ENGLISH

AV210

SERVICE MANUAL

BBK

BBK ELECTRONICS CORP., LTD.

BBK

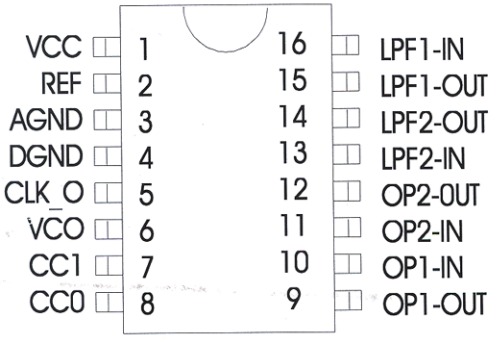
DESCRIPTION

PT2399 is an echo audio processor IC utilizing CMOS Technology which is equipped with ADC and DAC, high sampling frequency and an internal memory of 44K Digital processing is used to generate the delay time, it also features an internal VCO circuit in the system clock, thereby, making the frequency easily adjustable. PT2399 boast of very low distortion (THD<0.5%) and very low noise (No<-90dBV), thus producing high quality audio output. The pin assignments and application circuit are optimized for easy PCB layout and cost saving advantage.

FEATURES

- ❒ CMOS Technology
- ❒ Least External Components
- ❒ Auto Reset Function
- ❒ Low Noise, No<-90dBV Typical
- ❒ Low Distortion, THD<0.5% Typical
- ❒ External Adjustable VCO
- ❒ Available in 16 pins, DIP or SO package

PIN CONFIGURATION



PT2399

CAUTIONS

- There is high voltage inside this unit. Make sure to pull out the plug of this unit before repairing!
- There are many high voltage components inside this unit. Please pay attention to all warnings and instructions marked on this unit to avoid electric shock!
- Specifications of the replaced components must be the same as that of the original components. Do not change the components' specifications to prevent risks!

CONTENTS

[redacted] 1
[redacted] 1
[redacted] 3
3
4
8
10
12
12
16
24
24
25
27

1. INPUT PART

AV210 has three ways of the analog audio source input and one group of 5.1 channel input jacks. Their switch is realized by the electronic switch. The circuit incorporates two kinds of electronic switch IC: CD4052 (dual channel one out of four electronic analog switch) and Cd4053 (trio channel one out of two electronic analog switch). Their real value tables are as follows:

CD4052 REAL VALUE TABLE

	X0	X1	X2	X3
A	0	1	0	1
B	0	0	1	1

CD4053 REAL VALUE TABLE

A	X	B	Y	C	Z
0	X0	0	Y0	0	Z0
1	X1	1	Y1	1	Z1

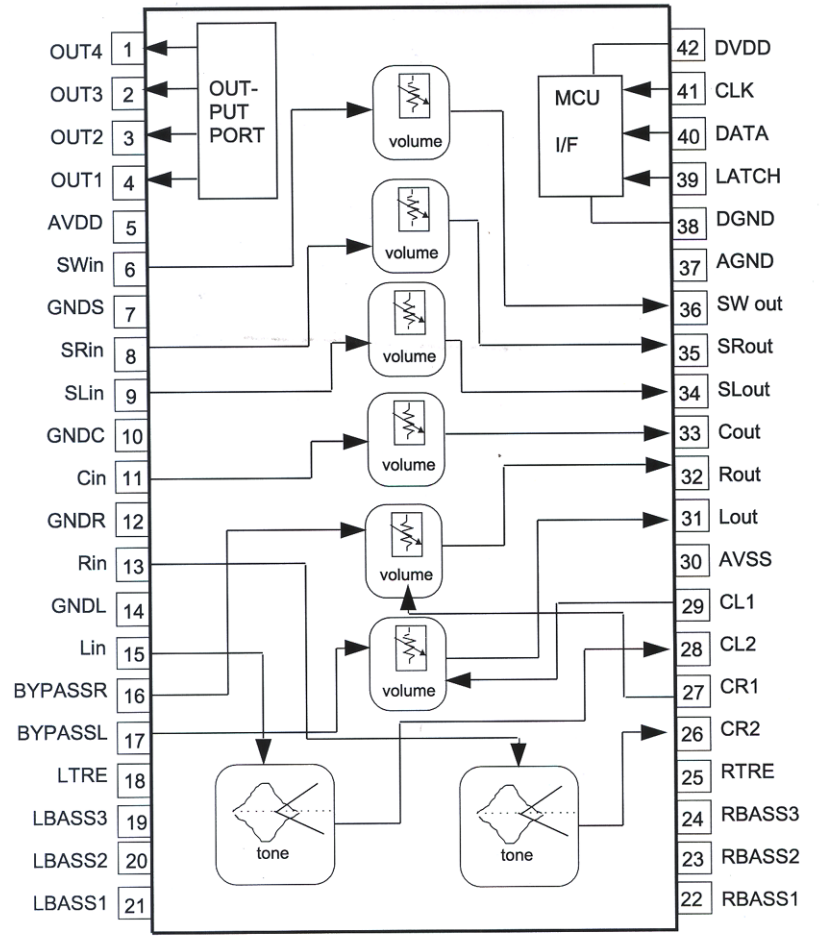
There are still two important control signals SEL and SEL1 in this circuit. When SEL is high level, the circuit is in the mode of 5.1 CH input from outside. When SEL1 is high level, the circuit is in the cyber logic mode. When both of them are low level, the circuit is in the Hi-Fi mode (direct mode) and the standard sound field processing mode. They work in the following steps. When pressing the INPUT button, the levels A and B from the pins 38 and 39 of the CPU N422 are added into the pins 9 and 10 of the electronic switch N401. The electronic switch selects the input mode circularly from VCD, CD, AUX and 5.1CH according to different combinations of levels A and B. It can be divided into two modes: 5.1CH and three analog input modes. Their signals' flow is as follows:

1.1 5.1CH input mode: In this mode, A and B are high levels, L and R channel signals are sent out from the pins 3 & 13 of N401. Then the levels reach IC N402 to be master volume adjusted after amplified by N407A and N407B. At the same time, the pin 32 of CPU N422 sends out a high level to the electronic switch N410's pins 9, 10 and 11 (SEL control signal). C, SR and SL signals are sent out from the N410's pins 14, 15 and 4 to IC N402 where separate volumes are adjusted. SW signals (D-SW) is sent to the IC N402's where the volume is adjusted. Therefore, the 6 channel signals of 5.1 CH input are selected by the electronic switch and added into the electronic volume adjusting IC where the separate volume adjustment is performed. Then the signals pass to the rear circuit, the whole unit's input source is selected as 5.1CH input mode.

1.2 Three analog input mode: Press the INPUT button to select one of the VCD, CD and AUX. The select function is performed when the control levels A and B from the pins 38&39 of the CPU N422 are added to the pins 9&10 of the electronic switch N401. The signals of L & R channels are sent out from the pins 3&13 and then amplified in the oper ational amplifier N407A and N407B. AV210 incorporates three processing modes to the signals: Hi-Fi, Cyber Logic and standard stereo. Their signal's flow is as follows:

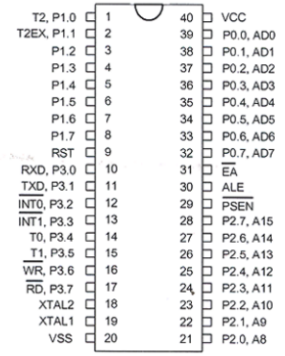
1.2.1 Standard Stereo Processing Mode: The L & R channel signals from the N407A and N407B are added to the IC N402 where the electronic volume is adjusted. At the same time, a signal selected from the L channel passes N408A and N406B where the signal is processed through low pass filter to obtain a subwoofer signal (S-SW). S-SW is added to N411's pin 5 and the pin 9 (SEL) is low level. According to the real value table, S-SW signal is sent out from the pin 4 to N402's pin 6 where the electronic volume is adjusted. In this mode, this unit is in the three channel output mode.

PIN CONFIGURATION AND IC INTERNAL BLOCK DIAGRAM



PIN CONFIGURATIONS

40-Pin DIP (W78E54)



volume control IC M62446

DESCRIPTION

The M62446FP is 6 channels electric volume controlled 3-wire serial data. The IC is suitable for use in home-use audio systems and TV sets.

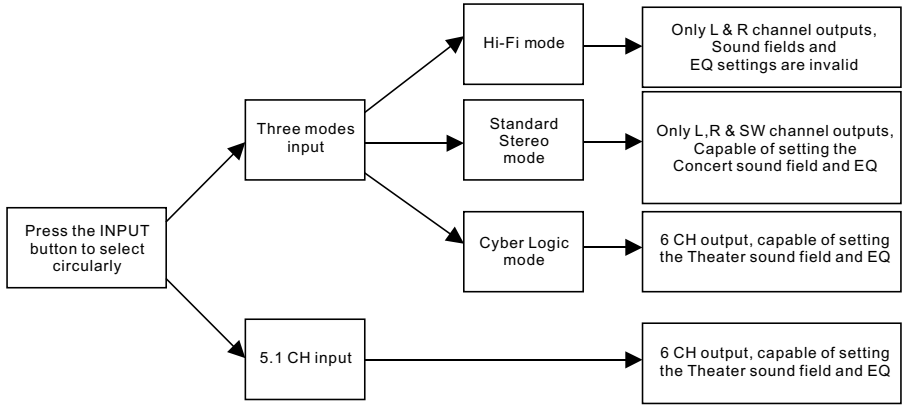
FEATURES

- Electric volume
  - •Volume level•••••••• 0dB ~ -79dB,- ∞dB (1dB / step)
- Tone control
  - •Bass / Treble , 0dB ~ ±10dB(2dB / step)
- 4 Output ports
- Built-in microcomputer interface circuit controlled by 16-bit serial data.

1.2.1 Hi-Fi Processing Mode: The signal flow is the same as that of the standard stereo mode. The electronic volume adjusting IC N402 shut off other audio channels under the control of the CPU. Neither the sound fields processing and balance adjustment can be performed. Therefore, S-SW cannot be sent out and the whole unit is in the two channel output mode.

1.2.3 Cyber Logic: L&R channel signals sent out from N407A and N407B reach the IC N402 where the electronic master volume is adjusted. Meanwhile, the signals selected from the channel L passes through the low pass filter N408A where it is divided into two lines. One line reaches the pin 13 of N411 through R657 and another line reaches the pin 5 of N411 after it is amplified through the low pass filter N406B. The signal selected from the channel R reaches the pin 1 of N411 after being amplified through the low pass filter N408B. N411's pin 9 (SEL) is the low level. According to the real value table, the S-SW signal sent out from the pin 4 is added to the pin 6 of N402 where the electronic volume is adjusted. The pins 10&11 (SWLL) are high level. According to the real value table, the central channel signal (S-C) sent out from the pin 14 of N411 and the surround channel signal (S-S) sent out from the pin 15 of N411 are added to the pins 12, 2 and 5 of N410. (The S-S is divided into two signals surround left and surround right.) At this time, the pins 9, 10 and 11 (SEL) are low level. According to the real value table, these three lines of signals sent out from the pins 14, 15 and 4 reach the IC N410 where the volume is adjusted separately. This unit is in the six-channel output mode.

The relationship of all input source switches and sound processing mode is shown as Figure 1.



(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.

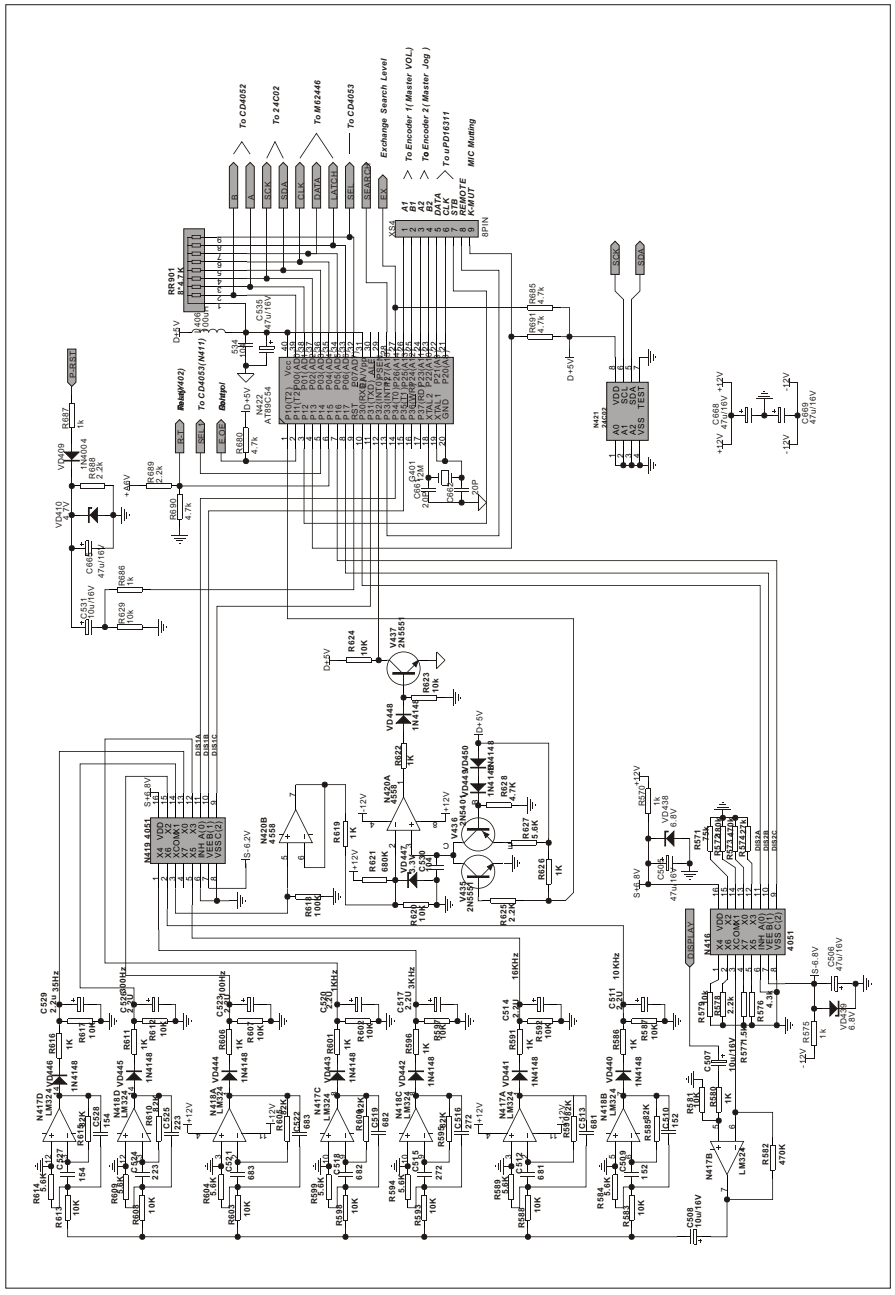
The W78E54 microcontroller supplies a wider frequency range than most 8-bit microcontrollers on the market. It is functionally compatible with the industry-standard 80C52 microcontroller series, except that one extra 4-bit bit-addressable I/O port (Port 4) and two additional external interrupts ($\overline{INT2}$,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

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



3.2 Spectrum Sampling Amplification Circuit: The routes carrying the five-channel signals sent from the IC N402 are connected to the sampling resistors R494, R495, R496, R565 and R566 respetively.(The SW channel sends out the signals directly.) After being mixed by these resistors, the signals reach N406A to be amplified. The incurred spectrum analyzing signal source is sent to the front panel circuit.

4. Control Circuit.

The control circuit of this player is divided into CPU Circuit, Front Panel Control and Display Circuit and Spectrum Analyzing Circuit.

4.1 CPU Circuit

N422 (AT89C540) is this unit's CPU which sends all commands to the command-controlled circuits to perform all control functions. It incorporates +5V power supply and its pin 40 is the power supply pin. The 12M crystal oscillator provides the work clock for itself. The pin 9 is the restoration pin. When this unit is getting started, +5V passes VD409 to reach the positive pole of C531. Because of the C531's charging, its negative end sends out an instantaneous high level which passes through R686 to reach the pin 9 of N422. The pin 9 of N422 restores the low level mode with the end of charging. This restoration circuit's style is the high level restoration to keep in low level. You can also refer to the circuit diagram for other command instructions.

The static information such as the power-on logo and on screen displays when this unit is working is stored in the CPU's static memory. N421 is a power-off-mode memory which can record the working information when this unit is turned off and call back these information when this unit is turned on next time. Therefore, you need not to readjust the unit every time you turn it on. Furthermore, the sound field modes that you set are also stored in N421, which can be called back when needed.

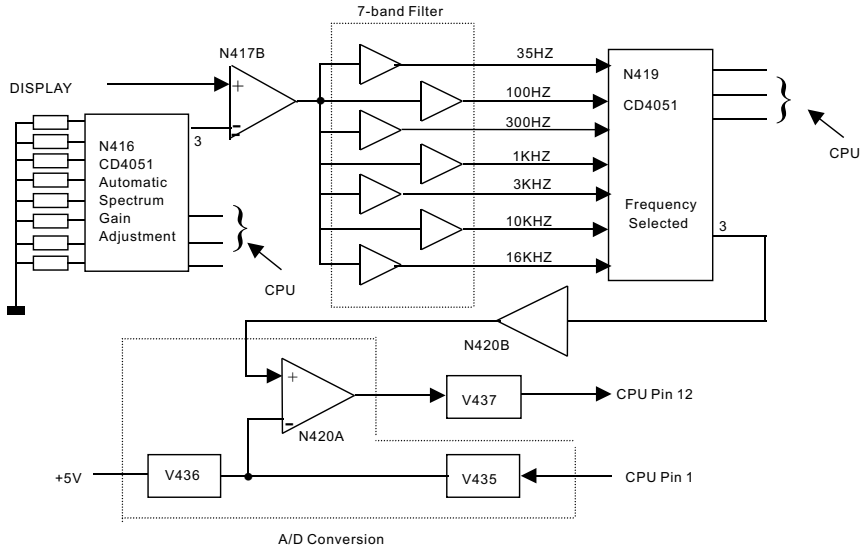
4.2 Front panel control and display circuit

This circuit incorporates an exclusive IC N901 (UPD16311). Its pins 10, 11, 12 and 13 are connected to the press scan matrix which receives the control commands from the user and process them into two-line outputs: One line reaches to the VFD to display the working modes, another line passes pins 5, 6, 8 and 9 to CPU to finish the control functions.

N902 is the remote control sensor. It convert the infrared signals received to electric signal and then send it to the pin 13 of CPU to finish the remote control function.

RP901 and RP905 comprise a digital pulse potentiometer. When rotating it, a series of digital pulse will be sent out and added to the pins 23, 24, 25 and 26 to be detect and processed to finish the control functions. RP901 finishes the master volume adjustment and RP905 finishes multi-function adjustment.

4.3 Spectrum analyzing circuit (The flow chart is shown an Figure 2)



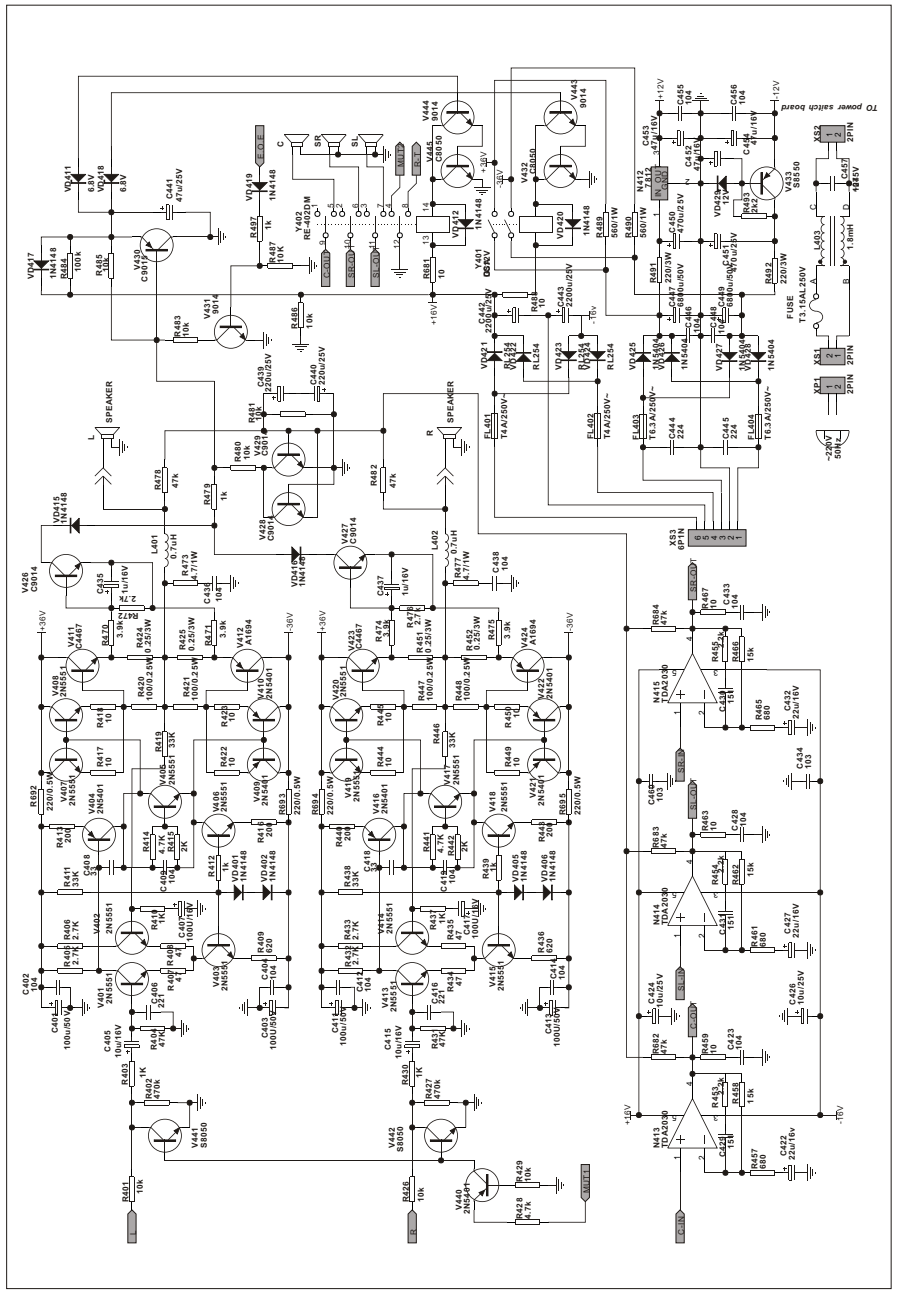
(Figure 2)

4.3.1 Automatic spectrum gain adjustment circuit: In order to avoid that the display amplitude is too narrow when the input signals are too weak or the whole display appears when the input signals are too strong, this unit incorporates an automatic spectrum gain adjustment circuit which employs a single channel 1-out-of-8 electronic analog switch N416 (CD4051). Its real value table is below. Its working principle is that it changes the opposite-phase ground resistor's resistance value of the operational amplifier N417B to change the gain times.

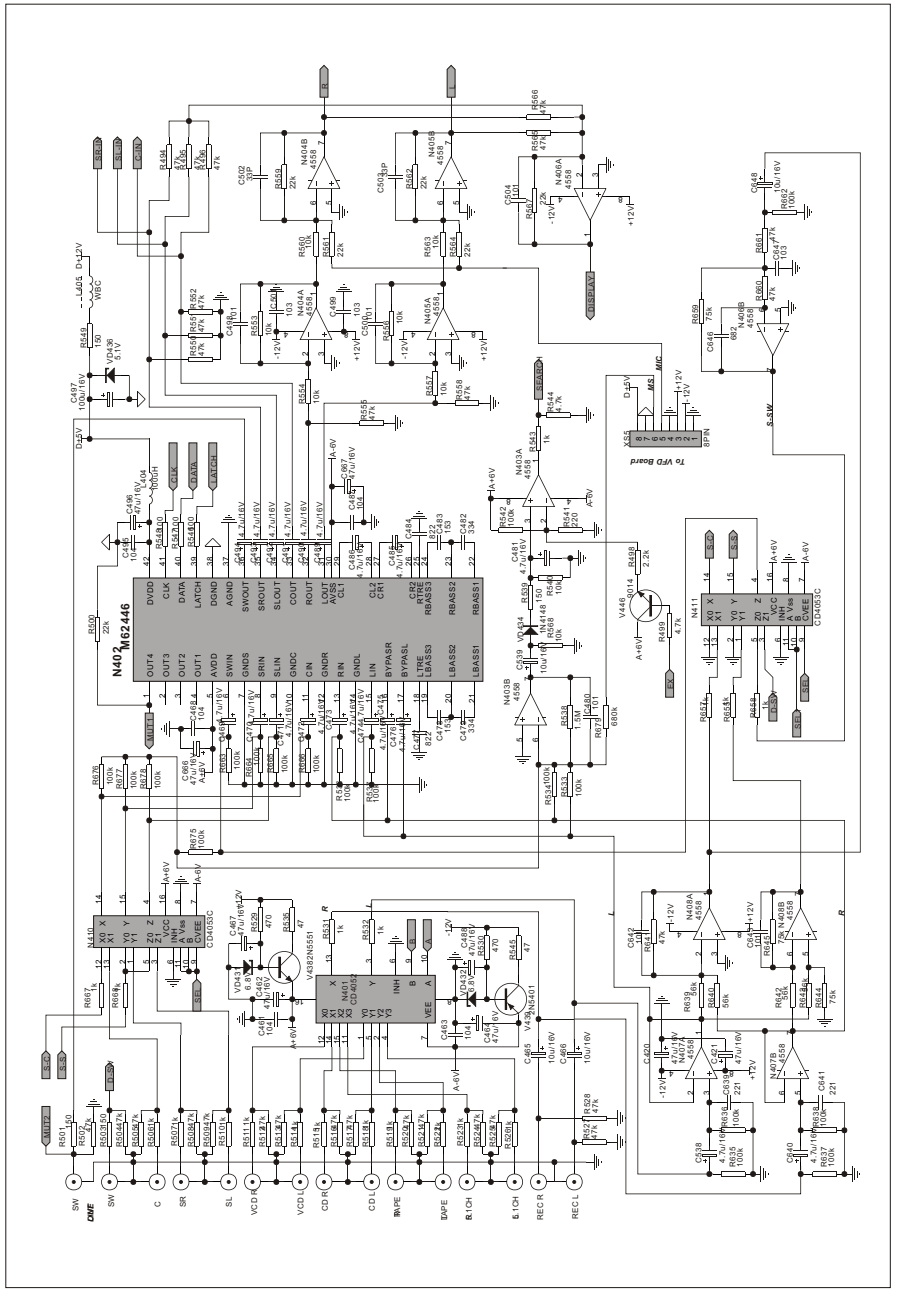
We have mentioned before that the spectrum analyzing signal source is sent to the operational amplifier N417B's in-phase input terminal to be amplified. Its amplified times depend on the resistance value of the resistor connected through the electronic switch N416 to the opposite-phase terminal. When the master volume is too big, the CPU will automatically add the ground resistor's resistance value to reduce the am plification times. When the master volume is too small, the CPU will automatically reduce the ground resistor's resistance value to increase the amplification times.
CD4051Real Value Table

CD4051 Real Value Table

	X0	X1	X2	X3	X4	X5	X6	X7
A	0	1	0	1	0	1	0	1
B	0	0	1	1	0	0	1	1
C	0	0	0	0	1	1	1	1

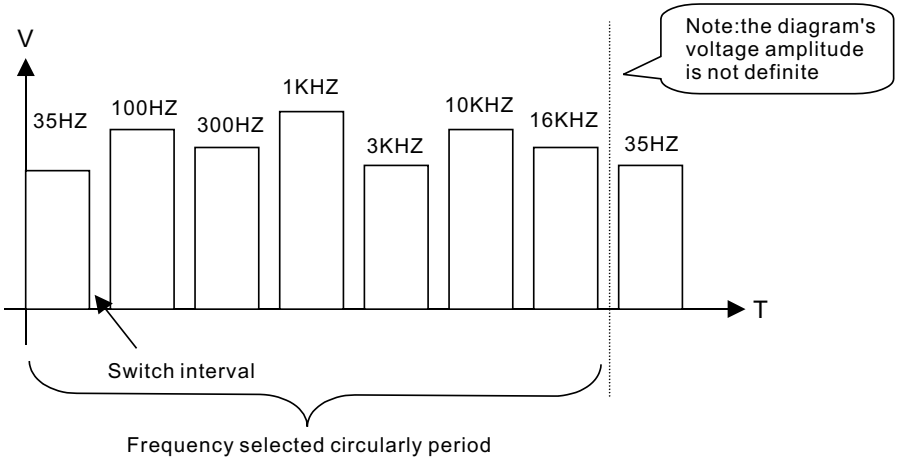


SCHEMATIC DIAGRAM OF THE MAIN AMP BOARD



4.3.2 Frequency Selected Circuit

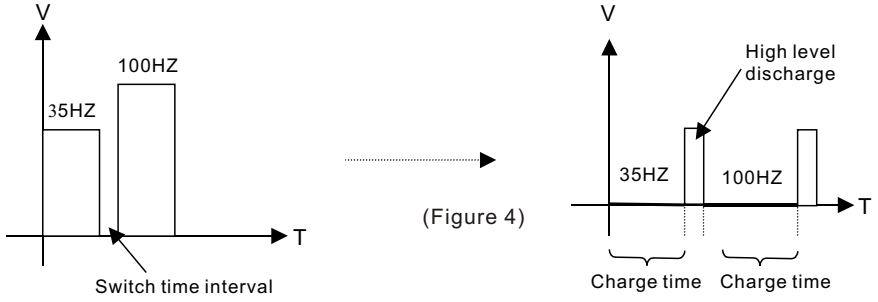
The signal amplified by the N417B is coupled by C508 and then sent to the 7-band filter composed of the operational amplifiers. Setting its feedback capacitor's capacity can define the corresponding frequency amplitude. The frequency value marked on their output points is the frequency band's central frequency. There's a half-wave rectifying circuit connected to the every band filter's output end. The circuit will rectify the amplified AC signals into the DC voltage. The circuit is mainly performing the frequency sampling function which can show the amplitude of every frequency of the whole audio signals through the DC voltage. If the low frequency of the current audio signals is strong, the DC voltage of the 35Hz and 100Hz band filter is higher. If the high frequency is strong, the DC voltage of the 10K and 16K band filter is higher. The output end of these seven band filters is connected to seven input terminals of the electronic switch N419 (CD4051). CPU will send commands to make this electronic switch select the frequencies circularly (Refer to the above real value table). The output terminal of the pin 3 of N419 will send out a series of voltage representing the corresponding frequency's amplitude. (See Figure 3)



(Figure 3)

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.



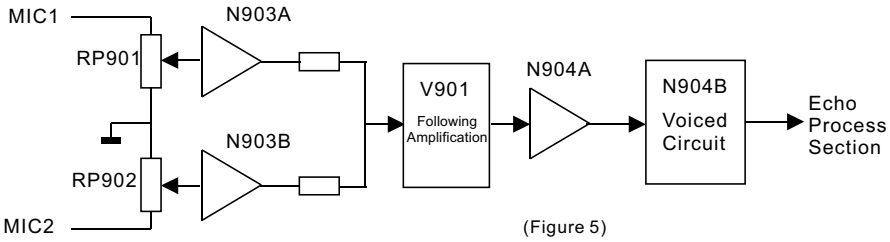
127	CONNECTION CORDS	¦ 6 SHAPED 10mm	W4,W6,W7,W9,W13,W17,W23,W25,W29,W31,W32,W35, W40,W41,W44~W47,W54,W55,W62,W65,W80,W90,W97, W103,W111,W112,W117,W121,W122,W133,W137,W142, W143,W154,W163,W167,W168,W174,W177,W178,W180, W181,W185,W186,W190,W207,W208,W209,W37
128	CONNECTION CORDS	¦ 6 SHAPED 12.5mm	W57,W60,W67,W68,W70,W71,W77,W93,W104, W120,W123,W124,W128,W130,W131,W144,W145,W148, W204
129	CONNECTION CORDS	¦ 6 SHAPED 15mm	W83,W85,W86,W107,W115,W126,W129,W146,W147, W169~W173,W175,W176,W182,W183,W191,W201,W82
130	CONNECTION CORDS	¦ 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	22 80mm 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	¦ 3 7.2 0.5	
148	SPRING SPACER	¦	
149	INSULATION RING	¦ 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

92	VOLTAGE REGULATOR DIODE	5.1V 1/2W	VD436,VD411
93	VOLTAGE REGULATOR DIODE	12V 1/2W	VD429
94	VOLTAGE REGULATOR DIODE	6.8V 1/2W	VD431,VD432,VD438,VD439
95	TRIODE	2N5401	V404,V409,V410,V416,V421,V422,V440,V436,V439
96	TRIODE	2N5551	V401,V402,V403,V405~V408,V413,V414,V415,V417~V420, V435,V437,V438
97	TRIODE	8050C	V432,V445,V441,V442
99	TRIODE	9014C	V426~V429,V431,V443,V444,V446
100	TRIODE	9015C	V430
	TRIODE	S8550D	V433
101	TRIODE	KB688O	V412,V424
	TRIODE	KB688Y	V412,V424
102	TRIODE	KD718O	V411,V423
	TRIODE	KD718Y	V411,V423
103	IC	LM324N DIP	N417,N418
104	IC	NJM4558D DIP	N403~N408,N420
	IC	4558C DIP	N403~N408,N420
105	IC	L7812CV GOLD-SEALED TO-220	N412
	IC	LM7812 GOLD-SEALED TO-220	N412
106	IC	CD4051 DIP	N416,N419
107	IC	CD4053BCN DIP	N410,N411
108	IC	CD4052BCN DIP	N401
109	IC	M62446FP SOP	N402
110	IC	24C02 DIP	N421
111	IC	LM1875T T05B	N413,N414,N415
112	SOFTWARE PROGRAM CPU	CPU-AV210(RU)-0	N422
113	CRYSTAL OSCILLATOR	12.00MHz 49-U	G601
114	RELAY	JH1806-012-(3H1,J,Z1) DC12V	Y402
115	RELAY	JH4237-012-2H DC12V	Y401
116	PCB	4210-3	
117	TERMINAL SOCKET	AV6-8.4-53	XC401
118	TERMINAL SOCKET	AV8-8.4-62	XC402
119	TERMINAL SOCKET	AV1-8.4-5 BLACK	XC403
120	SOCKET	8 PINS 2.5mm	XS5
121	SOCKET	9 PINS 2.5mm	XS4
122	SOCKET	2 PINS 7.92mm	XS1,XS2
123	SOCKET	6 PINS 3.96mm	XS3
124	CONNECTOR'S SOCKET	WP4-10A	XL401
125	CONNECTOR'S SOCKET	WP6-10A	XL402
126	CONNECTION CORDS	¦ µ6 SHAPED 7.5mm	W1~W3,W5,W8,W10~W12,W14~W16,W18~W22,W24, W26~W28,W30,W36,W38,W39,W42,W43,W49,W50,W52, W53,W56,W58,W59,W61,W63,W64,W66,W69,W72~W76, W78,W79,W81,W84,W87~W89,W91,W92,W94~W96, W98~W102,W105,W106,W108~W110,W113,W116, W118,W119,W125,W127,W135,W136,W138~W140, W149~W153,W155~W162,W164,W165,W179,W184, W187~W189,W193~W195,W197~W199,W205,W206

5. Microphone Circuit

The microphone circuit is divided into two parts: The Front Process Section and Echo Process Section

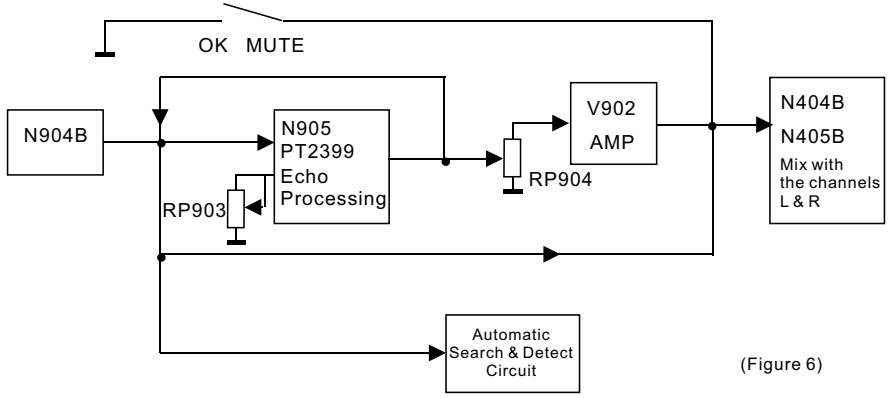
5.1 Front Section Circuit: Mainly performing volume adjusting/amplifying/modifying function. The flow chart is shown as Figure 5.



(Figure 5)

5.2 Echo Process Section

The flow chart is shown as Figure 6. The front section signal is divided into three lines: One line is sent by R980 and C958 to N403B's opposite-phase end. This line is just the signal search and detect circuit we have mentioned before. When the front section circuit of the microphone has signal output, the auto-search mode will be stopped. Another line of signal is sent directly after being coupled by R946 and C926. This line is the stereo channel of the echo channels. The third line is the feedback channel which is coupled by R947, C927, C928 and R948 and then sent to the echo process IC N905's 16th pin. The line is LPF amplified and digitally delayed and then sent out from the pin 14. The RP 903 connected to the pin 6 is the echo delay adjustment potentiometer. The pin 14's signal is coupled by R951 and R952 into two lines:



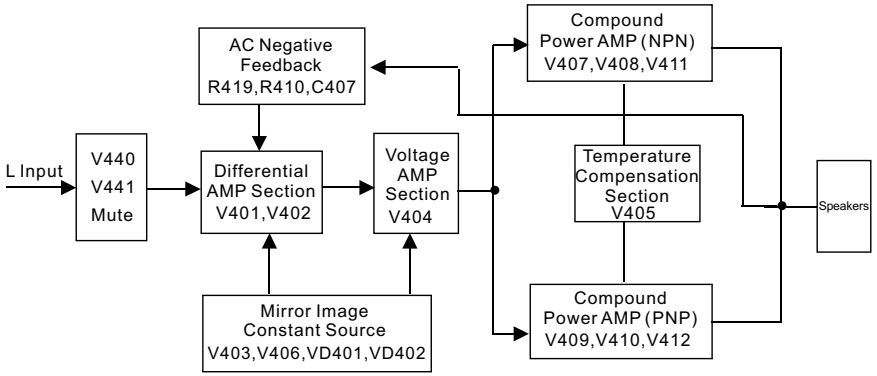
(Figure 6)

59	PORCELAIN CAPACITOR	50V 683 ±10J P5mm	C521,C522
60	PORCELAIN CAPACITOR	50V 154 +80%-20% 5mm	C527,C528
	PORCELAIN CAPACITOR	100V 104±20J P5mm	C412,C414,C402,C404,C458,C459,C434,C460
61	TERYLENE CAPACITOR	100V 104 ±10% 7mm	C423,C428,C433,C436,C438
62	TERYLENE CAPACITOR	100V 224 ±10% 8mm	C444,C445
63	TERYLENE CAPACITOR	100V 472 ±5% 3.5mm	C646
	TERYLENE CAPACITOR	63V 104 ±5% 5mm	C446,C448
64	METAL POLYESTER FILM CAPACITOR	CL21X 63V 153 ±5% 5	C478,C483
65	METAL POLYESTER FILM CAPACITOR	CL21X 100V334±10% 7.5	C479,C482
66	METAL POLYESTER FILM CAPACITOR	CL21X 100V 104 ±10J P5	C530
67	CD	CD11 16V10U±20%5*11 2	C465,C466,C507,C508,C531,C405,C415,C539,C648
	CD	CD11 25V10U±20%5*11 2	C465,C466,C507,C508,C531,C405,C415,C539,C648
68	CD	CD11 16V22U±20%5*11 2	C427,C432,C422
69	CD	CD11 16V47U±20%5*11 2	C420,C421,C464,C462,C467,C488,C505,C506,C535,C452 C666~C669,C453,C454,C496,C665
70	CD	CD11 16V100U±20%6*12 2.5	C407,C417,C497
71	CD	CD11 50V2.2U±20%5*11 2	C511,C514,C517,C523
72	CD	CD11 50V4.7U±20%5*11 2	C424,C426,C670,C671
73	CD	CD11 25V100U±20%6*12 2.5	C441
74	CD	CD11 25V220U±20%8*12 3.5	C439,C440
76	CD	CD11 35V470U±20%10*20 5	C450,C451
77	CD	CD11 50V100U±20%8*12 3.5	C403,C413,C401,C411
78	CD	CD11 16V1U±20%5*11 2	C435,C437
79	CD	CD11 16V4.7U±20%5*11 2	C469~C476,C481,C485,C486,C489~C494,C538,C640
	CD	CD110 35V3300U±20%16*35 7.5	C442,C443
	CD	CD11C 50V2.2U±20%4*7 1.5	C520,C526,C529
80	CD	LUA 50V6800U±20%30*50 10	C447,C449
83	MAGNETIC BEADS INDUCTANCE	W4B WBC 6*10-1.5T	L405
	MAGNETIC BEADS INDUCTANCE	100UH ±10% 0410 VERTICAL 10mm	L404
	INDUCTANCE	47UH ±10% 0410 VERTICAL 10mm	L406
84	INDUCTANCE COIL	0.7UH SC-0.8*8.0*11.5	L401,L402
85	CHOKE COIL	UU10.5-1.8mH	L403
86	DIODE	1N4004	VD409
87	DIODE	1N4148	VD440~VD446,VD448,VD449,VD450,VD401,VD402,VD405, VD406,VD415~VD417,VD419,VD420,VD434,VD412
88	DIODE	RL254	VD421~VD424
89	DIODE	1N5404	VD425~VD428
90	VOLTAGE REGULATOR DIODE	3.3V 1/2W	VD447
91	VOLTAGE REGULATOR DIODE	4.7V 1/2W	VD410

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	3	POWER TUBE SCREW
72	MICA SPACER	24 20 0.1	4 FOR POWER TUBE / LARGE RADIATOR

6. Power Amplification and Protection Circuit

6.1. Channels L&R Power Amplification Circuit: The L&R power amplifier employs separate components. Taking the L channel as an example, its construction is shown in Figure 7.



(Figure 7)

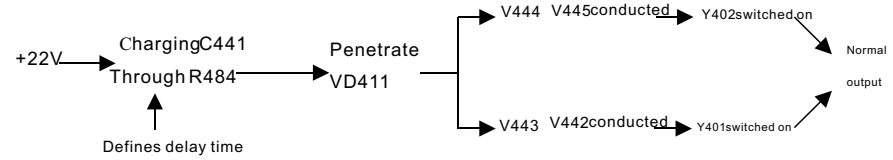
The L channel signal is sent to the power amplification section by the electronic volume adjusting circuit. A mute circuit installed in the input end. When press the MUTE button on the remote control, a high level mute command is sent from the pin 1 of the electronic volume adjusting IC N402. It makes V440 and V441 conductive to finish the mute control function.

The L channel signal is coupled by the R403&C405 and sent to the base of the differential AMP section V401. V401 and V402 compose the single-end input/output differential amplification circuit. The audio signal is sent from the collector of V401 to the base of the voltage amplification section V404 where its voltage is amplified and sent to the compound power amplification section. V403, V406, VD401 and VD402 compose mirror image constant circuit. VD401 and VD402 provide constant base current for V403 and V405. V403's emitter resistor defines the current of the differential amplification section. V406's emitter resistor defines the current of the voltage amplification section.

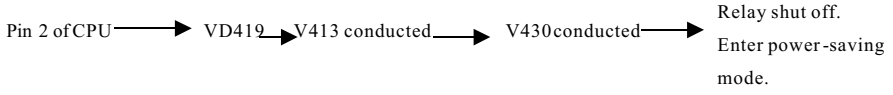
V407, V408 and V411 make up the NPN of compound power amplifier. V407 and V408 are parallel connected. Their function equals a triode (able to amplify power). Then they mix with V411 to constitute NPN compound tube (capable of enhance amplification times). V409, V410 and V412 constitute the PNP of the compound amplifier. Its circuit construction is the same as NPN. The temperature compensation section V405 has two functions in the circuit: First it is a biasing of the NPN and PNP. Its working status defines the static working current of the compound power amplification section. That is to say, we can adjust the inductance degree of V405 to define the static working point of the compound power amplification section. The usual way is to adjust the base resistor of V405. It can also automatically adjust the working status of the compound power amplification section when the temperature rises.

6.2 C, SR and SL power amplification circuit: These three channels employ the exclusive power amplifier IC LM1875 (or TDA2030). It has five pins and is a good power amplifier IC. The application circuit is very simple. It has 15W power output in the rated condition. The pins 5 & 3 are the positive/negative power supplying pins and employ

6.3 Protection circuit: This unit incorporates the power-saving function. The L/R channel's protection is performed by cutting off the relay Y401 to cut off the [illegible]

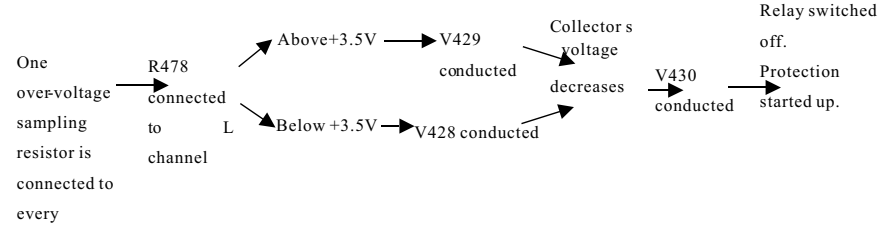


6.3.2 Power-saving Control: When press the POWER SAVING button on the front panel and



remote control, the pin 2 (EOX) of the CPU sends out a high level. It passes through VD419 and reaches to the base of V431. When V431 is conducted, V430 is also conducted. Therefore, the positive end voltage of C441 is decreasing, VD411 is stopped. The relays Y402 and Y401 are cut off, this unit enters the power-saving mode. At the same time, the CPU sends out data demands to the front panel display IC and then this unit enters the power-saving mode.

6.3.3 Mid-point Over-voltage Protection: An over-voltage sampling resistor is connected to the every channel's output. The channel L's is R478. When there is one output mid-point DC voltage which is higher than +3.5V or lower than 3.5V, V429 and V428 are conducted. Their base voltage will decrease and V430 is conducted. At last, the relay switches off and the protection circuit is getting started.

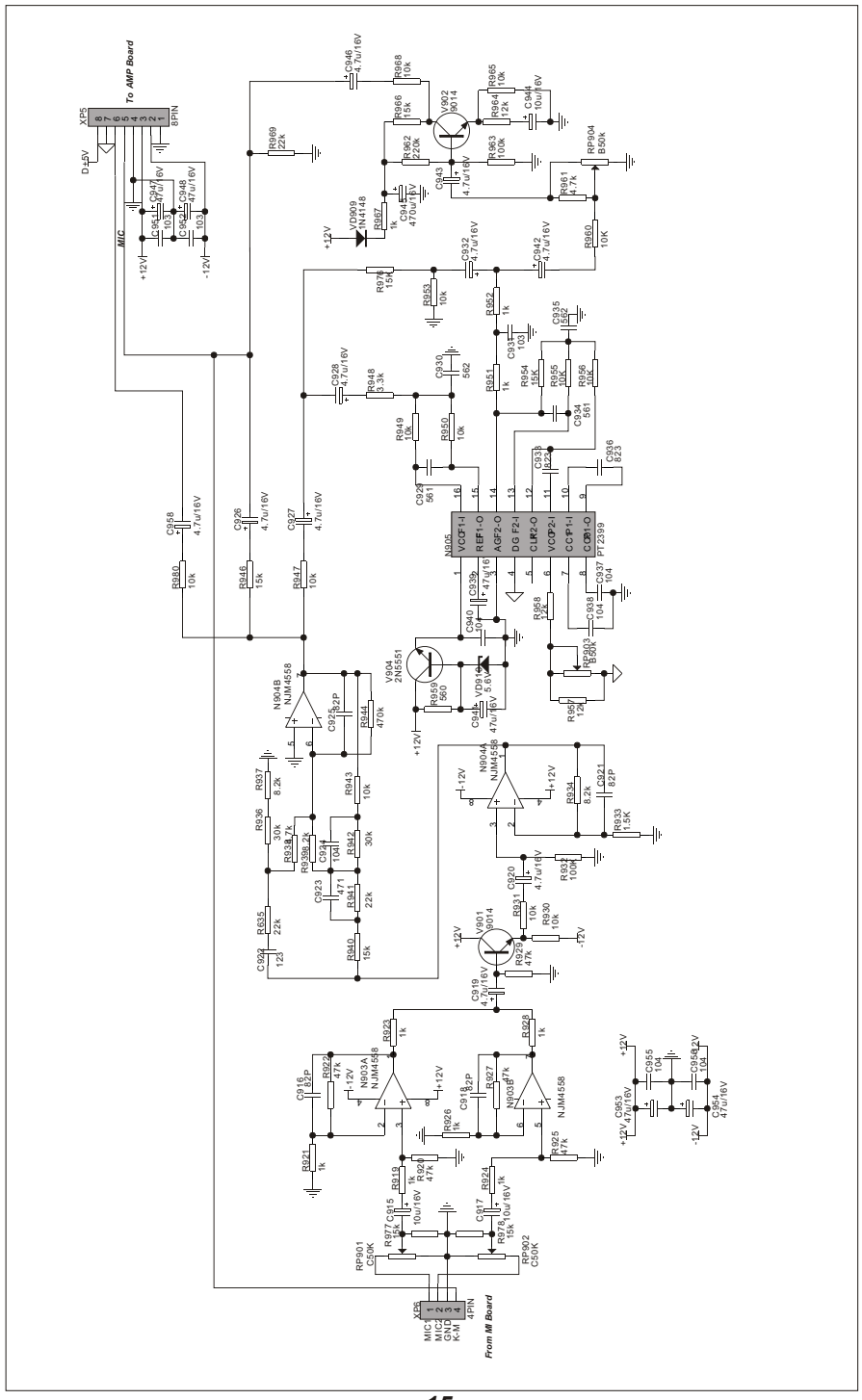


2. THE MAIN AMP PART

MAIN PARTS LIST OF THE MAIN AMP BOARD

COMPONENTS LIST FO THE MAIN AMPLIFICATION BOARD

NO.	DESCRIPTION	SPECIFICATIONS/PART NO.	LOCATION SPECIFICATIONS
1	CARBON-FILM RESISTOR	1/6W10¦ ±5% SHAPED 7.5	R417,R418,R422,R423,R444,R445,R449,R450
2	CARBON-FILM RESISTOR	1/6W100¦ ±5% SHAPED 7.5	R546~R548,R541
4	CARBON-FILM RESISTOR	1/6W1K±5% SHAPED 7.5	R506,R507,R510,R511,R514,R515,R518,R519,R522,R523, R526,R529~R532,R543,R655,R657,R658,R667,R403, R410,R430,R437,R412,R439,R479,R580,R586,R591,R596, R601,R606,R611,R616,R619,R622,R626,R570,R575,R686, R497,R457,R461,R465
5	CARBON-FILM RESISTOR	1/6W1.5K±5% SHAPED 7.5	R577
6	CARBON-FILM RESISTOR	1/6W2.2K±5% SHAPED 7.5	R625,R578,R689,R493,R498
7	CARBON-FILM RESISTOR	1/6W4.7K±5% SHAPED 7.5	R544,R628,R499,R690,R685,R691,R428,R576,R587,R607, R602,R612,R617,R592,R597,R480,R483,R453,R454,R455
8	CARBON-FILM RESISTOR	1/6W5.6K±5% SHAPED 7.5	R584,R589,R594,R599,R604,R609,R614,R627
9	CARBON-FILM RESISTOR	1/6W10K±5% SHAPED 7.5	R581,R583,R588,R593,R598,R603,R608,R613,R620,R623, R624,R579,R629,R540,R554,R557,R560,R563,R487,R481, R485,R553,R556,R401,R426,R429,R568,R641
10	CARBON-FILM RESISTOR	1/6W20K±5% SHAPED 7.5	R661
11	CARBON-FILM RESISTOR	1/6W22K±5% SHAPED 7.5	R500
12	CARBON-FILM RESISTOR	1/6W27K±5% SHAPED 7.5	R574,R458,R462,R466
13	CARBON-FILM RESISTOR	1/6W33K±5% SHAPED 7.5	R446,R419
14	CARBON-FILM RESISTOR	1/6W47K±5% SHAPED 7.5	R502,R527,R528,R550,R551,R552,R555,R558,R660, R404,R431,R504,R505,R508,R509,R512,R513,R516,R517, R520,R521,R524,R525,R682~R684,R536,R537,R663,R664, R665,R666,R567
15	CARBON-FILM RESISTOR	1/6W100K±5% SHAPED 7.5	R635,R636,R637,R638,R662,R618,R565,R566,R494~R496,R542
	CARBON-FILM RESISTOR	1/6W1M¦ ±5% SHAPED 7.5	R534
16	CARBON-FILM RESISTOR	1/4W47¦ ±5% SHAPED 10	R535,R545
17	CARBON-FILM RESISTOR	1/4W100¦ ±5% SHAPED 10	R420,R421,R447,R448
18	CARBON-FILM RESISTOR	1/4W4.7K±5% SHAPED 10	R414,R441,R486,R680
19	CARBON-FILM RESISTOR	1/4W33K±5% SHAPED 10	R411,R438
20	CARBON-FILM RESISTOR	1/4W47K±5% SHAPED 10	R478,R482
21	CARBON-FILM RESISTOR	1/4W1M¦ ±5% SHAPED 10	R533,R675,R678
22	CARBON-FILM RESISTOR	1/6W18K±5% SHAPED 7.5	R559,R561,R562,R564
23	CARBON-FILM RESISTOR	1/6W75K±5% SHAPED 7.5	R571,R644,R645,R659
24	CARBON-FILM RESISTOR	1/4W2K±5% SHAPED 10	R415,R442,R688
25	CARBON-FILM RESISTOR	1/6W150¦ ±5% SHAPED 7.5	R501,R503,R539
26	CARBON-FILM RESISTOR	1/2W220¦ ±5% SHAPED 12.5	R692~R695
	CARBON-FILM RESISTOR	1/6W2.2M¦ ±5% SHAPED 7.5	R679
27	CARBON-FILM RESISTOR	1/6W2.7K±5% SHAPED 7.5	R472,R476,R405,R406,R432,R433,R470,R471,R474,R475



6.3.4 Over-current short circuit protection: An over-current resistor sampling triode is parallel connected to the output load resistor of the channels L&R respectively. The channel L's sampling tube is V426 and its load resistor is R424 and R425. Another three channel power amplification IC have over-current protection function. When over-current fault occurs to the L or R channel, the potential between R424 and R425 will increase sharply. When it supersedes 0.7V, V426 will get conducted. So will v430. Finally, the relay is switched off and the protection circuit is getting started.

Over-current Sampling triode connected to every channel → Channel L s is V426 → R424 R425 over-current. Potential increases. → V426 conducted → Collector s voltage decreases → V430 Conducted → Relay swit ched off. Protection started up.

COMPONENTS LIST OF THE FRONT PANEL

NO.	DESCRIPTION	SPECIFICATIONS/PART NUMBER	LOCATION SPECIFICATIONS
1	CARBON-FILM RESISTOR	1/6W100¦ ê5% SHAPED 7.5	R905,R906,R910,R907
2	CARBON-FILM RESISTOR	1/6W560¦ ê5% SHAPED 7.5	R959
3	CARBON-FILM RESISTOR	1/6W1K±5% SHAPED 7.5	R919,R921,R924,R926,R967,R952,R923,R928
4	CARBON-FILM RESISTOR	1/6W1.5K±5% SHAPED 7.5	R933,R951
5	CARBON-FILM RESISTOR	1/6W4.7K±5% SHAPED 7.5	R916,R970,R971,R972,R938,R961
6	CARBON-FILM RESISTOR	1/6W10K±5% SHAPED 7.5	R955,R956,R960,R965,R930,R931,R943,R947,R949, R950,R953,R968,R901~R904,R911~R914,R980
7	CARBON-FILM RESISTOR	1/6W12K ±5% SHAPED 7.5	R958,R957,R964
8	CARBON-FILM RESISTOR	1/6W22K±5% SHAPED 7.5	R969,R941,R935
9	CARBON-FILM RESISTOR	1/6W47K±5% SHAPED 7.5	R920,R922,R925,R927,R929
10	CARBON-FILM RESISTOR	1/6W100K±5% SHAPED 7.5	R932,R963
11	CARBON-FILM RESISTOR	1/6W15K±5% SHAPED 7.5	R954,R966,R946,R976,R977,R978,R940
12	CARBON-FILM RESISTOR	1/6W3.3K±5% SHAPED 7.5	R948
13	CARBON-FILM RESISTOR	1/6W220K±5% SHAPED 7.5	R962
14	CARBON-FILM RESISTOR	1/6W30K±5% SHAPED 7.5	R936,R942
15	CARBON-FILM RESISTOR	1/6W8.2K±5% SHAPED 7.5	R937,R939,R934
16	CARBON-FILM RESISTOR	1/2W100¦ ê5% SHAPED 12.5	R915
	CARBON-FILM RESISTOR	1/6W56K±5% SHAPED 7.5	R908
17	CARBON-FILM RESISTOR	1/6W47¦ ê5% SHAPED 7.5	R909
18	CARBON-FILM RESISTOR	1/6W470K±5J ¦SHAPED 7.5	R944
19	Rotating Potentiometer	A115NOED-H1B503-007	RP903,RP904
20	Rotating Potentiometer	R1111NOA-V1C503FK00-01	RP901,RP902
21	Digital Potentiometer	E1611A3A-V1FG05-01 WITH SPACER	RP905

22	PORCELAIN CAPACITOR	50V 82P ±10% 2.5mm	C916,C918,C921,C925
24	PORCELAIN CAPACITOR	50V 221 ±10% 2.5mm	C959,C960,C961
25	PORCELAIN CAPACITOR	50V 561 ±10% 2.5mm	C929,C934
26	PORCELAIN CAPACITOR	50V 103 ±20% 2.5mm	C906,C907,C909,C910,C951,C952,C931
27	PORCELAIN CAPACITOR	50V 562 ±20% 2.5mm	C930,C935
28	PORCELAIN CAPACITOR	50V 471 ±10% 2.5mm	C923
29	PORCELAIN CAPACITOR	50V 104 ±10% 5mm	C902,C903,C912,C937,C938,C940,C955,C956
30	PORCELAIN CAPACITOR	50V 823 ±10% 5mm	C933,C936
31	METAL POLYESTER FILM CAPACITOR	CL21X 100V 104 ±10% P5	C924
32	TERYLENE CAPACITOR	100V 123 ±5% 5mm	C922
33	CD	CD11 16V47U±20%5*11 2	C953,C954
34	CD	CD11 16V470U±20%8*11 3.5	C945
35	CD	CD11C 50V4.7U±20%4*7 1.5	C926,C946,C927
36	CD	CD11 16V4.7U±20%5*11 2	C920,C928,C932,C942,C943,C919,C958
37	CD	CD11C 16V10U±20%4*7 1.5	C915,C917,C944
38	CD	CD11C 16V47U±20%5*7 2	C939,C947,C948,C941,C901,C911
39	CD	CD11 35V47U±20%6*12 2.5	C904
40	CD	CD11 35V100U±20%8*12 3.5	C905
41	DIODE	1N4004	VD908
42	DIODE	1N4148	VD901~VD905,VD909
43	VOLTAGE REGULATOR DIODE	30V 1W	VD907
44	VOLTAGE REGULATOR DIODE	5.6V 1/2W	VD906,VD910
45	TRIODE	2N5551	V904
46	TRIODE	9014C	V901,V902
47	IC	NJM4558D DIP	N903,N904
	IC	4558C DIP	N903,N904
48	IC	PT2399 DIP	N905
49	IC	D16311GC QFP	N901
50	VFD	GTD-1501A	VFD901
51	LIGHT TOUCH RESTORE SWITCH	HORIZONTAL 6*6*H	S901~S920
52	PCB	9210-3	
53	CONNECTION CORDS	¦Õ0.6 SHAPED 7.5mm	W1,W3,W4,W6,W9~W14,W19,W21,W25~W27,W29,W30, W35,W36,W32
54	CONNECTION CORDS	¦Õ0.6 SHAPED 10mm	W7,W16,W20,W22,W23,W24,W33
55	CONNECTION CORDS	¦Õ0.6 SHAPED 12.5mm	W8,W17,W18,W28,W31,W34
56	RAFT CORDS	3P60 2.5 2 PLUG WITH DOUBLE NEEDLES	XP7
57	RAFT CORDS	5P60 2.5 2 PLUG WITH L NEEDLE / SM HEAD	XP8
58	RAFT CORDS	8P200 2.5 T2 2P SHIELD WITH L NEEDLE, 4 GROUND PINS	XP5
59	RAFT CORDS	9P330 2.5 2 PLUG WITH L NEEDLE	XP4
60	RAFT CORDS	4P60 2.5 2 PLUG 3P SHIELD WITH L NEEDLE	XP6
61	INFRARED SENSOR	HS0038B	N902
62	SOFT SPONGE SPACER	10*10*0 DOUBLE FACED, HARD	N902/PCB
63	SOFT SPONGE SPACER	10*10*5 DOUBLE FACED, HARD	VFD901/PCB

SCHEMATIC DIAGRAM OF THE FRONT CONTROL PANEL BOARD