

# LPF-1

## LOW-PASS FILTER

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Brooklyn, New York 11201

**Kit Contents:** LPF-1 PC Board Assembly, Volume Control Capacitor, Foam tape, Installation instructions.

**GENERAL:** The LPF-1 was designed as an add-on for the Newtech Model 6 and Model 68 Music Boards to filter out high frequency sampling noise. The LPF-1 is inserted between the music board's DAC output and audio amplifier. The filter employs six amplifiers, the six inverters of a CMOS 4069 logic IC operating in a linear mode. It is a biquad implementation of a 3.3KHz fourth-order 1db ripple Chebyshev response. The LPF-1 input is AC coupled, so it is technically a bandpass filter, but its low frequency cut-off is below the audio range. When used on the Model 6 and Model 68 Music Boards the filter is powered from the Board's 5 Volt power supply, drawing typically 10 ma.

**FOR USE ON OTHER DAC's:** The LPF-1 can also be used on homebrew and other DAC boards. Newtech tests each filter at 5 Volts, but the filter should work on supplies up to 15 Volts. The filter incorporates a resistor and capacitor in series with the output to divide the output voltage for the Model 6 and Model 68 output amplifier. For other applications the resistor and capacitor can be changed, if necessary.

The filter cut-off frequency is inversely proportional to the value of C2, C3, C4 and C5; therefore, to change the cut-off frequency, only these capacitors need be changed, and none of the resistors. The interested experimenter is referred to the references below. It is NOT recommended that users remove or add parts unless they are familiar with filter theory, and have the proper test equipment.

### REFERENCES:

Frank P. Tedeschi, The Active Filter Handbook (1979, Tab Books: Blue Ridge Summit, Pa.)

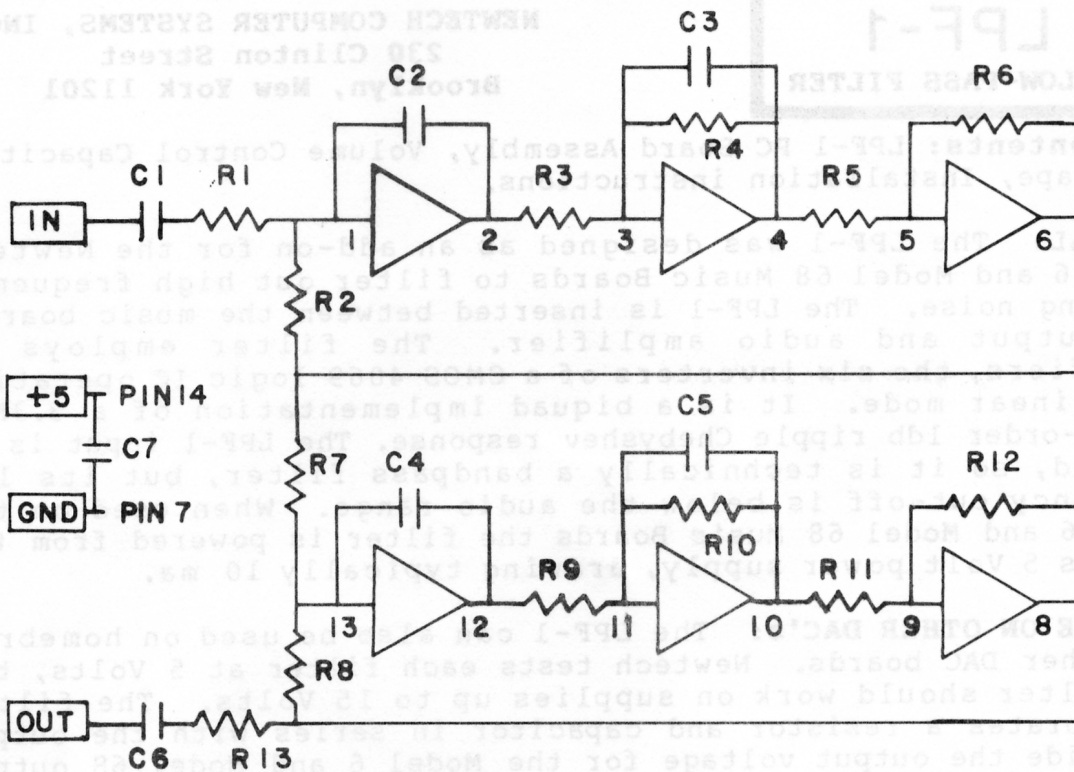
P. E. Fleischer and J. Tow, "Design Formulas for Biquad Active Filters Using Three Operational Amplifiers" Proceedings of the IEEE, May 1973, pp.62-3.

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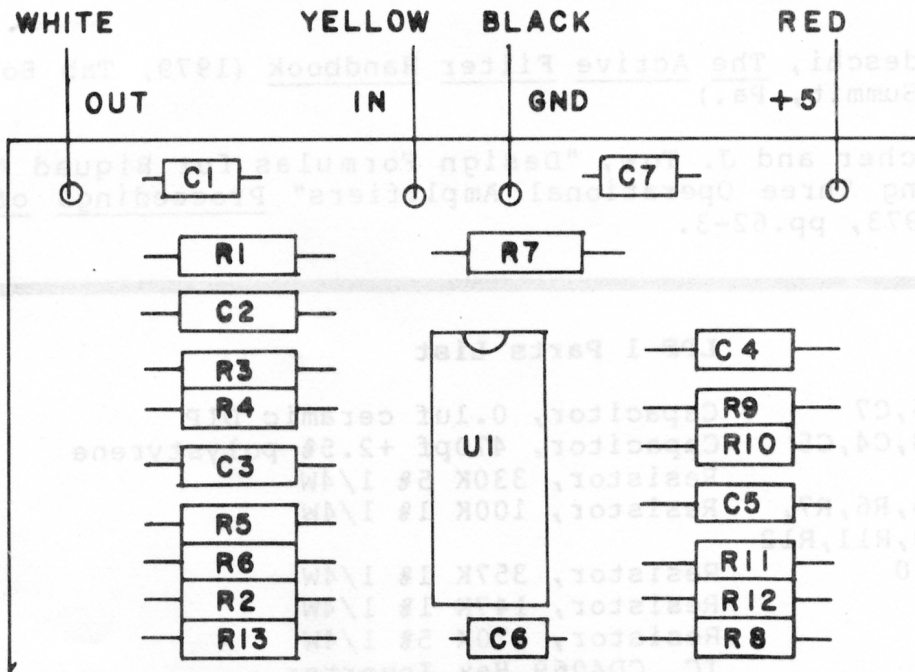
### LPF-1 Parts List

C1,C6,C7	Capacitor, 0.1uf ceramic DIP
C2,C3,C4,C5	Capacitor, 470pf +2.5% polystyrene
R1	Resistor, 330K 5% 1/4W
R2,R5,R6,R7,	Resistor, 100K 1% 1/4W
R8,R9,R11,R12	
R3,R10	Resistor, 357K 1% 1/4W
R4	Resistor, 147K 1% 1/4W
R13	Resistor, 470K 5% 1/4W
U1	IC, CD4069 Hex Inverter

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LPF-1 SCHEMATIC DIAGRAM



LPF-1 ASSEMBLY DIAGRAM

## LPF-1 MODEL 6 INSTALLATION INSTRUCTIONS

**CAUTION! THE INSTALLATION OF THE LPF-1 REQUIRES KNOWLEDGE OF HOW TO SOLDER AND POSSESSION OF CERTAIN TOOLS SPECIFIED BELOW. IF YOU DO NOT HAVE BOTH, GET A QUALIFIED PERSON TO INSTALL THE FILTER FOR YOU.**

### Required tools:

- 1) Soldering iron
- 2) Solder
- 3) Diagonal Pliers
- 4) Wire strippers
- 5) Scissors
- 6) Solder suction or similar tool

### Instructions:

1. The LPF-1 has four color-coded wires. Trim them to the indicated lengths, then strip about 3/16" of the insulation off the free ends and tin these ends.

<u>Wire</u>	<u>Length</u>
White	3-1/2"
Red	1-3/4"
Black	2"
Yellow	2"

2. (Refer to Fig.1) Remove Capacitor C7, Resistor R14, and any capacitor which may be across the leads of the volume control (R15). These parts will be discarded, so they can be cut or otherwise destroyed in their removal.

3. Note the gray area on Fig. 1 which indicates where the LPF-1 is to be located. It should be component side up, with the LPF-1 wires near the top of the Model 6.

4.
  - a) Solder the LPF-1 white wire (output) to the Model 6 land "W" (see Fig. 1).
  - b) Solder the yellow wire (input) to the Model 6 land "Y".
  - c) Solder the red wire (+5 Volt) to the Model 6 foil trace area "R". This trace is sufficiently wide so that the red wire can be held in place by solder without drilling a hole for it.
  - d) Solder the black wire (Ground) to the Model 6 foil trace area "B".

5. DOUBLE-SIDED ADHESIVE-COATED FOAM TAPE IS USED TO SECURE THE FILTER TO THE MODEL 6. THIS TAPE IS VERY STICKY AND IS NOT READILY MOVED ONCE IT IS PUT IN PLACE. BE CAREFUL. DO IT RIGHT THE FIRST TIME!

- a) Attach the 2" piece of foam tape to the bottom of the

filter as indicated (Fig. 2).

b) The height of the Model 6 DAC ladder resistors is less than that of IC4. Since the filter is mounted above these components, the second piece of tape, about 1-1/2" long, should be attached to the first piece in such a way as to take up this extra space (see Fig. 2).

c) Position the filter/foam tape assembly as shown in Figs. 1 & 2. Push on it gently to attach it to the Model 6.

6. Install the Volume Control Capacitor across the leads of the volume control (R15) on the Model 6 as indicated (Fig. 1). This could be a little difficult, so BE CAREFUL. Trim the capacitor leads so as not to sort out anything!

FINISHED!

