Technics
by Panasonic

CD-4 FM/AM 4-CHANNEL/2-CHANNEL RECEIVER

SA-8000X

OPERATING INSTRUCTIONS

Before operating this set, please read these instructions completely.

Your new "Technics by Panasonic" CD-4 FM/AM 4-channel/2-channel receiver was manufactured and assembled under exacting quality control standards.
The incorporation of the latest advances in design and the use of the most modern components assure outstanding performance with superb sensitivity and tonal quality.
A few minutes of your time, wisely spent reading carefully through this instruction booklet, will assure you of getting the maximum benefit of this fine component's potential.

CONTENTS

MAINTENANCE

WARNING CONCERNING REMOVAL OF COVERS

NOTE: This set should be serviced by qualified technicians only.
No service information is provided for customers.

PRODUCT SERVICE

Should your "Technics by Panasonic" product ever require servicing, refer to the Directory of Authorized Service Centers or your franchised "Technics by Panasonic" dealer for detailed instructions.

WARRANTY

Two years parts and labor, subject to the terms of the warranty. Read your warranty carefully.

LOCATION OF SERIAL NUMBER

You will find the serial number located at the bottom of the unit.

HELPFUL HINTS

1. Keep this unit away from electrical noise-generating devices such as motors and fluorescent lamps.
2. The set should not be exposed to direct sunlight and should be kept free from dust, moisture and vibration.
3. The set is ventilated through vents on the top and bottom of the cabinet. Do not place any object on the top or place the set on a soft surface which might block the ventilation holes and result in too much internal heat.
   Place the receiver in a position away from any heat source.
4. The cabinet of your set should be given the same care which you would give any piece of fine furniture. The front panel should be cleaned with a soft cloth moistened with a mild soap-and-water solution.
   NEVER USE A SOLUTION CONTAINING BENZOL OR PETROLEUM.

STAR FEATURES

AMPLIFIER SECTION

■ Differential, All-stage, Direct-Coupled OCL-Amplifier Circuit

The main amplifier of this receiver uses an all-stage direct-coupled OCL circuit with a differential amplifier unit in the first stage. As this circuitry has no output capacitor, the band width of the low frequency region is wide; further, as there is no interference with the low frequency damping factor, sufficient damping can be applied to the speakers. Complete absence of muffling in the bass region means that bass tones can be reproduced at high volume with utmost clarity. The use of a differential amplifier unit in the first stage means that power stability is maintained even if there is variation in the voltage or temperature. Moreover, as the power circuit of the differential amplifier unit uses a zener diode, direct current stability at the speaker terminals is further improved. These features result in excellent performance characteristics over the whole sound range at any output level.

■ Balanced-Transformerless Circuit for Improved 2-channel Reproduction

Though the SA-8000X is a 4-channel receiver, switching the balanced-transformerless circuit during 2-channel reproduction will activate all four main amplifiers.

■ Unique Tone Control

The tone control circuit is of unique construction, employing the NFB circuit of the main amplifier.
The high-level NFB technology adopted in the OCL circuit affords smooth frequency variation, enabling ready control of the sound characteristics to suit the acoustic properties of the room and personal taste.
Moreover, the absence of a tone control amplifier means that there is no distortion due to the tone control circuit.

■ Low-Noise, 2-stage, Direct-Coupled Equalizer Circuit

As the input stage to the amplifier, an equalizer circuit which can handle the weakest of signals is necessary for a high S/N ratio, one of the most important factors for good performance.
The equalizer circuit featured in this unit is a PNP-NPN, 2-stage direct-coupled circuit, incorporating a combination of low-noise PNP and NPN transistors. The direct-current NFB from the emitter of the NPN transistor of the second stage is applied to the base of the first stage, resulting in

a circuit with a high direct-current stability, a low distortion factor and a high S/N ratio.

■ Two Tape-Monitor Circuits

This receiver houses two tape-monitor circuits. Two 4-channel tape decks can be connected to the unit, and simultaneous recording on two decks or tape-to-tape dubbing is possible. An extremely convenient feature is the ability to monitor during dubbing, switching from the source sound to the just-dubbed recording.

■ Built-in CD-4 Demodulator

Because this unit has a built-in CD-4 demodulator, the purchase of a 4-channel cartridge to playback discrete 4-channel sounds from CD-4 records is all that is necessary. When playing a CD-4 record, the separation and the carrier level of the 4-channel signal are changed depending upon the characteristics of different 4-channel cartridges. This unit has a volume control for the separation and for the carrier level to assure faithful response to all 4-channel cartridges. Any type of 4-channel cartridge can be used with confidence that the best performance from the CD-4 record will be fully demonstrated.

■ Flexible AFD Controls for Matrix Operation

The exciting SA-8000X incorporates a special encoding-decoding circuit to transform 2-channel input signals to 4-channel sound ambiance. With the 4-channel matrix circuit, it is also possible to convert all your 2-channel material to 4-channel sound and record it. Also, since it features completely variable (0~1) AFD controls, you can match its decoding factors with the matrix encoding factor of any 4-2-4 records, thus recreating the original acoustic conditions.

But the real secret of quality 4-channel reproduction is in the phase difference in the rear speakers.

The SA-8000X mode selector (14) enables you to select either a 90° or 0° phase difference.

■ Large, Peak-indication-type VU Meters

Because a peak-indication-type VU meter, which indicates the peak output of the program source, is utilized for each channel, the dynamic range of the program source can be determined at a glance. In addition, these meters can be used to adjust the output level of each channel of the program source and to check the frequency characteristics of the cartridge and the tape head. Moreover, a meter sensitivity selector is used.

TUNER SECTION

■ Highly Sensitive FM Front-End

Because it is the input stage to the FM tuner, the FM front-end determines the performance of the receiver. The front-end of this receiver has high input impedance, using a 4-pole MOS-type FET with good S/N characteristics. The FET not only has high impedance, but also an extremely low level of feedback, resulting in a high S/N ratio and superb sensitivity. The variable capacitor is the frequency-linear type, allowing easy station selection.

■ High Performance IF Amplifier Circuit

The IF amplifier circuit has an important bearing on the gain and selectivity obtained. The IF section of this receiver features five-stage construction (including three differential amplifier stages) and three two-element ceramic filters. This gives it higher limiter characteristics and better selectivity. Full exploitation of each of the amplification stages gives a selectivity of better than 65 dB and an S/N ratio as high as 65 dB.

■ Highly Efficient Muting Circuit

A true muting circuit, incorporating a double-tuned LC circuit, affords clean cut-out of inter-station noise and exclusion of unwanted interference from strong signals.

■ IC-Engineered MPX Circuit

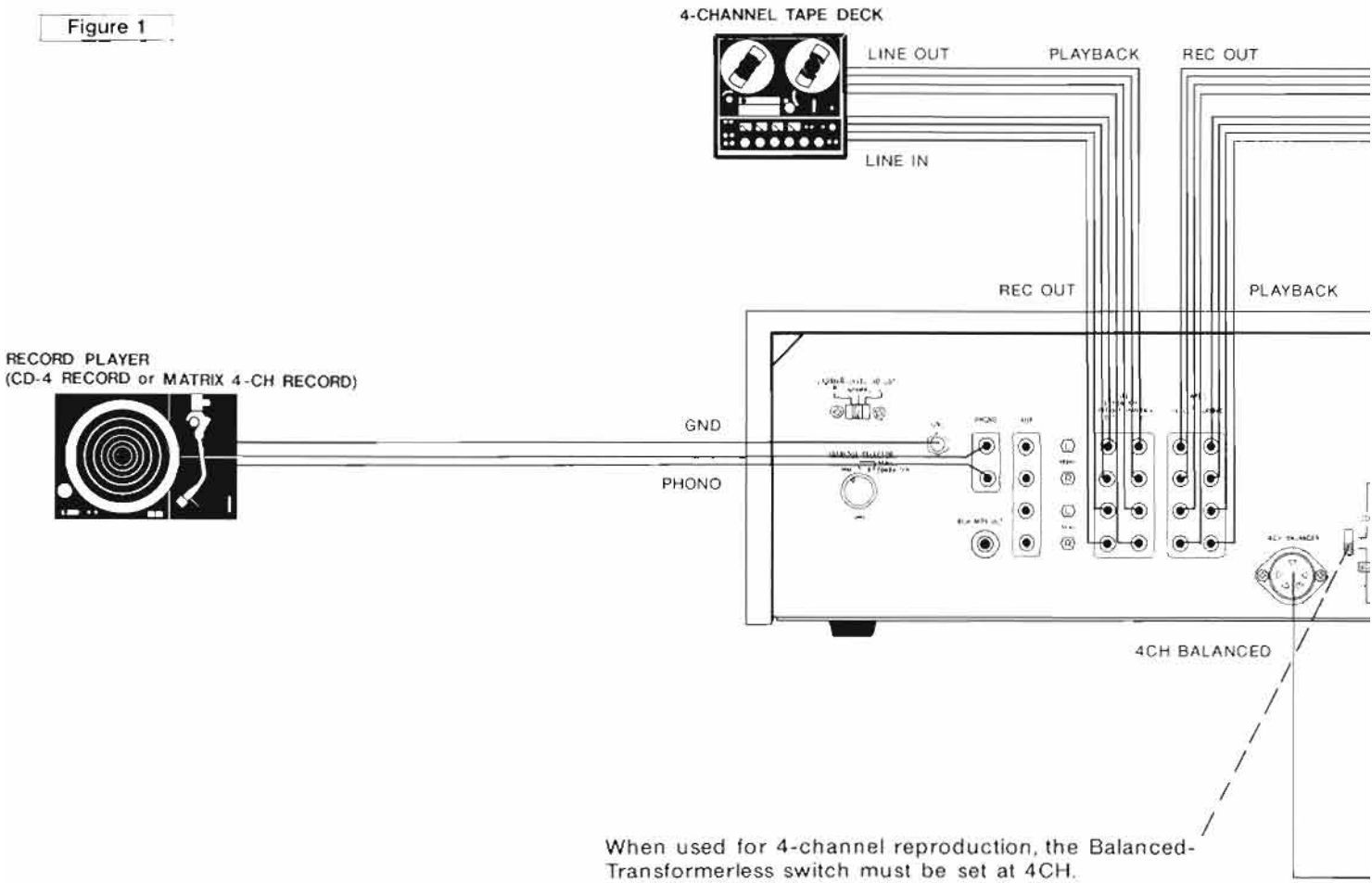
The MPX circuit of this receiver includes a monolithic IC, incorporating two differential switching circuits. It features stable performance, unaffected by heat or humidity.

■ High Performance AM Tuner

A ceramic filter exclusive for AM is used, giving high selectivity and sensitivity. This section also has a frequency-linear variable capacitor to assure easy station selection.

CONNECTION WIRING FOR 4-CHANNEL SYSTEM

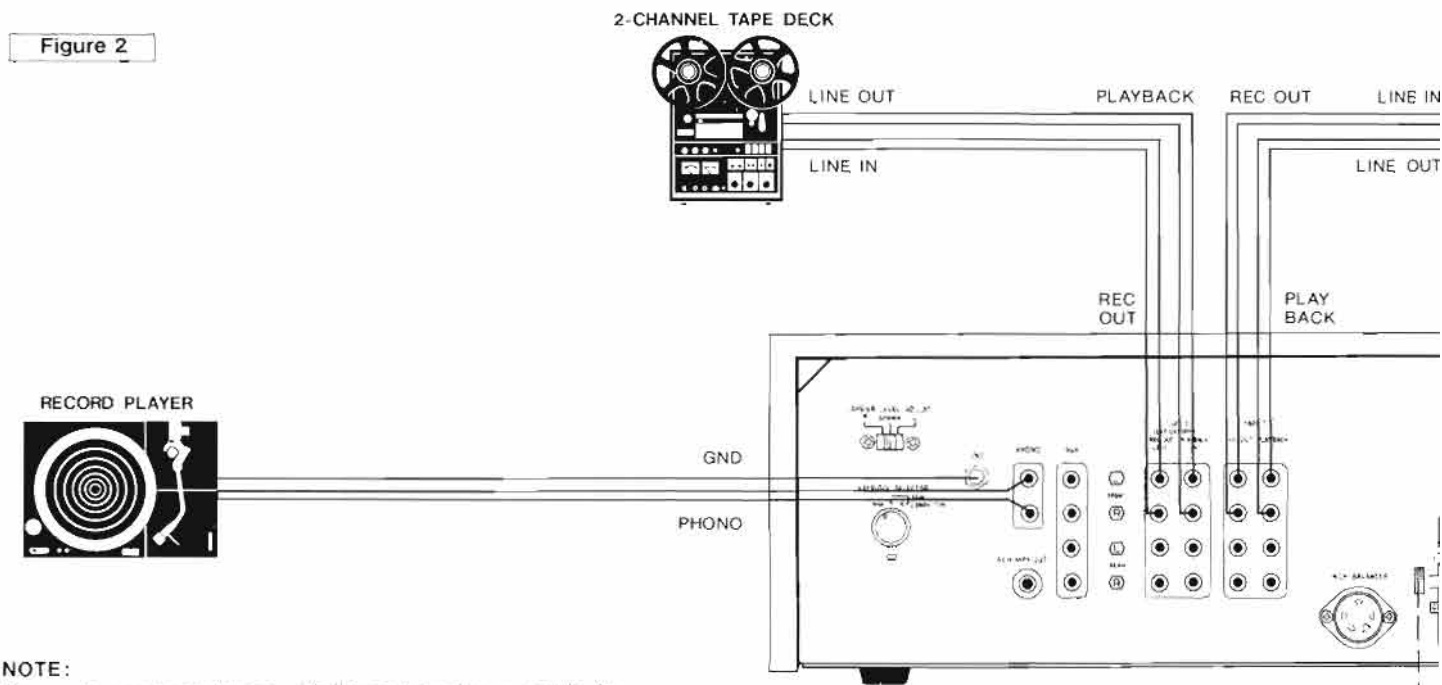
Figure 1



When used for 4-channel reproduction, the Balanced-Transformerless switch must be set at 4CH.

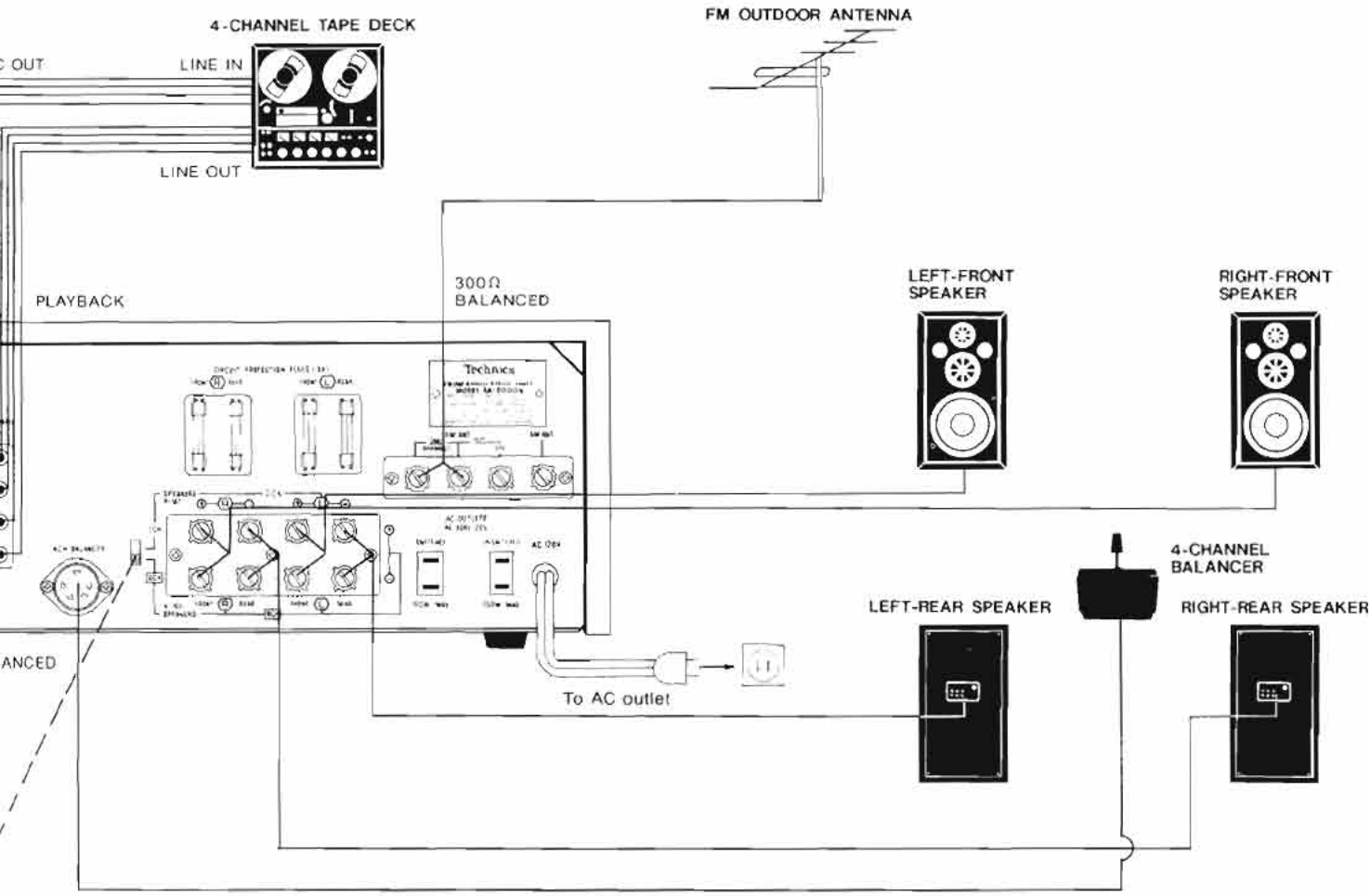
CONNECTION WIRING FOR 2-CHANNEL SYSTEM (BALANCED-TRAN

Figure 2

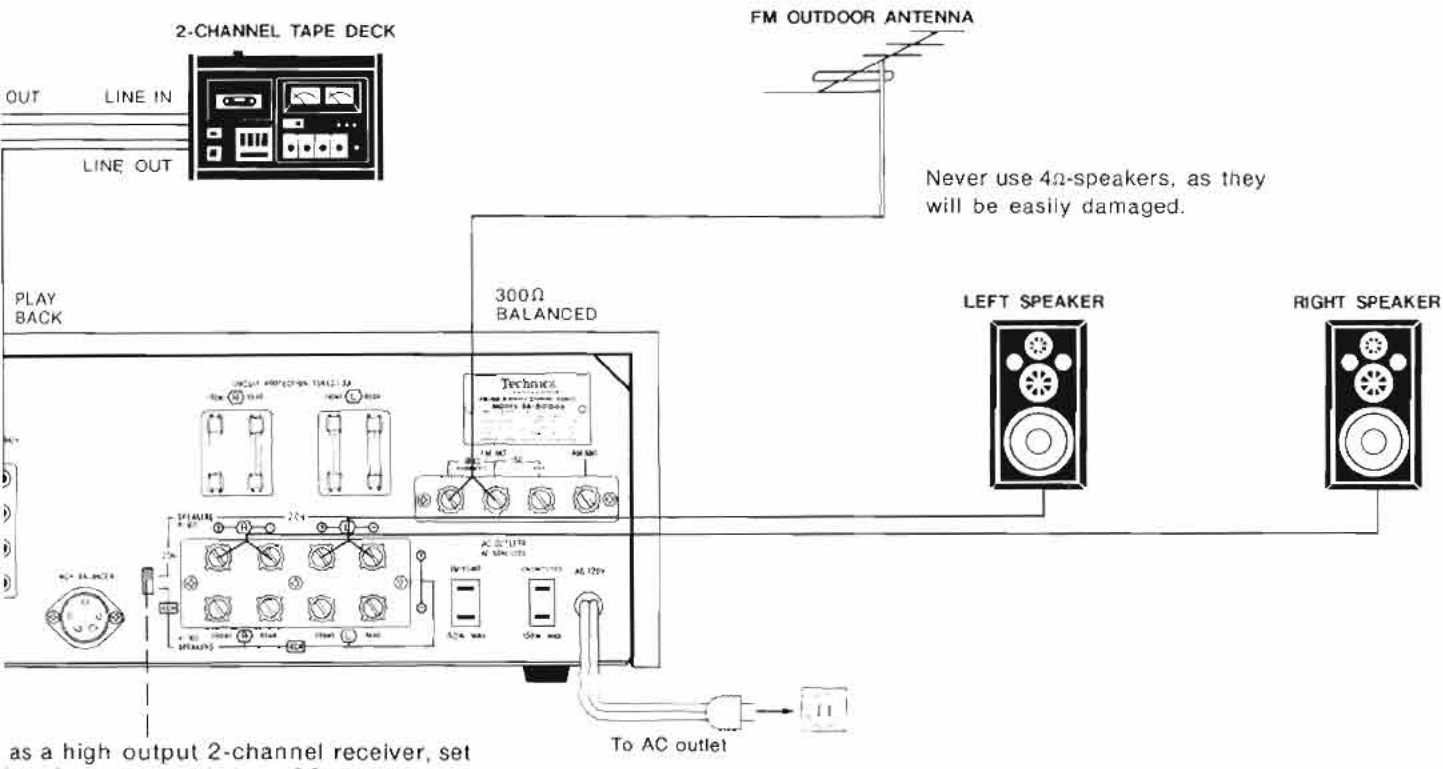


NOTE:
Connection in accordance with figure 1 is also possible for 2-channel reproduction (provided the rear speakers are not connected).
However, for high-output 2-channel reproduction connect as shown in this figure.

To use the set as a high outp
the Balanced-Transformerless
the speaker connections as



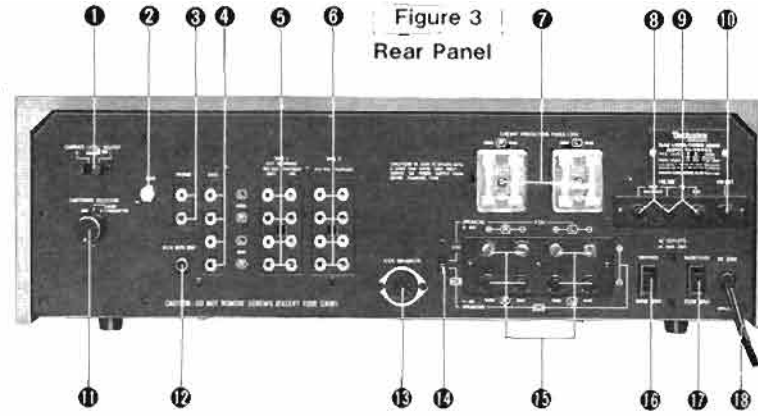
ICED-TRANSFORMERLESS)



as a high output 2-channel receiver, set
ransformerless switch at 2CH and make
onnections as shown in this figure.

CONNECTION PROCEDURE

Figure 3
Rear Panel



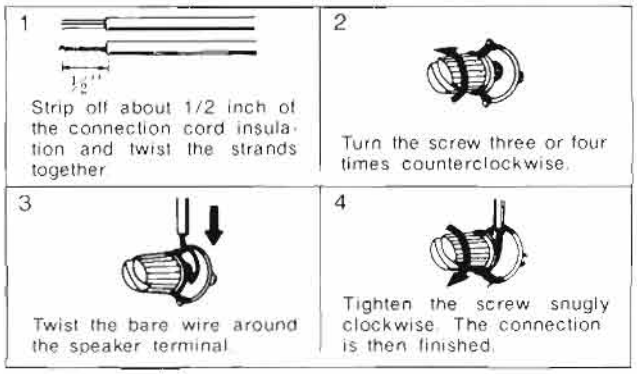
NOTE:

Do not plug the receiver into a power outlet until all other connections have been made. Keep the power pushbutton ① released to the off position.

Speaker connections (SPEAKERS ⓯)

Use medium-gauge wire, such as AC power cord, for speaker connections so as not to decrease the damping factor. For perfect connections, follow the procedure shown in figure 4.

Figure 4



Using 4～16Ω-impedance voice-coil speakers, make the connections as shown in figure 1. From left to right in the figure, the speaker terminals are: R-front, R-rear, L-front, L-rear. The + terminals are red; the − terminals black.

L-front terminal .....left-front speaker
R-front terminal .....right-front speaker
R-rear terminal .....right-rear speaker
L-rear terminal.....left-rear speaker

(For 2-channel reproduction, use the R-front and L-front terminals.)

With the speakers connected in this way, the balanced-transformerless switch ⓮ must be set to the 4 CH position. If it is set to the 2 CH position when a 4-channel input is used, the rear signals will be cut out: both front and rear speakers will receive identical signals, and a true 4-channel acoustic field will not be obtained.

Balanced-Transformerless Connections (2-channel reproduction)

With a 2-channel input, two speakers can be connected in the balanced-transformerless mode; the set then acts as a high-output 2-channel receiver. In this case, the balanced-transformerless switch must be set to the 2 CH position. If it is set to the 4 CH position, the sound will not always come from the speakers used. Use 8～16Ω-impedance voice-coil speakers and connect as shown in figure 2.

Never use 4Ω-speakers, as they will be easily damaged

Connect the speakers to the upper four red terminals. From the left in the figure, connect the first two upper terminals to the right speaker, the left one to the + speaker terminal, the right one to the − speaker terminal; connect the second pair of upper terminals to the left speakers in the same way.

NOTE:

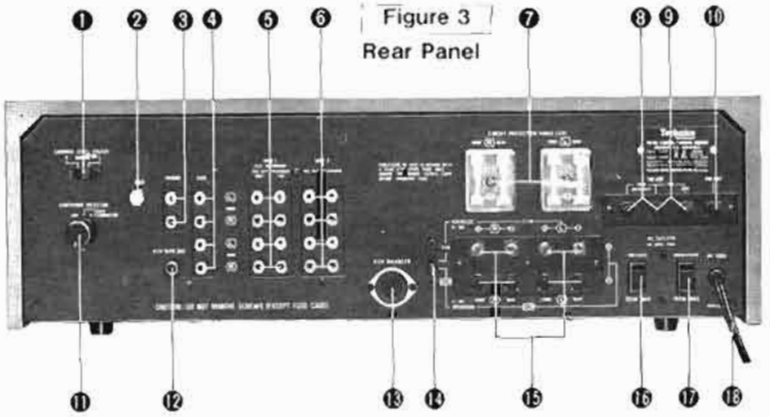
- Be sure to connect the left and right channels correctly. Double check that each speaker is properly connected to the plus and minus terminals.
  If the polarities are reversed, the speaker will be out of phase, the bass tones will appear low, and the stereo effect will be ruined.
  How to check
  Set the mode selector ⓭ to the MONO position.
  Front speakers:
  Turn the L-REAR ⑧ and R-REAR ⑪ channel level controls to their "0" positions in order to hear sounds from the front speakers only.
  If the polarity is correct, the sound will seem to be heard from the center, between the left and right speakers. If it is incorrect, the sounds will not appear to gather at the center, but will seem dispersed. If so, confirm that the connections of the speakers are correctly made. In order to correct the polarity, if it is incorrect, reverse the polarity connection between the amplifier and either the right or the left speaker.
  Rear speakers:
  Turn the L-FRONT ⑦ and R-FRONT ⑩ channel level controls to their "0" positions in order to hear the sounds from the rear speakers only.
  The position of other controls should be the same as when checking the front speakers.
- Be extremely careful that the terminals or speaker wires do not short each other out. Never use the minus speaker terminal for ground connections.
- It is better to use the same type speakers for the rear as for the front. For enjoying realistic 4-channel sounds, it is important to make the rear as perfect as possible. The four channels should be treated equally, just as the right and the left channels for stereo must be completely equal. If you have to use different speakers, adjust their tonal output so that their characteristics are as alike as possible.

Balanced-Transformerless Switch ⓮

This switch is for converting the set to a high-output 2-channel receiver. Normally, keep the switch in the 4 CH position; in this position, 2-channel reproduction can also be made. With the switch in the 2 CH position, the rear signals are cut out and only the front signals (2-channel signals) pass through the main amplifier. If the speaker connections are then made as shown in figure 2, the set acts as a high-output 2-channel receiver.

Used in this mode, the output power is increased, and therefore speakers with large input capabilities must be used. Use 8～16Ω-impedance voice-coil speakers.

Figure 3
Rear Panel



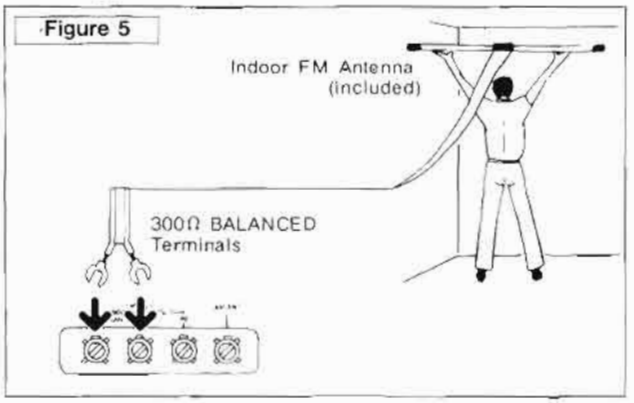
Connection of Antennas

300Ω FM Antenna Terminal ❽

Unfold the indoor FM antenna supplied with this unit and connect it to the "FM ANT 300Ω BALANCED" terminals (figure 5).

Mount the antenna in a "T" shape near a window or on a wall. The indoor FM antenna will provide good reception of most local FM stations. However, if you happen to be in an area with exceptionally weak FM signals (i.e., far from broadcasting stations, or in a reinforced-concrete building where the signal intensity is low), the indoor FM antenna may not supply sufficient signal input. An optional FM outdoor antenna for the FM band then becomes necessary, just as for a television receiver. The 300Ω-feeder wire of this antenna may also be connected to the "FM ANT 300Ω BALANCED" terminals.

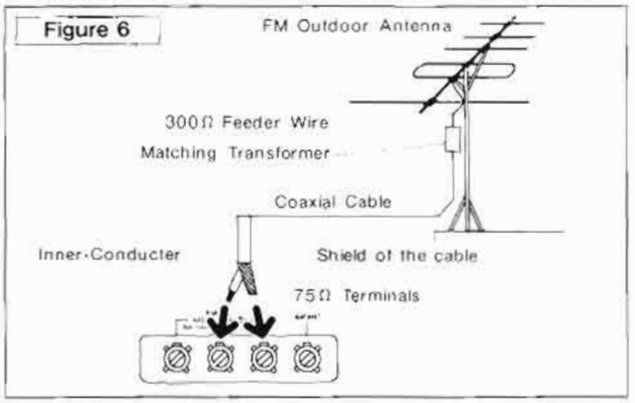
Figure 5



75Ω Antenna Terminals ❾

If an optional FM antenna is used and the antenna is far from the receiver or if noise interference ruins the reception, use coaxial cable (75Ω). Use an impedance-matching transformer between the antenna and the coaxial cable to match the impedance with the unit's terminals (figure 6). Connect the shield of the cable to the 75Ω GND terminal.

Figure 6



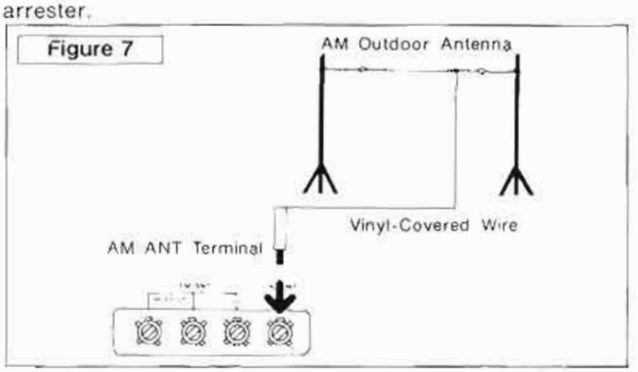
AM Antenna

This receiver incorporates a highly-sensitive built-in AM ferrite bar antenna for receiving normal AM broadcasting signals. No additional antenna should be necessary for receiving local AM stations.

AM Antenna Terminal ❿

In weak signal areas, far from broadcasting stations, or in a reinforced-concrete building, the highly-sensitive built-in ferrite-bar antenna alone may fail to provide good AM reception. If so, connect a length of vinyl-covered wire to the AM antenna terminal (labeled "AM ANT", on the rear panel). Then place this antenna outdoors a short distance away from the building. Because the sensitivity of an outdoor antenna varies greatly with its position, someone should listen for the strongest signals as the antenna is oriented. For safety reasons, the antenna should include a lightning arrester.

Figure 7



Input Source Connections

Use good quality shielded cable and cut it as short as possible to avoid picking up noise and to preserve the delicate treble characteristics of the input signal.

Phono Terminals ❸

Use a record player cartridge (4-channel cartridge or 2-channel cartridge) which has an output of 1 mV to 10 mV (50 mm/sec).

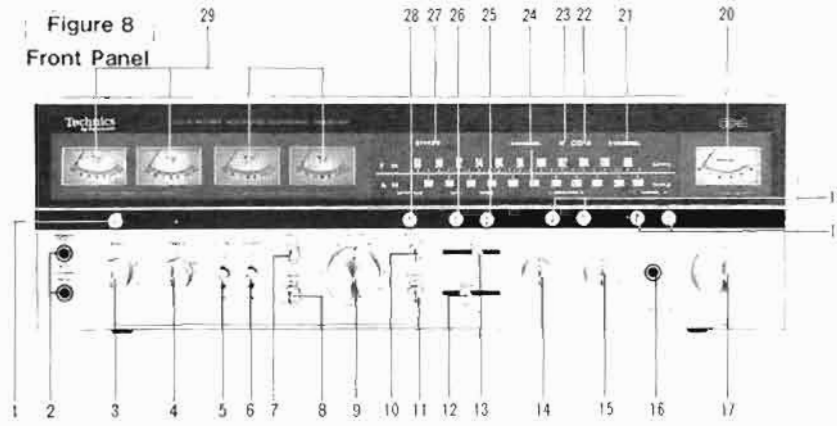
If the record player has an earth-ground terminal wire, connect it to the earth-ground terminal ❷ of this unit.

Cartridges

The setting of the cartridge selector ⓮ can be changed to permit the unit to be used with various cartridges. At the MM position, magnetic type cartridges (the moving-magnet type (MM), the induced-magnet type (IM), or the moving-coil type (MC)) can be used.

Note that a moving-coil cartridge with low output cannot be connected directly to this unit. If must be used with either a boosting transformer or a head amplifier. At the SEMICONDUCTOR position, a semiconductor type cartridge can be used.

Figure 8
Front Panel



Cartridge Selector ⓫

Set this switch to the position corresponding to the type of cartridge which is to be used with a record player connected to this unit.

MM .....Set to this position when using a magnetic-type cartridge.

SEMICONDUCTOR...Set to this position when using a semiconductor type cartridge.
There are two positions, A and B. For ordinary use, the A position should be used. If the record player used is the type which turns off the output of the cartridge with the arm after record performance has finished, such as an automatic-change turntable, the B position should be used.
Note that if the A position is used for this type of turntable, an electric "shock" noise will be heard when the output of the cartridge is turned off. At the B position, special circuitry is utilized to reduce such noises. Note, however, that the characteristics are slightly decreased as compared with the A position.

NOTE: In order to operate a semiconductor-type cartridge, a bias current is necessary. For this reason, this unit is designed so that, when this selector is set to the SEMICONDUCTOR A or B position, bias current is obtained from the PHONO terminals❸. If this selector is set to either SEMICONDUCTOR A or B when using a magnetic-type cartridge, bias current will flow to the magnetic-type cartridge, causing a reduction in the performance characteristics. Be sure to confirm the type of cartridge used, before turning on the power, and set the selector to the correct position accordingly.
When using a semiconductor cartridge, set the input selector to the CD-4 position for both CD-4 play as well as for 2-channel play.

Carrier Level Adjustment Switch ❶

This switch, together with the carrier level control on the front panel, is used to control the input level of the 30kHz carrier signal of a 4-channel cartridge.

L .....Set to this position for adjustment of the input level of the left channel.

R .....Set to this position for adjustment of the input level of the right channel.

NORMAL...Set to this position after the input levels of the left and right channels have been adjusted.
Set to this position during the performance of a CD-4 record.

(For further details, refer to the explanation of "Input level control for the 30kHz carrier signal" on page 15.)

Auxiliary Terminals ❹

The sensitivity level of these terminals is 150 mV, and the input impedance is 60 kΩ. They are for connection with the output of a tape player or 8-track stereo, a semiconductor cartridge with head amplifier, etc. When connecting a 2-channel source, connect it directly to the L- and R-front terminals.

Tape Deck Terminals (TAPE 1 ❺, TAPE 2 ❻)

You can connect 2 separate tape decks directly to this unit. You may use either 4- or 2-channel tape decks for recording or playback. However, when using a 2-channel tape deck, be sure to connect it to the left- and right-front terminals only. The electronic characteristics of both tape deck terminals (1 and 2) are identical.

Playback Terminals

Connect the output terminals of tape decks to these terminals (input sensitivity = 150mV, input impedance = 60kΩ).

Recording Output Terminals

These are used for recording the output signal of the receiver. Connect the input leads of the tape deck here (output level = 150mV).
The signal to be recorded is selected by the input selector, but tone, volume and other receiver controls have no bearing on the recording of the signal, which can be regulated only by the tape deck recording level control(s).

4-channel Remote Balancer Connection (4 CH BALANCER) ⓭

This is the terminal for a 4-channel remote balancer ("Technics by Panasonic" SH-1010). It can be used to obtain the best listening position anywhere in the room. Since the most effective listening area for 4-channel playback is rather small, this unit is most convenient for positioning it.

4 CH MPX Terminal ⓬

This is a signal output terminal for future discrete 4-channel FM broadcasts. A decoder for discrete 4-channel broadcasts will also be necessary, in addition to an ordinary stereo system.

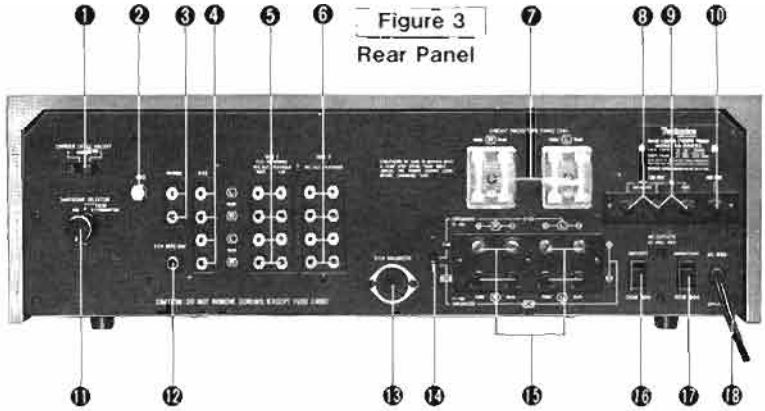


Figure 3
Rear Panel

SWITCHES AND CONTROLS

Power outlet (AC OUTLET)
Switched ⑯

Other equipment connected to this outlet can be switched on and off with the power pushbutton ① on the front panel. Use this outlet as a power source for other audio units (output power: 150W).

Unswitched ⑰

This outlet can always be used as a power source for other equipment regardless of the front panel power pushbutton position (output power: 150W).

Ground Terminal (GND) ❷

The ground leads of the turntable and tape deck should be connected to this ground terminal (GND). If hum is heard, an external ground may be necessary. It is advisable to ground the chassis in order to get the best signal-to-noise characteristics.

Circuit Protection Fuse ❼

If no sound is heard from one or more speakers when the unit has been installed and the pilot lamp is illuminated, turn off the power and check to see if the circuit protection fuse (on the rear panel) has failed. If so, replace it with a new fuse (fuse number XBAS1A 3001) after determining and correcting the cause of the fuse failure (such as a shorted speaker wire). Use only fuses numbered XBAS1A3001.

Power Requirement

The "Technics by Panasonic" SA-8000X requires an AC power source of 120V, 60 Hz.

NOTE:

Be sure that the connections to the speakers and the input source are securely made. If the connections are not secure, the receiver will not operate normally and may produce unnecessary noise.

This section (figure 8) describes the function of each of the controls of the receiver in the order of normal usage. By following these instructions in order, you will understand the operation of the receiver with a minimum of difficulty.

NOTE: Before switching the power pushbutton ① on, set the volume control to the "0" position.

Power Pushbutton ①

Upon pushing this button, the tuning dial, the signal-strength meter ⑳ and the VU meters ㉙ will illuminate, indicating that the receiver is on. To turn the receiver off, push the button again; the lights of the tuning dial, signal-strength meter and VU meters will go off. This pushbutton also controls the power to the switched outlet ⑯ on the rear panel of the receiver.

Input Selector ⑮

For selection of the input sound source.

PHONO When playing matrix 4-channel records and 2-channel records.

CD-4 When playing CD-4 records.

AUX When input is from another unit through the AUX terminals ❹ on the rear panel.

FM AUTO To hear FM broadcasts.
When a stereo signal is received, the unit will automatically switch to stereo. When a monaural signal is received, it will be automatically switched to monaural.

AM To hear AM broadcasts.

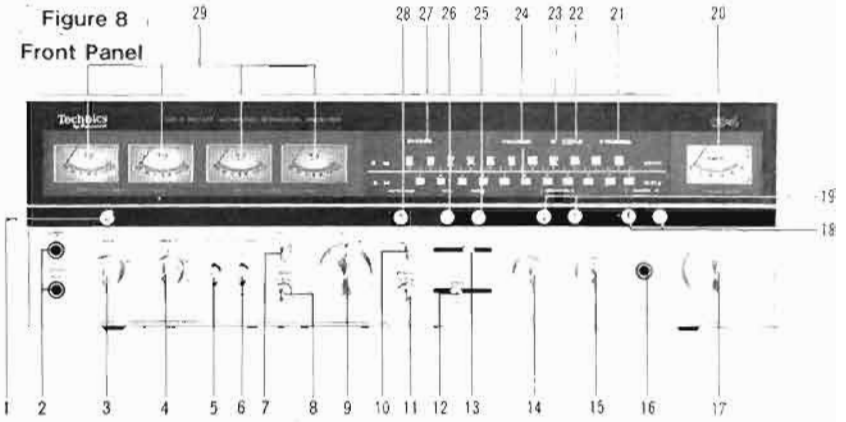
MIC When input is from a microphone.

NOTE: If the input levels of each program source are not matched and the input selector is inadvertently switched, there is a danger that a large sound output may be applied to the speakers, causing damage to them.
To avoid this, make sure, when switching inputs, either that the input levels are matched, or that the volume is turned down before switching.

Carrier Level Control ⑱

This is the input level volume control used in order to obtain the 30kHz carrier signal output (from a 4-channel cartridge) which is most suitable for the input of this unit. Use this control for adjustment when playing a CD-4 record with this unit for the first time, and when exchanging the 4-channel cartridge.
(For further details, refer to the explanation of "Input level control for the 30kHz carrier signal" on page 15.)

Figure 8
Front Panel



4-channel "Radar" (23)

This indicates the best level when adjusting the 30kHz carrier signal input from a 4-channel cartridge with the carrier level control.
When the most suitable input level is obtained, this lamp will illuminate.
When playing a CD-4 record, this lamp will also illuminate.
(For further details, refer to the explanation of "Input level control for the 30kHz carrier signal" on page 15.)

Separation Control (19)

This control is used for adjustment of the separation of 4-channel signals from a 4-channel cartridge. This is necessary because the separation of the 4-channel signals will vary depending upon the difference in the characteristics of the 4-channel cartridges used.
Use this control for adjustment when playing a CD-4 record with this unit for the first time, and when exchanging the 4-channel cartridge.
(For further details, refer to "Control of the separation" on page 15.)

CD-4 Indicator (22)

When the input selector (15) is set to the CD-4 position, this indicator illuminates at the same time.

Tape-Monitor Pushbuttons (TAPE 1) (26), (TAPE 2) (25)

When playing back from a tape deck, set the pushbutton to the TAPE 1 (pressed) or TAPE 2 (pressed) position. When playing back from the source designated by the input selector, set it to the SOURCE (released) position.
When using a 3-head tape deck, the sound which has just been recorded can be monitored by setting the pushbutton to the pressed (TAPE 1 or TAPE 2) position. The sound just prior to recording can be monitored by setting the pushbutton to the SOURCE (released) position. In addition, the recording condition can be checked during recording by setting this pushbutton alternately to the TAPE 1 (TAPE 2)/SOURCE position.

Tape 1 pushbutton (26): For monitoring tape deck 1 (TAPE 1) sound.
Tape 2 pushbutton (25): For monitoring tape deck 2 (TAPE 2) sound.

NOTE: When monitoring with the tape 1 pushbutton, be sure to set the tape 2 pushbutton to the SOURCE position. When monitoring with the tape 2 pushbutton, be sure to set the tape 1 pushbutton to the SOURCE position. Both sources, tape deck 1 (TAPE 1) and tape deck 2 (TAPE 2), cannot be played back simultaneously, the unit being designed so that tape deck 2 will have priority.

Mode Selector (MODE) (14)

MONO This position is for a monaural signal. If the signal is 2-channel, it mixes the left and right and delivers them equally through all 4 speakers. With a 4-channel signal, it mixes the left and right front signals and then delivers them through all 4 speakers.

STEREO For ordinary stereo performance. At this position, the left signal comes from the left speaker and the right signal from the right speaker. With 4-channel signals, it delivers the left front signal through the left speakers and the right front signal through the right speakers.

4 CH MATRIX Set the switch to this position for 4-channel reproduction of 2-channel sources, as well as matrix 4-channel sources. At the matrix 4-channel position, either of 2 types of phase difference can be selected.

- **PHASE 90°** At this position, the reverberations cover the listener with natural and realistic sound.
- **PHASE 0°** The orientation at the back becomes more distinctive as the sound from front and rear reach the listener at the same time, recreating a life-like true-to-the-original sensation.

4 CH DISCRETE Set to this position for reproduction of discrete 4-channel signals of CD-4 records, 4-channel tapes, etc.
(4-channel reproduction is explained in more detail in a later section.)

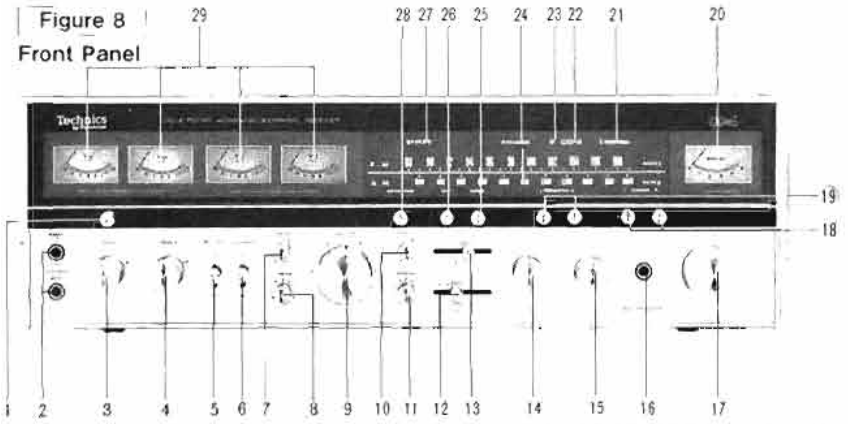
AFD Controls (Acoustic Field Dimension) (12), (13)

These special slide switches control the numerical values of the decoding factors for matrix 4-channel playback. With them, you can create the most fitting acoustic field. The WIDTH (13) regulates the right and left width, and the DEPTH (12) is for regulating the front and rear depth. The higher the graduation, the larger both fields become.

Channel Indicator (21) (24)

This is a channel indicator which operates in accordance with the setting of the mode selector (14).
At "4 CH DISCRETE" or "4 CH MATRIX" (i.e., for 4-channel), the 4-channel indicator (24) will illuminate.
At the "STEREO" position, the 2-channel indicator (21) will illuminate.
At the "MONO" position, neither of the indicators will illuminate.

Figure 8
Front Panel



Tuning Control (17)

Turn the tuning control slowly until the main dial pointer indicates the desired FM or AM broadcast frequency. Always tune for the highest possible signal strength meter (20) reading, which indicates the optimum receiving position. This will assure clear, undistorted reception, minimum interference from adjacent stations, and maximum left-right channel separation during FM stereo broadcasts. The value of the signal strength meter reading will depend on the signal strength of that particular station.

Weak station signals and transmission difficulties may cause the stereo indicator to blink on and off momentarily during FM broadcasts. Should this happen, set the mode selector (14) to the MONO position. In all probability, the interference will stop and you can continue listening to the program monaurally. If switching to the MONO position doesn't help, the interference could be caused by strong signals from nearby stations. Setting the muting switch (5) to the ON position will help to eliminate this problem. If you encounter this problem with many stations, you may be in a locality that requires a special type of antenna for reliable reception. The same is true if you encounter consistently poor reception on the AM band.

Signal Strength Meter (20)

Tune the receiver to the approximate frequency of the desired station. Observing the signal strength meter, tune until its pointer moves to the maximum position, which indicates the position of best tuning.

Stereo Indicator (27)

The stereo indicator is illuminated in orange when the receiver is tuned to a station broadcasting in FM multiplex stereo. If the mode selector (14) is set to the MONO position, the stereo indicator will not illuminate even though the broadcast is in stereo.

Volume Control (9)

This control simultaneously adjusts the volume of the front and rear.

Turning the control clockwise (maximum position is "10") increases the volume. Always set the volume control at "0" before turning on the set.

Channel Level Controls (7) (8) (10) (11)

These controls are for individual adjustment of the volume of the channels. The extreme right position ("10") gives maximum volume; the extreme left position ("0") gives mimimum volume. To balance the volume between channels, it is convenient to set each of these controls at position 7. For adjusting the volume of the left and right channels during 2-channel reproduction, use the left-front (7) and right-front (10) controls.

Bass Control (3)

From the mid-position ("0"), turning this control clockwise increases the bass; turning it counterclockwise decreases it.

Treble Control (4)

From the mid-position ("0"), turning this control clockwise increases the treble; turning it counterclockwise decreases it.

Muting Switch (5)

This switch should be kept on while tuning in order to eliminate annoying inter-station noise and extremely weak stations on the FM band.

Because weak-signal stations are difficult to tune in, nearly impossible to listen to in stereo, and will not give the noise-free reception of strong-signal stations, we recommend that you keep the muting switch on while tuning. Should you wish to search for and listen to these weak-signal stations, turn the muting switch off.

Loudness Control ⑥

Generally speaking, the human ear cannot clearly perceive the bass range at a very low volume.
The loudness control is used for correcting this condition. The bass range is emphasized when this control is turned on and the volume control is set at a low position.

VU Meters ㉙

The indicator needle of each meter indicates the output level from the speaker output terminal.
The channels are, from left to right facing the unit, the left-front, the right-front, the left-rear, and the right-rear channels. Because these meters are the peak-indication type, the peak output of the program source which is playing can be easily observed.

Meter Sensitivity Selector ㉘

This button is used to change the sensitivity of the VU meters.
When the button is in the released position (not pushed) and the rated output is emitted from the speaker output terminal by applying a continuous sine wave, the VU meters will indicate 0 dB. If the meter needle movement is small because the output is small, push this switch to set to the −10dB position. In this position, when the rated output is −10dB, the indicator needles of the VU meters will indicate 0dB.
(It is recommended that the switch be usually kept in the released position (not pushed) in order to protect the VU meters.)

Microphone Jack ⑯

The input sensitivity of this terminal is 2mV, and the input impedance is 50kΩ.
Use a dynamic or electrolytic-capacitor microphone.
Microphones are of either high or low impedance. Since high-impedance microphones have high sensitivity, if the connecting cable is long, induced noise is easily picked up, and there is a danger that the frequency characteristics (especially the high-frequency characteristics) will deteriorate. To prevent this when using a high-impedance microphone, make sure that the connecting cable is not more than 16 feet long.
Low-impedance microphones have the advantage that, even if the connecting cable is long, external noise is not easily induced and the frequency characteristics do not deteriorate. However, such microphones have very low sensitivity: about −70 dB (1 kHz, 1μ bar). There is no problem if the sensitivity is more than −80 dB.
If a low-impedance type microphone is used, it is necessary to use a step-up transformer.

Headphones Jacks ②

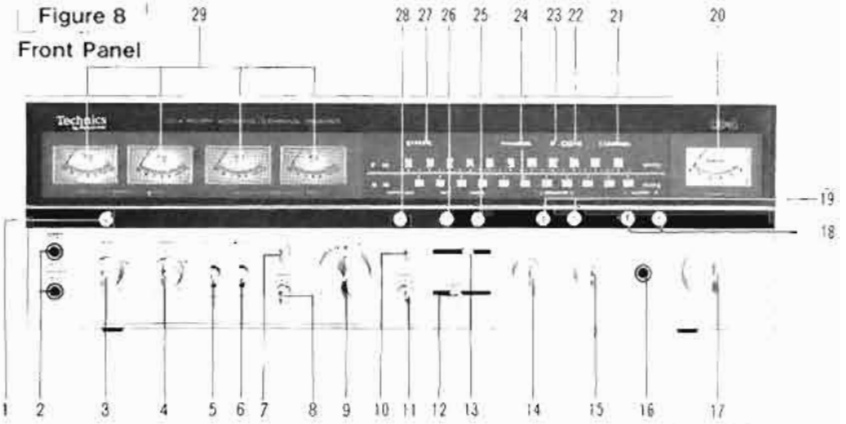
Use 4～16Ω-impedance voice-coil headphones. When headphones are plugged into the "FRONT" jack, the front speakers are cut out; when plugged into the "REAR" jack, the rear speakers are cut out. When the unit is used as a high-output 2-channel receiver (balanced transformerless), plugging headphones into either the "FRONT" or "REAR" jacks cuts out the sound from the speakers.
2-channel reproduction (balanced transformerless) can be enjoyed through two sets of headphones by plugging into both the "FRONT" jack and the "REAR" jack.

NOTE:

After switching on the power, do not attempt to use the controls for a few moments. The output of this unit is large, and, if excessive input is applied, it may result in damage to the speakers. For this reason, be sure to decrease the volume before making connections or disconnections of the input terminals.

OPERATING PROCEDURE

Figure 8
Front Panel



This section explains the operating procedure for 2-channel reproduction of each 2-channel program source.
In 2-channel operation, the rear channel level controls: left-rear (8) and right-rear (11), and the AFD controls, have no effect on the sound level.
This receiver includes a balanced-transformerless circuit. When the balanced-transformerless switch (24) on the rear panel is set to 2 CH, and the speaker connections are made as shown in figure 2, the unit acts as a high output 2-channel receiver. When high output is necessary for 2-channel reproduction, it is recommended that the receiver be used as described in this section. However, during balanced-transformerless reproduction, care must be taken about the impedance of the voice-coil speakers used: they should have a voice-coil impedance of 8~16Ω.

Broadcast Reception

FM Broadcasts

1. Set the input selector (15) to the FM AUTO position.
2. Release the tape 1 (26) and tape 2 pushbutton (25) to the SOURCE position.
3. Set the mode selector (14) to the STEREO position.
4. Tune the receiver to the desired FM signal.
   When the signal strength meter (20) needle moves farthest to the right, the best tuning position has been located. The stereo indicator (27) at the upper left illuminates whenever the receiver is tuned to a stereo broadcast.
5. Set the front channel level controls (left-front (7) and right-front (10)) to position 7.
6. After pinpointing the desired station, increase the volume (9) to the most comfortable listening level.
7. Using the left-front and right-front channel level controls, adjust the balance level of the left and right channels. (Set the mode selector to MONO and adjust the channel levels so that the sound from both left and right speakers seems to come from a position mid-way between the speakers.)
8. Make other adjustments in accordance with your taste and the acoustics of the room.
   - The mode selector of this unit can be used for on/off switching of the MPX circuit. In areas far from the broadcasting source, or in areas with heavy electrical interference, set the mode selector to the MONO position to decrease noise. Stereo broadcasts may then be received, but will be heard monaurally.
   - Set the muting switch to the ON position when tuning in order to eliminate inter-station noise.

AM Broadcasts

1. Set the input selector to the AM position.
2. Release the tape 1 and tape 2 pushbuttons to the SOURCE position.
3. Set the mode selector to either the MONO or STEREO position.
4. Tune the receiver to the desired AM signal.
   When the best tuning position has been located, the needle of the signal strength meter will be farthest to the right.
5. After tuning to the desired station, increase the volume to the most comfortable listening level.
6. Make other adjustments in accordance with your taste and the acoustics of the room.

Turntable Operation (2-channel)

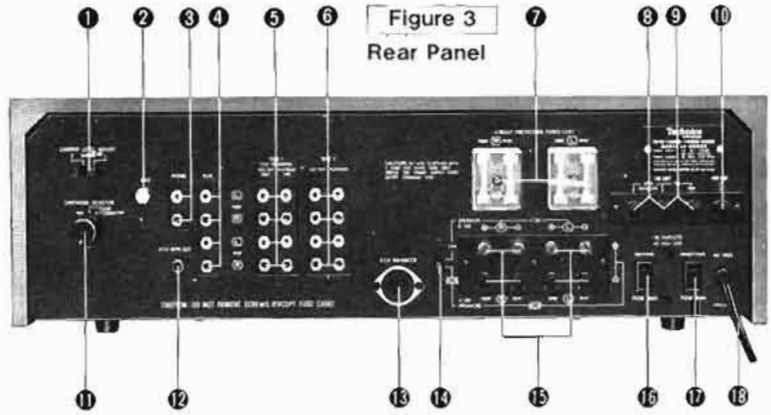
1. Set the input selector (15) to the PHONO position.
   (When using a semiconductor cartridge, however, set the input selector to the CD-4 position to enjoy 2-channel sound.)
2. Release the tape 1 (26) and tape 2 (25) pushbuttons to the SOURCE position.
3. Set the mode selector (14) to the STEREO position.
4. Set the left-front (7) and right-front (10) channel level controls to position 7.
5. Switch the turntable on and select the proper playing speed.
6. Place the pickup arm on the record and increase the volume gradually to the most comfortable listening level.
7. Using the left-front and right-front channel level controls, adjust the balance level of the left and right channels. (Set the mode selector to MONO and adjust the channel levels so that the sound from both left and right speakers seems to come from a position mid-way between the speakers.)
8. Make other adjustments in accordance with your taste and the acoustics of the room.

Recording and Playback Using a Tape Deck

Playback from a Tape Deck

1. Set the volume control (9) at the lowest position. Select the tape deck with the tape monitor pushbuttons ((26) or (25)). When playing from TAPE 1, release the tape 2 pushbutton to SOURCE.
2. Set the mode selector (14) to the STEREO position.
3. Set the left-front (7) and right-front (10) channel level controls to position 7.
4. After preparing the tape deck for playback, increase the volume gradually to the most comfortable listening level.
5. Using the left-front and right-front channel level controls, adjust the balance level of the left and right channels. (Set the mode selector to MONO and adjust the channel level so that the sound from both left and right speakers seems to come from a position mid-way between the speakers.)
6. Make other adjustments in accordance with your taste and the acoustics of the room.
   - This unit is designed for use with two tape decks, but it has a special circuit which allows tape deck 2 to take priority. In other words, only tape deck 2 is heard if

Figure 3
Rear Panel



the tape 1 and tape 2 pushbuttons are respectively, in the TAPE 1 and TAPE 2 positions at the same time.

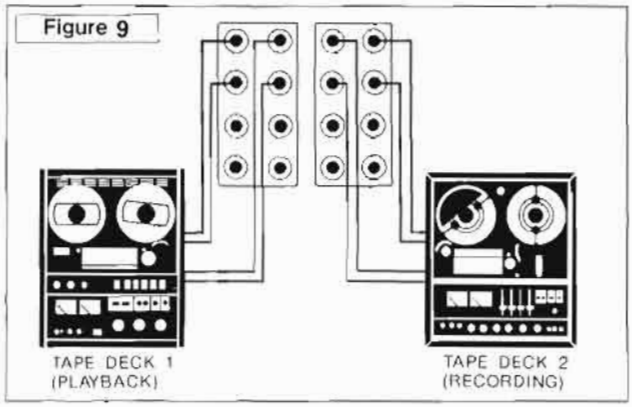
* When using 4-channel tape decks, the operation procedure is the same as the above except that the mode selector should be set to the 4 CH DISCRETE position.

Recording with a Tape Deck

1. Set the input selector according to the program source which is to be recorded.
2. Prepare the tape deck for recording.
   The program which has been selected can then be recorded onto the tape. Be sure to adjust the recording level of the tape deck. Note that the recording level is not affected by any controls of this unit, such as the volume or tone controls.
3. The recording conditions can be checked by using the tape monitor pushbuttons. By releasing the appropriate pushbutton to the SOURCE position, you can check the signal just prior to recording. By pressing it to the TAPE 1 (or TAPE 2) position, you can check the signal that has just been recorded.
   Use the tape 1 pushbutton to monitor tape deck 1, and the tape 2 pushbutton for tape deck 2. When using only one tape deck, release the other pushbutton to the SOURCE position.
   * Because the "REC OUT" terminals for tape deck 1 and tape deck 2 have the same output power, you can record on only one tape deck, if desired, or two tape decks simultaneously.
   * The recording operation with a 4-channel tape deck is the same as that with a 2-channel tape deck, except that the sources which can be recorded are limited to CD-4 records or a 4-channel source which is connected to the AUX terminal ❹. Matrix 4-channel signals, which are 4-channel sounds from 2-channel signals, cannot be recorded using the TAPE 1 ❺ or the TAPE 2 terminals ❻.

To Record from Tape Deck 1 to Tape Deck 2

Figure 9



1. Press the tape 1 pushbutton to the TAPE 1 position.
2. Prepare tape deck 1 for playback and tape deck 2 for recording.
   It is now possible to "dub" the program of tape deck 1 onto tape deck 2. In this case, all other controls will have no effect on the recording conditions.
3. Check the dubbing condition by using the tape 2 pushbutton.
   By releasing it to the SOURCE position, you can check the signal just prior to recording, and, by pressing it to the TAPE 2 position, the signal which has just been recorded can be checked.
   This unit cannot be used for recording from tape deck 2 to tape deck 1.

Microphone Operation

Use a dynamic or electrolytic-type microphone, connect it to the microphone jack ⑯ on the front panel.

1. Set the input selector ⑮ to the MIC position.
2. Release the tape 1 ㉖ and tape 2 ㉕ pushbuttons to the SOURCE position.
3. The mode selector ⑭ can be set at any position without effect. The sounds from the microphone can be heard from all four speakers.
4. Adjust the microphone volume with the volume control ⑨.
5. Make further adjustments according to the acoustics of the room and your own taste.

NOTES:

If unwanted noise, such as hum or "howling," occurs while listening to a record or tape, and the amplifier is operating correctly, the noise may be caused by one or more of the following:

1. If the record player is placed directly on or near a speaker, the sound vibration from the speaker may be transmitted, causing howling. Move the record player away from the speaker or place a flat cushion under the record player so that the vibration is not transmitted to the player.
2. Hum might be caused if the shield and center core are connected in reverse, or if the motor is not properly grounded.
3. When a microphone is used, howling can also occur if the volume is too high. If so, move the microphone farther away from the speaker, turn the microphone so that it is not facing the speaker, or reduce the volume level.

4-CHANNEL SYSTEM

What is a 4-channel system?

Conventional 2-channel stereo systems reproduce left and right signals through two (left and right) speakers. A 4-channel system, however, reproduces left and right signals from a rear speaker system as well as from a front speaker system. In a concert hall, for example, the sound from the instruments is reflected by the four walls, surrounding the listener from a all directions, thus creating a lifelike musical presence and a rich acoustic field.

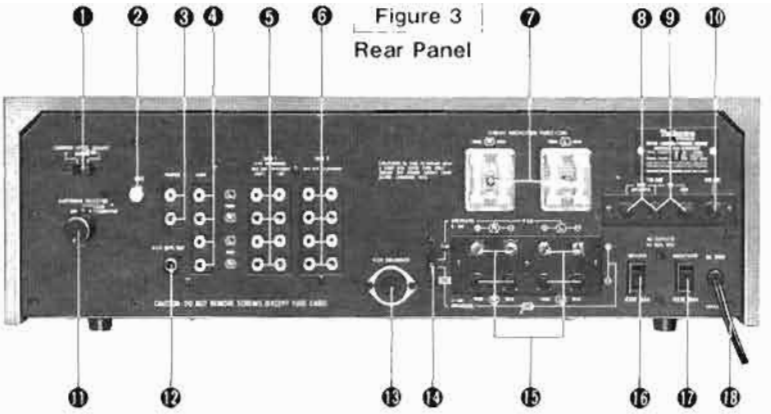


Figure 3
Rear Panel

4-Channel Reproduction

As you can therefore understand, four speakers are necessary for 4-channel reproduction. These are connected as shown in figure 1.
The balanced transformerless switch⓮ on the rear panel must be set to the 4 CH position.

■ Discrete 4-channel Reproduction

The four channels are completely independent, and perfect 4-channel reproduction can be made. At present, program sources available for discrete 4-channel reproduction are CD-4 records and 4-channel tapes.

● CD-4 record performance

Preparation

In order to demonstrate the performance of the CD-4 record adequately, make adjustment of both the 30kHz carrier signal input level control and the separation control. These two controls are necessary in the following instances:

1. When playing a CD-4 record with this unit for the first time.
2. When exchanging the 4-channel cartridge.
3. When the controls (carrier level control or separation control) have been set, in error, to a different position.

A. Before operation

1. Set the cartridge selector❶ to the position corresponding to the 4-channel cartridge to be used.
   Set to the MM position if a magnetic-type cartridge is to be used, or to either the SEMICONDUCTOR A or B position if a semiconductor-type cartridge is to be used.
   (The Panasonic EPC-450C is recomended as the most suitable 4-channel cartridge for this unit. If the EPC-450C is used, set the cartridge selector to the SEMICONDUCTOR A position because it is a semiconductor-type cartridge.)
2. Set the input selector⓯ to the CD-4 position and set both TAPE 1 ㉖ and TAPE 2 ㉕ switches to the SOURCE positions.
3. Set the mode selector⓮ to the 4 CH DISCRETE position.
4. Adjust the channel level controls, L-FRONT⑦, R-FRONT ⑩, L-REAR ⑧ and R-REAR ⑪, to position 7.
5. Confirm that the volume control ⑨ is set to the "0" position and then turn the power on.
6. Play side A of the included record (band 1, "Introduction"), increase the volume and confirm that sounds are emitted from the speakers of each channel.

B. 30kHz carrier signal input level control

The purpose of this control is to enable this unit to be used under the conditions which are most suitable for the 30kHz carrier signal output level from the 4-channel cartridge.
Play side A of the included record (band 1, "Introduction"). Adjustment of both channels, the left and the right, are explained in the following.

1. Before adjusting the left and the right channels, turn the left and right carrier level controls⓲ to their minimum position (completely counterclockwise).
2. Adjustment of the left channels
   a. Set the carrier level adjustment switch❶ (on the rear panel) to the "L" position.
   b. Playback side A of the included record (band 1, "Introduction") and turn the carrier level control for the left channel slowly to its maximum position (clockwise). The 4-channel radar, (located in the upper right part of the dial), will illuminate.
      (During adjustment, turn the left and right carrier level controls so slowly that it takes 20 to 30 seconds for them to be completely turned.)
      Stop turning the control as soon as the 4-channel radar illuminates. The position of the control just at the point when it illuminates is the point at which the adjustment is best.
      The adjustment for the left channels is then complete.
3. Adjustment of the right channels
   Following the adjustment method of the left channels described above, set the carrier level adjustment switch to the "R" position.
   Play band 1, "Introduction," and turn the right channel carrier level control slowly clockwise until the 4-channel radar illuminates.
   The position of the control just at the point when it illuminates is the point at which the adjustment is best.
   The adjustment of the right channels is then complete.
4. When the left channels and the right channels are completely adjusted, set the carrier level adjustment switch to the NORMAL position.
   The input level adjustment of the 30kHz carrier signal from the 4-channel cartridge is then complete.

NOTE:

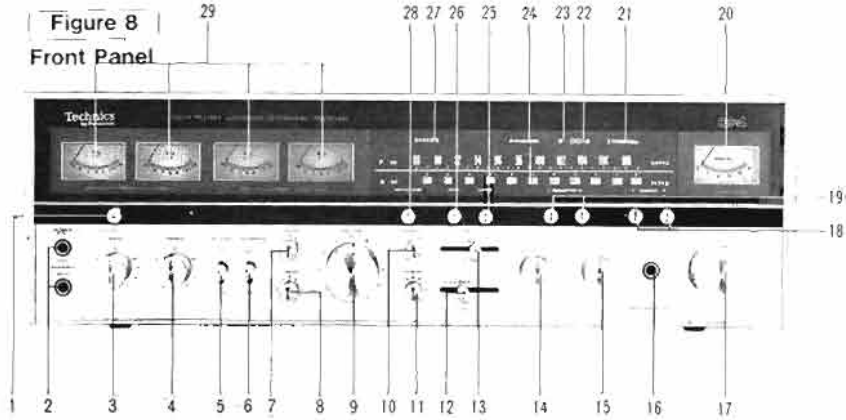
* If the carrier level control is turned beyond the point at which the 4-channel radar illuminates, the radar will remain on, but the level is no longer at the best position. Therefore, if the control is turned too far, turn it counterclockwise until the radar goes out and then proceed as before, turning the control clockwise until the exact point is reached where the radar illuminates.
* During control of the input level of the 30 kHz carrier signal, it may happen that, depending on the type of cartridge, the 4-channel radar doesn't illuminate even if the carrier level control is turned completely to the right. (If the carrier level adjustment switch is set to the NORMAL position, the 4-channel radar will illuminate.) When playing a CD-4 record with this type of cartridge, turn the carrier level control completely to the right. The reproduction will not be perfect CD-4 reproduction, but the 4-channel effect will be very realistic.

C. Control of the separation

Side A of the included record, band 2, "Separation of the

(For this model, we also have EPC-450C-II (new 4-channel cartridge).

Figure 8
Front Panel



left channels," includes a warbling tone which has been recorded for adjustment of the left channels. Band 3, "Separation of the right channels," includes a tone for the right channels. Each of these tones lasts for 30 seconds and is used as the separation control signal.
Adjust the separation after the 30kHz carrier signal input level has been adjusted.

1. Turn the left-front and right-front channel level controls completely counterclockwise in order to hear only the rear sounds.
2. Play band 2 ("Separation of the left channels") which has the separation control signal for the left channels, and turn the left separation control ⑲ until the left-rear sound becomes minimum.
3. Similarly, play band 3 ("Separation of the right channels") which has the separation control signal for the right channels, and turn the right separation control until the right-rear sound becomes minimum.
4. The adjustment of the separation is then complete. Turn the left-front and right-front channel level controls which had been turned completely counterclockwise, to their original positions (i.e., to position 7).
5. Then, according to the announcements from the 4 individual speakers, and then from all 4 speakers (band 4, "Sound volume balance"), adjust the volume balance of each channel.

All preparations for CD-4 records are now complete.
Be sure not to disturb the position of the carrier level controls or the separation controls except when exchanging the cartridge of the record player.
To play CD-4 records, follow the steps described in "Discrete 4-channel playback" below.

● Discrete 4-channel playback

1. Use the input selector ⑮ and the tape monitor pushbuttons ㉕ and ㉖ to choose the program source to be used. When playing CD-4 records, set the input selector to the CD-4 position and the tape monitor pushbuttons to the SOURCE position.
   When listening to a 4-channel program source which is connected to the AUX terminals ❹, set the input selector to the AUX position and the tape monitor pushbuttons to the SOURCE position.
   When using a 4-channel tape deck, set the tape monitor pushbuttons to the TAPE 1 or to the TAPE 2 position, whichever is applicable.
2. Set the mode selector ⑭ to the 4 CH DISCRETE position.
3. Set the L-FRONT ⑦, R-FRONT ⑩, L-REAR ⑧ and R-REAR ⑪ channel level controls to position 7.
4. Switch on the sound source and adjust the volume control ⑨.
5. Use the channel level controls to adjust the volume balance between each channel. (By using the "Technics by Panasonic" SH-1010 4-channel balancer, the volume balance between channels can be simply controlled by a single lever.)
6. Make any further adjustments according to the acoustic properties of the room, the speaker characteristics, and your own taste.

● Speaker placement

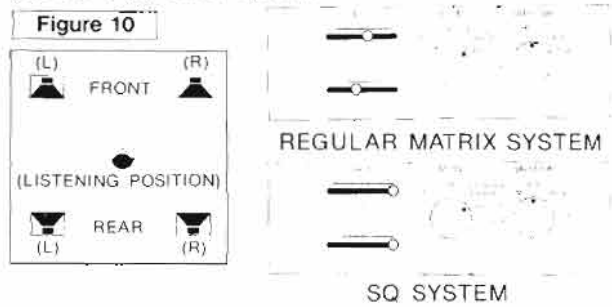
The usual placement is to put one speaker at each corner of a square.

■ Matrix 4-channel Reproduction

● 4-2-4 playback system

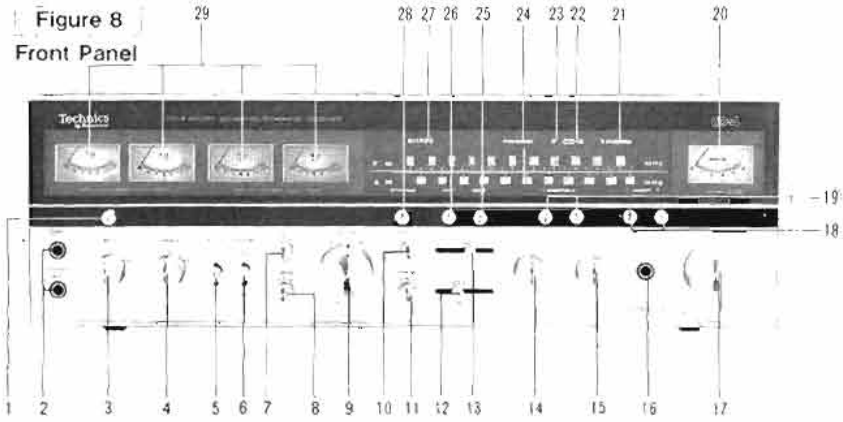
The 4-2-4 system converts 4-channel signals into 2-channel signals by an encoder matrix. These 2-channel signals are then recorded on records or tape, or transmitted as FM stereo broadcasts. To hear this sound as 4-channel sound, the original 4-channel signals are then reproduced by a decoder matrix. There are two types of 4-2-4 systems: the regular matrix system and the SQ system. With this receiver, you can enjoy either system.

Figure 10



1. Select the program source with the input selector ⑮ and/or the tape monitor pushbutton ㉖ and/or ㉕.
2. Set the mode selector ⑭ to 4 CH MATRIX PHASE 0 , and the AFD controls (WIDTH and DEPTH) to the MTX 1 (RM) position for regular matrix program sources.
   For SQ program sources, set the AFD controls to MTX 2.
   Although these are the usual settings for these two 4-2-4 systems, in practice it is best to switch the mode selector back and forth (PHASE 0 ‹›PHASE 90) and adjust the AFD controls while listening to the performance to see which setting actually gives the best sound.
3. Set the L-FRONT ⑦, R-FRONT ⑩, L-REAR ⑧ and R-REAR ⑪ channel level controls to position 7.
4. Switch on the sound source and adjust the volume control ⑨.
5. Use the channel level controls to adjust the volume balance between each channel. (By using the "Technics by Panasonic" SH-1010 4-channel balancer, the volume balance between channels can be simply controlled by a single lever.)
6. Make any further adjustments according to the acoustics properties of the room, the speaker characteristics and your own taste.

Figure 8
Front Panel



● Speaker placement of the 4-2-4 system

The usual placement is to put one speaker at each corner of a square.

Generally, if adjustments are made as explained previously, the most coordinated separation will be obtained from this system. This is similar to placing speakers at two corners of a triangle.

However, depending on the shape of the room, it may not always be possible to place the speakers in a square. And, for use with the 2-2-4 system (explained below), they may be placed in a rectangle (narrow at the front and rear). The original acoustic field, however, will seem enlarged at the front and rear. This, however, can be corrected with the AFD controls.

● 2-2-4 playback system

This type of system converts the stereo signals of a record or an FM stereo broadcast into 4-channel signals by means of a matrix circuit. Theoretically, this is not possible, because the original stereo signal was not intended for 4-channel reproduction. A quasi-four channel effect can, however, be obtained with this type of system.

Two-channel stereo records are often recorded by a "volume-and-phase" method in order to emphasize left and right separation. This produces a result substantially similar to that obtained with a 4-2 encoder. Therefore, playback of these records through a 4-2-4 system, as previously explained, can be highly effective.

1. Select the program source with the input selector (15) and/or tape monitor pushbutton (26) or (25).
2. Set the mode selector (14) to either of the 4 CH MATRIX positions.
   Adjustments of the AFD controls and the 4-channel matrix selector depend on speaker placement. Speaker placement is discussed in detail below.
3. Set the channel level controls, L-FRONT (7), R-FRONT (10), L-REAR (8) and R-REAR (11), at position 7.
4. Switch on the sound source and adjust the volume control (9).
5. Use the channel level controls to adjust the volume balance between each channel.
   (By using the "Technics by Panasonic" SH-1010 4-channel balancer, the volume balance between channels can be simply controlled by a single lever.)
6. Make any further adjustments according to the acoustic properties of the room, the speaker characteristics, and your own taste.

● Speaker placement of the 2-2-4 system

With this type of system, speaker placement is unrestricted. Place the four speakers at positions where the separation effect is the best. Two examples are given here, but other variations are possible (e. g., placing the rear speakers on the ceiling can create a very interesting effect).

A. Standard speaker placement for the 2-2 system

This is the most suitable speaker placement for recreating the concert hall effect. The direct sound component is reproduced from the front speakers and the reverberation sound (diffused sound) components from the rear speakers.

The standard adjustment positions are shown in the figure. Because the effect varies from one record to another, adjust the AFD controls gradually and select the 4-channel matrix phase while actually listening. For example, for a record where one singer is singing with an orchestra in the background, set the AFD-DEPTH control to position 10.

Only the reverberation sound of the singing voice will then be heard from the rear speakers, and the direct sound will not be heard at all.

At this time, of course, the direct sound component of the singer's voice is reproduced from the front speakers.

Depending on the setting of the 4-channel matrix phase selector, the reverberation sound effect can be adjusted as follows:

90°... The phase difference of the rear signal becomes 90°, the natural field is enjoyed, and there is no orientation.
In other words, an effect similar to the reverberation sound is obtained.

0°... The rear signal becomes "in-phase", and orientation of the rear sound becomes distinct. A more natural sound is produced, one which does not tire the ears even after several hours of listening.

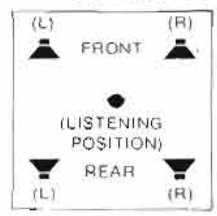
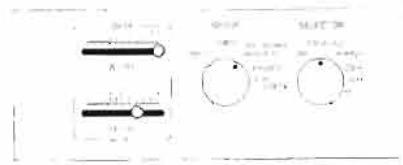


Figure 11



B. In-line speaker placement of the 2-2 system

This speaker placement is recommended for classical music.

If it can be considered that 2-channel stereo reproduces an orchestra as a line, then this placement can be considered to result in reproduction of an orchestra as a plane, and, therefore, the separation of the instruments is distinguished more clearly.

The standard adjustment positions are shown. Make adjustments gradually while actually listening.

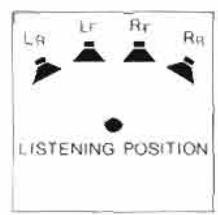


Figure 12

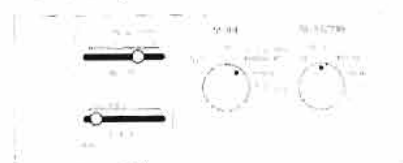
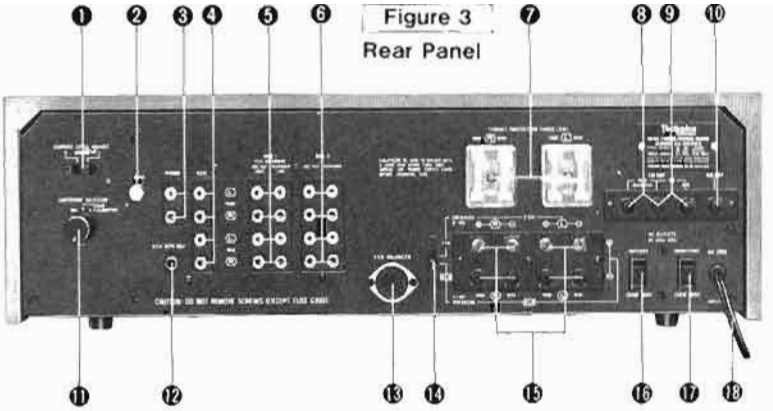


Figure 3
Rear Panel

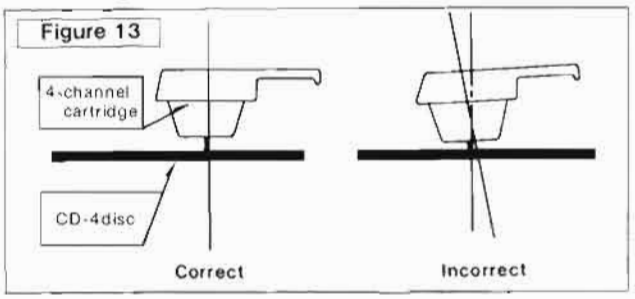


Notes when playing CD-4 records

(1) Concerning mounting of a 4-channel cartridge

If, when a 4-channel cartridge is mounted, it inclines as shown in the following figure, the tone quality will be ruined. The left and right separation will not be good, and the sound level will vary unnaturally. When a cartridge is exchanged, therefore, be sure that it is correctly mounted so that the record surface and the cartridge are perpendicular, as shown in figure 13.

Figure 13



(2) Dust on CD-4 records and the stylus

Because the stylus tip traces higher-frequency signals during CD-4 record play as compared with 2-channel play, even a small amount of dust will adversely influence the performance, causing the following:

a) Good separation cannot be obtained.
b) The tone quality will become poor.
c) The sound level will vary unnaturally.
d) Abnormal sounds will be heard.

In order to avoid these problems, the following steps should be taken.

a) Carefully wipe away all dust from CD-4 records, using a good record cleaner.
b) Gently clean the stylus tip, using a soft brush to remove dust, before playing.

(3) Stylus tip damage

The stylus tip life is approximately 300 hours. If it is used for more than 300 hours, not only does the noise increase, but the record life is also shortened. It is therefore recommended that the stylus be replaced before 300 hours have elapsed.

(4) Stylus pressure

The cartridge stylus pressure influences CD-4 record performance considerably.

Be sure to maintain the stylus pressure at that which is recommended by the cartridge manufacturer. If it is not, the following problems may occur:

a) Good separation cannot be obtained.
b) An unwanted variation in the sound level may occur.

(5) The cartridge stylus

Use a stylus which is designed exclusively for 4-channel cartridge use. If not, the record may become damaged or unwanted noise may be emitted.

(6) Television interference

When playing CD-4 records while a television is on, maintain a distance between the television and this unit of about 2 to 3 feet to prevent interference noises from the television.

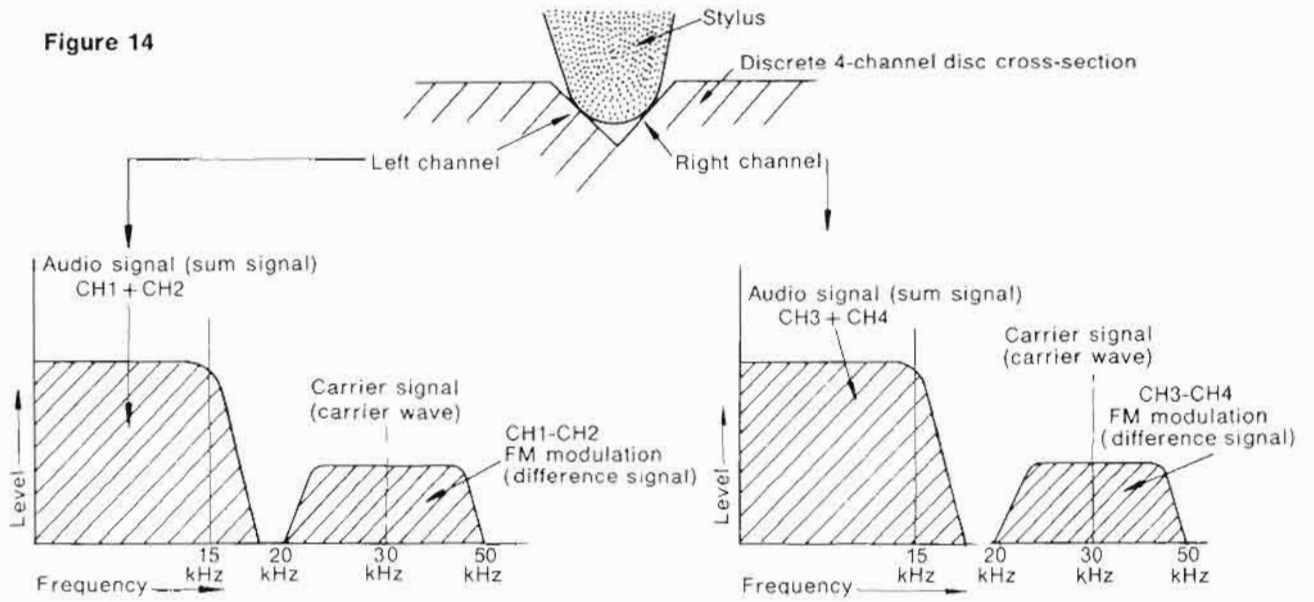
(7) Adjustment of the input level and the separation

Adjust the input level and the separation depending upon the type of 4-channel cartridge used. Once they are adjusted, there is no need for further adjustment except when the cartridge is exchanged.

A brief explanation of the CD-4 system

Recording

Figure 14



The following is a brief explanation of how four sounds, each independent of the other, are obtained from one groove of a disc.

By studying the disc cross-section, shown in figure 14, it will be recognized as the 45-45 system, the same as conventional stereo. On the left channel of the sound groove, however, are inscribed both the audio signal (the sum signal)—made up of channels one and two—as well as the carrier signal (the carrier)—which has been frequency (FM) and phase (PM) modulated by the audio signal (the difference signal) made up of the difference between CH1 and CH2.

Of these two signals, the carrier signal varies from 20 kHz to 50 kHz as a result of being frequency modulated.

In the same way, the right channel is inscribed with the CH3 + CH4 audio signal and with the carrier signal—which has been modulated by the signal which is the difference between CH3 and CH4.

Playback

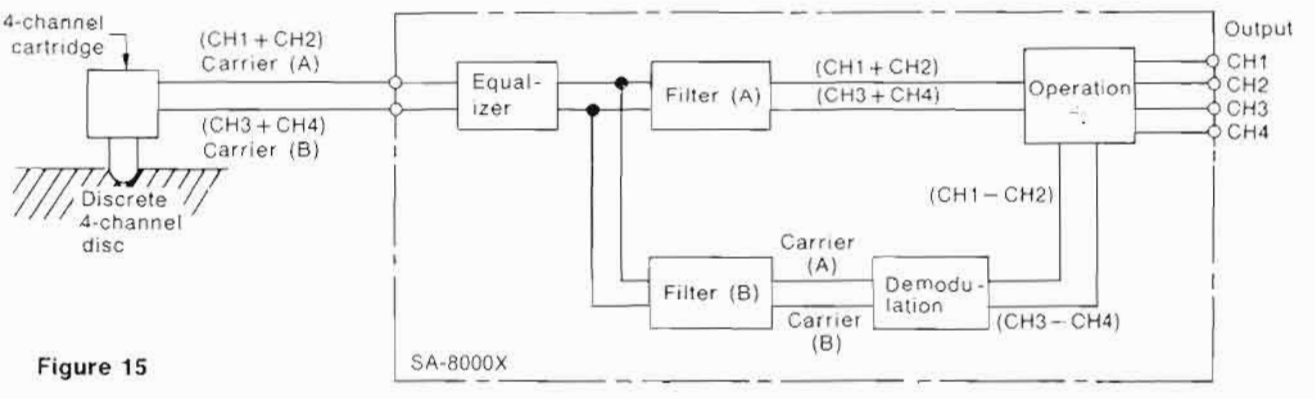


Figure 15

The block diagram will serve to explain how four independent sounds are picked up from the discrete 4-channel disc. First, both the sum signal of CH1 + CH2 and the carrier signal (which has been modulated by the difference signal of CH1 − CH2) are picked up from the left channel of the disc by the CD-4 cartridge and are sent to the SA-8000X unit, where they enter, without change, filter A and filter B after passing through the equalizer (RIAA curve). These filters separate the signals into (1) the sum signal of CH1 + CH2 and (2) the modulated carrier signal. The sum signal enters the operation circuitry without change, while the modulated carrier signal passes through the demodulation circuitry and enters the operation circuitry, becoming a difference signal CH1 − CH2 (which is a modulated wave). Then addition and subtraction are accomplished by the operation circuitry.

Specifically:

Addition: (CH1 + CH2) + (CH1 − CH2) = 2(CH1)

Subtraction: (CH1 + CH2) − (CH1 − CH2) = 2(CH2)

By this process, CH1 and CH2 are sent to the output.

In the same way, the signal picked up from the right channel of the disc is sent out as CH3 and CH4. This explanation has, we hope, served to explain how four signals are picked up from one groove of a disc as completely independent sounds.

TECHNICAL SPECIFICATIONS

AMPLIFIER SECTION

IHF Music power	
4-channel operation	160W (4Ω)
Balanced-Transformerless operation	160W (8Ω)
1 kHz RMS (continuous) power	
4-channel operation	
each ch. driven	30W/30W/30W/30W (4Ω) 22W/22W/22W/22W (8Ω)
all ch. driven	18W + 18W + 18W + 18W (4Ω) 16W + 16W + 16W + 16W (8Ω)
Balanced-Transformerless operation	
each ch. driven	57W/57W (8Ω)
both ch. driven	42W + 42W (8Ω)
20 Hz~20 kHz RMS (continuous) power	
4-channel operation	
all ch. driven	13W + 13W + 13W + 13W (8Ω)
Balanced-Transformerless operation	
both ch. driven	36W + 36W (8Ω)
Total harmonic distortion	0.5%
Intermodulation distortion (60 Hz : 7 kHz = 4 : 1, SMPTE)	0.7%
Power bandwidth (all ch. driven at 8Ω)	5 Hz~40 kHz, −3 dB
Frequency response	
PHONO	RIAA standard curve ±1 dB
AUX	10 Hz~50 kHz, $^{+0}_{-3}$ dB
Residual hum & noise	1.5mV
S/N (IHF, A)	
PHONO	70 dB
AUX	90 dB
Damping factor	30 (8Ω)
Input sensitivity & impedance	
PHONO MM	1.5mV/50kΩ
AUX	150mV/60kΩ
MIC	2mV/50kΩ
Tone control	
BASS	50 Hz, +13 dB −13 dB
TREBLE	10 kHz, +10 dB −10 dB
Loudness control (volume at −30 dB)	50 Hz, +10 dB
Tape monitors 1 and 2	
PLAYBACK	150mV/60kΩ
REC OUT	150mV
Load impedance	
4-channel operation	4~16Ω
Balanced-Transformerless operation	8~16Ω

FM TUNER SECTION

Frequency range	88~108 MHz
Sensitivity	1.9μV
Alternate channel selectivity	65 dB
Total harmonic distortion	
MONO	0.3%
STEREO	0.4%
S/N	65 dB
Frequency response	20 Hz~13 kHz, ±1 dB
Image rejection (at 98 MHz)	55 dB
IF rejection (at 98 MHz)	60 dB
Spurious response rejection (at 98 MHz)	60 dB
Capture ratio	1.8 dB
AM suppression	50 dB
Stereo separation (at 1 kHz)	40 dB
Leak carrier	50 dB

AM TUNER SECTION

Frequency range	520~1610 kHz
Sensitivity	20μV
Selectivity	25 dB
Image rejection	40 dB
IF rejection	40 dB

GENERAL

Power consumption	280W
Power supply	AC 120V, 60 Hz
Dimensions (overall) W × H × D	19⅛" × 6⅞" × 15⅜"
Weight	29.8 lb.

Specifications are subject to change without notice for further improvement.

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