

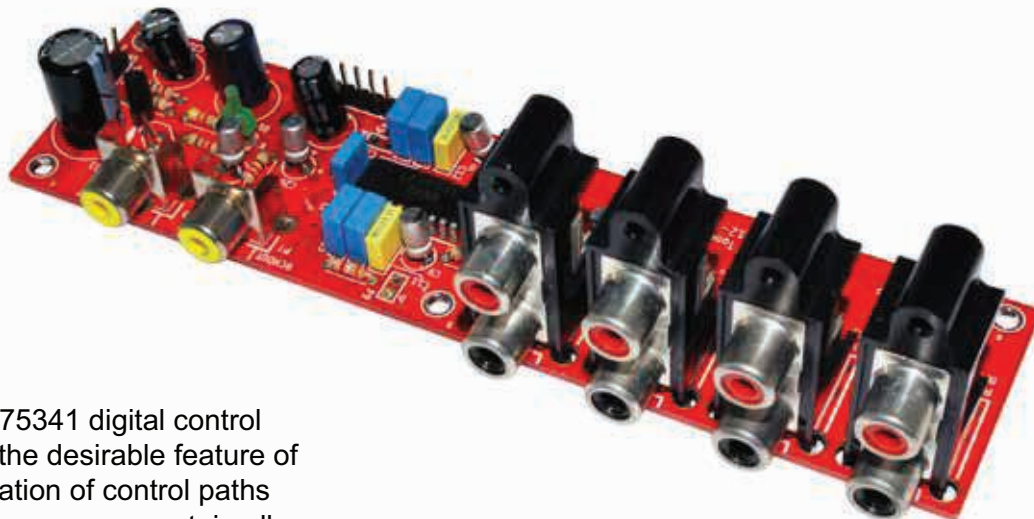
# Digital Control Audio Preamplifier and Tone Control

Technical Manual Rev 1r0

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The Digital Control Audio Preamplifier and Tone Control kit contains the basic functions needed to build a digitally controlled preamplifier circuit. These functions includes 4-way input selector, volume, bass, and treble control.

It is based on Sanyo's LC75341 digital control preamplifier chip. Among the desirable feature of this chip is the total separation of control paths to signal paths. This means, we can contain all the signal carrying routes within the PCB- signal comes in and out only on the input and output RCA jack ports. This contributes to the low noise and low distortion performance of the preamplifier.



## Features

- 0 to +20dB Bass boost control range
- +/- 10dB Treble control range
- 4 input electronic selector
- On board signal I/O RCA connectors

## Measured Performance:

Test conditions:  
Input Level: 0dbV

<b>THD+N @ 1kHz :</b>	0.015%
100Hz:	0.01%
10KHz:	0.02%
<b>S/N:</b>	108dB at full volume
<b>Noise Floor:</b>	5uV 400hz-30KHz
<b>Crosstalk:</b>	-74dB
<b>Input Overload:</b>	2.96Vrms 1kHz 1% THD
<b>Insertion Loss:</b>	0.89dB
<b>Min Volume:</b>	-95dB
<b>Input select isolation:</b>	108dB @ 1kHz, -98dB@10KHz



Digital control circuitry means a controller is needed by the circuit to operate. A user programmable controller kit specially tailored for this purpose- Programmable Control Panel kit, is available and can be purchased separately. This is an Arduino IDE compatible board preloaded with a working tone control program. If you can program in Arduino, then you have the option to work the source code further, and reprogram the controller to put in your own functions and improvements.

CONNECTORS AND MAJOR PARTS PLACEMENT

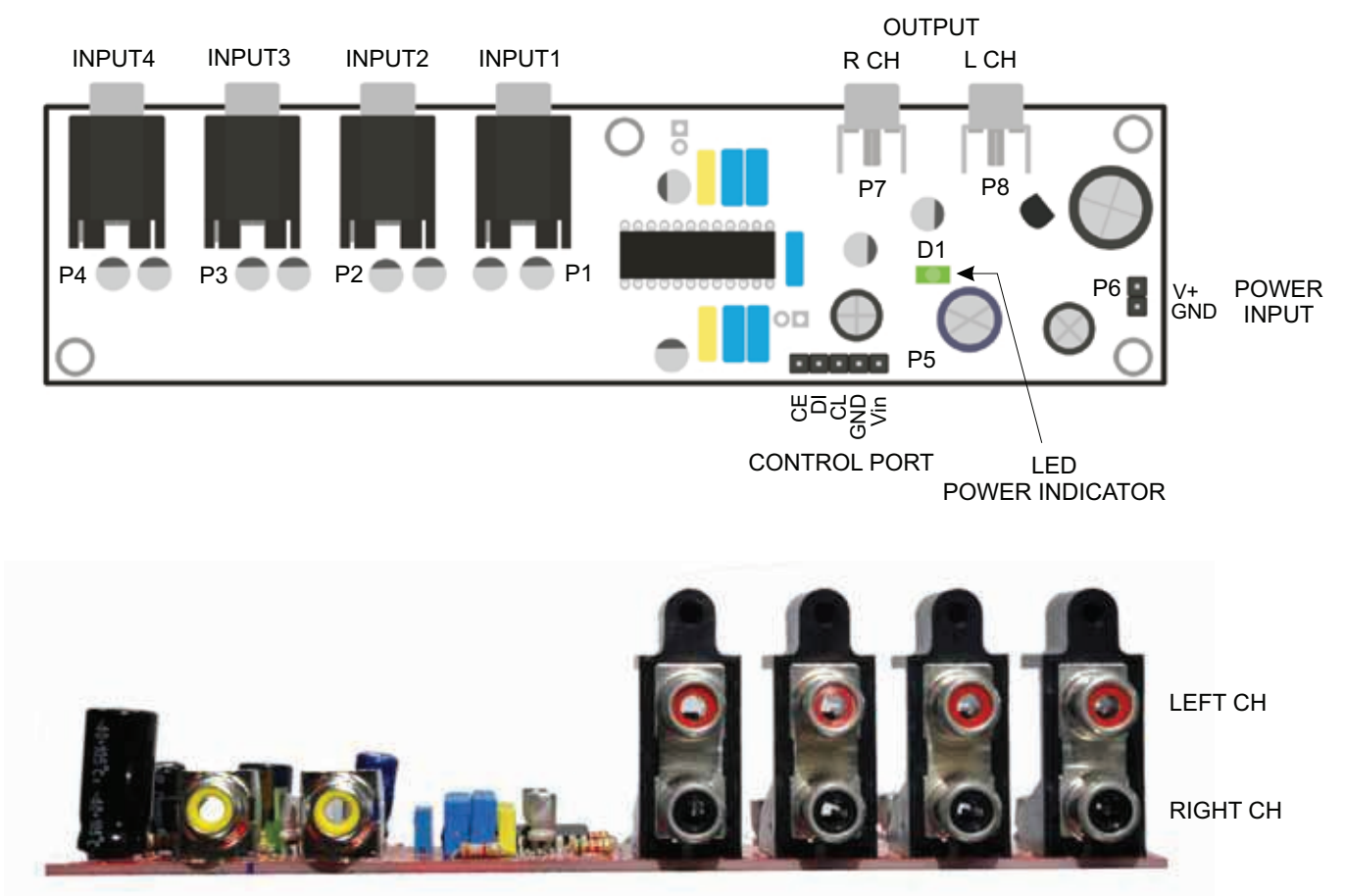


Figure 1. The Digital Audio Preamplifier and Tone Control board layout showing the audio connectors (RCA jacks) and digital control port connectors. The input RCA jacks are shorted to signal ground when nothing is plugged in it.

Table 1. P5 Control Port

PIN	ID	DESCRIPTION
1	CE	Chip Enable
2	DI	Data Input
3	CL	Clock
4	GND	Ground
5	Vin	Tied to P6 V+, Input Power 10-18VDC

Table 2. P6 Power Input Port

PIN	ID	DESCRIPTION
1	GND	Chip Enable
2	V+	Input Power, +10V-18VDC

For a complete description and programming of this port, please download the Sanyo LC75341 datasheet.

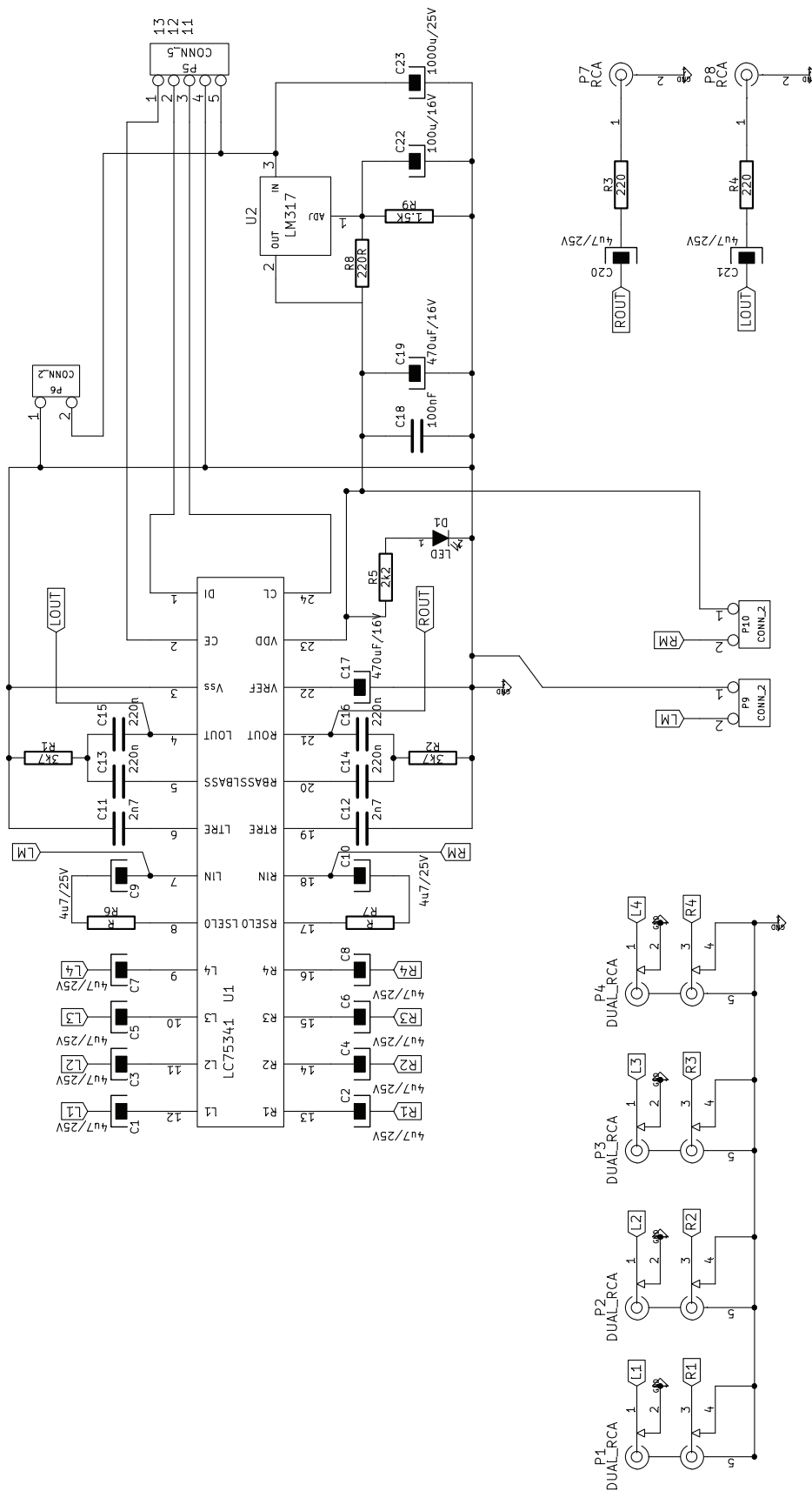


Figure 2. Complete schematic diagram of the Digital Control Audio Preamplifier and Tone Control kit. The circuit is based on Sanyo's LC75341 IC

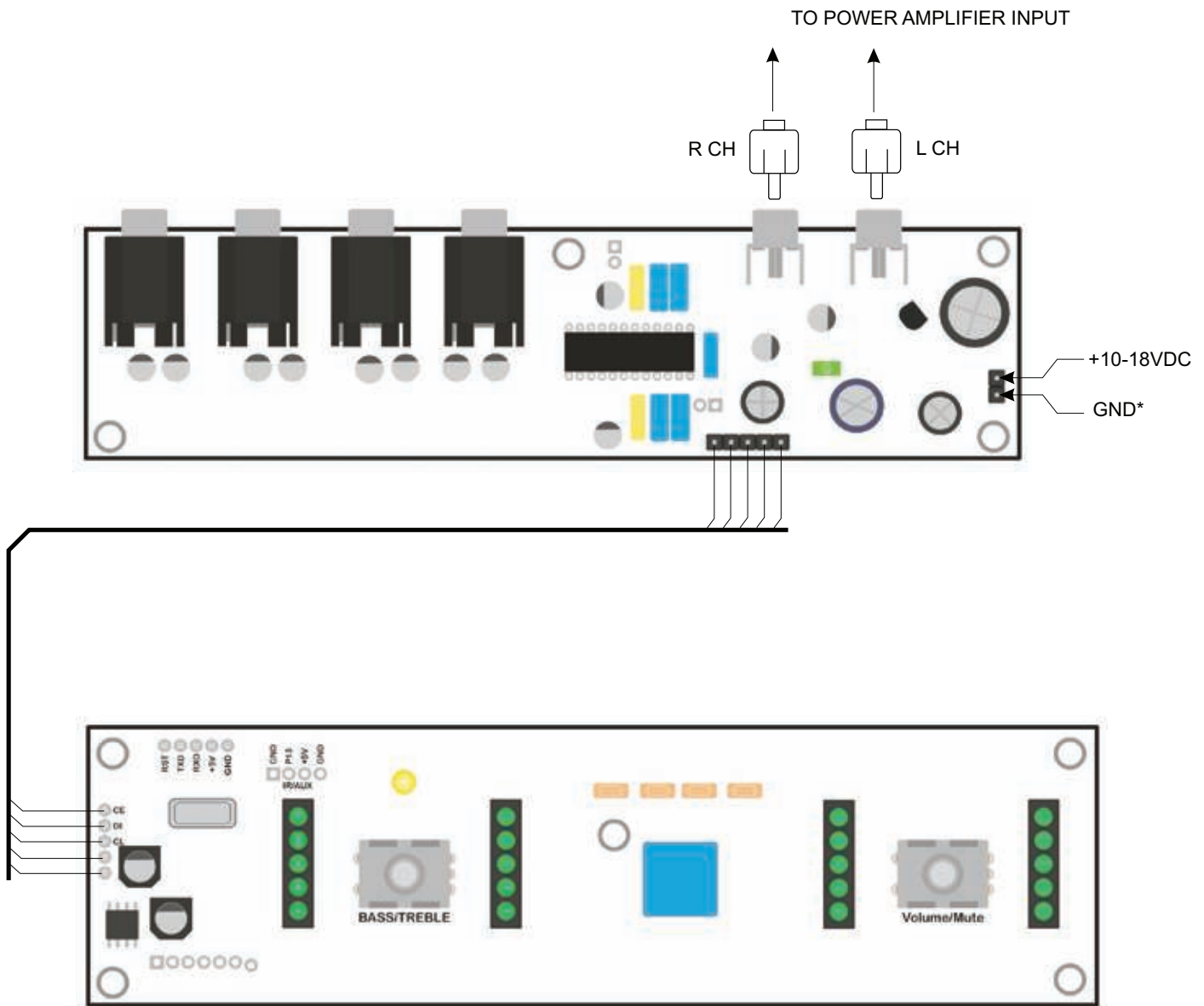
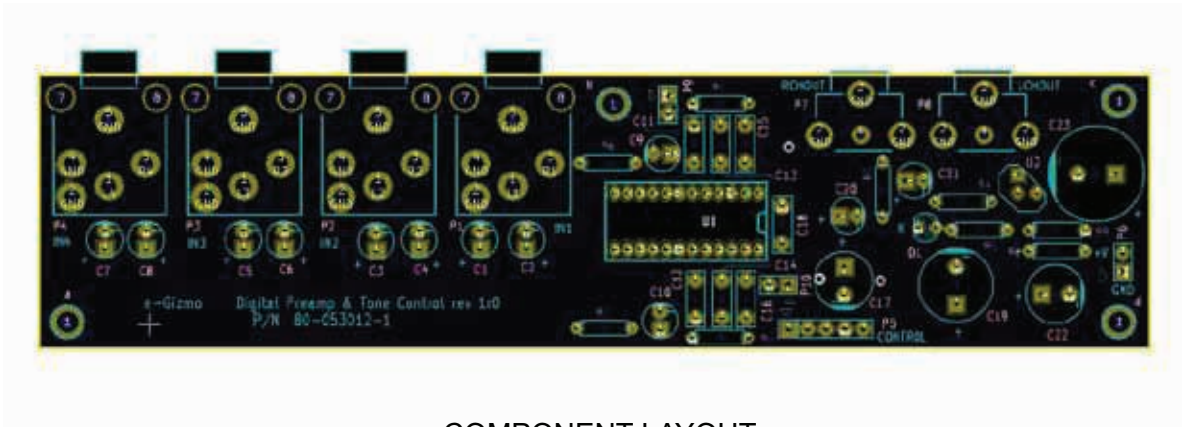


Figure 3. Control to the Digital Control Audio Preamplifier is done by sending a series of synchronous binary pulses through its control port P5. Details of this operation can be obtained from LC75341 Data sheets. A controller suitably built for this purpose is available for DIYer's not keen in doing some programming work. Just connect the Programmable Control Kit and you are good to go.

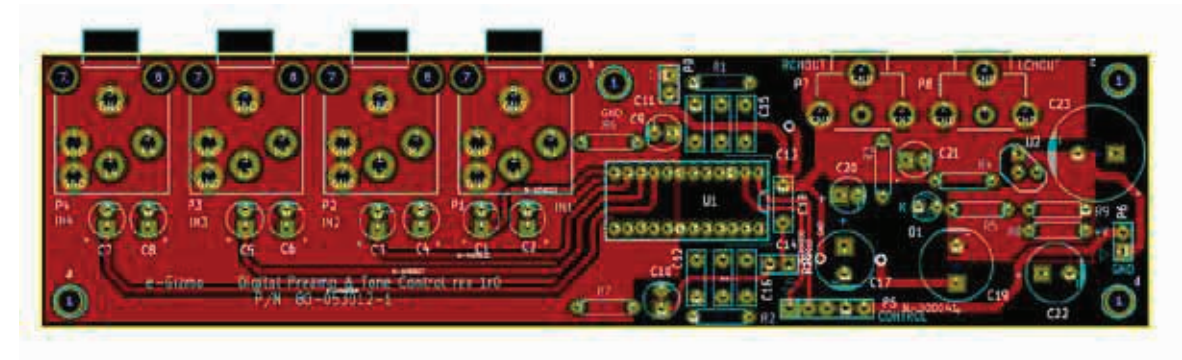
Figure 4. e-Gizmo Programmable Control Kit is a user programmable Arduino IDE compatible controller. It is pre loaded with the necessary program to control the Audio Preamplifier Kit. A copy of the source code is provided to allow you to customize the Control Kit, like add new functions and features.



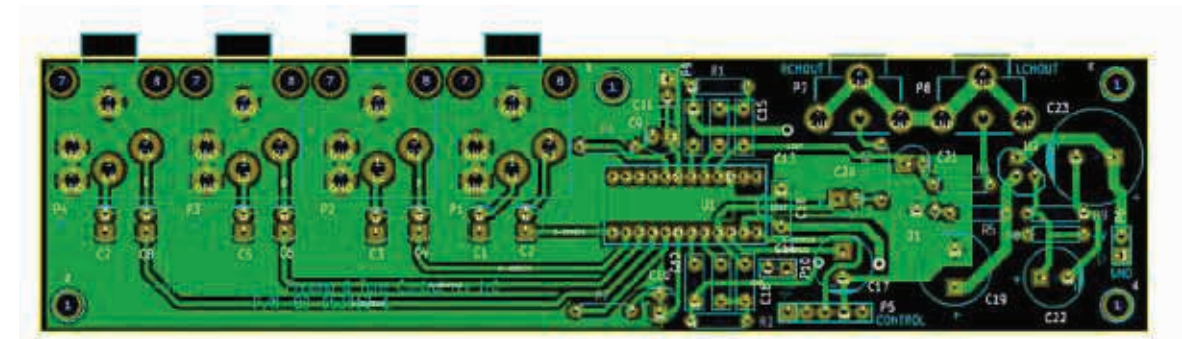
PCB LAYOUT



COMPONENT LAYOUT



COMPONENT SIDE COPPER PATTERN



BOTTOM SIDE COPPER PATTERN

## APPLICATION TIPS

The Digital Audio Preamplifier and Tone Control kit exploits the most desirable feature of the LC75341 chip- its digital control capability allowed us to route the entire signal carrying wires within the PCB. Not only this approach eliminates bundles of wires and the work and ugliness associated with it, it is also responsible for the overall low noise and excellent THD figure we are getting from the kit.

For best results, use a well filtered power source, galvanically isolated from the power amplifier power supply. The kit will work with any single ended power supply sourcing voltages ranging from 12VDC to 20VDC @ 100mA.

Like any audio device, this kit demands a thoughtful wiring to prevent it from misbehaving. For example, a haphazard wiring can easily form a ground loop, causing the system to produce loud humming sound, probably completely drowning out the music it is supposed to reproduce. I wrote a short article discussing this subject in very short detail. Spare some time to read it. It can be downloaded using the following link:

<http://www.e-gizmo.com/KIT/apnotes/Audio/FreedomFromHum.pdf>

## BILL OF MATERIALS

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C1	4u7/25V	electrolytic
C2	4u7/25V	electrolytic
C3	4u7/25V	electrolytic
C4	4u7/25V	electrolytic
C5	4u7/25V	electrolytic
C6	4u7/25V	electrolytic
C7	4u7/25V	electrolytic
C8	4u7/25V	electrolytic
C9	4u7/25V	electrolytic
C10	4u7/25V	electrolytic
C11	2n7	Box polyester
C12	2n7	Box polyester
C13	220n	Box polyester
C14	220n	Box polyester
C15	220n	Box polyester
C16	220n	Box polyester
C17	470uF/16V	electrolytic
C18	100nF	electrolytic
C19	470uF/16V	electrolytic
C20	4u7/25V	electrolytic
C21	4u7/25V	electrolytic
C22	100u/16V	electrolytic
C23	1000u/25V	electrolytic
D1	LED Green	
P1	DUAL_RCA	
P2	DUAL_RCA	
P3	DUAL_RCA	
P4	DUAL_RCA	
P5	5 pins header	
P6	2 pins header	
P7	RCA	
P8	RCA	
R1	3k7 1/4W	
R2	3k7 1/4W	
R3	220 1/4W	
R4	220 1/4W	
R5	2k2 1/4W	
R6	8k2 1/4W	
R7	8k2 1/4W	
R8	220R 1/4W	
R9	1.5K 1/4W	
U1	LC75341	
U2	LM317 TO-92	

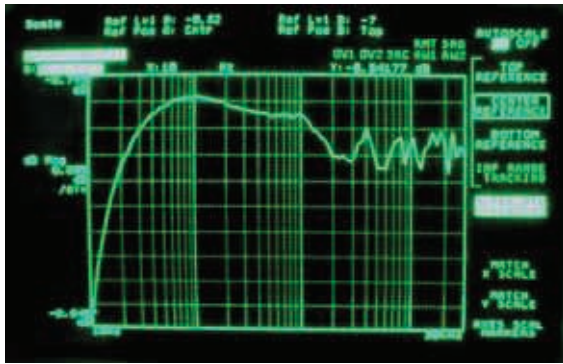


Figure 6. Frequency Response plot of the preamplifier kit with controls all set to flat (0dB). Note the db scale of 0.005dB/div. This plot shows and amplitude flatness within 0.075dB from 20Hz to 30KHz. Measured with HP35665A Dynamic Signal Analyzer.

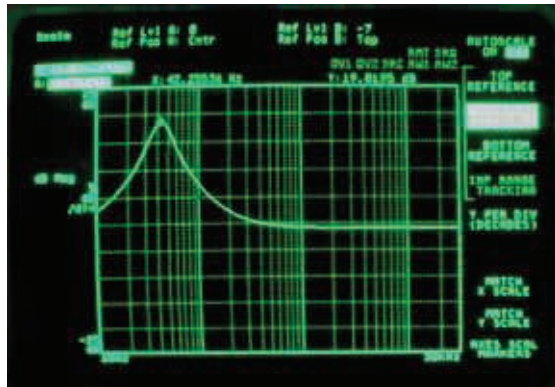


Figure 7. Frequency response plot with bass control set to +20dB boost. Taking into consideration the preamp insertion loss of about 1dB, the plot shows a 20dB boosts peaking at approximately 42Hz.

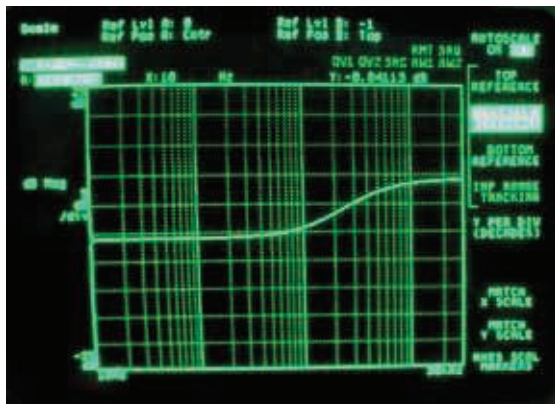


Figure 8. Frequency response plot with treble set control to +10dB.

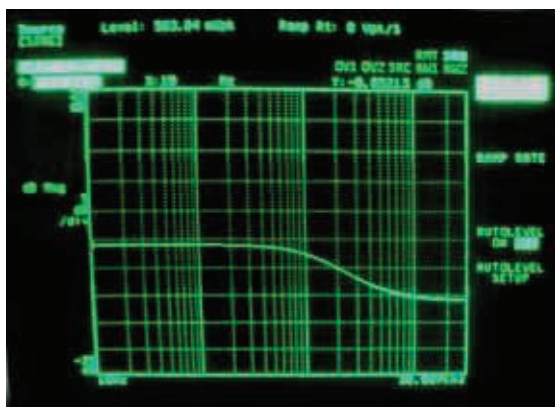


Figure 9. Treble control set to -10 dB.

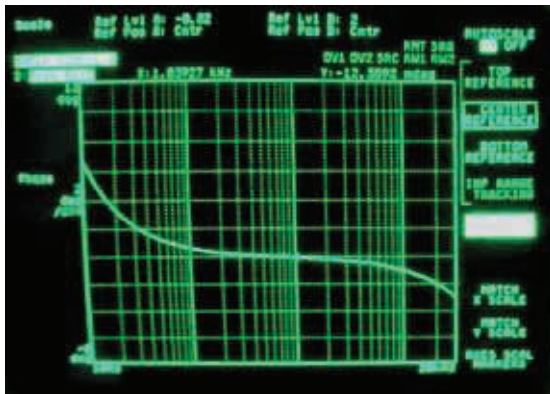


Figure 10. Phase response with all controls set to flat position. Phase scale set to 2 degrees per division.

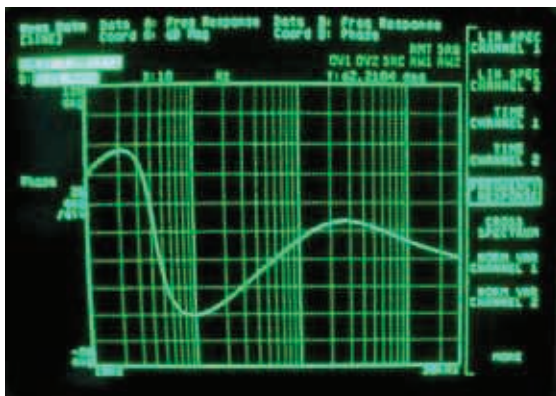


Figure 11. Phase response with bass set to +20dB and treble set to +10dB. Phase scale set to 20 degrees per division.