M3-ATX PSU technical notes No.4.

M3-ATX PSU

TIMING DIAGRAMS

**Knowledge base about operation modes
And other functions of the PSU**

● M3-ATX PSU's operating mode selection

First of all you must take care to select the wanted operation mode. There are **five** different modes (P0 to P4) of operation, which can be selected with different jumper combination.

● Short description of operating modes (please read carefully)

P0: In this mode, the M3-ATX behaves like a regular ATX power supply.

P1: Sends ON pulse to motherboard when ignition is ON for more than 2 seconds, sends OFF pulse to motherboard **5 seconds** after ignition is turned off. Waits another **1 minute** and then shuts down 5VSB to conserve battery. In this mode, the M3-ATX consumes less than 0.5mA. **This is our recommended setting.**

P2: Sends ON pulse to motherboard when ignition is ON for more than 2 seconds, sends OFF pulse to motherboard **60 seconds** after ignition is turned off. Waits another **5 minutes** and then shuts down 5VSB to conserve battery.

P3: Sends ON pulse to motherboard when ignition is ON for more than 2 seconds, sends OFF pulse to motherboard **30 minutes** after ignition is turned off. Waits another **2 hours** and then shuts down 5VSB to conserve battery.

P4: Can be set to any value. Setting can be done via an optional serial cable. (Default values for P4 are Off-delay=2hours, Hard-off=30sec)

LINK BETWEEN JUMPER POSITIONS AND OPERATION MODES:

P0		DUMB PSU mode (regular ATX PSU)
P1		OFF delay 5sec / Hard OFF 1min
P2		OFF delay 1min / Hard OFF 5min
P3		OFF delay 30min / Hard OFF 2hour
P4		OFF delay 2hrs/ Hard OFF 2hrs (user settable)

● How to connect M3-ATX to a motherboard?

Please connect the M3-ATX PSU in the motherboard's ATX power connector outlet and push downward until the fixing claw clicks. Now connect the additional wire harness for motherboard ON/OFF switch and Thump control to the M3-ATX PSU's jumper block (see the diagram below).

Check and find the motherboard's ON/OFF switch pinout and make the connection between the M3-ATX ON/OFF switch poles (red and black wire pair)

Motherboard ON/ OFF Switch pole A

THUMP Signal Output   Motherboard ON/ OFF Switch pole B
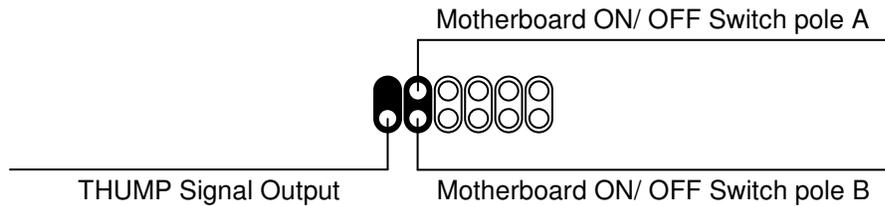
and this pinouts.

- ● **IMPORTANT NOTE!** Without this connection the M3-ATX will NOT BE ABLE to control the motherboard in P1, P2, P3 and P4 modes.

Using THUMP signal (white wire) is optional. If used please connect to the car's audio amplifier remote ON/OFF connector.

● P0 Mode of operation, timing diagram

In this mode the M3-ATX behaves like a regular ATX power supply with an added function: gratuitous ON pulse sent to motherboard if the PSU's ON/OFF wires are connected to the motherboard's ON/OFF pinouts.
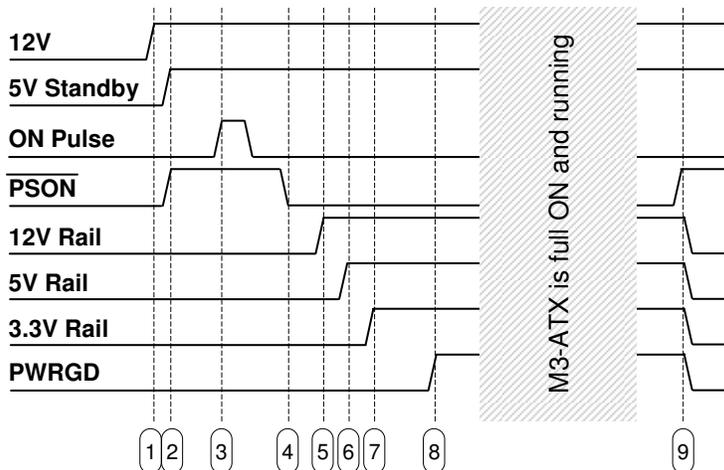
1. Primary PSU is starting
2. M3-ATX 5V Standby starts
3. M3-ATX gives the gratuitous ON pulse
4. Motherboard reacts with the PSON signal
5. M3-ATX 12V rail is starting
6. M3-ATX 5V rail is starting
7. M3-ATX 3.3V rail is starting
8. M3-ATX Power Good signal is coming ON
9. Motherboard shuts down the M3-ATX (rails and PWRGD becomes off, except 5V Standby)
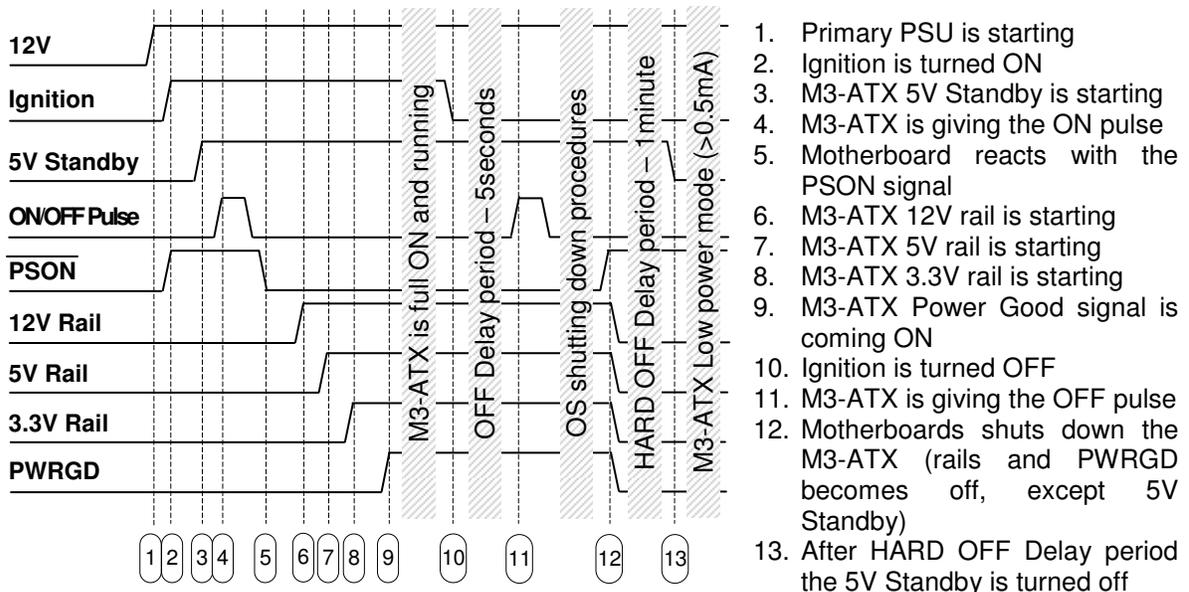
● P1 Mode of operation, timing diagram

In this mode M3-ATX sends ON pulse to motherboard when ignition is ON for more than 2 seconds. After ignition is turned off first time since the PSU running the PSU waits **1 minute** in case of the user changes his mind and turns back ON the ignition. If the ignition remains turned off in this extra 1 minute timeout the PSU sends OFF pulse to motherboard after **5 seconds later**. As a result in P1 mode the PSU begins to turning off the motherboard after a total time of ~1 minute and 5 seconds.

There are a total of **3 retries** to shutting down the motherboard. The timeout between two retries is **10 seconds**. After all retries timeout periods were spent and the motherboard hesitates to respond in this time the PSU shuts down its rails (12V, 5V and 3.3V). Only the 5VSB remains ON.

Waits another **1 minute** and then shuts down 5VSB to conserve battery. In this mode, the M3-ATX consumes less than 0.5mA. **This is our recommended setting.**

Note:
- in the most common case the total time between ignition turned off and the PC shuts down will result:

  1minute + **5seconds** + **N seconds** (until the OS shutting down the system) = **65 + N seconds**

- in the worst scenario, when the motherboard won't shutting down (probably the OS hanged up) the total time between ignition turned off and the PC shuts down will result:

  1minute + **5seconds** + **(4x10) seconds** = **105seconds**

1. Primary PSU is starting
2. Ignition is turned ON
3. M3-ATX 5V Standby is starting
4. M3-ATX is giving the ON pulse
5. Motherboard reacts with the PSON signal
6. M3-ATX 12V rail is starting
7. M3-ATX 5V rail is starting
8. M3-ATX 3.3V rail is starting
9. M3-ATX Power Good signal is coming ON
10. Ignition is turned OFF
11. M3-ATX is giving the OFF pulse
12. Motherboards shuts down the M3-ATX (rails and PWRGD becomes off, except 5V Standby)
13. After HARD OFF Delay period the 5V Standby is turned off

P1 Mode timing diagram (non linear representation)

● P2 Mode of operation, timing diagram

In this mode M3-ATX sends ON pulse to motherboard when ignition is ON for more than 2 seconds. After ignition is turned off first time since the PSU running the PSU waits **1 minute** in case of the user changes his mind and turns back ON the ignition. If the ignition remains turned off in this extra 1 minute timeout the PSU sends OFF pulse to motherboard after **1 minute later**. As a result in P2 mode the PSU begins to turning off the motherboard after a total time of ~2 minutes.
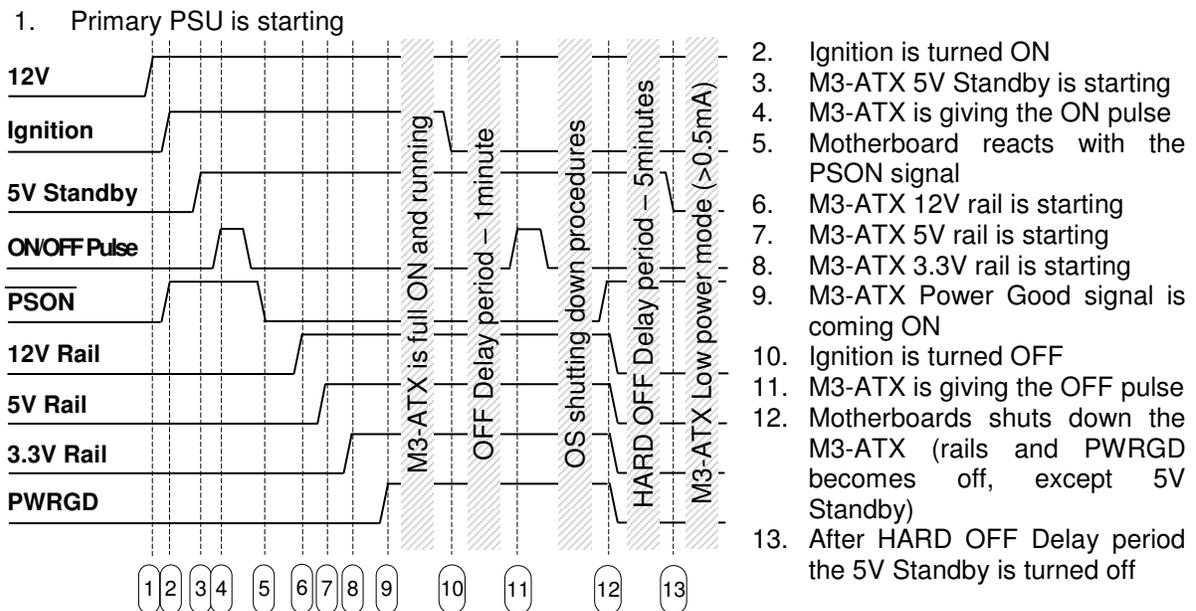
There are a total of **3 retries** to shutting down the motherboard. The timeout between two retries is **10 seconds**. After all retries timeout periods were spent and the motherboard hesitates to respond in this time the PSU shuts down its rails (12V, 5V and 3.3V). Only the 5VSB remains ON.

Waits another **5 minutes** and then shuts down 5VSB to conserve battery. In this mode, the M3-ATX consumes less than 0.5mA.

> **Note**:
> - in the most common case the total time between ignition turned off and the PC shuts down will result:
>   > **1minute** + **1minute** + **N seconds**   (until the OS shutting down the system) = ~**120** + **N seconds**
>
> - in the worst scenario, when the motherboard won't shutting down (probably the OS hanged up) the total time between ignition turned off and the PC shuts down will result:
>   > **1minute** + **1minute** + **(4x10) seconds** = ~**2minutes and 40seconds**

P2 Mode timing diagram (non linear representation)

1. Primary PSU is starting
2. Ignition is turned ON
3. M3-ATX 5V Standby is starting
4. M3-ATX is giving the ON pulse
5. Motherboard reacts with the PSON signal
6. M3-ATX 12V rail is starting
7. M3-ATX 5V rail is starting
8. M3-ATX 3.3V rail is starting
9. M3-ATX Power Good signal is coming ON
10. Ignition is turned OFF
11. M3-ATX is giving the OFF pulse
12. Motherboards shuts down the M3-ATX (rails and PWRGD becomes off, except 5V Standby)
13. After HARD OFF Delay period the 5V Standby is turned off
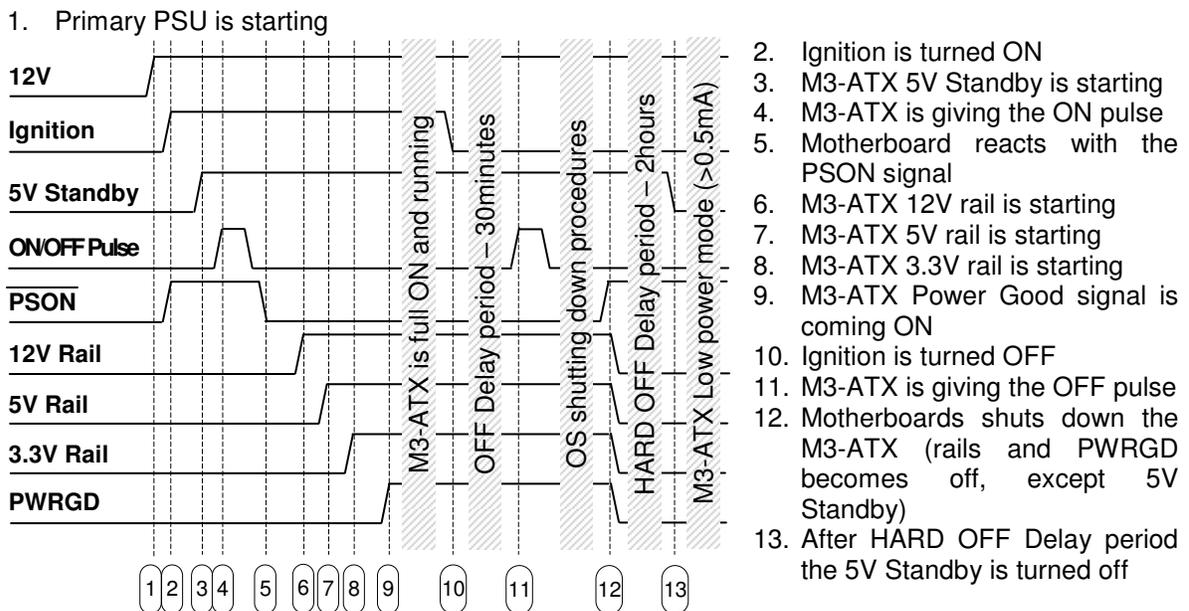
● P3 Mode of operation, timing diagram

In this mode M3-ATX sends ON pulse to motherboard when ignition is ON for more than 2 seconds. After ignition is turned off first time since the PSU running the PSU waits **1 minute** in case of the user changes his mind and turns back ON the ignition. If the ignition remains turned off in this extra 1 minute timeout the PSU sends OFF pulse to motherboard after **30 minutes later**. As a result in P3 mode the PSU begins to turning off the motherboard after a total time of ~31 minutes.

There are a total of **3 retries** to shutting down the motherboard. The timeout between two retries is **10 seconds**. After all retries timeout periods were spent and the motherboard hesitates to respond in this time the PSU shuts down its rails (12V, 5V and 3.3V). Only the 5VSB remains ON.

Waits another **2 hours** and then shuts down 5VSB to conserve battery. In this mode, the M3-ATX consumes less than 0.5mA.

> **Note**:
> - in the most common case the total time between ignition turned off and the PC shuts down will result:
>   > **1minute** + **30minutes** + **N seconds** (until the OS shutting down the system) = ~**31minutes** + **N seconds**
>
> - in the worst scenario, when the motherboard won't shutting down (probably the OS hanged up) the total time between ignition turned off and the PC shuts down will result:
>   > **1minute** + **30minutes** + **(4x10) seconds** = ~**31minutes and 40seconds**

1. Primary PSU is starting
2. Ignition is turned ON
3. M3-ATX 5V Standby is starting
4. M3-ATX is giving the ON pulse
5. Motherboard reacts with the PSON signal
6. M3-ATX 12V rail is starting
7. M3-ATX 5V rail is starting
8. M3-ATX 3.3V rail is starting
9. M3-ATX Power Good signal is coming ON
10. Ignition is turned OFF
11. M3-ATX is giving the OFF pulse
12. Motherboards shuts down the M3-ATX (rails and PWRGD becomes off, except 5V Standby)
13. After HARD OFF Delay period the 5V Standby is turned off

P3 Mode timing diagram (non linear representation)

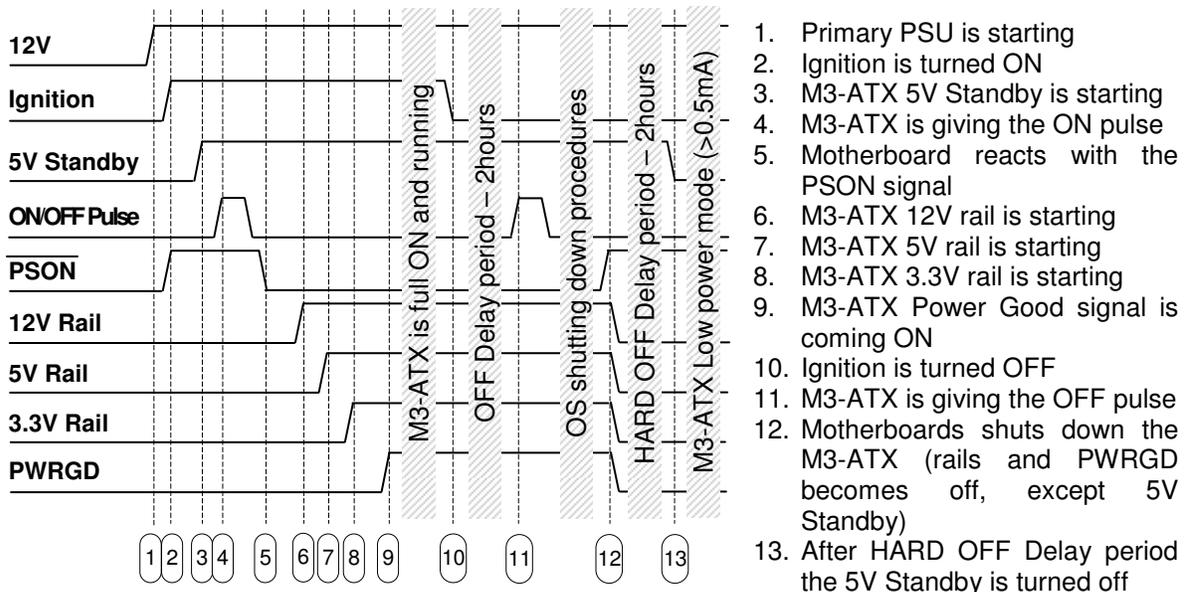### ● P4 Mode of operation, timing diagram

In this mode M3-ATX sends ON pulse to motherboard when ignition is ON for more than 2 seconds. After ignition is turned off first time since the PSU running the PSU waits **1 minute** in case of the user changes his mind and turns back ON the ignition. If the ignition remains turned off in this extra, 1-minute timeout the PSU sends OFF pulse to motherboard after **2 hours later**. As a result, in P4 mode the PSU begins to turning off the motherboard after a total time of ~2 hours and 1 minute.

There are three **retries** to shutting down the motherboard. The timeout between two retries is **10 seconds**. After all retries timeout-periods are spent and the motherboard hesitates to respond in this time the PSU shuts down its rails (12V, 5V and 3.3V). Only the 5VSB remains ON.

Waits another **2 hours** and then shuts down 5VSB to conserve battery. In this mode, the M3-ATX consumes less than 0.5mA.

> **Note**:
> - in the most common case the total time between ignition turned off and the PC shuts down will result:
>   **2hours** + **1minute** + **N seconds** (until the OS shutting down the system) = ~**2hours and 1minute** + **N seconds**
>
> - in the worst scenario, when the motherboard won't shutting down (probably the OS hanged up) the total time between ignition turned off and the PC shuts down will result:
>   **2hours** + **1minute** + **(4x10) seconds** = ~**2hours and 100seconds**

1. Primary PSU is starting
2. Ignition is turned ON
3. M3-ATX 5V Standby is starting
4. M3-ATX is giving the ON pulse
5. Motherboard reacts with the PSON signal
6. M3-ATX 12V rail is starting
7. M3-ATX 5V rail is starting
8. M3-ATX 3.3V rail is starting
9. M3-ATX Power Good signal is coming ON
10. Ignition is turned OFF
11. M3-ATX is giving the OFF pulse
12. Motherboards shuts down the M3-ATX (rails and PWRGD becomes off, except 5V Standby)
13. After HARD OFF Delay period the 5V Standby is turned off

P4 Mode timing diagram (non linear representation)

● **M3-ATX PSU features explained**

- **What means OFF Delay in other words?**

OFF Delay is the time interval between the moment when ignition is turned off and the PSU sends the first OFF pulse to motherboard. Sending OFF pulse to motherboard means to make an electrical contact on motherboards power switch input. This needs proper interconnection of M3-ATX and motherboard (see page 3).

- **What happened if in Off Delay the ignition signal is turned back ON?**

If the ignition signal is turned back ON In Off Delay period, the PSU will continue to run without interruption. No OFF pulse will be send to motherboard.

- **What means Hard OFF Delay in other words?**

Hard OFF Delay is the time interval between the moment of shutting down the PSU main rails (12V, 5V, 3.3V) and shutting down the 5V Standby voltage too. When the PSU is in the Hard OFF Delay time interval, only the 5V Standby voltage is present. Sometimes it could be difficult to observe anything alive on the motherboard because most of the peripherals are shut down. Only the USB devices keep some LEDs accidentally turned on.

- **What is extra 1 minute IGNITION OFF suppression?**

First time when the PSU starts from low power mode an extra 1 minute delay is set up in the ignition detection algorithm. This means the ignition turning OFF will be ignored for least one minute before the OFF Delay count will beginning. If in this 1 minute time interval the user changes his mind and turns back ON the ignition, the PSU will continue running without any reaction. Next time the ignition will turn OFF there are no more extra timeouts and the OFF Delay stage is imminent. If the PSU shuts down back in the low power mode on the next coming up the whole procedure is repeated. Please do not confuse this extra timeout with the official OFF Delay timing values. Every "first time" this extra timeout will be added to the OFF Delay count.

- **What is "scheduled" Turn ON after motherboard shuts down?**

Scheduled turn ON is a simple feature and it means the motherboard will be turned ON again if in time it shuts down the motherboard, the user turns back ON the ignition signal. If the OFF Delay period is already spent when it happens, the OS most probably prepares to shut down the motherboard. The PSU waits until the OS finishes his job and the motherboard was shut down properly when suddenly the motherboard will be restarted with a new ON pulse.

- **Observing the PSU LED, why it blinks in different modes?**

    The M3 ATX PSU has an on board LED situated in the bottom-middle side of the jumper block. This LED will show different status of the PSU i.e.: low power mode, power up timeout, VIN too low / too high, Hard OFF Delay, standby ON or recovery mode.

    FLASHING MODES:

Two short blinks in every 20 seconds	Low Power Mode
Three burst of very fast LED blinking	Start up delay
Slow blinking (~1sec period)	Standby (only 5VSB is ON)
Constant light	All rails ON, PSU runs normally
Two short flashing in 20 second	Hard OFF mode
Fast blinking in normal running mode	V(in) to low / to high
Fast blinking in recovery mode	System variables recovered

- **Monitoring the battery voltage**

    Once powered the M3-ATX constantly monitors the battery voltage on its input. If the battery voltage is below 11.2V, the PSU will not start to conserve battery power except the P0 (DUMB) mode. In P0 mode, the PSU will start even if the battery voltage is below 6V.
    When the PSU runs in one of the P1 to P4 modes and the battery voltage drops below 7V more than 10seconds the PSU will try to kindly shut down the motherboard following the standard shut down procedure. If the battery voltage recovers in 10seconds over 7V again, the PSU will continue to run.

- **What is Low Power Stage and when the PSU enters this stage?**

    Low Power Stage is one of the basic stages of the M3-ATX, when all rails are stopped and the PSU consumes fewer than 600 µA. The system LED will blink twice in every 20 seconds.
    To achieving low power stage a basic condition must complete: run the PSU in one of the four modes: P1 to P4. In DUMB mode (P0) the M3-ATX will newer enter low power stage! In P1 to P4 modes the M3-ATX always starts in low power stage and remains in this stage until the ignition signal turns ON. The M3-ATX will return in low power stage all the time the ignition was OFF and the Hard OFF Delay is over. If in time of Hard OFF Delay the ignition will turned back ON the low power stage will be avoided by the PSU starting a new running cycle.