

Appendix B FloppyDisk Controller

Command Instruction Set

Appendix B: Floppy Disk Controller Command Instruction Set

The tables in Appendix B list the command and result bytes for the floppy disk controller (FDC) operations, as follows:

- B.1 Read data
- B.2 Read deleted data
- B.3 Write data
- B.4 Write deleted data
- B.5 Read a track
- B.6 Read ID
- B.7 Format a track
- B.8 Scan equal
- B.9 Scan low or equal
- B.10 Scan high or equal
- B.11 Recalibrate
- B.12 Sense interrupt status
- B.13 Specify
- B.14 Sense drive status
- B.15 Seek
- B.16 Invalid

The command bytes for each operation must be written to the floppy disk controller in the exact order indicated in the table. The result bytes for each operation must be read in the exact order indicated in the table. Failure to write all command bytes or read all result bytes will leave the floppy disk controller inoperative.

The figures following the tables illustrate the necessary sequences in the command, execution, and result phases of each of the instructions.

- Figure B.1 Command phase
- Figure B.2 Execution phase (read and write instructions)
- Figure B.3 Result phase (read and write instructions)
- Figure B.4 Seek, recalibrate, sense interrupt status, and invalid instructions

Table B.1. Read Data Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	SK	0	0	1	1	0	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	-----C-----								Sector ID information prior to Command execution.
	W	-----H-----								
	W	-----R-----								
	W	-----N-----								
	W	-----EOT-----								
	W	-----GPL-----								
	W	-----DTL-----								
Execution										Data transfer between the FDD and main-system.
Result	R	-----ST0-----								Status Information after Command execution.
	R	-----ST1-----								
	R	-----ST2-----								
	R	-----C-----								Sector ID information after Command execution.
	R	-----H-----								
	R	-----R-----								
	R	-----N-----								

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Table B.2. Read Deleted Data Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	SK	0	1	1	0	0	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	-----C-----								Sector ID information prior to Command execution.
	W	-----H-----								
	W	-----R-----								
	W	-----N-----								
	W	-----EOT-----								
	W	-----GPL-----								
	W	-----DTL-----								
Execution										Data transfer between the FDD and main-system.
Result	R	-----ST0-----								Status Information after Command execution.
	R	-----ST1-----								
	R	-----ST2-----								
	R	-----C-----								Sector ID information after Command execution.
	R	-----H-----								
	R	-----R-----								
	R	-----N-----								

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Table B.3. Write Data Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	0	0	0	1	0	1	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	—————C—————								Sector ID information prior to Command execution.
	W	—————H—————								
	W	—————R—————								
	W	—————N—————								
	W	—————EOT—————								
	W	—————GPL—————								
	W	—————DTL—————								
Execution										Data transfer between the FDD and main-system.
Result	R	—————ST0—————								Status Information after Command execution.
	R	—————ST1—————								
	R	—————ST2—————								
	R	—————C—————								Sector ID information after Command execution.
	R	—————H—————								
	R	—————R—————								
	R	—————N—————								

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Table B.4. Write Deleted Data Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	0	0	1	0	0	1	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	—————C—————								Sector ID information prior to Command execution.
	W	—————H—————								
	W	—————R—————								
	W	—————N—————								
	W	—————EOT—————								
	W	—————GPL—————								
	W	—————DTL—————								
Execution										Data transfer between the FDD and main-system.
Result	R	—————ST0—————								Status Information after Command execution.
	R	—————ST1—————								
	R	—————ST2—————								
	R	—————C—————								Sector ID information after Command execution.
	R	—————H—————								
	R	—————R—————								
	R	—————N—————								

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Table B.5. Read a Track Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	0	MF	SK	0	0	0	1	0	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	_____C_____								Sector ID information prior to Command execution.
	W	_____H_____								
	W	_____R_____								
	W	_____N_____								
	W	_____EOT_____								
	W	_____GPL_____								
	W	_____DTL_____								
Execution										Data transfer between the FDD and main-system. FDC has read all of the cylinder's contents from index hole to EOT.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								Sector ID information after Command execution.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.6. Read ID Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	0	MF	0	0	0	0	1	0	Commands
	W	X	X	X	X	X	HD	US1	US0	
Execution										The first correct ID information on the cylinder is stored in the Data Register.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								Sector ID information after Command execution.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.7. Format a Track Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	0	MF	SK	0	0	0	1	0	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	_____N_____								Bytes/Sector Sectors/Track Gap 3 Filler Byte
	W	_____SC_____								
	W	_____GPL_____								
	W	_____D_____								
Execution										FDC formats an entire cylinder.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								In this case, the ID information has no meaning.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.8. Scan Equal Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	SK	1	0	0	0	0	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	_____C_____								Sector ID information prior to Command execution.
	W	_____H_____								
	W	_____R_____								
	W	_____N_____								
	W	_____EOT_____								
	W	_____GPL_____								
	W	_____DTL_____								
Execution										Data compared between the FDD and main system.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								Sector ID information after Command execution.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.9. Scan Low or Equal Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	SK	1	1	0	0	1	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	_____C_____								Sector ID information prior to Command execution.
	W	_____H_____								
	W	_____R_____								
	W	_____N_____								
	W	_____EOT_____								
	W	_____GPL_____								
	W	_____STP_____								
Execution										Data compared between the FDD and main system.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								Sector ID information after Command execution.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.10. Scan High or Equal Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	MT	MF	SK	1	1	1	0	1	Command Codes
	W	X	X	X	X	X	HD	US1	US0	
	W	_____C_____								Sector ID information prior to Command execution.
	W	_____H_____								
	W	_____R_____								
	W	_____N_____								
	W	_____EOT_____								
	W	_____GPL_____								
	W	_____STP_____								
Execution										Data compared between the FDD and main system.
Result	R	_____ST0_____								Status Information after Command execution.
	R	_____ST1_____								
	R	_____ST2_____								
	R	_____C_____								Sector ID information after Command execution.
	R	_____H_____								
	R	_____R_____								
	R	_____N_____								

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Table B.11. Recalibrate Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	0	0	0	0	0	1	1	1	Command Codes
	W	X	X	X	X	X	HC	US1	US0	
Execution										Head retracted to Track 0.

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Table B.12. Sense Interrupt Status Instruction Set

Phase	R/W	Data Bus								Remarks
		D7	D6	D5	D4	D3	D2	D1	D0	
Command	W	0	0	0	0	0	0	0	0	Command Codes
Result	R	_____ST0_____								Status information at the end of seek operation about the FDC.
	R	_____PCN_____								

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Table B.13. Specify Instruction Set

Phase	R/W	Data Bus	Remarks
		D7 D6 D5 D4 D3 D2 D1 D0	
Command	W	0 0 0 0 0 0 0 0	Command Codes
	W	—SRT— → ← —HUT—	
	W	—HLT— → ← —ND—	

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Table B.14. Sense Drive Status Instruction Set

Phase	R/W	Data Bus	Remarks
		D7 D6 D5 D4 D3 D2 D1 D0	
Command	W	0 0 0 0 0 1 1 1	Command Codes
	W	X X X X X HD US1 US0	
Result	R	—ST3—	Status information about FDD.

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Table B.15. Seek Instruction Set

Phase	R/W	Data Bus	Remarks
		D7 D6 D5 D4 D3 D2 D1 D0	
Command	W	0 0 0 0 1 1 1 1	Command Codes
	W	X X X X X HD US1 US0	
	W	—NCN—	
Execution			Head is positioned over proper cylinder on diskette.

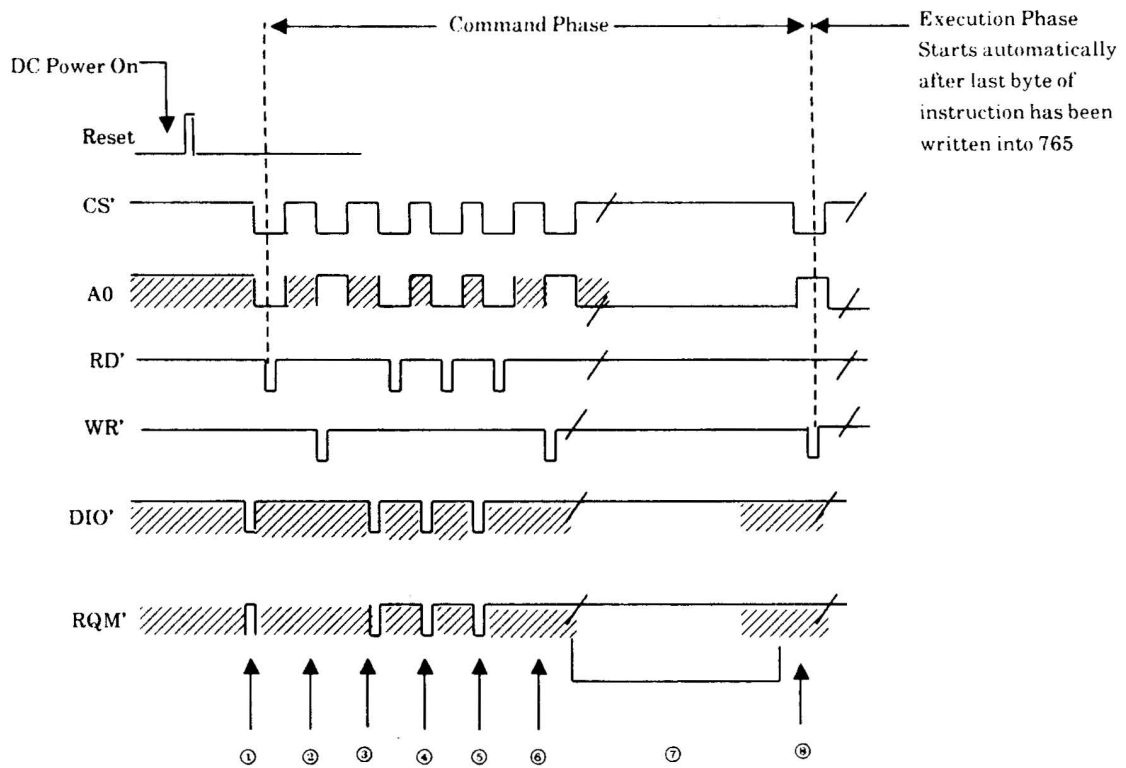
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Table B.16. Invalid Instruction Set

Phase	R/W	Data Bus	Remarks
		D7 D6 D5 D4 D3 D2 D1 D0	
Command	W	—Invalid Codes—	Command Codes
Result	R	—ST0—	ST0-80 (16)

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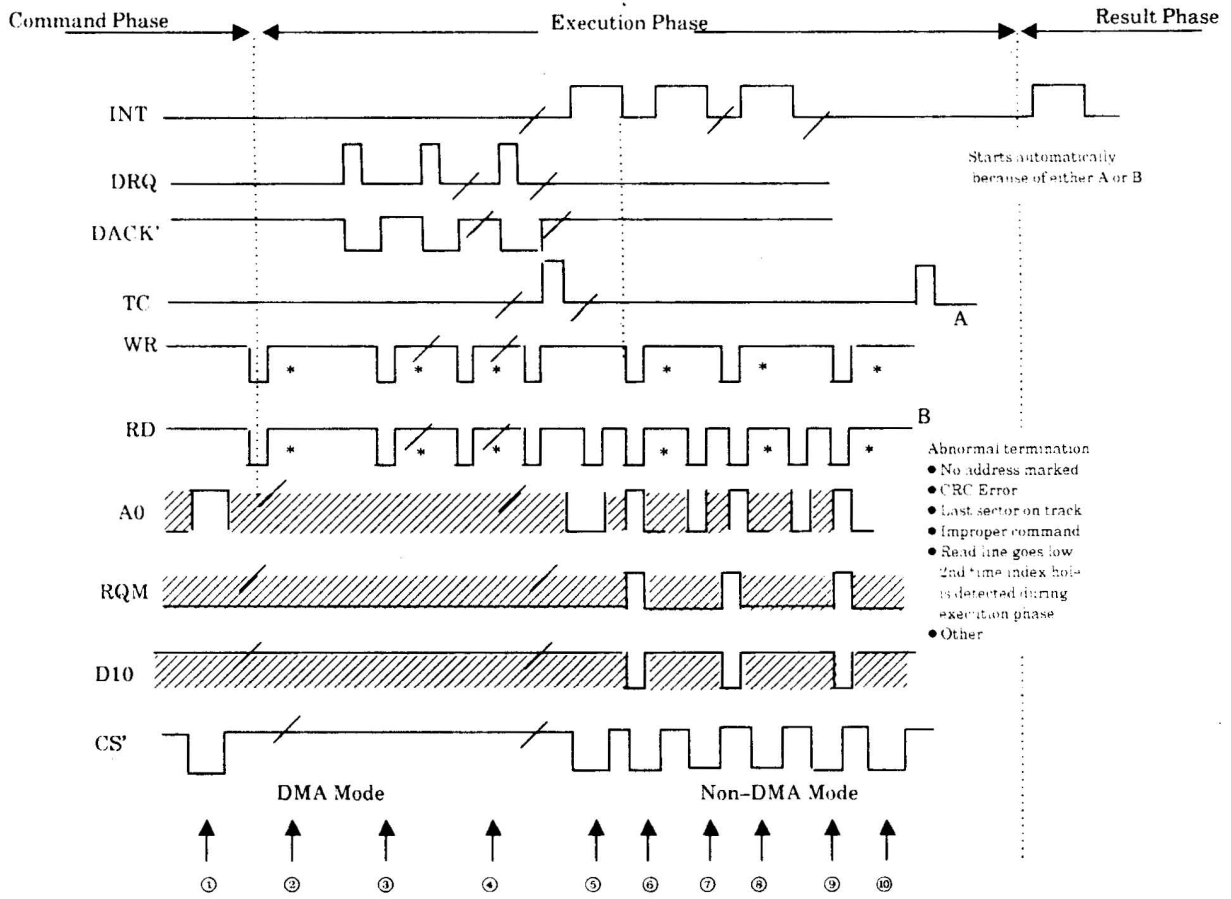
Note: Shaded portion indicates don't care state



- Key:
- ① Processor reads main status reg. (MSG) Does RQM = 1 and DIO = 0; if yes, then write first byte of instruction into 765.
 - ② First byte of instruction written into 765 by processor.
 - ③ Processor reads MSR, does RQM = 1 and DIO = 0; if no, then do it again.
 - ④ No Do again, RQM still = 0.
 - ⑤ Does RQM = 1 and DIO = 0; if yes, then write second byte of instruction into 765.
 - ⑥ Second byte of instruction written into 765 by processor.
 - ⑦ Repeat steps 3 through 6 until all bytes in instruction have been written into 765.
 - ⑧ Last byte of instruction written into 765 by processor.

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Figure B.1. Command phase



- Abnormal termination
- No address marked
 - CRC Error
 - Last sector on track
 - Improper command
 - Read line goes low
 - 2nd time index hole is detected during execution phase
 - Other

- Key:
- ① Last byte of instruction written into 765.
 - ② Processor sends or receives 1st data byte to or from diskette. (1st byte).
 - ③ Processor sends or receives 2nd data byte to or from diskette.
 - ④ Processor sends or receives nth data byte to or from diskette.
 - ⑤ Processor must read MSR to see who interrupted.
 - ⑥ Processor sends or receives 1st data byte to or from diskette.
 - ⑦ Processor must read MSR to see who interrupted.
 - ⑧ Processor sends or receives 2nd data byte to or from diskette.
 - ⑨ Processor must read MSR to see who interrupted.
 - ⑩ Processor sends or receives nth data byte to or from diskette.

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Figure B.2. Execution phase (read and write instructions)

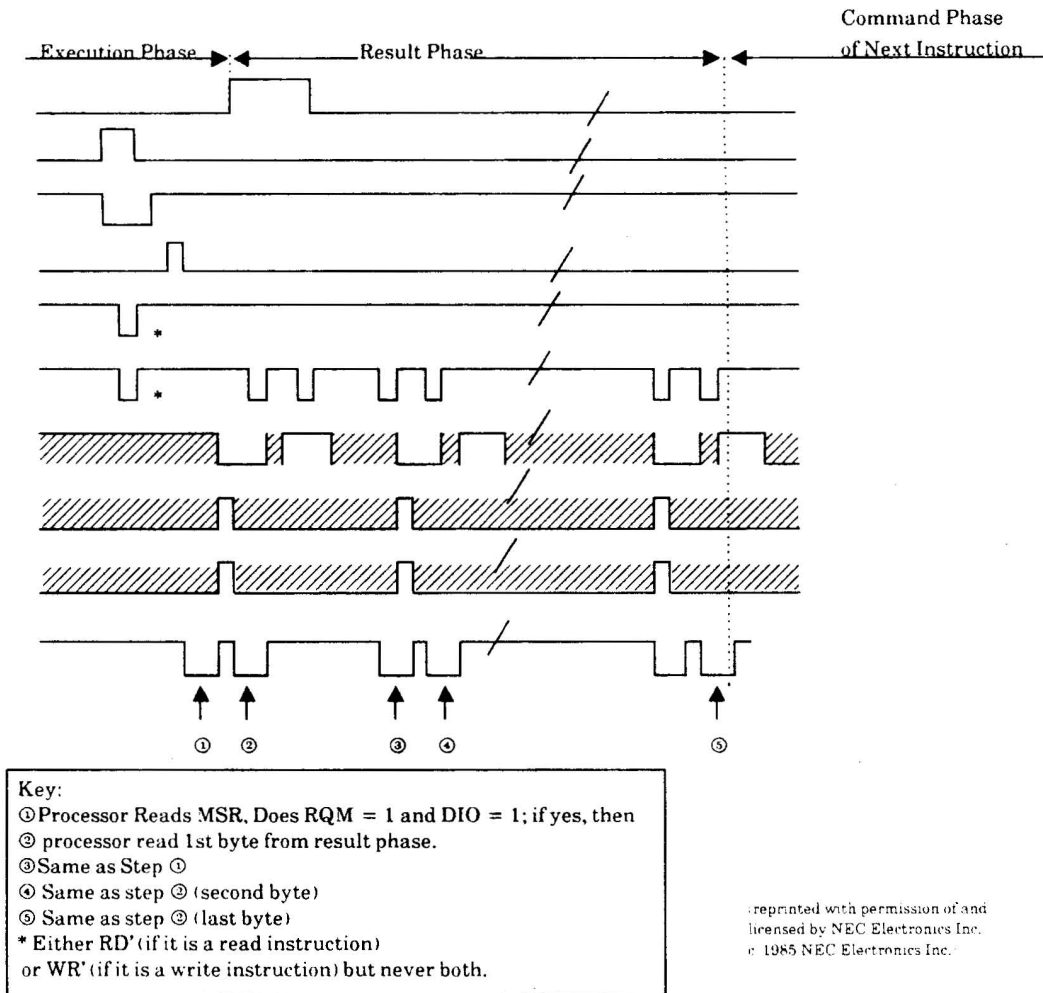
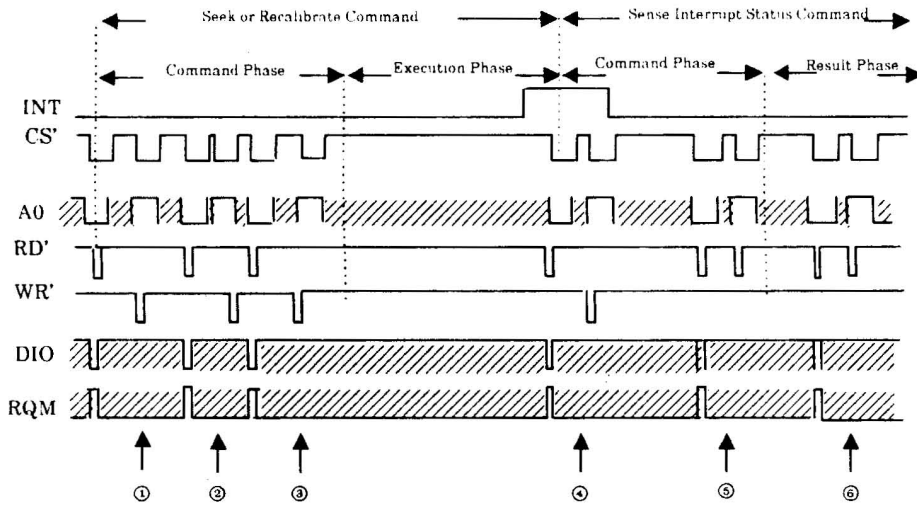
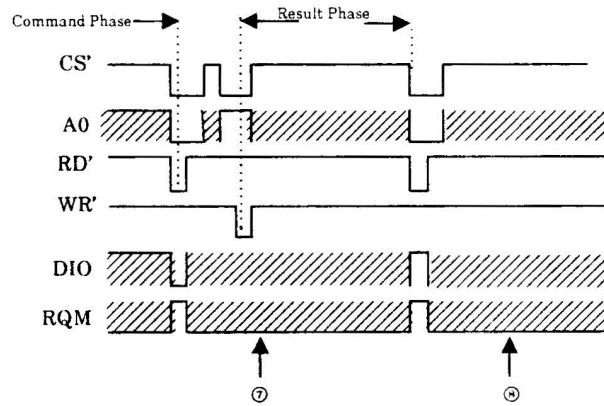


Figure B.3. Result phase (read or write instructions)



Seek, recalibrate, and Sense Interrupt Status

- Key:
- ① OP code for instruction written into 765.
 - ② HD/Drive No written into 765.
 - ③ INC written into 765.
 - ④ OP code for instruction written into 765.
 - ⑤ Status Register STO read by processor.
 - ⑥ RCN read by processor.
 - ⑦ Invalid instruction issued to 765.
 - ⑧ Status register STO read by processor.



Invalid

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Figure B.4. Seek, Recalibrate, Sense Interrupt Status, and Invalid Instructions