TEXAS INSTRUMENTS

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MEMORANDUM:

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SUBJECT: PROPOSED SCSI DIAGNOSTIC ENHANCEMENTS

REFERENCES: ANSI X3T9.2/86-109, Revision 10B

In testing and evaluating SCSI winchester disk drives, certain areas have been identified where standardization of certain diagnostic functions would be broadly useful.

Since a physical interface has not been standardized for extracting and using this needed information (such as an RS232 port), it appears that a mechanism via the drive interface (if the interface can support it) should be entertained.

The following sections describe proposed enhancements and/or additions to the current SCSI command set to allow for more efficient testability and in some cases provide a mechanism for a knowledgeable user to possibly recover user data that otherwise might not be recovered with the current SCSI commands.

Per the SCSI-2 document, the SEND DIAGNOSTIC and RECEIVE DIAGNOSTIC RESULTS commands were conceived to facilitate the execution of tests or operations outside the normal operational activities of SCSI devices, with a large number of pages set aside for these operations. A few pages have already been reserved for standardization with one of them, Page 40h, now being utilized by some drive manufacturers as the Translate command (i.e. logical to physical address conversion).

Thus, we propose that we leverage on the current allowances made by the SCSI document to include the following pages under the SEND DIAGNOSTIC Pages section of the SCSI specification.

Regards,

Ricardo V. Dominguez
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ABSTRACT:

This is a proposal of diagnostic test facilities intended to supplement the already existing diagnostic features defined in SCSI-1 and SCSI-2. This is intended for use by system integrators, peripheral suppliers and test equipment manufacturers in testing SCSI peripherals such as rigid disk drives, flexible disks, magnetic tape devices and optical disks through a standardized test medium.

SUMMARY OF PROPOSED PAGE CODES:

As per the SCSI-2 document, the page code field indentifies which diagnostic page is being sent or returned. We propose that Table 8-40 of SCSI-2 be updated for direct-access devices to reflect the additional page codes described herein.

Page Code [1]	Description	Section
C4h	Format Track	8.X.X.X
C8h	Diagnostic Read	8.X.X.X
C9h	Diagnostic Read ID	8.X.X.X
CAh	Diagnostic Write	8.X.X.X
D5h	[2] Configuration	8.X.X.X
DCh	Diagnostic Erase	8.X.X.X
DDh	[2] Diagnostic Read-Write Recovery	8.X.X.X

NOTES: [1]   These page codes are currently defined by SCSI-2 as vendor unique. Thus, this as well as any descriptions, format, or other verbage in this proposal not in line with X3T9.2 format may be modified by X3T9.2 as needed.

[2]   These Page descriptions will be forwarded at a later time.

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PROPOSED DIAGNOSTIC PAGES:

Format Track

This command allows the initiator to format a specified track as a
single sector or as specified by the Mode Sense "current" parameters
defined in page 03, Scn 8.3.3.3, via the last successful Mode Select
command.

Table 8-XX: Format Track - Send Diagnostic

BYTE# \ BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
00	Page Code (C4h) [1]							
01	Reserved							
02	(MSB) Page Length (0014h)							
03								(LSB)
04	Reserved					Supplied Format		
05	(MSB) Address Field							
12								(LSB)
13	Reserved							
14	(MSB) Transfer Length							
21								(LSB)
22	Reserved							
23	Reserved							

The page length field contains the number of parameter bytes that
follow.

The Supplied Format field specifies the format of the Address Field.
Valid values for this field are as defined by the Format Unit command
for the Defect List Format, Table 8-5.

Acceptable values for this command include both the logical and
physical sector formats.

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This command allows addressing of the appropriate starting block
address and precludes the use of defect management. This allows
formatting of physical locations that have been previously
deallocated, spare sectors, etc.

In the Logical Block Format mode, bytes 06-09 are reserved and bytes
10-13 specify the logical block with byte 13 the LSB.

In the Physical Sector Format mode, bytes 06-08 specify the cylinder
number where byte 08 is the LSB. Byte 09 specifies the head number.
Bytes 10-13 specify the physical sector where byte 13 is the LSB.

Reserved cylinders are accessed using 2's complement addressing (e.g.
cylinder address FFFFFEh would refer to reserved cylinder 2.

The Transfer Length specifies the format mode. A transfer length
of zero indicates that the drive will use the values specified in Mode
Sense page 03 (current values). For this mode, it is preferred that
the new format ID's be the same as the original format ID information.

A transfer length of one indicates that the track will be formatted as
a single sector ignoring the Mode Select/Sense information. The ID
information will be defined by the supplier.

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Diagnostic Read

This command allows the initiator to read the specified location using Supplied Format addressing.

Table 8-XX: Diagnostic Read Page - Send Diagnostic

BIT BYTE#	7 (MSB)	6	5	4	3	2	1	0 (LSB)
00	Page Code (C8h) [1]							
01	Reserved							
02	(MSB)							
03	Page Length (0014h)							(LSB)
04	Reserved					Supplied Format		
05	(MSB)							
12	Address Field							(LSB)
13	Reserved							
14	(MSB							
21	Transfer Length							(LSB)
22	Reserved							
23	Reserved							

The page length field contains the number of parameter bytes that follow.

The Supplied Format field specifies the format of the Address Field. Valid values for this field are as defined by the Format Unit command for the Defect List Format, Table 8-5.

Using the Bytes from Index or Physical Sector Formats allows addressing and retrieving the data from the physical medium location specified and preclude the use of defect management. This allows reading of physical locations that have been previously deallocated, spare sectors, etc.

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The Address Field contains the address of the sector to be read. The
format of this field depends on the value in the Supplied Format field.

In the Logical Block Format mode, bytes 06-09 are reserved and bytes
10-13 specify the logical block with byte 13 the LSB.

In the Bytes from Index Format mode, bytes 06-08 specify the cylinder
number where byte 08 is the LSB. Byte 09 specifies the head number.
Bytes 10-13 specify the bytes from index where byte 13 is the LSB.

In the Physical Sector Format mode, bytes 06-08 specify the cylinder
number where byte 08 is the LSB. Byte 09 specifies the head number.
Bytes 10-13 specify the physical sector where byte 13 is the LSB.

Reserved cylinders are accessed using 2's complement addressing (e.g.
cylinder address FFFFFEh would refer to reserved cylinder 2.

The Transfer Length shall specify the number of contiguous physical
blocks of data to transfer.

Reading of reserved or diagnostic cylinders can be done with only the
Physical Sector Format (i.e.101b).

Given that a track was previously formatted as a single sector per
track, this command will allow reading of same.

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Diagnostic Read ID

This command allows the initiator to read the sector header information at the location specified in the Address Field.

Table 8-XX: Diagnostic Read ID Page - Send Diagnostic

BYTE# \ BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
00	Page Code (C9h) [1]							
01	Reserved							
02	(MSB) Page Length (0014h)							
03								(LSB)
04	SKDIS	Reserved				Supplied Format		
05	(MSB) Address Field							
12								(LSB)
13	Reserved							
14	(MSB Transfer Length							
21								(LSB)
22	Reserved							
23	Reserved							

The page length field contains the number of parameter bytes that follow.

Enabling the implied seeking (SKDIS=0) shall cause the drive to seek before reading any sector ID. The Address Field will be ignored when SKDIS=1.

The Supplied Format field specifies the format of the Address Field. Valid values for this field are as defined by the Format Unit command for the Defect List Format, Table 8-5.

Acceptable values for this command include both logical and physical sector formats.

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This command allows addressing and retrieving the header (ID) information from the physical medium location specified and preclude the use of defect management. This allows reading of physical locations that have been previously deallocated, spare sectors, etc.

The Address Field contains the address of the sector to be read. The format of this field depends on the value in the Supplied Format field.

In the Logical Block Format mode, bytes 06-09 are reserved and bytes 10-13 specify the logical block with byte 13 the LSB.

In the Physical Sector Format mode, bytes 06-08 specify the cylinder number where byte 08 is the LSB. Byte 09 specifies the head number. Bytes 10-13 specify the physical sector where byte 13 is the LSB.

Reserved cylinders are accessed using 2's complement addressing (e.g. cylinder address FFFFFEh would refer to reserved cylinder 2.

The Transfer Length specifies the number of contiguous physical sector headers to transfer. A Transfer Length of 1 will return the ID of the current sector. A transfer length of zero will return all ID's from Index of the current track.

Reading of reserved or diagnostic cylinders can be done with only the Physical Sector Format (i.e.101b).

Given that a track was previously formatted as a single sector per track, this command allows reading of same.

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Diagnostic Write

This command allows the initiator to write the data in the specified location addressed in the Address Field

Table 8-XX: Diagnostic Write Page - Send Diagnostic

BYTE# \ BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
00	Page Code (CAh) [1]							
01	Reserved							
02	(MSB)							
03	Page Length (0014h)							(LSB)
04	HF	LF	ITI	WS	Rsvd	Supplied Format		
05	(MSB							
12	Address Field							(LSB)
13	Reserved							
14	(MSB							
21	Transfer Length							(LSB)
22	Reserved							
23	Reserved							

The page length field contains the number of parameter bytes that follow.

The Supplied Format field specifies the format of the Address Field. Valid values for this field are as defined by the Format Unit command for the Defect List Format, Table 8-5.

These address modes allow writing of data to the physical medium location specified and also precludes the use of defect management. This allows writing of physical locations that have been previously deallocated, spare sectors, etc.

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The HF (High Frequency) and LF (Low Frequency) bits in byte 04 define the following functions:

HF	LF	Function
0	0	Write data specified by initiator to the address specified by the address field
0	1	Write target default Low Frequency worst case pattern for the particular notch zone or drive.
1	0	Write target default High Frequency worst case pattern for the particular notch zone or drive.
1	1	Write the sector address as data in the data field

The WS (Write Same) bit in byte 04 enables or disables writing of a single block of data transferred by the initiator to the medium multiple times by the target. Refer to Scn 8.2.24. Setting WS bit to one enables this function and setting this bit to zero disables it.

For a notched target, the target automatically adjusts the patterns for the specific notch area when the HF/LF bits are set to 01b or 10b.

The ITI bit, bit 05 of byte 04, allows the initiator to write data from Index To Index with no sector header information. When the ITI bit is set to one, the target writes data from Index to Index. When the ITI bit is set to zero, the target writes data on the given track per the specified format. If the ITI bit is set to one, the Transfer Length field and the HF/LF combination of 11b are not applicable.

> IMPLEMENTORS NOTE: It is not the intent of this function to corrupt any target-specific information required for normal operation (e.g. servo information). Thus, as is the case for any normal write operation, it is necessary that the target gate the pertinent signals to protect the target from any corruption of necessary information.

The Address Field contains the address of the sector to be written. The format of this field depends on the value in the Supplied Format field.

In the Logical Block Format mode, bytes 06-09 are reserved and bytes 10-13 specify the logical block with byte 13 the LSB.

In the Bytes from Index Format mode, bytes 06-08 specify the cylinder number where byte 08 is the LSB. Byte 09 specifies the head number. Bytes 10-13 specify the bytes from index where byte 13 is the LSB.

In the Physical Sector Format mode, bytes 06-08 specify the cylinder number where byte 08 is the LSB. Byte 09 specifies the head number. Bytes 10-13 specify the physical sector where byte 13 is the LSB.

Reserved cylinders are accessed using 2's complement addressing (e.g. cylinder address FFFFFEh would refer to reserved cylinder 2.

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The Transfer Length specifies the number of contiguous physical
blocks of data to transfer. A transfer length of zero indicates
that all remaining blocks on the medium will be written. Any other
value indicates the number of physical blocks that will be
transferred.

Writing of reserved or diagnostic cylinders can be done with only the
Physical Sector Format (i.e.101b).

Given that a track was previously formatted as a single sector per
track, this command allows writing of same.

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Diagnostic Erase

This command allows the initiator to DC erase a track from Index to Index.

Table 8-XX: Diagnostic Erase Page - Send Diagnostic

BYTE# \ BIT	7 (MSB)	6	5	4	3	2	1	0 (LSB)
00	Page Code (DCh) [1]							
01	Reserved							
02	(MSB)							
03	Page Length (0014h)							(LSB)
04	Reserved					Supplied Format		
05	(MSB							
12	Address Field							(LSB)
13	Reserved							
14	(MSB							
21	Transfer Length							(LSB)
22	Reserved							
23	Reserved							

The page length field contains the number of parameter bytes that follow.

The Supplied Format field specifies the format of the Address Field. Valid values for this field are as defined by the Format Unit command for the Defect List Format, Table 8-5. the Bytes

Either of these addressing modes allows erasing of the track and also precludes the use of defect management. This allows erasing of physical locations that have been previously deallocated, spare sectors, etc.

Acceptable values for this command include both the Bytes from Index and Physical sector formats.

IMPLEMENTORS NOTE: It is not the intent of this function to corrupt any target-specific information required for normal operation (e.g. servo information). Thus, as is the case for any normal write operation, it is necessary that the target gate the pertinent signals to protect the target from any corruption of necessary information.

The Address Field contains the address of the track to be erased. The erase operation is performed from Index to Index on the track referred by the information provided in the Address Field.

In the Bytes from Index Format mode, bytes 06-08 specify the cylinder number where byte 08 is the LSB. Byte 09 specifies the head number. Bytes 10-13 specify the bytes from index where byte 13 is the LSB.

In the Physical Sector Format mode, bytes 06-08 specify the cylinder number where byte 08 is the LSB. Byte 09 specifies the head number. Bytes 10-13 specify the physical sector where byte 13 is the LSB.

Reserved cylinders are accessed using 2's complement addressing (e.g. cylinder address FFFFFEh would refer to reserved cylinder 2.

The Transfer Length specifies the number of tracks to be erased. A transfer length of zero indicates that all remaining tracks on the medium will be be erased. Any other value indicates the number of tracks that will be erased.

Erasing of reserved or diagnostic cylinders can be done with only the Physical Sector Format (i.e.101b).

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