Maxtor

Drive families: Diamond Max VL40 (PROXIMA), D531X (NIKE), D536DX(VULCAN), Diamond Max Plus 60(RIGEL), D540-4D(ROMULUS), D541X(ATHENA), Fireball 3 (ARES 64K), Diamond Max Plus 16(FALCON), Diamond Max Plus 8 (N40P), Diamond Max Plus 9 (CALYPSO), Diamond Max 10 (SABRE)

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1. Purpose

The utility described herein is included into the PC-3000 for Windows hardware and software complex; it can be used for service maintenance of Maxtor drives. Basic repair capabilities:

- Correction of damaged data structures in drive service area
- Hiding physically damaged parts of drive surface using reserved space provided by the manufacturer
- Provision of access to disk surface using its actual physical coordinates (Cylinder, Head, Sector) and taking into account the translation tables created for Data Extractor software
- Removal of data protection password.

We have also reviewed repair methods for electronic boards of the drives as well as causes of specific malfunctions.

Attention! The drives described further have certain malfunctions, for which software repair methods may virtually exist. However, the methods are not implemented so far because of insufficiency of available information. E.g., loss of adaptive data on a completely functional drive (HDA and electronics board) makes its repair (and data recovery from it) impossible. Although utility developers took steps to decrease the probability of situations when data essential for drive functioning may be lost, still such cases may virtually exist.

All utility features have been tested with corresponding drive families. Please keep in mind, however, that some of the described drives are still manufactured and the manufacturer may modify them as needed. We cannot exclude completely the chances for production of drives using functioning algorithms incompatible with the utility. Utility developers track all changes introduced by the manufacturer in HDD FW and modify our software accordingly.

2. Basic options for repair of Maxtor drives

The described utility of the PC-3000 package for Windows is designed for work with ***D536DX***, ***D541X***, ***Diamond Max VL40***, ***D540-4D***, ***D531X***, ***Diamond Max Plus 60***, ***D541X***, ***Diamond Max Plus 16***, ***Fireball 3***, ***Diamond Max Plus 8***, ***Diamond Max Plus 9 HDD.*** It provides for the following repair operations:

- drive testing in techno mode
- restoration of the drive service data
- reading and recording of the drive's serial Flash ROM contents (if present)
- reviewing and checking of the service data structure (including the interactive mode)
- loading of a program for access to service data (*LDR file*)
- creation of an LDR file from functional or a non-functional drive to accomplish the match between the programs loaded and stored in the service area. A non-functional drive is can be started using any loader, which provides reading access to its service area
- reviewing the G-List and P-List tables of hidden defects
- addition of discovered defects to P-List or G-List
- translator regeneration
- modification of configuration parameters
- resetting of S.M.A.R.T. and error logs
- running and monitoring of a drive's self-testing routine.

3. Getting started

While preparing, please note the position of jumpers on the drive and PC-3000 PCI tester board. The utility functions in master mode. If the CSEL0 or CSEL1 jumper is enabled (depending upon the used port) on the PC-3000 PCI board, then it will also work in Cable Select mode provided that the same is enabled on the HDD being tested as well.

4. Architecture review of Maxtor HDD

4.1. Drive firmware

Maxtor drive firmware runs in RAM; it can be loaded from three sources. The first source is the masked ROM inside the processor chip (or internal boot ROM). The second source is Flash ROM (or external boot ROM) if it is installed, the third one is the drive's service area. Correct HDD identification and further work using logical sectors (LBA) require execution of the code stored in the electronics board with a subsequent reading and correct initialization of the code portion from the service area.

PCB firmware consists of two portions: masked ROM in the processor and an external parallel or serial Flash ROM. Such a scheme has been implemented most likely because masked ROM inside the processor cannot be modified without processor replacement. The processor is initialized from the external ROM. If the latter is missing or damaged, the firmware microcode will be started from ROM inside the processor. A situation is possible, when the microcode inside processor may belong to another drive family. E.g., CALIPSO drives with disconnected external ROM may be identified as N40P.

In Maxtor drives the service area is accessible through logical sectors specifically assigned for that purpose and called «UBA» (**U**til **B**lock **A**ddressing, somewhat similar to LBA), automatically converted by the microcode into respective physical location on disk surface taking into account the defects in the service area. The service area occupies the outer cylinders (disk edge) in half-size HDD and internal cylinders (closest to the parking zone) in full-size HDD.

Maxtor drives have a «safe mode» jumper. When it is enabled, only firmware stored on the PCB loads but the routine for starting motors and initialization of service data portion on disk is skipped. The «safe mode» jumper also influences the procedure of drive initialization in case, when an LDR file (or loader) is employed. Some initialization steps will be skipped. *That is why there is a difference between launch of an LDR file with the «safe mode» jumper enabled and disabled (see Fig. 4.1).* You can identify precisely the version of PCB firmware. In order to do so enable the «safe mode» jumper and launch the utility. The «Firmware» line will show ROM version. Besides, if you short-circuit the 5th and 6th contacts of the serial Flash chip at power-up, the version will change because doing so will force loading of firmware code from the processor. The alternative service area or ALT-SA is described in *section 4.5.*

Drive initialization for an operational condition requires complete replacement of the PCB firmware with the firmware copied from the service area on disk. If for any reason the firmware cannot be launched from the service area, the drive enters the «FAIL» state similar to «safe mode» because in both cases a drive is identified by an alias. To exit the «FAIL» state, you should load the whole firmware (ROM + overlays) to processor RAM using an LDR file. During the procedure. keep in mind that an LDR file contains just microcode (ROM copy and overlays) but it does not contain the data necessary for drive operation (defect lists, adaptive data and other settings). PCB microcode and firmware on disk have different versions. That difference helps to tell which version is currently being run by the processor. If the last character in version number is 'Z', it means that the initialization procedure has not been performed by the drive completely, e.g.: you may see WAK21R90 after a completely successful start and WAK21R9Z if the start has failed. In Poker/Ardent drive families the service area contains two programs for drive control

- program 1 consisting of modules: 38h, 39h, 4Fh;
- program 2 consisting of modules: 97h, 96h, 98h

Each of the microprograms exists in three variations denoted by the letters A, B or C in version number. E.g., in N40P drive family: NARxxxxZ, NBRxxxxZ and NCRxxxxZ. Version A is also assigned to boot ROM, but the actual program is totally different from the code recorded in the service area under the NARxxxxZ version.

Please note that different drive manufacturers (e.g., IBM, Samsung, etc.) approach loader objects from various viewpoints as regards the ideology behind their functioning. They are named identically because loader start is accomplished with all ATA drives using the DOWNLOAD MICROCODE (92h) command with the purpose of microcode update.

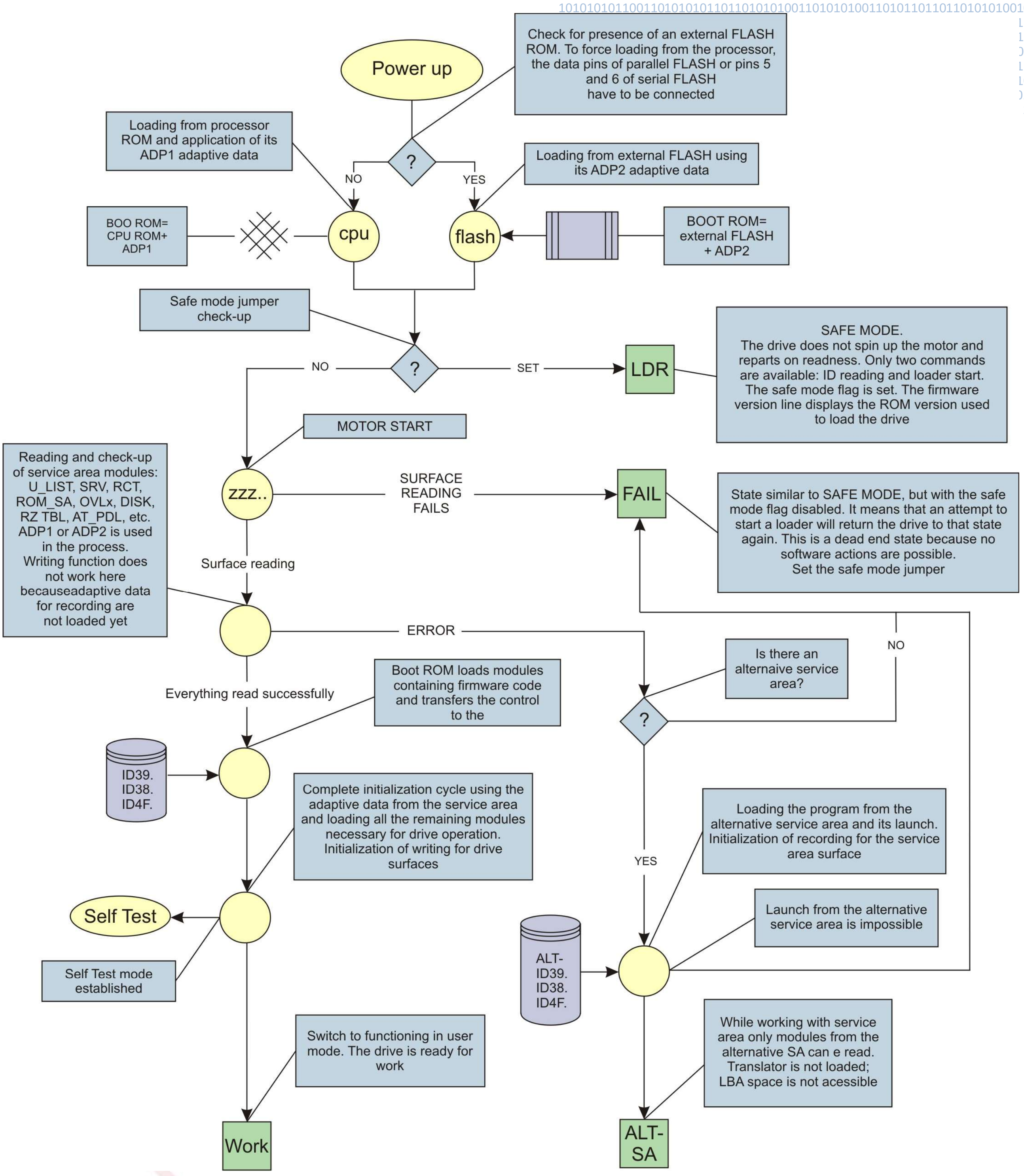

Power up
Check for presence of an external FLASH ROM. To force loading from the processor, the data pins of parallel FLASH or pins 5 and 6 of serial FLASH have to be connected
Loading from processor ROM and application of its ADP1 adaptive data
?
NO
YES
Loading from external FLASH using its ADP2 adaptive data
BOO ROM= CPU ROM+ ADP1
cpu
flash
BOOT ROM= external FLASH + ADP2
Safe mode jumper check-up
?
NO
SET
LDR
SAFE MODE. The drive does not spin up the motor and reparts on readness. Only two commands are available: ID reading and loader start. The safe mode flag is set. The firmware version line displays the ROM version used to load the drive
MOTOR START
Reading and check-up of service area modules: U_LIST, SRV, RCT, ROM_SA, OVLx, DISK, RZ TBL, AT_PDL, etc. ADP1 or ADP2 is used in the process. Writing function does not work here becauseadaptive data for recording are not loaded yet
zzz..
SURFACE READING FAILS
FAIL
State similar to SAFE MODE, but with the safe mode flag disabled. It means that an attempt to start a loader will return the drive to that state again. This is a dead end state because no software actions are possible. Set the safe mode jumper
Surface reading
ERROR
Is there an alternaive service area?
NO
?
Everything read successfully
Boot ROM loads modules containing firmware code and transfers the control to the
ID39. ID38. ID4F.
Complete initialization cycle using the adaptive data from the service area and loading all the remaining modules necessary for drive operation. Initialization of writing for drive surfaces
Loading the program from the alternative service area and its launch. Initialization of recording for the service area surface
YES
Self Test
Self Test mode established
Launch from the alternative service area is impossible
ALT- ID39. ID38. ID4F.
Switch to functioning in user mode. The drive is ready for work
While working with service area only modules from the alternative SA can e read. Translator is not loaded; LBA space is not acessible
Work
ALT- SA

Fig. 4.1. Maxtor HDD start chart.

4.2. Identification of firmware version

Firmware version is recorded on the main HDA label; it may look like: 6E030L0510202C (MODEL+HDA+PCBA+UNIQUE). The utility displays the line in the «Utility status» dialog *(see Fig. 4.2)* taking it from the [LABEL] PN=48h module. If the module containing version number cannot be read, the utility does not display it (replacing it with dots).

Now let us examine a case, when we have to pick a functional board as replacement for a burnt one. If you take another drive with the same version, you will notice that in some cases board compatibility is hard to guarantee. The likelihood of incompatibility between HDA and PCB both in case of version match or a mismatch is quite low for all

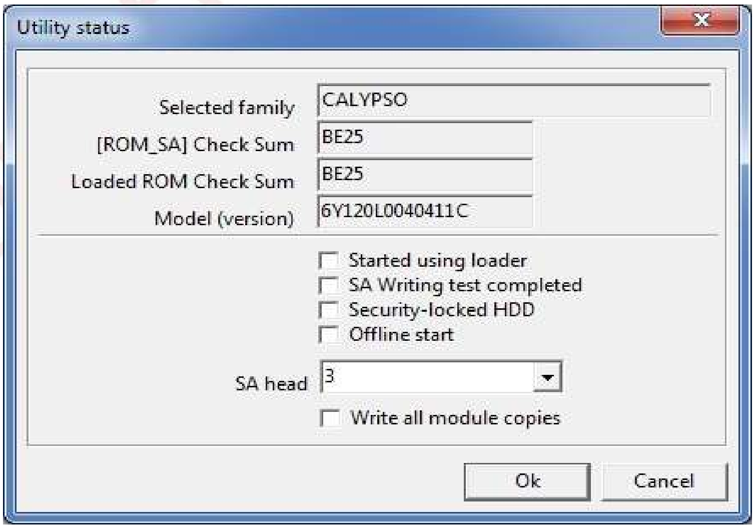
HDD models except for N40P and CALYPSO families. That is so because the settings recorded in (external or internal) boot ROM allow reading of the service area and as soon as the drive reads modules from that area it no longer uses the board settings. The situation is different with N40P and CALYPSO drives. In those two families the board settings play even more essential role while reading the information from the service area, although this does not exclude completely the likelihood of compatibility between different settings. The issue of board compatibility for N40P and CALYPSO is discussed in detail in *sections 9.11* and *9.12* respectively.

Now let us examine the situation when firmware version matches the version of the drive used as loader source. We have to note that the code is service area does not supplement ROM contents but actually replaces boot ROM completely. Other HDD manufacturers use other schemes, so for their drives other compatibility rules will apply. They employ an overlay structure meaning that there is a strict correspondence between ROM code and overlay on disk surface. If the firmware code and overlay belong to different versions, the mismatch will prevent a drive from starting. In case of Maxtor drives, there is no such correspondence. The manufacturing factory does not mark in any way the versions of firmware code (or rather adaptive data it includes) that a specific HDD can use. The problem of loader incompatibility is caused by presence of unique data in each loader, which results in the impossibility of passing its own initialization procedure. If the initialization procedure cannot be passed, a drive either «hangs» or returns to ROM firmware code («FAIL» status), or tries to use the alternative service area («ALT-SA» status). Furthermore, the «safe mode» flag does not disable all the validity checks of service area, which may cause a drive to hang during loader initialization. Based on the above, the actual criterion of compatibility between a malfunctioning drive and the loader used to start it is the family code only. There are no other drive-controlled compatibility signs while drive start or failure to start depends on compatibility of settings inside the loader with the current state of the HDA (which cannot be specified once for all cases). Example: in case of disk replacement on a N40P drive its service area cannot be read using the loader from the donor drive or using a loader created in the original drive firmware, but it can be read using a loader generated on another HDD with a completely different ID (version, checksum, date of manufacture, etc.).

Our developers have not addressed replacement of control program in the service area so far because a drive is unlikely to lose it without external influence. It is a confirmed fact, though, that replacement of program code in service area is quite able to cause a situation when the drive cannot interpret its adaptive data normally, therefore such drive will stop correct reading or writing.

When you are selecting a donor drive for head replacement, you should use the comma-delimited letter indications as guidelines (e.g., K,M,B,E). The first letter means amplifier type and the second stands for the used head type. Their complete match is advisable.

The status dialog *(see Fig. 4.2)* for a hard drive has one more peculiarity: it displays the checksum of ROM loaded in the drive at the moment of utility start (in the «Loaded ROM checksum» line) and checksum of the ROM from the first program set (program 1) of its service area (in the «[ROM_SA] checksum» line). The checksum values will be different, if a drive has been started using a «borrowed» loader.


Utility status

Selected family: CALYPSO
[ROM_SA] Check Sum: BE25
Loaded ROM Check Sum: BE25
Model (version): 6Y120L0040411C

☐ Started using loader
☐ SA Writing test completed
☐ Security-locked HDD
☐ Offline start

SA head: 3

☐ Write all module copies

Fig. 4.2. Viewing the utility status.

4.3. Service data modules

Modules map in Maxtor drives contains no names of modules, though some of them still do have names. Such names are stored in the header of a respective module. Therefore, it is impossible to find out the name of a module without reading its contents. It is possible to introduce unified numbering of modules for various Maxtor drive families, i.e. the so-called position number (hereinafter ID or PN), that allows convenient identification of specific modules' purpose.

Service area data is organized according to the hierarchy shown in the *Fig. 4.3.* At its top you can see the physical drive space, where the service data can be placed. The space is assigned to a separate zone with its own data density. UBA sector numbering is introduced for each head (sequential numbering of sectors in a track first and then of the actual tracks), making up the space for a lower stage represented by the active service area. The service area is active drive uses for its operation just one head corresponding to the service area. The active service area consists of module groups; each group has a copy located within the described zone. Service data are always recorded to both copies at once thus preventing the use of the second copy if a module becomes damaged while writing because the other copy will be damaged, too. The «group of modules» (*see Fig. 4.3)* unites modules according to the following guidelines (one step lower in the hierarchy): «data modules», «firmware modules» and «techno modules». The drive uses its firmware modules for reading access only during regular operation while practically all data modules are used both for write and read access – that fact results in their damage in case of brief problems with recording. Techno modules are used at the manufacturing factory during the assembly process; they are not involved in normal drive functioning in any way.

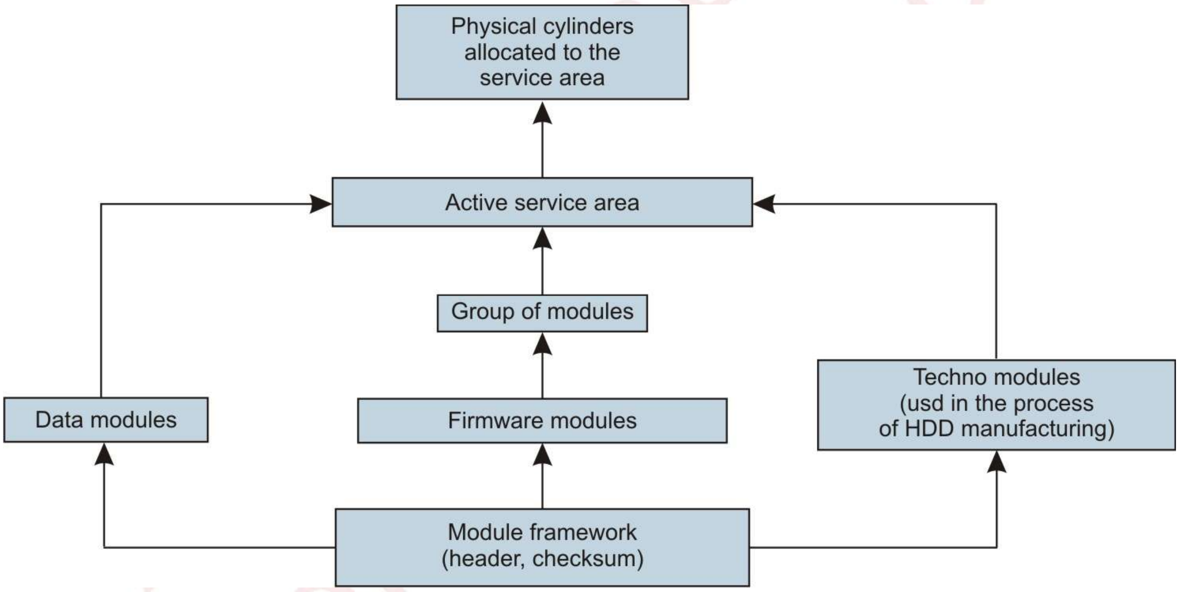

Physical cylinders allocated to the service area
Active service area
Group of modules
Data modules
Firmware modules
Techno modules (usd in the process of HDD manufacturing)
Module framework (header, checksum)

Fig. 4.3. Hierarchy of service area structure.

Table 1 contains a list of data modules. They are grouped in the ascending order according to their UBA; thus you can track their positional relationship. Table 2 contains a list of firmware modules. First three ones are modules containing user firmware while the following three contain the program used during drive manufacture. However, the latter is not present in all the HDD. Table 3 lists techno modules containing data. As a rule, they represent Self Test settings and its logs.

Module names in square brackets are assigned by utility developers.

Table 1. Data modules in service area of Maxtor drives.

Pos. number (PN), hex	Module purpose	Importance
37	U_LIST – service area translator	Ad
1F	DISK – drive ID.	B
78	RZTBL – zone table (translator component).	Ad
18	AT_PDL (P-List, translator component).	Ad

21	RCT – adaptive information of data zone on disk surface.	As
1E	SRV – calibration adaptive data.	As
1A	SECU – security system module (ATA passwords).	C
2F	S.M.A.R.T. thresholds	C
30	S.M.A.R.T. attributes	C
63	Copy of S.M.A.R.T. attributes	C
22	ATAF – ATA settings flags	B
34	ARREH	D
48	[LABEL] – drive parts information.	D
1D	DMCS	B
1B	AT_POL (G-List) – growing table of defects.	C
35	AT_XAL	C
64	MAXATG	D
5E	EVTLG_00 connected with G-List	D
70	S.M.A.R.T. Summary Log.	C
71	S.M.A.R.T. Self-Test Log.	C
72	S.M.A.R.T. Host Vendor Log	C
7B	FW	D
95	Additional DISK. The module is present in module map only on disks without an alternative SA.	B
93	FMTI – module containing unique zone allocation table.	Ad
A7	AT_POL – G-List copy	C

Table 2. Firmware modules in service area of Maxtor drives.

Pos. number (PN), hex	Module purpose	Importance
39	[ROM_SA] ROM copy.	B
38	[OVL ATA] First portion of firmware overlays.	B
4F	[OVL TECH] Second portion of firmware overlays.	B
97	[ROM_ST] ROM copy.	E
96	[OVL ST1] First portion of firmware overlays.	E
98	[OVL ST2] Second portion of firmware overlays.	E

Table 3. Techno modules in service area of Maxtor drives.

Pos. number (PN), hex	Module purpose	Importance
33	HLUTL & HUSR – defect lists	Dd
11	MX_ST_CFG1	Dr
43	MX_ST_CFG2	Dr
0D	MX_ST_CFG3	Dr
0E	MX_ST_SCRIPT	Dr
7A	U_LIST – copy of service area translator.	D
83	Information on drive parts.	D
31	DISK – second drive ID copy.	D
14	STRS	D
46	OPTI – self-testing settings.	Dr
47	STRS	Dr

Codes of the «Importance» column in Tables 1, 2 and 3:

- ***A*** essential module for a specific HDD: As – adaptive settings, Ad – translator tables. Replacement of the module with an identical module from another drive will result in the loss of reading/writing settings and data loss (e.g., adaptive data modules);
- ***B*** the module is necessary but it but can be replaced with one from another drive. Sometimes version and module match may be required.
- ***C*** the module is necessary but partial module corruption does not prevent drive from starting. The drive may correct module contents (recalculated automatically during the procedure of defects relocation) independently in certain circumstances.
- ***D*** the module does not affect drive operability. The category usually includes informational modules. Dd – original defect lists used to generate drive translator. «Dr» stands for techno Self Test modules.

U_LIST (PN=37h) service area translator.

The drive uses the presence or absence of this module to identify the active service area. It may be preserved in up to 8 copies. Only two of them are indicated in the module table. The copies are accessed via the UBA range read function in the "View modules" mode *(section 6.2.1.2).* The U_LIST module has an individual structure for each head; the structure includes an explicit indication of head number and the table of service area defects for that head. The module also contains the information about the number and addresses of defective sectors in the service area. It also indicates the number of actually used sectors in the P-List (PN=18h) module. It means that if P-List module is borrowed from another drive, the firmware will receive incorrect information about its length being unable to use the module (the checksum will be invalid). If the table of defects for the service area contains hidden defects, then data in U_LIST can be considered unique (overwriting the U_List module with a copy borrowed from another drive will cause a shift in service area resulting in a seriously complicated HDD restoration). If there are no hidden defects, you can specify in U_LIST the correct value for the used portion of the P-List module to allow using the module copied from another HDD (you will have to recalculate module checksum using the corresponding extension command in HEX editor). The general procedure will be added in future manual editions.

Drive firmware sometimes overwrites the module during operation. As a result a drive may fail to record it (in case of a write failure) losing the information about the service area defects and the used length of the P-List module. During translator regeneration, P-List length in the U_LIST module is corrected automatically.

DISK (PN=1Fh) configuration module.

The module contains information about drive configuration, such as model name, serial number, maximum LBA, physical head map and the number of heads. Physical head map is not the main one. The head map acting as the basis for translator generation is stored in drive firmware.

RZTBL (PN=78h) module.

The module is a part of drive translator. It contains the zone allocation table for the drive. Each zone corresponds to its own sequence of defects in the P-List module. RZTBL contains the number of heads used for translator generation.

AT_PDL (PN=18h) module.

The module contains the factory table of defective sectors in user area. Information about defects in that module is recorded in format corresponding to the zones described in RZTBL.

AT_POL (PN=1Bh) module and a copy thereof (PN=A7h)

G-List table of defects growing during drive operation. Its copy (PN=A7h) can be found in N40P and CALYPSO drives manufactured in 2004 and in SABRE drive family only.

FMTI (PN=93h) module.

This module is used in full-sized drives[1]. It contains zone allocation tables and adaptive settings for each zone; therefore the module is essential for access to data.

«RCT» (PN=21h) module.

The structure and purpose of that module are not completely clear so far, but its overwriting with a copy borrowed from another drive does not cause drastic functionality loss (the number of BAD blocks will increase). The drive will

[1] – Tables of drive family specifications in chapter 9 indicate full-size and half-size families.

still write and read data in most cases. The module is generated during factory self-testing from several preset portions, i.e. the data used for its generation remain unknown to the drive itself, so their loss will make obtaining a correct module impossible.

«SRV» (PN=1Eh) module.

The structure and purpose of that module are not completely clear so far. In case of its replacement with another copy, disk surface reading will encounter defective sectors and recording will be completely impossible. The module is generated during factory self-testing from the data provided by the servo system calibration subprograms. It is not clear, whether its generation is based on preset data portions.

[ROM_SA] (PN=39h) module.

The module acts as the source for loading the ROM portion of firmware in regular operation mode *(see Fig. 4.1)*. Program 1 consists of that module and module [OVL ATA].

ATA overlays [OVL ATA] (PN=38h).

The set of overlays mostly serves as firmware extension in normal mode. If any of the overlays cannot be read, then all or some of ATA commands may function incorrectly (e.g., SMART commands). An overlay is a portion of program code, which can be connected to processor code segment from buffer RAM. Only one overlay can be connected at a time.

Overlays implementing techno commands [OVL TECH] (PN=4Fh).

The set of overlays is required for firmware operation in techno mode.

Firmware switching module PN=95h.

The drive uses the second word in that module (bytes 4 and 5 in module view) to determine, whether program 1 or program 2 should be started. Boot ROM in Poker/Ardent drives without an alternative service area reads that module among the first ones; a drive will not start if the module is damaged. Please note, that if you start a loader from a N40P drive with an alternative service area in a N40P drive without an alternative SA, then the utility will show that module 95h has an incorrect header. It is so because the module does not actually exist on disk.

[ROM_ST] PN=96h [OVL_ST] PN=97h and PN=98h.

The modules constitute Program 2. Its functions depend on drive family and service area (primary or alternative).

AT_XAL (PN=35h) module

Sometimes may cause a drive to start but fail to work using LBA. The module can be found in older DSP-based drives (e.g., RIGEL); it is used as an intermediate table for defects appended to G-List.

HLUTL & HUSR (PN=33h)

Module (or HLists shortly) contains a set of tables. The first table is always HLUTL (16384 bytes long with a 8-bytes header and checksum). It contains the list of defects in service area. Then follows a chain of HUSRxxxx tables, where xxxx stands for table serial number. The size of each table is 8192 bytes and just like the first table, they have headers and checksums. The number of added tables depends on the total number of defects in user data area.

Hereinafter for the purposes of this description we shall use either module names or names combined with a position number.

The rest modules

Pos. number (PN), hex	Importance	Utility name	CS Type	Description
FF	B	[RCT0]	FM	Adaptive settings for the service area. The module appears in Maxtor ATHENA and later drives. When a HDD starts, the bootup code attempts to read the module and, if it succeeds, loads the reading settings for the read channel. The module exists in 8 copies, so the probability of its corruption is very low. All 8 copies are recorded when module groups 8 and 9 are written. Typically, the module is recorded for all existing HDD heads unlike all other modules.
0	Dr	[STL_00]	–	Factory self-testing log.
1	Dr	[STHL_01]	FM	Factory self-testing log.

2	Dr	[STEL_02]	–	Factory self-testing error log.
3	Dr	[STHL_03]	FM	Factory self-testing log.
4	Dr	[STHL_04]	FM	Factory self-testing log.
5	Dr	[STHL_05]	–	Factory self-testing log.
6	Dr	[STHL_06]	–	Factory self-testing log.
7	Dr	[STHL_07]	–	Factory self-testing log.
8	Dr	[STHL_08]	FM	Factory self-testing log.
9	Dr	[STHL_09]	–	Factory self-testing log.
A	Dr	[STHL_0A]	–	Factory self-testing log.
B	Dr	[STHL_0B]	–	Factory self-testing log.
C	Dr	[STHL_0C]	–	Factory self-testing log.
D	Dr	[ST_CFG]	FM	Factory self-testing configuration.
E	Dr	[ST_SCRIPT]	FM	Factory self-testing script. It is displayed as a table in the interactive Self Test mode.
F	Dr	[ST_TST_0F]	FM	Test pattern. These modules are used for surface testing during the factory Self Test procedure.
10	Dr	[ST_TST_10]	–	Test pattern. These modules are used for surface testing during the factory Self Test procedure.
11	Dr	[ST_RES]	FM	Self Test status sector.
12	Dr	[STEL_12]	FM	Factory self-testing error log.
13	Dr	[ST_RCT_13]	FM	Module containing the read channel settings template (RCT). It is used in the factory self-testing procedure.
14	Dr	[ST_RCT_14]	FM	Module containing the read channel settings template (RCT). It is used in the factory self-testing procedure.
15-17	–	[UNK_15] – [UNK_17]	–	Purpose unknown.
19	–	[UNK_19]	–	Purpose unknown.
1A	C	SECU	FM	SECU – security system module (ATA passwords).
1C	–	[UNK_1C]	–	Purpose unknown.
1D	B	DMCS	FM	DMCS translator control.
20	–	[UNK_20]	–	Purpose unknown.
22	B	ATAF	FM	ATAF – ATA settings flags, in DSP drives the header consisted of double A letters.
23	C	AT_POL 2	FM	G-List module in HDD using the translation type =2 (see the drive family specifications).
24-2B	–	[STHL_24] – [STHL_2B]	–	Factory self-testing log.
2C	C	AT_POL 2	FM	(copy) G-List copy module in HDD using the translation type = 2 (see the drive family specifications).
2D	Dr	[STHL_2D]	FM	Factory self-testing log.
2E	Dr	[STHL_2E]	–	Factory self-testing log.
2F	C	[SMRT_T]	SM	Related to drive’s SMART. Purpose unknown.
30	C	[SMRT_A]	SM	Related to drive’s SMART.

				Purpose unknown.
31	Dr	[ST_CFG_31]	FM	Read channel settings for factory self-testing.
32	–	[UNK_32]	–	Purpose unknown.
34	D	ARREH	FM	Log of errors occurring during drive operation.
36	Dr	[STL_36]	FM	Factory self-testing log.
37	Ad	U_LIST	FM	U_LIST is a service area translator for the drives using the translation type =1. A drive recognizes the active service area by the presence or absence of this module. The module has 8 copies, but only two of them are specified in the modules table. The copies can be accessed using the UBA range reading feature in the «View modules» mode. U_LIST module has an individual structure for each head containing explicitly specified head number and the list of service area defects for that head. The module contains information about the number and locations of defective sectors reassigned in the service area, and the number of actually used sectors in the P-List (ID=18h) module. It means that if you copy the P-List module from another drive, the firmware will be misinformed about its length and will be unable to apply it (the checksum will be calculated incorrectly). If the defects list of the service area contains reassigned defects, data in the U_LIST module can be called unique (overwriting the U_LIST module with a copy from another drive will result in offsets in the service area, which will seriously complicate HDD restoration). If there are no reassigned defects, you can rewrite U_LIST from another drive having entered in it correct value for the used portion of the P-List module; the module checksum must be recalculated then using appropriate extension command in HEX editor.
3A-40	Dr	[STL_3A]	–	Factory self-testing log.
41	C	[SMRT_LOG]	SM	SMART log.
42	Dr	[STL_42]	FM	Factory self-testing log.
43	Dr	[STL_43]	FM	Factory self-testing log.
44	–	[UNK_32]	–	Purpose unknown.
45	C	[SMRT_H]	SM	Related to drive’s SMART. Purpose unknown.
46	Dr	[ST_RCT_46]	FM	Module containing the read channel settings template (RCT). It is used in the factory self-testing procedure.
47	Dr	[ST_RCT_47]	FM	Module containing the read channel settings template (RCT). It is used in the factory self-testing procedure.
48	–	[UNK_48]	–	Purpose unknown.
49	Dr	[STL_49]	FM	Purpose unknown.
4A	Dr	[STL_4A]	FM	Factory self-testing log.
4B	Dr	[STL_4B]	FM	Factory self-testing log.
4C	Dr	[STL_4C]	FM	Factory self-testing log.
4D	Dr	[STL_4D]	FM	Factory self-testing log.
4E	–	[UNK_4E]	–	Purpose unknown.
50	Dr	[STL_50]	FM	Factory self-testing log.
51	–	[UNK_51]	–	Purpose unknown.

52	–	[UNK_52]	–	Purpose unknown.
53	–	[UNK_53]	–	Purpose unknown.
54	Dr	[STL_54]	FM	Factory self-testing log. It is related to the stability test of the read/write heads.
55	–	[UNK_55]		Purpose unknown.
56	Dr	[STL_56]	FM	Factory self-testing log.
57	Dr	[STL_57]	FM	Factory self-testing log.
58	Dr	[STL_58]	FM	Factory self-testing log.
59	Dr	[STL_59]	FM	Factory self-testing log.
5A-5D	Dr	[STLH_5A] – [STLH_5B]	FM	Factory self-testing log.
5E	D	EVTLG	FM	Associated with the G-List (there are in the main group). It stores information about the error events. It is used by the manufacturer for failure analysis HDD.
5F	Dr	[STLH_5F]	FM	Factory self-testing log.
60-62	Dr	[STL_60]-[STL_62]	FM	Factory self-testing log.
63	C	[SMRT_AC]	SM	S.M.A.R.T. attribute copy.
64	B	MAXATG	SM	Different production information.
65	C	[SMRT_65]	SM	Related to drive’s SMART. Purpose unknown.
66	C	[SMRT_66]	SM	Related to drive’s SMART. Purpose unknown.
67	C	[SMRT_67]	–	Related to drive’s SMART. Purpose unknown.
68	Dr	[ST_CFG_68]	FM	Factory self-testing log.
69-6F	Dr	[STL_69] – [STL_6F]	FM	Factory self-testing log.
70	C	[SMRT_SL]	SM	S.M.A.R.T. Summary Log.
71	C	[SMRT_ST]	SM	S.M.A.R.T. Self-Test Log.
72	C	[SMRT_HV]	SM	S.M.A.R.T. Host Vendor Log
73	C	[SMRT_WT]	SM	Related to drive’s SMART. Purpose unknown.
74-76	Dr	[STLH_74] – [STLH_76]	FM	Factory self-testing log.
77	Dr	[STL_77]		Factory self-testing log.
79	Dr	[STLH_74]	FM	Factory self-testing log.
7A	Ad	U_LIST	FM	U_LIST – service area translator copy.
7B	–	[UNK_7B]	–	Purpose unknown.
7C-7F	–	[UNK_7C] – [UNK_7F]	–	Purpose unknown.
80	–	[UNK_80]	–	Purpose unknown.
81	Dr	[STL_81]	FM	Factory self-testing log.
82	Dr	[STL_82]	FM	Factory self-testing log.

83	Dr	[PARTS]	FM	Module with a detailed description of the component.
84-8B	Dr	[STLH_84] – [STLH_8B]	FM	Factory self-testing log.
8C	Dr	[STL_8C]	FM	Factory self-testing log.
8D	Dr	[STL_8D]	FM	Factory self-testing log.
8E	Dr	[STLH_8E]	FM	Factory self-testing log.
8F	Dr	[STLH_8F]	FM	Factory self-testing log.
90	Dr	[ST_CFG_90]	FM	Factory self-testing log.
91	Dr	[STL_91]	–	Factory self-testing log.
92	Dr	[STL_92]	–	Factory self-testing log.
94	Dr	[LOG_94]	–	Purpose unknown.
96	Dr	[OVL_ST1]	OV	Part of the "Program 2". Its functions depend on the family and the service area (primary or alternate).
97	Dr	[ROM_ST]	FM	Part of the "Program 2". Its functions depend on the family and the service area (primary or alternate).
98	Dr	[OVL_ST2]	OV	Part of the "Program 2". Its functions depend on the family and the service area (primary or alternate).
99	–	[UNK_99]	–	Purpose unknown.
9A	–	[UNK_9A]	–	Purpose unknown.
9B	Dr	[STL_9B]	FM	Factory self-testing log.
9C	Dr	[STL_9C]	–	Factory self-testing log.
9D	Dr	[STL_9D]	–	Factory self-testing log.
9E	–	[UNK_9E]	–	Purpose unknown.
9F	Dr	[ST_CFG_9F]	FM	Factory self-testing configuration.
A0	Dr	[ST_CFG_A0]	FM	Factory self-testing configuration.
A1	Dr	[UNK_A1]	–	Purpose unknown.
A2	Dr	[STLH_A2]	FM	Factory self-testing log.
A3	–	[UNK_A3]	–	Purpose unknown.
A4	Dr	[STL_A4]	–	Factory self-testing log.
A5	–	[UNK_A5]	–	Purpose unknown.
A6	C	[TERM_LOG]	–	Temperature log.
A8	–	[UNK_A8]	–	Purpose unknown.
A9	–	[UNK_A9]	–	Purpose unknown.
AA	Dr	[STLH_AA]	FM	Factory self-testing log.
AB	Dr	[STLH_AB]	–	Factory self-testing log.
AC	Dr	[STLH_AC]	–	Factory self-testing log.
AD	Dr	[STL_AD]	–	Factory self-testing log.
AE	Dr	[ST_CFG_AE]	FM	Factory self-testing configuration.
AF	Dr	[STLH_AF]	FM	Factory self-testing log.
B0	Dr	[STL_B0]	FM	Factory self-testing log.
B1	–	[UNK_B1]	–	Purpose unknown.

B2	–	[UNK_B2]	–	Purpose unknown.
B3	–	[UNK_B3]	–	Purpose unknown.
B4	Dr	[STL_B4]	–	Factory self-testing configuration.
B5	–	[UNK_B5]	–	Purpose unknown.
B6	Dr	[STL_B6]	FM	Factory self-testing log.
B7	Ad	PDM_LST0	UL	Service area translator "0" for the type of HDD translator = 2. (see the technical description of the families).
B8	Ad	UA_LST 0	FM	Service area translator "1" for the type of HDD translator = 2. (see the technical description of the families).
B9	–	[UA_LST x]	–	Service area translator "2" for the type of HDD translator = 2. (see the technical description of the families).
BA	Ad	POR_A 0	FM	Service area translator "1A" for the type of HDD translator = 2. (see the technical description of the families).
BB	Ad	POR_A 0 CP	FM	Service area translator "2A" for the type of HDD translator = 2. (see the technical description of the families).
BC	–	[POR_A 1]	–	Service area translator "1B" for the type of HDD translator = 2. (see the technical description of the families).
BD	–	[POR_A 1]	–	Service area translator "2B" for the type of HDD translator = 2. (see the technical description of the families).
BE	B	[BOOT_RCT]	FM	Copy 0 for BOOT RCT.
BF	B	[BOOT_RCT]	FM	Copy 1 for BOOT RCT.
C0	–	[UNK_C0]	–	Purpose unknown.
C1	–	[UNK_C1]	–	Purpose unknown.
C2-C4	Dr	[STL_C2] – [STL_C4]	FM	Factory self-testing log.
C5	–	[UNK_C5]	–	Purpose unknown.
C6	–	[UNK_C6]	–	Purpose unknown.
C7	–	[UNK_C7]	–	Purpose unknown.
C8	–	[UNK_C8]	–	Purpose unknown.
C9	–	[UNK_C9]	–	Purpose unknown.
CA	–	[UNK_CA]	–	Purpose unknown.
CB	–	[UNK_CB]	–	Purpose unknown.
CC	–	[UNK_CC]	–	Purpose unknown.
CD	Dr	ES	–	Purpose unknown.
CE	–	[UNK_CE]	–	Purpose unknown.
CF	–	[UNK_CF]	–	Purpose unknown.
D0	Dr	[STL_D0]	FM	Factory self-testing log.
D1	–	[UNK_D1]	–	Purpose unknown.

Codes of the Importance column:

- ***Module A*** is unique to the drive: As – adaptive settings, Ad – translator tables. Replacement of the module with an identical module from another drive will result in the loss of reading/writing settings and data loss (e.g., adaptive data modules).
- ***Module B*** is necessary but it but can be replaced with one from another drive. Sometimes version and module match is required.

- ***Module C*** is necessary, but partial module corruption will not prevent drive start. In certain circumstances the drive may correct module contents (recalculated automatically during the procedure of defects relocation) on its own.
- ***Module D*** does not affect drive operability. Typically these modules serve informational purposes. Dd – original defect lists used to generate drive translator. Dr - factory Self-Test modules.

Checksum types:

- ***«–»*** – no checksum;
- ***FM*** – checksum applies to the entire module;
- ***UL*** – checksum applies to the number of sectors specified in U_LIST;
- ***SM*** – byte checksum of the SMART modules;
- ***HL*** – block checksum of module 33;
- ***OV*** – checksum of the overlay module.

4.4. Adaptive data

Maxtor drives have a number of unique modules containing adaptive data. The data is used to fine-tune reading and writing to magnetic surfaces. Overwriting of the adaptive data modules with copies from another drive will at least result in the loss of access to user data area.

Modules containing adaptive data essential for access to user data: SRV (PN=1Eh), RCT (PN=20h), FMTI[1] (PN=93h) plus overlays (PN=4Fh). Please note that if you record those modules to a donor drive and perform HOT SWAP, then most likely the access to user data will be restored, but it is very probable that an attempt to record the native modules back to that donor drive will fail.

The role of adaptive settings increases together with the growth of data recording density. E.g., ATHENA drives could be easily restored using the HOT SWAP procedure and at the same time, it is practically impossible to write anything to a drive or read user data in N40P or CALYPSO HDD. The situation may be caused by many reasons beginning with incorrect distance between the reading and recording head elements taken from donor adaptive settings. The distance exceeds track size by 2-3 times.

Another important peculiarity is the ability of boot ROM to read the service area[2]. A HDD becomes able to write to a SA only after the translator and adaptive data modules are loaded. Access to a drive's SA requires both adaptive data for reading and for recording. Keep in mind that although SA reading still may be possible without adaptive data (using boot ROM or a loader), recording without adaptive data is completely impossible. The situation follows from the fact that the writing head may simply miss the track, which has to be recorded. Therefore, if the respective distance between heads does not match the service area, the head will actually write information to a neighbouring track.

If drive translator is damaged, then during loader start the adaptive modules will be read without using the SA translator. Therefore, if adaptive modules in a drive have been replaced, it is impossible to write them back. Still, for drives using an alternative SA drive restoration is possible if a backup copy of adaptive data is available (see the description in *chapter 8*).

Recalculation of adaptive data using internal drive tools (Self Test) helps in HDD repair but it cannot assist during data recovery because recalculated adaptive data will prevent reading of data recorded by the drive using earlier adaptive information. Two possible solutions exist for that situation; they are not completely implemented in the utility yet as their development continues. The first method uses loading of known adaptive data to a drive via its interface instead of using the SA as the source. That allows reading data without restoration of SA functionality. The method is already available for drives using an alternative SA. The second approach uses selection of matching adaptive data to enable reading of the information recorded using lost adaptive modules.

4.5. Alternate service area

The manufacturer uses the alternate service area (ALT-SA) in N40P, CALYPSO and SABRE drive families. Still, not all the N40P drives have an alternative service area. For convenience, the utility at the start logs for supporting models a message informing the user that «HDD has an alternate service area». The presence of an alternate SA can be identified by the PN=95h module in the module table; if module 95h is present, the drive has no alternate SA. This rule

[1] – Present in full-size drives only with possible number of read/write header greater than 1.
[2] – Boot ROM contains built-in adaptive data for SA reading only. The parameters are not unique; they may be identical for many drives within a family. This issue arises during search for a compatible control board; it is discussed in *chapter 9*.

has exceptions in N40P family because a drive with an alternate SA can be used to start a loader created from another drive without alternate SA. In that case the module table will contain a record of module 95h; however, an attempt to read it will demonstrate that it is empty.

The alternate service area is used during drive manufacturing for creation of the main SA and hiding of its defects; it contains the same collection of modules, but their content differs.

The alternative program version is NCRxxxx0 in N40P or YCRxxxx0 in Calypso family; its brief representation is «Program C». The program from the main SA is called «Program A», respectively.

In a HDD with an alternate SA, drive boot ROM after motor start reads the modules containing program code and the translator from the main SA checking their structure. If the structure turns out to be invalid of a module cannot be read, then loading switches to the alternate SA *(see Fig. 4.1).* A drive in that case initializes on its own using the alternate SA. It means that switching the drive back to operation with the main SA requires recovery of its translator and program modules. The opportunity for recording the main SA from another drive to an alternate SA is not thoroughly studied yet. We can only make assumptions about possible results. The program in the main SA is set up to work with its physical location despite its launch from the alternate SA. Boot ROM will run the code of program A from the alternate SA, but the data modules will still be read from the main SA. If you start a loader with program A, then the main SA will be linked to the UBA space; if you start it with program C, then the alternate SA will be linked instead. There is one more difference between the A and C programs: the overlays of program A are modified during Self Test while the overlays of program C remain the same for an identical checksum.

Microprogram C is unable to run the translator of the user zone and its adaptive modules are not suitable for reading that zone. As a result, such drive will not be visible in LBA.

In *section 4.1* we introduced the notions of: «program 1» and «program 2». It is essential to understand the difference between an alternate SA and program 2. It follows from the mechanism implemented in a drive for switching between HDD start with program 1 or program 2 using the PN=95h module. However, in case of an alternate SA there is no such switch. A drive switches in case of problems with the main SA.

Is there a way to switch between service areas on a functional drive? There are two methods for switching a functional drive to the alternate SA:

1) Start an alternative loader created from the drive, when it initialized using its ALT-SA.

2) You can also switch a drive from the main to its alternate SA by enabling the «Write all module copies» option in the «Utility status» dialog *(Fig. 4.2),* then modify a byte of the PN=18h module header in the module viewing mode ([Ctrl] + [Alt] + [2]) and save the module.

In some drives the «program 2» in the alternate *(section 4.1)* SA contains program A in its state prior to modification by Self Test; it has the same ROM version as the main one, which may be useful. To start a drive using that program:

1) enable the «safe mode» jumper

2) start an alternative loader

3) perform a «Restart using internal HDD SA», having selected «program 2».

In *chapter 9*, descriptions of N40P and CALYPSO drive families contain additional information about their alternate SA.

4.6. Translator in Maxtor drives

Translator is a complex of programs and tables, which performs conversion between logical sectors (LBA) used by the operating system and physical sectors of a HDD. In all Maxtor HDD factory defects (in service area and data zone) are hidden by exclusion from translation.

Translator program data are stored in the following modules: U_LIST (PN=37h), AT_PDL (PN=18h), and RZTBL (PN=78h). HDD forms its translator tables on the basis of the defect list (PN=33h). In that table, defects are listed in their general notation: cylinder, head, sector. Thus translator tables can be assembled from the defect list using the «Translator regeneration» command. If you overwrite translator modules (e.g., with copies from another functional drives in case, when native modules are damaged), then the utility will still display the same list of defects as it did before modification of translator modules; then translator regeneration will restore its actual values.

5. Launching the utility

During start the utility sends a command to read HDD ID and identify the «safe mode» status. If the «safe mode» is enabled in the *utility start* dialog *(see Fig. 5.2)*, you will see the message: «HDD Safe Mode detected'». The utility selects the family of the connected HDD automatically using the information received as response to the identification command. You can specify drive family manually, when you connect a HDD belonging to a family, which the utility cannot identify correctly or does not support.

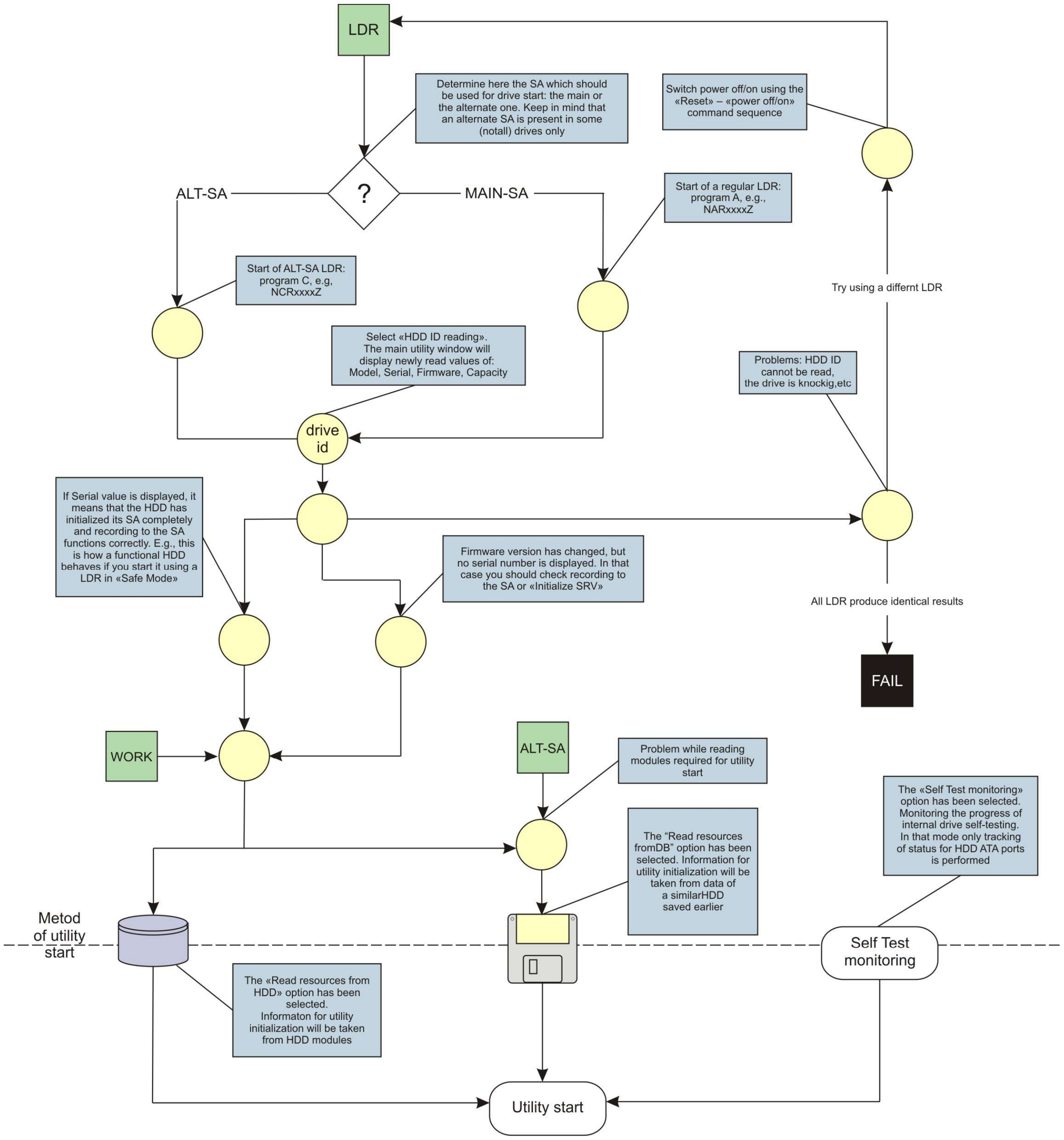
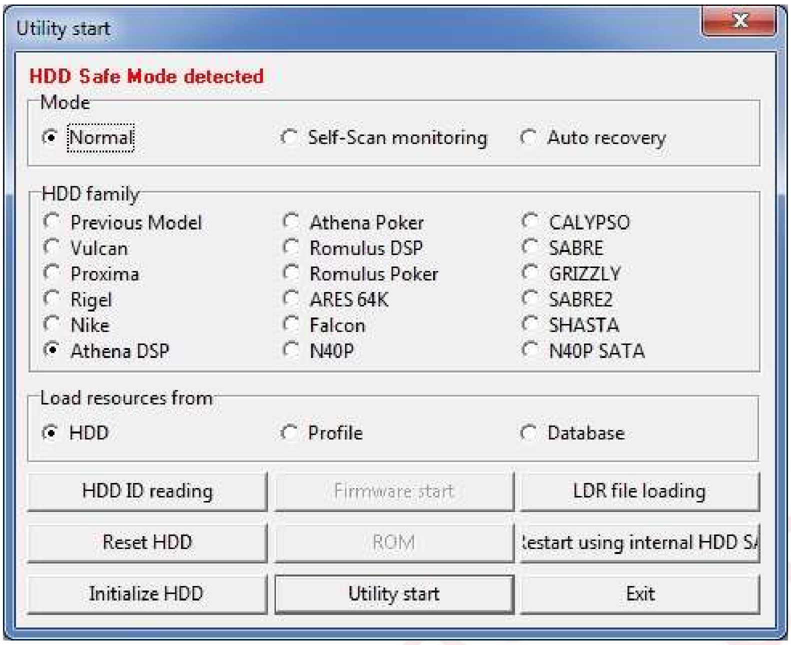

LDR
Determine here the SA which should be used for drive start: the main or the alternate one. Keep in mind that an alternate SA is present in some (notall) drives only
Switch power off/on using the «Reset» – «power off/on» command sequence
ALT-SA
?
MAIN-SA
Start of a regular LDR: program A, e.g., NARxxxxZ
Start of ALT-SA LDR: program C, e.g, NCRxxxxZ
Try using a differnt LDR
Select «HDD ID reading». The main utility window will display newly read values of: Model, Serial, Firmware, Capacity
Problems: HDD ID cannot be read, the drive is knockig,etc
drive id
If Serial value is displayed, it means that the HDD has initialized its SA completely and recording to the SA functions correctly. E.g., this is how a functional HDD behaves if you start it using a LDR in «Safe Mode»
Firmware version has changed, but no serial number is displayed. In that case you should check recording to the SA or «Initialize SRV»
All LDR produce identical results
FAIL
WORK
ALT-SA
Problem while reading modules required for utility start
The "Read resources fromDB" option has been selected. Information for utility initialization will be taken from data of a similarHDD saved earlier
The «Self Test monitoring» option has been selected. Monitoring the progress of internal drive self-testing. In that mode only tracking of status for HDD ATA ports is performed
Metod of utility start
Self Test monitoring
The «Read resources from HDD» option has been selected. Informaton for utility initialization will be taken from HDD modules
Utility start

Fig. 5.1. Utility start chart.



Utility start

HDD Safe Mode detected

Mode

● Normal ○ Self-Scan monitoring ○ Auto recovery

HDD family

○ Previous Model ○ Athena Poker ○ CALYPSO
○ Vulcan ○ Romulus DSP ○ SABRE
○ Proxima ○ Romulus Poker ○ GRIZZLY
○ Rigel ○ ARES 64K ○ SABRE2
○ Nike ○ Falcon ○ SHASTA
● Athena DSP ○ N40P ○ N40P SATA

Load resources from

● HDD ○ Profile ○ Database

Fig. 5.2. Utility startup dialog.

The start dialog of the utility combines actions necessary for work with a HDD in «safe mode» to initialize the firmware in memory on drive PCB. Then drive family selection follows; the family is represented by its factory alias. The correspondence between drive families and specific models is discussed in chapter 9, «Description of peculiarities in Maxtor drive families».

Let us examine the sequence of utility start shown in *Fig.5.1*. Boxes in the scheme correspond to specific statuses: «Work», «LDR» and «ALT-SA» matching drive status during start *(see the start chart in Fig. 5.1)*. The sequence of actions required for utility start is determined depending upon the status established by a drive at the start. There is also a separate start branch intended for reviewing of HDD registers while monitoring the Self Test process. In the Work status, while firmware is started, there is an opportunity to launch the utility in case, when one or more modules essential for initialization cannot be read: it is the «Read resources from DB» branch. E.g., if the DISK module required for utility initialization cannot be read from the service area (read error UBA=8), then the utility can be started using the module from an identical drive provided that its off-line start resources are available in the DB. Successful loader start brings a drive into status similar to «Work». Please *see chapter 7* for methods of using loaders for drive start-up.

«Utility start» dialog features *(see Fig. 5.2)*

1) ***HDD ID reading*** updates configuration data in the «Model» and «Firmware» strings. That helps estimate the results of commands, which can be executed in protected mode, i.e. «LDR file loading» and «Firmware start».

2) ***Firmware start*** is a feature similar to the «*Initialize from SA*» command in DOS version of Maxtor utility. The command may be used when firmware reads the SA correctly, but the data thus read make it freeze. The start algorithm is explained in *chapter 7.*

3) ***LDR file loading*** means loader start from a file or database. Starting loaders is described in detail in *chapter 7.*

4) ***Reset HDD*** contains an additional submenu offering commands to perform «software» or «hardware» reset, or «Switch power on/off». Soft reset is necessary for step-by-step loader start. Hardware reset has no specific use so far. If LDR start has failed (the drive start knocking or hangs) you might try to «Switch power on/off» and retry using another loader.

5) ***ROM*** – reading or writing. The feature is available for N40P and CALYPSO drive families only. Enable the safe mode jumper to use it. The feature works flawlessly on drives with an external Flash ROM with serial access (ST25P10 or ST25P10A, size: 131072 bytes). The utility allows reading and recording not only for Maxtor HDD firmware, but for any other data as well. Thus it can be used as a programming

device for microchips of that type. During ROM recording the LED will blink at 20Hz for approximately 40 seconds. After ROM reading or writing you should switch the drive's power supply off/on; you can accomplish that using the «Reset HDD» – «Switch power on/off» command sequence. If you skip that step, drive firmware will freeze at the attempt to perform any subsequent operation.

6) *Restart using internal HDD SA* – the feature works as follows: it reads the microcode from the service area and uses it as the basis to form a loader, switches power off/on and starts the loader thus formed. It is intended to immediately restart a drive using its native SA after loader selection and access to HDD SA. The feature is necessary because each program is unique. Please *see chapter 7* for its more detailed description.

7) *Initialize SRV* – the feature allows initialization of writing for the service area, the actual writing test is not performed during the procedure. If fact, it is a portion of the «SA writing test» *(section 6.1.2.1.5)* responsible for loading of adaptive data.

8) *Utility start*

9) *Exit*

Procedure of utility start:

1) *Reading of roadmap (module locations)* – the map is output by the loaded program (without surface reading). If the program is not loaded or failed during the initialization procedure, the roadmap cannot be retrieved and the utility reports an initialization error with the «Roadmap reading» context.

2) *Zone allocation table reading* – the utility reads the zone table.

3) *Automatic identification of the head corresponding to the active service area.* This is performed through search for U_LIST using all heads. The search begins with head 2, then 3, 4, 5, and only then proceeds to heads 0 and 1. The algorithm is determined by some peculiarities of firmware used in the drives, where more than 1 head can be installed. If the SA head has to be changed for some reason, the obtained value can be modified in the «Utility status» dialog *(Fig.4.2).*

4) *DISK module reading* – the module is used as the source of the number of heads and their map.

5) *Reading of the last ROM sector to determine the checksum.*

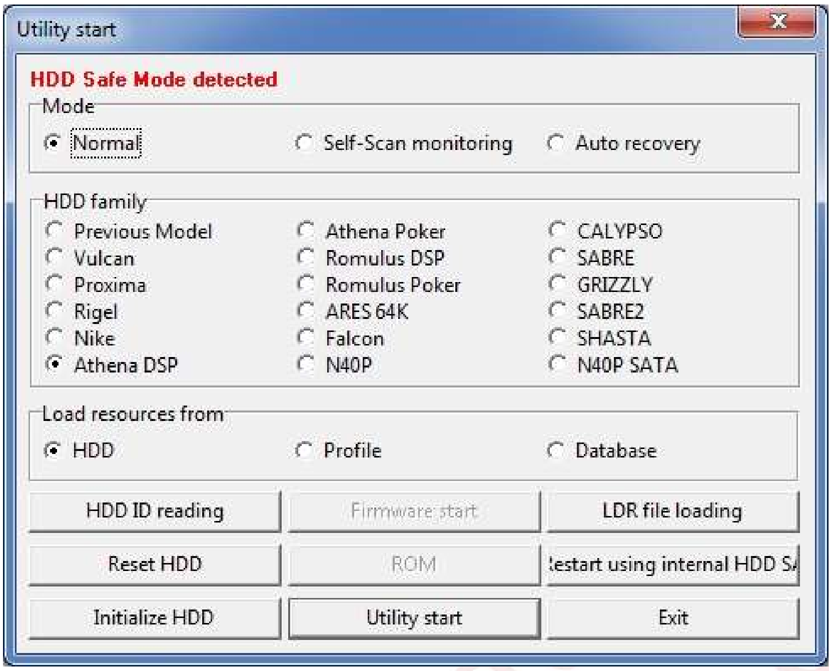
6) *Reading of the sector with mark similar to the following: «6E030L0510201».*

5.1. LDR-based automatic restoration mode

The utility offers a fundamentally new mode that allows starting a Maxtor drive using its logical parameters if the original modules containing adaptive data and the translator are accessible for reading in the utility or stored in the profile directory. The mode is initiated **while the safe mode mode is active**. In the utility startup dialog *(Fig. 5.3),* toggle the Mode to «Auto recovery». Once the utility starts in the automatic recovery mode, click the «Start recovery» toolbar button *(Fig. 5.4).*

Selection of a suitable program for automatic restoration will be based on the boot ROM version (which can be read in safe mode only). If the firmware version does not match any of the automatic recovery resources, a corresponding message will be displayed *(Fig. 5.5)*. If the ROM version is not found in the list of automatic recovery resources, you can try selecting one of the existing resources, but the probability of failure during subsequent steps of the procedure will be high because of potential incompatibility. The message may also appear if the Safe mode is not active.

Then the utility displays the recovery dialog to confirm that automatic selection is correct *(Fig. 5.6),* you can also use it to change the directory for automatic saving of the modules during the recovery procedure.



Utility start

HDD Safe Mode detected

Mode

● Normal ○ Self-Scan monitoring ○ Auto recovery

HDD family

○ Previous Model	○ Athena Poker	○ CALYPSO
○ Vulcan	○ Romulus DSP	○ SABRE
○ Proxima	○ Romulus Poker	○ GRIZZLY
○ Rigel	○ ARES 64K	○ SABRE2
○ Nike	○ Falcon	○ SHASTA
● Athena DSP	○ N40P	○ N40P SATA

Load resources from

● HDD ○ Profile ○ Database

Fig. 5.3 Utility start-up dialog.

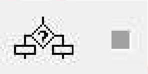
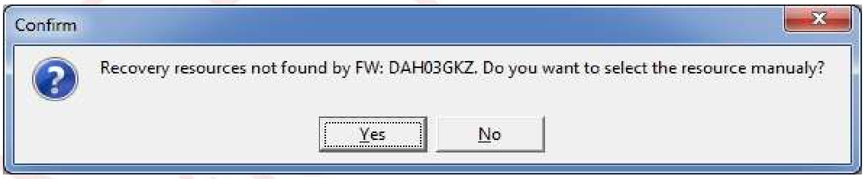


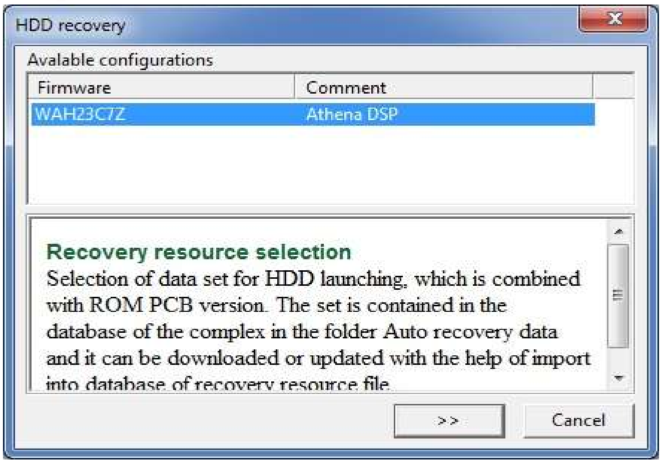
Fig. 5.4.



Confirm

Recovery resources not found by FW: DAH03GKZ. Do you want to select the resource manualy?

Fig. 5.5.



HDD recovery

Avalable configurations

Firmware	Comment
WAH23C7Z	Athena DSP

Recovery resource selection

Selection of data set for HDD launching, which is combined with ROM PCB version. The set is contained in the database of the complex in the folder Auto recovery data and it can be downloaded or updated with the help of import into database of recovery resource file.

Fig. 5.6.

Maxtor

PC-3000 EXPRESS / UDMA / PORTABLE ®
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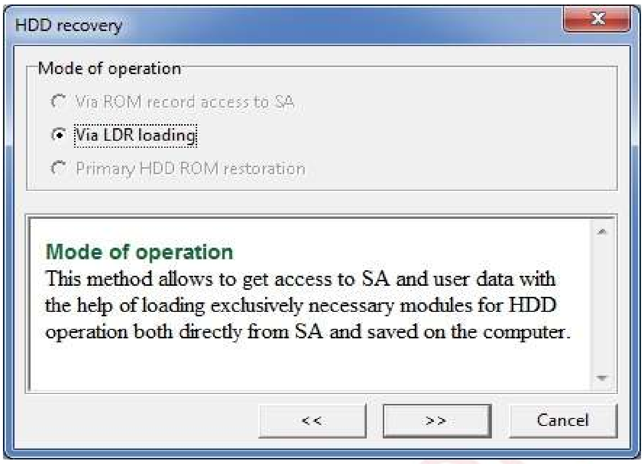
010101011001101010101100110101010110011010101011001101010101100110101010110011010101011001101010101100110
1001101010101100110101010110011010101011001101010101100110101010110011010101011001101010101100110101010110011010101010110110101010011
1010101011001101010101101101010100110101010011010110110110101010100101
10110101011001101010101101010110110101111010011
11010101101101010100111110
11010101011
0111011110
111101
011
11
1

Once the automatic recovery resource is selected, the utility displays a dialog reflecting the opportunities it provides.


HDD recovery

Mode of operation
○ Via ROM record access to SA
● Via LDR loading
○ Primary HDD ROM restoration

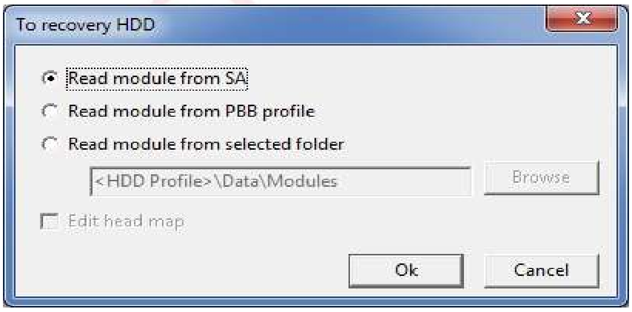
Mode of operation
This method allows to get access to SA and user data with the help of loading exclusively necessary modules for HDD operation both directly from SA and saved on the computer.

Fig. 5.7.

- ♦ ***Start using SA access ROM recording*** allows to read the modules from service areas (both the main and the alternate ones) without loader start. The mode serves as an auxiliary trial step in solving the problems with HDD start in case of considerable SA corruption or damaged heads. Its drawbacks include inability to write to the service area and the requirement for an external Flash ROM, which must be present on the PCB. Please also note that if the SA access ROM is written to a HDD, the normal loader start method will not work. To return the PCB to the original condition, use the «Restore original HDD ROM» startup method in the automatic mode.

- ♦ ***Start using LDR***. If you select a start using LDR, you will have to specify the profile folder and the directory, which the utility will use as the destination to read HDD modules critical for drive start, or as a source thereof (for example, if they have been read before head replacement).

Then the utility starts the loader[1] from the recovery resources and then displays the following dialog:


To recovery HDD

● Read module from SA
○ Read module from PBB profile
○ Read module from selected folder

<HDD Profile>\Data\Modules

□ Edit head map

Fig. 5.8.

Here you can select the method that will be used to retrieve the modules required for operation based on logical parameters. Depending on your selection, the utility will read the modules from the service area or from a specified directory containing the set of modules to load.

[1] – If the system head cannot find the servo labels, the utility may exit the automatic recovery mode upon timeout. Try installing a more suitable head (provided that the spindle motor and the PCB are functional and the surface has no scratches) and if the attempt fails, such HDD can be recognized as one beyond repair.

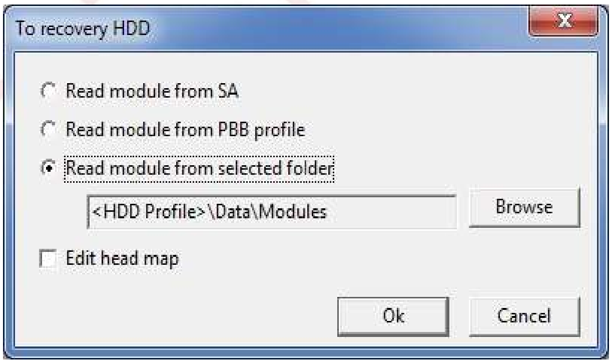
«Read module from SA» branch

To start a HDD using its logical parameters, valid and correct contents of the following modules must be read:

Module	Purpose
U_LIST	Service area translator. The module contains the list of defects reassigned in the service area and the size of the AT_PDL module. In HDD using the newer translation system the module is called UA_LST.
DISK	The module contains the map of physical heads and some other parameters. It is identical in models with the same capacity (with very rare exceptions).
FMTI	Module containing the zone allocation table. If it is lost, selection of its substitute is a fairly complicated task, though it can be accomplished. Drives using just one magnetic head (e.g., N40P) or old models (made before 2002) have no such module.
RCT	Module containing adaptive settings of the read channel.
SRV	Module containing adaptive settings of the positioning system.
AT_PDL	Translator portion. The module is necessary for accounting of hidden defects. If an empty module or a copy from another HDD is used instead, it will results in shifts in user data. In HDD using the newer translation system the module is called PDM_LST.
RZTBL	Translator portion. The module is necessary for accounting of hidden defects. Drives using the newer translation system, for example, Sabre 2, contain no such module.

«Read module from HDD profile» or «Read module from selected folder» branch

The opportunity to start a drive using a previously saved set of modules required for the procedure is implemented to address situations when an essential module is lost, or to allow restart. E.g., a drive may for some reason fail to read the RCT module (to the 0162000B_21.rpm file). You can copy to the profile the module file from another drive and try to start the HDD. Availability of previously saved files allows you to specify before start the heads to use and to disable. The translator will start then considering the original number of heads.



○ Read module from SA
○ Read module from PBB profile
● Read module from selected folder
<HDD Profile>\Data\Modules

□ Edit head map

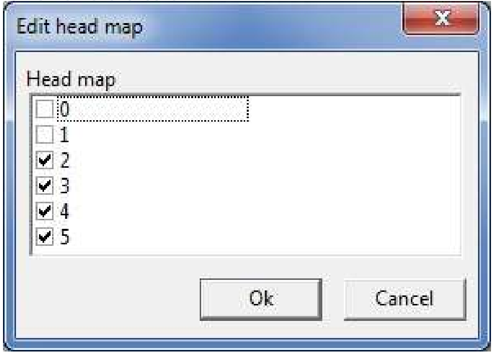
Fig. 5.9.

Automatic recovery branch involving the head map editing

Automatic recovery using modification of the heads map can be initiated from a HDD profile or from specified folder because the procedure requires a saved DISK module.

After the modules are loaded to HDD, you can proceed to work in the utility or additionally check logical access *(Fig. 5.11)*. If you click «Yes», the utility will test a single track from each zone and each head and attempt to read the zero LBA.

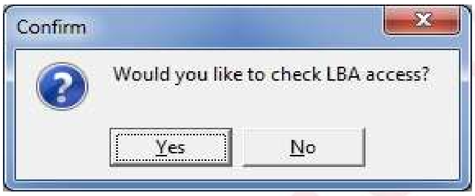
To restart the drive, you do not have to exit the utility; just switch the HDD power supply off/on and initiate the recovery mode again instead.



Head map

- ☐ 0
- ☐ 1
- ☑ 2
- ☑ 3
- ☑ 4
- ☑ 5

Fig. 5.10.



Would you like to check LBA access?

Fig. 5.11.

Attention! The automatic mode has certain peculiarities when used with some drive families, they are described in the next section.

5.2. Automatic recovery resources

5.2.1. Sabre drive family

Boot ROM version	Drive family	Interface	Available functionality
BACE7Z4Z	Sabre firmware: BAC	SATA	**ROM mode:** SA access for automatic mode, system head switching. Since the PCB contains no external Flash ROM, it has to be soldered in the location marked as U200. You can borrow the chip, for example, from a Calypso drive. **LDR mode: available.**
BAH42B7Z	Sabre firmware: BAH	PATA	**ROM mode:** SA access for automatic mode, system head switching. **LDR mode: available.**
BAJ47Z4Z	Sabre firmware: BAJ	PATA	**ROM mode:** SA access for automatic mode, system head switching. **LDR mode: available.**
BANC2E0Z	Sabre firmware: BAN	SATA	**ROM mode:** SA access for automatic mode, system head switching. **LDR mode: available.**

Peculiarities:

- This drive family consists of 4 subfamilies, which can be identified by the initial three letters in the firmware version: BAC, BAH, BAJ or BAN. Generally these subfamilies are not compatible with each other.

5.2.2. Grizzly drive family

Boot ROM version	Drive family	Interface	Available functionality
HA3D2C6Z	Grizzly	PATA	**ROM mode:** SA access for automatic mode, system head switching. **LDR mode: not available.**
HA432C0Z	Grizzly	SATA	**ROM mode:** SA access for automatic mode, system head switching. **LDR mode: not available.**

5.2.3. Shasta drive family

Boot ROM version	Drive family	Interface	Available functionality
KA102V0Z	Shasta	SATA	**ROM mode:** System head switching. SA access is not implemented completely. **LDR mode: not available.**

Peculiarities:

♦ This family is very rare, its normal support is complicated by insufficient supply of damaged drives; therefore, various issues are possible during interaction of the Maxtor utility with these drives.

5.2.4. N40P drive family

Boot ROM version	Drive family	Interface	Available functionality
NAN5248Z	N40P	SATA	**ROM mode:** SA access for automatic mode. **LDR mode: available.**
NAR5730Z	N40P	PATA	ROM programming for N40P using processor series C5-C1.
NAR6253Z	N40P	PATA	**ROM mode:** SA access for automatic mode. **LDR mode: not available.**
NAR62G3Z	N40P	PATA	**ROM mode:** SA access for automatic mode. It is intended for N40P HDD with an alternate service area and PCB with a C5-C1 processor. **LDR mode: not available.**
NAR63G4Z	N40P	PATA	**ROM mode:** SA access for automatic mode. Internal ROM of C9-C1 processor. **LDR mode: available.**

Peculiarities:

♦ After access using logical parameters (even reading of a single sector), the factory mode commands stop working. Consequently, there is no way to build the heads map. To bypass the problem, you have to cancel testing of logical access during the HDD start stage. Then leave the Maxtor utility running, switch to Data Extractor, create a task and build the heads map. You can proceed to LBA reading only after the map is built.

5.2.5. Sabre2 drive family

Boot ROM version	Drive family	Interface	Available functionality
VA11280Z	Sabre2	SATA	**ROM mode:** SA access for automatic mode, system head switching. The program has a limitation: just the system head 3 can be tested. **LDR mode: available.**

Peculiarities:

- Sometimes the loader start procedure may freeze for unknown reasons. Start the loader again.

5.2.6. CALYPSO drive family

Boot ROM version	Drive family	Interface	Available functionality
YAR42RWZ	CALYPSO	PATA	**ROM mode:** SA access for automatic mode, system head switching. This is boot ROM version from drives manufactured in 2002 using the recording density of 60GB/disk. When this ROM is started with drives manufactured in 2003 and using the recording density of 80 GB/disk, obtaining access to the service area is not possible. **LDR mode: not available.**
YAR43KJZ	CALYPSO	PATA	**ROM mode:** SA access for automatic mode, system head switching. Internal ROM of C8-C1 processor. It is compatible with all CALYPSO HDD manufactured in 2003 and using the density of 80 GB/disk. This program is also suitable for diagnostics of SATA drives (provided that a PATA board is installed instead of the SATA one) using the C8-C1 or C10-C1 processors. **LDR mode: available.**

Peculiarities:

- For cases when RZTBL or AT_PDL modules are corrupted, automatic translator recalculation on the basis of DMSC and PN=33h (HLIST) modules is implemented.
- Some commutator versions may have occasional freezes during reading based on logical parameters. The problem may be bypassed by sending a soft reset while reading in Data Extractor. While the procedure is carried out, the utility automatically detects the commutator type and loads the corresponding firmware.
- After access using logical parameters (even reading of a single sector), the factory mode commands stop working. Consequently, there is no way to build the heads map. To bypass the problem, you have to cancel testing of logical access during the HDD start stage. Then leave the Maxtor utility running, switch to Data Extractor, create a task and build the heads map. You can proceed to LBA reading only after the map is built.

6. Utility features

Specific utility features can be invoked from the «Tests» and «Tools» – «Utility extensions» menu. The remaining functions are inherited from the universal utility *(see the description for the universal utility).*

Table 4. Keyboard shortcuts for specific utility features

Mode	Keyboard shortcut
SA testing and recovery	[Ctrl]+[Alt]+[1]
View modules	[Ctrl]+[Alt]+[2]
Self Test	[Ctrl]+[Alt]+[3]
Test servo labels	[Ctrl]+[Alt]+[4]

6.1. «Tests» menu

6.1.1. Utility status

An opportunity to view the utility status and edit some of its parameters has been introduced to create a mechanism, which would warn about dangerous user actions and provide an opportunity to correct any errors possible during operation of automatic modes, which identify the status of connected HDD *(see Fig. 4.2).*

Displayed statuses:

- Drive family selected during utility start.
- ROM checksum read from ROM_SA.
- Checksum of the ROM loaded to drive memory at the moment when the utility started. If the utility was started in the off line mode the parameter value will correspond to the drive from which the resources for off-line start were copied.
- A string containing the model and version from the module PN=48h.
- The drive was started using an LDR file.
- SA writing test has been performed successfully.
- Status of the drive's security subsystem.
- Utility start in the off-line mode.
- SA head identified during initialization. The parameter can be modified to provide for an opportunity to switch the utility to work with the SA using another magnetic head.
- «Write all module copies» flag – an option for the drive's techno command. It can be changed. While recording a module or UBA range, the HDD firmware saves duplicate copies on its own.
- SA copy – status parameter, which allows complete switching of the utility to work with a copy within the service area specified by the «SA head» parameter.

6.1.2. Service information

6.1.2.1. Work with service area

«Work with service area» unites all technological modes that enable operations over service data and microcode modules.

6.1.2.1.1. SA surface verification

The test serves to check readability of UBA ranges occupied by copies 0 and 1 of module groups. Some modules, for instance, Self Test or PN=33h (defect list), have no copies. The test does not access service area portions, which do not affect drive operation. We recommend running the test solely for diagnostic purposes. There are no recovery features associated with it. Reassignment of defects in the service area is implemented in the «SA testing and recovery» interactive mode *(section 6.2.1.1).*

6.1.2.1.2. SA structure test

The test allows the user to estimate the validity of data recorded in the SA. If a HDD does not function because of damaged data in SA, the test will identify corrupted modules. Then you can use that information to plan further drive restoration. Please note that drive functioning does not necessarily require reading of all modules and total absence of defective sectors in the SA. Utility developers have analyzed all available cases of SA problems and identified a number of modules and relations between them, which should be taken into account during HDD restoration. Of course, the utility cannot yet diagnose every possible case of damage in SA so as long as new Maxtor HDD malfunctions appear the utility will be supplemented with respective mechanisms for SA structure checks. A large part of the test functionality is also available in the «SA testing and recovery» interactive mode *(section 6.2.1.1)*. Thus the user can combine the process of modifying SA modules and testing of SA structure.

The test uses the head specified in the «Utility status» dialog *(section 6.1.1)*. To make the test use another head, you should change the SA head.

The test procedure is as follows:

1) The utility uses a techno command to identify the minimum and maximum cylinders of HDD physical space. If the utility fails to obtain those values, it means that the drive has been initialized by non-functional firmware.

2) U_LIST check. The utility reads the module and verifies its checksum and header. If the module cannot be recognized, some checks for the AT_PDL module become impossible.

3) DISK configuration module. The utility reads the module and verifies its checksum and header obtaining from it the head map and the number of heads.

4) Check-up of calibration adaptive data – the «SRV» module. The utility reads the module and verifies its checksum and header.

5) Check-up of adaptive information for data surface – the «RCT» module. The utility reads the module and verifies its checksum and header.

6) Check-up of the zone allocation table. The utility issues a techno command to the drive to read the zone table. If the table cannot be read, it means that the controller firmware has been started incorrectly (e.g., improperly started loader).

7) ROM copy check. The test reads ROM and verifies its checksum.

8) Check-up of ATA overlays. The utility reads each overlay individually validating its checksum and header.

9) Check-up of techno overlays. The utility reads each overlay individually validating its checksum and header. ATHENA drives have no overlay 18h.

10) RZTBL check. The utility reads the module and verifies its checksum and header. The module data are used then to check the RZTBL and AT_PDL validity.

11) P-List (AT_PDL) check. The module constitutes the main translator part, which actually contains exact locations of defects. The table does not occupy the whole module but rather a small part of it. Therefore the checksum is calculated for its portion only instead of the whole module. The number of sectors occupied by the table is specified in U_LIST.

12) G-List check. The test verifies its checksum. Data structure validity is not checked.

13) RZTBL and P-List validity check. The test runs a comparison of the main translator parts. The comparison uses the number of records declared for each zone and the records actually present in P-List. This step helps reveal invalid information about defects, which accidentally appeared in P-List, RZTBL or in both tables at once.

14) H-Lists – RZTBL check – the test determines the correspondence between the HLIST table of defects (or module PN=33h) and the translator. A situation is virtually possible, when translator and defect list contain different defects, e.g., when the translator is recorded from another drive or when it has been overwritten with an empty copy (P-List and G-List have been cleared).

15) H-Lists check. The utility reads the modules and verifies their checksums and headers.

16) Security module check. The test displays information about ATA passwords. A drive may not function because of a password set in it. Sometimes a drive fails to recalculate the module checksum. Problems with the SECU module checksum never prevent firmware start.

17) Test of S.M.A.R.T. modules reads them. No checksum testing follows, because HDD corrects checksum value after the ATA command to get SMART data. If the utility starts checksum testing an error may result in a false impression of module malfunction.

18) FMTI check. The module is used in full-size drives and contains various adaptive settings for zones.

19) Check-up of [DISK/PW] (or PN=95h). The module is employed by boot ROM to switch drive start between «program 1» and «program 2». If the module cannot be read or its checksum is invalid, then boot ROM will not start the SA firmware portion.

6.1.2.1.3. Reaing / Writing modules

Reading and writing help preserve or overwrite completely all SA modules within a single copy thereof, provided they described in the module table. However, besides the modules there is a number of supplementary data not included into that table, e.g., the alternate SA or module copies.

Modules can be handled both in the old style of PC-3000 (DOS) or in a new manner using the database *(9.1).*

6.1.2.1.4. Modules group Reading / Writing

The option extends the opportunities provided by SA reading and writing by access to operations with copies of module groups. Please keep in mind that a group contains the same modules as those available for reading of individual modules plus inactive SA spaces between the modules. E.g., you can transfer all Self Test modules from one drive to another without enumeration, as a whole group.

If you need to overwrite a whole actively used part of service area you can certainly accomplish that working with groups of modules. Module groups are not included into work with the database because overwriting of the whole SA from another drive would be useless.

6.1.2.1.5. SA writing test

The test executes a techno command loading calibration adaptive data from the service area. If command performance completes with an error, it means that the module containing adaptive data is either missing or has damaged data structure. Then the command writes a single sector with random content and attempts to read it. If the read data do not match the recorded information, then the utility searches for the latter within the UBA range where recording has occurred. If it discovers the recorded data, the utility displays a message informing that «Data have not been written». If the data cannot be found, the utility returns an error telling that the offset cannot be found. Problems with SA recording are usually caused by the deviation of magnetic head parameters from the values specified in the module with calibration adaptive data.

Attention! In that case recording to SA is impossible; therefore, it cannot be restored. Although sometimes recording may function despite the failed test, SA recovery is very risky – you may end up with an irreparable HDD.

6.1.2.1.6. Module recovery

The feature works with 4 modules: DMCS, U_LIST, AT_POL, and AT_PDL. In fact, firmware of Maxtor drives can modify the headers of those modules keeping their contents unchanged in case of any recording problems. If module header has been changed, the next drive start may result in an error or even cause the HDD to freeze.
The feature works as follows: the utility reads a module from disk surface (reading errors make recovery impossible), corrects its header replacing it with a valid one, recalculates its checksum and writes the module back. Recording errors may cause the module to be written incorrectly or to another location, which may result in damage to neighbouring modules.

Attention! Therefore before the procedure you should save copies of all essential modules and run the «SA writing test».

6.1.2.1.7. Translator regeneration

The feature allows the user to rebuild translator modules PN=18h, PN=37h, PN=78h based on the data found in general defect list from the module PN=33h. Regeneration process clears the translator adding the defects from that list one by one using the techno command for defect assignment. There is an important peculiarity: if a drive had tracks hidden on the RZTBL level, they will be shifted to the P-List level. That may cause modifications in the interpretation of defects by the drive (which are hard to explain so far). No shift of user data occurs in that case.

6.1.2.1.8. Hardware translator regeneration

Hardware recalculation mode invokes a special feature of the drive, which builds the translator using the modules ID=33h and DMCS. Correspondence of the DMCS module to the structure of the module ID=33h is verified during the procedure. If discrepancies are detected, the utility generates correct content for the DMCS module on its own and initiates the translator regeneration *(Fig. 6.1)*.

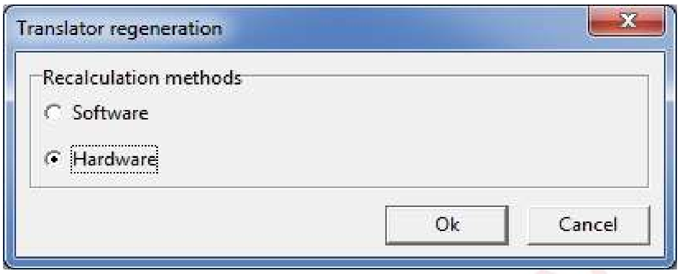


Fig. 6.1.

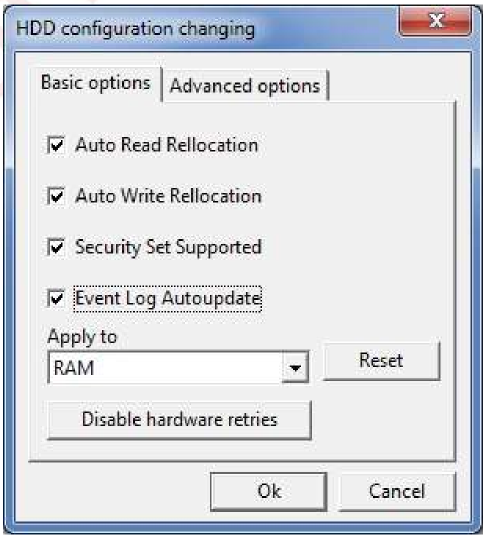
When P-List & G-List are cleared, the DMCS module is cleared as well, but the contents of the module ID=33h remain unchanged. When hardware regeneration is initiated, the utility compares the number of defects actually present in the ID=33h module and listed in DMCS. If the numbers do not match, the DMCS module will be corrected, with a subsequent translator regeneration.

6.1.2.1.9. HDD configuration changing

HDD configuration consists of various software settings and switches stored in the form of bit-maps in the ATAF (PN=22h) module. Selection of that menu item invokes reading of those parameters[1]; then the utility displays them in the «Basic options» tab as enabled or disabled checkboxes:

- ***«Auto Read Reallocation»*** – automatic addition of defects to G-List if a BAD sector is encountered while reading.
- ***«Auto Write Reallocation»*** – automatic addition of defects to G-List if a BAD sector is encountered while writing.
- ***«Security Set Supported»*** – enabling/disabling of the ATA password system in a drive.

It is frequently necessary to disable automatic hiding of defects during data recovery from a drive with defective surface. It allows the user to avoid unwanted attempts to write to the service area and cancel automatic reallocation of defective sectors by HDD firmware.


HDD configuration changing

☑ Auto Read Rellocation
☑ Auto Write Rellocation
☑ Security Set Supported
☑ Event Log Autoupdate
Apply to: RAM

Fig. 6.2. HDD configuration changing.

[1] – HDD always produces an ABRT error while reading the parameters.

Enabled or disabled flags can be temporarily saved (until power-off) in RAM or for permanent storage in the SA. If you select SA, the data are written to module ATAF (PN=22h).

Clicking the «Reset…» button executes a techno command, which returns all drive settings to their default state. During the procedure, if the «Apply to» switch is to «RAM», then the reset will be performed in drive RAM only. The command is convenient because parameter reset enables LBA48 support without recording anything to the SA. You are also advised to reset the configuration by setting the «Apply to» switch to «SA» before running Self Test.

The «Advanced options» tab contains the «LBA48 support» and «Support for Self Test monitoring via COM port» settings. They are assigned to a separate tab, because they cannot be set in drive RAM; instead, the ATAF (PN=22h) module has to be modified directly.

6.1.2.1.10. Technological ID

The menu item allows to view decrypted contents of the DISK module in a drive, and change the model name and serial number in it. The list of drive family models is taken from the module and in most cases it contains LBA, which do not correspond to actual addresses. It does not mean any problems of the list or the utility. We can consider it a peculiarity of the DISK module.

6.1.2.1.11. Secuirity subsystem

The item allows the user to view or clear the HDD passwords specified in the SECU module.

6.1.2.1.12. View extended zone allocation table

This utility command appears if you have selected a drive family with a full-size HDA because half-size drives do not have an extended zone table. The command uses two methods to obtain the zone table: from drive RAM and from the FMTI module of the SA. The data will be output to the utility log. The command is intended for checks of utility compatibility with the zone allocation table of the connected HDD.

6.1.2.2. Loader

LDR files or loaders are intended to start a hard drive in case of problems with start-up firmware initialization or for its online replacement (e.g., if the firmware fails to read correctly any of the translator tables). The firmware in that case enters the error state and prevents access to any of commands for access to data in the user and service areas. In that case you have to start the drive in such a manner as to prevent its standard initialization making the HDD skip it. Of course, many firmware algorithms in that case will be blocked, e.g. access to user data area or work with its defects, etc. Furthermore, the drive will not load its adaptive data so the commands for access to the service area may function erratically.

If a drive is completely functional or it has already been started using a compatible LDR file, you can create a native loader from that drive. Then restart the utility selecting the LDR file thus created at the start. The step would prevent incompatibility between an LDR file and the drive being repaired.

Loader start can be invoked from the utility start-up dialog *(see chapter 5).* The running utility provides access to the features for loader creation both from a connected drive or from profile files or database.

The «Utility off-line start resources reading» mode allows the user to add to the database modules from a functional drive, which may help start a malfunctioning HDD.

6.1.2.3. Work with DB

6.1.2.3.1. Report on database resources

Maxtor utility allows generation of a report on DB contents for a selected directory: use the «Tests» – «Report on database resources». If you specify a folder, the utility will create a report for that folder; if you select the database root, it will create a report on the whole database portion pertaining to Maxtor drives. The report is generated as follows: first text data from the «HDD Info» are displayed and then you can view the profile data, which the utility receives automatically during initialization of a connected drive. The report is a convenient tool to check available data and arrange its various parts.

6.1.3. Surface test

6.1.3.1. Logical test

This is a drive surface test utilizing logical parameters in LBA notation. After the test, the utility displays a dialog window with an offer to hide revealed defects, which will be added to P-List. The feature is derived from the universal utility.

6.1.3.2. Physical test

This is a test of physical tracks of a drive. There are two possible modes: verification and reading. Enable the «Save defects» checkbox in the reading parameters to keep track of the discovered defects. The feature works correctly with ARES, N40P or CALYPSO drives only if LBA48 support is enabled. The test allows estimating the quality of magnetic surfaces. Since deactivation of heads is not implemented yet, the mode has little use. Its sole advantage over logical scanning is manifested in the possibility to ignore some of the heads installed in a HDD while scanning.

6.1.4. Defect lists

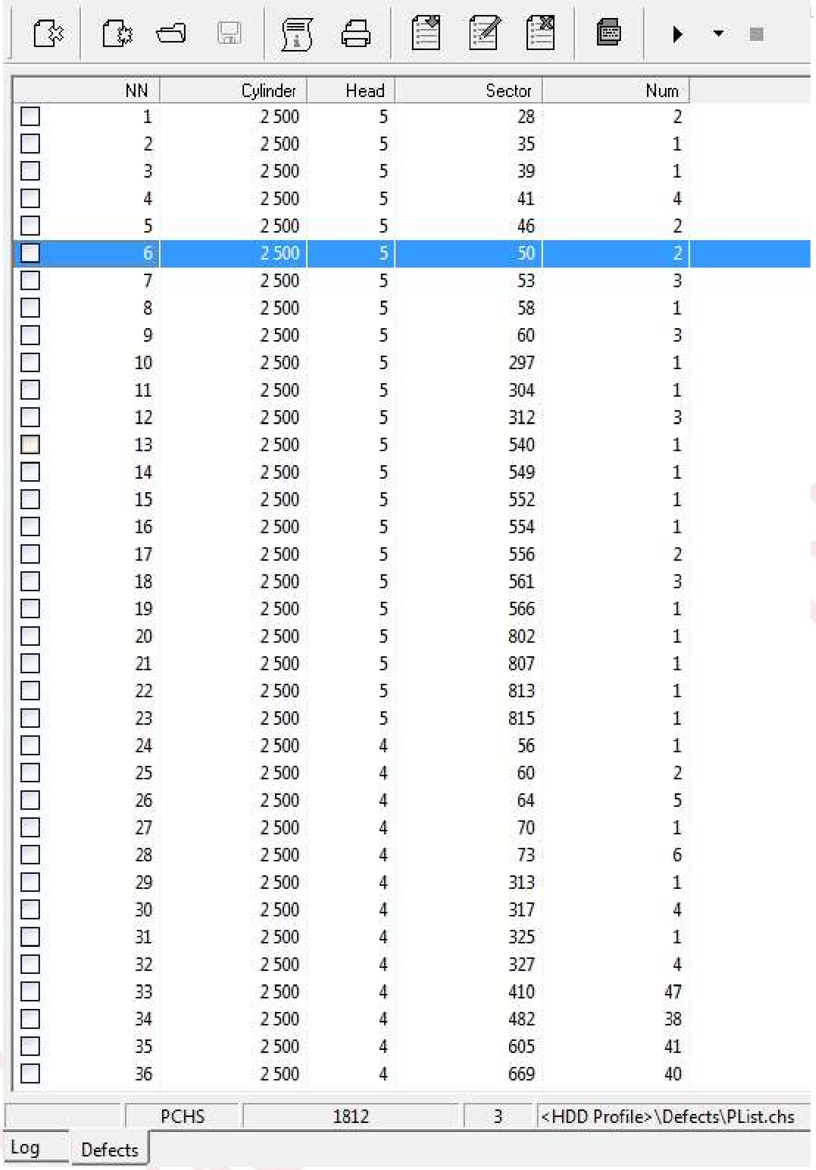
These are features available for work with defect lists:

- ***RZTBL Viewing.*** The feature allows the user to view decrypted RZTBL contents.
- ***P-List (HUTL) reading*** loads the table from module PN=33h to the defect editor.
- ***G-List reading*** loads the G-List table to the defect editor. For N40P and CALYPSO drives the feature allows formula selection.
- ***P-List (AT_PDL) reading*** loads to the defect editor the table generated by the utility using the translator modules.
- ***Reading of SA defects*** loads to the defect editor the table the table responsible SA defects from the PN=33h module and U_LIST.
- ***Moving G-List to P-List*** – procedure accomplished using a drive command.
- ***Clearing G-List*** – resets G_LIST only using internal drive tools. If you copy G-list from another drive and then reset it, the module structure will be restored.
- ***Clearing G-List and P-List*** – the feature resets the translator by sending a techno command to HDD. In some drives, e.g., ROMULUS, it also resets the module containing the PN=33h defect list.
- ***Removing candidate defects from G-List.*** Removes from G-List defects marked as «candidate».

The viewing mode for the defect lists allows access to the universal functions of defect list editing and Maxtor-specific tools:

- ***Reassign defects*** – relocates defects to the selected P- or G-List table using a techno command.
- ***Reassign SA defects*** – relocates defects using the techno command to hide SA defects. The procedure does not actually move the modules as necessary to prevent their shift after drive start.
- ***Defects count*** – calculates the total number of defective sectors in a loaded table.

Guidelines for defect relocation can be found in *section 8.2.*



	NN	Cylinder	Head	Sector	Num
☐	1	2 500	5	28	2
☐	2	2 500	5	35	1
☐	3	2 500	5	39	1
☐	4	2 500	5	41	4
☐	5	2 500	5	46	2
☐	6	2 500	5	50	2
☐	7	2 500	5	53	3
☐	8	2 500	5	58	1
☐	9	2 500	5	60	3
☐	10	2 500	5	297	1
☐	11	2 500	5	304	1
☐	12	2 500	5	312	3
☐	13	2 500	5	540	1
☐	14	2 500	5	549	1
☐	15	2 500	5	552	1
☐	16	2 500	5	554	1
☐	17	2 500	5	556	2
☐	18	2 500	5	561	3
☐	19	2 500	5	566	1
☐	20	2 500	5	802	1
☐	21	2 500	5	807	1
☐	22	2 500	5	813	1
☐	23	2 500	5	815	1
☐	24	2 500	4	56	1
☐	25	2 500	4	60	2
☐	26	2 500	4	64	5
☐	27	2 500	4	70	1
☐	28	2 500	4	73	6
☐	29	2 500	4	313	1
☐	30	2 500	4	317	4
☐	31	2 500	4	325	1
☐	32	2 500	4	327	4
☐	33	2 500	4	410	47
☐	34	2 500	4	482	38
☐	35	2 500	4	605	41
☐	36	2 500	4	669	40

PCHS 1812 3 <HDD Profile>\Defects\PList.chs

Fig 6.3. Defect editor.

6.1.5. Clear S.M.A.R.T.

This menu item allows the user to reset to the initial state (the best condition) all time-critical attributes and initialize all logs.

You can select «Tools» – «View S.M.A.R.T» or the [Alt]+[S] keyboard shortcut to review the current attribute values.

The command initializes the attribute associated with the number of reassigned defects. To reset it, you will have to clear G-List.

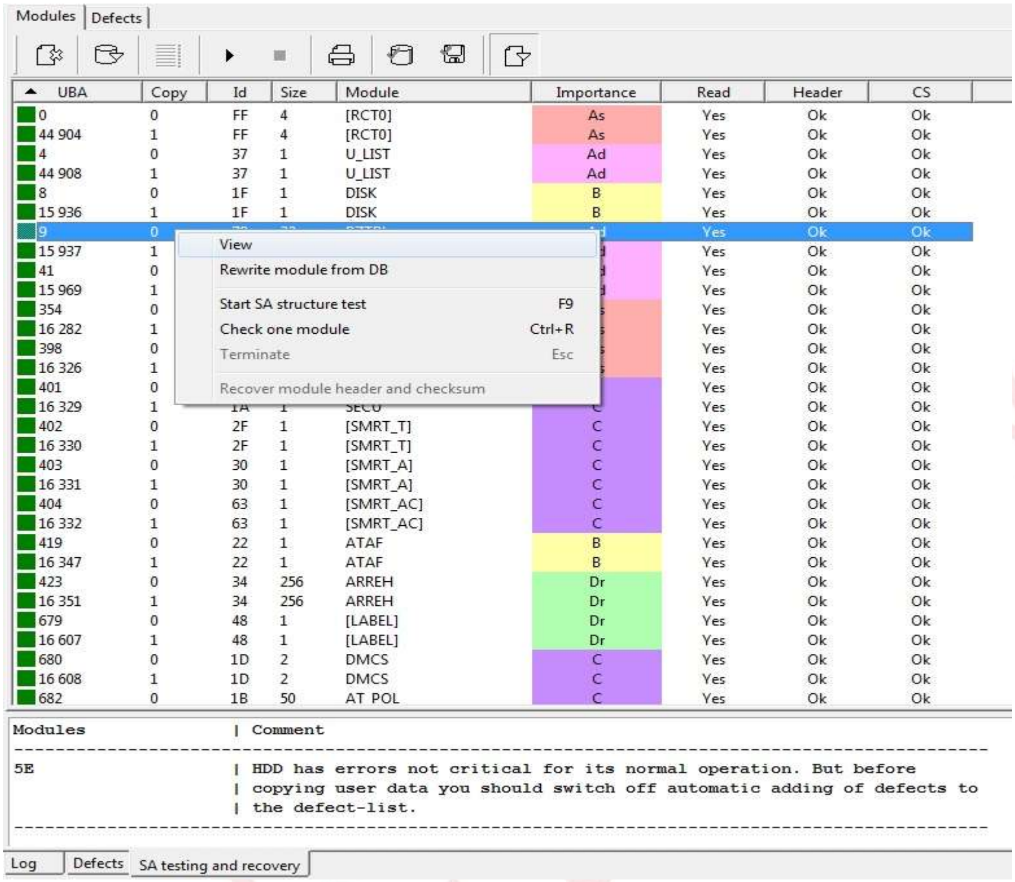
6.2. «Tools» menu

The «Tools» menu traditionally contains a standard collection of interactive modes described in the manual for the universal utility and some Maxtor-specific options available via the «Utility extensions» mode.

6.2.1. Utility extensions

The extensions are actually interactive modes and plug-in modules for the HEX editor.

6.2.1.1. SA testing and recovery



UBA	Copy	Id	Size	Module	Importance	Read	Header	CS
🟩 0	0	FF	4	[RCT0]	As	Yes	Ok	Ok
🟩 44 904	1	FF	4	[RCT0]	As	Yes	Ok	Ok
🟩 4	0	37	1	U_LIST	Ad	Yes	Ok	Ok
🟩 44 908	1	37	1	U_LIST	Ad	Yes	Ok	Ok
🟩 8	0	1F	1	DISK	B	Yes	Ok	Ok
🟩 15 936	1	1F	1	DISK	B	Yes	Ok	Ok
9	0					Yes	Ok	Ok
🟩 15 937	1					Yes	Ok	Ok
🟩 41	0					Yes	Ok	Ok
🟩 15 969	1					Yes	Ok	Ok
🟩 354	0					Yes	Ok	Ok
🟩 16 282	1					Yes	Ok	Ok
🟩 398	0					Yes	Ok	Ok
🟩 16 326	1					Yes	Ok	Ok
🟩 401	0					Yes	Ok	Ok
🟩 16 329	1	1A	1	SECU	C	Yes	Ok	Ok
🟩 402	0	2F	1	[SMRT_T]	C	Yes	Ok	Ok
🟩 16 330	1	2F	1	[SMRT_T]	C	Yes	Ok	Ok
🟩 403	0	30	1	[SMRT_A]	C	Yes	Ok	Ok
🟩 16 331	1	30	1	[SMRT_A]	C	Yes	Ok	Ok
🟩 404	0	63	1	[SMRT_AC]	C	Yes	Ok	Ok
🟩 16 332	1	63	1	[SMRT_AC]	C	Yes	Ok	Ok
🟩 419	0	22	1	ATAF	B	Yes	Ok	Ok
🟩 16 347	1	22	1	ATAF	B	Yes	Ok	Ok
🟩 423	0	34	256	ARREH	Dr	Yes	Ok	Ok
🟩 16 351	1	34	256	ARREH	Dr	Yes	Ok	Ok
🟩 679	0	48	1	[LABEL]	Dr	Yes	Ok	Ok
🟩 16 607	1	48	1	[LABEL]	Dr	Yes	Ok	Ok
🟩 680	0	1D	2	DMCS	C	Yes	Ok	Ok
🟩 16 608	1	1D	2	DMCS	C	Yes	Ok	Ok
🟩 682	0	1B	50	AT POL	C	Yes	Ok	Ok

```
Modules                | Comment
---------------------------------------------------------------------------------------
5E                     | HDD has errors not critical for its normal operation. But before
                       | copying user data you should switch off automatic adding of defects to
                       | the defect-list.
---------------------------------------------------------------------------------------
```

Fig. 6.4. Window appearance in the «SA testing and recovery» mode.

The mode includes all features necessary for interactive restoration of the SA, i.e. the process of structure analysis is combined with the recovery process. The mode can be initiated with the following sequence: «Tools» – «Utility extensions» – «SA testing and recovery».

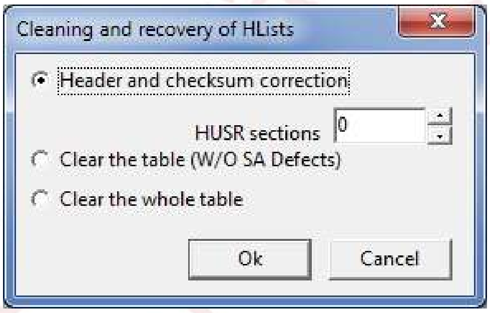
Figure 6.4 demonstrates the utility window appearance in that mode after SA testing. The «Modules» tab displays a table of modules essential for HDD functioning as determined by the utility developers. The table lists the modules in the ascending order by their UBA number. One can see that practically all modules with «A» importance occupy lower UBA and therefore they are at the top of the table. A module record consist of: initial UBA sector, ID or PN, length in sectors, short name, level of importance *(section 4.3)*, header check status and checksum verification status. A coloured square in the beginning of each line reflects the check-up results:

- Red – error reading module
- Yellow – checksum error
- Pink – header comparison error
- Green – no errors.

Commands available from the right-click menu:

- ***Start SA testing*** – the command launches the process of reading modules and analyzing their structure; then it fills in the module status fields. Before the launch, you will have to select the drive profile if it has not been selected yet and specify the directory for backup copies of modules read during the test. If the specified directory already contains files with modules, they will be overwritten without warning. When backup copies have to be created for several tests of the same drive we recommend creating in the browsing window a new directory (instead of the default one) and selecting it for further work.

- ***Module viewing*** – opens the HEX editor window (this viewing module is identical to *section 6.2.1.2*), with the module contents loaded to it. Module sectors, which cannot be read, will be filled with double-byte hex words: 0DEh and 0ADh or «DEAD». The viewing procedure creates no backup module copies.
- ***Rewrite module from DB*** – provides an opportunity to overwrite the module from the table with an identical one from the DB. The «Rewrite module from DB» dialog offers an opportunity to run a module search. The checksum [ROM_SA] will act as the search criterion. You can also specify the module manually. The module may be selected if the search produced no results. In that case, the utility controls UBA and module length. If you select an inappropriate module, the «Wrong module» error will be output to utility log.
- ***Start SA testing*** – the command launches testing process depending upon the selected mod.
- ***Terminate process*** – allows the user to stop the process of structure testing or module reading.
- ***Recover module header and checksum*** – allows header restoration for modules: DMCS, U_LIST, AT_POL, AT_PDL and [HUTL/HUSR]. Restoration of the headers, except for [HUTL/HUSR], works in accordance with the algorithm described in *section 6.1.2.1.6. Figure 6.5* displays the dialog containing the parameters of [HUTL/HUSR] module modification. For the «Header and checksum correction» mode, you should specify the number of sections, because there is no way for the utility to identify it automatically if the module is corrupted. [HUTL/HUSR] module structure is described in *section 4.3*. The «Clear the table (W/O SA Defects)» feature leaves HUTL in its place and erases all HUSR tables leaving one copy with a correct header and checksum. The «Clear the whole table» function leaves in a module only two clear HUTL sections and a single HUSR.


Cleaning and recovery of HLists

● Header and checksum correction

HUSR sections 0

○ Clear the table (W/O SA Defects)

○ Clear the whole table

Fig. 6.5. HLists clearing and recovery.

- ***Show log*** – the switch is available from the toolbar of the «Modules» tab to show/hide a window containing the log of module structure testing.

The «Defects» tab, when the mode is selected, loads the SA defects from the U_LIST module using the active SA head. During SA test all revealed defects are added to the list and marked with yellow boxes. The toolbar provides access to the button, which serves for hiding the SA defects. Clicking it reads the modules, adds each defect to the SA translator and writes the SA data back. The mode has a number of drawbacks and limitations discussed in *chapter 8.*

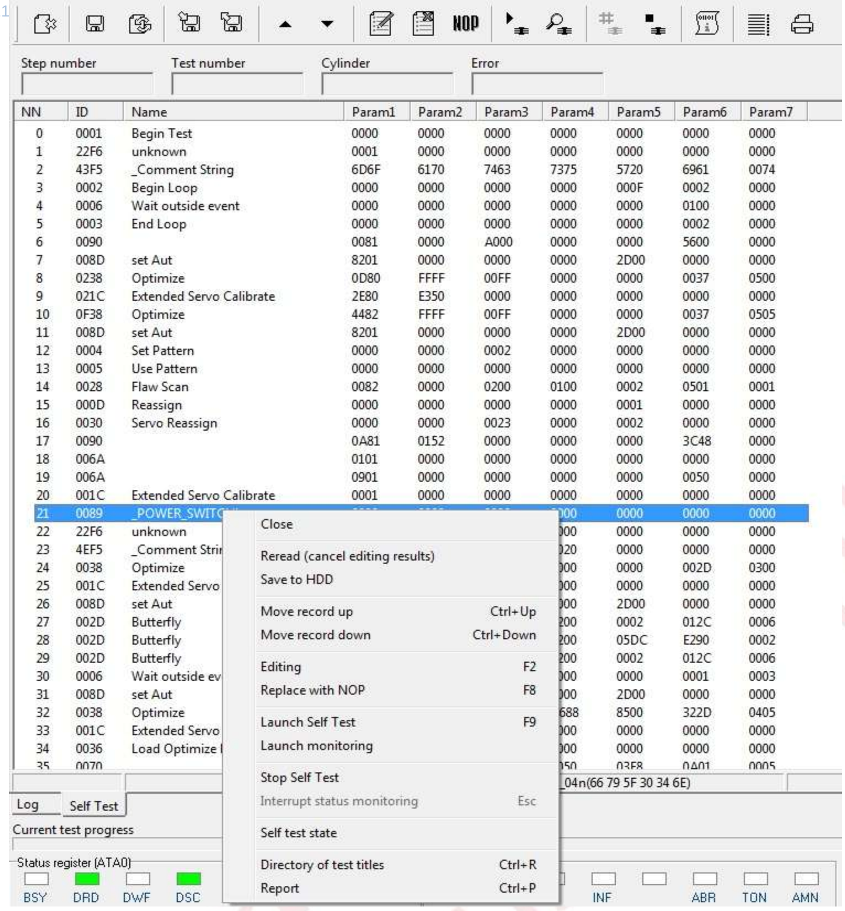
6.2.1.2. View modules

The interactive mode allows loading of the following objects into the HEX editor: modules from the table of modules, ranges of UBA sectors and physical tracks. You can specify for a module the head, which can be used to read it. There are also some service functions, e.g. checksum recalculation and verification for a block or a whole module.

The process of object loading can be terminated. The HEX editor in that case will display as many data sectors as the utility has managed to read.

6.2.1.3. Self test

This interactive mode *(Fig. 6.6)* allows the user to run the techno self-testing routine, edit its script (Self Test program) and monitor the current status while a HDD passes the test.



NN	ID	Name	Param1	Param2	Param3	Param4	Param5	Param6	Param7
0	0001	Begin Test	0000	0000	0000	0000	0000	0000	0000
1	22F6	unknown	0001	0000	0000	0000	0000	0000	0000
2	43F5	_Comment String	6D6F	6170	7463	7375	5720	6961	0074
3	0002	Begin Loop	0000	0000	0000	0000	000F	0002	0000
4	0006	Wait outside event	0000	0000	0000	0000	0000	0100	0000
5	0003	End Loop	0000	0000	0000	0000	0000	0002	0000
6	0090		0081	0000	A000	0000	0000	5600	0000
7	008D	set Aut	8201	0000	0000	0000	2D00	0000	0000
8	0238	Optimize	0D80	FFFF	00FF	0000	0000	0037	0500
9	021C	Extended Servo Calibrate	2E80	E350	0000	0000	0000	0000	0000
10	0F38	Optimize	4482	FFFF	00FF	0000	0000	0037	0505
11	008D	set Aut	8201	0000	0000	0000	2D00	0000	0000
12	0004	Set Pattern	0000	0000	0002	0000	0000	0000	0000
13	0005	Use Pattern	0000	0000	0000	0000	0000	0000	0000
14	0028	Flaw Scan	0082	0000	0200	0100	0002	0501	0001
15	000D	Reassign	0000	0000	0000	0000	0001	0000	0000
16	0030	Servo Reassign	0000	0000	0023	0000	0002	0000	0000
17	0090		0A81	0152	0000	0000	0000	3C48	0000
18	006A		0101	0000	0000	0000	0000	0000	0000
19	006A		0901	0000	0000	0000	0000	0050	0000
20	001C	Extended Servo Calibrate	0001	0000	0000	0000	0000	0000	0000
21	0089	_POWER_SWITC				000	0000	0000	0000
22	22F6	unknown				000	0000	0000	0000
23	4EF5	_Comment Stri				020	0000	0000	0000
24	0038	Optimize				000	0000	002D	0300
25	001C	Extended Servo				000	0000	0000	0000
26	008D	set Aut				000	2D00	0000	0000
27	002D	Butterfly				200	0002	012C	0006
28	002D	Butterfly				200	05DC	E290	0002
29	002D	Butterfly				200	0002	012C	0006
30	0006	Wait outside ev				000	0000	0001	0003
31	008D	set Aut				000	2D00	0000	0000
32	0038	Optimize				688	8500	322D	0405
33	001C	Extended Servo				000	0000	0000	0000
34	0036	Load Optimize				000	0000	0000	0000
35	0070					050	03F8	0A01	0005

_04n(66 79 5F 30 34 6E)

Fig. 6.6. Window appearance in the «Self Test» mode.

When you initiate the mode (keyboard shortcut: [Ctrl]+[Alt]+[3]) the utility reads from the SA module PN=0Eh containing the test script and displays it as a table. The table shows both active program steps and inactive steps (test code 00 – or «End Test»). The right-click menu available from the list or window toolbar provides access to the following commands:

- ***Close*** – closes the interactive mode.
- ***Read again*** – reads again the Self Test script from the corresponding module in SA.
- ***Save to HDD*** – writes the script to module PN=0Eh in SA.
- ***Save to file*** – saves the script in the format of module PN=0Eh to the SelfScanData.bin file in the current profile.
- ***Load from file*** – loads from file a script in the format of module PN=0Eh. You can specify an RPM file corresponding to the PN=0Eh module.
- ***Move record up*** – moves the selected test one line up.
- ***Move record down*** – moves the selected test one line down.
- ***Edit*** – modifies a test record. The command displays a dialog window, where you can change text ID and its parameters.
- ***Replace with NOP*** – replaces the current test identifier with the «no operation» identifier (ID=F5h).
- ***Launch Self Test*** – performs correction of SA modules to launch Self Test.
- ***Interrupt status monitoring*** – discontinues the display of current Self Test status. You cannot exit the utility if you have launched status monitoring and haven't stopped it.
- ***Directory of test titles*** is a file containing the links between test identifiers and their names, e.g. the ID code of test 01, which corresponds to the record entitled «Begin Test». Titles are assigned to some tests, though not all of them; you can add your own titles or change the existing ones. The file is located in the directory, where PC-3000 for Windows is installed, its name is MaxtorSelfTests.ini.

Poker/Ardent drives do not display upper bits of cylinder number, therefore the «Cylinder» field values for them do not always reflect the reality. The error field shows the status of the drive error register. Usually it contains 1 as its value.

The fundamental principles of self-testing are described in *section 8.2*. Some peculiarities typical of different drive families are discussed in *chapter 9*.

6.2.1.4. Test servo labels

Our plans include a number of graphic tools, which should help estimate the functioning of heads/surfaces. Currently the utility offers a PES test, which allows the user to check the average deviation of tracks from the centre. It is not intended for relocation of defects.

6.2.1.5. Defectoscope

Please see the universal utility manual for a description of that mode.

7. Diagnostics of malfunctions

The task of data recovery from a Maxtor drive requires, first of all, precise diagnostics of malfunction, preferably without HDA disassembly; with simultaneous minimizing of further damage to the drive or data loss. Malfunctions, just like methods of diagnostics can be subdivided as follows:

- PCB malfunction.
- Motor/bearing failure.
- Parking element failure.
- Failure of one or more reading/writing.
- Heads failure and surface scratch.
- BAD sectors.
- Instabilities of reading/writing.
- Complete or partial loss of service information.

When the scope of problems is identified it is time to begin diagnostics. What of the above has happened?

7.1. Step 1: electronics

Let us begin with the electronics board. In order to make sure that the board is operational it is sufficient to connect it to another drive with the same firmware version and check, whether the drive works flawlessly with the board. Our guidelines for PCB selection on the basis of HDD version can be found in *section 4.2*. A HDD in that case may be started and identified with its factory alias and ROM version on the board, but a loader cannot be started in that case.

Attention! Malfunctioning PCB makes software restoration of the drive from within the utility impossible.

7.2. Step 2: mechanical/electrical parts

If the problem is not caused by electronics then motor diagnostics should be performed. If the motor does not spin up though the board is operational the cause is either damaged motor winding or heads sticking to disk surface. Sometimes the motor damage causes the motor controller chip failure. One more cause preventing rotation is seizure of a fluid dynamic bearing. Seizure practically does not occur in drives using ball bearings in spindle, but another problem appears, namely motor operation with obviously high noise level caused by a considerably greater disk beating. One more motor problem may be related to bad contact or cable break in the connector between the electronics board and HDA. As a result motor problems can be identified by the following signs:

- Winding closure or break.
- Seizure of fluid dynamic bearing (FDB).
- Motor operation with a considerable noise level.
- Problem with connection between the motor and electronics board.

Attention! A malfunctioning motor makes software restoration of a HDD impossible.

7.3. Step 3: magnetic surface

If a drive with operational electronics having no obvious problems in motor functioning (VCM & Spindle Motor) does not knock heads or produce slight knocking at attempted calibration we should proceed to the following Step 4. Now we should start diagnostics of surface scratch. It is difficult to perform the diagnostics completely without drive disassembly, but through the STW lifter opening one can see up to 90% of the surface from the PCB side. In half-size drive families the opening shows the work surface and the amplifier chip. Examples of the STW pin openings can be found in *section 9.12* for half-size HDAs and in *section 9.13* for full-size HDAs. Scratches on disk surface or detached heads make drive restoration impossible.

7.4. Step 4: firmware status during start / magnetic heads

During this step you will have to solve a very complicated task and tell a head malfunction from a damaged firmware structure[1]. The task complexity is so obvious because the manifestations of both malfunctions are very close and it is not always possible to identify the difference. E.g., if a drive has a module with damaged structure and the adaptive parameters do not match the current condition of the writing head then an attempt to restore that module will cause complete destruction of several service data tracks. If you have not prepared a backup copy of the SA during the diagnostics stage, data recovery from such drive becomes impossible. All tools necessary for diagnostics can be found in the utility start-up dialog window *(see figure 5.1).*

First, you should identify the status, which the HDD enters after its start in regular manner (use the drive start-up chart, *Fig. 4.1*). There are three possible variants:

- ***FAIL*** – in that status you should run the «HDD ID reading» command and note drive firmware version. If it matches the drive ROM version, it means that SA surface either cannot be read at all or there are damaged portions in the modules checked by boot ROM prior to starting the code from the service area ([ROM_SA]). If the PCB is functional and it matches the HDA, the problems with firmware start from SA can follow only from drive's inability to read the SA or its damaged structures. You should start a loader to perform more precise diagnostics of that status.
- ***ALT-SA*** – the status can be identified using the guidelines from *section 4.5*. It means that the reading magnetic head used by boot ROM for drive start is functional. You can proceed to Step 5. However, if you attempt writing a sector to the alternative SA and it cannot be read any longer or its data thus read turn out to be invalid, it definitely means damage of the recording component in the magnetic head.
- ***Work*** – in that status drive firmware is functional if a drive can be read using LBA. In case of availability via LBA and the need to recover user data, the utility must be used only to disable automatic relocation of defects *section (6.1.2.1.8);* all other functions do not improve the reading results. Please keep in mind that an ATA password may be set *(section 6.1.2.1.10).* Of course, the adaptive parameters may not correspond to the current status of drive heads (quite frequent condition in N40P and CALYPSO families), preventing you from reading user data and combined with damages surface (scratches, data «misplaced» during recording or software BAD sectors, dust, etc.). Those problems cannot be eliminated using software tools of the utility when data recovery is required, but they can be addressed during repair with the help of Self Test *(section 8.5).*

You should enable the safe mode jumper to identify precisely the cause making the drive enter the FAIL status. The location of that jumper is shown in the *chapter 9* for each drive family. Before you proceed with loader start, check in the PC-3000 options ([Alt]+[T]) the value of the «HDD Timeout» parameter, which should be 15 seconds or more. Start the loader of program A. In drive families without an alternative SA actually act as the program A. Program A loaders created from different drives will be different even if their checksums [ROM_SA] are the same. The difference is in their adaptive settings built into the overlays.

A loader should be started as follows:

- Select the «LDR file loading» item in the utility start-up dialog. Loading from the database is more convenient than loading from file because the list of available loaders is more informative and reflects the selected drive family only. As soon as you connect to the database, the utility displays a list of firmware versions available for the selected family. If new drives have been added to the database since you last created the list of loaders, then you should run the «Rebuild new list ...» command. Of course, you do not

[1] – Recording to a HDD a completely operational firmware copied, however, from another drive can also be viewed as structure damage.

have to rebuild the list each time you start a loader because it is a rather long process. Then specify the loader to be started.

- ♦ Select «ROM + Overlays» in available start variations.

If the start-up process passes without errors, perform «HDD ID reading» and continue diagnostics based on the drive ID information:

- ♦ Correct HDD serial number appears, firmware version ends in '0' and drive model is identified correctly. In that case the loader program initialization succeeded completely and you can start the utility and proceed to Step 5.
- ♦ The serial number is not displayed, but firmware version ends in '0' and drive model is identified by its factory alias. It means that the loader failed to start the SA translator and read a number of modules required for initialization. That may be caused by the fact that some SA modules are unreadable. You may launch the utility and proceed to Step 5. There should be no errors while reading the roadmap of modules. An error while reading the DISK module is possible. In that case you should start the utility using the resources for its offline start.
- ♦ The serial number is not displayed, firmware version is identical to [ROM_SA] or the one specified on HDA label and ends in 'Z'. That means that something prevented loader overlays from loading.
- ♦ The serial number is not displayed, firmware version matches the ROM version on the drive PCB. We have not encountered such cases in practical work. Most likely, it may be caused by a problem while starting the loader ROM.

If the loader starts with errors:

- ♦ Error while loading ROM or drive readiness error. Most probably, the safe mode jumper is disabled. Electronics malfunction has been excluded during Step 1.
- ♦ Error loading overlays. It may be caused by the failure to start of the loaded ROM. The loader file is likely to have an invalid structure or belong to a different drive family.
- ♦ After loading of overlays, the drive started its spindle motor and froze. In that case, you should try a different method to start the loader (see the «Procedure for loader start in case of HDD hanging during start-up» described below).
- ♦ After loading of overlays the drive starts the spindle motor and starts knocking, which continues more than a minute. It means that nothing can be read from disk surface. The situation is possible for CALYPSO drives only, when a HDD with recording density of 40 GB per side was started using a loader from a drive with the 30 GB per side recording density or vice versa. You should select the right loader. Please see *section 9.13* for guidelines regarding the selection. A drive may also produce knocking sounds because of PCB incompatibility with the HDA.

If drive start using a loader has failed, you will be unable to work with it since its memory contains no required code, which should be loaded from disk surface. To switch the drive to the state, when you can run factory (techno) commands, you have to start it using a LDR file.

Why does an «empty» SA prevent HDD start enabling reading/writing? In fact, the code portion constituting the loader file is actually the program borrowed from the SA of another drive; it is formed with the assumption that the SA in the drive using it is completely functional. It means, that it has no routines for initialization of adaptive parameters and the translator in memory. Therefore, if the SA is empty, there will be no opportunity to start a drive for reading of data and recording to SA. The situation is very different with HOT SWAP. In that case, the memory contains both adaptive data and the translator, but they belong to a different drive. We can consider one of possible restoration methods the transfer of translator modules *(section 4.6)* and adaptive data *(section 4.4)* from a malfunctioning drive to a donor HDD with a subsequent HOT SWAP. The donor drive at that will stop writing and reading the user data zone, but if it has an alternative SA, it can be restored by running its Self Test from it. For old drives you can do without copying the adaptive data because HDD parameters are very close. Please keep in mind, however, that a magnetic head could be malfunctioning and there is a possibility to damage the amplifier chip. We have also noted that if the loader does not start, HOT SWAP will not help because drive head(s) does not perform its reading function.

The «Restart using internal HDD SA» feature *(see figure. 5.1)* is implemented to automate the start of firmware from the SA and it functions in safe mode *only*. It is intended to provide an opportunity for running the native firmware from disk containing adaptive settings for the current HDA. You can even do without launching the utility. Complete automation is probably not recommended. You can also employ the feature to determine whether a drive reads the SA after loader start without running the utility.

Procedure for loader start in case of HDD hanging during start-up.

The method is applicable for Poker/Ardent and ROMULUS DSP-based drives because they support the «Firmware start» command *(see figure. 5.1).* A drive hangs when the following start-up variant fails: safe mode, then ROM + Modules. It happens as follows: the drive spins up the spindle motor, unparks the heads and hangs (i.e. does not report on readiness, no matter how much time you wait). In that case no head knocking occurs. This hanging is caused by the termination of firmware execution during the stage, when it should initialize the module read from the SA

The start-up procedure is as follows:

1) Enable the safe mode jumper.

2) Launch the utility.

3) In the firmware version string, note the version which identifies the drive from ROM.

4) Click the «Start firmware» button.

5) As a result of step 4 the drive starts its motor and unparks the heads.

6) Click «HDD ID reading». The firmware string should change after that. If it does not change and the drive hangs, then the situation has no solution so far. The firmware line displays the version of ROM loaded from SA.

7) Now you should start the loader and select the «Overlays only» option. The procedure has one peculiarity. You should guess, what the ROM checksum was and load the overlays with that checksum. If the checksum of ROM loaded from the SA by the «Start firmware» command and the ROM checksum from the used loader do not match, then an attempt to run the utility will result in a roadmap reading error. Then you should try loading the overlays using another loader.

8) Click «HDD ID reading».

9) The last character in firmware number must become 0. The zero will also be displayed if you haven't guessed the correct checksum of the overlays.

10) If you have guessed write, you will have access to the SA.

What is the basic difference between those two methods of loader start? This method differs from drive start in safe mode with a «ROM + overlays» loading by the fact that actual HDD start is accomplished using various ways.

First of all, you should keep in mind that damage does not usually appear in the SA of Maxtor drives for no reason. They are frequently caused by regular (appearance of multiple BAD sectors) or temporary failures of mechanical (bearing, etc.) or electronics (amplifier, heads, motor controller chip, etc.). We have noted that surface recording errors occur with new (Poker/Ardent) drives considerably more frequent than with older (DSP-based) drives. Supposedly, it is a result of head construction and double recording density.

If you fail to make the drive firmware function, software restoration of such drive using the utility would be impossible.

7.5. Step 5: Firmware corruption

You have already entered the utility. The utility provides two mechanisms for estimation of the SA condition, i.e. «SA structure test» and «SA testing and recovery». You are advised to launch the latter («SA testing and recovery») first because it creates backup copies of everything it manages to read during the test. If the test reveals damage in the SA, you can proceed to its recovery. We recommend using the «SA structure test» to make diagnostics more precise.

The utility informs about errors in the headers of certain modules having D importance in some drive families. That is so because Maxtor does not follow a strict scheme in the headers of non-critical modules.

BAD blocks in the SA represent a normal phenomenon even for completely functional drives. Do not pay attention to them unless they coincide with critical modules.

The utility status dialog allows viewing of the ROM version used to start the drive and the version in the PN=39h ([ROM_SA]) module; thus you can quickly tell whether a suitable firmware copy was used to start the drive.

After SA diagnostics you should have identified the cause of malfunction. If no damaged modules have been found, it means either damaged data structures of the translator modules or the G-List module structure, which should be restored using the «Clearing G-List» command *(section 6.1.4)* because recording a module from another HDD does not always remedy the situation. If you need to keep the defects hidden to G-List, then prior to clearing, you should review G-List, save the defects and as soon as the drive restarts clear G-List again and hide the previously saved defects to G-List.

Before you proceed to repair of modules, you should make sure that sector recording to the SA functions correctly. As a matter of fact, LDR file used to start a drive does not initialize firmware completely and that may result in errors in its operation and possible inoperability of the writing head. We have noted a curious fact: if a drive displays its serial number after loader start, then the recording function has definitely been initialized; if the drive refuses to write data it means that the recording element is damaged (there is no software solution to that situation).

There are two methods to test recording:

- ♦ Execute the «SA writing test» command *(section 6.1.2.1.5).* The test consists of two parts: loading of adaptive data from module PN=1Eh and checking the opportunity for recording to the SA by writing any single sector with random contents to an unused SA part called «swap1». Alternatively, you can select the «Initialize SRV» from the utility start-up dialog *(see figure. 5.1).*
- ♦ Load the U_LIST module in the interactive mode and change any byte in it. Then write the module and read it again. If the module has been read successfully, then recording functions normally and you should return the modified byte to its initial value and write it back. We propose the U_LIST module because it has 4 within a single SA copy and a drive will start if at least one of those copies is readable.

There is no way to determine for sure that recording to the SA is possible. E.g., a drive may stop recording to the SA after some time.

Warning! Save all modules from a drive prior to recording anything to it. That requirement is determined by unstable drive behavior during recording to its SA. It means that in case of problems with adaptive data one module can be written over another! That will lead to loss of service data, which will be unrecoverable, if the data hasn't been saved!

What should be done when the «SA writing test» fails? Let us examine the problems, which may occur during the test.

- ♦ The writing test fails because the loaded firmware is incompatible with the HDA. You should create a loader right from that drive or use after loader start the «Restart using internal HDD SA» feature *(5).*
- ♦ If the PN=1Eh module is damaged, the loading of adaptive data will terminate with an error, which will definitely prevent correct recording to the SA. In case of a recording shift no operations with the service data will be possible; that may happen because of a drive failure during the loading of adaptive information.

If unreadable sectors in the SA do not disappear after module recording, then you should: read code and data module groups and write them after that. A situation is possible, when writing to SA in one location damages data integrity in another. For higher reliability we recommend making backup copies of the SA and two groups of modules: code and data. Ignore their reading errors during the backup procedure.

So far restoration of the SA is impossible without revival of the recording function. Of course, there is an opportunity to use HOT SWAP, but it produces results in rare cases. Anyway, repair of such a drive will be useless. If you are trying to recover the data, probably head replacement might be necessary.

8. Software restoration

The utility offers several methods for drive restoration. Specific modes should be selected depending upon your goal. The main modes are:

- ♦ Restoration of the SA functionality (SA testing, overwriting or recovery of damaged modules)
- ♦ Data recovery without restoration of SA to a functional state (LDR file start, HOT SWAP)
- ♦ Relocation of defects while scanning a drive with utility tools (surface scanning, addition of defects to a defect list)
- ♦ Tuning of adaptive parameters and reassigning of defects using the drive's internal Self Test routing.

8.1. Work with the SA

The utility allows to switch the head used for operations over the SA and change the copy within the selected service area.

If the «Write all module copies» option is enabled, the utility sets a corresponding flag in the techno command for recording. The setting of the SA head at that stops working. Now the drive determines the head on its own.

You can use the «View modules» interactive mode *(section 6.2.1.2)* to read and write modules, UBA ranges or physical tracks. The HEX editor in that case allows searching for a specified set of bytes, to move to a specified sector from the beginning of a read range, to verify or recalculate checksums both for a highlighted part or for a whole read block. All these features allow the user to examine closely the SA structures. E.g., you can check the correspondence of the U_LIST module to the AT_PDL module. The word made up by the bytes 10 and 11 in the U_LIST module contains the number of sectors used in the AT_PDL module. Then you should load the PN=18h module, highlight the number of sectors obtained from U_LIST and verify the checksum.

Module damage usually is manifested only by an incorrect identification string while the checksum remains correct. In order to restore such a module (e.g., P-List), it should be sufficient to write the correct header and recalculate the resulting checksum. This kind of damage can be encountered in the following modules: P-List (PN=18h), G-List (PN=1Bh), DMCS (PN=1Dh). When they are damaged, their identification strings become replaced with: NO_PLIST, NO_GLIST, NO_DMCS. A similar case of damage is also possible with module U_LIST00 (PN=37h), but it is very rare. If the module has a correct header, we do not advise using automatic recovery for it.

Although practically all the modules have copies, they does not help to restore them from the copies because they are corrupted, too. Module checksum is practically always correct although their contents might be invalid.

Use the following command sequence to restore a module with a damaged header: «Service information» → «Work with SA» → «Module recovery» *(section 5.2.2.2).* Then you have to specify the name of the damaged module from: DMCS, U_LIST, AT_POL (G-List), AT_PDL (P-List) and press [Enter]. If a module is not damaged and its restoration has been accidentally selected, module contents will not be affected by the procedure in any negative way.

Warning! The «Module recovery» command corrects module header and recalculates its checksum only! Module contents remain identical to the information read from the drive being restored. If the module contains invalid data and causing the drive to hang while loading then the «Module recovery» command will produce no effect. The command also does not control recording, i.e. if a drive writes a module incorrectly or misplaces it while recording, the recovery procedure will not return any errors!

Warning! The «Module recovery» command writes the module being restored to the SA; a failure while writing may cause erasure of important information in the SA. Therefore, we recommend saving backup copies of modules and creating an LDR file prior to running the command.

8.2. Relocation of defects

The utility allows hiding defects to the P-List factory defects table as well as to user's G-List table. If you need to restore the original translator for subsequent data recovery, you should save the translator modules and the defect list in module PN=33h to have an opportunity to cancel the modifications to translator.

You can view the P-List in two modes: direct translator decoding in «P-List (AT_PDL) reading» and reading of defects from the PN=33h module provided for in «P-List (HUTL) reading». If you run «P-List (AT_PDL) reading» on a full-size drive started with a loader, an error will occur. The error is caused by the fact that in such cases the drive returns its extended zone table for some (not all) of its heads only. Those two methods, which help obtain the P-List table, may output different results if the translator modules are damaged or if the PN=33h module does not correspond to the current translator status (e.g., it has been copied from another HDD).

If you load a defect list (in LBA notation) into the defect editor of Maxtor utility, you can hide it or convert to physical notation (PCHS).

Logical of physical surface scanning forms the tables of revealed defects upon completion. The defects may be added to P-List or to G-List. In the process, there is a potential risk of encountering defects outside the zone of physical cylinders actually used by the drive in translation. The utility does not check revealed defects for eligibility. Therefore, we recommend physical surface testing for diagnostic purposes only. Logical scanning has been inherited from the universal utility – to make the utility display upon test completion the dialog for selection of target table for the defects, enable the «Reassign defects using Maxtor utility» checkbox. Alternatively, save the table to a file, then load it in the defect editor and run the relocation procedure. You can also search for defects in the «Defectoscope» mode.

The utility uses the techno command to hide defects. The command may not work properly for a few reasons:

- Problems with sections of the PN=33h module. Their solution requires the SA testing and recovery feature to restore the headers of HLists.
- Difference between translator module copies within the active SA.
- Problems with stable recording to the SA.

We would also like to observe that greater number of defects reassigned to a defect list make the process of adding new defects lower. It follows from the fact that a drive sorts the PN=33h module from the beginning during each step of defect relocation, so numerous defects make the sorting longer.

8.2.1. Defects in SA

The utility allows relocation of defects in the SA in case, when they do not prevent normal drive start-up. Defects are reassigned using the drive command, which functions normally only when translator modules and module PN=33h are functional. The relocation process initiated from the «SA testing and recovery» mode is as follows: the utility reads SA modules, reassigns a defect, then writes modules back to avoid a shift, which would occur because of defect relocation.

In case of translator recalculation, however, the utility takes into account the SA defects. There is also an opportunity to hide a previously compiled or manually prepared table of SA defects using the «Reassign SA defects» *(section 6.1.4)* command. The command does not move the modules; this task should be accomplished manually by overwriting them (except for the translator modules): U_LIST, AT_PDL and RZTBL.

Reassignment of defects in the SA has some problems. The main problem is manifested in the fact that a drive has no features for UBA conversion to PCHS. As a result, the conversion has to be performed by the utility to allow using of the command for defects assignment provided by the drive. There is a very high probability of a mismatch between the zone table and the actual start of UBA translation for the SA. Therefore, the conversion produces an incorrect result and defect relocation makes the drive unable to interpret the U_LIST module preventing it from normal start. So far the relocation task is solved only for cases, when SA start matches the zone beginning in the zone allocation table. This condition is usually met in N40P.

8.3. Typical cases of data recovery

Very rarely incorrect information in G-List may prevent a drive from starting or cause it to hang although the header and checksum are valid. A started LDR file would allow G-List viewing. If you attempt to clear (recording to the SA must function correctly) G-List in that mode, its clearing will be performed not quite properly: reassignment LBA will be specified as –1. Another, more adequate method would be to write a clean G-List from another drive of the same family with the same capacity.

Quite often you may encounter a situation when translator modules have correct headers and checksums and all other critical modules are in order, but a drive still does not function using the logical parameters. At present, there are two known causes of that situation:

Along with modified headers of the translator modules there is a problem, when random or pseudorandom information accidentally becomes written to the data fields of the translator tables (data from one module may end up in another one). Module headers and checksums at that may appear intact. Automatic recovery of modules in that case will not help restore the drive. You should restore the whole translator.

To perform diagnostics of the situation with invalid data in the translator tables, you should write to the non-functional drive the translator modules (PN=37h, PN=18h and PN=78h) copied from a normal drive with the same capacity. Prior to the procedure, you should back up all SA modules (especially module 33) and make sure that the SA has no reassigned defects. In case of hidden defects in the SA that diagnostics method is inapplicable. If the drive starts normally being accessible via its logical parameters after recording of the translator modules, it means that the problem was cause by invalid information inside the modules.

If the PN=33 module is functional (the utility displays a list of defects after query to P-List) you can perform translator regeneration *(section 6.1.2.1.7)*.

Example of simple N40P restoration.

- Start a loader: checksum = 2E46h, safe mode.
- Read HDD ID: Firmware and Capacity appear, the serial number is not displayed.
- Run «Restart using internal HDD SA», then select program 1.
- The loading procedure completes successfully. Now «Initialize SRV» – OK.
- Launch the utility – OK.
- Tools – «SA testing and recovery».
- └> Start scanning for all modules.
- └> Select the profile.
- └> Diagnostics reveals damage in modules: 18, 1A, 30, 34, 1D, 1B.
- During the procedure, backup copies of the modules are saved.
- Now we should test recording by modifying the U_LIST module – OK.
- Restore P-List: it contains several defects in the unused module portion; used sectors are normal. Therefore the procedure should be: load the module in the «View modules» mode. Clear the unused module portion using the HEX editor option. U_LIST review shows that in AT_PDL 53 sectors are occupied by the table, so we have to clear the module beginning from sector 54 to the module end.
- We can pay no attention to modules 30 and 34, but modules 1D and 1B have to be copied from another HDD.
- Now restart the drive without the safe mode jumper – OK.

8.4. Techno reading using physical

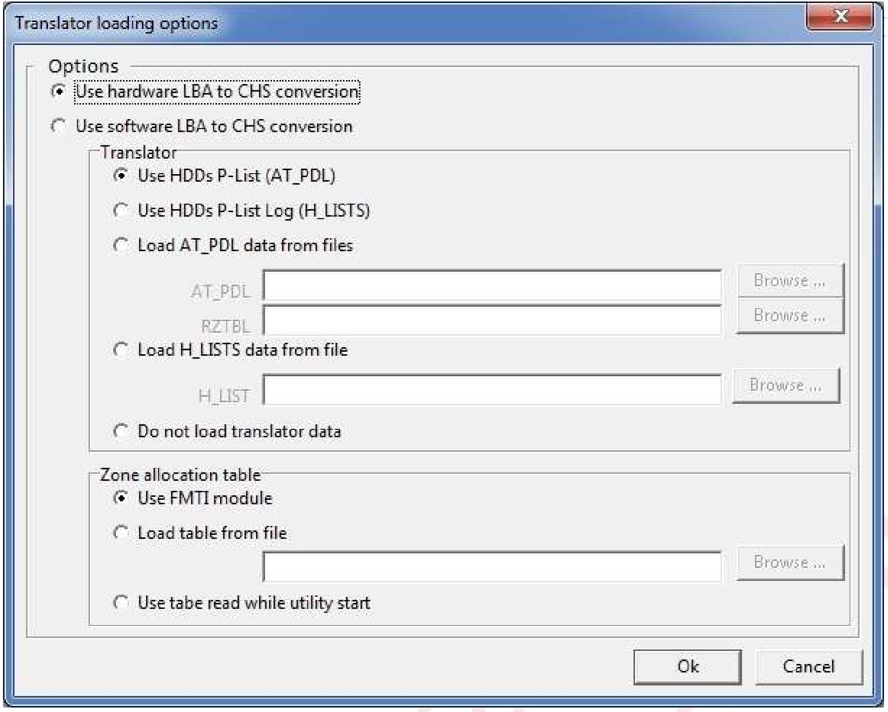
The utility allows access to the user data acting together with Data Extractor and using the command for data reading by physical coordinates: zone, cylinder, head, sector. The feature has been built-in to allow reading of user data area after drive start with an LDR file. In that case you do not have to restore the SA. ***The mode is not implemented completely and can be used for diagnostic purposes so far.*** One yet unsolved problem is that the techno reading command does not function without loading the modules with adaptive data from the SA; besides, it functions incorrectly in some N40P. Our developers work on a solution for these and other related problems of the mode.

The feature works as follows: Maxtor utility starts then use the «Windows» menu to switch to «Utility selection» and launch Data Extractor. Then create a new copying task[1] and specify the «Use active PC-3000 utility» mode. As soon as the task performs initialization, specify «Read from active PC-3000 Utility» in the reading command tab. The utility will display a dialog window *(Fig. 8.1)*. Use it to select the source for loading of the translator and zone allocation table.

The translator is built using the zone allocation table and the data about defective sectors. The information about defects can be obtained from the translator tables (AT_PDL & RZTBL) or from the HLists (PN=33h) module containing defect lists. The modules can be read from a connected drive or from files. For half-size HDD the zone allocation table can be obtained using firmware command only while the full-size drives allow one more method: the table can be obtained from the FMTI module or a file containing it.

Please note that the zone table frequently turns out to be unique. In half-size drives it is built into firmware overlay 0Fh, while in full-size drives it is located in module FMTI.

[1] – The mode is implemented for copy creation tasks only.



Translator loading options

Options

● Use hardware LBA to CHS conversion

○ Use software LBA to CHS conversion

Translator

● Use HDDs P-List (AT_PDL)

○ Use HDDs P-List Log (H_LISTS)

○ Load AT_PDL data from files

AT_PDL

RZTBL

○ Load H_LISTS data from file

H_LIST

○ Do not load translator data

Zone allocation table

● Use FMTI module

○ Load table from file

○ Use tabe read while utility start

Fig. 8.1. Translator reading options.

8.5. Self test

Maxtor drives support self-testing with various functioning rules. The drives supported in the utility can be subdivided into several groups, which differ in terms of ideology behind the Self Test functions. This section covers the testing ideas common for all the drives. Step-by-step method descriptions can be found in *chapter 9.*

A complete and successfully past self-testing makes a drive to recalculate its adaptive parameters, reassign defective sectors, reset S.M.A.R.T. attributes to factory defaults, etc.

You can switch a drive to the self-testing mode by the «Launch Self Test» command *(section 6.2.1.3).* Two methods are available: using the command (immediately) and test start after switching power off/on. Those methods are not identical and they influence the result. If you select the second method, then after the next power-up the drive will make a pause for 30 seconds or 10 minutes (depending upon drive family), before it starts self-testing. While waiting, the drive's LED on PC-3000 PCI tester board blinks at 2 Hz. If you send a reset or HDD ID reading command during that wait period, the drive will switch to its normal operational mode until the next power off/on.

The drive's LED blinks at a different rate while the HDD passes tests.

Before you run the Self Test from the *main service area* you are advised to clear the defect lists and the PN=33h module (the respective feature is described in *section 6.2.1.1*). That is necessary to enable the Self Test routines to hide defects correctly.

The utility allows monitoring of the Self Test progress. You can do that in a running utility by pressing the «Launch monitoring» or in its start-up dialog *(see figure. 5.1)* by selecting the «Launch monitoring» feature.

As a summary, we can suggest two methods for indication of self-testing progress with monitoring of a drive connected or not connected to a PC and powered by an independent supply.

Procedure of drive start with status monitoring.

- SELF TEST – Launch Self Test
- Without leaving the utility and with IDE cable connected to the drive, switch its power off and on.
- Start View Self Test status, then the self-testing progress report will be displayed on-screen.

Procedure of self-testing using an independent power supply without a connection to PC.

- SELF TEST – Launch Self Test
- Disconnect the drive and connect it to an independent power supply unit.
- Since electronics boards of Maxtor drives have no LEDs you can connect an external LED as shown in *figure 8.2.*

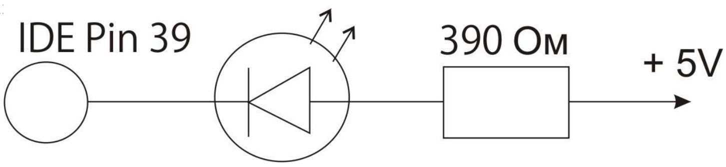


Fig. 8.2. Connection of an external LED for monitoring the drive self-testing process.

Warning! In some cases when self-testing terminates with a fatal error, the service area is considerably damaged (modules essential for drive operation are missing), therefore you must always backup the service area before beginning self-testing procedure.

Warning! The self-testing procedure will destroy all user data.

Table 5. Purpose of some tests.

ID	Title	Purpose
01	Begin Test	The test initializes logs and testing script.
00	End Test	Switches the self-testing mode off. All inactive script slots contain that test record.
06	_WAIT FOR EXTERNAL EVENT	Waits for a command from the factory testing facility. It must be deactivated with a comment sign.
38	OPTIMIZE	The test performs a large part of adaptive setup. If the test fails, it means that the drive is unable to perform its setup.
90	!SERVICE AREA SETTINGS	The test performs service area setup. Sometimes it hangs. If you deactivate it with a comment sign, it will cause no problems with subsequent Self Test steps.
89	Power switch	The test restarts a HDD. Option 7 of that test is responsible for switching between program A (value 0) and B (value 0100h) through modification of the module PN=95h.
0C,31,32,…	NOP	The test does nothing.
F5	/* Comment string */	This test is identical to an empty test. One difference is that its parameters include various comment strings recorded at the factory.

It is rather difficult to judge about completion of the self-testing procedure when a drive is running on an individual power supply unit. In case of a fatal error a HDD usually stops its motor and discontinues LED blinking. In case of a successful completion the drive does not stop the motor, but the LED may behave in a different manner.

8.6. Software restoration prospects

There is a whole number of tasks pertaining to software restoration of hard drives that need to be solved just as firmware damage, which cannot be repaired using conventional tools. Our developers constantly update the utility and design new methods for data recovery and repair of Maxtor HDD. Please pay attention to software and documentation updates at our technical support server.

9. Description of peculiarities in Maxtor drive families

9.1. Creation of a reference database

The utilities of the PC-3000 complex for Windows employ a database for storage of HDD firmware. Its use allows convenient ordering of firmware copies and searching using various sings, e.g. by ROM checksum. All records belonging to a single resource are united into a single profile; thus you can reliably determine the HDD (its ID and factory data) used as the source of a specific record, which is impossible when the service area is saved as files. Another advantage of the database is in the opportunity to import/export one or more firmware copies making it easier to exchange such data. When you are importing objects into the database, you can review the description and factory data about the drive used to copy the firmware. In case of firmware exchange in files the data had to be added manually and many people forget to do that.

Addition of drive firmware to the database:

1) Connect the functional HDD containing the service data, which should be added to the database.

2) The mode for work with the database is invoked by pressing [Alt]+[B] or via the «Tools» – «Database» sequence of menu items. You can set up access to the database by clicking the «Database access» button on the toolbar (the third one from the right). The database may be stored on your local computer or on a server. Several PC-3000 complexes for Windows can conveniently use a single common database. You should not specify an empty directory as the database folder. The PC-3000 installer copies the files of an «empty» database. Its configuration and universal service functions are covered in detail in the corresponding manual devoted to the Administration of HDD Firmware Database.

3) Addition of firmware components to the database:

- ♦ Use the «Read modules» command. After its selection, the utility will ask you to specify the directory for the profile. It is necessary to provide a choice for reading the information to *a profile*, or a *database directory*. If no profile has been created earlier for the connected drive, the program will suggest creating it. If it has already been connected before, the program will find the profile and highlight it positioning the cursor over it. Profile selection is performed once per each utility start. If no connection to the database has been performed, it will be started. Use the right-click menu available over the list of modules for manipulating the selected objects. By default, all modules will be selected.
- ♦ Service information – «Loader» – «Utility off-line start resources reading». During this step, the profile and database directory are determined already.
- ♦ In the database content viewing mode ([Alt]+[B]) you should find the directory of our connected HDD (this can be conveniently accomplished using comparison of the serial number of the drive and directory name in the database). It will contain the «Modules» and «Utility start resources» subdirectories together with a «HDD Info» record. Select the HDD Info record (the «HDD Info» title can be changed, but that will make automatic generation of report on resource content impossible) and press F2 or select the «Edit» command from the right-click menu. Then the program will display its dialog for database record editing. The dialog consists of two tabs: «Data» and «Profile». In the text entry field of the «Data» tab you can enter text printed on HDD label. We recommend adding to the text data the following data (a Calypso drive serves as an example):

Processor: ARDENT-C5C1-875UK
Processor build in ROM version: YAR42RWZ
External EEPROM: yes
Motors controller: L7250E 1.0
Parts: N,M,C,D

Having performed those actions you can be sure that all useful data from a functional drive have been saved. Now let us examine some peculiarities of work with the database.

During file import into the database, the program tracks duplicates (firmware copies similar both in the database and in the file being imported); duplicate resources, which have differences, will be placed in a separate database directory. Identical HDD firmware copies will not be added to the database. E.g., if you attempt to add the same file twice, the second attempt will add nothing to the database.

Directory removal. You cannot directly remove a whole directory because it contains records. If you wish to delete it, highlight a single record and delete it. The program will display a dialog, where you can confirm removal and check the «Delete all data in the current folder» box. After that you will be able to delete the empty directory.

The opportunities for generation of a report on database contents are mentioned in *section 6.1.6*.

The «LDR file loading» – «from database» command sequence creates a loader using modules PN=39h, 38h and 4Fh. If new firmware copies have been added to the database, click the «Rebuild new list» button to update the list of available loaders. As a result, the program will update database index of loaders for the current drive family using the «loaders» record in family directory.

Resources for utility off-line start are used only when you select «Utility start method» – «Read resources from DB». Off-line start is described in more detail in *chapter 5*.

The features for exporting modules from the database in PC-3000 ISA/DOS format and addition to the database modules saved as files are not implemented. This is caused by a number of difficulties, which the current utility version has not solved yet.

9.2. General information about drive families

- Drive families are represented by their factory aliases. Though an alias is not printed (usually on HDA label) it can be seen quite easily by means of setting the safe mode jumper. If the jumper has been set correctly the drive will not spin up its disks and it will be identified as «Maxtor <alias>», for example, «Maxtor N40P». The string is formed by a ROM microprogram and output either in safe mode, or when an error occurs during SA initialization. In some drive families aliases are marked on PCBs.
- Safe Mode jumper location is shown in figures representing external view of drive electronic boards.
- The D541X and D540X-4D families consist of two subfamilies: «DSP» and «Poker». They differ considerably as regards the operation of factory techno commands. «DSP» and «Poker» are labels of the system controller chip.
- In drives using a single disk and one head only models with smaller capacity are produced using modification of the zone allocation table and adaptive settings.
- Peculiar issues of PCB compatibility are mentioned individually for drive families characterized by such cases.
- Some drive families manufactured before 2001 are not supported. The utility also does not support some drive families belonging to the large-capacity line. PC-3000 developers were unable to find the number of such drives, which would be sufficient enough for utility creation.
- The tables of drive family parameters the algorithm of loader start is recorded as a formula, where:

  ROM – ROM loading.

  Soft Reset – software reset.

  OVLs – loading of overlays.

  Init SA – the family allows using the «Firmware start» command.

  Ovl_1B, Ovl_1C – individual loading of the 1B & 1C overlays to allow ROM start. Before ROM loading, Poker/Ardent drives need to load the 1B and 1C overlays because ROM image in the SA (ROM_SA) will not pass the initialization procedure (hang), if the 1B and 1C modules are not loaded into memory.

9.3. Diamond Max VL40 or PROXIMA drive family

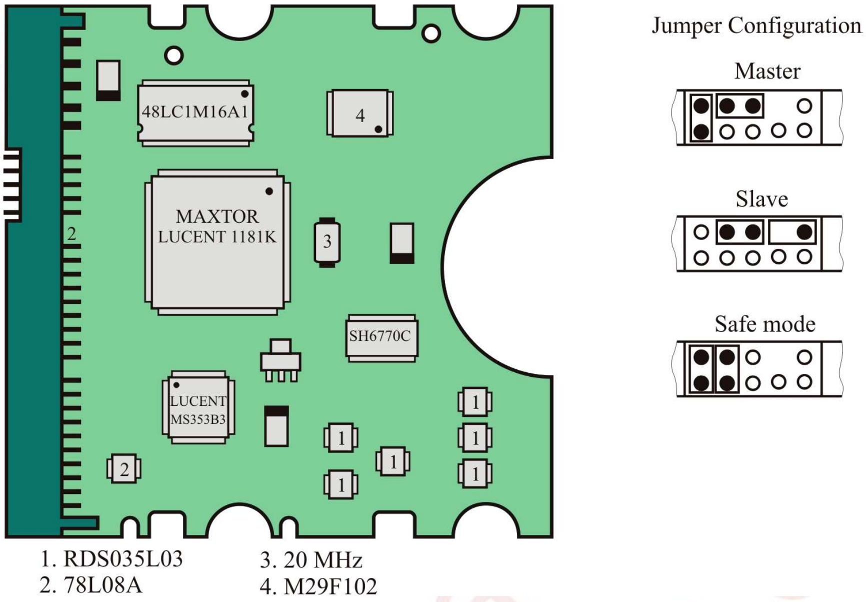


Fig. 9.1. External view of the controller board in MAXTOR PROXIMA drive family.

Table 6. PROXIMA family models

Family, factory alias.	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max VL40, PROXIMA	34098H4	40.9	2	4	80,043,264
	33073H3	30.7	2	3	60,032,448
	32049H2	20.4	1	2	40,021,632
	31535H2	15.3	1	2	30,015,216
	31024H1	10.2	1	1	20,010,816

Table 7. PROXIMA family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	5400 RPM
LBA48 support	No
Preamplifier	–
HDA	Full-size[1]
ROM	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
Self Test start.	Without script modification
ALT-SA present	No
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

[1] – The case allows installing up to three disks.

9.4. Diamond Max Plus 60 or RIGEL drive family

This family uses G_List format different from the standard. Therefore, the information output by the «G-List reading» command will be not quite precise. Still, defects will be added to G-List correctly. Automatic recovery of the G-list module will also function correctly.

If such drive starts correctly but cannot be accessed using LBA you should write the AT_XAL module from a functional HDD.

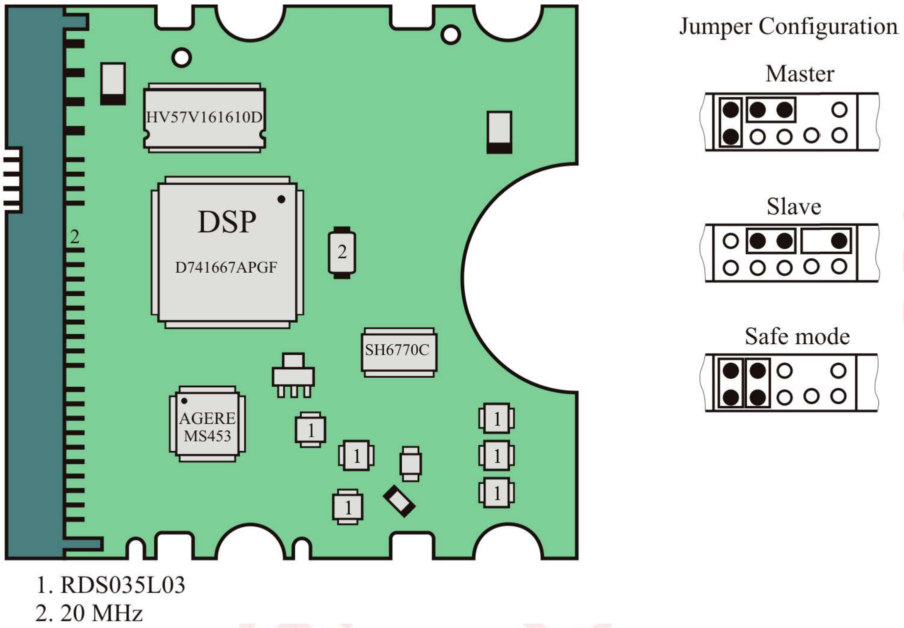


Fig. 9.2. External view of the controller board in MAXTOR RIGEL drive family.

Table 8. RIGEL family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max Plus 60, RIGEL	5T060H6	61.5	3	6	120,103,200
	5T040H4	40.9	2	4	80.043,264
	5T030H3	30.7	2	3	60,030,432
	5T020H2	20.4	1	2	40,021,632
	5T010H1	10.2	1	1	20,010,816

Table 9. RIGEL family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	7200 RPM
LBA48 support	No
Preamplifier	–
HDA	Full-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

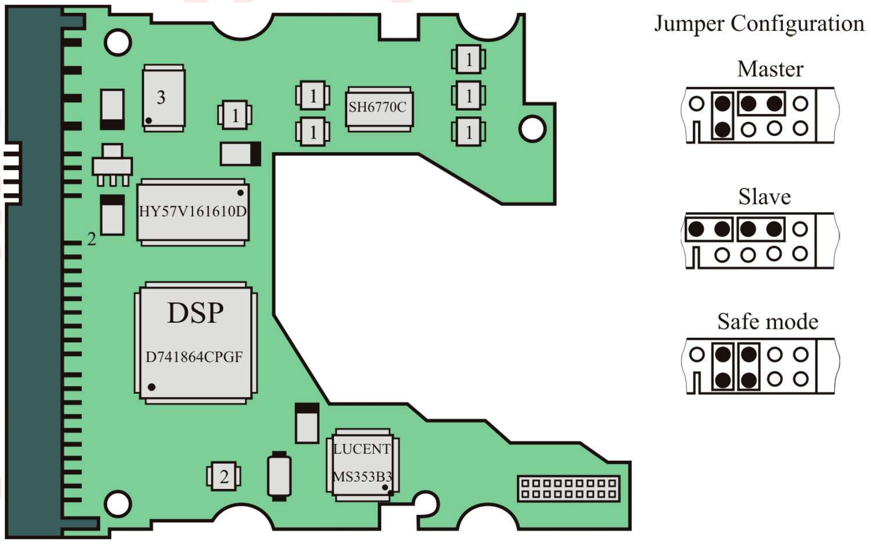
9.5. D531X or NIKE drive family

Table 10. NIKE family models.

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
D531X, **NIKE**	2R015H1 2R010H1	15.0 10.2	1 1	1 1	29,297,520 20,011,824

Table 11. NIKE family specifications.

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	5400 RPM
LBA48 support	No
Preamplifier	–
HDA	Half-size[1]
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No



1. B3185
2. 78L08A
3. M29F102BB

Fig. 9.3. External view of the controller board in MAXTOR NIKE drive family.

[1] – For installation of a single magnetic head only.

9.6. ATHENA DSP drive family

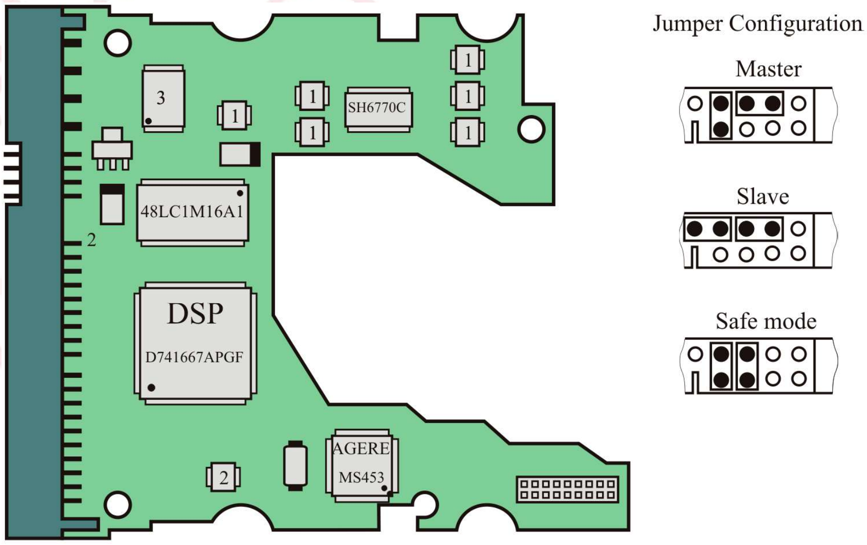
Table 12. ATHENA DSP family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
D541X, ATHENA DSP	2B020H1 2B015H1 2B010H1	20.4 15.4 10.2	1 1 1	1 1 1	40,020,624 30,214,800 20,012,832

One quite frequent peculiarity of drives belonging to the family is demonstrated by their behaviour in case of P-List malfunctions, when after motor spin-up and removing the heads from parking area a drive turns the spindle motor off but «forgets» to park the heads. The problem can be identified by a typical sound heard, when the motor is turned off. To restore such a drive, use the algorithm for starting an LDR file in safe mode *(7)*. Then perform diagnostics of SA malfunctions, saved drive modules and regenerate its translator.

Table 13. ATHENA DSP family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	5400 RPM
LBA48 support	No
Preamplifier	1710AGB1 / Texas Instruments
HDA	Half-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No



1. B3185
2. 78L08A
3. M29F102BB

Fig. 9.4. External view of the controller board in MAXTOR ATHENA ATA2-PLUS drive family.

Appendix 1 hereto contains an electrical layout of connections for the motor control chip on ATHENA DSP controller PCB.

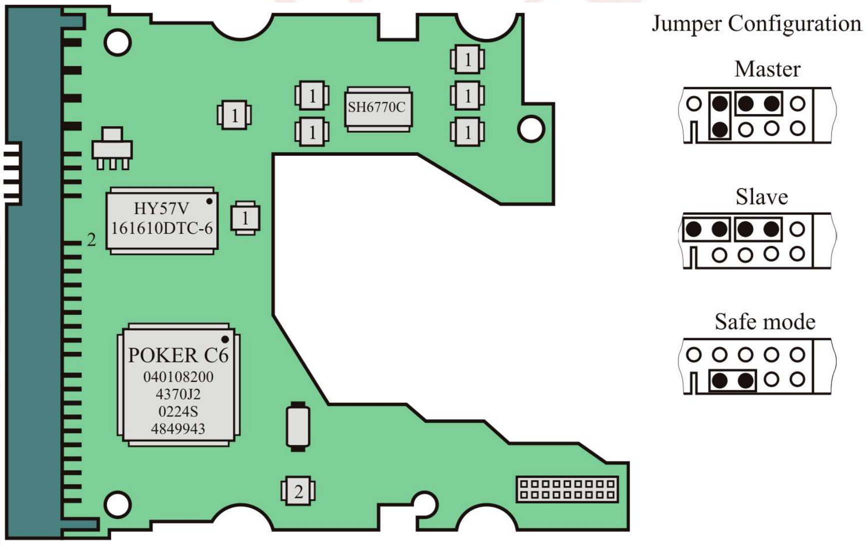
9.7. ATHENA Poker drive family

Table 14. ATHENA POKER family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
D541X, ATHENA Poker	2B020H1 2B015H1 2B010H1	20.4 15.4 10.2	1 1 1	1 1 1	40,020,624 30,214,800 20,012,832

Table 15. ATHENA POKER family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	5400 RPM
LBA48 support	Yes
Preamplifier	–
HDA	Half-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset + init SA
ALT-SA present	No.
Self Test start	Test ID=89h modification is required.
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No



1. B3185
2. 78L08A

Fig. 9.5. External view of the controller board in Poker-based MAXTOR ATHENA drives.

9.8. ROMULUS DSP/Poker drive family

Table 16. ROMULUS DSP family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
D540-4D, ROMULUS DSP/Poker	4D080H4 4D060H3 4D040H2 4D030H2	82.0 61.5 41.0 30.0	2 2 1 1	4 3 2 2	160,086,528 120,069,936 80,043,264 60,030,432

Table 17. ROMULUS DSP family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	7200 RPM
LBA48 support	No
Preamplifier	–
HDA	Full-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No.
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

Table 18. ROMULUS POKER family specifications

Parameter	Value
Group of drive families (architecture)	POKER
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	–
HDA	Full-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset + init SA
ALT-SA present	No
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

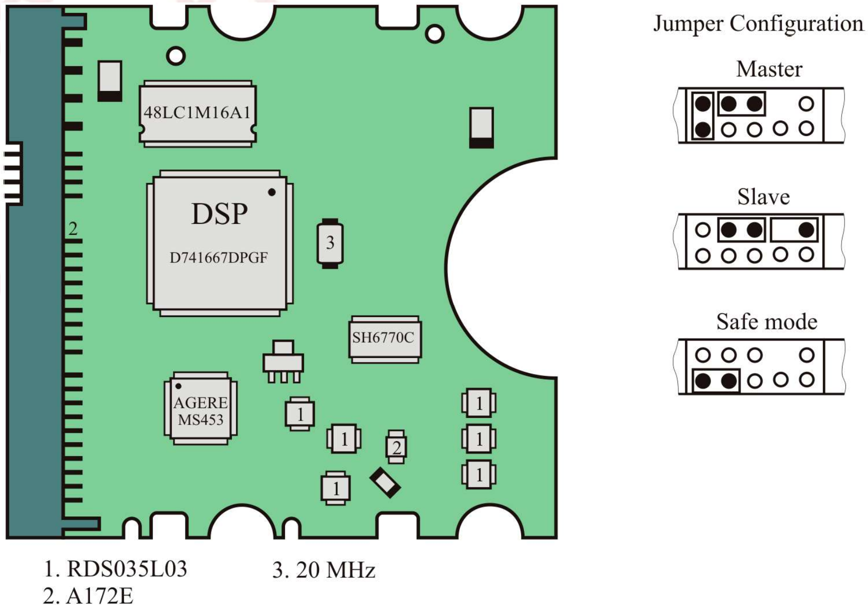


Fig. 9.6. External view of the controller board in MAXTOR ROMULUS drive family.

9.9. VULCAN drive family

Table 19. VULCAN family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
536DX, VULCAN	4W100H6	100	3	6	195,711,264
	4W080H6	80	3	6	160,086,528
	4W060H4	60	2	4	120,103,200
	4W040H3	40	2	3	80,043,264
	4W030H2	30	1	2	60,030,432

Table 20. VULCAN family specifications

Parameter	Value
Group of drive families (architecture)	DSP
Motor rotational speed	7200 RPM
LBA48 support	No
Preamplifier	–
HDA	Full-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No.
Self Test start	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

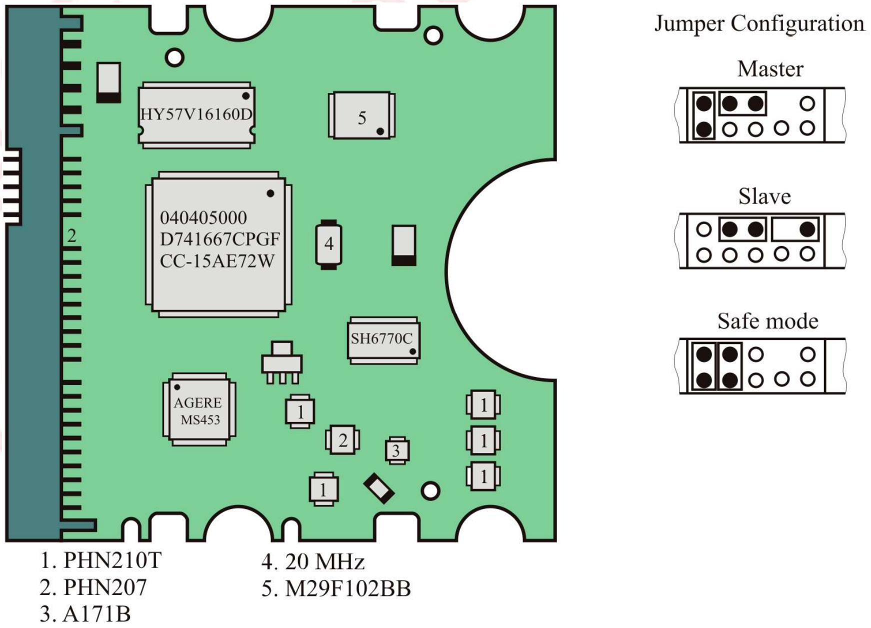


Fig. 9.7. External view of the controller board in MAXTOR VULCAN drive family..

9.10. ARES 64K drive family

Table 21. ARES 64K family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Fireball 3, ARES 64K	2F040J0/L0 2F030J0/L0 2F020J0/L0	40 30 20	1 1 1	1 1 1	80,293,248 60,058,656 40,718,160

«L» letter in model name indicates that a fluid dynamic bearing was used, for example, 2F040L0. «J» letter means that a ball bearing was used, for example, 2F040J0.

«64K» in factory alias is used most likely because it is the first MAXTOR drive with the number of physical cylinder exceeding 65535, i.e. more than a 16 bit memory variable can handle. All drives manufactured after that model use 32 bit cylinder variables.

Table 22. ARES 64K family specifications

Parameter	Value
Group of drive families (architecture)	POKER
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	–
HDA	Half-size
ROM type	Type: serial; label: ST25P10/ ST25P10A; indication on board: U102.
LDR algorithm	Ovl_1B, Ovl_1C, ROM, SoftReset, OVLs, SoftReset
ALT-SA present	No
Self Test start	Test ID=89h modification is required.
Self Test wait period	30 seconds / 10 minutes.
Serial port for Self Test monitoring	Yes

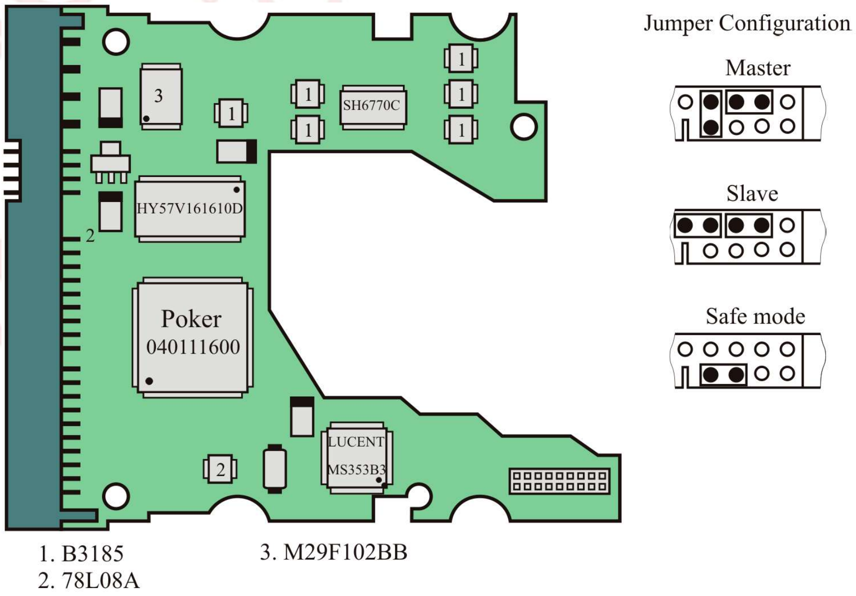


Fig. 9.8. External view of the controller board in MAXTOR ARES 64K drive family.

9.11. Diamond Max 16 or FALCON drive family

Table 23. FALCON POKER family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max 16, FALCON	4R060L0/J0	60	1	2	120,103,200
	4R080L0/J0	80	2	3	н.д.
	4R120L0	120	2	4	н.д.
	4R160L0/J0	160	4	8	н.д.

Table 24. FALCON POKER family specifications

Parameter	Value
Group of drive families (architecture)	POKER
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	–
HDA	Full-size
ROM type	Type: parallel; label: M29F102BB; indication on board: U303.
LDR algorithm	ROM, SoftReset, OVLs, SoftReset + init SA
ALT-SA present	No.
Self Test start from ALT-SA	Without script modification
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

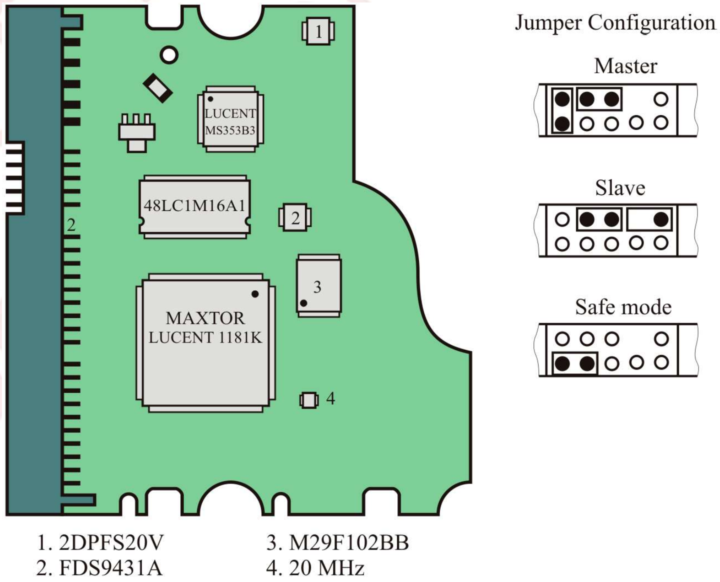


Fig. 9.9. External view of the controller board in MAXTOR FALCON drive family.

9.12. Diamond Max Plus 8 or N40P drive family

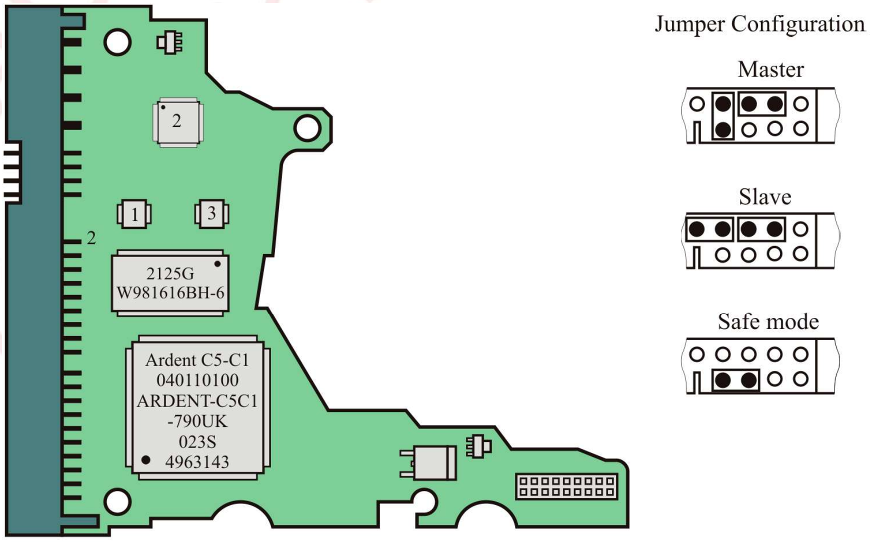
Table 25. N40P family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max Plus 8, N40P	6E040L0 6E030L0 6E020L0	20 30 40	1 1 1	1 1 1	80,293,248 60,058,656 40,718,160

Table 26. N40P family specifications

Parameter	Value
Group of drive families (architecture)	ARDENT
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	1715ADA1 / Texas Instruments
HDA	Half-size
ROM type	Type: serial; label: ST25P10/ ST25P10A; indication on board: U102.
LDR algorithm	Ovl_1B, Ovl_1C, ROM, SoftReset, OVLs, SoftReset
ALT-SA present	On some (not all) drives only
Self Test start	Self Test start is described in 9.12.2.
Self Test wait period	30 seconds / 10 minutes.
Serial port for Self Test monitoring	Yes

Beginning with that family, Maxtor developers started using two service areas with similar structures but absolutely different purposes *(fig.4.5)*. During normal operation a drive uses the main service area containing all required module. However, since not all the drives in the N40P family contain an alternate SA, there appears a number of problems related to the selection of a suitable loader and execution of factory Self Test, which could not be encountered in earlier drive families.



1. ST25P10V6
2. SH6782B
3. FDS9431A

Fig. 9.10. External view of the controller board in MAXTOR N40P drive family.

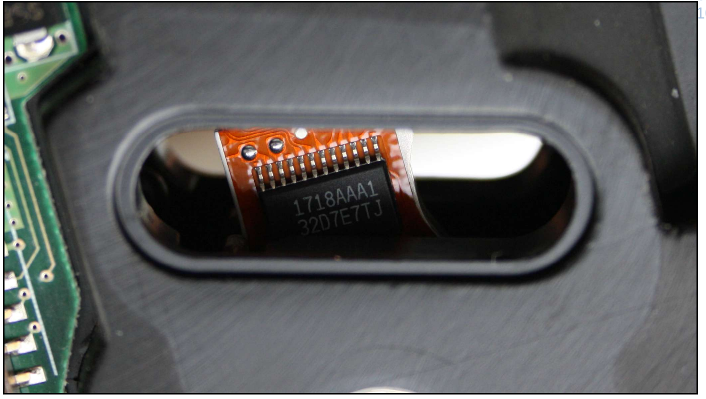


Fig. 9.11. STW pin opening.

The N40P drive family suffers from a very frequent problem: unstable recording. It complicates restoration of the service area, which usually contains unreadable sectors in all copies, which appear exactly in case of recording failures. Quite often during operation a drive produces new unreadable areas, which appear because of write failures.

The instabilities are caused by temporary or constant difference in the parameters of the magnetic head and adaptive data associated with them. If in that case you replace the adaptive parameters (overwrite the modules) or recalculate them, then user data recorded earlier will become inaccessible. If a drive has been used as donor and adaptive modules from a malfunctioning HDD have been written to it, you can restore such drive by running its Self Test from the alternate SA in its current state. There is yet no opportunity to write modules to the main service area in a drive started from the alternate SA.

9.12.1. Compatibility of electronics boards

The first thing to consider while searching for a suitable board is the processor chip label, e.g.: «ARDENT-C9C1-790UK» and the presence of serial ROM. If there is no serial ROM, then a board with an identical processor label will definitely be compatible. If the serial ROM is present, there is sense in soldering it to another board with the same processor. The probability that a PCB burnout will cause the ROM to burn as well remains not too high, because power supply to ROM is disabled while a drive is operating. If you install to a drive with an alternate service area a PCB from another drive without Alt-SA[1] you will be unable to start a loader and gain access to the main SA.

Compatibility of a PCB and code in the service area is determined by the processor only. The program from the SA at that may not start because of incompatible HDA settings built into it.

9.12.2. Starting Self Test

In drives without an alternate service area Self Test functions according to the regular scheme of its start from the main SA and modification of the test ID=89h to prevent switching to program B. As a matter of fact, if you reset the settings *(6.1.2.1.8)* the ID=89h test will not force the testing to stop.

If a drive has an alternate SA, then Self Test launch will result in program attempts to create a clean service area despite the fact of being inside a service area, which will cause data corruption in it.

Scan launch from alternate SA for N40P should be performed according to the algorithm below:

1) Start an alternative loader in safe mode.

2) Perform «HDD ID reading» *(see figure. 5.1)* and make sure that firmware string corresponds to NCRxxxx0 template and drive serial number is displayed. If the serial number does not appear, it means most likely an inappropriate alternative loader (you should try using another) or corruption in the alternate SA. Self Test start in that case will produce no results.

3) Launch the utility and check the «Utility status», use it to compare the checksum of the loaded program and [ROM_SA]. If they do not match, then immediately create a loader from the connected drive and use it to start the drive. Alternatively, you can add all modules to the database and then start the loader from database (you should execute the «Rebuild new list..» command first, because a new program has been

[1] – The presence or absence of an alternate service area is determined in a board by the ROM microprogram. If there is no external ROM, then such board is sure to support the alternate service area.

added to the database). We have noted, that programs in the alternate SA are identical, so if a program with a specific ROM checksum is already present in the database, then loader creation is not obligatory.

4) Now switch to the Self Test mode ([Ctrl]+[Alt]+[3]) and start testing having selected a delayed start (at next power-up) and disabled monitoring.

5) Switch off the power and start the same loader. After loader start the drive will be blinking in series of 5 times for 10 minutes. Then it will launch testing. To view the current status, switch in the utility start-up dialog to «Self Test monitoring», then launch the utility. In that case you will be able to «load script from file» or launch monitoring only.

After the start, testing will continue for approximately 5 minutes. Then the drive will restart using the ID=89h test to switch from the alternate service area to the main one. It means that the main SA has been restored from the alternate area (defects were hidden, required modules recorded, adaptive data recalculated). Then you will have to switch off the HDD, disable the «safe mode» jumper and switch power on. Now the drive will blink constantly for 10 minutes without loader start, then it will continue running tests but this time it will take them from the main SA.

9.13. Diamond Max Plus 9 or CALYPSO drive family

Table 27. CALYPSO family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max Plus 9, CALYPSO	6Y200P0	200	3	6	398,297,088
	6Y160L0/P0	160	3	5	320,173,056
	6Y120L0/P0	120	2	4	240,121,728
	6Y080L0/P0	80	2	3	160,086,528
	6Y060L0	60	1	2	120,103,200

Table 28. Serial ATA variation

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max Plus 9, CALYPSO	6Y200M0	200	3	6	398,297,088
	6Y160M0	160	3	5	320,173,056
	6Y120M0	120	2	4	240,121,728
	6Y080M0	80	2	3	160,086,528
	6Y060M0	60	1	2	120,103,200

Table 29. MaXLine Plus II variation

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
MaXLine Plus II, CALYPSO	7Y250PO/ 7Y250MO	250	3	6	490,234,752

The variation labeled as MaXLine Plus II *(Table 29)* differs from CALYPSO drives by model name only. All the remaining technical specifications are exactly as with CALYPSO family.

The drive family includes models with recording density of 60 GB per disk and 80 GB per disk. You can determine the number of heads using the following line:

6Y080L01**3**1013 – 80 GB drive with three heads. Density: 30 GB/side..
6Y080L04**2**2011 – 80 GB drive with two heads. Density: 40 GB/side.

One difficulty is in the fact that a drive may be limited both by disabling some heads or zones. Therefore you may encounter quite intricate combinations of the number of heads, recording density and drive capacity.

The drive family uses two formats for the G-List defect table. The utility cannot recognize the table format automatically, so you can select its format manually.

If a drive cannot spin up its spindle motor because of bearing seizure or because heads are stuck to magnetic surfaces, it produces melodic sounds using the voice coil of head actuator.

Table 30. CALYPSO family specifications

Parameter	Value
Group of drive families (architecture)	ARDENT
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	MVL5108-TAB, MVLG5108-TAB
ROM	Type: serial; label: ST25P10/ ST25P10A, indication on board:: U401.
LDR algorithm	Ovl_1B, Ovl_1C, ROM, SoftReset, OVLs, SoftReset
HDA	Full-size 1[1] or full-size 3"[2]
Self Test start	Self Test start is described in 9.13.2.
ALT-SA presence	Yes, in all models
Self Test wait period	30 seconds
Serial port for Self Test monitoring	No

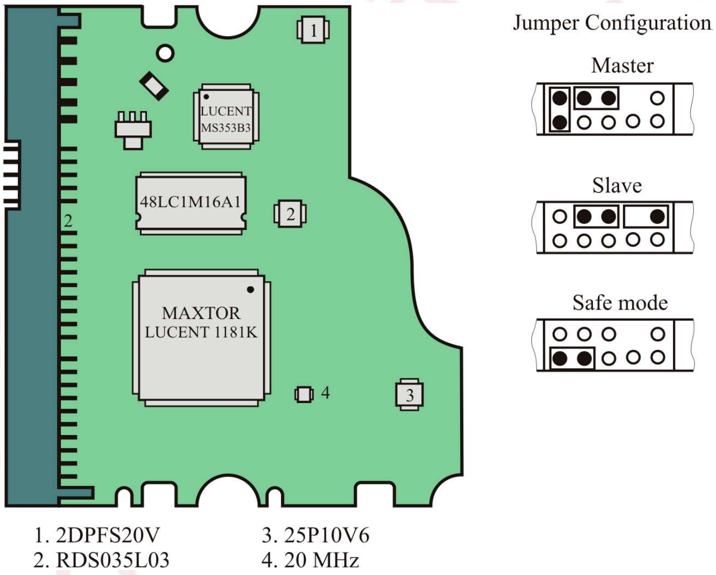


Fig. 9.12. External view of the controller board in MAXTOR CALYPSO drive family.

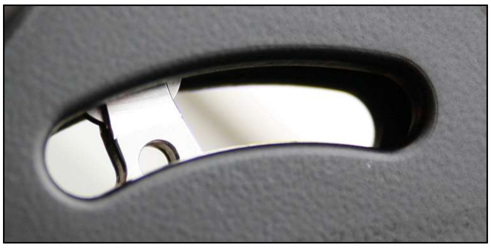


Fig. 9.13. STW pin opening.

[1] – The case allows installing of one disk only.
[2] – The case is designed to accommodate up to three disks.

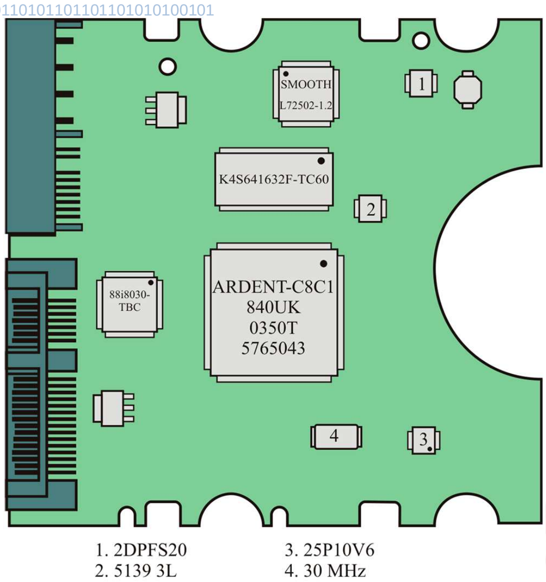


Fig. 9.14. External view of the controller board in MAXTOR CALYPSO Serial ATA drive family.

To set the safe mode, use the adapter PC-MXSAFE without connecting to a power supply cable and set the jumper «CALYPSO».

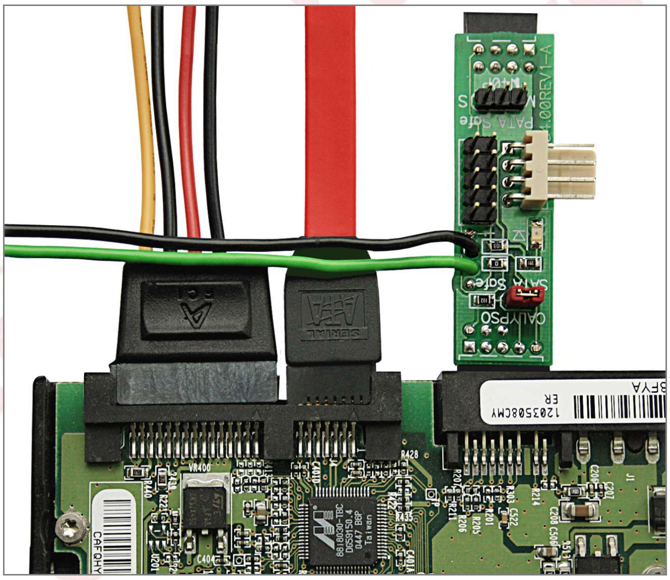


Fig. 9.15.

9.13.1. Compatibility of electronics boards

CALYPSO drive families is characterized by the same issues as are typical for N40P, but there is also one complication following from the presence of drives with two recording densities in the family. *Table 31* allows identification of recording density for a certain selection of on-board ROM versions.

Table 31. Correspondence between ROM versions and ROM checksums in the service area [ROM_SA]

On-board ROM version	Compatible checksums [ROM_SA]	Density, GB/side
YAR42KWZ	66BF	60
YAR425WZ	C47E	60
YAR42TWZ	BE25 E10D	60
YAR42DWZ	C505	60

YAR42BWZ	7F2C	60
YAR42CWZ	8E89	60
YAR42RWZ	102F 792D	60
YAR42NWZ	E22C	60
YAR42KJZ	1B5C 55A4	80
YAR43KJZ	AC1D 55A4 FFE9	80

Basically, the utility allows the user to work with Serial ATA drives via the SATA HDD adapter to PATA HOST, but for some reason the adapter may not let some techno commands pass. If the adapter does not function as intended, you can install a regular PATA board with the same processor label. However, there is a limitation for drives with capacity greater than 130 GB. They enable the 120 GB limitation in cases, when a PATA board is installed. Actually you can bypass the limitation by loader start.

You can find the basic electronics layout of CALYPSO drives in the Appendix 2.

9.13.2. Starting Self Test

In CALYPSO drive family you can start Self Test both from the main or the alternate SA. However, there is a whole group of drives with an alternate SA, which still cannot start Self Test from it. You can identify those models by viewing the script in the alternate SA. If the number of enabled tests is about 7, then Self Test will not start from the alternate SA; instead, it should be started from the main SA. Starting the Self Test from the main SA on a HDD with a complete script in the alternate SA will result in program attempts to create a clean service area despite the fact of being inside a service area, which will cause data corruption in it.

The algorithm for test start from the alternate SA is as follows:

1) Start an alternative loader in safe mode.

2) Perform «HDD ID reading» *(see figure. 5.1)* and make sure that firmware string corresponds to NCRxxxx0 template and drive serial number is displayed. If the serial number does not appear, it means most likely an inappropriate alternative loader (you should try using another) or corruption in the alternate SA. Self Test start in that case will produce no results.

3) Launch the utility and check the «Utility status», use it to compare the checksum of the loaded program and [ROM_SA]. If they do not match, then immediately create a loader from the connected drive and use it to start the drive. Alternatively, you can add all modules to the database and then start the loader from database (you should execute the «Rebuild new list ..» command first, because a new program has been added to the database). We have noted, that programs in the alternate SA are identical, so if a program with a specific ROM checksum is already present in the database, then loader creation is not obligatory.

4) Now switch to the Self Test mode ([Ctrl]+[Alt]+[3]) and estimate the number of tests in script. If there are few tests (7 or so), then testing start is impossible – you are dealing with a drive, which cannot run Self Test from ALT-SA.

5) Modify the script. Use the «NOP» button to convert into comments all «Wait for external event» tests ID=06h (a script usually contains 2 of them), and the loop (cycle start and stop tests acting as a frame for expectation of an external event), if present. Besides, you should comment the first ID=90h test from the beginning using the «NOP» button. Utility developers considered it inexpedient to create an automatic mode for disabling of tests.

6) Save the modified script to drive and to a file (to load it conveniently in case of monitoring start from the initial utility dialog).

7) Perform the «Launch Self Test» command having selected a delayed start (at next power-up) and disabled monitoring.

8) Switch the drive's power supply off and on. Use the alternate loader again to start it. Then leave the device for 30 seconds because it will not blink, but in 30 seconds it will start the tests. The testing procedure will continue for approximately 5 minutes. Then the drive will restart using the ID=89h test to switch to the main service area and begin blinking with its LED. The blinking will continue for 30 seconds. Then the drive will proceed with tests from the main service area. When it restarts, you can interrupt testing and check the changes in the main service area.

9) The tests performed further will be taken from the main SA.

Self-testing in drives with a truncated script in the alternate SA is performed using the common scheme, but you will have to modify the script just as in Step 5 of the algorithm provided for test launch from ALT-SA.

9.14. Diamond Max 10 or SABRE[1] drive family

Table 32. SABRE family models

Family, factory alias	Model	Capacity, GB.	Disks	Reading/writing heads	Maximum LBA
Diamond Max Plus 10, SABRE	6B300S0	300	3	6	593,129,376
	6B250S0	250	3	5	490,234,752
	6B200M0/S0	200	2	4	398,297,088
	6B160M0	160	2	4	320,173,056
	6B120M0	120	2	3	240,121,728
	6B080M0	80	1	2	160,086,528

Table 33. SABRE family specifications

Parameter	Value
Group of drive families (architecture)	BEAGLE
Motor rotational speed	7200 RPM
LBA48 support	Yes
Preamplifier	–
ROM	Type: serial; label: ST25P10/ ST25P10A.
LDR algorithm	Not supported by the utility at present.
HDA	Full-size
Self Test start	–
ALT-SA presence	Yes
Self Test wait period	–
Serial port for Self Test monitoring	–

9.15. Enabling Safe Mode in SATA drives of the Sabre, Sabre2, Grizzly, N40P, and Shasta drive families

To enable the Safe mode, use the PC-MXSAFE adapter and make sure that the power supply cable is connected.

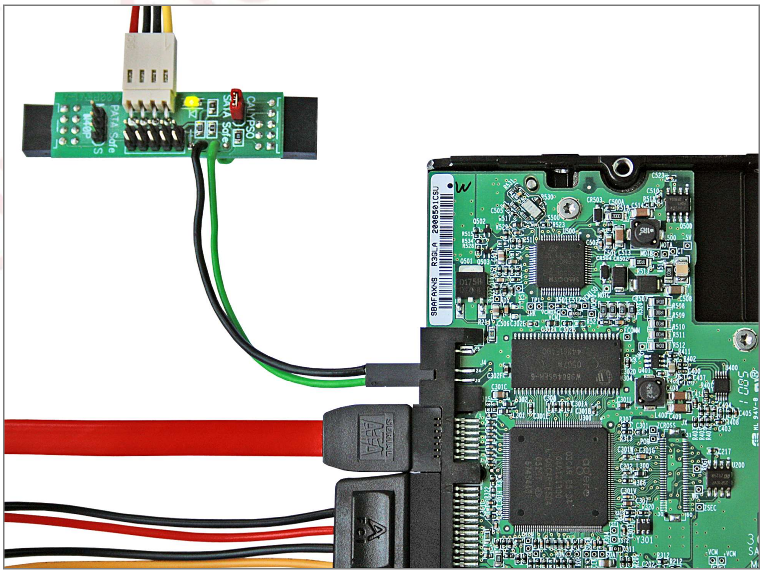
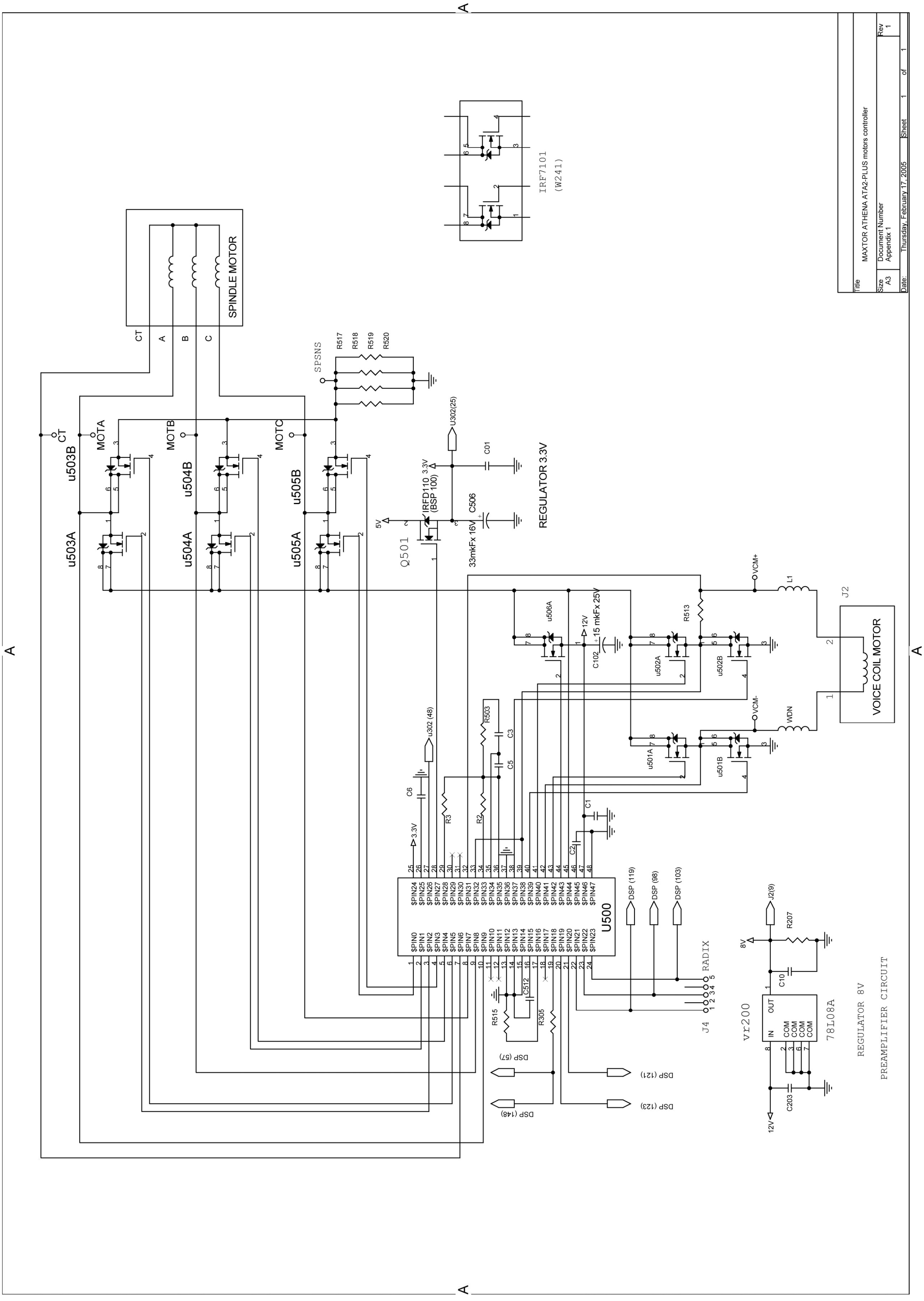
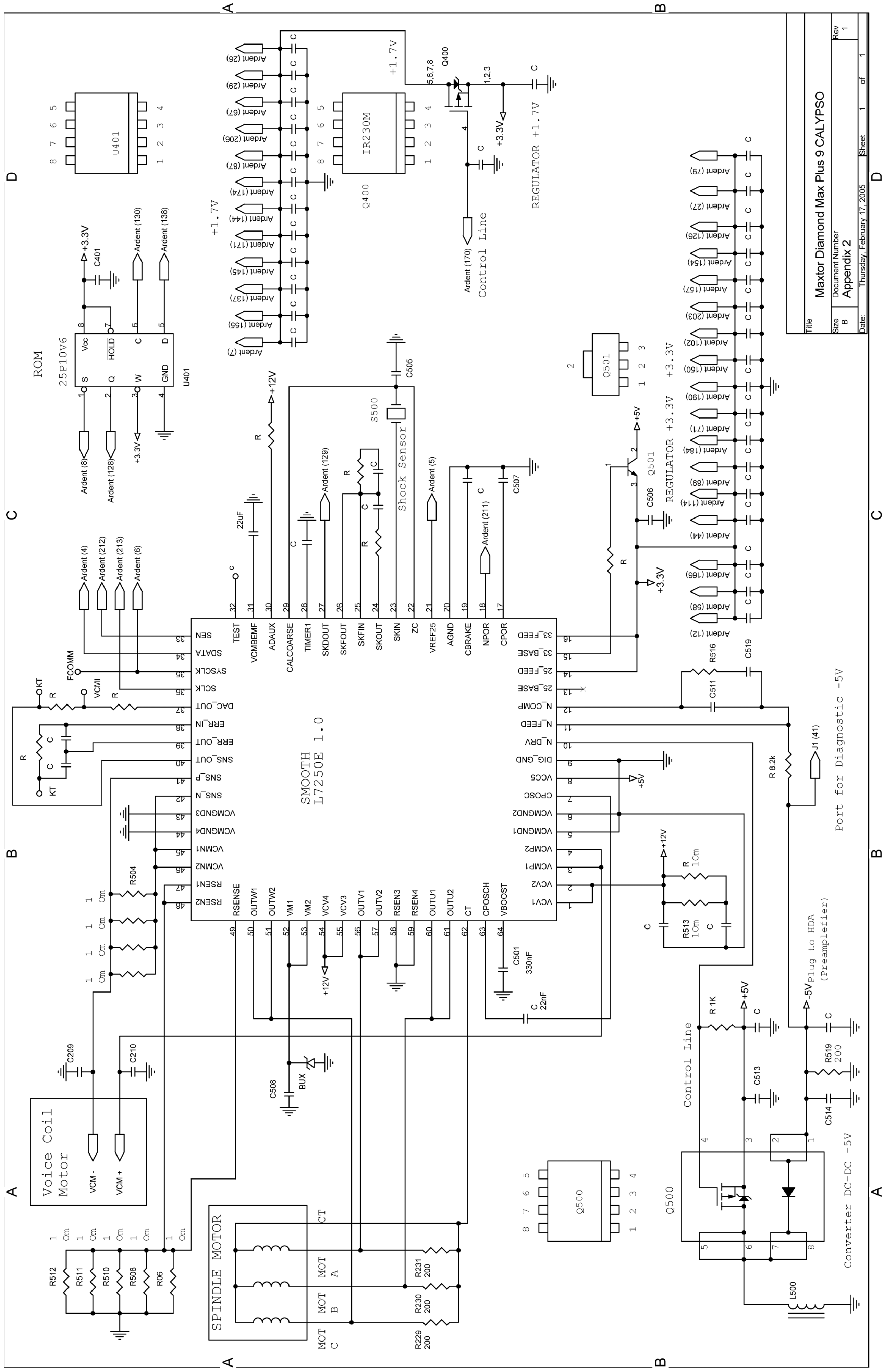


Fig. 9.16.

[1] – This drive family is not completely supported.


SPINDLE MOTOR
CT
A
B
C
SPSNS
R517
R518
R519
R520
CT
MOTA
MOTB
MOTC
u503A
u503B
u504A
u504B
u505A
u505B
Q501
IRFD110
(BSP 100)
5V
3.3V
U302(25)
C01
C506
33mkFx 16V
REGULATOR 3.3V
IRF7101
(W241)
VCM+
L1
J2
R513
u506A
12V
15 mkFx 25V
C102
u502A
u502B
VOICE COIL MOTOR
VCM-
WDN
u501A
u501B
R503
C3
C5
u302 (48)
C6
R3
R2
C1
C2
3.3V
U500
DSP (119)
DSP (98)
DSP (103)
RADIX
J4
R515
C512
R305
DSP (57)
DSP (121)
DSP (148)
DSP (123)
J2(9)
R207
8V
C10
vr200
78L08A
IN
OUT
COM
C203
12V
REGULATOR 8V
PREAMPLIFIER CIRCUIT
A
Title
MAXTOR ATHENA ATA2-PLUS motors controller
Size
A3
Document Number
Appendix 1
Rev
1
Date:
Thursday, February 17, 2005
Sheet 1 of 1


Title
Maxtor Diamond Max Plus 9 CALYPSO
Size B
Document Number
Appendix 2
Rev 1
Date: Thursday, February 17, 2005
Sheet 1 of 1
SMOOTH L7250E 1.0
ROM 25P10V6
U401
Q400
IR230M
REGULATOR +1.7V
Control Line
Ardent (170)
+1.7V
+3.3V
+12V
+5V
-5V
Q501
REGULATOR +3.3V +3.3V
S500
Shock Sensor
C505
C506
C507
C501 330nF
C 22nF
22uF
C508
BUX
C209
C210
Voice Coil Motor
VCM -
VCM +
SPINDLE MOTOR
MOT A
MOT B
MOT C
CT
R231 200
R230 200
R229 200
R512
R511
R510
R508
R06
R504
1 Om
Q500
Converter DC-DC -5V
L500
R 1K
C513
C514
R519 200
Plug to HDA (Preamplefier)
R 8.2k
J1 (41)
Port for Diagnostic -5V
R516
C519
C511
R513 1Om
R 1Om
KT
VCMI
FCOMM
SEN
SDATA
SYSCLK
SCLK
DAC_OUT
ERR_IN
ERR_OUT
SNS_OUT
SNS_P
SNS_N
VCMGND3
VCMGND4
VCMN1
VCMN2
RSEN1
RSEN2
TEST
VCMBEMF
ADAUX
CALCOARSE
TIMER1
SKDOUT
SKFOUT
SKFIN
SKOUT
SKIN
ZC
VREF25
AGND
CBRAKE
NPOR
CPOR
33_FEED
33_BASE
25_FEED
25_BASE
N_COMP
N_FEED
N_DRV
DIG_GND
VCC5
CPOSC
VCMGND2
VCMGND1
VCMP2
VCMP1
VCV2
VCV1
RSENSE
OUTW1
OUTW2
VM1
VM2
VCV4
VCV3
OUTV1
OUTV2
RSEN3
RSEN4
OUTU1
OUTU2
CPOSCH
VBOOST
Vcc
HOLD
S
Q
W
GND
C
D
Ardent (4)
Ardent (212)
Ardent (213)
Ardent (6)
Ardent (8)
Ardent (128)
Ardent (130)
Ardent (138)
C401
Ardent (129)
Ardent (5)
Ardent (211)
Ardent (7)
Ardent (155)
Ardent (137)
Ardent (145)
Ardent (171)
Ardent (144)
Ardent (174)
Ardent (87)
Ardent (206)
Ardent (67)
Ardent (29)
Ardent (26)
Ardent (12)
Ardent (58)
Ardent (166)
Ardent (44)
Ardent (114)
Ardent (89)
Ardent (184)
Ardent (71)
Ardent (190)
Ardent (150)
Ardent (102)
Ardent (203)
Ardent (157)
Ardent (154)
Ardent (126)
Ardent (27)
Ardent (79)
A
B
C
D