



Technology Backgrounder

LightScribe Direct Disc Labeling

Technology summary

LightScribe Direct Disc Labeling is a technology that enables images and text to be etched onto CD and DVD disc labels using the same laser in the optical drive used to burn data. Invented by HP, the technology requires three elements to deliver silkscreen-quality labels: 1) a LightScribe-enabled optical disc drive, 2) LightScribe-compatible media, and 3) LightScribe-supported software applications. LightScribe is licensed by leading optical disc drive manufacturers, media manufacturers, software providers and computer and consumer electronics brands.

What is it?

LightScribe Direct Disc Labeling is a complete system that, with LightScribe-enabled hardware, software and media, allows consumers to burn labels directly on their discs using the drive's existing laser. LightScribe licensees receive access to enabling technology, and LightScribe licensing requirements and component compliance testing ensure system compatibility. Licensed components carry the LightScribe trademark so consumers can quickly identify LightScribe-enabled drives, media and software.

A typical label-burning scenario might start with the consumer burning music tracks to a disc. During the data mastering operation, the software collects information that appears in a preview of an automatically generated disc label design. When the consumer has finished burning his music, photos, video or other data, the system verifies that the disc is a LightScribe disc by reading identifying information from the disc. If the consumer approves the preview label design, he launches the etching operation, removes the disc from the drive, flips it over and reloads it label side down. The system collects additional information from the drive and uses it in conjunction with the disc information to create the circular image file. The system sends the labeling commands to the drive, which the drive uses to direct the laser to write the disc label. The finished, labeled disc is ejected automatically.



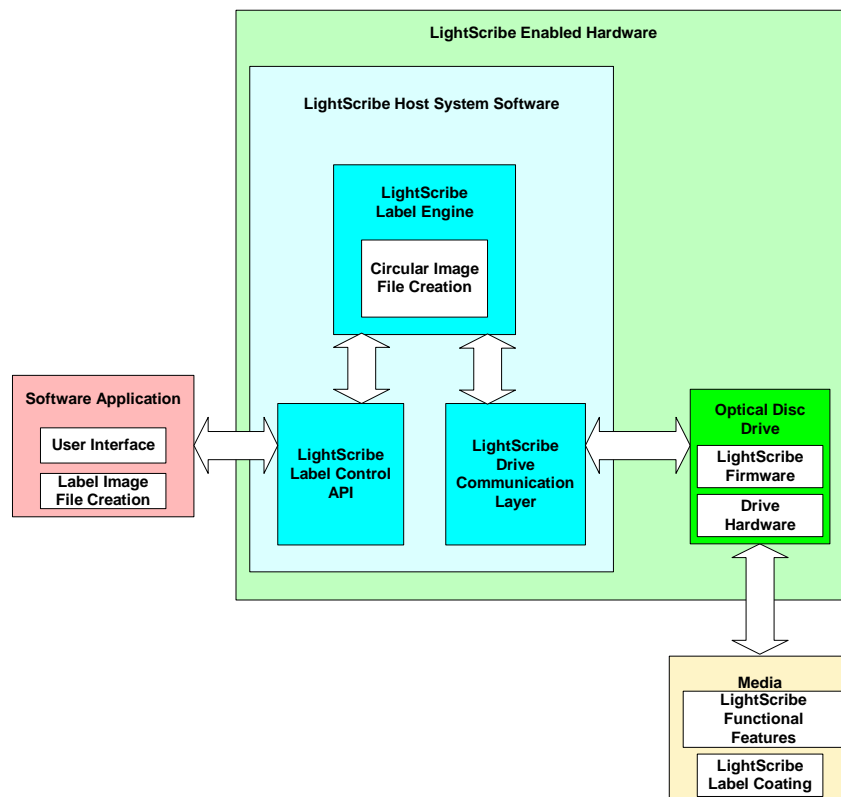
How does it benefit consumers?

LightScribe Direct Disc Labeling delivers:

- Silkscreen-quality labels with the precision and fine detail. No more messy, marker-scrawled labels.
- A no-hassle way to burn labels directly to CDs and DVDs. No adhesive labels that require aligning and stamping. No more voided CD or DVD disc drive warranties when the adhesive label delaminates in the drive.
- Freedom to print when and where the consumer wants, without using a printer, as LightScribe is can be used anywhere a laptop goes.
- The ability to make simple or complex labels of uniformly high quality. Labels can be as creative as consumers wish, with text and graphics designed to express their unique styles.

How does it work?

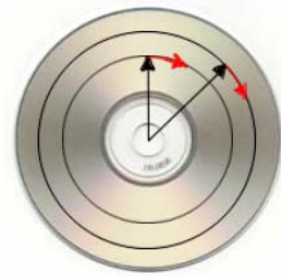
The consumer experience is influenced by each component of the LightScribe Direct Disc Labeling system:



Hardware

With minimal modifications to hardware and firmware, LightScribe licensees can manufacture drives that print labels on LightScribe media using the same laser that burns data on the discs' content side. A high-speed interface coordinates drive capabilities to optimize labeling and imaging commands to facilitate burning. Drives are turned into combination label burners and data reader/writers via systems that include:

- Laser focus. A novel focus strategy provides sufficient focus control for consistent, uniform imaging on the label surface.
- Tracking control. Images are printed as concentric circular tracks, so precise tracking control is required. A tracking feature maintains constant track spacing, measured in microns, as the laser moves across the disc.
- Low-speed spindle control. Accurate speed control is essential for pixel placement along a track as the disc rotates. A speed control system achieves the required pixel placement accuracy.
- Write channel. A high-speed hardware communications channel—distinct from that used for data writing—is used for labeling.



Application Software

LightScribe-licensed software applications have a number of specific capabilities, including:

- Templates. For easy creation of labels from simple, quick title labels to elaborate, creative full discs.
- Print modes. Three different modes—Draft, Normal and Best—which range in print speed and quality.
- Interface. Two-way communication between the application and the print control engine via a proprietary interface. Print commands, status and media or drive information are shared through this interface.

Host System Software

The LightScribe host system software provides communication between the components of the system:

- LightScribe Label Control API. The communication interface between the print engine and the software application.
- LightScribe Drive Communication Layer. A high-speed communication path that encompasses all hardware communication and control in addition to providing hardware status and capabilities.

- LightScribe Label Engine. Orchestrates all the system's components. It receives label information from the software application, printing capabilities from the drive, and labeling parameters from the media. The label engine transforms the rectangular label image to the optimized circular print format and achieves optimal imaging via:
 - *Radial coordinate system*. A coordinate system achieves a constant marking density using fixed coordinate precision.
 - *Image processing*. A unique image pipeline transforms continuous tone rectangular images to a circular system with scaling, color separation, half-toning and pixel mapping.
 - *Imaging tools*. Imaging tools developed for inkjet, LaserJet, and liquid electrophotography are adapted for the LightScribe imaging system.
 - *Labeling optimization*. Novel circular labeling strategies, unique to LightScribe, increase label speed and quality.

Media

LightScribe-enabled media have a unique, laser-imageable, screen-printed coating on the label side. This coating absorbs laser light, which triggers a chemical reaction that produces a visible color change. LightScribe media also have embossed functional features, which enable these capabilities:

- Optimized label creation. Information on disc type, size and color can be accessed by the software application to optimize the labeling process.
- Optimized imaging. Media-specific parameters are matched to the drive's capabilities to ensure optimal imaging.
- System safety. Media-specific information ensures the data, label and drive are not damaged during labeling.



LightScribe CDs are available in five additional rich and saturated color-backgrounds: red, orange, yellow, blue and green. The development of LightScribe's color-background CDs was possible through LightScribe's Media Version 1.2 coating technology. With this next-generation LightScribe coating technology, the same precise, silkscreen-quality black text and graphics labels available on gold-background discs can be burned onto the label-side of LightScribe-enabled CDs in stunning, jewel-toned background colors.

Summary

LightScribe Direct Disc Labeling technology brings together existing data writing capabilities and a laser labeling system to dramatically change how CD/DVD labeling is done. As LightScribe is embedded in a growing number of optical disc drives, incorporated in multiple formats of optical disc media, and supported by a wide range of software applications, computer and consumer electronics users everywhere can enjoy its benefits. LightScribe: the market standard for direct disc labeling.