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Astron RS-20, RS-35 and RS-50 replacement Regulator Board.
Latest Revision September 2005

Hello there,

I want to thank you for purchasing the replacement Astron Power Supply Regulator Board(s). The boards are drop-in replacements for the original series of Astron Regulator Boards. The replacement board connection points are probably in the exact same locations. The basic pc board is a near clone of Astron's circuit. Indeed as of the date of this article both the new/current Astron and my updated circuit use the same cloned circuit board with minor revisions where noted.

You should have at least basic electronic tools, a soldering iron or gun, solder and some solder wick (braid). It's nice to have a "solder sucker", but (in my opinion) the wick is better for this job. A good quality multi (volt) meter is very helpful. Rubber gloves if nail polish remover (acetone) bothers your skin.

A few words of advise before you start the retrofit project. ***Please consider taking the time to read the entire instructions through before you complete the following steps.***

On a note pad or scratch paper, please write down the large transistor(s) part numbers and location(s) on a (your) hand drawn picture of the power supply. Remove each heat sink mounted power transistor and clean it with Acetone (Nail Polish Remover) or similar solvent. Try to carefully remove each of the transistor mica or thermal insulators for cleaning. Any broken insulator or transistor mount should be replaced.

Purchase a small amount of transistor heat sink compound, also known as thermal bond compound. Set the transistors, mount insulators, screws and thermal bond compound safely aside after cleaning. We'll mount the transistors after the following steps.

Observe the original regulator board location and draw out a basic sketch diagram on your note pad. Note and record the wires (number of, colors and location), which lead the main regulator board holes in your sketch. I supply a similar type drawing, which you should use as a backup reference example. Although my paperwork should be trouble free, where possible you should want to use your original circuit board notations. Note most versions of Astron's and my regulator board do have numbered (wire lead) holes in some (all) locations.

The regulator board mounts on the main electrolytic filter capactor(s) and is removed by unscrewing the capacitor top mount (connection) screws. The board will lift out of the chassis when you carefully use your soldering iron/gun to remove each of the regulator board wire leads. It's a good idea to again count; verify the locations and colors of each regulator board wire lead (on your note pad) as they are removed from the pc board.

Before you reassemble the supply, a few part value and physical condition checks are in order. Note the large square high power resistors at, on or in the lead to each of the large pass transistor mounts. Each of these resistors should not be inspected and checked for proper value. Most should be very similar in rated value (often 0.05 ohms depending on the supply output rated current value) and show no signs of stress or damage (cracks or dark color). Visually inspect the chassis wiring and repair any obvious defects. Please check the fuse for proper value. Now back to remounting the pass transistors.

Please test each of the output "pass transistors" before you replace them into service. Also test each of the large stud diodes with a quality tester (Fluke brand multi meter diode test function) where possible. The chassis or panel mounted SCR is also diode function checked for short, not-shorted properties.

Put a thin but liberal (film coating) amount of thermal bond (heat sink grease) on each TO-3 (type) pass transistor-mounting (collector) face the chassis side mica-insulating washer. The insulator mounts on the transistor, the transistor face grease holding it in place while you re-fix both to the chassis heat sink. Again, the insulator to chassis heat sink (mount) should also have a thin but liberal amount of grease coating. Both sides of the mica insulator have a thin coating of thermal compound. Note the transistor mount is directional; loosely snug both transistor-mounting screws into place. **The final transistor screw tightening is done after all the transistors are back on their respective heat sinks.** Simply wipe off any grease, which extrudes from under the transistor mounts during reassembly. Check the transistor mounts for miss-matched mating surfaces before and after the final transistor mount screws are tightened. Check the main AC fuse for proper value.

Make sure the pc board variable pot is preset to 1/3 cw rotation when facing the control white thumb wheel knob. Actually anywhere from 1/3 to 1/2 cw rotation will be adequate. Mount the new regulator board on the filter capacitor(s) in the same (original) board location and orientation. The capacitor mounting holes should mate with the new regulator board, regardless of the generation of your Astron Supply. **The mounting fit should be near, if not exact to the original Astron Regulator Board.**

Attach each of the regulator board wire leads using your notes and my supplied diagrams (drawings). Please double-check your work, being careful not to bridge any solder connections. Assemble and remaining parts or hardware not previously mentioned. Replace the main power supply cover after you've safely completed a few basic checks mentioned below. The supply is ready for initial testing.

If you have the luxury of a Variac or Variable AC Supply, it wouldn't hurt to bring the repaired supply up slowly the first time after your work is completed. Increase the Variac output (to Astron AC input supply with the Astron Power Switch on) up to 20 or 30 volts AC and carefully measure the AC voltage on/across the Astron power transformer high-current secondary windings, large stud diodes and regulator board pin 5 &6 inputs (the power transformer higher voltage – low current secondary winding).
With the volt meter, you are probing for non shorted secondary voltages in excess of .5 to 1 volt, indicating the measured location is probably not shorted (a good thing). Higher measured voltages during the variac power up is even better and should be expected. The measured locations are the (relative) low voltage - high current and regulator board (relative) higher voltage – lower current supply transformer secondary connections. During this low voltage pre-testing: if a problem exists, the transformer secondary voltages might indicate a short below 1 volt typical for a shorted or miss wired diode.

After a possible supply pre-test, power the supply up with normal line voltage and measure the supply dc output voltage. The supply output can be set to any proper range value using the regulator board thumb wheel potentiometer (control) on the parts side of the pc board. Please exercise caution when moving the output control in larger increments to avoid placing the output voltage up close to the crowbar circuit trip voltage. **Warning! The supply must be powered off and unplugged from the AC Mains to adjust the output voltage control!** The most desired dc voltage is about 13.6 volts dc under load, the resting no-load voltage no higher than 14.2 volts dc.

Technical Notations:

The replacement regulator board has an updated pre regulation circuit (vs the original Astron design). The higher current supply regulator boards (RS-20 and higher) benefit from enhanced pre-drive thermal capacity. The problematic crowbar circuit values have been properly engineered for more reliable operation. Indeed Astron's current regulator board now uses most of the same design improvements. Looking at the latest generation Astron Boards shows the basic pc board layout to be nearly exact, **less some metal film resistor**

values and locations. My board also supports the VS (variable) control option without modification. Please note the boards are part value sized per the current ratings of the respective supply. As an example, although similar the RS-35 regulator board will not drop into the RS-50 supply without modifications. Also note some early versions of the RS-35 supply remote mount the Q1 pre-driver.

I always like a schematic to a project, so I'm supplying a revised Astron diagram with notations, my rough hand drawn block diagram and an original board on the photo copier style diagram for reference. The variable pot connections on the photo copier board diagram are for the VS-20 supply and should be ignored for all other versions.

Please note these diagrams are generic for all models and some of the actual part values for your specific board might be slightly different. ***I expect and hope your regulator board retrofit will be a straight forward "plug and play" process.***

The only possible remaining supply problem might be tired filter capacitors. It's a simple matter to check for ac ripple (with a scope), while the supply is under heavy load (current draw). Aged filter capacitors can be replaced or additional parts (caps) can be paralleled within normal (practical) limits. As of this date, I've not had to replace any original Astron Supply filter capacitors for reasons of excessive ripple or esr issues.

I'm available by Email and phone if you have additional questions or comments.

If everything checks out as normal, your supply should be ready to return to active service.

Enjoy and thank you very much

Cheers,
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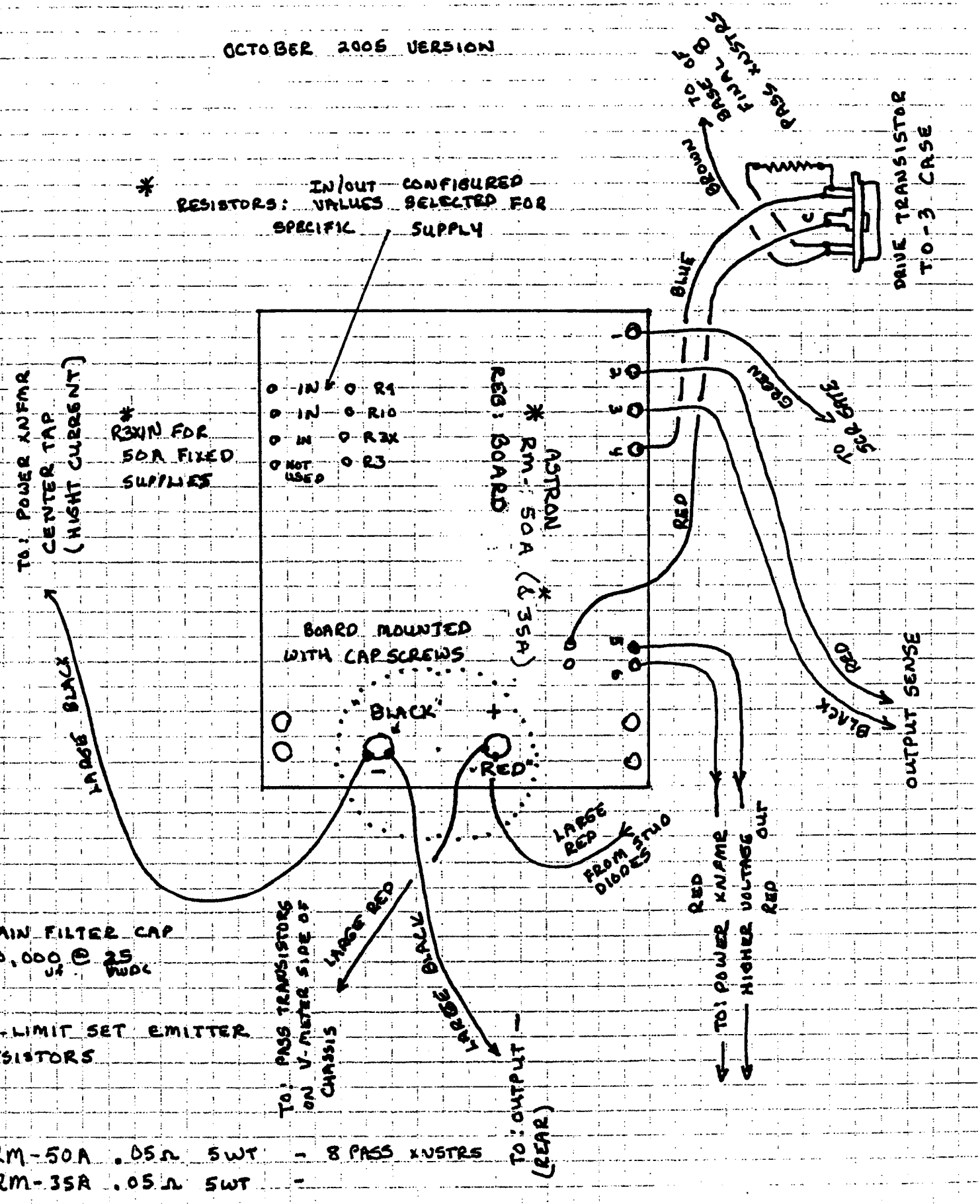
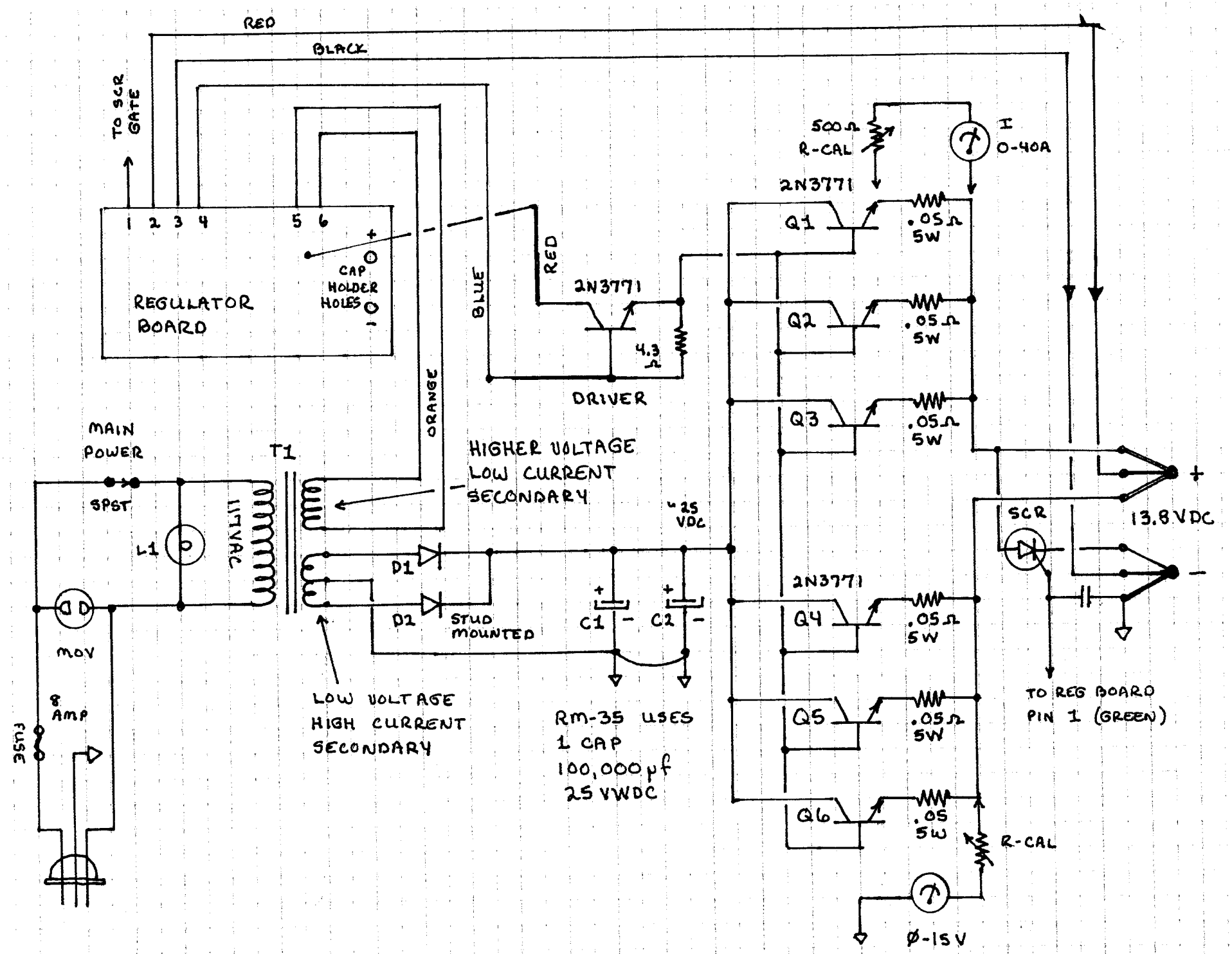
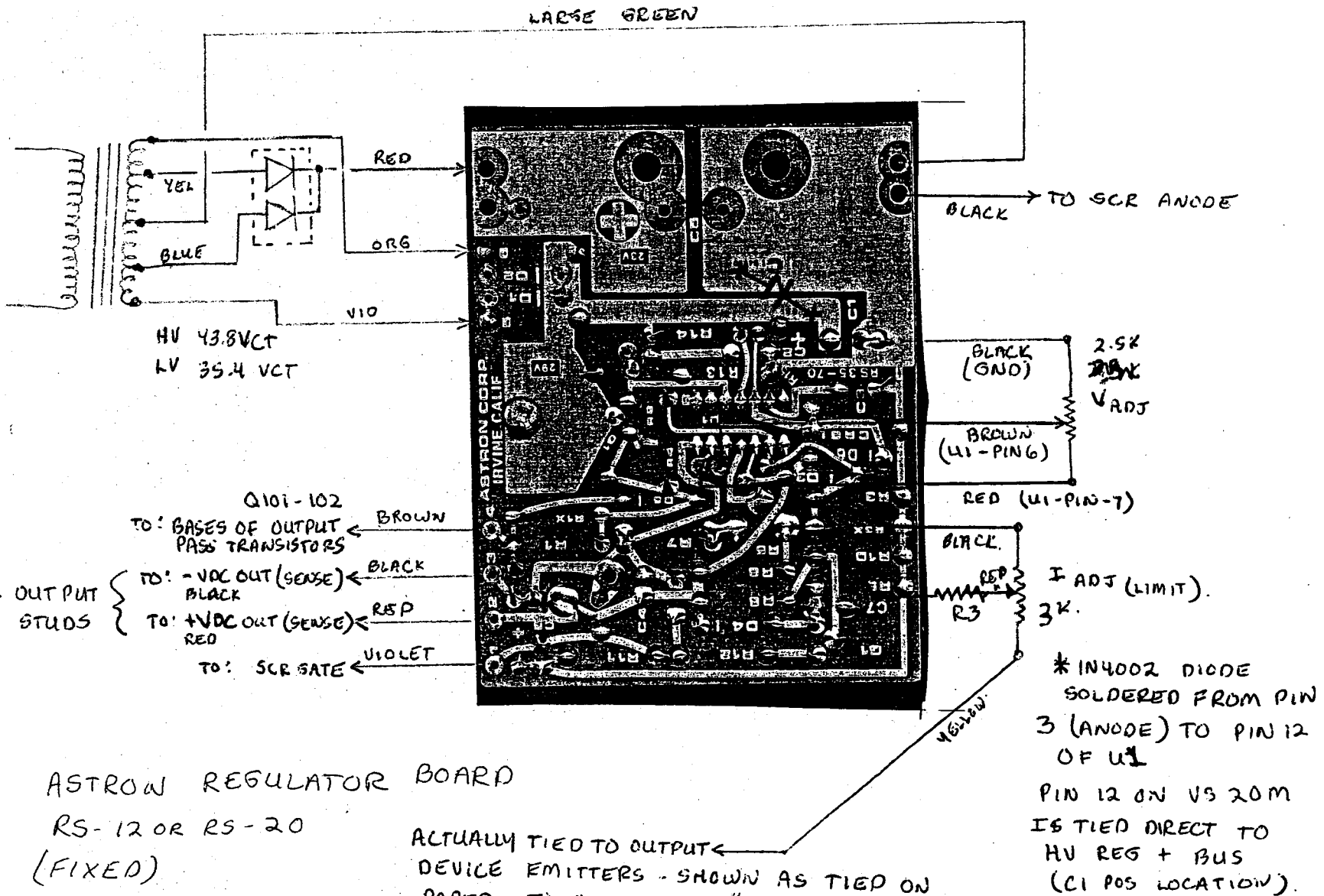
OCTOBER 2005 VERSION




RED
BLACK
TO SCR GATE
1 2 3 4 5 6
REGULATOR BOARD
CAP HOLDER HOLES
+
-
BLUE
RED
2N3771
4.3 Ω
DRIVER
ORANGE
500Ω R-CAL
I 0-40A
2N3771
Q1
Q2
Q3
Q4
Q5
Q6
.05Ω 5W
MAIN POWER
SPST
L1
115VAC
T1
HIGHER VOLTAGE LOW CURRENT SECONDARY
~25 VDC
D1
D2
STUD MOUNTED
C1
C2
MOV
8 AMP FUSE
LOW VOLTAGE HIGH CURRENT SECONDARY
RM-35 USES 1 CAP 100,000 pf 25 VWDC
SCR
13.8 VDC
TO REG BOARD PIN 1 (GREEN)
R-CAL
Ø-15V



ASTRON REGULATOR BOARD

RS-12 OR RS-20

(FIXED)

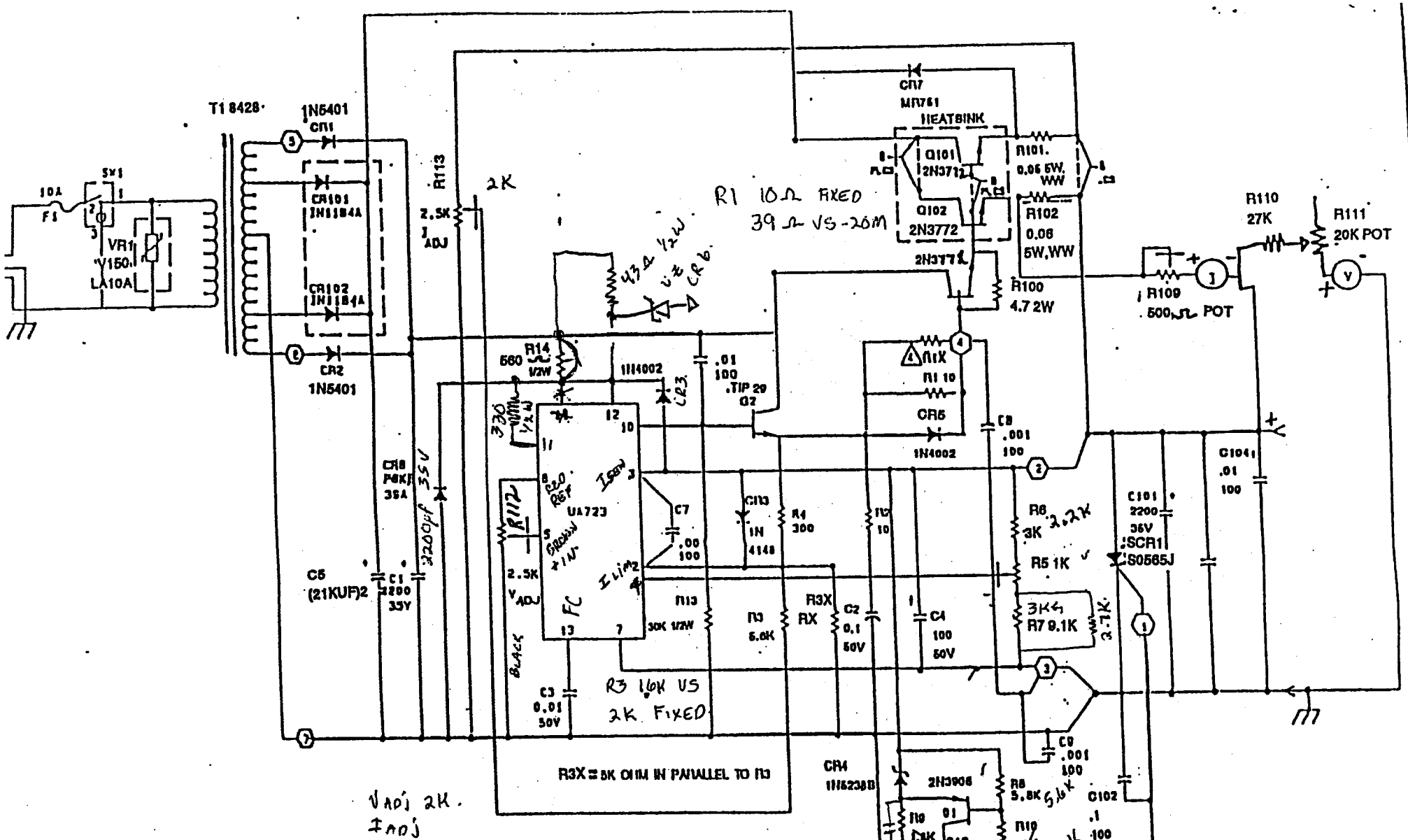
NOTATIONS OF V/ADJ & IADJ ARE FOR VS-20 MODEL.

ACTUALLY TIED TO OUTPUT DEVICE EMITTERS - SHOWN AS TIED ON PAPER TO "OTHER SIDE" OF BALLAST RESISTORS ON DIAGRAM.

WIPER RESISTOR R3, ONE END OFF PCB (GROUND SIDE).

* IN4002 DIODE SOLDERED FROM PIN 3 (ANODE) TO PIN 12 OF U1

PIN 12 ON VS 20M IS TIED DIRECT TO HV REG + BUS (C1 POS LOCATION).



SOME NOTATED DIFFERENCES FROM RS-12/20 BOARD TO MODEL VS-20

UNLESS OTHERWISE NOTED
. ALL RESISTORS 5% 0.5W. C.F. IN OHM.
. ALL CAPACITORS IN MICROFARADS.
. O PRINTED CIRCUIT BOARD.
\ TO BE SELECTED IN TEST.

A1 VOLTAGE

PIN#	NO LOAD	FULL LOAD
2	13.1V	14.0V
3	13.8V	13.7V
4	7.2V	7.2V
5	7.2V	7.2V
6	7.2V	7.2V
7	0.0V	0.0V
10	14.8V	10.5V
11	29.0V	25.0V
12	29.0V	25.0V
13	16.1V	17.6V

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DATE: 05-01-95 APPROVED:

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Supplement to Astron Replacement Regulator Board Instructions.

Last Revision September 2005, this Supplement March 2006

Hello there,

Please take a moment to read through the original Replacement Regulator Board Instructions and this Supplement information before starting work. Please feel free to contact me if you have any questions.

I've sold nearly 200 of the Replacement Astron Regulator Boards (thank you!). A number of persons have requested these boards to repair other non-Astron brand power supplies. This supplemental instruction sheet offers information to those persons trying to retrofit the Replacement Regulator Board into not-exact-fit (non Astron) power supply applications. Vista and Triplite are two name examples where the regulator boards can be used in place of the original problematic circuits.

Overview:
The replacement regulator board provides the required drive signal to the external/case mounted pass transistors. Depending on your specific power supply and regulator board, a pre-drive (or current amplifier) transistor is mounted on the PC Board or external to the board on a heat sink within the power supply chassis. This pre-drive current amplifier provides the base current to/for the series pass transistors.

Astron Power Supply Design Engineers were at least smart enough to include a large SCR Type "Crow-Bar" circuit for over voltage protection. The sample and SCR Gate Control circuit is contained on the regulator board with the actual SCR most often mounted on the power supply chassis. It is your option to add an adequate rated SCR when placing this regulator board into non-original Astron Power Supplies. You need not connect Regulator Board Hole Pin-1 if not using an external SCR for over voltage protection. I would suggest you include an SCR connected as shown in your other brand power supply circuit.

The Regulator Board circuit operates from a separate moderately higher voltage – low current power transformer winding. The primary high current relatively low voltage winding provides the regulated output voltage through 4, 6 or 8 series pass transistors, each transistor with a low value – high wattage resistor (.05 ohm – 5 watt) in series with the emitter lead. **Both winding share a common center-tap** and both windings deliver to full wave rectifier circuits.

The original Astron Supply physical layout has the regulator board mounted on top of a large filter capacitor, which is a smart and novel construction technique. Please note various combinations of Astron Supplies made through the years have different physical size filter capacitor connections and the number of actual large filter capacitors used (most often one or two).

So you need to understand the regulator board holes need to have connections to the high current full wave rectifier output. The regulator board cap negative hole is the main supply output and regulator board circuit ground/return and should be connected through large conductor black wire(s) to the common (ground) or negative return path if you don't mount the replacement board mounted on a large capacitor. The original Astron method uses longer capacitor conductor screws with wire crimp terminals to make the large conductor connections convenient. The positive or red hole side of the regulator board was use mostly as the capacitor and high current rail (via large red wire with terminal crimp connections) is not required if you don't mount the board on a large filter capacitor.

The Regulator Board wire connections are fairly straightforward. PC board Hole-1 connects to the gate of the Crow-Bar SCR (if used). Holes 2 & 3 are the output voltage sense wire connections and are simply routed to the main supply output terminals Hole-2 is the positive and Hole-3 is the negative voltage sense lines as shown in the supplied circuit diagram. Hole-4 is the series regulator drive transistor output. This is most often a large 2N3771 TO-3 Case pass-transistor like the output pass transistors. You might need to add this current driver stage to your existing supply if it doesn't have a similar circuit in the original design. ***Note the external drive transistor collector receives higher voltage direct from the regulator board positive dc supply, shown on my diagram as a red wire going to a location near board Holes 5 & 6. A solder connection hole for the drive transistor collector lead is available right at/on the regulator pc board near the cathode end of diodes D1 & D2. The part id labels are silk screened on the pc board.***

Holes 5 & 6 are for the regulator boards higher (operating) voltage – lower current secondary winding connections. The nominal PC Board Hole 5 & 6 measured voltage is about 40 VAC; keeping in mind the center tap is common to both transformer secondary windings.

That's pretty much it... if you complete the retrofit as shown, being careful to make sure all positive and negative locations are properly made, the board should work 100% right out of the starting gate. *Please do consider using the now very reliable SCR Crow-Bar Circuit. You need add only the large SCR to include it in your completed power supply.*

Again, thank you and please feel free to contact me if you have any questions.

Regards,

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