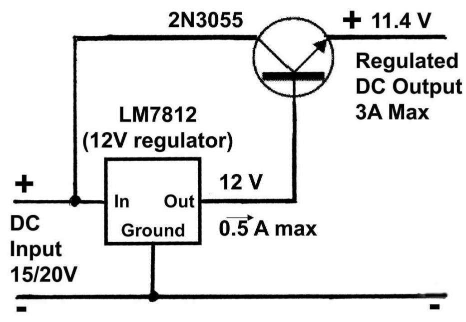
SHAK NOWTZ BY "MAD" FRANK - G3ZMF

SHAK NOWTZ No 2 - PSU TIPS

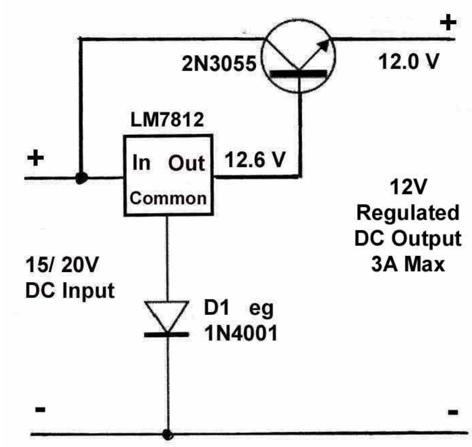
Continuing from last month's article (Shak Nowtz No 1), I will now outline some of the circuits I have picked up over the last 40 years as a licensed amateur. Don't time fly when you're having fun?!

1 BASIC LOW CURRENT REGULATED POWER SUPPLY UNIT (PSU)



Note: Although the regulator outputs 12V to the base of the pass transistor, there is a 0.6V drop (on average) from base to emitter. The output voltage equals the regulator output minus 0.6V for every base/emitter junction in series with the path to the output terminals – in this case 11.4V. Here, the regulator is grounded.

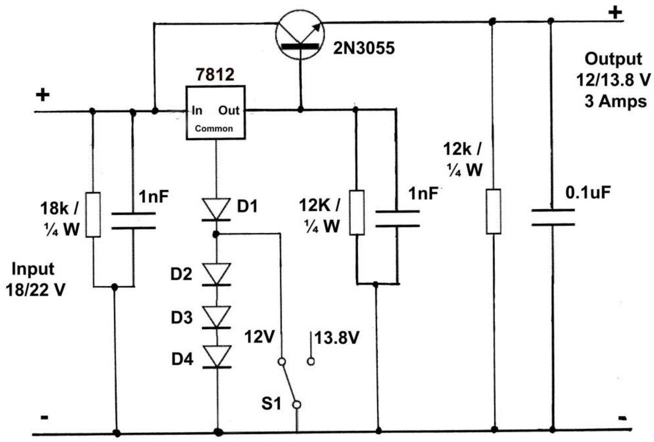
2 BASIC LOW CURRENT REGULATED POWER SUPPLY UNIT (PSU) WITH 12.0 V DC OUTPUT



Components as in (1) but with an extra diode.

Note: With the diode in the ground leg of the regulator, the regulator must be mounted on a suitable insulated spacer, with no connection to the negative rail.

3 PRACTICAL LOW POWER, 12/ 13.8 V REGULATED PSU, SUITABLE FOR USE IN HIGH RF FIELDS



By putting a resistor across the input and the output of the regulator so that 1 or 2 mA is drawn, a DC "path" is provided for the internals of the regulator. The 1nF capacitors across the input/ output of the regulator act to help reduce RF interference.

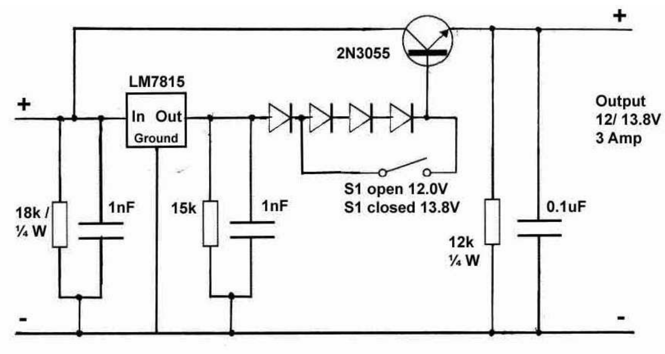
By switching/ shorting diodes in the ground leg of the regulator, dual output voltage is achievable, remembering that 0.6V is added to the regulator's output per diode in circuit. Don't forget the 0.6V forward voltage drop in the series regulating pass transistor.

D1 remains in circuit to compensate for the base/emitter voltage drop on the pass transistor.

4 ALTERNATIVE CIRCUIT WITH 15V REGULATOR

In this variant, we use a grounded 15V regulator, this time reducing the base drive voltage by series diodes.

PTO



The regulator will produce 15V. The output voltage of the complete circuit will therefore be 15.0V, less 0.6V in the pass transistor (TR3), less 0.6V for every series diode. Therefore, to achieve 12.0V output, 4 diodes are needed in circuit. To achieve 13.8V, 1 diode is required.

Minimal load and RF protection is applied as in (3).

Special Note : Pass Transistor Rating & Encapsulation – For the main pass transistor, I always recommend devices with at least **twice** the maximum load for safety. In practice, I always use a 2N3055 on a suitable heatsink and insulating washer as I have a large stock of them. The 2N3055 is rated at 15 amps, so I use a maximum of 7 amps. Don't forget the power the pass transistor has to dissipate when regulating from input to output voltage. For example, 17V input, 12V output (5V drop) at 3A will dissipate 5 x 3 = 15 watts, well within the maximum rated dissipation for a 2N3055 (115 watts.)

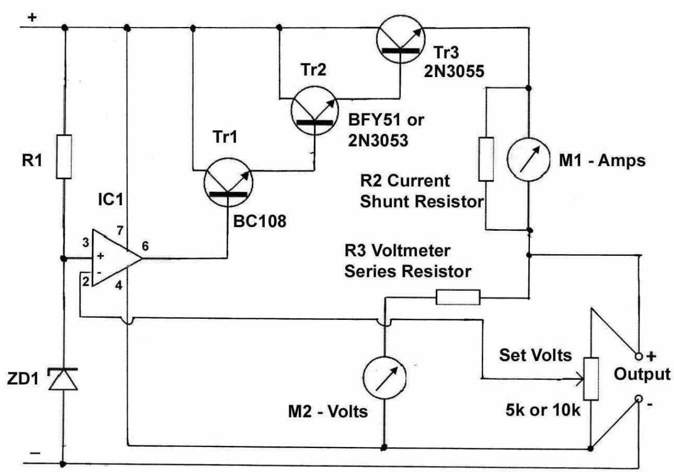
For higher output currents, additional pass transistors can be wired in parallel – but don't forget – they all need drive current applied to their bases, so additional transistors in pre-stages are needed to drive them. Also, these pass transistors **must** have their output currents balanced/ shared as equally as possible. This is done by fitting very low value resistors in **each** individual emitter circuit, and only commoning up at the output terminal. These "equalizing resistors" can take the form of **equal** lengths of wire of suitable current rating.

Don't forget that most high/ medium transistors have their metal case bonded to the collector to help dissipate the internally-generated heat, and therefore require electrical isolation from ground/ negative chassis, whilst maintaining maximum heat transference to the heatsink.

5 A BASIC VARIABLE POWER SUPPLY

To get full output current at the top of the voltage range, select a transformer of 25 to 50% higher rating than required. Otherwise the "copper losses" and "iron losses" of the transformer will come into play, causing voltage reduction when on full load.

In the following circuit, the transistor parameters are the same as for the fixed/ switched voltage PSU, but now a 741 op amp is used as a comparator, to detect voltage at the output terminals and correct the drive to the pass transistor accordingly. It is important to wire the "Voltage Potentiometer" and Pin 4 of IC1 direct to the output terminals, so that the potentiometer samples the true output voltage correctly. The max output drive current from a 741 IC is only 50 mA, so additional current amplification is required to drive the final pass transistor/ transistors.



Components

IC1 generic 741 op amp
ZD1 4v7, 100 mW. ZD1 is chosen as 4v7 so that the output can be reduced to about 5.3 volts. Dropping the value of ZD1 to 3v9 would bring the minimum output voltage to below 5V.

R1 to suit ZD1 ie 4V7/ 100 mW = max current 20 mA. Set for 10mA with a supply of 20V = 2kΩ so use either 1k8 or if 21 to 23 volts use 2k2. ½ watt rated resistor will be fine.

Don't forget: all those "lost volts" and "current passed" will result in **lots of watts** being dissipated in the pass transistor. For example, 20 volts in, 12 volts out at 3A, heat generated = (20-12) x 3 = 24 watts. I always install a small fan to blow across the pass transistor's heatsink to assist in the cooling process

See Yer !
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