

4-WATT PLL PRO III

HI GAIN

PROFESSIONAL EXCITER

CONSTRUCTION GUIDE

OVERVIEW

The PLL PRO III High-Gain is a very high quality phase-locked-loop based transmitter. Frequency stability and spectral purity were major factors in the design process and achieve the highest standards. **NRG** have a policy of continual design and development, and this unit is the product of an extensive design process and exhaustive testing.

The circuit can be examined in the attached schematic diagram. You will see that there are essentially two sections – the transmitter and the logic. The transmitter has a unique oscillator design, which eliminates the need for a separately aligned frequency multiplier stage, even though signal generation is at half of the output frequency, which eliminates RF feedback and hum problems associated with “at frequency” designs. The next two stages are amplifiers. The gain profile of these can be adjusted by the user to yield an output of either 1 Watt or 4 Watts. A lowpass filter follows the output stage to ensure exceptional spectral purity. The logic side of the board is a phase-locked-loop with a pre-settable divider for output frequency setting. A new additional function of this model is out - of -lock power down.

The printed circuit board layout has been carefully designed to give reliable and consistent results. If you follow the simple construction details accurately, you'll easily build this high specification FM transmitter.

Please read fully before construction starts

First, check that the kit contains all the parts detailed in 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 your kit for a ready built unit at this stage if you are unsure. (*You only pay the price difference*).

The **tools** you'll need are:

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

The **printed circuit board (PCB)** has a **silk screen print** on the top side. You can see **component shapes** and their **identification 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 certain that all components are correctly placed.

Some ICs may be static sensitive, so ensure that your soldering iron is properly earthed, and avoid handling the logic ICs any more than is necessary. We always use anti-static wrist straps connected to an earth point when we're constructing projects, though touching an earthed object just prior to handling an IC will discharge any static build-up on your body, and is almost as effective!

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: All components must be pushed down flat to the PCB, (unless stated otherwise). The reliability and repeatability of this unit depend upon your accuracy of construction!

Use the photograph and the component-fitting guide to help you further.

1. Fit and solder the **resistors** (R1 – R69). Identify and insert a few at a time. We have given you the colour code for each part in the Components List. When you have soldered a few components, use your Side Cutters to trim back the excess leads. Resistors can be fitted either way round. The two **thick film resistor** packs (TFR1 & TFR2) should now be fitted. They each have nine pins, and **must** be fitted so that the grey/white spot on the component lines up with the large white dot on the board.
2. **Diodes** (D1 – D7) and **Zener Diodes** (ZD1– ZD4) are next. Make sure you fit these the right way round. The 4 Zener diodes have a white mark on them. Remember, make sure you are still fitting the components flat down to the PCB.
3. Fit and solder the **integrated circuits** (ICs) IC1 – IC5. They **must** be fitted the right way round with the notch on the IC lining up with the notch on the PCB silk screen-print. Double check they are correct before you start to solder. Solder these items carefully to avoid bridging pins with solder. Do not handle the ICs more than you need to because they are static-sensitive. You should leave fitting IC6 until after all the other parts, as it

is easily broken off at the legs once soldered in place. You should fit **DIL switches** SW1 and SW2 next.

4. **Transistor** TR6 next. TR8 will be pre-bonded to the PCB before it's shipped. This component (TR6) has absolutely got to be flat the PCB. TR6 is a 2N4427 type. TR8 is a 2SC1947 (marked C1947). All the other transistors cannot push down fully flat to the board, but leave them no higher than 5mm (see component fitting guide). Take great care in identifying the part numbers of the small transistors – there are four different types used, and they all have the same package outline. Fit the **LEDs** next and line up the flat section on the devices with that on the PCB silk screen. All components in this section, up to now, must be fitted the correct way round. An error could damage some parts, and the unit would certainly not work. Fit **VCD1** next noting that this item can actually fit either way round.
5. 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. Are all the parts flat to the board?
6. Now fit the **variable resistor** VR1, followed by the **capacitors** C1 – C70. 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 – they have polarity identification markings.
7. Fit the **coils** L1 – L7 next. We again have to remind you: as with most other parts, push these coils fully down to the PCB. Take care with the fragile coils L2 and RFC1 though. RFC1 must have a ferrite bead slipped over each lead prior to fitting it to the board – the RFC wires just go through the middle of the beads, so it stands a little way off the board.
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.
9. Now fit and solder the rest of the parts, taking a regular glance at the component fitting guide pictures. The two **fuse holder clips** have to be fitted the correct way round or the fuse won't fit. Take care with the **Trimmer Capacitor** VC1. Be careful that you do not catch your soldering iron on the thin film separating the vanes on this part, it is easily done. Solder the **red & black wire** to the + and – pads (underside and close to FB1 & FB2) with the red wire to +. The last part to fit is **IC6**, a 3 pin IC. It cannot push flat to the board because of steps in the legs. Do not bend this component on the legs, as the legs are brittle.
10. Now check the finished PCB by holding it up to the bright light. If you can see light shining through component holes it means you have not soldered that particular component properly, if at all. All the soldered joints should be bright and shiny – a dull joint usually indicates a "dry" joint. Check all the ICs to make sure they are in the right places and the right way round. Check that all the electrolytic capacitors are the correct way round and also double-check the transistors and diodes. If a soldered component, like an IC has to be removed, you will need a de-soldering pump to do it correctly.

11. You can now fit the heatsink to the output transistor TR8. Look at picture 1 on the component-fitting guide. Make sure you push the heatsink vertically down onto TR8, with no sideways pressure. This transistor can be a little fragile, so please take care. That's it.
12. Now, does your finished PLL PRO III look anything like the one in the large photograph? Well, we hope so!

Note: NEVER operate your transmitter without a proper load connected to the output – either a dummy load or a correctly matched aerial. Failure to do so could result in the destruction of your output transistor!

SWITCH ON TIME

1. Connect the Plug type 50-ohm dummy load (supplied with this kit) to the RF output SO239 socket. Set the trimmer capacitor and VR1 to their mid positions with a small flat blade screwdriver.
- Note:** The dummy load should not be used for periods longer than 30 seconds when the transmitter is at full power!
2. Set the two 8-way DIL switches to the required frequency using the look-up tables, and remove the power level selection jumper J3, so that the unit is set to 1 Watt output.
 3. Connect the red/black power input wire to a regulated 13.8-volt supply. Absolute maximum supply voltage is 15volts.
 4. Adjust VC1 until the red LED3 (unlock) starts to dim. Continue until the green LED4 suddenly illuminates and the red LED goes out altogether. The unit is now locked on your programmed frequency. A second or so later, LED1 will light indicating RF output. Turn the power off for a few seconds, and then re-apply the power. Re-adjust VC1 if the unit does not lock when you switch back on. Lock up should take 3 – 5 seconds from switch on.

Note: You can bypass the out-of-lock powerdown by fitting J2.

There will be no output power indication until the PLL locks, unless J2 is fitted. This is a protection feature, which prevents the transmitter operating on the wrong frequency. The output power LED will illuminate about a 5 seconds after the green 'lock' LED comes on.

5. Connect audio at line level to the phono socket. Whilst listening on a FM radio, adjust VR1 for the correct sound level – you can compare with other stations.
6. An aerial can now be connected to the RF output socket and your signal will be radiated. The aerial should have an impedance of 50 ohms at the frequency you want to use, and the feeder should also be a 50 ohm type. You can consult us if you need help or advice about aerials.
7. Select your required power output level. If you require 4 Watts, re-fit the power level selection jumper J3.
8. Finally, a note on pre-emphasis. You have three choices with this unit – **75 uS** for the Americas, **50 uS** for the rest of the world, and **'none'** if you use a stereo coder and/or a limiter compressor unit with the PLL PRO III. You can make your selection with the push – fit jumper J1 near to VR1.

PROBLEMS?

If the unit does not work when you first switch on, then the first thing to do is to carefully re-check your entire construction and component placement. It is unlikely that any parts supplied were faulty to start with, although not unheard of.

- 1. No Life in the unit at all.** It could be your power supply unit – is the power LED lit? Check that the red/black power supply wire is wired to the PCB correctly with the red wire going to positive terminal pin – reverse connection will blow the fuse. Finally, try fitting a replacement 1 amp fuse.
- 2. Buzz on the sound.** This is probably RF getting into your audio equipment from the transmitting aerial. The transmitting aerial must be above the building and not inside the building. If you disconnect the audio source from the PLL and the buzz goes away then the audio equipment is certainly picking up RF. If the buzz is still there, then your power supply probably has a lot of ripple on its output. Try another power supply. Also realise that some receivers buzz anyway when they are close to a transmitter, due to overloading. A good car radio is often best for checking for buzzing.
- 3. Unstable Performance.** Too many components stood up on long legs above the PCB. Dry soldered joints or joints missed completely.

COMMON CONSTRUCTION ERRORS

1. One or more LEDs fitted wrong way round.
2. One or more Diodes fitted wrong way round
3. Transistors fitted in wrong location
4. ICs fitted in wrong location
5. IC pins bridged with solder
6. Centre pin of SO239 not soldered.
7. Joints not soldered at all
8. Very poor soldering quality
9. Solder splashes

You can check the soldered joints better with a magnifying glass and also find shorted tracks. A multimeter is also very handy at locating shorted or broken tracks.

This is a complex circuit, so if it is not working correctly after you have built it, please do not panic! Give us a call for advice on what to do next.

THE NEXT STEP

We would recommend that any transmitter be properly cased in a metal box. This ensures that the unit cannot suffer from interference from local sources, and protects against damage. There are mounting holes provided in the corners of the PCB, to make assembly into a case easy.

You will have to use appropriate audio, power and RF sockets. We would recommend keeping the power supply separate, as this prevents the problems associated with power supplies in the same box as a transmitter!

If you need advice about mounting your transmitter into an enclosure, you can contact us.

Check our website, or contact us for details of new products and add-ons to your transmitter. **NRG** continually develop new products, and improve existing ones – modifications will be posted to the website.

**PLEASE NOTE THAT YOU
MAY NEED A LICENCE TO
OPERATE A RADIO
TRANSMITTER.**

NEW COMPONENT LIST FOR 4 WATT PLL PRO3xxx

R1	47R	yellow purple black gold	C1	100pF	101J	VC1	40pF	Purple Trimmer
R2	33K	orange orange orange gold	C2	1.5nF	152	VR1	10K	Variable Resistor
R3	8K2	grey red red gold	C3	2.2nF	222	IC1	4060B	4060B
R4	10K	brown black orange gold	C4	10uF	10uF 16V	IC2	74LS76	74LS76
R5	3K3	orange orange red gold	C5	47uF	47uF 16V	IC3	74LS86	74LS86
R6	100K	brown black yellow gold	C6	100pF	101J	IC4	74ALS74	74ALS74
R7	6K8	blue grey red gold	C7	56pF	56J	IC5	HC4059E	HC4059E
R8	4K7	yellow purple red gold	C8	56pF	56J	IC6	L7805	7805
R9	4K7	yellow purple red gold	C9	22pF	22J	TR1	BC558B	C558B
R10	270R	red purple brown gold	C10	22pF	22J	TR2	BF199	F 199
R11	270R	red purple brown gold	C11	1.8pF	1.8C	TR3	BF199	F 199
R12	68K	blue grey orange gold	C12	1.8pF	1.8C	TR4	BF245	245C
R13	68K	blue grey orange gold	C13	22pF	22J	TR5	BF245	245C
R14	1M	brown black green gold	C14	27pF	27J	TR6	2N4427m	M 2N4427
R15	560R	green blue brown gold	C15	1nF	102	TR7	BC548C	C548B
R16	1M	brown black green gold	C16	1nF	102	TR8	2SC1947	2SC1947
R17	560R	green blue brown gold	C17	27pF	27J	TR9	BC548C	C548B
R18	0R	single black band	C18	22pF	22J	TR10	BC548C	C548B
R19	0R	single black band	C19	1nF	102	TR11	BC558B	C558B
R20	120R	brown red brown gold	C20	220uF	220uF 16V	TR12	BC548C	C548B
R21	2M7	red purple green gold	C21	33pF	33J	TR13	BC558B	C558B
R22	0R	single black band	C22	1nF	102	D1	1N4148	4148
R23	0R	single black band	C23	10nF	103	D2	1N4148	4148
R24	2M7	red purple green gold	C24	1nF	102	D3	1N5402	1N5402
R25	5R6	green blue gold gold	C25	47uF	47uF 16V	D4	1N4148	4148
R26	6K8	blue grey red gold	C26	10nF	103	D5	1N4148	4148
R27	4K7	yellow purple red gold	C27	1nF	102	D6	1N4148	4148
R28	15K	brown green orange gold	C28	100pF	101J	D7	1N4148	4148
R29	15R	brown green black gold	C29	1nF	102	ZD1	BZX7V5	7V5 white spot
R30	680R	blue grey brown gold	C30	220pF	221J 100v	ZD2	BZX7V5	7V5 white spot
R31	68R	blue grey black gold	C31	56pF	56J	ZD3	BZX7V5	7V5 white spot
R32	10R	brown black black gold	C32	1nF	102	ZD4	BZX7V5	7V5 white spot
R33	0R	single black band	C33	1nF	102	VCD1	KV1330	330
R34	330R	orange orange brown gold	C34	10nF	103	LED1	GREEN	5mm green LED
R35	2K7	red purple red gold	C35	100pF	101J	LED2	RED	5mm red LED
R36	0R	single black band	C36	5.6pF	5.6 or 5.6C	LED3	RED	5mm red LED
R37	33R	orange orange black gold	C37	33pF	33J	LED4	GREEN	5mm green LED
R38	0R	single black band	C38	56pF	56J	X	AEL 6.4000 MHz CRYSTAL	
R39	0R	single black band	C39	27pF	27J	SW1	8 way DIL switch	
R40	0R	single black band	C40	56pF	56J	SW2	8 way DIL switch	
R41	0R	single black band	C41	27pF	27J			
R42	0R	single black band	C42	1nF	102	FB1	5 turn Ferrite Bead	
R43	0R	single black band	C43	1.8pF	1.8C	FB2	5 turn Ferrite Bead	
R44	4K7	yellow purple red gold	C44	5.6pF	5.6 or 5.6C	FB3	5turn Ferrite Bead	
R45	4K7	yellow purple red gold	C45	1nF	102	FB4	5turn Ferrite Bead	
R46	1K5	brown green red gold	C46	1nF	102	2 x	Loose Ferrite Bead	
R47	470R	yellow purple brown gold	C47	1nF	102	RFC1	RF CHOKE	
R48	100K	brown black yellow gold	C48	2.2uF	2.2uF 63V	L1	6 x 2 turn coil 5mm i.d.	
R49	1K5	brown green red gold	C49	2.2uF	2.2uF 63V	L2	6 turn small enamelled coil	
R50	12K	brown red orange gold	C50	100nF	.1K63 or 100nK63	L3	3 turn coil 5.5 mm i.d.	
R51	5K6	green blue red gold	C51	220uF	220uF 16V	L4	4 turn coil 4.5mm i.d.	
R52	1K5	brown green red gold	C52	10nF	103	L5	5 turn coil 6mm i.d.	
R53	1K5	brown green red gold	C53	1nF	102	L6	5 turn coil 6mm i.d.	
R54	10K	brown black orange gold	C54	100nF	.1K63 or 100nK63	L7	5 turn coil 6mm i.d.	
R55	22K	red red orange gold	C55	100nF	.1K63 or 100nK63	FUSE	2 x 20mm fuse clips + 1A fuse	
R56	12K	brown red orange gold	C56	100nF	.1K63 or 100nK63	SKT 1	PCB phono socket	
R57	270R	red purple brown gold	C57	1nF	102	- +	2 x Terminal Pins	
R58	560R	green blue brown gold	C58	100nF	.1K63 or 100nK63	J 1	3 pin Pre-emphasis Jumper	
R59	33R	orange orange black gold	C59	100nF	.1K63 or 100nK63	J 2	2 pin Jumper	
R60	56R	green blue black gold	C60	33pF	33J	J 3	2 pin Jumper	
R61	15R	brown green black gold	C61	100pF	101J	PLLPRO	3 printed circuit board	
R62	18K	brown grey orange gold	C62	4.7nF	4n7K100 or 4n7J 100	PL259	Dummy Load	
R63	10K	brown black orange gold	C63	220nF	.22K63 or 220nK63	Heatsink for TR 8		
R64	1K5	brown green red gold	C64	10nF	10nK63 or 10nK100	1 metre Red/Black Wire		
R65	2K2	red red red gold	C65	220nF	.22K63 or 220nK63	SO239	square socket	
R66	5K6	green blue red gold	C66	100nF	.1K63 or 100nK63	4 screws + washers + nuts		
R67	47K	yellow purple orange gold	C67	10nF	103			
R68	33R	orange orange black (2W)	C68	220uF	220uF 16V			
R69	33R	orange orange black (2W)	C69	1000uF	1000uF 10V			
TFR1	2K2	x 8 222 J	C70	220uF	220uF 16V			
TFR2	2K2	x 8 222 J						

NRG PLL PRO III Hi-Gain Frequency Look Up

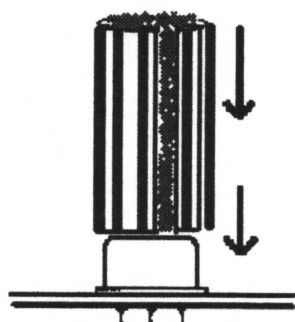
Switch 1									Switch 2							
MHz	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
87.5	ON	ON	ON	ON	off	ON	ON	ON	ON	off	off	off	ON	off	ON	off
87.6	ON	ON	ON	ON	off	ON	ON	ON	ON	off	off	off	ON	off	off	ON
87.7	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off	off	ON	off	off	off
87.8	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off	off	off	ON	ON	ON
87.9	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off	off	off	ON	ON	off
88.0	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	ON
88.1	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off
88.2	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off
88.3	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	ON	off
88.4	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON
88.5	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON
88.6	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON
88.7	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON
88.8	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	off	ON	ON
88.9	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON	off	ON	ON
89.0	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON
89.1	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off
89.2	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off
89.3	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off
89.4	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON
89.5	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON
89.6	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON
89.7	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON
89.8	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON
89.9	ON	ON	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off
90.0	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON
90.1	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off
90.2	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON
90.3	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON
90.4	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	off	ON	ON
90.5	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	off	ON	off
90.6	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	off	off	ON
90.7	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	off	off	off
90.8	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	off	ON	ON	ON
90.9	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	off	ON	ON	off
91.0	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	ON	ON	ON
91.1	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	ON	ON	off
91.2	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	ON	off	ON
91.3	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	ON	ON	off
91.4	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	off	ON	ON
91.5	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	off	ON	off
91.6	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	off	off	ON
91.7	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON	off	off	off
91.8	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	off	ON	ON	ON
91.9	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	off	off	ON	ON	off
92.0	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON
92.1	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	ON	ON	off
92.2	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON
92.3	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	ON	off	off
92.4	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	ON	off	ON
92.5	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	off	ON	off
92.6	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	off	off	ON
92.7	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	ON	off	off	off
92.8	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON
92.9	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	ON	off	ON	ON	off
93.0	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON
93.1	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	ON	ON	off
93.2	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	ON	off	ON
93.3	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	ON	off	off
93.4	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	off	ON	ON
93.5	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	off	ON	off
93.6	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	off	off	ON
93.7	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	ON	off	off	off
93.8	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	off	ON	ON	ON
93.9	ON	ON	ON	ON	off	ON	ON	off	ON	ON	off	off	off	ON	ON	off
94.0	ON	ON	ON	ON	off	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON
94.1	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	ON	ON	off

MHz	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
94.2	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	ON	off	ON
94.3	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	ON	off	off
94.4	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	off	ON	ON
94.5	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	off	ON	off
94.6	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	off	off	ON
94.7	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	ON	off	off	off
94.8	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	off	ON	ON	ON
94.9	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	ON	off	ON	ON	off
95.0	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	ON	ON	ON
95.1	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	ON	ON	off
95.2	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	ON	off	ON
95.3	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	ON	off	off
95.4	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	ON	off	ON
95.5	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	off	ON	off
95.6	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	off	off	ON
95.7	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	off	off	off
95.8	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	off	ON	ON	ON
95.9	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	off	ON	ON	off
96.0	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	ON	ON	ON
96.1	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	ON	ON	off
96.2	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	ON	off	ON
96.3	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	ON	off	off
96.4	ON	ON	ON	ON	off	ON	ON	off	ON	off	ON	off	ON	off	ON	ON
96.5	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	off	ON	off
96.6	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	off	off	ON
96.7	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	ON	off	off	off
96.8	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	off	ON	ON	ON
96.9	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	ON	off	ON	ON	off
97.0	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	ON	ON	ON
97.1	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	ON	ON	off
97.2	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	ON	off	ON
97.3	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	ON	off	off
97.4	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	off	ON	ON
97.5	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	off	ON	off
97.6	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	off	off	ON
97.7	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	ON	off	off	off
97.8	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	off	ON	ON	ON
97.9	ON	ON	ON	ON	off	ON	ON	off	ON	off	off	off	off	ON	ON	off
98.0	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	ON	ON	ON
98.1	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	ON	ON	off
98.2	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	ON	off	ON
98.3	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	ON	off	off
98.4	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	off	ON	ON
98.5	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	off	ON	off
98.6	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	off	off	off
98.7	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	ON	off	ON	ON
98.8	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	off	ON	ON	ON
98.9	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	ON	off	ON	ON	off
99.0	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	ON	ON	ON
99.1	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	ON	ON	off
99.2	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	ON	off	ON
99.3	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	ON	off	off
99.4	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	off	ON	ON
99.5	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	off	ON	off
99.6	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	off	off	ON
99.7	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	ON	off	off	off
99.8	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	off	ON	ON	ON
99.9	ON	ON	ON	ON	off	ON	ON	off	off	ON	ON	off	off	ON	ON	off
100.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
100.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	off
100.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	off
100.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	off	off
100.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	off	ON	ON
100.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	off	ON	off
100.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	off	off	ON
100.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	ON	off	off	off
100.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	off	ON	ON	ON
100.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	ON	off	ON	ON	off
101.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON
101.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	off

MHz	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
101.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	ON	off	off
101.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON
101.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	off	ON	off
101.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	off	off	ON
101.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	off	off	ON
101.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	ON	off	off	off
101.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	off	ON	ON	ON
101.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off
102.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON	ON
102.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON	off
102.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	off	ON
102.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	off	off
102.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	ON
102.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	off
102.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	off	ON
102.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	off	off
102.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	ON
102.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	off
103.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	ON	ON
103.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	ON	off
103.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	ON
103.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	off
103.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	ON	ON
103.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	ON	off
103.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	off	ON
103.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	off	off
103.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	ON
103.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	off
104.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON	ON
104.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON	off
104.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	off	ON
104.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	off	off
104.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	ON
104.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	off
104.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	off	ON
104.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	off	off
104.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	ON
104.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	off	ON	off
105.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	ON
105.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	off
105.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	off
105.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	ON	off
105.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	off	ON
105.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	off	off
105.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	off	ON
105.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	ON	off	off
105.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	off	ON	ON
105.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	off	off	ON	off
106.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	ON	ON
106.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	ON	off
106.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	ON
106.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	off
106.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	ON
106.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	off
106.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	off
106.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	ON	off	off
106.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	ON	ON
106.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	ON	off	ON	off
107.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	ON
107.1	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	off
107.2	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	off
107.3	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	ON	off
107.4	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	off	ON
107.5	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	off	off
107.6	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	off	ON
107.7	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	ON	off	off
107.8	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	off	ON	ON
107.9	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	off	off	off	ON	off
108.0	ON	ON	ON	off	ON	ON	ON	ON	ON	ON	off	ON	ON	ON	ON	ON

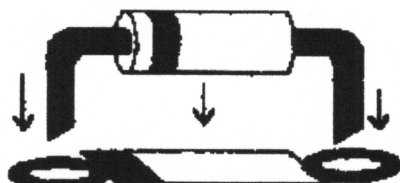
1 HEATSINK

Push the heatsink vertically onto the output transistor (TR8)



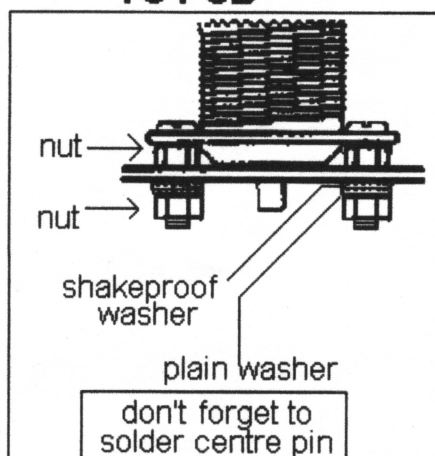
4 DIODES & ZENER DIODES

MUST BE FITTED THIS WAY IN PCB



PUSH FLAT TO PCB

2 MOUNTING SO239 TO PCB

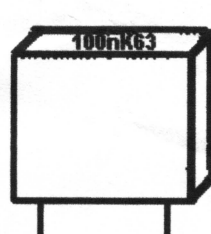


5 CAPACITORS

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

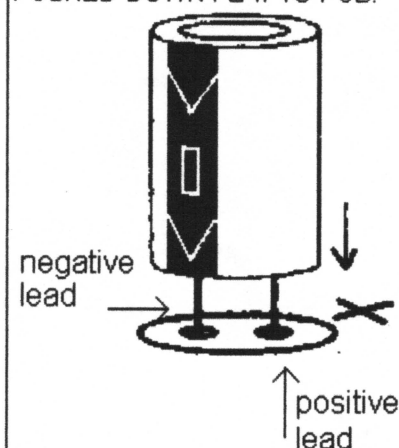
ceramic disc capacitor

polyester capacitor



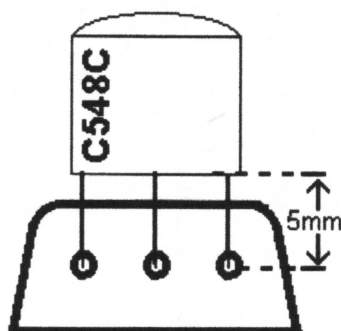
3 ELECTROLYTIC CAPACITORS

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

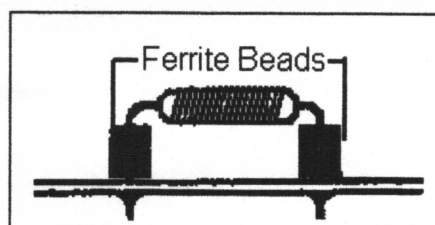


6 SMALL TRANSISTORS

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

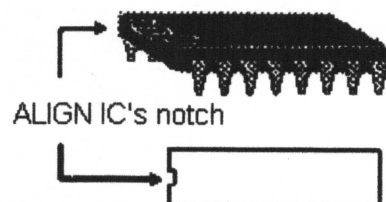


RF CHOKE (RFC1)



INTEGRATED CIRCUITS

MUST BE FITTED CORRECT WAY ROUND

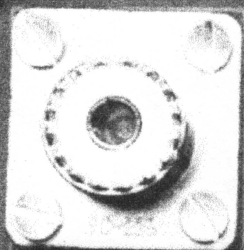


!



PLL-PRO III HI-GAIN

1-1 Watts in
0-1 Watts out
Wideband FM
Dual Pre-amp



RF OUT

PLL-PRO III
NRG

1444009
CD74HC4031E

POWER

OLPD

AUDIO IN

EQ

75uS

LED3 unlock

LED4 lock

R62

R63

R64

R65

R66

R67

R68

R69

R70

R71

R72

R73

R74

R75

R76

R77

R78

R79

R80

R81

R82

R83

R84

R85

R86

R87

R88

R89

R90

R91

R92

R93

R94

R95

R96

R97

R98

R99

R100

R101

R102

R103

R104

R105

R106

R107

R108

R109

R110

R111

R112

R113

R114

R115

R116

R117

R118

R119

R120

R121

R122

R123

R124

R125

R126

R127

R128

R129

R130

R131

R132

R133

R134

R135

R136

R137

R138

R139

R140

R141

R142

R143

R144

R145

R146

R147

R148

R149

R150

R151

R152

R153

R154

R155

R156

R157

R158

R159

R160

R161

R162

R163

R164

R165

R166

R167

R168

R169

R170

R171

R172

R173

R174

R175

R176

R177

R178

R179

R180

R181

R182

R183

R184

R185

R186

R187

R188

R189

R190

R191

R192

R193

R194

R195

R196

R197

R198

R199

R200

R201

R202

R203

R204

R205

R206

R207

R208

R209

R210

R211

R212

R213

R214

R215

R216

R217

R218

R219

R220

R221

R222

R223

R224

R225

R226

R227

R228

R229

R230

R231

R232

R233

R234

R235

R236

R237

R238

R239

R240

R241

R242

R243

R244

R245

R246

R247

R248

R249

R250

R251

R252

R253

R254

R255

R256

R257

R258

R259

R260

R261

R262

R263

R264

R265

R266

R267

R268

R269

R270

R271

R272

R273

R274

R275

R276

R277

R278

R279

R280

R281

R282

R283

R284

R285

R286

R287

R288

R289

R290

R291

R292

R293

R294

R295

R296

R297

R298

R299

R300

R301

R302

R303

R304

R305

R306

R307

R308

R309

R310

R311

R312

R313

R314

R315

R316

R317

R318

R319

R320

R321

R322

R323

R324

R325

R326

R327

R328

R329

R330

R331

R332

R333

R334

R335

R336

R337

R338

R339

R340

R341

R342

R343

R344

R345

R346

R347

R348

R349

R350

R351

R352

R353

R354

R355

R356

R357

R358

R359

R360

R361

R362

R363

R364

R365

R366

R367

R368

R369

R370

R371

R372

R373

R374

R375