

NRG STEREO LIMITER KIT

CONSTRUCTOR GUIDE

Please read fully before construction starts

First, check that the kit contains all the parts listed on the component list. If any parts are missing or damaged, contact us immediately. Next, is your soldering of a reasonable standard and have you got a soldering iron with a tip size of 2.5 mm or smaller. Only proceed if your answer is yes. Remember that you can change the kit for a ready built unit at this stage if you are unsure. (You only pay the price difference).

The printed circuit board (PCB) has a silk screen print on the topside. You can see component shapes and numbers. With this, and the component parts list you have all you need to identify components and fit them correctly into the PCB. Take care and time to make sure all components are correctly placed. Finally, make sure that you have the following tools:

Side Cutters: Long Nose Pliers: Screwdrivers: Soldering Iron: Solder: Please note that you get better results using thin 22 SWG solder rather than the thick 18 SWG type.

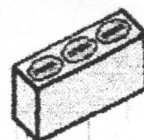
BUILDING STARTS HERE!

GENERAL: Separate the pages of this manual so you can clearly see this sheet, the component fitting guide, the component list and the large photograph, all at the same time. Fit the smaller components first and work your way through progressively larger components. **Remember this: All components should be pushed down flat to the PCB, (unless stated otherwise).** Use the photograph and the component-fitting guide to help you further.

1. First, fit and solder the **resistors** (R1 – R117). When you have soldered a few components, use your Side Cutters to trim back the excess leads. Resistors can be fitted either way round.
2. **Diodes** (D1 – D9) are next. Make sure you fit these the right way round. Remember, make sure you are still fitting the components flat down to the PCB. **Zener Diodes** ZD1 and ZD2 are white spotted whilst ZD3 is much larger.
3. We can now fit the four ICs (integrated circuits), **IC1, IC2, IC3 and IC4.** These devices must be fitted the right way round with the notch on the IC lining up with the printed shape on the PCB. Make sure that all 14 pins on each device actually go through the holes in the PCB. You may have to bend the pins slightly, with pliers, to make them fit. Before soldering, make sure that the ICs are flat to the PCB. Solder these components carefully as it is very easy to bridge pins together with solder.
4. At this stage hold the board under bright light and check that you have soldered every component connection so far in the PCB. Also check that connections close to each other aren't bridged with solder. Do the components look to be reasonably flat to the board?
5. Now fit the **variable resistors** VR1 and VR2, followed by the **capacitors** C1 – C43. Note that C33 and C37

have pre-formed leads and **no force** should be used to fit these. Have a look at the component-fitting guide for help on fitting capacitors to the PCB. **Remember,** fit the parts flat (or very close to) the PCB. Make sure that you fit all the **electrolytic** capacitors the correct way round.

6. Fit the **ferrite beads** (FB1 – FB6) next. We again have to remind you: as with most other parts, push these components fully down to the PCB. Next fit the **Transistors** (TR1, TR2, TR3, TR4, TR5 AND TR6). Now, these six components will not go flat to the PCB, so push them down to within 5mm of the PCB. Make sure you fit them the right way round and in the correct locations.
7. There are four black phono sockets to fit next. These are a tight fit into the circuit board. At the locations marked 'phono', patiently and carefully insert the sockets. Some force will be needed and you must make sure that the plastic lugs are through the holes in the board. Once they are all inserted neatly, solder the 3 large connections on each socket.
8. Right, it's time to hold the PCB under the bright light again and check your work carefully for joints you have missed with your iron and also solder splashes. If everything looks OK, you can proceed to fit the black plastic dual pin headers (jumpers) at locations J4 and J3. Next fit the triple pin headers at J1 and J2. The white 4 pin plug should be soldered at location PL1 (stereo expand)
9. Now fit and solder the 6 green LEDs. You can solder them flat down to the PCB, but it will look better if you bend the leads at a right angle and have the LEDs facing forward. The LED's must be fitted the correct way round. All the remaining parts should now be fitted and soldered. The **fuseholder** clips must be fitted the correct way round to enable the fuse to fit. Solder the **red/black wire** to the large tinned pads, underside, at location marked '13.8 volt DC', with the red wire to +.



15KHz Low
Pass Filter

10. Care should be taken with the **15KHz Low Pass Filters.** The pins should be soldered quickly so as not to damage the part through overheating. Make certain all the pins have gone through the PCB holes. Take care not to bridge any of the pins together with solder. **DO NOT ADJUST FILTER CORES!!!!**
11. Check the finished unit for good soldering and that all the components are in the right location, the right way round. You are now ready for testing the assembled Stereo Limiter/Compressor.

APPLICATION

The **NRG Stereo Limiter Compressor** is the ideal unit to keep the sound level under control on your FM broadcasts. With your FM transmitter sound level set correctly, the Limiter will enable you to transmit audio that is always optimised towards a 100% modulation level. Any attempt at high sound levels without a good limiter always results in overmodulation and distortion.

The **NRG Stereo Limiter** has newly designed circuitry, which allows you to **dynamically 'expand'** the stereo image, which provides more depth and a rich warm surround sound on stereo receivers. Another exciting feature is the inclusion of selectable release times, which enables you to get the very best sound for your particular station programme type/format. 15KHz low pass filters are also included to prevent unwanted high frequency signals from CD players upsetting the transmitter system, particularly for stereo broadcasts. **Please note that you must disable any pre-emphasis on your transmitter or stereo coder before you start broadcasting with the new stereo limiter connected.** The Pre-emphasis function will now be carried out by the stereo limiter!

SWITCH ON TIME

1. Connect the red/black power wires to a 13.8 volt regulated power supply. Turn on the power supply. The green LEDs should illuminate for a while after switch-on.
2. Adjust the preset resistors VR1 and VR2 to their mid position. VR1 and VR2 controls the sensitivity of the green LEDs. The LEDs actually indicate the amount of limiting that is taking place. Remove the socket (if fitted) at PL1 and remove the jumpers at J4 and J3, they simply pull up and off. The jumpers J1 and J2 should however be fitted, at either 50uS or 75uS settings.
3. A CD player can be connected to the Limiter phono input, using a stereo phono lead. Now, play the loudest CD you have got and take a look at the green LEDs. **With VR1 and VR2 correctly set you can expect to see two LEDs permanently lit with third LED flashing now and again.** If no LEDs are lit, then **slowly** adjust VR1 and VR2 in an anti-clockwise direction (viewed from above) until they are working correctly. If all the LEDs are lit all the time, then slowly turn VR1 anti-clockwise to get the calibration correct.
4. Now, get another stereo phono lead and connect it between the Limiter phono output and the input of your stereo transmitter, or stereo coder. Now listen to the signal on a FM radio and set the modulation preset(s) on the transmitter (or stereo coder) for the correct sound level. By correct sound level, we mean the same level as BBC Radio1 for example and no louder.
5. **Using the new features on the NRG Stereo Limiter.** If things have tested satisfactorily up to this point, you can experiment with the various settings available. **The Release Time setting** has an effect on the overall quality of music. With jumpers J3 and J4 removed, the release time is rapid and is best suited to stations with lively aggressive speech sessions. With the above jumpers fitted, the compressor release time is longer and this will give the best possible reproduction of

music. **Dynamic Stereo Expand** is activated by fitting the white 4 way socket onto the white 4 pin plug, at location PL1. On most stereo music, you will find the difference quite amazing! When operating the stereo expand mode, you are strongly advised to use the longer release time setting, that is with jumpers J3 and J4 fitted. A versatile 3-way **Pre-emphasis** system is provided on the NRG stereo limiter. For FM broadcasting, pre-emphasis is needed, or the received signal will sound dull. For the USA and Canada, please fit the jumpers at J1 and J2 for 75uS operation. For just about everywhere else, you should use the 50uS setting. If you are using the stereo limiter for recording purposes, you may want to disable the pre-emphasis altogether by removing the above jumpers completely.

6. If things are working, as they should be, you should notice that your transmitted sound level is a lot more consistent than it was before. You will notice a big improvement on live speech, which is difficult to transmit correctly, without a Limiter.

PROBLEMS

1. *The Limiter seems totally dead.*
 - Check that you have connected the red/black wires correctly on your power supply. Test your power supply for the correct voltage or try a known working appliance on it.
 - Check the fuse on the limiter. Replace only with a 1-amp type.
 - Go over the soldered joints on the PCB to see if have missed soldering a joint.
2. *The green LEDs flash momentarily when first switched on but there is no output and no green LEDs flashing with a loud input.*
 - Replace the phono lead, as they are prone to failure. Also try another audio source if necessary.
 - If just one channel is down, another thing you can try is to bypass the 15KHz filter just in case the filter is causing the loss of output. There are nine pins in a row on the filter. Connect pin 1 to pin 9 with a short piece of wire. If the limiter now appears to work, the filter is faulty and should be replaced.
3. *The transmitted audio has far too much treble, contains sibilance, and generally sounds "tinny".*
 - Make sure you have disabled the pre-emphasis on your transmitter and/or stereo coder.

COMMON CONSTRUCTOR ERRORS

1. One or more LEDs fitted wrong way round.
2. One or more diodes fitted wrong way round
3. Transistors incorrectly fitted.
4. ICs incorrectly fitted or pins bridged with solder
5. Joints not soldered at all
6. Very poor soldering quality

If the unit does not work and you have done all you can then please do not worry. Give us a call for advice on what to do next.

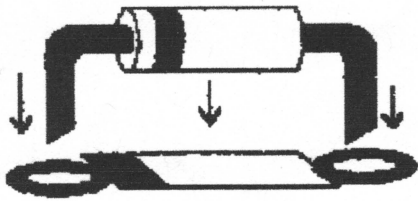
COMPONENT LIST FOR PRO 3 STEREO LIMITER

R1	270K	red purple yellow gold	R74	1K	brown black red gold	C30	10uF	10uF 10V tantalum
R2	270K	red purple yellow gold	R75	1M	brown black green gold	C31	2.2uF	2.2uF 10V tantalum
R3	33K	orange orange orange gold	R76	3K9	orange white red gold	C32	4.7uF	4.7uF 10V tantalum
R4	3K9	orange white red gold	R77	0R	single black band	C33	0.68uF	680nK 100 (orange)
R5	33K	orange orange orange gold	R78	10K	brown black orange gold	C34	10uF	10uF 10V tantalum
R6	3K9	orange white red gold	R79	2K2	red red red gold	C35	2.2uF	2.2uF 10V tantalum
R7	3K9	orange white red gold	R80	0R	single black band	C36	4.7uF	4.7uF 10V tantalum
R8	10K	brown black orange gold	R81	4K7	yellow purple red gold	C37	0.68uF	680nK 100 (orange)
R9	0R	single black band	R82	68R	blue grey black gold	C38	10uF	10uF 16V
R10	3K9	orange white red gold	R83	220R	red red brown gold	C39	10uF	10uF 16V
R11	47R	yellow purple black gold	R84	1K	brown black red gold	C40	100pF	101J
R12	0R	single black band	R85	56K	green blue orange gold	C41	100pF	101J
R13	10K	brown black orange gold	R86	10K	brown black orange gold	C42	100pF	101J
R14	1K	brown black red gold	R87	47R	yellow purple black gold	C43	100pF	101J
R15	100K	brown black yellow gold	R88	270R	red purple brown gold	IC1	TLO74	TLO74
R16	1K	brown black red gold	R89	4K7	yellow purple red gold	IC2	TLO74	TLO74
R17	56K	green blue orange gold	R90	10K	brown black orange gold	IC3	TLO74	TLO74
R18	1K	brown black red gold	R91	33R	orange orange black gold	IC4	TLO74	TLO74
R19	1M	brown black green gold	R92	100K	brown black yellow gold	TR1	BC548B	C548B
R20	3K9	orange white red gold	R93	1K	brown black red gold	TR2	BC548B	C548B
R21	2K2	red red red gold	R94	3K3	orange orange red gold	TR3	BC548B	C548B
R22	0R	single black band	R95	680R	blue grey brown gold	TR4	BC548B	C548B
R23	220R	red red brown gold	R96	680R	blue grey brown gold	TR5	2N3819	3819
R24	4K7	yellow purple red gold	R97	680R	blue grey brown gold	TR6	2N3819	3819
R25	68R	blue grey black gold	R98	3K3	orange orange red gold	LED1	5mm Green Hi-Bright Led	
R26	0R	single black band	R99	68K	blue grey orange gold	LED2	5mm Green Hi-Bright Led	
R27	4K7	yellow purple red gold	R100	100K	brown black yellow gold	LED3	5mm Green Hi-Bright Led	
R28	82K	grey red orange gold	R101	100K	brown black yellow gold	LED4	5mm Green Hi-Bright Led	
R29	68K	blue grey orange gold	R102	3K9	orange white red gold	LED5	5mm Green Hi-Bright Led	
R30	4K7	yellow purple red gold	R103	3K9	orange white red gold	LED6	5mm Green Hi-Bright Led	
R31	4K7	yellow purple red gold	R104	22R	red red black gold (2W)!	LED7	5mm Red Hi-Bright Led	
R32	0R	single black band	R105	0R	single black band	D1	1N4148	4148
R33	0R	single black band	R106	2K2	red red red gold	D2	1N4148	4148
R34	0R	single black band	R107	2K2	red red red gold	D3	1N4148	4148
R35	0R	single black band	R108	1K	brown black red gold	D4	1N4148	4148
R36	0R	single black band	R109	0R	single black band	D5	1N4148	4148
R37	0R	single black band	R110	2K2	red red red gold	D6	1N4148	4148
R38	0R	single black band	R111	2K7	red purple red gold	D7	1N4148	4148
R39	270R	red purple brown gold	R112	4K7	yellow purple red gold	D8	1N4148	4148
R40	4K7	yellow purple red gold	R113	4K7	yellow purple red gold	D9	1N5402	1N5402
R41	270R	red purple brown gold	R114	68K	blue grey orange gold	ZD1	BZY9V1	9V1 white spot
R42	4K7	yellow purple red gold	R115	82K	grey red orange gold	ZD2	BZY9V1	9V1 white spot
R43	10K	brown black orange gold	R116	4K7	yellow purple red gold	ZD3	9V1	1N5346
R44	33R	orange orange black gold	R117	2K2	red red red gold	VR1	2K	Preset Resistor
R45	100K	brown black yellow gold	C1	100pF	101J	VR2	2K	Preset Resistor
R46	1K	brown black red gold	C2	100pF	101J	FB1	5turn Ferrite Bead	
R47	2M	red black green gold	C3	100pF	101J	FB2	5turn Ferrite Bead	
R48	680K	blue grey yellow gold	C4	100pF	101J	FB3	5turn Ferrite Bead	
R49	1K	brown black red gold	C5	2.2nF	222	FB4	5turn Ferrite Bead	
R50	22K	red red orange gold	C6	1.5nF	152	FB5	5turn Ferrite Bead	
R51	0R	single black band	C7	1.5nF	152	FB6	5turn Ferrite Bead	
R52	3K9	orange white red gold	C8	2.2nF	222			
R53	680R	blue grey brown gold	C9	1uF	1uF 63V			15 KHz FILTER BLOCK
R54	3K3	orange orange red gold	C10	1uF	1uF 63V			15 KHz FILTER BLOCK
R55	680R	blue grey brown gold	C11	1000uF	1000uF 10V			FUSE: 2 x 20mm fuse clips + 1A fuse
R56	3K3	orange orange red gold	C12	10uF	10uF 16V	J1	3 pin Pre-emphasis Jumper	
R57	68K	blue grey orange gold	C13	100pF	101J	J2	3 pin Pre-emphasis Jumper	
R58	680R	blue grey brown gold	C14	68pF	68J	J3	2 pin Jumper	
R59	3K9	orange white red gold	C15	0.22uF	220j 63 (ORANGE)	J4	2 pin Jumper	
R60	22K	red red orange gold	C16	220uF	220uF 16V	PL1	4 pin plug + removable socket	
R61	1K	brown black red gold	C17	220uF	220uF 16V	Phono	4 x PCB Phono Sockets	
R62	680K	blue grey yellow gold	C18	220uF	220uF 16V			PRO 3 Stereo Limiter printed circuit board
R63	2M	red black green gold	C19	220uF	220uF 16V			1 metre Red/Black Wire
R64	4K7	yellow purple red gold	C20	220uF	220uF 16V			
R65	270R	red purple brown gold	C21	220uF	220uF 16V			
R66	0R	single black band	C22	1nF	102			
R67	0R	single black band	C23	220uF	220uF 16V			
R68	47R	yellow purple black gold	C24	1000uF	1000uF 10V			
R69	0R	single black band	C25	220uF	220uF 16V			
R70	47R	yellow purple black gold	C26	0.22uF	220j 63 (ORANGE)			
R71	0R	single black band	C27	68pF	68J			
R72	0R	single black band	C28	100pF	101J			
R73	100K	brown black yellow gold	C29	10uF	10uF 16V			

1

DIODES

MUST BE FITTED THIS WAY IN PCB

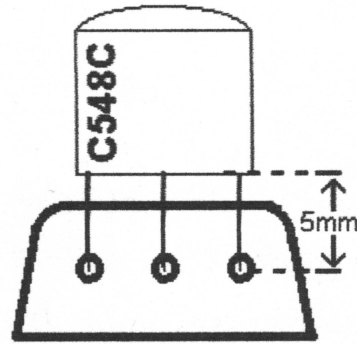


PUSH FLAT TO PCB

4

SMALL TRANSISTORS

MUST BE FITTED THE CORRECT WAY ROUND IN THE PCB. THE TRANSISTOR BODY SHOULD BE WITHIN 5mm OF THE PCB

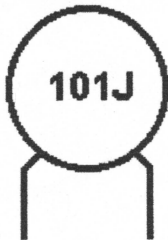


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CAPACITORS

these are fitted flat to the pcb but can fit either way in the PCB holes

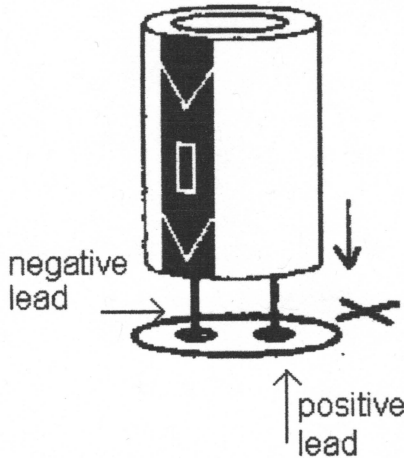
ceramic disc capacitor



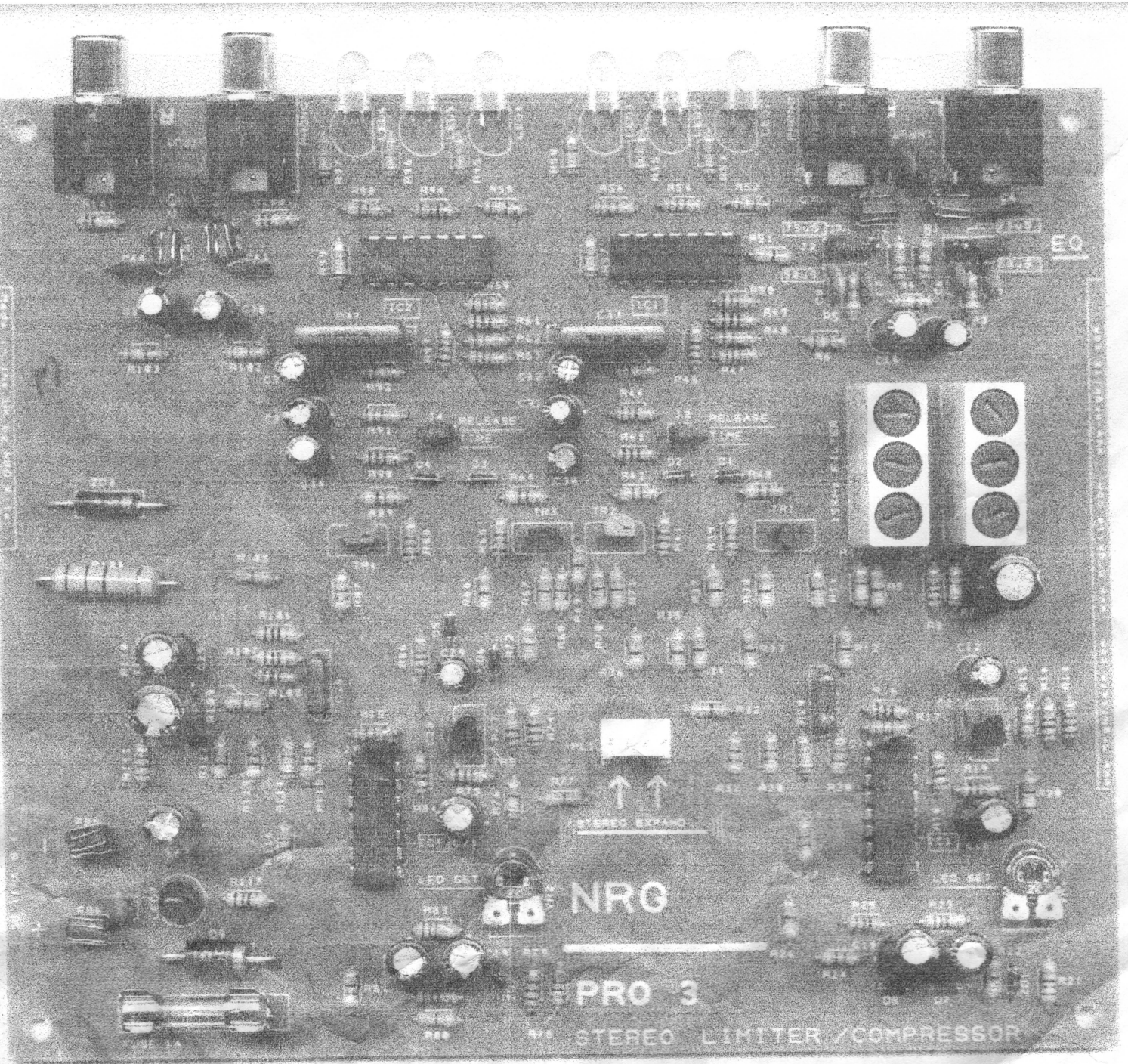
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ELECTROLYTIC CAPACITORS

FIT IN PCB LIKE THIS AND MUST BE PUSHED DOWN FLAT TO PCB.



COMPONENT FITTING GUIDE



NRG

PRO 3

STEREO LIMITER / COMPRESSOR

STEREO EXPAND

LED SET

LED SET

RELIEF TIME

RELIEF TIME

EO

