RIGID DISK DRIVE HEAD AND MEDIA GLOSSARY

SCOPE

This glossary is intended primarily for engineers involved in disk drive design, evaluation and usage. It defines terns either unique to disk drives (example: Cylinder Zero) or terms used in a unique manner in disk drives (example: Resolution). It does not attempt to define terms used in disk drives that are correctly used in a disk drive application {example: volt).

REFERENCED STANDARDS

TO BE DETERMINED

CONVENTIONS

Words that are capitalized indicate that they are terms defined elsewhere in the glossary.

ABBREVIATIONS

1F	First Frequency
2F	Second Frequency
ABS	Air Bearing Surface
AGC	Automatic Gain Control
ATI	Adjacent Track Interference
BPI	Bits Per Inch
Br	Remanent Flux
CPU	Central Processor Unit
CRC	Cyclical Redundancy Code
DASD	Direct Access Storage Device
Dx, Dy	Read Signal
ECC	Error Correction Code
EDAC	Error Detection and Correction
ENDEC	Encoder/Decoder
ERP	Error Recovery Procedure
ETW	Effective Track Width
FCI	Flux Changes per Inch
FDD	Flexible Disk Drive
FRPI	Flux Reversals Per Inch
FM	Frequency Modulation
FXD	Fixed Disk Drive
HAA	Head Arm Assembly
Hc	Coercive Force

ABBREVIATIONS Cont.

Hd	Demagnetizing Force
HDA	Head Disk Assembly
HDD	Hard Disk Drive
HDI	Head-Disk Interference
HF	High Frequency
HGA	Head Gimbal Assembly
HSA	Head Stack Assembly
ID	Inner Diameter
ISI	Intersymbol Interference
ISV	Instantaneous Speed Variation
LE	Leading Edge
LF	Low Frequency
Mr	Remanence
Mb	Megabit
MB	Megabyte
MFH	Modified Frequency Modulation
MFRS	Million Flux Reversals per Second
MMFM	Modified Modified Frequency Modulation
MTBF	Mean Time Between Failures
MTS	Million Transistiors per Second
MTTR	Mean Time to Repair
NRZ	Non-Return to Zero encoding
NRZI	Non-Return to Zero Inverted encoding
OD	Outer Diameter
Oe	Oersted
OEM	Original Equipment Mbnufacturer
OU	Overwrite
PES	Position Error Signal
PWxx	Pulse Width at xx% Amplitude
PLL	Phase Locked Loop
RES	Resolution
RPM	Revolutions per Minute
RLL	Run Length Limited
RVA	Runout, Velocity (of Runout), Acceleration (of Runout)
TAA	Track Average Amplitude (Obsolete)
TE	Trailing Edge
TFH	Thin Film Head
TFM	Thin Film Media

ABBREVIATIONS Cont.

TIR	Total Indicated Reading
TPI	Tracks Per Inch
TVA	Track Varying Amplitude (Obsolete)
TU	Track Width
Vta	Track Average Amplitude (Preferred)
Vva	Voltage, varying amplitude
VCM	Voice Coil Motor

DEFINITIONS

-A-

Acceleration - The rate of change of velocity with respect to time. The second derivative of position. In media testing, the term most often refers to the rate of change of axial or radial runout velocity, with the concern being head disk interference.

AC Erase — see Erase.

Access — Refers to the process of obtaining data from, or placing data into, a RAM or disk storage device.

Access Line — The line along which a head gap moves to access the tracks of a disk.

Access Time — The delay between the issuing of an access command and the instant that the target data may be read or written.

Acicular — Needle shaped; used to describe the shape of oxide particles.

Acicularity — The ratio of the major and minor axes of a magnetic particle.

Actuator — A mechanical device for producing motion and/or maintaining position, of the read/write heads in a disk drive.

Additive — Any material in the coating other than oxide and binder resins.

Address — A number, generally binary, distinguishing a specific member of an ordered set of locations. In disk engineering, the set may consist of drives (unit address), radial positions (cylinder address) or circumferential positions(sector address).

Adjacent Track Interference — The amount of interference from adjacent track signals relative to a given track, caused by fringing effects and gap width in various combinations of on and off track conditions.

Agglomerate — A defect on the surface of an oxide disk caused by coating buildup.

Air Bearing — A thin layer of compressed air between moving media and a recording head. Air bearings which rely on boundary layer air moving with the medium are called self-actuating or hydrodynamic.

Air Bearing Surface — The highly polished surface of a flying head on which pressure is exerted on to lift the head. This also usually is the surface of the head that comes into contact with the disk, should that occur.

Alternate Track — A spare track used in the event that a normal track becomes damaged or is unusable.

Analog Test — Method of evaluating heads and/or media using the analog read signal.

Anisotropy — Variation of a property of matter as a function of direction. In disk engineering, the term most often refers to the difference between "hard" and "easy" axes of magnetization which arise from the orientation of acicular magnetic particles in an oxide disk coating.

Areal Density — Number of bits stored per unit area of storage media surface. The product of the circumferential ("linear" or "bit") density and radial ("track") density of magnetic recording in a given disk drive.

Asperity — A peak on an otherwise smooth surface, especially one on a disk which may cause head-disk interference.

Asymmetry — A distortion of the readback signal which is shown in different intervals between the positive and negative voltage peaks.

Automatic Gain Control — An electronic mechanism which maintains at its output a fixed-amplitude replica of some varying-amplitude signal applied to its input. Such circuits are characterized by their "attack" and "decay" times, the former giving the time for the circuit to respond to an increasing, and the latter to a decreasing, input signal.

Auxiliary Memory — Memory other than main memory. Generally a mass-storage sub-system containing disk and tape drives.

Average Access Time — The average time to make all possible length accesses (seeks).

Axial Runout — The vertical departure of a rotating disk from an imaginary surface normal to the rotational axis of the disk, measured at a given radius.

Axial TIR — See Axial Runout

Axial Waviness — The difference in distance from a reference plane measured to the surface of the disk at two points which are separated by a defined distance on a circle of a given radius.

Azimuth - The angle between the centerline of the head gap and a line through the center of rotation of the disk and the center of the head gap.

-B-

Backup File — The file copies made on removable media (either disk or tape) and kept to ensure recovery of data lost due to equipment failure, human errors, updates, disasters, etc.

B-H Loop — The operating characteristic of applied field versus the retained magnetism in a magnetic material.

Binder — The nonmagnetic portion of an oxide coating which holds the magnetic particles in place.

Bit — The fundamental unit of information, often used loosely to refer to a circuit or magnetization state at a particular instant in time. The word bit is derived from a contraction of the words “binary digit”.

Bit Cell — In encoded data, the time or distance unit representing one bit. Often the actual value of the bit depends in part on the contents of adjacent cells and the recording code in use. In MFM encoding, for instance, a bit cell is comprised of both a clock and data window.

Bit Crowding — See Pulse Crowding.

Bit Density — See Linear Density.

Bit Error Rate — See Error Rate.

Bit Jitter — See Transition Jitter.

Bits per Inch — A specific measure (unit) of linear density.

Bit Shift — See Peak Shift.

Blank — The beginning of a rigid disk substrate. The surface finish is rough and the dimensions are larger to allow for finishing operations.

Bleed Holes — Used in some older (IBM 2311, 2314) flying heads to allow lower, stable flying heights.

Blending — This is a technique that rounds the sharp edges of a slider, making it less prone to damaging the disk surface during manufacture, use and transport.

Block — A group of bytes handled, stored and accessed as a logical data unit, such as an individual file record.

Bulk Erase — The process of erasing a magnetic media by placing it entirely in a high intensity magnetic field, contrasted with erasing a track at a time.

Buried Servo — A closed loop head positioning system using two layer media. The lowest thick layer of high coercivity material stores permanent low frequency servo information. The top (thin) layer is used for high frequency read/write data.

Burnish — To polish a disk surface so as to remove or minimize asperities.

Bus — A collection of functionally parallel electrical conductors and connection points that forms an interconnection between functional blocks in a digital device.

Burr — A thin raised rough edge of material commonly on the ID and/or OD of disk substrate.

Byte — An ordered collection of bits treated as a unit. Most often, a byte is understood to consist of eight bits.

-C-

Capacity — The amount of data, usually expressed in bytes, which can be stored in a given device or portion of same.

Cartridge — A protective enclosure usually containing one removable rigid disk.

Certifier — An electromechanical device for measuring the magnetic recording properties of disks, more especially the location and extent of surface defects.

Chamfer — A term that describes the geometry on the outer/inner edge of a disk substrate that has a radius or non-perpendicular angle.

Channel — A collection of electronic circuits used in the process of writing and reading information to and from magnetic media.

Character — An ordered collection of bits representing one of a set of predefined symbols. Often the term is used interchangably with byte, but this is inexact.

Check Bits — See Parity Bits.

Clamp Force — The specified physical force (pressure) exerted to the surface of the substrate in a designated area.

Closed Loop — See Closed Loop Servo.

Closed Loop Servo — A servo control technique that uses position feedback to correct off-track errors. See Track Following Servo.

Clamping Area — The designated area near the inner diameter of the disk which has a force applied to secure it to the spindle.

Coating — 1) The magnetic layer, usually oxide, that is applied to the substrate. 2) The thin protective layer applied to thin film media.

Coercivity — A measure of the amount of applied magnetic field (of opposite polarity) that is necessary to restore a magnetized material (or media) to a state of zero magnetism.

Coercive Force — Symbolized by Hc. The magnetizing force that must be applied to a magnetic material to reduce the residual field to zero.

Composite Bead — A head using a composite slider.

Composite Slider — A Winchester or Whitney technology flying head slider that is manufactured with the core glass bonded into a ceramic slider. This is contrasted to a monolithic slider.

Concentricity — The amount of variation of a point from its nominal distance around an axis of rotation. The distance separating the center of the substrate hole from the center of the outside radius.

Contamination — Undesirable material that any cause either magnetic degradation or head crashes in an HDA.

Contour — 1) The deviation from perfect flatness of the ABS of a slider. 2) A map of media surface variations.

Controller — An electronic device for connecting one or more mass storage peripherals (rigid disk drives, tape drives, optical disk drives) to the input/output circuits of a host computer. Controllers vary in complexity, with more sophisticated units able to buffer and schedule commands, correct data errors, and bypass media defects without host intervention.

Core — The central magnetic conductor in a magnetic head. Usually a “ring” style for longitudinal recording.

Core Assembly — The combination of parts that make up a multi-part core.

Core Recession — The distance of the core face or gap edges below the face (or ABS) of a head.

Core Tip — See Throat Height.

Core Width — The finished width of a solid or laminated core, which is almost the same as Effective Track Width.

Correctable Error — An error that can be overcome by the use of Error Detection and Correction.

Crash — See Head Crash.

Crash Stop — A mechanism that limits the motion of the Actuator either at the extreme ID or OD.

Crown — A Slider Contour with a front to back direction.

Cross Curve — A Slider Contour with a side to side direction.

Cross Talk — The unwanted injection of a signal into a circuit from another one because of physical proximity. In disk drives this can be either electrical or magnetic in nature.

Cyclical Redundancy Code — A type of error detection code.

Cylinder — On several disk surfaces sharing a common rotational axis, the aggregate of tracks at a given radial position.

Cylinder Zero — Typically the outermost cylinder in a drive that can be used for data storage.

-D-

Data — An ordered collection of information. In a specific case it is the information written and read from a disk drive.

Data Separator — An electronic circuit which decodes playback data and produces separate clock and data bits. Sometimes incorrectly used to denote a data synchronizer.

Data Synchronizer — An electronic circuit producing a clock signal that is synchronous with the incoming data stream. This clock signal is then used to decode the encoded Readback Signal into user data.

Data Transfer Rate — The rate that digital data is transferred from one point to another. Commonly expressed in either bits/second or bytes/second.

DC Erase — The method of Erasing a track using a DC arise/erase current through either a Read/Write or Erase head.

Decoder Clock Input Signal — A digital clock train, either (1) the same signal as PLL Output or (2) an input signal by which the read decoder circuitry may be stimulated.

Decoder Data Input Signal — A digital pulse train, either (1) the same signal as Pulse Detect (q.v.) or {2) an input signal by which the read decoder circuitry may be stimulated.

Dedicated Landing Zone — A designated radial zone on the disk where contact starting and stopping occurs by design.

Dedicated Servo — A servo scheme in which a prerecorded pattern on an otherwise unused disk surface provides position information to the servo circuitry by means of a head reading that surface.

Defect — A magnetic imperfection in a recording surface.

Defect Management — A general methodology of avoiding data errors on a recording surface by avoiding the use of known bad areas of the media. Usually defective sectors or tracks are retired and data are written in alternate locations. Several algorithms are possible such as “sector slipping”, or “spare sector per track”.

Defect List — See Defect Map.

Defect Map — A list of defects that fall within a pass/fail criteria of a user. This list is usually used by an operating system or a disk drive controller for defect management.

Defect Skipping — A defect management scheme for avoiding surface defects. It has data written before and after the defect, instead of using alternate tracks or sectors to avoid use of the defective area.

Degauss — To neutralize the existing magnetic field in a magnetic material.

Demagnetizing Force — A magnetizing force applied in such a direction that it reduces the residual induction in a magnetized particle or object.

Detectable Error — A data error that can be found with either EDAC or other error detection method (such as CRC). This is contrasted to the situation where an error exists, but it is not detectable by the algorithm used.

Dibit — 1) A group of two bits which are isolated from other ones in time. 2) A disk drive servo pattern. The readback signal produced from a magnetic head which has a magnetic surface with two closely spaced magnetic transitions (usually from two adjacent servo tracks) passed under it. When the head is positioned exactly on track the electrical output of it will be first two pulses in one polarity, and then two pulses with the other polarity. The amplitude of the polarities is equal when the head is exactly on track.

Digital Magnetic Recording — A subset of magnetic recording that encodes the data on the magnetic medium in a digital binary manner.

Digital Testing — A method used to test file media by writing various digital patterns on the media and comparing the read data to what was written.

Directory — A listing of files maintained by the disk operating system that cross references file names and physical and/or logical storage locations.

Direct Access — See Random Access Memory.

Direct Access Storage Device — IBM term for disk memory unit.

Disable Guard Band Protection Signal — A digital input signal level, which overrides any internal protection against positioner movement into the guardbands.

Disc — See Disk.

Disk — A platter of non-magnetic substrate material with a thin layer of magnetic material that can hold localized magnetic charges.

Disk Drive — A device used to store and retrieve information by reading and writing data (actually flux reversals) on a magnetic disk.

Diskette — See Flexible Disk.

Disk Memory Device — See Disk Drive.

Disk Operating System — The master computer system program that schedules tasks, allocates the computer system resources, controls accesses to mass storage devices, manages files, and so forth. Typical disk operating systems include CP/M, AS-DOS, and UNIX.

Disk Pack — A number of disks packaged in a canister for removal from a disk drive.

Dispersion — A suspension of magnetic particles in the oxide coating.

Domain — A localized magnetized area in a magnetic material.

Domain Boundary — The edge of a magnetic domain.

Domain Hall — See Domain Boundary.

Double Frequency Encoding — Another name for FM encoding. This is because all possible data combination will result in only two possible temporal displacements of adjacent data bits, specifically “1F” and “2F”.

Down Head — A magnetic disk head which has its surface facing the base of the file.

Drive Tester — A device used to exercise and test a disk drive. Usually a “stand alone” item, that can be used independently of the computer system the drive is used in.

Dropin — See Extra Pulse.

Dropout — See Missing Pulse.

-E-

Early Bit — A bit that occurs before the center of the data window.

Early Window — A data window that has been intentionally shifted ahead in time.

Effective Track Width — The actual track width that is recorded on a magnetic surface.

Embedded Servo — A servo technique used for track following. Position information is prerecorded between data areas in a track so that a data head, and proper additional circuitry, can determine the data head location with respect to the center position of the track (or cylinder) in question.

Erase — A process by which a signal recorded on a medium is removed and the medium made ready for rerecording.

Erase Gate Signal — A digital input signal level, which causes erase current to be applied to a recording head. Applies only to drives that have separate erase heads or gaps.

Erase Gate Monitor Signal — A digital signal level which is active when erase current is applied to a recording head.

Erase Head — A magnetic head that is designed only for the erase operation.

Equalization — An intentional departure from response flatness to compensate for complementary characteristics introduced elsewhere in the disk. Can be implemented as either precompensation or postcompensation, which indicates respectively if it was core in the write or read operation.

Error — Information that, when retrieved from storage, is not correct.

Error Correction Code — A mathematical algorithm that can detect and correct errors in a data field. This is accomplished with the aid of Parity Bits added to the raw data.

Error Detection and Correction — See Error Correction Code.

Error Free — A recording surface that has no defects.

Error Rate — The number of errors (type must be specified) that occur in specified number of bits read.

Error Recovery Procedure — The specified process that occurs in response to a data error. In a drive without ECC this could include recalibration and reseeking to the specified track, and rereading the suspect data.

Extra Sit — See Extra Pulse.

Extra Pulse — Term used in surface certification. It is when a flux field discontinuity remains after the recording surface is erased, thereby producing an electrical output from a read head when it passes over the area containing the discontinuity. An Extra Pulse occurs when the electrical output is larger than a specified threshold.

-F-

Feedback — In a control system, the signal returned from a controlled process to denote its response to the command signal. Specifically in a disk drive, this signal is proportional to the amount of offtrack error the read/write head has with respect to the track.

Ferrite — A crystalline ceramic-like magnetic material made of oxides of iron and other metals such as zinc, manganese, and nickel used as the core material of a head.

Ferrite Head — A magnetic head that uses ferrite, as opposed to some type of metal, for forming the necessary magnetic paths.

Fetch — A read operation and its related data transfer operations.

File — A set of related records that are treated as a single logical unit in a mass storage device.

Filter output signal — See Read Chain Monitor.

Firm Error — A repeatable soft error.

First Frequency (1F) — The low frequency used in Head and Media testing, usually related to the frequencies used in the chosen Modulation Code.

Fixed Disk — A disk drive, usually rigid, that has non-removable media. Sometimes used incorrectly to indicate a rigid, fixed disk drive.

Fixed Bead — A head that does not move in relation to a track on the media, usually used in a fixed disk drive.

Flag — A term used to describe a track or sector on a disk that is unusable. A flagged track ia one that the computer will not access.

Flatness — The variation of a flat surface relative to a datum surface.

Flaw — See Defect.

Flaw Map — See Defect Map.

Flexible Disk — A circular magnetic media, usually enclosed in a jacket that has a non-rigid substrate material.

Flexure — A flexible piece of metal that attaches a read/write slider to a carriage assembly. It is designed to properly align the head in the plane of the media but still allow it to move in pitch, roll, and vertical [z] direction to follow variations in the media.

Floppy Disk — See Flexible Disk.

Flux — Lines of magnetic force.

Flux Density — The number of lines of flux, or maxwells, per unit area in a section normal to the direction of the flux, often measured at the head gap.

Flux Changes per Inch — A measure of linear density, specifically the number of magnetic flux reversals per inch measured along the recorded track.

Flux Reversals per Inch — See Flux Changes per Inch.

Flyability — A general figure of merit of how reliably a flying head is able to fly on a disk.

Flying Height — The amount of separation between the mean surface height of a disk and a magnetic head, typically measured at the read/write gap of the head.

Foam Pocket — An indentation on the surface of the substrate caused by finisher pads.

Format — The "housekeeping" information that surrounds data in a magnetic storage system to facilitate storage and movement of data in a computer system. This extra information usually contains location (track, sector) information and error correcting codes (ECC) or error detecting codes (EDC or CRC). The net effect of this is to reduce the actual data storage capacity of a magnetic medium.

Formatted Capacity — The actual capacity available to store data in a mass storage device. The formatted capacity is the gross capacity, less the capacity taken up by the overhead data used in formatting the media.

Formatter — A device or software that creates formatted tracks on a disk drive.

Frequency Modulation — A recording code. A flux reversal at the beginning of a cell time represents clock bit; a "1" bit is a flux reversal at the center of the cell time, and a "0" bit is an absence of a flux reversal.

Frequency Response — A measure of how effectively a circuit or device transmits the different frequencies applied to it. In disk drives this refers to the electronic read/write channel. It can also refer to the dynamic mechanical characteristics of a positioning system.

Fringing Flux — The extension of the flux in a field beyond the edges of a gap in a magnetic circuit. The fringing flux field is designed so that it will create recorded flux reversals on magnetic media. May occur both on track and adjacent to the track.

-G-

Gap — The space between the pole pieces of a magnetic head. Magnetic fields may either be produced or sensed by the gap when it is the part of a magnetic head.

Gap Depth — See Throat Height.

Gap Height — See Throat Height.

Gap Length — The measurement of the distance between the magnetic pole pieces in a core.

Gap Width — The distance along a gap that has core material on both sides of the gap. This is an optical/mechanical measurement used to estimate actual written magnetic track width.

Gap Skew — See Azimuth.

Gimbal — Part of the flexure that allows rotation.

Glide Bead — The head used for glide testing.

Glide Test — The process of testing a disk surface for the occurrence of head disk interference.

Guard Band — 1) The physical separation between adjacent tracks. 2) Refers to areas just beyond the user accessible regions on the disk. It is used to tell the servo system that it is beyond the usable area. See Inner and Outer Guard Band. 3) The delta between test criteria and specified criteria to assure compliance.

-H-

Hard Disk — See Rigid Disk.

Hard Error — An error that is not able to be overcome by repeated readings and/or repositioning means.

Hard Sectored — A technique where a digital signal indicates the beginning of a sector on a track. This is contrasted to soft sectoring, where the controller determines the beginning of a sector by the reading of format information from the disk.

Harmonic Distortion — Measured in Readback signals to determine asymmetry (even harmonics in the 1F signal) or Bit Crowding Peak Shift (third harmonic in the 2F signal).

Head — The device that contains a read core(s) and/or a write core(s) and/or erase core(s) which is used to produce or receive magnetic flux. Sometimes the term is all inclusive to mean the carriage assembly which includes the slider and flexure.

Head Crash — The inadvertent touching of a disk by a head flying over it (usually destroys a portion of the media, and therefore data, and/or the head).

Head Disk Assembly — The mechanical portion of a rigid, fixed, disk drive. It usually includes disks, heads, spindle motor, and actuator.

Head Disk Interface — The general term for the contact area between a head and the medium, either at rest (contact) or in motion (flying, start/stop).

Head Disk Interference — An occurrence of a flying head contacting a disk surface in other than the predetermined landing zone.

Head Landing Zone — See Head Loading Zone.

Head Load Force — The amount of force used to direct a head toward the media surface.

Head Loading Zone — Dedicated annulus on each disk surface in which heads are loaded, unloaded, or flying height is established. Head-disk contact may occur in some instances; typically no data is recorded in this area.

Head Positioner — See Actuator.

Head Select Signal — The signal(s) that is used to enable an individual head in a mass storage device.

High Frequency (HF) — The highest recording frequency used in a particular magnetic recording device. With FM or MFM channel codes this frequency is also called "2F".

Home Address Area — An error free portion of each track reserved for the recording of system addressing information.

Horizontal Recording — See Longitudinal Recording.

-I-

Index — 1) Similar to a directory, but used to establish a physical to logical location cross reference. 2) Used to refer to the once per revolution Index Pulse Signal.

Index Cylinder — See Cylinder Zero.

Index Pulse Signal — A digital pulse signal indicating the beginning of a disk revolution. Embedded servo pattern or other prerecorded information may be present on the disk when Index is active.

Inner Diameter — See Inside Diameter.

Inner Guard Band — An annulus of control information on the servo surface (or on a data surface in an embedded servo system) used to position the heads away from the spindle and into the servo zone.

Inside Diameter — The smallest diameter of 1) substrate 2) flyable zone 3) data zone.

Initialization — Applying input patterns or instructions to a device so that all operational parameters are at a known value.

Instantaneous Speed Variation — Short term change in the disk rotational velocity relative to the Read/Write Head.

Intelligent Peripheral — A computer peripheral device that has at least some embedded control functions.

Interface — The data transmitters, data receivers, logic and wiring that link one piece of computer equipment to another, such as a disk drive to a controller, or a controller to a system bus.

Interface Standard — An agreed upon [industry] specification to allow the exchange and interchange of computer equipment, as far as the device electrical interface in concerned.

Interrupt — A high priority request to a central processor unit for service.

Intersymbol Interference — Interaction between [adjacent] bit cells which may cause errors in data recovery.

Intrinsic Coercivity — The maximum value of the intrinsic coercive force corresponding to the saturation flux density for the material.

Intrinsic Coercive Force — The magnetizing field strength needed to reduce flux density from saturation to zero in a magnetic material.

Intrinsic Flux Density — In a sample of magnetic material, for a given value of the magnetizing field strength, the excess of the normal flux density over the flux density in vacuum.

Intrinsic Hysteresis Loop — A curve showing the relation between intrinsic flux density and magnetizing field strength, when the magnetizing field is cycled between equal negative and positive values.

Intrinsic Flux — In a uniformly magnetized sample of magnetic material, the product of the intrinsic flux density and the cross-sectional area.

-J-

Jitter — See Transition Jitter.

-K-

Kilobyte — 1,024 bytes.

-L-

Late Bit — A bit that occurs after the center of the data window.

Late Window — A data window that has been delayed in time.

Latency — A delay encountered in a computer when waiting for a specific response. In a disk drive there is both seek latency and rotational latency.

Line of Access — See Access Line.

Linear Density — The number of bit cells per unit distance as disposed circumferentially on a disk surface; a measure of recording compactness.

Linear Voice Coil Motor — A positioning motor similar to the voice coil in a loudspeaker. A motor that has no detent positions. The mechanical output of the motor is in a linear direction, both in and out.

Load — The force applied to the slider by the flexure in normal operation of the disk drive.

Load Force — In flying heads, the constant spring force provided by the suspension assembly to hold the slider toward the disk. The load force exactly matches the lift provided by the air bearing at the desired flying height.

Logical Address — A storage location address that may or may not relate directly to a physical location. Usually used to request information from a controller, which performs a logical to physical address conversion, and in turn retrieves the data from a physical location in the mass storage peripheral.

Logical Block Address — See Logical Address.

Logical Track — A track extending from index to index, dedicated to data information.

Loop — See Closed Loop Serve or Open Loop Servo.

Longitudinal Density — The number of information units per unit length. In magnetic recording this could be either bits per inch or flux reversals per inch.

Longitudinal Recording — Magnetic recording process with magnetization of the medium occurring in a direction essentially parallel to the line of travel of the medium with respect to the gap.

Low Frequency (LF) — The lowest recording frequency used in a particular magnetic recording device. With FM or MFM channel codes this frequency is also called “1F”.

Lubricant — A substance sometimes used in conjunction with, or in place of, a disk overcoat. It is used to insure damage free contact start-stops.

-M-

Magnetic Disk — See Disk.

Magnetic Flux — A condition in a medium, produced by a magnetomotive force such that, when altered in magnitude, a voltage is induced in an electrical circuit linked with the flux. The cgs unit of it is the Maxwell.

Magnetic Head — A transducer device that is used to write magnetic transitions on a medium, and to read those transitions back during the read mode. In some cases is also capable of erase operations.

Magnetic Media — A non-magnetic substrate material coated with a thin layer of magnetic material that can hold localized magnetic charges.

Magnetic Recording — The process of using magnetic phenomena to store and retrieve digital or analog data on a magnetic medium.

Magnetostriction — The alteration of magnetic field intensity of a particle or body by exerting force or pressure on it. Conversely, it also means the property of a material to expand or contract by changing the magnetic field it is exposed to.

Marginal Error — An intermittent Unrecoverable Error.

Maximum Intrinsic Flux Density — The maximum value, positive or negative, of the intrinsic flux density of a magnetic material.

Media — See Magnetic Media.

Megabyte — One million bytes. Actually is 1,048,576 bytes because of a computer's method of accessing memory.

Metal In Gap (MIG) — Commonly refers to the addition of a high saturation magnetization film to one or both of the pole faces of a ferrite core.

Metallic Media — Magnetic media whose magnetic layer is composed of a metallic film or metallic particles, as opposed to using an oxidized metal for the active magnetic elements.

Million Flux Reversals per Second — Specific measure of data transfer rate.

Million Transitions per Second — Specific measure of data transfer rate.

Mini — Composite Head - A read/write magnetic head utilizing a mini-composite slider.

Mini — Composite Slider - A composite slider that is approximately 2/3 the size of the original (full sized) version.

Mini-Monolithic Head — A read/write magnetic head utilizing a nini-monolithic slider.

Mini-Monolithic Slider — A slider that is approximately 2/3 the size of the original (full sized) version.

Minus-Even Tack — A magnetic surface that produces dibits with the leading pulse negative and the trailing pulse positive when read by a servo head.

Mis-Correction — when an ECC code operation corrects an error wrong, or corrupts correct data.

Missing Bit — See Missing Pulse.

Missing Pulse — A term used in surface certification. It is when a prerecorded pulse's read back amplitude is below a predetermined threshold.

Modified Frequency Modulation — Also called "three frequency recording". Recording code that only uses synchronizing clock pulses if data bits are not present. Doubles the lineal bit density without increasing the lineal flux reversal density, compared to Frequency Modulation.

Modified Modified Frequency Modulation — A recording code similar to MFM that has a longer run length limited distance

Modulation — A common term for amplitude modulation which is the variation of the readback voltage.

Modulation Code — A recording code, such as FM, MFM or RLL, to translate between flux reversals and bits or bytes.

Monolithic Head — A read/write magnetic head utilizing a monolithic slider.

Monolithic Slider — A Winchester technology slider that is composed entirely of magnetic ferrite, even for portions of it that are not part of the magnetic structure of the slider.

-N-

Noise — Any unwanted electrical signals that occur in the read/write channel.

Nonremovable Media — Fixed disk. Media that is permanently installed in a disk drive.

Non Return to Zero — A form of data encoding that is not self clocking, in other words it needs to be provided with an external bit cell clock signal.

Non Return to Zero Inverted — The same as Non Return to Zero encoding, except that it has inverted logical polarity from that method.

-O-

Oersted - A unit of magnetic field strength.

Open Loop — See Open Loop Servo.

Open Loop Servo — A head positioning system that does not use positional information to verify and correct the radial location of the head relative to the track. This is usually achieved by use of a stepper motor which has predetermined stopping points that corresponds to track locations.

Orientation Ratio — The ratio of the residual flux density in the circumferetial direction to the residual flux density in the radial direction.

Outer Diameter — See Outside Diameter.

Outer Guard Band Zone — An annulus of control information on the servo surface (or on a data surface in an embedded servo system) used to position the heads toward the spindle and into the servo zone.

Outside Diameter — The largest diameter of l) the substrate 2) the flyable zone 3) the data zone.

Overcoat — A protective layer applied over the magnetic layers in a rigid disk.

Overwrite — A measure of the ability of a magnetic system to write over data previously written.

Oxide Media — A recording disk which contains a coating of microscopic particles of ferric oxide dispersed in a liquid binder.

-P-

Packing Density — See Longitudinal Density.

Parallelism — 1) The condition of two planes or lines being parallel. Important in disk drives because a lack of it in mechanical assemblies can result in positioning inaccuracy. 2) Is the local variation in disk thickness measured independently of thickness itself.

Parity — A staple method of data error detection that always makes the number of bits in a word either odd or even.

Parity Bits — A generic term to denote the extra bit attached to a data word to effect error detection and/or correction.

Partial Erasure — See Stress Demagnetization.
Particle Orientation — The process by which acicular particles are rotated so that their longest dimensions tend to lie parallel to one another.

Particulate Media — Magnetic recording media which is made by use of small magnetic particles suspended in a binder, which is then coated on a substrate. This is contrasted to film or sputtered media.

Peak — The point in time when a readback signal is at its maximum absolute voltage output from the read head. This is related to the magnitude of the flux entering the gap from flux reversals on the recording surface.

Peak Shift - 1) The shifting in time of the zero-slope portion of a readback voltage from the values contained in the write current waveform. 2) Sometimes incorrectly used to describe bit jitter.

Peak to Valley — A measure of surface roughness. The maximum vertical distance of adjacent high and low points on the surface.

Peripheral Device — Auxiliary memory, displays, printer and other equipment usually attached to the computer system's CPU via controllers and cables.

Permeability — The measurement of the ease with which a material may be magnetized.

Perpendicular Recording — Magnetic recording process with magnetization of the medium occurring in a direction essentially normal to the surface of the media. Also sometimes called vertical recording.

Phase Locked Loop — A circuit whose output locks onto and tracks the phase (and therefore the frequency) of an input signal. Sometimes incorrectly called a data separator.

Phase Margin - 1) See Window Margin. 2) Measurement of stability in Servo System.

Physical Address — See Address.

Physical Head Address — A group of digital signal levels encoding the current head number to be used for reading, writing, or erasing. This signal group is useful where interface command buffering or automatic relocation over head boundaries is used.

Pinhole — Small hole occurring as an imperfection which penetrates entirely through a file layer.

Pit — An open void on the surface of a substrate or recording surface.

Pitch - 1) The distance between adjacent tracks (track pitch). 2) Angular rotation of the slider about the axis which is parallel to the plane of the media and perpendicular to the recorded track. Also can be stated as “nose down” “nose up”. Plated Media — Magnetic media that has its magnetic layer formed by electrochemical deposition.

PLL Input Signal — A digital pulse train, either (1) the same signal as Pulse Detect (q.v.) or (2) an input signal by which the read clock recovery PLL may be stimulated.

PLL output Signal — A digital clock train, locked during reading to the Pulse Detect signal or equivalent at some multiple of the read transition rate.

Pole Tip — See Throat Height

Plus Odd Tracks — A magnetic surface that produces dibits with the leading pulse positive and the trailing pulse negative when read by a servo head.

Polishing — A mechanical and sometimes mechanical-chemical operation used to remove small amounts of material leaving a smooth mirror like surface.

Positioner — See Actuator.

Position Error Signal — See Servo Error Signal.

Precompensation — See Write Precompensation.

Pulse Crowding — Modification of playback amplitude due to superpositioning of adjacent flux reversal fields being sensed by the read/write gap.

Pulse Detect — A digital pulse train in which (1) each leading or trailing edge or (2) each leading and trailing edge corresponds to a magnetic transition read from the disk. If transition qualification circuitry exists in the drive, this signal is the output of same. Syn.: Transition Detect.

Pulse Width — The duration of the pulse created by a change of flux from saturation in the opposite direction, measured at a predetermined percentage of the peak amplitude. (Typically 50%)

Pulse Write Data Signal — A digital input pulse train of which each leading edge causes a transition to be recorded on the disk.

-R-

Radial Bow — The measure of curvature relative to a flat disk, in a radial direction.

Radial Runout — The radial departure, in or out, of a rotating disk from an imaginary circle with a specified radius.

Radial Waviness — The difference in distance from a reference plane measured to the surface of the disk at two points which are separated by a defined distance described by a line in a radial direction at a given circumferential location.

Read — To sense the presence of flux reversals on magnetic media. Usually implemented such that a dynamic flux amplitude will cause a proportional electrical output from the transducer.

Read Chain Monitor Signal — A single-ended or differential signal carrying the output of the filters, equalizers, and other analog signal processing elements of the read chain, of which each zero crossing corresponds to a magnetic transition on the disk. This signal is usually applied directly to the pulse detector.

Read Gate Monitor Signal — A digital signal level which is active when the drive circuitry is recovering data.

Read Gate Signal — A digital input signal level which causes the drive circuitry to recover data.

Read Head — A magnetic head which is designed solely for the read operation.

Read Margin — See Window Margin.

Read Signal — A differential analog signal pair carrying the read signal voltage of a selected head after the first stage of preamplification. Syn.: Dx, Dy.

Read/Write Head — A transducer device that is used to write magnetic transitions on a medium, and to read those transitions back during the read mode.

Recalibrate — The action of moving the head of a disk drive to cylinder zero.

Record - 1) Write a magnetically encoded track on a disk.

Recording Density — See Linear Density.

Recoverable Error — A read error, transient or otherwise, falling within the capability of an ECC mechanism to correct, or able to be overcome by rereading the data in question.

Remanence — The extent to which a body remains magnetized after removal of a magnetizing field that has brought the

body to its saturation magnetization.

Remanent Amplitude — The average of the signal measured on an erased track.

Removable Media — Media that can be removed from the drive for use either at a later time in the same drive or in other similar drives.

Rerecord — To write data over a track that previously had data recorded on it.

Residual Flux — In a uniformly magnetized sample of magnetic material, the product of the residual flux density and the cross-sectional area.

Residual Flux Density — The magnetic flux density at which the magnetizing field strength is zero when a sample of magnetic material is in a symmetrically, cyclically magnetized condition.

Residual Noise — See Remanent Amplitude.

Resolution — In magnetic recording, the ratio of highest frequency readback signal divided by the lowest frequency readback signal.

Restore — See Recalibrate.

Retentivity — See Remanence

Rezero — See Recalibrate.

Rigid Disk — Non-flexible magnetic media. Usually requires a flying head.

Roll — Rotation of a slider about the axis that is parallel to the travel of the media. Long axis rotation of a slider.

Roll Off — Term given the corner (intersection) of two surfaces. In terms of a flatness measurement, usually where the surface changes by 5X is considered the edge limit.

Rotational Latency — The amount of delay in obtaining information from a disk drive attributable to the rotation of the disk.

Rotary Voice Coil Motor — A positioning motor that uses the same principle as a voice coil in a loudspeaker. The motor has no detent positions. The mechanical motion output of it is rotary.

Run Length Limited Encoding — A recording code. Various types exist, with different efficiencies and run lengths. Sometimes meant to denote “2,7 RLL” which can signify 1.5 times the bits as MFM, given the same number of flux reversals in a given lineal distance.

Runout — The amount of radial or axial deviation from a true path of a rotating object during a single revolution.

-S-

Sampled Servo — See Embedded Servo.

Saturation — The state of magnetism beyond which a material is incapable of further magnetization - i.e. the point beyond which the B/H curve is a straight line.

Saturation Current — The amount of write current needed to effect saturation in the media.

Second Frequency (2F) — The upper (high) frequency used in Head and Media testing. This usually also relates to the upper frequency of the chosen Modulation Code.

Sector — A logical segment of information on a particular track.

Sector Pulse Signal — A digital signal pulse which indicates the beginning of a sector. Embedded servo pattern or other prerecorded information may be present on the disk when Sector is active. Only present in hard sectored drives.

Seek — The act of moving a set of read/write heads so that one of them is over the desired cylinder.

Seek Complete Signal — A digital signal level which indicates that the positioner is not moving and is located over a cylinder or offset position.

Seek Time — The amount of time between when a step pulse or seek command is issued until the heads settle onto the desired cylinder. Sometimes is measured without settling time.

Self Demegnetization — The process by which a magnetized sample of magnetic material tends to demagnetize itself by virtue of the opposing fields created within it by its own magnetization. Self demagnetization inhibits the successful recording of signal components having short wavelengths or sharp transitions.

Self Erasure — The attenuation of a recorded signal by magnetostriction means affected by head media contact.

Servo Burst — A momentary servo pattern used in embedded servo control implementations, usually positioned between sectors or at the end of a track.

Servo Control — A technique by which the speed or position of a moving device is forced into conformity with a desired or standard speed or position.

Servo Error Signal — A signal in a servo control loop that is proportional to the difference between the current and desired position or speed.

Servo Head — A magnetic head designed for accurately reading (only) of servo information.

Servo Motor, Linear — See Linear Voice Coil Motor.

Servo Motor, Rotary — See Rotary Voice Coil Motor.

Servo Offset Signal — A group of digital input signal levels which cause the servo to position the heads off track by fractional amounts. Often In/Out or Plus/Minus are modifiers when two signals are used; Hub/Rim are preferred.

Servo Pattern — A readback signal that indicates the position of a head relative to a track.

Servo Position Signal — An analog voltage representing the instantaneous error in the head radial position. Syn.: Position Error Signal.

Servo Reference Clock Signa1 — A digital clock train locked to the rotational speed of the disk(s) at some multiple of the write transition rate.

Servo Surface — A recording surface in a multi-surface disk drive that only contains control information which provides timing, head position and track following information for the data surfaces.

Servo System — The head position control system in a disk drive.

Servo Track — A track on a servo surface.

Servo Track Writer — See Servo Writer.

Serve Wedge — A track following scheme that records position information just prior to the interface index pulse on one or more recording surface in a disk drive.

Servo Writer — A precision machine that records servo patterns on desired areas.

Serve Zone — An annulus of control information on the servo surface used to define the area of data tracks on the data surfaces.

Settling Time — The time it takes a head to stop vibrating, within specified limits, after it reaches the desired cylinder.

Slider — In a disk magnetic head, it is the portion of it that provides the air bearing surface.

Soft Error — An data error which can be overcome by rereading the data or repositioning the head.

Soft Sectored — A technique where the controller determines the beginning of a sector by the reading of format information from the disk. This is contrasted to hard sectoring, where a digital signal indicates the beginning of a sector on a track.

Spindle — The rotating hub structure to which the disks are attached.

Spindle Motor — The motor that rotates the spindle, and therefore the disks.

Sputtered Media — Magnetic disk or tape that has the magnetic layer deposited by sputtering means.

Stepper Motor — A motor that has known detent positions where the rotor will stop, with the proper control in some cases.

Stiction — The static friction between two surfaces when a moving force is applied.

Storage — Memory.

Storage Capacity — The amount of data that can be stored in a memory.

Storage Density — The compactness of data storage. In disk and tape drives it usually refers to areal density.

Storage Location — A memory location, identified by an address, where information may be read or written.

Straddle Erase — An erase technique that is used to erase the area between two adjacent tracks, where the erase gaps are perpendicular to the read/write gap.

Stress Demagnetization — The gradual erasure of recorded signals due to magnetostriction effects of the recording heads on the medium.

Strobe Offset Signal — A group of digital input signal levels which cause the read PLL and/or data decoder to shift the decoding windows by fractional amounts. Often Early/Late are modifiers when two signals are used.

Substrate — The structural material in magnetic media.

Super Pulse — A playback voltage peak that is larger than the recorded signal because of coincidental imperfection in the recording medium.

Supply Voltage Monitor(s) — Signal A group of analog signal test points carrying the power supply voltages for the drive. These are low-current sense lines which may be used to measure the supply voltages experienced by the drive exclusive of any voltage drops on the high-current supply lines.

Surface Analysis — 1) Examination of a recordable surface for magnetic defects. 2) Examination of a recordable surface for mechanical defects under dynamic conditions. 3) Examination of a surface for surface roughness.

Surface Analyzer — A machine that does a specific type of surface analysis.

Surface Roughness — The topography characteristics of a surface described, for example, by peak-to-valley variations about a reference datum plane.

Surface Total Indicated Reading - 1) Axial runout measured over the entire surface of the disk. 2) The total peak-to-peak variation perpendicular to the disk surface measured over the entire surface.

-T-

Tape Drive — Sequential access memory device whose magnetic media is tape in a cassette, cartridge or reel.

Taper — Difference in disk thickness between inner diameter and outer diameter.

Taper, Negative — The thickness at the outer diameter is greater that the thickness at the inner diameter.

Taper, Positive — The thickness at the inner diameter is greater that the thickness at the outer diameter.

Test Node — An operational mode of a disk drive that allows extra functions to be performed, even if they may cause harm to the drive. Used for diagnostic purposes.

Test Mode Enable Signal — A digital input signal level which commands the drive circuitry to enter test mode.

Texturing — The operation yielding a particular surface finish quality by surface scratching a smooth surface in a controlled manner with a known particle size.

Thickness — The absolute value of the difference between top and bottom disk surfaces independent of local minor variations.

Thin-Film Head — A magnetic transducer manufactured by deposition of magnetic and electrical materials on a base material, contrasted with prior art mechanical methods.

Thin-Film Media — Usually denotes sputtered or plated rigid media, but more precisely defines media that the thickness has been reduced to support increased recording density.

Throat Height — The height of the parallel core faces forming the gap. Measured perpendicular to the Air Bearing Surface along the gap faces starting at the surface adjacent to the Air Bearing Surface and ending at the Apex or point where the gap faces are no longer parallel.

Total Indicated Runout — See Runout.

Track — A path which contains reproducible information left on a magnetic medium by recording means energized from a single channel.

Track Average Amplitude — The mean time integrated amplitude of a single revolution track readback signal.

Track Density — The number of tracks per unit length, measured radially across the surface. The conventional unit is Tracks Per Inch (TPI).

Track Following Servo — A closed loop positioner system control system that continuously corrects the position of the head.

Tracks per Inch — A measurement of radial density.

Track Pitch — The center-to-center distance between adjacent tracks.

Track Positioner — That which affects track positioning.

Track Positioning — The method, both mechanical and electrical, used to position the heads over the correct cylinder in a disk drive system.

Track Spacing — See Track Pitch.

Track Width — The width of the track or stripe of data that is laid down on the magnetic medium.

Track Offset — See Serve Offset.

Track Zero Signal — A digital signal level which is active when the positioner is located at the first or reference cylinder. Syn.: Cylinder Zero (preferred).

Transition — The junction between zones of opposite magnetic orientation in recorded media.

Transition Detect Signal — See Pulse Detect Signal.

Transition Jitter — A signals deviation in time from its reference timing position.

Tribit — A servo or data signal using a group of three closely spaced bits.

Tunnel Erase — A erase technique that is used to erase the area between two adjacent tracks, where the erase gaps-are parallel to the read/write gap.

-U-

Uncorrectable Error — An error that is not able to be overcome with Error Detection and Correction.

Undetectable Error — A data error that is not sensed by either an error correction or error detection code.

Unformatted — Magnetic media with no control information written on it.

Unformatted Capacity — The raw capacity of a drive not taking into account the capacity loss due to storage of the format control information on the disk surfaces.

Unrecoverable Error — A read error falling outside the capability of an ECC mechanism to correct, or not able to be overcome by rereading the data in question, with or without repositioning the head.

Up Head — A head which has its surface facing away from the base of the file.

Velocity — The rate of change of distance with respect to time. The first derivative of position. In media testing, the term most often refers to the rate of change of axial or radial runout, with the concern being head disk interference.

Vertical Recording — See Perpendicular Recording.

Voice Coil Rotor — A positioning motor that uses the same principle as a voice coil in a loudspeaker. The motor has no detent positions. The mechanical motion output of it can be either rotary or linear.

Void — A location on the media were there is a lack of a coating either magnetic or protective overcoat.

-W-

Wedge Servo — See Servo Wedge.

Whitney Head — A successor to the original Winchester read/write head design. The primary change was to make the flexure smaller and more rigid. First used in IBH 3370/3384 DASD.

Whitney Technology — A method of constructing a read/write head in a rigid disk drive using a Whitney head. In all other details it is the same as Winchester technology.

Wiggle — A read signal distortion effect in thin-film heads relating to domain wall effects and/or saturation problems.

Winchester Drive — Originally meant to signify that the drive used Winchester technology, but many times it is used to mean it is a fixed disk drive, implementing either Winchester or Whitney technology in it.

Winchester Head — The read/write head used in Winchester technology drives. May be either a monolithic or composite type.

Winchester Technology — A method of constructing a rigid disk drive using concepts introduced in the IBH oodel 3340 disk drive. The primary changes from prior art technology was to lower the mass of the slider, use of a monolithic slider, radically changing the design of the flexure, ard having the slider come to rest on a lubricated disk surface when disk rotation ceases. In addition to the above, a totally sealed chamber containing the read/write heads and disks was used to protect against contamination

Window — See Bit Cell.

Window Margin — The amount of tolerance a read/write system has for Transition Jitter combined with Peak Shift at a specific Error Rate level.

Word — A number of bits, typically a multiple of eight, processed in parallel.

Write — The recording of flux reversals on magnetic media.

Write Precompensation — The intentional time shifting of write data to offset the effects of bit shift in magnetic recording.

Write Current Monitor Signal — An analog voltage representing the amount of write or erase current applied to the recording heads.

Write Fault Signal — A digital signal level indicating one or more of the following conditions: no write current during write or erase; write current out of range; absence of transitions during writing (may or may not be active during erase).

Write Gate Signal — A digital input signal level which causes the drive circuitry to record data.

Write Gate Monitor Signal — A digital signal level which is active when the drive circuitry is recording data.

-Y-

Yaw — Rotation of a slider about the axis that is perpendicular to the plane of the media. Side to side rotation.

-Z-

Zero Crossing Detector Signal — Signal produced by a zero crossing detector circuit when the differentiated input signal passes through its zero reference signal.

Zig-Zag Walls — The phenomenon that occurs in thin film disks where the transition wall forms a saw tooth pattern.