Linear Power Supply

Model 9771-15
Assembly and Using Manual

Build this dual-polarity, regulated 15 volt power supply for use as the power source in a fractional rackmount system of 9700 Series modules or other devices needing clean, stable, DC power.

The Positive and Negative DC supplies are each rated at up to 650mA

Twelve, four-circuit (V+, G, SG, V-) power connection areas are made available for powering a system of modules. A single-width FracRak format panel provides on/off control and indication of the AC input voltage and DC output voltages, and mounts the supply to an FR-7 Chassis or some other custom housing.

ASSEMBLING THE 9771-15 POWER SUPPLY

Before beginning assembly, go through the manual. Look at the drawings. Feel the parts. You're naturally eager to plunge right in, but take a few deep breaths first. Check the parts supplied against the packing list at the back of this manual.

In some cases, notes packed with the parts will be used to call your attention to special situations. ***If parts are missing, please notify PAiA at missing@paia.com or by phone at (405) 340-6300, fax (405) 340-6378.***

Notice that each step in the manual is marked with a checkoff box like this:

DESIGNATION	DESC.	MARKING
( ) R27	100ohm	brn-blk-brn-gld

Checking off each step as you do it may seem silly and ritualistic, but it greatly decreases the chance of omitting a step and also provides some gratification and reward as each step is completed.

THE CIRCUIT BOARD

The 9771-15 Power Supply is built on a double-sided circuit board. Note the “top” side of the board has the parts placement designators. Install parts to the top of the board and solder them on the bottom.

This board is used in other versions of power supply kits too. The schematic notes the variations and related assembly steps will provide explanation as well.

TOOLS

You'll need a minimum of tools to assemble the kit – a small pair of diagonal wire cutters, pliers, screwdriver, soldering iron, and solder.

Modern electronic components are small (in case you hadn't noticed) and values marked on the part are often difficult to see. Another handy tool for your bench will be a good magnifying glass. Also use the magnifier to examine each solder joint as it is made to make sure that is doesn't have any of the problems in the SOLDERING section which follows.

SOLDERING

Select a soldering iron with a small tip and a power rating of not more than 35 watts. Soldering guns are completely unacceptable for assembling solid-state equipment because the large magnetic field they generate can damage components.

Use only a high quality electronic solder. Your kit is compatible with lead-free and/or tin-lead flux-core solders made especially for electronic assembly. Plumbing solder will destroy your kit with its acid core. Jewelry solder (silver solder) will destroy your kit with its high working heat. Neither is for electronics work.

A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of the lead passing through it.

There are two improper connections to be aware of: Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a thin layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder.

Too much solder may produce a conducting bridge of excess solder between adjacent pads causing a short-circuit. Continued feeding of solder into a hot joint can result in accumulation on the underside of the board and may cause bridges or impede the action of mechanical components. If you see this, position the board above the iron tip and the excess will flow to the tip.

Use care when mounting all components. Never force a component into place.

Refer to the following diagram of the top side of the printed-circuit-board and its parts placement markings in the following parts installation steps.

The best results will be achieved by installing the parts one at a time, soldering each leg/lead and clipping the excess at the top of the joint. In the event a part has to be removed, it will be much easier and less likely to damage the printed circuit pads and traces if the legs/leads are not bent over, but left at a right angle to the plane of the board.

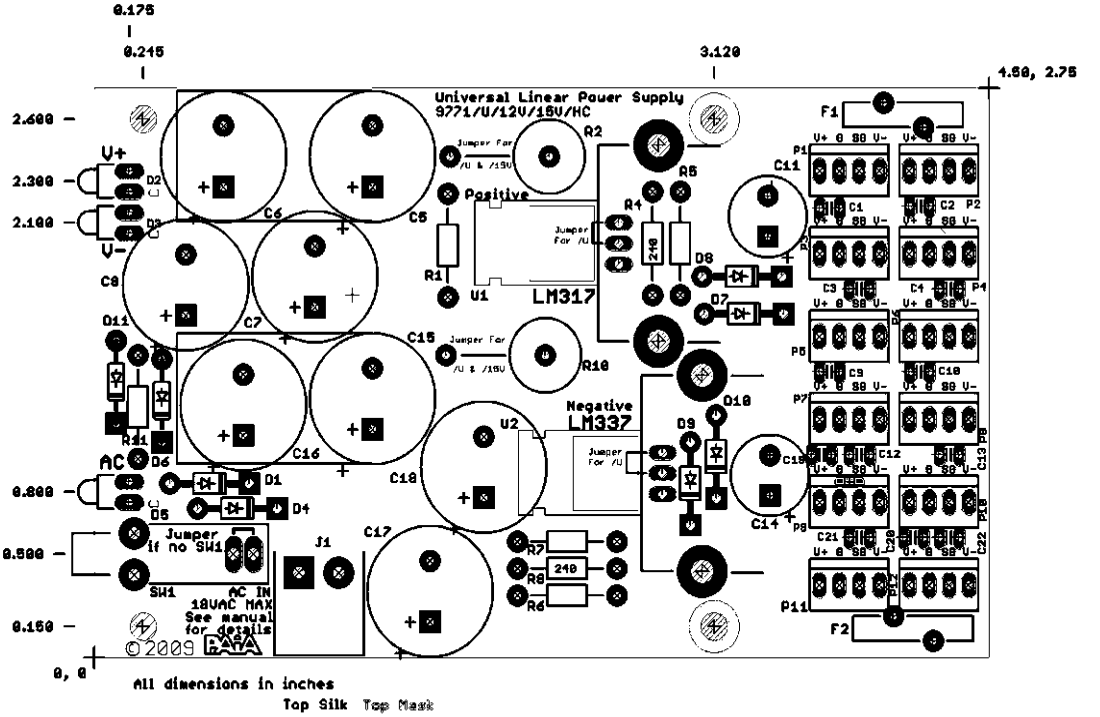
A slight outward splaying of the leads is sufficient to hold the part in place until it is soldered, but they can be left extending straight through if something holds them in place as they are soldered.

Steady the part in place as the board is turned-over for soldering and the weight of the board against the part will work to hold it in place. Soldering one leg/lead and checking the positioning before soldering the others will allow a re-positioning with the melting of the single joint.

Tip: A jig can be made with a thin piece of cushioning (foam rubber, etc.) and some cardboard. Use a rubber band to hold this sandwich together as the first joint for a part is soldered.

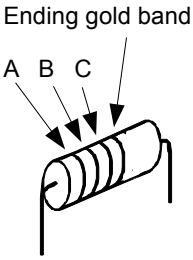
Tip: A tiny spot of fast drying glue (hot-melt) can be used to hold the part in a desired positioning.

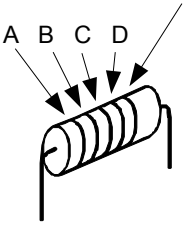
Usually jumper wires are soldered in first to get some practice in for soldering, but we'll go with resistors and capacitors first, and save some of the clippings for use as jumper wires in following steps. The capacitors legs are often a bit longer and will work best for jumpers.



RESISTORS

Install resistors by bending the legs as shown to the right and inserting them through holes on the top side of the board. Solder each leg on the bottom side of the board and clip the excess at the top of the joint.



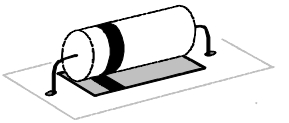


DESIG.	DESC.	MARKING A-B-C-D
( ) R1	3.3K, 5%	orange-orange-red-gold
( ) R6	3.3K, 5%	orange-orange-red-gold
( ) R11	3.3K, 5%	orange-orange-red-gold
( ) R4	240ohms, 1%	red-yellow-black-black-brown
( ) R8	240ohms, 1%	red-yellow-black-black-brown
( ) R5	2.67K, 1%	red-blue-violet-brown-brown
( ) R7	2.67K, 1%	red-blue-violet-brown-brown

DIODES

Install diodes by bending the legs as shown to the right and inserting them through holes on the top side of the board. Solder each leg on the bottom side of the board and clip the excess at the top of the joint.

DESIG.	DESC.	MARKING
( ) D1	1N400x	4001, 4002, etc.
( ) D4	1N400x	4001, 4002, etc.
( ) D7	1N400x	4001, 4002, etc.
( ) D9	1N400x	4001, 4002, etc.



Do not install diodes D8 and D10 on this 9771-15 board.

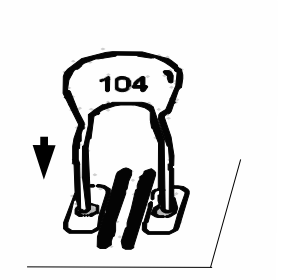
( ) D6	1N4148	1N4148 or 1N914

Do not install diode D11 on this 9771-15 board.

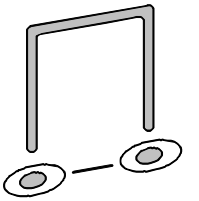
CAPACITORS, Ceramic

Install the small, coated, ceramic capacitors at the following designations in the connector/wiring area at the edge of the board. Insert them through holes on the top side of the board. Solder the legs on the bottom side of the board and clip the excess at the top of each joint. Note that if adding headers for the power supply connections, it will be important these capacitors don't tilt into this area. Save some clippings for use as jumper wires.

DESIG.	DESC.	MARKING
( ) C1	100nF	104
( ) C2	100nF	104
( ) C3	100nF	104
( ) C4	100nF	104
( ) C9	100nF	104
( ) C10	100nF	104
( ) C19	100nF	104
( ) C12	100nF	104
( ) C13	100nF	104
( ) C21	100nF	104
( ) C20	100nF	104
( ) C22	100nF	104



WIRE JUMPERS

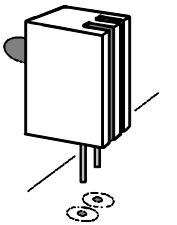


Using clippings from the previous step, form wire jumpers by making right angle bends at distances equal to those between the holes/printed-circuit-pads as shown to the right. Insert the jumper through the holes from the top side of the board. Solder the leads/legs and clip the excess at the top of each joint.

There are four jumper wires on the 9771-15: Two are at the R2 and R10 designations and two are at the F1 and F2 designations.

( ) R2 Jumper
( ) R10 Jumper
( ) F1 Jumper
( ) F2 Jumper

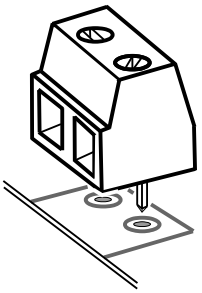
LEDs



The installation of the three Housed LEDs requires extra attention with respect to getting them flat and aligned with the edge of the board. This is a spot where some glue or adhesive might make things easier, but to just solder one leg first works too. With one leg soldered the alignment can be confirmed, and if needed, the joint reheated to allow for adjustment of the mounting. Finish each by soldering the second of the two leads/legs.

DESIG.	DESC.	MARKING
( ) D2	Housed LED, yellow	+, -
( ) D3	Housed LED, yellow	+, -
( ) D5	Housed LED, yellow	+, -

POWER TERMINAL BLOCK

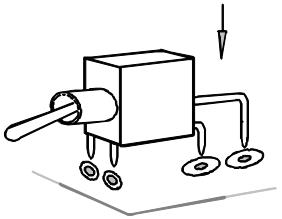


A Terminal Block is provided for the connection of the wall-mounted transformer wires to the power supply board.

Insert the part and solder one of the two legs, check the mounting is flat against the board and if not remelt the joint as it is repositioned, then solder the other.

( ) J1 Terminal Block

POWER SWITCH

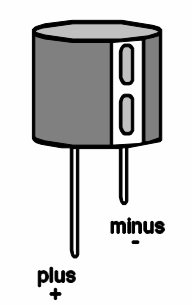


Insert the power switch, check alignment, and solder one of the two mounting pins located at the front of the part. When satisfied with the alignment, solder the other mounting pin and the two terminal leads/legs.

Or, install a wire jumper as marked if not using a switch.

( ) SW1 SPST, right-angle, pc-mount, mini-toggle switch

ELECTROLYTIC CAPACITORS



The electrolytic capacitors installed in the following steps are polarized. Usually the polarity is marked with a minus symbol within a stripe down one side of the part. Sometimes the plus leg is longer and the minus leg shorter. As the part is inserted, put the plus leg in the hole marked with a plus symbol.

These capacitors can only withstand a certain amount of voltage. The voltage rating on the capacitor must be greater than, or equal to, the amount specified below.

Insert the capacitor through the holes on the top side of the board. On the bottom of the board, solder one leg, check the installation, and solder the other leg. Clip the excess at the top of each joint.

DESIG.	DESC.	MARKING
( ) C11	470uF/25V	470uF 25v
( ) C14	470uF/25V	470uF 25v

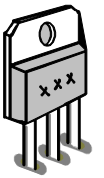
We will continue with the taller, remaining electrolytic capacitors, but in keeping with assembly order according to part height, the voltage regulators will be installed next.

VOLTAGE REGULATORS

The two, three-terminal voltage regulator ICs should be identified according to the number marked on the face of the part. The 337 is for negative DC and it goes at the U2 designation. The 317 is for positive DC and it goes at the U1 designation.

Install the part with the plastic face towards the back edge of the board with the twelve power connection areas. Leave about a 3 to 4 mm gap between the bottom of the part and the top of the board as they are inserted and solder in place. On the bottom side of the board, solder one leg and check the mounting. Solder the other two, and clip the excess from the top of each joint.

Disregard the Jumper markings between pins at the U1 and U2 designations.



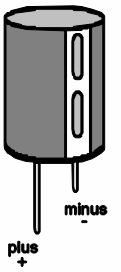
DESIG.	DESC.	MARKING
( ) U1	Positive Regulator	317
( ) U2	Negative Regulator	337

ELECTROLYTIC CAPACITORS

The final stage of the circuit board assembly is the installation of the remaining, largest electrolytic capacitors. Identify the band with the minus symbol down one side. Insert the other side in the hole on the board marked with a plus symbol

All the capacitors on the board have the minus end pointing “up” with respect to the lettering on the board (and a square pad).

Resist the temptation to put them all in at once before soldering – you'll get the best angle for getting in at the joint with the tip of the iron and the solder when making the joint without the obstruction of many leads. Insert the parts one at a time, double-check the polarity and solder one leg. If fully seated without any tilt, solder the other.



DESIG.	DESC.	MARKING
( ) C5	2200uF/35V	2200uF 35V
( ) C6	2200uF/35V	2200uF 35V
( ) C7	2200uF/35V	2200uF 35V
( ) C15	2200uF/35V	2200uF 35V
( ) C16	2200uF/35V	2200uF 35V
( ) C18	2200uF/35V	2200uF 35V

If you have a Rev 2 printed-circuit-board (marked on the top right of the bottom side), don't unplug that iron yet. A link between the G and SG ground circuits did not result as had been intended. A final jumper wire can be added linking the G and SG pads of power connection area P11 near the lower edge of the board, or, an intentional solder bridge can be made to link the G and SG, P11 pads. The jumper is best, but if making the solder bridge, it can be made better by including some wire in the bridge – after any wires or a header are or is in place at P11.

( ) P11 G-SG Link

Now that all parts are in place, it would be a good idea to take another quick look to be sure the diodes D1 and D4 have their bands to the right. D7 too. D9's should be towards the lower edge. The minus of the capacitors should all be towards the top. The 317 is the part for U1, near the top edge – the 337 is U2 near the lower edge.

Inspect the soldering looking to see the solder has flown to both the printed-circuit pad and the wire leg/lead extending through. If the solder looks like a ring dropped-down over the wire, reheat the joint and feed in a bit more solder if needed to get the joint to flow. Many joints are at 0.1” spacing. If you see one big joint, it might be a bridge. The schematic will show if two circuit nodes are common to each other or not.

Next we'll prepare the transformer wiring, connect it with the board, and test operation, but not necessarily in that order. To be on the safe side, having the panel in place and the module in an FR-7 Chassis or similar would prevent the bottom of the board from accidentally touching something it shouldn't, and, in the event of a malfunction/catastrophic-failure (i.e., a capacitor exploding), the trouble would be contained.

If building the kit for a custom application, just be mindful of the above situations and clear a non-conductive (wood, cardboard, etc.) test site and perhaps cover the board and/or wear eye protection when applying power and testing. There is not a concern with being shocked as there are only relatively low voltages.

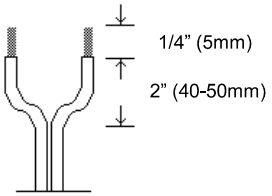
TRANSFORMER WIRING

A wall-mount AC transformer provided with this kit. If it has wire extending from it, clip any connector so the mate to the previously installed shrouded header can be used for the termination. If the transformer is a screw-terminal type, a length of 'zip' cord (SPT-2, 2x18ga.) is supplied as well.

( ) Use a knife to start a cut separating the two wires. They should pull apart easily the remainder of the appx. 2” or 50mm back. Use a tool to strip about 1/4” (5mm) of insulation from the end of each wire and twist the strands so they all clinch together. If more than one or two strands of the wire were cut when stripping, start again so this vital link is not a weak one.

The ends of your wire should resemble the example shown to the right.

Tip: If one wire is slightly shorter than the other by about 1/8" or 2.5mm, then an angle to the "rear" can exist and this helps because the wire exits "down" but will immediately need to run "back". Or, bend up, away from the board, then with a gentle lateral bend/twist to the back with the wire.

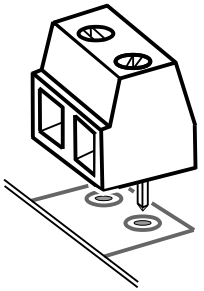


Tip: If opting to use a input connector for the transformer, select a part which isolates the two wires from the chassis to prevent a possible short-circuit or the introduction of ground hum.

Tip: When installing in an FR-7, leave some slack so the module can be removed from the front with any connector or strain-relief anchoring the wire at the rear.

TRANSFORMER WIRING (cont.)

The transformer wire can now be attached to the board-mounted J1 Terminal Block. Notice that it has two openings in the side for the wires and at the end are associated flat-blade screws for operating clamps within the wire receptacles. Clockwise adjustment of the screws tighten the clamp.



Tip: If using a wired transformer, pass the wire through any opening, grommet, or strain-relief before the next step.

( ) Loosen the set-screws by turning them counter-clockwise and note the board will need to be tilted so gravity pulls the floating clamps to the screws leaving an opening for the wire.

( ) Insert both wires and while holding them steady against the back of the receptacles. When satisfied there are no stray wire strands not sticking out to the side, or worse, going into the other receptacle, use a small screwdriver to tighten each screw. Either wire can go in either hole. Go in until resistance is felt and then about another quarter-turn.

Tip: If using a screw-terminal transformer, pass the wire through any opening, grommet, or strain-relief before the next step, connecting the wires to the transformer.

SCREW-TERMINAL TRANSFORMER CONNECTION

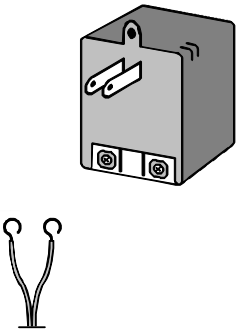
Prepare the ends of the transformer wire for connection to the transformer by separating the two as was done at the other end, but this time split the two a bit more since we'll be stripping more insulation so hooks can be formed in the wire end. About another half to three-quarters of an inch should be enough (12-18mm).

Strip about 5/8" (15mm) of insulation from each wire end and twist the stands of each. Form each in a clockwise hook by bending them around a small screwdriver shaft or similar.

Loosen the screw-terminals on the transformer and place the hooked wire ends around the screw in a clockwise direction, below any clamping washer, and securely tighten the screw (another half-turn or so, after feeling resistance).

Tip: The transformer might have a screw through an upper tab which is provided to secure the unit to the wall outlet with this screw replacing the one for the outlet cover.

( ) Attach each of the two transformer wires to each of the two transformer screw-terminals.

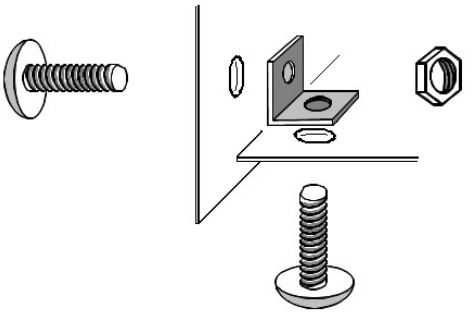


PANEL INSTALLATION

The FracRak format panel attaches to the power supply printed-circuit-board using L-Brackets and #4-40 machine screws and hex nuts. Notice one of the two holes in the bracket is threaded and one is not. A screw and nut mounts the bracket to the panel through the non-threaded hole and a screw-only goes up through the bottom of the board to meet the threaded hole of the bracket. Refer to the following diagram for this operation.

( ) Attach L-Brackets to the panel using screws through the panel, through the non-threaded hole, and secure with a hex nut. Position the lower section of the “L” towards the lower edge of the panel and loosely tighten the hardware.

( ) Fit the board to the panel and hold it in place as screws are started up through the bottom and into the threaded holes. Securely tighten these screws and return to securely tighten the screws through the panel while steadying the nut.



TESTING

With the module or board situated so there is no contact between the parts and their solder joints and anything else metal such as tools, wire, hardware, etc., the unit can be powered for testing. The voltages on the board are not enough to cause a shock, but they would spark if shorted to metal and possibly damage a part. The use of safety goggles or some barrier between you and the board as it is powered the first time is recommended as large electrolytic capacitors can explode like fireworks if a rectifier diode or the capacitor is backwards or not properly polarized.

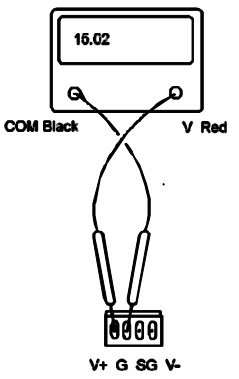
It is normal for the two voltage regulators to be very warm to hot, especially when devices are connected and being powered.

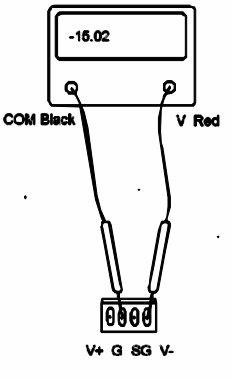
The three LEDs will light when the circuit is operational so this is a quick first indication of AC input voltage and DC output voltage status. If these don't light, switch-off or disconnect power to the unit and confirm the outlet is live by plugging in a lamp or some other powered device. Use a multitester set to measure 16V AC and confirm that touching the two transformer wires results in a reading of about 19, the unloaded peak amount. Either probe can touch either wire for this test, but both probes must each touch a wire or terminal.

One of the DC voltage indicator LEDs (V+ or V-) not glowing could be one or more of several other possibilities. Go ahead and read through the following information about testing DC voltages before jumping ahead to the troubleshooting section.

All LEDs glowing yellow and no smoke or burning smells are signs of successful completion and operation. Congratulations -- a minute or two of operation in this condition tells us everything is likely in order and we can be a bit less worried about any explosions.

DC voltage tests can be made to confirm the V+ and V- power supply connection points are indeed, the intended positive and negative fifteen volt amounts. If using a tester with a meter-movement or a needle that swings across a scale, certain precautions must be observed and these are described later. A tester with a digital readout likely features auto-polarity detection and will indicate negative DC with a minus symbol preceding the digits (positive dc has the digits only, or maybe a plus symbol). If the tester has a selection for the measurement, select DC Volts (may be labeled with a dashed line above a solid line) and if there is a selection for range, choose one for eighteen or more. With the black probe touching G or SG, use the red probe for a measurement of the voltage on the V+, then the V- outputs in the power connection areas at the back edge of the board. Each should be very near, if not exactly fifteen.





When using a tester with a meter-movement, attention must be given to the expected DC polarity so the needle doesn't try to swing in the opposite direction of its at-rest, all the way to the left, position. Maybe the tester has a switch for polarity marked -DC or +DC. If so, select -DC when you anticipate measuring a negative DC and +DC for positive measurements. The black (Common) probe can always be the one on the ground/circuit-common/0Vdc (G, SG) points. Otherwise, you must consider the expected polarity and reverse the probes contact with the circuit nodes for negative readings. If not sure of the polarity, start with the range much higher than expected and watch for a slight deflection of the needle. If it slightly moves to the right, the DC is positive. If it doesn't move or moves slightly left, it is negative: Reverse the probes and check again.

When satisfied about the polarity of the DC voltage for the circuit nodes in contact with the probes, the range can be set to show eighteen volts or more. To summarize, if your tester is an inexpensive analog type, you probably need to put the red probe to ground and use the black probe when looking for negative DC voltage (black to ground and red to voltage for positive DC).

Tip: An alligator-clip test-lead can be used to jumper the common probe to a ground point freeing up one hand and making it easier to make multiple tests.

Tip: Measuring a battery will serve as a reference to confirm your tester is operating as expected and the range is correct and the leads don't have a broken wire.

TROUBLESHOOTING

When there is trouble in one or more areas, first, check the soldering. Look for joints where the solder did not flow to the solder pad and the component lead or wire extending through. Reheat to melt the joint and flow in a bit more solder, or remove the solder and make the joint anew. Look for joints with a smooth, shallow dome of solder without signs of the excess having been clipped: The part or wire might have dropped out of the joint as it was being made. Maybe your lighting wasn't good and you just missed soldering a joint. Good lighting and a magnifying glass can reveal trouble that would otherwise involve numerous possible tests. If two joints touch but you aren't sure if they should or not, identify the parts or wires on the top side of the board and look to see if they are shown connecting on the schematic. Note however, the schematic doesn't show connections between grounds, supply voltages, and other circuits joining many nodes, so if you aren't sure, phone or email before cutting or scraping the board. Or, remove the solder and if there is a gap between the solder pads, a bridge had occurred and the two joints can be soldered again.

Check the top side of the board too. Maybe a stray piece of wire or hardware has lodged between things and is resulting in a short-circuit.

Identify parts shown on the schematic that are parts of the malfunctioning circuit section. Double-check these parts on the board to be sure they are indeed the part specified and that they look intact. Give the part a gentle nudge. This could reveal it has been stressed and is broken.

Testing for AC and DC voltages throughout the board can reveal if a connection is not being made even though nothing looks wrong. Parts shown joined on the schematic should have the same voltage measurements. On the printed-circuit-board (pcb) the traces or copper lines can be seen joining solder pads. Some travel to the top side of the board through plated holes. If by chance a part is installed and then removed without regard for the plating of the hole walls, the circuit could have opened due to the removal of the part taking the plating with it. Excessive heat during soldering can compromise the adhesive which holds the plating to the board and when it detaches, any force against the part above can cause the circuit to break.

Some testers can make a continuity test which is usually a tone that sounds when the two probes are touched together or two two ends of a wire or two parts that are supposed to be connecting. Before doing touching any circuit points for this sort of test, be sure the power is off but also that capacitors have discharged. When some device is connected to the outputs of the power supply and is working to load the outputs, they will quickly discharge, but without anything connected it can take as long as a minute or so. You'll see this as the V+ and V- DC indicator LEDs will remain glowing after power is removed until they discharge through the load of their respective LED circuit. If you're inclined to make any continuity or resistance tests on the board, use a low valued resistor (about 1Kohm) to link the two ends of any capacitor in the circuit section in question so as to dump and zero any charge.

CONNECTING DEVICES

Use the four-circuit power connecting cables (when provided in the PAiA product being powered) to make soldered connections to the areas at the end of the board.

( ) Strip about ¼" (5mm) of insulation from the ends of each of the four wires. Be especially careful to not cut any of the strands: The remaining stubs can become exposed and after the wire is moved around a time or two, and reach over and touch a neighboring circuit. And, the wire strength and current carrying capability is compromised.

( ) Twist the exposed strands to form a smooth, straight group and "tin" them by flowing just enough solder into the strands to hold them together.

( ) Match the recessed side of the housed-terminal end of the connecting cable with the polarizing tab marking on the board to identify the color of the wire for each circuit and note this so each wire is soldered to the proper hole.

( ) Insert and the wires in their respective holes (i.e. red in V+, black in G, yellow in SG, and blue in V-, or whichever colors as previously noted) and when soldering, take measures necessary to position the wire so it is extending straight through the hole and not bent over or tilted towards another pad/circuit. This will lessen the tendency for the solder to bridge as each joint is made.

Search the PAiA website for details on the components of these cables for building custom sets. The ones in PAiA kits are comprised of 16 inches of #22 gauge, insulated, stranded hook-up wire, terminals, terminal housing, a board-mounted header, and some wire ties to group the four wires.

When using an alternative method, avoid the use of solid wire which has less surface area than the stranded type and is not as flexible. The #22 gauge is recommended for the hole size and the improved conductivity compared to a thinner (higher gauge number) wire. It will be best keeping runs to less than three feet or a meter.

G and SG are joined at the power supply but run out to the devices over separate wires. On PAiA devices, G goes to parts which have hum or switching currents and this helps keep them from being imposed on the audio or particularly sensitive or critical circuits at the end of the SG wiring.

Add the current ratings for the devices connected. The total should be below the 650mA available from each supply with a 16VAC, 1.2A transformer as the power source.

DESIGN ANALYSIS

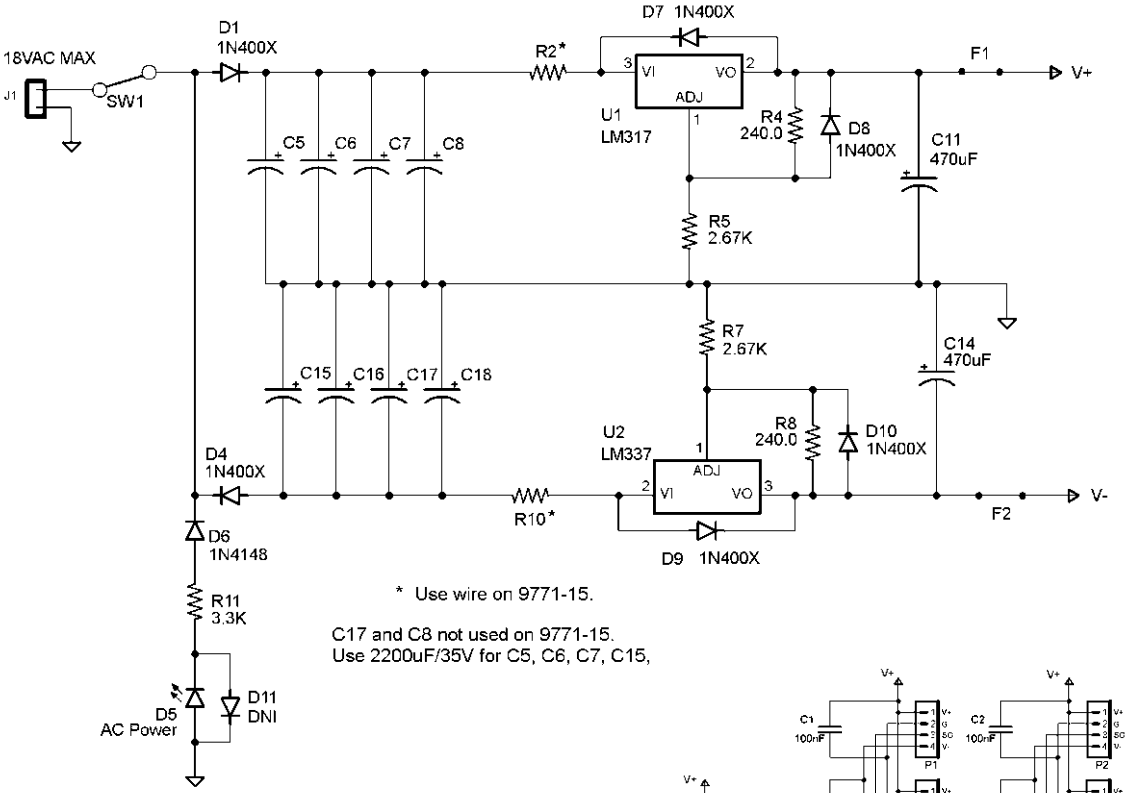
The AC voltage from the transformer connected as the power source is input to a half-wave rectified, voltage-doubling circuit comprised of rectifier diodes D1 and D4 and capacitors Cs 5-7 and Cs 15, 16, & 18. As the transformer voltage transitions between negative and positive peaks, D1 is forward biased and C5 charge to attain the transformer peak voltage. This results in about +23V DC on this capacitor. As the transformer peaks positively and begins to transition negatively, D1 is reverse biased, D4 forward biases and C18 charges with the opposite polarity. The charge on these capacitors adds, resulting in a doubling of the voltage from the transformer. This action repeats 60 times a second, the line voltage frequency, and the capacitors work to store the voltage between 'recharges'.

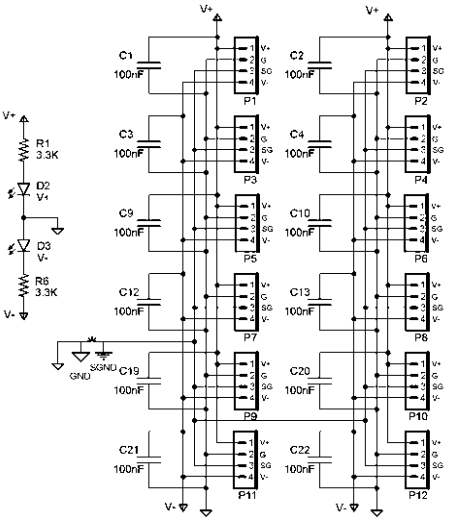
This is seen with the LEDs continuing to glow when power is removed (and with no devices connected, serving to load the supply). There is a balance between capacitance, their ability to store and keep the input fluctuations constant, and the load connected on the output.

The resulting stored, positive and negative DC voltages go adjustable voltage regulator ICs U1 and U2, a 317 and 337 respectively. They only allow a certain amount of the input voltage to appear at their output and because it is less than what is input (15v for this supply), they can let voltage through that is free of any fluctuations. It is regulated or stabilized.

Resistors connected as a voltage tap from their output to ground set their voltage (Rs 4 & 5 for the positive and Rs 8 & 7 for the negative). Diodes D7 and D9 work to provide a discharge path and prevent voltage at the output pins of the regulators from exceeding the voltage input to the part. More capacitors connect from the positive and negative supplies to ground at the output of the voltage regulators for further filtering/smoothing. Cs 11 and 14 take care of any lower frequency fluctuations and the smaller capacitors at the connection areas as shown on the schematic suppress any higher frequency fluctuations which could to develop with the connected load.

LEDs D2 and D3 are forward biased with their connections to the positive and negative supplies and glow with an intensity as set by their associated current limiting resistors Rs 1 and 6. LED D5 receives negative half cycles of the AC input voltage through diode D6 and the current flow is set by resistor R11 causing the LED to glow with the presence of the input voltage.





9771-15 Specifications (w/16.5VAC, 1.212A transformer)

Voltage	Current
+15VDC	+650mA
-15VDC	-650mA

9771-15 PARTS LIST

Please check the parts against this list. As you locate a part type and verify the quantity (and mounting hardware -- if required) check it off in the space provided.

If anything is missing please notify PAiA at missing@paia.com or by phone at (405) 340-6300, fax (405) 340-6378.

	Quan	Description	Ref Des	Marking
( )	1	8' length, 18 gauge, SPT-2 “Zip” Cable		
( )	1	9771 PCB, Power Supply		
( )	1	9771 Front Panel, Power Supply		
( )	1	16.5 Vac, 1212mA Wall-mounted Transformer		
( )	6	2200uF, 35V Capacitor, Electrolytic, Radial	C5-7, C15, C16, C18	
( )	1	Terminal Block, 2 Pin, Right-angle, PC-Mount	J1	
( )	1	Switch, Toggle, SPST, RA, PCB Mount	SW1	
( )	1	317, Positive Voltage Regulator	U1	
( )	1	337, Negative Voltage Regulator	U2	
( )	2	470uF, 25V Capacitor, Electrolytic, Radial	C11, C14	
( )	3	LED, Yellow Diffused, RA, PCB Mount	D2, D3, D5	
( )	12	100nF, Capacitor, Ceramic, Epoxy-coated	C1-C4,	104
			C9-C10,	104
			C12-C13	104
			C19-C22	104
( )	4	1N400x, Rectifier Diode	D1, D4, D7, D9	
( )	2	2.67K ohm Resistor, Metal Film, 1%, 1/4W, Axial (Rd-Bl-Vi-Br-Br)	R5, R7	
( )	2	240 ohm Resistor, Metal Film, 1%, 1/4W, Axial (Rd-Yl-Bk-Bk-Br)	R4, R8	
( )	3	3300 ohm Resistor, Carbon Film, 5%, 1/4W, Axial (Or-Or-Rd-Gl)	R1, R6, R11	
( )	4	Machine Screw, #4-40 x 1/4”		
( )	2	L-Bracket		
( )	2	Hex Nut, #4-40		
( )	2	#4 Sheet Metal Screw, Black		

9771-15 Linear Power Supply