http://monitor.espec.ws

BBK AV-215T

Chapter One Product Description

AV215T (RU) is an advanced power amplifier with complete functions that adds LCD to its predecessor as well as 16 kinds of spectrum displays in the sky-blue background which makes it more extraordinary. The radio reception makes this type of device the best choice for users who are fond of radios. Its main features are as follows:

1. Built-in 5-track power amplifier that can adapt to AC-3/DTS and stereo music playback. It is powerful with 80W main channel and 15W centre surround sound.
2. Mixing input interface of AC-3/DTS, VCD and DVD and DBB and stereo output interface.
3. 6-channel volume control and independent level control as well as 7-band EQ.
4. Bass Enhancer system, cyber logic and Hi-Fi playback.
5. One button for movie, music and karaoke.
6. Multiple EQ modes that adapt to different music styles.
7. Automatic spectrum analysis and compensation, automatic signal compensation.
8. Multiple spectrum display modes.
9. Complete karaoke function including microphone independent volume control, overall volume control, pitch adjustment, voice compensation, delay and echo adjustment as well as the newly added earphone output.
10. Karaoke wide sound field function.
11. Tuning function.
12. Intelligent protection of over-current and over-voltage.

Chapter Two Operating Principle

Section One Overall Structure

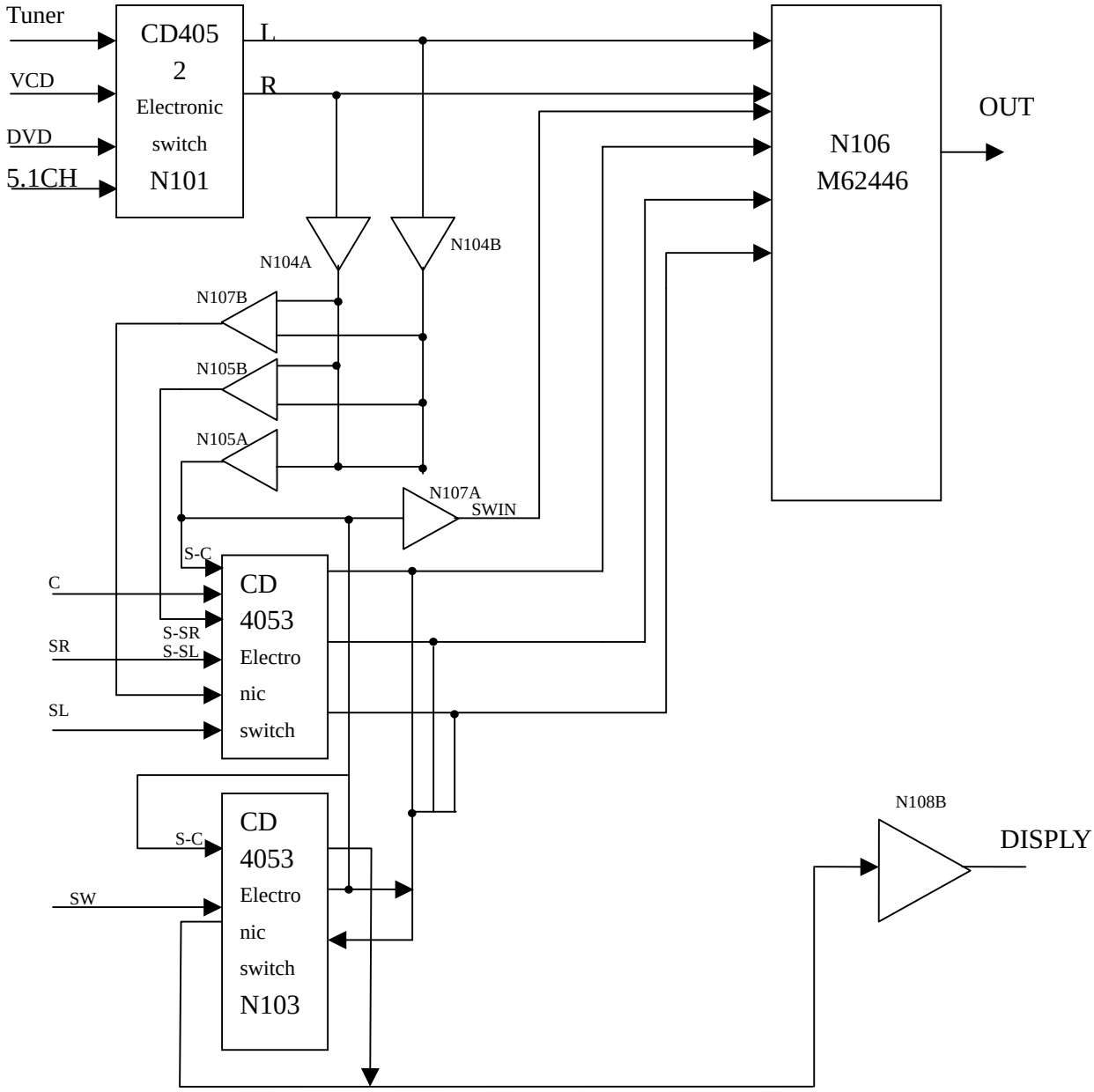
AV215T (RU) mainly consists of the following seven parts:

I. Volume Board: Select input signal source, cyber logic and bass enhancer.
II. Signal Processing Board: Karaoke signal processing and 5.1CH signal amplification.
III. CPU Board: Overall control, frequency point gating, automatic circuit search.
IV. Control Panel: LCD display, remote control keyboard and backlight display.
V. Power Panel and Protection Circuit: Provide operating voltage required by unit circuits and overall protection.
VI. Power Amplifier Board: Power amplification of 5.1CH signal or analog signal.
VII. Tuner: Receive radio signal and send to amplifier for signal-processing.

Section Two Volume Board

AV215T (RU) has four input modes: Radio input, VCD, DVD and 5.1CH.
The cyber logic function of AV215T (RU) is to get C/SR/SL/SW track signals by sampling from L/R track and then processing through low-pass filter and adder subtractor. Mode

switch is achieved by using electronic analog switch. The signal flow chart is as follows:



I.

Input selection and sound field processing mode

The input selection of AV215T (RU) is achieved via electronic switches CD4052 and CD4053, the truth tables of which are as follows:

CD4052 Truth Table

	Tuner	VCD	DVD	5.1
A	0	0	1	1
B	0	1	0	1

CD4053 Truth Table

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

5.1CH input mode: Now A/B/5.1CH control pins of M62446 are of high level. L/R

track signal of 5.1 input is outputted from pin 3/13 of N101 and sent to IC N106 for volume and tone adjustment; meanwhile, C/SR/SL signal on 5.1 input terminal is respectively sent from pin 14/15/4 output of N410 to IC N106 for independent volume adjustment. And SW signal is outputted via pin 4 of N103 and then send to M62446 after being amplified by N107A.

Three analog input modes: AV215T (RU) totally has three analog input modes: Tuner receiving signal/VCD/DVD, which are controlled via A/B signal respectively (see details in truth tables).

AV215T (RU) totally has three sound field modes: standard sound field, cyber logic and Hi-Fi.

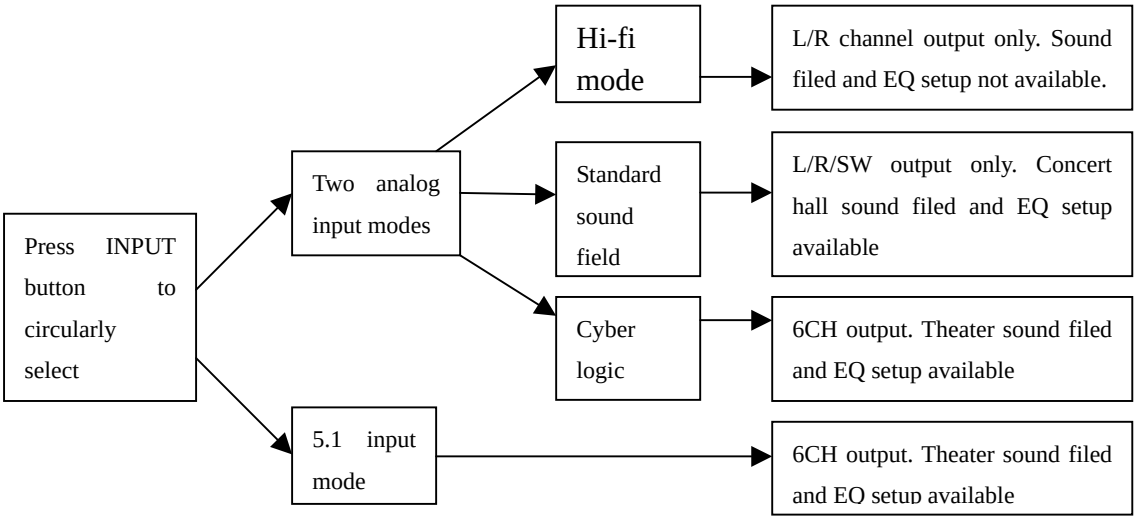
1. Standard sound field: Under overall CPU control, when bass enhancer is off, L/R channel and subwoofer output are available; when bass enhancer is on, only L/R channel output is available.
2. Hi-fi: Under overall CPU control, only L/R tracks output is available to M62446;
3. Cyber logic:

   Pin 9/10 of electronic switch N101 (CD4052) select a series of analog L/R track input signals according to the truth table. L/R signals are outputted from pin 13/3 via the internal electronic switch of N101, and divided into two ways. One way is respectively sent into pin 13/15 of M62446, for electronic volume and tone control. The other way produces SW/S-SR/S-SL/S-C signals via buffer, adder-subtractor and low-pass filter. SW/S-SR/S-SL signals are sent to pin 12/2/5 of N102. N102 select cyber logic signal input (see truth table of CD4053) from cyber logic and 5.1CH signals, outputs C/SR/SL signals and sends into pin 11/8/9 of M62446 for volume control. Still another way of SW signal directly sends to pin 6 of M62446 after being outputted from N107A. 5.1CH signal sent into M62446 is outputted from pin 31-36 after volume and tone control, and then outputted to signal board by XS20 power distributor.

The relation between sound sources in input circuit and sound processing modes is as illustrated below.

II. Control circuit

Pin 23/26/27 of CPU (N100) output data, PVST and clock signal and send to pin 39/40/41 of M62446 to control pin 1/2/3/4 of M62446 to output control level, so as to select input signal and spectrum sampling signal. It is worth noting that PVST signal is a latch control signal. When data and clock of CPU are sent to M62446, an identification signal will be added, indicating that this signal can only be used by M62446 while other IC of I^2C bus cannot use current data and clock signal.



III. Frequency spectrum sampling circuit

Only S-C/S-SR/S-SL/SW signals are sampled during frequency spectrum sampling in AV215T（RU）and added to pin 14 via a 150K sampling resistance. Another S-C cyber logic signal is added to pin 1 of N103, called S-C. 5.1CH and LR-T of M62446 select sampling signals. When cyber logic is selected, the control signal of 5.1CH is of low level while pin 9/11 of N103 is of low level. According to the truth table, it is known that the outputs are X0/Z0. Sampling signal is grounded while LR-T is of H level. Select Y1, S-C ' signal is outputted from pin 15 of N103 to N108B, adding to OK-R signal for the amplification of frequency spectrum signal, and then sent to frequency point gating and auto search circuits.

Ⅳ. Tuning function

This device has the tuning function which provides users a good functional option. It directly controls radio-head and receives audio frequency signal mainly via CPU and then outputs after amplified via power amplifier. The clock and data line of radio-head are shared with LM62446 and the other two control lines are connected to CPU directly. L, R signal processed by radio-head can be sent to N101 IC CD4052 directly to input the selected track.

Section Three　Signal Processing Board

The signal processing board superposes, mixes and amplifies 5.1CH signal sent from the volume board, voice signals from the voice board and karaoke signal.

I.　AV215T（RU）Karaoke Circuit

1. Function: this circuit processes human voice through power amplifier and reproduces it via speaker. It includes human voice beautification circuit, wide sound field processing circuit, karaoke echo and delay adjusting circuit.

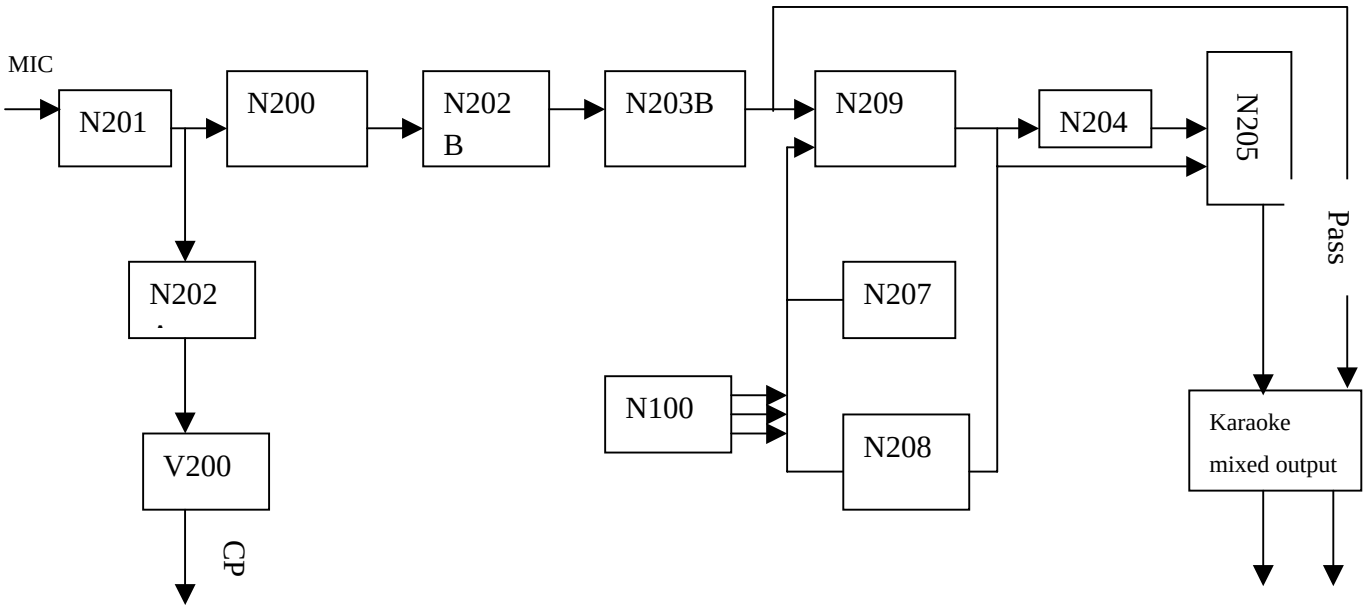
IC and its functions for karaoke

IC serial number	Name of IC	Functions
N201	4558	Transmittal. Preamplification for karaoke signal
N200	PT2315	Volume control of karaoke, including tone control
N205	CD4053	Electronic switch
N209	PT2399	Karaoke echo processing
N207	CD4051	Karaoke delay adjustment
N208	CD4051	Karaoke echo control
N204	4558	Phase inverter

PT2315 functional pin

S/N	Name of pin	Description	Remarks
1	REF	Reference voltage (1/2VDD)	
2	VDD	Power supply	
3	AGND	Analog	
4	TREB L	L/R channel treble control pins	
5	TREB R		
6	RIN	R channel input	
7	LOUD-R	R channel loudness control pin	
9	LOUD-L	L channel loudness control pin	
11	LIN	L channel input	
12	BIN L	L channel bass control input/output pin	
13	BOUT L		
14	BIN R	R channel bass control input/output pin	
15	BOUT R		
16	RFOUT	R channel output	
17	LFOUT	L channel output	
18	DGND	Digital	
19	DATA	（DATA）control data of sequence transmission (DATA)	
20	LCK	Clock input of sequence transmission	
8，10	NC	Not connected	

3. Flow chart of karaoke signal



When the microphone is inserted, MIC signal is sent via MIC to the transmittal circuit combined by N201A for amplification. Amplified MIC signal gives CPU a MIC identification signal after N202A amplification, followed by VD201 rectification and filtering control triode V200. CPU sends PKM signal, which is of low level, causing cutoff of triode V103/V105 and enabling output of MIC signal; another way reaches pin 6/11 of PT2315 after C219/C222 coupling, outputs from pin 16/17 after internal volume and tone control, mixed into one way and sent to N202B and then reversely send to N203B for amplification. Signals amplified by N203B are divided into two ways. One way is directly outputted. The other way is outputted from pin 14 after being coupled by R222/C247 to PT2399 for internal delayed reverberation adjustment, reversed by N204 and outputted by mixing with karaoke signal. While OK-R is outputted from pin 14 after being gated by N205 and superposed to L/R track.

In this circuit, the bass boost network made up of triode V201 connected to the negative terminal of N202B is primarily for bass boost of 75HZ low frequency signal.

During delay adjustment for PT2399, first control signal is given to CPU, which controls N207 after being expanded via N211 IC CD4049 and connects with pin 6 of PT2399 by selecting different resistance values for purpose of delay adjustment.

Reverberation control is to change the resistance value at the connection point to R229, so as to change the superposition on through connect signal for reverberation control.

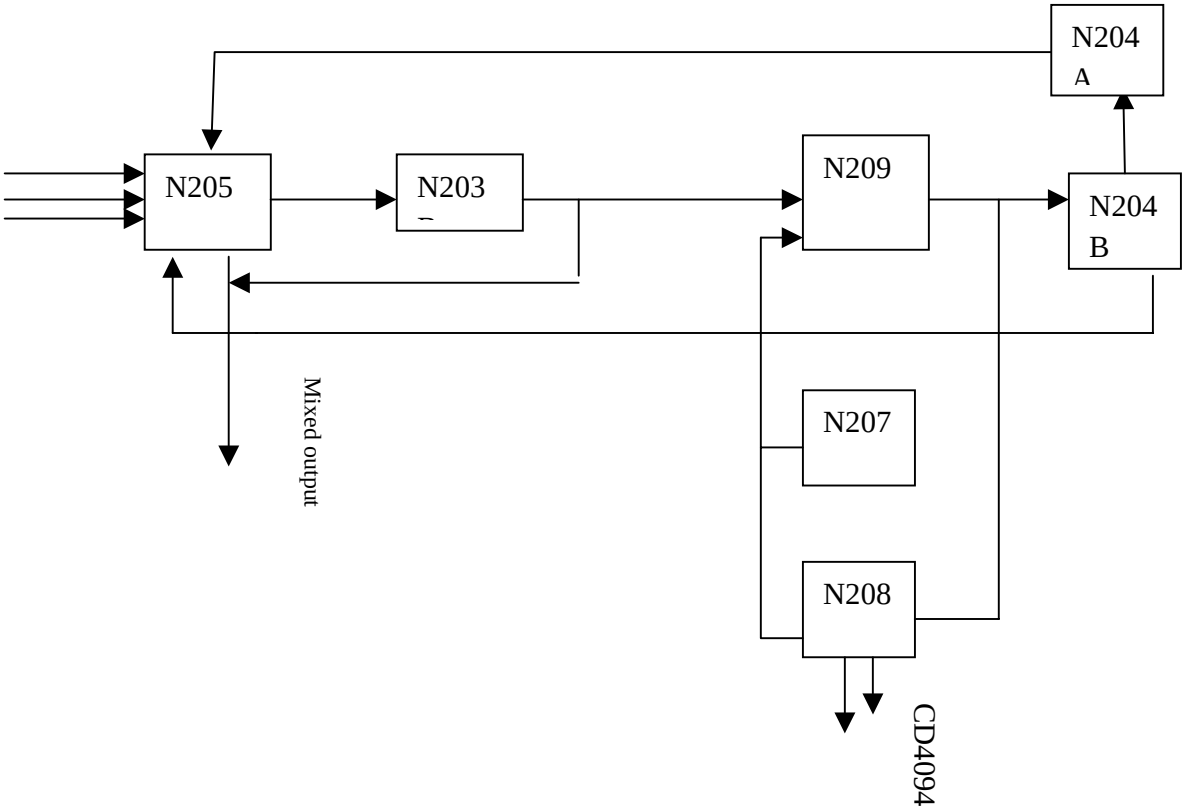
The broadband processing control signal of SOK's karaoke is in broadband mode when it is of high level, when the signal of OK-R is the OK signal inverted by N204A.

A sense signal of OK-SW on the MIC plug conducts MIC signal detection together with the network made up of V200. When MIC is not plugged, it is of low signal; when plugged, it is of high signal.

Karaoke auto mute is also available. When P-KT fails to detect signal for a continuous time, CPU will send a P-KM signal to mute karaoke and avoid MIC receiving noise, which may affect on sound effect.

- **Signal flow chart of profiles**

AV215T (RU) has a special function that switching between 5 profiles is available without karaoke. Its flow chart is as follows:



When pin 9/10 are of high level, sampled L/R/C signals are outputted via pin 3 N205 gating, and sent to the internal of PT2399 after amplification by N203B for reverberation delay adjustment (by IC CD4049), and then superposed to L/R/C track to form different profiles.

In this circuit, MIC shall not be inserted and is only available in 5.1CH mode. N203A is for the purpose of reversal.

In addition, this device is added earphone output function. PHSW is low level and each track has output when earphone is not inserted. But when earphone is inserted, PHSW will be high level for the mechanical settings thus LRM and SCM signal change into high level at the same time and realize muting in each track, so the signal is only outputted from earphone, i.e. there is no signal output with each track when connecting with earphone output.

II. Bass enhancer circuit

P-BURST is the switch signal of burst driver. When it is of high level and added to the base electrode of V102, V102 will be switched into conduction. When the collector electrode outputs low level, V107 will be cut off; when the collector electrode is of low level, V107 will also be cut off. SW signal is normally outputted to external terminal. Meanwhile, the high level signal of P-BURST is added to the emitter electrode of V108. V108 is positively biased and switched into conduction. The collector electrode adds high level to the base electrode of V101. V101 is positively biased and switched into conduction,

and ground SW signal, not superposing it to L/R track signal.

In reverse, when P-BURST is of high level, V100 will be switched into conduction and SWM signal cannot be outputted from external terminal. Meanwhile, V101 is cut off and SW signal is superposed to L/R track signal.

The burst driver of AV215T (RU) can be divided into three steps. This principle is to change the volume of burst driver by changing the SW output volume of M62446.

Meanwhile, SWM signal is added to relay via XS9. When the relay is off, SW signal will be grounded, disabling the output at super bass port.

III. Mixing and amplification circuit of 5.1 signal and karaoke

When L/R track signal of 5.1 signal is superposed with SW signal and amplified by N101B/N100B, it is sent to the reverse phases of N101A/N100A. Meanwhile, OK-R/OK-L signals are also respectively added to the reverse phases of N101A/N100A. After mixing and amplification by N101A/N100A, they are outputted respectively from pin 1 of N100A/N101A to power amplification circuit for power amplification.

Meanwhile, the C-1 signal sent by volume board is added to the reverse phase of pin 6 of N102B and added to the reverse phase of N102A after amplification. Now C1-1 signal after electronic reverberation processing is also added to the reverse phase of N102A and sent to power amplification circuit after mixing and amplification.

SR-1/SL-1 of another volume board is also added to the reverse phases of N103B and N104B for amplification and then sent to N103A and N104A for further amplification, and later sent to power amplification circuit.

One way of 5.1 signal being mixed and amplified is sent to power amplification circuit passing through XS9, and the other way forms DIST (distortion error detecting signal) signal passing through R111-R113/R142/R145/VD100-VD104, which will be added to CPU for automatic gain, so as to control volume output.

Section Four CPU Board

Achieve overall control, automatically search input signal and analyze spectrum

1. CPU Overall Control

N100, the overall CPU, is the overall control center, inputting all kinds of control instructions to controlled circuits to achieve all kinds of control functions. It adopts +5V supply with pin 40 as its supply pin. Pin 18 and pin 19 connect externally with 12M crystal oscillator to provide working clock frequency for itself. Pin 9 is its reset pin. When starting, +5V charges C106 via R100. The voltage of two ends of capacitance cannot be mutated, thus B-pole of triode V100 is low level, that is, V100 conduction gives a high-level reset signal to CPU. When capacitance C106 finishes charge, V100 stops and then reset finishes. The form of this reset circuit is to reset high level and keep low level.

When the machine is working, the static information of start log in the screen and Chinese characters are stored in CPU internal static memory. N101, a status memory, can record the current working status of machine when cutting off and show the status when next starting up, avoiding users to re-adjust. The sound mode set by users is also stored in it and can be activated when necessary.

Ⅱ. Detect Input Signal and Automatically Search Circuits

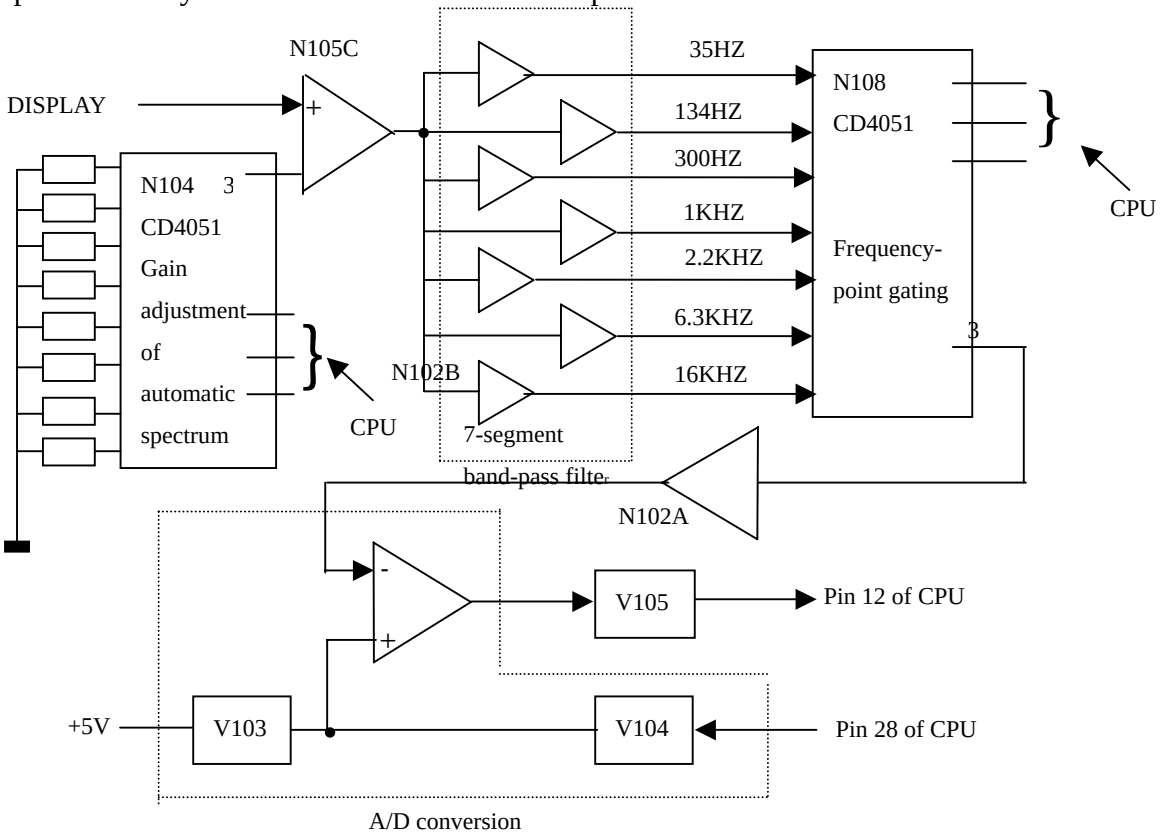
DISPLAY signal from volume board is sent to N103A to amplify and limit level, then sent to inverse end of voltage comparator N103B after capacitance coupling. It inputs from pin 7 of N103B and then is sent to pin 16 of CPU via VD103, V101, R109 and R107. When N103B inputs a high level, VD103 is in reverse cut-off status, B-pole of switch tube V101 is high level and is in conducting status, then gets an about +5V high level (signal input) to CPU after VD101's stabilization and stop searching. When the output end of N103B outputs a low level, VD103 is in conducting status, B-pole of switching tube V101 is low level and is in cut-off status, and then CPU detects the low level (no signal input). Its working principles are:

①After starting up, under CPU internal program's control, a data signal is outputted via pin 23 to M62446, and then M62446 scans each input port of N101, N102 and N103 by emitting high and low levels. When the input ports have no signal input, it automatically becomes standby status. When any of ports has signal input, track paths of input N101, N102 and N103 has A/C signal which is amplified and limited level by N108B and N103A of CPU board, then compares with pin 5 of N103B and gets plus-minus level close to supply power. The co-phase voltage of N103B is about 0.1V. After the direct current voltage is over 0.1V, the output end of N103B outputs low level is close to negative-power voltage, VD103 positive-bias conducts, switch tube V101 (S9014) stops, emitter outputs a low level to pin 16 of CPU which by controlling IC M62446 makes search level lock on the port through which signal inputs, to enter normal play.

②When pressing "search" key of remote controller, it is converted from optical signal to electric signal by the remote receiving head of panel. Pin 14 of CPU emits a high level to conduct V102 and search according to the same previous process.

Ⅲ. Spectrum Analysis Circuit (see the following illustration)

Spectrum analysis circuit is divided into three parts:



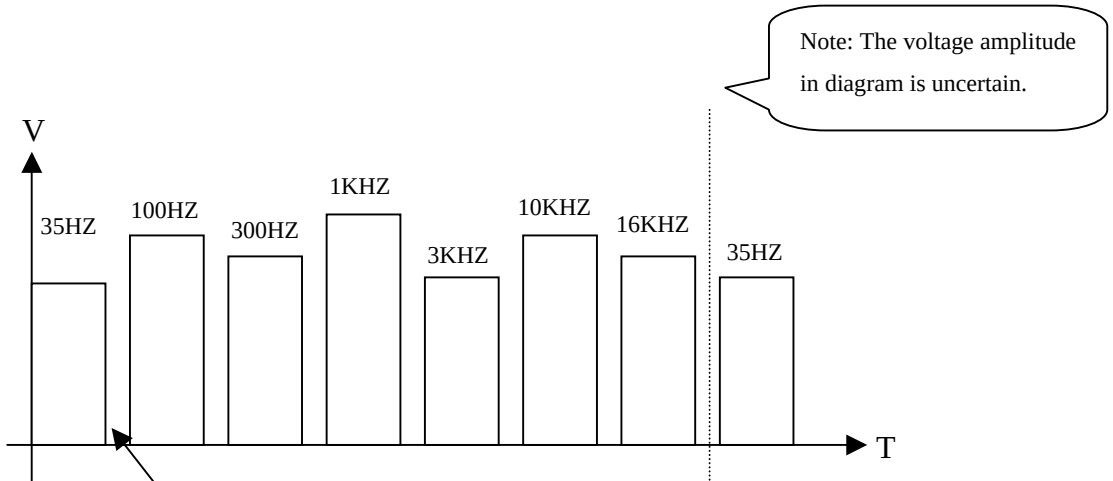
1. Automatic spectrum gain adjustment circuit: To avoid two situations that spectrum display amplitude is too low when input signal is too weak or spectrum display is in full screen when input signal is too strong, AV215T (RU) sets automatic spectrum gain adjustment circuit, using a single-track one-from-eight electronic analog switch, its true value diagram is as follows:

Its main working principle is to change the value of inverse ground resistance of transmittal N104 to change the transmittal gain multiple. Let's see the detailed work of the whole circuit. We've referred that spectrum analysis signal source (display) is sent to the co-phase input end of transmittal N105C to amplify. Its amplification factor is determined by the value of the resistance connecting with the electronic switch of its inverse end N104. When the main volume is large, CPU will automatically increase the value of ground resistance and decrease the amplification factor; when the main volume is small, CPU will automatically decrease the value of ground resistance and increase the amplification factor.

CD4051Truth 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

2. Frequency-point gating circuit: signal amplified by N105C is sent via C115 coupling to seven band-pass filters composed of transmittals. By setting its capacity of feedback capacitance, its frequency-band range can be determined. The frequency value of superscript of the output points is the central frequency-point of the frequency band. The output end of each band-pass filter is connected with a half-wave rectifier circuit. The amplified A/C signal is rectified to direct current. The circuit is mainly to achieve frequency-point sample. It can display the amplitude of all frequency-points of the whole sound signal via direct-current voltage. If the low frequency of sound signal is stronger, the current voltage of output end of 35HZ and 100HZ band-pass filter is higher. When high frequency is stronger, the current voltage of 10K and 16K band-pass filter is higher. The output ends of the seven band-pass filter are connected with the seven input ends of electronic switch N108 (CD4051). These electronic switches will quickly circularly-switch among frequency points (referring to previous true value diagram). Pin 3 output end of N108 will output a string voltage value representing frequency point signal amplitude (see next diagram).

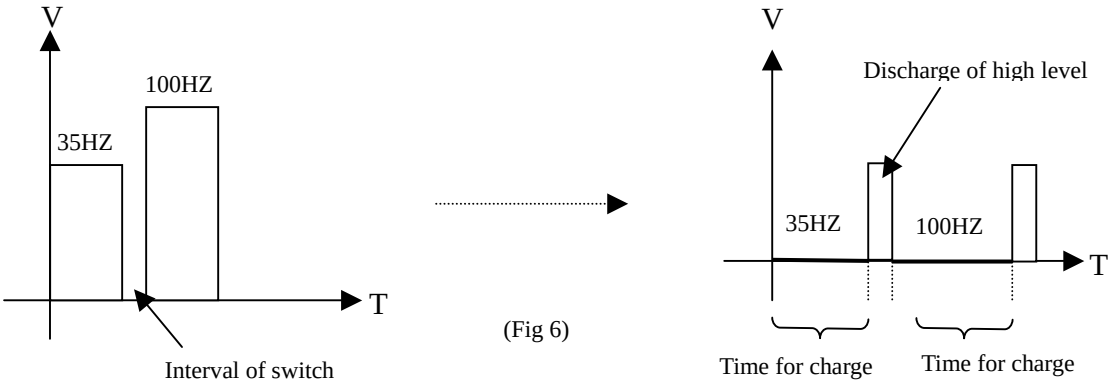


Frequency-point circle

gating period

3. A/D conversion and output circuit display (two situations):

1. When no signal input, pin 28 of CPU sends a high level to B-pole of V104. The positive end of N102B is low voltage, the inverse end of N102B gets partial voltage of R189 and R172, making N102B output a low level, that is, triode V105 stops and C-pole of V105 will give a high level to pin 12 of CPU to let CPU not conduct AD conversion (pin 6/7/8 of CPU are inactive and keep high level).



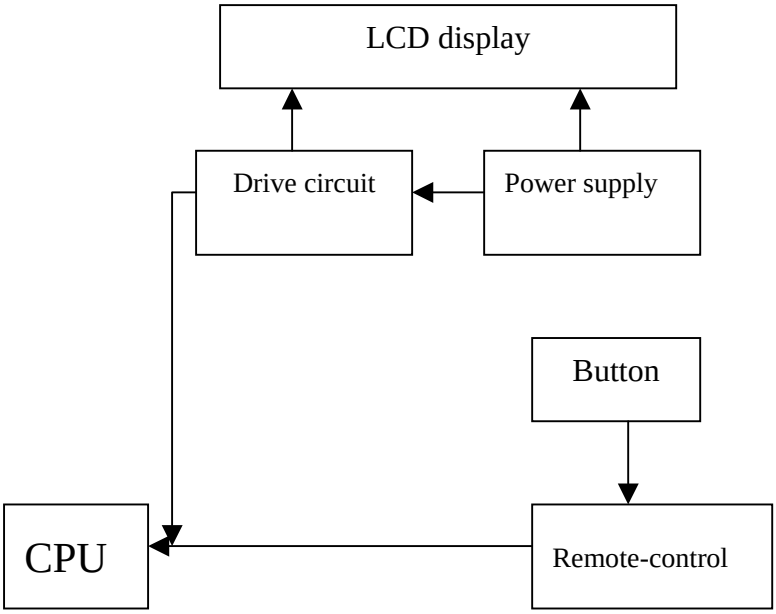
(Fig 6)

2. When the machine has detected the signal (the inverse end of N102B has a current voltage representing 35HZ signal amplitude), pin 28 of CPU is converted into low level and +5V voltage charges for C137 via V103. When reaching the voltage value of inverse end, the comparator converts and N102B outputs high level. Once CPU receives low-level signal, it stops 35HZ level gating and converts into next frequency point 100HZ. During conversion, pin 28 of CPU outputs an instant high level to conduct V104, leak the voltage capacity of C137 and make the co-phase end of N102B restart to charge 100HZ from 0-level. When the charge of 100HZ finishes, the charge and discharge of next frequency point begin, and such process occurs circularly under the control of CPU. The charge time form 0-level to the occurrence of output conversion represents the signal amplitude of current frequency point—the larger the amplitude, the longer the time and the amplitude displaying in screen is higher; the smaller the amplitude, the shorter the time and the amplitude displaying in screen is lower. Digital pulse outputted from N102B output end is added by V105's inverse to pin 12 of CPU which handle it and output to panel to display dynamic frequency in screen. The display of original frequency points is sequential. However, the above circular process is extremely quick, thus, what we see in screen is the progress of the whole spectrum displaying synchronously.

Section Five Control Panel

The panel control circuit is the window for man-machine interaction. It can communicate

the operation command with CPU to finish kinds of artificial operations. At the same time, it is the window of the complete machine by which human can predominate the complete machine's working status. It is also an important element to its appearance. The AV215T （RU） panel control circuit block diagram are showed as follows:



(1) **Power supply circuit**

1. AV215T (RU) has two groups of voltage of +3.3V and +5V in control panel. Voltage of +5V after voltage stabilization from signal panel supply power to N102, N103, IC CD4013 and N101 PT2222 after voltage reduction via two diodes of VD105、VD106、VD107、VD108.

(2) LCD display driver and button circuit

This circuit is made up of N101, N102, N103 and LCD.

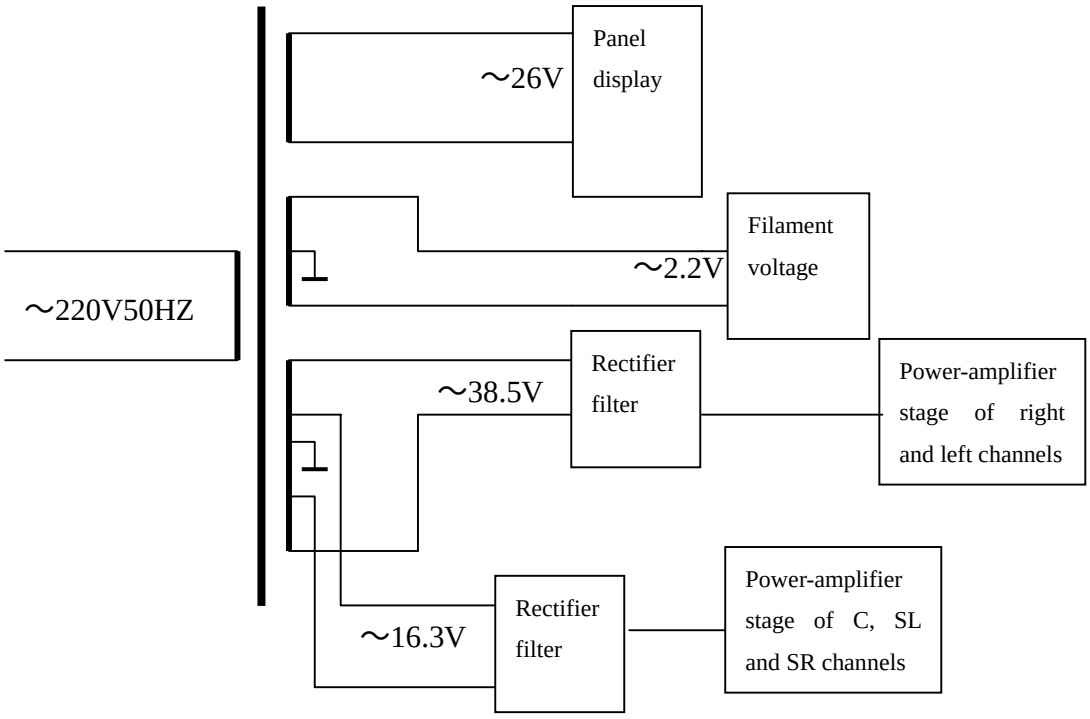
Working principle: display of this device is directly controlled by P0 interface of CPU and IC is bound inside of LCD. Working voltage of display is 3.3V and voltage of control line sent out from CPU is 5V, so the level between CPU and LCD display is transferred via two ICs of 74VHC245 thus control the display screen by transferring control level of 5V from CPU to 3.3V.

Button circuit of this device is an equivalent to remote controller. After being received by PT 2222, signal of button matrix controls the conducting degree of triode V100 via pin 7 thus makes the signal sent by diode VD100 of infrared luminescent and processed by CPU after being received by receiver of remote controller.

Section Six Power Board

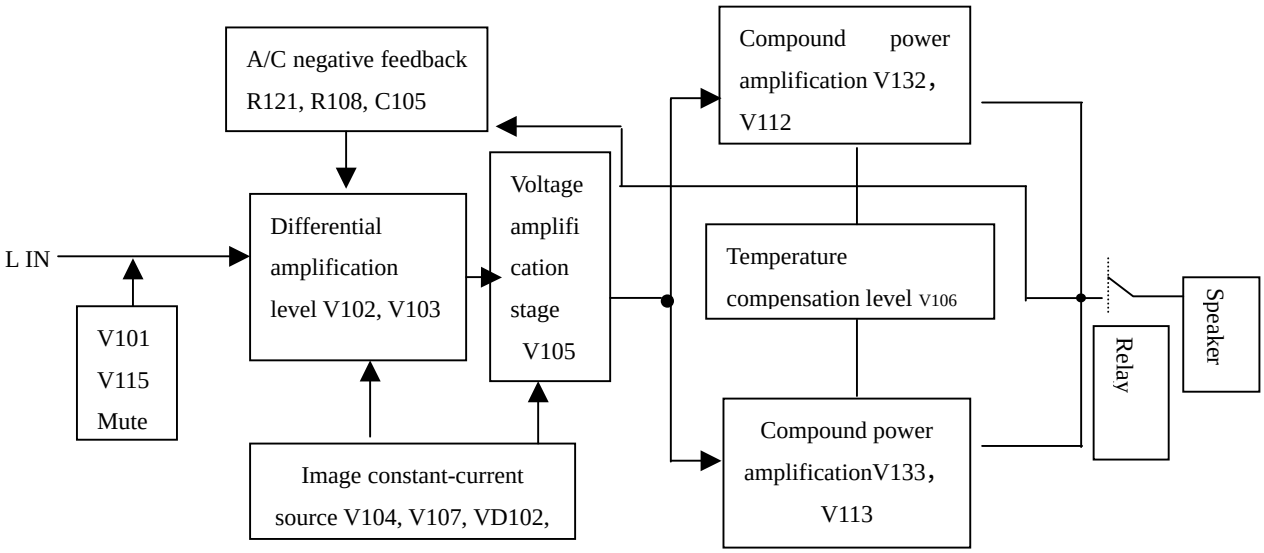
It is used for providing all kinds of needed working voltage for units of the whole machine. AV215T (RU) adopts a ring transformer with 335W power. The middle and surround channel of AV215T (RU) respectively adopt LM1875 and LM1876. LM1876, the dual-channel power amplification IC, supplies power by separate positive power, ensuring there is high separating degree between two surrounds. It adds ±VSS supply comparing with previous machines. The diagram of power supply circuit is as following:

1. Two A/C 38V of transformer first level output is rectified and filtered by four IN5404 and two big electrolytic capacitors (15000uF/68V) and gets plus-minus 53V power to supply for right and left channels.
2. Two A/C 21V voltage outputted by second level of transformer is rectified and filtered by four IN5404 and two electrolytic capacitors (4700uF/35V) and gets plus-minus 28V power to supply for SL/SR/C channels. Other ICs and operational amplifiers are stabilized by stabilizing tube L7812 and L7912 and gets power to supply for other IC.



Section Seven Power-amplification Board and Protective Circuit

Ⅰ. Power amplification circuit of L and R channels: L and R main power amplification circuits of AV215T (RU) are composed of separate elements. The block diagram is as following (taking L channel for example)



L-track signal is sent by coupling of R101, R103 and C101 to B-pole of differential amplification stage V102. V102 and V103 compose of differential amplification circuit of single-end input and output. Speech signal is outputted from C-pole of V102 to B-pole of voltage amplification stage V105, and then to compound power amplification stage after amplifying voltage. V104, V107, VD102 and VD103 compose of image constant-current source circuit. VD102 and VD103 provide constant base current for V104 and V107. The emitter resistance of V104 defines the working current of differential amplification stage and the emitter resistance of V107 decides the working current of voltage amplification stage. V132 and V112 compose of compound tube amplification, making the final stage of power amplification with strong current amplification, which compose of wave plus half-circle amplification. V133 and V113 compose of wave minus half-circle amplification, whose circuit structure is completely the same to the previous tube. Two functions of temperature compensation tube V106 are: firstly, it is the base-level bias of upper and lower tubes. Its working status determines the static working current of compound power amplification. That is, we can set the static working point of compound power amplification stage by adjusting V106 conduction. The common way is to change the base resistance of V107. It can also automatically adjust the working status of compound power amplification stage when the temperature arises. The adjusting process is:

Total current of output stage = working current + leakage current

When temperature arises, leakage current also arises, causing the static working point flow (bad). At the same time, the leakage current of V106 arises and Uce decreases, causing the bias current of output stage decreases, working status changes and working current of back pole decreases, in order to compensate temperature.

Voltage negative feedback is introduced in power amplification circuit of AV215T (RU), composing of R121, R109 and C105, stabilizing the static working point of differential stage. AV215T (RU) adopts direct output. R111 and C116 of its output end compose of Zobel Filter, preventing high-frequency self-excitation caused by A/C inductive reactance of loudspeaker speech coil.

Ⅱ. The principle of R-track is same to that of L-track. No more words here.

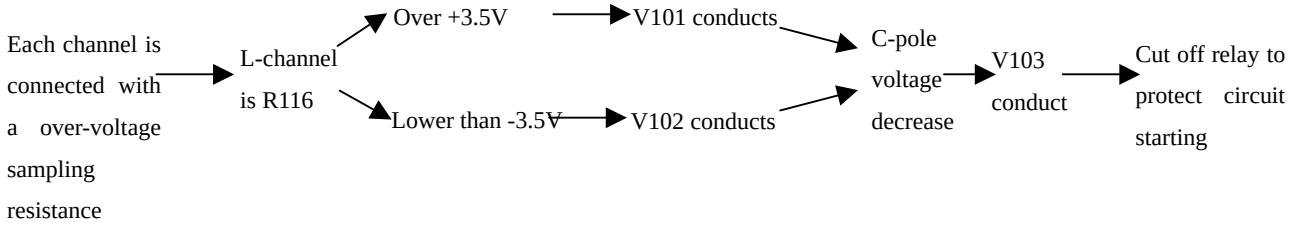
Ⅲ. **Mute circuit:** when pressing mute key of remote controller, a photoelectric conversion mute signal by remote receiving head is sent to CPU, whose pin 35 and 36 emit a high-level mute instruction to conduct V115, V101 and V116 and L and R-track signal short pass ground, achieving the mute control.

Ⅳ. **C, SR and SL power amplification circuit:** Compared with previous machines, these three tracks of AV215T (RU) adopt special power amplification LM1876 and IC LM1875. LM1876 has 15 pins. The pin 2, 15 and 4 are respectively its plus-minus power pins. The pin 7/8/12/13 are its co-phase and inverse input ends. The rated output power of each track of the power IC can reach 20W with automatic mute function when starting up. 1875, five pins, is a power amplification IC with better performance and extremely simple application circuit which has 15W power output in rated status. Its pin 5 and 3 is plus-minus power supply pin.

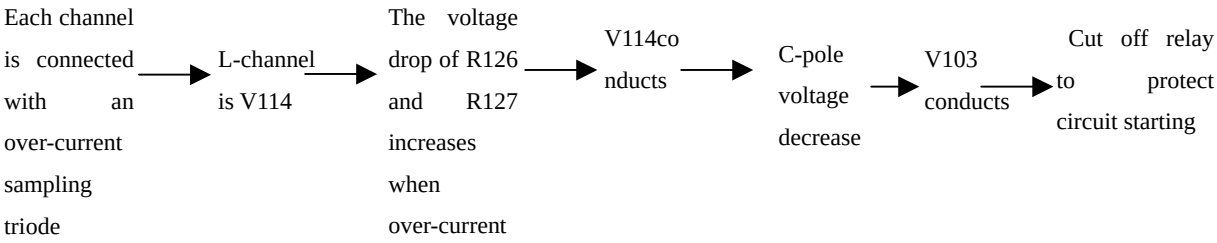
V. **Protective circuit**

The protective way of L, R and C tracks is to cut off relay Y100 when starting up to cut off its output. SR and SL tracks protect by mute. AV215T (RU) has functions of starting delay protection, mid-point over-voltage and over-current protection and standby protection.

1. **Starting delay response protective circuit:** because the circuit is unstable when starting up and its dash current does great harm to sound box and power amplification circuit, the delay response protective circuit is set. There are two steps for starting delay response protective circuit: Firstly, C, L and R. Its working process is: the A/C of transformer is rectified and filtered by VD113 and C110 to form a 22V voltage, then R108 charges C115 to inversely breakdown VD111 and V105 and V104 forward conduct, finally the Y100 responses and delay forms. Secondly, L and R surround tracks take starting anti-dash protection by following ways: when the system resets, pin 33 of CPU outputs a high level, passing R164 to pin 9 and 14 of LM1876 which outputs mute. After machine succeeds in delaying starting, pin 33 of CPU switches into low level and SL/SR path normally outputs.
2. **Mid-point over-voltage protection:** the output end of each track is connected with a SL are respectively R119 and R120. As long as any mid-point voltage of tracks is over +3.5V or lower than -3.5V, V101 or V102 conducts to decrease their C-pole voltage, then V103 conducts to finally cut off relay to protect circuit starting.



3. Over-current and short-circuit protection: output load resistances of L- and R-track are connected with an over-current sampling triode. The sampling tube of L-track is V114 and load resistance is R126 and R127. The power amplification IC of other three tracks has functions of over-current protection. As long as over-current occurs in L-track, the voltage drop of R126 and R127 will rapidly increase. Once the voltage drop of R129 is over 0.7V, V114 will conducts, and then V103 conducts and finally relay cuts off to protect circuit starting.



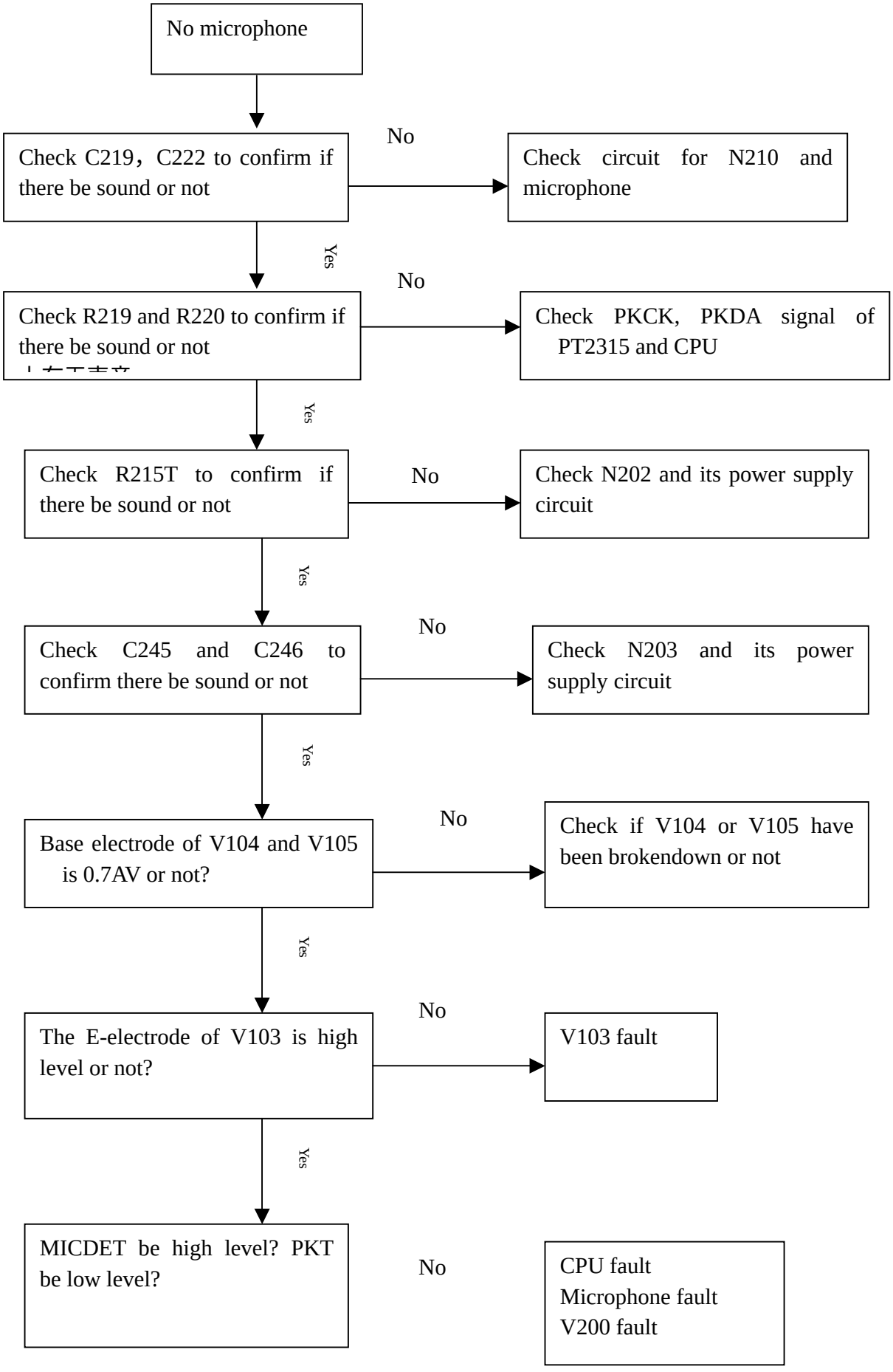
With the same manner, voltage of R159 will be over 0.7V to conduct V129, then conduct V103 and finally cut off relay to protect loudspeaker.

4. Energy-saving protection: when standby time reaches 10 minutes and still needs continuing, CPU pin 34 output PRC signal is high level which saturates and conducts V100 via VD108 and R101, then conducts V103 and finally cuts off relay to save standby energy.

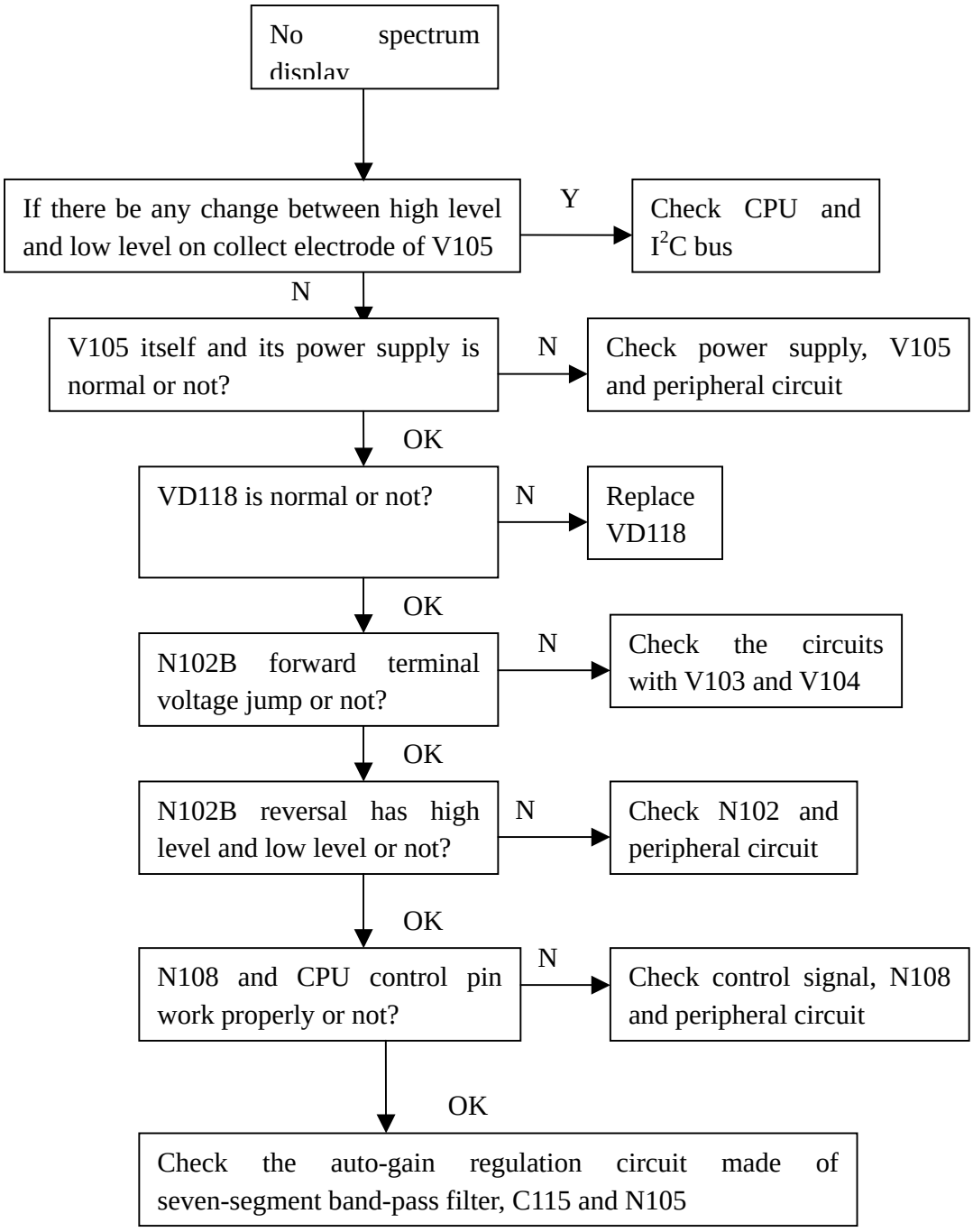
Maintenance and Repair Flow

Ⅰ. Malfunction Phenomenon： Sound fault

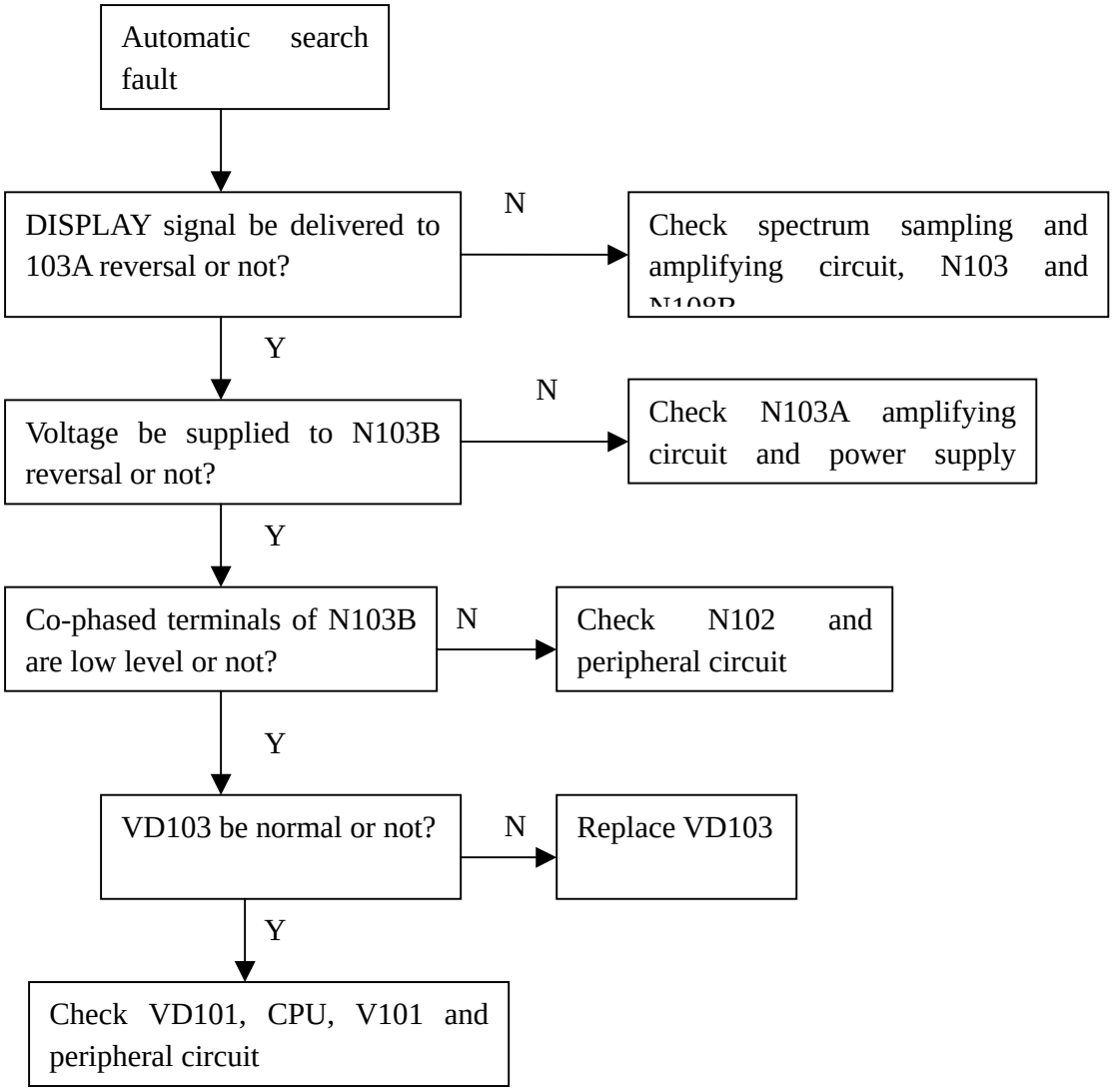
Analysis：Generally, such fault can be checked by signal injection step by step. If the speaker of any step has no disturbance, there must be problems with this step. In general, this method should be carried out from rear step to front step. Another method is signal detection, which is carried out from front step to rear step. If there be no sound with any step, this step must be the fault point. Specific examine and repair flow for this fault is showed as follows:


No microphone
Check C219，C222 to confirm if there be sound or not
No
Check circuit for N210 and microphone
Yes
Check R219 and R220 to confirm if there be sound or not
No
Check PKCK, PKDA signal of PT2315 and CPU
Yes
Check R215T to confirm if there be sound or not
No
Check N202 and its power supply circuit
Yes
Check C245 and C246 to confirm there be sound or not
No
Check N203 and its power supply circuit
Yes
Base electrode of V104 and V105 is 0.7AV or not?
No
Check if V104 or V105 have been brokendown or not
Yes
The E-electrode of V103 is high level or not?
No
V103 fault
Yes
MICDET be high level? PKT be low level?
No
CPU fault
Microphone fault
V200 fault

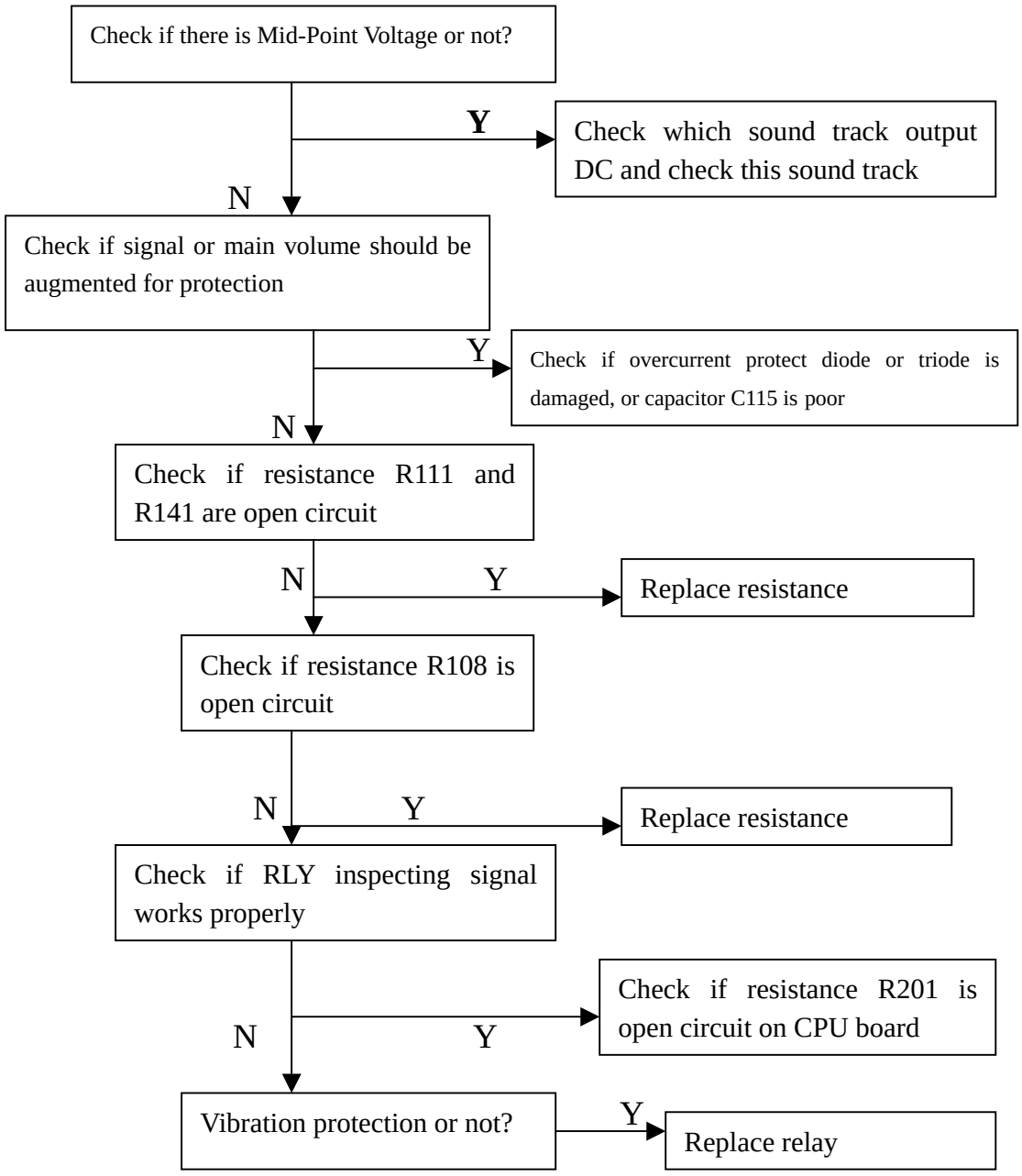
Ⅱ.Fault phenomenon: No spectrum display

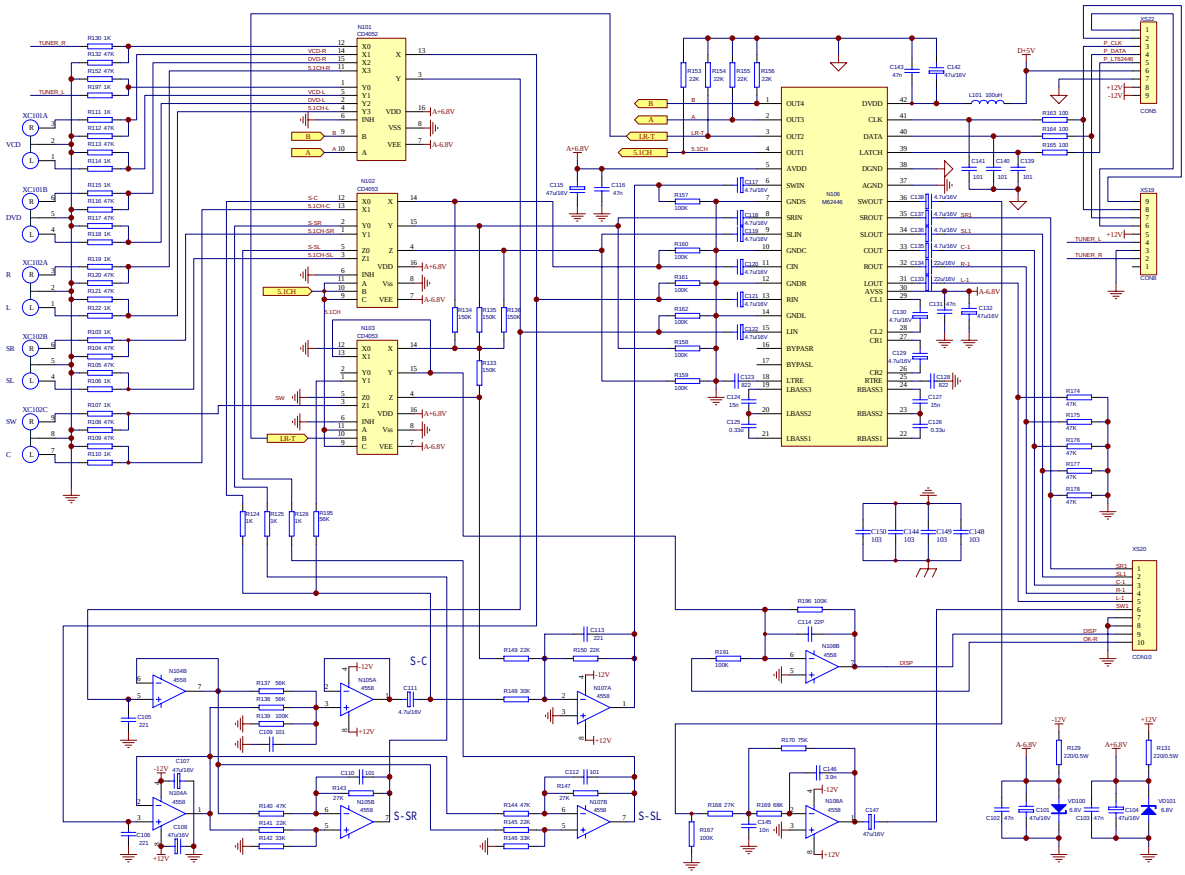


Ⅲ. Fault phenomenon：Automatic search fault

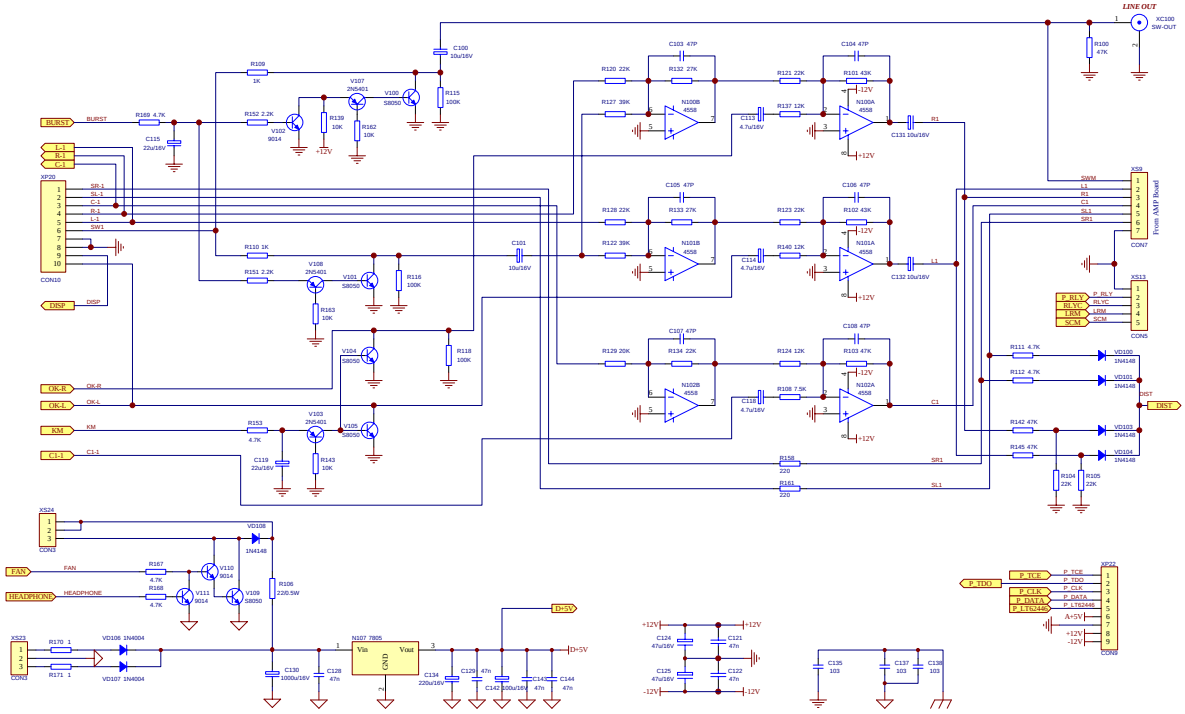


Ⅳ. Starting up protection

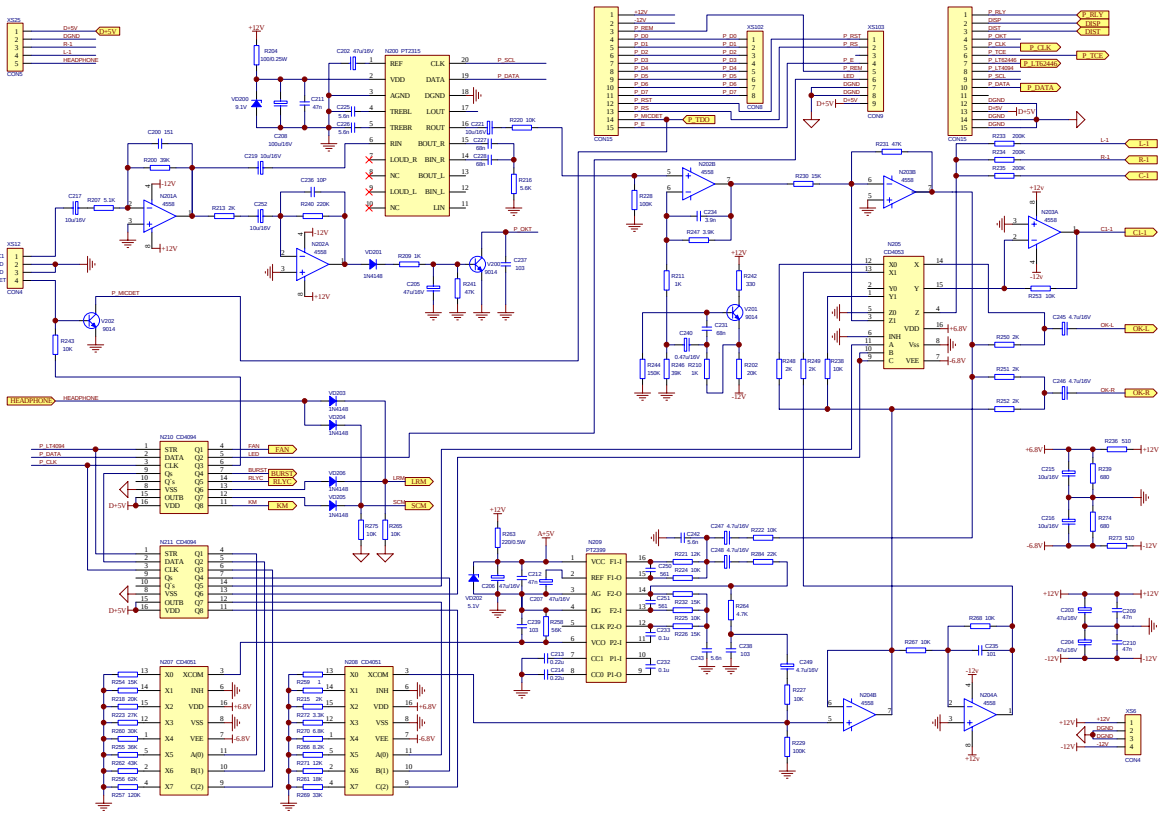




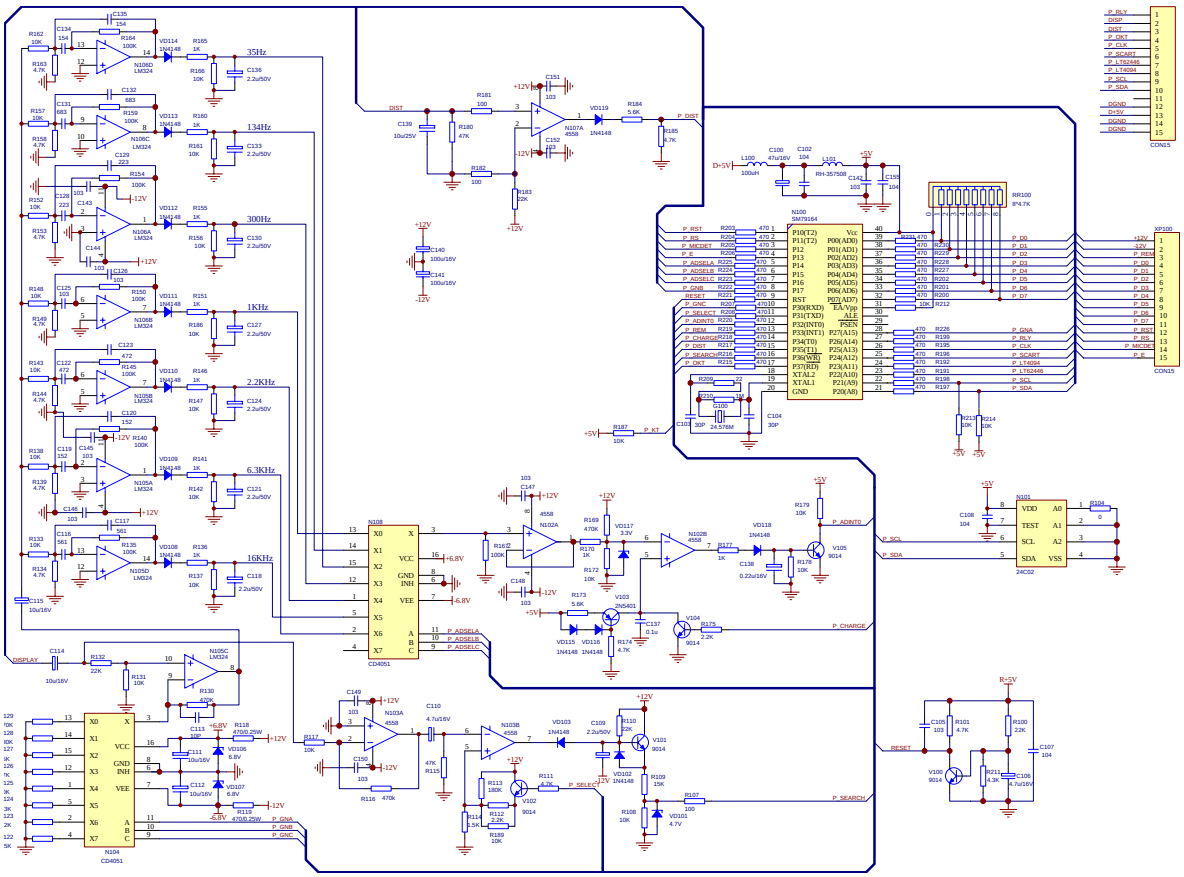
Volume Board



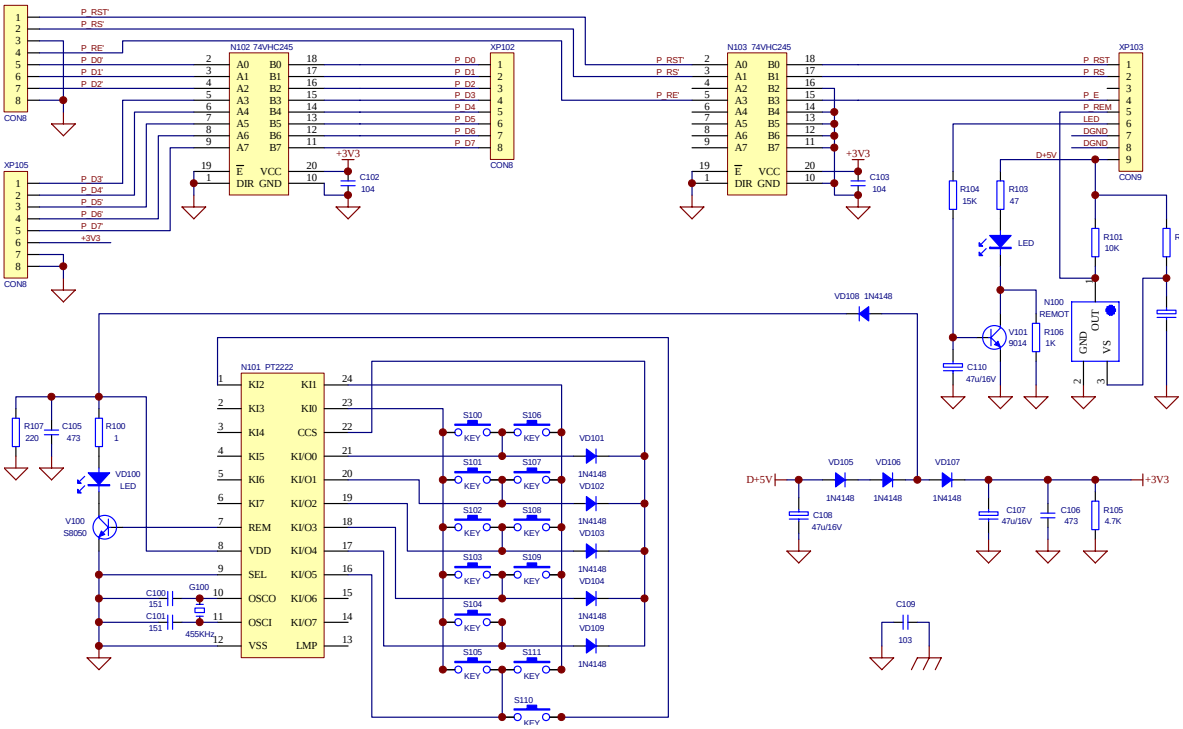
Signal Processing Board(一)



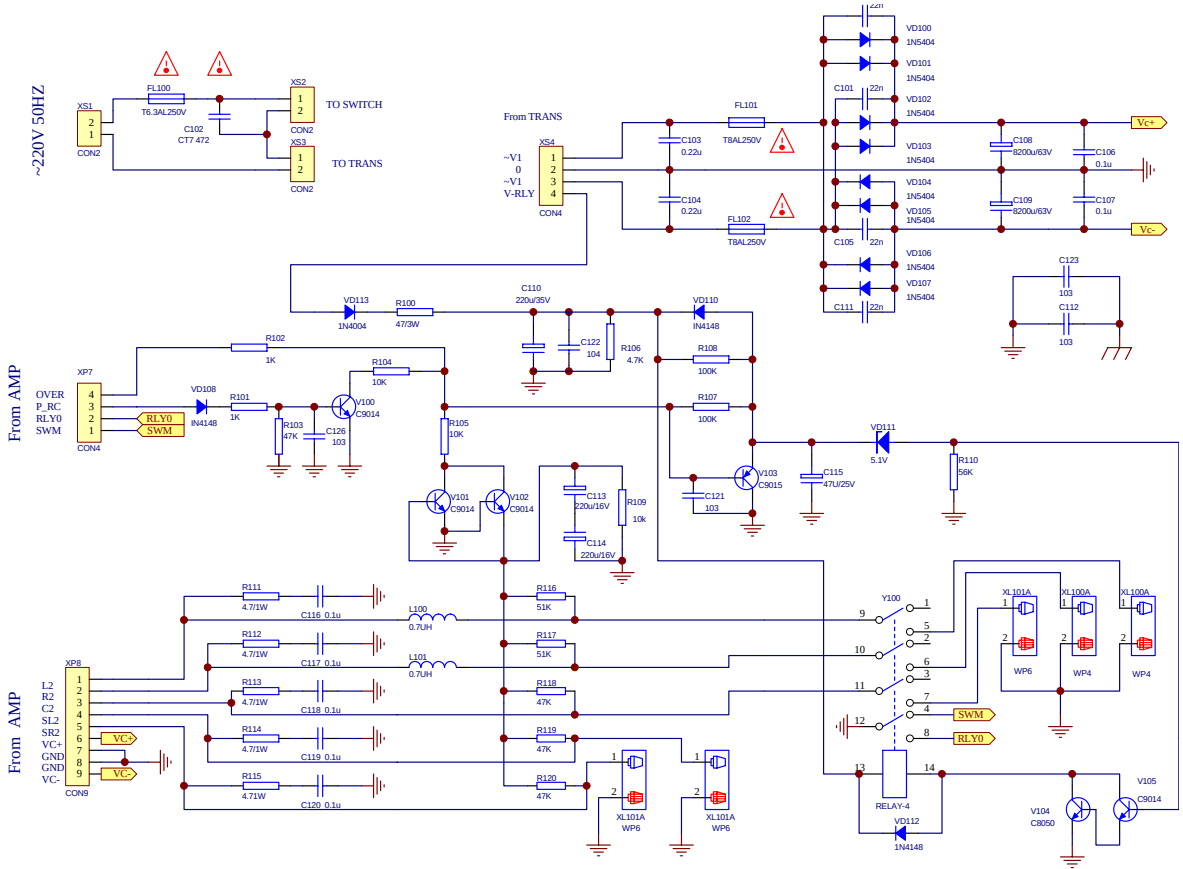
Signal Processing Board(二)



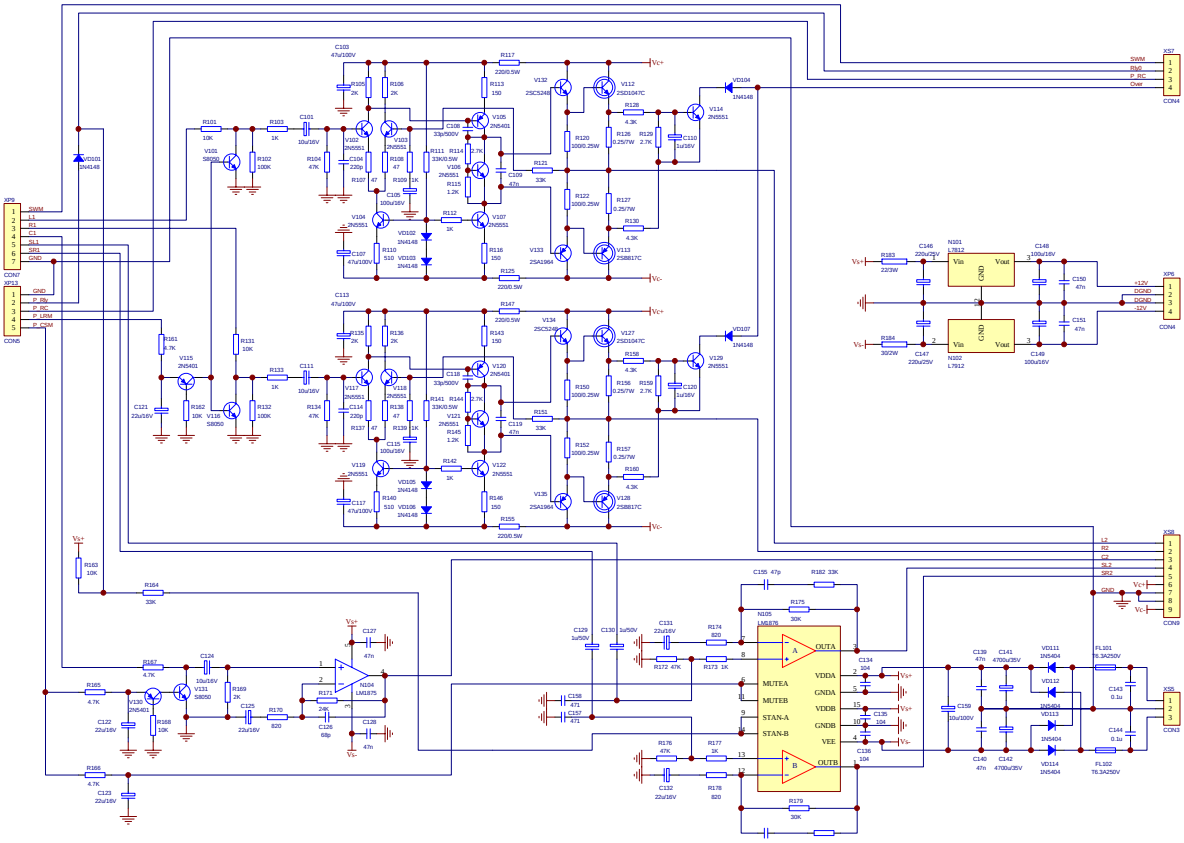
CPU Board



Control Panel



Power Board



Power-amplification Board and Protective Circuit