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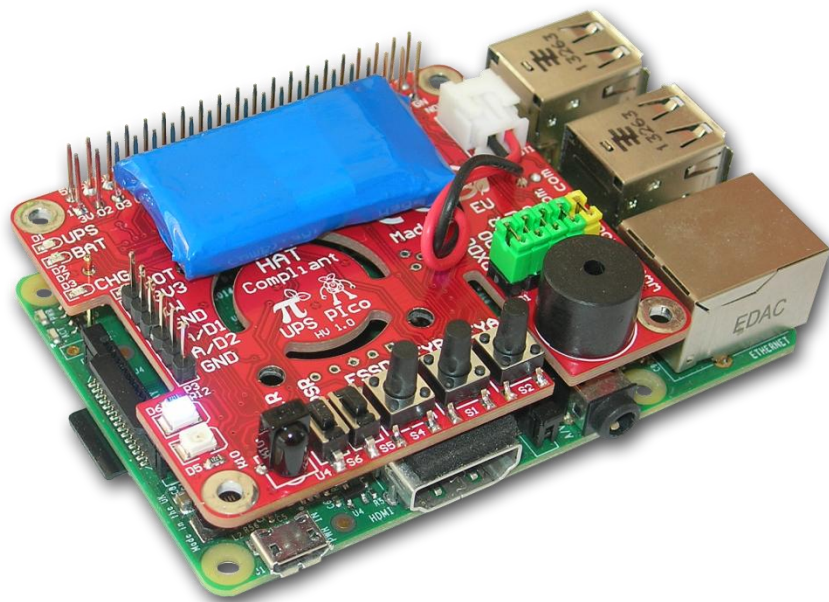# UPS PIco

Uninterruptible Power Supply

with Peripherals and I²C control Interface

to be used with

Raspberry Pi® B+, A+, B, and A

HAT Compliant

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Frequently Asked Questions V1.0

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Intelligent Modules for your Raspberry Pi®

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System Overview

Introduction

The **UPS PIco** is an advanced uninterruptible power supply for the Raspberry Pi® that adds a wealth of innovative power back-up functionality and development features to the innovative microcomputer!

The standard **UPS PIco** is equipped with a 300mAh LiPO battery specially designed to enable safe shutdown during a power cut. Additionally, this can be easily upgraded to the extended 3000mAh version, which enables prolonged use of a Raspberry Pi for **up to 8 hours** without a power supply connected!

The **UPS PIco** features an embedded measurement system that continuously checks the powering voltage of the Raspberry Pi®. When the cable power on the Raspberry Pi® is absent, insufficient, or the device detects a power failure, the **UPS Pico** automatically switches to the unit's battery source. The module then continues to check the voltage on the Pi and switches automatically back to the regular cable supply when power is once again available.

The **UPS PIco** is powered and the battery pack intelligently charged via the GPIO pins on the Raspberry Pi®, so no additional cabling or power supply is required.

The **UPS PIco** is designed to be 100% compliant with **HAT standards** for the Raspberry Pi® B+ and A+, and is mechanically compatible with the original Raspberry Pi® models A and B when an extension header is used. In addition to this, because the **UPS Pico** requires no external powering and fits within the footprint of the Raspberry Pi®, it is compatible with most cases.

The **UPS PIco** can also be equipped with an optional **Infra-Red Receiver** which is routed directly to GPIO18 via the PCB. This opens the door for remote operation of the Raspberry Pi®and **UPS Pico**!

Finally, the **UPS Pico** features an implemented Automatic Temperature Control **PWM FAN controller**, and can be equipped with a micro fan kit, which enables the use of the Raspberry Pi® in extreme conditions including very high temperature environments.

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Applications

UPS PIco is equipped with plenty of features which make it an extremely useful tool for Raspberry Pi® project development. It not only provides powering continuity, but also offers extra user programmable LEDs, Sensors, buttons and I/O's. The unit also features a dedicated **10-bit analogue to digital converter** with two channels making it the perfect board for remote and unmanned sensor deployment. These extra features result in the **UPS Pico** being a superior all-in-one device perfect for many innovative projects, and embedded applications.

Features

The list of features of the **UPS PIco** is as follows:

- Raspberry Pi B+ **HAT Compliant**
- **Plug and Play**
- **Smart Uninterruptible Power Supply (UPS)**
- **Integrated LiPO Battery** (8-10 Minutes of Power Back-Up)
- **Intelligent Automatic Charger**
- **No Additional External Power Required**
- **Optional 3000 mAh** Battery for 8 Hours Run-Time (Not Included)
- **5V 2A Power Backup (Peak Output 5V 3A)**
- Integrated Software Simulated **Real Time Clock (RTC)** with Battery Back-Up
- **File Safe Shutdown** Functionality
- Raspberry Pi B+ **Activity Pin**
- **PWM FAN control** (Fan Not Included)
- **2 User Defined LEDs**
- **2 User Defined Buttons**
- **Integrated Buzzer** for UPS and User Applications
- **Status Monitoring** - Powering Voltage, UPS Battery Voltage and Temperature
- **I2C PICo Interface** for Control and Monitoring
- **RS232 Raspberry Pi** Interface for Control and Monitoring
- **XTEA Based** Cryptography User Software Protection
- 2 Level **Watch-dog Functionality** with **FSSD and Hardware Reset**
- **Raspberry Pi B+ Hardware Reset Button via Spring Test Pin** (Not Included)
- **Jumpers for Raspberry Pi B+ Pin** Functionality Selection
- **Stackable Header** for Add-On Boards
- **Boot Loader** for Live Firmware Update
- Compatible with **Intelligent IR Remote Power ON/OFF (PowerMyPi)**
- **Integrated ESD-Protected 2 Channel A/D 10 Bit Converters 0-5.2V**
- **Integrated ESD-Protected 1-Wire Interface**
- **Labeled J8 Raspberry Pi B+ GPIO Pins** for Easy Plug & Play
- **Infra Red Receiver** Sensor Interface (IR Not Included)
- **Upgradable** with **PIco Add-on Boards**
- **Fits Inside Most Existing Cases**

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Frequently

Asked

Questions

Version 1.0

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Q: Why do I need to use the UPS PIco Module?

A: Like every on computer, Raspberry Pi ® is running an Operating System which stores system's and user's files on the SD card. With any unexpected luck of power failure can cause lose or corruption of those files. **UPS PIco** Module filters such powering failures and in addition, provides plenty of extra features that make it very friendly tool for beginners and advanced users. Our company spent a very long time carefully designing the **UPS PIco** Module in order to provide to the user **as much features as possible** at the **lower possible cost.**

Q: Is the UPS PIco Module true Plug and Play?

A: Yes, the **UPS PIco** Module is 100% Plug and Play; from the hardware side, you do not need to add anything else, just plug it on top and play. You don't even need to change the micro USB power connection plugged to your Raspberry Pi®. In fact there is **no other micro USB connector** available like in other UPS modules available for the Raspberry Pi®. You will just plug-in the **UPS PIco** Module to the **J8** (**P1 for model B/A)** connector on the top of your **Raspberry Pi®** and use it. However you need to install a simple Python script that will take care of the safe shutdown process of the Raspberry Pi® and will inform your **UPS PIco** Module that Raspberry Pi® is running. It will solve all possible powering issues and offer you a battery backup.

Q: Is the UPS PIco Module fits to existing cases?

A: Yes, **UPS PIco** Module requires no external powering cables and fits within the footprint of the Raspberry Pi®, it is compatible with most cases.

Q: Is the UPS PIco Module compatible with other models of the Raspberry Pi?

A: Yes. The **UPS PIco** Module Module is 100% compatible with Raspberry Pi® model B+ and A+. It is also compatible with the Raspberry Pi® B and A models, if the required extension connector is used.

Q: How it is possible that UPS PIco Module does not need additional micro USB power input like other Raspberry Pi ® UPS available o the market?

A: Due to proprietary powering analysis algorithms, **UPS PIco** Module continuously analyze powering conditions, and decides within 100 uS to switch to **internal battery** or to **cable powering.**

Q: Can I use the UPS Pico Module with other boards?

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A: Yes. Just plug them on top of it, or use the version of the **UPS Pico** Module with extended **J8** (**P1 for model B/A**) connector, and then plug-in the other board on top of it. The **UPS Pico** Module will power also your additional boards and other existing peripherals.

Q: How long power loses UPS Pico recognizes and filters?

A: Any luck of power on the **J8** (**P1 for model B/A**) connector that takes more than 100 uS, or continuously dropping of powering voltage within time frame of 500uS, or drop of powering voltage below of USB recommendations will automatically initiate the battery powering back up and filter it, providing continuously powering to the Raspberry Pi®.

Q: Is it possible that UPS PIco Module switch to battery during "normal" usage of the Raspberry Pi®?

A: YES, even within "normal" usage of the Raspberry Pi® can happen voltage drops that will be recognized by the **UPS PIco** Module and cause automatically switch to battery source. It happens very rarely, and not affects the operation of the Raspberry Pi®. After a short time running on battery, the **UPS PIco** Module will automatically switches back to the cable powering.

Q: How Raspberry Pi® is protected from direct powering provided to the J8 (P1 for model B/A) connector?

A: Following Raspberry Pi® HAT recommendations there are implemented 3 level of powering protection:

1. **ZVD circuit**
2. **PPTC Fuse of 2.6A**
3. **Ultra Fast FET based Analog Power Switch micro controller supervised**

Q: What is the maximum current that Raspberry Pi® can draw from the UPS PIco Module?

A: Following Raspberry Pi® HAT recommendations the **UPS PIco** Module should be able to provide continuously **1.4A**, however **we increased this level to 2A,** and allows to have peaks up to 3A (very short time peaks)

Q: What type of battery is used by the UPS PIco Module?

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A: The standard **UPS PIco** Modules shipped to the user equipped with a LiPO battery of **300 mA.**

Q: Is it possible to use a battery with bigger capacity on the UPS PIco Module?

A: YES, our company offers tested and approved LiPO batteries with capacity up to **3000 mA.**

Q: How is the battery charged on the UPS PIco Module?

A: The **UPS PIco** Module is equipped with intelligent automatic charger that takes care of having the battery always fully charged, and recognizes various charging conditions and also monitoring the environment temperature. If powering conditions are not sufficient, **UPS PIco** Module automatically stops the battery charging in order to provide most of the available power to the Raspberry Pi®

Q: How long can the Raspbeerry Pi® be running, with the standard battery in case of power luck?

A: It depends on the current load of the system; estimated the **UPS PIco** Module can supply the standard used (without extra modules) Raspberry Pi® for about 8 – 10 minutes with a battery of 300 mAh and about 8 hours with a battery of 3000 mAh.

Q: Is it possible to have batteries with higher capacity, and how long do they last?

A: YES, Practically any LiPO battery can be used with higher capacity. Such battery should meet the required specifications, which are: charging voltage 4.2 V, nominal voltage 3.7V, and minimum provided current 6A. However, as the charging current is 212 mA, batteries with capacity higher than 4200 mAh will take more than 20 hours to fully charge.

Q: Is the UPS PIco Module integrated battery protected?

A: Yes, the **UPS PIco** Module has built in multiple battery monitoring and protection systems that contains: over current, overcharge and over discharge battery protection. In addition battery temperature is monitored as well, and the system reacts accordingly when temperature is too high or too low.

Q: I need more running time on battery. Is there are any other way to extend battery runtime?

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A: YES, you can use the embedded internal **timed ON** and file safe **timed OFF** feature which its runs your Raspberry Pi® only on requested time schedule, when the system is running on battery. All other time it will be switched off. With such approach you can save a lot of energy as your system will be running only on requested time slots.

Q: Can I use the UPS PIco Module with other chemistry types of batteries?

A: <u>NO</u>, the **UPS PIco** Module has been designed exclusively for the LiPO batteries with nominal voltage of 3.7V and charging voltage of 4.2 V. <u>It is not allowed to use it with different chemistry types of batteries.</u> However there is on the way a **PIco EPR** board that will handle other chemistries batteries and external extended voltage and will be co operating with the **UPS PIco** Module.

Q: What is the PICo Interface?

A: The **P**eripherals **I**^{2}C **Co**ntrol – The **PICo Interface** is an implementation of **I**^{2}C interface adapted to easily control the peripherals connected on the RaspberryPi® via command line. Due to human understandable, simple commands, control of peripherals is extremely simple. Control from the level of programming language is also possible and simple. The core concept of the **PICo** interface is that all peripheral device control and data exchange between it and Raspberry Pi® variables are common for the **I**^{2}**C** interface as also for the peripheral itself. Therefore any change of them by one of the pair Raspberry Pi®and peripheral cause immediate update and action.

Q: What do I have available additionally to the UPS functionality?

A: The **UPS PIco** Module - **U**ninterruptible **P**ower **S**upply with **P**eripherals and **I**^{2}**C** **co**ntrol Interface is an advanced uninterruptible power supply for the Raspberry Pi® that adds a wealth of innovative power back-up functionality and development features to the innovative microcomputer

Q: What GPIO Pins are required to have the UPS PIco Module Running?

A: For the Basic operation **UPS PIco** Module is using only the **5 VDC** pin and **GND** and in addition interact with the GPIO_GEN22 and GPIO_GEN22. Additionally on user's request some additional features require RS232, I^{2}C, 1-wire and IR Receiver.

Q: Do I have any indications about the UPS PIco Module status?

A: Yes. You have LEDs indicating you about the powering source, battery status, charging status, system temperature as also 2 LED available for user's application. All

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indication as well as system status information, is available if requested via RS232 and I^{2}C interface.

Q: Can I control my UPS PIco via scripting commands?

A: Yes. There are plenty of commands for full system control. Thanks to the implemented bootloader, the set of commands can be enhanced with new ones, as we release fixes and updates. We are open to customer suggestions about new commands to implement. Customers can propose new commands via e-mail or on our forum: if we consider them generally useful, then we will implement them for free and distributed them via our bootloader system.

Q: What is the bootloader system, why do we need it?

A: Bootloader System is a live updating procedure for the embedded microcontroller on the **UPS PIco** Module. This system gives you access to any new version of the firmware every time that it becomes available.

Q: How can I upload new firmware to the UPS PIco Module?

A: Just download the .HEX file from our website, and update the **UPS PIco** Module directly from the Raspberry Pi® using python script**.** It is very simple.

Q: What is the Analog Temperature Sensor?

A: The **Analog Temperature Sensor** is placed near the **J8** connector on the **UPS PIco** Module and can be read by the user via I^{2}C or RS232. The resolution is 1 degree Celsius and it is mainly used for battery temperature monitoring (for safety reasons), however can be used also to monitor the Raspberry Pi® environment temperature. If e.g. the temperature is too high, then the Raspberry Pi® can be shutdown (on user request), or fan can be automatically started (via embedded Relay on **UPS PIco** Module). It is very useful if you are using the Raspberry Pi® in the outside environment.

Q: What IC of RTC UPS PIco Module is using?

A: There is no physical RTC IC. The microcontroller controlling all the **UPS PIco** Module functionalities is emulating the RTC chip. Currently we have implemented the DS1307. However in the future any other chip can be implemented and upload to your **UPS PIco** Module via bootloader procedure. The RTC system has its own crystal of 32768 Hz and is powered by the **UPS PIco** Module embedded LiPO battery.

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Q: How can I use additional embedded features of the UPS PIco Module?

A: The **UPS PIco** Module has additional 2 LEDs, 2 Buttons, Buzzer, 2 x 10bits A/D converters. Each of these extra features can be accessed via I2C or RS232 port and embedded to the user applications. In addition there is 1-wire interface directly connected to the Raspberry Pi® as also IR receiver interface. This set of additional features makes this board ideal for rapid prototyping and final project deployment.

Q: What is the PWM fan control interface?

A: The **UPS PIco** Module has an embedded interface. The PWM (Pulse Width Modulation) technology allows changing the embedded fan rotation speed. Thus give multiple levels of speed, noise and current, which are 0%, 25%, 50%, 75% and 100% of the fan speed.

Q: Is the embedded fan necessary?

A: No, However very useful, as it guarantee that Raspberry Pi®, **UPS PIco** Module and any additional board will have always the proper temperature.

Q: What is the ESD protection that provides the UPS PIco Module?

A: The ESD protection is the Electrostatic Discharge protection and is provided on each I/O pin that is handled by the UPS PIco (1-wire, and both A/D interfaces)

Q: How can I become a distributor of your products?

A: Very simple. Just send us an e-mail with your request to b2b@pimodules.com