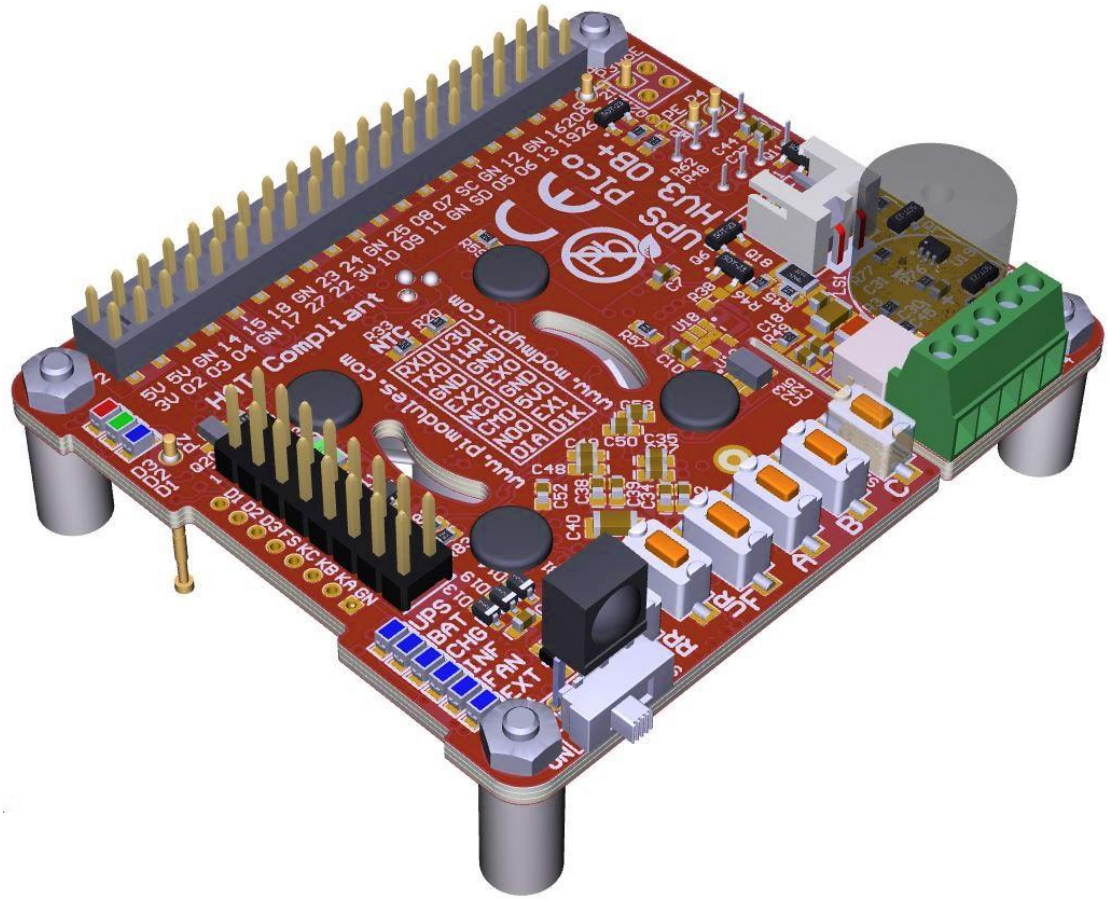
UPS PIco HV3.0B+ HAT Advanced

Intelligent Mobile Power Bank and Uninterruptible Power Supply with RTC, Peripherals and I²C control Interface



Especially Designed for the

New Raspberry Pi® 3 Model B+

HAT Compliant

The **UPS PIco HV3.0B+ HAT Advanced 450** is an advanced **Intelligent Mobile Power Bank** and **Uninterruptible Power Supply** especially designed for the **Raspberry Pi® 3 Model B+**, that adds a wealth of innovative powering/backup functionality and development features to the innovative microcomputer! The **UPS PIco HV3.0B+ HAT Advanced 450** will automatically shut-down your Raspberry Pi® if there is a power failure, supply mobile applications from battery source, and can be set to automatically monitor and reboot your Raspberry Pi® once power has been restored! It is equipped also with an **Intelligent Externally Accessed** (with **Files Safe Shutdown**) **Slide Power Switch** that allows to safety **System Switch ON/OFF** whenever you like, without worrying about files corruption as it is always properly shutdown the system before cable power will be disconnected. This new and very advanced feature, switches OFF also the **Raspberry Pi® 3 Model B+** even if it is powered via their micro USB powering cable. This allows also to charge (optionally) the battery when **Raspberry Pi® 3 Model B+** is OFF however still connected to the micro USB cable powering source.

If used as **Mobile Power Bank** it is equipped with an **Intelligent Externally Accessed** (with **Files Safe Shutdown functionality**) **Power Slide Switch** that allows to safety **System Switch ON/OFF** whenever you like, without worrying about files corruption as it is always properly shutdown the system before battery will be disconnected (keep battery connected until system shutdown)!

The **UPS PIco HV3.0B+ HAT Advanced 450** features a **5V 3A** total current output on battery powering, designed for use on the latest **Raspberry Pi® 3 Model B+.**

UPS PIco HV3.0B+ HAT Advanced 450 offers now **3** User Programmable Keys, **3** separate User programable LEDs with different colors, support for **multiple** and different chemistry of a high capacity batteries, **bi-stable relay** (latching, Zero Power) configured as 2 Amp **DPDT**, as also **3 x A/D 12-bit** converters with pre-adjustable readings to 5.2V. As also 10V, 20V and 30V voltage conversion (when used with **Terminal Blocks PCB** or separate external resistors). Now, with number of embedded sensors (inbound current, outbound current, temperature, voltages), **true 5V 1-wire** interface, optional high voltage RS232 interface and many, many additional features!!

The **UPS PIco HV3.0B+ HAT Advanced 450** is standard equipped with a **450mAh 15C LiPO battery (able to supply up to 6.5A)** specially designed to enable safe shutdown when cable power cuts. Additionally, this can be easily upgraded to the extended 1500mAh, 4000mAh, 8000mAh or even 10400mAh (on Special Order) capacities, which enables prolonged use of a Raspberry Pi for **more than 24 hours** without a power supply connected!

The **UPS PIco HV3.0B+ HAT Advanced 450** design support now batteries with different chemistry like: **LiPO, Li-Ion** as also **LiFePO4**. Especially the **LiFePO4** batteries are addressed to applications where temperatures environment is more restricted as can be used for supplying from -**10 degrees up to +60 degrees**. In addition, the **LiFePO4** have a unique extremely long life of charging/discharging that can achieve up to **2000 cycles** or **10 years life time!!**

Now, with new add-on board (**PIco LP/LF Li-Ion 18650 Battery Holder**) you can use all **Li-Ion 18650 batteries** from electronic cigarettes wide available on the local markets approaching total capacity of 7200mAh, as also 18650 LiPO and LiPo4Fe (called also 123).

With additional **External Supply Powering Input**; that has implemented **Dynamic Power Tracking (**based on **Voltage Proportional Charge Control – especially designed for Solar Cells)**; automatically adjust battery charging current according to power availability from 100mA – 800 mAh, in order to use all available energy from the Solar Panel in case of use. This feature has been especially designed to support **Solar Panel Powering Raspberry Pi® Systems**, as it is adjusting the charging battery current to available Sunning conditions, which is varring. The **External Supply Powering Input** is able to accept power from **7 V DC** up to **28 V DC!!** Thus, make it ideal for Cars, Trucks, Buses and any industrial applications where voltage is usually higher than 24V DC. The **External Supply Powering Input** is equipped with Over Current protection, Over Voltage protection, ESD protection as also with **Zero Voltage Drop Inverse Polarity Protection** protecting Raspberry Pi® System from improper usage, but also offers, due to zero voltage drop, usage of most of available energy from the **Solar Panel** in case of use.

The **UPS PIco HV3.0B+ HAT Advanced 450** is powered and the Battery Pack intelligently charged via the GPIO pins on the Raspberry Pi®, therefore no additional cabling or power supply is required (if used Raspberry Pi® PSU 5V supply). Due to that fact **UPS PIco HV3.0B+ HAT Advanced 450** requires no external cable powering and fits within the footprint of the Raspberry Pi®, it is compatible with most cases. If powered via External Power Input (7V-28VDC) the there are cases available to hold your designed system.

Also, in case the **UPS PIco HV3.0B+ HAT Advanced 450** is powered from the Extended Power Input, it allows to charge the battery even if Raspberry Pi® is not powered. Thus, functionality in combination with **Events Scheduler** make the system always full of energy when needed to be running.

Professional developers often need to protect their application. To support them **UPS PIco HV3.0B+ HAT Advanced 450** offers the **XTEA** dual path encryption engine that protect the developed software with the secure code**.**

The new PCB is designed with **2 oz copper** and **4 layers,** especially for high current powering systems offering **Multilayer Copper Thermal Pipes** for increased System Thermal Response and better passive cooling!!

The **UPS PIco HV3.0B+ HAT Advanced 450** can also be equipped with an optional **Infra-Red Receiver** which is routed directly to GPIO18.

The embedded **Electromagnetic Programmable Sounder** can be used as a **simple buzzer** but also as **music player** due to implemented sound generator and dedicated programmer interface.

The **IoT** developers will find useful the **3 independent ESD protected 12 bits buffered A/D converters** as also number of internal sensors and sensor interfaces that can be used for system monitoring such as Battery Voltage, Raspberry Pi Voltage, Inbound/Outbound Current measure, System Temperature and true **5V 1-wire interface**.

The integrated **Hardware RTCC** enables a new extremely usefully feature – the **Events Triggered RTCC Based System Actions Scheduler**. The **Events Triggered RTCC Based System**

Actions Scheduler allows to timely start up, or shutdown the **Raspberry Pi®** on various internal or external events that include, data available on RS232, A/D, RTCC, and temperature, or just on requested Time Stamp.

Finally, the **UPS PIco HV3.0B+ HAT Advanced 450** 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. The FAN speed can be manually/automatically adjusted according to system temperature conditions linear from 0 % (FAN is OFF) up to 100% by increasing and decreasing rotation speed. Thus, guarantees the possible lowest level of noise and always cool **Raspberry Pi® 3 Model B+.**

The **UPS PIco HV3.0B+ HAT Advanced 450** can also be equipped with an optionally with:

- **Infra-Red Receiver** which is routed directly to GPIO18 via the PCB for remote IR operations.
- Additionally the PIco includes an 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.
- Bi-Stable (Latching), Zero Power Relay, configurable for a double **DPDT 1A/30V or single SPDT 2A/30V.**
- **Terminal Blocks PCB** offering 12V RS232 interface, and all I/O interfaces Terminal Blocks capabilities
- **PIco LP/LF Li-Ion 18650 Battery Holder** (single or double) that allows using all **Li-Ion 18650 batteries** from electronic cigarettes wide available on the local markets, as also **18650 LiPO** and **18650 LiPo4Fe** (known as 123 type).
- The **UPS PIco HV3.0B+ HAT Advanced 450** is designed to be 100% compliant with **HAT standards** for the Raspberry Pi and includes a **Gold Plated Reset Pin**, with install locations for the Raspberry Pi Zero/W, A+, B+/2 and 3.

Features

The list of features of the **UPS PIco HV3.0B+ HAT Advanced 450** are as follows:

General

- **Designed Especially for the Raspberry Pi® 3 Model B+**
- **HAT Compliant** (HAT dimensions and HAT EEPROM)
- **Plug and Play –** Ultra Simple Semi-**Automatic Installation** via GitHub
- **Standard Interrupts driven interaction with Raspberry Pi® based on Daemons** using GPIO27 (Pin13) & GPIO22 (Pin15), very responsive on massive files copying
- (Optional) **GPIO free** (all GPIOs are available for user application) **interaction with Raspberry Pi®** is based on current consumptions and I^2C activity
- Simple **status email broadcasting application based on Daemons** when Powering Status Changed
- Enhanced **System Monitoring** and **Programming API**
- **Labeled J8 Raspberry Pi® GPIO Pins** for Easy Plug & Play of experimental cables
- Standard **THT 40 Pin** connector (not soldered)
- **Remote bootloader** for Live Firmware Update on remote locations
- **Local bootloader** for Live Firmware Update

Powering Options

- **Intelligent Uninterruptible Power Supply** (UPS)
- **Mobile Battery Power Bank** (starts-up without cable power cycling)
- **File Safe Shutdown** and **Start-up** Functionality on a Single Button
- **Single slide ON/OFF switch for battery powered (mobile) and cable powered applications** running without power cycling (with **File Safe Shutdown functionality when OFF**)
- **Switches ON/OFF the Raspberry Pi® 3 Model B+** even if it is powered via their micro USB cable power!!
- Possibility to solder **external ON/OFF switch** (Ready Soldering PADs)
- **Integrated LiPO Battery** 450 mAh 15C (10-15 Minutes of Power Back-Up)
- **5V 2.6A Power Backup (Peak Output 5V 3A)**
- **No Additional External Power Input Required.** System is monitoring power status over 5V GPIOs, therefore is compatible with 99.99% of all existing cases
- **Additional programmable 5V power source with battery backup,** available for user applications also when Raspberry Pi is OFF (5V@750mA) **protected with PPTC FUSE** and **reverse current flow diode**, controlled by User and RTC Scheduler.
- User and RTC Scheduler controlled, 0.2A@3.3V protected output (sourced from independent and dedicated LDO)

Supported Batteries Types and Capacities

- **Support for LiPO, LiFePO4 and Li-Ion Chemistry Batteries** on the same PCB (with high current cable connection) with dedicated plastic base
- **Support for Li-Ion 18650 low cost batteries** (from Electronic Cigarettes) with **dedicated mounting base PCB screwed on top**

- **Support for LiPO 18650 batteries** with **dedicated mounting base PCB screwed on top**
- **Support for LiFePO4 18650 batteries** with **dedicated mounting base PCB screwed on top**
- Intelligent **Automatic Battery Charger**
- Available Standard Batteries Capacities are:
    - LiPO 1500 mAh
    - LiPO 4000 mAh
    - LiPO 8000 mAh
    - LiPO 10400 mAh
    - LiFePO4 3000 mAh
    - LiFePO4 4000 mAh
    - LiFePO4 8000 mAh
    - Li-Ion from 1200 mAh up to 7200 mAh
    - Any user selected 16850 battery capacity

Embedded Peripherals and Interfaces

- **3 User Programmable LEDs** for user own application **with additional connectivity** to external User LEDs
- **3 User Programmable Buttons** for their own application **with additional cable connectivity** to external User Buttons
- **System File Safe Shutdown/Start-up button** with additional cable connectivity to external button
- **Single slide ON/OFF switch for battery powered applications** with additional cable connectivity to external User Switch (OFF is always combined with File Save Shutdown capability)
- Standard equipped with **Bi Stable Relay (Latching Relay - Zero Power) assembled on two different mounting positions:**
    - **with two galvanic isolated independent contacts DPDT 1A/30V**
- Standard equipped with **Opto-Coupler Interface**, useful for High Voltage Interfaces or Interfaces where separated grounding is needed. The Opto-Coupler Interface can be read as digital (Hi/Low) or Analog Value
- Integrated **True 5V** ESD protected **1-wire interface** (with voltage converter to 3.3V) connected directly to the GPIO4
- Integrated **ESD-Protected 3 x 12-bit A/D** converters with voltage conversion embedded calculators and raw data option (implemented in firmware extensive Lowpass and Olympic Score filtering):
    - 0V-5.2V
    - 0V-10V
    - 0V-20V
    - 0V-30V
- **Infra-Red Receiver** Sensor Interface (IR Not Included) directly connected to the GPIO18
- **Programmable Integrated PWM Sounder** (programmable by user API or Automatic), able to play music
- Integrated **Hardware Real Time Clock (RTC)** with Battery Back-Up
- **PWM fan control** with dedicated Temperature sensor touching the Raspberry Pi ® PCB, based on Raspberry Pi or Embedded Temperature Sensor (Fan need to be ordered separately)

- On Battery Powered **System Available Running Time** (calculated on battery capacity, Battery Level and System Current Consumption)

- (optional) **second RS232 port** (5V tolerant, or 12V via Terminals Block PCB)

Embedded Sensors

- **Outbound current** measure sensor when Battery powered
- **Inbound current** measure sensor when Cable powered
- **NTC** based **onboard** temperature sensor
- (Optional) TO92 Temperature sensor
- Battery Level Voltage
- Raspberry Pi GPIO 5V level

User/Programmer Interface

- **I²C PICo API Interface** for Control and Monitoring, with over 50 programming registers
- Support for **3 different** users selectable I2C addresses sets:
    - **DEFAULT:** 0x68, 0x69, 0x6A, 0x6B, 0x6C, 0x6D, 0x6E, 0x6F
    - **NO_RTC:** 0x69, 0x6B
    - **ALTERNATE:** 0x58, 0x59, 0x5A, 0x5B, 0x5C, 0x5D, 0x5E, 0x5F

System Schedulers

- **Basic Time Scheduler**
- **Event Triggered RTC Based System Actions Scheduler** (ETR SAS)
  System can wakeup and sleep on external or internal events like:
    - temperature,
    - 3 x A/D levels,
    - voltage,
    - RS232 data;
- as also can trigger Actions like: Relay, Auxiliary Voltage ON/OFF, RS232 data **with or without involvement** of the Raspberry Pi®. Always based on internal Hardware RTC

Case Compatibility

- **No Additional External Power Input Required.** System is monitoring power status over 5V GPIOs, therefore is compatible with 99.9% of all existing cases
- **Fits Inside Most Existing Cases as no extra cabling is needed**
- **Fits inside to the Official Raspberry Pi Case with closed lid** (version Top-End only)

System Monitoring

- **Status Monitoring** – Powering Mode, Inbound current, Outbound current, Powering Voltage, UPS Battery Voltage, Current and Temperature
- **Events Pi** Log feature

- **System LEDs** – UPS, BAT, CHG, INF, FAN (optionally selected can be mapped to User LEDs)
- **System Healthy**, that informs user remotely if Raspberry Pi and UPS Pico HV3.0 are running properly and system is power protected (based on various internal system triggers)

User Applications Security

- (optional) **2**-way **XTEA** Based **Encryption Engine** for **User Intellectual Properties** protection

System Protection

- Direct **Raspberry Pi® Hardware Reset Button** via Spring Test Pin (pogo pin)
- **Programmable Watch-Dog Hardware** feature (**St**ill **A**live Timer)
- **PPTC 2.6A fuse**
- **ZVD circuit** on 5V GPIO connections
- **Microcontroller watch-dog**
- Over Temperature protection
- Over Current protection

System Design

- Designed and Analyzed with one of the most advanced CAD/CAM Tools - Mentor Graphics PADS
- Design Based on Microchip 16-bit 16MIPS micro controller
- Industrial Originated

PCB Construction

- **2 oz copper** PCB manufactured for proper high current supply
- 8mils track/8mils gap technology **4 layers PCB**
- PCB Surface Finishing - Immersion Gold
- **Multilayer Copper Thermal Pipes** for increased System Thermal Response and better passive cooling

Designed and Manufactured in Europe

UPS PIco HV3.0B+ HAT Technical Specifications

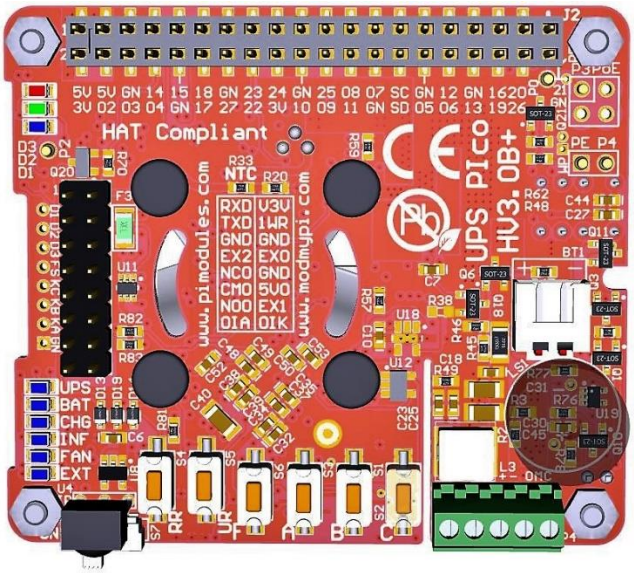
Features	UPS PIco HV3.0B+ HAT Models		
	UPS PIco HV3.0B+ HAT Stack 450	**UPS PIco HV3.0B+ HAT Stack Advanced 450**	**UPS PIco HV3.0B+ HAT Top-End 450**
Raspberry Pi®			
Raspberry Pi® System Compatibility			
Compatible Raspberry Pi Models	Designed for Raspberry Pi® 3 Model B+	Designed for Raspberry Pi® 3 Model B+	Designed for Raspberry Pi® 3 Model B+
Cases Compatibility			
Cases	Most of the cases ModMyPi cases PiModules PIco case	Most of the cases ModMyPi cases PiModules PIco case	Most of the cases **Recommended Raspberry Pi Original Case**
Raspberry Pi® GPIO Usage (occupation)			
Permanent use of I²C **User selectable addresses**	GND, 5V, SDA0, SCL0 I²C Addresses 1: **68 69 6a 6b 6c 6d 6e 6f** I²C Addresses 2: **58 59 5a 5b 5c 5d 5e 5f** I²C Addresses 3: **69 6b**	GND, 5V, SDA0, SCL0 I²C Addresses 1: **68 69 6a 6b 6c 6d 6e 6f** I²C Addresses 2: **58 59 5a 5b 5c 5d 5e 5f** I²C Addresses 3: **69 6b**	GND, 5V, SDA0, SCL0 I²C Addresses 1: **68 69 6a 6b 6c 6d 6e 6f** I²C Addresses 2: **58 59 5a 5b 5c 5d 5e 5f** I²C Addresses 3: **69 6b**
Selectable use of Raspberry Pi® RS232	GND, TXD0, RXD0 OFF(HiZ)	GND, TXD0, RXD0 OFF(HiZ)	GND, TXD0, RXD0 OFF (HiZ)
Selectable use of Raspberry Pi® GPIO **Optional**	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (System Shutdown initiator) GPIO_GEN18 (if IR receiver is used) GPIO_GEN4 (if 1-wire is used) None of GPIO used	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (System Shutdown initiator) GPIO_GEN18 (if IR receiver is used) GPIO_GEN4 (if 1-wire is used) None of GPIO used	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (System Shutdown initiator) GPIO_GEN18 (if IR receiver is used) GPIO_GEN4 (if 1-wire is used) None of GPIO used
Interactions with Raspberry Pi®			
Standard **Optional**	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (pulse replying and System Shutdown initiator) I²C and current measure	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (pulse replying and System Shutdown initiator) I²C and current measure	GPIO_GEN22 (pulse train generator) GPIO_GEN27 (pulse replying and System Shutdown initiator) I²C and current measure
Batteries and Charger			
Supported Batteries Types			
LiPO 3.7V with silicone high current cables			
	Standard - LiPO 450 mAh	Standard - LiPO 450 mAh	Standard - LiPO 450 mAh (dedicated to be used with Raspberry Pi Original Case)
	Optional - LiPO 4000 mAh	Optional - LiPO 4000 mAh	
		Optional - LiPO 8000 mAh	
LiFePO4 3.2V with silicone high current cables			
	Optional – LiFePO4 4000	Optional - LiFePO4 4000 mAh	
		Optional - LiFePO4 8000 mAh	
		Optional - LiFePO4 12000 mAh (due to big size of batter only on special order)	
Li-Ion 3.7V with silicone high current cables	Optional – Li-Ion 3200 mAh	Optional – Li-Ion 3200 mAh	Optional – Li-Ion 3200 mAh
Additional Batteries Options			

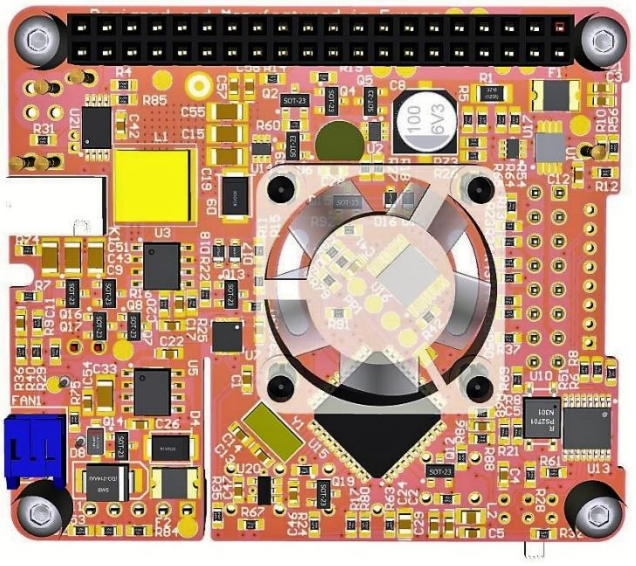
Pico Single LP/LF/Li-Ion 18650 Battery Holder **Pico Double Li-Ion 18650 Battery Holder**	Held 18650 single batteries (all supported types) up to 3200 mAh, with extra reverse polarity protection Held 18650 double batteries (ONLY LI-Ion Type) up to 3200 mAh, with extra reverse polarity protection	Held 18650 batteries (all supported types) up to 3200 mAh, with extra reverse polarity protection Held 18650 double batteries (ONLY LI-Ion Type) up to 3200 mAh, with extra reverse polarity protection	Held 18650 batteries (all supported types) up to 3200 mAh, with extra reverse polarity protection Held 18650 double batteries (ONLY LI-Ion Type) up to 3200 mAh, with extra reverse polarity protection
Battery Life Charge/Discharge Cycles			
LiPO	450 cycles	450 cycles	450 cycles
LiFePO4	2000 cycles	2000 cycles	2000 cycles
Li-Ion	300 cycles	300 cycles	300 cycles
Battery Charger			
	Standard - Continues fixed current 303 mAh	Automatic Dynamic Power Tracing (Voltage Proportional Charge Control – especially designed for Solar Cells support) Charger with charging current 100 mA – 800 mA, triggered by voltage changes on the 5V GPIO or External Power Source	Standard - Continues fixed current 303 mAh
Charging Modes			
LiPO	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging
LiFePO4	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging
Li-Ion	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging	Automatic Selected: Full Charging Cycle Trickle Charging
Battery Protection			
450 mAh	On board cut-off protection system when thermal, overcharge or over discharge	On board cut-off protection system when thermal, overcharge or over discharge	On board cut-off protection system when thermal, overcharge or over discharge
High Capacity Li-Ion, LiPO and LiFePO4	On board cut-off protection system when thermal, overcharge or over discharge On battery, PCM additional protection	On board cut-off protection system when thermal, overcharge or over discharge On battery PCM additional protection	On board cut-off protection system when thermal, overcharge or over discharge On battery PCM additional protection
Battery Electrical Isolation System	Battery is Electrically Isolated (however cable connected) until system start up for the first time and receive 5V from GPIO	Battery is Electrically Isolated (however cable connected) until system start up for the first time and receive 5V from GPIO or 7-28V from EXT	Battery is Electrically Isolated (however cable connected) until system start up for the first time and receive 5V from GPIO
Optional	Slide ON/OFF switch (external or internal), OFF always with File Save shutdown functionality	Slide ON/OFF switch (external or internal), OFF always with File Save shutdown functionality	Slide ON/OFF switch (external or internal), OFF always with File Save shutdown functionality
Battery Back-Up			
System Battery Backup	Standard – 5V 2.6A current continuous supply to Raspberry Pi via GPIO Pins	Standard – 5V 2.6A current continuous supply to Raspberry Pi via GPIO Pins	Standard – 5V 2.6A current continuous supply to Raspberry Pi via GPIO Pins
Auxiliary 5V and 3V3 Battery Backed Supply on PIco I/O Pins	Standard – 5V 750 mA current and 3V3 continuous supplies on PIco I/O Pin battery backed, with possibility to continuous supply auxiliary devices with Raspberry Pi disconnected. Total system current should not exceed 3A.	Standard – 5V 750 mA current and 3V3 continuous supplies on PIco I/O Pin battery backed, with possibility to continuous supply auxiliary devices with Raspberry Pi disconnected. Total system current should not exceed 3A.	Standard – 5V 750 mA current and 3V3 continuous supplies on PIco I/O Pin battery backed, with possibility to continuous supply auxiliary devices with Raspberry Pi disconnected. Total system current should not exceed 3A.
Battery Back-up Type			
UPS	UPS Standby Type, with switch over time of 250 uS, during switching time the protected system (Raspberry Pi®	UPS Standby Type, with switch over time of 250 uS, during switching time the protected system (Raspberry Pi®	UPS Standby Type, with switch over time of 250 uS, during switching time the protected system (Raspberry Pi®

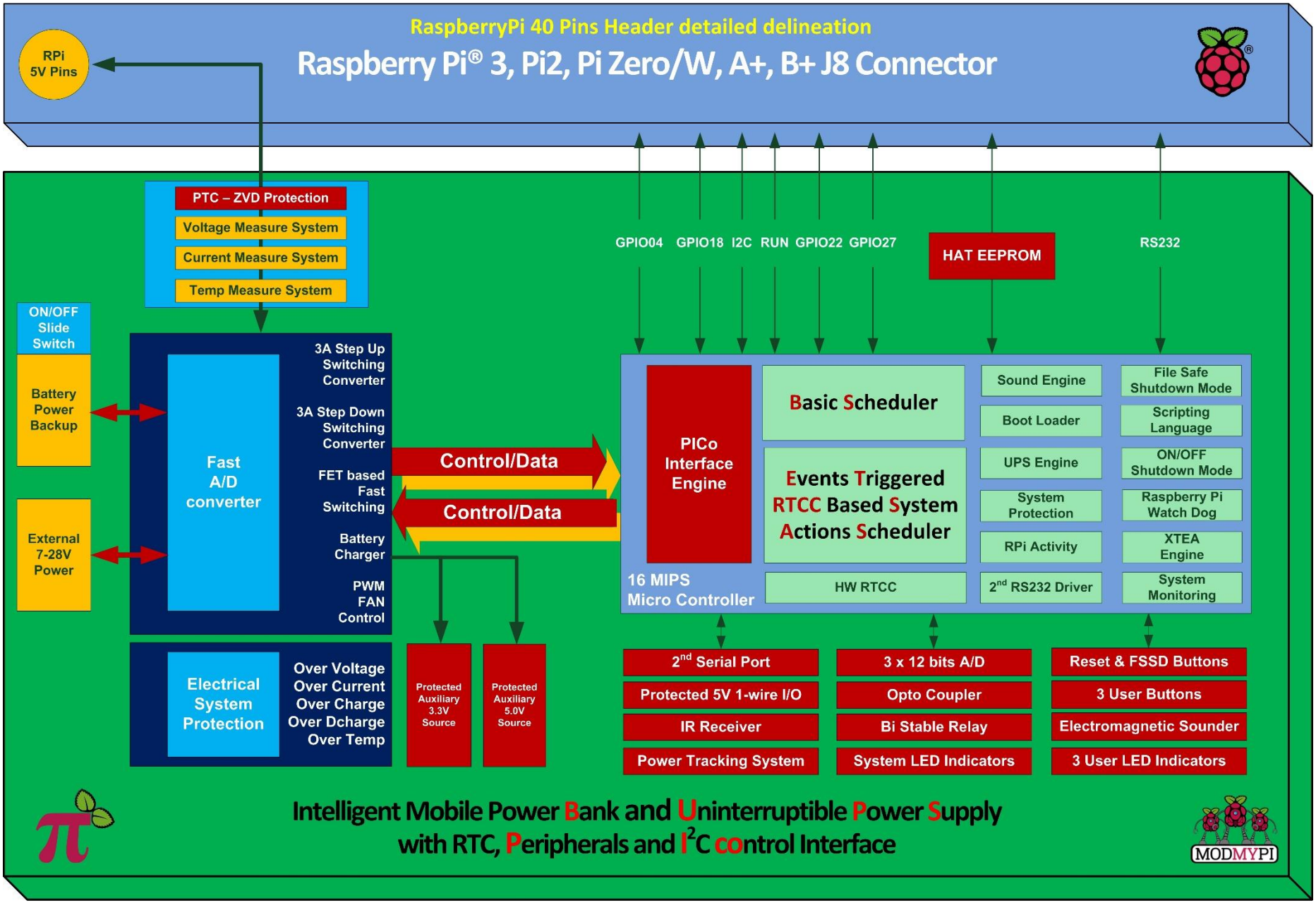
	with added hardware) is powered by auxiliary online power source for maximum 10mS, therefore no power gap on GPIO during switching time	with added hardware) is powered by auxiliary online power source for maximum 10mS, therefore no power gap on GPIO during switching time	with added hardware) is powered by auxiliary online power source for maximum 10mS, therefore no power gap on GPIO during switching time
Powering Monitoring Point	Raspberry Pi® GPIO 5V	Raspberry Pi® GPIO 5V	Raspberry Pi® GPIO 5V
UPS Activation Powering Triggers	GPIO 5V pins <=4.65V Proprietary Algorithm of Falling Power Peak Analysis	GPIO 5V pins <=4.65V Proprietary Algorithm of Falling Power Peak Analysis	GPIO 5V pins <=4.65V Proprietary Algorithm of Falling Power Peak Analysis
Cable Powering Reactivation	After 3s of continuously cable powering (without spikes)	After 3s of continuously cable powering (without spikes) on any cable power source (GPIO or External)	After 3s of continuously cable powering (without spikes)
Intelligent Mobile Power Bank			
Direct Battery Powering with Internal/External ON/OFF Slide Switch	ON/OFF Slide Switch with File Safe Shutdown functionality when switching to OFF (keep battery powering ON until system shutdown)	ON/OFF Slide Switch with File Safe Shutdown functionality when switching to OFF (keep battery powering ON until system shutdown)	ON/OFF Slide Switch with File Safe Shutdown functionality when switching to OFF (keep battery powering ON until system shutdown)
Cable Powering Sources			
Cable Powering Sources			
Raspberry Pi ® GPIO 5V Pins	2.6 A	2.6 A	2.6 A
External Power Source 7 - 28 VDC		3A max (adjusted according dynamic power tracking algorithm - Voltage Proportional Charge Control – especially designed for Solar Cells)	
Additional Features - Peripherals			
HAT Compliant			
HAT EEPROM	Exists	Exists	Exists
HAT Dimensions	Compliant	Compliant	Compliant
PIco I/O Interface			
Independent from Raspberry Pi ® 3.3 V supply @200 mA With battery Back-up (Raspberry Pi ® can be OFF when this power Auxiliary 3.3 V source is available)	Yes	Yes	Yes
ESD Protected True 5V 1-wire interface	Yes	Yes	Yes
Independent from Raspberry Pi ® 5.0 V supply @750 mA With battery Back-up (Raspberry Pi ® can be OFF when this power Auxiliary 5 V source is available)	Yes	Yes	Yes
12 Bit A/D converters ESD protected, pre-scaled to 5V, 10V, 20V and 30V (on TB PCB) with Sampling rate 100K SPS, buffered	Yes	Yes	Yes
3V3/5V0 RS232 Port that can be programmed as: primary Raspberry Pi® Port Secondary (independent from the existing on Raspberry Pi®)	Yes	Yes	Yes
Optical Isolated Interface (readable as digital or analog)	none	Yes	none
Primary 3 Pin Bi-stable (Zero Power) Relay Interface Rating (resistive) Maximum Switching Current/Voltage on Terminal Block Current/Voltage on 16 Pin Header	Yes (Optional) with two galvanic isolated independent contacts DPDT 1A/30V with single high current contacts SPDT 2A/30V	Yes (Standard) with two galvanic isolated independent contacts DPDT 1A/30V	Yes (Optional) with two galvanic isolated independent contacts DPDT 1A/30V with single high current contacts SPDT 2A/30V

		with single high current contacts SPDT 2A/30V	
PIco Terminals Block Extension PCB (Supplied separately)			
12 V RS232 converter attached to primary or secondary Serial Port	Yes (Optional with TB PCB)	Yes (Optional with TB PCB)	Yes (Optional with TB PCB)
Terminal Block on Each PIco I/O Interface listed above	Valid only for existing Interfaces	Valid only for existing Interfaces	Valid only for existing Interfaces
PIco Plus Terminal Block Standard Interface			
DC in 7 – 28 V with Power Tracking	none	Yes	none
Secondary 3 Pin Bi-stable (Zero Power) Relay Interface	Optional if Relay Installed	Yes	Optional if Relay Installed
Hardware User Interface			
System LEDs Indicators	UPS, BAT, CHG, INF, FAN	UPS, BAT, CHG, INF, FAN, EXT	UPS, BAT, CHG, INF, FAN
User LEDs Indicators	Blue, Green, Red With capability to connected external LEDs	Blue, Green, Red With capability to connected external LEDs	Blue, Green, Red With capability to connected external LEDs
System Keys	RPiR, UPSR, FSSD	RPiR, UPSR, FSSD	RPiR, UPSR, FSSD
User programmable Keys	AKEY, BKEY, CKEY	AKEY, BKEY, CKEY	AKEY, BKEY, CKEY
External Connectivity to PIco Keys	FSSD, AKEY, BKEY, CKEY With capability to connected external KEYs) ON/OFF slide Switch	FSSD, AKEY, BKEY, CKEY With capability to connected external KEYs) ON/OFF slide Switch	FSSD, AKEY, BKEY, CKEY With capability to connected external KEYs) ON/OFF slide Switch
Audio Interface	Electromagnetic Transducer, with programmable sound duration and frequency, able to play music	Electromagnetic Transducer, with programmable sound duration and frequency, able to play music	Electromagnetic Transducer, with programmable sound duration and frequency, able to play music
Other Features			
Battery Backed Hardware Real Time Clock and Calendar	Yes Only when UPS (power cycling is used)	Yes Only when UPS (power cycling is used)	Yes Only when UPS (power cycling is used)
Bi-Stable (Zero Power) Relay	Yes (optional)	Yes	Yes (optional)
Passive Cooling System	Based on multiple copper layers thermal pipes for heating dissipation	Based on multiple copper layers thermal pipes for heating dissipation	Based on multiple copper layers thermal pipes for heating dissipation
Automatic Active Cooling System (FAN)	Yes (optional if FAN installed) based on temperature of the Raspberry Pi® PCB read by separate external Sensor	Yes (optional if FAN installed) based on temperature of the Raspberry Pi® PCB read by separate external Sensor	Yes (optional if FAN installed) based on temperature of the Raspberry Pi® PCB read by separate external Sensor
Automatic File Safe Shutdown Functionality	Yes	Yes	Yes
Raspberry Pi® Reset via POGO Pin	Yes	Yes	Yes
Automatic Restart on Power Return	Yes	Yes	Yes
Events Triggered RTCC Based System Actions Scheduler	Yes	Yes Extended on more Events	Yes
Real Time Raspberry Pi® current measure	Yes (both ways) Incoming to UPS PIco Outgoing from UPS PIco	Yes (both ways) Incoming to UPS PIco Outgoing from UPS PIco	Yes (both ways) Incoming to UPS PIco Outgoing from UPS PIco
Real Time Battery Capacity Measure	Yes (based on System current consumption)	Yes (based on System current consumption)	Yes (based on System current consumption)
Secondary Serial Port (based on software driver)	Yes (future firmware option)	Yes (future firmware option)	Yes (future firmware option)
IR interface	Yes	Yes	Yes
Optimized design for a very low noise A/D operation	Yes Split grounds, extended Improved filtering on PSU High Speed Separate Tracing	Yes Split grounds, extended Improved filtering on PSU High Speed Separate Tracing	Yes Split grounds, extended Improved filtering on PSU High Speed Separate Tracing
Optimized Ultra Low Power design for a long time Battery System Operation	Yes	Yes	Yes

XTEA Encryption	Yes	Yes	Yes
Extended Raspberry Pi® Watch-Dog (Still Alive)	Yes	Yes	Yes
System Monitoring	Battery Voltage, Raspberry Pi® Voltage, Current Consumption by Raspberry Pi® and PIco, Temperature	Battery Voltage, Raspberry Pi® Voltage, External Voltage, Current Consumption by Raspberry Pi®, Temperature	Battery Voltage, Raspberry Pi® Voltage, Current Consumption by Raspberry Pi® and PIco, Temperature
I2C PIco Programmer Interface	Yes	Yes	Yes
RS232 @command Interface on Primary and Secondary Serial Port	Yes	Yes	Yes
Bootloader for Live Firmware Update	Yes	Yes	Yes
PCB Construction			
PCB Manufacturing	4 Layers, 2 OZ Copper, 8mils/8mils Immersion Gold Plated PB Free alloy assembly	4 Layers, 2 OZ Copper, 8mils/8mils Immersion Gold Plated PB Free alloy assembly	4 Layers, 2 OZ Copper, 8mils/8mils Immersion Gold Plated PB Free alloy assembly






RaspberryPi 40 Pins Header detailed delineation
Raspberry Pi® 3, Pi2, Pi Zero/W, A+, B+ J8 Connector
RPi 5V Pins
PTC – ZVD Protection
Voltage Measure System
Current Measure System
Temp Measure System
GPIO04
GPIO18
I2C
RUN
GPIO22
GPIO27
HAT EEPROM
RS232
ON/OFF Slide Switch
Battery Power Backup
External 7-28V Power
Fast A/D converter
3A Step Up Switching Converter
3A Step Down Switching Converter
FET based Fast Switching
Battery Charger
PWM FAN Control
Control/Data
Control/Data
PICo Interface Engine
Basic Scheduler
Events Triggered RTCC Based System Actions Scheduler
16 MIPS Micro Controller
HW RTCC
Sound Engine
Boot Loader
UPS Engine
System Protection
RPi Activity
2nd RS232 Driver
File Safe Shutdown Mode
Scripting Language
ON/OFF Shutdown Mode
Raspberry Pi Watch Dog
XTEA Engine
System Monitoring
Electrical System Protection
Over Voltage
Over Current
Over Charge
Over Dcharge
Over Temp
Protected Auxiliary 3.3V Source
Protected Auxiliary 5.0V Source
2nd Serial Port
Protected 5V 1-wire I/O
IR Receiver
Power Tracking System
3 x 12 bits A/D
Opto Coupler
Bi Stable Relay
System LED Indicators
Reset & FSSD Buttons
3 User Buttons
Electromagnetic Sounder
3 User LED Indicators
Intelligent Mobile Power Bank and Uninterruptible Power Supply
with RTC, Peripherals and I2C control Interface
MODMYPI