

Accuphase

CD TRANSPORT

DP-90

MMB DIGITAL PROCESSOR

DC-91

- HPC digital transmission system for high-quality transmission
- New MMB type D/A conversion system ensuring 20-bit resolution linearity and low noise
- Automatic detection of three sampling frequencies and three frequency accuracy levels



DP-90

CD TRANSPORT

High-quality transmission – HPC optical and HPC balanced digital outputs are provided to implement ideal digital signal transmission.

Rigid heavyweight structure with 8mm thick solid aluminum chassis

Auto-lock mechanism that frees the CD transporter from harmful resonances

HPC (High-Performance Connection) Digital Outputs for Flawless Transfer Characteristics

The optical connection principle that Acaphone introduced to the world with the DP-80/DC-81 system was adopted by the EIAJ and has found wide acceptance as a link for high-grade stereo components. But in order to ensure even higher data transfer precision, the DP-90 goes one step further. Its HPC optical output uses an ultra-fast Hewlett-Packard optical link that has a data transmission rate of 150M BPS. The supplied optical fiber cable for this connection is a multi-mode graded index type made of quartz glass, with a core/clad diameter of 50/125 µm. This eliminates pulse distortion and jitter, resulting in absolutely pure digital signal transmission.



HPC optical fiber cable **HPC balanced-type cable (110 ohms)**

The DP-90 further provides a three-conductor HPC balanced output conforming to AES/EBU specifications, and a suitable cable with a characteristic impedance of 110 ohms and XLR type connectors is supplied. The balanced principle offers similar advantages as for analog signal transmission, namely effective rejection of externally induced noise. This output is especially useful for professional ap-

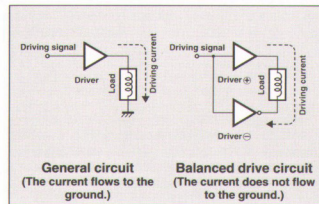
plications such as in broadcasting or recording studios. In addition, EIAJ-standard optical and coaxial outputs for connection to ordinary converters are also provided, so that the DP-90 is perfectly equipped for any situation.

Laser Pickup with Integrated RF Amplifier for Minimum Noise

Since the output level of a laser pickup is very low, it is highly vulnerable to externally induced noise. To prevent such problems, the pickup used in the DP-90 employs a newly developed RF amplifier that is so compact that it can be directly integrated in the pickup assembly. Therefore, the high-level output signal is not affected by any kind of noise interference.

Balanced Drive Circuitry for Servo Motors

The motors and actuators which drive the spindle, sled, focusing and tracking assembly, disc tray etc. require a rapidly fluctuating drive current, depending on the respective load condition. In conventional designs, such current fluctuations can affect the operation of other circuit areas, which in turn can lead to sound quality degradation. In the DP-90, two amplifiers, arranged in a balanced configuration provide the drive currents to all actuators and



motors. Because there is no circuit flowing in the ground line, the operation of other circuits in the player remains entirely unaffected.

8-mm Thick Solid Aluminum Chassis

The mechanical assembly and the controller assembly are supported by a solid aluminum chassis that is 8 mm thick. The high rigidity of this chassis prevents acoustical or mechanical vibrations arising outside the player from affecting playback. This guarantees that the digital signal is always read off the disc with optimum precision.

CD Transport Mechanism Designed for Superb Reliability and Long-Term Precision

The extra-thick 3-mm spindle of the brushless disc drive motor is securely supported by sapphire bearings. This gives excellent wear resistance and assures stable drive conditions also after many years of use.

Auto-lock Mechanism Prevents Tray Resonances

If the disc tray is separated from the rotating assembly during playback, resonances can degrade the signal quality. In the DP-90, the disc tray is firmly locked in place during playback, to eliminate any possibility of harmful resonances.

Separate Power Supplies with Dual Transformers

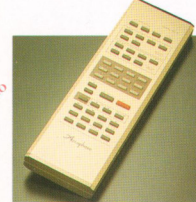
The DP-90 has two separate transformers for handling different functions: one for the digital signal processing, microprocessor and display circuitry, and one for powering the spindle, sled, focusing and tracking and disc tray actuators, whose load fluctuates drastically. This assures highly stable, high-quality digital signal readout.

Gold-plated Printed Circuit Boards for Superb Sound Quality

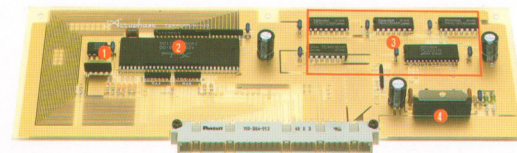
The separate controller board and transport units are connected via a motherboard, which virtually eliminates the need for internal wiring and greatly improves reliability. For optimum sound quality, all printed circuit boards employ gold-plated traces.

Multifunction Remote Commander RC-9 (supplied with the DP-90)

The RC-9 can be used to remotely control both the DP-90 and the DC-91. In addition to the functions of these two units, the RC-9 is complete with a variety of other functions including Display On/OFF, Dimmer that controls the brightness of the display in three stages, Direct Play, Repeat, Programming, and Time display.



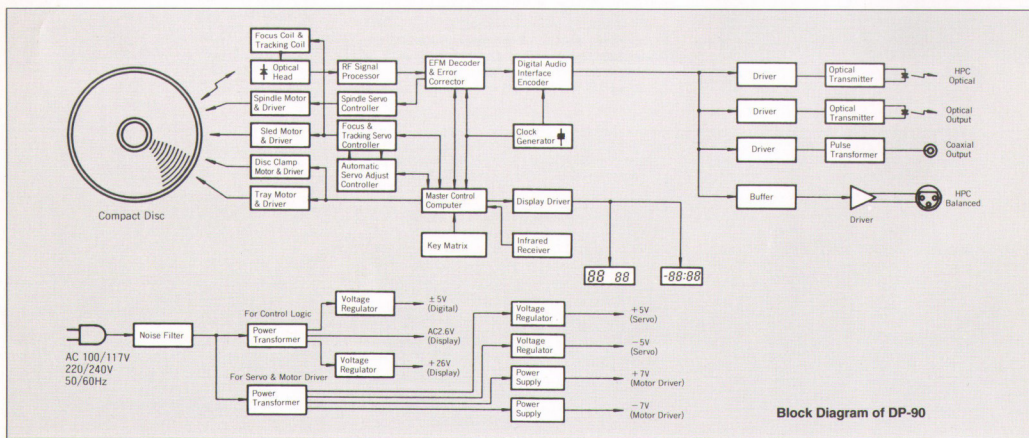
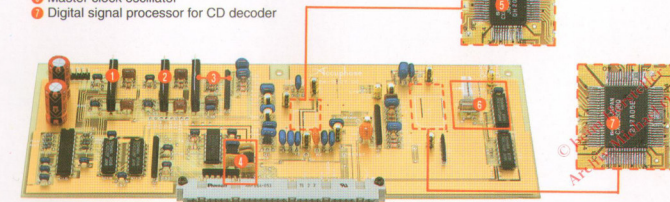
Remote Commander RC-9



- ▲ System Control Assembly**
- Memory IC
 - 8-bit microprocessor for system control
 - DAI encoder IC group
 - Balanced driver for disc tray

▼ Actuator Control Assembly

- ① Balanced driver for focusing
- ② Balanced driver for tracking
- ③ Balanced driver for sled
- ④ Regulated power supply for laser pickup
- ⑤ Servo signal processor
- ⑥ Master clock oscillator
- ⑦ Digital signal processor for CD decoder



DC-91

DIGITAL PROCESSOR

Ultimate in multibit configuration — Implements theoretical-limit performance as high as 20 bits with the newly developed MMB D/A conversion system.

Equipped with HPC digital inputs for high-quality digital signal transmission.

Handles three different sampling frequencies and automatically detects three frequency accuracy levels.

Newly Developed MMB Principle Yields 20-bit Linearity and Minimum Noise

The D/A converter design is an essential criteria for sound quality. The DC-91 positively excels in this regard, thanks to its newly developed MMB converter system. The acronym MMB stands for "Multiple Multi-Bit" and refers to sixteen strictly selected 20-bit D/A converter elements which are connected in parallel. The improvement yielded by the parallel connection is exemplified by the fact that connecting n elements in parallel will yield twice the current but distortion and residual noise will increase only by a factor of 1.4. The improvement in terms of signal versus noise in this case is 3 dB. With several elements in parallel, the improvement can be calculated according to the following equation, where "n" is the number of parallel elements:

$$20 \log (1/\sqrt{n}) \text{ [dB]}$$

Since the DC-91 uses sixteen elements, the improvement is 12 dB.

As can be seen from the graph, response of digital input versus analog output is absolutely linear from very high to extremely low levels. Distortion and noise are also virtually absent, so that the converter attains the theoretical limits of performance. And even more importantly, the improvement provided by the MMB principle is not dependent on frequency or signal level. Linearity at very low levels — a weak point of conventional multi-bit converters — has been perfectly corrected.

HPC (High Performance Connection) Digital Inputs

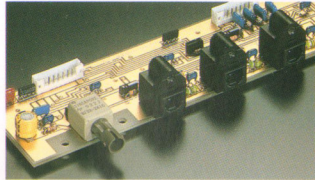
receive the high-quality digital signals from the CD Transport DP-90, the DC-91 has dedicated HPC optical and balanced inputs. The optical input uses the same ultra-fast Hewlett-Packard link with a data transfer rate of 150 MBPS. The total absence of pulse distortion and jitter ensures absolutely pure digital signal transmission.

The HPC balanced link is totally impervious to externally induced noise and is therefore particularly suitable for installations where long cable runs are required. The output conforms to AES/EBU specifications, making it perfect for professional applications such as in broadcasting or recording studios.

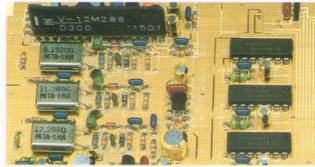
Thirteen Digital Inputs, Two Outputs and Three Sets of Terminals for Digital Recorders

Besides the HPC optical and balanced inputs, the DC-91 provides three optical and three coaxial inputs conforming to the EIAJ Digital Audio Interface standard. In addition, three sets of terminals for digital recording devices such as DAT, DCC, or MD devices are also provided. One of these is a balanced connection, which conforms to the AES/EBU professional format.

All digital inputs are designed internally to handle 24-bit audio data, to allow for future expansion. Two 24-bit digital outputs are also provided, making the unit ready for the next generation of digital audio components.



HPC optical and Toslink optical transmitters

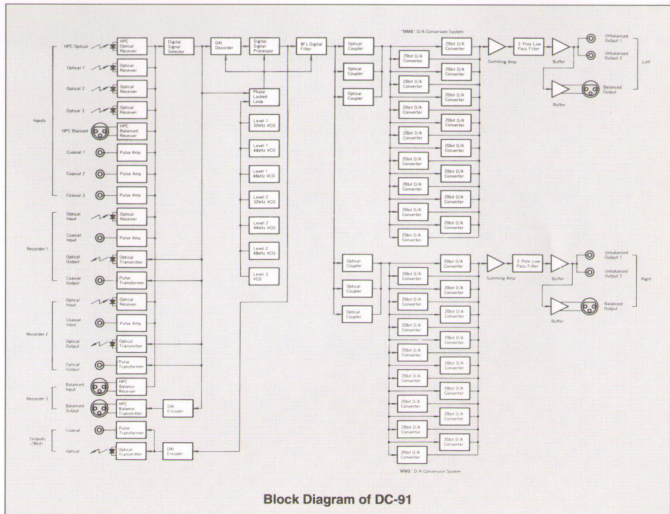


Absolute Phase Selection and Level Control in the Digital Domain

In a high-quality playback system, absolute phase can be critical. To prevent any possibility of sound quality degradation, the DC-91 allows absolute phase selection in the digital domain, thanks to the DSP (Digital Signal Processor) that has the capability to operate with 34-bit arithmetic precision. The signal level is also adjusted by the DSP chip with 24-bit output precision, which is 8 bits more than the 16-bit CD signal requires. This means that the level can be reduced by 8 bit (corresponding to -48 dB) before any degradation would occur. To further provide a safety margin, the control range is set to -40 dB.

Input Selector with Memory

A unit with as many digital inputs and functions as the DC-91 could be a nightmare when it comes to remembering various signal levels, frequency precision levels, and phase settings. But the DC-91 is not only versatile, it is also easy to use, thanks to a built-in memory that stores all settings associated with every input.



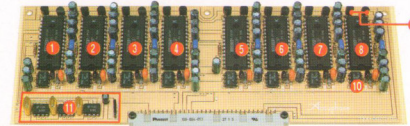
Block Diagram of DC-91

Three Separate Power Transformers

Separate power transformers are provided for the digital circuits and for the left-channel and right-channel analog sections. Because of the

MMB principle, the DC-91 has a total of 32 D/A converters. Each converter in turn has a local regulator with a positive and negative regulated power supply, resulting in a total of 64

power supply circuits in this section alone. This lavish design extracts optimum performance from each converter.

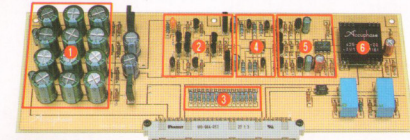


MMB D/A Converter Assembly
(Four boards of this assembly are used to make up the D/A conversion system.)

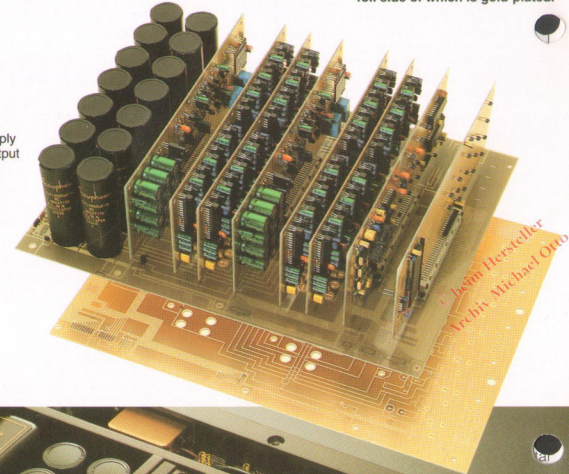
- 1 - 10 High-precision 20-bit D/A converters (8 converters are parallel-connected per board.)
- 1 Positive/negative regulated power supply
- 1 Ultrahigh-precision IV converter
- 1 Ultrahigh-speed optoisolator

Output Amplifier Assembly

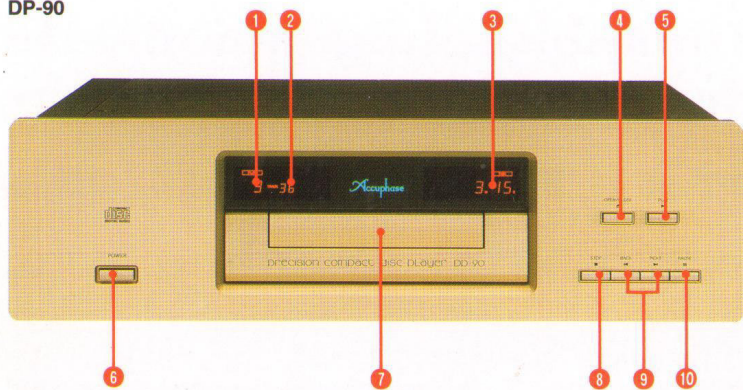
- 1 Filter & capacitor group for power supply
- 1 Ultrahigh-speed amplifier for MMB output synthesis
- 1 Ultrahigh-precision resistor group for MMB output synthesis
- 1 3-pole GIC filter
- 1 Unbalanced type output amplifier
- 1 Balanced type output amplifier



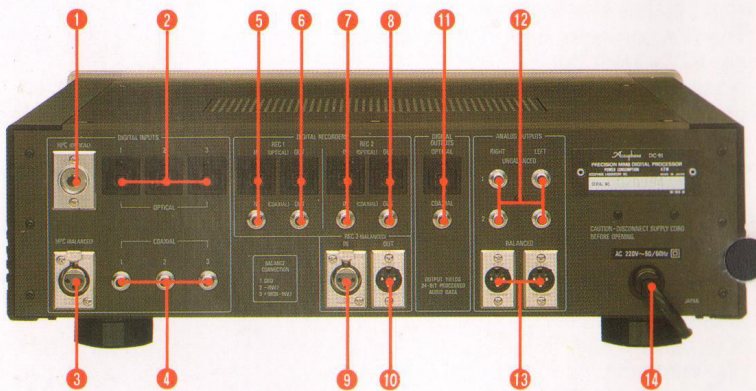
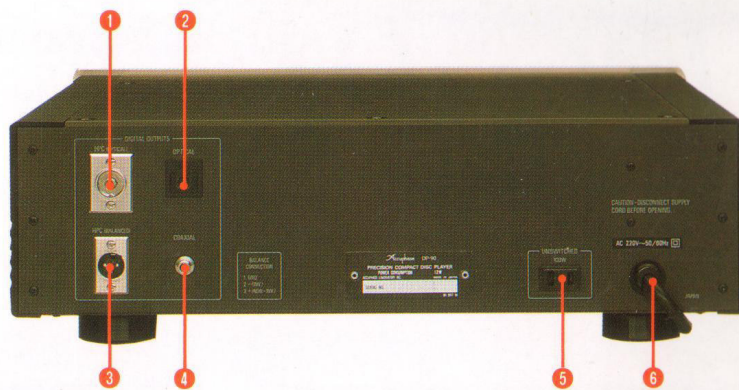
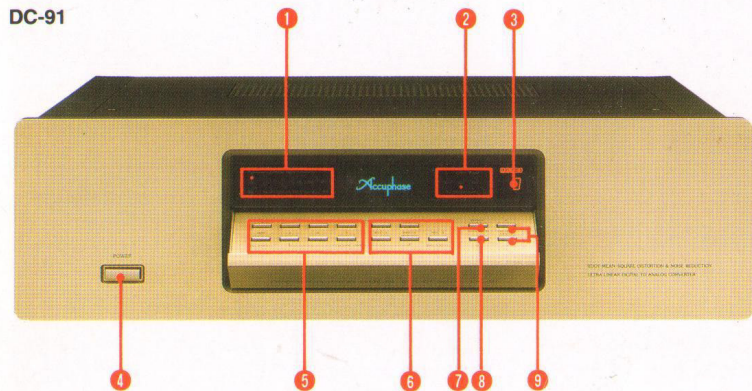
MMB D/A converter assemblies, digital modulation/demodulation assembly, system control assembly, and audio output assembly arranged neatly on the motherboard, the copper foil side of which is gold-plated.



DP-90



DC-91



FRONT PANEL

- DP-90**
- 1 PLAY TRACK Indicator
 - 2 TRACK/INDEX Indicator
 - 3 TIME Indicator
 - 4 Disc Tray OPEN/CLOSE Key
 - 5 PLAY (Playback Start) Key
 - 6 POWER Switch
 - 7 Disc Tray STOP Key
 - 8 TRACK SEARCH Keys
 - 9 PAUSE Key

- DC-91**
- 1 Input Position Indicators
 - 2 EMPH, PHASE, and Sampling Frequency Indicators
 - 3 LEVEL-dB Indicator
 - 4 POWER Switch
 - 5 INPUT Selector Keys
 - 6 REC-1, REC-2, REC-3 (Recorder) Selector Keys
 - 7 PHASE (Output Phase) Selector Key
 - 8 SFA (Sampling Frequency Accuracy) Key
 - 9 OUTPUT LEVEL Adjust Keys

- REAR PANEL**
- DP-90**
- 1 HPC optical fiber output connector
 - 2 Toslink optical fiber output connector
 - 3 HPC digital input balanced type connector
 - 4 Coaxial output jack
 - 5 Unswitched AC outlet*
 - 6 AC power cord
- DC-91**
- 1 HPC optical fiber input connector
 - 2 Toslink optical fiber input connector

- 3 HPC digital input balanced type connector
 - 4 Coaxial input jacks
 - 5 REC1 input connector (Toslink/Coaxial)
 - 6 REC1 output connector for recording (Toslink/Coaxial)
 - 7 REC2 input connector
 - 8 REC2 output connector for recording
 - 9 REC3 balanced-type input connector
 - 10 REC3 balanced-type output connector for recording
 - 11 24-bit digital output connector (Toslink/Coaxial)
 - 12 Unbalanced type output jack for audio output
 - 13 Balanced type output connector for audio output:
 - ① Ground, ② Inverted (-), ③ Non-inverted (+)
 - 14 AC power cord
- *Remarks:**
The unswitched AC outlet may not be supplied depending on the safety standards or regulations applicable in the particular country to where the unit is destined.

GUARANTY SPECIFICATIONS

(Guaranty specifications are measured according to EIAJ standard CP-307.)

Performance Guaranty

All Accuphase product specifications are guaranteed as stated.

CD TRANSPORT DP-90

- **Product Type** Digital Compact Disc playback unit
- **Format** Standard CD format
 - Error correction principle: CIRC
 - Number of channels: 2
 - Revolution speed: 500 - 200 rpm (constant linear velocity)
 - Scan velocity: 1.2 - 1.4 m/s, constant
- **Data read Principle** Non-contact optical pickup (semiconductor laser)
- **Laser Type** GaAlAs (double heterodyne diode)
- **Digital Signal Output Format and Level (EIA)**
 - Timing precision: Level I
 - HPC optical: Output -19 to -14 dBm, Wavelength 820 nm
 - HPC balanced: 5 V_{p-p}, 110 ohms
 - OPTICAL: Output -21 to -15 dBm (EIAJ), Wavelength 660 nm
 - COAXIAL: 0.5 V_{p-p}, 75 ohms
- **Power Requirements** 100/117/220/240 V, 50/60 Hz
- **Power Consumption** 12 W

- **Maximum Dimensions** 475 mm (18-3/4") width x 149 mm (5-7/8") height x 379 mm (14-15/16") depth
- **Weight** 20.5 kg (45.2 lbs.) net, 25.5 kg (56.2 lbs.) in shipping carton

DIGITAL PROCESSOR DC-91

- **Product Type** Digital processor unit
- **Input/Output Format** Standard EIA format
 - Quantization: 16 - 24 bit linear
 - Sampling frequencies (automatic detection): 32 kHz, 44.1 kHz, 48 kHz
 - Timing precision (automatic detection): Level I, II, III
- **Frequency Response** 4.0 - 20,000 Hz ±0.3 dB
- **D/A Converter** MMB type, 20-bit
- **Digital Filter** 20-bit 8-times oversampling filter, Digital deemphasis, Tolerance: ±0.001 dB
- **Total Harmonic Distortion** 0.002% (20 - 20,000 Hz)
- **Signal-to-Noise Ratio** 120 dB
- **Dynamic Range** 98 dB
- **Channel Separation** 112 dB
- **Rated Output Level and Impedance**
 - BALANCED: 2.5 V/50 ohms, XLR-type connector
 - UNBALANCED: 2.5 V/50 ohms, RCA-type phono jack
- **Output Level Control** 0 to -40 dB in 1-dB steps (digital control)

- **Digital Signal Input Format (EIA)**
 - HPC optical: Input -30 to -10 dBm
 - HPC balanced: minimum input 0.2 V, 250 ohms
 - OPTICAL: Input -27 to -15 dBm
 - COAXIAL: 0.5 V_{p-p}, 75 ohms
- **Power Requirements** 100/117/220/240 V, 50/60 Hz
- **Power Consumption** 42 W
- **Dimensions** 475 mm (18-3/4") width x 149 mm (5-7/8") height x 379 mm (14-15/16") depth
- **Weight** 22.5 kg (49.7 lbs.) net, 27.5 kg (60.6 lbs.) in shipping carton

Remote Commander RC-9

(Supplied with DP-90, but also available as an option.)
Remote control principle: infrared pulse
Power supply: 3V DC (IEC R03 (size AAA) batteries x 2)
Dimensions: 66 mm (2-5/8") x 225 mm (8-7/8") x 20 mm (13/16")
Weight: 280 g (0.6 lbs.) (including batteries)

OPTIONAL PARTS

- HPC Optical Fiber Cable HLG-10 (1m)*
 - HPC Balanced-type Cable HLC-10 (1m)*
 - Toslink Optical Fiber Cable LG-10 (1m)
- *Supplied with DP-90
(Each cable is available with a length of 2m, 3m, and 5m.)



ACCUPHASE LABORATORY INC.