Accuphase

DP-70V
COMPACT DISC PLAYER

- 20-bit Discrete D/A Converter
- 8-Time Oversampling Digital Filter
- 3-Pole GIC Butterworth Lowpass Filter
- Digital Control Center Functions
- Digital and Analog Circuits Perfectly Separated by Ultra-high-speed Opto-couplers
Equipped with the World-Proud, High-Precision 20-bit Discrete D/A Converter, 8-Time Oversampling Digital Filter, and Digital Control Center Functions Corresponding to Three Sampling Frequencies.

The DP-70V is an integrated type CD player created to meet the highest standards of sound reproduction by employing the technology developed for the separate type CD player model DP-90/DC-81L. This Model offers a digital control center function to meet the requirements of the next generation of audio technology. This function allows DP-70V's the high-quality, precise D/A converter to demodulate and record digital signal inputs from multiple digital audio tape (DAT) recorders or BS (Satellite Broadcast) tuners. The DP-70V was developed to meet the following basic objectives:

1. Application of discrete components for the genuine 20-bit converter at the heart of the unit to achieve the performance of the most precise and highest quality D/A conversion available.
2. Digital control center function to allow the high-performance converter to process signals from DAT recorders and BS tuners.
3. Comprehensive vibration countermeasures to ensure faithful signal reproduction.
4. Perfection of construction design, circuit topology and electrical as well as constructional isolation to cut off high-frequency noise.
5. Emphasis on ensuring good sound quality, while avoiding conscious efforts to artificially tailor sounds, in every part of the audio frequency spectrum from low level to high level signals as well as on faithful reproduction of any atmosphere of concert halls.

We believe that the DP-70V meets these stringent objectives. The following is a brief description of the DP-70V:

The D/A converters employed are Accuphase's exclusive 20-bit discrete converter constructed with carefully selected superb discrete components. Each converter is carefully adjusted at the manufacturing stage to achieve exactly 18 times the conversion accuracy of a 16-bit D/A converter.

The noise shaper technique employed successfully reduces undesirable resonantized noise to extremely low levels that the feeling of silence in the sound reproduction is demonstrated.

The digital filters employed are of the 8-times oversampling type with -110dB attenuation capability, thus successfully eliminating unwanted noise-band components over 32kHz.

The 3-pole GIC audio filters have been employed to ensure optimum sound reproduction quality.

The D/A converter, as shown in Fig. 1, is a 16-bit floating-point, 8-time oversampling converter with a 32kHz anti-aliasing filter. The digital signal input is converted into an analog signal through the D/A converter, and the analog signal is output from the output terminal.

The D/A conversion method employed is a current-addition type, which features low noise and linearly characteristics. The digital processor unit is constructed of carefully selected discrete components to ensure the maximum theoretical 20-bit performance. The constructional design is shown in Fig. 1. The filters consist of the conversion stage, where the signal is converted to a digital signal, and the interpolation filter stage, where the digital signal is interpolated to ensure ideal performance throughout the entire output range from minimum distortion to maximum output.

The digital filter used for the DP-70V employs a sophisticated digital algorithm to suppress unwanted components in the range of 24kHz to 32kHz by 110dB. Bandpass ripple, which can cause deterioration of the sound quality, is kept within ±0.0001% by these filters.

3-Pole Discrete GIC Butterworth Active Filter with Strictly Selected Components

Because the sampling frequency is increased from 32kHz to 256kHz, the signal output from the D/A converter contains high-frequency components over 32kHz. Naturally, unwanted components also exist, even if the sampling frequency is increased 16 times or 24 times for example. Thanks to the high order of the oversampling, audio lowpass filters with moderate 3-pole (18dB/oct) characteristics are sufficient to eliminate these unwanted components and to contribute to the sound quality. The discrete 3-pole GIC Butterworth type active filter employed is a construction of strictly selected components to eliminate any possibility of sound deterioration.

Digital and Analog Circuits are completely Isolated to Prevent Deterioration of Sound Quality by High Frequency Noise

Digital signals contain components of extremely high frequency, which may reduce the sound quality by interfering with the demodulated audio signals. This effect can be eliminated by completely isolating the digital circuits from the analog circuits electrically, statically, and electromagnetically.

In the DP-70V, all analog circuits following the D/A converter, including the CD transport section, are electrically isolated from the digital circuits by means of opto-couplers. The four ultra high speed, 4mA on-off opto-couplers per channel provide excellent electrical insulation, while faithfully transmitting signals in the form of light.

High frequency noise can also be transmitted through the power supply circuit, even if the digital and analog circuits are isolated. To control this noise, an independent power transformer is provided for each of the digital and analog circuits.

To further improve the audio characteristics, the power for the left and right channel is supplied from different windings of the transformer.

High frequency noise can also be transmitted through air as static-electricity and electromagnetic interference. This interference is eliminated by shielding the digital and analog circuits from each other by means of a thick metallic plate placed between the two circuit sections.
Digital Control Center Functions

Digital DAT technology is now coming of age, and satellite broadcasting is becoming ever more popular. DAT tape recorders and BS tuners are providing direct digital outputs, thus offering an excellent opportunity of high-grade, high-quality sound reproduction through a high-quality D/A converter. To provide compatibility with these new technologies, the DP-70V is equipped with digital input terminals, which assure excellent sound quality thanks to its high-quality converter. The DP-70V digital control center functions allow the internal converter to reproduce these digital signals. The three pre-programmed sampling frequencies (32kHz, 44.1kHz, and 48kHz) are selected automatically to match the source frequency.

A lithium-tantalate monocrystal oscillator is used in the VCO, which generates the sampling frequencies. The lithium-tantalate monocrystal resonator restricts the side-spectrum to the level achieved by a crystal resonator, while offering a wide locking range of the sampling frequencies.

The four pairs of digital inputs (two optical and two coaxial) and two pairs of digital outputs (one optical and one coaxial) permit direct digital copying.

Noise Shaper Reduces Quantization Noise

The noise shaper reduces noise across the audio frequency band by feeding back the interpolation errors generated by the digital filter to the next data.

Coupled with the 20-bit conversion, the noise shaper effectively reduces the quantized noise to extremely low levels. This considerably improves the sensation of silence in sound reproduction and the sound quality, while allowing full reproduction of delicate nuances.

Digital Deemphasis Circuit

Achieving the Ideal Characteristics of 0.001dB Deviation and a Phase Difference Within 1.5°

To improve the S/N ratio, some CD's are produced using special recording methods, in which the high-frequency area of the recording is emphasized. The emphasis of the high-frequency band should be deemphasized during playback. These CD’s include a special signal, which is detected by the player during reproduction to automatically deemphasize such emphasized high-frequency characteristics.

Normally, these characteristics cause CR elements to change the frequency characteristics of the audio circuits, but the DP-70V employs a digital deemphasis circuit to change the characteristics already at the digital signal stage.

The deemphasis circuit achieves the ideal performance characteristics of deviation of ±0.001dB and phase difference within 1.5° vis-a-vis the prescribed characteristics to prevent sound deterioration of such emphasized CD’s.

Digital Level Control

The disc access can be controlled from the remote commander, but it is extremely inconvenient to have to rely on the setting of the amplifier function knobs to control the volume level.

In the DP-70V, the advantages of the 20-bit D/A converter have been exploited to provide a digital volume control. The volume can be adjusted in 12 steps from -40dB. Thanks to the extra four bits, ideal level control is achieved without deterioration of the sound quality even at low volume.

Fully Balanced Output

The DP-70V is equipped with two pairs of normal RCA phono jack terminals and one pair of XLR type balanced connectors, which Accuphase favors for their noise-free, high-quality sound reproduction.

PLAYER UNIT

The CD transport mechanism is mounted on a floating aluminum diecast frame to eliminate vibrations and resonance. Extra heavy chassis

Since the spindle rotates at high speeds, between 200 to 500 rpm., measures are required to restrict vibration and resonance, which may cause internal parts to vibrate and thus impair sound quality. The DP-70V mechanism is mounted on an aluminum diecast frame to prevent resonance. If this frame is floated above the chassis to cut off the transmission of vibrations, as a result, the entire disc tray is floating to minimize external vibrations on the mechanism.

Analysis of the vibration modes of the mechanical construction has revealed that by supporting the mechanism on a thick metal chassis, it is most effective in improvement of the resistance to secondary vibrations. The rigid frame construction makes the unit impervious to external vibrations, so that sound quality is unaffected by the location or by sound pressure from nearby speakers.

In normal CD players, the output of the photodetector mounted to the laser pickup, which reads the signals, is conducted outside the CD transport unit, where it is then amplified by the RF amplifier. This system is susceptible to noise and code distortion due to the low photodetector output voltage.

This noise susceptibility has been overcome in the DP-70V by the development of an ultra compact RF amplifier, which is attached to the photodetector to increase the output signal voltage, thus ensuring an accurate digital signal.

All Operations Controlled from a Single Master Clock to Eliminate Sound Deterioration by Beats

It is a crystal resonator clock that creates the standard signal, which controls the operation of a CD player. Normally, two separate clocks are used to control the digital processor and the microprocessor. However, if the frequencies generated by these two clocks differ by even a small amount, the system can produce beats, which impair the sound quality.

In the DP-70V, a single crystal resonator is used to generate a standard clock signal, which controls all unit operations. The single clock signal eliminates the possibility of harmful beats, thus guaranteeing excellent interference-free sound quality.

Linear Motor Pickup and 8-bit Microprocessor Achieve Access Time under 1 second

Key selection of tracks in CD is one of the most attractive features of CD players. The DP-70V employs the most advanced linear motor mechanism to drive the laser pickup. Controlled by the 8-bit microprocessor, which has been exclusively developed for Accuphase CD players, the pickup smoothly and quickly selects any track in approximately one second.

In addition, the rapid disc transport tray action imparts a smooth, soft feeling.

Frame Reproduction Function Permits 1/75 sec. Access Time and Reproduction

The CD digital signals are divided into 1/75 second units, known as frames. The DP-70V permits access and reproduction of each such frame, thus enabling the selection of explosive sounds from a cannon or quick, pulse type signals to be accurately output.

Simple, Elegant Design Harmonizes with Other Accuphase Products

The simple layout with the operational controls arranged in a separate sub-panel and an elegant champagne gold finish, makes the DP-70V harmonize perfectly with other Accuphase components.

The natural persimmon sideboard enhances the atmosphere of your listening room.

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**Fig.2 DP-70V Block Diagram**
Remote Commander RC-7
- Functions added separately from the main unit
- LED transmitting section
- Direct selection key
- Program key

Ultra high precision 20-bit discrete D/A converter

Circuit Board
- Precision potentiometer meters
- Ultra precision metal foil resistors
- 4 bit x 5 current switches
- Ultra high speed photo isolators
- Regulated power supply for analog circuit
- Output circuit
- Current and voltage converter
- 3-pole G/C Butterworth lowpass filter
- 8-bit, 16byte original microcomputer
- Digital signal processor
- IC for DAI (Digital Analog Interface)
- IC for digital signal processing circuit (on the back of the circuit board)
- PLL (phase-locked loop) circuit
- Laser pickup driver
- IC for servo signal processing circuit (on the back of the circuit board)
- Digital potentiometer
- VCO for 32kHz, 44kHz, and 48kHz
- Power supply for logical circuit
We have a philosophy of offering products that can satisfy music lovers who want high quality audio reproduction. We don't want to make just ordinary audio equipment, but rather equipment that will move one's heart or set it at rest with the sound of the music that the equipment can produce. This is the philosophy of Accuphase.

GUARANTY SPECIFICATIONS

Performance Guarantee:
All Accuphase product specifications are guaranteed as stated.

TRANSPORT SECTION
- Format: CD standard format
- Error correction method: CIRC
- Number of channels: 2
- Spindle speed: 200 to 500 r.p.m. (CLV)
- Scan velocity: 1.2mm (or 1.4mm)
- Data read method: Non-contact optical pick-up (semiconductor laser pickup)
- Laser: BaAlGa (double heterodyne diode)
- Digital output format level (conforming to EIA standards):
  - Format: Digital audio interface
  - Optical Output: 21 to 150Ohm (JEITA)
  - Wavelength: 660nm
  - Coaxial: 0.7V/P-P at 75 ohms

DIGITAL PROCESSOR SECTION
- Format: EIA standard format
- No. of quantizations: 16 bits linear
- Sampling frequency: 48kHz
- Tracking accuracy: Level II
  - 32kHz: 0.01%
  - 44.1kHz: 0.01%
  - 48kHz: 0.01%
- Frequency response: 4Hz to 20,000Hz ±0.95dB
- D/A converter: 20-bit, discrete type
- Digital filter:
  - 20bit, 8-times oversampling
  - Noise shaping function
  - Digital deepmarks function
- Total harmonic distortion & noise:
  - 0.001% (1kHz)
  - 0.002% (20 to 20,000Hz)

- Signal-to-noise ratio (SNR): 115dB
- Dynamic range: 96dB
- Channel separation: 105dB
- Rated output voltage and impedance:
  - Balanced: 2.5V at 300 ohms (25-50 ohms), balanced XLR type
  - Unbalanced: 2.5V at 50 ohms, RCA phone jack type
- Output level control:
  - 0dB to 45dB, 18dB steps (digital method)
- Bit depth format level (conforming to EIA standards):
  - Format: Digital audio interface
  - Optical Output: 21 to 150Ohm (JEITA)
  - Coaxial: 0.5V/P-P at 75 ohms

OTHERS
- Semiconductors complement:
  - 32 transistors, 74 IC's, 46 diodes
- Power requirements:
  - 100V, 110V, 220V, 240V, 50/60Hz
- Power consumption:
  - 25W
- Dimensions:
  - 475mm (18-11/16") width, 35mm (5-5/16") height, 275mm (11-1/4") depth
- Weight:
  - 24.3kg (53.6 lbs) net
  - 29.3kg (64.6 lbs) in shipping carton

Supplied Remote Commander RC-7
- Remote control system: Infrared pulse
- Power requirements: 3V DC
- Batteries: 2 x IEC designation R6 (size AA)
- Dimensions: 60mm (2-1/2") width x 10mm (11/16") height x 176mm (6-15/16") depth
- Weight: 160g (6 oz) including batteries

- THD vs. frequency characteristic
- Spectrum analysis of reproducing signal at 1kHz: -60dB
- Spectrum analysis of non-signal reproduced noise vs. frequency characteristic (382kHz sampling frequency is attenuated to about 105dBV)

Accuphase
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