2. Seagate Diagnostic Commands

Upon power up, the drive will respond to a set of diagnostic command send through serial port. Because of the number of commands supported, the commands are broken up into 'Levels'. Many, the progress may be sent over the serial port for number of bits written and read, and command such as read, write, seek, and error log manipulation are available at several different levels. Diagnostic commands are used in place of ATI scripts to do testing. While the drive is running these diagnostic commandshard/soft error rates, a number indicating the test currently being performed, and various information for status of the current test.

The firmware consists of 2 flash codes and numerous supporting files. The two flash codes are known as factory code and customer code. The factory code contains all the serial port diagnostics command but no AT interface command. The customer code contains all AT interface command but minimal set of serial port diagnostics command.

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively.

The following is a short list of some of the serial port commands:

Level T - Certification Tests.
Download code
Start manufacturing test
Set drive 'Age'
Commands to read cert logs, read error logs, write test data to flash, etc.

Level 1 - Memory Control Commands.
Commands to display buffer, display memory, set memory, copy buffer to flash, read sysvars from disk, etc.

Level 2 - Drive Level Commands
A command to configure the cylinders, heads for testing, gives option for random cylinder/head and random data patterns
Commands to set data patterns, perform ECC tests, manipulate the error log, dump the sequencer ram.
Commands to do physical to logical conversion, assign skips and alternates, etc.
Commands to spinup, spindown, seek, read, write, read long, write long, read compare, sleep, set retries, etc.

Level 3 - Seeking Commands
Display the zone table
Motor acceleration test
Measure head switch & settling times
Display head offset
Move actuator open loop
Seek, seek physical, varying length seek test
Latch test
Display position of actuator
Hysteresis test
Latch Exerciser test

Level 4 - Servo Tracking Commands
Manipulate a skipped cylinder table
Tracking error test

Display position error signal
Zap servo burst
Set servo offset
Set/display tracking gain
Send impulse to actuator

Уровень 5. Используется только в заводских условиях

Уровень 6 – Команды batch файлов

Batch файлы для тестирования запусков-остановок, переключения головок, CSS, тестов 1, 2, 3 коррекции burts, files to test start-stop, head switch, CSS, 1,2,or 3 burst correction test, назначаемые тесты, тесты сравнения данных, возможность вводить различные batch файлы в RAM.

Level 7 - Adaptive Control Commands

Tune parameter control and display
Diagnostic read track
AGC gain control
Perform VCO calibration for all zones

Level 8 - Special Packwriter Commands

- Servo diagnostic sub commands
- Configuration commands
- Lock spin external, spin speed adjust
- Set actuator bias current

Level 9 – Drive Level Command (Full-slipping Defect Management Mode)

Beside the above nine levels of commands, there are two additional sets of commands, the On-line commands and Common commands. The main purpose of On-line command is to display varies type of status. Common command is use to ‘poke’ and ‘peek’ into memoery to allow access to registers, buffer memory and data memory.

2.1 ON-LINE COMMANDS

The On-Line commands may be initiated at any time. For the Interface-specific commands, the Interface code must be present in the current memory map for successful execution; the General commands are always available.

Interface-Specific Commands

Command	Description	Availability
^E	Interface State: Max C.H.S. / RW multiple block size / Current transfer mode settings	B
^F	Read Segment Record(s)	B
^G	Write Queue Dump	B
^I	Controller Register Dump ** **(See figure 2.1.7)**	B
^K	Reserved	
^Q	Reserved	
^R	Reserved. This command can only be used when the drive is spun down	
^S	Snapshot current execution address	B
^V	Interface Command Echo and Activity Trace Toggle	B
^X	Interface and Niwot Command History ** **(See figure 2.1.6)**	B
^Y	Display Raw SMART Values (used for computing SMART Attributes)	B
‘~’	Interface Command State	B

General Commands

Command	Description	Availability
^B	(Reserved for Servo Use)	F
^D / ^N	**Retry Activity Display Toggle.** A message will be displayed as follows: e c r = 0 1 0 where 'e' = error tracing, 'c' = command tracing & 'r' = retry tracing. 0=disable, 1=enable. When enabled causes the following characters to be sent to the serial port: '.' = First data retry ',' = subsquent data retry 'c' = Successful On-The-Fly correction occurred 'f' = Shifted Header retry. 'H' = Header retry 'I' = Sequencer was force-stopped. 's' = Servo Recovery 'w' = Write Retry '+' = Index active on non-index sector 'D' = Spin speed outside of tolerance 'L' = Latch retry 'X' = Resync servo bursts '<' = Fine Track window exceeded. '$' = Missing servo burst mark.	B
^L	**Display Sign-on Message, including firmware version.**	B
^O	**Advanced Servo Tracing**	B
^P	**Power Chop enable/disable toggle.**	B
^T	**Restart Test. Causes the drive to restart testing at the current age.**	B
^C	**Software Reset Command, Causes the drive to spin down re-initialize itself, spin backup, and come ready again.**	B
^Z	**Restart the Diagnostic Monitor.**	B
!	**Display Current R/W Channel Settings**	B
%	**Show Mux Status. ** (See figure 2.1.1)**	B
'	**Display Transfer Status (See figure 2.1.2)**	B
.	**Display Active Status. ** (See figure 2.1.3)**	B
;	**Display Machine Status. ** (See figure 2.1.4)**	B
<	**Decrement read/write scope synchronization pulse position.**	B
>	**Increment read/write scope synchronization pulse position.**	B
?	**Show Buffer Allocation. ** (See figure 2.1.5)**	B
^	**Show Elapsed Time since start of cert test or last ^Z.**	B
`	**Show Read/Write Statistics.**	B
{	**(Reserved for Servo Diagnostic Use)**	B
}	**(Reserved for Servo Diagnostic Use)**	B
ESC	**Interrupt Loop or Batch file execution.**	B
=	**Display power up time**	B

Figure 2.1.1: '%' command display format

Returned data format:

aabbccccddeeffgg AX'iiiiiiii ' “jjjjjjjjjj’

aa	Age
bb	Program
cccc	Accumulated health
dd	Drive type
ee	This is the Atlantis ECA0h WRSTATS register value
ff	Error code byte
gg	Maximum number of heads for this type
iiiiiii	Drive serial number
jjjjjjjjjj	PCBA serial number

Figure 2.1.2: ‘ ‘ ’ command display format

Returned data format:

```
Cmd Cyl  Hd Sct  Cnt  Stbuf Segl Csct Cbuf Actv Ercd    Rtry    Flags
aa  bbbb cc dddd eeee ffff  gg   hhhh iiii  j    kk  mmmm.nn.pp  qq
```

Cmd aa	Last command type
Cyl bbbb	Cylinder of current command
Hd cc	Head of current command
Sct dddd	Start sector of current command
Cnt eeee	Length or block count EVER = R/W Forever
Stbuf ffff	Start buffer number
Segl gg	Buffer size
Csct hhhh	Current Sector
Cbuf iiii	‘Intfwork1’ address
Actv j	CIP
Ercd kk	Error Code
Rtry mmmm.nn.pp	Retry parameters (see level 2 Y command) mmmm - retry control bit nn – read retries count pp - write retries count
Flags qq	R/W flags

Figure 2.1.3: ‘ . ’ command display format

Returned data format:

```
Pgm=aa Trk=bbbb(cccc).d.eee Zn=f Err=gg ErCt=hhhh Hlth=iiii Chlth=jjjj Ready
```

Pgm=aa	Active program 00 is diagnostic monitor. 50 is interface program All other numbers are current test running.
Trk=bbbb(cccc).d.eee	Currently selected logical cylinder (physical cylinder), head, sector. Sector will normally point to one past the last sector read or written.
Zn=f	Zone
Err=gg	Error code from current operation
ErCt=hhhh	Error count since last reset of drive or last reset error log command

Hlth=iiii	Accumulated health bits - four digits
CHlth=jjjj	Current health bits – four digits
Ready	Drive status. Can be Ready or Ntrdy

Figure 2.1.4: ‘ ; ’ command display format

Returned data format:
Age=aa Type=bb MxCyl=cccc MxHd=d MxSct=eee Bsz=ffff TCode=gggg

Age=aa	Current drive age
Type=bb	Current drive type
MxCyl=cccc	Maximum cylinders for this drive type in hex
MxHd=d	Maximum heads for this drive type in hex
MxSct=eee	Maximum Sector for this drive type in hex
BSz=ffff	Buffer size in hex
Tcode=gggg	Test code for T.E. Hda Test

Figure 2.1.5: ‘ ? ’ command display format

Returned data format:
RD:xxxx:yy
WR:xxxx:yy
AC:xxxx:yy
AS:xxxx:yy
DP:xxxx:yy
BA:xxxx:yy
ST:xxxx:yy
logbps:xxxx
codebps: xxxx

uP:xxxx:yy
CO:xxxx, yy
FM:xxxx:yy
AD:xxxx:yy

RDxxxx:yy	xxxx = Buffer number for read buffer yy = Buffer size in sectors
WR:xxxx:yy	xxxx = Buffer number for write buffer yy = Buffer size in sectors
AC:xxxx:yy	xxxx Buffer number for active log buffer yy = Buffer size in sectors
AS:xxxx:yy	xxxx= Buffer number for ascii log buffer yy = Buffer size in sectors
DB:xxxx:yy	xxxx = Buffer number for display log buffer yy = Buffer size in sectors
BA:xxxx:yy	xxxx = Buffer number for batch file buffer yy = Buffer size in sectors
ST:xxxx:yy	xxxx = Buffer number for statistics log buffer yy = Buffer size in sectors
logpbs:xxxx	Bytes per sector in cert log area
codebps:xxxx	Bytes per sector in code area

uP:xxxx:yy	xxxx = Buffer number for microprocessor ram yy = Buffer size in sectors
CO:xxxx, yy	xxxx = First code buffer address yy = reserved
FM:xxxx:yy	xxxx=Buffer number for format operations (moving alts) yy=Buffer size in sectors
AD:xxxx:yy	xxxx=Buffer number for reading/saving adaptives yy=Buffer size in sectors

2.2 COMMON COMMANDS: (Available from All Levels)

The Common Commands may be executed whenever the diagnostic monitor prompt is present and the monitor is waiting for a command request.

The '-' and '=' commands involves access of absolute address inside the embedded environment. Each address has 20-bit address. Please get the memory map from DE.

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail.
CR	**Loop Break.**	B
*	**Special Function for batch file:** *1 = Pause batch file execution until input *2,x = Delay x milliseconds *3,x = Branch to Label x *4,x = Increment head and branch to Label x *5 = Clear monitor screen *6 = Stop on error *7,x = Load batch loop counter with x *8, x = Decrement batch loop counter, branch to label x if 0,	B
+x,yyyy	**Peek Byte. Display the byte data content of the specified memory address.**	B
+xyyyy	**Peek Byte. x - upper bits of a greater-than-16 bit address**	B
+yyyy	**Peek Byte. yyyy - lower 16 bits address. The high address in previous x,yyyy is used.**	B
/x	**Change Level to Diagnostic Monitor Level x.**	B
=x,yyyy,zz	**Poke Byte. Replace the contents of the specified address with the specified data.** Note that non-volatile area cannot be modified by this command. zz – byte data content to be written at the specified address	B
=xyyyy,zz	**Poke Byte. Replace the contents of the specified address with the specified data.** Note that non-volatile area cannot be modified by this command. zz – byte data content to be written at the specified address	B
=yyyy,zz	**Poke byte. Replace the contents of the speficied address with the specified data. yyyy – lower 16-bit address. The high address in previous x,yyyy is used.** Note that non-volatile area cannot be modified by this command. zz – byte data content to be written at the specified address	B
@x	**Label.** During batch file entry, define this location as Label x, where x = single digit numeric label specification.	B
-x,yyyy	**Peek Word. Display the word contents of the specified address.** x – upper bits of 20-bit address yyyy – lower 16 bits of 20-bit address	B

Axx	**Set Test Space. Next command to repeat execution as specified by xx:**
	`Bit 7 6 5 4 3 2 1 0`
	`. . . . . +-- 1=all head, 0=current head`
	`. . . . . +---- 1=all cyl, 0=current cyl`
	`. . . . . +------ 1=random cyl/hd, 0=sequential cyl/hd`
	`. . . . +-------- 1=set special (see below)`
	`. . . +---------- 1=even cyl, 0=all cyl`
	`. . +------------ 1=odd cyl, 0=all cyl`
	`. +-------------- 1=sequential out, 0=sequential in`
	`+---------------- 1=random data, 0=existing buffer data`
	
	xx – if not present, display current test space.
	
	Special setting:
	A8,yyyy = Set minimum cylinder to yyyy
	A9,yyyy = Set maximum cylinder to yyyy
	AA,y = Set maximum head to y
	AB,y = Set minimum head to y
	AC,yyyy = Set command timeout to yyyy ms
	AD = Set mins/maxs to defaults
		B

2.3 LEVEL T COMMANDS

Command	Description	Avail.
Bxxx	**Set Baud Rate** xx — baud rate 1152 — 115.2k 625 — 62.5k 576 — 57.6k 384 — 38.4k 288 — 28.8k 192 — 19.2k 96 — 96.k 48 — 4.8k	B
C	**Reset Certification Test.** Resets health bits and sets age to 1.	B
Dxx,yy,zz	**Display Cert Logs sequentially from Log xx.** xx – Log to start sequential display; if blank, display only logs of failed tests. yy – Displays only log entries with this error code If yy = AA, enables Special Log Controls zz. zz – Special function: If zz = 40 - Enable fast dump capability for data cataloger capture. Inhibits time delay between log dumps and enables fast, unformatted log dump	B
Exx,yy,zz	**Display/Edit Cert Log(s)** xx - Log number to display (no entry) Display Active Log = 0 - Clear Active Log <> 0 - Display Log xx yy - Displays only log entries with this error code If yy = AA, enables Special Log Controls zz. zz - Special function: = 08 – Clear and insert ASCII characters from serial port into ASCII log. When CR is entered, save to Log xx and close ASCII Log. = 10 - Append characters from serial port to ASCII Log xx. Close on receipt of CR. = 20 – Write Active Log to Log xx. = 40 – Enable fast dump capability for data cataloger capture. Inhibits time delay between log dumps and enables fast, unformatted log dump. = 80 – Display address of Log xx (Formerly zz = FF)	B
Gx,y	**Read/Write critical component vendor sector** x = which vendor sector y = if not specified: read, specified: write	B

Hxx,yy,zz	**Display/Reset Health Status Bits.** xx - (anything entered) - Display Current Health - (nothing entered) - Display Accumulated Health yy - (not used) zz - =22h => Reset both current and accumulated health to 0000.	B
I	**Cert the reserved cyl**	F
Jxx,yy	**Set Scope Sync from Cert Log entries:** xx - Use entries from Cert Log xx; Blank => Use Active Log. yy - Blank => all entries; yy = sync only on Error Code yy entries.	B
Nxx	**Set Drive Age to xx.**	B
R	**Read System Sector into System RAM**	B
Txx	**Run Factory Test xx**	B
Wxx,yy,zz	**Save System RAM into System Sector.** If age <> 60 then xx,yy,zz is not used. If age == 60 then xx - (not used) yy - (not used) zz - =22h => Reset Adaptives	B
Yxx	**Set Drive Type to xx.** Sets drive type to its default configuration stated below. All defect tables and tuned read/write parameters will be initialised by this command. For safety reasons, this command does not write drive type to system tracks. A W must be issued to write the information to the drive. xx = E0: 1 header version = E1: 2 header version = E2: 3 header version = E3: 4 header version	B

dxx	**Download CERT, RWF, CSPT, DEF from Serial Port to Buffer then write to reserved cyl.** xx = - FILEKEY for downloading. 1H OVLY_CCT 2H OVLY_ACT 3H OVLY_XX 4H DEFRSV 5H DEFFTY 6H DEFUSR 7H DEFLZT 8H RWF 9H SYSVAR1 AH SYSVAR2 BH CSPT CH VBPI DH FLSH_AT EH FLSH_CT 0FH AT_STUFF 10H SECURITY 11H VENDOR_SPEC 12H SMART ATTRIBUTE 13H SMART THRESHHOLD 14H SMART DIRECTORY 15H SMART ERROR LOG 16H SMART COMPREHENSIVE LOG 17H SMART SELF_TEST_LOG 18H SMART CRITICAL_EVENT_LOG 19H SMART HEALTH_LOG 1AH SMART DRIVE_VENDOR_LOG 1BH SMART HOST_SPECIFIC_LOG 1CH WRITE_PROTECT 1DH CON GEN 1EH SKIP CYLINDER LIST = 8X – For DLE only, ie. Only downloaded to buffer Ram. = 88 – DLE only for RWF. = 8B – DLE only for CSPT	
uxx	**Upload CERT, RWF, CSPT, DEF from Serial Port to Buffer then write from resv** Performs the uploading of files from the reserve tracks. The keys are exact the same as those in the download command.	B

fxxxx,yyyy	**Download new flash code from Serial Port to Buffer then burn it in** xxxx - Algorithm Selector Word (ASW) yyyy - None zero number will program this as the User Default ASW (See figure 2.3.1 for ASW bits definitions) (a) if xxxx is not specified => a.1) if default ASW is 0 or ffffh => current ASW is obtained from table, next ASW = ffffh a.2) if default ASW is other values => current ASW = next ASW = default ASW (b) if xxxx is specified => b.1) if yyyy is 0 => next ASW is default ASW, current ASW = xxxx b.2) if yyyy is ffffh => next ASW is default ASW, current ASW = xxxx b.3) if all other yyyy values => next ASW = xxxx, current ASW = xxxx	B
#	**Enter HDA Serial Number.** The S/N may be up to 8 A/N characters long, left justified, and right padded with spaces until string length is 8 characters.	B
[x	**ASCII Log Control:** x = A Enables ASCII logging x = B Disables ASCII logging x = D Displays ASCII log	B

ASW WORD

The Algorithm Selector Word (ASW) is a command to tell the flash upgrade routine to select the correct flash programming algorithm. It can be issued as a parameter in the SDLE.EXE software. The idea is to have single generic routine to cater for different flash memory programming algorithm. Typical flash programming involves 'word programming' and 'sector programming'. If a new flash vendor is cut in, the firmware is not required to change. Just use the correct ASW will do.

Figure 2.3.1

Low Byte

7	6	5	4	3	2	1	0
Future use	Future use	Future use	Future use	Future use	Future use	Word Programming	Reserved (was 128-word pgm)

High Byte

15	14	13	12	11	10	9	8
Chip Erase & Reprogram	Main Memory Erase & Reprogram	Future Expansion	Future Expansion	Future Expansion	Future Expansion	Future Expansion	Future Expansion

2.4 LEVEL 1 COMMANDS: Memory Manipulation Commands

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail.
Bxx,yy	**Buffer Display** xx - Buffer number to display. Note: If the displayed buffer is a read buffer, then low-lighted bytes which do not compare to the corresponding write buffer. yy - Buffer number to compare data to (non matching data is high-lighted). If xx is a read buffer and yy is not entered, data matching the corresponding write buffer location is low-lighted; non matches are high-lighted.	B
Dx,yyyy,zz	**Display Memory.** Displays 256 bytes of memory starting at address xyyyy. x - upper bits of >16 bit address yyyy - lower 16 bits of >16 bit address or the 16 bit address zz - high-light bytes matching this value.	B
E	**Erase System Information- Set all parameters to defaults.** *** Drive must be power cycled for this command to take effect	B
F	Read jumper infomation. Returns message: Jumper: yy yy = 00: Slave (no jumper installed) yy = 01: Master with ATA slave or single drive (jumper near ATA cable installed) yy = 02: Cable Select (jumper near serial connector installed) yy = 03: Master with non-ATA slave (both jumper installed)	**B**
M	**Show Flash ROM Device Code, Manufacturer Code, User Default Algorithm Selector Word (ASW), and Fallback Default ASW. Drive will reboot after finishing this command.**	B
Nxx	**SMART Serial Port Control** xx – Level 1 N Subcommand = 1 – Create Smart Sector. = 2 – Update SMART Attributes (same as SMART D3h option in interface) = 3 – Do Smart Firmware Upgrade = 5 – Dump SMART attribute data = 6 – Dump SMART threshold data = 7 – Dump G-List = 8 – Dump Critical Event Log = 9 – Dump P-List = A – Dump two hour Health Log = B – Run DST Short Test = C – Run DST Long Test	B

Sx,yyyy	**Edit Memory Byte.** x - upper bits of >16 bit address yyyy – lower 16 bits of >16 bit address or the 16 bit address The uP will continue to read the memory byte and will update the display if the byte changes. After entering desired edit value, the following actions may be taken: DEL - Re-edit same byte CR(^M) - Close out and exit LF(^J) - Edit the next sequential location	B
Ux,yyyy	**Edit Buffer Byte.** This is the same command as **S** except the Buffer Memory is edited.	B
Vxx,yy,zz	**Verify and count the number good copies of CERT, RWF, CSPT, DEF in Reserve** xx = - FILEKEY for verifying (same as level T, **d** command, except the following, which are not supported) = 0D – CERT FLSH (for auto reflash) = 0E – AT FLSH (for auto reflash) = 0F – AT_STUFF = 10 – Security (not used, as it is auto downloaded by drive firmware) = 11 – Vendor Specific Entry = 12 ~ 1B – SMART related entries = 1C - Write Protect = 1E – SKIP_TRK **Note**: Although the number of good copies valid might be displayed for the above FILEKEYs, these are strictly **not** valid. yy = - Not entered for just counting the number of good copies available. - If entered, is the Copy Number, which is reserved for DE **internal** use only. Zz = - Not entered for just counting the number of good copies available. - If entered, is the Head Number, which is reserved for DE **internal** use only.	B
W	**Compare PCB serial number with system sector's serial number** If both serial number are equal, print "01". If not, print "00". This feature is for process to detect if PCB has been swapped across HDA.	B
Yxxxx	**Converts desired cylinder number to gray code and display the result.** xxxx - specifies the cylinder number to convert.	B
fxxxx	**Program the FlashROM with either AT- or CERT-built code stored on the reserved tracks** xxxx = AAAA Flash with AT (customer) code xxxx = CCCC Flash with CERT (factory) code Use SDLE to download the code files onto the reserved tracks.	B
mx,yyyy	**Edit memory word. Operates same as level 1 'S' command, except operates on words.**	B
yxxxx	**Converts desired gray code to a cylinder number and displays the result.** xxxx - specifies the gray code to convert	B
$	**Set PCB information and update flash** The user will be prompted to enter PCB EC#, PCB S/N and PCB P/N. This feature is used by PCB plant to burn in PCB#, EC# and serial #. Then the drive plant will automatically retreive the information.	B

#	**Display PCB information** Display the PCB information burnt by $ command.	B

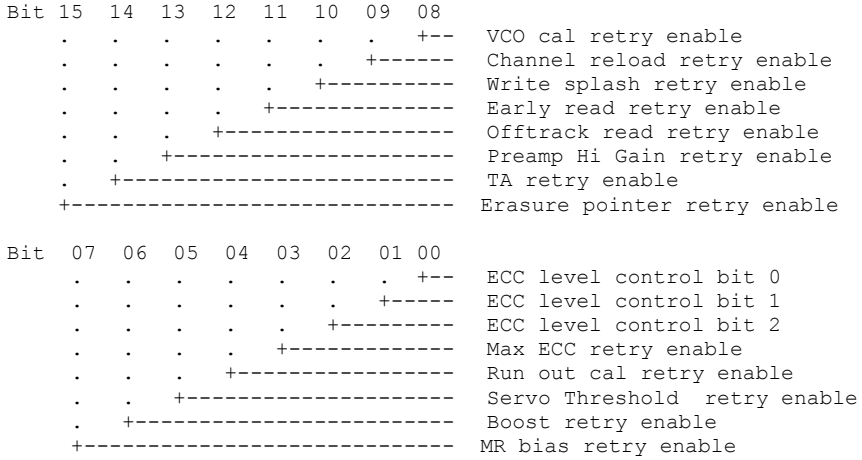
2.5 LEVEL 2 COMMANDS: Niwot Read/Write Commands

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail.
Bxx,yy	**Display Buffer** xx = 512 byte buffer number yy = buffer number for Data match. If xx is a read buffer and yy is not entered, data matching the corresponding write buffer location is low-lighted; non matches are high-lighted.	B
Cxx,yy,zz	**Copy Buffers** xx = Source buffer for the data. yy = Destination buffer of the data. zz = number of 512 byte buffers to copy (1 is default)	B
Exx,yy,zz	**Display/Edit Cert Log(s)** xx - Log number to display. - If no entry, Display Active Log = 0 - Clear Active Log <> 0 - Display Log xx yy - Displays only log entries which have Error Code yy. If yy = AA, enables Special Log Controls zz. zz - Special Log Controls: = 08 – Clear and insert ASCII characters from serial port into ASCII log. When CR is entered, save to Log xx and close ASCII Log. = 10 - Append characters from serial port to ASCII Log xx. Close on receipt of CR. = 20 – Write Active Log to Log xx. = 40 – Enable fast dump capability for data cataloger capture. Inhibits time delay between log dumps and enables fast, unformatted log dump. = 80 – Display address of Log xx (Formerly zz = FF)	B
Hx	**Select Head** xx - Head to Select.	B
Ixx,yy,zz	**Display/Modify Adaptive Settings.** (no parameters) – Display current heads adaptive values xx - zone number yy - parameter number to modify zz - value to assign to parameter yy	B
Jxx,yy	**Scope Sync from Log.** xx - cert log number to take entries from - Default: use Active Log yy - sync only on entries with this error code.	B

Kxxxx,y	**Set Tracking Offset** xxxx - signed, 16 bit integer in units of 265/band (band = 2/3 track). Default = 0. y = 0 : xxxx is temporary offset and is cleared with next seek. Default = temporary. y = 1 : xxxx is persistent offset and is cleared on power cycle or servo cal.	B
Lxx,yyyy **OR** **Lxx,zz,yyyy**	**Loop. Causes the next command to repeat execution, subject to controls specified by xx , yyyy and zz** Bit 7 6 5 4 3 2 1 0 . . . . . +------ 1 = Continue on error, 0 = Stop on error . . . . . +-------- 1 = Stop on no error . . . . . +---------- 1 = Spindown on error, 0 = don't spindown on error . . . . +------------ 1 = Reserved . . . +-------------- 1 = Inhibit err msg on error . . +---------------- 1 = Stop on error code=yyyy, 0 = Loop count . +------------------ 1 = Looping primed (internal use) +-------------------- 1 = Looping active (internal use) yyyy = Error code to stop or Loop count zz = Hi-byte of loop count For example: L1,12,3456 - Don't stop on error , loop for 123456h times L0,78 - Stop on error or repeat for 78h times whichever comes first. L2 - Stop on NO error L20,43 - Stop on error code 43h. L24,43 - Stop on error code 43h., spindown drive when stop L30,43 - Stop on error code 43h, disable error messages display .	B
Oxxxx,yyyy,zzzz	**Seek-Seek on current head:** xxxx - Cylinder to seek from. Default is MinCyl yyyy - Cylinder to seek to. Default is MaxCyl zzzz - Number of seeks to perform. Default: continue until next keyboard entry	B

Pxxxx,yy,zz	Set Buffer Pattern. Note : yyyy and zzzz formats will depend on xx xx - Pattern options to write into buffer. - 8100 = incrementing pattern - 8200= random pattern - 8400 = isolating pulse pattern - 9400= fill buffer memory with the 16-byte memory array yyyy - buffer number to fill, default all write buffer zzzz - ignored xx - NN = defined buffer number to fill with the pattern - 9000 = fill the 16 bytes memory array with pattern - 9100 = fill last 12 bytes of memory array with pattern - 9200 = fill last 8 bytes of memory array with pattern - 9300 = fill last 4 bytes of memory array with pattern yyyy - lower word of pattern to fill zzzz - higher word of pattern to fill Example : P8200,1F -- fill buffer number 1Fh with random pattern P8100 -- fill enitre write buffer with incrementing pattern --- P,1234,5678 – fill entire wrtie buffer with '12345678' P0A,2222 -- fill buffer number 0Ah with pattern '2222' --- P9000,0000,0000 -- fill 16-byte memory array with 0s P9100,0000,0000 -- fill last 12 bytes of memory arrary with 0s P9200,FFFF,FFFF -- fill last 8 bytes of memory array with 'F's P9300,FFFF,FFFF -- fill last 4 bytes of memory array with 'F's P9400,10 -- fill buffer 10h with pattern : (after cmd P90,P91,P92,P93) '0000 0000 0000 0000 FFFF FFFF FFFF FFFF' P9400 -- fill entire write buffer with '0000 0000 0000 0000 FFFF FFFF FFFF FFFF'	B
Qxx,yy	**Write/Read/Read Data.** xx - Start sector # on each track yy - Number of sectors to transfer (limited to # sectors remaining on track). Default: Number of sectors remaining on track.	B
Rxx,yy	**Read Data.** xx - Start sector number (default = 0) yy - Number of sectors to read . Default: Number of sectors remaining on this track.	B
Sxxxx,yy,zzzz	**Seek Cyl/Head.** xxxx - Cylinder number yy - Desired destination head. If the most significant bit is set, the command will seek to the physical cylinder number specified in the first parameter; else, the seek will be to the logical cylinder zzzz - Track follow offset. Signed 16 bit integer	B
Tx	**Measure Throughput.** x not entered: Measure Read Throughput x = 1 Measure Write Throughput	B

Uxx,yy	**Spin-Up** xx not entered: Normal spin-up until drive ready xx value: - 0 spin up with no hold states - 1 advance hold state - 2 release all hold states - 3 hold in warm up state - 4 hold in buzz state - 5 hold in pre-lock state - 6 hold in lock state - all others = no hold state change yy - Head number to use to go active.	B
Vxx,yy,zz	**Read/Compare against corresponding write buffer.** xx - Starting sector on each track (default 00) yy - Number of sectors to read (default is number remaining on track). zz - Buffer to compare data against. Default: first Write Buffer.	B
Wxx,yy	**Write Data.** xx - Starting sector on each track (default is 00) yy - Number of sectors to write (default is remainder of track)	B
Yxx,yy,zzaa	**Show/Set Retry Controls** xx (not entered) - Show current settings  yy – data retry count zz- ID retry count updated only when not 0 aa – write retry count	B
Z	**Spin-Down.**	B
b	**Display Buffer Starts** Displays the first two bytes of each sector-sized buffer.	B
cxx,yy	**Compare Buffers.** xx - Source buffer (default is first read buffer) yy - Reference buffer to compare against (default is first write buffer)	B

exx,yy	**Save Log to Cert Log yy.** xx - Source Log type: 0 = Active Log, 1 = ASCII log, 2 = Display log yy - Destination Cert Log number	B

hxxxx,yy,zz	Translate Niwot CHS to Logical CHS. Maximum Niwot CHS allowed is NiwotCHS of (Stuff.TotalUserCapacity-1) .
	
	Xxxx - Niwot cylinder
	yy - Niwot head
	zz - Niwot sector
	
	- Algo:
	if (translated LBA <Stuff.TotalUserCapacity)
	{
	display LBA;
	if (Logical CHS < Stuff.CurrentAT CHS)
	display logical CHS;
	else
	display invalid CHS FFFF/ F/ FF;
	}
	else
	display Param Invalid;
	Examples:
	"h73,0,0" yields "0000000, 0000/ 0/ 00"
	"h31A,0,1B" "003E3FF, 00FF/ F/ 3E"
	-where "003E3FF" is LBA, and "00FF/ F/ 3E" is NiwotCHS
	"h434f,3,13f" "201F77F, FFFF/ F/ FF"
	-invalid CHS displayed as max logical geometry is 3FFE/F/3E
		B

lxxxx,yy,zz	**Translate Logical CHS /LBA to Niwot CHS** <u>LogicalCHS i/p:</u> xxxx - Logical cylinder yy - Logical head zz - Logical sector <u>LBA i/p:</u> Xxxx - LBA hi-word Yy - LBA lo-word Note: 1. All three input arguments start counting from zero 2. When no arguments are entered, max user LBA and its NiwotCHS are returned Examples: 1. LogicalCHS to NiwotCHS "l0,0,0" yields "0000000, 0073/ 0/ 000" "lFF,F,3E" "003E3FF, 031A/ 0/ 01B" "l" "1F7F81F, 4233/ 2/ 10B" 2. LBA to NiwotCHS "l201,F77F" "201F77F, 434F/ 3/ 13F"	B

rxx	**Read Long from current track** Xx - Sector to read (including ECC Syndrome bytes)	B
t	**Returns number of physical sectors per track for the current track**	B
u	**Unsleep.** Wakes the drive up, spins it up and makes it come ready.	B
vxx,yy	**Write-Read-Compare** xx – Starting sector on each track (default 00) yy – Number of sectors to write/read (default is number remaining on track).	B
wxx	**Write Long to current track** xx – Sector to write (including ECC Syndrome bytes)	B
x	**Show Zone Boundaries**	B
y	**Show Retry Counters**	B
zx	**Sleep.** x not sent - Standby Mode, Spin down, park heads, power off channel and pre-amp. x = 1 - Sleep Mode, in addition to above the buffer is powered down. Requires a power cycle to recover from this mode.	B
$xxxx	Set sector per track for the entire drive. * xxxx - sector per track * This command is strictly for engineering puprposes only. Use at own risk	B
&xxxx,yy,zz	& - Display current skew information and first sector next to index * xxxx = CADE followed by yy and zz to set skew. * xxxx = DEAD , perform write gate timing test. Destructive command! yy = head skew zz = cylinder skew • This command is strictly for engineering puprposes only. Use at own risk. Examples: 1. Perform 63/62h error test 2>&DEAD <cr> 2. Display skew information 2>& <cr> CSkew = 16 Hskew = 13 CurSkew = 0039 IdxSec = 0164 3. Set HeadSkew=0 and CylSkew=1 2>&CADE,0,1 <cr> CSkew = 1 Hskew = 0 CurSkew = 0000 IdxSec = 0000 4. Display SPLITCNT 2>&1A <cr> 2>Split = 00DC ; sector 1A has split at byte DCh 2>&1C <cr> 2>Split = 0000 ; sector 1C has no split	B

2.6 LEVEL 3 COMMANDS: Servo Seeking Commands

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail.
A	**Set Test Space** Refer to 'Common Command' section for detail information	B
B	**Graphic Torque Constant** Measures Acceleration Constant across entire pack and graphs the results.	F
Cxxxx,yyyy	**Acceleration Constant Measurement Test** xxxx - ID cylinder limit for test yyyy - OD cylinder limit for test *Note: xxxx > yyyy*	B
Dxx, yy, zzzz	**Access Times Measurement** If bit7 of yy is 0, then do normal access time test xx : 1) xx=no entry, the access time test is on different seek length 2) xx=0, Random seek 3) others, xx denote as a seek length yy : 1) yy=no entry, assume yy=0 2) yy bit0 determines settling type [bit 0] = 0, denotes read settling [bit 0] = 1, denotes write settling 3) yy bit1 determines seek direction (not valid for random seek) [bit 1] = 1, seek from RdWrMinCyl to RdWrMaxCyl [bit 1] = 1, seek from RdWrMaxCyl to RdWrMinCyl zzzz : specify the loop count (default/no entry = 400h) If bit 7 of yy is 1, then do head switch test at particular track xx : denotes the track where head switch will be done yy : bit0 determines settling type [bit 0] = 0, denotes read settling [bit 0] = 1, denotes write settling zzzz : specify the loop count (default/no entry = 400h)	B
Exxxx	Display/Edit CertLog Refer level 2 for more detail information.	B
Gxxxx,yy	**Translate Hex to Gray** xxxx – Cylinder number to translate to Gray yy – servo zone yy = 0 , access servo band < 16482 yy = 1 , access servo band > 16482	B
Hx	**Head Select** x - head to select	B
J,yy,zz	**Servo Settle/Head Switch Offset Test** yy - test cylinder (current cylinder if no value entered) zz - settling limit (default = head_skew+4)	B

Kxx,yy,zz	**Head Settling Time** xx – Offtrack disturbance amplitude yy –Track nos (default=75) zz – Start Head nos. (default=0)	B
Lxx	**Loop. See the same command in Level 2**	B
Mxx,yy	**Actuator Open-loop Move** xx - DAC output value (max=1FFF Hex) yy - DAC control value (Drive specific)(Bit 0= 0 for in, Bit 0=1 for out)	F
Oxxxx,yyyy,zzzz	**Seek-Seek on current head:** For x<y, use read settle. x>y, use write settle. xxxx - Cylinder to seek. Default: MinCyl yyyy - Cylinder to seek to. Default: MaxCyl zzzz - Number of seeks to perform. Default: 65536 cycle. Note: If 'CHANGEKK013_00' switch is not enabled, it perform normal seek-seek only.	B
Qxxxx,yyyy	CertWrite Read xxxx –First sector (default=0) yyyy –Transfer length (default=full track)	B
Rxx,yyyy,zz	**ReadGrey** xx –0 read for 1 sector; not 0 read for 1track. yyyy –Desired track zz –Desired sector	B
Sxxxx,yy,zzzz	**Seek Cyl/Head.** xxxx - Target cylinder number yy - Desired destination head. If the most significant bit is set, the command will seek to the physical cylinder number specified in the first parameter; else, the seek will be to the logical cylinder zzzz - Track follow offset. Signed 16 bit integer	B
T	**Servo Calibrations**	B
Ux	**Spin-Up** x – 0 = Spin up with no hold states 1 = advance hold state 2 = release all hold state 3 = hold in warm up state 4 = hold in buzz state 5 = hold in pre-lock state 6 = hold in lock state all other = no hold state change	B
W	**'Where-is' Actuator/Read Physical Grey**	B
Y	**Hysteresis** Performs Hysteresis test across the entire pack and displays the results graphically. In addition the inward seek integrator value is plotted. * = Hysteresis value o = -Integrator value x = +Integrator value Note: Integrator values are scaled , /4 .	B
Z	**Spin-Down**	B
gxxxx,yy	**Translate Gray to Hex** xxxx - Gray code value to translate to Cylinder number yy - Servo zone yy = 0 , access servo band < 16482 yy = 1 , access servo band > 16482	B

jxxxx	**Latch Exerciser Test** xxxx - No of times to do latch and unlatch process.	
k	Measure head Offset position	
l	**Latch Test** Perform spin down/ spin up for 8 times and output average value	
lxxxx,yyyy,zzzz	**Latch Tuning Test** xxxx = limit counter yyyy = acceleration frequency count zzzz = deceleration frequency count Note: This command is enabled when LATCH_TEST_TUNING is turned on.	*
pxxxx,yy,zz	**Translate Niwot CHS to Logical CHS** xxxx - Niwot cylinder yy - Niwot head zz - Niwot sector	B
qxxxx,yy,zz	**Translate Logical CHS to Niwot CHS** xxxx - Logical cylinder yy - Logical head zz - Logical sector Note: All three input arguments start counting from zero	B
sxxxx,yy,zzzz	**Seek to Physical Cylinder and Head, ignore Skipped Cylinder** xxxx –Target cylinder yy –Target head zzzz – Track follow offset. Signed 16 bit integers.	

2.7 LEVEL 4 COMMANDS: Servo Tracking Commands

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'C', 'P' and 'S' denote the command is available only if the code is compiled in 'Cert mode', 'Packwriter mode' and 'Servo Mode' respectively.

Command	Description	Avail.
Bxx,yy	**SP-ZAP Test. Scheduled-Parameter WI-RRO Compensation to achieve ZAP (ZAP: Zero-Acceleration-Path)** Format: 4>Bxx[,yy] Enter: 'B' Default . Show RROZAP status 'B0' Default. Show RROZAP status 'Bxx' SP-ZAP actions xx= 1 -> Learn RROZAP table and compensate from it. Clear table before learning xx= 14 -> Master lock status. Toggles between normal RRO ZAP operation and 'freezing' the status to always compensating from the ram table. xx= 2 -> Set "Comp" on and "FrmTbl" on. xx= 3 -> Set "Comp" on and "FrmTbl" off. xx= 4 -> Set "Comp" off and "FrmTbl" off. xx= 5 -> Clear RROZAP table. xx= 6 -> Same as "1" but with pure DACImage xx= 7 -> Display RROZAP Table Note: no "yy" when "xx" is 2,3,4,5,7. "yy", the number of learning iterations (default: 2).	S
v	**Display RRO ZAP table** Display the RRO ZAP values in the ram table	
Cxx,yyyy,aazz	**Tracking Test.** Checks the current track for missing sector marks, bad gray codes, position errors greater than the test threshold, and position errors greater than the write threshold. xx - Test threshold setting yyyy - Position settle delay zz - Loop count for each track aa - Zap enable flag (if non-zero)	F
Exx,yy,zz	**Display Active Log.** See /2 E for further detail.	F
Fxx,yy,zz	**Seek Settle Adaptation Test (All Zones)** xx - Head nos. Test on single head with head nos. entered. No entry/default will be tested on all heads. yy - Seek Length (Default = 10h, Max = 80h) zz - Nos of average count. (Default = 20h) Note : Compensation count for each head after this test will be stored into system log and upload during initial spin-up.	F, S
Gxx	**Set Tracking/Seek Gain** xx - Tracking gain value to set (default is to display current gain).	F
Hx	**Select Head x**	F
Kxx	**Servo Offset** xx - Offset (signed, 8-bit integer)	F
Lxx	**See level 3 L command**	F

Mxx,yy	**Actuator Open-loop Move** xx - DAC output value yy - DAC control value (Drive specific)	F
O	**Display MR Offset for the current head and track.**	B
Px	**Position Error Display for current track.** x = 1 - Loop until next keyboard entry = 0 - (Default) Perform one pass	F
Sxxxx,yy,zzzz	**Seek Cyl/Head** xxxx - Cylinder number yy - Desired destination head. If the most significant bit is set, the command will seek to the physical cylinder number specified in the first parameter; else, the seek will be to the logical cylinder. zzzz - Track follow offset. Signed 16 bit integer	F
W	**'Where-Is' Actuator**	F
X,n	To get accumulate PES and velocity when n=0(or default),Examine Position Bursts (if n = 1, it shows only accumulated PES/rev and accumulated velocity PES/rev)	F
Zxx	**Zap Servo Burst xx of the current track.**	F
f	**Fill Skipped Cylinders (NOT IMPLEMENTED)**	F
pxxxx,yyyy,zzzz	**Display Spin Error** xx –Test control bit 0 : Set loop bit 1 : Trap on threshold violation bit 2 : 1 = Spin speed error/servo burst 0 = Spin speed error/rev bit 3 : Spin speed step to normal yyyy –Threshold setting zzzz –Spin speed offset in .1% incr , this is used when bit 3 is set.	F
qxxxx	**Change Spin Speed** xxxx –Spin speed offset in .1% incr.	B
t	**Change Threshold** t0 – set normal threshold t1 – set loose threshold for bode sweep	S
xcccc,hh	**Skip Cylinder cccc; Skip Head hh** If **cccc** & **hh** omitted, Skipped Cylinder and hd will be listed	F
zcccc,hh	**Unskip Skipped Cylinder(s) , Head** cccc = Cylinder to unskip = ffffh unskip all skipped cylinders = (default) display skip cylinder list hh = Head to unskip	F
i	**PES DFT**	F
k	**Perform Resonance Identification (Similar to certtest)**	F
lxx,yyyy	**Display Resonance Identification results.** Also can change test C result in RAM(will not be saved to disk). To perform above-mentioned change, xx is the logical head number, while yyyy is the value to be changed to.	F

mx,yyyy,zzzz	**SelfBode command** x-0 openloop bode 2 plant bode 4 controller bode yyyy- bode starting frequency {actual frequency(Hz)/(base frequency/4)} zzzz- bode end frequency {actual frequency(Hz)/(base frequency/4)} (base frequency=(1/time per rev) in Hz	F

2.8 LEVEL 6 COMMANDS: Batch File Commands

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

See also the common commands ***, @,** and **|.** These commands define the batch file flow control.

Command	Description	Avail.
	Run Batch File x - Batch file number (default = current batch buffer contents).	B
Dx	**List Batch File**	B
Ex	**Enter Batch File**	B

2.9 LEVEL 7 COMMANDS: Read Channel Adaptive Commands

These commands provide tools for determining and modifying the read/write channel adaptive parameters.

In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail.
Bxx,yy	**See same command in Level 2**	F
Cxx,yy,zz	**See same command in Level 2**	F
Dxx	**Display Temperature Diode Values** xx = when entered will force diode values to be saved to system sectors	F
Exx,yy	**See same command in Level 2**	F
Hx	**Select Head x**	F
Ixx,yy,zz	**Display/Modify Adaptive Settings for the Current Head** (no parameters) – Display current head's adaptive values xx = zone number if xx = the number of zones then modify all zones yy = parameter number to modify zz = value to assign to parameter yy	F
Jxxyy,aabb,mmnn	if yy = 1, capacity tuning xx = wc tune start point yy = wc total test points aa = write current weightage bb = tune test zone mm = first bpi stress point nn = last bpi stress point else, write current tuning xx =: Bit 7 = 1 => forced de-type tuning yy = 01 = 0 => normal capacity tuning Bit 6 = 1 => de-frequency disable = 0 => de-frequency enable Bit 5 = 1 => de-pop disable = 0 => de-pop enable Bit 4 - 0 => range of the left & right limits of quick tuning = 00000 => quick tuning off aa =: Bit 7 = 1 => bits 6 - 0 rep. % range allow of 0 to 100 allow for BPI errors bb = tune test zone Bit 7 = 0 => bits 6 - 0 rep. % range allow of 0.00 to 0.99 allow for BPI errors mm = first bpi stress point nn = last bpi stress point	F
Lxx	**See same command in Level 2**	F

Nxxyy,aabb,mmnn	**Adaptive Test** xx - start point of tuning range for WP or left range for FC yy - total points in tuning range for WP or right range for FC aa - parameter select 1 - Write pre-compensations (WP) 2 - Boost frequency and Frequency cutoff (FCFB) bb - upper nibble:start zone, lower nibble:end zone mm - start point of tuning range (applicable for FCFB only) nn - total points in tuning range (applicable for FCFB only) mm and nn are only applicable to FCFB tuning. Tuned value is updated in RAM.	F
Oh,z,deff	**Read/Write Coarse Offset Calibration** h - Head number (default = head 0) z - Zone number (default = all) if z = number of zones then calibration is done at the ID of the last zone. if z = number of zones +1 then OD of zone 0 is calibrated Tuning is done using the VGA mode. And ff indicate the de - first data rough gain to use ff - last data rough gain to use Best offset value is updated in RAM.	F
Pxxxx,yy,zz	**Set Buffer Pattern** xxxx - Pattern to write into buffer. Default: Random data. yy - Length (in bits) of repeat pattern on non-random data (default = 10h) zz -- Buffer number (no entry => entire Write Buffer)	F
Qxx,yy	**Write/Read/Read Data** xx - Start sector # on each track yy - Number of sectors to transfer (limited to # sectors remaining on track).	F
Rxx,yy	**Read Data** xx - Start sector number (default = 0) yy - Number of sectors to read (default = remaining # of sectors on this track)	F
Sxxxx,yy,zzzz	**Seek Cyl/Head.** xxxx - Cylinder number yy - Desired destination head. If the most significant bit is set, the command will Seek to the physical cylinder number specified in the first parameter; else, the seek will be to the logical cylinder zzzz - Track follow offset. Signed 16 bit integer	F
Fxx,yy	**Find and Set FIR** xx – zone, yy –head	F
g	**Tuning Servo AGC preset value** g – display the average servo VGA of current track g,2 – tune the servo AGC preset value of all heads at the MD	F

Wxx,yy	**Write Data** xx - Starting sector on each track (default is 00) yy – Number of sectors to write (default is remainder of track)	F
Yxx,yy,zzaa	**Set retry. See same command in Level 2**	F
Z	**Spin Down Command**	F
dx,y,f	**Reset Adaptives to the Default Settings** x - Zone Number (default = current zone) if x = number of zones then reset all zones y - Head Number (default = current head) if y = number of heads then reset all heads f - Flag. If f is entered, the head offset values are reset instead of the channel adaptives (default is channel adaptives).	F
e	**Show diagnostic error counter in the Atlantis (DIAGERRCNT)**	F
H	**Read write usafe status 1 from GC80 AD_STAT register**	F
j	Show head resistance	F
p	**Set parameters for Read / Write operation (precedes i command).**	F
swwxx,yyzz	**Send Byte to Read Channel or Preamp or spindle/VCM controller chip** ww - Register Address xx - Data[7:0] yy - Data [15:8] zz - chip selector if yyzz =0000, write Data [7:0] to preamp if yyzz =0001, write Data [7:0] to channel if yyzz =0003, write Data [7:0] to spindle/VCM controller chip if zz =04, write Data [15:0] to spindle/VCM controller chip	F
txx,z	**Get Data from Read Channel or Preamp or spindle/VCM controller chip** xx - Register address z - if z=0 read from Preamp shadow RAM - if z=1 read from read channel directly - if z=2 read from Preamp directly (For packwriter mode only). - if z=3 read 8 bit data from spindle/VCM controller chip - if z=4 read 16 bit data from spindle/VCM controller image	F
x	**Show Zone Boundaries**	F

2.10 LEVEL 8 COMMANDS: Pack Writer Commands

Pack writer commands are not available in normal firmware release. The firmware must be specially generated. All the AT interface commands will not be available in Pack Writer code too.
In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively. Besides, a 'P', 'S', and '*' denote the command is available only if the code is compiled in 'Packwriter Mode', 'Servo Mode' and 'Special Mode' respectively.

Command	Description	Avail
A	**Set Test Space** Refer to 'Common Command' section for detail information	B,P,S
Bxx	**Set read head Bias** xx = MR read head bias (0 = 6 mA, 1F = 18mA)	P
Cxx,yyyy,zzzz	**Execute the servo diagnostic sub commands** xx = diagnostic number yyyy = optional diagnostic parameter zzzz = optional diagnostic parameter	P,B,S
C00,xxxx,y	Flex bias cal xxxx = optional cylinder y = optional head	
C02,xxxx,yyyy	Set access display and reset rate masks xxxx = optional display rate mask yyyy = optional reset rate mask	
C03,xxxx,yyyy	Set min and max cylinder limits xxxx = min cylinder yyyy = max cylinder	
C04,llhh,yyyy	Acceleration constant cal hh = optional seek length ll = optional head yyyy = optional cylinder	
C05,xxxx,y	Set seek delay xxxx = seek delay in servo bursts y = (1= force slow settle)	
C07,xxxx	Head switch up and down the stack xxxx = optional cylinder (default = current cylinder) Fast or slow settle seek employed depends on C05 setting	

C08,x	Random seeks x = optional heads only Fast or slow settle seek employed depends on C05 setting	
C09,xxxx,yyyy	Seek to and from inward and outward within the min and max cylinder limits xxxx = optional seek length (default = 1) yyyy = optional cylinder (default = current cylinder) Fast or slow settle seek employed depends on C05 setting	
C0A,xxxx,yyyy	Seek to and back inward and outward within the min and max cylinder limits xxxx = optional max seek length (default = max length) yyyy = optional min seek length (default = 1) Fast or slow settle seek employed depends on C05 setting	
C0B,xxxx,y	Serpentine seeks inward up and down the head stack within the min and max cylinder xxxx = optional cylinder (default = current cylinder) y = optional head (default = current head) Fast or slow settle seek employed depends on C05 setting	**P**
C0C,xxxx,yyyy	Seek to seek between cylinders xxxx = optional 1st cylinder (default = min cylinder) yyyy = optional 2nd cylinder (default = max cylinder) Fast or slow settle seek employed depends on C05 setting	
C0D,xxxx,yyyy	Head to head between heads on the same cylinder xxxx = optional 1st head (default = head #0) yyyy = optional 2nd head (default = heads-1) Fast or slow settle seek employed depends on C05 setting	
C0E,xxxx,yyyy	Set servo gains xxxx = Ka yyyy = optional Ktf	
C0F,xxxx,y	Encode cylinder/ decode gray code xxxx = optional cylinder or gray code (default = current cylinder/gray code) y = (0 = encode, 1 = decode)	
C10,xxxx	Radial Head Switch Offset Test. xxxx= optional cylinder for head switch Note: "CHANGESY001_01" ON to perform both Tangential and radial head switch test Fast seetle seek employed	

C11,xxxx,yyyy	Head linearization xxxx = # of iterations, # of linerization range for average 00xx = # of lineraize range eg. = 1: +/- LINEARIZERANGE = 2: +/- LINEARIZERANGE*2 xx00 = # of iterations for linearization, <128 only effective if yyyy:bit0 = 0 default xxxx = 0A04h yyyy = calibration options bit 0 – 0: performance linearization 1: measure OL gain only bit 1 – 0: silent mode during linearization 1: display gains profile and linearization coefficients while doing head linearization. Only effective when bit 0 = 0 bit 2 – 0: all heads 1: current head only bit 3 – 1: display head linearized coefficients only bit 4 – 1: clear head gain coefficient default yyyy = 0 Note: Slow settle seek employed	
C12,xx,yy	Run out compensation	
C15,xxxx	Change write threshold xxxx = enter a new write threshold	
C16,xx	Disable prediction stuffing on zapped servo samples xx = 0 => allow stuffs 1 => diable stuffs	
C18	Perform All Servo Calibration	
C1A,xxxx,yy	Measure raw PES avg. xxxx = optional nos. of PES samples taken at each sector for averaging (default=100) yy = desired sector PES to display (0 if not entered, default = index) Output format (in word value) : aaaa bbbb cccc dddd eeee ffff gggg hhhh where, aaaa = Ave (A-B) at desired sector bbbb = Ave (C-D) at desired sector cccc = Overall ave (A-B) of all revs taken dddd = Overall ave (C-D) of all revs taken eeee = Min (A-B) ffff = Max (A-B) gggg = Min (C-D) hhhh = Max (C-D) Note : This command is enabled by turn on Measure_Raw_PES switch	

C1B,xxxx,yy	Measure single track PES with repetitive nos. xxxx = optional cylinder (default = current cylinder) xxxx = 0 - measure PES and DAC. Output will be in two columns first being PES and second being DAC. yy = nos of time to repeat (default nos =1) Output format (in word value): A signed value of PES at every sector will be displayed and the first output will be PES value at Index burst. After one rev have been displayed, a carriage return will be invoked. Note : This command is enabled by turn on Measure_Single_PES switch	
C1C,xxxx,yyyy	Measure raw N(A-B) and Q(C-D) values with repetitive nos. xxxx – optional cylinder (default is the current cylinder) yy – no of times to repeat (default is 100) Output format: N and Q will be displayed and the first output is index burst. After one rev, a carriage return will be invoked. Note: This command is enabled when MEASURE_SINGLERAW_PES is turned on.	
CIF	Display servo calibration data	
C23,xxxx	Measure RRO on STW xxxx = optional # of samples (default = 100) Note : This command is enabled with "MEASURE_PES" switch is on.	
C24,xxxx	Measure PES synchronously at every sector on present trk and compute PES avg and Sigma^2 xxxx = optional # of samples (default = 100) Note : This command is enabled with "MEASURE_PES" switch is on.	
C25,xxxx	To display C24 measurement results at every sector Note : This command is enabled with "MEASURE_PES" switch is on.	
C27,xxxx	Ramp DACs xxxx = enter the DAC peak ramp value (Default = 180h)	
C28,xxx	Write servo DACs xxx = 12 bit signed value	
C29,xx,yy	Seek Settle Adaptation on single track xx – Seek length (default = 1) yy – Nos. of average count (default = 1) yy = FFFF, to display resonance screen results(settling time) yy = FFFE, to display compensation results yy = FFFD, to clear the compensation table Note : The results will not store into sys log. It is enabled by turn on SEEK_SETTLE_ADAPT Switch.	F, S

C2A,xx,yy	**Measure seek settling for TMR budgeting** xx = no of rev (default = 1) yy = settling type, 0 denotes read settling and 1 denotes write settling Output format (in double word value): A signed value of PES at every sector will be displayed and the first output will be PES value at Index burst. After one rev have been displayed, a carriage return is invoked. Note : this command is enabled when switch TMR_SEEK_SETL is turned ON.	*
C2B	**Save Servo Parameters, Bias Table, Ka Table, Head Linearization Gain**	
C2C	**Retrieve Servo Parameters, Bias Table, Ka Table, Head Linearization Gain**	
D1	**Read and display serial number raw data.**	F
D	**Read serial number from HDA. This # is written by pack writer.** It will be logged to reserve E1 area.	P,S
DE1	**Read serial number from HDA. This # is written by pack writer.** It will not be logged to reserve E1 area. Cancun packwriter = +cccc hh bb oooo ff cccc = max cylinder (excluding guard band cylinders) hh = max head number bb = number of bursts oooo = oscillator clocks per bursts ff = oscillator frequency in MHz	P,S
E	**Lock Spin External**	P
Gxxxx	**Set Spin Gain** xxxx = spin gain (0800h default)	P
Hx	**Select head directly** x = head number (0..7)	P
Ixxxx	**Push-Inward Actuator** xxxx = 12 bit DAC command	P
Jxxxx	**Spin Speed Adjust** xxxx = signed number of timer ticks (fe00 .. 0200)	P
Jxx,yy,zz	**Seek Settle Adaptation Test** Similar to level 4, F command except the results are store into RAM table instead of system log.	F, S,*
K	**Added track offset in track follow state**	P
L	**Unimplemented**	P
M	**Increment Head (current head + 1)**	P

N	**Report Logical Spin State** 00 = reset 01 = fault 02 = initialize 03 = stopped 04 = spindown 05 = spinup 06 = wait (held need refer) 07 = open loop (lost refer) 08 = close loop (found refer) 09 = ready (spinning at speed) 10 = busy (recovery) 11 = invalid	P
Ox	**Message Display** x = 0 is display output off, 1 is display output on (default).	P
Pxxxx	**Push-Out Actuator** xxxx = 12 bit DAC command	P
Qx	**Read channel** x = 0 is channel off, 1 = channel on	P
Rxxxx	**Read Gray Code** xxxx = expected gray code	P
Sxxxx,yy,zzzz	**Seek Cyl/Head** xxxx - Cylinder number yy - Desired destination head. If the most significant bit is set, the command will seek to the physical cylinder number specified in the first parameter; else, the seek will be to the logical cylinder zzzz - Track follow offset. Signed 16 bit integer	P,S
Sxxxx,yyyy	**Compaq slam test** xxxx = vel to slam (recommended max = 5FEEh) yyyy = determines dir of the slam test and whether to do the slam test or not. Bit 10 set indicates do the test; not set indicates don't do the test Bit 11 set indicates a ID crash stop slam; not set indicates a OD crash stop slam Note : This command is enabled by turn on SLAM_TEST switch	*
Uxx	**Spin-Up Motor** xx hold state(optional)	P
Vx	**Spin-Up** x = actuator bias direction, (0 = outward, 1 = inward)	P
Wxx	**Set Write Current** xx = preamp write current	P
X	**AC unlatch for high latch force HAD**	P
Z	**Spin-Down**	P

ff,ww	**Set bank write mode** Sets the preamp write bank mode on/off and sets the write current. f = 1 bank write ON = 0 bank write OFF ww = write current register value.	P
g	**IMRON signal polarity** Returns a 01 if the IMRON preamp signal is active high and a 00 if active low.	P

2.11 LEVEL 9 COMMANDS: Full slipping / Defect-Skip Mode

Basically level 9 supports all commands in level 2. The only difference is all defects are skipped. There is no change in command parameters passing except the sector number will be treated as logical sector. Cylinder and head number remained the same as in level 2.

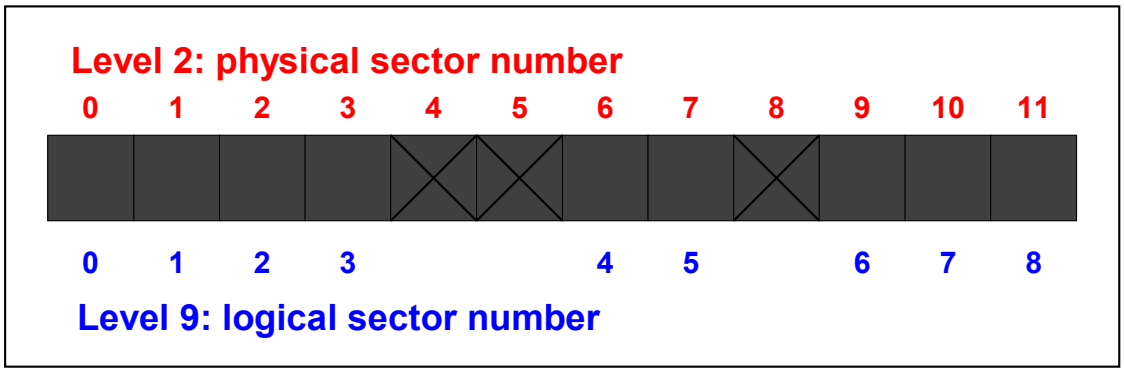
Example:

If a physical track consists of 12 sectors and 3 of them are defects, then in level 2 'W' would mean writing 12 sectors. However in level 9 'W' would mean writing 9 sectors since 3 sectors has been skipped.

W2,4 in level 2 means writing to physical sector 2,3,4,5 (physical sector 2,3,4,5).
W2,4 in level 9 means writing to logical sector 2,3,4,5 (physical sector 2,3,6,7).

In summary all sector representation in level 9 are in 'defect skip mode'.

Note: Due to LBA seeding, if there's a defect slip in level 2 sector 4, then sector 5 and above cannot be read by level 2 command anymore if it has been written in level 9.



In the 'Availability' column, a 'F', 'C' and 'B' indicate the command is available at 'Factory Code', 'Customer Code' and 'Both codes' respectively.

Command	Descriptions	Avail.
Rxx,yy	**Read Data.** xx - Start logical sector number (default = 0) yy - Number of sectors to read . Default=whole track	
Rxx,yy,1	**Read Data with level 9 reassignment ON.** xx - Start logical sector number (default = 0) yy - Number of sectors to read . Default=whole track 1 - a '1' indicate level 9 reassignment turn ON	B

Sxxxx,yy	**Seek Cyl/Head.** xxxx - Physical cylinder number (as in Level 2) yy - Physical head number. (as in Level 2)	B
Wxx,yy	**Write Data.** xx - Start logical sector number (default = 0) yy - Number of sectors to write. Default=whole track	
Wxx,yy,1	**Write Data with level 9 reassignment turn ON.** xx - Start logical sector number (default = 0) yy - Number of sectors to write. Default=whole track 1 - a '1' indicate level 9 reassignment turn ON	B
Fxx,y	**Insertion & Deletion of Defects** Fxx,A - **Insert reassignment at sector xx.** **Fxx,B** - Insert pending at sector xx. **F0,C** - Remove all reassignment and pending entries in defect table. Fxx,D,yy - **Insert yy slip at sector xx** **F0,E** - Reinitialize defect table **Fxx,F** - Delete pending at sector xx. **F0,F0** - To allow media test. **F0,F1** - To fail media test. **F0,FF** - To check for drive reboot	B
t	**Returns number of logical sectors per track for the current track** This command is useful when an error is encountered and the host sofware wants to figure out which sector is the one in error. The host issues this command to find out the sector/track and then read single sector one by one from (0..max_sec_per_track – 1)	B
……	**Support all other commands as in Level 2**	B

Appendix A: Error Codes

00h	No error
03h	Bad ROM CRC
10h	RRO fail ZAP code
11h	Spin error
12h	Oscillatory wavy PES
13h	Offtrack
14h	Write fault
15h	Velocity PES harmonics
16h	Seek timeout
17h	'false' AMDET (mis-timed)
18h	Bad burst error code
19h	Bad grey code
1ah	Early sync code
1bh	Missed am
1ch	Failed the servo defect screen threshold
1dh	Time out waiting for servo ready (approv. 4sec)
1eh	Target generator sector error
1fh	Physical sector error
20h	RWF init error
21h	RWF file incompatible with Current ROM code
30h	Data miscompare
31h	Data miscompare on read longs
36h	Pending block encountered during a write
37h	Pending block encountered and read successfully
38h	Pending block encountered and read failed
40h	Id not found
41h	Long ECC error correction code
42h	Missed servo sector mark
43h	Dataecc error
44h	Fifo over/underrun
45h	Track ID miscompare error
46h	Track ID read TO code
47h	Missed data sync byte (1st data fragment)
48h	Missed data sync byte (after splitted fragment)
49h	Thermal asperity code
4ah	Write integrity error
4bh	Error log full
4ch	Controller stopped without a reason
4dh	Sd counter not the expected value
4eh	Block release timeout error
4fh	Servo assist error
50h	Skipped sector
51h	Alternated sector
52h	Pad and fill defects
53h	Pad/fill is alt dst, realt source
54h	Error during scratchfill
55h	Bad alt dest ID info
56h	Unable to find valid alt dest
57h	Unable to delete alt dest

58h	Too many defects per head
59h	Too many defects per track
5ah	Too many defects per drive
5bh	Defect table full
5ch	Slips overflowed
5dh	Invalid defect entry
5eh	Padding of data region of zapped burst
60h	No spares available
73h	Unable to read defect sectors code
61h	Write blocked w/o a reason
62h	Write gate came on early
63h	Write gate went off late
64h	GC thermal sensor fault detected
65h	Shock sensor fault detected
66h	Scratch ram protection error
70h	Bad disk resident cert/diag code
71h	Unable to read system sectors code
72h	Unable to read packwriter auto-stamp
83h	Invalid command
8dh	Cylinder filled in
8eh	Cylinder skipped out
8fh	Max cylinder skips has been reached
90h	Zapped burst
91h	2 consecutive zapped bursts
92h	Too many zapped bursts on a track
93h	Unable to zap - 2 consecutive bad bursts
94h	Unable to zap - too many bad bursts on a track
95h	Unable to zap bad burst
97h	Couldn't find burst
98h	Timeout waiting for r/w
A0h	Preamp miscommunication
C1h	Wrong major/minor version error
C2h	Wrong engr version error
C3h	File size mismatch error
C4h	DLE checksum = 0 error
C5h	AutoDLE upload error
C6h	Wrong overlay flag dat in byte 8,9
C7h	Read1Cp checksum=0 error
C8h	Exceed max key defined for DLE
C9h	Error during reading resv
Cah	Error comparing Signature
Cbh	Defect map sequence error
Fbh	Defect unspared
Fch	Command aborted (internal only)
Fdh	R/W command rejected
Feh	Invalid address passed to Niwot

Appendix B: Online Command Display Descriptions

Statistics Display Description(')

When the drive is running diagnostic commands, certain statistics are logged and may be displayed while operations are in process. Statistics for each head are displayed in decilog form.
(e.g. 10.3 = 10**10.3 = 2x10**10)

Rbit	This column displays the number of bits read in decilog.
Hard	This column displays the hard error rate for reads using the specified retry options. (If no retries are selected any error is a hard error). Any error displayed to the terminal using the level 2 R or Q commands will be counted in the hard error rate.
Firm	
Soft	
Raw	
Rhdr	
Wbit	This column displays the number of bits written in decilog.
WHrd	This column displays the hard error rate for writes using the specified retry options. (If no retries are selected any error is a hard error). Any error displayed to the terminal using the level 2 W or Q commands will be counted in the hard error rate.
Wrty	
Whdr	

Appendix C: Servo Message Tracing

MESSAGE TRACING LEVELS:

CTRL O will be used to set tracing to one of 4 levels. Each CTRL O will step to the next level as defined below.

LEVEL	S0	S1	DEFINITION
0	0	0	No error or offtrack tracing enabled
1	0	1	Error tracing enabled (All but offtrack errors will be reported)
2	1	0	Offtrack tracing enabled (Offtrack errors during TF will be reported)
3	1	1	Both offtrack and error tracing enabled

MESSAGE TRACING STRINGS		DESCRIPTION OF MESSAGES
($….)	Error	1 missed AM ($, prev cyl, present cyl, offset, head, sector)
(s….)	Error	Error recovery seek (s, prev cyl, present cyl, offset, head, sector)
(ot…)	Offtrack	Broke write thld during TF (ot, , prev cyl, present cyl, offset, head, sector)
(bs…)	Error	Bad sample (bs, grey code, prev cyl, present cyl, offset, head, sector)
ref “byte”	Always	Spin up current measured across spin Rsense during spin up.

MESSAGE TRACING STRINGS		DESCRIPTION OF MESSAGES
Switch to….	Always	Switch to full int. spining closed loop on AM’s
Ready	Always	Spin up complete

MESSAGE CHARACTERS	TRACING LEVEL	DESCRIPTION
$	Always	3 missed AM’s in a row
+	Always	Index found on wrong burst twice in a row
A	Error	AM time out during spin up ONLY
Z	Error	ZERO crossing time out during spin up ONLY
-	Error	Motor commutation table pointer was NOT advanced during spin up ONLY
*	Error	Motor commutation table pointer was advanced during spin up ONLY.

Appendix D: Health Bits Defininitions

The health byte is in the following format: X X X X . X X X X
The first 4 nibbles are the Current Health Bit and the last 4 are the Accumulated Health Bits.
The bits in the health byte description follows:

Bit # (if 1)	**Meaning**	**Bit # (if 1)**	**Meaning**
15	Excessive Skips or Alts	7	(internal use- abort test flag)
14	Hardware Error	6	not assigned
13	Serious R/W Error	5	not assigned
12	Error Rate Health	4	not assigned
11	Offtrack Error	3	R/W Warning
10	Actuator Error	2	Unable to Assign Skip or Alt
9	Servo Error	1	Spin Current Warning
8	Spin Error	0	Spin Error During Seek