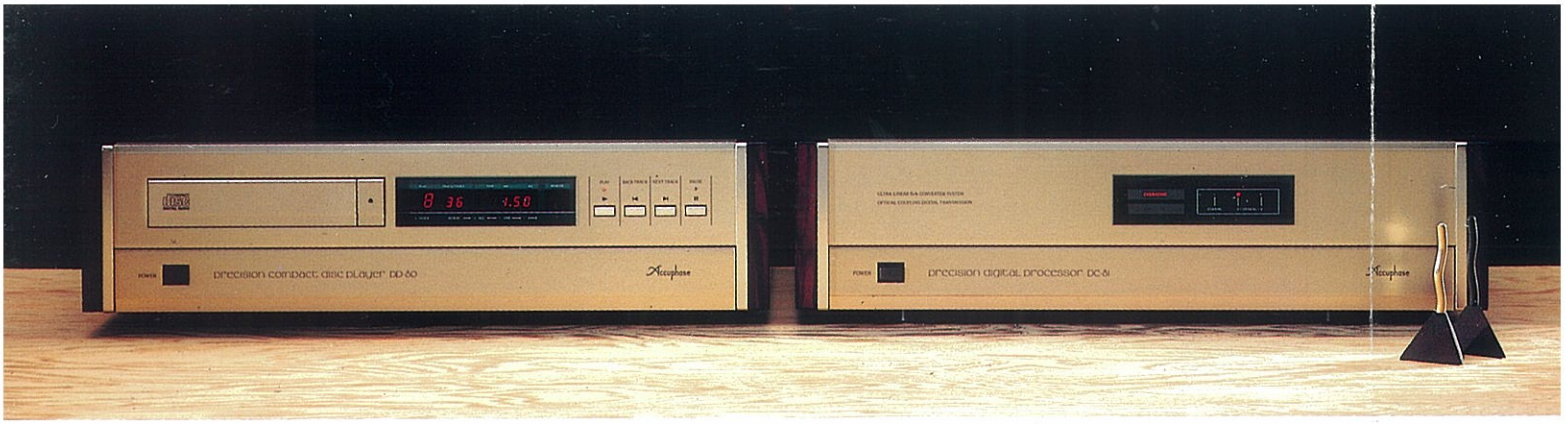
Accuphase

COMPACT DISC PLAYER

DIGITAL PROCESSOR

DP-80 · DC-81

COMPACT disc DIGITAL AUDIO



That the sound quality recorded at the studio or concert hall is reproduced true to life in the confines of the home is the one major attraction of digital audio. Its standard-bearer is the Compact Disc which is responsible for the ongoing big change in the audio world.
We at Accuphase predicted the coming of the digital audio day years ago and embarked on the development of CD players. The DP-80 CD player and the DC-81 digital processor are the first fruits of our relentless efforts. We are confident that the CD player system consisting of this player and digital processor combination is on the threshold of the highest available quality.

Basic Concept of CD Player Development

In the analog disc world, components such as tape recorders, cartridges, tone arms, and shells have their own effects that modify the original sound. Moreover, they closely interact with one another, resulting in a reproduced sound peculiar to that system. In the digital recording/reproduction world, the tendency is to eliminate modification of sound by components and the degree of freedom is narrower from the viewpoint of creating unique sound. However, because of virtually no sound modification, reproduction of actual sound field is unlimitedly possible. And this is the big attraction of digital recording/ reproduction. You may consider this feature of digital audio systems to be rigid and inflexible if you are one of those who enjoy the "tinted" sounds of analog systems. However, the digital systems' greatest advantage lies in the fidelity to the actual sounds.
What is required from a digital audio system is therefore to reproduce the beauty of the program source with the utmost accuracy and faithfulness, preventing the quality of the actual sound field from being degraded.
As mentioned, the biggest advantage of analog audio systems is that the sounds they process are open to slight modification. However, in a digital system in which the signals are encoded and processed, such modification of the actual sounds hardly takes place. A defective digital system may cause dropout or distortion of sounds. In developing a digital system, therefore, the utmost emphasis must be placed on how to prevent such dropout and distortion of the actual sounds and to improve the system's performance up to the theoretical upper limit. This should be the basic policy of manufacturers of digital audio systems. Without adhering to this policy, manufacturers should never attempt anything that may result in modification of the actual sounds nor attempt to compensate for the dropped out or distorted sounds by means of sound modification technique.
In developing a digital audio system, there is one problem to be solved. Since digital signals contain radio-frequency noise components in a wide range, extending up to the bandwidth equivalent to VHF band of TV broadcasting frequency, these noise components interfere with the audio signals and cause cross-modulation distortion which lowers the sound quality. This degradation of the sound quality is sometimes witnessed when audio equipment is placed very close to a computer radiating strong spurious waves. Therefore, eliminating the interference of the digital signal and radio-frequency noise inside the equipment and eliminating the spurious radiation from the equipment are important points in improving the sound quality. To suppress the radio-frequency noise components, radio-frequency technology is indispensable. Consequently, it can be said that digital audio equipment is not completed by digital signal technology alone but through integration with such other technologies as the radio-frequency technology and audio technology.
With this philosophy in mind, Accuphase has developed a CD player in which theoretical upper-limit performance is achieved.

System Outline

This system consists of the DP-80 CD player, which reads digital signals from compact discs, and the DC-81 digital processor, which converts the digital signals the DP-80 reads into audio signals.

DP-80 CD PLAYER

Fig. 5 shows the block diagram of the DP-80 CD player. The DP-80 outputs digital signals only and therefore, is used with a processor.
The output digital signals are transmitted by the Accuphase's original optical fiber transmission system, which completely blocks spurious radiation, and thus excellent sound quality is assured. Moreover, the DP-80 is equipped with a coaxial cable output of standard format. Therefore, not only the DC-81, a processor exclusively developed for the DP-80, but also digital processors of other make can be connected to the CD player. The laser pickup is driven by a linear motor and controlled by an exclusively developed 8-bit microprocessor. Therefore, an access time of less than one second has been achieved.
As the reference clock signal that controls the operation of the player and the timing of the digital signals, the single-master-clock system is employed. Consequently, a beat which degrades the sound quality is seldom generated. Heavy and rigid construction of the housing is highly resistant to vibrations caused by the disc revolution and eliminates the adverse effect on the sound quality by the sound pressure from the speakers. In addition, the complete shielding and the line filter prevent spurious radiation from the radio-frequency noise components.
Weight is placed on the simplicity of operation. Only four keys appear on the front panel. Other control keys are hidden in the subpanel at the lower part of the front panel. Therefore, you can operate the DP-80 CD player as if you are operating a conventional analog disc player. The DP-80 can be fully remote-controlled by the RC-1 remote commander attached as an accessory.

DC-81 DIGITAL PROCESSOR

The most unique feature of this CD player system is the DC-81 digital processor. Fig. 6 shows the block diagram of this processor. In addition to the standard 75-ohm coaxial cable terminal, two optical fiber receptacles, which prevent the spurious radiation, are provided for receiving the signals sent from the DP-80 CD player. The 75-ohm coaxial cable terminal allows the digital processor to be connected to CD players of other manufacturers.
The D/A converter which converts digital codes into analog signals is the heart of the digital processor depending on which the reproduced sound quality varies. For the first time in the world, Accuphase has employed a D/A converter configured of discrete elements which attains the theoretical zenith of the digital signal processor. Additionally, each discrete element is carefully adjusted so that the zero-cross distortion does not occur even when signals with a small magnitude are to be processed.
The 16-bit digital signal are input to each of the right and left channels of the D/A converter through 17 optoisolators so that the analog circuitry is completely electrically isolated from the digital circuitry by these 34 optoisolators. As a result, the interference between the digital circuit and analog circuit are eliminated, preventing the degradation of the sound quality. Moreover, an independent transformer is employed exclusively for the digital circuitry and the digital and analog circuits are shielded to prevent mutual interference.
To eliminate the unwanted components outside the audio frequency range, the double over sampling frequency method is adopted with the 121-stage digital filter which offers the best available performance. As a result, amazing characteristics such as an attenuation of −90dB at 24.7kHz and a ripple of ±0.001dB within the band have been achieved. The phase difference at high frequencies between the left and right channels is eliminated by an independent digital filter provided for both the channels.
Nine-pole GIC type Butterworth active filters having specially selected elements are employed in the analog circuit for the better sound quality. The final output circuit consists of only a DC-direct coupled buffer amplifier for direct output.

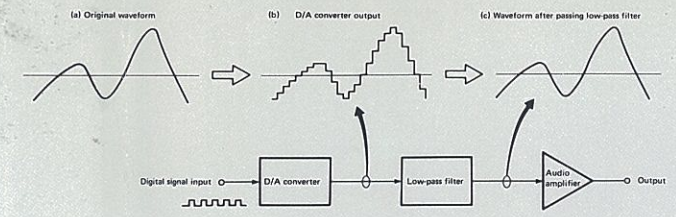


Fig. 1 Configuration of Typical CD Player

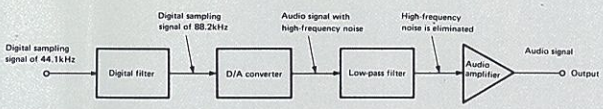


Fig. 3 Configuration with Digital Filter and Audio

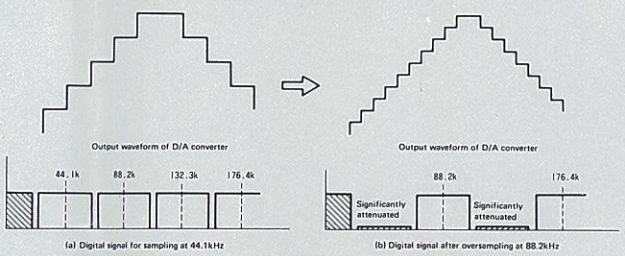


Fig. 4 Operational Concept of Digital Oversampling Filter

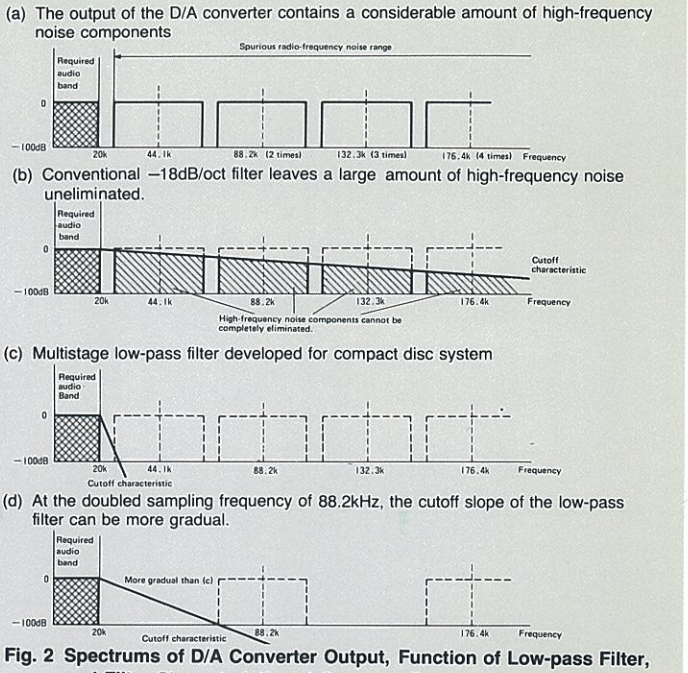


Fig. 2 Spectrums of D/A Converter Output, Function of Low-pass Filter, and Filter Characteristics at Oversampling

The DC-81 digital processor employs a pair of digital filters for oversampling at two times the original sampling frequency. Each digital filter is a circuit that carries out the filtering process without any change to digital signals. Unlike analog filters, the functions of digital filters are quite sophisticated. Therefore, the concept of digital filtering is discussed here.

A large amount of radio-frequency noise components are contained in the output of a D/A converter. A low-pass filter is required to remove these noise components

Fig. 1 shows a D/A converter and components in the subsequent stages in a typical CD player configuration. Because a signal input to each converter is sampled at 44.1kHz, the converter output which is restored to an analog signal contains a staircase waveform as shown in Fig. 1 (b) as a result of the superposition of a 44.1kHz square wave on the original waveform shown in Fig. 1 (a). This staircase waveform is also at 44.1kHz.

Then, what frequency components are contained in the output signal of the D/A converter? The spectrum of the sampled output signal is as shown in Fig. 2 (a). In addition to audio signals of up to 20kHz, contained are radio-frequency noise components ranging up to TV broadcast frequency bands such as 44.1±20kHz, 88.2±20kHz which is two times the original sampling frequency, 132.3±20kHz, three times the original sampling frequency, and so on. These components are outside the audible frequency range. Therefore, some may think, they are inaudible and need not be eliminated. However, the radio-frequency noise components will, in fact, cause the following serious problems.

(a) Cross-modulation distortion of audible components in the nonlinear ultrahigh frequency range of audio circuits, preamps, or power amps in the processor, resulting in degradation of sound quality.
(b) Intrusion of noise components into other audio equipment such as AM/FM tuner and tape recorder, resulting in degradation of sound quality.
(c) Overheating of, and damage to, components in the output stage due to constant flow of high-frequency current into wideband power amplifiers (all transistor amplifiers are wideband).
(d) Overheating of, and damage to, voice coils due to flow of high-frequency energy into speakers, especially, tweeters.

In order to eliminate these problems, in the CD player, frequencies above 20kHz are suppressed by using a filter so that the reproduced audio signal contains no high-frequency noise.

Low-pass filters must have a sharp cutoff characteristic. This, however, may lead to degradation of their frequency response characteristic and phase characteristic

A low-pass filter passes all frequencies below a specified frequency with little or no loss and discriminates strongly against higher frequencies. A filter whose attenuation is flat up to 20kHz, and sharply drops down to −80dB and even to −90dB if possible at 24kHz is preferable for the filtering process in the CD player. Low-pass filters are used in preamplifiers; however, their most sharp cutoff characteristic is −18dB/oct.

Fig. 2 (b) shows the cutoff characteristic with conventional filters rated at −18dB/oct. Their attenuation are −18dB at 40kHz, −36dB at 80kHz, and −64dB at 160kHz. Therefore, these filters are not suitable for eliminating high-frequency noise components. A number of filters, each of which has the cutoff characteristic as shown in Fig. 2 (b), should be connected in series for sharp cutoff as shown in Fig. 2 (c). However, it is very difficult to realize such a characteristic that attenuation is flat up to 20kHz and sharply drops after 20kHz. Multistage (11-stage) low-pass filters are generally used in CD players. However, ripple occurs in their frequency characteristic due to deterioration of the phase characteristic. Nonlinear distortion will also be caused by a number of components used in such multistage configuration. Because of sharpened cutoff characteristic, the other characteristics of the filters are deteriorated. Therefore, if there is any method to attain the intended purpose with a gradual cutoff characteristic, these problems can be eliminated. A digital filter is intended to solve these problems.

A digital filter functions to oversample at two times the original sampling frequency (i.e., 88.2kHz). This allows the low-pass filter in the audio circuit to have a gradual cutoff characteristic

Fig. 2 (d) shows the frequency spectrum when the sampling frequency is 88.2kHz. As apparent from the figure, the noise component at the original sampling frequency of 44.1kHz ±20kHz is eliminated by oversampling at 88.2kHz. Therefore, the cutoff slope of the low-pass filter can be as gradual as shown in the figure. Consequently, its phase characteristic is improved. The digital filter functions to double the original sampling frequency (or oversample at four, six ... times the original sampling frequency). Fig. 3 shows a circuit configuration using a digital filter to eliminate high-frequency noise components. In other words, the D/A converter is sandwiched between the digital filter and the analog low-pass filter.

Fig. 4 illustrates the operating principle of the digital filter. Input and output signals to and from the digital filter are digital. Therefore, an analog signal as shown in the figure cannot actually be observed. The waveform of a digital signal converted into an analog signal by the D/A converter, and its spectrum are shown here. As shown in Fig. 4 (b), the output of the digital filter becomes the sampling frequency which is two times the original sampling frequency, and the frequency of the square wave superposed upon the reproduced signal is also doubled.

Two important features of the digital filter are large attenuation at the sampling frequency of 44.1 ±20kHz and low ripple in the audio band

It should be remembered that noise components centered on 44.1kHz, 132.3kHz, and so on are not completely eliminated by the digital filter but they are merely attenuated as shown in Fig. 4 (b). Therefore, in addition to multiplying the sampling frequency by multiples of two, the digital filter plays an important role in attenuating spurious frequency components at 44.1kHz ±20kHz and at even multiples of the original sampling frequency. If this attenuation is insufficient, spurious frequency components leak into the output of the processor. Therefore, the two ideal characteristics of the digital filter are to attenuate spurious frequency components as much as possible and to minimize ripple in the audio band. Which oversampling is better, at two times or at four times the original sampling frequency, cannot be judged without taking into account the total characteristics of both the digital filter used and the following audio low-pass filter.

Optical transmission system adopted for the first time in the world; single-master-clock system; extremely heavy and rigid construction; selection time takes less than 1 second

1 In addition to a standard 75-ohm coaxial cable connector, a wideband optical fiber output connector is provided for dedicated use in the CD player system. Spurious radiation is suppressed to prevent sound distortion. A full-scale line filter shuts off interference from the power line

The digital signals are output from a standard 75-ohm coaxial cable connector, which outputs the digital signal in accordance with the standard format shown in Fig. 5, and an Accuphase dedicated optical fiber connector. The optical transmitter is capable of sending 7M bits per second; therefore, high-quality digital signals can be sent to the digital processor. Optical fiber is used to send digital signals so that spurious radiation which lowers the quality of the sound does not occur. The spurious radiation through the power line is virtually eliminated by a full-scale line filter.

2 One master clock controls all operation timing; so, no beat is generated

The reference signal which controls operations inside the player is generated by the crystal clock oscillator. Generally, two clock oscillators are used, one for digital signal processing and the other for microprocessor. However, if the frequencies of the two oscillators differ even slightly, beat is generated and the sound quality may be lowered. This unit uses only one clock oscillator as shown in Fig. 5 so that no beat can be generated.

3 Selection time of less than 1 second is achieved by employing a linear motor laser pickup and 8-bit microprocessor

The direct key selection is an attractive feature of the CD player. This unit employs the most advanced linear motor mechanism which can operate swiftly and smoothly for the tracking of the laser pickup. With this linear motor mechanism and an 8-bit microprocessor developed for this CD player, selection time of less than 1 second is achieved. Additionally, the disc compartment can be opened or closed swiftly so that minimum effort is required to enjoy the player.

4 The mechanism is mounted on a ceramic composite special resin mounting floated from the chassis so that the effect of vibration and resonation on the sound quality is virtually eliminated

The disc rotates at 200 to 500rpm. Therefore, if measures to eliminate vibration and resonation are not taken, components inside the unit are vibrated to cause deterioration of the sound quality. In this CD player, the mechanism itself is mounted on a very hard ceramic special resin mounting floated from the chassis so that vibration is almost totally dampened. Together with the mechanism, the disc compartment is also floated from the chassis so that the external shock to the mechanism is minimized.

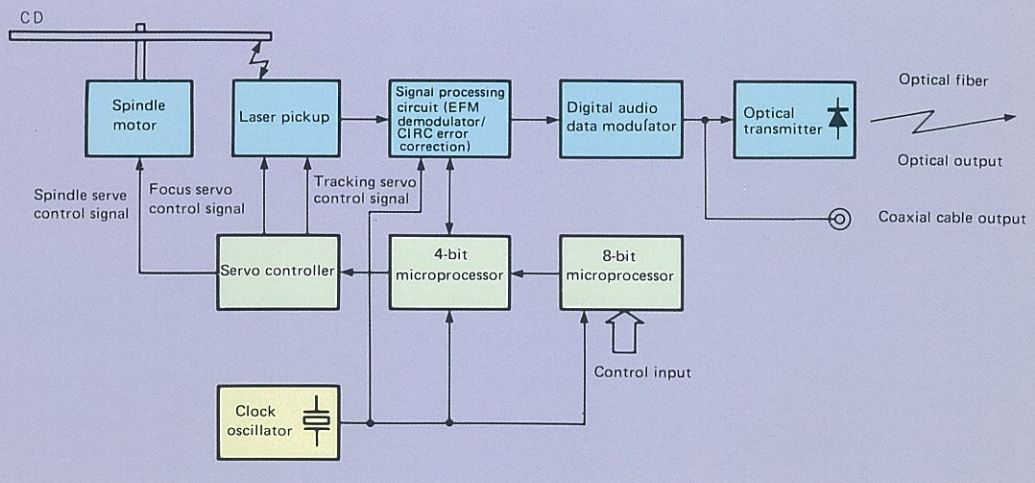
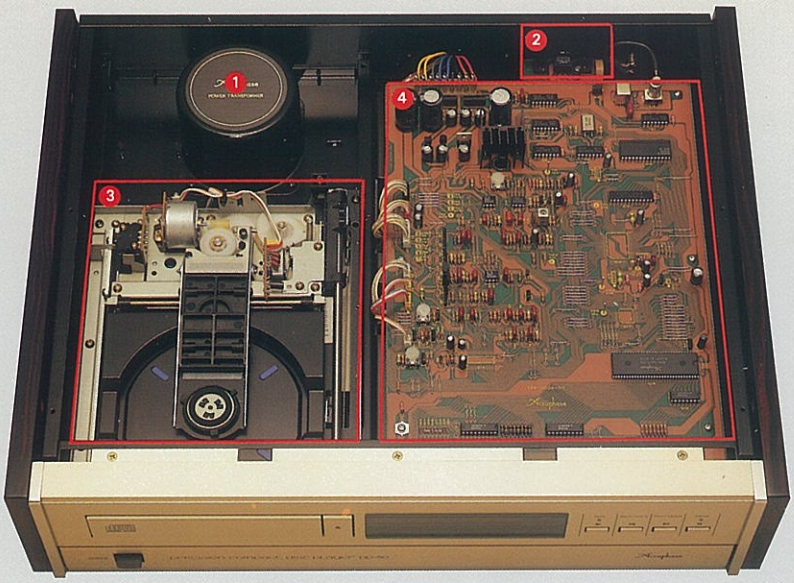


Fig. 5 DP-80 Block Diagram



1. Power transformer
2. Optical fiber transmitter
3. CD mechanical deck
   The CD deck is mounted on a ceramic composite special resin mounting floated from the chassis so that the effect of vibration and resonation on the sound quality is virtually nil.
4. Servo circuit, signal processing circuit, mechanical control circuit, master clock generator, etc., are mounted. ICs and microprocessors are also mounted on the rear of the circuit board.

5 Heavy chassis kills resonation

The DP-80 CD player weighs 15kg and can be classed to belong among extremely heavy CD players. The rotating section is supported by a thick metal frame, and the entire unit is designed to resist vibration. The sturdy frame construction employed in the entire unit is also effective against resonation. Therefore, the sound quality is not affected by the sound pressure from the speakers or location. These guarantee stable operation.

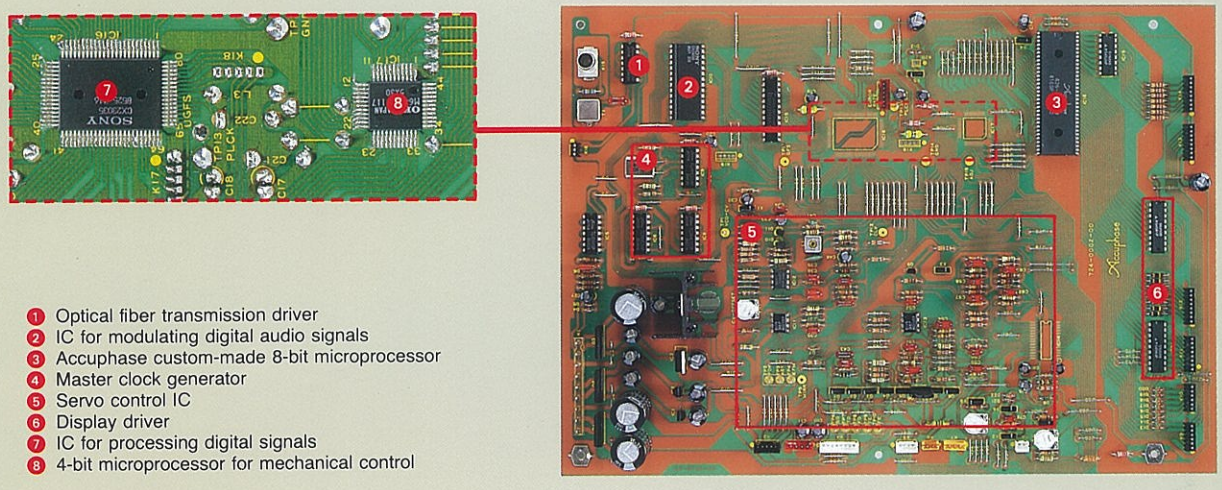
6 Operation is as simple as an analog player

The external appearance is designed to be much simpler than the general CD players. As can been seen in the photograph on the cover, only the PLAY, TRACK SEARCH, and PAUSE keys are on the front panel. With these keys, you can operate this CD player as though you are operating an analog player. Other control keys are hidden behind the subpanel. All functions, except power ON/OFF and disc compartment OPEN/CLOSE, can be controlled from the supplied remote commander.

7 Simple, beautiful appearance of the CD player harmonizes with other Accuphase products

A hairline finish golden panel and natural persimmon sideboard offer good coordination with other Accuphase products, and blend right into the room to add comfort to listening.

● Remote commander RC-1



1. Optical fiber transmission driver
2. IC for modulating digital audio signals
3. Accuphase custom-made 8-bit microprocessor
4. Master clock generator
5. Servo control IC
6. Display driver
7. IC for processing digital signals
8. 4-bit microprocessor for mechanical control

The world's first discrete D/A converter; 121-stage double oversampling digital filter provided in each channel independently

DC-81

Digital processor

1 In addition to a 75-ohm standard coaxial cable input connector, wideband optical fiber input receptacles are provided for dedicated use in the Accuphase system

The digital signals can be input from a standard 75-ohm coaxial cable connector and an Accuphase dedicated optical fiber connector. The optical receiver has the bandwidth same as the transmitter in the DP-80 CD player; therefore, it is wide enough for receiving data of 7M bits per second so that the high-fidelity digital signals can be sent from the DP-80 CD player to the DC-81 digital processor. The use of optical fiber causes no spurious radiation that lowers the sound quality.

2 Near theoretical limit performance is achieved by employing the discrete D/A converter for the first time in the world

The D/A converter which converts a digital signal to an analog signal is the heart of the digital processor. How accurately the original audio signal is reproduced is the most important point of the D/A converter.
In the DC-81, the multiplying D/A converters are employed, which has an excellent linearity. These D/A converters are discretely configured for the first time in the world to achieve the near theoretical limit performance for 16-bit digital signals. As shown in the right side of the conceptual drawing in Fig. 7, the precision current switch elements and super-precision resistors are used to do so. Additionally, each unit is carefully adjusted to exact its maximum quality; therefore, a total distortion which is very close to the theoretical-limit-distortion ratio of 0.001% is achieved (0.0016 typical).
Zero-cross distortion, which can be pronounced with a multiplying D/A converter especially at low-power output, is virtually eliminated.

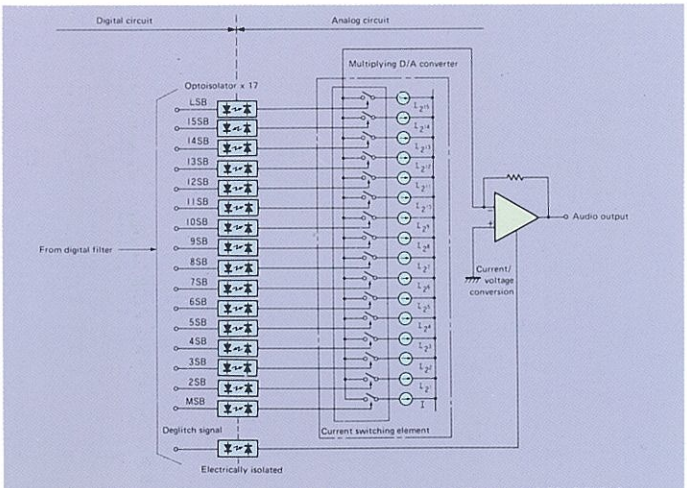


Fig. 7 Operational Theory of Unique Optoisolator and Multiplying Discrete D/A Converter

3 For the first time in a CD player, 16-bit digital signal and deglitch signal for each channel are input to the D/A converter through 17 optoisolators (meaning a total of 34 isolators for the L and R channels) so that the digital circuit and analog circuit are electrically isolated; as a result, the interference from the digital circuit is eliminated.

As well-known, radio-frequency noise interferes with audio signals. Therefore, each digital filter output is converted to the light signal and the light signal is then converted back to the electrical signal in the optoisolator whose bandwidth is wide enough to carry data of 7M bits/sec. The digital circuit and the analog circuit are isolated in this manner as shown in the right side of Fig. 7, and the interference by the noise from the digital circuit is practically nullified. The output of each optoisolator goes through the mother printed board outside the shielded frame and is input to the D/A converter in the magnetically and electrically shielded analog circuit.

4 121-stage double over sampling digital filter is provided independently in each channel for better sound quality

The left-channel digital signal and the right channel digital signal are sent in a serial operation in the standard format from the player. That is, the digital signals for both the channels are sent in a single transmission line. Generally the digital signals of both channels are input to one D/A converter; the output of the D/A converter is then discriminated to the left and right channels. However the DC-81 employs a more advanced method whereby the digital signals are discriminated into left channel and right channel signals; the signal of each channel is then input to an independent D/A converter.
As shown in Fig. 6, digital filters are used to clear unnecessary frequency bands. A 121-stage double oversampling type digital filter is independently used for each channel. Because of this, the ripple of passband with effects on sound quality is within ±0.001dB and depressed to −90dB(24.7kHz), that is the best value currently available. Therefore, it can be said that the highest possible performance with today's technology has been obtained.

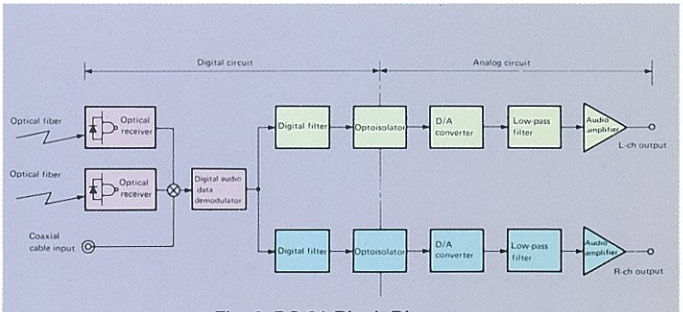
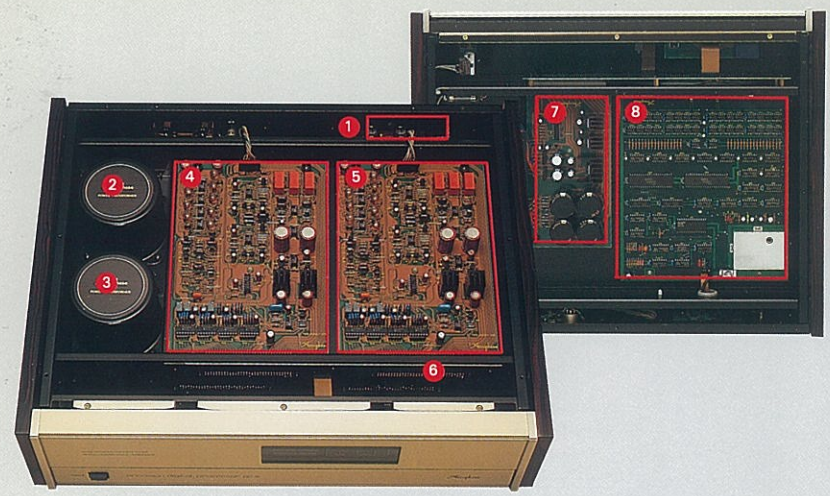


Fig. 6 DC-81 Block Diagram



1. Optical fiber transmission receiver
2. Power transformer for analog circuits
3. Power transformer for digital circuits
4. Analog circuit board, D/A converter, low-pass filter, audio amp, etc., for left channel are mounted.
5. Analog circuit board for right channel
6. Digital signals that transited the optoisolators enter the D/A converter and subsequent analog circuits after going through this motherboard.
7. Power supply circuit board
8. Digital signal processing circuit board

5 9-pole GIC type Butterworth active filters having specially selected elements are employed

The sampling frequency is doubled to 88.2kHz. Therefore, the signal output from the D/A converter contains the high-frequency components of over 68.2kHz (88.2−20=68.2kHz), but the low-pass filter in the stage next to the D/A converter clears these high-frequency components. The DC-81 employs the 9-pole GIC type discrete Butterworth active filter in this stage, where considerations for high-fidelity sound are also made.

6 Directly coupled 0dB-gain buffer amp is solely employed as output stage

The quality of the last audio stage is very important for the sound quality. Many new ideas are also incorporated in this stage. First, the output level of the D/A converter is set in a manner that no amplification is necessary in the following stage. Therefore, the output stage consists simply of a buffer amplifier. Second, the Accuphase original circuits and push-puli DC servo direct coupling method are used. As a result, an outstanding signal-to-noise ratio and linearity are achieved.

7 De-emphasis circuit consisting of passive elements and buffer amplifier

On some CD discs, the recording level is emphasized towards the higher frequency when recorded. This is called pre-emphasis. When playing a pre-emphasized disc, measures to offset the pre-emphasis must be taken. This is called de-emphasis. These procedures are to improve the signal-to-noise ratio through the recording and reproducing processes. However, pre-emphasis and de-emphasis are not especially necessary for digital recording.

A disc whose contents are pre-emphasized contains a special signal which indicates that the contents are pre-emphasized. This signal is detected by the player, and the response characteristics are automatically changed. Fig. 8 shows the de-emphasis circuit which is important for the sound quality. The de-emphasis circuit consists of a passive filter and buffer amplifier so that an excellent sound quality is maintained.

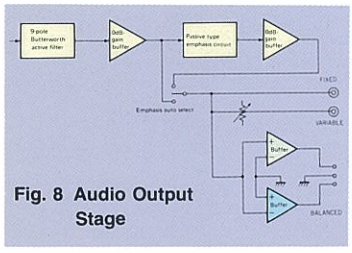


Fig. 8 Audio Output Stage

8 An independent power transformer for each digital and analog circuits. The analog and digital circuits are isolated by metal shield. The analog circuit is divided into the left and right channels on each independent PCB. The power to each channel is supplied from the independent power transformer winding to reduce the cross-channel interference.

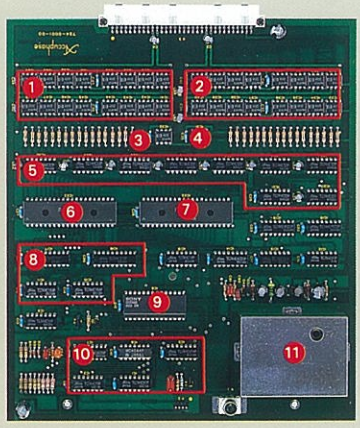
Even though the digital and analog circuits are isolated by optoisolators, the radio-frequency noise can come through the power line or space. Therefore, in this unit, the both digital and analog circuits are shielded by metal shield. In addition, the digital and analog circuits have their own independent power transformer to maintain their isolation. For the audio circuit, the power to the left and right channels are supplied from different windings to reduce the cross-channel interference.

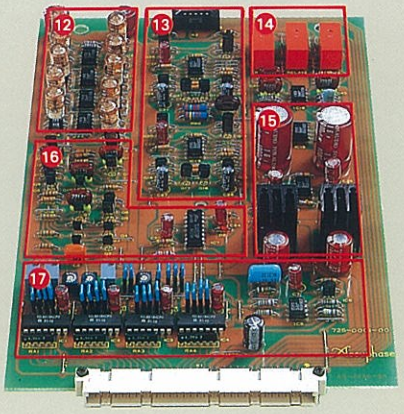
9 Uncompromising measures to reduce spurious radiation

Most audio equipment suffer interference by the spurious wave radiated from the unit, and the sound quality is affected. Radio-frequency technology is necessary to solve the problem of the spurious wave. Accuphase has extensive experience in this area gained through the development of AM/FM tuners. A number of high-speed CMOS's which have low spurious-wave radiation are used in the digital circuit. The spurious radiation through the power line is suppressed by a full-scale line filter. Additionally, the internal circuits are well-shielded.

10 Fixed level audio output and variable level audio output and additional XLR-type balanced output are provided

Two pairs of RCA type phono jacks, one for fixed level output and the other for controlled output level, are provided. The output level for the controlled output can be adjusted by the volume control on the subpanel. The XLR-type balanced output connectors are also provided for commercial use. These outputs are low impedance (50 ohms: 25/25) (Fig. 8).





1. 16-bit data optoisolators for left channel
2. 16-bit data optoisolators for right channel
3. Optoisolators for deglitch signal
4. Optoisolators for deglitch signal
5. Drivers for optoisolators
6. 121-stage digital filters for right channel
7. 121-stage digital filters for left channel
8. Serial parallel converters
9. IC for demodulating digital audio signals
10. PLLs
11. Voltage control oscillator (VCO) using cristal oscillator
12. 9-pole GIC type Butterworth low-pass filter
13. Cascode push-pull DC servo directly coupled buffer amp
14. De-emphasis /muting relays
15. Regulated power supply
16. Current/voltage conversion circuit
17. Discrete16-bit D/A converter

GUARANTY SPECIFICATIONS

- **PERFORMANCE GUARANTY:**
  All Accuphase product specifications are guaranteed as stated.
  This system complies with the EIAJ CP-307.

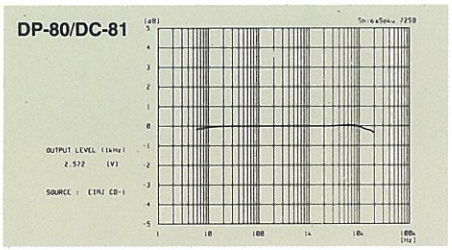
DP-80 CD PLAYER

- **Type:** Digital player for compact disc system
- **Format:**
  Compact disc standard format
  Error correction method: CIRC
  Number of channels: 2
  Spindle speed: 200 to 500 rpm
  (constant linear velocity)
  Scan velocity: 1.2 to 1.4m/s
- **Data read:**
  Non-contact optical pickup
  (semiconductor laser pickup)
- **Laser:**
  Semiconductor laser: GaA1As (double heterodyne diode)
- **Digital signal output format level:**
  Format: Digital audio interface
  Optical: Output: −9dBm
  Wave length: 660nm
  Coaxial: 0.5V p-p, 75 ohms
- **Semiconductors used:**
  22 transistors, 27 ICs, 34 diodes
- **Power requirements:**
  Voltage selection by rewiring for 100V, 117V, 220V and 240V, 50/60Hz operation
  Power consumption: 15W
- **Dimensions:**
  475mm (18-23/32 inches) width, 135mm (5-5/16 inches) height*, 373mm (14-11/16 inches) depth
  *including legs
- **Weight:**
  15kg (33.1 lb) net, 20kg (44.2 lb) in shipping carton

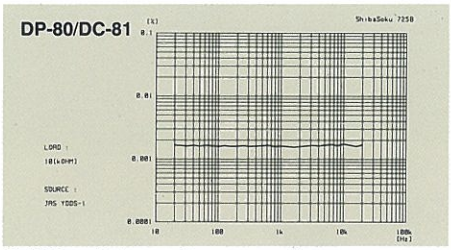
- **Supplied remote commmander RC-1**
  Remote control system: Infrared control
  Power requirements:
  3Vdc with two batteries IEC designation R6 (size AA)
  Dimensions:
  64mm (2-9/16 inches) width, 49mm (5-15/16 inches) height, 18mm (6/8 inch) depth
  Weight: 115g (4.1 oz)

DC-81 DIGITAL PROCESSOR

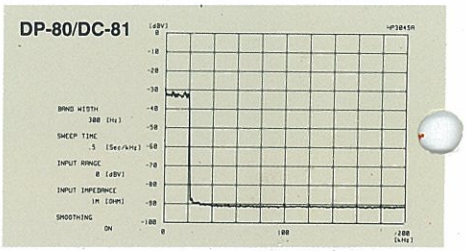
- **Type:**
  Digital processor for compact disc system
- **Format: Compact disc standard format**
- **Number of quantizations:** 16-bit linear
- **Sampling frequency:** 44.1kHz ±5Hz
- **Frequency response:** 4.0 to 20,000Hz ±0.3dB
- **Total harmonic distortion + noise:**
  0.002% (1kHz)
  0.008% (20Hz to 20kHz)
- **S/N and dynamic range:** 106dB
- **Channel separation:** 100dB
- **Output voltage and impedance:**
  FIXED: XLR-type
  BALANCED: 2.5V/50 ohms (25 ohms/25 ohms)
  UNBALANCED: 2.5V/50 ohms RCA type phono jack
  VARIABLE: UNBALANCED: 0 to 2.5V/1.25k ohms (max.)
  RCA type phono jack
- **Digital signal input format level:**
  Format: Digital audio interface
  Optical: Input:−15 to −28dBm
  Coaxial: 0.5V p-p, 75 ohms
- **Semiconductors used:**
  66 transistors, 8 FETs, 68 ICs, 44 diodes
- **Power requirements:**
  Voltage selection by rewiring for 100V, 117V, 220V and 240V, 50/60Hz operation
  Power consumption: 25W
- **Dimensions:**
  475mm (18-23/32 inches) width, 135mm (5-5/16 inches) height*, 373mm (14-11/16 inches) depth
  *including legs
- **Weight:**
  15.5kg (34.2 lb) net, 20.5kg (45.2 lb) in shipping carton



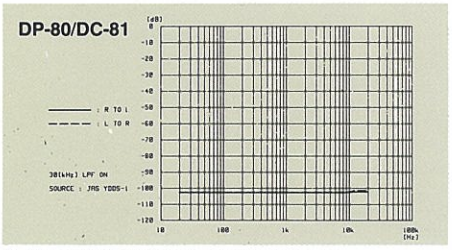
● **Frequency Characteristic**



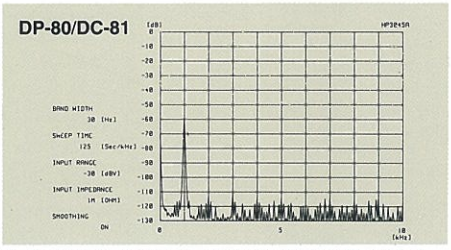
● **THD + Noise vs. Frequency Characteristic**



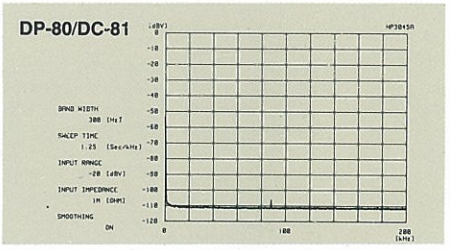
● **Spectrum Analysis of −20dB White Noise**



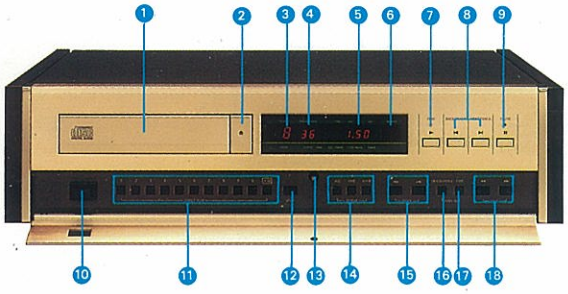
● **Channel Separation Characteristic**

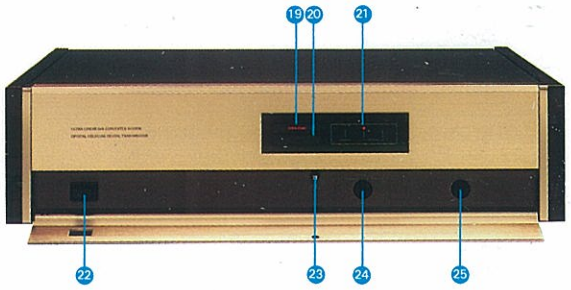


● **Spectrum Analysis of Reproducing Signal at 1kHz: −60dB**



● **Spectrum Analysis of Non-signal Reproduced Noise vs. Frequency Characteristic**





1. **Disc compartment**
2. **Disc compartment OPEN/CLOSE key**
3. **PLAY track display**
4. **TRACK/INDEX display**
5. **TIME display**
6. **REMOTE sensor**
7. **PLAY key**
8. **BACK TRACK–NEXT TRACK (track search) key**
9. **PAUSE key**
10. **Power switch**
11. **DIRECT PLAY (direct selection) key**
12. **STOP (reset) key**
13. **Subpanel open/close magnet catch**
14. **REPEAT key**
15. **INDEX (index search) key**
16. **TRACK/INDEX select key**
17. **DISPLAY select key**
18. **FAST REVERSE – FAST FORWARD keys**
19. **OPERATING indicator**
20. **EMPHASIS indicator**
21. **INPUT indicator**
22. **Power switch**
23. **Subpanel open/close magnet catch**
24. **INPUTS selector**
25. **OUTPUT LEVEL selector**

Accuphase

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