PRELIMINARY AND UNTESTED

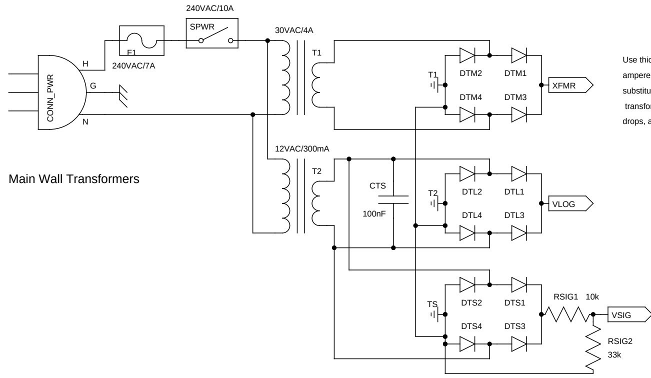
2012−06−09

Direct Drive Lead Acid Battery Desulfator

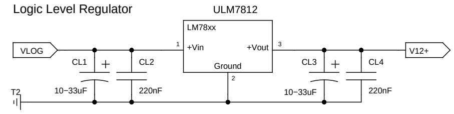
Original Design by Tusconshooter/Mark. Forum:
http://leadacidbatterydesulfation.yuku.com/topic/1162/Direct−Drive−Desulfator−Design?page=1

Use thick wires for the T1 transformer and diode bridge. T1 provides the high current power for the desulfator. T1's ampere rating will be the limiting factor of how much current will be pulsed into the battery. The fuse may be substituted with a circuit breaker. Diodes should be 10amp rated or better with high pulse current. T2 is a small transformer to provide power for the logic circuits. T2 will isolate the logic from the high ripple current, voltage drops, and ground bounces caused by the high current desulfator circuits.

Main Wall Transformers

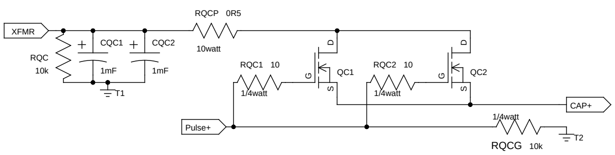


Logic Level Regulator



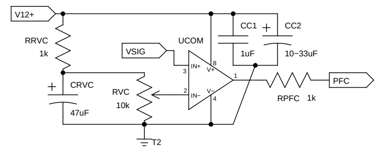
VSIG provides a rectified AC wave form signal to the comparator used for Power Factor Correction (PFC). AC line frequency doesn't matter. Since this is a low current signal, standard rectifier or signal diodes may be used.

Charge MOSFET Bank



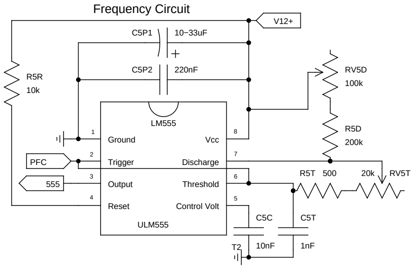
Use thick wires connecting all the parts except the Pulse+ lines. RQCP is used to take the edge off the initial surge current for parts safety and longevity. Both MOSFET's and capacitors have a limit on the current they can instantly handle. If the MOSFET's get hot, RQCP may be slightly increased (and/or charge pulse lengthened). Use low ESR capacitors for the electrolytics. Higher values are acceptable. For safety and longevity, capacitor voltage rating should be at least 30% above the rectified transformer voltage. Since the charging time is much longer compared to the discharging time, fewer MOSFET's are needed compared to the discharge MOSFET bank. Duplicate RQC+QC blocks for higher output. Choose MOSFET's based on the discharge MOSFET bank criteria (although these don't have to have as high of ratings). A low resistance MOSFET shouldn't get hot, but add a small heat sink with a little thermal compound to it anyways.

PFC Comparator



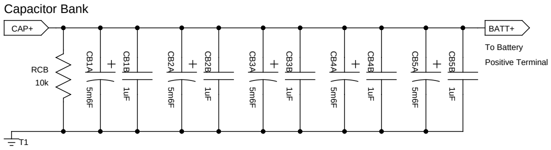
Choose a comparator model that uses a pull up resistor on the output (but don't actually implement the pull up resistor). When the comparator's output is high, the output pin would be high impedance and not interfere with anything. When the comparator's output is low, it would short one of the signal lines to ground and stop the 555.
The idea is to leave the capacitor bank charged during the wait time instead of fully dumping the capacitor bank into the battery and having a really high recharge current after the wait time ends. Looking at this backwards, after the wait time ends, the capacitor bank will probably be charged a little higher than usual and give a higher pulse current the first time. Since the PFC sub−circuit would cause regular wait periods and allow a little extra cool down time, perhaps the desulfator output could be boosted a little more to compensate.

Frequency Circuit



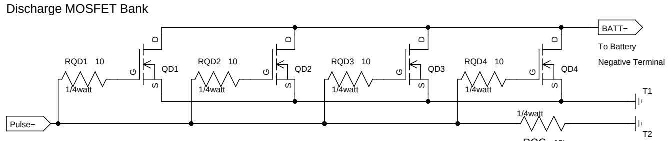
CLEAN OFF EXCESS FLUX!!! Resistors made by left over flux will cause the 555 to lock up.
All 3 brands of my 555's had a +3v spike on the top of the square wave and −3v spike below ground. This was somewhat minimized after the output was hooked to a load. Running the 555 unloaded is not recommended.
Scope'd from the MOSFET gate, the 555 should be delivering a 1−3uS pulse and a 200−300uS space. When setting up the 555, try to keep the duty cycle below 1% or things will deliver too much current, over heat, and burn out. The low duty cycle also allows time for the capacitor bank to properly recharge. Mine runs with these settings at about 3kHz. RV5D will increase the space as resistance increases (pulse width doesn't change). RV5T will make the total pulse cycle longer as resistance is increased (both pulse and space are changed). R5D+RV5D should start around 300k. R5T+RV5T should be about 1k. Even with these minimal settings, the battery charge may float well above 14v. Keep an eye on it and be careful.

Capacitor Bank



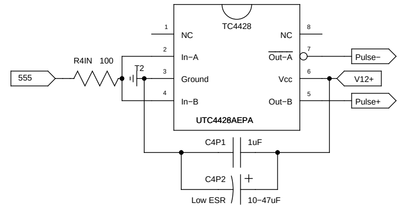
Low ESR capacitors connected to very thick wire. Using larger and more capacitors is acceptable.
Total capacitance should be around 20−30mF. For safety and longevity, capacitor voltage rating should be at least 30% above the rectified transformer voltage.

Discharge MOSFET Bank

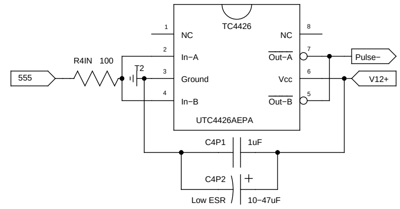


Duplicate RQ+Q blocks for higher output. Use very thick wire for drain and source connections. Choose MOSFET's based on 70−100V, 80−150 amps, 300−500 peek amps, fast rise and fall times (less than 130nS, less than 50nS ideal), and low resistance (less than 0.005ohm). Preferred choices: IRFB3307 or IRFB4710 (mine are NXP PSMN6R5−80PS).
A low resistance MOSFET shouldn't get hot, but add a small heat sink to it anyways.

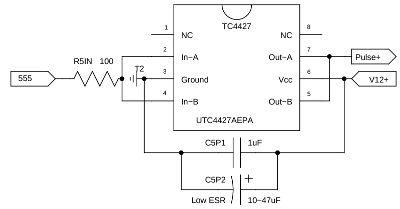
Inverting And Non−Inverting
MOSFET Driver

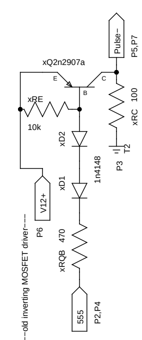


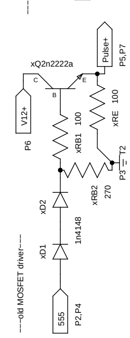
Inverting MOSFET Driver



Non−Inverting MOSFET Driver







Inverting and non−inverting MOSFET drivers. If the DIP8 chips cannot be found, use the discrete transistor circuits to the right (pin numbers are given to plug into the DIP8 sockets). The TC4428 contains both on one chip. It cannot output as much current as both channels tied together, but that's probably not a problem in most instances.