



Department of Electronic & Telecommunication Engineering
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EN2160 - Electronic Design Realization

THE SPECIFICATIONS AND EXTRA FEATURES
MINI UPS FOR ROUTER

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This report is submitted as the initial technical report of module EN2160

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ABSTRACT

I am going to design mini-ups for the WIFI router at the end of the semester-04 for the module EN2160. This report briefly explains the specifications and extra features that I am going to implement.

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1 THE SPECIFICATIONS AND EXTRA FEATURES

1.1 Introduction to product

This 12V uninterruptible mini ups initially designs to drive my fiber optic modem/router. The key reason to build this power supply is to get continuous internet and phone connection during power failures. The core components of this power supply are PIC /Atmega 328p Micro-controller, Liquid Crystal Display (LCD), a constant voltage charger, a 12V DC power supply, an AC line monitoring unit, and a 12V high-capacity sealed lead-acid battery. The entire system will be designed using available components.

1.2 Technical Feasibilities

This mini-ups circuit provides an uninterrupted power supply (UPS) to operate 12V, 9V, and 5V DC-powered instruments at up to 1A current. The backup battery takes up the load without spikes or delays when the mains power gets interrupted. It can also be used as a workbench power supply that provides 12V, 9V, and 5V operating voltages. The circuit immediately disconnects the load when the battery voltage reduces to 10.5V to prevent deep discharge of the battery. LED1 indication is provided to show the full charge voltage level of the battery.

My system is an improved model. There already exists a system, which is mini ups without display and it can provide power for 2 hours. I expect to make a system with a display, which can display the charge going from ups or direct power supply. Then if it's from ups then it will show the percentage of charge remaining in the power bank. And planned to make it, able to provide power for approximately 7 hours.

1.3 Product Specifications

- * Two Output Ports: 12V /1A and 5V/1A or 9V/1A
- * Current: 1A
- * Additional Protection (current limiting)
- * Plastic enclosure and better PCB
- * weight: 350 g (approximately)

1.4 Technical Specifications for product

- * Powered using 230AC power supply
- * It can convert 230 AC to 12V.
- * It will provide power for around 2 hours
- * There are LEDs to show the charging
- * It can provide only through DC Jack- Female

1.5 Extra features for product

- * It will extend to give power for around 7 hours
- * Display can show, whether the router is powered by main current or ups
- * It can provide power through USB also.
- * It can be used as a mobile power bank also.

1.6 Simplified Circuit components specifications and specifications of functionalities

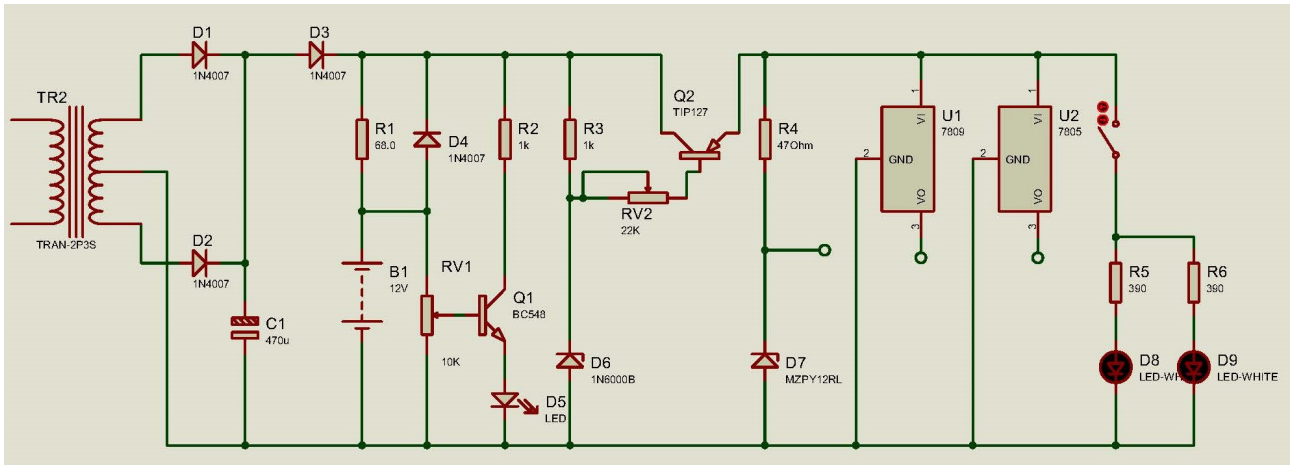


Figure 1 — Simple draft circuit

A standard step-down transformer provides 12V of AC, which is rectified by diodes D1 and D2. Capacitor C1 provides a ripple-free DC to charge the battery and to the remaining circuit. When the mains power is on, diode D3 gets forward-biased to charge the battery. Resistor R1 limits the charging current. Potentiometer VR1 (10k) with transistor T1 acts as the voltage comparator to indicate the voltage level. VR1 is so adjusted that LED1 is in the 'off' mode. when the battery is fully charged, LED1 glows indicating a full voltage level of 12V.

When the mains power fails, diode D3 gets reverse biased and D4 gets forward biased so that the battery can automatically take up the load without any delay. When the battery voltage or input voltage falls below 10.5V, a cut-off circuit is used to prevent deep discharging of the battery. Resistor R3, zener diode ZD1 (10.5V), and transistor T2 form the cut-off circuit. When the voltage level is above 10.5V, transistor T2 conducts and its base becomes negative (as set by R3, VR2 and ZD1). But when the voltage reduces below 10.5V, the zener diode stops conduction and the base voltage of transistor T2 becomes positive. It goes into the 'cut-off' mode and prevents the current in the output stage. Preset VR2 (22k) adjusts the voltage below 0.6V to make T2 work if the voltage is above 10.5V.

When power from the mains is available, all output voltages-12V, 9V, and 5V-are ready to run the load. On the other hand, when the mains power is down, output voltages can run the load only when the battery is fully charged (as indicated by LED1). For the partially charged battery, only 9V and 5V are available. Also, no output is available when the voltage

goes below 10.5V. If battery voltage varies between 10.5V and 13V, output at terminal A may also vary between 10.5V and 12V, when the UPS system is in battery mode.

Outputs at points B and C provide 9V and 5V, respectively, through regulator ICs (IC1 and IC2), while output A provides 12V through the zener diode. The emergency lamp uses two ultra-bright white LEDs (LED2 and LED3) with current limiting resistors R5 and R6. The lamp can be manually switched ‘on’ and ‘off’ by S1. The circuit is assembled on a general-purpose PCB. There is adequate space between the components to avoid overlapping. Heat sinks for transistor T2 and regulator ICs (7809 and 7805) to dissipate heat are used.

1.7 Components specifications

Item	Quantity
Transformer (230 AC to 12 V)	1
Diode (IN4007)	4
Zener(10.5V , 0.5W)	1
Zener(12V , 1W)	1
Transistor(BC548)	1
Transistor(TIP127)	1
Resistors(1K)	2
Resistors(390 ohms)	2
Resistors(68 ohms, 0.5W)	1
Resistors(47 ohms , 1W)	1
Variable Resistors(10 k)	1
Variable Resistors(22 k)	1
Polarized Capacitors(470uF , 4.5AH)	1
LEDs	3 (different colours)
Regulator(IC 7809)	1
Regulator(IC 7805)	1
Rocker Switch	1
DC Jack- Female	2
DC Jack- male	2
USB Boost Converter	1
ATMEGA 328P	1
Liquid crystal Display	1

Table 1 — List of components