SANYO

PLUS N55

SANYO SUPER D NOISE REDUCTION ADAPTOR

OPERATING INSTRUCTIONS

LIMITED WARRANTY TO ORIGINAL PURCHASER

NOISE REDUCTION ADAPTOR

This Sanyo Product is warranted against manufacturing defects in materials and workmanship for the period specified:

PARTS	LABOR
2 YEARS	2 YEARS

Sanyo will repair or replace (at our option) at no charge, any part(s) found to be defective during the warranty period.
This warranty period starts on the date of purchase by the original consumer.
The warranty repairs must be performed at a Sanyo Authorized Service Station. A list of the Sanyo Authorized Service Centers can be obtained from the dealer, or from

Sanyo Electric, Inc.
1200 W. Artesia Blvd., P.O. Box 5177, Compton, CA 90220
(213) 537 – 5830

OBLIGATION OF THE ORIGINAL OWNER

1. **The dealer's original dated bill of sale must be retained as a proof of purchase and must be presented to the Sanyo Authorized Service Station.**
2. **Transportation to and from the service center is the responsibility of the customer.**

EXCLUSIONS OF THE WARRANTY

The warranty does not cover accident, misuse, fire, flood and other Acts of God, incorrect line voltage, damage caused by improper installation, labor cost of removing or reinstalling of the product for repairs, improper or unauthorized repair, cartridge and stylus, antenna, broken or marred cabinet, when applicable; 50/60 cycle/60/50 cycles conversions, missing or altered serial numbers and customer adjustments that are not covered in the instruction book. This warranty is valid only on products purchased and used in the United States of America.

EFFECTIVE JULY 4, 1975

MARCH 1976

ATTENTION

For your protection in the event of theft or loss of this product, please fill in the information requested below which is for your own personal records.

Model No. _____ Serial No. _____
(Located on back or bottom side of unit)

Date of Purchase _____ Purchased Price _____

Where Purchase _____

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

PREPARATION FOR USE

PLACE FOR INSTALLATION

Install your PLUS N55 noise reduction adaptor at a proper place of installation. Avoid a place where:

* It is exposed to direct sunlight or heat from a stove and other heating appliances;
* Humidity and dust pose problems; and
* Poor ventilation impedes dissipation of heat from the PLUS N55 chassis.

POWER SUPPLY

* Connect your PLUS N55 to an AC120V 60Hz household power outlet.
* Plug the power cord securely into an AC wall outlet.
* Hold the power cord by the plug when unplugging it. (Do not pull on the power cord.)
* Do NOT touch the power cord with a wet hand.

SAFETY PRECAUTIONS

* Do NOT disassemble or modify your PLUS N55 unit. We shall not be held responsible for trouble and hazards accruing from such an attempt.
* Should water be spilled over your PLUS N55 unit by accident, unplug the power cord immediately and contact your nearest SANYO service center or the store of purchase for advice. This is necessary to prevent hazards due to short-circuits and power leakage.
* A clip, a hair-pin or any other metal piece may become a cause of trouble if it falls into the PLUS N55 cabinet. Due caution is required.

PROTECTION AGAINST SHOCK NOISE

* Be sure to switch off all the system components when connecting or reconnecting your PLUS N55 unit to the system amplifier or tape deck. This precaution is necessary to protect the speakers from destruction due to shock noise caused by a surge current.
* Prior to switching on and off your PLUS N55 unit, turn the volume controls of the system amplifier to the minimum settings. If not, shock noise may come out. (This should not be construed as an indication of trouble.)
* Turn the volume controls of the system amplifier to the minimum positions before plugging or unplugging the power cord of the system amplifier or tape deck. Shock noise can be prevented by taking this precaution.

MAINTENANCE

CLEANING

When dusty, wipe the front panel and cabinet of your PLUS N55 unit clean with soft dry cloth.
Remove stains, if any, with soft cloth soaked in water mixed with a small amount of synthetic detergent, and wrung dry.

Do NOT use benzene, solvent and other volatile liquids or chemicals, or cabinet surfaces may be discolored. Do NOT spray insecticide on the PLUS N55 cabinet.

SUPER D – THEORY OF OPERATION

Cassette tape decks are popularly used today among audiophiles for sound recording and reproduction. Despite their many excellent performance characteristics, there are some problems which have remained unsolved. Of these, the most notable one derives from the slow tape speed and the narrow sound tracks, which make it difficult to tape-record and play back record music, FM broadcasts, live performance and sound existing in the natural world with a superb SN ratio and without sound distortion over a wide dynamic range by cutting noise at the small sound level and by eliminating distortion due to saturation at the large sound end.
By the combined application of the level compression-expansion techniques and the newly developed complementary band divider, the SUPER D system of SANYO compresses (encodes) sound signals in the recording process and restores them to their original condition by expanding (decoding) them in the playback process. This is, accordingly, a kind of the compander system. (See Fig. 10 on page 7) Fig. 11 on page 7 shows the circuit block diagrams of the SUPER D unit in the recording (compression) mode, left, and in the playback (expansion) mode, right.

The SANYO SUPER D (model PLUS N55) unit, when adopted, expands the dynamic range of a cassette tape deck approximately 100 times (by about +40 dB) wider than when it is not in use. At the same time, noise can be reduced to about 1/100 (by about –40 dB). Thus, clear high-fidelity sound can be reproduced over a very wide dynamic range. Meanwhile, the breathing phenomenon (i.e. noise fluctuations due to changes in signal level) in the actual application of the SUPER D system has been reduced to an imperceptible level by incorporating into it a complementary band divider.
Continued on page 7 and 8 in detail.

CONTROLS

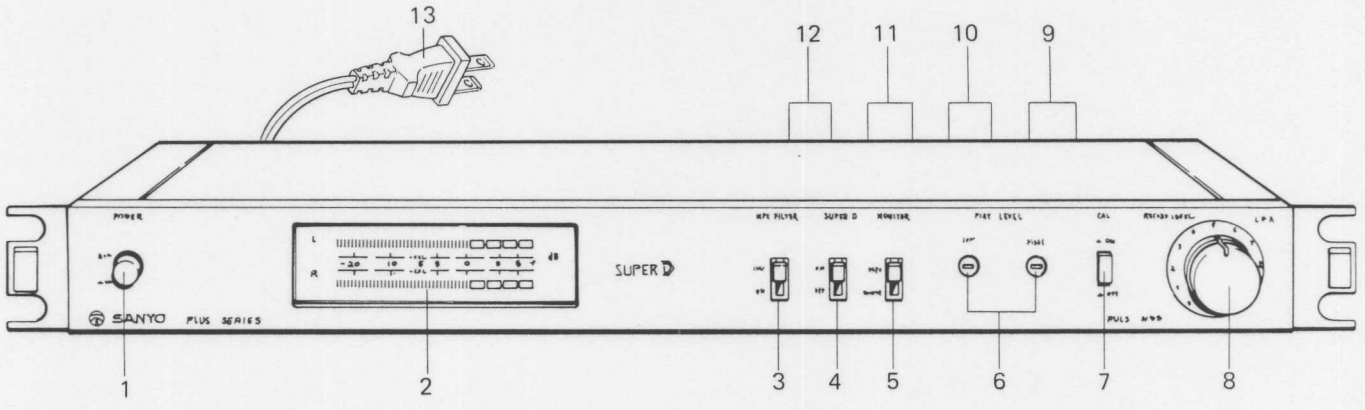


Fig. 1

1. POWER switch
   When this ON/OFF switch is pushed, power is switched on. When pushed for the second time, it pops out and power is switched off. The FL display level meter lights up when power is on.
2. FL-display level meter
   The peak levels of input and output levels (i.e. signals before encoding and after decoding) indicate on the display.
3. MPX FILTER switch
   Set this switch to ON, when an FM broadcast it to be recorded. In turn, 19kHz multiplex signals are cut off and operating errors of the PLUS N55 SUPER D unit are therefore prevented.
4. SUPER D switch
   With this switch set to ON, when music is being recorded in and played back through the PLUS N55 SUPER D unit. At the OFF position the SUPER D circuitry is off.
5. MONITOR switch
   When the tape deck being used has three heads or a monitoring feature, this switch enables the monitoring of the taped sound. Set the switch to "tape", and the speakers will deliver decoded sound. Set it to "source", the unencoded sound will come out. Instant sound comparison is possible by flipping the switch lever from one position to another.
6. PLAY LEVEL controls
   These controls are provided for the calibration of playback sound. Turn the "left" and "right" PLAY LEVEL controls with a screwdriver supplied from SANYO.
7. CAL (calibration) switch
   Set this switch to ON prior to doing calibration and the built-in oscillator (1kHz) will also be switched on.
8. RECORD LEVEL controls
   These are the controls for regulating recording levels. The outer knob is for the L (left) channel and the inner knob for the R (right) channel.
9. ENCODE IN (TAPE REC) jacks (Rear side)
   These are the jacks for signal input to the encoder. Therefore connect them to the REC (recording) output jacks of the receiver/amplifier system to be used.
10. DECODE (TAPE PLAY) jacks (Rear side)
    These are the jacks for signal output from the decoder. Therefore connect them to the tape PLAY (playback) input jacks of the receiver/amplifier system to be used.
11. ENCODE OUT (LINE IN) jacks (Rear side)
    These are the jacks for signal output from the encoder. Therefore connect them to the REC (recording) or LINE IN (input) jack of the tape deck to be used.
12. DECODE IN (LINE OUT) jacks (Rear side)
    These are the jacks for signal input to the decoder. Therefore connect them to the PLAY or LINE OUT (output) jacks of the tape deck to be used.
13. Power cord (Rear side)
    For plugging into a household AC 120V 60Hz outlet.

CONNECTIONS

NOTE: * Do not plug the power cord into a household power outlet until after all connections have been made.

* Make correct connections, paying due attention to the R (right) and L (left) channels, and plug the cords securely into the jacks. Incorrect or loose connections may become the cause of sound reproduction failure or noise.
* Do not pull on the cord but hold it by the plug when disconnecting it.

Example arrangement, using PLUS N55 SUPER D and cassette deck (optional)

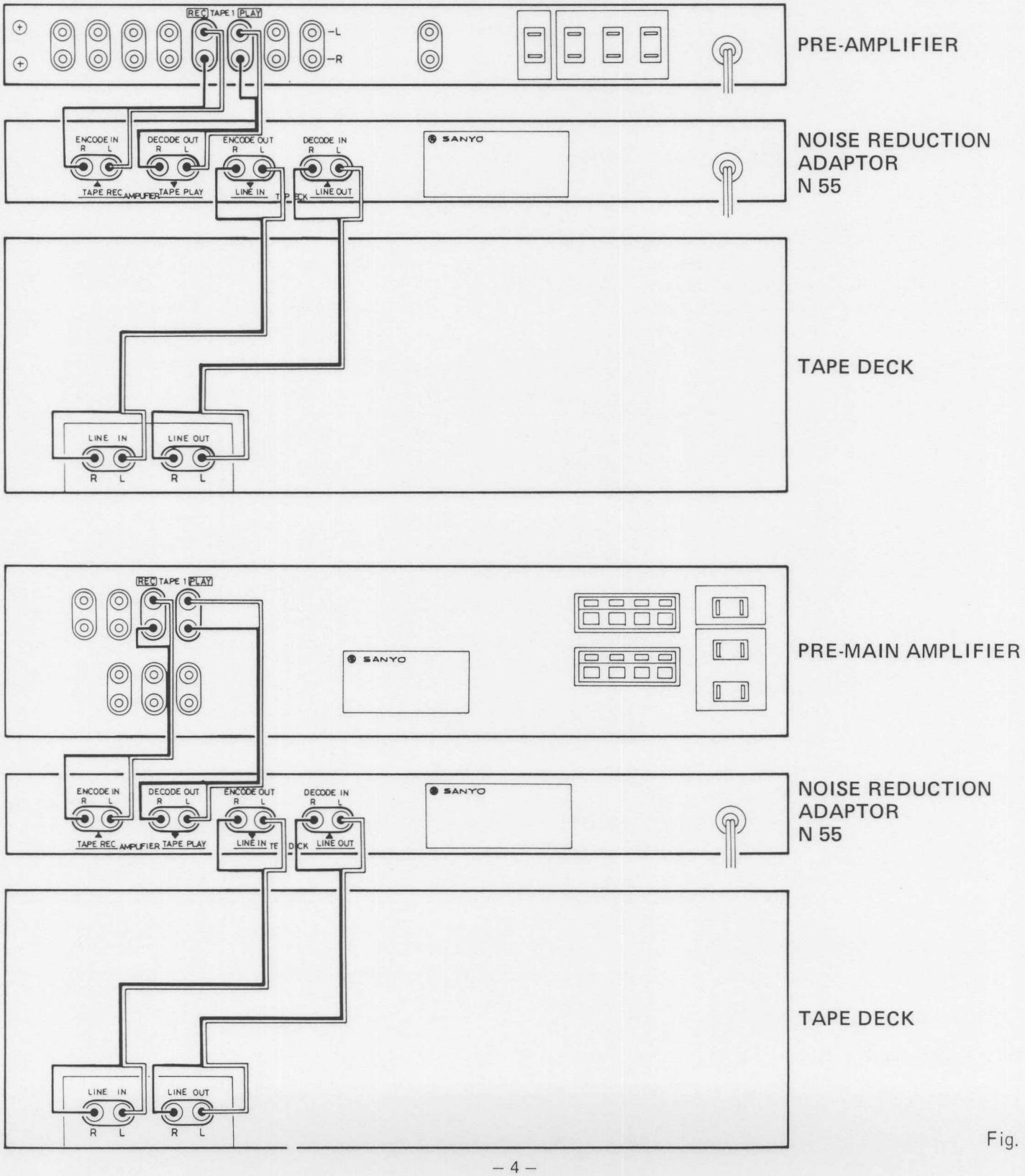


Fig. 2

CALIBRATION

Calibration is the process of making it easy to match the reference levels for encoding (recording) and decoding (playback) between the SUPER D unit and the tape deck system.
First, connect the system components as illustrated on pages 4. Then, do as instructed below.

1. Be sure to turn the volume controls of the system amplifier to the minimum settings prior to doing calibration work.
   This precaution is required to provide the speakers which are hooked to the amplifier from destruction that may be caused by the input of 1kHz calibration signals.
2. Switch on power by pushing the POWER switch, and the scales inside the FL display meter will light up.

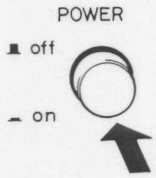


Fig. 3

3. Set the SUPER D and MONITOR switches, both on the front panel of the SUPER D unit, to "on" and "source" positions respectively. After this, set the CAL (calibration) switch, also on the SUPER D unit, to "on". This done, the readings of the FL display level meter will be "–5dB" (i.e. reference levels) for both the L (left) and R (right) channels.

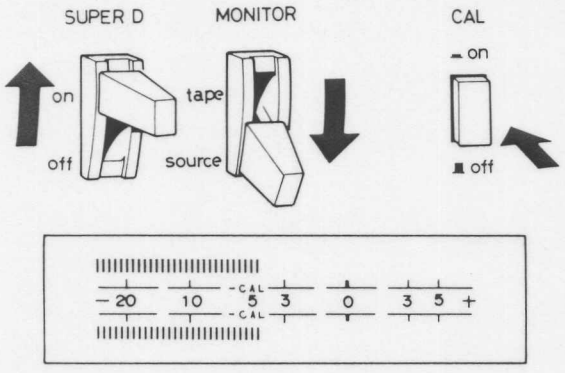


Fig. 4

4. Set the system tape deck in the recording mode by depressing the RECORD, PLAY and PAUSE buttons. Turn the INPUT (recording) LEVEL controls on the front panel of the system tape deck and set the readings of the level meter to "–5" for both the L (left) and R (right) channels.

NOTE: In case the readings of the level meter on the system tape deck fail to reach "–5", turn the INPUT LEVEL controls to the maximum settings.

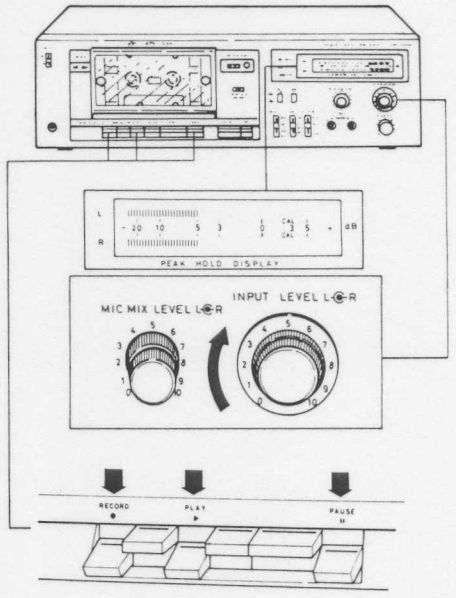
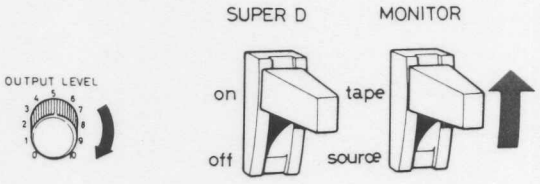


Fig. 5

5. Push and release the PAUSE button, and record about 10 seconds.
6. Rewind the tape to the original position after 10 seconds of recording.
7. If the tape deck is provided with an OUTPUT LEVEL control, turn it to the maximum position.
   Set the MONITOR switch to "tape" from "source".



(When PLUS D60 is in use)

Fig. 6

8. Set the system tape deck in the PLAY mode. While reproducing the sound recorded as in Step 5, turn the PLAY LEVEL calibration controls, marked "left" and "right", on the SUPER D unit until the FL display level meter readings for the left (L) and right (R) channels hit "–5" dB.

NOTE: Once the calibration controls have been set, their readjustment is unnecessary as long as the same system tape deck is in use.

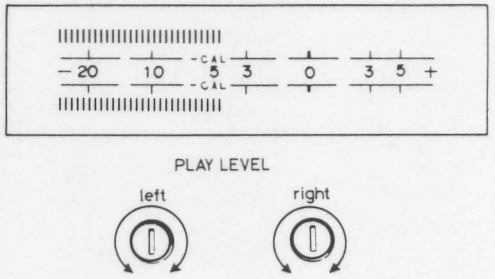


Fig. 7

Use the screwdriver supplied with the SUPER D unit when making calibration adjustment. The PLAY LEVEL calibration controls turn about 300 degrees.

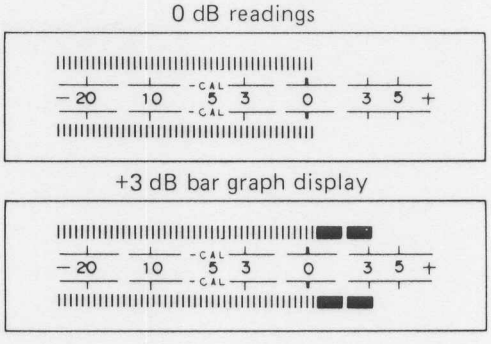
9. Set the CAL (calibration) switch on the SUPER D unit to the "off" position at the end of the calibration process.

Fig. 8

CONTROLLING RECORDING LEVELS

The RECORD LEVEL controls are located on the front panel of the SUPER D unit for regulating the recording levels of the L (left) and R (right) channels. The appropriate recording levels are about "0" dB on the FL display level meter, also located on the front panel of the SUPER D unit. Be sure that momentary large inputs do not exceed "+3" dB. They will be indicated by the flashing of the indicators above and below the "+3" mark.

This level meter indicates signal peaks and responds faithfully and without fail to momentary signals with high pulse contents, a feature not possessed by conventional VU meters with pointers.



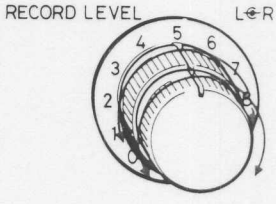


Fig. 9

IMPORTANT

1. **Do not turn the recording level controls of the system tape deck after finishing with calibration or it will become necessary to do it all over again.**
2. Encoded (compressed) signals are delivered through the headphones hooked to the system tape deck. Proper sound monitoring is possible by setting the MONITOR switch of the system amplifier to SOURCE or TAPE.
3. Readings of the level meters on the system tape deck indicate the levels of encoded (compressed) signals when the SUPER D unit is in use. If the tape deck is provided with the VU meters or the meters which are slow in response speed, the swing motions of their needles may be small. A sufficient S/N ratio can, however, be obtained.
4. A very large sound may come out at the moment of setting the SUPER D switch from "on" to "off" while playing back recordings on the system tape deck with three heads. This should not be interpreted as an indication of trouble, but is due to the momentary reproduction of the encoded signals that have been left undecoded.
5. Be sure to set the SUPER D switch to "on" prior to playing back any of the tapes recorded through the SUPER D unit. Set it to "off" when playing those tapes whose recordings were made with the SUPER D switch at the "off" setting.
6. When a Dolby tape deck is to be used for recording sound in combination with the SUPER D unit, be sure to set the Dolby switch is OFF.
7. Set the SUPER D switch to "off" and the RECORD LEVEL controls to "0" before erasing taped sound.
8. Noise components will also be encoded when the SUPER D unit is in use for recording source sound high in noise level. Accordingly, Automatic Search if deck is so equipped may fail to function properly during playback, in case the system tape deck is provided with such a mechanism.

USEFUL HINTS

1. Prior to recording an FM broadcast, set the MPX FILTER switch to "on". This will help prevent the operating errors of the SUPER D unit by cutting off 19kHz MPX signals.
2. Tape-record 5cm/sec. horizontal test signals when a test record is available or 50% modulation signals when a tuner with a built-in air check signal generator is in used. Appropriate recording levels can be obtained by adjusting the readings of the FL display level meter of the SUPER D unit to −5dB or thereabout.

RECORDING

After finishing with calibration and the selection of recording levels, set the system tape deck in the recording mode. Then, music will be recorded.

PLAYBACK

Set the system tape deck in the playback mode. During playback, be sure to use the sound controls of the system amplifier, instead of the output controls of the system tape deck, for regulating the playback sound levels.

In the play mode, the MONITOR switch of the SUPER D unit has to be set to the "tape" position.

BYPASSING SUPER D UNIT

When it is desired to bypass the SUPER D unit, either in the recording or play mode, without disconnecting it, set the SUPER D switch to "off". Then, the SUPER D circuitry will remain cut off.

After finishing with calibration, recording and playback on the system tape deck can be monitored by watching the FL display level meter of the SUPER D unit. To do this, go through the following steps.

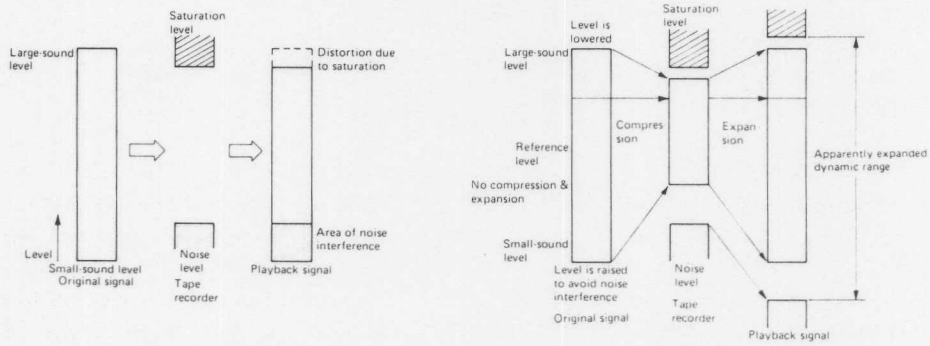
1. Set the POWER switch to "on".
2. Set the SUPER D switch to "off".
3. Set the CAL switch to "off".
4. Regulate the recording levels by turning the RECORD LEVEL controls.

NOTE: 1. Even when the POWER switch is set to "off", regulation of the recording levels is possible by turning the RECORD LEVEL controls. Watching the level meters of the tape deck is posible because the FL display level meter will be out of operation.

2. The SUPER D unit is a device designed to reduce hissing and other noise components which occur during the tape recording and playback processes, and does not reduce noise contained in signal input. It is recommended, therefore, that a high-quality sound source be used to obtain the most satisfactory result from the use of the SUPER D unit.

SUPER D – Theory of Operation

Circuit block diagram



Ordinary recording & playback

Recording & playback with compander

Fig. 10

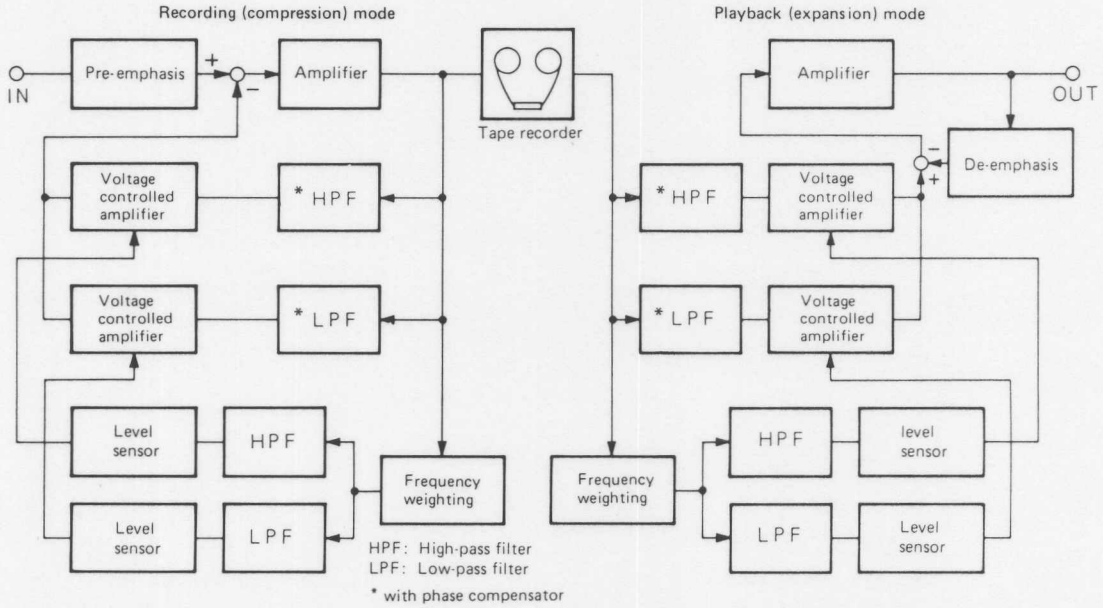


Fig. 11

Effects Obtained by Expending Dynamic Range

The dynamic range of a tape deck is determined by its noise and saturation levels. The SUPER D unit, when adopted, raises the saturation level and lowers the noise level over the entire band width. Hence, the dynamic range of the typical cassette tape recorder is expanded to about 100dB, when the SUPER D unit is adopted, from about 60dB, which is normal when it is not in use. This means an improvement of approximately 40dB (=100 times) in performance, giving the cassette tape deck a dynamic range even wider than those of expensive reel-to-reel tape decks.

Noise Reduction

The SUPER D unit achieves an improvement of 35 ~ 40dB in SN ratio, which is regarded as epoch-making. Consequently, hissing noise is eliminated to an almost imperceptible level.

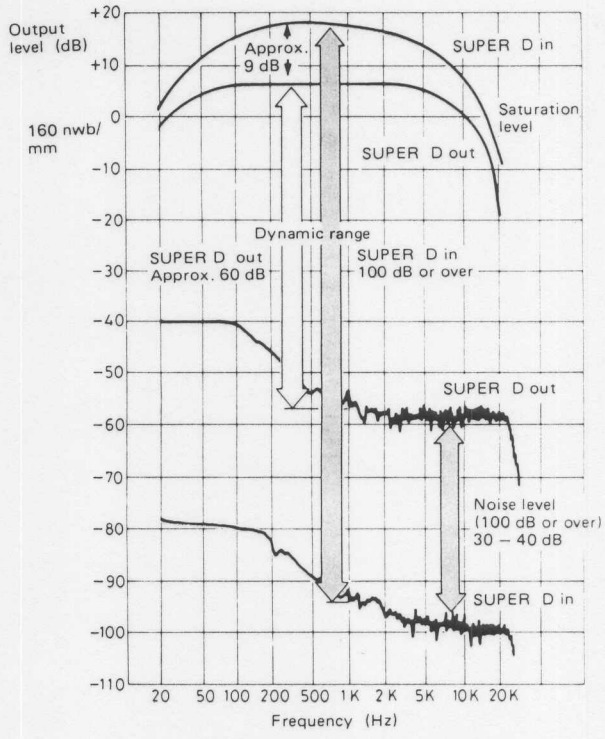


Fig. 12

Reduction of Breathing Phenomenon

The complementary band divider incorporated into the SUPER D unit makes it possible to effect compression and expansion of signals under optimum conditions within respective band widths. Thus, the breathing phenomenon itself is reduced and noise within respective band widths is lessened to an inaudible level as it is covered by signal sound.

Compansion Characteristics

Level-matching is easy in both the recording and playback modes and compansion characteristics stay constant at any level. Accordingly, original sound is reproduced with high-fidelity even when recording and playback levels differ from each other.

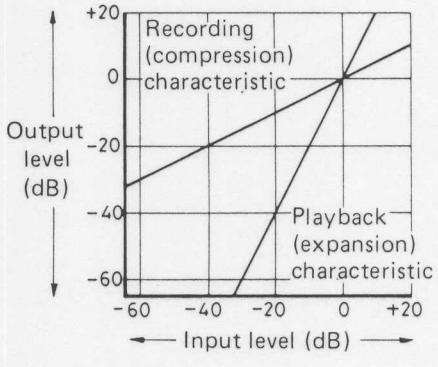


Fig. 13

SPECIFICATIONS

Systems	Level compansion & complementary band division
Compansion rates	Compression rate: 1/2 Expansion rate: 2/1
SN ratio improvement	35~40dB (concerning tape decks with SN ration of 50dB or more)
Distortion rate	0.08% (reference input level: 1kHz)
No. of channels	4 (2 recording and 2 playback channels)
Input impedance/ sensitivity	LINE IN: 50KΩ/100mV PB (playback) OUT: 50kΩ/85mV
Output impedance/level	LINE OUT: 7KΩ or lower/0.53V (at 50KΩ load) REC OUT: 7KΩ or lower/80mV (at 50KΩ load)
Frequency response	10Hz - 30kHz (during encoding & decoding processes)
Power supply	AC 120V 60Hz
Power consumption	12W
Outside dimensions	17 5/16"(W) x 11 3/4"(D) x 1 3/4"(H) (440 x 297 x 45 mm Incl. knobs) (Incl. knobs & feet)
Weight	9.5 lbs (4.3 kg)
Accessories	Screwdriver for adjustment x 1 Patch cord (pin plug – pin plug) x 2 Rack handles x 2

* The specifications and design change without notice.

RACK INSTALLATION

This unit is specially designed to install into the EIA Standard Rack with other audio components. Fig. 14 shows an example of use with SANYO PLUS SERIES audio components.
We include mounting hardware as follows:

* Rack Handle .....2 pcs

NOTE: Generally, audio components may be adversely affect each other by noise, hum, heat, etc. generated from them selves.
To minimize above mentioned problems and obtain best performance from SANYO PLUS SERIES components we recommend you to stack them in the order as the follows in Fig. 14.

Installation Procedure (See Fig. 14)

1. Remove 4 rubber foots from the bottom cabinet.
2. Remove 2 Flat Head Screws from the both side panels.
3. Install 2 Rack Handles onto the both side panels, using 4 screws(both side) removed from the unit.
4. Using the 2 Rack Handles as templates, choose 4 mounting holes to be used on the rack.
5. Install the whole unit into the rack, using 4 bolts provided with an EIA Standard Rack.

To purchase an EIA Standard SANYO AR SERIES Rack, ask your SANYO dealer or local electronics store.

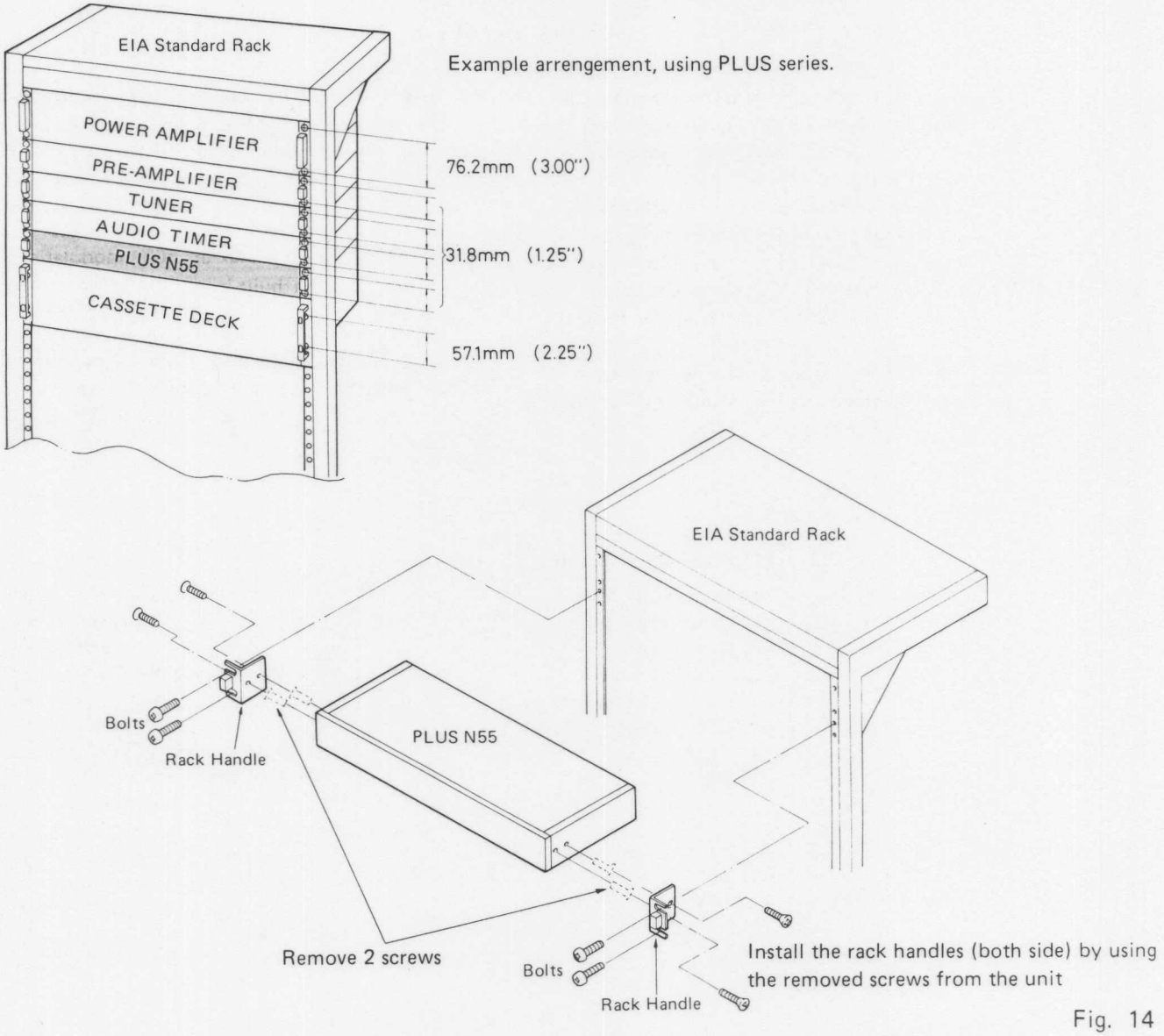


Fig. 14

SANYO ELECTRIC INC.
1200 W. ARTESIA BLVD.
P. O. BOX 5177
COMPTON, CA 90220

Printed in Japan
141-6-410T33600A

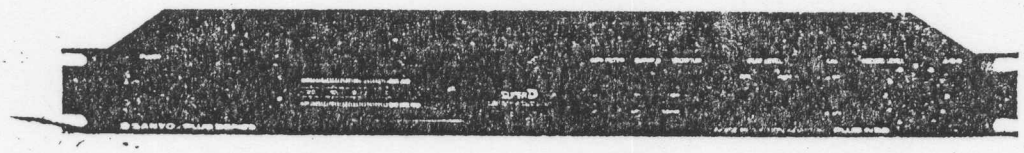
SERVICE MANUAL

SANYO

NOISE REDUCTION SYSTEM

PLUS N55

(U.S.A.)



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Weight	9.5 lbs (4.3 kg)
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MODIFICATION NOTICE

NOISE REDUCTION SYSTEM

SANYO

PLUS N55 (USA)

Date Feb. 12, 1980 Issued by

The following corrections should be made in the SERVICE MANUALS and PARTS (PRICE) LIST.

		Section	Key No.	Part No.	Description	Q'ty	Remark	Reason
1	From	DC Power PCB Assy	IC301		IC TA78018	1		E
	To				Not used			
2	From	"	Q309		Transistor 2SD333	1		E
	To		Q309		" 2SD330	1		
3	From							
	To							

INTERCHANGEABLE NOT INTERCHANGEABLE	Serial No. Chassis No.	Effective from
Q'ty of initial production before modification.	Identification of modified unit.	

REASON FOR MODIFICATION

A ..... Standardization
B ..... Change of materials
C ..... Improvement of reliability
D ..... Improvement of performance
E ..... Miss print
F ..... Miss register
G .....

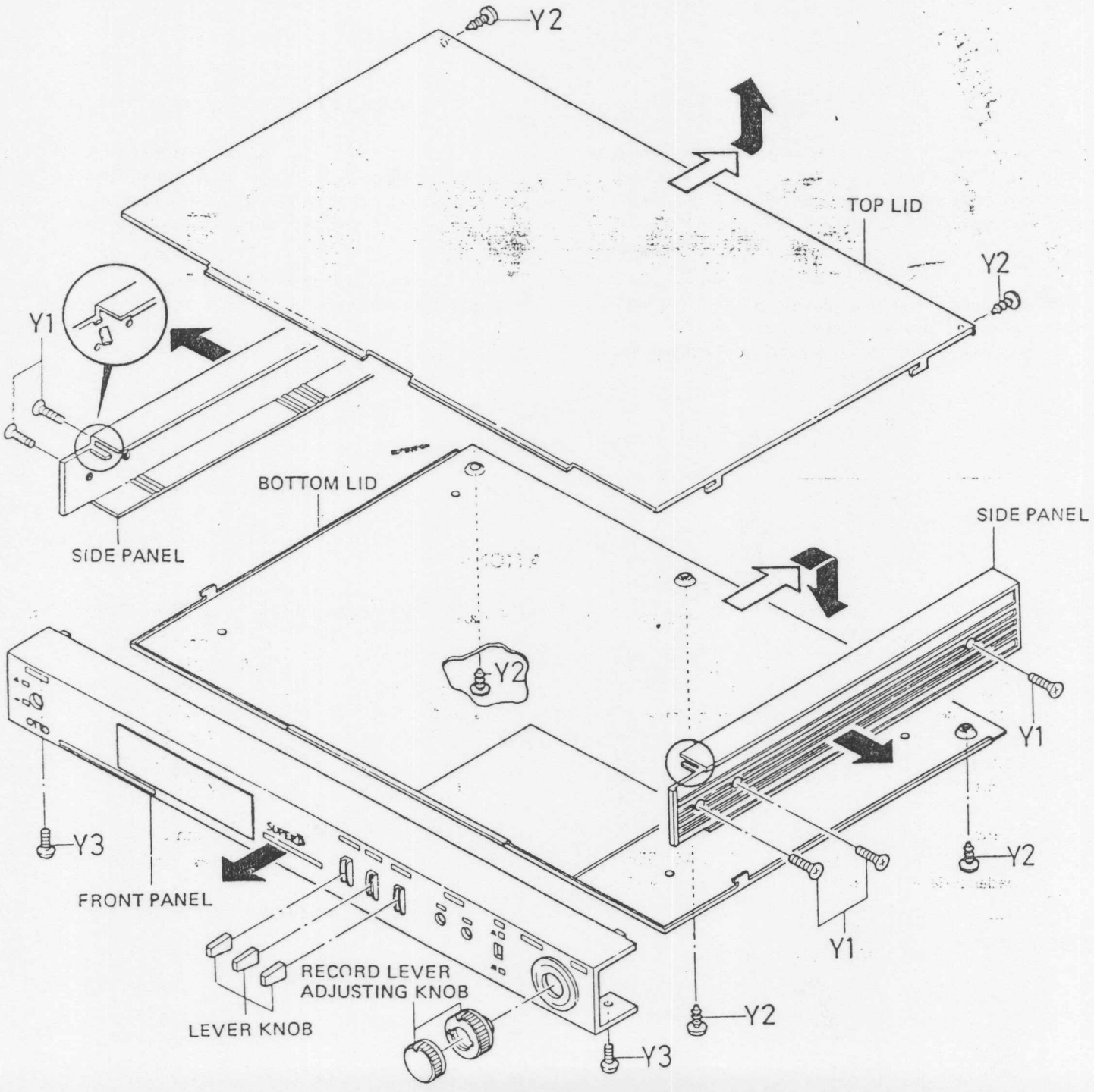
Printed in Japan 7000

SANYO ELECTRIC TRADING CO., LTD.
OSAKA, JAPAN

WM- 4702

REMOVAL OF CABINET AND CHASSIS

1. **Removing the side panels**
   Take out 6 screws Y1 (flat head, 4 x 10mm) from right and left side panels, and dismount the panels gradually, using care not to break the pawl part (encircled part).
2. **Removing the top lid**
   Take out 2 screws Y2 (binding head tapping, 3 x 6mm) from the top lid, slide the lid rearward about 1cm, and pull it off upwards.
3. **Removing the front panel**
   Take out 3 lever knobs, 2 RECORD LEVEL adjusting knobs, and 2 screws Y3 (pan head, 3 x 6mm) from the front side of the head, then the panel can be dismounted forward.
4. **Removing the bottom lid**
   Take out 3 screws Y2 (binding head tapping, 3 x 6mm) from the bottom lid, and remove the bottom lid downward while sliding it about 5mm rearward.



Outline

When recording input signals having a wide dynamic range into a cassette tape recorder, the upper limit of dynamic range of tape recorder is limited by the tape saturation level and the lower limit by the tape hiss noise level, as shown in Fig. 1, and the recording is disturbed by distortion when the signal is large or by noise when the signal is small.

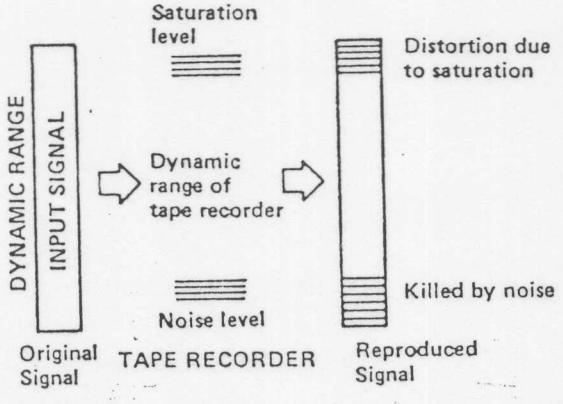


Fig. 1- Normal record and playback.

In order to solve this problem, various noise reduction methods have been developed conventionally, and saturation distortion has been improved owing to the dynamic range expanded by the reduction of hiss noise.

Among the methods to perform complementary signal compression and expansion in record and playback for noise reduction purpose, there is a method to use an encoder (a compressor) to compress signals to high level when recording and a decoder (an expander) to expand signals when playing back to return to the original level so as to reduce the noise existing between them. This is generally called a "compander." (See Fig. 2.)

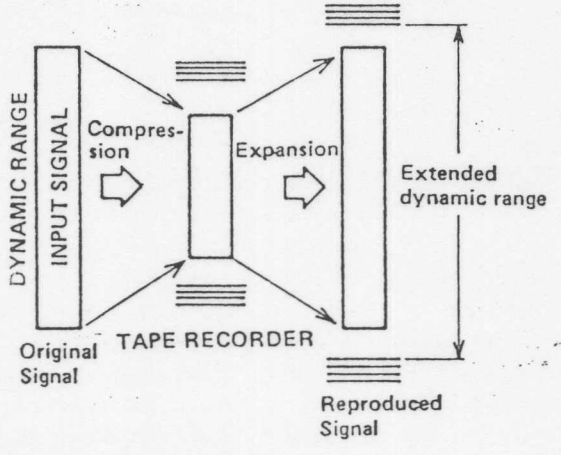


Fig. 2- Record and playback by compression and expansion.

However, the conventional companders have not been satisfactory with respect to the fidelity. Recently, thanks to the progress of semiconductor technology including ICs, the fidelity has been greatly improved.

The "Super D" method is a new circuit method intended to compress and expand in two divisions: medium-low band, and medium-high band.

Compander

The basic constitution of the compander is shown in Fig. 3. Both the compressor and the expander are composed of variable gain amplifier and signal level detector (or level sensor).

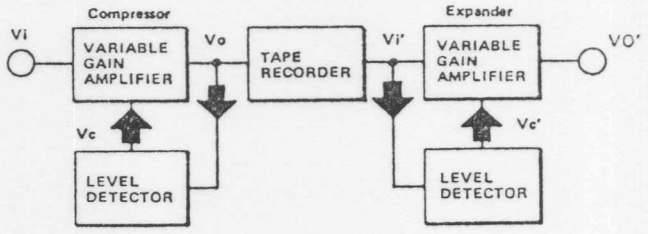


Fig. 3

Fig. 3- Basic constitution of compander.

The level sensor detects the level of signal and applies control signal according to the detected level to the variable gain amplifier.

The variable gain amplifier, responding to the control signal sent from the level sensor, changes the gain, and controls the amplitude of the signal.

Working in this principle, the compander is capable of improving the S/N ratio (expanding the dynamic range). That is, when the original signal at S dB level is fed to the compressor, the signal passes through the variable gain amplifier, and its output is supplied into the level sensor. Suppose the compression/expansion ratio of the compander is 2 : 1, the original signal level S dB appears to be raised to S/2 dB because the variable gain amplifier increases the gain by S/2 dB, and, as a result, the level is compressed. The signal of S/2 dB level is recorded into tape recorder and played back. At this time, the S/N ratio becomes N dB – S/2 dB.

This playback signal is fed into the variable gain amplifier of the expander and is simultaneously supplied into the level sensor.

Since the variable gain amplifier reduces the S/2 dB gain in response to the control signal from the level sensor, the playback signal level is expanded to S dB to be delivered. At this time, the level of hiss noise changes from N dB to N dB + S/2 dB, so that S/N ratio improvement of S/2 dB is realized.

Or, when the signal level is higher than the reference level, the variable gain amplifier of the compressor reduces the gain while the variable gain amplifier of the expander increases the gain, thus performing compression and expansion. Therefore, the dynamic range above the reference level can be extended.

However, even if the dynamic range above the reference level appears to be extended, saturation distortion may be caused when the tape recording level is high. Hence, it is an effective way of using the noise reduction system to record at a slightly lower level than usual, by making use of the dynamic range improved by the noise reduction effect.

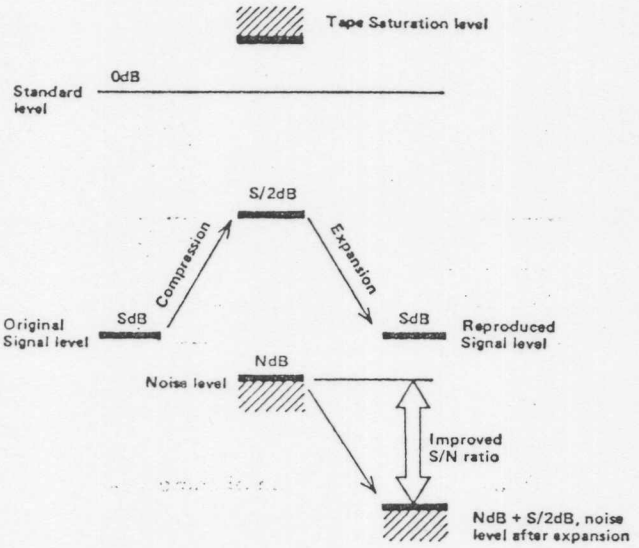


Fig. 4- Improvement of S/N ratio.

Breathing

Generally, the larger the compression/expansion ratio of the compander, the greater becomes the improvement of S/N ratio. However, as shown in Fig. 5, when the signal level changes, the gain of the variable gain amplifier varies accordingly. Besides, as shown in Fig. 4, the noise level also changes, and the noise changes as in Fig. 5

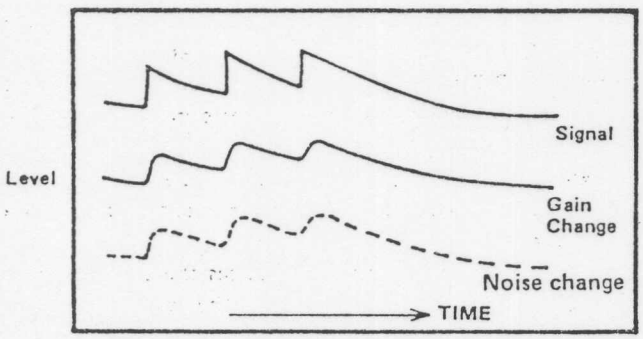


Fig. 5- Breathing.

On the other hand, the human ear is sensitive to "noisiness" at higher frequency, and the noise in the vicinity of high signal level tends not to be felt by masking effect. Therefore, in signals of large amplitude having relatively rapid attenuation of reverberation and harmonics, and which are remote from the frequency range of tape hiss noise, the change of noise becomes obvious as the gain of variable gain amplifier changes, and a "breathing" sound is heard. (This phenomenon, called "breathings", is inevitable for the compander, but is improved to practical level by some means or other.

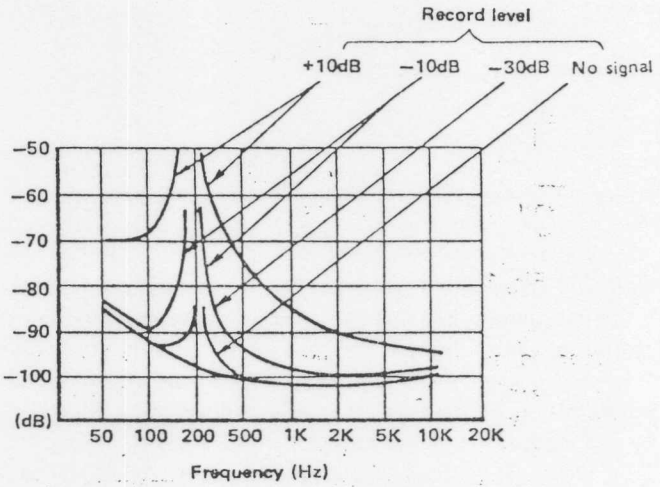


Fig. 6- Change of hiss noise.

In addition, as an intrinsic phenomenon of a tape recorder, the higher the recording level, the higher becomes the hiss noise. This tends to be obvious when the S/N ratio is improved by the compander.

In order to improve this and also to reduce high frequency noise, the pre-emphasis and de-emphasis method is appended to the method of compression and expansion, and the rate of S/N ratio improvement is usually increased by this procedure.

Circuit description of Super D

Figure 7 is the block diagram of this unit. The playback input terminal is connected to the playback output terminal of the deck, the record output terminal to the record input terminal of the deck, the input terminal to the record output terminal of the preamplifier, and the output terminal to the tape playback terminal of the preamplifier.

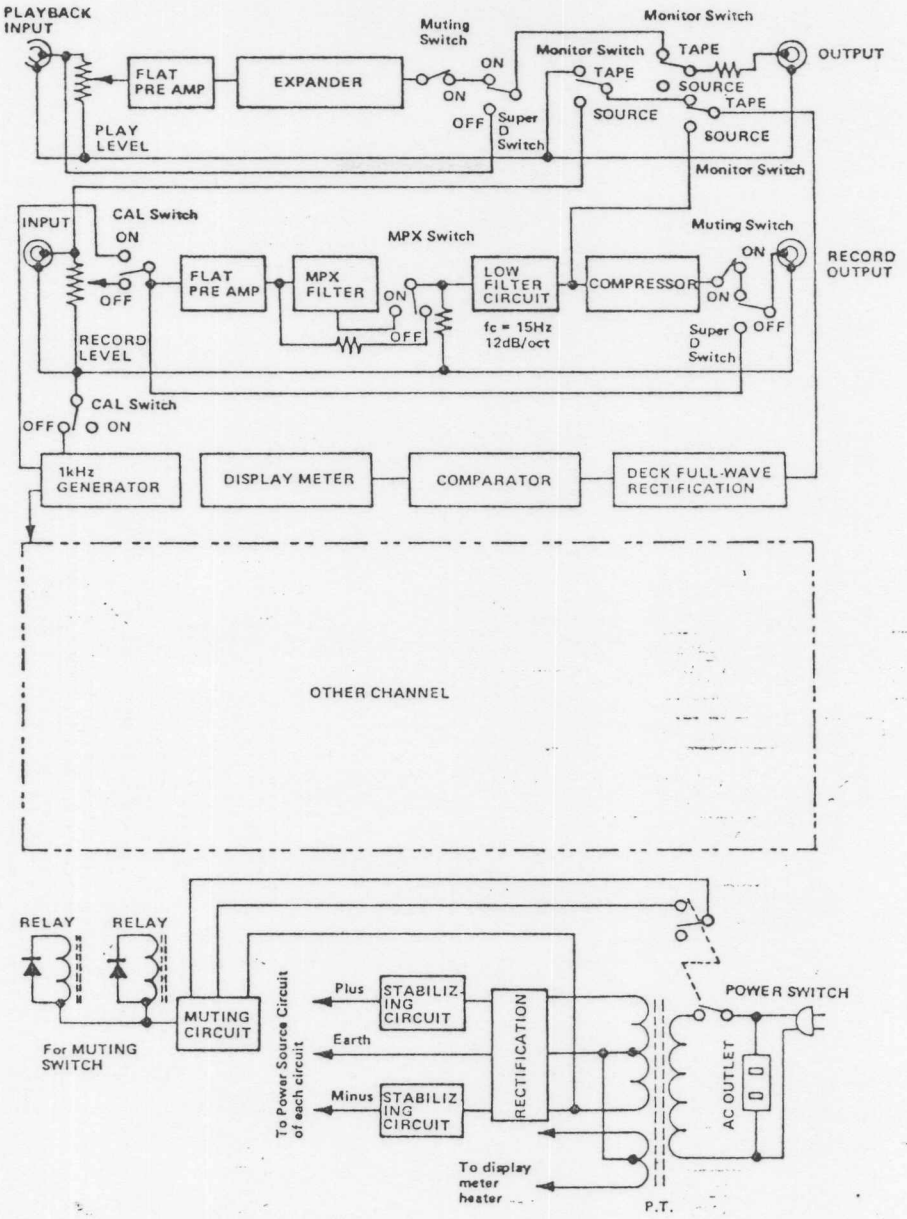


Fig. 7- Block diagram of PLUS N55.

When the tape monitor switch of the preamplifier is set to the tape side, the source signal can be directly monitored through speaker by turning on the SUPER D switch and setting the monitor switch to SOURCE side. The meter indicates the input level of the compressor, and its input level can be adjusted by RECORD LEVEL knob. The meter is a peak meter of 10 msec. attach time and 1.5 sec recovery time.

When the monitor switch is set to TAPE side, the output of the deck can be monitored. At this time, the meter shows the output signal of the expander circuit. When the SUPER D switch is turned off, the record signal passes only through the RECORD LEVEL and the playback signal is directly delivered, so that the recording level of the deck can be set by the RECORD LEVEL knob. Besides, since this circuit does not include amplifier, it can be used similarly whether the power switch is turned on or off.

The flat preamplifier is designed to amplify the input signal to the level to permit the expander circuit and compressor circuit to function at the optimum S/N ratio point.

The MPX filter in the encoder circuit is designed to remove pilot signal in order to prevent malfunction of the compressor circuit due to pilot signal when recording FM broadcast. The low filter circuit prevents malfunction of compressor circuit due to ultralow sound caused by "warp" of disc when recording from disc record.

The 1 kHz generator is intended to facilitate input and output level setting of Super D and the deck. Once set, it is not necessary to set again if tapes are changed.

Compressor circuit (encoder)

The input signal of the compressor circuit passes through the pre-emphasis circuit of high range elevation, and is led to operational amplifier, of which output, partly, is divided by high pass filter and low pass filter to be fed into the VCAs. And, the other output passes through the weighting line which emphasises the high frequency range, and is divided by the high pass filter and low pass filter to be fed into the level sensors in each band. The level sensors operate according to the time constant in each band to actuate the VCAs. As a result, the feedback amount of the operational amplifier is determined, and the output is changed by the amount corresponding to 1/2 of the input changing amount. (See Fig. 8.)

(VCA: voltage control amplifier)

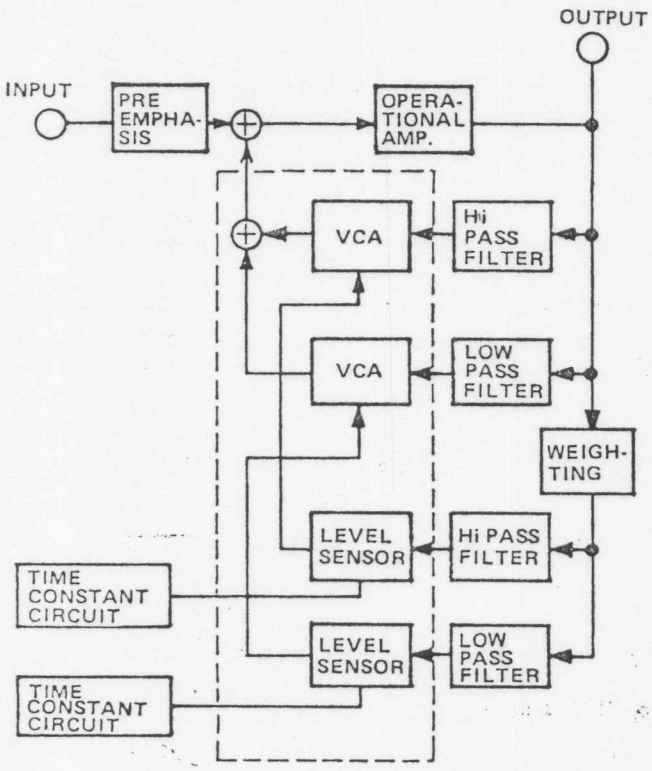


Fig. 8- Compressor circuit (encoder).

Expander circuit (decoder).

The input signal of the expander circuit, partly, is divided by high pass filter and low pass filter, and is fed into VCAs, while the rest passes through the weighting line which emphasizes the high frequency range, and is divided by high pass filter and low pass filter, then led into the level sensors. According to the time constant in each band, the level sensors are operated, and the gain of VCA is determined.

The output of VCA is fed into the operational amplifier having the de-emphasis of high range lowering, and is then delivered. (See Fig. 9.)

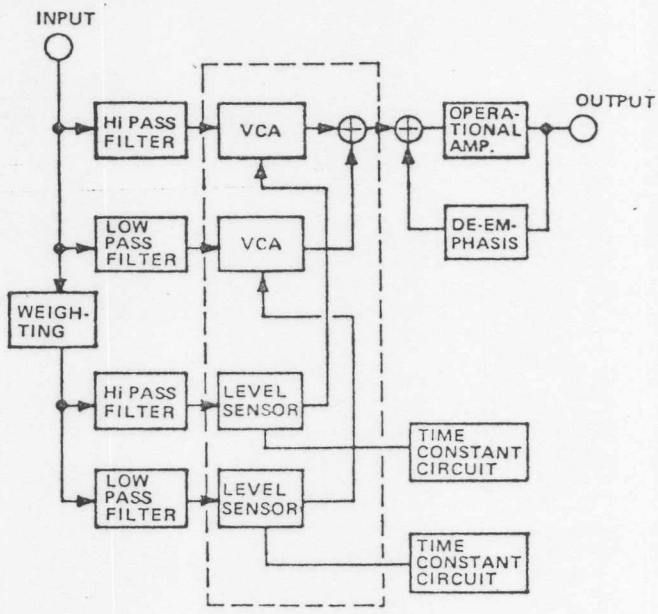
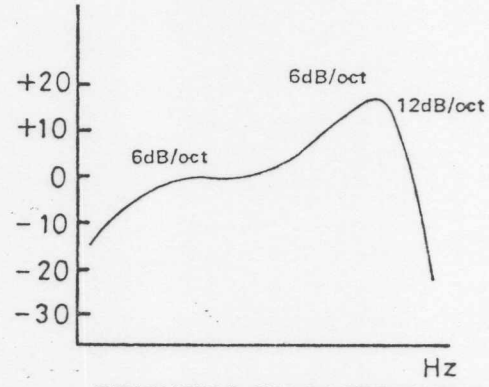


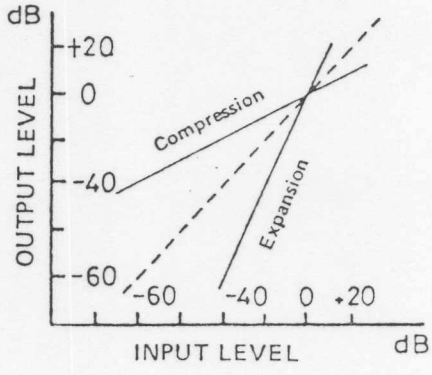
Fig. 9- Expander circuit (decoder).

Time constant in each band (msec)

	Attack time	Recovery time
Compression (high/low)	2/15	50/50
Expansion (high/low)	5/50	100/70



WEIGHTING CHARACTERISTICS



INPUT & OUTPUT CHARACTERISTICS

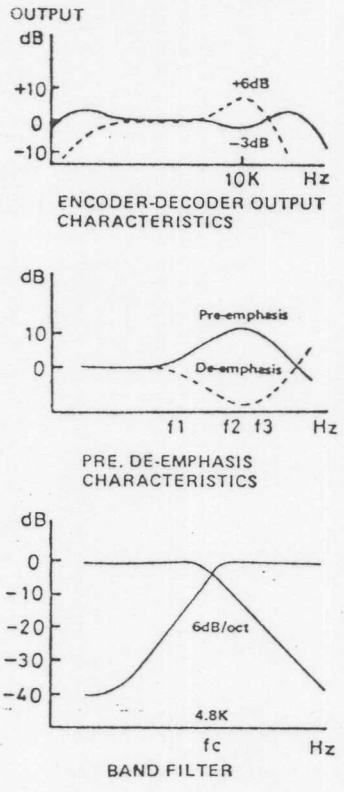


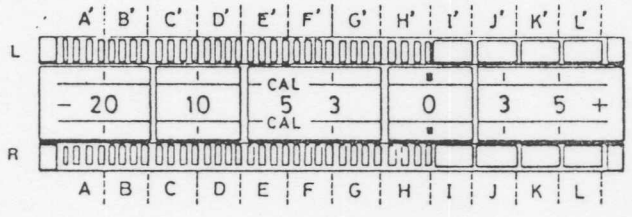
Fig. 10

FL display level meter

The output from the TAPE or SOURCE side of the monitor switch of the Super D is full-wave rectified and amplified by IC3 and IC4, and, after offset voltage is applied, is rectified by D5 and D11 to be applied to terminal (1) of IC1 and IC2.

As shown in Fig. 11, IC1 and IC2 consist of voltage comparator circuit and switching circuit. Based on the constant voltage power source (Vcc) supplied into terminal (9), the voltage fed from terminal (1) is compared. According to the result of voltage comparison, the switching circuit is operated to set the plate output voltage to 15V or 0V, thereby controlling the plate voltage of FL meter. SVR3, SVR4 are the variable resistors for setting the reference comparative voltage at the time of specified record level input (0 dB adjustment).

Figure 12 shows input voltages (V_{IN}) of IC1, IC2 necessary for illuminating the indicators of FL meter.



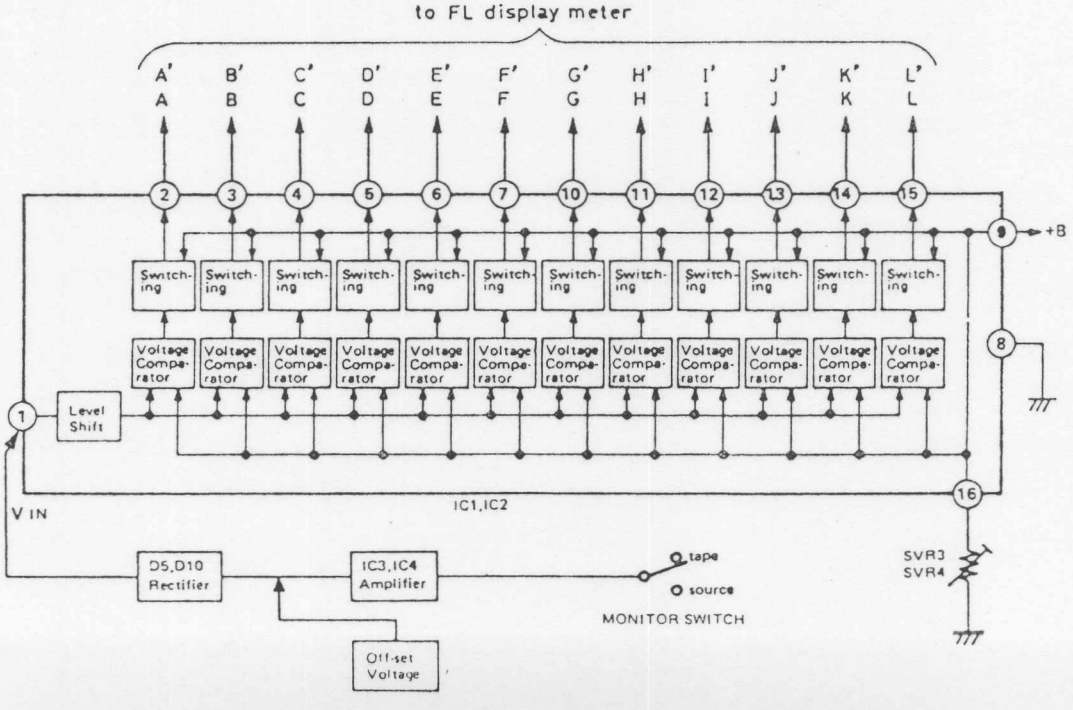
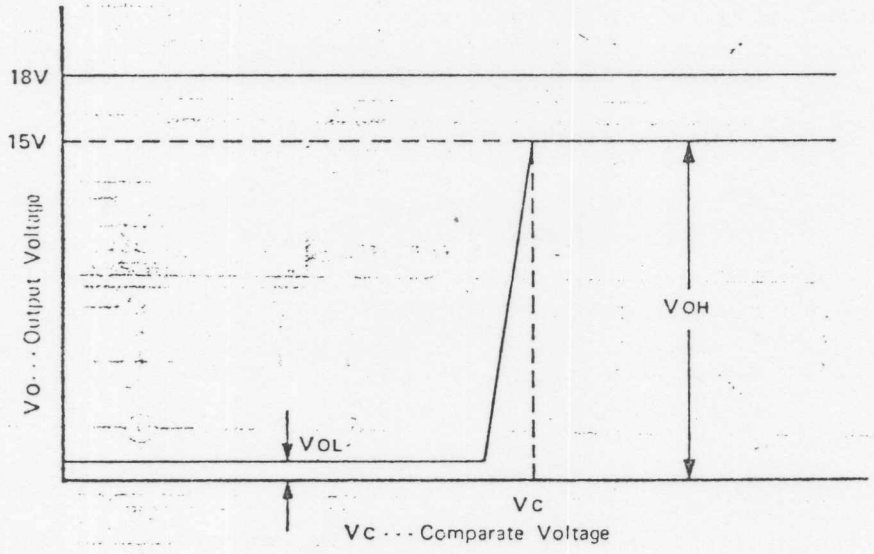


Fig. 11

	Input voltage (V_{IN})			Remarks
	Min.	St'd	Max.	
Output voltage, low V_{OL}	—	0 V	0.5 V	
Output voltage, high V_{OH}	14.0 V	15.0 V	—	
Offset voltage V_{OS}	1.1 V	1.35 V	1.6 V	
Comparate voltage V_C −20 dB	—	0.30 V	—	Voltage at 15.0 V, output of pin 2
Comparate voltage V_C −15 dB	0.40 V	0.46 V	0.52 V	Voltage at 15.0 V, output of pin 3
Comparate voltage V_C −10 dB	0.65 V	0.73 V	0.83 V	Voltage at 15.0 V, output of pin 4
Comparate voltage V_C −7 dB	0.92 V	0.99 V	1.07 V	Voltage at 15.0 V, output of pin 5
Comparate voltage V_C −5 dB	1.15 V	1.23 V	1.30 V	Voltage at 15.0 V, output of pin 6
Comparate voltage V_C −3 dB	1.43 V	1.52 V	1.61 V	Voltage at 15.0 V, output of pin 7
Comparate voltage V_C −1 dB	1.77 V	1.88 V	2.00 V	Voltage at 15.0 V, output of pin 10
Comparate voltage V_C 0 dB	—	2.10 V	—	Voltage at 15.0 V, output of pin 11
Comparate voltage V_C +1 dB	2.21 V	2.34 V	2.49 V	Voltage at 15.0 V, output of pin 12
Comparate voltage V_C +3 dB	2.76 V	2.93 V	3.10 V	Voltage at 15.0 V, output of pin 13
Comparate voltage V_C +5 dB	3.37 V	3.66 V	3.97 V	Voltage at 15.0 V, output of pin 14
Comparate voltage V_C +8 dB	4.72 V	5.12 V	5.76 V	Voltage at 15.0 V, output of pin 15

*$V_{IN} = V_C + V_{OS}$



ADJUSTMENT OF SUPER D SECTION

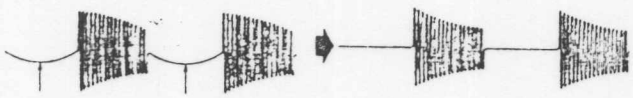
Adjustment of compressor circuit (encoder)

Turn on SUPER D switch, set monitor switch to SOURCE side, turn off MPF filter switch and CAL switch, and feed input signal of –6 dB (1 kHz) into IN (input) terminal. Connect VTVM and oscilloscope to TP-3 and the earth. Turn RECORD LEVEL adjusting knobs until the output becomes 350 mV ± 0.2 dB. Then, connect VTVM and oscilloscope to TP-4 and the earth. In the following explanation, the SVR refers to the left channel, and that of the right channel is included in parentheses.

1. **Tracking adjustment (1 kHz)**
   Set input signal to –46 dB (1 kHz). Turning SVR506 (SVR706), find the level transformation part, and set SVR just before this point.
2. **Tracking adjustment (10 kHz)**
   Set input signal to –46 dB (10 kHz). Adjust SVR503 (SVR703) in the same manner as in item 1.
   * In both items 1 and 2, set input signal to –66 dB, and make sure the output drops by 10 dB.
3. **Output adjustment (1 kHz)**
   Set input signal to –6 dB (1 kHz). Turn SVR501 (SVR701) until the output becomes 350 mV ± 0.2 dB.
4. **Output adjustment (10 kHz)**
   Set input signal to –46 dB (10 kHz). Turn SVR502 (SVR702) until the output lowers 3 dB from that in item 3.
5. **DC shift adjustment (1 kHz)**
   Using tone burst generator (e.g. TRIO Model 5201), set input signal to –46 dB (1 kHz), and adjust SVR504 (SVR704) to obtain the output waveform as shown below.

Set these segments as straight as possible, and make the waveform symmetrical vertically.

6. **DC shift adjustment (10 kHz)**
   In the same manner as in item 5, set input signal to –46 dB (10 kHz), and adjust SVR505 (SVR705) to obtain the output waveform as shown below.



Set these segments as straight as possible, and make the waveform symmetrical vertically.

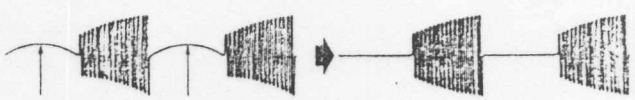
* Since the adjustments in items 5 and 6 influence each other, repeat the adjustments to check the result.

7. **Output adjustment**
   Connect VTVM to REC (record output) terminal. Set input signal to –6 dB (1 kHz). Turn SVR101 (SVR201) until the REC terminal output becomes 58 mV.
8. **CAL OSC adjustment**
   Connect VTVM to D401. Turn off SUPER D switch, turn on CAL switch. Adjust SVR401 so that the output of D401 becomes 6V.
9. **CAL level adjustment**
   Connect VTVM to REC (record output) terminal. Turn off SUPER D switch, turn on CAL switch. Adjust SVR402 so that the REC terminal output becomes 58 mV.

Adjustment of expander circuit (decoder)

Turn on SUPER D switch, set monitor switch to TAPE, turn off MPX filter switch and CAL switch, and feed input signal of –6 dB (1 kHz) into PB (playback input) terminal. Connect VTVM and oscilloscope to TP-2 and the earth. Set PLAY LEVEL knob so that the output becomes 350 mV ± 0.2 dB. Then, connect VTVM and oscilloscope to TP-1 and the earth. The SVR in the following explanation refers to the left channel, and that of the right channel is given in parentheses.

1. **Tracking adjustment (1 kHz)**
   Set input signal to –16 dB (1 kHz). Turning SVR603 (SVR803), find the level transformation point, and set it to the position just before this point.
2. **Tracking adjustment (10 kHz)**
   Set input signal to –16 dB (10 kHz). Adjust SVR606 (SVR806) in the same manner as in item 1.
   * Both in items 1 and 2, set input signal to –36 dB, and make sure the output lowers by 40 dB.
3. **Output adjustment (1 kHz)**
   Set input signal to –6 dB (1 kHz). Turn SVR601 (SVR801) until the output becomes 300 mV ± 0.2 dB.
4. **Output adjustment (10 kHz)**
   Set input signal to –16 dB (10 kHz). Turn SVR602 (SVR802) until the output rises 6 dB from that in item 3.
5. **DC shift adjustment (1 kHz)**
   Using tone burst generator (e.g. TRIO Model 5201), set input signal to –16 dB (1 kHz), and adjust SVR605 (SVR805) so as to obtain the output waveform as shown below.



Set these segments as straight as possible, and make the waveform symmetrical vertically.

6. DC shift adjustment (10 kHz)
   In the same manner as in item 5, set input signal to −16 dB (10 kHz), and adjust SVR604 (SVR804) so as to obtain the output waveform as shown below.

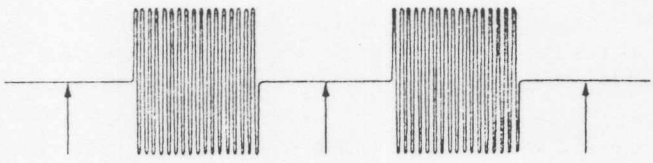
Set these segments as straight as possible, and make the waveform symmetrical vertically.

* Since the adjustments in items 5 and 6 influence each other, repeat the adjustments to check the result.

Checking of comprehensive characteristics

Set RECORD LEVEL and PLAY LEVEL adjusting knobs to maximum position, turn on SUPER D switch, place monitor switch in TAPE position, turn off MPX filter switch and CAL switch, feed input signal into IN (input) terminal, and connect VTVM and oscilloscope to OUT (output) terminals.

1. Frequency response
   Feed input signals 0 dB (20 Hz, 1 kHz, 10 kHz, 20 kHz), and make sure the output is, when the output at 1 kHz is taken as 0 dB, ± 1.5 dB at 20 Hz, ± 1 dB at 10 kHz, and ± 1.5 dB at 20 kHz.
   * When failing to satisfy the values above, check items 3 and 4 of the adjustment of compressor circuit and expander circuit.
2. Tracking
   Change input signals 0 dB (100 Hz, 1 kHz, 10 kHz) to −60 dB, and make sure the outputs are also lowered by 60 dB.
3. Tone burst characteristics
   Feed input signals −20 dB (1 kHz, 10 kHz), and make sure the output waveform becomes as follows.



These segments should be straight. The waveform should be symmetrical vertically.

ADJUSTMENT OF FL DISPLAY LEVEL METER

Turn on SUPER D switch, set monitor switch to TAPE, turn off MPX filter switch and CAL switch, feed input signal of −6 dB (1 kHz) to PB (playback input) terminal, and connect VTVM to OUT (output) terminal.

1. Adjustment of 0 dB
   Adjust PLAY LEVEL control until the output becomes 530 mV. At this time, make sure the display tube is illuminated up to 0 dB (the segment of No. 11 part in Fig. 15). If not illuminated, adjust be means of SVR3, SVR4.
2. Adjustment of −20 dB
   Set input signal to −15 dB, and make sure the display tube lights up and −20 dB (the segment of No. 2 part in Fig. 15) and goes out at −16 dB. If not satisfactory, adjust by means of SVR1, SVR2.
3. Return input signal to −6 dB, and make sure the display tube lights up to 0 dB.

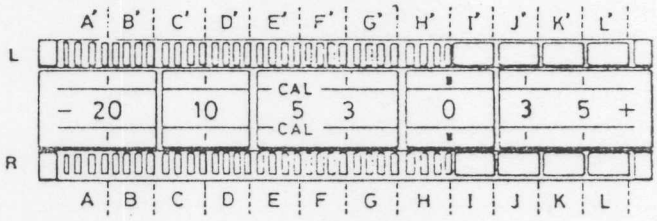


Fig. 12

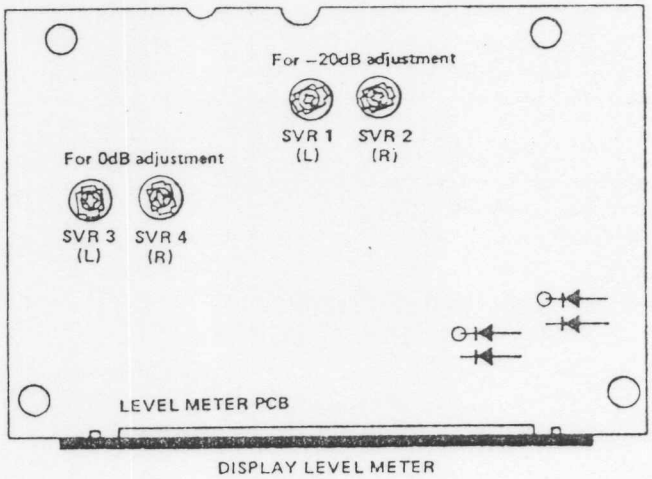
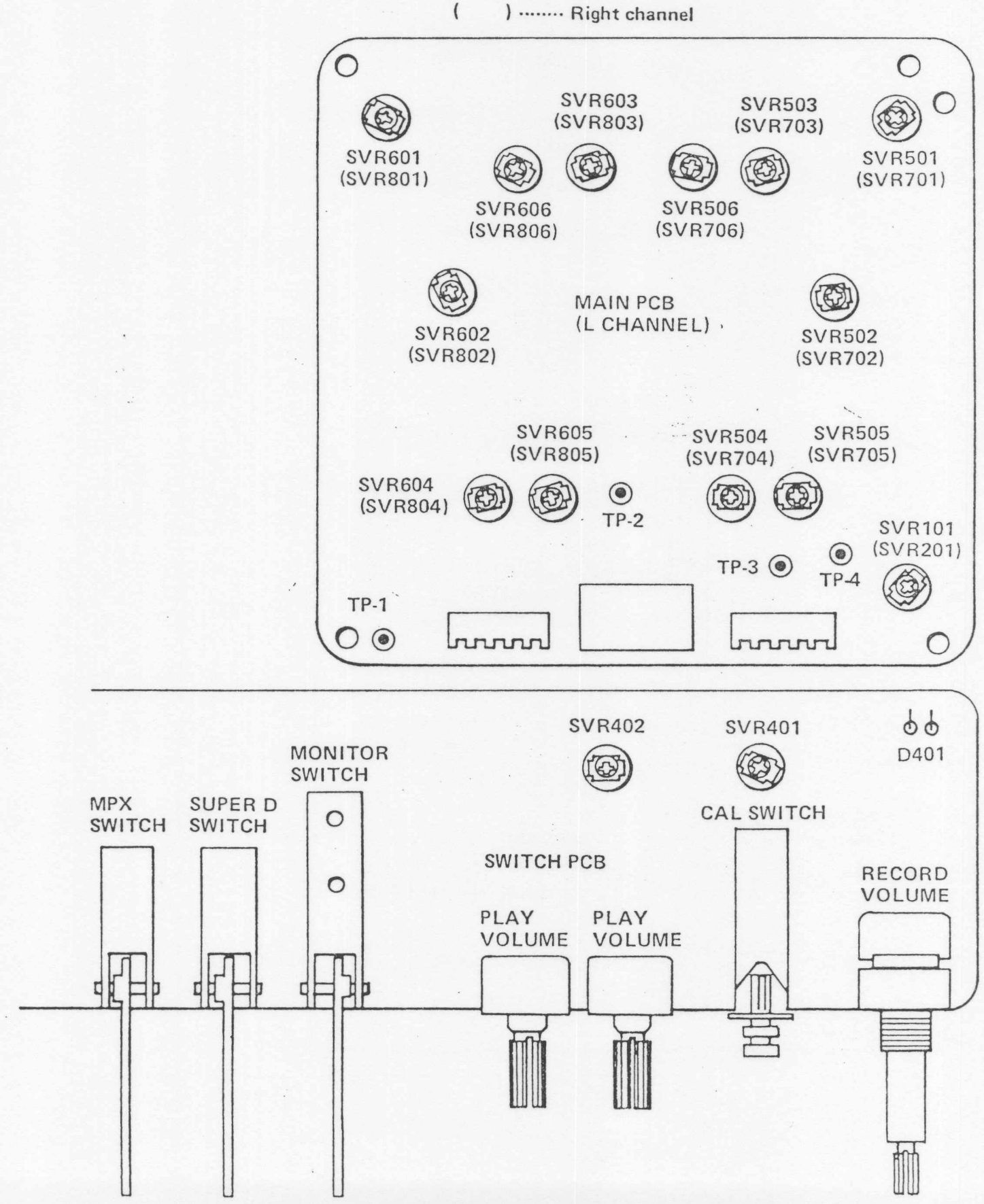
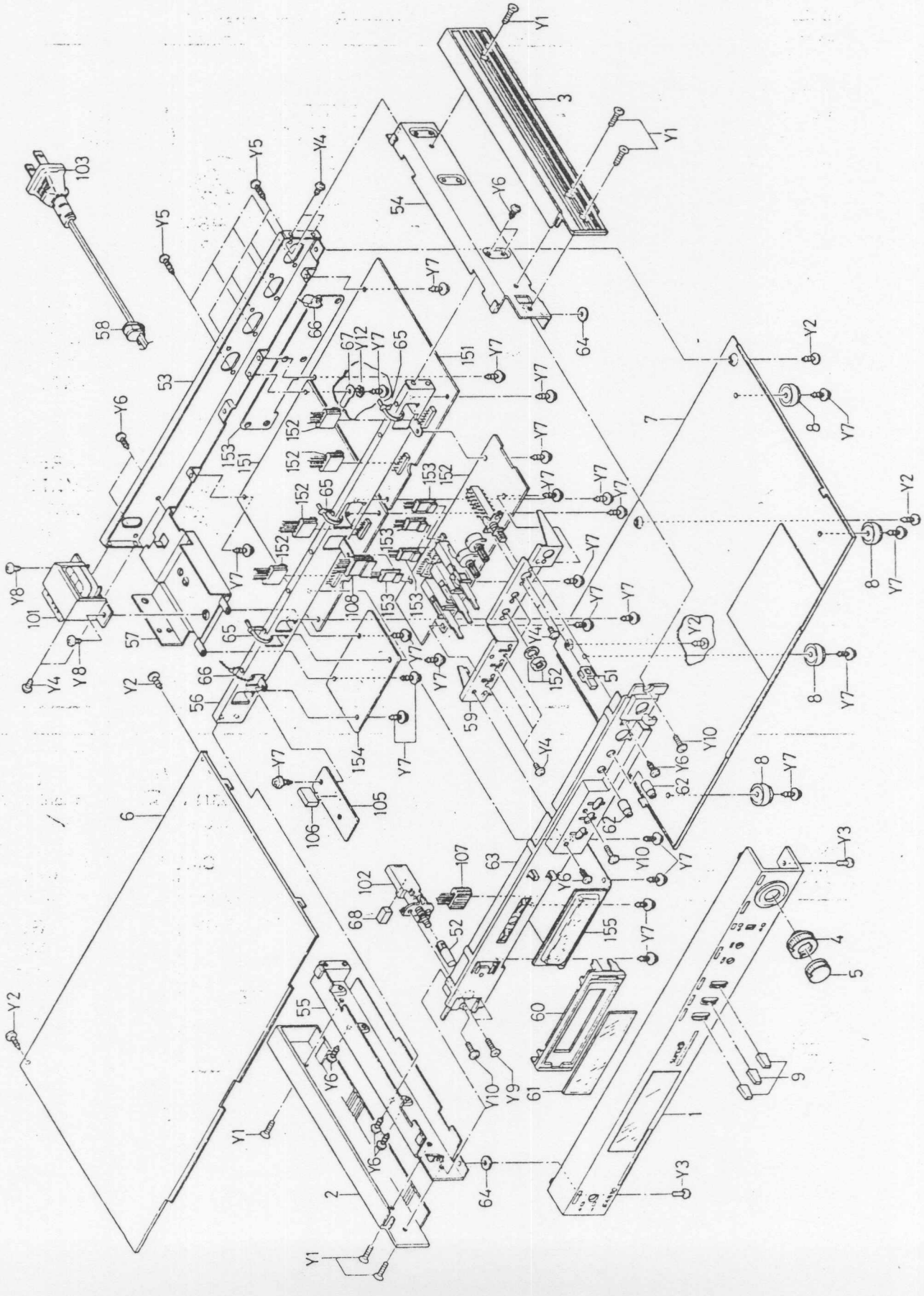


Fig. 13


( ) ..... Right channel
SVR601
(SVR801)
SVR603
(SVR803)
SVR503
(SVR703)
SVR501
(SVR701)
SVR606
(SVR806)
SVR506
(SVR706)
SVR602
(SVR802)
MAIN PCB
(L CHANNEL)
SVR502
(SVR702)
SVR605
(SVR805)
SVR504
(SVR704)
SVR505
(SVR705)
SVR604
(SVR804)
TP-2
TP-3
TP-4
SVR101
(SVR201)
TP-1
SVR402
SVR401
D401
MONITOR
SWITCH
MPX
SWITCH
SUPER D
SWITCH
SWITCH PCB
CAL SWITCH
RECORD
VOLUME
PLAY
VOLUME
PLAY
VOLUME

EXPLODED VIEW (CABINET)



PARTS LIST

Key No.	Part No.	Description	Q'ty
PACKING			
	141-6-133T-05500	Individual Carton	1
	141-6-144T-58100	Foam Plastic Case	2
	141-6-317T-15200	Pad	1
	141-6-231T-40552	Inner Polye Cover, Set	1
	141-6-231T-10300	Inner Polye Cover, AC cord	1
	141-6-231T-10150	Inner Polye Cover, Bracket Handle	2
	141-6-231T-25350	Inner Polye Cover, Printed Matter	1
	141-6-472T-17100	Caution Label	4
	141-6-440T-08000	Hang Tag	1
ACCESSORY			
	141-6-410T-33600	Instruction Manual	1
	141-6-493T-01100	Customer Card	1
	141-2-862T-00500	Driver, Tuning	1
	141-0-271T-15100	Bracket, Ass'y, Handle	2
	4-243T-13302	Lead Cord Ass'y	1
CABINET			
1	141-0-122T-29001	Front Panel Ass'y	1
2	141-0-123T-05100	Side Panel Ass'y, Right	1
3	141-0-123T-05200	Side Panel Ass'y, Left	1
4	141-0-163T-59830	Rotary Knob Ass'y	1
5	141-0-163T-59930	Rorary Knob Ass'y	1
6	141-2-124T-24530	Top Lid	1
7	141-2-125T-17030	Bottom Lid	1
8	141-0-174T-05101	Stand Ass'y	4
9	141-2-162T-16030	Lever Knob	3
CHASSIS			
51	141-0-156T-23730	Knob Ass'y, CAL	1
52	141-0-156T-21730	Knob Ass'y, Power Switch	1
53	141-2-126T-29201	Back Lid	1
54	141-2-315T-17900	Reinforcement, Right	1
55	141-2-315T-18000	Reinforcement, Left	1
56	141-2-315T-17500	Reinforcement, Center	1
57	141-2-310T-21301	Bracket, Trans	1
58	141-2-464T-11800	Fixer, AC Cord	1
59	141-2-365T-42700	Bracket, Switch	1
60	141-2-210T-11500	Bracket, Degital	1
61	141-2-132T-14330	Sign window	1
62	141-2-163T-61100	Rotary Knob, VR	2
63	141-2-210T-13800	Bracket, Front Chassis	1
64	141-2-453T-02101	Washer 3 x 10 x 0.3	2
65	141-2-464T-20671	Fixer	4
66	141-2-464T-08700	Fixer	1
67	123-2-472R-00401	Lug	1
68	141-2-445T-23200	Rubber Cushion 8 x 8 x 15	1
SCREW MOUNTING			
Y1		Flat Head Screw 4 x 10mm	6
Y2		Binding Head Tapping Screw 3 x 6mm	5
Y3		Pan Head Screw 3 x 6mm	2
Y4		Pan Head Screw 3 x 4mm	4
Y5		Tapping Screw 3 x 10mm	9
Y6		Tapping Screw 3 x 6mm	9
Y7		Washer Head Tapping Screw 3 x 6mm	18
Y8		Binding Head Screw 3 x 4mm	2
Y9		Flat Head Screw 3 x 10mm	2
Y10		Binding Head Screw 3 x 6mm	2
Y11		Pan Head Screw 3 x 4mm	3
Y12		External Toothlock Washer 3 x 6.5 x 0.45mm	1

Key No.	Part No.	Description	Q'ty
ELECTRICAL PARTS			
101	4-300T-04500	Power Trans	1
102	4-231T-76500	Power Switch	1
103	4-243T-81200	Power Supply Cord	1
104	141-2-382T-07300	Terminal	3
105	4-233T-20700	P.C. Board, Connecting	1
106	4-227T-01000	CR Pack	1
107	4-235T-71600	Socket	1
108	4-235T-71700	Socket	1
MAIN PCB ASS'Y			
151	141-4-230T-95400	P.C. Board Ass'y, Main	1
SVR101, 502, 602, 503, 603, 504, 604, 505, 605, 506, 606	4-222T-62083	Semifixed Variable Resistor 10KΩ	11
SVR501, 601	4-222T-62089	Semifixed Variable Resistor 100KΩ	2
	4-236T-10273	Plug	2
	4-232T-04500	Relay	1
IC102, 152, 103, 153		IC LM324N	4
IC104, 154		IC μA747C	2
IC151		IC NJM4558	1
IC106		IC LM301A	1
IC105, 155		IC NE570N	2
Q101,151, 102,152		Transistor 2SC536	4
D504,604		Diode RD5.6E B3	2
D508,509		Diode O2BZ4.7	2
D501,601, 505,605, 506,606, 507,607, 502,602, 503,603, 610		Diode DS442X	13
	RESISTORS		
R507,607		Metal or Carbon 82K ohm ±2% 1/4W	2
R506,606		Metal or Carbon 8.2K ohm ±2% 1/4W	2
R539,639		Metal or Carbon 10K ohm ±2% 1/4W	2
R541,641		Metal or Carbon 68K ohm ±2% 1/4W	2
R540,640		Metal or Carbon 12K ohm ±5% 1/4W	2
R647,648		Carbon 33K ohm ±5% 1/4W	2
R551,555, 651,655		Carbon 330 ohm ±5% 1/4W	4
R512,612		Carbon 330 ohm ±5% 1/4W	2
R549,649		Carbon 3.3M ohm ±5% 1/4W	2
R550,650		Carbon 100 ohm ±5% 1/4W	2
R556,656		Carbon 6.8K ohm ±5% 1/4W	2
R547,548		Carbon 33K ohm ±5% 1/4W	2
R542,642		Carbon 1K ohm ±5% 1/4W	2
R502,503, 602,603		Carbon 33K ohm ±5% 1/4W	4
R605,505 611,511		Carbon 10K ohm ±5% 1/4W	4
R153		Carbon 56K ohm ±5% 1/4W	1
R154		Carbon 15K ohm ±5% 1/4W	1
R152		Carbon 330 ohm ±5% 1/4W	1
R537,637		Carbon 4.7K ohm ±5% 1/4W	2

PARTS LIST

Ref. No.	Part No.	Description	Q'ty
MAIN PCB ASS'Y			
R538,638		Carbon 3.3K ohm ±5% 1/4W	2
R535,536, 635,636		Carbon 1K ohm ±5% 1/4W	4
R518,519, 618,619		Carbon 1K ohm ±5% 1/4W	4
R522,523, 622,623		Carbon 2.2K ohm ±5% 1/4W	4
R532,534, 632,634		Carbon 2.2K ohm ±5% 1/4W	4
R521,621, 533,633		Carbon 220 ohm ±5% 1/4W	4
R524,624, 531,631		Carbon 56 ohm ±5% 1/4W	4
R515,615, 517,617		Carbon 10K ohm ±5% 1/4W	4
R553,653, 644		Carbon 10K ohm ±5% 1/4W	3
R508,608		Carbon 39K ohm ±5% 1/4W	2
R509,609		Carbon 47K ohm ±5% 1/4W	2
R530,630, 554,654		Carbon 33K ohm ±5% 1/4W	4
R520,620		Carbon 33K ohm ±5% 1/4W	2
R513,613, 501,601		Carbon 33K ohm ±5% 1/4W	4
R504,604, 616		Carbon 100K ohm ±5% 1/4W	3
R514,614, 516		Carbon 100K ohm ±5% 1/4W	3
R646		Carbon 330 ohm ±5% 1/4W	1
R529,629, 528,628		Carbon 15K ohm ±5% 1/4W	4
R552,553, 653,652		Carbon 6.8K ohm ±5% 1/4W	4
R525,625		Carbon 3.9K ohm ±5% 1/4W	2
R527,627, 526,626		Carbon 68K ohm ±5% 1/4W	4
R151		Carbon 100K ohm ±5% 1/4W	1
R543,643		Carbon 10K ohm ±5% 1/4W	2
R155		Carbon 10K ohm ±5% 1/4W	1
	CAPACITORS		
C501,601, 526,626		Mylar 0.1μF 50V ±5%	4
C502,602, 534,634		Mylar 0.001μF 50V ±5%	4
C522,622, 533,633		Mylar 0.001μF 50V ±5%	4
C606,506, 611,511		Mylar 0.001μF 50V ±5%	4
C505,605, 519,619		Mylar 0.0022μF 50V ±5%	4
C550		Mylar 0.001μF 50V ±5%	1
C503,603		Ceramic 270pF 50V ±5%	2
C535		Ceramic 150pF 50V ±5%	1
C525,625		Ceramic 100pF 50V ±5%	2
C153,618		Ceramic 10pF 50V ±5%	2
C518		Ceramic 5pF 50V ±0.5pF	1
C536		Ceramic 120pF 50V ±5%	1
C504,604		Electrolytic 100μF 25V	2
C527,627		Electrolytic 100μF 16V	2
C523,623		Electrolytic 22μF 25V	2
C155,154, 555,655		Electrolytic 10μF 25V	4
C551,552, 553,554		Electrolytic 10μF 25V	4
C651,652, 653,654		Electrolytic 10μF 25V	4
C508,608, 528		Electrolytic 1μF 50V	3
C529,531, 629,631		Electrolytic 1μF 50V	4
C516,616, 524,624		Electrolytic 1μF 50V	4
C617,621		Electrolytic 4.7μF 25V	2
C517,521		Electrolytic 4.7μF 25V	2
C514,515		Electrolytic 3.3μF 25V	2
C513,613		Al Electrolytic 0.1μF 16V +40–20%	2
C614,615		Electrolytic 3.3μF 25V	2

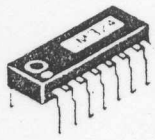
Ref. No.	Part No.	Description	Q'ty
MAIN PCB ASS'Y			
C628		Electrolytic 2.2μF 50V	1
C151		Electrolytic Nonpolar 1.0μF 50V	1
SWITCH PCB ASS'Y			
152	141-4-230T-95500	P.C. Board Ass'y, Switch	1
VR101, 201	4-222T-78000	Variable Resistor 50K, Rec	1
VR151, 251	4-222T-74290	Variable Resistor 50K, Play	2
S2,3	4-231T-82300	Switch, MPX Super D	2
S4	4-231T-87900	Switch, Monitor	1
S5	4-231T-80771	Switch, CAL	1
SVR402	4-222T-62089	Semifixed Variable Resistor 100KΩ	1
SVR401	4-222T-62083	Semifixed Variable Resistor 10KΩ	1
L101,201	4-255T-01600	MPX Coil	2
	4-236T-10273	Plug	1
	4-236T-10200	Plug	4
	4-235T-71400	Socket	1
	4-235T-71500	Socket	3
IC401		IC RC4558P	1
IC101, 201		IC NJM4558	2
D401,402		Diode DS442X	2
	RESISTORS		
R104,204		Carbon 5.6K ohm ±5% 1/4W	2
R105,205		Carbon 47K ohm ±5% 1/4W	2
R111,211		Carbon 100K ohm ±5% 1/4W	2
R103,203		Carbon 330 ohm ±5% 1/4W	2
R115,215		Carbon 10K ohm ±5% 1/4W	2
R117,217		Carbon 39K ohm ±5% 1/4W	2
R112,212		Carbon 100K ohm ±5% 1/4W	2
R113,213		Carbon 330 ohm ±5% 1/4W	2
R107,207		Carbon 2.7K ohm ±5% 1/4W	2
R109,209		Carbon 5.6K ohm ±5% 1/4W	2
R102,202		Carbon 150K ohm ±5% 1/4W	2
R610,810		Carbon 330 ohm ±5% 1/4W	2
R404,405		Carbon 10K ohm ±5% 1/4W	2
R401,402		Carbon 150K ohm ±5% 1/4W	2
R116,216		Carbon 150K ohm ±5% 1/4W	2
R114,214		Carbon 100K ohm ±5% 1/4W	2
R108,208		Carbon 2.7K ohm ±5% 1/4W	2
R403		Carbon 150K ohm ±5% 1/4W	1
R406		Carbon 150K ohm ±5% 1/4W	1
R28,29		Carbon 120K ohm ±5% 1/4W	2
	CAPACITORS		
C103,203		Ceramic 33pF 50V ±10%	2
C100,200		Ceramic 100pF 50V ±10%	2
C106,206, 107,207		Mylar 0.15μF 50V ±5%	4
C401,402		Mylar 0.001μF 50V ±5%	2
C404		Mylar 0.047μF 50V ±20%	1
C104,204, 110,210		Electrolytic 10μF 25V	4
C403		Electrolytic 1μF 50V	1
C101,201		Electrolytic Nonpolar 4.7μF 25V	2
C108,208		Electrolytic Nonpolar 2.2μF 50V	2
SOCKET PCB ASS'Y			
	141-4-230T-95600	P.C. Board Ass'y, Socket	1
	4-235T-68571	Socket	4
	4-235T-71300	Socket	1
	4-235T-71371	Socket	1

PARTS LIST

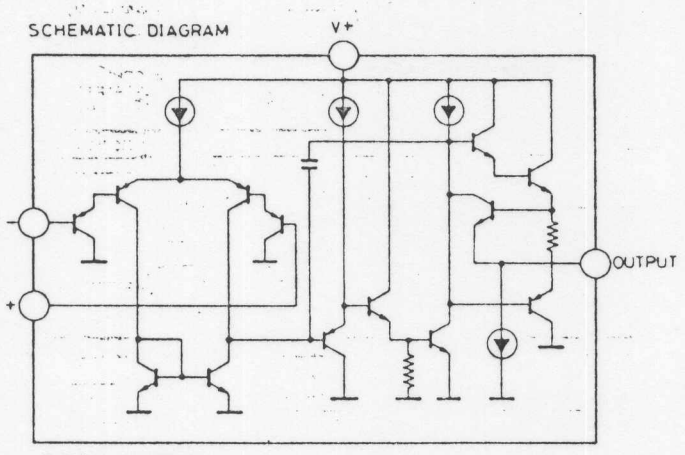
Ref. No.	Part No.	Description	Q'ty
SOCKET PCB ASS'Y			
	4-235T-71372	Socket	1
	4-235T-71373	Socket	1
C331,332, 333,334		Ceramic Cap. 0.01μF 50V +80–20%	4
R118,218		Carbon Res. 1K ohm ±5% 1/4W	2
DC POWER PCB ASS'Y			
154	141-4-230T-95700	P.C. Board Ass'y, DC Power	1
	4-227T-01000	CR Pack	1
IC301		IC TA78018	1
Q305,306 308,311		Transistor 2SC536	4
Q307		Transistor 2SB560	1
Q309		Transistor 2SD333	1
D304		Diode W02	1
D301		Diode DS442X or 1S2473	1
D303		Diode WZ157	1
D321		Diode RD5.6E B3	1
	CAPACITORS		
C312,313		Electrolytic 1000μF 35V	2
C322,323		Electrolytic 220μF 25V	2
C315,316		Electrolytic 470μF 25V	2
C311,314		Electrolytic 100μF 25V	2
C303		Electrolytic 1μF 50V	1
C304		Electrolytic 470μF 6.3V	1
C317		Ceramic 0.01μF 50V +80–20%	1
	RESISTORS		
R314		Metal 5.6 ohm ±5% 1W	1
R313		Metal 100 ohm ±5% 1W	1
R307		Carbon 100K ohm ±5% 1/4W	1
R304		Carbon 150K ohm ±5% 1/4W	1
R306		Carbon 39K ohm ±5% 1/4W	1
R305		Carbon 33K ohm ±5% 1/4W	1
R302		Carbon 27K ohm ±5% 1/4W	1
R303		Carbon 22K ohm ±5% 1/4W	1
R308		Carbon 15K ohm ±5% 1/4W	1
R311,312		Carbon 820 ohm ±5% 1/4W	2
R324		Carbon 10K ohm ±5% 1/4W	1
R323		Carbon 5.6K ohm ±5% 1/4W	1
R322		Carbon 6.8K ohm ±5% 1/4W	1
R325		Carbon 5.6K ohm ±5% 1/4W	1
R321		Solid 5.6 ohm ±10% 1/2W	1
LEVEL METER PCB ASS'Y			
155	141-4-230T-95800	P.C. Board Ass'y, Level Meter	1
SVR1,2	4-222T-62081	Semifixed Variable Resistor 4.7KΩ	2
SVR3,4	4-222T-62083	Semifixed Variable Resistor 10KΩ	2
	4-985T-01100	Fluorescent Display	1
	4-236T-10274	Plug	1
IC1,2		IC BA658	2
IC3,4		IC RC4558P	2
D1 ~ 10		Diode 1S2473	10
	RESISTORS		
R1,11		Carbon 20K ohm ±2% 1/4W	2
R2,12		Carbon 20K ohm ±2% 1/4W	2
R3,13		Carbon 20K ohm ±2% 1/4W	2
R4,14		Carbon 10K ohm ±2% 1/4W	2
R5,15		Carbon 10K ohm ±5% 1/4W	2
R6,16		Carbon 10K ohm ±5% 1/4W	2
R7,17		Carbon 1M ohm ±5% 1/4W	2
R8,18		Carbon 270 ohm ±5% 1/4W	2
R9,19		Carbon 680K ohm ±5% 1/4W	2

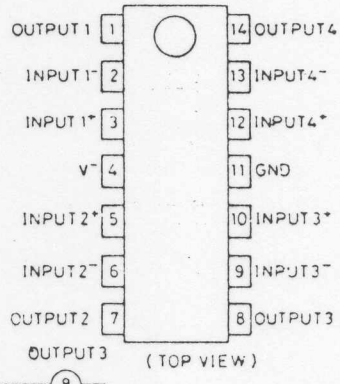
Ref. No.	Part No.	Description	Q'ty
LEVEL METER PCB ASS'Y			
R10,20		Carbon 1K ohm ±5% 1/4W	2
R21		Carbon 10K ohm ±5% 1/4W	1
R22		Carbon 820 ohm ±5% 1/4W	1
R24		Solid 82 ohm ±10% 1/2W	1
R25,26		Carbon 1M ohm ±5% 1/4W	2
R27		Carbon 10K ohm ±5% 1/4W	1
	CAPACITORS		
C2,5		Electrolytic 4.7μF 16V	2
C1,4		Electrolytic Nonpolar 1.0μF 50V	2
C7		Electrolytic 220μF 25V	1
C3,6		Tantal 2.2μF 16V ±20%	2

LM324 (OPERATIONAL AMPLIFIERS)

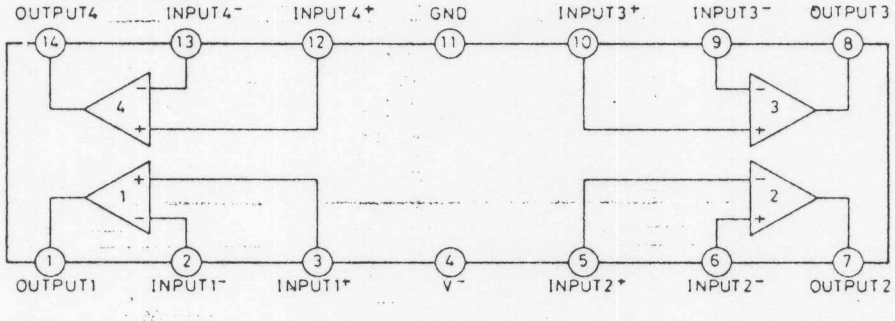


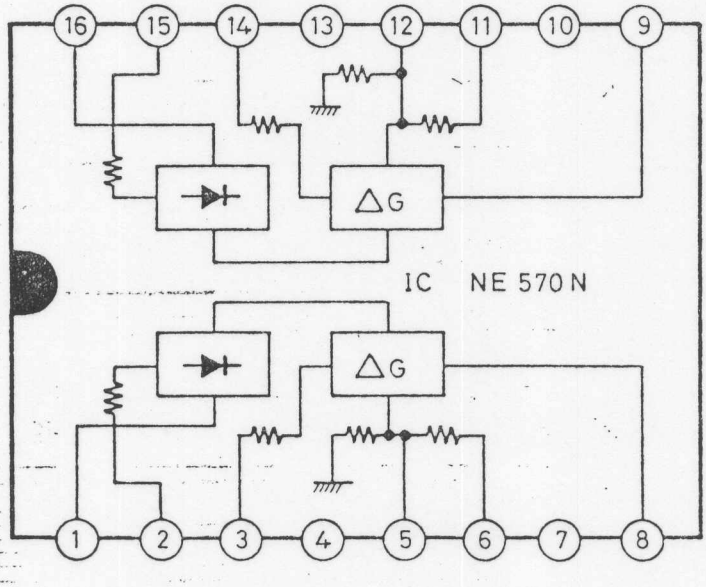
SCHEMATIC DIAGRAM



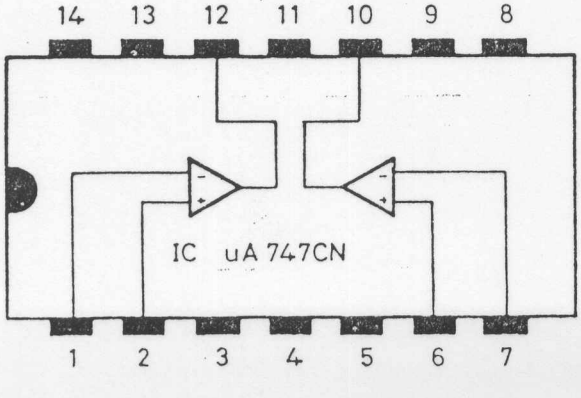


BLOCK DIAGRAM

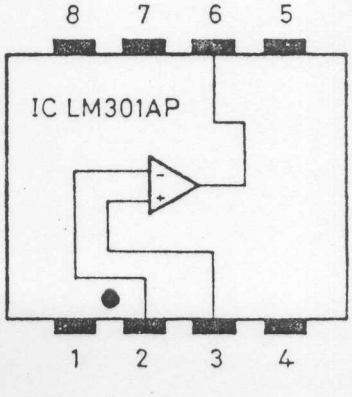




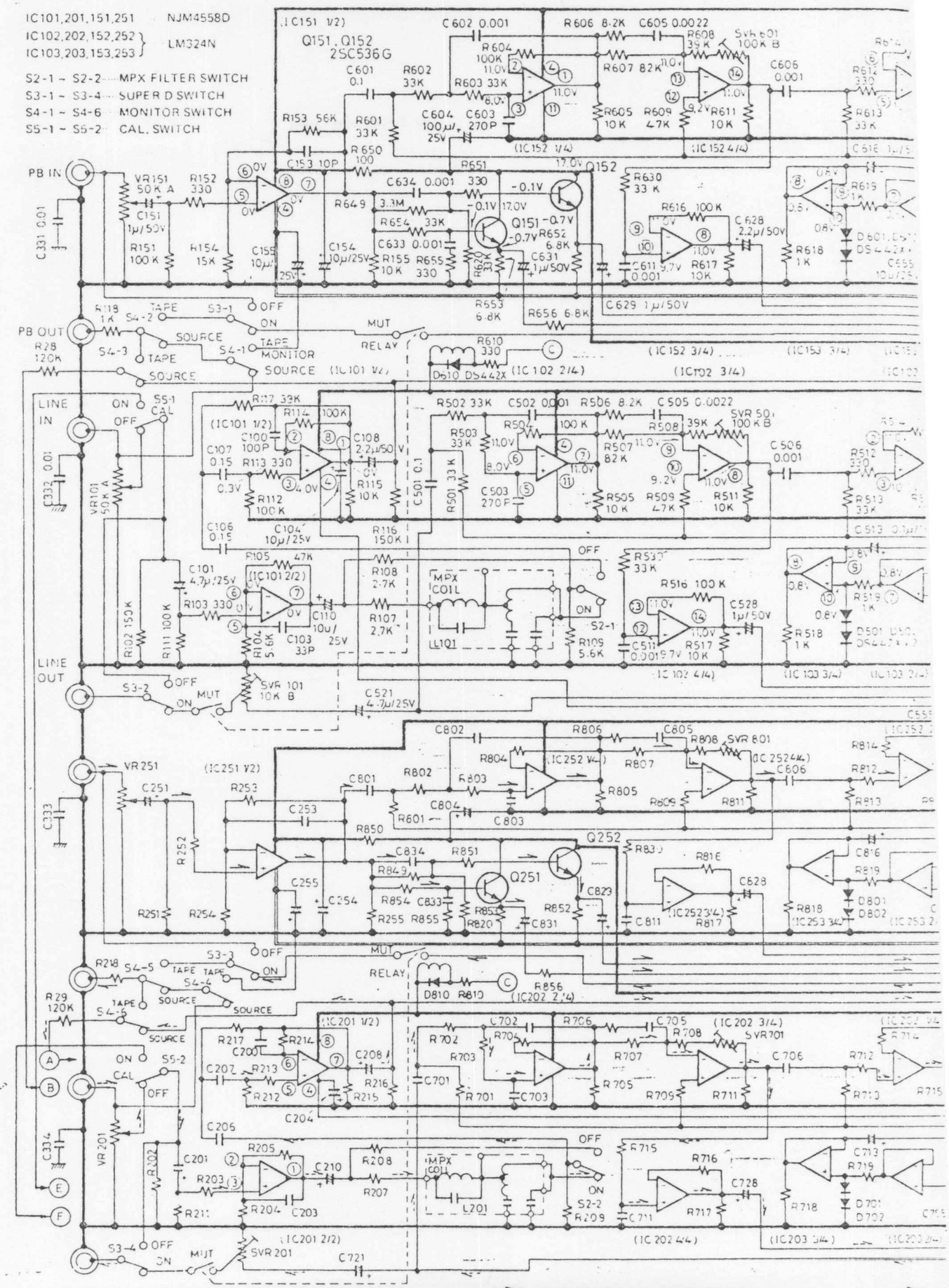
IC NE 570 N

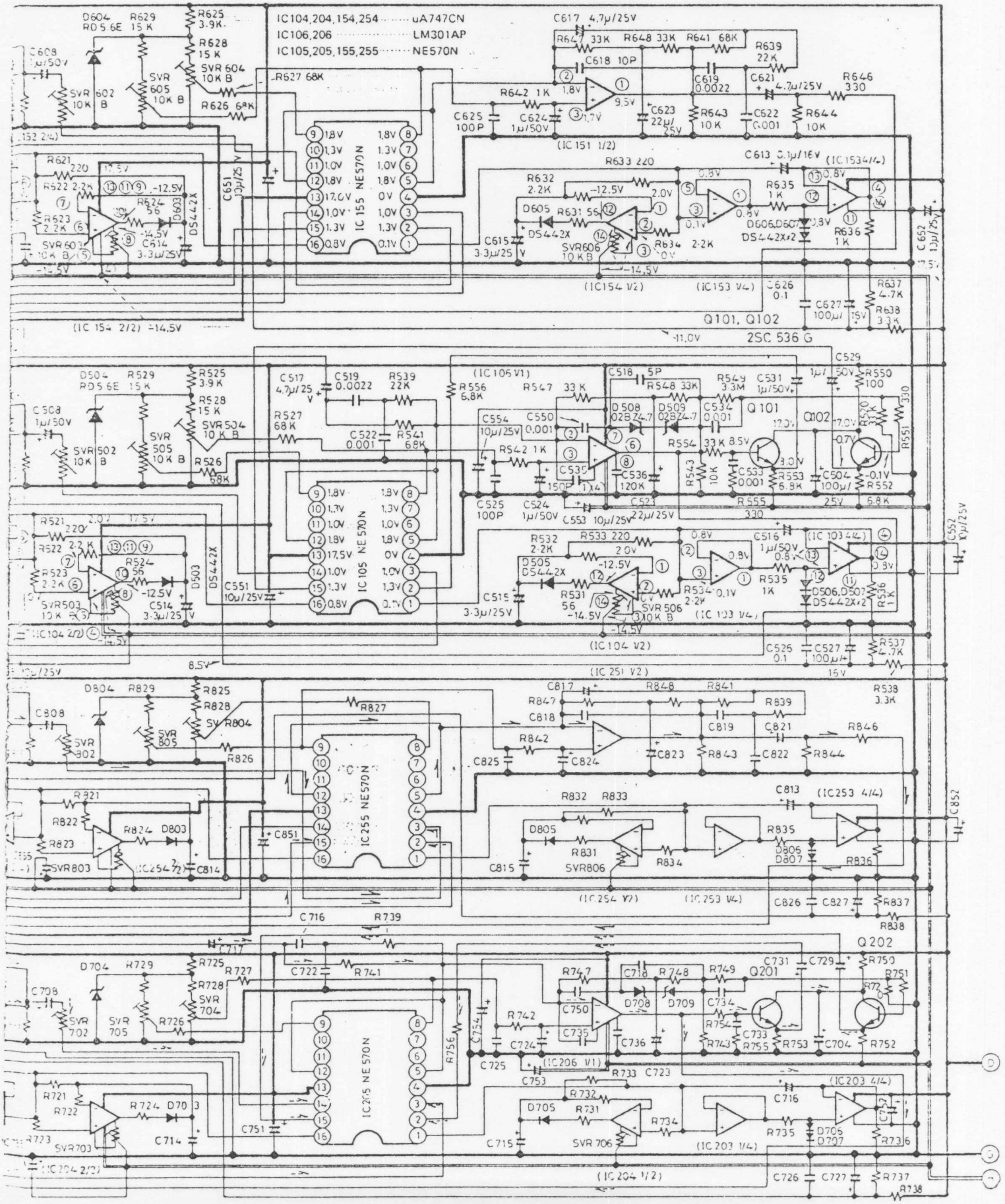


IC uA 747CN



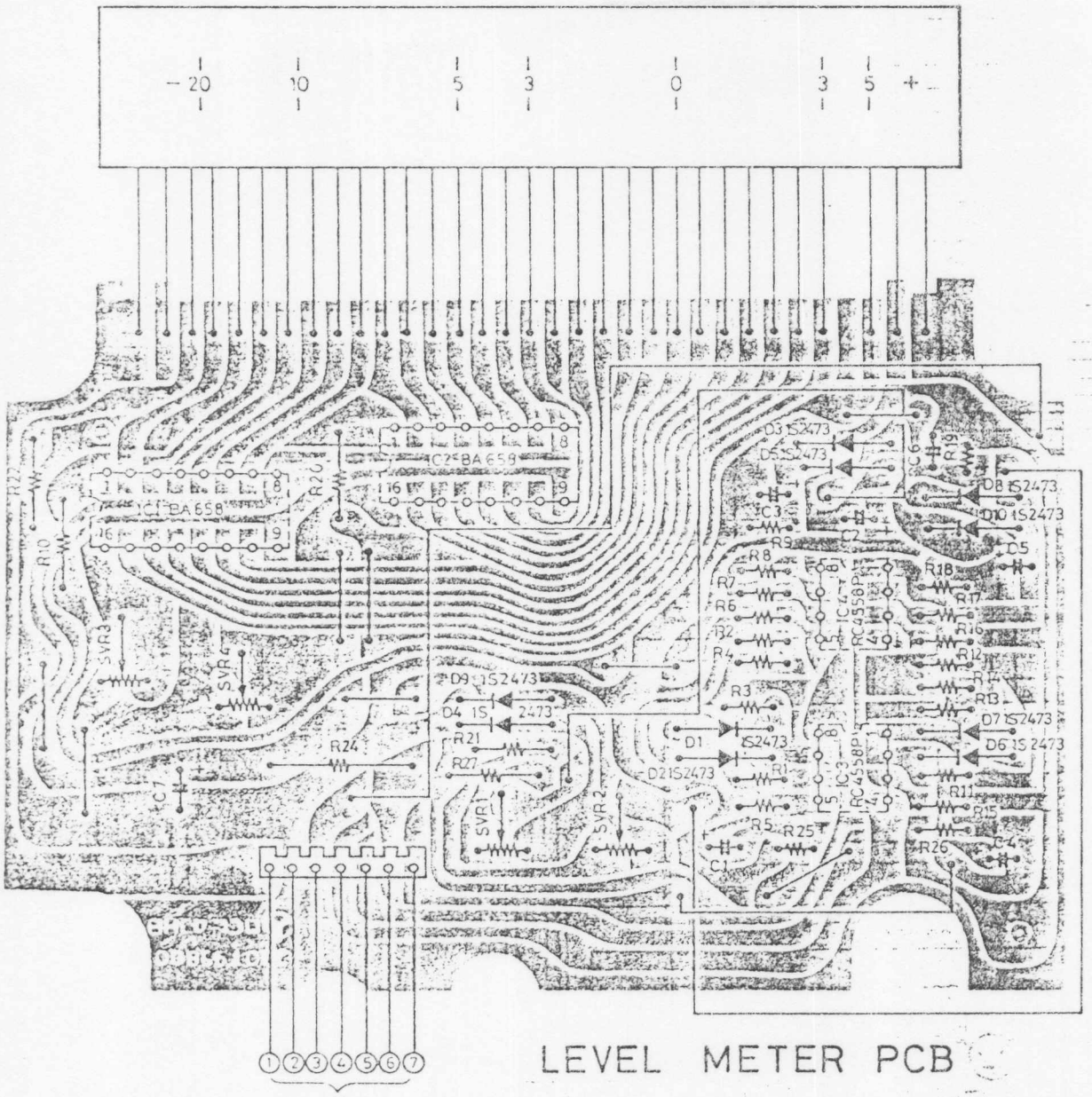
IC LM301AP


IC101,201,151,251 NJM4558D
IC102,202,152,252 } LM324N
IC103,203,153,253 }
S2-1 ~ S2-2 MPX FILTER SWITCH
S3-1 ~ S3-4 SUPER D SWITCH
S4-1 ~ S4-6 MONITOR SWITCH
S5-1 ~ S5-2 CAL. SWITCH
PB IN
PB OUT
LINE IN
LINE OUT
TAPE
SOURCE
MONITOR
MUT
RELAY
ON
OFF
CAL
MPX COIL
Q151, Q152 2SC536G
Q251
Q252
indicates signal flow of DECODER CIRCUIT.
indicates positive line.
indicates negative line.

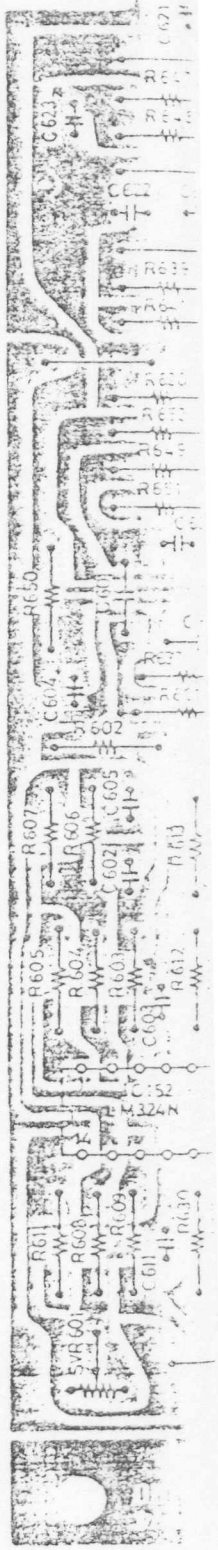


* Indicates signal flow of ENCODER CIRCUIT.

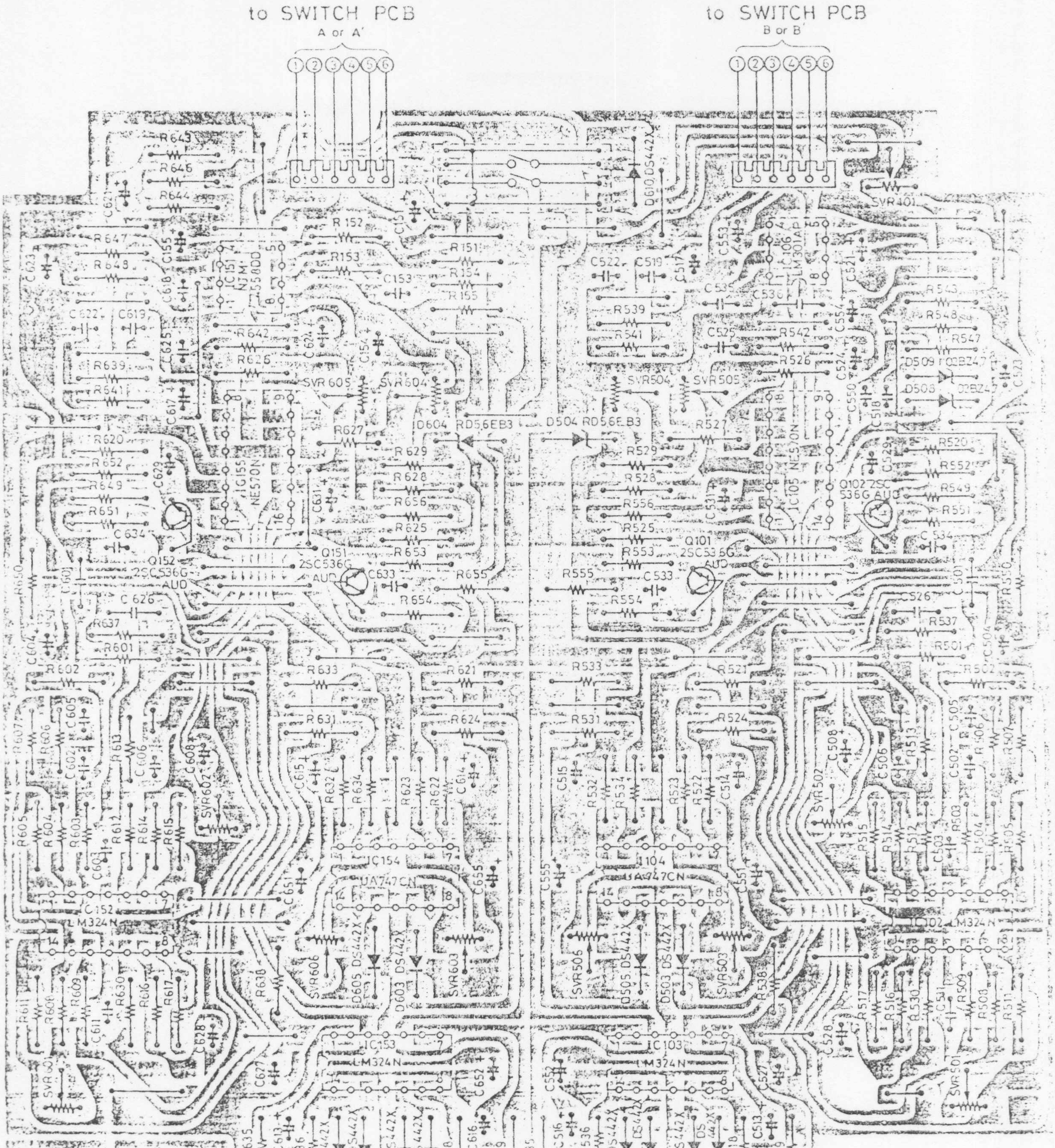
Indicates ground.



LEVEL METER PCB

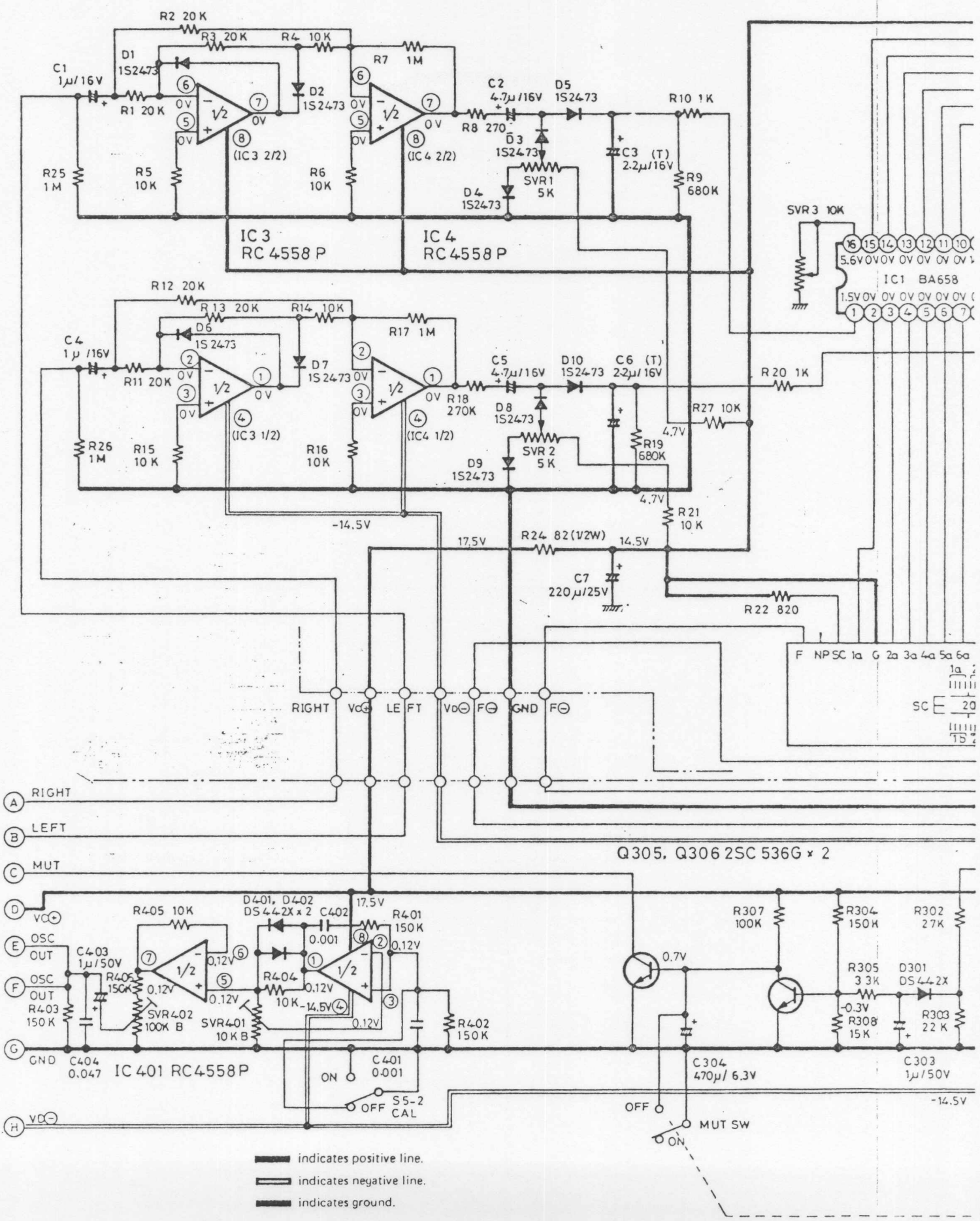


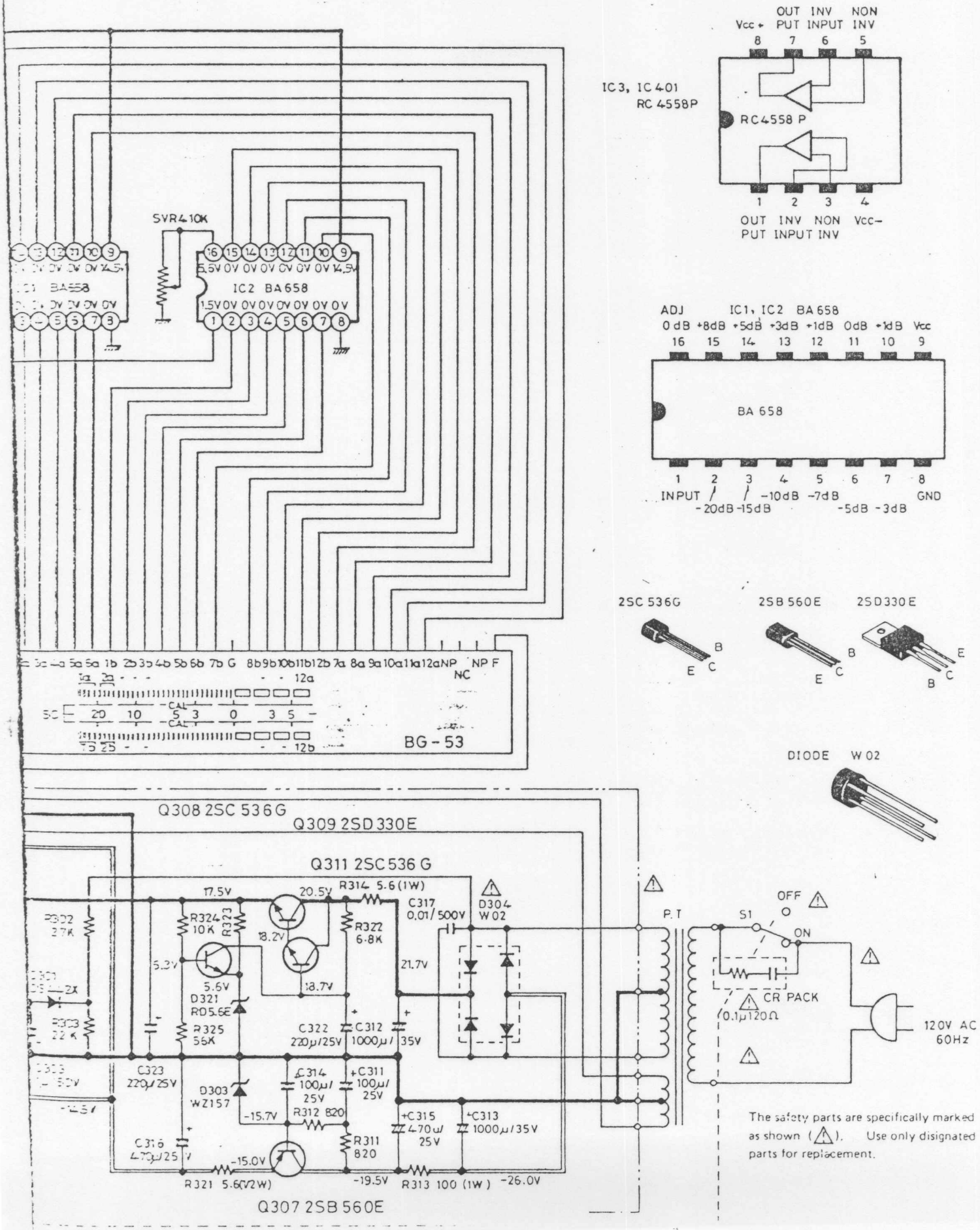
MAIN


to SWITCH PCB
A or A'
to SWITCH PCB
B or B'
IC151 NJM 558DD
IC106 LM301AP
IC155 NE570N
IC105 NE570N
Q151 2SC536G AUD
Q152 2SC536G AUD
Q101 2SC536G AUD
Q102 2SC536G AUD
D604 RD5.6EB3
D504 RD5.6EB3
D610 DS442X
D509 02BZ4.7
D508 02BZ4.7
SVR401
SVR504
SVR505
SVR604
SVR605
IC154 UA747CN
IC104 UA747CN
IC152 LM324N
IC102 LM324N
IC153 LM324N
IC103 LM324N

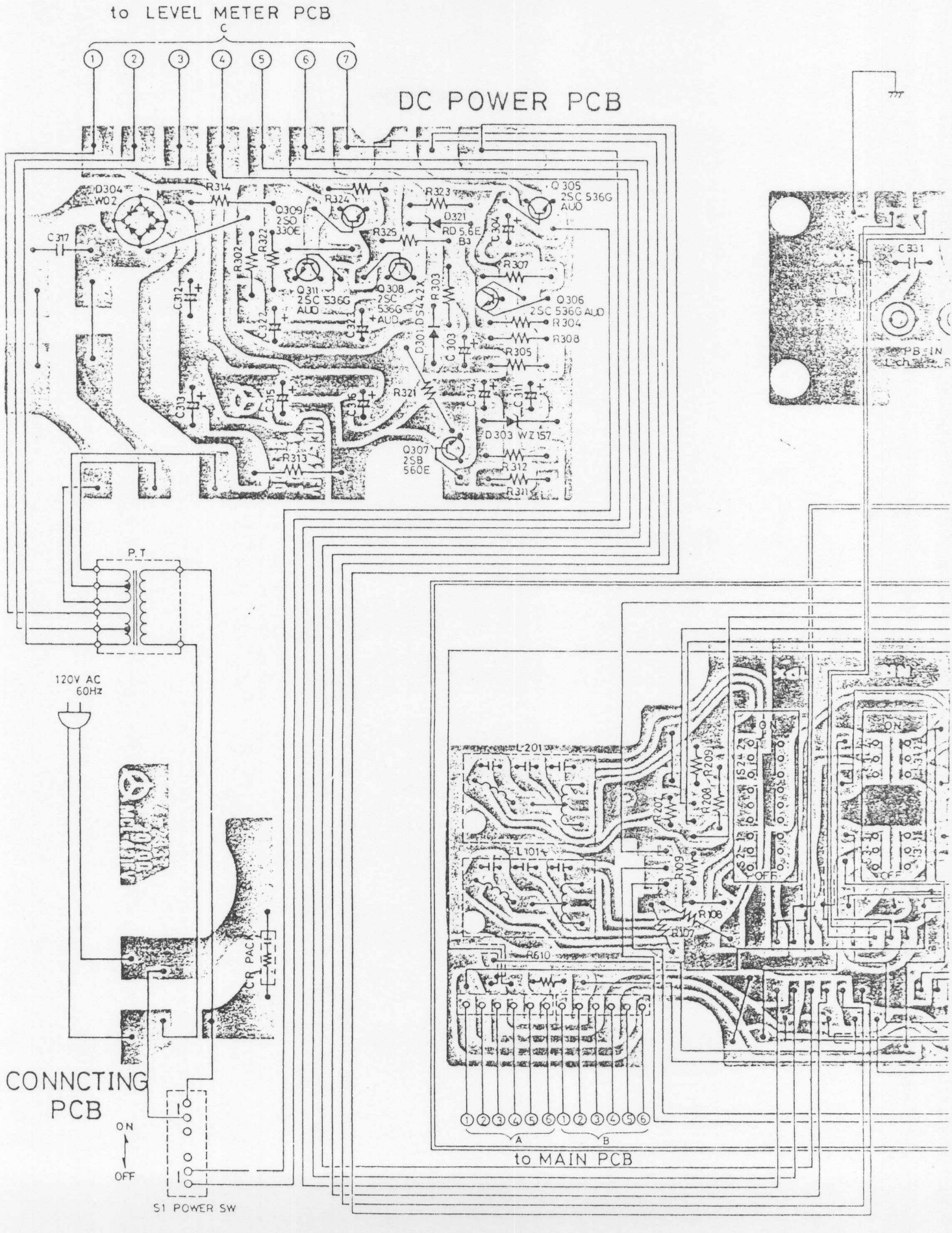
MAIN PCB

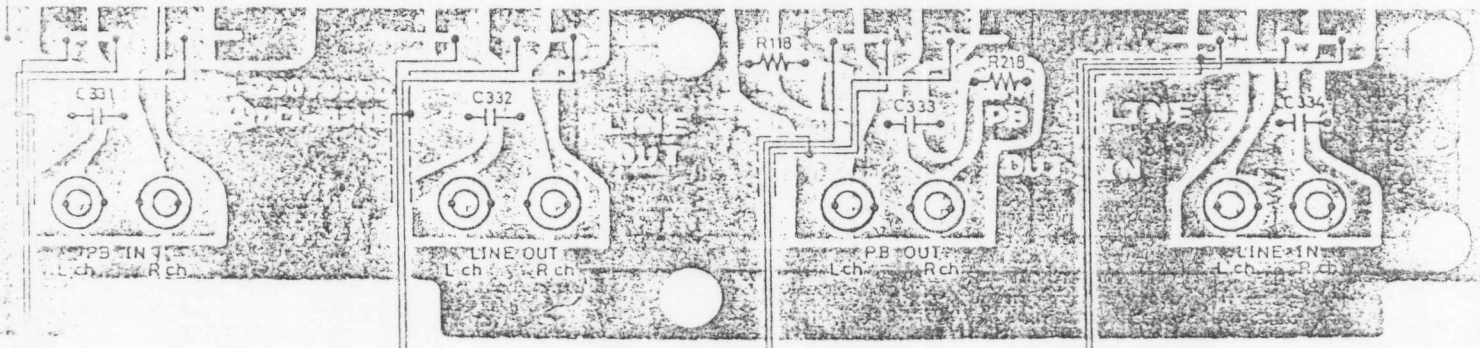
SCHEMATIC DIAGRAM



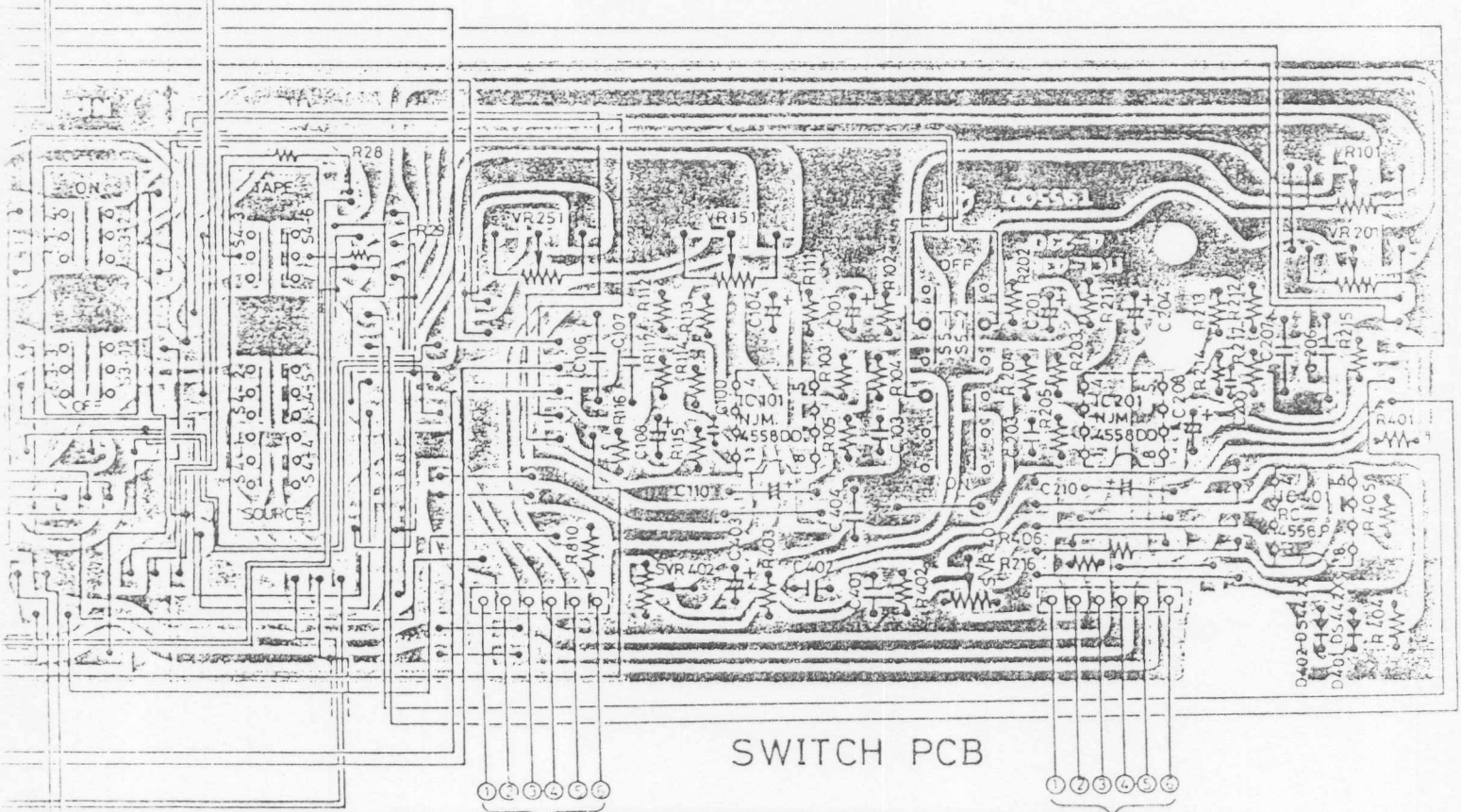


The safety parts are specifically marked as shown (⚠). Use only disignated parts for replacement.


to LEVEL METER PCB
C
1
2
3
4
5
6
7
DC POWER PCB
D304 W02
R314
Q309 2SD 330E
R324
R323
Q321 RD 5.6E B3
Q 305 2SC 536G AUD
C317
R325
C304
R307
R302
R322
Q 311 2SC 536G AUD
Q308 2SC 536G AUD
R303
Q 306 2SC 536G AUD
R304
C312
C322
C323
D301 DS442X
C 303
R308
R305
C313
C315
C316
R321
C314
C311
D303 WZ157
Q307 2SB 560E
R312
R313
R311
C331
PB IN
Lch
P.T
120V AC 60Hz
L201
L101
R207
R208
R209
R109
R108
R107
R610
CR PACK
CONNCTING PCB
ON
OFF
S1 POWER SW
1 2 3 4 5 6 1 2 3 4 5 6
A
B
to MAIN PCB



SOCKET PCB



SWITCH PCB

to MAIN PCB

to MAIN PCB