Pi16340 SMART UPS

Description:

The Pi16340 SMART UPS (Pi-S-U) is a Power Supply and Backup UPS for the Raspberry Pi board. This unit allows you to operate your Raspberry Pi with or without a power cable and can use a type CR123A Lithium Ion battery. On board is one 100mA battery charging circuit for charging the battery. Power supply is up to 24VDC max.

How It Works:

The Pi-S-U holds one single cell lithium Ion 16340 (CR123A) form factor battery which should have integrated battery protection circuits. Using Lithium Ion batteries without protection circuits can be very dangerous. The boost circuit maintains the voltage to the Pi 5.1V for battery voltages of 3.7V to 4.2V. The 3-Pin jumper allows you to disable power to the Pi and Isolate the battery circuit or start the Pi. This jumper can be used with an external relay providing automatic

control from circuit or system. It also includes one charging IC's which can charge up to 100mA from the Power Supply Input connector Battery voltage can be read from a python script and another script can be used to read the temperature-humidity sensor via I2C. Any DC power supply, adaptor or solar panel up to 24V max can be used with the Input connector for charging and running the system. Pluggable connectors provide easy access to connect and remove wires in your system setup.

Proper shutdown is required for all computers using an operating system otherwise data or system corruption will occur reducing your system run times and performance. Using a UPS keeps the system running regardless of a power failure, brown-out or supply line interruptions and allows a quick and seamless software shutdown when needed.

Please follow the safety precautions of your Li-Ion battery supplier and use only with li-Ion batteries containing internal protection circuitry. When purchasing your batteries, check that they have protection circuits and if not listed, contact your supplier prior to purchasing. Lithium Ion batteries provide a substantial amount of energy storage compared with other technologies but much care must be taken when using, storing, disposing of and handling these type of batteries. We are not responsible for any damage or injury that may occur from misuse of the device.

Use Cases:

- Industrial Automation and Control Systems
- Remote battery operation for photography, security filming and monitoring
- Data logging for IoT/IIoT applications, Embedded systems
- Research and Development

Technical Specifications:

Charge Current:	100mA DC
Operating Temperature:	Per battery specifications (-20 to 40C)
Charge Time:	Varies with battery capacity
Backup/Operating Time:	Varies with battery capacity
ROHS Compliant:	Yes
Operating Input Voltage:	5V - 24V DC
UPS Mode:	Up to 1.8A for Raspberry Pi/Device
Battery Only Mode:	Up to 1.8A for Raspberry Pi/Device

Calculating Operating Times:

The Pi-S-U uses 16340 form factor Li Ion battery which come in various capacities. To calculate the run time on a battery, an example is provided below. The total current consumption or all attached peripherals to the Raspberry Pi/device can be measured via the jumper by the +ve battery terminal.

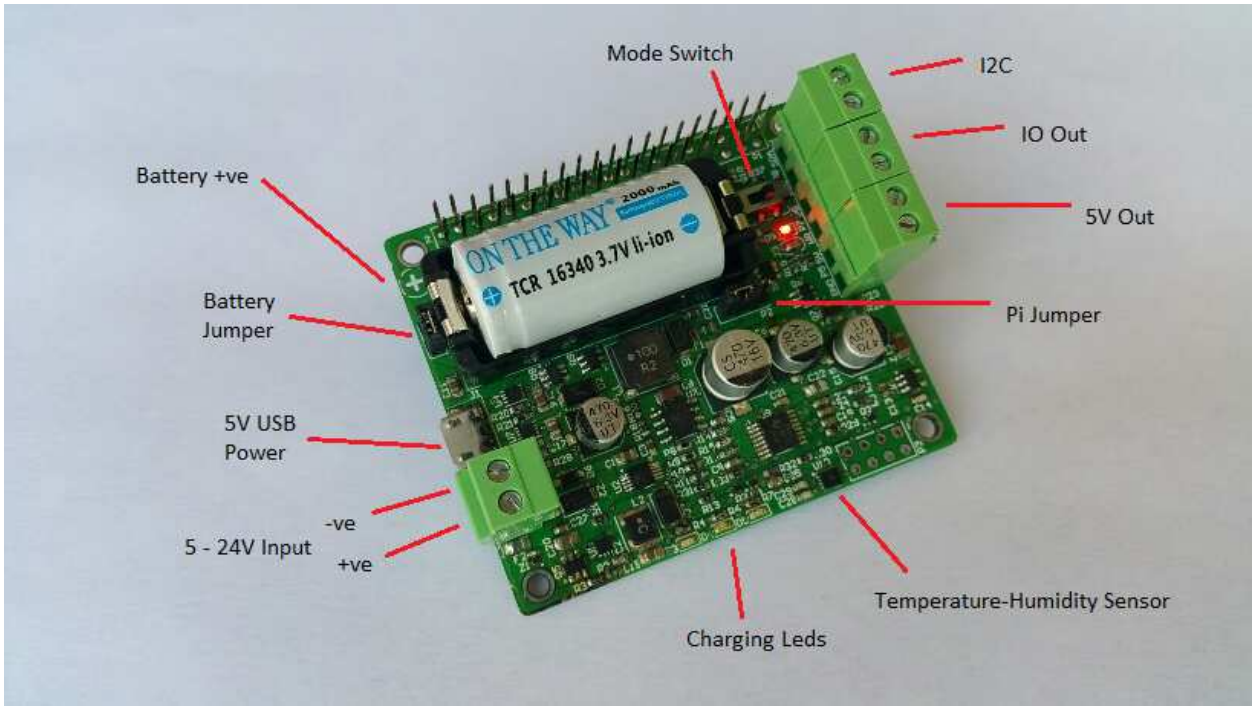
As an example the Raspberry Pi Zero uses approximately 87mA without and 103mA with a USB dongle plugged in. With a fully charged 700mAh battery, the Pi would last 6.79 Hrs with nothing attached (ideal conditions).

During testing we have found that most Chinese batteries do not have the capacity that are labelled on them. The best batteries to use are Fenix and other brand name batteries, although they do cost much more than other clones. Also not that using with Pi3 or Pi4, a considerable amount of current is used upon bootup which would directly affect the run times on battery if no external power is applied to charge the battery.

Battery Capacitry / Load = Run Time
700mAh / 103mA = 6.79hrs

Operating Instructions:

The Pi-S-U has several jumpers, pluggable terminal blocks and switches for operation of the device seen in the image below.



The 2-Pin battery jumper allows the user to disable all power drain from the battery for storage (Note: charging is also disabled when this jumper is removed).

Note: The proper polarity for inserting your 16340 battery as reverse protection has been removed. The MODE SWITCH located at the negative side of the battery allows the user to switch between two Modes of operation.

Mode (0): Battery mode operation in which the system continues to operate in the absence of a power supply. The system will operate off battery power up until the battery voltage reads 3.4Va t which time the shutdown timer will start and set GPIO_2 (HIGH) indicating that power will be turned off within 30 seconds.

Mode (1): UPS mode operation in which the system will initiate a power down sequence when input power supply is absent setting 2_1 (HIGH) and disabling power to the output within 30 seconds and restart as soon as input power supply has returned. (Default position with the switch to the left side closest to the battery holder.

Charging LED's: (MCP73833 - 100mA charge current)

STAT1 (ON)

STAT2 (OFF) - Pre-Conditioning or Fast Charge Mode

STAT2 (ON) STAT1 (OFF) - Charge Complete

PWRGD (ON) - Power Is Good For Charge

Output Enable Jumper allows the user to disable power to the output or can be used with relays for external operation. The ON position is the left-middle pin connection and OFF right-middle pin connection.

5V(out) LED just below the Mode switch provides visual indication of output power is present on the V(out) terminal blocks in the top right corner of the board. There is a solder jumper SJ1 just below the LED which will disable it to save power when running on battery alone.

On P5 terminal, 5V(out) plus and minus terminals provide an additional power connection for external devices. If using with a Pi, do not put too much additional load or the Pi will not start.

I2C communication to the Pi/Device can be achieved using the P8 terminal SCL-SDA terminals. Our example python script with the Pi shows reading info from the supervisory microcontroller. When using with a Raspberry Pi, no external pullups are required.

On P7 labelled 2_1 on the IO Out terminal which is connected to GPIO22 on the Pi, provides a (HIGH) shutdown in progress and (LOW) normal operation to the Pi which can be used to initiate a soft-shutdown using a python monitoring script.

Onboard firmware provides algorithms to filter out voltage spikes, brownouts and power losses under a specified period of time to allow smooth operation of your connected Pi/Device. The firmware also detects the Mode switch position which can be changed on the fly if needed.

A 5V USB power cable can provide power to the UPS but is not enough to power a device such as a Pi4. To power a Pi4, the 5 - 24VDC input should be used with at least 2.1A rating. A Pi4 can consume over 400mA peak during bootup and even more with attached peripherals. Another thing to note is that when tested with a Pi4, the charging circuit can stop shortly after starting if no cooling is provided to the UPS and Pi4 as there is a considerable amount of heat generated from the processor causing the thermal sensor on the charging circuit to stop the charging process. Care must be taken when using the USB input as the connector is only a SMT version and can easily be damaged if too much force is applied when inserting the cable.