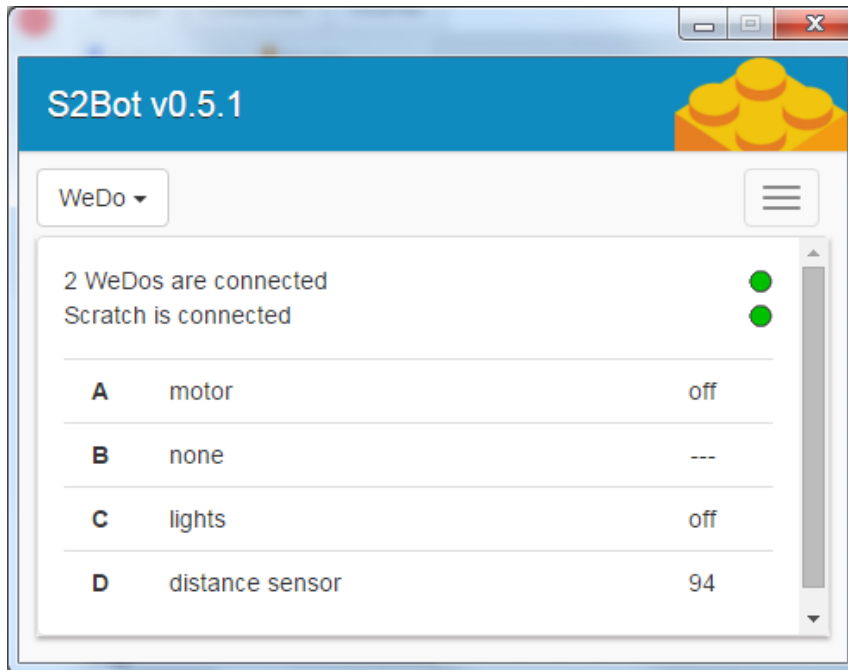S2Bot Native Version   please see www.picaxe.coms/docs/s2bot.pdf

S2Bot App Version   *(this document)*

S2Bot - App Version:

The App is available as a standalone app for Windows, Mac and Linux. It can also be installed free of charge from the Chrome app store for Chromebooks.

http://www.picaxe.com/s2bot

https://chrome.google.com/webstore/detail/s2bot-4-scratch/pllkalmkifgmanfoghenhgafbcpbicdj
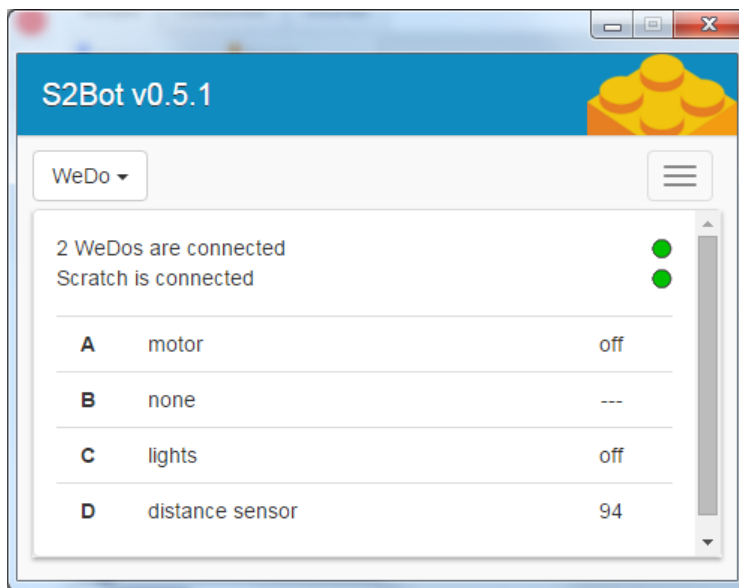

Note that any firewall on the computer must allow localhost (127.0.0.1) http communication on ports 17300 to 17330. This is to allow Scratch to 'talk' to S2Bot on the local computer.
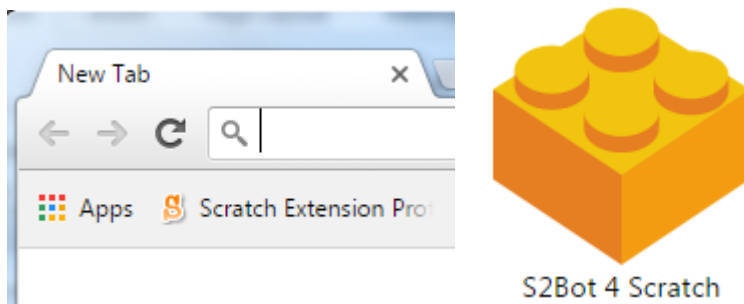
Contents

1.0 Quick Start Notes (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

Start the S2Bot app and then select the desired interface type (and communications port, if required).

If using more than one device at the same time make sure they are all now physically connected and recognised.

For instructions on how to connect to a BLE device (Boost, WeDo 2.0, SBrick, Ollie, BB8 etc.) see section 1.3 below. Appendix A explains how to initially install the BLED112 dongle. For more details on purchasing and installing a BLED112 dongle please see:

www.picaxe.com/bled112

1.2 Opening the template file within Scratch

Within the S2Bot app click the 'menu' icon (top right) to generate and save a new template .sb2 file to use within Scratch.

The 'new Scratch Template' menu is only enabled when the device(s) are already connected (this is because the template file changes, for instance, depending on how many WeDo devices are connected).

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

https://scratch.mit.edu/ and click 'Create'

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

> 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 within Scratch. 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!

1.2 Sharing Projects

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

1.3 Connecting a BLE Device

1. Insert the BLED112 dongle
2. Start the S2Bot app
3. Select the robot device from the S2Bot drop down list
4. Click the 'Scan for devices' button (make sure the robot is switched on)
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

After a few seconds of initialisation the robot will be ready for use and sensor values will be displayed. If desired it can be tested using the buttons within the 'Test' dialog.

To now use Scratch:

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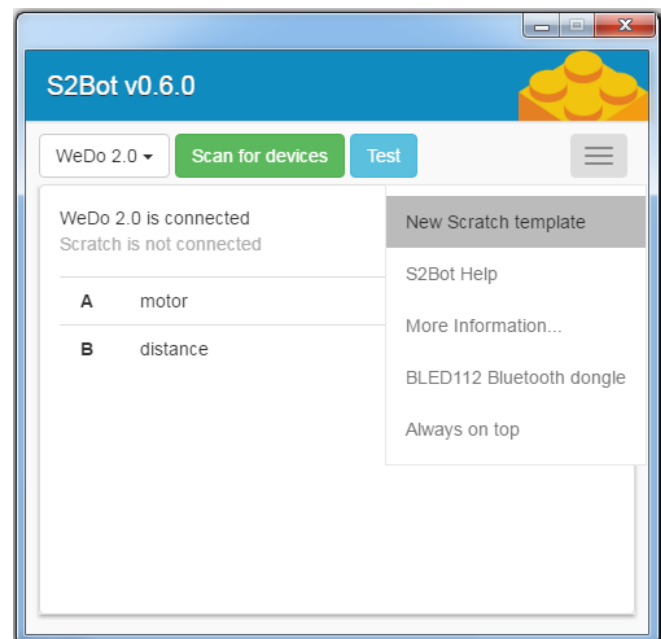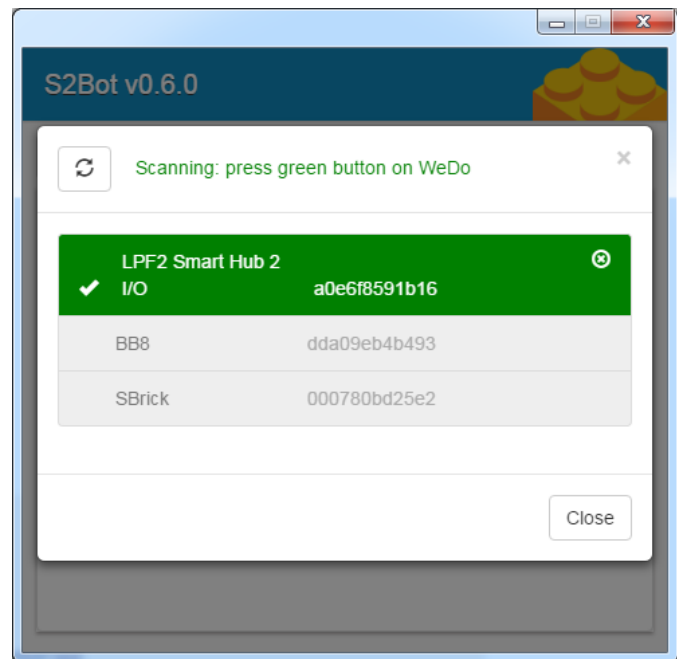
S2Bot should now show both the robot device and Scratch as being connected. The system is now ready for use.

2.0 Notes on using the LEGO Boost / PoweredUp / 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, PoweredUp and Boost hubs are bluetooth smart / bluetooth low energy (BLE) devices.

See section 1.3 for details on how to connect the hub 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

Boost	WeDo 2.0	PoweredUp
2 x Internal Interactive Motors	-	-
RGB LED Light	RGB LED Light	RGB LED Light
Internal Tilt Sensor	-	-
-	Piezo Sounder	
Voltage Sensor	Voltage Sensor	Voltage Sensor
Current Sensor	Current Sensor	Current Sensor
Externally connected devices:		
Medium & Train Motors	**Medium & Train Motors**	**Medium & Train Motors**
Interactive motor	Interactive motor (no sensor)	Interactive motor (no sensor)
Lights	Lights	Lights
Motion Sensor	**Motion Sensor**	Motion Sensor
Tilt Sensor	**Tilt Sensor**	Tilt Sensor
Colour / Distance Sensor	Colour Sensor	Colour Sensor

For more detailed information on how to use the inputs/outputs please see www.picaxe.com/boost

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

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
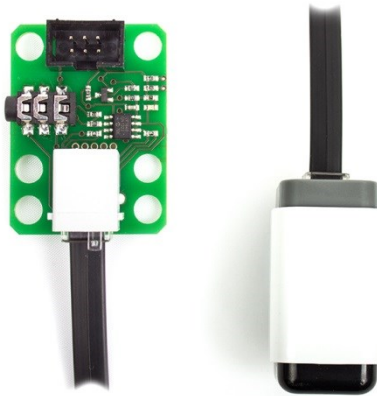
As we have also made our own 'home-made' sensors and NXT/Wedo adapters to allow NXT sensors to work with WeDo 1.0 you will also see an extra 'custom' reporter block available beside the normal tilt and distance reporters. This allows Scratch to display/use the raw ADC reading from any home-made sensor (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 1 / 2.0 / SPRK with S2Bot

This section is for Sphero versions 1 / 2.0 / SPRK.   For version SPRK+ see section 5.0 instead.

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.

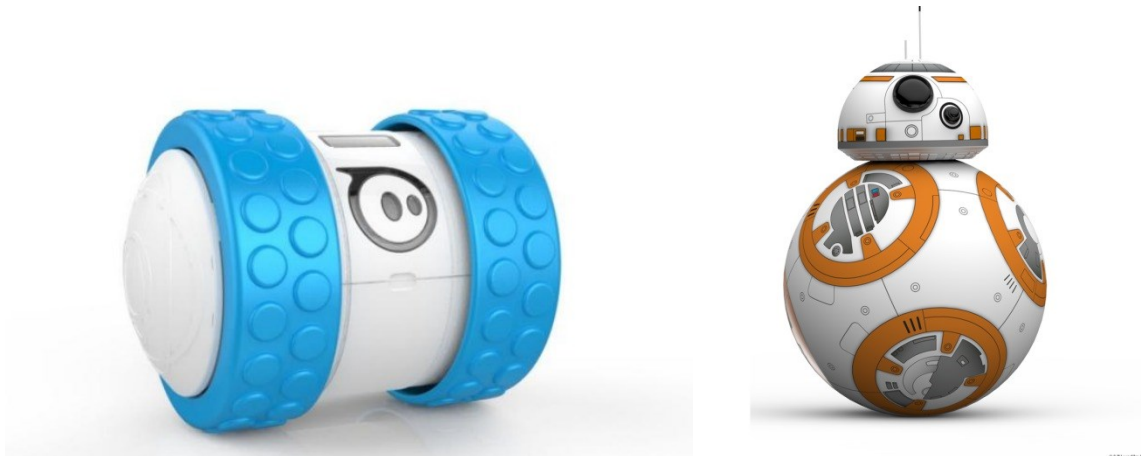For bluetooth LE devices use the BLED112 instead.

See the appendices at
www.picaxe.coms/docs/s2bot.pdf
for setup instruction.

4.4 Sphero Firmware

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

5.0 Notes on using the Sphero SPRK+ or Ollie or BB8 with S2Bot

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

The SPRK+/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 SPRK+/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 SPRK+/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

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.
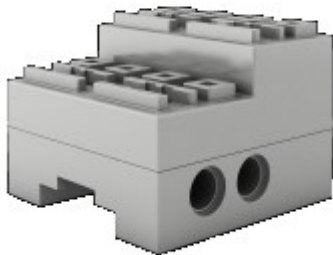

5.2 Chromebook

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 / SBrick+ with S2Bot

The SBrick / SBrick+ must be running firmware version 18 or later . Use the Vengit iPad/Android SBrick app to check and update the firmware (if required). The app will not function correctly with earlier firmware versions.

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.

The SBrick+ can control 4 motors **or** 2 motors and 2 sensors (tilt/distance). The LEGO sensors are connected in positions C and D (the 'lower step'). To enable the sensors you must add the 'enable sensors' block to the top of your Scratch program.

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

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.

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

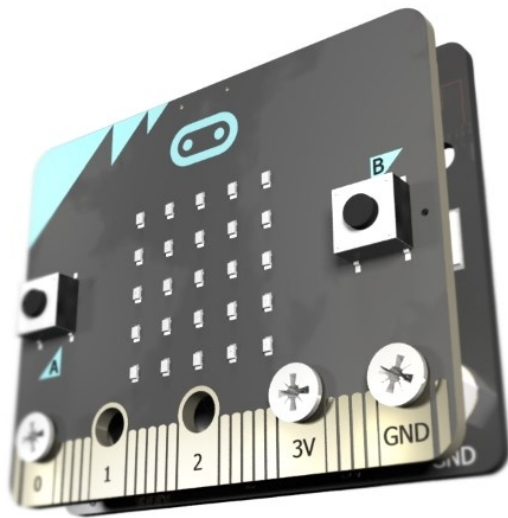## 8.0 Notes on using the BBC micro:bit with S2Bot

Image shows BBC micro:bit fitted with the optional Kitronik MI:power board.

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

The micro:bit can be used as a 'games controller' for Scratch, sending button, tilt, bearing and temperature information to Scratch. It is also possible to display text messages and sounds on the micro:bit *(to generate sounds the Kitronik MI:power board is required).*

8.1 Firmware Setup
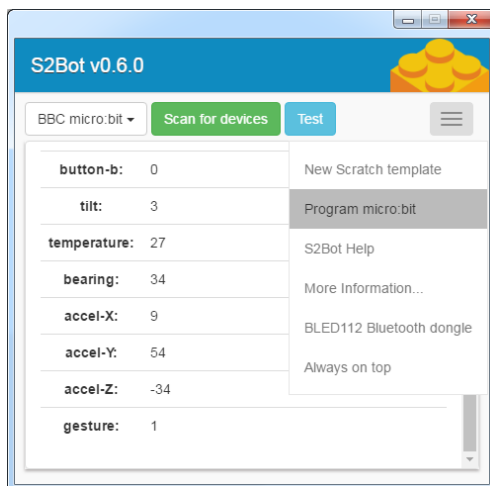
The micro:bit **MUST be programmed** with the bluetooth firmware before S2Bot use. To do this connect the micro:bit to the computer via the USB cable and then click the 'Program micro:bit' menu within S2Bot.

Save the .hex file to your desktop. From the desktop then drag this new firmware file onto the 'MICROBIT' drive to reprogram the micro:bit.

Once file copying is complete disconnect from the USB cable and use the battery (or the MI:power pack) instead.

After the micro:bit resets it will ask you to 'Draw a Circle' by tilting the board to light the outer LEDs in sequence (this is to calibrate the internal sensors). Once the calibration is complete the board is ready for use. For more details see www.picaxe.com/microbit

See section 1.3 for details on how to connect the micro:bit 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

8.2 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

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.

8.3 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

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 ort 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.

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.

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

www.picaxe.com/bled112

Once the dongle is correctly installed see section 1.3 for instructions on how to connect the BLE device.

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 select the port from the list.

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
```