

# KENWOOD

CAR Hi-Fi

CAR STEREO

TECHNICAL

INFORMATION

KRC-949D

FM/MW/LW Synthesizer Cassette-Tuner

KENWOOD CORPORATION

## KENWOOD TECHNICAL INFORMATION

KRC-949D

### Introduction

The model introduced here is our top-of-the line KRC-949D, a cassette-tuner unit with a number of advanced circuit design features in addition to many electronic functions. It is a unit that fully reflects our commitment to quality in mobile stereo.

When we entered the car stereo market in 1980, it was with the aim of utilising the experience and know-how gained from more than 30 years in the world home hi-fi stereo market, where we occupy a leading position as a specialist audio manufacturer. The three principles we established for our car stereo products are:

- Hi-fi performance
- High reliability
- High added value

We did not intend to offer simply car radios that would be given away with new cars. We did intend to provide the finest possible sound quality, performance and utility inside the "mobile listening room".

It is just this quality that can be experienced from the KRC-949D. Prominent cassette mechanism features of this unit are its hyperbolic-contoured bi-azimuth sendust tape head; three motors including an FG servo drive system; an automatic tape-slack adjusting mechanism, and full-logic microprocessor control of the tape transport mechanism. A primary reason for this unit's extremely high sound quality (which is on a level with home audio) is the physical separation of its power supply stage from the audio signal circuits. It features a dual  $\pm$ power supply system with DC-to-DC converter; independent ten-stage power supply stabilisation; and six regulated power supplies that totally prevent mutual interference via the power supply lines. The tuner circuitry is among the most sophisticated ever devised for car stereo. It exhibits wide dynamic range and low harmonic and IM distortion, providing outstanding reception quality in strong signal areas, thanks to an advanced double balanced mixer stage.

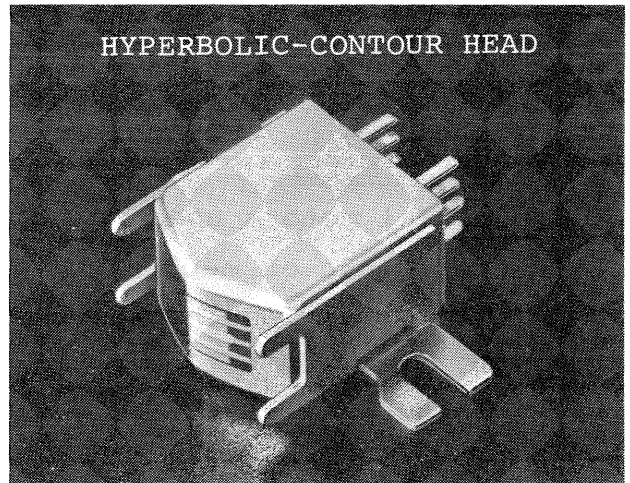
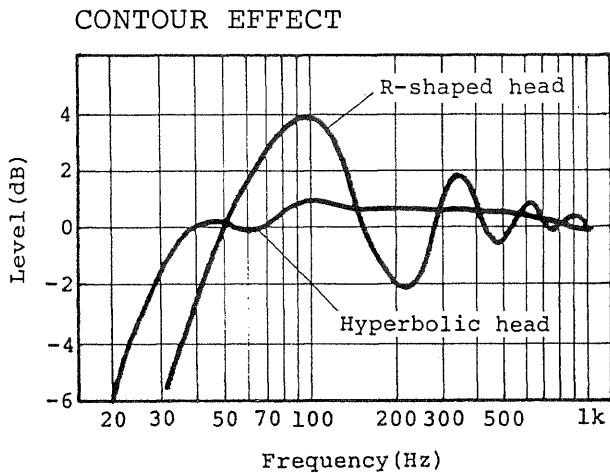
Achieving hi-fi performance and specifications is one thing. But this would be meaningless unless it could be strictly maintained in a moving car. This is where our experience in developing Car Transceivers and Land Mobile equipment is proving a big help. So is our position as the world's leading maker of amateur radio communications equipment. The accumulated technology means that our car units will maintain reception performance under a variety of road and climate conditions. We have not only raised the hi-fi status of car stereo, but have also succeeded in significantly increasing the reliability factor. Naturally, we have also concentrated on devising automatic and electronic systems that reduce the driver's operating chores to a minimum.

Kenwood analog and digital testing and measuring instrumentation plays a fundamental role in backing up our car stereo. Such high-precision instruments are widely used in the audio and communications industries - including by our competitors. Today, as a result, we occupy a prominent position in the manufacture of broadcast satellite receivers and digital encoders as well as compact disc players. We are active in a number of other fields where precision instruments of this kind are vital, including the medical field.

**Cassette Section**

**1. Hyperbolic-contour head**

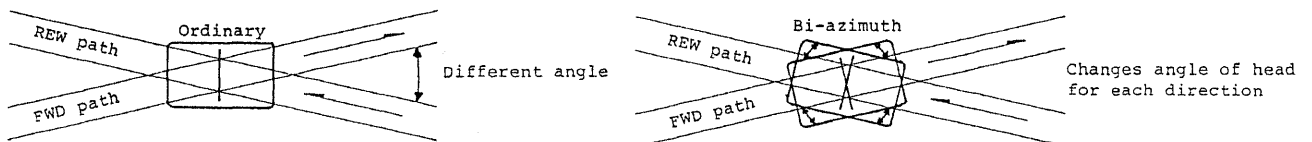
The KRC-949D is equipped with a hyperbolically contoured tape head which provides improved head-to-tape contact and improved low-frequency response performance. As shown in the diagram, the conventional R-shaped head produces variations in response at low frequencies (the so-called "contour effect"). These are eliminated by the new hyperbolic contoured head. The reason why hyperbolic heads have not been used much in auto-reversing cassette decks is because of the problem of accurate azimuth adjustment. But this has now been solved with the introduction of our Bi-azimuth auto-adjusting head system, allowing independent forward and reverse azimuth adjustment.

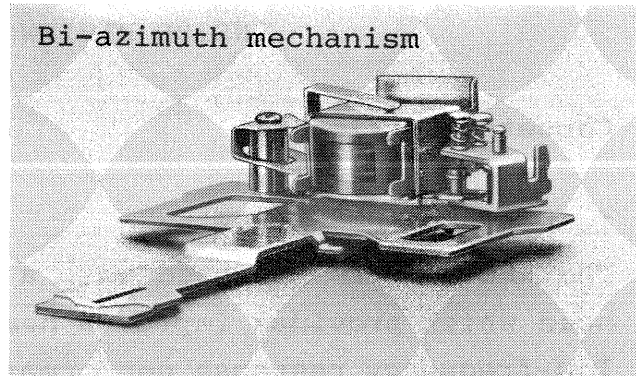
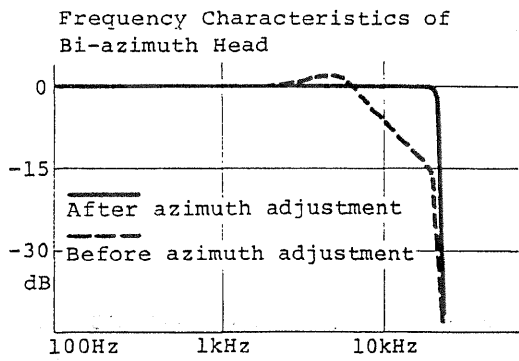


**2. Bi-azimuth tape head**

The Bi-azimuth auto-adjusting tape head automatically repositions the head angle for correct azimuth alignment when the mechanism goes into auto-reverse. In this way, high-frequency performance is improved, while optimum and identical frequency response is achieved in both directions.

Bi-azimuth tape head



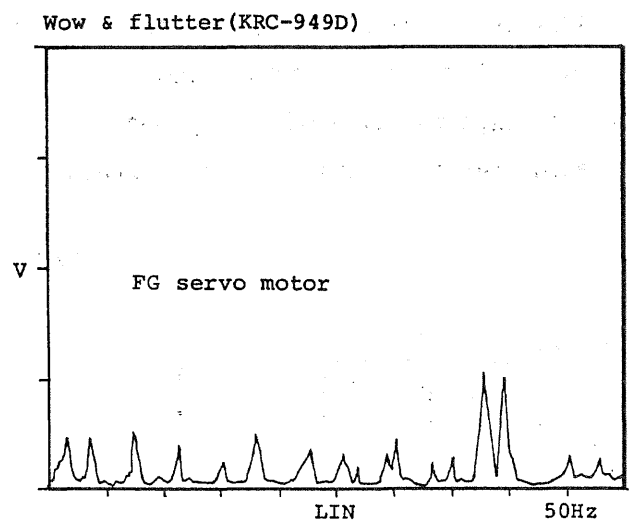
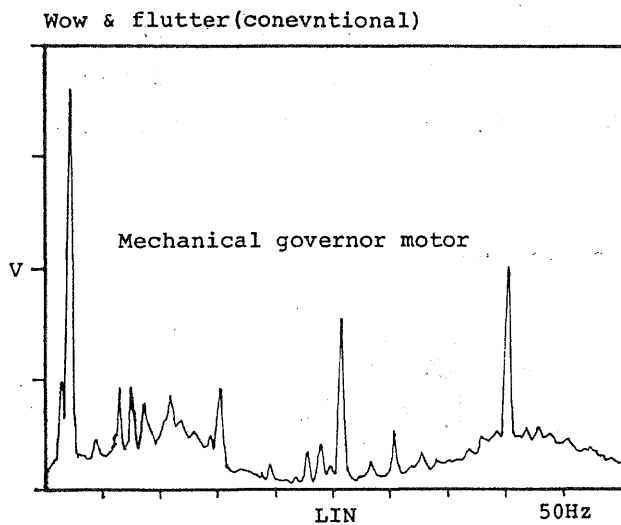


### 3. Head material for wide dynamic range

The tape head employed for the KRC-949D includes a sendust material with a high magnetic flux density that provides a very high saturation threshold. It is thus highly suitable for playback of tapes with wide dynamic range. It means that, even in the severe acoustic ambience of the car, dynamic tape sound can be obtained. Sendust is also highly resistant to wear and abrasion -- another important consideration for car cassette tapes.

### 4. FG servo-motor

Conventional motors used in mobile cassette decks have usually used electronic or mechanical governors to maintain constant motor revolution. But these are not free from problems. For example, after detection of the motor's inverse voltage, the controlling electronic governor has the demerit of varying contact resistance of the brushes. It is also unstable against temperature variations. The mechanical governor produces problems in degraded wow-and-flutter when the motor's centrifugal force is used as a centrifugal switch.



The KRC-949D avoids these problems by using a generator in its motor. The FG (Frequency Generator) servo-motor controls the generator's voltage, excluding those external factors (brushes, switches, etc.) that affect wow-and-flutter and tape speed stability. You can see in the diagram that instability is significantly improved in the region of 40Hz, where such effects are critical to performance and sound quality.

#### 5. Tape slack cancelling mechanism

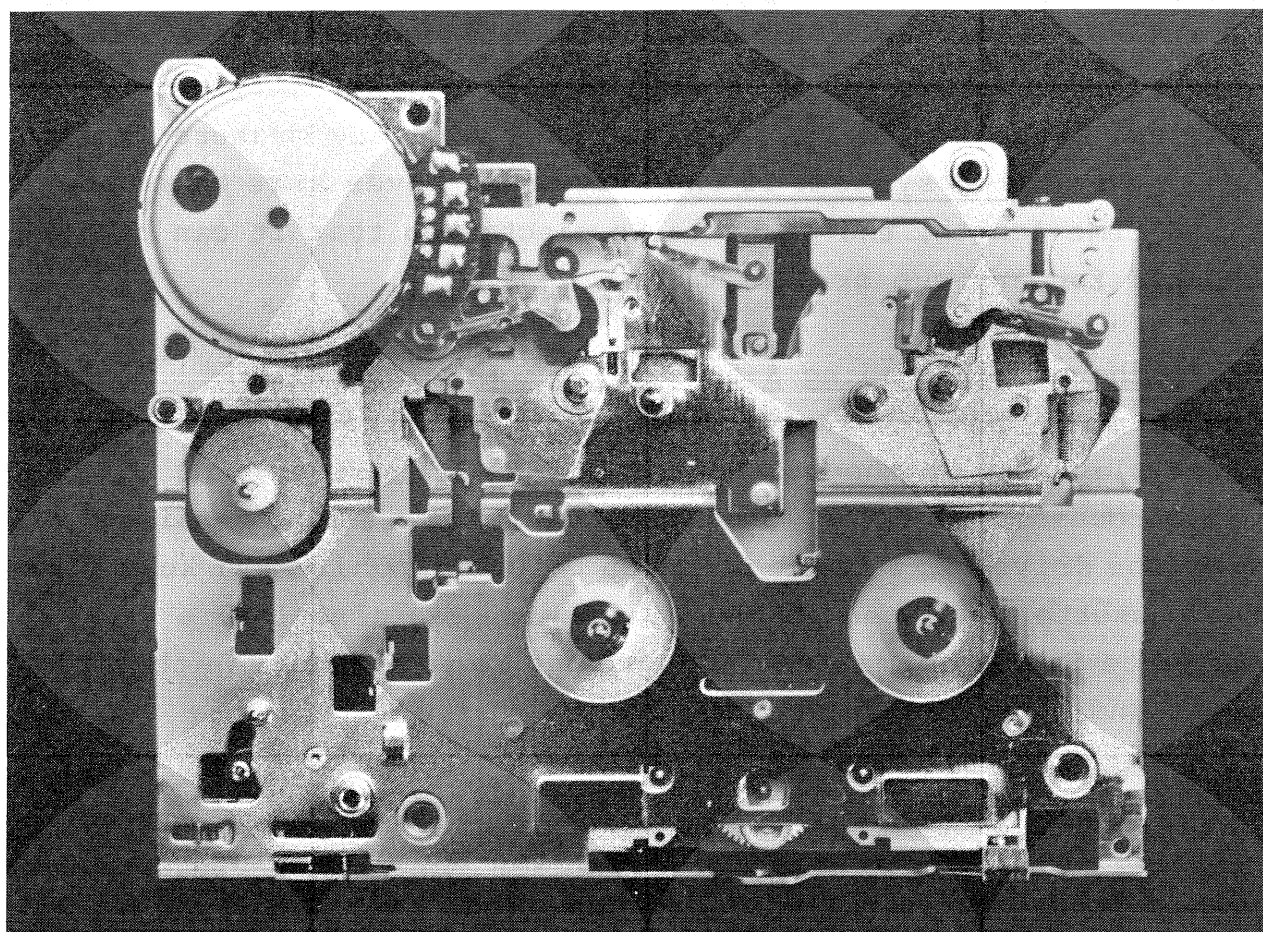
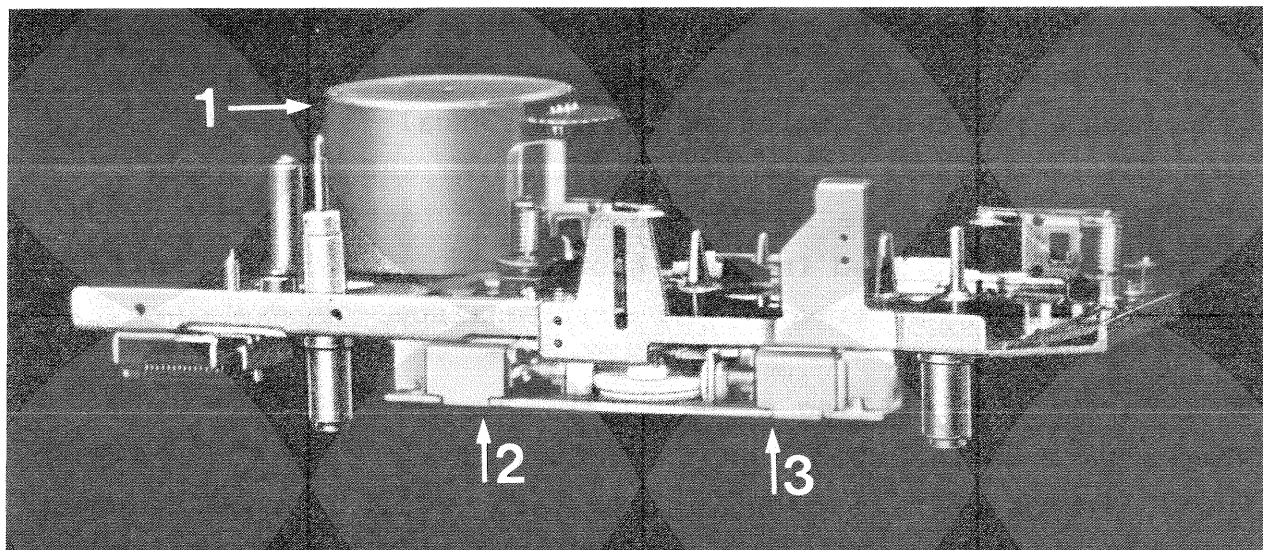
When a tape is inserted, for a fraction of a second the KRC-949D fast-forwards to take up any slack. This useful feature prevents unstable tape playback and is an indication of the careful design of this cassette-tuner. When the drive reel moves (taking up any tape slack) the take-up reel also moves, automatically setting the tape mechanism to its stand-by mode. A safety measure is also built-in to this system. If the drive reel moves more than the fixed time-length, the cassette is ejected so that it can be checked for any cut or defect.

#### 6. Feather-touch loading & full-logic control

You normally have to push a cassette into position in order to start playback. In the case of the KRC-949D, however, a microprocessor does the loading for you. All that is required from the driver is a light press on the electronic PLAY key after the cassette is placed in the window. You can also load a cassette in the normal way, by pushing it in - but even this is a light and easy operation.

#### 7. Other features

- Besides being computer-controlled, the KRC-949D's tape transport system is fully logic controlled, providing smooth directional changes and total freedom from tape stress.
- There are three motors: one is the FG servo-motor for the main capstan drive, one is used for the take-up reel (blocking any undesirable effects of this reel on the capstan), the third is used for automatic functions. This system makes loading, ejection and other operations very quiet.
- A rust-free stainless steel chassis is used for the tape transport, designed to withstand vibration from the car. The chassis also incorporates springs to counter external pressures caused by the movement of the car.



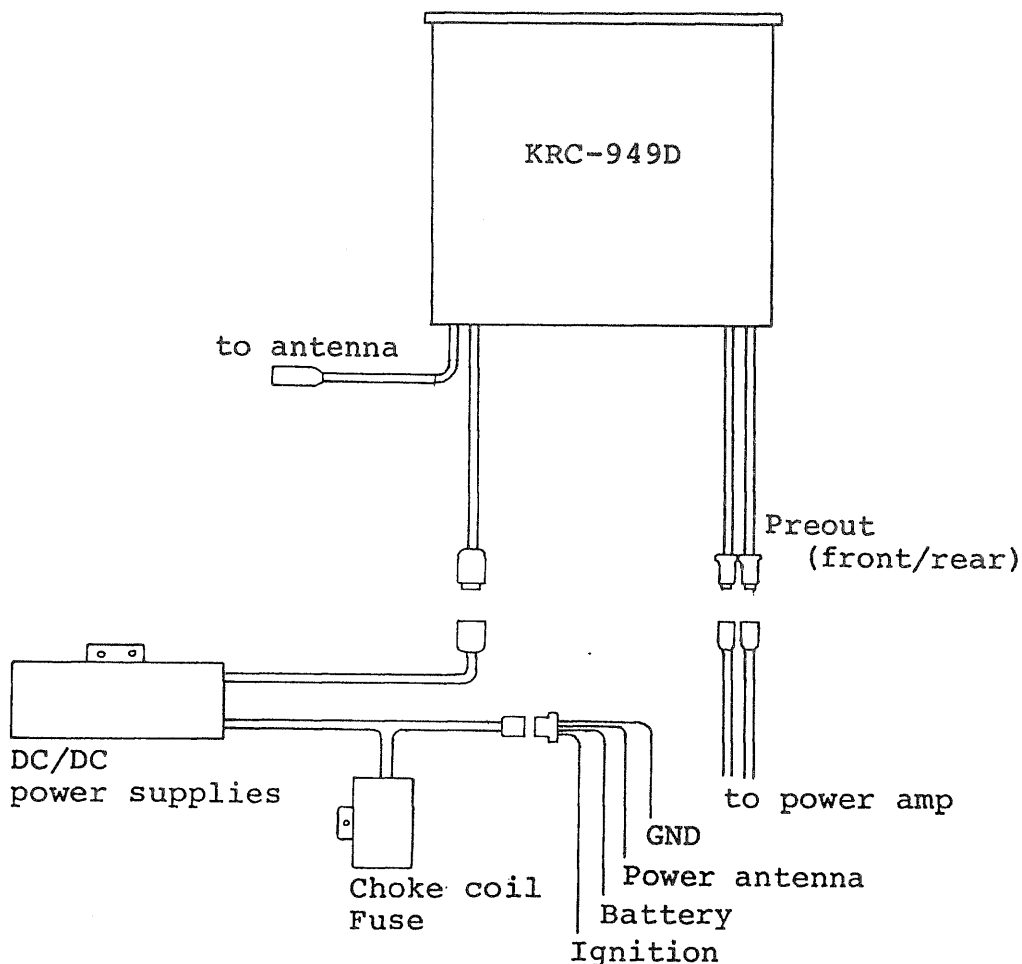
#### 8. CD player connection

A useful automatic function is provided when the KRC-949D is used in connection with the Kenwood KDC-9 CD player: when a compact disc is loaded, any cassette in the 949D will eject.

## Audio/Electrical Circuitry

### 1. Easy installation and separated power supply

One reason why the KRC-949D boasts such impressive audio performance is that the power supply (a major potential source of signal degradation) is separated from the audio circuits, because the DC-DC converter includes a near-40Hz oscillator which can affect the audio signal. Physically separating the unit and sealing the oscillator prevents this. Connection between the two units is easily made (see the diagram).



### 2. Dual plus/minus power supplies

Car battery voltage is normally between 12 to 14.4 volts. If audio circuits are operated with the battery just as it is, there will be problems in obtaining the desired output constantly. For example, while a 20W/ch amplifier can achieve its output with 12 volts, the battery will not be able to provide enough energy for 50W/ch or higher. The function of a DC-to-DC converter therefore is to increase the voltage for a higher output. Thus, our KAC-



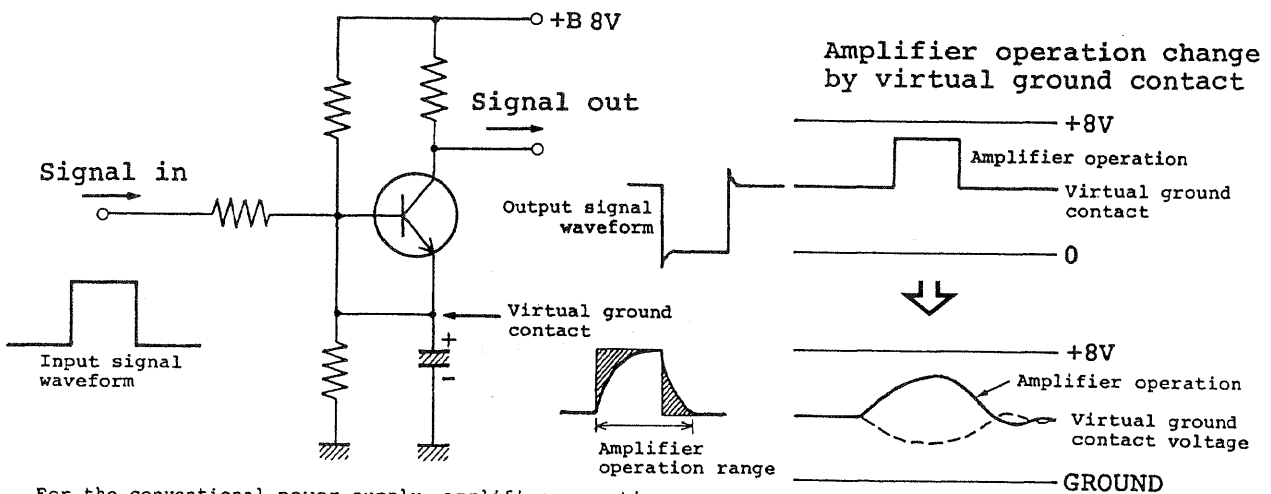
9020 power amplifier can provide  $\pm 44$  volts for a 100W/ch output from 20Hz to 20kHz at 1% THD.

But preamp circuits for small signals have until now been designed just for 12V. Pre-activated output in 1.5V steps was obtained from 12V and so there was little motivation to try to provide better quality sound. However, in order to obtain wider dynamic range, wider frequency response and better sound quality, the  $\pm$  power supply system is necessary. The DC-DC converter in the KRC-949D obtains  $\pm 5.5$ V and supplies this to the preamp stage. Ten individually stabilized power supplies are used for the KRC-949D's circuits, allowing the unit to provide the same level of sound quality that you expect to hear from high-class home audio.

### 3. Dual plus/minus power supply system eliminates ground effects

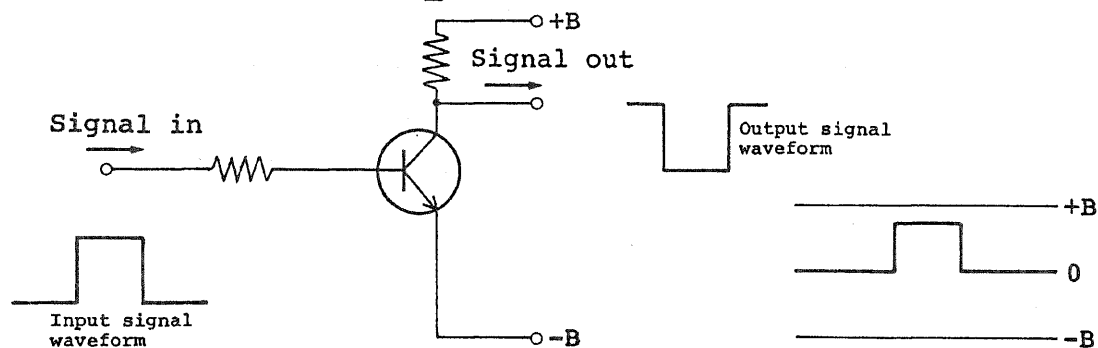
The dual  $\pm$  power supply system created by the use of the DC-DC converter eliminates distortion at the ground reference point, providing clearer sound. In the diagram, you can see the difference in audio amplifier operation between an ordinary power supply and the dual  $\pm$  power supply of the DC-DC converter in this respect.

Amplifier operation with conventional power supply



For the conventional power supply, amplifier operation changes are due to the amplifier's virtual contact with the input signal.

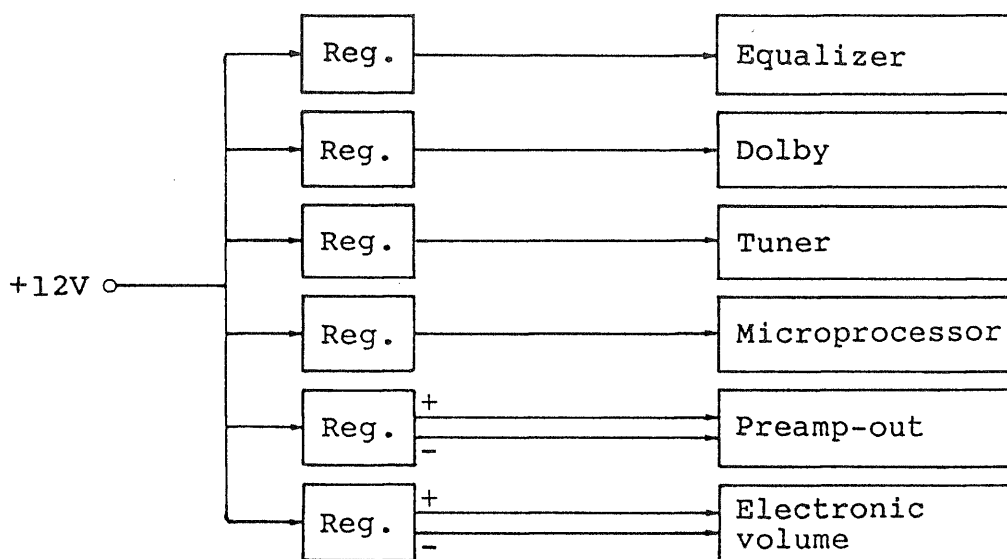
### Amplifier operation with $\pm$ power supply



For the  $\pm$  power supply, since the amplifier's ground contact with the input signal does not change, the output signal is amplified with fidelity to the input signal. Compared with the conventional amplifier, it provides a very clear sound quality with no distortion.

### 4. No mutual interference with independent power supplies

In conventional power supplies feeding power to each circuit, one or possibly two regulator circuits are used. But this arrangement allows interference between circuits. There are six regulator circuits in the KRC-949D, eliminating all inter-stage interference and helping to enhance the outstanding sound quality of this unit.

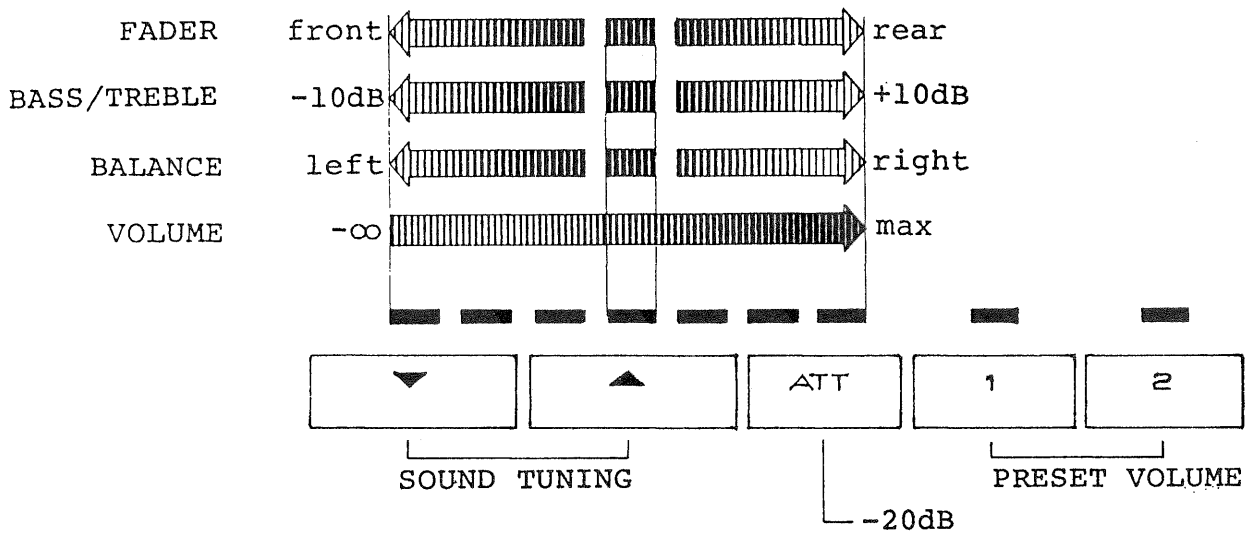


### 5. Electronic volume control

The preamplifier stage is entirely controlled by a microprocessor. An electronic volume control circuit at its heart exhibits low noise (S/N ratio 120dB) and low distortion (THD 0.005%) - performance that is on a level with home audio. Without any mechanical parts, the preamp section is practically free from static effects and has high reliability.

The electronic volume circuit controls not only volume but also balance, bass and treble tone, and the fader in a single integrated circuit. Adjustment is in precise 2dB steps. The volume has a memory in which you can store two preferred volume levels for instant recall. An attenuator switch instantly mutes the volume level by -20dB.

Another electronic switch is that for power on/off. All of these electronic switches are touch-keys.

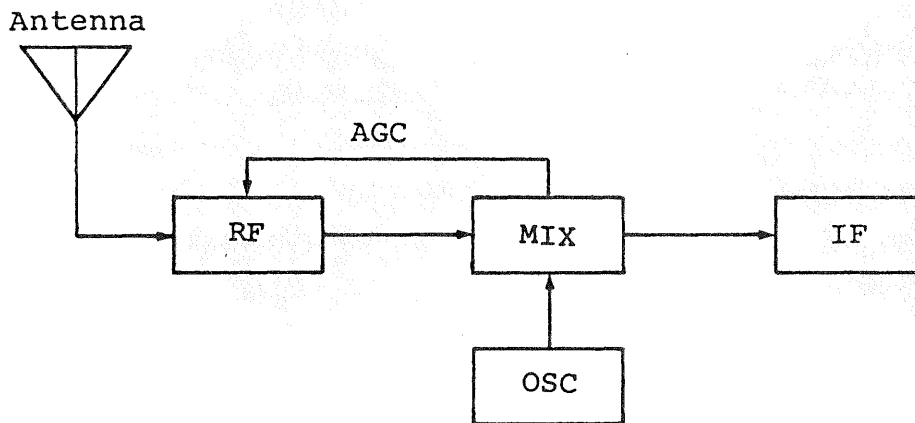


## Tuner Section

### 1. Freedom from interference and low distortion

Due to the advanced circuitry and sophisticated layout of its tuner section, the KRC-949D shows an outstanding ability to suppress interference and maintain low harmonic and intermodulation distortion even in areas where there are strong electrical fields.

#### KRC-949D front-end circuit layout

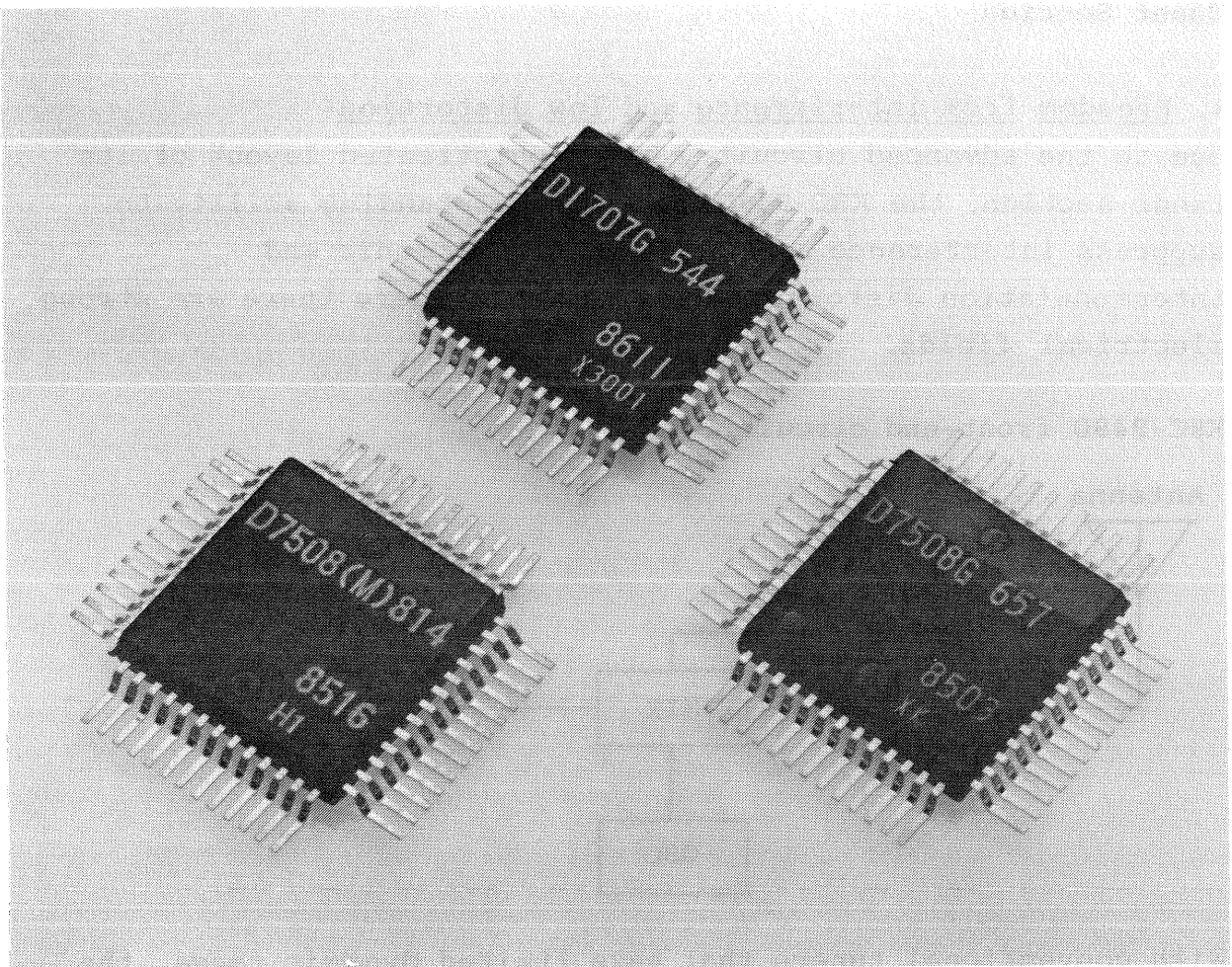


With conventional tuners that have limited dynamic range, the input of a strong signal affects the RF (radio frequency) amplifier, which generates harmonic distortion and IM distortion, ultimately adversely influencing sound quality. A double balanced mixer in the KRC-949D provides wide dynamic range, so that even with strong input signals there is no distortion. As you see in the diagram, an AGC circuit detects the control voltage at the mixer stage, feeding back to the RF stage to allow control over a wide bandwidth. In the conventional front end circuit, a narrow-band AGC at the IF stage was not able to control interference from large signals in the 300kHz to 1MHz range. Such effects are now eliminated.

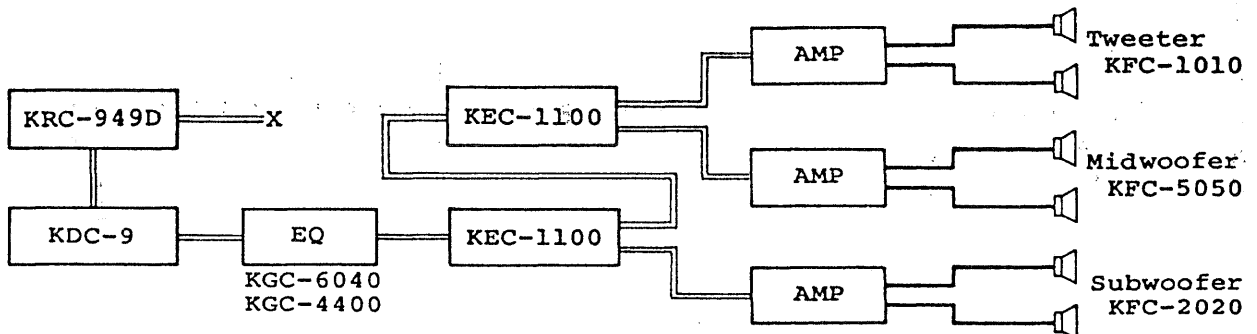
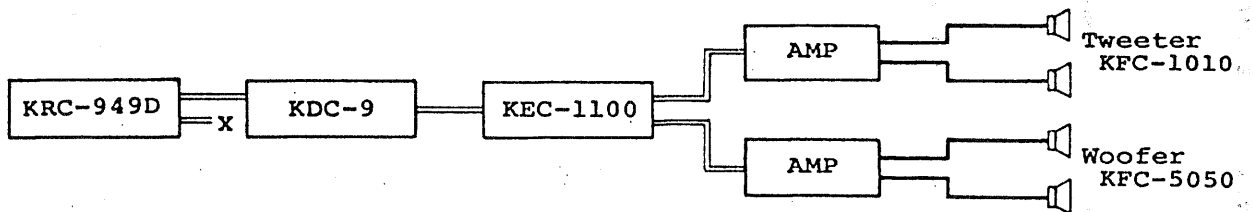
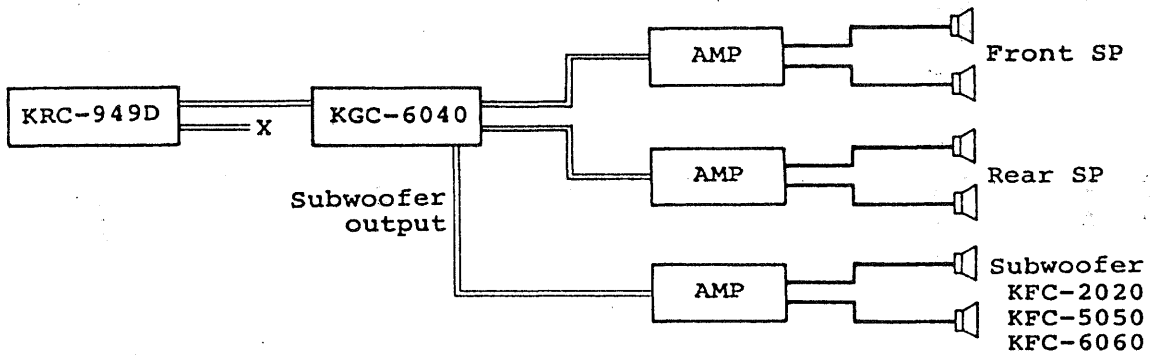
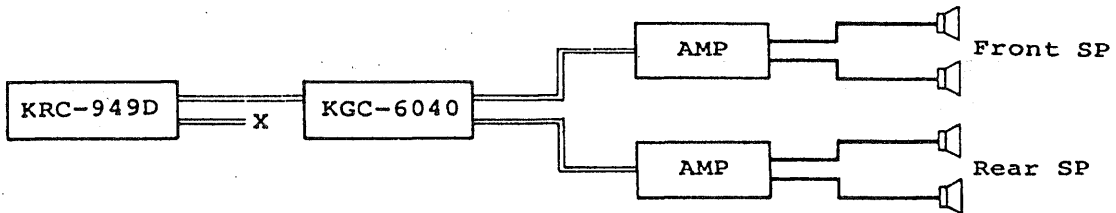
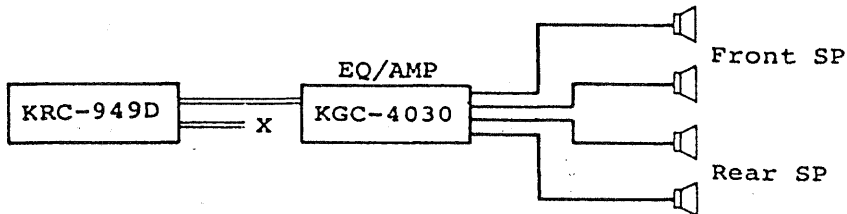
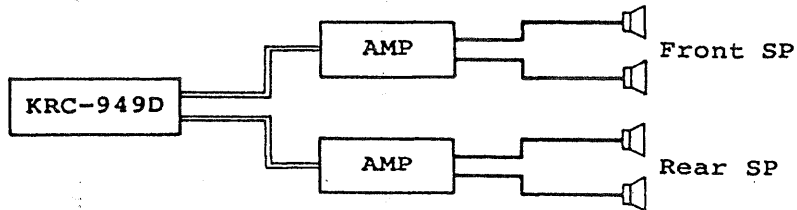
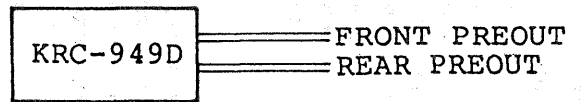
### 2. 3 microprocessors and multi-functions

This unit is fully computerised with each circuit and the power switch controlled electronically.

1. IC-10 for operation control of synthesizer tuner (4K RAM)
2. IC-5 for display, volume, mechanical key reception (4K RAM)
3. IC-2 for mechanical drive control (4K RAM)



KRC-949D System Expansions



FEATUER COMPARISON CHART

MODEL NAME	KRC-949D	KRC-747D	KRC-525D	KRC-525L	KRC-444D	KRC-444L	KRC-323D	KRC-323L
<b>TUNER</b>								
TUNING SYSTEM	PLL	PLL	PLL	PLL	PLL	PLL	PLL	PLL
PRESET	12+6+6	12+6+6	6+6+6	6+6+6	6+6+6	6+6+6	6+6 (M+L)	6+6 (M+L)
AUTO-MEMORY	o	o	-	-	-	-	-	-
PRESET SCAN	o	o	-	-	-	-	-	-
SEEK	o	o (up/down)	o	o	o	o	o	o
ANRC	o	o	o	o	o	o	o	o
ABSS	o	-	-	-	-	-	-	-
LOCAL/DX	o	-	-	-	-	-	-	-
MONO/STEREO	o	-	-	o	-	o	-	-
PNBS	o	o	o	o	o	o	o	o
TRAFIC INFORMATION*	BK	SDK	SDK	-	SDK	-	SDK	-
SIGNAL METER	o	-	-	-	-	-	-	-
<b>TAPE</b>								
MECH. CONTROL	FULL-LOGIC	FULL-LOGIC	-	-	-	-	-	-
BI-AZIMUTH	o	o	-	-	-	-	-	-
TAPE HEAD**	SE	SUPER HP	HP	HP	HP	HP	HP	HP
AUTO REVERSE	o	o	o	o	o	o	o	o
TAPE ADVANCE	o	o	-	-	-	-	-	-
METAL/CHROME	o	o	o	o	o	o	-	o
dbx	o	-	-	-	-	-	-	-
DOLBY	B/C	B/C	B	B	-	-	-	-
TUNER CALL	o	o (auto)	-	-	o (auto)	o (auto)	-	-
INDEX SCAN	o	-	-	-	-	-	-	-
REMAIN DISPLAY	o	-	-	-	-	-	-	-
KEY-OFF EJECT	o	o	-	-	-	-	-	-
<b>AUDIO</b>								
POWER OUTPUT	-	6W x 2	6W x 2	6W x 2	6W x 2	6W x 2	6W x 2	6W x 2
FADER	o	DUAL	DUAL	DUAL	-	-	-	-
PREOUT	o	o	o	o	o	o	-	-
PREOUT LEVEL SW	o	o	-	-	-	-	-	-
ELECT. VOLUME	o	-	-	-	-	-	-	-
BASS/TREBLE	o	o	o	o	TONE	TONE	TONE	TONE
LOUDNESS	o	o	o	o	o	o	-	-
THEFT PREVENTION	COVER	TPC	TPC	TPC	TPC	TPC	-	-
ILLUMINATION SW	-	oBLU/ORG	-	-	-	-	-	-
DC-DC COMVERTER	o	-	-	-	-	-	-	-
BODY SIZE	DIN155	DIN155	DIN168	DIN168	DIN155	DIN155	DIN155	DIN155

\* For German only \*\* SE=Sendust HP=Hard Permalloy