1.0 What is S2P?

S2P is a free helper app than enables you to simulate and program PICAXE microcontroller projects from within Scratch 2.0 (http://scratch.mit.edu)

S2P and Scratch 2.0 interact together (ie they are both run at the same time on the same computer) to add extra PICAXE features to Scratch. You can use either the online or offline standard versions of Scratch 2.0.

The S2P helper app is available for Windows, Mac and Linux from

http://www.picaxe.com/s2p

Please also see the YouTube tutorial vidoes on the S2P web page

2.0 How does it work?
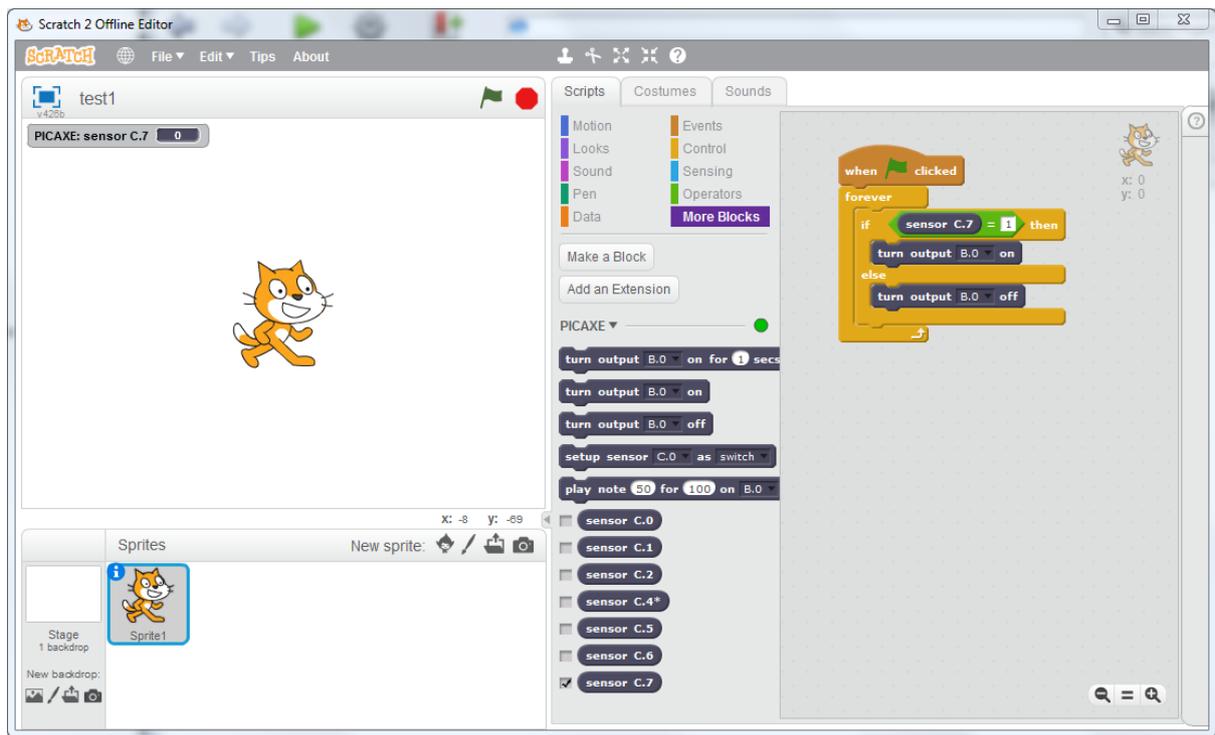
S2P interacts with Scratch in two separate, different ways –

Mode 1 - Connected Mode:

In connected mode the Scratch project you have developed 'runs' within the Scratch software on the computer as normal, but can now also control real life outputs and respond to real-life inputs as the project runs. This is useful for developing and testing projects. In connected mode the PICAXE chip simply runs a small 'communicator' program that enables it to communicate with the S2P helper app via the AXE027 USB cable.

Mode 2 - Remote Run Mode:

In remote run mode the Scratch project is converted into microcontroller code and then downloaded into the PICAXE microcontroller. Therefore the computer can be completely disconnected and the code now runs entirely on the microcontroller. This is normally used for building real-life projects e.g. robots, that you want to run autonomously (by themselves).

2.1 How do I control inputs and outputs?

The S2P helper app 'adds' extra new blocks into the Scratch software. These enable you to control outputs (e.g. through the switch on/off or motor blocks) or detect changes in real-life inputs via new 'reporter blocks'.

2.2 Are there any limitations to the blocks I can use in Scratch projects?

If you only use 'connected' mode there are no limitations, as the program still runs on the computer. So you can use all of Scratch's blocks and interact with real life sensors e.g. move a sprite on screen or play a sound when an input switch changes in the real world.

However in 'remote run' mode some Scratch blocks no longer have any meaning, e.g. you cannot move a screen sprite, change costumes or respond to a keyboard (simply because the PICAXE microcontroller does not have a screen or keyboard connected!). So these types of block are just ignored in a remotely run program.

For 'remote run' mode the following Scratch 2.0 script blocks are currently supported:

More Blocks

(all of the new PICAXE blocks)

Hat Events

When Green Flag Clicked (which now means 'when power is connected')

Control

Wait / Wait Until

Repeat / Repeat Until

Forever

If / If Else

Operators

+ - * /

< = >

and or not

Data

Make a variable (please use the PICAXE variable names, w0, w1, w2 etc).

The 14M2 / 18M2 / 20M2 support up to 8 parallel tasks (8 parallel scripts starting with a hat block).

The 08M2 supports up to 4 parallel tasks.

The X2 parts support one task.

2.3 System requirements and installation

The S2P helper app currently runs on Windows, Mac and Linux. It is a traditional 'installed' application, not a browser app. It is a free download from http://www.picaxe.com/scratch

You can use either the online or offline versions of Scratch 2.0 (v425 or later)

The (very old) Scratch version 1.4 is not supported.

The S2P helper app can be used with any PICAXE project board that is fitted with a PICAXE M2 or X2 microcontroller.

For communication to the project board you require either an AXE027 USB download cable or the radio ERF/URF pair (for wireless programming).

After installing the S2P helper app double click on the 'gear' icon to run it (under Linux make sure it has executable permission - right click>Properties>Permissions>Execute).

Select the desired PICAXE chip type from the 'target' list.

(If using a bluetooth device make sure it is now switched on and paired and connected – see the appendices at the end of this document).

Select the correct port from the list (or type it in).

If you do not know the correct port then use the 'Device Manager' (Windows) or 'Scan' (Mac / Linux) link to help find the port name.

2.4 Sharing Projects

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

3.0 Mode1 : Connected Mode Step by Step Guide

Make sure the USB cable is connected and the PICAXE board is powered. It is assumed that you have installed the driver for the AXE027 cable (http://www.picaxe.com/axe027)

Run the S2P helper app.

Select the correct PICAXE type and COM port (e.g. COM5) within the S2P app

Click the 'Connect' button to start communicating with the PICAXE chip *(note that you must have already downloaded the special communicator program into the PICAXE chip. If you have not already done this use the 'Download Communicator Program' button to download this program).*
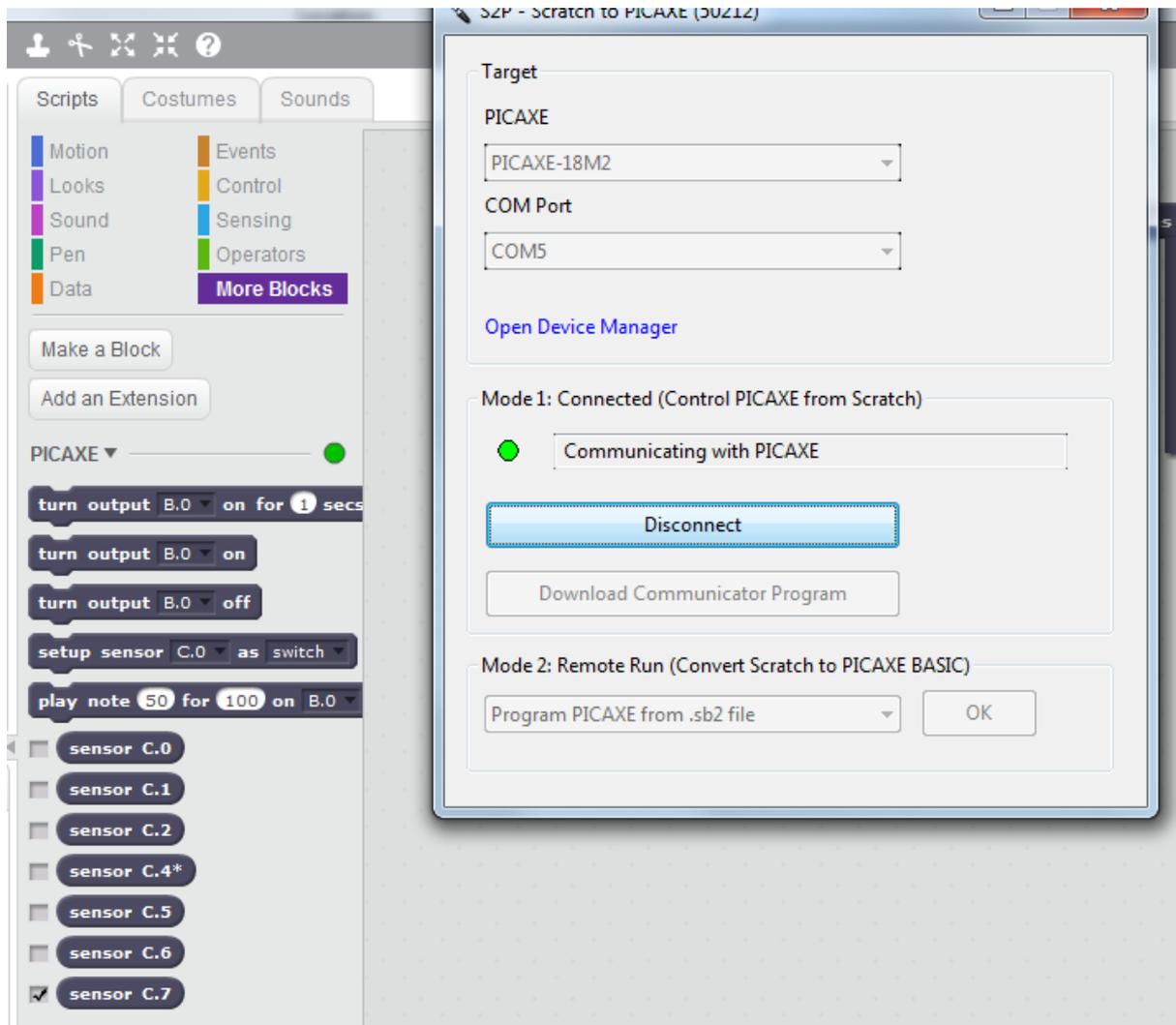
Run Scratch 2.0 and Open your PICAXE .sb2 project file.

Note – if starting a completely new project use the S2P 'Template for new Scratch Project' feature to automatically open a new project file based upon the selected template.

Click File>Save As and save the template with a different filename

Now click on the 'More blocks' section with Scratch. You should now have several additional new blocks to use in your project. The coloured 'dot' ndicator next to the word PICAXE shows connected status:

Red Dot   - S2P is not running

Yellow Dot   - S2P is running but not communicating with PICAXE chip

Green Dot   - S2P is running and connected to the PICAXE chip

When your program runs the sensor values will come from the real-life PICAXE chip and the outputs can be directly controlled.

3.1 First simple script – Flash an LED
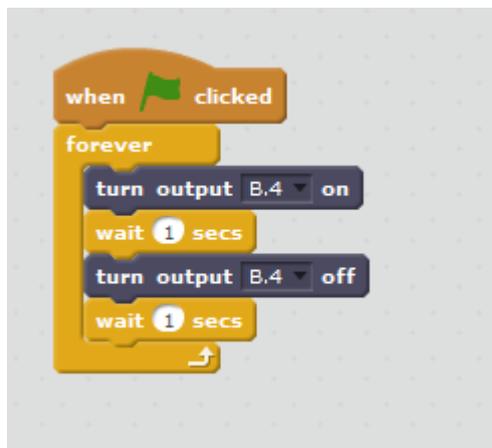
Try the simple script above, using an LED connected to a suitable output pin. When the script is run the real life LED should flash on and off once a second.

3.2 Setting sensor types
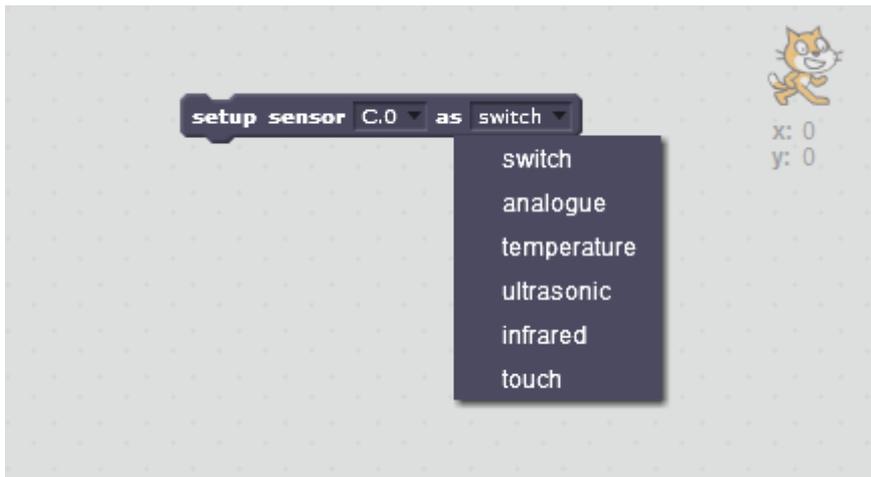
PICAXE input pins ("sensors") default to digital switches, and so provide a reading of 0 or 1. To convert the pin to a different type of sensor simply drag out a sensor block, set the desired sensor type, and double click on the block to activate it. Sensors can be set as follows:

Switch   - This is a digital on/off input   0, 1

Analogue   - This is an analogue input using the internal ADC   0-255

Temperature   - Uses a DS1B20 sensor, degrees Celsius   0-120

Ultrasonic   - SRF005 Ultrasonic sensor, distance in cm   3-255

Infra-red   - IR sensor from TV style remote control, last code received   0-127

Touch   - This is a touch sensor using the internal ADC   0-255
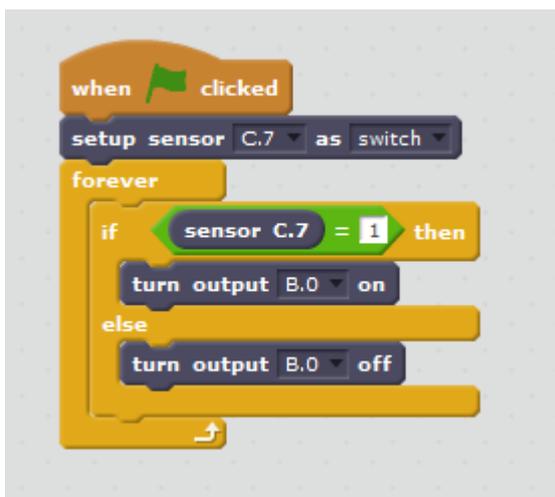
Note that the checkbox beside the reporter on the palette allows the reporter values to be seen within the stage area. This is very useful when working with analogue sensors.

3.3 Using Variables
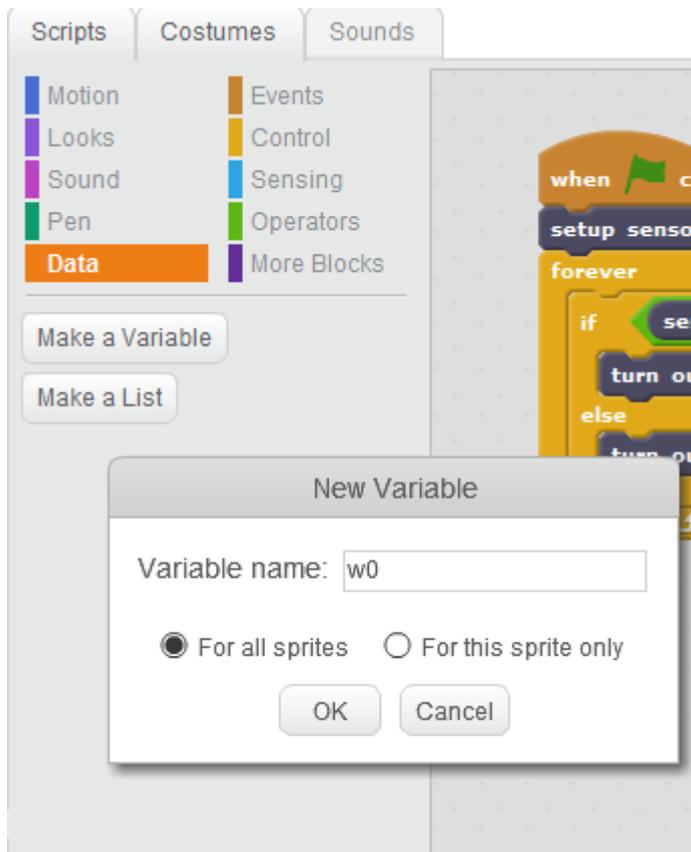
PICAXE variables may also be used in advanced programs. The standard PICAXE variable names should be used (e.g. w0 or b0) when creating the variable. Remember that in the PICAXE chip word variables contain a number 0-65535 and byte variables contain a value 0-255. Negative numbers and fractions are not supported.

Scratch lists are not currently supported in downloaded programs.

4.0 Mode 2: Remote Run Mode Step by Step Guide

Make sure the USB cable in connected and the PICAXE board is powered.

Run the S2P helper app.

Run Scratch 2.0 and open your project

Within Scratch select File > Save As (offline version) or File > Download to your computer (online version)

Save the project file with any filename you desire.

Select the correct COM port (e.g. COM5) within the S2P app

Click the 'OK' button (or use the convert option to just see the program without programming).

Select the Scratch project filename that you just saved and then click OK.

Your program will then be converted into a microcontroller program and downloaded into the PICAXE microcontroller. After download is complete you can remove the programming cable.

The new program will now run every time the power is connected to the PICAXE board.