COMPACT DISC PLAYER
P-D1

COMPACT disc DIGITAL AUDIO

PIONEER®

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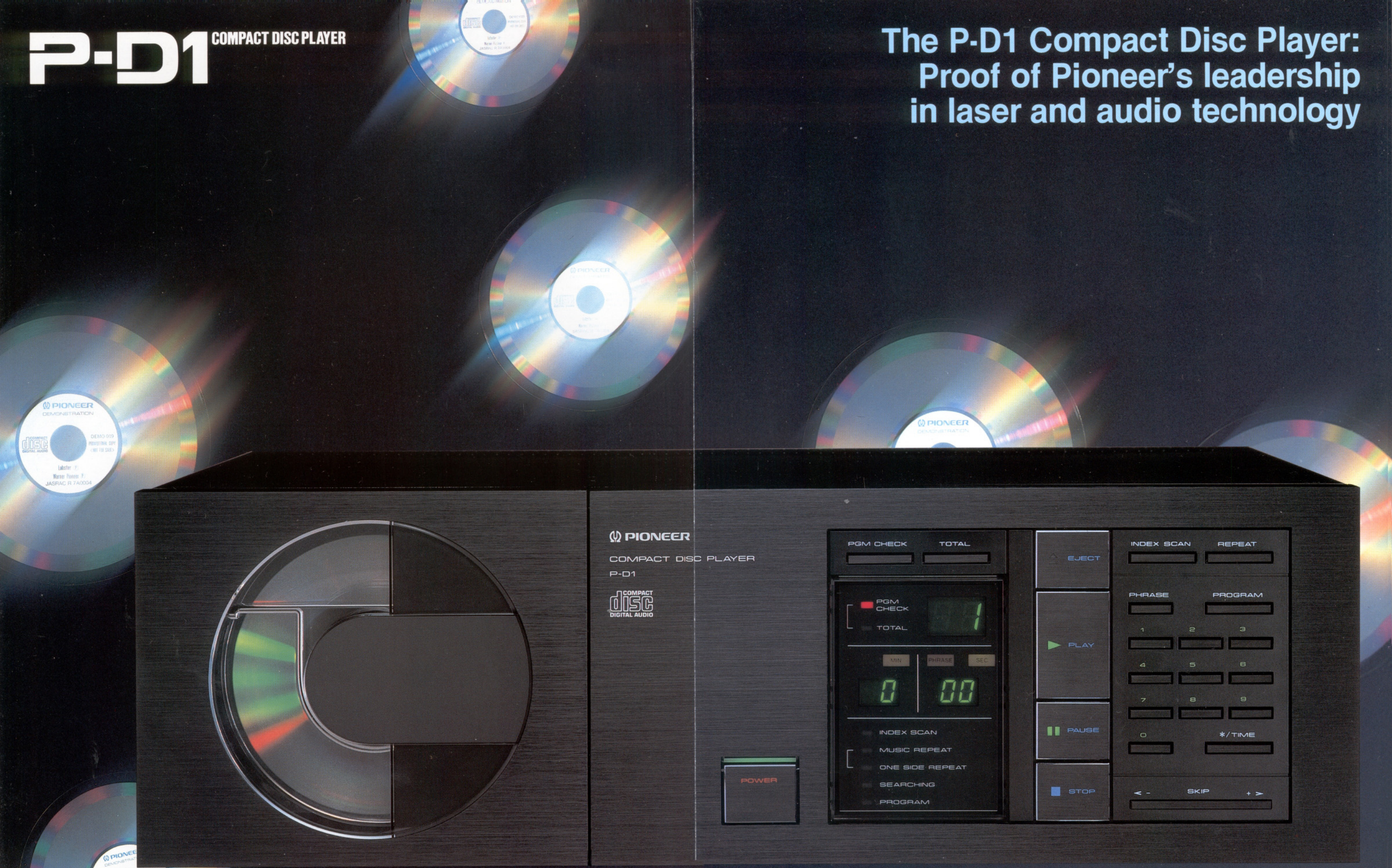
The P-D1 Compact Disc Player: Proof of Pioneer's leadership in laser and audio technology



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Compact Disc — the digital revolution

The Compact Disc represents a radical departure from conventional analogue forms of music reproduction. Instead of recording music in the form of tiny bumps on vinyl or magnetic pulses on tape, musical information is translated into binary digits which are transferred onto a plastic disc in the form of microscopic pits. This information is retrieved by a non-contact laser beam and then translated back into music.

The advantages of digital recording are exciting. First, digital information can be transferred from one source to another with no degradation in quality, so the sound you hear is as crisp and sharp as the original master recording.

Second, the Compact Disc itself continues to provide superior sound quality even after years of use. This is because vital musical data is sealed beneath a protective layer of plastic, invulnerable to dirt or small scratches, untouched by stylus or tape head.

Finally, a Compact Disc can contain about 60 minutes of music on just one of its sides, and yet it is only 12cm in diameter — small enough to carry around in your pocket. The digital format also makes possible a variety of convenient search and random access functions.

Super Specifications

You have to hear the sound of the Compact Disc System to believe it. Noise and distortion are, for all practical purposes, nonexistent. Frequency response and channel separation are dramatically increased. Dynamic range is a 50% improvement over conventional analogue systems, very nearly reproducing the dynamics of a live performance. The specifications are nothing short of electrifying:

- Dynamic range is over 90dB.
- Signal-to-noise ratio is better than 90dB.
- Harmonic distortion is less than 0.006%.
- Channel separation is greater than 90dB.
- Frequency response is flat within ±0.5dB from 5Hz to 20kHz.
- Wow and flutter are unmeasurable by state-of-the-art instrumentation.

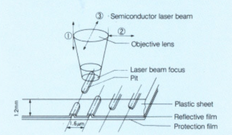
Pioneer microelectronics

When the CD player reads the microscopic pits that store musical information, it must do so at high speed and with perfect accuracy. To keep the pickup on track, we've used three sophisticated servo systems — a focus servo, a tracking servo and a spindle servo.

The focus servo keeps the laser beam focused on the reflective surface of the Compact Disc by moving the objective lens toward or away from the disc. The tracking servo allows the focus of the laser beam to follow the centre line of a track by monitoring adjacent tracks. The spindle servo keeps the linear velocity of the disc constant by continuously adjusting the speed of the spindle motor.

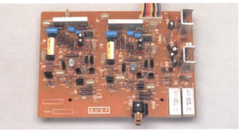
All of this advanced Pioneer electronics ensures that tracking remains smooth, precise and free of transfer error.

Pioneer servo technology and pits on Compact Disc



Best quality audio circuitry

The sound quality of a CD player relies on more than just the digital circuitry. Analogue circuitry — a series of stages after the D/A (Digital-to-Analogue) converter — handles music in its original analogue audio form. The very best analogue technology is needed to ensure that distortion does not creep in at this final stage. That's why for the P-D1, we've used our finest audio circuitry, built around select parts such as our polypropylene capacitors. Pioneer's unmatched reputation for excellence in analogue audio technology is your guarantee of incomparable sound quality.



D/A converter circuit board built around high-quality parts for audio use

Convenient features of the P-D1

In addition to musical information, a Compact Disc contains a digitally-encoded table of contents and indexes for instant cueing. This makes possible the following convenient functions:

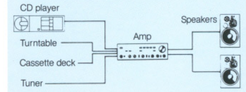
- *Random Search:* Lets you start playback from any desired point on a disc. Select by means of specific track (selection) or by means of elapsed time (from start of the track).
- *Phrase Play:* When a phrase number is entered, playback starts automatically from the beginning of any phrase within a single track.
- *Skip:* Lets you backtrack to the beginning of the current track (selection) or skip ahead to the next one.
- *Index Scan:* Lets you hear the first 7 seconds of every track (selection) on a disc in succession.
- *Music Repeat/One-Side Repeat:* Permit repeat of any track (selection), and repeat of the whole side of a disc, respectively.
- *Programmed Function:* Lets you hear any number of tracks (selections) up to 16 in any order you desire.
- *Status Indications:* When the "Total" key is touched, the total number and total play time of selections you have programmed are displayed. Touch the "PGM Check" key to find out the track number of the current selection and the total time of selections yet to be played.

Disc loading and unloading mechanisms are motor powered, for greater comfort and convenience. Function buttons are soft-touch operated for comfortable operating feel.

Compatible with conventional hi-fi systems

To play and hear Compact Discs, all you need, in addition to your present hi-fi system, is a CD player. For best possible performance, your amp should produce as little noise and distortion as possible. A high power output will make the most of the Compact Disc's wide dynamic range. Ideal speaker systems are those with large input power handling and peak music power capabilities, low distortion and high efficiency.

Connection diagram for CD System



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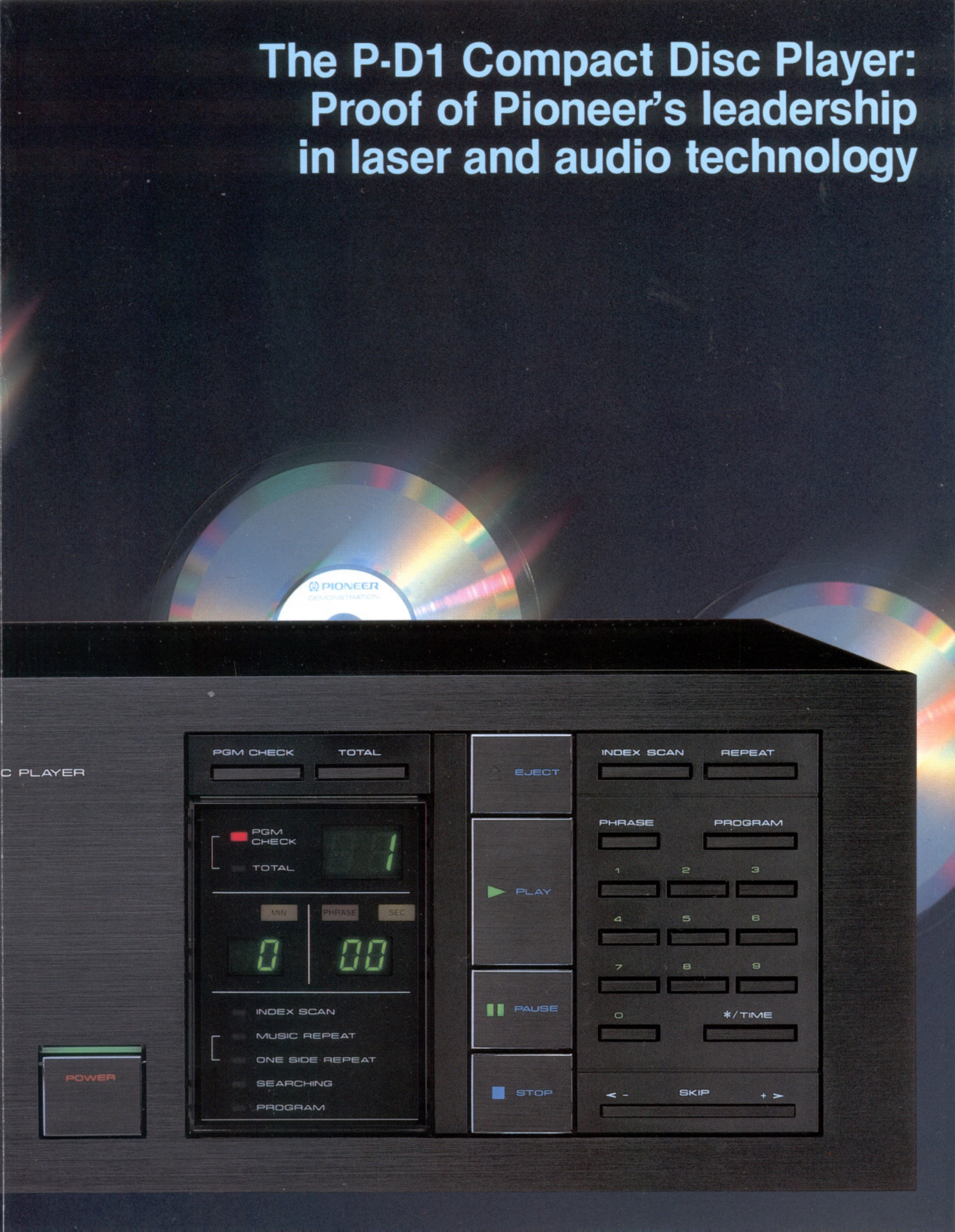

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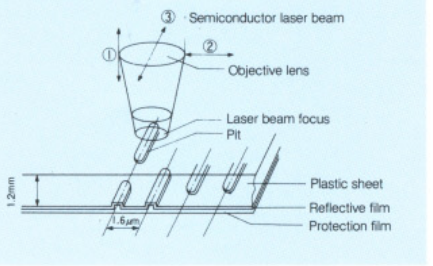

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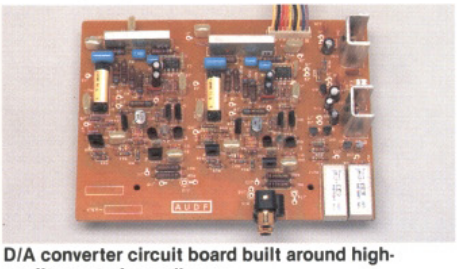

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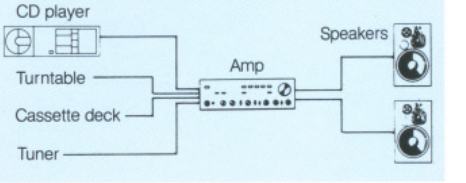


The greatest breakthrough in audio since Edison

It is no exaggeration to say that the Compact Disc Digital Audio System is the greatest breakthrough in audio technology since Edison. More than just another refinement of the same analogue formats that have been used since the Gramophone, the CD system is an entirely new way of storing and retrieving musical information. Simply put, music is converted into numbers which are then transferred to a plastic disc and read by a sharply focused laser beam. The musical result is astoundingly accurate and practically invulnerable to damage and wear.

In producing this Compact Disc player, our engineers applied to audio reproduction the same sophisticated Pioneer technologies used in our LaserDisc™ video system — laser optics and digital electronics. With the CD player, Pioneer once again push forward the frontiers of audio technology.

How does the Compact Disc System Work?

In essense, all electronically reproduced music is analogue. The signal that goes to your speakers is an electrical representation of continuously variable musical information. In conventional audio systems, that information is also stored in analogue form — as continuously variable impressions on vinyl or magnetic pulses on tape. The problem is that during recording, storage and retrieval, musical information in analogue form is particularly susceptible to distortion, damage and wear.

Digital Recording

The Compact Disc Digital Audio System solves this problem by recording, storing and retrieving music in *digital* form. Digital signals are made up of binary numbers, that is, musical information translated into a series of bits representing 1's and 0's. To record in this way, musical information is sampled at a frequency of 44.1kHz and turned into series of discrete stepped voltages, which are then converted into digital "bits" by an A/D (Analogue-to-Digital) converter. This process is called "quantisation."

Digital Storage

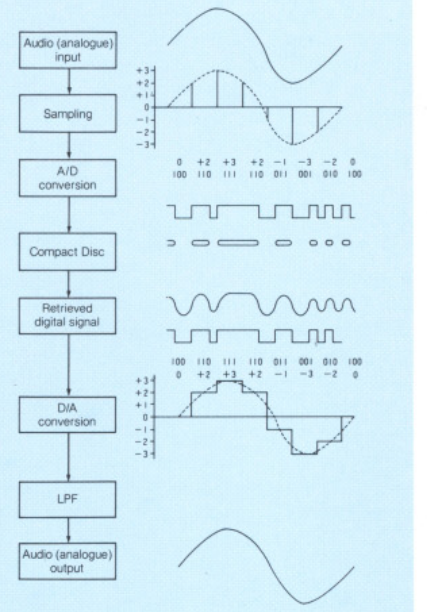
The digital bits are then stored on the plastic Compact Disc in the form of microscopic pits arranged in tracks only 1.6μm apart. Since the pits are read optically by a laser beam, the pits can be sealed safely under a layer of transparent plastic without affecting reproduction quality. Stored in this way, musical signals in digital form are not subject to external noise and distortion, even after several stages of transmission or after generations of copying.

Digital Playback

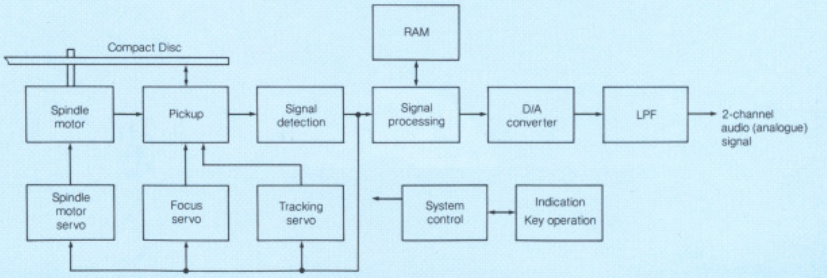
Retrieving digital information is extremely simple in principle. A digital reader need only differentiate between 1 (presence of a bit) or 0 (absence thereof), leaving very little room for error. To ensure that the correct signals are read at the correct time, the CD player employs three servo systems to monitor tracking. To compensate for dropouts, the system uses a powerful error correction system. Missed signals are interpolated from signals preceding and following, so that the loss does not appear at the output.

Next, the digital signal is converted back into an analogue signal by a D/A (Digital-to-Analogue) converter. Finally, the signal goes through a low-pass filter to eliminate extraneous ultra high frequencies, and appears as an audio signal at the output. This output is fed to an amplifier, just like the signal from a turntable or tape deck.

Operating principle of CD System



Block diagram of CD player



P-D1 Specifications

1. General

System	Compact Disc Digital Audio System
Disc	
Diameter	120mm
Thickness	1.2mm
Playing time	over 60 minutes (stereo)
Scanning velocity	1.2—1.4m/sec
Rotation (as viewed from playing side)	Counterclockwise
Signal format	
Sampling frequency	44.1kHz
Quantisation	16 bits linear/channel
Transfer bit rate	4.3218M bits/sec
Modulation system	EFM
Error correction	CIRC system
Pre-emphasis	50/15μsec (automatic switching)
Pickup laser	Semiconductor laser; wavelength, 0.78μm
Power requirements	220/240V (switchable) 50/60Hz
Power consumption	46 watts
Dimensions (without package)	420(W) × 140(H) × 330(D) mm 16-9/16(W) × 5-1/2(H) × 13(D) inches
Weight (without package)	12.1 kg/26 lbs. 11 oz.

2. Audio Section

Frequency response	5Hz — 20kHz ±0.5dB
Signal-to-noise ratio	more than 90dB
Dynamic range	more than 90dB
Channel separation	more than 90dB (1kHz)
Wow and flutter	unmeasurable (dependent on accuracy of crystal oscillator)
Distortion	less than 0.006% (1kHz, 0dB)
Output voltage	190mV (1kHz, −20dB)
Number of channels	2 (stereo)

3. Functions

Play/Pause/Index Scan/Repeat/Skip/Time Display/ Phrase Display/Time Search/Phrase Search/ Programmed Playback/Programme Check/Total Time Display

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PIONEER®

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