

Systems Reference Library

IBM 1401/1460 Instruction and Timing Summary

This publication is a summary of instructions and timings for the 1401 and 1460 systems. Listed for each instruction is: instruction name, operation code, mnemonic, operands, d-character, word marks required, address registers after operation, remarks and timings.

This material is printed on one side only so that it can be arranged for a ready reference to assist programmers, or it can be placed in a 3-ring binder for 8 1/2" x 11" pages.

This publication, Form A24-6447-0, obsoletes Form X24-6447 and Form X24-6532. The information contained in these two publications is incorporated in this publication.

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SYMBOL AND ABBREVIATION KEY

A	A-Address of the instruction.
A _p	The previous setting of the A-address register .
B	B-address of the instruction .
B _p	The previous setting of the B-address register .
BI	Address of the next instruction if a branch occurs.
dbb	The d-character and blank in the units and tens position .
F _M	Forms movement times .
GM	Group Mark .
GM-WM	Group-Mark with a Word-Mark .
I/O	Timing for input or output cycle .
IRG	Inter-record gap .
LA	The number of characters in the A-field.
LB	The number of characters in the B-field.
L _I	Length of instruction .
L _F	Length of field .
L _S	Number of characters per sector .
L _W	Length of A- or B-field, whichever is shorter .
LX	Number of characters to be cleared .
N	System processing cycle time (.0115 ms for 1401; .006 ms for 1460).
NSI	Address of the Next Sequential Instruction .
SC	Sector Count .
T	If indexing is installed .
T _F	The number of characters in A-field to be translated .
T _M	Tape movement Times .
WM	Word Mark .
*	Instruction cannot be chained .
.	The d-character must appear in the operand .
+	If indexing is installed .
Σ	Number of fields included in the operation .
Ns	Number of Sectors .

IBM 1401/1460 INSTRUCTION AND TIMING SUMMARY

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
ARITHMETIC INSTRUCTIONS										
Add (One Field)	A	A	<u>A</u>	xxx			A-L _A	A-L _A	A-L _A	Blanks are treated as zeros. Unsigned field treated as positive. 1401: T = .0115 (L _I +3+2L _A) ms 1460: T = .006 (L _I +1+2L _A) ms
Add (Two Fields)	A	A	<u>A</u>	xxx	xxx		B-L _B (Req'd in A if shorter than B)	A-L _W	B-L _B	Blanks are treated as zeros. Unsigned field treated as positive. 1401 No Recomplement Cycles: T = .0115 (L _I +3+L _A +L _B) ms 1401 Recomplement Cycle: T = .0115 (L _I +3+L _A +4L _B) ms 1460 No Recomplement Cycle: T = .006 (L _I +1+L _A +L _B) ms 1460 Complement Cycle: T = .006 (L _I +1+L _A +3L _B) ms 1460 Complement with Multiply-Divide: T = .006 (L _I +1+L _A +2L _B) ms
Subtract (One Field)	S	S	<u>S</u>	xxx			A-L _A	A-L _A	A-L _A	Unsigned field treated as positive. 1401: T = .0115 (L _I +3+2L _A) ms 1460: T = .006 (L _I +1+2L _A) ms
Subtract (Two Fields)	S	S	<u>S</u>	xxx	xxx		B-L _B (Req'd in A if shorter than B)	A-L _W	B-L _B	Unsigned field treated as positive. 1401 No Recomplement Cycle: T = .0115 (L _I +3+L _A +L _B) ms 1401 Recomplement Cycle: T = .0115 (L _I +3+L _A +4L _B) ms 1460 No Recomplement Cycle: T = .006 (L _I +1+L _A +L _B) ms 1460 Complement Cycle: T = .006 (L _I +1+L _A +3L _B) ms 1460 Complement with Multiply-Divide: T = .006 (L _I +1+L _A +2L _B) ms
Zero and Add (One Field)	ZA	ZA	<u>?</u>	xxx			A-L _A	A-L _A	A-L _A	Zones are stripped, except over units position. T = N (L _I +1+2L _A) ms
Zero and Add (Two Fields)	ZA	ZA	<u>?</u>	xxx	xxx		B-L _B (Req'd in A if shorter than B)	A-L _W	B-L _B	Zeros are stripped, except for units position. T = N (L _I +1+L _A +L _B) ms
Zero and Subtract (One Field)	ZS	ZS	<u>!</u>	xxx			A-L _A	A-L _A	A-L _A	A-field sign changes T = N (L _I +1+2L _A) ms
Zero and Subtract (Two Fields)	ZS	ZS	<u>!</u>	xxx	xxx		B-L _B (Req'd in A if shorter than B)	A-L _W	B-L _B	T = N (L _I +1+L _A +L _B) ms
LOGIC INSTRUCTIONS										
Branch (Unconditional) *	B	B	<u>B</u>	xxx			Adjacent to 1-Address	BI	Blank or (NSI)	Branch (without indexing): T = N (L _I +1) ms Branch (with indexing): T = N (L _I +2) ms
			<u>B</u>					A _p	B-1	

* Indicates the instruction cannot be chained.

unchanged from prev. ACE

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Branch if Arithmetic*	B	BAV	<u>B</u>	xxx		Z		BI	dbb, Blank, (or NSI)	No Branch 1 T = N (L ₁ +1) ms
Branch if Carriage Channel #9*	B	BC9	<u>B</u>	xxx		9		BI	dbb, Blank, (or NSI)	Branch (without indexing): T = N (L ₁ +1) ms
Branch if Carriage Channel #12*	B	BCV	<u>B</u>	xxx		@		BI	dbb, Blank, (or NSI)	Branch (with indexing): T = N (L ₁ +2) ms
Branch if Character Equal	B	BCE	<u>B</u>	xxx	xxx	x		BI	B-1, Blank, (or NSI)	
Branch if Either a Word Mark, or No Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	3		BI	B-1, Blank, (or NSI)	
Branch if Either a Word Mark, or 12-Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	C		BI	B-1, Blank, (or NSI)	No Branch: T = N (L ₁ +2) ms
Branch if Either a Word Mark, or 11-Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	L		BI	B-1, Blank, (or NSI)	Branch (without indexing): T = N (L ₁ +2) ms
Branch if Either a Word Mark, or Zero Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	T		BI	B-1, Blank, (or NSI)	Branch (with indexing): T = N (L ₁ +3) ms
Branch if No Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	2		BI	B-1, Blank, (or NSI)	
Branch if Printer Error (I/O Check Stop Switch Off)*	B	BIN*	<u>B</u>	xxx		≠		BI	dbb, Blank, (or NSI)	No Branch: T = N (L ₁ +1) ms
Branch if Processing Check (Check Stop Switch Off)*	B	BIN*	<u>B</u>	xxx		%		BI	dbb, Blank, (or NSI)	Branch (without indexing): T = N (L ₁ +1) ms
Branch if Punch Error (I/O Check Stop Off)*	B	BIN*	<u>B</u>	xxx		!		BI	dbb, Blank, (or NSI)	Branch (with indexing): T = N (L ₁ +2) ms
Branch if Reader Error (I/O Check Stop Switch Off)*	B	BIN*	<u>B</u>	xxx		/		BI	dbb, Blank, (or NSI)	No Branch: T = N (L ₁ +1) ms
Branch if Unconditional*	B	B	<u>B</u>	xxx		blank		BI	dbb, Blank, (or NSI)	Branch (without indexing): T = N (L ₁ +1) ms
Branch if Unequal Compare*	B	BU	<u>B</u>	xxx		/		BI	dbb, Blank, (or NSI)	Branch (with indexing): T = N (L ₁ +2) ms
Branch if Word Mark	BWZ	BWZ*	<u>V</u>	xxx	xxx	1		BI	B-1, Blank, (or NSI)	
Branch if Zero-Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	S		BI	B-1, Blank, (or NSI)	No Branch: T = N (L ₁ +2) ms
Branch if 11-Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	K		BI	B-1, Blank, (or NSI)	Branch (without indexing): T = N (L ₁ +2) ms
Branch if 12-Zone	BWZ	BWZ*	<u>V</u>	xxx	xxx	B		BI	B-1, Blank, (or NSI)	Branch (with indexing): T = N (L ₁ +3) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Compare	C	C	<u>C</u>	xxx	xxx		A- and B-field	A-L _W	B-L _W	First word mark encountered ends operation. Unequal compare results if B-field is longer than A-field. T = N (L _I +1+2L _W) ms
DATA-MOVING INSTRUCTIONS										
Load Characters to A Word Mark (One Field)	LCA	MLCWA	<u>L</u>	xxx			A-field	A-L _A	B _p -L _A	A-field word mark ends operation. B-field word marks cleared from positions worked on. T = N (L _I +1+2L _A) ms
Load Characters to A Word Mark (Two Fields)	LCA	MLCWA	<u>L</u>	xxx	xxx		A-field	A-L _A	B-L _A	A-field word mark ends operation. B-field word marks are cleared. T = N (L _I +1+2L _A) ms
Move Characters and Edit *	MCE	MCE	<u>E</u>	xxx	xxx		A- and B-field	A-address minus A-field length	B-L _B	Will be location of special control zero plus 1 with zero suppression.
Move Characters and Suppress Zeros *	MCS	MCS	<u>Z</u>	xxx	xxx		A-field	A-L _A	B+1	A-field word mark ends operation. T = N (L _I +1+3L _A) ms
Move Characters to A or B Word Mark (One Field)	MCW	MLC	<u>M</u>	xxx			A-field	A-L _W	B _p -L _W	T = N (L _I +1+2L _W) ms
Move Characters to A or B Word Mark (Two Fields)	MCW	MLC	<u>M</u>	xxx	xxx		A- or B-field	A-L _W	B-L _W	First word mark encountered ends operation. T = N (L _I +1+2L _W) ms
Move Numeric	MN	MLMS	<u>D</u>	xxx	xxx			A-1	B-1	Numeric bits of A moved to B. B zone bits are retained. T = N (L _I +3) ms
Move Zone	MZ	MLZS	<u>Y</u>	xxx	xxx			A-1	B-1	Zone bits of A moved to B. B numeric bits are retained. T = N (L _I +3) ms
MISCELLANEOUS INSTRUCTIONS										
Clear Storage	CS	CS	<u>1</u>	xxx				A	X00-1	T = N (L _I +1+L _X) ms
Clear Storage and Branch	CS	CS	<u>1</u>	xxx	xxx			BI	Blank or (NSI)	Branch (without indexing): T = N (L _I +L _X) ms Branch (with indexing): T = N (L _I +1+L _X) ms
Clear Word Marks (One Address)	CW	CW	<u>1</u>	xxx				A-1	A-1	Word mark is cleared from the A-address. Data is undisturbed. T = N (L _I +3) ms
Clear Word Mark (Two Addresses)	CW	CW	<u>1</u>	xxx	xxx			A-1	B-1	Word marks are cleared from the A- and B-address. Data is undisturbed. T = N (L _I +3) ms
Halt*	H	H	<u>.</u>					A _p	B _p	Press key to resume operation. T = N (L _I +1) ms
Halt and Branch*	H	H	<u>.</u>	xxx				BI	Blanks or (NSI)	Branch (without indexing): T = N (L _I +1) ms Branch (with indexing): T = N (L _I +2) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
No Operation*	NOP	NOP	<u>N</u>					A _p	B _p	Program resumes at next op code with a word mark. T = N (L ₁ +1) ms
Set Word Mark (One Address)	SW	SW	<u>1</u>	xxx				A-1	A-1	Sets word mark in the A-address. Data is undisturbed. T = N (L ₁ +3) ms
Set Word Mark (Two Addresses)	SW	SW	<u>1</u>	xxx	xxx			A-1	B-1	Sets word mark in A- and B-address. Data is undisturbed. T = N (L ₁ +3) ms
IBM 1402 CARD READ-PUNCH INSTRUCTIONS										
Branch if Last Card Switch On (Sense Switch A)*	B	BLC	<u>B</u>	xxx		A		BI	dbb, Blank, (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Punch Card (and Branch)*	P	P	<u>4</u>	(xxx)				Ap(BI)	181	T = N (L ₁ +1) ms + I/O Punch cycle - 240 ms
Read and Punch (and Branch)*	RP	RP	<u>5</u>	(xxx)				Ap(BI)	081 or 181	Normally the B-address register is at 181 unless punching is completed first. T = N (L ₁ +1) ms + I/O Read and punch cycle - 240 ms
Read Card (and Branch)*	R	R	<u>1</u>	(xxx)				Ap(BI)	081	T = N (L ₁ +1) ms + I/O Read cycle - 75 ms
Select Stacker-Pocket* 1 2 4 8	SS	SS (SSB)	<u>K</u>	(xxx)		1 [2] [4] [8]		dbb(BI)	dbb, (Blank or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Read-Punch Feed (and Branch)*	P	RF	<u>4</u>	(xxx)		R		dbb(BI)	181, (Blank or NSI)	T = N (L ₁ +1) ms + 37 ms Punch start time + 184 ms punch time.
Read-Punch Feed, Write (and Branch)*	WP	WRF	<u>6</u>	(xxx)		R		dbb(BI)	181, (Blank or NSI)	T = N (L ₁ +1) ms + 308 ms (see publications for more detail)
IBM 1403 PRINTER INSTRUCTIONS										
Control Carriage - After Print 1 [2 or 3] Space(s) (and Branch)*	CC	CC* (CCB)	<u>F</u>	(xxx)		/ S or T		dbb(BI)	dbb, (Blank or NSI)	T = N (L ₁ +1) ms + F _M time
Control Carriage - Immediate Skip to Channel 1 2 - 12 (and Branch)*	CC	CC* (CCB)	<u>F</u>	(xxx)		1 #, @		dbb(BI)	dbb, (Blank or NSI)	T = N (L ₁ +1) ms + F _M time
Control Carriage - Immediate Space, 1 2 or 3 Space(s) (and Branch)*	CC	CC* (CCB)	<u>F</u>	(xxx)		J K or L		dbb(BI)	dbb, (Blank or NSI)	T = N (L ₁ +1) ms + F _M time
Control Carriage - Skip After Print to Channel 1 [2 - 12] (and Branch)*	CC	CC* (CCB)	<u>F</u>	(xxx)		A B-1, ?, ..		dbb(BI)	dbb, (Blank or NSI)	T = N (L ₁ +1) ms + F _M time

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Write and Punch (and Branch)*	WP	WP	<u>6</u>	(xxx)				A _p (BI)	181	T = N (L ₁ +1) ms + I/O (see publication for more detail)
Write and Read (and Branch)*	WR	WR	<u>3</u>	(xxx)				A _p (BI)	081	T = N (L ₁ +1) ms + I/O (see publication for more detail)
Write Line (and Branch)*	W	W	<u>2</u>	(xxx)				A _p (BI)	335 or 333 (print storage)	T = N (L ₁ +1) ms + I/O (see publication for more detail)
Write, Read, and Punch (and Branch)*	WRP	WRP	<u>7</u>	(xxx)				A _p (BI)	181 or 081	T = N (L ₁ +1) ms + I/O (see publication for more detail)
Write Word Marks (and Branch)*	W	WM	<u>2</u>	(xxx)				dbb(BI)	335 or 333 (print storage)	T = N (L ₁ +1) ms + I/O (see publication for more detail)
IBM 1403 SELECTIVE TAPE LISTING (SPECIAL FEATURE) INSTRUCTION										
Space Tape 1 [2 - 8] One Space	CC	CC*	<u>F</u>			A B - H		dbb	dbb	T = N (L ₁ +1) ms + F _M time
IBM 1460 MULTIPLE PRINTER INSTRUCTION										
Printer Pre-Select Printer 1 [2 or 3]	CU	CU*	<u>V</u>			1 2 or 3		dbb	dbb	T = .006 (L ₁ +1) ms
IBM 1447 CONSOLE INSTRUCTION										
Read From Console Printer (With Word Marks)	MU (LU)	MU* (LU)*	<u>M</u> (<u>L</u>)	%TO	xxx	R		%30	B+L _B +1	GMWM needed to right of last message character. T = N (L ₁ +1) ms + operator keying time
Write On Console Printer (With Word)	MU (LU)	MU* (LU)*	<u>M</u> (<u>L</u>)	%TO	xxx	W		%30	B+L _B +1	T = N (L ₁ +1) ms + 68 L _B ms + 800 (number of carrier return operations -1) ms
IBM 1406 STORAGE UNIT INSTRUCTION										
Modify Address (One Address)	MA	MA	<u>#</u> -	xxx				A-3	A-1 or A-3	Carry from hundreds to units position required: T = N (L ₁ +9) ms No carry required: T = N (L ₁ +8) ms
Modify Address (Two Addresses)	MA	MA	<u>#</u> -	xxx	xxx			A-3	B-1 or B-3	Carry from hundreds to units position required: T = N (L ₁ +9) ms No carry required: T = N (L ₁ +8) ms
IBM 1301 DISK STORAGE INSTRUCTIONS (1460)										
Branch if Access Busy	B	BIN	<u>B</u>	xxx		\				
Branch if Access Inoperable	B	BIN	<u>B</u>	xxx		N				

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Branch if Any Disk Condition	B	BIN	<u>B</u>	xxx		Y				No Branch $T = .006 (L_1+1) \text{ ms}$ Branch (without indexing): $T = .006 (L_1+1) \text{ ms}$ Branch (with indexing): $T = .006 (L_1+2) \text{ ms}$
Branch if Disk Error	B	BIN	<u>B</u>	xxx		V	BI	dbb, Blank, or (NSI)		
Branch if Unequal-Address Compare	B	BIN	<u>B</u>	xxx		X				
Branch if Wrong Length Record	B	BIN	<u>B</u>	xxx		W				
Seek Disk	MU LU	SD	<u>M</u> <u>L</u>	%FO	xxx	R/W	B+6	B+7	Seeks specified cylinder $T = .006 (L_1+7) \text{ ms} + \text{access time}$	
Read Disk Sector(s)	MU	RD	<u>M</u>	%F1	xxx	R	B+6	B+11+N ₅ L ₅	Complete when SC = 000 $T = .006 (L_1+1) \text{ ms} + 1.7 N_5 + \text{disk rotation}$	
Read Disk Sector(s) with Word Marks	LU	RDW	<u>L</u>	%F1	xxx	R	B+6	B+11+N ₅ L ₅		
Read Disk Track Sectors with Addresses	MU	RDT	<u>M</u>	%F6	xxx	R	B+9	B+11+2120	Reads 2120 characters with sector addresses $T = .006 (L_1+1) \text{ ms} + 33.3 \text{ ms} + \text{disk rotation}$	
Read Disk Track Sectors with Addresses and Word Marks	LU	RDTW	<u>L</u>	%F6	xxx	R	B+9	B+11+1920	Reads 1920 Characters with Sector Addresses $T = .006 (L_1+1) \text{ ms} + 33.3 \text{ ms} + \text{disk rotation}$	
Read Disk with Sector Count Overlay	MU	RDCO	<u>M</u>	%F5	xxx	R	B+6	B+8+N ₅ L ₅	Multiple-sector-count field in first-record read determines number of sectors read $T = .006 (L_1+1) \text{ ms} + 1.7 N_5 + \text{disk rotation}$	
Read Disk with Sector Count Overlay with Word Marks	LU	RDCOW	<u>L</u>	%F5	xxx	R				
Write Disk Check	MU	WDC	<u>M</u>	%F3	xxx	W	Depends on Previous Operation		Data in specified core-storage area compared with data written on disk.	
Write Disk Check with Word Marks	LU	WDCW	<u>L</u>	%F3	xxx	W	Depends on Previous Operation		Data in specified core-storage area compared with data written on disk. $T = .006 (L_1+1) \text{ ms} + 1.7 N_5 + \text{disk rotation}.$	
Write Disk Sector(s)	MU	WD	<u>M</u>	%F1	xxx	W	B+6	B+11+N ₅ L ₅	Complete when SC = 000 $T = .006 (L_1+1) \text{ ms} + 1.7 N_5 + \text{disk rotation}$	
Write Disk Sector(s) with Word Marks	LU	WDW	<u>L</u>	%F1	xxx	W				
Write Disk Track Sectors with Addresses	MU	WDT	<u>M</u>	%F6	xxx	W	B+9	B+11+2120	Writes 2120 characters and sector addresses $T = .006 (L_1+1) \text{ ms} + 33.3 \text{ ms} + \text{disk rotation}$	
Write Disk Track Sectors with Addresses and Word Marks	LU	WDTW	<u>L</u>	%F6	xxx	W	B+9	B+11+1920	Writes 1920 characters and sector addresses $T = .006 (L_1+1) \text{ ms} + 33.3 \text{ ms} + \text{disk rotation}$	
Write Disk with Sector Count Overlay	MU	WDCO	<u>M</u>	%F5	xxx	W	B+6	B+8+N ₅ L ₅	Multiple-sector-count field, minus one, is written as first 3 characters of first sector	

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Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Write Disk with Sector Count Overlay with Word Marks	LU	WDCOW	<u>L</u>	%F5	xxx	W				$T = .006 (L_1+1) \text{ ms} + 1.7 N_5 + \text{disk rotation}$
IBM 1311 DISK STORAGE DRIVE INSTRUCTIONS										
Branch if Access Busy	B	BIN	<u>B</u>	xxx						No Branch $T = N (L_1+1) \text{ ms}$
Branch if Access Inoperable	B	BIN	<u>B</u>	xxx		N				Branch (without indexing) $T = N (L_1+1) \text{ ms}$
Branch if Any Disk Condition	B	BIN	<u>B</u>	xxx		Y				Branch (with indexing) $T = N (L_1+2) \text{ ms}$
Branch if Disk Error	B	BIN	<u>B</u>	xxx		V		BI	dbb, Blank, or (NSI)	
Branch if Unequal Address Compare	B	BIN	<u>B</u>	xxx		X				
Branch if Wrong Length Record	B	BIN	<u>B</u>	xxx		W				
Seek Disk	MU LU	SD	<u>M</u> <u>L</u>	%F0	xxx	R/W		B+6	B+7	Seeks specified cylinder $T = N (L_1+7) \text{ ms} + \text{access time}$
Read Disk Sector(s)	MU	RD	<u>M</u>	%F1	xxx	R		-B+6	B+11+N ₅ L ₅	Complete when SC = 000
Read Disk Sector(s) with Word Marks	LU	RDW	<u>L</u>	%F1	xxx	R		B+6	B+11+N ₅ L ₅	$T = N (L_1+1) \text{ ms} + 2 N_5 + \text{disk rotation}$
Read Disk Track Sectors with Addresses	MU	RDT	<u>M</u>	%F6	xxx	R		B+9	B+11+2120	Reads 2120 characters with sector addresses $T = N (L_1+1) \text{ ms} + \text{disk rotation}$
Read Disk Track Sectors with Addresses and Word Marks	LU	RDTW	<u>L</u>	%F6	xxx	R		B+9	B+11+1920	Reads 1920 characters with sector addresses $T = N (L_1+1) \text{ ms} + \text{disk rotation}$
Read Disk with Sector Count Overlay	MU	RDCO	<u>M</u>	%F5	xxx	R		B+6	B+8+N ₅ L ₅	Multiple-sector-count field in first record read determines number of sectors read $T = N (L_1+1) \text{ ms} + 2 N_5 + \text{disk rotation}$
Read Disk with Sector Count Overlay with Word Marks	LU	RDCOW	<u>L</u>	%F5	xxx	R		B+6	B+8+N ₅ L ₅	Multiple-sector-count field in first record read determines number of sectors read $T = N (L_1+1) \text{ ms} + 2 N_5 + \text{disk rotation}$
Write Disk Check	MU	WDC	<u>M</u>	%F3	xxx	W		Depends on Previous Operation		Data in specified core-storage area compared with data written on disk $T = N (L_1+1) \text{ ms} + 2 N_5 + \text{disk rotation}$
Write Disk Check with Word Marks	LU	WDCW	<u>L</u>	%F3	xxx	W		Depends on Previous Operation		Data in specified core-storage area compared with data written on disk $T = N (L_1+1) \text{ ms} + 2 N_5 + \text{disk rotation}$

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/1-	B-			A	B	
Write Disk Sector(s)	MU	WD	<u>M</u>	%F1	xxx	W		B+6	B+11+N _S L _S	Complete when SC = 000 T = N (L ₁ +1) ms + 2 N _S + disk rotation
Write Disk Sector(s) with Word Marks	LU	WDW	<u>L</u>	%F1	xxx	W				
Write Disk Track Sectors with Addresses	MU	WDT	<u>M</u>	%F6	xxx	W		B+9	B+11+2120	Writes 2120 characters and sector addresses T = N (L ₁ +1) ms + 42 ms + disk rotation
Write Disk Track Sectors with Addresses and Word Marks	LU	WDTW	<u>L</u>	%F6	xxx	W		B+9	B+11+1920	Writes 1920 characters and sector addresses T = N (L ₁ +1) ms + 42 ms + disk rotation
Write Disk with Sector Count Overlay	MU	WDCO	<u>M</u>	%F5	xxx	W		B+6	B+8+N _S L _S	Multiple-sector-count field minus one written as first 3 characters of first sector. T = N (L ₁ +1) ms + 2 N _S + disk rotation
Write Disk with Sector Count Overlay with Word Marks	LU	WDCOW	<u>L</u>	%F5	xxx	W				
IBM 1311 SPECIAL FEATURE SCAN DISK										
Scan Disk Equal	MU	SDE	<u>M</u>	%F8	xxx	W		B+6	B+11+L _F	Records must be in sector format test. Result with appropriate Branch instruction GMWM must be set at right of search argument. Search argument must be less than one sector. T = .0115 (L ₁ +1) ms + 2 N _S + disk rotation
Scan Disk Equal with Word Marks	LU	SDEW	<u>L</u>	%F8	xxx	W		B+6	B+11+L _F	
Scan Disk High or Equal	MU	SDH	<u>M</u>	%F9	xxx	W		B+6	B+11+L _F	
Scan Disk High or Equal with Word Marks	LU	SDHWC	<u>L</u>	%F9	xxx	W		B+6	B+11+L _F	
Scan Disk Low or Equal	MU	SDL	<u>M</u>	%F7	xxx	W		B+6	B+11+L _F	
Scan Disk Low or Equal with Word Marks	LU	SDLW	<u>L</u>	%F7	xxx	W		B+6	B+11+L _F	
IBM 1311 SPECIAL FEATURE TRACK RECORD										
Read Disk-Track Record	MU	RDTR	<u>M</u>	%F2	xxx	R		B+6	B+11+2980	Reads 2980 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
Read Disk-Track Record with Addresses	MU	RDTA	<u>M</u>	%F@	xxx	R		B+9	B+11+2986	Reads 2986 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
Read Disk-Track Record with Addresses and Word Marks	LU	RDTAW	<u>L</u>	%F@	xxx	R		B+9	B+11+2688	Reads 2688 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
Read Disk-Track Record with Word Marks	LU	RDTRW	<u>L</u>	%F2	xxx	R		B+6	B+11+2682	Reads 2682 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Write Disk-Track Record	MU	WDTR	<u>M</u>	%F2	xxx	W		B+6	B+11+2980	Writes 2980 characters T = .0115 (L ₁ +1) + 40 ms + disk rotation
Write Disk-Track Record with Addresses	MU	WDTA	<u>M</u>	%F@	xxx	W		B+9	B+11+2986	Writes 2986 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
Write Disk-Track Record with Addresses and Word Marks	LU	WDTAW	<u>L</u>	%F@	xxx	W		B+9	B+11+2688	Writes 2688 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
Write Disk-Track Record with Word Marks	LU	WDTRW	<u>L</u>	%F2	xxx	W		B+6	B+11+2682	Writes 2682 characters T = .0115 (L ₁ +1) ms + 40 ms + disk rotation
IBM 1405 DISK STORAGE INSTRUCTIONS										
Branch if Access Inoperable	B	BIN	<u>B</u>	xxx		N		BI	dbb, Blank or (NSI)	
Branch if any Disk Unit Error Condition	B	BIN	<u>B</u>	xxx		Y				
Branch if Read-or-Write-Parity Check or Read Back Check Error	B	BIN	<u>B</u>	xxx		V				No Branch: T = .0115 (L ₁ +1) ms Branch (without indexing): T = .0115 (L ₁ +1) ms Branch (with indexing): T = .0115 (L ₁ +2) ms
Branch if Unequal-Address Compare	B	BIN	<u>B</u>	xxx		X				
Branch if Wrong-Length Record	B	BIN	<u>B</u>	xxx		W				
Read Disk Full-Track	MU	RDT	<u>M</u>	%Fn	bbb	R			B+1010	
Read Disk Full-Track with Word Marks	LU	RDTW	<u>L</u>	%Fn	bbb	R		B+1	B+890	T = .0115 (L ₁ +9) ms + 50 ms + disk rotation
Read Disk Single Record	MU	RD	<u>M</u>	%Fn	bbb	R			B+210	
Read Disk Single Record with Word Marks	MU	RDW	<u>L</u>	%Fn	bbb	R			B+186	T = .0115 (L ₁ +9) ms + 10 ms + disk rotation
Seek Disk	MU or LU	SD	<u>M</u> or <u>L</u>	%F0	bbb	R			B+8	T = .0115 (L ₁ +9) ms + access time
Write Disk Check	MU or LU	WDC or WDCW	<u>M</u> or <u>L</u>	%F3	bbb	W			B+210 or B+1010	T = .0115 (L ₁ +9) ms + 50 ms
Write Disk Full-Track	MU	WDT	<u>M</u>	%Fn	bbb	W			B+1010	
Write Disk Full-Track with Word Marks	LU	WDTW	<u>L</u>	%Fn	bbb	W			B+890	T = .0115 (L ₁ +9) ms + 50 ms + disk rotation

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Write Disk Single Record	MU	WD	<u>M</u>	%Fn	bbb	W			B+210	T = .0115 (L ₁ +9) ms + 10 ms + disk rotation
Write Disk Single-Record with Word Marks	LU	WDW	<u>L</u>	%Fn	bbb	W	B+1		B+186	
IBM 729 AND 7330 MAGNETIC TAPE UNIT INSTRUCTIONS										
Backspace Tape Record*	CU	BSP	<u>U</u>	%Un		B		%4n	dbb	Backspace one tape record T = N (L ₁ +1) ms + T _M
Branch if End of Reel*	B	BEF	<u>B</u>	xxx		K		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms
Branch if Tape Error*	B	BER	<u>B</u>	xxx		L		BI	dbb, Blank (or NSI)	Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Diagnostic Read*	-	-	<u>U</u>	%Bn		A		%2n	dbb	Tape advances to next IRG without transmitting data T = N (L ₁ +1) ms + T _M
Read Tape (with word marks)*	MU (LU)	RT (RTW)	<u>M</u> (<u>L</u>)	%Un	xxx	R		%4n	GM+1	IRG on tape or GMWM in core storage stops operation. GM is inserted in storage after last character read from tape. (Word separator characters are translated to WM in core storage.) T = N (L ₁ +1) ms + T _M
Rewind Tape (and Unload)*	CU	RWD (RWV)	<u>U</u>	%Un		R		%4n	dbb	
Rewind Tape (and Unload)*	CU	RWD (RWV)	<u>U</u>	%Un		(U)		%4n	dbb	T = N (L ₁ +1) ms (see publication for more detail)
Skip and Blank Tape*	CU	SKP	<u>U</u>	%Un		E		%4n	dbb	T = N (L ₁ +1) ms (see publication for more detail)
Write Tape (with word marks)*	MU	WT	<u>M</u>	%Un	xxx	W		%4n	GM+1	GMWM in core storage stops operation (WM in core storage written on tape as a word separator character.) T = N (L ₁ +1) ms + T _M
Write Tape Mark	CU	WTM	<u>U</u>	%Un		M		%4n	dbb	T = N (L ₁ +1) ms + T _M
IBM 1011 PAPER TAPE READER INSTRUCTIONS										
Branch if Input/Output Indicator On*	B	BIN	<u>B</u>	xxx		1		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms
Branch if Paper Tape Reader Ready*	B	BIN	<u>B</u>	xxx		2		BI	dbb, Blank (or NSI)	Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Read from Paper Tape (with word marks)			<u>M</u> (<u>L</u>)	%PI	xxx	R		%71	B+ message length + 1	T = N (L ₁ +1) ms + record transmission time
IBM 1012 TAPE PUNCH INSTRUCTIONS										
Backspace Tape (and Branch)*	SS	SS (SSB)	<u>K</u>	xxx		A		BI	dbb, Blank (or NSI+1)	Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/1-	B-			A	B	
Branch if in Back-space Operation*	B	BIN*	<u>B</u>	xxx		1		BI	dbb, Blank, (or NSI)	
Branch if Tape Punch Ready*	B	BIN*	<u>B</u>	xxx		2		BI	dbb, Blank (or NSI)	
Branch if Tape Punch Not Ready to Accept Data*	B	BIN*	<u>B</u>	xxx		3		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Tape Punch is Not Ready to Read*	B	BIN*	<u>B</u>	xxx		4		BI	dbb, Blank (or NSI)	
Branch if Tape Punch Overextended*	B	BIN*	<u>B</u>	xxx		5		BI	dbb, Blank (or NSI)	
Branch if Supply Reel Low or Chad Box Full*	B	BIN*	<u>B</u>	xxx		6		BI	dbb, Blank (or NSI)	
Write On Tape Punch*			<u>M</u>	%P1	xxx	W		%71	B+3	T = N (L ₁ +1) ms + transmission time
Tape Punch Read Back Check*			<u>M</u>	%P1	xxx	R		%71	B+3	T = N (L ₁ +1) ms + transmission time
IBM 7340 HYPERTAPE DRIVE INSTRUCTIONS										
Attention Response (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		B		dbb(BI)	dbb, Blank (or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Attention Indicator On*	B	BIN*	<u>B</u>	xxx		4		BI	dbb, Blank (or NSI)	
Branch if Normal End Indicator On*	B	BIN*	<u>B</u>	xxx		2		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Unusual End Indicator On*	B	BIN*	<u>B</u>	xxx		1		BI	dbb, Blank (or NSI)	
Branch if 7641 Busy Indicator On*	B	BIN*	<u>B</u>	xxx		3		BI	dbb, Blank (or NSI)	
Control Load Operation*			<u>L</u>	%11	xxx	W		%91	B+4	See Form A24-3069.
Control Move Operation*			<u>M</u>	%11	xxx	W		%91	B+4	See Form A24-3069.
End Response (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		E		dbb(BI)	dbb, Blank (or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Read Operation (with word marks)*			<u>M</u> <u>(L)</u>	%11	xxx	R		%91	GM+1	See Form A24-3069.
Sense Load Operation*			<u>L</u>	%11	xxx	R		%91	B+8	See Form A24-3069.

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Sense Move Operation*			<u>M</u>	%I1	xxx	R		%91	B+8	See Form A24-3069.
Start Control (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		F		dbb(BI)	dbb, Blank (or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Start Read*	CU	CU*	<u>U</u>	%I1		E		%91	dbb	See Form A24-3069.
Start Sense (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		G		dbb(BI)	dbb, Blank (or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Start Write*	CU	CU*	<u>U</u>	%I1		D		%91	dbb	See Form A24-3069.
Write Op (with WM's)			<u>M</u> (<u>L</u>)	%I1	xxx	W		%91	GM+1	See Form A24-3069.
IBM 1009 INSTRUCTIONS										
Branch if 1009 Run*	B	BIN*	<u>B</u>	xxx		1		BI	dbb, Blank (or NSI)	
Branch if End-of-Message Receive*	B	BIN*	<u>B</u>	xxx		5		BI	dbb, Blank (or NSI)	
Branch if End-of-Message Transmit*	B	BIN*	<u>B</u>	xxx		2		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Good Transmission*	B	BIN*	<u>B</u>	xxx		3		BI	dbb, Blank (or NSI)	
Branch if Receive Error*	B	BIN*	<u>B</u>	xxx		6		BI	dbb, Blank (or NSI)	
Branch if Transmission Error*	B	BIN*	<u>B</u>	xxx		4		BI	dbb, Blank (or NSI)	
Load Character from the Receiving 1009	LU	LCA	<u>L</u>	%D1	xxx	R		T41	B + 1	T = N (L ₁ +3) ms if ws + dead time T = N (L ₁ +2) ms
Load Character to the Transmitting 1009	LU	LCA	<u>L</u>	%D1	xxx	W		%41	B + 1	T = N (L ₁ +3) ms if ws + dead time T = N (L ₁ +2) ms
Move Character to the Receiving 1009	MU	MCW	<u>M</u>	%D1	xxx	R		%41	B + 1	T = N (L ₁ +2) ms + dead time
Move Character to Transmitting 1009	MU	MCW	<u>M</u>	%D1	xxx	W		T41	B + 1	T = N (L ₁ +2) ms + dead time
Set Ready to Receive*	CU	CU*	<u>U</u>	%D1		D		%41	d41	T = N (L ₁ +1) ms
Start Transmission*	CU	CU*	<u>U</u>	%D1		E		%41	d41	T = N (L ₁ +1) ms
Suppress 3-Second Alarm*	SS	SS*	<u>K</u>			A		dpp	dpp	T = N (L ₁ +1) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
IBM 1404 INSTRUCTIONS										
Control Carriage-Eject and Immediate Skip to Channel 1*	CC	CC*	<u>F</u>			I		dpp	dpp	Eject card at print station. T = .0115 (L ₁ +1) ms
Control Carriage-Eject and Skip to Channel 1 after next Print*	CC	CC*	<u>F</u>			A		dpp	dpp	Eject card at print station after next print cycle. T = .0115 (L ₁ +1) ms
For other Control Carriage instructions, refer to the IBM 1403 Printer Instruction Section										
Read Card from 1404 Printer	R	R	<u>1</u>			0		Ap	364	T = .0115 (L ₁ +1) ms + I/O
Write and Read 1404 Printer	WR	WR	<u>3</u>			0		Ap	081	T = .0115 (L ₁ +1) ms + I/O
Write Line	W	W	<u>2</u>					Ap	332	T = .0115 (L ₁ +1) ms + I/O
Read Compare 1404 Special Feature Instructions (Reference Text A24-3068)										
Branch if Invalid Card Code Indicator On	B	BIN*	<u>B</u>	xxx		0		BI	dbi, Blank or (NSI)	No Branch: T = .0115 (L ₁ +1) ms Branch (without indexing): T = .0115 (L ₁ +1) ms Branch (with indexing): T = .0115 (L ₁ +2) ms
Compare	C	C	<u>C</u>	xxx	363			A-L _W	B-L _W	T = .0115 (L ₁ +1+L _A +L _B) ms
IBM 1407 CONSOLE INQUIRY INSTRUCTIONS										
Branch if Inquiry Clear Indicator On	B	BIN*	<u>B</u>	xxx		*		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = .0115 (L ₁ +2) ms
Branch if Inquiry Request Indicator On	B	BIN*	<u>B</u>	xxx		Q				
Line Space	MU or LU	MU or LU	<u>M</u> or <u>L</u>	%TC	xxx	W	GM-WM in B	%30	B + 1	T = N (L ₁ +1) ms + space time
Read from Console Printer (with word marks)	MU LU	MU LU	<u>M</u> <u>L</u>	%TC	xxx	R		%30	B + Message Length + 1	T = N (L ₁ +1) ms + operator keying time
Write on Console Printer (with word marks)	MU LU	MU LU	<u>M</u> <u>L</u>	%TC	xxx	W		%30	B + Message Length + 1	T = N (L ₁ +1) ms + output typing time
IBM 1412 MAGNETIC CHARACTER READER, MODEL 1 INSTRUCTIONS										
Branch if Magnetic Character Reader Account-Number Field Indicator On*	B	BIN*	<u>B</u>	xxx		6		BI	dbb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Magnetic Character Reader Amount-Field Indicator On*	B	BIN*	<u>B</u>	xxx		4				

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Branch if Magnetic Character Reader Document-Spacing Check Indicator On*	B	BIN*	<u>B</u>	xxx		8				No Branch: $T = N (L_1+1) \text{ ms}$ Branch (without indexing): $T = N (L_1+1) \text{ ms}$ Branch (with indexing): $T = N (L_1+2) \text{ ms}$
Branch if Magnetic Character Reader-Late Read Indicator On*	B	BIN*	B	xxx		1				
Branch if Magnetic Character Reader Read-Check Indicator On*	B	BIN*	<u>B</u>	xxx		3				
Branch if Magnetic Character Reader Read-not-ready Indicator On*	B	BIN*	<u>B</u>	xxx		2				
Branch if Magnetic Character Reader Transmit-Routing Field Indicator On*	B	BIN*	<u>B</u>	xxx		7				
Disengage Magnetic Character Reader*	CU	CU	<u>U</u>	%S1		D	%21	dbb	$T = N (L_1+1) \text{ ms}$	
Engage Magnetic Character Reader*	CU	CU	<u>U</u>	%S1		E	%21	dbb	$T = N (L_1+1) \text{ ms}$	
Load from Magnetic Character Reader*	LU	LU	<u>L</u>	%S1	xxx	R	%21	B + Message Length + 1	$T = N (L_1+1) \text{ ms} + \text{message length} + \text{document movement (see publication for more detail)}$	
Move from Magnetic Character Reader*	MU	MU	M	%S1	xxx	R	%21	B + Message Length + 1		
Select Stacker-Pocket A [B, 0-9, Reject] (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		A [B, C-L, M]	dbb (BI)	dbb, Blank (or NSI)	No Branch: $T = N (L_1+1) \text{ ms}$ Branch (without indexing): $T = N (L_1+1) \text{ ms}$ Branch (with indexing): $T = N (L_1+2) \text{ ms}$	
IBM 1418 AND 1428 OPTICAL READER INSTRUCTIONS										
Branch if Character On-Line*	B	BIN*	<u>B</u>	xxx		6	BI	dbb, Blank or (NSI)		
Branch if Document End*	B	BIN*	<u>B</u>	xxx		5				
Branch if Document under Selected Read Station*	B	BIN*	<u>B</u>	xxx		3				
Branch if Empty Hopper and Transport*	B	BIN*	<u>B</u>	xxx		7				
Branch if Late-Read (or Late Reading Mode Change on 1428) Indicator On*	B	BIN*	<u>B</u>	xxx		1				

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Branch if Ready to Engage*	B	BIN*	<u>B</u>	xxx		2			No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms	
Branch if Ready to Read*	B	BIN*	<u>B</u>	xxx		8				
Control Unit-Disengage*	CU	CU*	<u>U</u>	%S2		D	%22	dbb	T = N (L ₁ +1) ms	
Control Unit-Engage*	CU	CU*	<u>U</u>	%S2		E	%22	dbb	T = N (L ₁ +1) ms	
Read In Move Mode*	MU	MU*	<u>M</u>	%S2	xxx	R	%22	B + 1	T = N (L ₁ +1) ms + message length + document length + 1 (See publication for more detail)	
Reading Mode Determination-Alphabetic Set (1428 only)*	SS	SS*	<u>K</u>			C	dbb	dbb	T = N (L ₁ +1) ms	
Reading Mode Determination-Alphabetic Set (1428 only)	SS	SS*	<u>K</u>			E	dbb	dbb	T = N (L ₁ +1) ms	
Reading Mode Determination-Numeric Set (1428 only)	SS	SS*	<u>K</u>			F	dbb	dbb	T = N (L ₁ +1) ms	
Select Second Read Station	SS	SS*	<u>K</u>			N	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket A [B, 0-9] (14-18)*	SS	SS*	<u>K</u>			A B, 09	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket A (1428)	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			A D H	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket B (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			B D H	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket R (1428)*	SS	SS*	<u>K</u>			G	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket 0 (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			B H G	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket 1 (1428)*	SS	SS*	<u>K</u>			A	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket 2 (1428)*	SS	SS*	<u>K</u>			B	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket 3 (1428)*	SS SS	SS* SS*	<u>K</u> <u>K</u>			A G	dbb	dbb	T = N (L ₁ +1) ms	
Select Stacker-Pocket 4 (1428)*	SS	SS*	<u>K</u>			D	dbb	dbb	T = N (L ₁ +1) ms	

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Select Stacker-Pocket 5 (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			A D G		dbb	dbb	T = N (L ₁ +1) ms
Select Stacker-Pocket 6 (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			B D G		dbb	dbb	T = N (L ₁ +1) ms
Select Stacker-Pocket 7 (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			A B D		dbb	dbb	T = N (L ₁ +1) ms
Select Stacker-Pocket 8 (1428)*	SS	SS*	<u>K</u>			H		dbb	dbb	T = N (L ₁ +1) ms
Select Stacker-Pocket 9 (1428)*	SS SS SS	SS* SS* SS*	<u>K</u> <u>K</u> <u>K</u>			A H G		dbb	dbb	T = N (L ₁ +1) ms
IBM 1418/1428 SPECIAL FEATURE INSTRUCTIONS										
Read Station, Additional or Mark Reading Station										
Select First Read Station*	SS	SS*	<u>K</u>			M		dbb	dbb	T = N (L ₁ +1) ms
IBM 1419 MAGNETIC CHARACTER READER INSTRUCTIONS										
Branch if Document-Spacing Error Indicator On*	B	BIN*	<u>B</u>	xxx		8				
Branch if Document to be Read Indicator On*	B	BIN*	<u>B</u>	xxx		1				
Branch if Document under Read Head (PDS 4) Indicator On*	B	BIN*	<u>B</u>	xxx		2				
Branch if Valid Account-Number Field Indicator On*	B	BIN*	<u>B</u>	xxx		5	BI	dbb, Blank (or NSI)		No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Valid Amount Field Indicator On*	B	BIN*	<u>B</u>	xxx		4				
Branch if Valid Serial-Number Field Indicator On*	B	BIN*	<u>B</u>	xxx		7				
Branch if Valid Transit-Number Field Indicator On*	B	BIN*	<u>B</u>	xxx		6				
Control Unit-Disengage*	CU	CU*	<u>U</u>	%S1		D		%21	dbb	T = N (L ₁ +1) ms
Control Unit-Engage*	CU	CU*	<u>U</u>	%S1		E		%21	dbb	T = N (L ₁ +1) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Read from 1419 in Load Mode*	LCA	LU	<u>L</u>	%S1	xxx	R		%21	B -- Mes- sage Length -- 1	T = N (L ₁ +1) ms + message length + document length + 1 (see A24-3068 for more information)
Read from 1419 in Move Mode*	MC W	MU	<u>M</u>	%S1	xxx	R		%21	B -- Mes- sage Length -- 1	T = N (L ₁ +1) ms + message length + document length + 1 (see A24-3068 for more information)
Select Stacker - Pocket A [B, 0-9, Reject] (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)		A B, C-L, M		ddb (B1)	ddb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
IBM 1448 TRANSMISSION CONTROL UNIT INSTRUCTIONS										
Branch if Early Warning Indicator On*	B	BIN*	<u>B</u>	xxx				BI	ddb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if End of Block Indicator On*	B	BIN*	<u>B</u>	xxx				BI	ddb, Blank (or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Disable Interrupt (and Branch) *	SS	SS (SSB)*	<u>K</u>	(xxx)				ddb (B1)	Blank (NSI)	Branch (with indexing): T = N (L ₁ +2) ms
Enable Interrupt (and Branch)	SS	SS (SSB)*	<u>K</u>	(xxx)				ddb (B1)	Blank (NSI)	
Scan*			<u>O</u>	xxx				BI	BI	See A24-3068 for timing information.
IBM 1401/1460 SPECIAL FEATURE INSTRUCTIONS -- ADVANCED PROGRAMMING										
Move Characters to Record Mark or Group-Mark WM	MC M	MR CM	<u>P</u>	xxx	xxx			A+L _A	B+L _A	Standard on 1460 T = N (L ₁ +1+2 L _A) ms
Store A-address Register 1*	SAR	SAR	<u>Q</u>	xxx				A-3	A _p	Store contents of A-address register in A-address. T = N (L ₁ +1+2 L _A) ms
Store B-Address Register - One Address 1*	SBR	SBR	<u>H</u>	xxx				A-3	B _p	Store contents of B-address register in the A-address T = N (L ₁ +4) ms
Store B-Address Register - Two Addresses 1*	SBR	SBR	<u>H</u>	xxx	xxx			A-3	B _p	T = N (L ₁ +7) ms
COLUMN BINARY										
Bit Test 2										
Branch if Bit Equal*	BBE	BBE	<u>W</u>	xxx	xxx	x		BI	B-1, Blank (or NSI)	No Branch: T = N (L ₁ +2) ms Branch (without indexing): T = N (L ₁ +2) ms Branch (with indexing): T = N (L ₁ +3) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/1-	B-			A	B	
Move and Binary Code	MC W	MBC	<u>M</u>	xxx	xxx	B		A-L _A	Address of preset WM in 400 area + 99	T = N (L ₁ +1+2 L _B) ms
Move and Binary Decode	MC W	MBD	<u>M</u>	xxx	xxx	A		Address of preset WM in 400 area + 99	B-L _B	T = N (L ₁ +1+2 L _B) ms
Punch Column Binary (and Branch)*	P	PCB	<u>4</u>	(xxx)		C		dbb (BI)	181 (Blank or NSI)	T = N (L ₁ +1) ms + I/O
Read Binary Tape*	MU	RTB	<u>M</u>	%Bn	xxx	R		%2n	B + Message Length + 1	T = N (L ₁ +1) ms + T _M
Read Column Binary (and Branch)*	R	RCB	<u>1</u>	(xxx)		C		dbb (BI)	481 (Blank or NSI)	T = N (L ₁ +1) ms + I/O
Write Binary Tape*	MV	WTB	<u>M</u>	%Bn	xxx	W		%2n	GM-WM+1	T = N (L ₁ +1) ms + T _M
COMPRESSED TAPE										
Move and Insert Zeros	M12	M12	<u>X</u>	xxx	xxx		High-order position of expanded fields	Address of preset GM-WM	Last B-field WM-1	GMWM to left of high order A-field position T = N (L ₁ +1+2 L _A + L _Z) ms
Read Compressed Tape*	MU	MU*	<u>M</u>	%Cn	xxx	R		%3n	Address of inserted GM	IRG stops operation T = N (L ₁ +1) ms + T _M
DIRECT DATA CHANNEL										
Branch if Data Transmission Ended*	B	BIN*	<u>B</u>	xxx		2		BI	dbb, Blank or NSI	
Branch if Read Request*	B	BIN*	<u>B</u>	xxx		3		BI	dbb, Blank or NSI	
Branch if System Stops*	B	BIN*	<u>B</u>	xxx		8		BI	dbb, Blank or NSI	
Branch if Transmission Error*	B	BIN*	<u>B</u>	xxx		1		BI	dbb, Blank or NSI	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Trying to Read*	B	BIN*	<u>B</u>	xxx		7		BI	dbb, Blank or NSI	
Branch if Trying to Write*	B	BIN*	<u>B</u>	xxx		6		BI	dbb, Blank or NSI	
Branch if Write Request*	B	BIN*	<u>B</u>	xxx		4		BI	dbb, Blank or NSI	
Read Data (with word marks)*	MU (LU)	MU (LU)	<u>M</u> <u>(L)</u>	%H1	xxx	R		%81	B + Message Length + 1	T = N (L ₁ +1) ms + transmission and start time.
Read Request*	SS	SS*	<u>K</u>			C		dbb	dbb	T = N (L ₁ +1) ms
Reset*	SS	SS*	<u>K</u>			E		dbb	dbb	T = N (L ₁ +1) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Write Data (with word marks)*	MU (LU)	MU (LU)	<u>M</u> (L)	%H1	xxx	W		%B1	B + Message Length + 1	T = N (L ₁ +1) ms + transmission and start time
Write Request*	SS	SS*	<u>K</u>			D		dbb	dbb	T = N (L ₁ +1) ms
HIGH-LOW-EQUAL COMPARE (standard on 1460)										
Branch if Equal Compare - B=A*	B	BE	<u>B</u>	xxx		S		BI	dbb, Blank or NSI	No Branch: T = N (L ₁ +1) ms
Branch if High Compare - B < A*	B	BH	<u>B</u>	xxx		U		BI	dbb, Blank or NSI	Branch (without indexing): T = N (L ₁ +1) ms
Branch if Low Compare - B > A	B	BL	<u>B</u>	xxx		T		BI	dbb, Blank or NSI	Branch (with indexing): T = N (L ₁ +2) ms
MULTIPLY-DIVIDE										
Divide*	D	D	<u>%</u>	xxx	xxx		A-field	A minus division length	Tens position of quotient	Quotient developed in high-order positions of B-field
Multiply*	M	M	<u>@</u>	xxx	xxx		A-field B-field	A minus multiplier length	B minus Product field length	Product developed in low-order positions of B-field
PROCESSING OVERLAP										
Branch if Punch Busy*	B	BIN*	<u>B</u>	xxx		H		BI	dbb, Blank or NSI	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Reader Busy*	B	BIN*	<u>B</u>	xxx		I		BI	dbb, Blank or NSI	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Branch if Tape or Input-Output Busy*	B	BIN*	<u>B</u>	xxx		J		BI	dbb, [0-Address Register Contents +] Blank, or NSI	No Branch (without indexing): T = N (L ₁ +1) ms No Branch (with indexing): T = N (L ₁ +2) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms
Overlap Off (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)				dbb (BI)	dbb (Blank or NSI)	T = N (L ₁ +1) ms
Overlap On (and Branch)*	SS	SS* (SSB)*	<u>K</u>	(xxx)			\$	dbb (BI)	dbb (Blank or NSI)	T = N (L ₁ +1) ms

* Indicates the instruction cannot be chained.

Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
Punch Card In Overlap Mode (and Branch)*	P	P	<u>4</u>	(xxx)				<u>0-Add. Reg.</u> 181	T = N (L ₁ +1) ms + I/O Branch (without indexing): T = N (L ₁ +1) ms + I/O Branch (with indexing): T = N (L ₁ +2) ms + I/O	
Read Card in Overlap Mode (and Branch)*	R	R	<u>1</u>	(xxx)				<u>0-Add. Reg.</u> 081	T = N (L ₁ +1) ms + I/O Branch (without indexing): T = N (L ₁ +1) ms + I/O Branch (with indexing): T = N (L ₁ +2) ms + I/O	
Read Tape In Overlap Mode (with word marks)*	MU (LU)	MU* (LU)*	<u>M</u> <u>L</u>	@Un	xxx	R		<u>0-Add. Reg.</u> GM+1	T = N (L ₁ +1) ms + T _M	
Reset Overlap (and Branch)	SS	SS* (SSB)*	<u>K</u>	(xxx)			dbb (B1)	dbb (Blank or NSI)	T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms	
Write Tape In Overlap (with word mark)*	MU (LU)	MU* (LU)*	<u>M</u> <u>L</u>	@Un	xxx	W		<u>0-Add. Reg.</u> GM+1	T = N (L ₁ +1) ms + T _M	
READ-PUNCH RELEASE										
Start Punch Feed*	SPF	SPF	<u>9</u>				Ap	Bp	T = N (L ₁ +1) ms	
Start Read Feed*	SRF	SRF	<u>8</u>				Ap	Bp	T = N (L ₁ +1) ms	
SCAN DISK 1301 AND 1311 (1460)										
Scan Disk Equal (with word marks)*	MU (LU)	SDE (SDEW)	<u>M</u> <u>L</u>	%F8	xxx	W	B + 6	B+11+L _F	Record must be in sector format. Test result with appropriate Branch instruction. GM-WM must be set to right of search argument L _F = 100 T = .006 (L ₁ +1) ms + 2 N _S + disk rotation	
Scan Disk High or Equal (with word marks)*	MU (LU)	SDH (SDHWC)	<u>M</u> <u>L</u>	%F9	xxx	W	B + 6	B+11+L _F		
Scan Disk Low or Equal (with word marks)*	MU (LU)	SDL (SDLW)	<u>M</u> <u>L</u>	%F7	xxx	W	B + 6	B+11+L _F		
SENSE SWITCHES (1401)										
Branch if Sense Switch B C-G On*	B	BSS*	<u>B</u>	xxx		B C-G	B1	dbb (Blank or NSI)	No Branch: T = N (L ₁ +1) ms Branch (without indexing): T = N (L ₁ +1) ms Branch (with indexing): T = N (L ₁ +2) ms	
SPACE SUPPRESSION (1401-standard on 1460)										
An Sd- character used with any one of the WRITE instructions prevents the automatic spacing operation after the print operation										

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Instruction Name	Mnemonic Op Code		Op Code	Address Registers		d-Char.	WM's Req'd	Address Registers After Operation		Remarks and/or Timing
	SPS	Auto-coder		A/I-	B-			A	B	
TRACK RECORD - 1301 (1460)										
Read-Disk-Track Record (with word marks)*	MU (LU)	RDTR (RDTRW)	\overline{M} (\overline{L})	%F2	xxx	R		B + 6	B+11+2543 (B+11+2261)	T = .006 (L ₁ +1) ms + 33.3 ms + disk rotation
Read-Disk-Track Record with Address (and word marks)*	MU (LU)	RDTA (RDTAW)	\overline{M} (\overline{L})	%F@	xxx	R		B + 9	B+11+2549 (B+11+2267)	T = .006 (L ₁ +1) ms + 33.3 ms + disk rotation
Write-Disk-Track Record (with word marks)*	MU (LU)	WDTR (WDTRW)	\overline{M} (\overline{L})	%F2	xxx	W		B + 6	B+11+2543 (B+11+2261)	T = .006 (L ₁ +1) ms + 33.3 ms + disk rotation
Write-Disk-Track Record with Address (and word marks)*	MU (LU)	WDTA (WDTAW)	\overline{M} (\overline{L})	%F@	xxx	W		B + 9	B+11+2549 (B+11+2267)	T = .006 (L ₁ +1) ms + 33.3 ms + disk rotation
TRACK RECORD - 1311 (1460)										
Read-Disk-Track Record (with word marks)*	MU (LU)	RDTR (RDTRW)	\overline{M} (\overline{L})	%F2	xxx	R		B + 6	B+11+2980 (B+11+2682)	T = .006 (L ₁ +1) ms + 40 ms + disk rotation
Read-Disk-Track Record with Address (and word marks)*	MU (LU)	RDTA (RDTAW)	\overline{M} (\overline{L})	%F@	xxx	R		B + 9	B+11+2986 (B+11+2688)	T = .006 (L ₁ +1) ms + 40 ms + disk rotation
Write-Disk-Track Record (with word marks)*	MU (LU)	WDTR (WDTRW)	\overline{M} (\overline{L})	%F2	xxx	W		B + 6	B+11+2980 (B+11+2682)	T = .006 (L ₁ +1) ms + 40 ms + disk rotation
Write-Disk-Track Record with Address (and word marks)*	MU (LU)	WDTA (WDTAW)	\overline{M} (\overline{L})	%F@	xxx	W		B + 9	B+11+2986 (B+11+2688)	T = .006 (L ₁ +1) ms + 40 ms + disk rotation
TRANSLATE (1460)										
Load Record			\overline{P}	xxx	xxx			A+L _A	B+L _A	T = .006 (L ₁ +1+2 L _A) ms
Translate (with word marks)*			\overline{I}	xxx	x00 (even hundreds position)					T = .006 (L ₁ +2+3 T _F) ms

* Indicates the instruction cannot be chained.

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IBM 1401/1460 Instruction and Timing Summary, Form A24-6447-0

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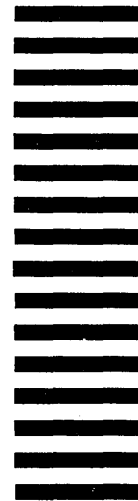
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