SWITCHING POWER SUPPLY ATX (2009)
How to create a SPS laboratory.
How to Convert a Computer ATX Power Supply to a Laboratory Power Supply
From 0.1V to 16V (30V) and from 0.15A to 16A (30A)

"Electronics design" of R.Chirio

[home] [online sales]

2008-2013
After the switching power supply of a TV, the ATX power supply is definitely the product electronic switching power supply, the most widespread in the world, in the last 10 years we have produced millions of pieces.
The average life of a PC does not exceed 3-5 years, so are many PCs that are scrapped or updated, and a component that is often replaced even if it still works just the ATX power supply, replaced by a more powerful model.
As it is known the ATX power supply is used to convert the energy of 220V alternating current, separate from the network and low value such as 3.3V 5V and 12V, voltages necessary for the operation of microprocessor cards.
For use by the electronics laboratory more often than it is necessary to obtain the values of voltage adjustable in continuity, to carry out all the appropriate tests. A power supply with these characteristics is expensive, especially if also capable of delivering 20A.
With relative ease, you can change an ATX for him to vary the output voltage and also to limit and regulate the current.
We must say that the part of the input to 220V should not be touched and changed. The changes should be made only on the secondary side as indicated. Opening the cover of 'ATX should never have the 220V mains connected, and then plug always replace and screw the metal cover.

For those who want to learn how it is done and how a Power Supply ATX, here you will find an excellent tutorial:

http://www.elma.it/TESTO/ali/00a_aliPC_introduz.htm

**Changing the Switching Power Supply ATX involves having good knowledge of electronics, necessary equipment and experience in electronic assembly.
And a clear competence in the use of devices to 220V.**

Not liable for damage to property and persons and for misuse of realization.

ATX 350W modified to make laboratory power supply, to the right the potentiometer (blue knob) for regulating the output voltage from 1 to 15V (20V in this case) and the potentiometer yellow for the regulation of the current from 0.15 to 15A . The voltage is

read with a digital voltmeter LED, powered by the internal section called + 5V Standby that has not been changed.

Models with more than 450W, and depending on the type of ATX recovered, you can reach out 20V 20A or 30V 12A, as a precaution you will learn how to make the less powerful model.

Before you begin to change the ATX is necessary to identify the most suitable model for the creation, the modified schema proposed works with most ATX containing the controller TL494 or KA7500 equivalent.

The integrated driver type 2003, 2005, SG6105, are not suitable to realize a Power Supply variable.
With the ' UC3843 can be done but is not suitable to the scheme proposed in this page.

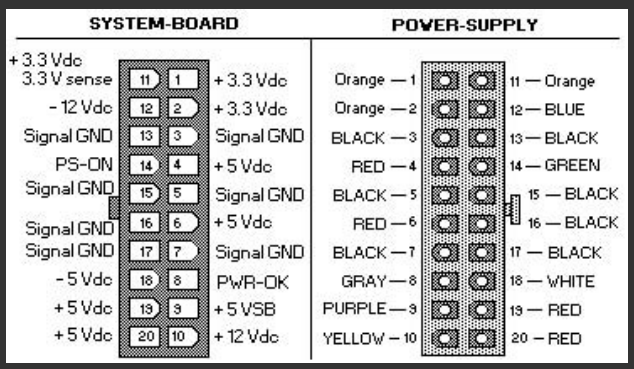
PWM driver:

(Download PDF Data Sheet)

KA7500 or TL494

The TL494 is built on ATX built in China from 1997 until the present date, even if the power increase, the driver is always the same, the rest has some good features as well as deploy it on ATX 200W up to 600W. What changes inside the power supply is the power of the components, such as ferrite transformer, transistors, MOSFET and power diodes as well as the value of the filter capacitors.

From model to model change the configurations of the circuit and that of the Power Good OverVoltage, this is not a problem, since these circuits, we do not care because it must be isolated and disconnected, see interruptions of the general scheme.

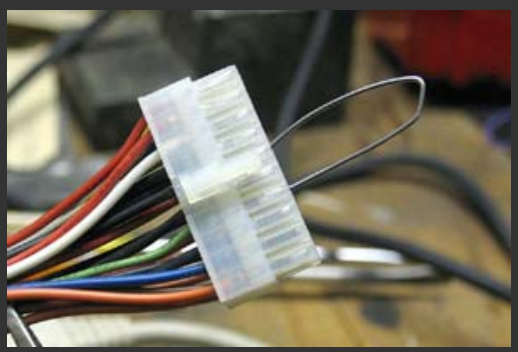


Before starting the construction it is good to try operating the ATX, and be sure that it works to load. In this case you need a jumper to ground the green wire (PS-ON), present on pin 14 of the main connector, and then to the mains voltage.

OK if you feel the fan turn.

Attention to the fact that the fan runs, is good sign but does not mean that the power part functions, necessary to measure the output voltages by connecting a load.

Measure the voltage on the white connectors and test the 5V (+/- 0.5V) between the red wire and the black, and then the 12V cable between the yellow and the black. For proof of the load operation must connect a power resistor 20W 10 ohm terminal on the 12V and verify that the voltage does not drop below the 11,80V. Okay even a light bulb 20W 12V no power greater otherwise the inrush current locks out the ATX.



Leave the connected load, for a while 'time and ensure that there are no problems of voltage drops or blocking the fan or overheating.

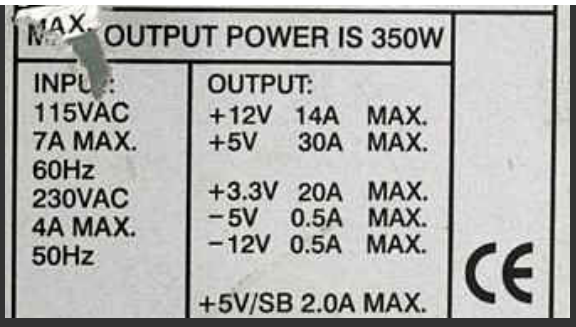
Any noisy fan, it is good to be replaced with a new one, if one were to stop while operating under load, in many ATX without thermal protection could easily create damage from overheating.

To know the maximum current that can be delivered, it is enough to read the nameplate value of the ATX.

In this case with the 12V maximum absorption is 14A.

Having loads on other outputs, it is reasonable to think that the 12V can absorb a higher current. 15 to 20A for no longer than 15 minutes.

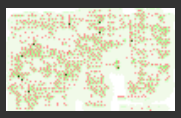
We can find 480-500W power supplies that provide the 12V 18-22A.



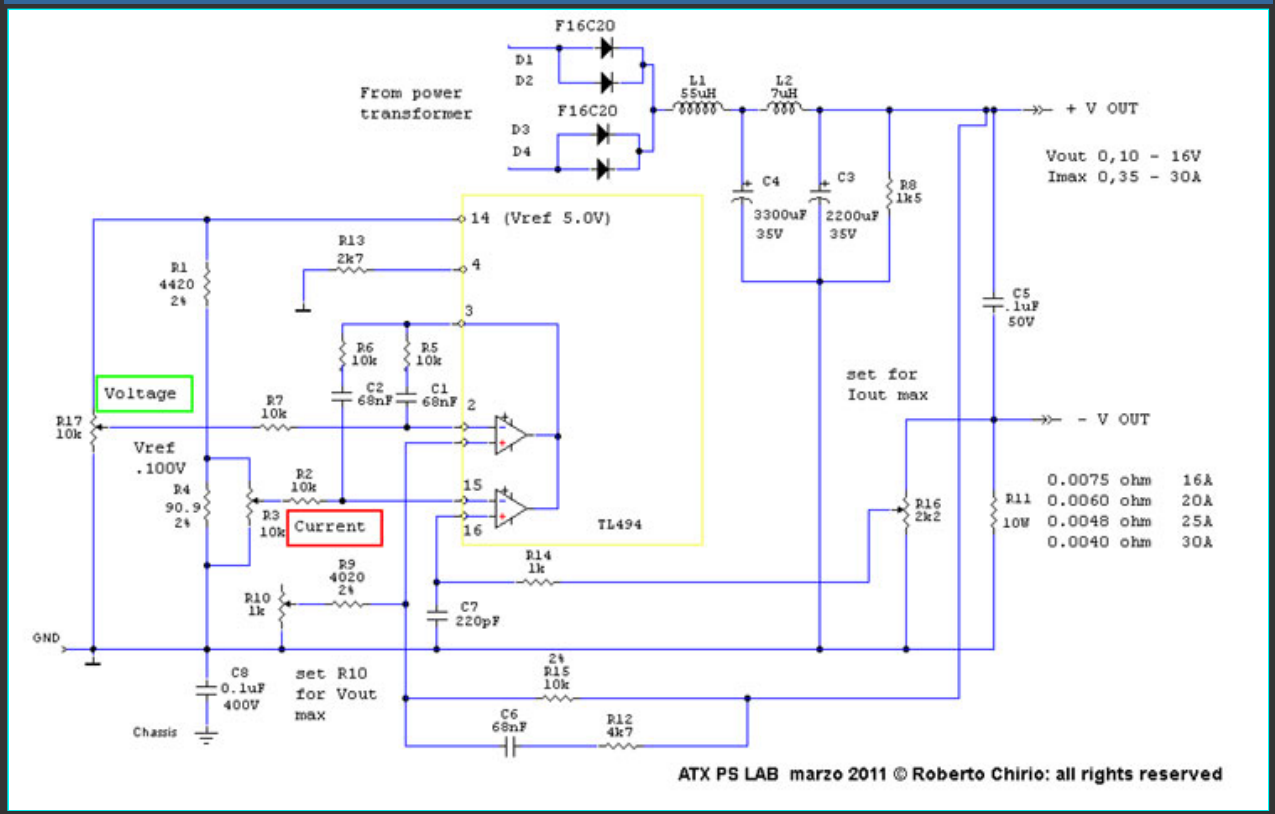
We can find many schemes ATX on this site: http://danyk.wz.cz/s_atx_en.html

WIRING ATX 200W

Diagram of a 200W ATX recovered network. (Please note that the original scheme has some errors.)
They are marked with red spots where isolate connections and green components to remove.
The basic pattern is always similar, change the circuits Overvoltage and power good (we will not use that and we're going to isolate) also with different power, will change the power components.
Identify replacement parts and service around the TL494 starting from the feet of the PWM controller itself.



WIRING ATX changes to control voltage and current.



(Version 2011/03)
Schema changes, to be made to the components around the TL494 regulator to get up to 30A output.
With this scheme, there is a better stability and accuracy in the adjustment.
The minimum and maximum voltage adjustable dropouts are less than 0,10V
For the general scheme refer to the two versions published later.
R3 is the potentiometer which adjusts the current, R17 is the potentiometer which regulates the tension, for greater accuracy must be flush 10 laps.

This is the pattern more stable, suitable for the various currents available in dell'ATX function chosen. Use the value of R11 as a function of the maximum current obtainable in output.

The feet refer to the integrated TL494 soldered on the PCB. For convenience feet 15:16 should be isolated from the original scheme, the integrated desoldering and before you can add it again, you fold up the 15 and 16, by doing so you avoid interrupting the slopes of CS.

The resistors R1, R4, R9 and R15 must be the type to 2% metal layer, while the R11 must be a power resistor flush with a total power of 10W. The value goes chosen in function of the maximum current obtainable in output. The thermal stability of the value of current is a function of the quality of resistance used. Place the R11 as much as possible on the flow of the fan.

The resistor R11, the capacitor C5 and the two potentiometers R3 and R17 are to be placed outside of the printed circuit.

The R10 serves to calibrate the full scale maximum value for the voltage (for example 16,0V compensating the tolerances of the potentiometer).

The R16 serves to calibrate the full scale maximum value for the current (for example 16,0A compensating the tolerances of the potentiometer).

The inductors L1 and L2 are the original on the CS, check that they can keep up to 30A.

The capacitors C3 and C4 replace the originals from 1000uF 16V, not sufficient to withstand over-voltage and higher current.

The group RC C6 R12 serves to stabilize the adjustment, eliminating noise return terminals output voltages of 9-10V.

They should be insulated tracks CS that lead to the negative mass, instead connect a capacitor from 0,1uF 400V, this to avoid ground loops on the current adjustment.

ATX 300 / 500W per output changes from 0.6V to 20V and current from 0.15 to 20A

Complete schema changes, eliminating the parts are no longer used.
Red new connections and components.
To connect the fan to use the scheme suggested below, using a separate transformer.

ATX 300 / 500W per output changes from 0.6V to 30V and current from 0.1 to 12A

Complete schema changes, eliminating the parts are no longer used.
And 'necessary to introduce a new bridge rectifier output, positioned on a new radiator isolated.
Eliminate the ground connection on the output of the transformer.
To connect the fan to use the scheme suggested below, using a separate transformer.

Realization

The realization of the Switching Power Supply involves having knowledge of electronics, is necessary equipment and experience in electronic assembly.

And a clear competence in the use of devices to 220V.

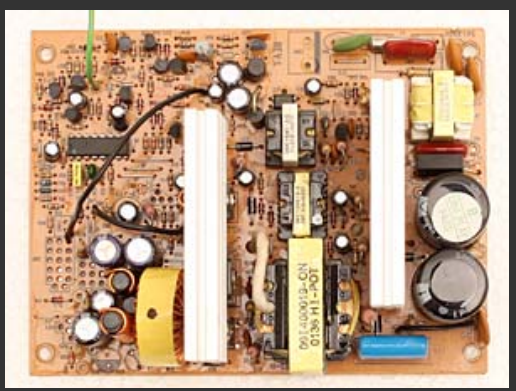
Not liable for damage to property and persons and for misuse of realization.

Photo Version 2007

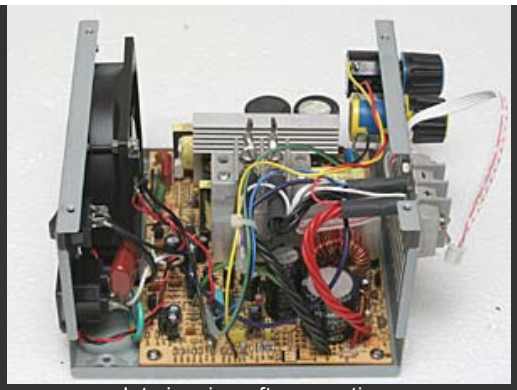
- Start with the remove CS from metal container, desoldering network cables and remove the 4 fixing screws.

- With a robust welder unplug all cables welded on CS, leaving only the green wire PS-ON and the cable Viola 5VSB.

- Remove unnecessary components of the various sections of the + 5V and + 3.3V and also the various strengths that will be replaced with the new values.



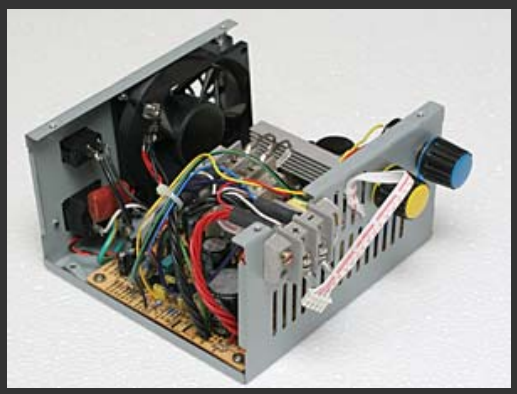
Card 350W ready for the changes.

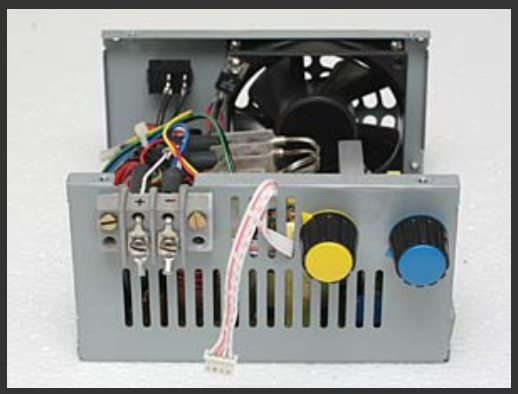

Interior view after mounting.


Interior view after mounting.

- Use at least 4 original cables for the power outputs, red for positive directly to the output terminal. Black for the connection to the resistance R11 and the resistance of Current Sensing towards the negative terminal.

- You notice capacitors 35V large replaced the originals alone 16V not suitable to withstand higher voltages. In the case it materializes the battery charger 12V we can keep the capacitors from the original 16V, as the same would go to work only in 14,50V.





- The white strip is used to supply the digital voltmeter to be placed outside of the container. (Inside there is no place.)

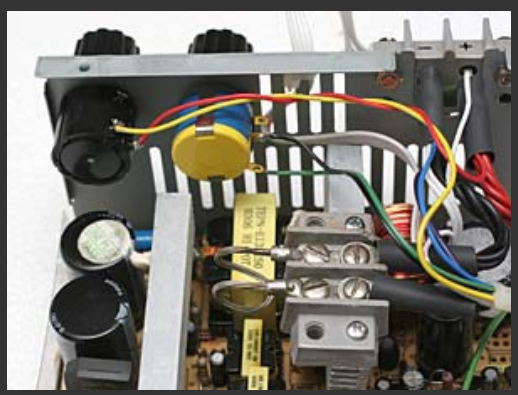
- The output terminal block must be of the type 30A so as to be able to fix cables 4 / 6mmq equipped with lugs.

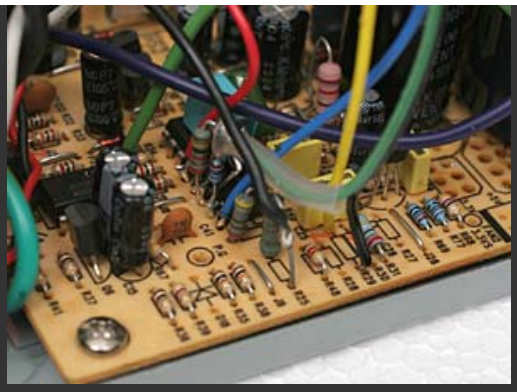
- The fan 12V can no longer be connected as originally output on the output, in this case take positive supply from pin 12 (+ 18V) of the TL494 and the negative from a common negative. With a 7812 regulator stabilize the fan power. The controller does not need the heat sink, in this case is secured by a screw directly to the fan. (Check the tension upstream of the regulator in that scheme, that is, with working fan does not drop below 17V, otherwise, use the solution with transformer Separate explained later.)

- Detail on the resistance R11 of current sensing, made of constantan wire and fixed to the terminal block 30A. The resistance is directly cooled by the flow of air aspirated by the fan, this keeps the temperature low then we will have a reduced drift values with increasing current.

The R11 is also readily achievable with the parallel of n resistors 3 / 5W in parallel.

Are noticed the two precision potentiometers 10-turn, keep the connection cables as short as possible, close to the metal of the container and away from the transformers, this to avoid interference.

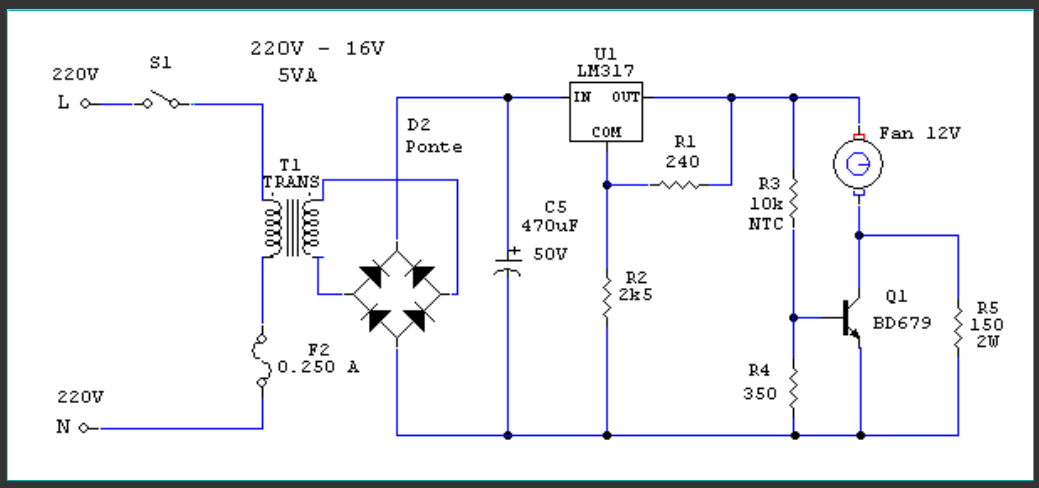




- You can see the resistance directly welded on the legs 13,14 and 16 and the two resistors on the CS in place of R25 and R31 which represent the new reference from 1.0V for the voltage control. (Version 2007)

Temperature-controlled ventilation.

Connect the fan to the primary flyback circuit, as described above in the scheme main, in many cases it reduces the efficiency of pilotage in conditions of maximum current out. To cool the ATX changed, it is good to use a circuit with separate transformer.



It uses a small transformer 220V-12 / 14V to 5VA. Followed by a rectifier circuit and ball.

- The LM317 regulator allows us to fine-tune the output voltage.
- R2 determines the maximum operating voltage on the fan normally 12V. Even 16V that require stronger ventilation.
- R5 determines the minimum voltage on the fan tip. 5.5V.
- R4 determines the minimum temperature of intervention tip.40 °

Eliminating the R5 the fan operates only exceeded the response temperature.

The NTC thermistor R3 must be fixed with silicone adhesive, on the radiator of the diodes righting power.

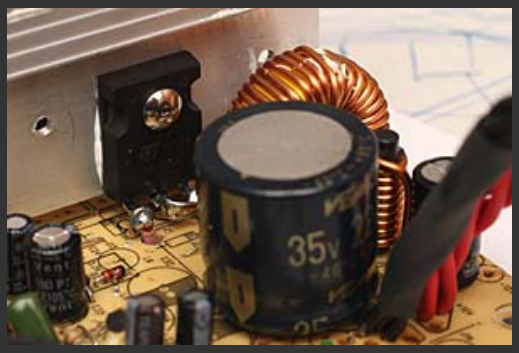
The values may vary depending on the fan used, we recommend using a fan of better quality than that usually mounted inside all'ATX.

Using a transformer with 12V output out you can omit the LM317 regulator circuit and connect the fan directly across the capacitor C5, verify that the open circuit voltage does not exceed 16V.

Obviously during load operation of our ATX, we hear the fan running at different speeds, depending on the temperature reached.

Improvements

With ATX 400-500W you can get out at 20-22V and 20-25A replacing the double diode rectifier of 12V with that of 5V suitable for 30A, also it has to use the section of the forever 5V toroidal inductor filter, more suited to withstand high currents, as well as the second inductor wire with a larger diameter.



Please note that the Schottky diode 30 A, working at 20V is at the limit of the threshold voltage, verify the voltage across, in the case burdening the RC snubber, to reduce spikes, or use a SBL3060PT, 60V.
Better still use two diodes fast 200V 16A one for each branch.

With these simple substitutions and adequate ventilation and efficiently should be able to have a more 20A and in continuous service, are always check the temperatures in the scheme, in particular of the power transformer.

For most experts recommend increasing the frequency of the TL494, rising no more than 20% but enough to squeeze something more out of the transformer. If then the nominal frequency is of the 50kz it leads to 60kHz acting on the R and C present on pins 6 and 5 of the driver TL494. It's okay to use an oscilloscope and / or frequency to read values. After this change is conceivable to achieve an increase in maximum output power, you must be fitted out fast diodes 16A 200V.
They are to take care of all the power connections, never less than 4mmq.
Check the efficiency of the fan, may adopt a model with greater capacity.
The addition of a digital voltmeter and an ammeter digital 20A, can finalize a great laboratory instrument. Recommended insertion into a movable metal of greater dimensions, suitable to contain all the electronic group with tools.

With the same scheme it is possible to realize an excellent battery charger for the 12V or 24V also for simply mounting inside two trimmers instead of potentiometers, and calibrating the output voltage for 14,5Volt (29V) voltage that corresponds to a battery End of charge.

In this case I entered the adjustment of external current, from 1 to 18A, while the voltage is fixed at 14,50V.

Causes failures ATX

- At 90% the ATX are replaced after 3-4 years because it does not have enough power bulge later upgraded video cards and motherboards, they generally throw ATX functioning. - The second cause is the overheating due to blocking of the fan, enters dust and slows or stops the fan, so the components will overheat, sometimes detach from CS, usually jumping for the first electrolyte. every 6 months would be enough to open the case and dust and clean the dust. Good practice to keep the tower and minitower off the floor. Even those who smoke contributes much to do block the fan ahead of time ... - Unlikely to skip the driver, if anything, the first stage of 5V standby that provides power to the driver. The first stage is a self-oscillating which is always under tension and provides some Watt the system to boot .... - It is also often the low quality of construction which leads to limit the internal components more solicited ...

Closing remarks

Definitely a great and mighty power. The original design, strong of millions of applications, is optimized, efficient and reliable. Under test conditions you can easily get 20V and 20A equal to 400W, not suitable for continuous service, but convenient for loads of short duration.

The cost of implementation can be considered very low, especially if you do not use multi-turn potentiometers and digital voltmeter.

The ATX changed to 13.8V 20A has been tried in connection radios VHF transmitters and the background noise is negligible. Not suitable for HF because it has a lot of noise. Good behavior with absorption impulsive presenting the type of switching a low impedance output.

The construction is suitable for those who already is an electronics expert and practical systems that work with 220V.

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Roberto Chirio is available for advice in designing and manufacturing Switching Power Supply.

Contact: info@chirio.com

www.chirio.com