

 **PIONEER**  
The future of sound and vision.

# PD-91

**REFERENCE COMPACT DISC PLAYER**



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## THE MOMENT OF TRUTH

The moment of truth has arrived. Truth in sound reproduction. With the PD-S1 Reference CD Player, Pioneer has succeeded in delivering both the most delicate and the most dynamic nuances of music to provide you with sheer, undiluted musical enjoyment. The best of our state-of-the-art engineering — both electronic and mechanical — was applied in the design and manufacture of this component. Parts were chosen for their ability to deliver the best possible performance. Digital sound has found its perfect match in the Pioneer PD-S1. And together they let you enjoy many moments of true, quality sound.

## A pickup and digital processing circuit that ensure pure digital sound

### Twin linear-envelope true 18-bit D/A converters

Our new D/A (Digital-to-Analogue) converter boasts an 18-bit quantisation level. This reduces residual quantisation noise to one-fourth the value of conventional 16-bit quantisation. Together with the 8-times oversampling process described below, our 18-bit D/A converter provides 8 times better resolution than a 16-bit D/A converter using 4-times oversampling. So the digital signal is converted into an analogue waveform extremely close to the original waveform; delicate nuances of soft sound are reproduced with higher accuracy and lower distortion. And since a converter is provided for each channel, inter-channel phase difference is reduced, improving sound imaging.

Moreover, our D/A converter is a most advanced linear-envelope true 18-bit configuration. Conventional 18-bit converters use 18 precision current sources. So even the slightest error in the current source can lead to conversion distortion, compromising the delicacy of low-level signals. With our new linear-envelope true 18-bit converter, however, conversion distortion is minimised because compensation is performed for not only zero-crossing distortion, a source of gross aberration; it is also performed for error of 2nd, 3rd and 4th current sources by adjusting external weighted currents for those sources. (Zero-crossing distortion is a gross conversion error due to errors in the current source that can occur when an analogue waveform switches from positive to negative, and vice versa.) The result is extremely accurate D/A conversion and low distortion from extremely high levels to infinitesimally low levels.

### 8-times oversampling digital filter

The Compact Disc format uses a sampling frequency of 44.1kHz, to provide a frequency bandwidth of from about 0Hz to 20kHz. This frequency can result in the generation of "sampling" noise because its "foldover" frequencies are spectrally close to the audible frequency range. These spurious frequencies — known as sampling noise — are normally eliminated by a higher-order analogue filter with steep attenuation response. Such filters, though, tend to cause a phase lag in frequencies of 10kHz and higher, making accurate signal reproduction impossible.

Our 8-times oversampling digital filter offers the solution. It samples the input signal at 8 times the normal frequency (that's 352.8kHz), shifting the spurious frequencies far out of the audio range. This makes it possible for us to use a low-order analogue filter, made from high-quality discrete parts, with mild attenuation response to remove the spurious frequencies. So our 8-times oversampling digital filter ends noise due to foldover frequencies, while maintaining accurate phase linearity up to 20kHz and enabling low-distortion output.

In actual figures, our twin linear-envelope true 18-bit D/A converters and 8-times digital filter have made possible a superb signal-to-noise ratio of 114dB and ultra-low distortion of 0.0015%.

### Pioneer Accu-Focus System

The laser beam that reflects off pits on the surface of the Compact Disc holds billions of bits of digital music information. The beam is detected by a pickup and the signals are passed on to a photodetector where they are converted into electric RF signals. The photodetector is divided into four components to control the focus servo, inevitably causing phase difference between the four signals the detector has received. The Accu-Focus System, however, solves this phase-related problem by adding a delay circuit for the first-arriving signals (see illustration), thus dramatically reducing distortion and improving frequency response in the RF output, especially at high frequencies. As a result, both noise and distortion are reduced in the audible frequency range.

The photodetector and buffer amp are integrated into a single IC (optoelectric IC) to provide steady performance that remains impervious to external disturbances.

### Precision moulded pickup unit

Our newly developed precision pickup uses an objective lens with an exceptionally high 7.5-time magnifying power. This has made the collimator and concave lens redundant, making it possible for us to design a more feasible beam path. Moreover, the beam splitter is thicker than normal and its incident angle is greater, so that it reduces distortion due to external stress and harmful chromatic aberration.

We designed the pickup using our advanced computer analysis system to find the optimum configuration and material, and built it from precision-moulded resin. Highly resistant to stress and using no precision-joining adhesives, it will retain its initial strength and mechanical accuracy for years to come.

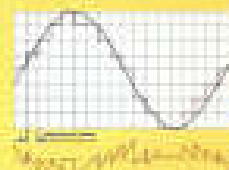
### Pioneer-exclusive ACCU-FOCUS system with laser pickup



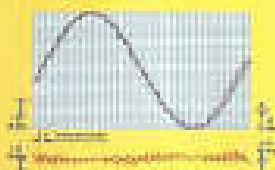
B1 and B2 receive signals before B3 and B4 do. B1 and B2 signals are sent to the delay circuit first, and then applied to the adding circuit. Then all four signals are synchronized and then mixed as RF signals, resulting in a high signal-to-noise ratio for the system.

### Quantization noise generation (conceptual)

16-bit 4 times oversampling



18-bit 8 times oversampling



### Spectra of sampling noise

16 times oversampling



8 times oversampling



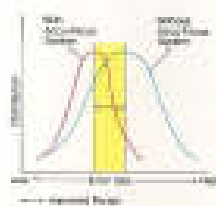


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Comparison of error rate

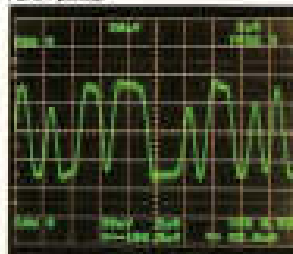


Group-delay response

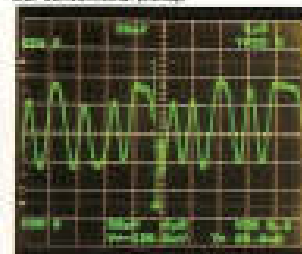


Comparison of Noise in RF signals when positive external signal is applied

PD-91 pickup



Old conventional pickup



(Note how disturbed the signal is.)

## Our electronics engineering and knowhow put to the best use

### Class-A FET buffer amps for audio circuits

All analogue circuits that follow the D/A converter — de-glitcher, low-pass filter, etc. — are constructed using class-A FET buffer amps. They ensure accurate signal transmission independent of power-supply load variations, mutual interference and the loads of the following stages — performance only class-A operation can guarantee. Our advanced circuit configuration ensures low impedance, low distortion and low noise. Exceptional clarity is the audible result.

### Multiple power supply

The PD-91 employs 11 regulators and 18 power supplies. There are separate power supplies for the analogue, servo and digital circuits, so that they do not interfere with each other. This elaborate power supply design prevents delicate analogue signals from being adversely affected by the digital and servo circuits.

### "Master" quartz clock

Inside the PD-91, operation of all the digital signal processing circuits — D/A converter, digital filter, EFM demodulator, even the system-control microcomputer — is synchronised to a single master clock, as opposed to conventional designs where each circuit has its own clock. This prevents audible beat noise generated by interference between various clock frequencies.

### Switchable digital and analogue outputs

Digital signal processing circuits can generate noise that compromises the signal, like noise from clock frequencies or power line noise. So we've provided the PD-91 with a switch that turns off the circuits that are not in use. For instance, you can turn the digital circuits off when using an analogue line output; conversely, the analogue circuit can be turned off for digital output. To further keep noise at bay, the headphone circuit remains inoperative until headphones are plugged in. The fluorescent display, also a source of switching noise, can be turned off whenever you want.

Block diagram of new master quartz clock



Output switch

Independent-transformer base



## Unresonating mechanical designs for the purest, cleanest sound

### Laminated base for the pickup mechanism

A pickup can read pits on a disc accurately only when it can perform its task unaffected by external vibrations. In the PD-91, the base for the pickup mechanism uses a double construction where the top portion is copper-plated. Then the entire base is moulded with resin. This elaborate "laminated" base has improved vibration-damping response for accurate tracking.

### Externally mounted power transformer

The power transformer for the PD-91 is mounted on the back of the cabinet, insulated from the player chassis. Therefore, the vibration and flux leakage the transformer may cause cannot degrade sound by affecting the circuits inside. Effective insulation is provided by the combined use of a thick aluminium crate and an insulator. A "10th foot" supports the transformer to improve stability.

### Copper-plated honeycomb chassis

The chassis is plated with copper to end magnetic distortion and damp vibration. Its honeycomb construction improves rigidity and further helps the unit to resist vibration.

### Large honeycomb insulators

The insulators that support the player also use a honeycomb construction and are made of special resin. They effectively decouple the player from the outside world thanks to their high vibration-damping response and rigidity.

### Large vertical-clamp disc stabiliser

With conventional players, the rotating disc is clamped just at the centre, leaving the middle section and outer rim subject to external vibration and acoustic pressure. But our vertical-clamp disc stabiliser secures the disc not only at its centre but also at its middle section. Moreover, a magnetic centre clamping is used in combination so that the clamped disc is completely detached from the player during playback. This prevents spurious vibration from the disc from being transmitted to the electronic circuits.

### Coaxial suspension system with ceramic supports

The base for the pickup mechanism is supported by a low-centre-of-gravity coaxial suspension system combining resonance-damping special rubber and springs, to provide higher resistance to vibration. The suspension system uses ceramic supports in combination that are highly rigid and feature optimised internal loss. As a result, rolling of the base for the pickup mechanism is drastically reduced, which allows the pickup to read a disc with exceptional precision.

### Heavy-duty gold-plated terminals

Terminals for analogue outputs are gold-plated, reducing contact resistance and providing constant performance over long periods of time. They are heavy-duty too: they are designed to stand up to strong force, to protect internal circuitry.

Copper-plated honeycomb chassis



## Features to provide smooth operation and extra convenience

### High-speed search

To drive the pickup, we use a responsive linear motor: to rotate the disc, we employ a high-torque coreless direct-drive motor. The result is quicker track access, because the pickup reaches the desired track faster and the disc attains the required speed more rapidly. Average access time is a mere 0.5 seconds.

### Two digital outputs — optical and coaxial

There are two digital outputs on the PD-81 that permit direct connection with other digital equipment (such as an amplifier with a built-in D/A converter). Of the two outputs, one is for optical connection that completely shuts out digital noise.

### Smooth and silent disc loading

The disc tray is formed of resin that is high in mass and features a precision finish. Parts that come in contact are made of precision wear-resistant metal which, in combination with a wire drive mechanism, ensures smooth, silent and "play"-free loading of discs.

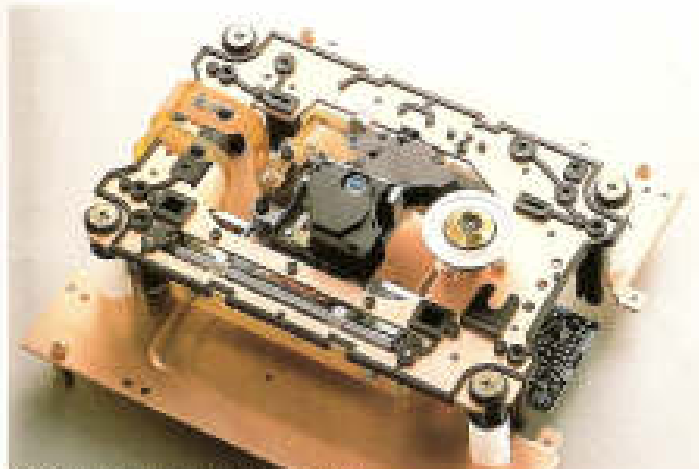
### An array of operating conveniences

While precision, accuracy and operating feel are simply superior, the PD-81 is also designed for unmatched ease of use. Here's a sampling of what these features let you do:

- Programme 24 tracks for playback in any order.
- Programme edit — a handy feature when dubbing from disc to tape.
- Time fade edit — music fades out after specified time.
- One-touch fade — music fades in and out at the touch of a remote button.
- "Music Window" — choose up to eight favourite phrases in pieces of music on a disc, and hear them fade in and fade out, one after another.
- Variable fade time, from 0 to 10 seconds.
- Random play for varied playback.
- Auto space to add 3 seconds of break between songs.
- Timer play for a musical wake-up call. (Timer is optional.)
- 20-track "calendar style" programme chart.
- Memory backup — the play mode, set when the player was turned off, will be automatically selected on power on.
- Ready to play 8cm singles.

### Classy looks

As our flagship model should, the PD-81 comes with a classy front panel in attractive Japanese lacquer-like black finish.



Optical pickup mechanism driven by linear motor



Optical and coaxial digital outputs



### SPECIFICATIONS

System:	Compact Disc digital audio system
Frequency Response:	2—20,000Hz ±0.3dB
Signal-to-Noise Ratio (EIAJ):	114dB
Dynamic Range (EIAJ):	96dB
Channel Separation (EIAJ):	100dB
Wow & Flutter (EIAJ):	Unmeasurable (±0.001%, weighted peak)
Distortion (EIAJ):	0.0015%
Output Voltage (EIAJ):	2V ±0.0V (RMS)
Power Requirements:	220/240V 50/60Hz
Power Consumption:	29W
Dimensions (W × H × D):	458 × 129 × 425mm (without package)
	18-1/16 × 5-1/16 × 16-3/4 inches
Weight (without package):	11.7kg/26 lbs, 13 oz.



This mark indicates compatibility with Pioneer system remote control.

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