

Command Format

This documents several sample versions of the READ SECTOR(S) EXT and READ SECTOR(S) commands. It raises several questions. Each command has documentation about protocol, status bits, etc. Some of this is definitely transport dependent. This version converts the register format to a table format. Each transport would need to provide guidance on how to use the table.

This format uses 2 words followed by a 48-bit data type followed by a word for all commands.

Are BSY, DRDY, and DRQ transport dependent? The documentation is the same for all of the commands in the normal and error outputs. The EXECUTE DEVICE DIAGNOSTICS command and PACKET COMMANDs are the only ones that deviate from the norm in that they do not require DRDY. BSY and DRQ are used as a part of the data transfer process the documentation does not change at all from command to command. Does an AHCI host need to do anything with BSY/DRQ when they are in AHCI mode?

Should we move to marking bits that were labeled na as reserved now? This term is only defined in a note in some earlier tables. If we keep na, I think it needs to be in the glossary or keyword section.

I think the protocol field still has value, but we need to agree on the various protocols and have each transport document define them. The command set standard will have a section on each protocol that describes its purpose, but the transport document contains the state transition diagrams.

The status bits are really a transport thing as well, I am not sure what to do about interrupts and DRQ blocks. Most of the descriptions say that the DEVICE generates an interrupt. This is not true for SATA. I think that we should define a unit of transfer called the DRQ block and use this term. The PATA transport can document that a DRQ block is followed by an interrupt. The SATA document can say that the Host Controller generates an interrupt when a DRQ block is received. I think this would be more accurate and more clear.

I have removed the device register from the commands. I believe that the DEV bit is transport dependent. I also believe that it is no longer necessary to document the LBA bit since it is documented as always being 1. I think the transport documents can document the function of these bits.

I will document that a word is 16 bits and the appropriate layout.

I will document that the 48-Bit data type is big Endian. I think this makes the mapping from the structure to the fields or registers more clear.

I could place a tables in the overview section that look like this:

SATA 48-Bit command-transport mapping:

	Bits															
Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Feature exp (Feature 15:8)								Feature (Feature 7:0)							
1	Sector Count (15:0)															
2	LBA (47:32)															
3	LBA (31:16)															
4	LBA (15:0)															

5	D	Reserved	Command
Note - D maps to the Device field bit 7.			

SATA 28-Bit command-transport mapping:

	Bits															
Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved								Feature							
1	Reserved								Sector Count							
2	Reserved								Reserved							
3	Reserved				LBA (27:16)											
4	LBA (15:0)															
5	Reserved								Command							

PATA 48-Bit command-transport mapping:

	Bits															
Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Feature Register (previous)								Feature Register (current)/Error							
1	Sector Count Register (previous)								Sector Count Register (current)							
2	LBA High Register (previous)								LBA High Register (current)							
3	LBA Mid Register (previous)								LBA Mid Register (current)							
4	LBA Low Register (previous)								LBA Low Register (current)							
5	Reserved								Command/Status							

PATA 28-Bit command-transport mapping:

	Bits															
Offset	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	Reserved								Feature Register							
1	Reserved								Sector Count Register							
2	Reserved								Reserved							
3	Reserved				Device Reg. (3:0)				LBA High Register							
4	LBA Mid Register								LBA Low Register							
5	Reserved								Command Register							

These tables could be placed in the Architecture Doc, or in both places. The appropriate table would also be placed in the transport doc.

I think this would make things clear, even for the commands that have different fields (use the registers differently).

1.1 READ SECTOR(S) EXT - 24h

1.1.1 Description

This command reads from 1 to 65,536 sectors as specified in Sector Count. A sector count of 0000h requests 65,536 sectors. The transfer shall begin at LBA. The device shall interrupt for each DRQ block transferred. **[Editors Note: The interrupt is transport dependent, do we keep it or find a way to document it in the parallel document?]**

The DRQ bit is always set to one prior to data transfer regardless of the presence or absence of an error condition.

1.1.2 Feature set

48-bit Address feature set

- Mandatory for all devices implementing the 48-bit Address feature set.
- Use prohibited when the PACKET command feature set is implemented

1.1.3 Protocol

PIO data-in (See Clause x.x **[Editors note: This is transport dependent. If we place this here, each of the transport standards needs to define it]**).

1.1.4 Inputs

Word	Name	Description
00h	Feature	Reserved
01h	Count	Number of sectors to be transferred
02h	LBA	MSB
03h		Address of first sector to read
04h		
05h	Command	24h

1.1.5 Normal outputs

Word	Name	Description																				
00h	Error	Reserved																				
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1.1.6 Error outputs

An unrecoverable error encountered during the execution of this command results in the termination of the command. The Command Block registers contain the address of the sector where the first unrecoverable error occurred. The amount of data transferred is indeterminate.

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1.1.7 Prerequisites

DRDY set to one.

1.2 READ SECTOR(S) - 20h

1.2.1 Description

This command reads from 1 to 256 sectors as specified by Sector Count. A sector count of 00h requests 256 sectors. The transfer shall begin at LBA. The device shall interrupt for each DRQ block transferred.

The DRQ bit is always set to one prior to data transfer regardless of the presence or absence of an error condition.

1.2.2 Feature set

General feature set

- Mandatory for all devices.
- Use prohibited when the PACKET command feature set is implemented

1.2.3 Protocol

PIO data-in (See Clause x.x).

1.2.4 Inputs

Word	Name	Description
00h	Feature	Reserved
01h	Count	Number of sectors to be transferred
02h	LBA	MSB _____
03h		Address of first sector to read.
04h		Bits 47:27 shall be cleared to zero _____
05h	Command	20h _____

1.2.5 Normal outputs

Word	Name	Description																				
00h	Error	Reserved																				
01h	Count	Reserved																				
02h	LBA	MSB _____																				
03h		Reserved _____																				
04h		_____																				
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1.2.6 Error outputs

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02h	LBA	MSB																				
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1.2.7 Prerequisites

DRDY set to one.

1.3 READ SECTOR(S) EXT - 24h, PIO Data In

1.3.1 Description

This command reads from 1 to 65,536 sectors as specified in Sector Count. A sector count of 0000h requests 65,536 sectors. The transfer shall begin at LBA. The device shall interrupt for each DRQ block transferred.

The DRQ bit is always set to one prior to data transfer regardless of the presence or absence of an error condition.

This command is mandatory for devices implementing the 48-bit Address feature set

1.3.2 Prerequisites

DRDY set to one.

1.3.3 Inputs

Word	Name	Description
00h	Feature	Reserved
01h	Count	Number of sectors to be transferred
02h	LBA	MSB
03h		Address of first sector to read
04h		
05h	Command	24h

1.3.4 Normal outputs

Word	Name	Description																				
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05h	Status	<table> <thead> <tr> <th>Bit</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>15:8</td> <td>Reserved</td> </tr> <tr> <td>7</td> <td>BSY - shall be cleared to zero indicating command completion.</td> </tr> <tr> <td>6</td> <td>DRDY - shall be set to one.</td> </tr> <tr> <td>5</td> <td>DF (Device Fault) - shall be set to one if a device fault has occurred.</td> </tr> <tr> <td>4</td> <td>N/A</td> </tr> <tr> <td>3</td> <td>DRQ - shall be cleared to zero.</td> </tr> <tr> <td>2</td> <td>N/A</td> </tr> <tr> <td>1</td> <td>N/A</td> </tr> <tr> <td>0</td> <td>ERR - shall be set to one if an Error bit is set to one.</td> </tr> </tbody> </table>	Bit	Description	15:8	Reserved	7	BSY - shall be cleared to zero indicating command completion.	6	DRDY - shall be set to one.	5	DF (Device Fault) - shall be set to one if a device fault has occurred.	4	N/A	3	DRQ - shall be cleared to zero.	2	N/A	1	N/A	0	ERR - shall be set to one if an Error bit is set to one.
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1.4 READ SECTOR(S) EXT - 24h, PIO Data In

1.4.1 Description

This command reads from 1 to 65,536 sectors as specified in Sector Count. A sector count of 0000h requests 65,536 sectors. The transfer shall begin at LBA. The device shall interrupt for each DRQ block transferred.

The DRQ bit is always set to one prior to data transfer regardless of the presence or absence of an error condition.

This command is mandatory for devices implementing the 48-bit Address feature set

1.4.2 Prerequisites

DRDY set to one.

1.4.3 Inputs

Word	Name	Description
00h	Feature	Reserved
01h	Count	Number of sectors to be transferred
02h	LBA	MSB
03h		Address of first sector to read
04h		
05h	Command	24h

1.4.4 Normal outputs

Word	Name	Description
00h	Error	Reserved
01h	Count	Reserved
02h	LBA	MSB
03h		Reserved
04h		
05h	Status	BSY DRDY DF N/A DRQ N/A N/A ERR

1.4.5 Error outputs

An unrecoverable error encountered during the execution of this command results in the termination of the command. The Command Block registers contain the address of the sector where the first unrecoverable error occurred. The amount of data transferred is indeterminate.

Word	Name	Description
00h	Error	N/A UNC MC IDNF MCR ABRT NM Obs
01h	Count	Reserved
02h	LBA	MSB
03h		Address of first unrecoverable error
04h		
05h	Status	BSY DRDY DF N/A DRQ N/A N/A ERR

1.5 READ SECTOR(S) EXT - 24h, PIO Data In

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This command is mandatory for devices implementing the 48-bit Address feature set

1.5.2 Prerequisites

DRDY set to one.

1.5.3 Inputs

Word	Name	Description
00h	Feature	Reserved
01h	Count	Number of sectors to be transferred
02h	LBA	MSB
03h		Address of first sector to read
04h		
05h	Command	24h

1.5.4 Normal outputs

Word	Name	Description
00h	Error	Reserved
01h	Count	Reserved
02h	LBA	MSB
03h		Reserved
04h		
05h	Status	0 1 0 N/A 0 N/A N/A 0

1.5.5 Error outputs

An unrecoverable error encountered during the execution of this command results in the termination of the command. The Command Block registers contain the address of the sector where the first unrecoverable error occurred. The amount of data transferred is indeterminate.

Word	Name	Description
00h	Error	N/A UNC MC IDNF MCR ABRT NM Obs
01h	Count	Reserved
02h	LBA	MSB
03h		Address of first unrecoverable error
04h		
05h	Status	0 1 DF N/A 0 N/A N/A ERR

2 Error Bits

The following section defines bits that can be returned in the Error field.

2.1 IDNF

ID Not Found (IDNF) shall be set to one if a user-accessible address could not be found. IDNF shall also be set to one if an address outside of the range of user-accessible addresses is requested when the ABRT bit is cleared to zero.

2.2 MC

Media Change (MC) shall be set to one if the media in a removable media device changed since the last command was issued. The device shall clear the device internal media change detected state.

2.3 UNC

Uncorrectable (UNC)error shall be set to one if data is uncorrectable

2.4 MCR

Media Change Request (MCR) shall be set to one if a removable media device has detected a media change request. This bit is only cleared by a GET MEDIA STATUS or a media access command.

2.5 ABRT

Abort (ABRT) shall be set to one if this command is not supported. ABRT may be set to one if the device is not able to complete the action requested by the command. ABRT shall be set to one if an address outside of the range of user-accessible addresses is requested when IDNF is not set to one.

2.6 NM

No Media (NM) shall be set to one if no media is present in a removable media device.

3 Status Bits

The following section defines bits that can be returned in the Status field

3.1 BSY

Busy (BSY) shall be cleared to zero indicating command completion.

3.2 DRDY

Device Ready (DRDY) shall be set to one.

3.3 DF

Device Fault (DF) shall be set to one if a device fault has occurred.

3.4 DRQ

Data Request (DRQ) shall be cleared to zero.

3.5 ERR

Error (ERR) shall be set to one if an Error bit is set to one.