



Disc Manufacturing, Inc.
A QUIXOTE COMPANY

A Glossary Of
CD And CD-ROM Terms

WHO IS DMI?

Disc Manufacturing, Inc. (DMI) manufactures all compact disc formats (i.e., CD-Audio, CD-ROM, CD-ROM XA, CDI, PHOTO CD, 3DO, KARAOKE, etc.) at two plant sites in the U.S.; Huntsville, AL, and Anaheim, CA. To help you, DMI has one of the largest Product Engineering/Technical Support staff and sales force dedicated solely to CD-ROM in the industry.

The company has had a long term commitment to optical disc technology and has performed developmental work and manufactured (laser) optical discs of various types since 1981. In 1983, DMI manufactured the first compact disc in the United States. DMI has developed extensive mastering expertise during this time and is frequently called upon by other companies to provide special mastering services for products in development.

In August 1991, DMI purchased the U.S. CD-ROM business from the Philips and Du Pont Optical Company (PDO). PDO employees in sales, marketing and technical services were retained.

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A GLOSSARY OF COMPACT DISC AND CD ROM TERMS

A-TIME - Absolute time. The CD encoding system includes a clock which constantly monitors and registers the elapse time from beginning to end of the recorded program.

A/D - Analog to Digital.

ADPCM - Adaptive Differential Pulse Code Modulation. An audio compression scheme used for CD-I and CD ROM X/A formats in order to increase the time of audio or to interleave it with other data on the disc. Using this scheme, up to 16 hours of AM-radio broadcast quality audio can be recorded on one disc.

ART WORK - Pattern materials required for the label on the CD. For screen printing, label art work should be delivered to the manufacturer on positive film, emulsion side up, one film for each color on the label with register marks on all four sides and center. Other specifications apply for offset printing and the manufacturer should be consulted as to the requirements.

ASCII - American Standard Code for Information Interchange - pronounced "ask-ee". A binary code for data that is used in communications, most minicomputers and all personal computers.

BIREFRINGENCE - Double refraction (of light). Plastic materials, such as a CD substrate, demonstrate this double refractive ability due to residual stresses remaining in the plastic from the molding process. High birefringence can interfere with the laser beam of the reader and cause reading errors.

BLER - BLOCK Error Rate. A measure of the integrity of the data retrieved from a compact disc. The block error rate can be measured over a given period of time. It is usually reported in two or three ways by analyzers, i.e.: Average block error rate over the entire part of the disc that has been read, peak BLER, etc. Average BLER of 220 is considered a marketable disc according to Red Book and Yellow Book standards. Most manufacturers set higher standards for themselves, striving for an average BLER of under 50.

BLOCK - A segment of data. Same as a sector. On CDs, data is arranged in BLOCKS which contain header and sync, user data, error detection and correction, and control information.

CAPACITY - (DATA CAPACITY) The amount of data which can be recorded and replicated on a CD. Normal capacity of a disc is 654.7 Megabytes (Mb), which is 335250 2k Sectors. This is equivalent to 74 minutes 30 seconds. The amount of data on a disc is controlled by several factors: track pitch, speed or rotation. It is possible to record and replicate somewhat more data on the disc than the "normal" capacity and still remain within Yellow Book specifications, but some drives have trouble reading data from these discs.

CAV - Constant Angular Velocity. Refers to the speed of the information track with relation to the reading head (laser). Video discs and most magnetic discs rotate at constant angular velocity, i.e. RPM is constant, so that the tracks on the outside radii move past the reading head much faster than the tracks on the inside radii. See CLV.

CD-DA - Compact Disc Digital Audio. Commonly called a CD, this is an audio disc that contains up to 72 minutes of hi-fi stereo sound. A CD, 4 3/4" in diameter, is like a miniature phonograph record, except that only one side of the disc contains recorded material. A CD is a direct access device, and the individual selections can be played back in any sequence. Unlike phonograph records in which the disc platter contains "carved sound" the CD is recorded in digital form as a series of tiny pits that are covered with a clear, protective plastic layer. Instead of a needle vibrating in the grooves, a laser in the CD player shines light onto the pits and picks up the reflections as binary code. Sound is converted in digital code by sampling the sound waves 44.1KHz per second and converting each sample into a 16 bit number. It requires almost a million and a half bits of storage for each second of stereo hi-fi sound. The reason digital sound is so clear is that the numbers are turned into sound electronically. Other forms of CDs (CD ROM, CD ROM X/A, CD-I and DVI) all stem from the audio CD. Introduced in the U.S. in 1983, sales of CDs and CD players exceeded sales of LP's and turntables in 1986. The standard specification for CD is known as the Red Book.

CD R-Compact Disc Recordable. See CD WO.

CD ROM - Compact Disc Read Only Memory. A compact disc format that is used to hold text, graphics and hi-fi stereo sound. The disc is almost the same as the music CD, but uses different tracks for data. The music CD player cannot play CD ROM discs, but CD ROM players may be able to play CD discs and have jacks for connection to an amplifier and/or earphones. A CD ROM player is cabled to and controlled by a card that is plugged into one of the computer's expansion slots. A CD ROM can hold in excess of 600 Mb of data, which is equivalent to about 250,000 pages of text or 20,000 medium-resolution images. CD ROM will be the basis of the new "MultiMedia" computers, which will combine voice, data and video into one system and put it on the desktop.

CD ROM DRIVE - The machine (hardware) used to read data from a CD ROM disc. Connects to a PC. See CD ROM PLAYER.

CD ROM EXPO - An annual conference/convention of CD ROM users, makers and publishers usually held in October.

CD ROM EXTENSIONS - MS-DOS CD ROM Extensions. Software from Microsoft which extends the normal MS-DOS (operating system) for PCs to allow CD ROM to be used with PCs.

CD ROM MODE 1 - Has 3 layers of error detection and correction for computer data.

CD ROM MODE 2 - Has 2 layers of error detection and correction, for audio or compressed audio/video.

CD ROM PLAYER - Same as CD ROM DRIVE.

CD ROM/XA - CD ROM Extended Architecture. A version of CD ROM which uses both Mode 1 and Mode 2 (X/A). It allows for the inclusion of various grades of medium to low-fidelity audio (see ADPCM) to be played concurrently while viewing data. Announced by Philips, Sony and Microsoft in August 1988, CD ROM X/A allows for data (text and pictures) to be viewed and narrated at the same time. It also functions as the audio bridge between CD ROM and CD-I. CD ROM X/A plays on a standard CD ROM PLAYER, but requires a CD ROM X/A controller card in the personal computer to decode the interleaved audio information and play it back.

CD+G - A CD which stores information in the SUBCODE for graphics, lyrics, etc.

CD-BRIDGE DISC - a Version of CD ROM X/A which contains additional information in the primary volume descriptor that allows information to be read by a CD I player. The disc must also contain the CD I application to be played on a CD-I player, as well as a CD ROM X/A player.

CD-I - Compact Disc-Interactive. A compact disc format that stores, audio, still video pictures and animated graphics and full motion video as well. CD-I provides up to 144 minutes of CD-quality stereo sound, up to 9.5 hours of AM-radio-quality stereo or up to 19 hours of single channel (mono) audio. Developed by Philips and Sony, CD-I is designed for home and business use with CD-I players connected to TVs and personal computers starting in the early 1990's. CD-I discs feature interactive games and education as well as reference works and movies. CD-I includes an operating system standard as well as a proprietary chipset for decompressing video images. CD-I discs require a CD-I player and will not play on a CD ROM player. The standards for CD-I are known as the Green Book.

CD-I READY - Refers to a standard audio disc with some additional features which can be accessed when the disc is played in a CD-I player. This information is included in the pre-gap of track #1 and will be ignored by a standard CD Audio player. A CD-I player, however, will read this information and display on a video screen such information as lyrics, graphics, discography, etc.

CD TV - Commodore Dynamic Total Vision. A special kind of CD ROM designed by and for Commodore computers.

CD V - Compact Disc Video. A version of CD which contains up to 5 minutes of full motion video plus up to 20 minutes of CD Audio. CDV requires a special CDV player to access video.

CD WO - Compact Disc Write Once. A CD ROM version of the WORM (Write Once Read Many) technology. For companies wishing to do in house preparation through premastering, this format is useful for creating test discs (ONE OFF) before sending data for mastering and replication. CD-WO discs conform to ISO 9660 standards and can be played in CD ROM drives.

CLV - Constant Linear Velocity. Refers to the speed of the information track with relation to the reading head (laser). CD tracks pass the laser head at a constant linear velocity (1.2 to 1.4 meters per second), meaning that the speed of disc rotation when reading the inner radii must be faster than when reading the outer radii. See CAV.

CODEC- The words compression and decompression combined.

COMPRESSION - Reducing the representation of the information, but not the information itself. Reducing the bandwidth or bits necessary to encode information. Compression saves transmission time or capacity. It also saves storage space on storage devices such as hard disks, tape drives and floppy disks. Data Decompression is used to restore the data to it's normal form for display. See decompression.

DAT - Digital Audio Tape (same as R-DAT). System for recording/reading digital data using a special tape cassette. A 4mm DAT drive holds over one gigabyte of data and is used as a high capacity backup medium for computers and as a master source medium for sending data to a CD manufacturer.

DATA CONVERSION - converting data from one format to another. Conversion typically falls into three basic categories. 1. To convert to a form usable by the equipment you have, e.g. you convert some data from tape to disc (because you don't have a tape drive). 2. convert from one method of encoding data to another, say from EBCDIC to ASCII, because you don't have software which can understand IBM's EBCDIC method of encoding. 3. converting from one format to another, e.g. from the Dbase method of encoding databases to the Paradox method, or from WordStar to WordPerfect. There are many service bureaus whose job is to convert computer data from one form to another and there are now many programs available to do the conversion. The term is also used by disc manufacturers in premastering e.g. to FORMAT data into ISO 9660 or HFS.

DATA TRANSFER RATE - The speed with which data can be read from a CD ROM drive. 150 kilobytes per second is the standard rate, although in 1992 drives became available which read at 2X or 300 kb/second. There are now drives becoming available that read at 600kb/s.

DIGITAL AUDIO - The storage and processing of audio signals digitally. It usually requires at least 16 bits of linear coding to represent each digital sample and is normally referred to Red Book or 44.1 KHz audio in the computer industry.

DIGITAL DATA - Data in digital form. All data that are entered into the computer are then in digital form.

DIGITIZE - Converting an analog or continuous signal into a series of ones and zeros, i.e., into a digital format. To convert an image or signal into digital code for input into the computer. It includes scanning an image, tracing a picture on a graphics tablet or converting camera images. 3-D objects can be digitized by a device which uses a mechanical arm that is moved on and around the object. Sound, temperature and movement are also said to be digitized when they are converted into digital code.

DOS - Disk Operating System. DOS is the software that organizes how a computer reads, writes and reacts with its disks - floppy or hard - and talks to its various input/output devices, including keyboards, screens, serial and parallel ports, printers, modems, etc. The most popular operating system for PCs is MS-DOS from Microsoft.

DRAW - Direct Read After Write. Refers to a recordable optical disc. See WO (Write Once).

DV I - Digital Video Interactive. DVI is a compression/decompression algorithm. Now owned by Intel, the technology is used in training and educational applications. It allows for full motion video and is available as an add-on board to be installed in an IBM compatible personal computer. Since DV I is only a CODEC, the data can be stored on any media type but is commonly stored on a compact disc in CD ROM format since CD ROM can store up to 650 megabytes.

ECC - Error Correction Code. In computers, rules of code construction that facilitate reconstruction of part or all of a message received with errors.

EDC - Error Detection Code.

ELECTROFORMING - A means of creating a metal master (father) disc by electroplating nickel, onto the glass master until a sheet of nickel has been built up to a usable thickness. The father can then be used in the same system to create a mother, and from the mother, stampers or metal parts that are used in the injection molding machine to manufacture the CD.

EXABYTE Tape-DAT System for recording/reading digital data using 8 mm video cassettes. A preferred medium for sending data to CD manufacturers.

FATHER - The first electroformed part made from a GLASS MASTER. See METAL MASTER.

FORMAT - The layout or organization of data. Also the physical MEDIUM on which the data are recorded, i.e. 8mm Exabyte, 9-track tape, etc.

FRAME - In video, the information (or time) required for one complete picture, (i.e. 1/30 of a second for NTSC) to view. Motion video is viewed at 30 frames per second; CD viewed at 1/75 of a second. Often confused, the frames of CD and the frames of video are not related.

GLASS MASTER - The medium on which manufacturers record data as the first step leading to the replication process. Consists of a glass disc larger than replicated discs, coated with photosensitive material in which the data are recorded by a laser beam recorder. (laser light)

HIGH SIERRA - The first draft proposal submitted to International Standards Organization for common file structure for CD ROM. When it became adopted, it was changed in minor ways and became known as ISO 9660.

IMAGE - In CD ROM, the data assembled in the exact form wanted on the replicated CDs, i.e., completely mastered or image ready.

INDEX - Searchable points within a track or multiple tracks. Up to 99 indices can be encoded within one track, so that up to 9801 searchable points can be encoded on one CD.

INJECTION MOLDING - A process for replication of CDs wherein molten plastic is injected into the cavity of a mold under pressure, cooled and removed as a solid, clear plastic disc. The data information is transferred to the plastic in this process from the "stamper".

ISO 9660 - a widely used file format for CD ROM. The ISO 9660 (formerly High Sierra) standard defines a directory structure which has been accepted by the International Standards Organization. This standard, supported by Microsoft in the MS/DOS Extensions, allows ISO 9660 formatted CD ROM discs to be read like a DOS write-protected hard disk. Formatting a CD ROM to this standard will allow CD ROM interchange on any platform that supports the ISO 9660 standard.

LABEL - In CD manufacturing, the printing is on the disc itself. Printed either by screen, pad or offset printing methods.

LEAD IN - On a CD, the area at the beginning of a disc where the Table of Contents (TOC) is recorded. The TOC contains a listing of where the tracks start. On a master tape, the area at the beginning of the tape which is recorded with Os (digital silence/video black) is a precursor to the user information to be recorded on the disc.

LEAD OUT AREA - A buffer area after the last track on a disc in case the player reads past the last track. When the player reads the lead out code, it either goes back to the beginning of track #1 or it stops playing, depending on how the player has been programmed or set.

MASTER - (verb) In compact disc manufacturing, the recording of the original media (glass) in preparation for making replicates (copies). (noun) In audio, the final recording (usually tape) to be used as a source for mastering. In CD ROM, the final recording of the desired CD ROM IMAGE to be used as a source for mastering; this may be on tape, magnetic disc, optical disc (M-O or W-O), etc.

MASTERING - The process of encoding input data (created during Premastering) to the compact disc standards and recording this information as a series of pits, in a light sensitive layer on a glass substrate.

METAL MASTER - The first electroformed part from a GLASS MASTER. See FATHER.

METALIZING - A process by which a thin metal coat (usually aluminum) is deposited on the clear plastic disc after it has been injection molded. The usual process is by sputtering, although vacuum vapor deposition or wet silvering can be used.

MICROSOFT CONFERENCE - The first conference/convention of CD ROM and MULTIMEDIA users, designers, publishers and manufacturers usually taking place in Feb./March. In 1993 the conference name was changed to "Intermedia" to reflect the addition of Multimedia.

MIDI - Musical Instrument Digital Interface. CD ROM can be used to store music samples which can then be accessed via MIDI and used to compose/record musical programs.

MIXED MODE - A CD which contains more than one type of track, i.e. computer data in track #1 and audio data in track #2.

M-O - Magneto-Optical. Rewritable (erasable) optical discs. 5 1/4" in size.

MOTHER - A metal part electroformed from the father, used for making stampers.

MULTIMEDIA - Term used to describe the use of more than one medium in a program or system. For example, use of audio, video, graphics, animation, computer data, etc., together. Historically, video has been considered separate from audio only (CDs, records, tapes) and computers separate from video and audio. Multimedia means the joining of any two or more of these. Multi-media computers playback high quality sound and video as well as text and graphics. Multi-media itself combines multiple forms of media in the communication of information between users and machines.

NTSC - National Television Systems Committee is the color television standard for the United States, Japan, Canada, Mexico, Taiwan and others (30 frames per second). European and South American countries have generally used another standard known as PAL. France uses a separate standard known as Secam.

NINE-TRACK TAPE (9 TRACK) - Half inch computer tape on reels. Used as a physical medium for sending data to CD manufacturers. Often being replaced today by 8mm Exabyte, DAT or CD WO disks.

ORANGE BOOK STANDARD - The standard for the recordable compact disc. The standard has two parts, one for M-O (rewritable) and one for W-O (write once).

OS-9 - The real time operating system used in CD-I.

PAL - Phase Alternation Line. 25 frames per second. The television standard used in most of Europe (except France) and South America. See NTSC.

PCM - Pulse Code Modulation. A standard method for encoding audio in a digital format at 44.1KHz. See ADPCM.

PHOTO CD - A development from Kodak. Photographs and/or 35mm slides, can be scanned, digitized and recorded on the PHOTO CD and then played back through CD ROM X/A, PHOTO CD Player, CD-I players or Photo CD compatible drives and displayed on a TV set or computer monitor. Each disc can contain 100 photos. The photos can also be printed out on regular photographic print paper by a special Kodak machine for high

resolution prints. In order to accommodate the different resolutions available for playback or printing, the format contains the picture in 5 different resolutions. It is also used in professional markets to store or archive photographs.

PIT (PITS) - Information spots on a CD (or optical disc). Pits are formed in a photosensitive layer on a **GLASS MASTER** by exposure to laser light. Exposed material washes away in the developing process to form a pit. A succession of pits comprises the **TRACK**. On a CD, the track is a spiral beginning at the inside of the disc and spiraling outward.

PORT- Move from one file structure, operating system or file format to another.

POST GAP - An area or time after the ending of a track (2 seconds in CD ROM). To meet the Yellow Book standard, this gap must be two seconds.

PRE GAP - An area or time before the beginning of a track.

PREMASTERING - Preparing the digital data to send to the CD manufacturer for mastering and replication. The data is assembled as a contiguous image the way it should appear on the CD ROM, including the file structure (such as ISO 9660). Disc manufacturers usually have hardware and software to premaster for customers, at an additional price.

PROGRAM AREA - The area within a track, on the disc where the user information (program) is stored.

PROOF DISC - A CD for testing. Usually refers to a ONE OFF, CD WO or CD R disc, but can also refer to one or more discs from a replicated group submitted for testing. Can be used as input for disc manufacturing.

PROTECTIVE COATING - A coating of lacquer or polymer deposited over the metal coating on a CD to protect and seal the metal layer. The most common method is spin-coating of a UV curable polymer over the surface of the metalized disc and then passing it under ultra-violet light to polymerize or cure it.

R-DAT - Same as DAT.

RED BOOK STANDARD - see CDA. CD Audio. As the CD standards were set by Philips & Sony, they were published in a book with a red cover, which became known as the **RED BOOK** for audio.

RIFF - Resource Interchange File Format. A multimedia format specification which allows graphics, audio, animation and other information to be stored in a common, platform-independent fashion.

ROM - Read Only Memory. Computer memory which can only be read. New data cannot be entered and the existing data are non-volatile. This means they stay there even when

power is turned off. A ROM is a memory device which is programmed at the factory and whose contents thereafter cannot be altered.

RTOS - Real Time Operating System. See OS-9.

SCSI - Small Computer Systems Interface. Pronounced "SCUZZY". An interface system for connecting peripheral equipment to computers.

SMPTE TIME CODE - A video time-code scheme of the Society of Motion Picture Television Engineers, used to mark the hours, minutes and frames of a program recorded on video tape thus: 00:59:22:06 would be 0 hours 59 minutes 22 seconds and 6 frames. In NTSC video there are 30 frames per second, so one frame equals 1/30th second. This time code is recorded on audio track 2 for CD master tapes in the Sony 1630 format.

STAMPER - A metal part electroformed from the mother. The stamper is inserted into the mold cavity to become one side of the cavity. "Stamper" is a misnomer inherited from the phonograph record industry. CDs are not stamped, but are injection molded.

SUBCODES - Codes used in the CD format, labeled P,Q,R,S,T,U,V,W. The P&Q codes are used for Table of Contents information. Exclusive uses of the R through W codes are not specifically defined but can be and have been used to encode graphics information (CD+G) which can be displayed on a video monitor. A special player must be used to read the subcode information and decode it. CD +G audio players connected to a TV CD I or Sega CD can access this information.

SUBSTRATE - The main physical body of a disc, on which other coatings or layers may be added. Compact discs are made of polycarbonate plastic, coated with metal, then coated with a UV curable polymer. A label is then printed. The polycarbonate is the substrate.

TAR - (TAR format) - Tape Archive and Retrieval. A file scheme to produce tapes on one system which are readable on other systems. For example, UNIX and XENIX systems can read tapes produced by an MS-DOS TAR program.

TIFF - Tagged Image File Format. A popular format used to capture graphic images. TIFF stores images in a bit-mapped (raster graphics) format.

TOC - Table of Contents. This is information located in the lead-in area. The TOC contains a listing of where tracks start on the disc, as well as indications to the player as to what kind of disc it is, ROM, audio, etc.

TRACK - In audio each recorded "song" is referred to as a track. In a CD ROM, which contains computer data only, there is only one track. If the CD ROM is MIXED MODE, or contains both audio and computer data, the CD can contain a track of computer data and also other tracks of audio. The CD format provides for up to 99 tracks. "Track" sometimes refers to the line of information put on a CD, as in "TRACK PITCH". See PIT.

TRACK PITCH - The physical distance between two rows of information pits, center to center. In CD the specification of track pitch is 1.5 to 1.7 microns. Most discs are recorded with a track pitch of 1.6 microns.

TURNAROUND TIME - The time required for CDs to be mastered, made and shipped, measured from the time premastered data, artwork and other materials are in the hands of the manufacturer.

UNIX - An immensely powerful and complex operating system for computers. UNIX is developed, marketed and trademarked by AT&T. It needs a computer with a large amount of RAM memory to support its power. It has been used extensively in universities, and it only now emerging onto the business scene. UNIX allows a computer to handle multiple users and multiple programs simultaneously. This means you can often take applications software which runs on UNIX and move it to a bigger, different computer or to a smaller, different computer. This process of moving programs to other computers is known as "porting". UNIX was developed in 1969 by Ken Thompson at AT&T Bell Laboratories.

USERS DATA - All the data on the CD ROM available to the end user. Not included are Sync, Header, EDC and ECC, etc.

VOLUME - In CD ROM a single reel of master tape, especially when 9-TRACK tape is used as a master source medium.

VOLUME DESCRIPTOR - An area at the beginning of a CD ROM reserved for the recording of information about the origination, originator, copyright, etc.

W-O - Write Once. Recordable optical disc. Can be recorded on, but not changed or erased. See WORM.

WORM - Write Once, Read Many. See W-O.

YELLOW BOOK STANDARD - When the standards were set by Philips and Sony for CD ROM, they were published in a book with a yellow cover.