

# BUZZ-KILL Assembly Manual

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## Introduction

Thank you for purchasing a BUZZ-KILL. We hope you will enjoy building it and find it a useful addition to your QRP station. This kit was conceived to fill a need within the hobby for an inexpensive, high-performing line noise filter capable of being added to nearly any receiver. The BUZZ-KILL uses simple analog signal-processing circuitry to provide highly effective line noise filtering from a compact, low-power circuit.

High quality, double sided printed circuit board construction is used, with solder mask and silk screened component reference designators. All components are through-hole for easy assembly. The BUZZ-KILL can be constructed by beginners as well as experienced builders. Construction time is approximately 1 to 2 hours, depending on experience level.

## Specifications:

Maximum Voltage Input:	5v peak/peak
Pass Band:	200 Hz to 5 KHz
Signal Gain:	0 dB to 20 dB, user selectable
DC Power:	7 to 13 VDC, <75 mA
Audio Power:	500 mW into 8 ohms, from 9v supply

## First Steps

Before getting started with building the BUZZ-KILL, take some time to organize and familiarize yourself with the parts provided and check them against the Bill of Material. Building over a cookie sheet is recommended to minimize parts being lost. To prevent static damage, it is recommended that the ICs not be removed from their anti-static packaging until you are ready to install them. If parts are missing in your kit, send an email to the BUZZ-KILL kitter listed at [4SQRP.com](http://4SQRP.com). He will promptly provide replacements.

Schematic and parts-placement files are provided as part of documentation package. It is highly recommended to print a couple of copies for reference during construction. As you build, use a highlighter to mark off parts that have been soldered onto the PCB on one copy. When you think you are done, you can check that copy to verify that all of the parts have been installed.

The BUZZ-KILL has two assembly options depending on how it is to be used. It can be used as an

outboard filter and amplifier, plugging into the headphone jack of an existing receiver, and driving a speaker or headphones. Alternately, it may be used as an add-on filter internally, in conjunction with an existing receiver that might need a line noise filter. The option of installing C29 adds an additional 20 dB gain to the circuit for those applications where it would be needed. For most applications, the standard 0 dB configuration should be used.

### Step 1 – Resistors

Decide which assembly option is desired. Insert and solder, and check off each when completed.

- R15 10 Brown-Black-Black
- R7 47 Yellow-Violet-Black
- R2 10k Brown-Black-Orange
- R3 10k Brown-Black-Orange
- R4 10k Brown-Black-Orange
- R5 10k Brown-Black-Orange
- R6 10k Brown-Black-Orange
- R9 10k Brown-Black-Orange
- R10 10k Brown-Black-Orange
- R11 10k Brown-Black-Orange
- R12 10k Brown-Black-Orange
- R13 10k Brown-Black-Orange
- R18 10k Brown-Black-Orange
- R19 10k Brown-Black-Orange
- R16 470k Yellow-Violet-Yellow
- R17 470k Yellow-Violet-Yellow
- R1 2.10k Red-Brown-Black-Brown
- R20 3.0k Orange-Black-Red

### Step 2 – Capacitors

- C9 0.01 103
- C10 0.01 103
- C18 0.01 103
- C19 0.01 103
- C1 0.047 473
- C7 0.047 473
- C11 0.047 473
- C16 0.047 473
- C24 0.047 473
- C2 0.1 104
- C3 0.1 104
- C5 0.1 104
- C12 0.1 104
- C13 0.1 104
- C20 0.1 104
- C21 0.1 104
- C25 0.1 104
- C26 0.1 104

<input type="checkbox"/>	C6	0.001	102	
<input type="checkbox"/>	C8	0.001	102	
<input type="checkbox"/>	C15	0.001	102	
<input type="checkbox"/>	C17	0.001	102	
<input type="checkbox"/>	C4	4.7	4.7	
<input type="checkbox"/>	C14	4.7	4.7	
<input type="checkbox"/>	C23	4.7	4.7	
<input type="checkbox"/>	C27	4.7	4.7	
<input type="checkbox"/>	C29*	4.7	4.7	* To be installed for optional 20 dB more gain.
<input type="checkbox"/>	C22	100	100	
<input type="checkbox"/>	C28	100	100	

### Step 3 – Semiconductors

Be certain that the ICs are inserted correctly, according to the silkscreen diagram.

<input type="checkbox"/>	U1	78L05	TO-92
<input type="checkbox"/>	U2	PT2399	DIP-16
<input type="checkbox"/>	U3	PT2399	DIP-16
<input type="checkbox"/>	U4	LM386	DIP-8

### Step 4 - Potentiometers

<input type="checkbox"/>	R8	1k	102
<input type="checkbox"/>	R14	100k	104

### Step 5 - Crystals

<input type="checkbox"/>	X1	11.52 MHz
<input type="checkbox"/>	X2	9.000 MHz

### Step 6 - Final Assembly

The last steps of assembling the BUZZ-KILL are attaching the interconnecting wires to the board. Pads are for connecting the input signal, DC power, and output. Wire gauges from 24 to 20 AWG are ideal. Best results will be had when twisted pairs are used. Use of two contrasting colors for signal and ground is suggested to avoid accidental reversal.

The BUZZ-KILL is capable of driving either low-impedance headphones, or a separate speaker. Alternately, it can be inserted into an existing receiver, and used with that rig's audio amp and speaker. The simplicity of this circuit permits countless variations in how it can be applied.

### Step 7 - Alignment

To accommodate the gain and delay tolerances of the two audio paths, there are two pots provided. R8 fine tunes the differential delay between the two audio paths, and R14 equalizes gain on the two paths. Connect the BUZZ-KILL to an audio source with poor line noise. When the BUZZ-KILL is connected in-line, these two pots should be adjusted to provide the deepest null of the line frequency buzz.

## Theory of Operation

With the proliferation of electronic power devices, the problem of line-frequency noise has affected HF communication with QRM. It shows up as a harsh buzzing in the received audio that can overwhelm the desired signals within a band.

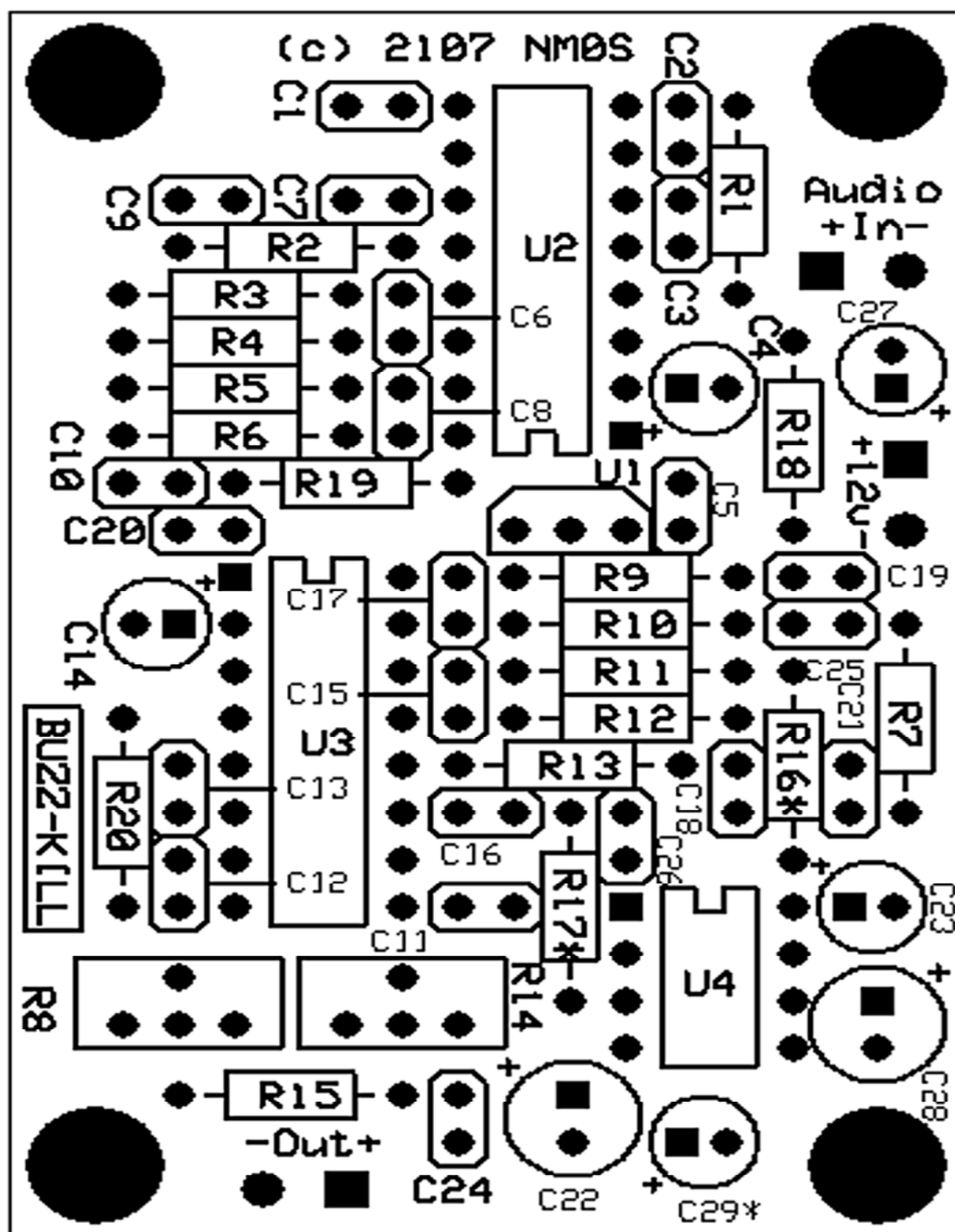
The noise is generated as the 60 Hz power line AC interacts with non-linear electronic components in the environment to create spectral components every 60 Hz throughout the RF spectrum.

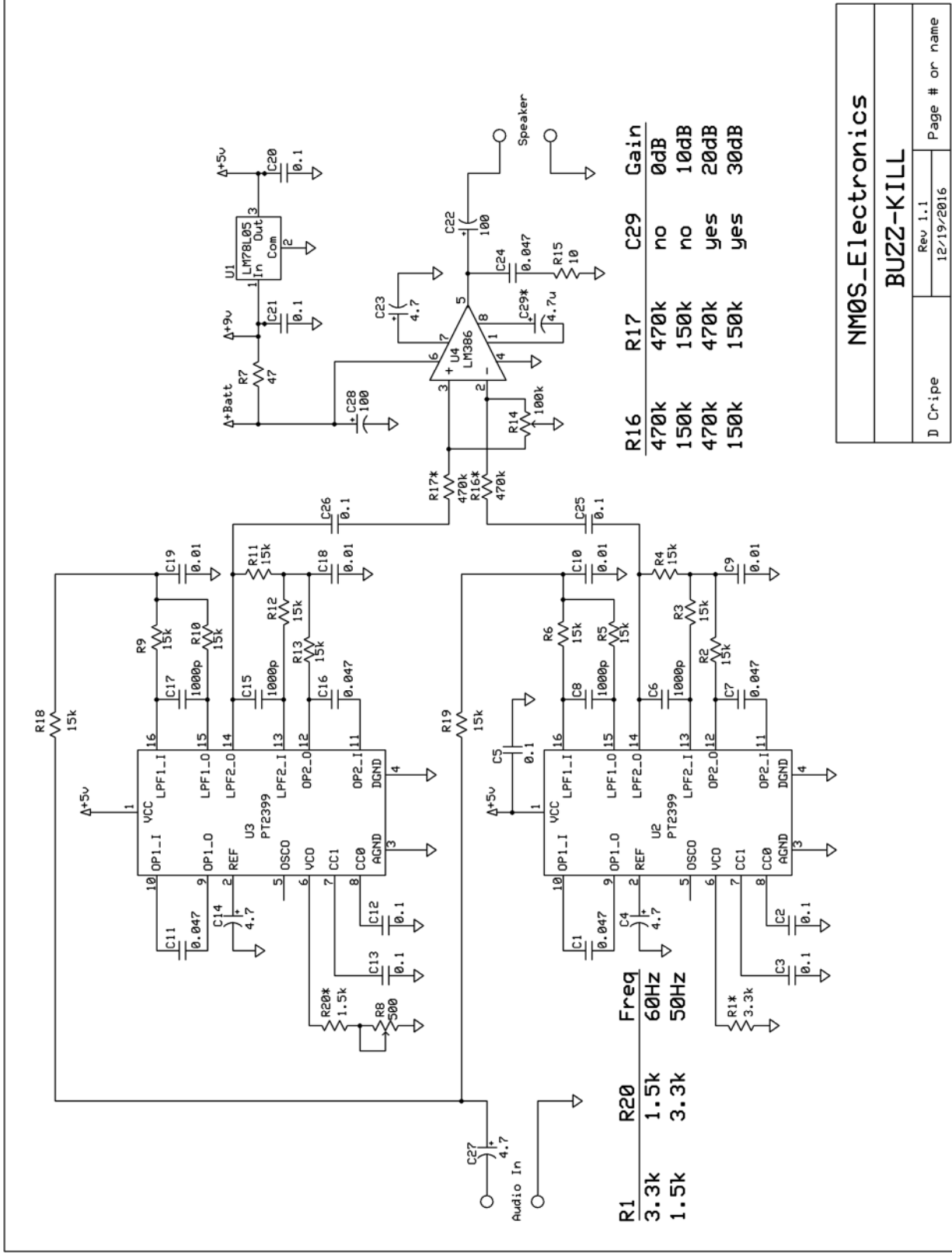
To cancel out this interfering noise, it is necessary to create a filter that blocks signals at 60 Hz and all harmonics of 60 Hz. Such a filter is called a Comb Filter, and it is implemented by taking two signals with a differential time delay equal of 16.66 msec, the period of 60 Hz.

The BUZZ-KILL uses two audio delay ICs , U2 and U3 to pass the receiver audio signal through two paths with a different delay time, before taking their difference in U4, an LM386 audio amplifier IC. Crystals set the oscillator frequencies on each IC, and a pot permits fine adjustment of the offset frequency.

## Application Notes

Because there are RF oscillators in the circuit, there will be some radiation of 9.00MHz and 11.52 MHz signals. If you are using the BUZZ-KILL with a short wave receiver, these signals will appear in the receiver as birdies. If the radiation from the board creates unacceptable interference when applied to your radio, mount it into a shielded metal enclosure.





R16	R17	C29	Gain
470k	470k	no	0dB
150k	150k	no	10dB
470k	470k	yes	20dB
150k	150k	yes	30dB

## Parts List

### Capacitors

0.01	Ceramic Disk	103	C9, C10, C18, C19	4
0.047	Monolithic	473	C1, C7, C11, C16, C24	5
0.1	Ceramic Disk	104	C2, C3, C5, C12, C13, C20, C21, C25, C26	9
4.7	Electrolytic	4.7	C4, C14, C23, C27, C29	5
100	Electrolytic	100	C22, C28	2
1000p	Monolithic	102	C6, C8, C15, C17	4

### Resistors

10	1/4w	Brown-Black-Black	R15	1
47	1/4w	Yellow-Violet-Black	R7	1
1k	10-turn pot	102	R8	1
100k	10-turn pot	104	R14	1
10k	1/4w	Brown-Black-Orange	R2, R3, R4, R5, R6, R9, R10, R11, R12, R13, R18, R19	12
470k	1/4w	Yellow-Violet-Yellow	R16, R17	2
3.0k	1/4w	Orange-Black-Red	R20	1
2.10k	1/4w, 1%	Red-Brown-Black-Brown	R1	1
9.000MHz	HC-49S		X1	1
11.52MHz	HC-49S		X2	1

### Semiconductors

LM78L05	1O-92	U1
P12399	DIP-16	U2
P12399	DIP-16	U3
LM386	DIP-8	U4