

# ITPS

## Low Dropout Regulator and Power Sequencer Module



## Installation Guide

Version ITPS-1B  
P/N ITPS-01

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**Before you start...**

Please take a moment and read this manual before you install the ITPS in your vehicle. Often times, rushing into installing the ITPS can result in serious damage to your ITPS board, computer and probably your car's electrical system.

The ITPS board has 7 cables that need to be installed in various places (2 power-in, 1 ignition, 2 power-out, 2 M/B on/off switch). Please be careful when performing the installation, **always double check the polarity** of your wires with a voltmeter before installing power terminals.

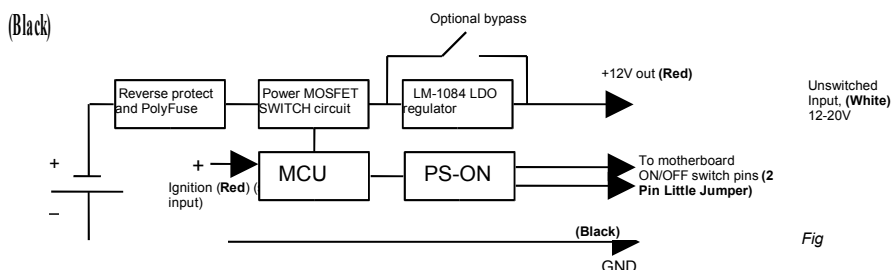
**The heatsink is connected to +12V!** Please ensure that the heatsink is not touching the ground when operating.

## Introduction

Thank you for purchasing the ITPS power sequencer and LDO unit!

This unit was designed to work with a wide variety of ATX DC-DC converter boards such as the PW-70/70/120 from mini-box.com or the Mores converters as well as with other computers systems operating at 12V. The main purpose of this board is to provide power sequencing and strict 12V regulation functions for automotive systems.

### 1.0 ITPS Logic diagram



1.0, ITPS Logic diagram

The ITPS unit is composed off several functions, as shown in fig. 1.0:

- 1) Reverse protection and resetable fuse.** This function provides reverse polarity protection in case the power leads are accidentally reversed. The Polyfuse, F1 will protect against currents greater than 8A.
- 2) MCU.** The 8 bit Microchip controller is at the heart of ITPS. The MCU controls timing and sends signals to the power switch MOSFET and controls the motherboard ON/OFF switch terminals based on status of ignition key.
- 3) Power MOSFET switching circuit.** Q2, the power MOSFET, controlled by the MCU, provides ON/OFF switching to the main power line. When used alone\*, this MOSFET can switch currents in excess of 15A.
- 4) LM-1084 LDO regulator.** The LM-1084 is a low dropout voltage IC that provides regulation for the ATX DC-DC converters or any other attached device. In case 12V regulation is not needed, the LM-1084 can be bypassed by applying a solder bump.\*
- 5) PS-ON.** The PS-ON circuit triggers the motherboard ON/OFF switch for 'soft' start/stop sequences. PSON is activated 5 seconds after the Ignition circuit is turned on and 10 seconds after the ignition turned OFF.

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\*NOTE: To bypass the LM-1084, turn the board upside down. You will notice 2 small solder pads in between 2 pins of the LM-1088. Apply a solder bump over this pad to bypass the regulator.

## 1.1 Mode of operation

The ITPS performs several timing routines and takes actions as follows:

- 1) Ignition=OFF. Nothing happens. IPTS is waiting for ignition signals.
- 2) Ignition=ON. ITPS waits for 3-4 seconds then turns on the main 12V rail. This function provides enough time for battery levels to reach a stable output. After another 1 second the MCU sends an "ON" signal to the motherboard via the 2 wires connected to the motherboard's ON/OFF pins. The motherboard will turn ON and your system should start booting.
- 3) Ignition=ON during driving: Nothing happens. Your computer will remain ON.
- 4) Ignition=OFF. IPTS waits for about 5 seconds and then it turns the motherboard OFF by sending a signal to the motherboard's ON/OFF switch. Your computer should turn off gracefully (shutdown procedure). During this time, power will still be available for your PC to perform shutdown.
- 5) Ignition=OFF after 5 seconds. Power will still be provided for another 45 seconds, long enough for most soft shutdown processes. In the event where the shutdown process is hanging, power will be shut down hard, turning off your computer's main power source to prevent battery drain. If ignition is turned on during this step, you computer should start again. Please note that your 12V might dip below 12V at startup. See NOTE2.
- 6) ITPS will go to step 1, until ignition is tuned ON again.

**NOTE1:** During the times when Ignition=off, the MCU is still running and waiting for signals. The power consumption is the mW ranges, thus not affecting your battery. Your car alarm system will drain more current than your ITPS.

**NOTE2:** If you want to ensure that your 12V system never goes below 12v, use a diode to isolate ITPS from your car battery. Install a small SLA battery (12V/1Ah) to the input of your ITPS. The diode will prevent discharging your SLA battery when the main battery dips below 12V.

## 1.2 Power dissipation

A typical car voltage is in between 13.4-15 V, the regulator power dissipation

$$P_D = (V_{in} - V_{out}) \times I_{in}$$

where  $V_{in}$  is the input voltage,  $V_{out}$  is the 12 V regulated voltage, and  $I_{in}$  is the total current consumed by your mini-ITX board. Here is an example:

$$P_D = (13.8 \text{ V} - 12.0 \text{ V}) \times 2 \text{ A} = 3.6 \text{ Watts.}$$

The ITPS board is equipped with a 10 Watt heat sink, being able to deliver currents in excess of 5A (power out=70Watt), suitable for most mini-ITX board configurations.

**NOTE:** The heat sink may get hot at times. The ITPS has advanced thermal protection, the board will not be damaged. Do not touch, surfaces may be hot!

## 1.3 Wiring diagram

**Step 1.** Place the board with components facing up.

- Left side 3 pin white connector (input).
- Right side, 2 pin white connector (out).
- Right side, top, J2, motherboard power ON jumper.

**Step 2.** Hook up the input wires: Black is GND. White is un-switched 12V. Red (center) is switched power (ignition). Switched power can be found at the cigarette plug. Un-switched power can be found near alarm circuits or by connecting straight to the battery. You can use blue/yellow Faston Crimp Connectors to clip into running wires.

**Step 3.** Hook up the output power wires. Black is GND. Red is +12V out. Morex users can simply plug into the Morex 12V input leads. For PW-60/70/120 from mini-box.com we recommend soldering or crimping the power input. The 2.5mm barrel connector on the PW-60/70/120 is not suited for high vibration environments.

**Step 4.** Hook up motherboard ON/OFF switch. Using a 2 pin wire, hook up the output of J2 to your motherboard PS-ON jumpers. Polarity is not important. Consult your motherboard manual for location.

**Step 5.** Turn on you car. In a few seconds, your motherboard should power on.

## 1.4 Troubleshooting

Problem: motherboard is not turning ON. Check input cables. Measure voltage on un-switched 12V. You should get 12V even if your car is turned OFF. Measure un-switched pin (red) while turning the car ON/OFF. You should see 12V (car on) or 0V (car off). If no voltage on both switch or un-switched circuits, check your car fuse system.

Problem: Motherboard is not turning ON (cont). Check your output cables, make sure polarity is OK. Turn on the car while measuring the output wires (black and red). After few seconds, you should see 12V on the red wire.

Schematic: ITPS schematic is available at: <http://www.mini-box.com/ITPS/ITPS.PDF>

Microcode: ITPS microcode can be found at <http://www.mini-box.com/ITPS/itps3.zip>

## 1.5 ITPS Characteristics

Input Min. voltage	5V
Input Max. voltage	20V
Current limit, regulated	6A@17V input.
Max Current (out), unregulated	15A
Line regulation	0.015%
Load Regulation	0.1%
Dropout Voltage	1.1V@3A
Operating temperature	-20 to +125 degrees Celsius
Storage temperature	-40 to +125 degrees Celsius