ENGLISH

AB217

AMPLIFIER

SERVICE MANUAL

BBK

BBK ELECTRONICS CORP., LTD.

BBK

FUNCTIONS OF THE PINS			
NAME OF PINS	I/O	DESCRIPTION	NUMBER OF PINS
VDD	P	DIGITAL POWER INPUT	1
XIN	I	OSCILLATOR INPUT	2
XOUT	O	OSCILLATOR OUTPUT	3
D1/ REQ	I	SIMPLE MODE: D1 DATA INPUT MICRO CONTROL MODE: DEMAND SIGNAL	4
D2/ SCK	I	SIMPLE MODE: D2 DATA INPUT MICRO CONTROL MODE: TIME PULSE INPUT	5
D3/ DATA	I	SIMPLE MODE: D3 DATA INPUT MICRO CONTROL MODE: DATA INPUT	6
D4/ IDSW	I	SIMPLE MODE: D4 DATA INPUT MICRO CONTROL MODE: IDENTIFYING CODE INPUT	7
TEST	I	EXCLUSIVELY FOR THE TEST. BE GROUNDED WHEN IN DAILY USE.	8
EASY/ U-COM	I	HIGH POTENTIAL: SIMPLE MODE LOW POTENTIAL: MICRO CONTROL MODE	9
SLEEP	I	HIGH POTENTIAL: SLEEP MODE LOW POTENTIAL: NORMAL MODE	10
D-GND	G	DIGITAL	11
A-GND	G	ANALOG	12
LPF2 OUT	O	LOW PASS FILTER 2 OUTPUT	13
LPF2 IN	I	LOW PASS FILTER 2 INPUT	14
OP2 OUT	O	INTEGRATOR 2 OUTPUT	15
OP2 IN	I	INTEGRATOR 2 INPUT	16
CC2	\	CURRENT CONTROL 2	17
CC1	\	CURRENT CONTROL 1	18
REF	\	ANALOG REFERENCE VOLTAGE 1/2Vcc	19
OP1 IN	I	IN INTEGRATOR 1 INPUT	20
OP1 OUT	I	INTEGRATOR 1 OUTPUT	21
LPF1 OUT	\	LOW PASS FILTER 1 OUTPUT	22
LPF1 IN	O	LOW PASS FILTER 1 INPUT	23
Vcc	P	ANALOG POWER INPUT	24

CONTENTS

1 Circuit Makeup

This unit's circuit can be divided into six parts.

1.1 Source Circuit

Supplies power to each circuit unit.

1.2 Input Circuit

Selects one of four lines of input analog signals and sends it to the rear circuit.

1.3 Volume and Tone Adjusting Circuits

Adjusts master volume and treble and bass tone of input signals.

1.4 Power Amplification and Protection Circuits

Amplifies input signals' power to drive speakers to produce sound; Protects circuits of speakers and power amplifier automatically in abnormal conditions.

1.5 Microphone Circuit

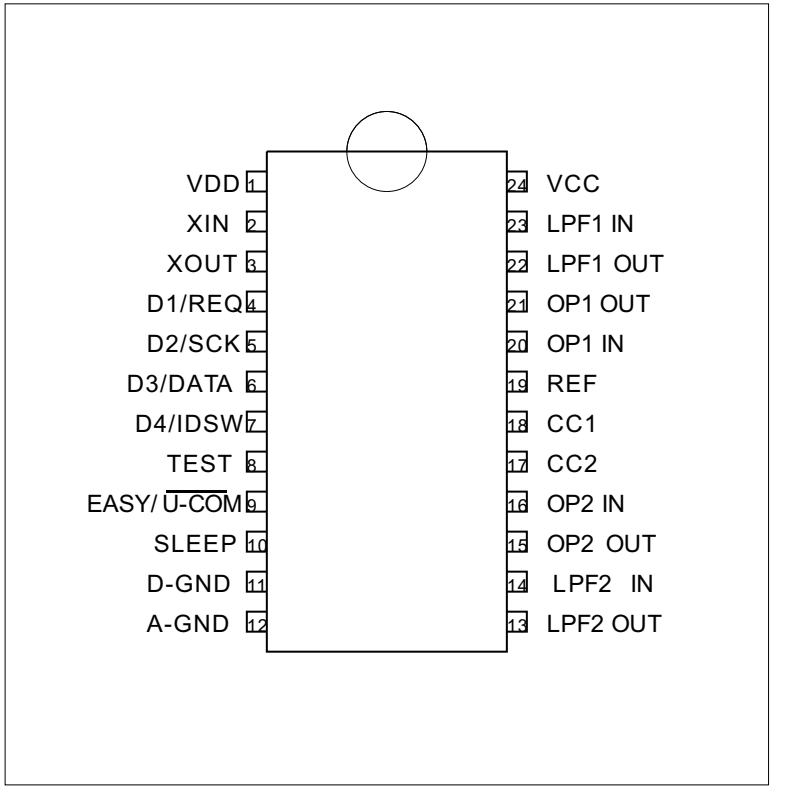
Adjusts volume and tone of signals from the microphone and superimpose them on left and right channels after echo processing.

1.6 Main Board Control and Display Circuits

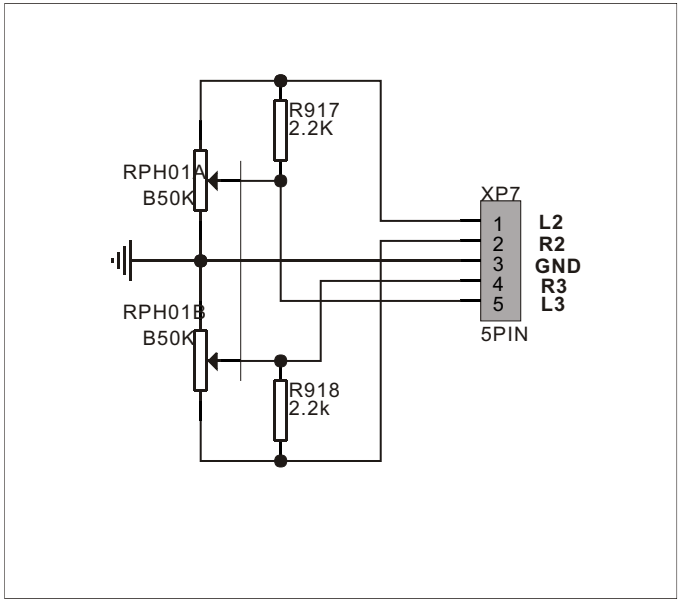
Receives control commands and send control signals to achieve control function. Drives the VFD screen to show the current working mode.

9 The Explanation For Key Components

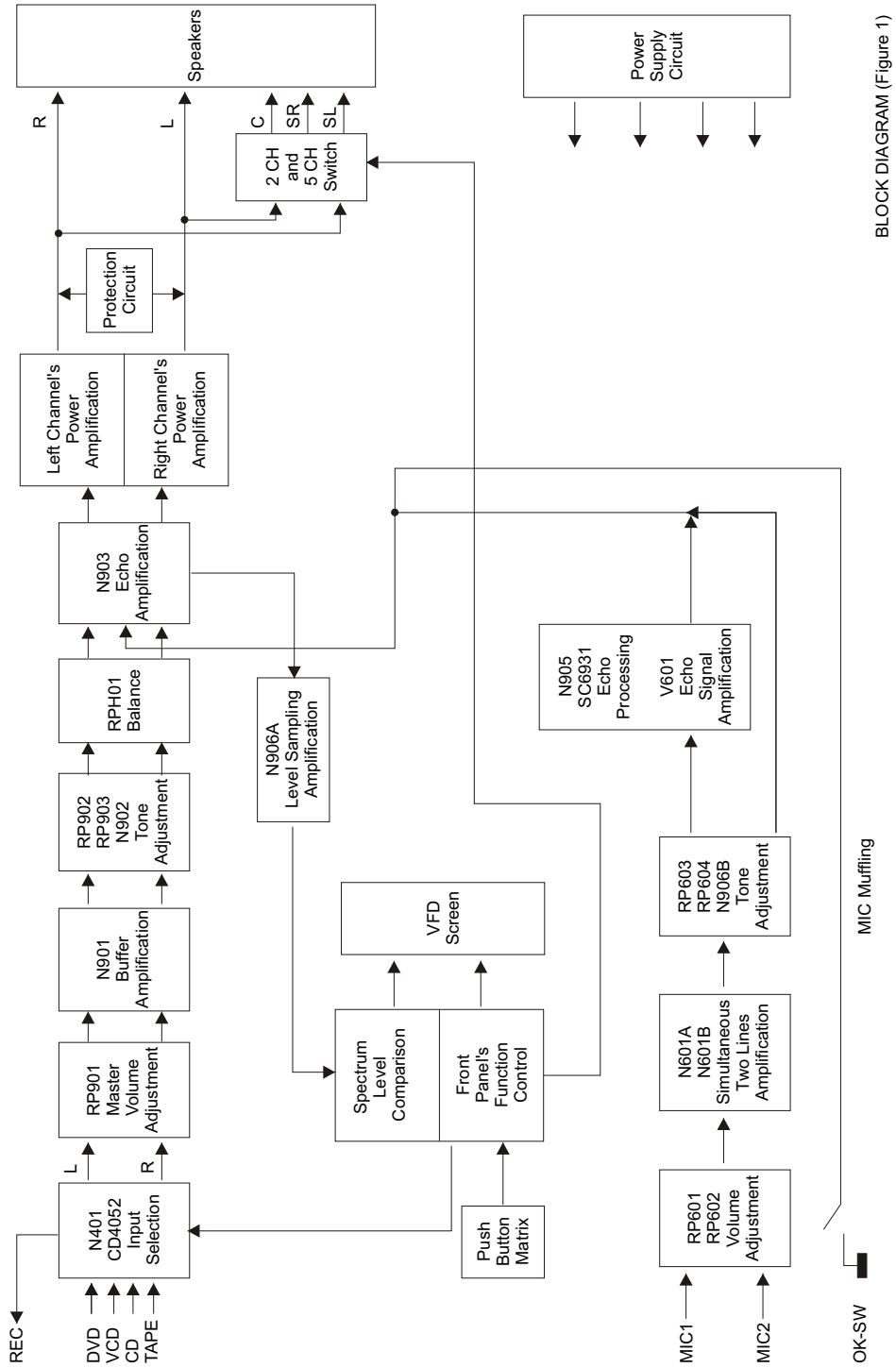
IC Sc6931P



8.3.2 Schematic Diagram of The Potentiometer



BLOCK DIAGRAM (Figure 1)



2. Volume adjustment, sound field processing and EQ adjustment circuits.

All channel signals are sent to N402 inside which the independent volume adjustment, EQ adjustment and all sound field modes process are performed.

The sound field processing and EQ adjusting circuit is mainly processing the L&R channel signals. According to the schematic diagram, the L&R channel signals are added simultaneously to the pins 15, 17, 13 and 16 of N402. When the unit mode is in the Hi-Fi mode, the internal circuit of the pins 17&16 is connected and the other input signals are cut off. At this time, only the L&R channel volume can be adjusted and only the pins 31&32 send out signals. Therefore, the unit is in the 2CH output mode. The unit mode is not in the Hi-Fi mode, other input signals are connected but the pins 17&16 signals are cutoff. At this time, all channel volumes can be adjusted independently and the sound field processing or EQ adjusting of the L&R channels can be performed. Finally, all channel signals pass out from the pins 31, 32, 33, 34, 35&36. The SW channel signal from the pin 36 reaches the amplified speakers to be amplified through the SW output terminals. Other channel signals reach to the power amplifying circuit to be amplified. The L&R channel signals will go through 1st grade LPF and MIX amplification (Karaoke signals are overlapped into L& R channels).

3. Input signals detect, search and frequency spectrum sampling cir cuits

3.1 Input signals detect and search circuit: The six channel signal lines of the input IC N402 are connected with 100K sampling resistors R533, R534, R657, R676 and R678 respectively. The signals are mixed by these resistors and added to the opposite-phase input terminal to be amplified. VD431 and C481 connected to N403B's output end constitute half-wave rectifying filter circuit. Then the signals reach the voltage comparer composed of N403A. The output end of N403A (SEARCH) is connected to the pin 28 of CPU. This control signal is the search and detect signal: when it is low level, it enters the search mode; when it is high level, it stops searching. Its works as follows:

3.1.1 When this unit is getting started, the A&B control signals from the pins 38&39 in the domination of the CPU's inter program are added to the input select circuit to search circularly once. When there are no signals in these four input connectors, the VCD mode stops automatically. When there are signals in one of the four connectors, AC signals will appear in all channels of the input N402. These AC signals are amplified by N403B and rectified and filtered by VD434 and C481 to become DC signals. At this time, the opposite-phase voltage of N403A is 0.01V. When this DC voltage surpasses 0.01V, the output end of N403B sends out a high level (SEARCH) close to positive power supply voltage (A+6V) which reaches the pin 28 of CPU. CPU keeps searching in the connector in which there are input signals and the unit will play normally.

1.2.2 When press the SEARCH on the front panel, CPU sends out A&B control signals again to start searching. Meanwhile, the pin 27 (EX) sends out a high level which makes V446 inductive. The emitter of V446 sends out a high level which passes through R498 which makes the opposite-phase voltage of N403A to be 0.4V. That is to say, if you want to stop searching of CPU, the gained voltage after the input signals are rectified and filtered must exceed 0.4V. This voltage is higher than 0.01V when this unit is getting started in order to avoid that the CPU receives signals mistakenly and stops searching due to the large external interference signals. If the input signals' amplitude is not high enough, CPU will continue searching. When the amplitude is high enough, N403A sends out high level to the pin 28 to stop searching. The pin 27 (EX) will become low level again and the opposite-phase voltage of N403A will also returns back to 0.01V. The whole searching process is finished.

GENERAL DESCRIPTION

The W78E54 is an 8-bit microcontroller that is functionally compatible with the W78C54, except that the mask ROM is replaced by a flash EEPROM with a size of 16 KB. To facilitate programming and verification, the flash EEPROM inside the W78E54 allows the program memory to be programmed and read electronically. Once the code is confirmed, the user can protect the code for security.

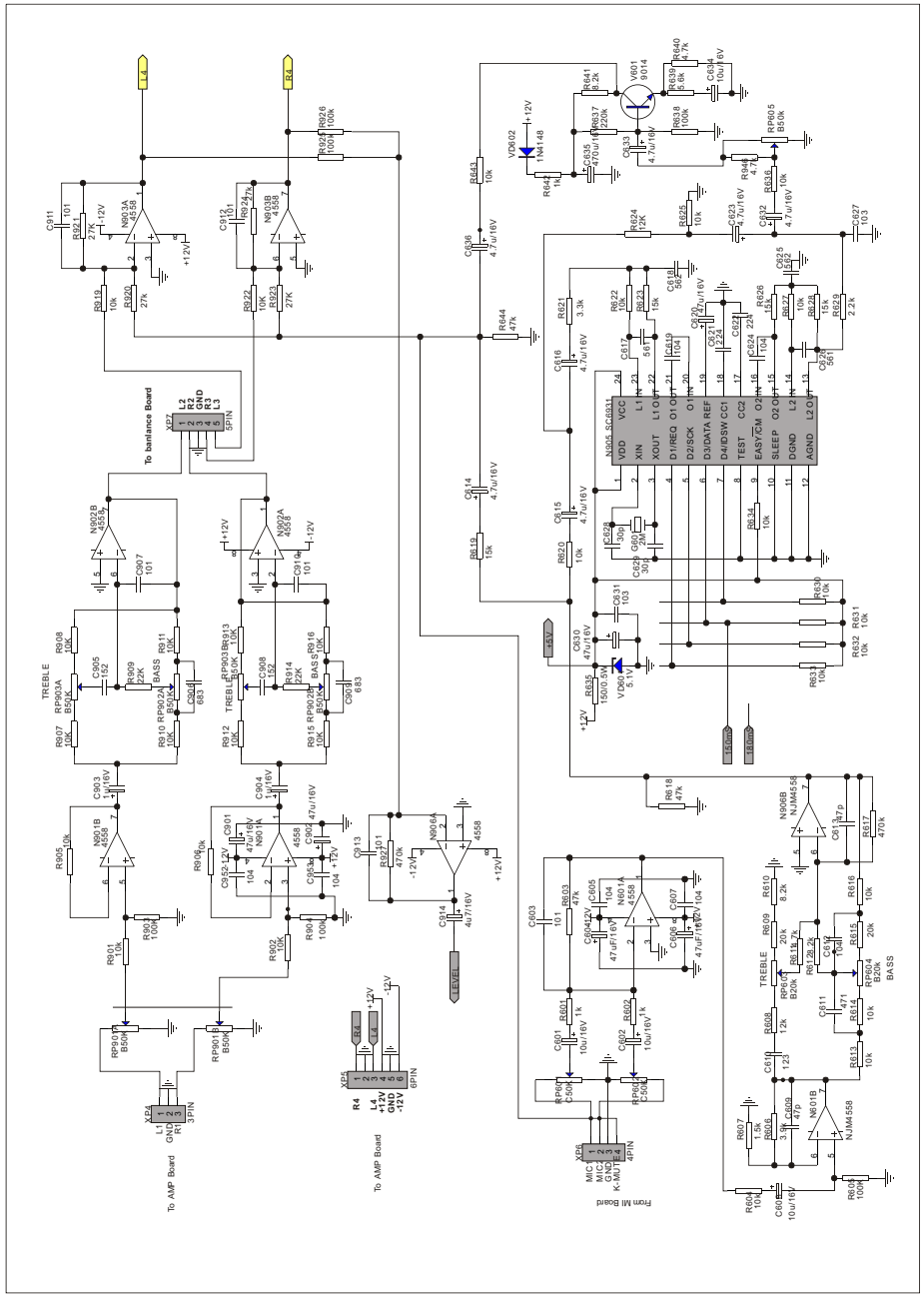
The W78E54 microcontroller supplies a wider frequency range than most 8-bit microcontrollers on the market. It is functionally compatible with the industry-standard 80C52 microcontroller series, except that one extra 4-bit bit-addressable I/O port (Port 4) and two additional external interrupts ($\overline{INT2}$, $\overline{INT3}$).

The W78E54 contains four 8-bit bidirectional and bit-addressable I/O ports, three 16-bit timer/counters, and a serial port. These peripherals are supported by a eight-source, two-level interrupt capability. There are 256 bytes of RAM and an 16 KB flash EEPROM for application programs.

The W78E54 microcontroller has two power reduction modes, idle mode and power-down mode, both of which are software selectable. The idle mode turns off the processor clock but allows for continued peripheral operation. The power-down mode stops the crystal oscillator for minimum power consumption. The external clock can be stopped at any time and in any state without affecting the processor.

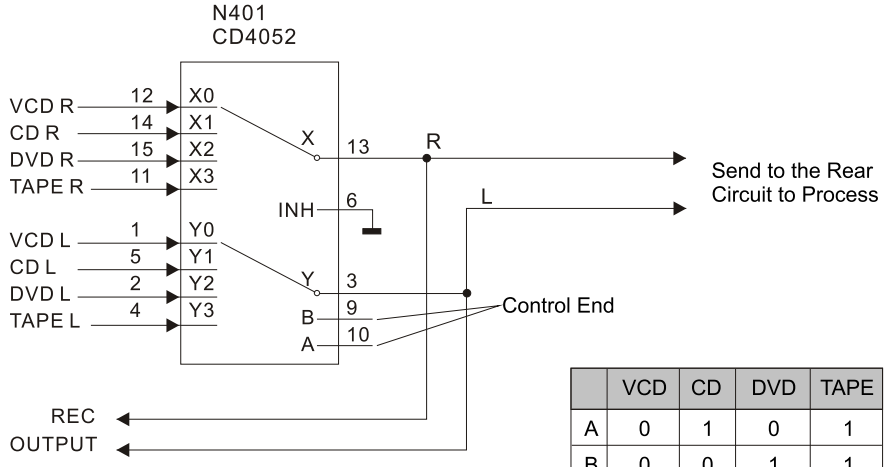
FEATURES

- 8-bit CMOS microcontroller
- Fully static design
- Low standby current at full supply voltage
- DC-40 MHz operation
- 256 bytes of on-chip scratchpad RAM
- 16 KB electrically erasable/programmable EPROM
- 64 KB program memory address space
- 64 KB data memory address space
- Four 8-bit bidirectional ports
- One extra 4-bit bit-addressable I/O port, additional $\overline{INT2}$ / $\overline{INT3}$ *(available on 44-pin PLCC/QFP package)*
- Three 16-bit timer/counters
- One full duplex serial port
- Boolean processor
- Eight-source, two-level interrupt capability
- Built-in power management
- Code protection mechanism



3 Input Circuit

The input circuit of AB217 incorporates a dual channel one-out-of-four electronic analog switch. Among four lines of analog signals VCD, CD, DVD, TAPE, Channel R is sent to Switch X and Channel L to Switch Y. Input signals can be selected through controlling high and low level combination of Pins 9&10 in N401. (Figure 3)



	VCD	CD	DVD	TAPE
A	0	1	0	1
B	0	0	1	1

Input Circuit Diagram and CD4052 Real Value Table (Figure 3)

For instance, when Pin 9 (End B) is measured to be high level and Pin 10 (End A) is measured to be low level, according to the real value table, the switch is connected to DVD signal and thus N401 sends the signal to the rear circuit to be processed. Through this process, N401 realizes the function of selecting the DVD signal from four lines of signals and sending the DVD signal to be processed. Pin 6 of N401 is the INH which decides whether the whole switch is effective or not. When it is low level, N401 is effective. When it is high level, the output end of N401 is suspended and therefore the switch is invalid. However, this unit is usually grounded, so the switch is always effective. Pin 6 is used as mute sound controlling pin.

The output CH L & R signals are coupled by R457/R458 into two lines: One line is coupled by C443 and C444 and sent out from REC jacks as signal source for recording. The other line is sent to the rear circuit to be processed.

4 Volume, Tone and Balance Adjusting Circuits

The L and R signals from input circuits pass through coaxial potentiometer to adjust master volume. Then the signals are buffered and enlarged through N901 and sent to the tone-adjusting circuit composed of RP903, RP902 and N902. RP902 is the bass tone-adjusting potentiometer and RP903 the treble tone-adjusting potentiometer.（Figure 4）

The tone-adjusted and volume-adjusted channels L and R signals from Pins 7&1 of N902 are added to balance potentiometer to adjust L's and R's balance. Finally the signals are sent to mix amplifying section N903. At this moment, the Karaoke signal from the MIC circuit passes through R920 and R923 to mix with L and R signals and finally goes to the main board's amplifier to be amplified.

L and R channels of N903 are connected to two sampling resistors R925 and R926 respectively, through which L and R signals are mixed. The mixed signals are amplified by N906A into LEVEL signal which is then sent to the front panel circuit as source signal of spectrum analysis.

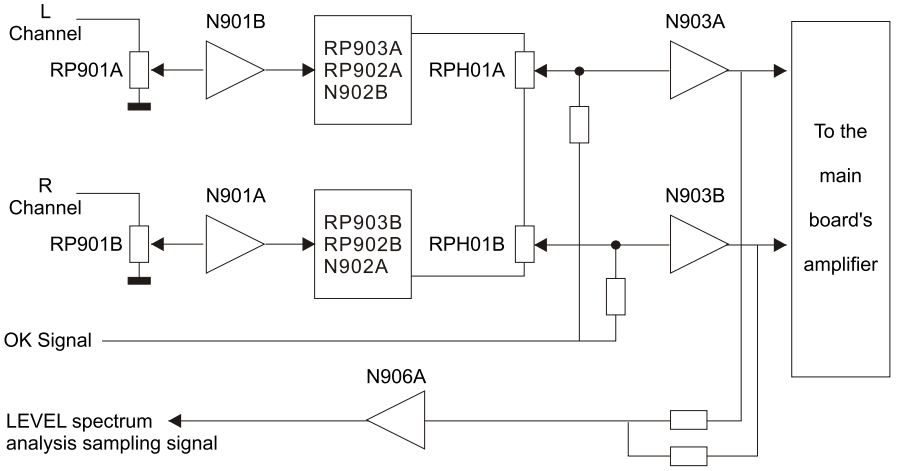
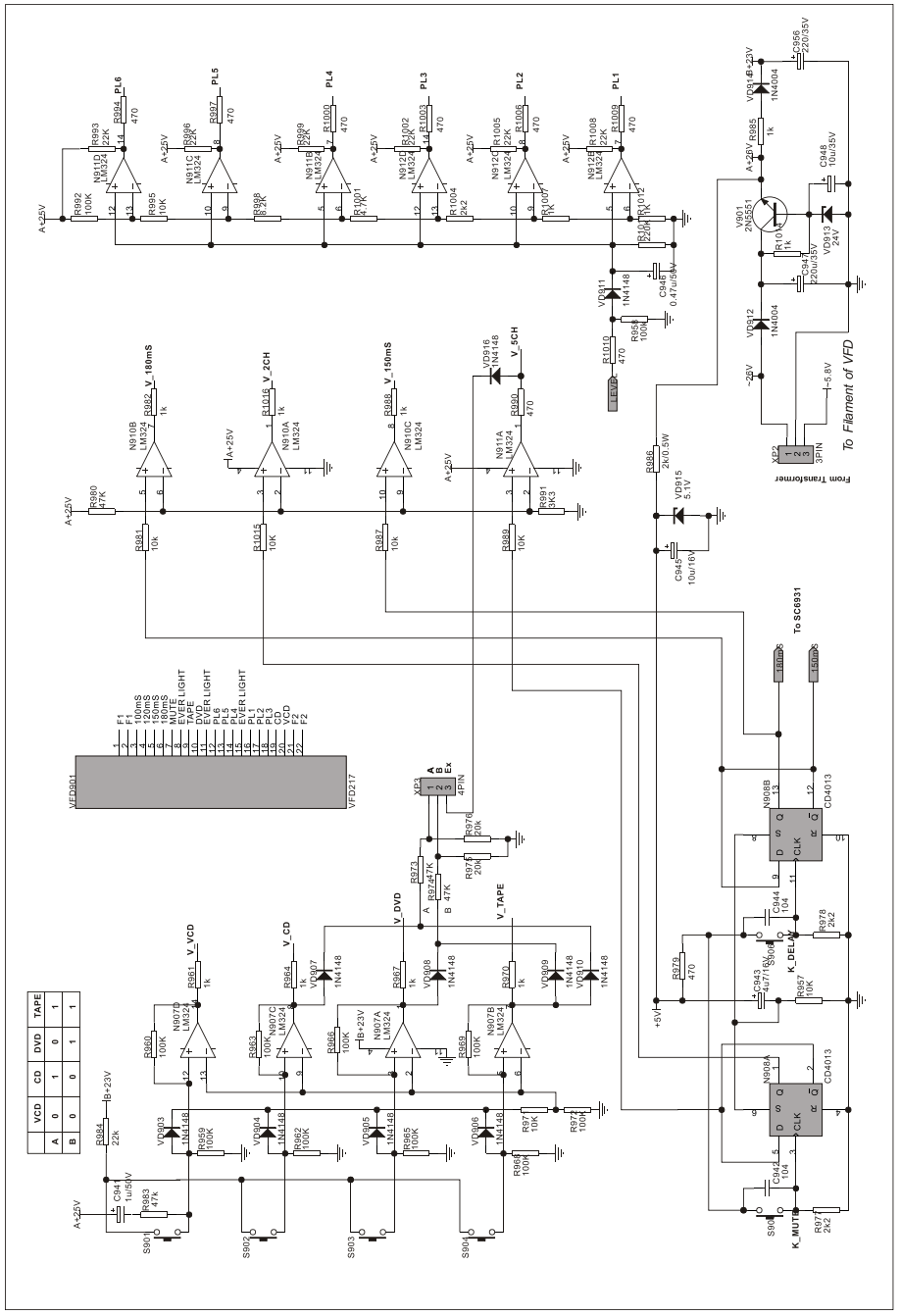


Figure 4

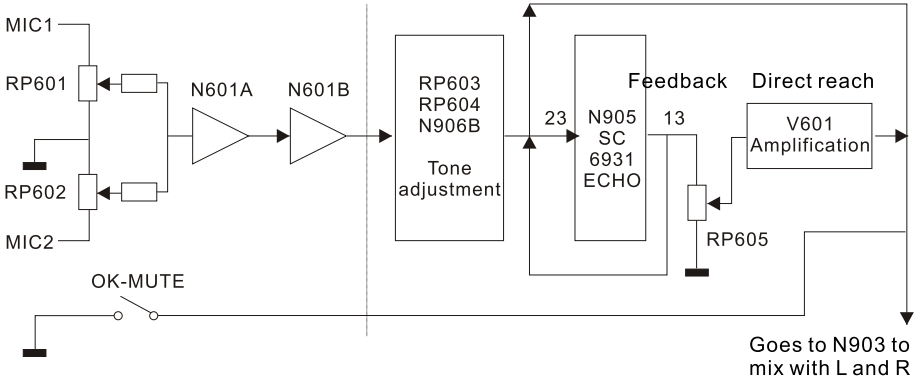
8.2.2 Schematic Diagram of The Front Panel's Control Board



47	CD	CD11C 50V1U±20%4Ч7 1.5	C903,C904,C941
48	CD	CD11C 50V10U±20%5Ч7 2	C601,C602,C608
49	CD	CD11C 16V47U±20%5Ч7 2	C620,C630
50	CD	CD11 35V220U±20J f0Ч15 5	C956,C947
51	DIODE	1N4004	VD912,VD914
52	DIODE	1N4148	VD903~VD911,VD916,VD602
53	VOLTAGE REGULATOR DIODE	5.1V 1/2W	VD601,VD915
54	VOLTAGE REGULATOR DIODE	24V 1/2W	VD913
55	TRIODE	2N5551	V901
56	TRIODE	9014C	V601
57	I C	LM324N DIP	N907,N910,N911,N912
58	I C	NJM4558D DIP	N901~N903,N906,N601
	I C	4558C DIP	N901~N903,N906,N601
59	I C	CD4013BCN DIP	N908
60	I C	SC6931P DIP	N905
61	CRYSTAL OSCILLATOR	2.00MHz 49-U	G601
62	VFD	YW-3707A	VFD901
63	LIGHT TOUCH RESTORE SWITCH	VERTICAL 6Ч6Ч11	S901~S906
64	PCB	9217-4	
65	CONNECTION CORDS	¦ µ6 SHAPED 7.5mm	W1~W4,W7~W9,W11~W13,W16,W19~W22,W29, W31~W34,W37,W38,W43,W46,W49,W52,W54, W56~W58,W62,W65~W69,W74,W75,W81,W82,W83, W90~W93,W99,W102,W103,W114,W116,W117
66	CONNECTION CORDS	¦ µ6 SHAPED 10mm	W5,W17,W18,W23~W28,W35,W36,W39,W40,W42, W47,W48,W59,W64,W70~W72,W76,W84~W86,W94, W95,W98,W100,W101,W104,W109~W112,W115
67	CONNECTION CORDS	¦ µ6 SHAPED 12.5mm	W10,W14,W15,W30,W44,W51,W61,W77,W78,W88, W89,W107,W108,R1013
68	CONNECTION CORDS	¦ µ6 SHAPED 15mm	W6,W41,W45,W50,W53,W55,W60,W63,W73,W79, W80,W87,W96,W97,W113
69	CONNECTION CORDS	¦ µ6 SHAPED 20mm	W105,W106
	CORDS	24# 50mm BLACK	
70	RAFT CORDS	3P360 2.5 2 PLUG WITH L NEEDLE	XP3
71	RAFT CORDS	5P60 2.5 2 PLUG WITH L NEEDLE	XP7
72	RAFT CORDS	3P80 2.5 2 PLUG WITH L NEEDLE	XP2
73	RAFT CORDS	3P360 2.5 2 PLUG WITH L NEEDLE , 2P SHIELDED	XP4
74	RAFT CORDS	4P60 2.5 2 PLUG WITH L NEEDLE, 3P SHIELDED	XP6
75	RAFT CORDS	6P360 2.5 2 PLUG WITH L NEEDLE, 2P SHIELDED	XP5
76	SOFT SPONGE SPACER	10Ч10Ч5 DOUBLE FACED, HARD	VFD/PCB

5 Microphone Circuits

The microphone circuit can be divided into two parts: Front-set processing section and echo processing section. (Figure 5)



Microphone Circuit Block Diagram (Figure 5)

5.1 Working Principle of the Front Processing Section.

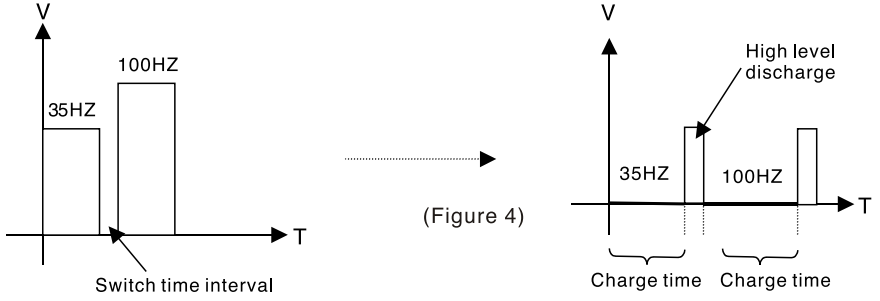
RP601 and RP602 adjust volume of MIC1 and MIC2 signals from two microphones separately and then send them through C601, C602, R601 and R602 to be mixed. The mixed signals go to the volume-adjusting circuit composed of RP603, RP604 and N906B after being buffered and amplified in N601A and N601B. RP603 is treble-adjusting potentiometer and RP604 is bass-adjusting potentiometer. The two potentiometers can modify and beautify our voices to make them sound more appealing and charming. The front-section Karaoke signals are sent to the echo processing section through the Pin7 of N906B

5.2 Working Principle of the echo processing section.

The echo effects are produced through the following process: The signals in the direct channel are picked up and handled through delay process and then fed back and overlapped in the direct channel. Therefore, there are two lines of signals : direct and feedback channels. To be specific, the front-section signals in AB217 circuit are divided into two lines: K Direct Channel: R619 and C614 send it directly to two inphase opposition input Pins 6&2 of the mix amplification section. L Feedback channel: It is coupled through R620, C615, C616 and R621 and then added to the Pin 23 of the echo processing IC N905 (SC6931). It is sent out through the Pin 13 after process of low-pass and band-pass filtering amplifying, A/D and D/A converting and digital delaying. At this moment, the signals are divided into two lines again: One line is fed back to the Pin 23 through C623 and R624. The other line passes through C632, R636, RP605 (Echo-level-adjusting potentiometer), V601 amplification, R601 and C636 to overlap with direct signals. The combined signals are also sent to two inphase opposition Pins 6&2 of the mix amplifying section. N903 mixes Karaoke signals with L/R main channels, where the OK-MUTE contact sheet inside MIC jacks is also located: when the microphone does not insert, the contact sheet is connected to the earth wire which can filter the noise short circuit from the MIC circuit; when the microphone inserts, the contact sheet is disconnected to the earth wire and there is normal output in the MIC circuit.

4.3.3 A/D conversion and display output circuit: The output voltage from the pin 3 of N419 passes through N420B where it is amplified and sent to the opposite-phase terminal of N420A. N420A composes a voltage comparer. We'll discuss its detailed working process according the voltage comparing characteristics (When the in-phase end's voltage is higher than that of the opposite-phase end, the output is the positive power. When the in-phase end's voltage is lower than that of the opposite-phase end, the output is the negative power.) and the figure 4.

When the opposite-phase end has a DC voltage representing 35Hz signal amplitude, the output of N420A is a low level close to the negative power supply. At the same time, +5V provides conditions for V436 to be conductive and a high level from the collector of V436 charges C530. The positive end's voltage of C530 (i.e. the in-phase end of N420A) is increasing gradually. When the voltage reach that of the opposite-phase end, the voltage comparer will overturn. Therefore, N420 sends out a high level close to the positive power supply voltage. When the comparer overturns, CPU will terminate the 35Hz level selection and switch to the next frequency 100Hz. During the switch interval, an instantaneous high level from the pin 1 of CPU makes V435 conductive and the voltage of C530 will be released. The in-phase end of N420A will be charged from 0 level to 100Hz. When 100Hz charge is finished, it will switch to the next frequency. The process is circulated under CPU's control. The charging time from the 0 level to overturn represent current frequency's signal amplitude. The amplitude is large, time is longer; the amplitude is small, time is shorter. We can conclude from the above circuit working process: An analog series of DC level which has concrete voltage value originally becomes two mode of 0 and 1. Its time period represents the digital pulse of the original information. That is to say, it finishes the analog-to-digital conversion process. The digital pulse sent out from the output terminal of N420A reaches the pin 12 of CPU after opposite-phased by V437. And then CPU processes it and sends it to front panel display IC N901 which will make dynamic spectrum display on the display. As a matter of fact, every frequency is displayed sequentially. However, what we see on the display screen is the working process all the spectrums are displayed simultaneously due to every frequency display circulate very quickly.



127	CONNECTION CORDS	μ 0.6 SHAPED 10mm	W4,W6,W7,W9,W13,W17,W23,W25,W29,W31,W32,W35, W40,W41,W44~W47,W54,W55,W62,W65,W80,W90,W97, W103,W111,W112,W117,W121,W122,W133,W137,W142, W143,W154,W163,W167,W168,W174,W177,W178,W180, W181,W185,W186,W190,W207,W208,W209,W37
128	CONNECTION CORDS	μ 0.6 SHAPED 12.5mm	W57,W60,W67,W68,W70,W71,W77,W93,W104, W120,W123,W124,W128,W130,W131,W144,W145,W148, W204
129	CONNECTION CORDS	μ 0.6 SHAPED 15mm	W83,W85,W86,W107,W115,W126,W129,W146,W147, W169~W173,W175,W176,W182,W183,W191,W201,W82
130	CONNECTION CORDS	μ 0.6 SHAPED 20mm	W33,W34,W48,W51,W114,W132,W134,W141,W166,W192, W196,W200,W203
131	CABLE	20# 60mm BLACK WITH CHIP SOLDER	GROUND WIRE
132	CABLE	18# 70mm BLACK	XJ1~XJ2
	CABLE	22φ ℓ80mm BLACK	XJ1~XJ2
133	FUSE TUBE	T6.3AL 250V	FL403,FL404
134	FUSE TUBE	T4AL 250V	FL405,FL401,FL402
135	FUSE HOLDER	BLX-2	FL405
136	RADIATOR BOARD	30 16 16 AB207	SRQ401
137	LARGE RADIATOR	267.5 91 70 AV210	CONNECTED TO THE MAIN AMPLIFICATION BOARD
138	FUSE HOLDER	0	FL401~FL404
139	SMALL CHIP	AB207	FIX TRIODE
140	ANGLE ALUMINUM	90 23.2 30 AV210	POWER IC / LARGE RADIATOR
141	TAPPING SCREW	BT 3 8 BLACK	2 FOR RADIATOR BOARD/MAIN AMPLIFICATION BOARD, 1 FOR N412/RADIATOR BOARD
142	TAPPING SCREW	PB 3 12H COLOR ZINC	2 FOR SMALL CHIP/LARGE RADIATOR, 5 FOR ANGLE ALUMINUM/LARGE RADIATOR
143	TAPPING SCREW	PWT 3 8 8 COLOR ZINC	1 FOR MAIN AMPLIFICATION/RADIATOR, GROUNDED
144	TAPPING SCREW	BT 3 8H COLOR ZINC	1 FOR MAIN AMPLIFICATION/RADIATOR, 3 FOR ANGLE ALUMINUM/POWER IC
145	MACHINE SCREW	PWM 3 16 8 COLOR ZINC	4 FOR POWER TUBE/LARGE RADIATOR
146	SCREW NUT	M3	
147	SCREW SPACER	μ 3 7.2 0.5	
148	SPRING SPACER	μ 3	
149	INSULATION RING	μ 3 6 3	N413~N415
150	MICA SPACER	18◊13◊0.1	3 FOR IC（N413,N414,N415）/RADIATOR
151	MICA SPACER	22◊19◊0.1	4 FOR POWER TUBE / RADIATOR

8.2 Front Panel's Control Board

8.2.1 Main Parts List of The Front Panel's Control Board

NO.	DESCRIPTION	SPECIFICATIONS / PART NUMBER	LOCATION SPECIFICATIONS
1	CARBON FILM RESISTOR	1/4W470¦ ±5% SHAPED 10	R979,R990,R994,R997,R1000,R1003,R1006,R1009,R1010
2	CARBON FILM RESISTOR	1/4W1K±5% SHAPED 10	R601,R602,R961,R964,R967,R970,R982,R988,R1016, R1012,R1007,R985,R1014,R642
3	CARBON FILM RESISTOR	1/4W1.5K±5% SHAPED 10	R607
4	CARBON FILM RESISTOR	1/4W2.2K±5% SHAPED 10	R629,R1004,R977,R978
5	CARBON FILM RESISTOR	1/4W3.3K±5% SHAPED 10	R991,R621
6	CARBON FILM RESISTOR	1/4W3.9K±5% SHAPED 10	R606
7	CARBON FILM RESISTOR	1/4W4.7K±5% SHAPED 10	R1001,R611,R946,R640
8	CARBON FILM RESISTOR	1/4W5.6K±5% SHAPED 10	R639
9	CARBON FILM RESISTOR	1/4W10K±5% SHAPED 10	R901,R902,R905~R908,R910~R913,R915,R916,R919, R922,R957,R971,R989,R995,R981,R987,R1015,R604, R613,R614,R616,R620,R622,R625,R627,R630~R634, R636,R643
10	CARBON FILM RESISTOR	1/4W12K±5% SHAPED 10	R608,R624
11	CARBON FILM RESISTOR	1/4W15K±5% SHAPED 10	R623,R626,R628,R619
12	CARBON FILM RESISTOR	1/4W20K±5% SHAPED 10	R975,R976,R609,R615
13	CARBON FILM RESISTOR	1/4W22K±5% SHAPED 10	R993,R996,R999,R1002,R984,R1008,R1005,R909,R914
14	CARBON FILM RESISTOR	1/4W47K±5% SHAPED 10	R973,R974,R980,R983,R959,R960,R603,R618,R644
15	CARBON FILM RESISTOR	1/4W100K±5% SHAPED 10	R903,R904,R925,R926,R962,R965,R968,R972,R963, R966,R969,R992,R958,R605,R638
16	CARBON FILM RESISTOR	1/4W220K±5% SHAPED 10	R1011,R637
17	CARBON FILM RESISTOR	1/4W470K±5% SHAPED 10	R927,R617
18	CARBON FILM RESISTOR	1/4W30K±5% SHAPED 10	R920,R921,R923,R924
19	CARBON FILM RESISTOR	1/4W8.2K±5% SHAPED 10	R998,R610,R612,R641
20	CARBON FILM RESISTOR	1/2W2K±5J ¦SHAPED 12.5	R986
21	CARBON FILM RESISTOR	1/2W150¦ ±5% SHAPED 12.5	R635
22	ROTATING POTENTIO-METER	A145GOED-H1B503-007	RP901
	ROTATING POTENTIO-METER	A145GOED-H1B503-007-01	RP901
	ROTATING POTENTIO-METER	A145GOED-H1B503-007-02	RP901
23	ROTATING POTENTIO-METER	A145GOED-H1B503-008	RP902,RP903

1. A+25V passes C941 and R983 and adds an instantaneous high level at the Pin 12 of N907D when this unit gets started. According to the above characteristics, the Pin 14 sends out a voltage which is comparatively closer to the voltage of the power supply B+23V. This voltage measures about +17V and is fed back to the Pin 12 through R960. Then this voltage is divided into about +8.5V by the resistor R959. That is to say, the inphase voltage of the calculating amplifier N907D keeps at about +8.5V. At the same time, +8.5V is divided by VD903, R971 and R972 and the voltage of the Pin13 of N907D measures about +7.5V. That is to say, the inphase opposition of N907D keeps at about +7.5V. At this moment, the inphase voltage (ca +8.5V) of the calculating amplifier N907D is higher than the inphase opposition voltage (ca +7.5V). The output Pin 14 also keeps at about +17V. Therefore, the above status retains. The Pin 14's high level of +17V passes R961 and reaches the display screen and lightens the VCD indicator. The 0 level is obtained at the controllers A&B of the electronic switch in the input circuit. According to the real value table, the electronic switch elects the VCD input mode. C941 is the open restoration capacitor because of which the input mode is switched to the default VCD. The inphase opposition voltage of another three calculating amplifiers is +7.5V (Their inphase opposition ports are connected together), but the positive voltage doesn't exist in the inphase ports. According to the voltage comparing characteristics, there is not the high level output in the inphase opposition ports. The other three input modes are shut off.

2. When we select other input modes, for instance, selecting DVD mode, we press the switch S903. The voltage of B+23V passes R984, S903 and R965 and is divided into about +18V voltage which is sent to the inphase port of N907A. At the same time, the +18V voltage is divided by VD905, R971 and R972 and there is about +17V level input at the inphase opposition port of N907A. The high level from N907A is fed back by R966. When loosening S903, N907's working voltages (The working principle is the same as that in the above-mentioned VCD mode.) are as follows: +8.5V at inphase port, +7.5V at inphase opposition port, +17V at output port. As mentioned before, the inphase opposition port's voltage is +17V when the switch is turned on. This voltage also reaches the calculating amplifier N907 in the VCD mode. Because the inphase port of N907D remains +8.5V and the inphase opposition port increases to +17V, the original output mode is breached and the high level cannot be sent out. Therefore, the VCD mode is shut off. At this moment, the high level of +17V of N907A's output is divided into two lines: One line is sent to the display screen by R967 to lighten the DVD indicator. Another line is divided by VD908, R974 and R975 and sent to the Port B of the electronic switch in the input circuit. Now, the Port A of N401 is 0 level and the Port B of N401 is 1 level. According to the real value table, the electronic switch selects the DVD mode, and the whole process is finished. When selecting other modes and pressing other switches, the caused motions are the same as above ones.

6.2 Channel and MIC Delay Selection

The delay circuit is made up of the D triggers N908A, N908B and voltage comparers N910B, N910C, N911A. The inching switch S905 is the channel selection button in the front panel. S906 is the MIC delay selection button.

The Real Value Table of the D Trigger

Input Port				Output Port	
CLK	D	R	S	Q	Õ
/	/	0	1	1	0
/	0	0	0	1	0
↑	1	0	0	0	1
↑	0	0	0	1	0

D, R and S are the controllers. It's low level when R is grounded. CLK is the triggering port whose output mode overturns when a high level comes. When A+25V passes through R980 and R991, the inphase opposition voltage of those four voltage comparers is divided into about +1.6V. The working modes are as follows. (Figure 8)

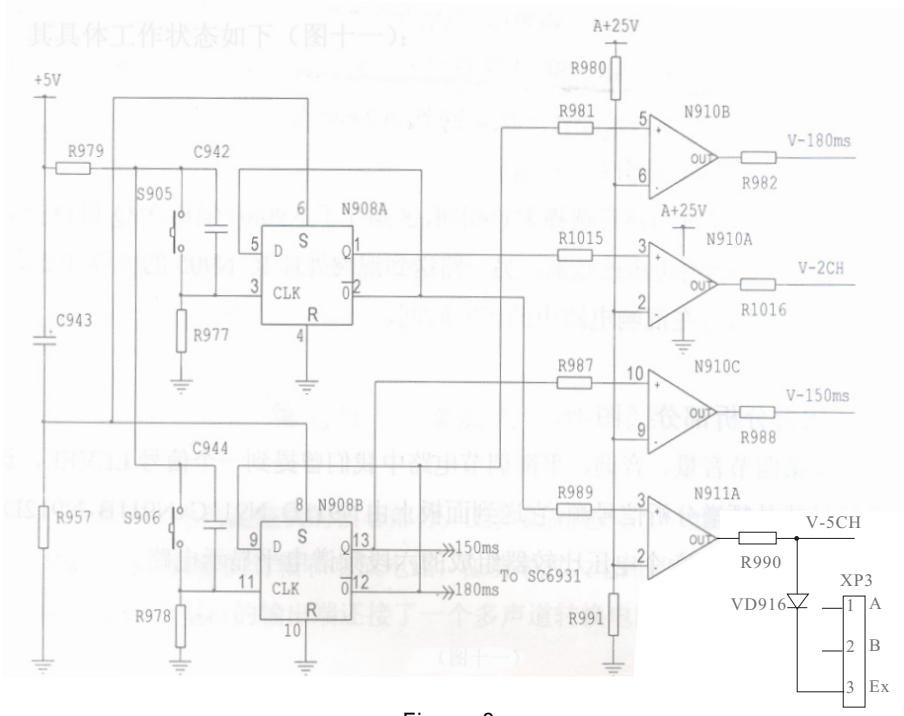
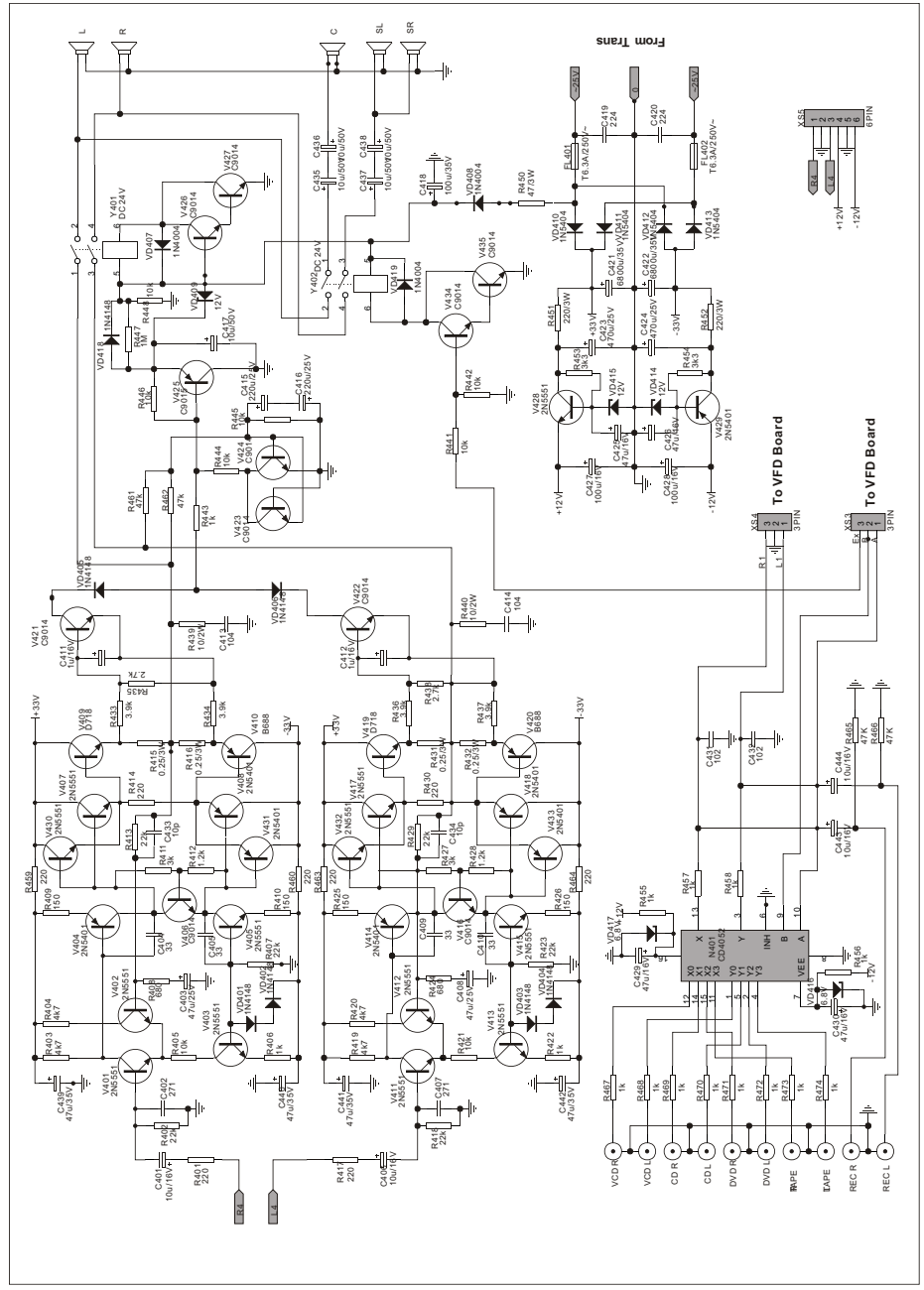


Figure 8

8.1.2 Schematic Diagram Of The Main Power Amplifying Board



30	CD	CD11 25V220U±20%8*12 3.5	C415,C416
31	CD	CD11 35V470U±20%10*20 5	C423,C424
32	CD	CD11 50V1U±20%5*11 2	C411,C412
33	CD	CD11 50V10U±20%5*11 2	C435,C436,C437,C438,C417
34	CD	CD11 35V47U±20%6*12 2.5	C439,C440,C441,C442
35	CD	CD11 35V100U±20%8*12 3.5	C418
36	CD	LUA 35V6800U±20 30*45 10	C421,C422
37	DIODE	1N4004	VD407,VD408,VD419
38	DIODE	1N4148	VD401~VD406,VD418
39	DIODE	1N5404	VD410~VD413
40	VOLTAGE REGULATOR DIODE	12V 1/2W	VD415,VD414,VD409
41	VOLTAGE REGULATOR DIODE	6.8V 1/2W	VD417,VD416
42	TRIODE	2N5401	V404,V408,V414,V418,V429,V431,V433
43	TRIODE	2N5551	V401,V402,V403,V405,V407,V411~V413,V415,V417, V428,V430,V432
44	TRIODE	9014C	V406,V416,V421,V422,V423,V424,V426,V427,V434,V435
45	TRIODE	9015C	V425
46	TRIODE	KB688O	V410,V420
	TRIODE	KB688Y	V410,V420
47	TRIODE	KD718O	V409,V419
	TRIODE	KD718Y	V409,V419
48	IC	CD4052BCN DIP	N401
49	RELAY	JH4237-024-2H DC24V	Y401,Y402
50	PCB	4217 3	
51	TERMINAL SOCKET	AV6-8.4-3B	XC2
52	TERMINAL SOCKET	AV4-8.4-3B	XC1
53	SOCKET	3 PIN 2.5mm	XS3,XS4
54	SOCKET	6 PIN 2.5mm	XS5
55	SOCKET FOR EXTERNAL CORDS	WP6-1B	XL1
56	POLE SOCKET	WP4-10A	XC3
57	CONNECTION CORDS	6 SHAPED 7.5mm	W29,W32,W35,W36,W39,W48,W54,W58,W13
58	CONNECTION CORDS	6 SHAPED 10mm	W10~W12,W15,W19~W21,W27,W31,W33,W34, W37,W43,W44,W47,W51,W53,W55
59	CONNECTION CORDS	6 SHAPED 12.5mm	W14,W16,W49,W50,W56
60	CONNECTION CORDS	6 SHAPED 15mm	W5,W7,W17,W18,W22,W23~W26,W28,W30,W45,W46 , W40,W41,W52
61	CONNECTION CORDS	6 SHAPED 20mm	W38,W42,W57
62	FUSE TUBE	T6.3AL 250V	FL401,FL402
63	LARGE RADIATOR	204*80*61 AB217	CONNECT TO THE MAIN AMP BOARD
64	FUSE HOLDER	0	FL401,FL402
65	SMALL CHIP	AB207	FIX THE TRIODES V406 AND V416
66	TAPPING SCREW	PB 3*12H COLOR ZINC	2 FOR SMALL CHIP AND LARGE RADIATOR
67	TAPPING SCREW	PWT 3*8*8 COLOR ZINC	2 FOR PCB/RADIATOR
68	MACHINE SCREW	PWM 3*16*8 COLOR ZINC	4 FOR POWER TUBE / LARGE RADIATOR
69	SCREW NUT	M3	POWER TUBE SCREW
70	SCREW SPACER	3*7.2*0.5	POWER TUBE SCREW
71	SPRING SPACER		POWER TUBE SCREW
72	MICA SPACER	24*20*0.1	4 FOR POWER TUBE / LARGE RADIATOR

6.2.1 Channel selection section.

When this unit gets started, +5V is charged by C943 and adds an instantaneous high level at the Port S. The Port R is grounded and is low level. According to the real value table, the Port Q sends out high level and the Port Q' sends out low level. Although the Port S becomes low level because C943 is full of charges, the Port D still keeps the original output modes for it stays in low level caused by the connection between the Ports Q and Q'. The high level of the Port Q of N908A is about 5V and reaches the inphase port of N910 through R1015. However, the inphase opposition of N910A is about 1.6V. Thereby, the output port of N910A sends out high level according to the voltage comparison characteristics. The level is sent by R1016 to the display screen to lighten 2CH indicator. This unit switches to the 2CH mode automatically when it gets started.

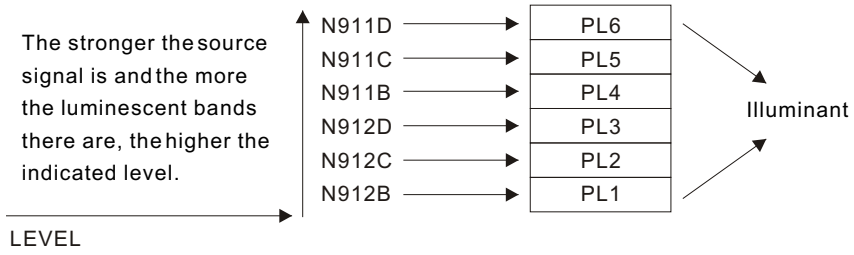
When pressing the switch S905, a triggered high level is sent to CLK. The output mode is revered. Port Q becomes low level and Port Q' becomes high level. Because Port Q' is connected to Port D, Port D also remains high level. Let go the switch S905, the input mode remains due to the reaction of Port D. Because Port Q is low level, the positive voltage of the inphase opposition of N910A will disappear. According to the voltage comparison characteristics, there's no high level sent out from the output port of N910A and thus the 2CH mode is shut off. Meanwhile, the high level passes through R989 and reaches the inphase port of N911A. The high level from the output of N911A is divided by R990 into two lines: One line reaches the display screen to lighten the 5CH indicator. Another line reaches to the amplification circuit via VD916 to switch on the multi-channel output relay Y402. The channels C, SR, SL are opened and there will be 5CH outputs. When pressing the switch S905, the output mode is reversed once and returns to the 2CH mode.

6.2.2 The MIC delay selection section.

Its working principle is approximately the same to the channel selection. The difference is that output Q and Q' will be divided into two lines: One line is sent to the voltage comparer. Another line is sent to the Pins 4&6 of the echo processing IC N905 to control the delay time of MIC signals in the echo circuit.

6.3 The spectrum analysis section (Figure 9)

We have mentioned a LEVEL signal in Chapter 4 Volume, Tone and Balance Adjusting Circuits. That signal is the spectrum analysis source. It was sent to 6-band spectrum level display circuit composed of 6 voltage comparers: N911D, N911C, N911B, N912D, N912C and N912B.



(Figure 9)

The detailed working process: The inphase opposition voltages of these six voltage comparers have their corresponding voltages respectively for the distributing resisters are connected differently. We call these separate voltages valve voltages: N912Bca 0.2V, N912Cca 0.4V, N912Dca 0.8V, N911Bca 1.6V, N911Cca 3.5V, N911Dca 5.2V. It's obvious that their valve voltages increase by degrees. The LEVEL signal is coupled by R1010, commutated and filtered by VD911 and C946. The output DC voltage is added at the inphase port of these six voltage comparers. According to the voltage comparison characteristics, when the source signal's voltage surpasses the valve voltage, the corresponding voltage comparer's outputs will export high level to lighten the display screen's illuminant. For instance, when input signal's voltage is 0.3V which exceeds the inphase opposition port's 0.2V valve voltage of the bottom N912B. Then the output of N912B exports high level to lighten the bottommost illuminant on the display screen. On the other hand, 0.3V voltage does not exceed the valve voltage of another five voltage comparers, so they will not export high level. Neither the display screen can be lightened. When the input signal exceeds 5.3V which is beyond the valve voltage of these six voltage comparers. Therefore, these six voltage comparers' output ports will sent out high level and all six-band illuminants on the display screen are lightened to achieve maximum display. Because the music signals are changing continuously, these six illuminants will rise or fall accompanying with strong or weak music signals. This is the basic working principle of the spectrum display circuit.

8 Detailed Circuit Explanations

8.1 The Power Amplifying Board

8.1.1 Main Parts List of The Matin Power Amplifying Board

NO.	DESCRIPTION	SPECIFICATIONS / PART NUMBER	LOCATION SPECIFICATIONS
1	CARBON FILM RESISTOR	1/4W680¦ ±5% SHAPED 10	R408,R424
2	CARBON FILM RESISTOR	1/4W1K±5% SHAPED 10	R467-R474,R455,R456,R457,R458,R443,R406,R422
3	CARBON FILM RESISTOR	1/4W3K±5% SHAPED 10	R411,R427
4	CARBON FILM RESISTOR	1/4W3.3K±5% SHAPED 10	R453,R454
5	CARBON FILM RESISTOR	1/4W3.9K±5% SHAPED 10	R433,R434,R436,R437
6	CARBON FILM RESISTOR	1/4W4.7K±5% SHAPED 10	R403,R404,R419,R420
7	CARBON FILM RESISTOR	1/4W10K±5% SHAPED 10	R405,R421,R445,R448,R444,R446,R441,R442
8	CARBON FILM RESISTOR	1/4W22K±5% SHAPED 10	R402,R407,R413,R418,R423,R429
9	CARBON FILM RESISTOR	1/4W47K±5% SHAPED 10	R462,R465,R466,R461
10	CARBON FILM RESISTOR	1/4W1M¦ ±5% SHAPED 10	R447
11	CARBON FILM RESISTOR	1/4W1.2K±5% SHAPED 10	R412,R428
12	CARBON FILM RESISTOR	1/4W220¦ ±5% SHAPED 10	R401,R417
13	CARBON FILM RESISTOR	1/4W150¦ ±5% SHAPED 10	R409,R410,R425,R426
14	CARBON FILM RESISTOR	1/4W2.7K±5% SHAPED 10	R435,R438
15	CARBON FILM RESISTOR	3W220¦ ±5% R-SHAPED 20Ч8	R451,R452
16	CARBON FILM RESISTOR	1/2W220¦ ±5% SHAPED 12.5	R459,R460,R463,R464,R414,R430
17	CARBON FILM RESISTOR	2W10¦ ±5Ј ґR-SHAPED 20Ч8	R439,R440
18	CARBON FILM RESISTOR	3W47¦ ±5Ј ґR-SHAPED 20Ч8	R450
19	CEMENT RESISTOR	3W0.25¦ ±5Ј ґR-SHAPED 25Ч8	R415,R416,R431,R432
20	PORCELAIN CAPACITOR	50V 10P ±10% NPO 2.5mm	C433,C434
21	PORCELAIN CAPACITOR	50V 33P ±10% NPO 5mm	C404,C405,C409,C410
22	PORCELAIN CAPACITOR	50V 271 ±5% NPO 5mm	C402,C407
23	PORCELAIN CAPACITOR	50V 102 ±10% 5mm	C431,C432
24	TERYLENE CAPACITOR	100V 104 ±10% 7mm	C413,C414
25	TERYLENE CAPACITOR	100V 224 ±10% 8mm	C419,C420
26	CD	CD11 16V10U±20%5Ч11 2	C401,C406,C443,C444
	CD	CD11 25V10U±20%5Ч11 2	C401,C406,C443,C444
27	CD	CD11 16V47U±20%5Ч11 2	C425,C426,C429,C430
28	CD	CD11 16V100U±20%6Ч12 2.5	C427,C428
29	CD	CD11 25V47U±20%5Ч11 2	C403,C408

7.2.3 Short Circuit over-current Protection

The channel R's output end is parallel connected with a over-current sampling triode V421. R415 and R416 are over-current sampling resistor. When current soars up sharply due to short circuit, the potential difference between R415 and R 416 also increases. The current passes to the base and emitter of V421 through R433 and R434. When their potential difference is beyond 0.7V, V421 is conducted and its collector's potential decreases. Finally, the current passes VD405 and R443 to make V425 conducted and thus the relay is shut off.

Over Current → Potential Difference Between R415 and R416 Increases → V421 Conducted → V425 Conducted → Relay Shut Off

7.3 Multi-channel Control Circuit

In the front panel circuit introductions, we have explained that when we choose the multi-channel output mode, N911A's output end sends out high level which reaches the base of a compound tube composed of V434 and V435 through R441. V434 and V435 are conducted and there is current in the coil Y402. Y402 is switched on. Channels C, SR and SL pick up signals from channels R and L and then send them out.

7 Power Amplification and Protection Circuits

The power amplification circuit is this unit's hard core which is working under high voltage and large current volume, so its failure rate is very high. A protection circuit is added to the power amplification's output to protect the amplifier and speakers' circuits. In addition, a multi-channel switching circuit is also connected to the output of AB217. We take the R channel as an ample to analyze the circuit as shown in the figure 10.

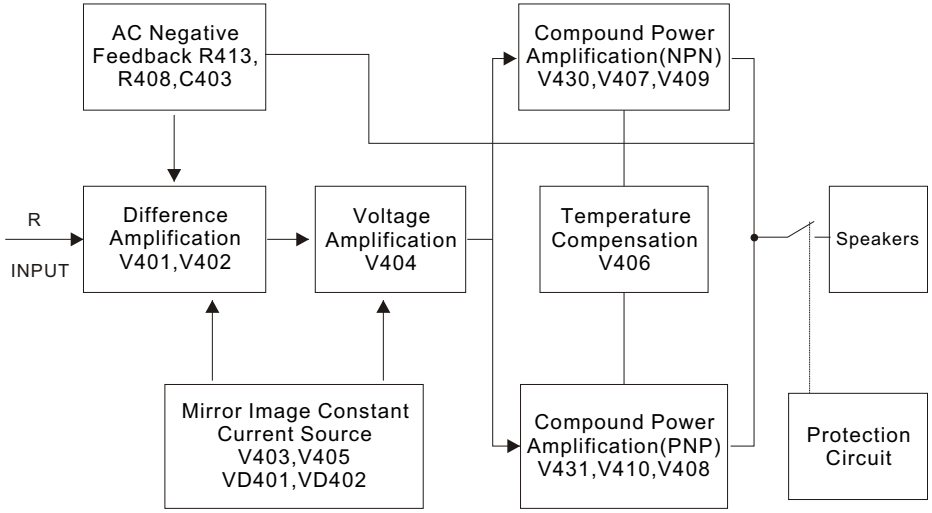


Figure 10

7.1 Power amplification section

The R channel signals are coupled by R401 and C401 and sent to the base of difference amplification section V401. V401 and V402 comprise the difference amplification circuit of single input and output. The sound signal is sent from the collector of V401 to the base of the voltage amplification section V404. The amplified signals reach the compound power amplification section. V403, V405, VD401 and VD402 constitute the mirror image constant circuit. VD401 and VD402 provide a constant base current to V403 and V405. The emitter resistor of V403 determines the working current of the difference amplification section and the V405's emitter resistor determines the working current of the voltage amplification section. V430, V407 and V409 constitute the upper tube (NPN) of the compound power amplification section. V430 and V407 are first parallel-connected to function as a triode (To raise the power) and then compound V409 to constitute a NPN type compound tube (To make amplification multiplied). V431, V408 and V410 constitute the bottom tube (PNP) of the compound power amplification. Its circuit construction is the same as that of the upper tube except that it's PNP typed after compounding. The temperature compensation section V406 has the following two functions in the circuit: First, it is composed of the voltage reversed triodes of the same parameters, so its working mode determines the static working current of the compound power amplification section. That is to say, we can set up the static working point of compound power amplification section through adjusting the V406 conducting level. The usual way is to change the base resistor of V406. Second, it functions as automatically adjust the working mode of the compound power amplification section when temperature rises. The adjusting process goes as follows:

TOTAL OUTPUT CURRENT = WORKING CURRENT + LEAK CURRENT

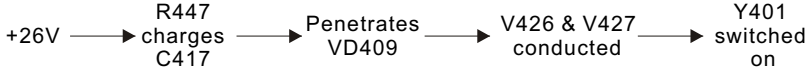
When temperature rises, the leak current increases thus the total current increases (unfavorable condition). At the same time, the base current of V406 increases and Uce decreases thus the output section's bias current decreases. Therefore, the working status changes and the back working current decreases. The total current is limited in a certain range.

7.2 Protection Circuit

The protection of the power amplifier's output section is performed by a relay series connected between the output end and the speaker. The power amplifying circuit is not stable when getting started and an impact current output will occur. If the output end has already been connected to the speaker when getting started, BOO sound will come out of the speaker. This is very harmful to the speaker. Therefore, we serial connect a relay between the output end and speaker. In this way, when this unit is getting started, the relay is switched off and the output end and the speaker will not be connected and thus the impact current will not occur. The relay will open only when the circuit works stably. Therefore, the protection is realized. In a similar way, when the circuit goes wrong and a high voltage and large current will occur in the output end, the protection circuit will also cut off the relay to realize the protection function. AB217 boasts its three protection functions: delay switch-on protection circuit, midpoint over-voltage protection circuit and short circuit over-current protection circuit. The working power of the protection circuit comes from a half-wave commutating circuit composed of VD408 and C418. It's about +26V.

7.2.1 Delay switch-on protection circuit

When this unit is getting started, +26V passes through R447 to charge C417. The positive end voltage of C417 increases slowly. When the voltage supersedes 12V, VD409 (12V voltage regulator diode) is penetrated and its negative end outputs high level which makes the compound tube composed of V426 and V427 conductive. Therefore, their collectors' potential is dragged down and there is current in the relay Y401. The relay is switched on. The delay time depends on the constant of R447 and C417 charging time. The positive end voltage of C417 is a key point through detecting which whether there is the voltage over +12V to judge whether the whole protection circuit is started. When there is a voltage over +12V and the relay is not switched on, it indicates that the problem only exists in the back components VD409, V426, V427 and Y401. When there is a voltage below +12 and the relay is switched on, it indicates that the protection circuit is started and you need only to check the corresponding circuits.



7.2.2 Midpoint Over-voltage Circuit

A midpoint over-voltage sampling resistor R462 is connected to the output end of Channel R (Channel L is R461). Because the power amplifying circuit is provided by twin power supplies, the output end usually has two conditions: positive or negative voltage. They will be analyzed respectively as follows. This protection circuit's protecting range is the voltage above +4V or below 4V.

When the output end voltage surpasses +4V, the base receives a voltage above +0.7V due to the voltage division by R462 and R445. V424 is conducted and the collector's potential is dragged down.

When the output end voltage is below 4V, the base of V423 receives a voltage below 0.7V due to the voltage division by R462 and R445. V423 is conducted and the collector's potential is dragged down..

According to the above statements, the collector's voltage will be dragged down whether the output end potential is over +4V or below 4V. This low potential passes R444 and makes the base's voltage of V425 decrease. V425 is conducted and thus its emitter's voltage decreases. That is to say, the positive end voltage of C417 decreases and the relay is shut off, thus the protection function starts.