UPS PIco HV4.0B

**The Ultimate Power Management System with RTC,
Enhanced Peripherals and I²C control Interface
Intelligent Mobile Power Bank**

Frequently Asked Questions & Answers

Question: What is UPS PIcoHV4.0B?
Answer: The UPS PIcoHV4.0B is an Ultimate Raspberry Pi Power Management System, that also contains the UPS functionality, as in addition a plenty of peripherals integrated in a functional single PCB HAT covering most of possible needs of build-up application based on Raspberry Pi ®. It has been especially designed for Raspberry Pi 4® however is compatible with all former models of Raspberry Pi ®.

Question: How many versions of UPS Pico HV4.0B are available?
Answer: There are 3 versions addressed to different applications sets: **UPS PIco HV4.0B Stack**, **Advanced** and **Passive PoE**. Detailed specifications and differences between all versions are available here.

Question: What integrated peripherals are offered by UPS Pico HV4.0B
Answer: There are a plenty of them, the huge list of them is included here.

Question: Is it possible to add some peripherals from one to other version?
Answer: Yes, but not all of them. Basically, all the THT parts. Users need to decide before buy what model covers better his applications needs. In example Version UPS Pico HV4.0B Stack can be equipped in additionally with DPDT Relay, or Super Capacitor but cannot be equipped afterword with Passive PoE functionality.

Question: What is the back-up current offered by UPS PIco HV4.0B to the Raspberry Pi®?
Answer: Due to new very advanced boost converter the UPS PIco HV4.0B offers continuously supply of **3.2A@5.25V** from any Battery/Super Capacitor source.

Question: What power Back-up sources can be used in the UPS PIco HV4.0B?
Answer: The UPS PIco HV4.0B can be used with various Chemistry Batteries or Super Capacitor(s) or both at the same time.

Question: What chemistry batteries can be used with UPS PIco HV4.0B?

Answer: The UPS PIco HV4.0B can charge and use most of the Available Chemistry Batteries like: Lithium Polymer, LiFePO4, Li-Ion, NiMH, SAL, as also 2.8V Super Capacitor. By default (pre-selected), it is provided with LiPO battery 450 mAh 15C. However, during the ordering process user can change this battery to another one or even order without battery.

Question: What is the battery charging current?

Answer: All batteries are charged with a dedicated algorithm. The maximum charging current is 1A (1000mA) however it is changing dynamically adopting to power supply conditions (i.e. Solar cells).

Question: What is and what are the benefits of Super Capacitor?

Answer: Super Capacitor is a dedicated technology of power storage device that has an extremely long live. It is calculated from 500K to 1M of Charge/Discharge cycles. In comparison with any other chemistry battery, it is thousands of time longer lifetime! However due to stored energy it is limited only to relatively short time running applications.

Question: What other benefits has the Super Capacitor?

Answer: Except of practically unlimited number of Charge/Discharge cycles the working temperature of Super Capacitor is significantly extended in comparison with batteries. It can be used from -25 up to +75 Celsius degrees.

Question: If Raspberry Pi® is Power Backed up with Super Capacitor 100F only, how long will be running if cable power is absent?

Answer: Due to limited capacity of power storage of the Standard offered 100F Super Capacitor, powering of the Raspberry Pi® System will be running about 50-60 seconds if system current draws of 1A. This allows to proper shutdown of any application. Depending to System requirements for current draw it can be supplied longer or shorter time. As the UPS PIco HV4.0B, is equipped with hardware high side current and voltage monitor with power calculation, user is informed in real time about available running time on Super Capacitor (stored energy).

Question: What I must do if my Applications need more time than offered by Super Capacitor.

Answer: Use in addition (standard preselected/included) battery, the 450 mAh. Their capacity allows your system to run for about 5-7 minutes. If your system running time requirements are longer, then use higher capacity battery so running time could be even many, many hours. Alternatively, user can use Super Capacitor Bank of 300F or 500F or both of them (Bank of Super Capacitors and High-Capacity Batteries). All options are possible.

Question: Can I use Super capacitor and Battery at the same time.

Answer: Yes. This is an option that is implemented ONLY in the UPS PIco HV4.0B and allows you to increase the battery lifetime. It is working as the Super Capacitor is used for a short cable power loss and if cable power loss is longer then system is automatically switched to battery power back up. Also, if stored energy in the Super Capacitor is not enough, then system decided

automatically to use only the battery on that cases instead of Super Capacitor. This implementation significantly improves the time life of the battery as decreases the real number of full charge/discharges cycles of battery. Switching time between Super Capacitor and battery is less than 1uS (without any power gap for the system)

Question: What is the charging current and how long Super Capacitor is going to be fully charged?
Answer: The charging current is dynamically charged and using an additional buck (step down) converter that converts the 5V of Raspberry Pi® to Super Capacitor charging voltage and adjusting the current according to the Super Capacitor voltage level. Full charging of the Super Capacitor of 100F takes about 2-3 minutes, however it is usable already at 50% of charge.

Question: What happens if battery is not available and Super Capacitor is still not fully charged?
Answer: User is on real time informed about status of charging of Super Capacitor. Therefore, writing data to the SD card can be performed only if/when Super Capacitor is fully charged. In addition, the Raspberry Pi® can be halted when starting up, until the Super Capacitor will be charged for the first time. If the cable powering system is too poor and has powering breaks so often then we do not recommend using Super Capacitor of 100F or use bigger one (300F or 500F) or use it with combination with battery.

Question: What Cable Power Sources I can use for my system with UPS PIco HV4.0B?
Answer: The UPS PIco HV4.0B (depending to version) can be supplied with cable power on various sources. The main (available on all versions) is the GPIO 5V. This is monitored and power back up is running as Line-Interactive UPS with response time of 25 uS max.

Question: What other Cable Power Sources I can use for my system with UPS PIco HV4.0B instead of the GPIO 5V?
Answer: All versions of the UPS PIco HV4.0B can be supplied with the GPIO 5V. In addition (and can be used together with GPIO 5V at the same time), the UPS PIco HV4.0B Advanced can be powered with 5.5V-32V EPR input, and the UPS PIco HV4.0B Passive PoE with 5.5V – 28 VDC (recommended 15V or 24VDC) over the Ethernet.

Question: What is the Magic Switch and what is the purpose to use it?
Answer: The Magic Switch is switching the UPS PIco HV4.0B/Raspberry Pi® model ON and OFF. It is smart and each switch OFF is going safe shutdown Raspberry Pi® before power is cut-off. Therefore, user do not need to worry about corrupted cards. It can be used if system is powered with battery, so acts as Intelligent Mobile Power Bank or If cable powered. There is also an especially important advantage of the Magic Switch. If system is powered via Raspberry Pi® USB cable, the Raspberry Pi® will be also switched OFF, as by using the PE POGO pin it disables the Raspberry Pi® PSU on its PCB.

Question: When I switch OFF the system with the Magic Switch is the embedded RTC still running?

Answer: Yes, the UPS PIco HV4.0B has running RTC even is the system is switched OFF by Magic Switch and even if battery powered only.

Question: Can I use external Slide ON/OFF Switch?
Answer: Yes, any external Slide Switch can be used on this place connected with cables.

Question: What type of UPS has been implemented in the UPS PIco HV4.0B Stack?
Answer: The UPS PIco HV4.0B Stack is interacting (monitoring) only the GPIO 5V pins. In case of absence of 5V cable power on the GPIO 5V pins the UPS PIco HV4.0B is automatically switching the battery power back up. This kind of UPS power back up is named as Line-Interactive UPS, and the response time (switching to Battery backup) takes 25uS.

Question: What type of UPS has been implemented in the UPS PIco HV4.0B Advanced and Passive PoE?
Answer: The UPS PIco HV4.0B Advanced and Passive PoE have implemented 2 different types of UPS functionality. The first one is used when it is powered via Raspberry Pi ® GPIO 5V and is like the version Stack, we called it Line Interactive. The second UPS Type is when system is powered via dedicated EPR 5.5-32V input and this is called Online UPS.

Question: Can I power UPS PIco HV4.0B Advanced and Passive PoE System via both cable power sources (GPIO 5V and EPR 5.5-32V/PPoE)?
Answer: Yes, both cable power inputs are "isolated" with high current ZVD circuit, so both can be connected at the same time. If one of cable power will be missing, then system will continue working with other one. If both are missing, then system will select automatically one of the implemented UPS Power Back up and activate it.

Question: Can I power UPS PIco HV4.0B Advanced via only one cable power EPR 5.5-32V?
Answer: Of course, YES!

Question: Can I power UPS PIco HV4.0B Advanced via only one cable power GPIO 5V?
Answer: Of course, YES!

Question: Can I power UPS PIco HV4.0B PPoE via only one cable power PPoE?
Answer: Of course, YES!

Question: Can I power UPS PIco HV4.0B PPoE via only one cable power GPIO 5V?
Answer: Of course, YES!

Question: What is recommended powering on voltage for the UPS PIco HV4.0B Advanced?
Answer: The UPS PIco HV4.0B Advanced can be powered with 5.5V-32V DC and can source up to 4A @5V.

Question: What Kind of protection has been implemented in the UPS PIco HV4.0B Advanced?

Answer: The UPS PIco HV4.0B Advanced can be powered with 5.5V-32V DC, and has implemented ESD protection, PPTC Fuse protection as also Zero Loss Inverse Polarity Protection.

Question: What additional functionality offers the UPS PIco HV4.0B PPoE?
Answer: UPS PIco HV4.0B PPoE (Passive PoE) offers an additional cable powering via Ethernet.

Question: What kind of protections has the UPS PIco HV4.0B PPoE?
Answer: UPS PIco HV4.0B PPoE has implement on the PPoE input 4 level of protections: ESD protection directly on Ethernet PoE Pins (4 pins header), Reverse polarity protection on them as also PPTC fuse, and finally Additional ESD protection on 28V.

Question: What is recommended powering on voltage for the UPS PIco HV4.0B PPoE?
Answer: It has been designed to be used with 5.5-24V, however it can be powered up to 28V. Therefore, any PPoE injector offering 15V or 24V is full operable.

Question: Can I use the UPS PIco HV4.0B PPoE Active PoE?
Answer: No! It will activate the PPTC fuse, and disconnect from the powering, it also can cause damage of the PPoE circuits. It is not allowed to use Active PoE on Passive PoE devices like UPS PIco HV4.0B PPoE.

Question: I see additional Terminals Block on the UPS PIco HV4.0B PPoE, can it be used for powering?
Answer: Yes. The UPS PIco HV4.0B PPoE can be powered at the same time from the GPIO 5V, and one of the other sources EPR or PPoE. However, the EPR is downgraded to 28VDC.

Question: Do I need any additional cabling when using the UPS PIco HV4.0B PPoE?
Answer: No, it is just plug and play for the hardware. It is not needed any additional cabling as system is powered via 4 pins PoE header of the Raspberry Pi®

Question: What cases can be used with UPS PIco HV4.0B and Raspberry Pi® based system?
Answer: Due to absence of external Cable Power inputs of Models UPS PIco HV4.0B Stack and UPS PIco HV4.0B Passive PoE (they are powered by via Raspberry Pi® USB or Ethernet) practically 99% of available cases are fine with this system. However, some cases can be incompatible due to height or thermal issues. Our Company strongly suggest using the well proven ThePiHut cases like this or this with the heigh extension if needed.

Question: OK. The UPS PIco HV4.0B Stack and UPS PIco HV4.0B Passive PoE do not need additional holes for cable powering, what about the UPS PIco HV4.0B Advanced, as it need input for the 5.5V-32V DC?
Answer: For the version UPS PIco HV4.0B Advanced we developed a special Pi Block Case the has the proper slots for the EPR cable powering but is has also additional slots that can be used for the Terminals Block PCB as also an additional external User Buttons and External ON/OFF Slide Switch. This case can be used with all UPS PIco HV4.0B Versions. More info about it is here

Question: Can I power my system with Solar Panel?

Answer: Yes, the EPR power input accept powering form (5.5V-32VDC) with automatic (dynamic change of battery charging current) according to existing sun conditions. Due to extended voltages capability, it can accept any industrial Solar Panel

Question: What is Bootloader?

Answer: Bootloader is an embedded piece of code that is placed in the UPS PIco HV4.0B microcontroller protected internal memory and allows to load new version of firmware remotely or locally. The bootloader guarantee that your system firmware is up to date all the time.

Question: The UPS PIco HV4.0B is advertised with 2 Bootloaders, do I need to have 2 types of bootloaders?

Answer: Yes, there are two Bootloaders: Local and Remote. The local bootloader is invoked by pressing 2 keys and can be used if there is a physical access to the UPS PIco HV4.0B. The remote bootloader is used when UPS PIco HV4.0B system is placed away for the user and is invoked by remote command send via SSH. Both versions are implemented in the UPS PIco HV4.0B. As the local bootloader is invoked by pressing of 2 keys (UR + F) then it can be used for a critical situation when something gone wrong with the remote firmware uploading.

Question: How the UPS PIco HV4.0B is interacting with Raspberry Pi®

Answer: The UPS PIco HV4.0B must interact with Raspberry Pi®, in order to recognize if Raspberry Pi is running or not, force shutdown, or update the RTC, send email on event, etc. For that reason, is used a threading-based System.d exceptionally light daemon.

Question: Do the UPS PIco HV4.0B is using any of the Raspberry Pi® J2 connector pins?

Answer: No. For the interaction of the UPS PIco HV4.0B with Raspberry Pi® is used exclusively the I^2C interface. Therefore, all other pins are free for user applications. Due to implemented of a very adaptive addressing scheme, user can use various I2C addresses to avoid any collision with other hardware using Raspberry Pi®I2C.

Question: How I can access the UPS PIco HV4.0B embedded peripherals from outside world?

Answer: The UPS PIco HV4.0B provide an extremely easy access to all embedded peripherals by the additional I/O header 2x10 pins 2mm. In addition, the embedded DPDT relay is accessed via dedicated High Current Terminals Block.

Question: How many buttons have UPS PIco HV4.0B and how many buttons are available for the user applications?

Answer: The UPS PIco HV4.0B contains 5 buttons and from them 2 are Reset, 1 is File Safe Shutdown/Wakeup and 2 are exclusive for user applications. Except of the Reset Buttons, the other 3 are routed to the I/O header 2x10 pins 2mm. All buttons routed to I/O header are ESD protected with appropriate TVS.

Question: How many and what specifications are the offered by UPS PIco HV4.0B A/D converters?

Answer: The UPS PIco HV4.0B offers 2 separated A/D Converters. They are SAR, 12 bits and the conversion rate is 200 KSPS. They are powered with dedicated noise filtered LDO. Both are rated to 5V and buffered with Voltage Follower in order to provide high impedance to the measured source. Both A/D are routed to the I/O header and protected with ESD protection.

Question: What software filtering is offered to the A/D converters?

Answer: The A/D data are available as raw data (as red from the A/D converter), but also filtered by firmware rolling buffer and Olympic filter.

Question: What accuracy are the A/D readings?

Answer: As the A/D reference has been used the VDD, so the accuracy is about 1% on that, in addition user need to take in to account that there is a voltage divider with resistors accuracy of 0.5%. Therefore, the total accuracy should be estimated to 1.5-2%.

Question: Can I read higher voltages than 5V with existing A/D converters?

Answer: Yes, but you need to add a voltage divider done by yourself. Such dividers are offered also by the Terminals Block PCB.

Question: What is the accuracy of the UPS PIco HV4.0B embedded RTC?

Answer: The standard UPS PIco HV4.0B is equipped with crystal 32.768 kHz with stability of 20ppm. However, user has an option to use a dedicated TXCO (Temperature Compensated Crystal Oscillator) with increased stability of 1.5ppm added during the ordering process.

Question: Can I play sound with UPS PIco HV4.0B?

Answer: Yes, there is implemented PWM transducer interface. It can be added with a very low-cost during ordering process. This audio interface can generate standard sounds of operational UPS PIco HV4.0B but also play musing as it is totally programmable.

Question: What about passive/active cooling of the UPS PIco HV4.0B?

Answer: These enhanced thermal requirements of the Raspberry Pi 4® forced the new designed UPS PIco HV4.0B to have much better thermal response with passive and active cooling. In order to cover the passive cooling, the UPS PIco HV4.0B PCB has been designed with 8 layers with cooling planes and a huge number of cooling vias (moving heating from bottom to top). In addition, there is added slow PWM FAN with variable rotation. The temperature from of the Raspberry Pi is read directly from the Pi processor core and the if exceed the threshold rotation speed of FAN is automatically adjusted as far the temperature is increasing. This mechanism guarantee that the possible FAN noise will be always as low as possible. There is also a temperature sensor on the UPS PIco HV4.0B PCB and FAN activity is adjusted if one of the temperature sensors (Pi or PIco) increases above the threshold. The Cooling FAN if offered as a standard for the version Advanced and PPoE and as optional for the version Stack

Question: My Application need to have remote (cabled) temperature 1-wire sensor, how I can handle it?

Answer: Very Easy, as there is embedded ESD protected, 3/5V 1-wire interface routed directly to the GPIO04 or the Raspberry Pi® connector. So, just take it and use it. The 1-wire as also powering for it (3V3 or 5V0) are available on the I/O connector of the UPS PIco HV4.0B on all versions.

Question: My Application need to have connected (read) I/O pin of remote system that has a separated and different grounding system, how can I handle this with UPS PIco HV4.0B in order to avoid ground loops?

Answer: Very Easy, we have implemented an embedded Opto-Isolator that guarantee galvanic isolation between platforms (the Raspberry Pi® bases system and remote one). This option is valid for the UPS PIco HV4.0B Advanced and PPoE.

Question: Can I use the UPS PIco HV4.0B with application that need to be used UR receiver?

Answer: The UPS PIco HV4.0B has a ready to use IR interface that is directly routed to the GPIO18. Any application that user IR can be easy implemented.

Question: Can I use the UPS PIco HV4.0B with application that need to be used DPDT Relay?

Answer: Applications that need to switch higher currents (up to 2A@32VDC) can be implemented within the same PCB as the UPS PIco HV4.0B Advanced and PPoE offer it as a standard option, for the UPS PIco HV4.0B Stack the DPDT Relay need to me ordered separately.

Question: The Raspberry Pi 4 ® has implemented a plenty of RS232 interfaces. I need to use some of them, but I need to add a separate HAT with +/-12V interfaces?

Answer: The UPS PIco HV4.0B took care for you, and in all versions offers a programmable double RS232 interface. It can be programmed by user and handle (always 2 of them) one of the following Raspberry Pi 4 serial interfaces serial0, serial2, serial4, serial5. If not used, then set to HiZ and not interfacing with any GPIO Pin.

Question: What about the serial0 port (GPIO14/15) can I use it for my applications?

Answer: Yes, the serial0 has a "special position" on the UPS PIco HV4.0B. It is used for firmware upload, it is used for optional monitoring of the system by serial messages in addition to I^{2}C, it can be routed to 12V driver, or it can be monitored by UPS PIco HV4.0B or can be free from any of these activities. The serial0 port (GPIO14/15) is routed to the I/O header two time. As 3V3 pins (these pins are 5V0 tolerant) and as driven 12V. On both cases they are ESD protected. It is up to user what needs do he has and how he uses it.

Question: I would like to know the current consumption of my system. What options do I have?

Answer: The UPS PIco HV4.0B has implemented hardware high side double way current monitor. On the version stack it is single and monitor only the incoming or outgoing current on GPIO 5V, on the version Advanced and PPoE it is double, and it is monitoring in addition the current on other cable powering sources (EPR 5.5-32VDC and PPoE 5.5-28VDC).

Question: I would like to know the voltage on the EPR (5.5V-32VDC), on the PPoE (5.5V-28VDC), on the GPIO 5V on battery etc. What options do I have?

Answer: The UPS PIco HV4.0B has an embedded high accuracy measuring system, so user can at any time read these values and many more by reading the I^2C registers or send them by email.

Question: What is shut-down and wake-up on event?

Answer: Normally the UPS PIco HV4.0B shut-down and wake-up on cable power presence, or F button pressed. However, in the new UPS PIco HV4.0B has been implemented an additional mechanism that allows your system to force shut-down and wake-up on other than powering or key events. It can force shut-down and wake-up on external events like i.e., RS232 activity (dedicated codes), so if the system receive in example code 0xFABCFABC system will start shutting down, and similarity if receive the similar codes system will wake up. The events can be set to I/O pin, Opto-Isolator, A/D(s) value, time, date, cable powering voltage level (i.e. if EPR is lower than 12V system will shut down and wake up if it is higher than), temperature of Raspberry Pi or PIco PCB, etc.

Question: What is Time Scheduler and what is the purpose to use it?

Answer: The UPS PIco HV4.0B is equipped with time scheduler and it can be used to wake-up or shut-down on/during requested time and/or date.

Question: The UPS PIco HV4.0B is advertised that has 2 User LEDs. How can I use them?

Answer: The UPS PIco HV4.0B has 2 User LEDs that can be also externally accessed via I/O. There is no need to connect resistors on them. In addition, there is Mapping procedure that allows to map any of vital functionality of the system to them.

Question: What is the email broadcasting and what is the usability of this feature?

Answer: The UPS PIco HV4.0B has installed email system that can spread some vital information: when system is going to shut-down or wake-up, the level of the powering sources, battery, current or temperature as also level of A/D etc.

Question: What is the XTEA encryption and what is the usability of that

Answer: The XTEA is used to protect user software developments from non-approved copying. This option is activated for free and on user request. This include also a serial number for each device.

Question: Do the UPS PIco HV4.0B schematic is offered?

Answer: Yes, our company is offering for free the root schematic in PDF format that allows user to have a detailed idea how the system is developed and working.

Question: What CAD/CAM tool has been used for designing of the UPS PIco HV4.0B?
Answer: The UPS PIco HV4.0B has been designed with [Altium Designer 20](#) and analyzed the PCB with their [PDA analyzer](#). PDN Analyzer allows to identify and resolve multi-network DC voltage and current density issues. Our company is providing a detailed result of this analysis.

Question: What language has been used for firmware development?
Answer: The UPS PIco HV4.0B firmware ware has been written in C with some time critical parts is Assembly.

Question: How is the UPS PIco HV4.0B manufactured?
Answer: Due to increased thermal/current/noises requirements of Raspberry Pi 4® the PCB of the UPS PIco HV4.0B follows special rules for their construction. It is 6 layers, with a huge grounding and colling planes, full of thermal vias able to transfer heat from itself or Raspberry Pi® to top layers (passive cooling). Enhanced ground planes and power filtering for the integrated A/D converters. Finally, due to current requirement is manufactured with 2oz copper.

Question: Why the UPS PIco HV4.0B is so low cost if compare quality of design (used CAD/CAM tools), peripherals and functionalities with other similar devices available on the market?
Answer: The UPS PIco HV4.0B is manufactured in Europe, so there are no customs between our company and manufacturer, in addition our company stuff has a huge experience in design/development and manufacturing of electronic products. Each part or functionality has been very carefully analyzed, and a proper part selected in order to offer the best possible result in a lowest possible cost.