

# HI-PER-MITE Assembly Manual

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## Introduction

Thank you for purchasing a HI-PER-MITE. 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 CW filter capable of being added to nearly any receiver. The HI-PER-MITE uses simple analog signal-processing circuitry to provide highly effective CW filtering from a simple 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. NO toroids are required. The HI-PER-MITE can be constructed by beginners as well as experienced builders. Construction time is approximately 1 hour, depending on experience level.

## Specifications:

Center Frequency:	700 Hz
3 dB Bandwidth:	200 Hz
Signal Gain:	0 dB to 50 dB, user selectable
DC Power:	5 to 13 VDC, <15 mA
Audio Power:	500 mW into 8 ohms, from 9v supply

## First Steps

Before getting started with building the HI-PER-MITE, 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 Terry Fletcher, WA0ITP at wa0itp@wa0itp.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 HI-PER-MITE has a number of 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. The HI-PER-MITE can be used as a high gain audio filter and speaker driver in conjunction with a homebrew receiver. Alternately, it may be used as an add-on audio filter internally, in conjunction with an existing receiver that might need a CW filter. Each option has a different assembly sequence.

The following assembly options are possible:

R1	R3	R11	R12	Gain	Suggested Application
1M	33k	47k	220k	0dB	(stand-alone, to be plugged into headphone jack of existing rig)
1M	33k	xxx	47k	20dB	
33k	1M	47k	220k	30dB	
33k	1M	xxx	47k	50 dB	-(to be used after product detector of homebrew rig)

Most users will use either the first or last options, but if other gain configurations are desired, the assembly options are listed. A user wanting a volume control may substitute a 100k audio potentiometer for R11 and R12

#### Step 1 – Resistors

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

- R1 \*
- R2 33k orange-orange-orange
- R3 \*
- R4 47k yellow-violet-orange
- R5 47k yellow-violet-orange
- R6 36k orange-blue-orange
- R7 36k orange-blue-orange
- R8 10k brown-black-orange
- R9 750k violet-green-yellow
- R10 10 brown-black-black
- R11 \*
- R12 \*
- R13 not used
- R14 10k brown-black-orange

#### Step 2 – Semiconductors

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

- U1 TLC274 dip 14
- U2 LM386 dip 8

Diode D1 is omitted.

Save one snipped-off resistor lead and insert and solder, bridging the two pads directly to the right of U2.

### Step 3 – Capacitors

( )	C1	0.1	104	
( )	C2	0.047	473	47n
( )	C3	0.036	363	36n
( )	C4	0.001	102	1n0
( )	C5	0.039	393	39n
( )	C6	0.001	102	1n0
( )	C7	0.0022	222	2n2
( )	C8	0.0022	222	2n2
( )	C9	0.001	102	1n0
( )	C10	0.1	104	
( )	C11	0.1	104	
( )	C12	220	220u	
( )	C13	220	220u	
( )	C14	220	220u	
( )	C15	0.1	104	
( )	C16	10p	10	10j

### Step 4 - Final Assembly

The last steps of assembling the HI-PER-MITE are attaching the interconnecting wires to the board. Pads are for connecting the input signal, DC power, and output. Wire gauges from 24 to 22 are ideal. Best results will be had when twisted pairs are used.

The HI-PER-MITE 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.

### Theory of Operation

The HI-PER-MITE provides narrow-bandwidth CW filtering without objectionable ringing to the CW signal. This is attained by careful design of the filter's frequency response to possess a flat group delay within the filter's pass-band. The implementation of this filter is with four, two-pole Sallen-Key op-amp filters; three low-pass filters, and one high pass filter. Each filter section is fairly low-Q, and the frequencies of resonance are staggered. Cascading these four sections in series creates the optimal filter response.

This circuit is based on the designer's 1994 article in '73' magazine: [http://www.archive.org/stream/73-magazine-1994-05/05\\_May\\_1994#page/n11/mode/2up](http://www.archive.org/stream/73-magazine-1994-05/05_May_1994#page/n11/mode/2up)