



## HDD Data Recovery Advanced Class

Duration: 3 Days

Prerequisites: Basic Knowledge of PC-3000

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### Learning Objectives:

- To know all of the firmware components of HDD and how they operate and interact.
- To understand how PC-3000 can be used as a tool to read and diagnose each component to determine the cause of the failure.
- To develop a strategy to fix the HDD based on diagnostic results gained from PC-3000 and specific design criteria of the make and model of the HDD.
- To work through various common scenarios of HDD failures and recovery procedures.

### Course Benefits:

Each **HDD failure and Data rescue is unique** but an organized plan can exist to ensure that the data is recovered. The course will show exact techniques and procedures to follow. The most **challenging aspect of data recovery is Vendor specific information**. As each manufacturer pushes the envelope to design superior HDD with larger and larger capacities, data recovery professionals need tools and knowledge to quickly solve problems they face to make the drive in front of them to work. Techniques and tools that work on one drive will not work on another HDD from a different manufacturer. Sometimes even different models of the same manufacturer have completely different design architectures.

### Course Content:

#### Day 1

#### Hard Disk Drives - Design principals and concepts:

- **Servo information:** Tracks locating, Heads fine positioning, Disk spin stabilization. Structure of servo data. Dedicated/Embedded servo. Embedded SPT/Constant density types. Servowriter requirements.
- **Track/Sector Data Format:** Synchronization Fields, Address Marker, ID Information, Data Field, Error Correcting Code (ECC), Gaps. Sector Interleaving.
- **Physical/Logical Geometry:** PCHS/LCHS/LBA addressing. Disk System Area (SA) - negative cylinders. Reserved Area. Zoned Bit Recording (constant writing density).
- **Defects Hiding:** Sector/Track/Cylinder/Zone/Heads tables. Types of remapping bad sectors: U-List/G-List/P-List. Importance of P-List for Data Recovery: LBA realignment.
- **Translator:** LBA addressing (LBA28/LBA48). Static/Dynamic translator types. Summary/Separate tables (Code+Data / Data: G-List, P-List, Zone Plan). Translator recovery procedures: Erasing, Copying, Regeneration.
- **HDD Firmware structure:** Embedded ROM. External flash ROM/NV-RAM. SA raw overlays. Adaptives. SA HDD OS. Standard/Safe modes.
- **Disk System Area:** SA copies: Main, Alternative, Factory. Modules Directory: ID, address, size. Module Header ID, CRC. Read/Write SA & modules. Error/Event Logs.
- **Recovery methods for damaged SA modules:** Using SA Copies. Repairing Modules. Copying modules from another drive. Reading with Ignore Reading Error. Modules Regeneration.
- **Recovery of critical SA modules:** U-List, G-List, P-List, Adaptives.
- **ATA registers:** Status Register, Error Register.
- **HDD configuration data:** Heads Map. Zone Plan. Sector Per Track (SPT). Adaptives: Production set, Single HDD. Host Protected Area (HPA).
- **Hot Swap:** System Area & User Data recovery. Success requirements: P-List, G-List, Firmware release dependencies.



- **Security Subsystem:** Master/User passwords. High/Maximum security. Unlock/Erase/Clear commands. Procedures to unlock an ATA drive.

## PC-3000 for Windows (PCI):

- **Product Overview:** General concepts. Application settings. USB terminal adapter. Customizing the application: Test Scripts. User Tests.
- **Database of firmware resources:** Profile folder/Database, Local/Remote servers, Data elements (Module/ROM/File, Hex edit, Profile), DB Import/Export/Backup, Element search.
- **Universal Utility:** HDD initial diagnostics. PCB test. HDD surface tests. Express & Complex tests. Security subsystem. Drive ID. SMART attributes. Resource editor. Defects tables: creating, loading, editing. HDD wipe/format.

## Day 2 & 3

### HDD vendor specific information and recovery procedures for ATA drives: Maxtor 3.5", Western Digital 3.5", IBM/HGTS 3.5"/2.5", Toshiba 2.5", Hitachi 2.5" (DK series), Fujitsu 2.5".

- **HDD Firmware structure:** Versioning/Compatibility. Configuration data. Microcode: ROM, Overlays. Adaptives.
- **ROM:** Data structure. Read/Write in Standard/Safe mode.
- **System Area:** Access to SA. SA copies. Modules Directory: RD, ID, CRC. Translator structure/regeneration.
- **Critical SA modules:** Unique, Release dependent, Model dependent. Modules recovery procedures.
- **PCB & Heads compatibility:** Swap requirements. Reprogramming Flash/NV-RAM.
- **Common failures, symptoms and recovery procedures**, such as "Maxtor N40P", "IBM clicking", "Slow Western Digital", "LBA realignment", etc.

### HDD vendor specific information and recovery procedures for Seagate 3.5" PATA/SATA and Seagate 2.5" ATA drives:

- **Terminal Commands:** Levels. Configuration commands. Loading objects from SA to RAM. Health Bits. Terminal Error Codes. USB terminal mode.
- **Firmware structure:** Embedded ROM, Flash ROM, Boot SA mode, System Sector (User Tracks Defect List), Boot Adaptives, App-code, CERT code/tables, Vendor track (DiskID, SMART, SN, etc), ATA overlay. Read/Backup Firmware.
- **ROM:** Read/Write, Compatibility, Common problems, SafeMode.
- **System Area:** Access by tracks/sectors. SA cylinder addressing: Safe & Standard modes. Firmware revisions. Common problems and recovery procedures. HDD SelfScan. Adaptives. SDDL firmware loading.

### PC-3000 for SCSI (optional section):

- **Product Overview:** General concepts. Application settings.
- **Universal Utility:** HDD initial diagnostics. PCB test. HDD surface tests. Complex test. Drive passport. Defects tables: PList/DList/GList, Formats (PCHS, Byte from Index, LBA), Hiding defects. HDD clone/format.
- **SCSI Error processing:** SRB Status, Host Adapter Status, Target Status, Sense Key, Additional Sense Code (ASC) and Additional Sense Code Qualifier (ASCQ). Error codes meanings: Data related & Hardware related errors.

### Questions & Answers session.