

Scribbler S3 Design Specification

Version 1.2 - June 25 2014



The Scribbler S2 robot will be updated with the following design changes to increase its marketability and keep pace with current technology trends. The new robot will be branded as the Parallax S3.

1. USB Programming

- a. The DB9 serial programming connector will be replaced with a USB programming connector.
- b. The DB9 hole in the S2 shell will be modified for a USB type A mini connector.
(Should we use a USB micro connector instead?)
- c. FTDI FT231X USB to serial convertor IC will be added.

2. Body Color

The ABS body resin color will be changed from red to yellow. Pantone color reference chip to be provided.

3. Rechargeable Battery

- a. The AA battery will be replaced with a 3.7V lithium polymer (LiPo) rechargeable battery pack.

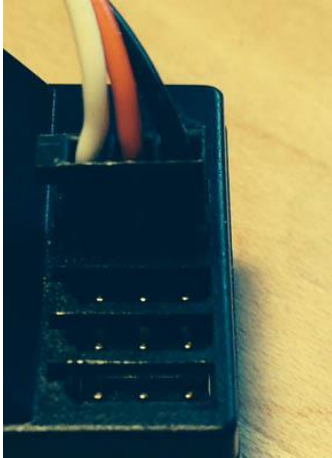


- b. The existing AA battery contacts and battery holder features will be removed from the case tooling.
- c. The S2 battery door will remain the same.
- d. The new battery will be housed inside of the existing battery compartment.
- e. Plastic features will be added to hold the pack.
- f. A battery charger and power path circuit will be added so that the battery can be charged at the same time the user is programming S3 when connected to a host computer.
- g. The battery can be charged from either a standard USB port at 2.5W or a high power USB port at 7.5W. The TI BQ24260 IC handles the USB charge rate selection automatically.
- h. The battery will have a pluggable connector so that it can be replaced by the user.
- i. The battery will be a super safe type with internal over voltage, over current, over charge and over discharge protection.
- j. A similar battery capacity to the S2 battery configuration of quantity 6 AA alkaline / NiMh cells is desired.
- k. The BQ24260 has an I2C interface for configuration which will be connected to processors EEPROM I2C bus.

4. Hacker Port

The hacker port enables users to add additional sensors and circuitry to the robot. It has proven to be a popular feature but we would like to make it more easily accessible. Using the hacker port previously required removing the case screws. The S3 will expose the hacker port through the front top of the case in a similar way that hobby airplane RC receivers do. The pins will be recessed

inside of the case such that a female 2.54mm pitch connector can be attached.



- a. An easily removable snap in place ABS or rubber cover will protect the hacker port when not in use.
- b. Parallax's hacker port expansion products are designed to operate from a 5V supply. Since the lithium batteries operate with a 3.7V nominal voltage, the existing 5V step down switching regulator will be replaced with a 5V boost power supply. The BQ24260 charger IC includes a boost 5V @ 1.0 Amp power supply, originally intended for USB OTG applications, which will supply to power to the hacker port from the battery. When a USB cable is connected, the hacker port power will be drawn from the USB cable.
- c. The hacker port's power output will include a dedicated self-resetting fuse.
- c. The robot's current hacker port utilizes a 3.3V to 5.0V logic level converter for the data signals. The converter has been problematic for some users so the converter circuitry will be removed and the data lines will be connected directly to the processor's 3.3V logic levels. The processor has 5V tolerant IO's.

5. Drive Motors

The same drive motors will be used as on the S2. A boost power supply will be designed to boost the battery voltage to ~9V for powering the motors. This will provide a desirable drive speed increase as well which many users have requested. The boost power supplies internal over current protection can replace the existing motor driver's hardware over current protection.

6. XBee Wi-Fi Radio

An internal 2.0mm pitch connector will be added to the main PCB for so that user can add an optional XBEE Radio module XB2B-WFPT-001. This will enable the user to upgrade their S3 can it can be programmed over Wi-Fi.

7. Configurable Line Detection Sensors

Some users have had trouble with the line sensors when using different line types such as black electrical tape rather than a printed or magic marker lines that the S2 line sensors were designed for. The line sensors will be modified to have a programmable gain or connected to the ADC inputs. This will allow users to calibrate the line sensors to different floor surfaces rather than relying on the fixed sensor levels as the S2 does. This is similar to how the Lego Next line sensors work.

8. Miscellaneous

- a. A single 64kb EEPROM will replace the dual 32kb EEPROM of the S2.

Initial Risk Mitigation Development Tasks

- Order a BQ24260 development board and test that it doesn't conflict with the FTDI serial convertor and that it will charge from a variety of sources at the higher current.
- Select the motor boost power supply IC, order a development board and try to run the motors off it from a lithium pack.
- See if we can hack the development boards onto an S2 along with an FTDI convertor as a first order system test.
- Test different line following surfaces such as electrical tape and confirm that the line following is workable with a wider range of surfaces.