6. EC-100 ELECTRONIC CROSSOVER

General

EC-100, a combination of a high-pass filter, a phase shifter and an adder, separates an input signal into a high-passed output and a low-passed output.

Each of the two output signals is delivered to a respective power amplifier for driving a 2-way speaker system.

A combination of two or more EC-100's makes it possible to drive a 3-way or 4-way speaker system.

The transfer function $G_H(s)$ of a high pass filter is given by the formula:

$$G_H(s) = \frac{S^2}{(S+\omega_0)^2} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad 1$$

The transfer function $G_P(s)$ of a phase shifter is expressed as:

$$G_P(s) = -\frac{S-\omega_0}{S+\omega_0} \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad 2$$

Further, the added output (Eq. 1 + Eq. 2) of the adder is:

$$G_H(s) + G_P(s) = \frac{\omega_0{}^2}{(S+\omega_0)^2} \quad \cdots\cdots\cdots \quad 3$$

The transfer function of Eq. 3 accords with that of a low pass filter circuit. Therefore the output of the adder is a signal of lower frequency range.

The crossover frequency setting of EC-100 at 19 steps from 66 Hz to 7.4 kHz is possible by adjusting the Frequency Control VR001.

The Frequency Control is interlocked at 19 frequency positions in total, including 10 positions marked on the Frequency Control and 9 positions at the middle of them. These frequencies are 66, 68, 78, 95, 120, 170, 250, 320, 370, 440, 530, 660, and 880 Hz and 1.4 k, 2.4 k, 3.9 k, 5.4 k, 7 k, and 7.4 kHz. The attenuation characteristic of the filters is 12 dB/oct.

EC-100 has the same characteristics as conventional multi-band filter circuits; however, in the crossover frequency switching system of EC-100 is improved from conventional systems that have to change the resistance and capacitance simultaneously to the system changing only the resistance.

Specifications

Maximum Power Consumption	2 VA
Current Consumption	100 mA
Attenuation	12 dB/oct.
Crossover Frequencies	66, 68, 78, 95, 120, 170, 250, 320, 370, 440, 530, 660, 880 Hz, 1.4 k, 2.4 k, 3.9 k, 5.4 k, 7 k, 7.4 kHz
Distortion	less than 0.005% (20 Hz – 20 kHz)
Signal-to-Noise Ratio	better than 110 dB (IHF-A Network)
Ref. Input Level/Input Impedance	1 V/50 kΩ
Ref. Output Level/Output Impedance	1 V/560 Ω
Maximum Input Level	4 V
Mute Function	Furnished
Dimensions	7-1/2(W) x 2-3/8(H) x 3-15/16(D) inches 190(W) x 60(H) x 100(D) mm
Weight	2.4 lb, 1.1 kg

System Diagram

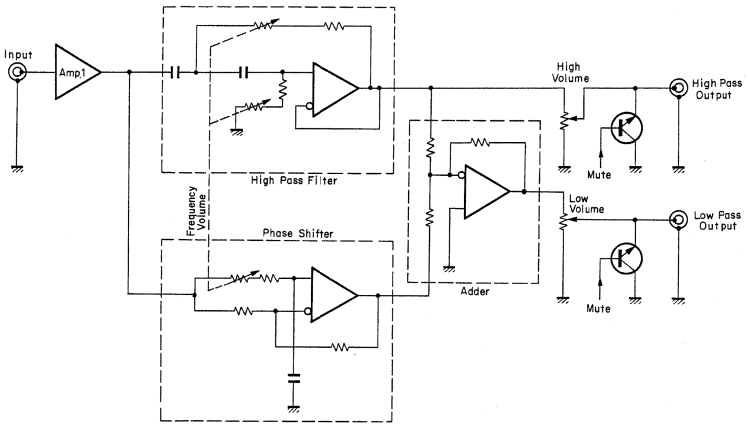

Fig. 6.1

Schematic Diagram

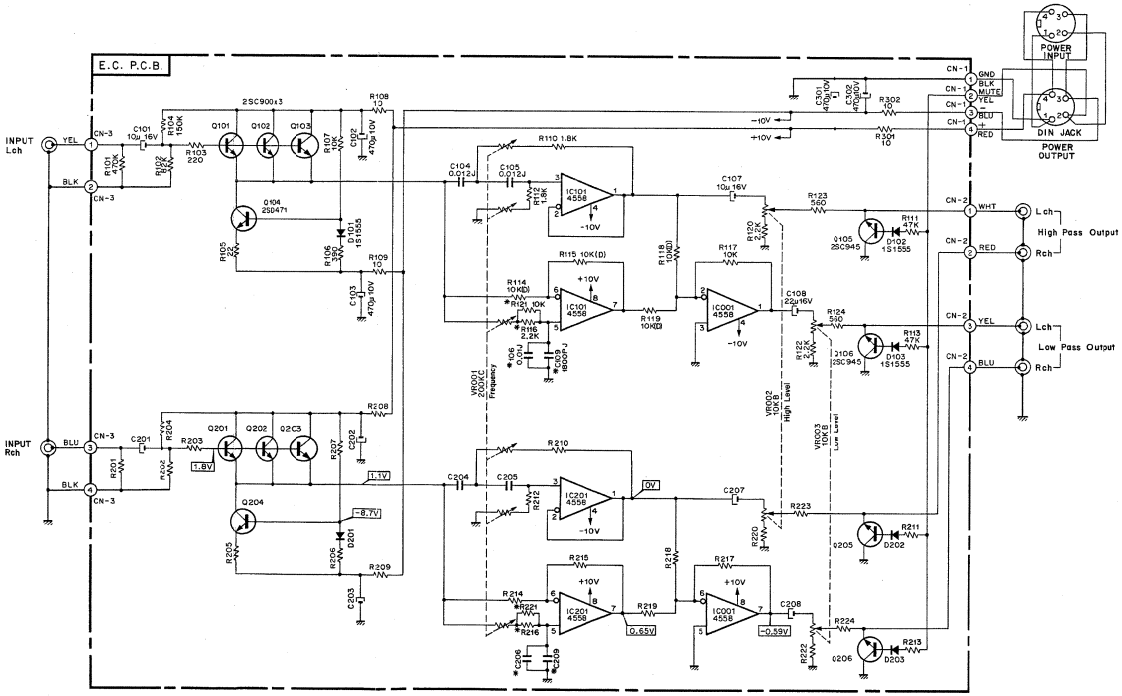

Fig. 6.2

Note:
Resistors and capacitors marked with * will be adjusted in order to achieve accurate crossover frequencies when frequency volume is interlocked at 19 positions.
The standard value of these resistors and capacitors are shown in the figure.

Mounting Diagram and Parts List

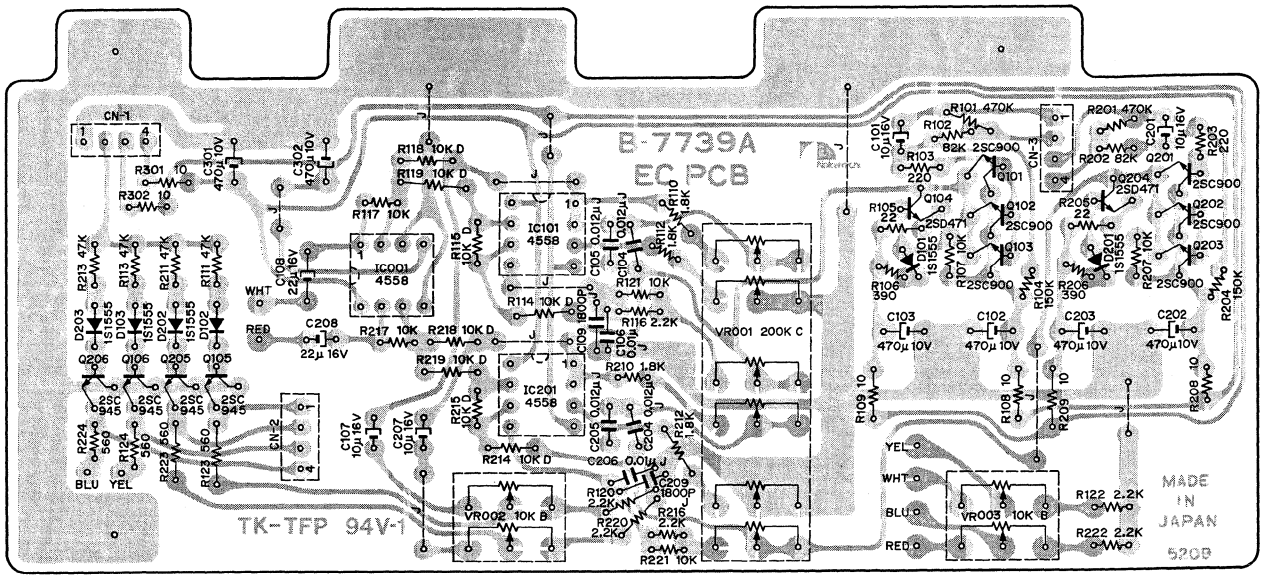

Fig. 6.3

Schematic Ref. No.	Part No.	Description		Schematic Ref. No.	Part No.	Description	
	BA03868A	**EC-100 P.C.B. Ass'y**		R114,115 118,119	0B05955A	Metal Film Resistor	10K ER0-25VK D
	0B07739B	EC P.C.B.		214,215 218,219			
IC001,101 201	0B06124A	IC	4558	R116,120	0B05566A	Carbon Resistor	2.2K ERD-25V J
Q101,102 103,201	0B01910A	Transistor	2SC900 (E)	122,216 220,222			
202,203				R123,124	0B05678A	Carbon Resistor	560 ERD-25V J
Q104,204	0B06066A	Transistor	2SD471	223,224			
Q105,106 205,206	0B01872A	Transistor	2SC945	C101,107 201,207	0B01412A	Electrolytic Capacitor	10μ 16V
D101,102 103,201	0B01909A	Silicon Diode	1S1555	C102,103 202,203	0B05884A	Electrolytic Capacitor	470μ 10V
202,203				301,302			
VR001	0B07182A	Volume	200K (C)	C104,105	0B05843A	Mylar Capacitor	0.012μ J
VR002,003	0B07181A	Volume	10K (B)	204,205			
R101,201	0B05700A	Carbon Resistor	470K ERD-25V J	C106,206	0B05681A	Mylar Capacitor	0.01μ J
R102,202	0B01564A	Carbon Resistor	82K ERD-25V J	C108,208	0B01862A	Electrolytic Capacitor	22μ 16V
R103,203	0B05608A	Carbon Resistor	220 ERD-25V J				
R104,204	0B05593A	Carbon Resistor	150K ERD-25V J	C109,209	0B01913A	Mylar Capacitor	1800P J
R105,205	0B05606A	Carbon Resistor	22 ERD-25V J	CN1,2,3	0B08236A	4P-T Post	
R106,206	0B05688A	Carbon Resistor	390 ERD-25V J				
R107,117 121,207	0B01833A	Carbon Resistor	10K ERD-25V J				
217,221							
R108,109 208,209	0B05663A	Carbon Resistor	10 ERD-25V J				
301,302							
R110,112 210,212	0B01830A	Carbon Resistor	1.8K ERD-25V J				
R111,113 211,213	0B05641A	Carbon Resistor	47K ERD-25V J				

Mechanism Ass'y and Parts List

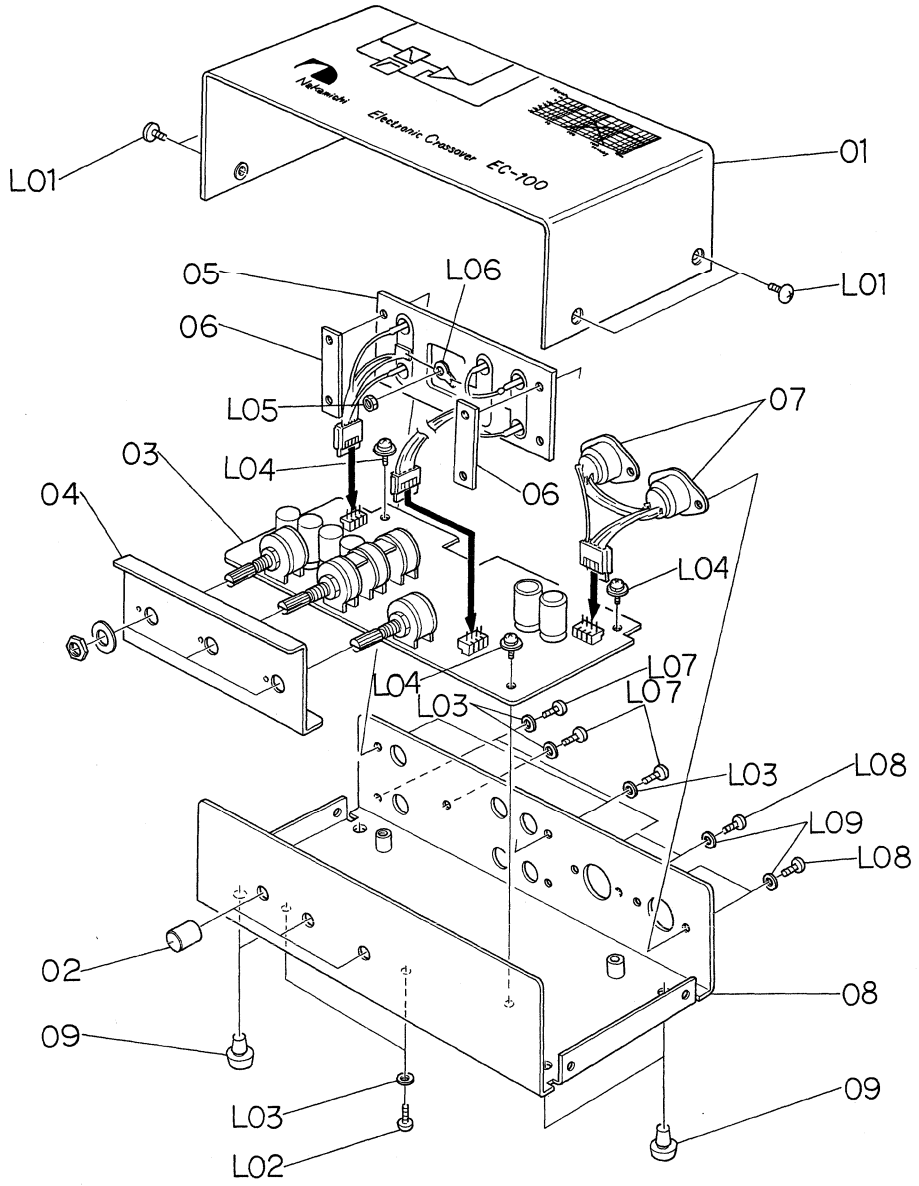

Fig. 6.4

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
		EC-100 Mechanism		L02	0E00593A	Screw M3x6 Philips Binding Head	2
01	0H03528A	Upper Cover EC	1	L03	0E00157A	Washer 3 mm (plastics)	7
02	HA03714A	VR Knob Ass'y	3	L04	0E00606A	Screw M3x6 Philips Pan Head (3A)	3
03	BA03868A	EC-100 P.C.B. Ass'y	1				
04	0J03689B	VR Holder MX	1	L05	0E00507A	Nut Hex. M3	1
05	0B08290B	6P Pin Jack	1	L06	0E00037A	Earth Lug B-5	1
06	0J03277A	Metal Seat Nut	2	L07	0E00594A	Screw M3x8 Philips Binding Head	5
07	0B08355A	4P DIN Socket	2				
08	HA03713A	Main Chassis EC Ass'y	1	L08	0E00714A	Screw M2.6x6 Philips Binding Head	4
09	0H03437A	Rubber Foot	4				
L01	0E00713A	Screw M3x6 Philips Truss Head	4	L09	0E00651A	Washer 2.6 mm (plastics)	4

7. MX-100 MICROPHONE MIXER

General

MX-100 is a mixing unit having three microphone inputs for L-channel, R-channel, and Blend. In addition to the use as a simple microphone mixer connected to line input terminals on a tape deck, the unit allows the application to a PA (public address) amplifier directly connected to an Aux. input of a preamplifier, etc.

Further, connection of this unit to Nakamichi 600 (a cassette console) makes microphone recording by Nakamichi 600 possible.

In addition, connection to the line input of a cassette system, such as Nakamichi 700II, 1000II or 500, allows recording using six microphones.

In Fig.7.1, the gain of the L-channel microphone amplifier is given by the formula:

$$Av(L) = \frac{Ry_1}{R_1 + Rx_1 + Ry_1} \quad \ldots\ldots\ldots\ldots \quad 1$$

and the gain of blend microphone amplifier:

$$Av(B) = \frac{Ry_2}{R_2 + Rx_2 + Ry_2} \quad \ldots\ldots\ldots\ldots \quad 2$$

The gains of the mixing amplifier:

$Av(ML) = R_5/R_3$ (for L-channel mic. amp. output),
$Av(MB) = R_5/R_4$ (for Blend mic. amp. output).

Therefore the output of the L-channel is expressed as:

$$Av(LO) = Av(L)\frac{R_5}{R_3} + Av(B)\frac{R_5}{R_4}$$

Similar to the L-channel, the signal of blend microphone is mixed in the R-channel.

Specifications

Maximum Power Consumption	1 VA
Current Consumption	50 mA
Total Harmonic Distortion	0.05% (10 kHz, 1 V Output, 1 V Input)
Input Sensitivity	0.2 mV
Input Impedance	10 kΩ
Output Level/Output Impedance	100 mV/560 Ω
Maximum Input Level	1 V (+ 74 dB)
Mute Function	Furnished
Dimensions	7-1/2(W) x 3-3/8(H) x 4-5/16(D) inches 190(W) x 60(H) x 110(D)mm
Weight	2.7 lb, 1.2 kg

System Diagram

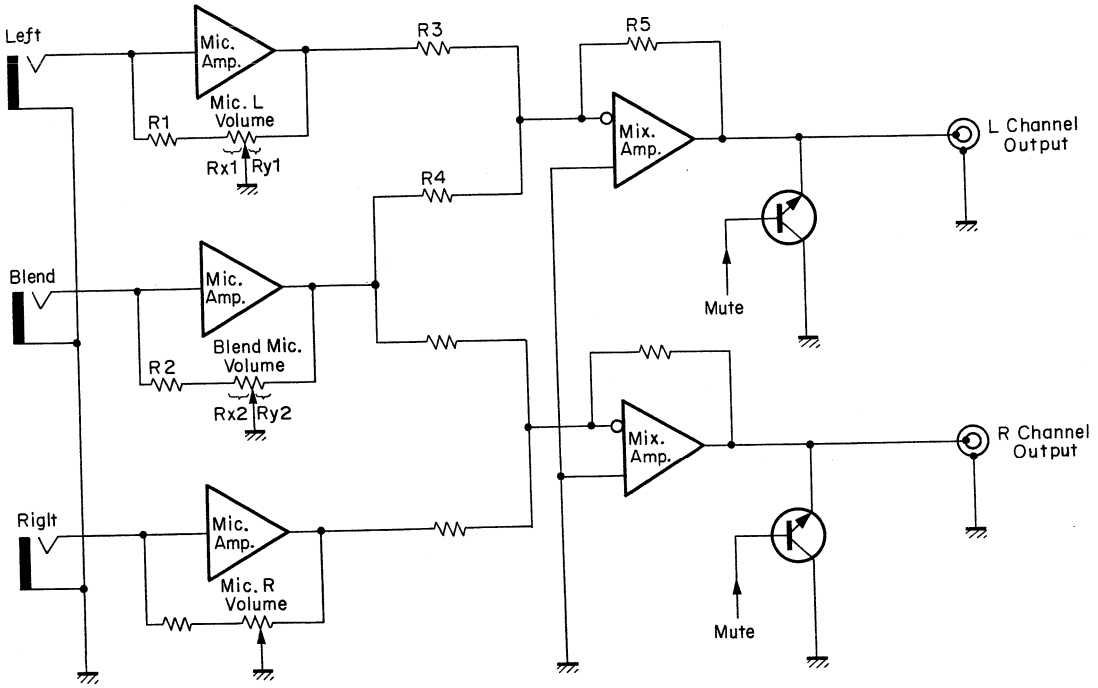

Fig. 7.1