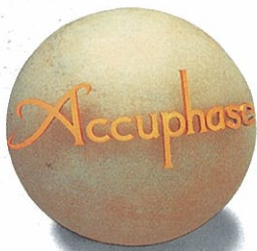


Accuphase

PRECISION DIGITAL PREAMPLIFIER *DC-300*

● Fully Digital Signal Processing Preamplifier ● Digital Level Attenuator With Advanced Noise Shaping Technology ● Volume Control Provides Smooth Analog Feel ● MMB Type D/A Converter Achieves 20-bit Linearity and Minimum Noise ● Ultra Jitter-Free PLL Circuit ● High-Precision Sampling Frequency Converter ● DSP Tone Control Allows Precise Adjustment Without Sound Quality Degradation ● Versatile Array of Digital and Analog Input/Output Options





Fully digital preamplifier opens up a new dimension in sound. Sophisticated noise shaping technology allows ideal digital volume control. Super-precise MMB type D/A converter, ultra jitter-free PLL circuit, and high-precision sampling frequency converter further contribute to superb performance. Tone control with advanced DSP adjusts timbre and allows loudness compensation without sound quality degradation. Versatile array of option boards for digital and analog input/output.

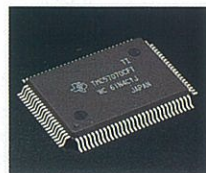
Ever since the advent of the Compact Disc, the shift from analog to digital has been gaining momentum in the audio world. Practically all program sources introduced in recent years, such as MiniDisc, DAT, and even satellite broadcasts are digital. When the source is digital, it is of course desirable that the reproduction system also be capable of handling the signal in the digital domain as far as possible, because this will assure that the signal quality remains at a high level. This especially is true in areas where the frequency spectrum is being altered, such as in tone control and filtering stages. Use of a digital design will assure much higher precision and sonic fidelity than analog circuitry can provide.

Looking towards the fast-approaching 21st century, Accuphase has harnessed its extensive expertise in digital technology for a new product that makes full use of advanced, high-speed digital signal processing power. By introducing the first fully digital preamplifier, Accuphase is again opening up new vistas that show the shape of things to come. From the outside, the DC-300 is deceptively similar to earlier high-class preamplifiers from Accuphase. But on the inside, it's a whole new story. Volume control, balance control, tone control, and loudness compensation are all achieved by sophisticated DSP technology, using a 48-bit wide data path. Only immediately before the output, a high-performance MMB type D/A converter turns the signal into analog form. Smoothness and ease of use are on a par with the best of Accuphase's analog components, while signal quality and performance have been further improved thanks to the all-digital principle. The DC-300 will lead the listener into a new realm of sonic enjoyment. Far beyond the analog versus digital debate, it reproduces music with spatiality and transparency that simply is in a class of its own.

System Features

Figure 1 shows a block diagram of the DC-300. An array of coaxial and optical inputs accepts digital signals of up to 24-bit resolution, with a sampling frequency of 32, 44.1 or 48 kHz. The DAI (Digital Audio Interface) decoder automatically locks to the sampling frequency. Input signals with a sampling frequency of 44.1 or 48 kHz and level I precision are supplied directly to the Ultra Jitter-Free PLL Circuit which extracts a master clock signal that is entirely devoid of pulse distortion and jitter. All other input signals are first routed through the SFC (Sampling Frequency Converter) which turns them into 48 kHz, level I high-

precision signals before clock extraction. The resulting signal is then processed by the DSP (Digital Signal Processor) performing all preamplifier functions such as tone control, loudness compensation, stereo/mono switching, phase switching, etc. All of these functions are handled in the digital domain, so that no signal quality degradation can occur.



Ultra-high-speed DSP chip

After being routed through the digital filter with 8-times oversampling, the signal enters the next stage with separate high-speed DSP chips for each channel. Here, digital gain control is performed using a revolutionary principle developed by Accuphase. Special noise-shaping technology allows attenuation down to -95 dB with minimum quality degradation. This stage also performs balance adjustment and attenuation switching.

Finally, the signal passes through ultra high-speed optocouplers which assure perfect electrical separation of digital and analog sections. The D/A converter section makes full use of the MMB (Multiple Multi-Bit) principle to achieve outstanding conversion precision. A 4-pole analog filter reliably removes all digital remnants, and the resulting ultra-pure analog signal is then output via balanced and unbalanced circuits.

Digital Volume Control With Special Noise Shaper Technology

An important task of any preamplifier is volume adjustment, a function which has a great bearing on sound quality. By employing a newly developed noise shaping principle for digital level control, Accuphase has made it possible to realize a fully digital, high-quality preamplifier.

When a conventional D/A converter is used for level control, digital noise increases at higher attenuation settings, leading to a pronounced downgrading of signal quality. The Accuphase noise shaper on the other hand, made possible by high-speed DSP technology, reduces noise within the audible

frequency band to the absolute theoretical minimum. Thanks to digital time division feedback, even extremely low-level data will not be buried in noise, achieving a much higher resolution than possible with the conventional

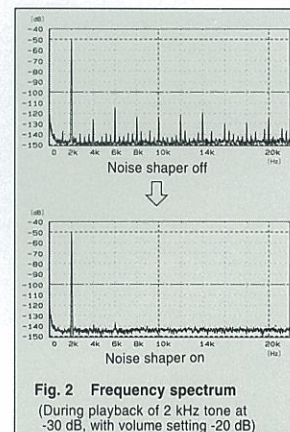


Fig. 2 Frequency spectrum (During playback of 2 kHz tone at -30 dB, with volume setting -20 dB)

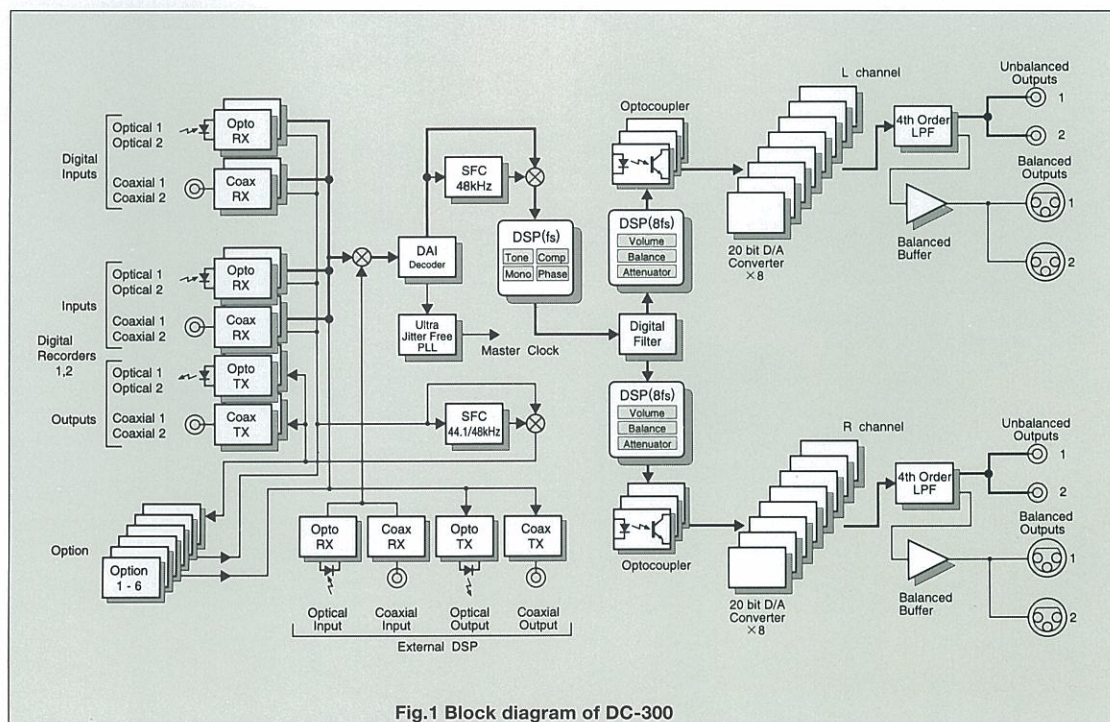


Fig.1 Block diagram of DC-300



Supplied remote commander RC-19
Allows input selection and adjustment of volume, balance, tone control, loudness compensator, etc.

D/A approach:
The Accuphase circuit allows level attenuation down to an amazing -95 dB with almost no degradation in the signal quality. Figure 2 shows the frequency spectrum and Figure 3 the linearity at a -90 dB setting of the volume control, both with noise shaping on and off. From these graphs, the benefits of the new Accuphase principle are clearly evident.

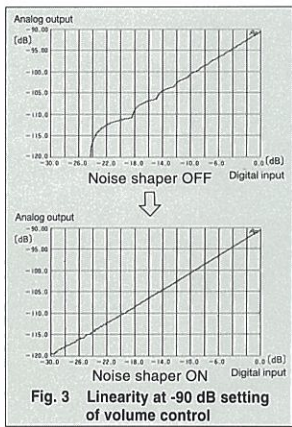
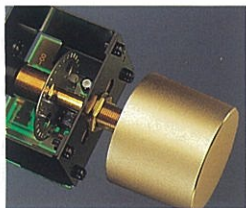


Fig. 3 Linearity at -90 dB setting of volume control

Volume Control With Smooth Analog Feel

A massive knob on a precision-machined shaft rotates a disc with star-shaped slits which generate a series of pulses in a phase detector. These pulses are utilized by a microprocessor to govern the



Digital gain control

volume control function. For the user, the volume control of the DC-300 operates with a remarkably smooth and natural feel that perfectly matches the audible change in volume. This intelligently ergonomic design makes the DC-300 a joy to operate.

Digital Processing Assures Outstanding S/N Ratio and Channel Separation

The digital processing principle of the DC-300 maintains signal quality and resolution at a consistently high level, regardless of the attenuation setting. The result manifests itself as excellent S/N ratio and near-perfect channel separation.

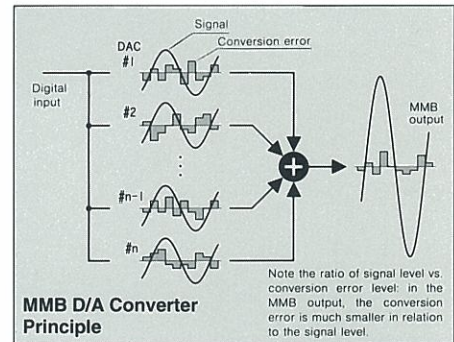
DSP Achieves High-Precision, High-Quality Tone Control and Loudness Compensation

Because the signal is being processed entirely in the digital domain, frequency response adjustments are possible without any alteration of the circuit impedance. For the listener, this means that sonic realism and imaging are maintained regardless of the control setting.

MMB Type D/A Converter in Output Section Achieves 20-Bit Linearity and Low Noise

The ground-breaking MMB (Multiple Multi-Bit) principle developed by Accuphase employs several specially selected D/A converters (eight in the DC-300) to achieve stunning performance and

sonic realism. As can be seen in the illustration, the high-speed output of an 8-times oversampling digital filter is fed to all converters whose output is then combined with high precision. Rather than using a simple parallel drive, MMB ensures phase matching at high frequencies and drives each converter individually to achieve best performance.



An important characteristic of the MMB principle is the fact that it improves performance at all signal levels and any frequency. MMB reduces even noise at very low signal levels, thus solving a vexing problem of conventional D/A converters. Music emerges with sparkling clarity and unprecedented detail, from a background of absolute silence.

DC-300 Application Examples

(Option model names given in brackets.)

Digital input

- * Accepts digital output signals from CD transports, digital recorders, MD and DAT
- * DC-300 main unit provides two coaxial and two Toslink optical inputs
- * Option boards can be mounted in the rear-panel slots for BNC(DI-BNC1), HPC optical cable (DI-ST1), and HPC balanced cable (DIO-PRO1)

Digital recorder facilities

- * Recording/playback for up to four digital recorders (DAT, MD, etc.)
- * Optional digital input/output board (DIO-OC1) provides connectors for two additional digital recorders
- * Optional AES/EBU standard digital input/output board (DIO-PRO1)
- * Dedicated SFC provides 44.1/48 kHz sampling frequency conversion for recording

Analog line input

- * Supplied as standard equipment, a line input board (AI-U1) accepts all analog line-level inputs from CD players, tuners, analog tape recorders, laser disc line-level audio output and the analog output of DAT and MD players
- * Additional unbalanced (AI-U1) or balanced (AI-B1) input boards possible

Phono playback

- * Optional analog disc input board (AI-AD1) allows playback of analog records
- * To provide separate inputs for MM and MC, two analog disc boards can be installed

Analog recording

- * Optional line input/output board (AIO-U1) allows recording and playback with analog tape recorder or analog connection of DAT, MD or similar
- * Optional unbalanced (AO-U1) or balanced (AO-B1) output boards provide dedicated high-quality signal for analog recording

Dubbing

- * Digital-to-digital copying possible
- * Digital-to-analog and analog-to-digital (AIO-U1) copying possible
- * Independent Rec Out selector allows recording and dubbing while listening to a different source

EXT DSP connectors

- * Digital I/O connectors allow connection of external digital graphic equalizer

Analog outputs

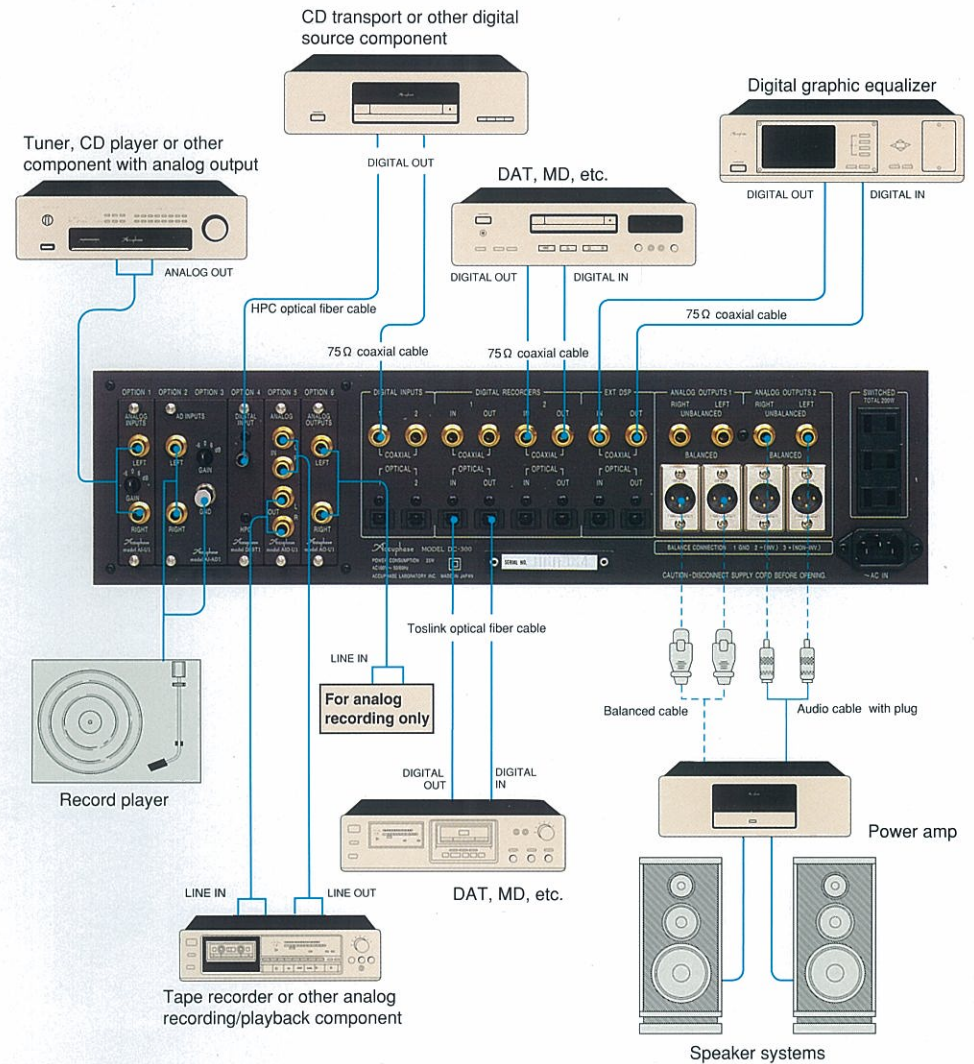
- * Two sets of unbalanced and balanced output connectors for power amplifier connection

Connection Diagram

The illustration shows a connection example with option boards installed.

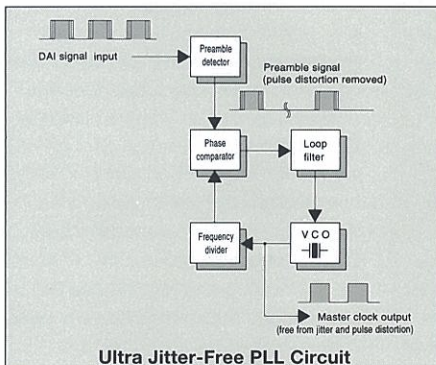
Option board installation example (from left)
 Line input board (AI-U1) (standard equipment)
 Analog disc input board (AI-AD1)
 HPC optical input board (DI-ST1)
 Line input/output board (AIO-U1)
 Line output board (AO-U1)

- * For connection to digital equipment, you can use 75-ohm coaxial cable, Toslink optical fiber cable, HPC optical fiber cable or similar.
- * For analog input/output connections, use audio cable equipped with phono plugs, and take care not to mix up left and right channels.



Ultra Jitter-Free PLL Circuit

For the purpose of synchronizing operation of the D/A converter with the digital audio interface (DAI), a phase-locked loop (PLL) circuit is used which generates a master clock to be used as a system reference. As shown in the diagram, the Ultra Jitter-Free PLL Circuit of the DC-300 consists of a preamble detector and a voltage-controlled oscillator (VCO) using a quartz crystal element. The master clock produced by this PLL circuit is totally free from the effects of pulse distortion and jitter.



illator (VCO) using a quartz crystal element. The master clock produced by this PLL circuit is totally free from the effects of pulse distortion and jitter.

High-Precision Sampling Frequency Converter

A sampling frequency converter (SFC) is available to transform the sampling frequency of digital input signals to the desired value. In the DC-300, the sampling frequency is arithmetically converted to a higher value (up-conversion) and then to the 48 kHz level I signal. The highly precise quartz oscillator used for this conversion assures flawless and virtually jitter-free performance.



High-precision SFC

20-Bit, 8-Times Oversampling Digital Filter

Moving unwanted sampling frequency remnants (also called aliasing components) far outside the au-

dible range is the task of an oversampling digital filter. The NPC (Nihon Precision Circuit) digital filter in the DC-300, custom manufactured for Accuphase, offers state-of-the-art characteristics in all vital aspects, such as absence of group delay, passband ripple, and attenuation, approaching the theoretical performance limits.



20-bit digital filter

4-Pole Analog Filter With Hand-Selected Components

To reduce noise in the upper frequency range and achieve high S/N ratio, a 4-pole Butterworth design is used for analog filtering. The active filter allows optimizing of the cutoff point, to keep phase shifts in the passband range at an absolute minimum. Strict selection of all filter components assures sonic purity and total musical accuracy.

OPTION BOARD

*All boards use the ADB (Accuphase Digital Bus) interface standard.

The DC-300 is a fully digital preamplifier, but it also allows input and output of analog signals via boards installed in dedicated rear-panel slots. One analog line input board is supplied as standard equipment, and more boards can be purchased as options. To meet the requirements of any system, a versatile lineup of digital and analog input/output boards is available.

Digital Boards



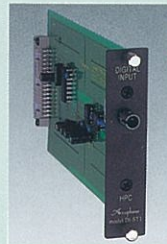
For BNC coaxial cable input:

HPC Coaxial Input Board DI-BNC-1

Allows connection of coaxial cable with 75-ohm BNC connector.

Guaranteed specifications

Digital input: 0.5 Vp-p, 75 ohms



For HPC optical cable input:

HPC Optical Input Board DI-ST1

Allows connection of ST type optical link.

This input is designed for an ultra high-speed link with a transfer rate of 150 MBPS.

*HPC optical fiber cables (HLG-10 etc.) are available from Accuphase.

Guaranteed specifications

Optical input: -30 to -10 dBm

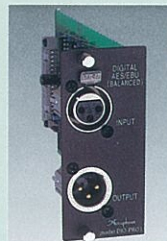


For additional digital input/output:

Digital Input/Output Board DIO-OC1

Provides two sets of coaxial and optical connectors, for recording/playback with two digital recorders.

COAXIAL: for 75-ohm coaxial cable
OPTICAL: for Toslink optical fiber cable



For professional-standard input/output:

AES/EBU Input/Output Board DIO-PRO1

Provides a set of XLR input and output connectors conforming to AES/EBU professional digital standards. Can be used to accept the output signal from a digital component or to perform playback and recording with a digital recorder having the same type of connectors.

*HPC balanced cables (HLC-10 etc.) are available from Accuphase.

Analog Boards

* Analog input signals are converted to digital signals by an A/D converter integrated in the board * Digital output signals are converted to analog signals by a D/A converter integrated in the board.



For playback of analog source equipment:

Line Input Board AI-U1

Provides a conventional unbalanced high-level input for the analog output signal from a CD player, tuner, tape recorder or similar component.

*One AI-U1 board comes as standard equipment, installed in the OPTION1 slot of the DC-300.

*Incorporates a 20-bit, 5-pole Delta-Sigma type A/D converter with 64-times oversampling.



For playback of analog records:

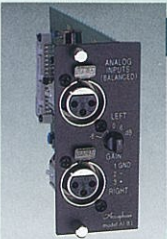
Analog Disc Input Board AI-AD1

The board incorporates a high-performance, high-gain phono equalizer for playback of analog (phono) records.

*Incorporates a 20-bit, 5-pole Delta-Sigma type A/D converter with 64-times oversampling.

*On-board controls for MM/MC switching and subsonic filter switching

[MM] gain: 30 dB, input impedance 47 kohms
[MC] gain: 60 dB, input impedance 100 ohms



For analog playback of equipment with balanced output:

Balanced Input Board AI-B1

Provides a conventional balanced high-level input for the analog signal from a CD player, tuner, recorder or similar component with balanced analog output.

*Incorporates a 20-bit, 5-pole Delta-Sigma type A/D converter with 64-times oversampling.



For analog recording and playback:

Line Input/Output Board AIO-U1

Provides analog inputs and outputs for use with a tape recorder.

*Incorporates an 18-bit, 4-pole Delta-Sigma type A/D converter with 64-times oversampling.

*Incorporates an 18-bit, 4-pole Delta-Sigma type D/A converter with 64-times oversampling.
(The signal chosen with the Rec Selector is converted to analog and output via this board.)



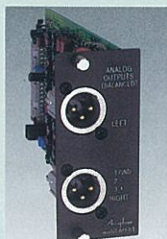
For high-quality analog recording:

Line Output Board AO-U1

Provides analog recording output for use with a tape recorder or the analog input of a DAT, MD or other recorder.

*The signal chosen with the Rec Selector is converted to analog and output via this board.

D/A converter: 20 bit, 4 MMB principle
Digital filter: 20 bit, 8-times oversampling



For analog recording on equipment with balanced input:

Balanced Output Board AO-B1

Provides an analog recording output for a recorder with balanced input.

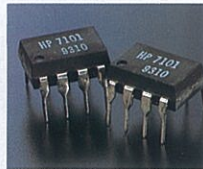
*The signal chosen with the Rec Selector is converted to analog and output via this board.

D/A converter: 20 - bit, 4 MMB principle
Digital filter: 20-bit, 8-times oversampling



Perfect Separation of Digital and Analog Sections

Ultra-high speed optocouplers rated for 40 MBPS are used to isolate the digital and analog sections of the DC-300. The characteristics of these couplers ensure that the signal is transmitted faithfully, effectively eliminating all noise artifacts and thus preserving the superior sonic transparency that is a hallmark of the DC-300.



40 MBPS Ultra-high speed optocouplers

User-Editable Alphanumeric Input Position Indication

Input sources are shown on the display of the DC-300 using alphanumeric characters. If desired, any position can be renamed, using a choice of 96 characters and symbols.

Fully Balanced Analog Output Circuitry

The analog output section, whose circuitry is fully balanced, is isolated from the ground line. A set of balanced XLR connectors and unbalanced RCA-type phono connectors accommodates any system requirements.

On the rear panel are slots for up to six option boards (ADB interface standard). Any board can be installed in any empty slot.

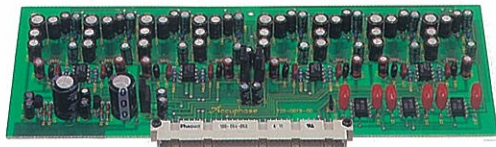
■ DSP assembly

Contains DSP circuitry for tone control, loudness compensation, volume and balance control, as well as digital filter and high-precision SFC.



■ DAI assembly

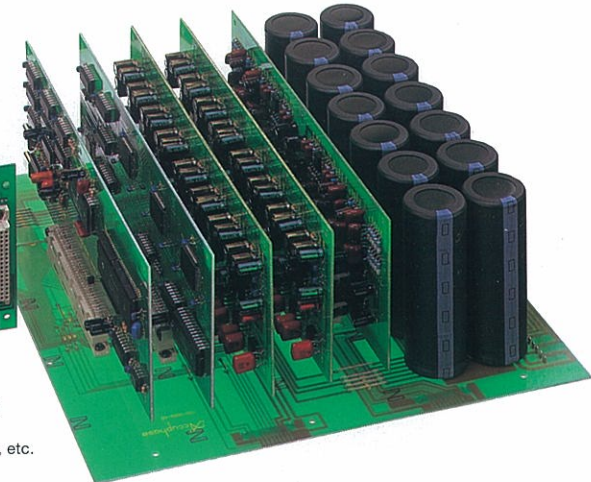
Contains the DAI decoder, Ultra Jitter-Free PLL circuit, microprocessor, etc.



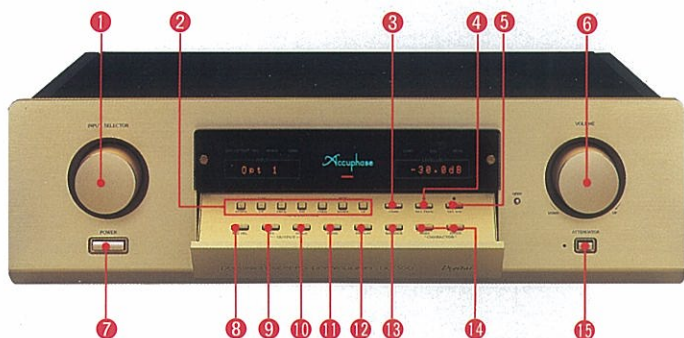
■ MMB D/A converter assembly (one channel)

Contains high-precision 20-bit D/A converters (8 on rear side), ultra high-speed optocouplers, etc.

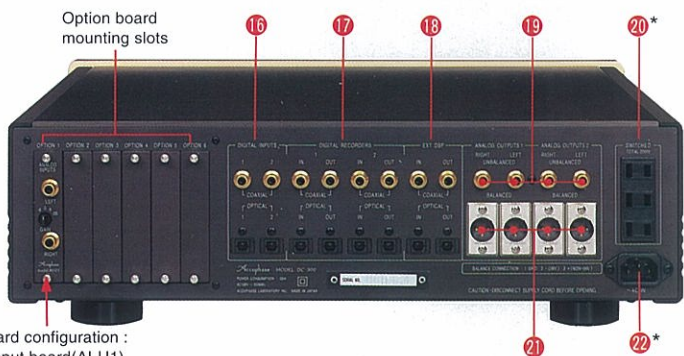
Neatly arranged on the motherboard are the power supply filtering capacitors and the various assembly boards, including DAI, DSP, and MMB D/A converter (2 boards).



■ FRONT PANEL



■ REAR PANEL



Standard configuration :
Line input board(AI-U1)

- | | |
|---|---|
| 1 INPUT SELECTOR | 12 DISPLAY button |
| 2 TONE CONTROL buttons | 13 BALANCE mode button |
| 3 COMP (loudness compensator) button | 14 CHARACTER input buttons |
| 4 REC FREQ (recording signal sampling frequency) button | 15 ATTENUATOR button |
| 5 EXT DSP (external digital signal processor) on/off button | 16 DIGITAL INPUTS |
| 6 VOLUME control | 17 DIGITAL RECORDERS (input/output) |
| 7 POWER switch | 18 EXT DSP (external digital signal processor) |
| 8 REC SEL button | 19 ANALOG UNBALANCED OUTPUT JACKS (2 sets) |
| 9 ANALOG OUTPUT ON/OFF button | 20 AC OUTLETS (switched) * |
| 10 PHASE SELECTOR button | 21 ANALOG BALANCED OUTPUT JACKS (2 sets) |
| 11 MONO button | (1) Ground (2) Inverted (-) (3) Noninverted (+) |
| | 22 AC POWER CONNECTOR (for supplied power cord) * |

Remarks

- ★ The shape of the AC inlet, plug of the supplied power cord, and AC outlet depends on the voltage rating and destination country.
- ★ These switched AC outlets may not be supplied depending on the safety standards or regulations applicable in the particular country to where the unit is destined

DC-300 GUARANTEED SPECIFICATIONS

Guaranteed specifications are measured according to EIAJ standard CP-2402.

- **Input format:** (EIA standard format) Quantization bits: 16 to 24 bits, linear
Sampling frequency (automatically selected): 32.0 kHz, 44.1 kHz, or 48.0 kHz
- **Digital input format level:** (EIAJ CP-1201) Format : digital audio interface
OPTICAL : optical input, -15 to -27 dBm
COAXIAL : 0.5 Vp-p, 75 ohms
- **Digital output format level:** (EIAJ CP-1201) Format : digital audio interface
OPTICAL : output -15 to -21 dBm
wavelength : 660nm
COAXIAL : 0.5 Vp-p, 75 ohms
- **Frequency characteristics:** 4.0 to 20,000 Hz ± 0.3 dB
- **D/A converter** 8-MMB type, 20 bits
- **Digital filter:** 20 bits, Eight-time oversampling
- **Total harmonic distortion:** 0.002% (20 to 20,000 Hz)
- **Signal-to-noise ratio:** 122 dB
- **Dynamic range:** 112 dB (24-bit input, low-pass filter off),
- **Channel separation:** 112 dB (20 to 20,000 Hz)
- **Output voltage and impedance:** Balanced : 5 V at 50 ohms balanced XLR type
Unbalanced: 5 V at 50 ohms RCA phono jack
- **Volume control (DSP):** 0 to -95 dB, (in 0.1 to 5 dB steps), -∞
Speed-sensing principle
- **Balance control (DSP):** Left/right level difference : 0 to -95 dB, (in 0.1 to 5 dB steps), -∞
- **Tone control (DSP):** Crossover frequency and adjustment range
Bass (LOW) : 200 Hz ± 6 dB (40 Hz), 0.5dB steps
500 Hz ± 6 dB (100 Hz), 0.5dB steps
Treble (HIGH) : 2 kHz ± 6 dB (10 kHz), 0.5dB steps
7 kHz ± 6 dB (20 kHz), 0.5dB steps
- **Compensation (DSP):** +6 dB (100 Hz)
- **Attenuator (DSP):** -20 dB
- **Power requirements:** 100 V, 120 V, 220 V, 230 V, 240 V (Voltage as indicated on rear panel) AC, 50/60 Hz
- **Power consumption:** 25 W
- **Maximum dimensions:** 475 mm (18-11/16") width,
150 mm (5-7/8") height,
406 mm (16") depth
- **Weight:** 21.5 kg (47.3lbs.) net
26.5 kg (58.4lbs.) in shipping carton
- **Supplied remote commander RC-19:** Remote control system: Infrared pulse
Power requirements: 3V DC
(IEC R03 batteries x 2)
Dimensions :66 mm width (2-5/8"),
175 mm height (6-7/8"),
20 mm depth (13/16")

Optional accessories (sold separately)

- (2 m, 3 m, and 5 m cables also ailable)
- HPC optical fiber cable HLG-10 (1 m)
- HPC balanced cable HLC-10 (1 m)
- Toslink optical fiber cable LG-10 (1 m)

※ Specifications and design subject to change without notice for improvements.



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