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FOR **MINI-COMPUTERS** PROGRAMING  
PROGRAMING AND DEBUGGING FORM

A Burroughs SL3 Quick-Reference Guide

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### SERIES L/TC INSTRUCTIONS

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### MACHINE LANGUAGE TABLES

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### MACHINE LANGUAGE TABLE REFERENCE

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### DECIMAL TO HEXADECIMAL CONVERSION

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### USASCII, EBCDIC, BCL CONVERSION

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### FIELD IDENTIFIER CODES

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### COMPACT OBJECT CODE

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### DATACOMM REG AND TRACE ANALYZER

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INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>NUMERIC KEYBOARD</u>					
Numeric Keyboard	NK	0-15	0-15		A=Max Digits Left of Decimal Point  B=Max Digits Right of Decimal Point
Numeric Keyboard, Permit Reverse Entry Key	NKR	0-15	0-15		
Numeric Keyboard, Permit C and M Keys	NKCM	0-15	0-15		
Numeric Keyboard, Permit Reverse Entry, C & M Keys	NKRCM	0-15	0-15		
<u>ALPHA KEYBOARD</u>					
Load Keyboard Base Register	LKBR	Label			A=Max No. of Characters
Type	TK	0-255			
Type into Memory, Print	TKM	0-255			
Enter Alpha into Memory, Non-Print	EAM	0-255			
Load Program Key Base Register	LPKR	Label			
Enable Program Key Group A	PKA	12345678			1st through 8th keys
Enable Program Key Group B	PKB	12345678			9th through 16th keys
Enable Program Key Group C	PKC	12345678			17th through 24th keys

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>PRINT</u>					
Load Print Numeric Base Register	LPNR	Label			
Print Numeric	PN	0-14	0-15		
Print Numeric, Shift Ribbon if Minus	PNS-	0-14	0-15		} A=Accum. Digit Position to Start Printing B=Print Mask Number
Print Numeric, Shift Ribbon if Plus	PNS+	0-14	0-15		
Print Character	PC	Char			
Print Character Previous Ribbon	PCP	Char			
Print Character, if Accumulator Minus, Previous Ribbon	PC-	Char			
Print Character, if Accumulator Plus, Previous Ribbon	PC+	Char			
Print Alphanumeric	PA	Label			
Load Position Register	POS	1-255			
Red Ribbon	RR				

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>FORMS CONTROL</u>					
Open Forms Transport	OC	0-255			A=No. Of Lines to Advance After Close
Close Forms Transport	CC				
Load Left Platen Count Register	LLCR	0-255			} Load Register with "A" Value
Load Right Platen Count Register	LRCR	0-255			
Load Left Platen Limit Register	LLLR	0-255			
Load Right Platen Limit Register	LRLR	0-255			
Advance Left Platen	AL	0-255			} Advance "A" Lines
Advance Right Platen	AR	0-255			
Advance Both Platens	ALR	0-255			
Advance Left Platen To	ALTO	1-255			} Advance to Line "A"
Advance Right Platen To	ARTO	1-255			

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>ARITHMETIC</u>					
Add to Accumulator	ADA	Label			
Add to Memory	ADM	Label			
Subtract from Accumulator	SUA	Label			
Subtract from Memory	SUM	Label			
Multiply	MUL	Label			
Multiply and Round	MULR	Label			
Divide	DIV	Label			
Transfer Remainder to Accumulator	REM				
Transfer to Accumulator	TRA	Label			
Transfer to Memory	TRM	Label			
Clear Memory Word	CLM	Label			
Clear Accumulator, Insert Constant	CLA	0-15	0-15		} A=Accum. Digit Pos. B=Constant
Insert Constant in Accumulator	INK	0-15	0-15		
Add Constant to Accumulator	ADK	0-14	0-9		
Subtract Constant from Accumulator	SUK	0-14	0-9		
Load Shift Register	LSR	0-15			
Shift Off	SLRO	0-14	0-14		} A=No. of Digit Positions Left B=No. of Digit Positions Right
Shift Off with Sign	SLROS	0-15	0-15		

INSTRUCTION	OP CODE	A	B	C	REMARKS
<b>FLAGS</b>					
Load Flags	LOD	AKRPXYL	-SCM 1234		} A=Flag Group B=Flags
Set Flags	SET	AKRPXYLD	-SCM 1234		
Reset Flags	RST	AKRPXYLD	-SCM 1234		
Change Flags	CHG	AKRPXYL	-SCM 1234		
<b>SKIP-EXECUTE</b>					
Skip If Any Flags	SK	ATKRPXYL BDVWS	-SCM 1234 ØLI WRF	1-4	} A=Flag Group B=Flags C=No. of Instructions
Skip If Every Flag	SKE	ATKRPXYL BDVWS	-SCM 1234 ØLI WRF	1-4	
Execute If Any Flags	EX	ATKRPXYL BDVWS	-SCM 1234 ØLI WRF	1-4	
Execute If Every Flag	EXE	ATKRPXYL BDVWS	-SCM 1234 ØLI WRF	1-4	
Skip If Digit Less than Constant	SKL	0-15	0-15	1-4	} A=Digit Position B=Constant C=No. of Instructions
Execute If Digit Less than Constaht	EXL	0-15	0-15	1-4	
Skip If Accumulator Zero	SKZ	1-4			} A=No. of Instructions
Execute If Accumulator Zero	EXZ	1-4			
Compare Alpha	CPA	Label			} Word = Accum, execute next instruct. Word < Accum, execute 2nd instruct.. Word > Accum, execute 3rd instruct.



INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>INDEX REGISTER</u>					
Load Index Register	LIR	1-4	0-255		} A=Index Register B=Constant
Add to Index Register	ADIR	1-4	0-255		
Increment Index Register	IIR	1-4	0-255		} A=Index Register B=Limit
Decrement Index Register	DIR	1-4	0-255		
Transfer Accumulator to Index Register	TAIR	1-4			} A=Index Register
Modify by Index Register	MOD	1-4			

INSTRUCTION	OP CODE	A	B	C	REMARKS
<b><u>BRANCH</u></b>					
Branch Unconditional	BRU	Label			
Subroutine Jump	SRJ	Label			
Subroutine Return	SRR	1-4			A=Return Level No.
<b><u>MISCELLANEOUS</u></b>					
No Operation	NOP				
Alarm	ALARM				
Stop	STOP				Return to "Ready" Mode
Check Digit Compute	CDC	2-15	0-9		} A=Accum Digit Pos B=Constant Remainder
Check Digit Verify	CDV	2-15	0-9		

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>PAPER TAPE INPUT</u>					
Read Alpha and Print	RTK	0-255			} A=Max No. of Characters
Read Alpha, Print & Punch	RXTK	0-255			
Read Alpha into Memory & Print	RTKM	0-255			
Read Alpha into Memory, Print & Punch	RXTKM	0-255			
Read Alpha into Memory, Non-Print	REAM	0-255			
Read Alpha into Memory & Punch, Non-Print	RXEAM	0-255			
Read Numeric into Accumulator	RNK	0-15	0-15		
Release Media Clamp	REL				

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>PAPER TAPE OUTPUT</u>					
Type, Punch and Print	XTK	0-255			} A=Max No. of Characters
Type To Memory, Punch and Print	XTKM	0-255			
Enter Alpha into Memory & Punch, Non-Print	XEAM	0-255			
Print Alpha and Punch	XPA	Label			
Punch Alpha from Memory, Non-Print	XA	Label			
Punch Code	XC	0-15	0-15		A=Column of ASCII Table B=Row of ASCII Table
Print and Punch Numeric	XPN	0-14	0-15		} A=Accum Digit Position to Start Punching and Printing B=Print Mask Number
Print and Punch Numeric, Shift Ribbon if minus	XPNS-	0-14	0-15		
Print and Punch Numeric, Shift Ribbon if plus	XPNS+	0-14	0-15		
Punch Numeric, Non-Print	XN	0-14	0-15		
Load Punch Count Register	LXC	0-255			
Modify By Punch Count Register	XMOD				
Punch Feed Codes	XB	0-255			A=255 Less Desired No. of Feed Holes

INSTRUCTION	OP CODE	A	B	C	REMARKS
<b>80 COLUMN CARD INPUT</b>					
Read Card	RCD				Read-in area, words 1-10
Load Memory from Card	LCD	1-255			A=Number of Cards
Load Card Format Register	LCFR	Label			
Transfer Card Columns to Accumulator as Numeric	TRCA	1-16			} A=Format No. in Format Register Table
Print Alpha from Card Read Area	PBA	1-16			
Print & Punch Alpha from Card Read Area	XPBA	1-16			
Punch Alpha from Card Read Area, Non-Print	XBA	1-16			
Transfer Card Columns to Memory as Alpha	TRCM	1-16			

INSTRUCTION	OP CODE	A	B	C	REMARKS
<b>80 COLUMN CARD OUTPUT</b>					
Type and Punch	XTK	0-255			} A=No. of characters
Type Into Memory, Punch and Print	XTKM	0-255			
Type Into Memory and Punch, Non-Print	XEAM	0-255			
Print and Punch Alpha from Memory	XPA	Label			
Punch Alpha from Memory, Non-Print	XA	Label			
Punch Code	XC	0-15	0-15		} A=Accum Digit Position to Start Punching and Printing B=Print Mask Number
Print and Punch Numeric	XPN	0-14	0-15		
Print and Punch Numeric, Shift Ribbon if Minus	XPNS-	0-14	0-15		
Print and Punch Numeric, Shift Ribbon if Plus	XPNS+	0-14	0-15		
Punch Numeric, Non-Print	XN	0-14	0-15		
Load Punch Count Register	LXC	0-255			} A=Card Column
Skip to Column	SKP	1-80			
Duplicate through Column	DUP	1-80			
Alternate Stacking Pocket	ALTP				

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>DATA COMMUNICATION INSTRUCTIONS</u>					
Transfer Receive Buffer	TRB	Label			
Load Receive Buffer Register	LRBR	Label			
Set Receive Character Pointer	RCP	1-255			
Increment Receive Character Pointer	IRCP	1-255			
Transfer to Accumulator as Numeric	TRBA	1-16			
Transfer Alpha	TRF	0-255			
Print Alpha from Receive Buffer	PAB	0-255			
Transfer Send Record Area	TSB	Label			
Load Keyboard Base Register	LKBR	Label			
Set Send Character Pointer	SCP	1-255			
Transfer Accumulator to Send Record Area	TRAB	0-15	0-1		}B=0 No Leading zeros }B=1 Leading zeros Transfer
Transfer Character	TRCB	0-15	0-15		
Type to Memory	TKM	0-255			
Power Off	OFF				
Print Motor Off	POF				}TC700
Print Motor On	PON				

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>DATA COMMUNICATION</u> <u>INSTRUCTIONS (CONTINUED)</u>					
Retrieve Send Address	RSA				
Load Send Address	LSA				
Retrieve Receive Address	RRA				
Load Receive Address	LRA				
Retrieve Expected Transmission Number	RTN				
Load Expected Transmission Number	LTN				
Retrieve Send Transmission Number	RSN				
Load Send Transmission Number	LSN				
Retrieve Header Register	RTH				
Retrieve Character Pointer Register	RPR				
Load Character Pointer Register	LPR				
Retrieve Polled Flags Register	RPF				
Load Polled Flags Register	LPF				



INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>DATA COMMUNICATION</u> <u>INSTRUCTIONS (CONTINUED)</u>					
Retrieve Two/Four Wire Control Word	RTF				
Load Two/Four Wire Control Word	LTF				
Retrieve Expected Broadcast Transmission Number	RBN				
Load Expected Broadcast Transmission Number	LBN				
Retrieve Expected Group Transmission Number	RGN				
Load Expected Group Transmission Number	LGN				

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>STRIPED LEDGER</u>					
Read Ledger	RL	0-5	0-15		<ul style="list-style-type: none"> <li>A = 0 - Read and align to the line number on the stripe.</li> <li>1 - Read and align to the number contained in the Stripe Count Register.</li> <li>2 - Read and align to posting line 1 (the first posting line).</li> <li>3 - Non-read and align to the line number contained in the Stripe Count Register.</li> <li>4 - Read and eject ledger.</li> <li>5 - Read from Auto-Reader.</li> </ul> <p>B = Number of Digits to be indexed with read</p>
Ledger Align	LA				
Eject Ledger	EL				
Retract Ledger Handler	RET				
Write Ledger	WL				
Load Stripe Count Register	LSCR	1-46			} A=Value to be loaded
Load Stripe Limit Register	LSLR	1-46			
Load Stripe Format Register	LSFR	Label			

INSTRUCTION	OP CODE	A	B	C	REMARKS
<b>STRIPED LEDGER (CONTINUED)</b>					
Print Alpha From Stripe Buffer	PAS	1-64			} A=Format Number
Transfer Alpha from Stripe Buffer to Memory	TSBM	1-64			
Transfer Alpha from Memory to Stripe Buffer	TMSB	1-64			
Transfer Numeric from Stripe Buffer to Accumulator	TSBA	1-64	0-1		} A=Format Number B=0 Unsigned 1 Signed
Transfer Accumulator to Stripe Buffer	TASB	1-64	0-1		
Add Stripe Ledger area to Accumulator	ADB	1-64	0-1		
Subtract Stripe Ledger area from Accumulator	SUB	1-64	0-1		

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>PSEUDO INSTRUCTIONS</u>					
Origin	ORG	0-767			
Word	WORD				
Region	REG	1-255			
Numeric Constant	NUM	0-15 Num Digits			0-14 Num Digits When Using Assemb I or VI
Alphanumeric Constant	ALF	0-99 Alpha Char			0-24 Char per Entry or Card
Print Mask	MASK				
Reserve Card Buffer	CDB				Reserves Word 1-10
Establish Data Comm Buffer	ESTB				Label must precede ESTB
Stripe Ledger Format	SLF	1-349	1-15 (Num) 1-63 (Alf)		{ A=Beginning Digit Pos B=Length of Field
Card Format	CDF	1-80	1-80		{ A=Beginning Card Column B=Length of Field
Note	NOTE				Used for additional remarks
Page	PAGE				Advances to next page
Advance Line	ADVL	1-4			A=No of lines to advance

INSTRUCTION	OP CODE	A	B	C	REMARKS
<u>PSEUDO INSTRUCTIONS</u> (CONTINUED)					
Define	DEF	0-767			
Define	DEFT	0-15	0-15		
Equate	EQU	Label			
Code	CODE	4 Hex Digits			
Library Routine	LIB	Label			
Documentation	DOC				
End	END				

INSTRUCTION	OP CODE	A	B	C	REMARKS

### TABLE OF MASK CODES

PRINT FUNCTION	MASK CODE	FIELD ON WHICH SIGNIFICANCE BASED	PRINTED RESULT		PUNCHED RESULTS		
			SIGNIFI- CANT	NOT SIGNIFI- CANT	SIGNIFI- CANT	NOT SIGNIFICANT	
						P-FLAG SET	P-FLAG NOT SET
Digit	D	UNCONDITIONAL	9	0	9	0	0
Decimal Point & Digit	.D	UNCONDITIONAL	.9	.0	9	0	0
Digit & Comma	D,	UNCONDITIONAL	9.	0.	9	0	0
Digit & Decimal Point	D:	UNCONDITIONAL	9.	0.	9	0	0
Leading Zero Suppress	Z	LEADING	9	sp	9	0	TAPE: No Feed CARD: 1 BL Col
Leading Zero Suppress & Comma	Z,	LEADING	9.	sp sp	9	0	
Leading Zero Suppress & Dec. Pt.	Z:	LEADING	9.	sp sp	9	0	
Single Digit Zero Suppression	S	DIGIT	9	sp	9	0	
Units of Cents	C	LEADING & TERMINAL	9	(no sp)	9	0	0
Tens of Cents	.C	LEADING & TERMINAL	.9	(no sp)	9	0	0
Terminal Zero Suppress	X	TERMINAL	9	(no sp)	9	0	0
Dec. Pt. & Terminal Zero Suppress	.X	TERMINAL	.9	(no sp)	9	0	0
Ignore Digit	I	IGNORE	(no sp)	(no sp)	No Effect		
Ignore Digit & End	E	END	(no sp)	(no sp)	No Effect		
MASK FLAGS	FLAG CODE	FLAG AFFECT ON PRINTING			AFFECT ON PUNCHING		
Safeguard	F	Prints safeguard symbol to left of most significant digit			No Effect		
Suppress Punctuation	+	Spaces replace Commas & Decimal Points			No Effect		
Punch Leading Zeros	P	No Effect			Punches leading zeros		
Print In Place	-	Punctuation Without Spacing			No Effect		

## FLAGS

### 1. ACCUMULATOR FLAGS

A	—	Sign
	S	Special
	C	Per Hundred
	M	Per Thousand

### 2. KEYBOARD BUFFER FLAGS

B	2	KB Buffer Filled
	3	KB Buffer Empty

### 3. DATA COMM FLAGS

D	1	Received TR# Not Equal Expected TR#
	2	Message Received
	3	Transmit Ready

### 4. OCK FLAGS

K	1	OCK - 1
	2	OCK - 2
	3	OCK - 3
	4	OCK - 4

### 5. L FLAGS (SHIFT REG)

L	1	
	2	
	3	
	4	

### 6. PUNCH FLAGS

P	1	Media Not Present
	2	Echo Check
	3	Tape Supply
	4	Punch Off

### 7. READER FLAGS

R	1	Reader Condition
	2	Message Received
	3	Transmit Ready
	4	Invalid Code

### 8. STRIPE LEDGER FLAG

S	∅	Not Used
	W	Write Error
	R	Read Error
	F	Filled Sheet

### 9. TEST FLAGS

T	∅	Overflow
	L	Forms Limit
	I	Index Register
	U	Unassigned

### 10. TELLER LOCK FLAGS

V	1	Teller 1
	2	Teller 2
	3	Supervisor
	4	Not Used

### 11. PASSBOOK FLAGS

W	1	Passbook Fold
	2	Last Print Line
	3	Not Used
	4	First Print Line

### 12. GENERAL PURPOSE FLAGS

X Y	1	
	2	
	3	
	4	



## OPERATION CODE AND PARAMETER TO MACHINE CODE

INSTRUCTION	MACHINE LANGUAGE CODE				REF.	INSTRUCTION	MACHINE LANGUAGE CODE				REF.
	OP CODE		PARAMETER				OP CODE		PARAMETER		
	UPPER	LOWER	UPPER	LOWER			UPPER	LOWER	UPPER	LOWER	
ADA	8	8	0-F	0-F	1*	CLM	D	8	0-F	0-F	1*
ADB	A	—	0	0	14.15	CPA	D	A	0-F	0-F	1*
ADIR	5	4	0-F	0-F	2	DIR	5	C	0-F	0-F	2
ADK	8	F	0-E	0-9		DIV	9	A	0-F	0-F	1*
ADM	8	0	0-F	0-F	1	DUP	E	1	0-5	0-F	
AL	E	D	0-F	0-F		EAM	A	9	0-F	0-F	8
ALARM	0	9	8	0		EL	A	7	B	0	
ALR	E	F	0-F	0-F		EX	4	—	—	—	4.5
ALTO	E	9	0-F	0-F		EXE	4	—	—	—	4.5
ALTP	E	5	0	0		EXL	6	—	0-F	0-F	4
AR	E	E	0-F	0-F		EXZ	4	—	D	0	4
ARTO	E	A	0-F	0-F		IIR	5	8	0-F	0-F	2
BRU	7	—	0-F	0-F	3	INK	9	E	0-F	0-F	
CC	E	C	0	0		IRCP	1	A	0-F	0-F	
CDC	B	2	2-F	0-9		LA	A	7	8	0	
CDV	B	3	2-F	0-9		LBN	3	4	A	9	
CHG	6	6	—	—	5	LCD	C	D	0-F	0-F	
CLA	8	E	0-F	0-F							

## OPERATION CODE AND PARAMETER TO MACHINE CODE

INSTRUCTION	MACHINE LANGUAGE CODE				REF.	INSTRUCTION	MACHINE LANGUAGE CODE				REF.
	OP CODE		PARAMETER				OP CODE		PARAMETER		
	UPPER	LOWER	UPPER	LOWER			UPPER	LOWER	UPPER	LOWER	
LCFR	D	C	0-F	0-F	1	LSN	3	4	A	7	
LGN	3	4	A	8		LSR	6	4	2	0-F	
LIR	5	0	0-F	0-F	2	LTF	3	4	A	4	
LKBR	F	0	0-F	0-F	1.10	LTN	3	4	A	6	
LLCR	E	0	0-F	0-F		LXC	0	6	0-F	0-F	
LLLR	E	4	0-F	0-F		MOD	6	0	0	0	2
LOD	6	4	—	—	5	MUL	8	A	0-F	0-F	1*
LPF	3	4	A	D		MULR	8	C	0-F	0-F	1*
LPKR	F	C	0-F	0-F	1	NK	A	6	0-F	0-F	
LPNR	F	8	0-F	0-F	1	NKCM	A	2	0-F	0-F	
LPR	3	2	4	A		NKR	A	4	0-F	0-F	
LRA	3	4	B	1		NKRCM	A	0	0-F	0-F	
LRBR	1	8	0-F	0-F	1.10	NOP	0	8	0	0	
LRCR	E	2	0-F	0-F		OC	E	8	0-F	0-F	
LRLR	E	6	0-F	0-F		OFF	0	9	1	0	
LSA	3	4	B	2							
LSCR	B	7	0	0	16						
LSFR	B	4	0-F	0-F	1						
LSLR	B	7	4	0	16						

## OPERATION CODE AND PARAMETER TO MACHINE CODE

INSTRUCTION	MACHINE LANGUAGE CODE				REF.	INSTRUCTION	MACHINE LANGUAGE CODE				REF.
	OP CODE		PARAMETER				OP CODE		PARAMETER		
	UPPER	LOWER	UPPER	LOWER			UPPER	LOWER	UPPER	LOWER	
PA	C	8	0-F	0-F	1*	RBN	3	C	A	9	
PA	I	8	0-F	0-F	1.13	RCD	C	C	0	0	
PAB	I	D	0-F	0-F	8	RCP	1	C	0-F	0-F	18
PAS	A	5	0	0	15	REAM	B	9	0-F	0-F	8
PBA	B	C	0	0	15	REL	0	1	0	1	
PC	C	0	-	-	19	REM	3	A	4	1	12
PC+	C	4	-	-	19	REM	3	B	4	1	13
PC-	C	5	-	-	19	RET	A	7	C	0	
PCP	C	1	-	-	19	RGN	3	C	A	8	
PKA	F	6	0-F	0-F	7	RL	A	7	0-5	0-F	17
PKB	F	7	0-F	0-F	7	RNK	B	0	0-F	0-F	
PKC	F	5	0-F	0-F	7	RPF	3	C	A	D	
PN	D	4	0-E	0-F		RPR	3	A	4	A	
PNS+	D	0	0-E	0-F		RR	0	7	0	0	
PNS-	D	1	0-E	0-F		RRA	3	C	B	1	
POF	0	1	1	0		RSA	3	C	B	2	
PON	0	1	2	0		RSN	3	C	A	7	
POS	E	B	0-F	0-F	8. 18	RST	6	5	-	-	5
						RTF	3	C	A	4	

## OPERATION CODE AND PARAMETER TO MACHINE CODE

INSTRUCTION	MACHINE LANGUAGE CODE				REF.	INSTRUCTION	MACHINE LANGUAGE CODE				REF.
	OP CODE		PARAMETER				OP CODE		PARAMETER		
	UPPER	LOWER	UPPER	LOWER			UPPER	LOWER	UPPER	LOWER	
RTH	3	C	A	0		STOP	0	0	0	0	
RTK	B	C	0-F	0-F	8	SUA	9	8	0-F	0-F	1*
RTKM	B	D	0-F	0-F	8	SUB	A	—	8	0	14.15
RTN	3	C	A	6		SUK	9	F	0-E	0-9	
RXEAM	B	B	0-F	0-F	8	SUM	9	0	0-F	0-F	1
RXTK	B	E	0-F	0-F	8	TAIR	9	C	0	0-3	6
RXTKM	B	F	0-F	0-F	8	TASB	A	—	C	0	14.15
SCP	1	4	0-F	0-F	18	TK	A	C	0-F	0-F	8
SET	6	7	—	—	5	TKM	A	D	0-F	0-F	8
SK	4	—	—	—	4.5	TMSB	A	5	8	0	15
SKE	4	—	—	—	4.5	TRA	3	8	0-F	0-F	1
SKL	6	—	0-F	0-F	4	TRAB	1	5	0-F	0-1	
SKZ	4	—	D	0	4	TRB	1	E	0	1-F	
SKP	E	3	0-5	0-F		TRBA	1	B	0-1	0-F	
SLRO	0	2	0-E	0-E		TRCA	B	8	0	0	15
SLROS	0	3	0-F	0-F		TRCB	1	6	0-F	0-F	11
SRJ	2	—	0-F	0-F	3	TRCM	B	9	0	0	15
SRR	0	4	0	—	9	TRF	1	7	0-F	0-F	

## OPERATION CODE AND PARAMETER TO MACHINE CODE

INSTRUCTION	MACHINE LANGUAGE CODE				REF.	INSTRUCTION	MACHINE LANGUAGE CODE				REF.
	OP CODE		PARAMETER				OP CODE		PARAMETER		
	UPPER	LOWER	UPPER	LOWER			UPPER	LOWER	UPPER	LOWER	
TRM	3	0	0-F	0-F	1	XTK	A	E	0-F	0-F	8
TSB	1	F	0	1-F		XTKM	A	F	0-F	0-F	8
TSBA	A		4	0	14,15						
TSBM	A	5	4	0	15						
WL	A	7	A	0							
XA	C	6	0-F	0-F	1*						
XB	0	C	0-F	0-F							
XBA	B	A	0	0	15						
XC	C	2	0-F	0-F	11						
XEAM	A	B	0-F	0-F	8						
XMOD	0	A	0	0							
XN	D	7	0-E	0-F							
XPA	C	A	0-F	0-F	1°						
XPA	1	C	0-F	0-F	1,13						
XPBA	B	E	0	0	15						
XPN	D	6	0-E	0-F							
XPNS+	D	2	0-E	0-F							
XPNS-	D	3	0-E	0-F							

**REFERENCE**

1. Modify LOWER OP CODE as follows:

<u>WORD NO.</u>	<u>ADD TO LOWER OP CODE</u>
0-255	0
256-511	1
512-767	2

\*These instructions are restricted to referencing words 0 to 511 of user memory.

2. Modify LOWER OP CODE as follows:

<u>INDEX REG NO.</u>	<u>ADD TO LOWER OP CODE</u>
1	1
2	2
3	3
4	0

3. LOWER OP CODE is determined as follows:

<u>WORD NO.</u>	<u>SYLLABLE</u>	<u>LOWER OP CODE</u>
0-255	0	0
	1	4
	2	8
	3	C
256-511	0	1
	1	5
	2	9
	3	D
512-767	0	2
	1	6
	2	A
	3	E

4. LOWER OP CODE is derived from table below.

NO. OF INSTRUCT.	LOWER OP CODE			
	SK/SKZ	EX/EXZ	SKE/SKL	EXE/EXL
1	1	5	9	D
2	2	6	A	E
3	3	7	B	F
4	0	4	8	C

5. (A) UPPER PARAMETER is determined as follows:

<u>FLAG TYPE</u>	<u>FLAG GROUP</u>	<u>UPPER PARAMETER</u>
ACCUMULATOR	A	C
KEYBOARD	B	3
DATA COMM	D	A
OCK	K	9
L (Shift Reg)	L	2
PUNCH	P	1
READER	R	0
STRIPE LEDGER	S	B
TEST	T	8
TELLER LOCK	V	F
PASSBOOK	W	E
X FLAGS	X	4
Y FLAGS	Y	5

- (B) LOWER PARAMETER is determined as follows:

<u>FLAG</u>	<u>LOWER PARAMETER</u>
- Ø Ø 4	1
S L W 1	2
C I R 2	4
M U F 3	8

6. Modify LOWER PARAMETER as follows:

<u>INDEX REG. NO.</u>	<u>LOWER PARAMETER</u>
1	1
2	2
3	3
4	0

7. PK PARAMETER is determined as follows:

	<u>UPPER</u>	<u>LOWER</u>
PROGRAM KEY	8 7 6 5	4 3 2 1
VALUE	8 4 2 1	8 4 2 1

8. PARAMETER LIMIT is determined as follows:

	<u>LIMIT</u>
15 INCH FORMS TRANSPORT	0-150
26 INCH FORMS TRANSPORT	0-255

9. LOWER PARAMETER is determined as follows:

SRR RETURN LEVEL	1 2 3 4
MACHINE CODE	0 1 2 3

10. Use UPPER and LOWER PARAMETER of 0 (zero) to indicate Data Comm Processor send or receive buffer.

11. UPPER and LOWER PARAMETERS are determined as follows:

UPPER PARAMETER	Column No. of ASCII Table
LOWER PARAMETER	Row No. of ASCII Table

12. For 32 track systems.

13. For 40 track systems.

14. LOWER OP CODE is determined as follows:

Unsigned	1
Signed	3

15. Add hexadecimal value of the Format Number, minus 1, to the PARAMETER.

16. Add hexadecimal value of Line Number, minus 1, to the PARAMETER.

17. UPPER PARAMETER is determined as follows:

- 0 Read and align to the line number on the stripe.
- 1 Read and align to the line number contained in the Stripe Count Register.
- 2 Read and align to the first posting line.
- 3 Non-read and align to the line number contained in the Stripe count Register.
- 4 Read and eject ledger.
- 5 Read from Auto-Reader.

18. The Machine Code for the UPPER and LOWER PARAMETER is the hexadecimal value of the "A" PARAMETER minus 1.

19. PC character codes are determined from the following chart:

Character	Internal Code	Indexing Value	Character	Internal Code	Indexing Value	Character	Internal Code	Indexing Value	Character	Internal Code	Indexing Value
End of Alpha (NUL)	0 0	0									
Space	2 0	32	0	3 0	48	@	4 0	64	P	5 0	80
!	2 1	33	1	3 1	49	A	4 1	65	Q	5 1	81
"	2 2	34	2	3 2	50	B	4 2	66	R	5 2	82
#	2 3	35	3	3 3	51	C	4 3	67	S	5 3	83
\$	2 4	36	4	3 4	52	D	4 4	68	T	5 4	84
%	2 5	37	5	3 5	53	E	4 5	69	U	5 5	85
&	2 6	38	6	3 6	54	F	4 6	70	V	5 6	86
'	2 7	39	7	3 7	55	G	4 7	71	W	5 7	87
(	2 8	40	8	3 8	56	H	4 8	72	X	5 8	88
)	2 9	41	9	3 9	57	I	4 9	73	Y	5 9	89
*	2 A	42	:	3 A	58	J	4 A	74	Z	5 A	90
+	2 B	43	;	3 B	59	K	4 B	75	[(%]	5 B	91
,	2 C	44	< (½)	3 C	60	L	4 C	76	\ (ð)	5 C	92
-	2 D	45	=	3 D	61	M	4 D	77	] (CR)	5 D	93
.	2 E	46	> (¾)	3 E	62	N	4 E	78	^ (°)	5 E	94
/	2 F	47	?	3 F	63	O	4 F	79	~ (◇)	5 F	95
									DEL	7 F	127



**PRINT MASK (MASK)**Mask Position 0-14Flag Position 15

MASK CHAR	C	E	S	I	X	Z	D	C	D	Z	D	X	Z	D	+	P	-	F		
HEX CODE	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	1	2	4	8

**CDV/CDC TABLE**

DIGIT POSITION	POSITIONS																				
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0					
	Next Word LOC		Mod				Digit Values														
TABLE ENTRY 1	0	1	5	5	F	F	8	1	5	9	2	6	A	3	7	0					
TABLE ENTRY 2	0	2	5	5	F	F	5	2	A	7	4	1	9	6	3	0					
TABLE ENTRY 3	0	0	5	5	F	F	9	8	7	6	5	4	3	2	1	0					

Sample CDV/CDC Table - 1, 3, 7 Modulus 11 Method

**CARD FORMAT TABLE (CDF)**

A Parameter				B Parameter											
Starting Card Column of Field				Number of Card Columns in Field											
8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
3				2				1				0			





## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO OP		PARAMETER FIELD		DEC. EQUIV.	ADD TO OP		PARAMETER FIELD		DEC. EQUIV.	ADD TO OP		PARAMETER FIELD			
	L	U	L	L		L	U	L	L		L	U	L			
0	0	0	0	0	32	0	2	0	64	0	4	0	96	0	6	0
1	0	0	0	1	33	0	2	1	65	0	4	1	97	0	6	1
2	0	0	0	2	34	0	2	2	66	0	4	2	98	0	6	2
3	0	0	0	3	35	0	2	3	67	0	4	3	99	0	6	3
4	0	0	0	4	36	0	2	4	68	0	4	4	100	0	6	4
5	0	0	0	5	37	0	2	5	69	0	4	5	101	0	6	5
6	0	0	0	6	38	0	2	6	70	0	4	6	102	0	6	6
7	0	0	0	7	39	0	2	7	71	0	4	7	103	0	6	7
8	0	0	0	8	40	0	2	8	72	0	4	8	104	0	6	8
9	0	0	0	9	41	0	2	9	73	0	4	9	105	0	6	9
10	0	0	0	A	42	0	2	A	74	0	4	A	106	0	6	A
11	0	0	0	B	43	0	2	B	75	0	4	B	107	0	6	B
12	0	0	0	C	44	0	2	C	76	0	4	C	108	0	6	C
13	0	0	0	D	45	0	2	D	77	0	4	D	109	0	6	D
14	0	0	0	E	46	0	2	E	78	0	4	E	110	0	6	E
15	0	0	0	F	47	0	2	F	79	0	4	F	111	0	6	F
16	0	1	0		48	0	3	0	80	0	5	0	112	0	7	0
17	0	1	1		49	0	3	1	81	0	5	1	113	0	7	1
18	0	1	2		50	0	3	2	82	0	5	2	114	0	7	2
19	0	1	3		51	0	3	3	83	0	5	3	115	0	7	3
20	0	1	4		52	0	3	4	84	0	5	4	116	0	7	4
21	0	1	5		53	0	3	5	85	0	5	5	117	0	7	5
22	0	1	6		54	0	3	6	86	0	5	6	118	0	7	6
23	0	1	7		55	0	3	7	87	0	5	7	119	0	7	7
24	0	1	8		56	0	3	8	88	0	5	8	120	0	7	8
25	0	1	9		57	0	3	9	89	0	5	9	121	0	7	9
26	0	1	A		58	0	3	A	90	0	5	A	122	0	7	A
27	0	1	B		59	0	3	B	91	0	5	B	123	0	7	B
28	0	1	C		60	0	3	C	92	0	5	C	124	0	7	C
29	0	1	D		61	0	3	D	93	0	5	D	125	0	7	D
30	0	1	E		62	0	3	E	94	0	5	E	126	0	7	E
31	0	1	F		63	0	3	F	95	0	5	F	127	0	7	F

## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO		PARAMETER		DEC. EQUIV.	ADD TO		PARAMETER		DEC. EQUIV.	ADD TO		PARAMETER			
	OP		FIELD			OP		FIELD				OP		FIELD		
	L	U	L		L	U	L		L	U	L		L	U	L	
128	0		8	0	160	0	A	0	192	0	C	0	224	0	E	0
129	0		8	1	161	0	A	1	193	0	C	1	225	0	E	1
130	0		8	2	162	0	A	2	194	0	C	2	226	0	E	2
131	0		8	3	163	0	A	3	195	0	C	3	227	0	E	3
132	0		8	4	164	0	A	4	196	0	C	4	228	0	E	4
133	0		8	5	165	0	A	5	197	0	C	5	229	0	E	5
134	0		8	6	166	0	A	6	198	0	C	6	230	0	E	6
135	0		8	7	167	0	A	7	199	0	C	7	231	0	E	7
136	0		8	8	168	0	A	8	200	0	C	8	232	0	E	8
137	0		8	9	169	0	A	9	201	0	C	9	233	0	E	9
138	0		8	A	170	0	A	A	202	0	C	A	234	0	E	A
139	0		8	B	171	0	A	B	203	0	C	B	235	0	E	B
140	0		8	C	172	0	A	C	204	0	C	C	236	0	E	C
141	0		8	D	173	0	A	D	205	0	C	D	237	0	E	D
142	0		8	E	174	0	A	E	206	0	C	E	238	0	E	E
143	0		8	F	175	0	A	F	207	0	C	F	239	0	E	F
144	0		9	0	176	0	B	0	208	0	D	0	240	0	F	0
145	0		9	1	177	0	B	1	209	0	D	1	241	0	F	1
146	0		9	2	178	0	B	2	210	0	D	2	242	0	F	2
147	0		9	3	179	0	B	3	211	0	D	3	243	0	F	3
148	0		9	4	180	0	B	4	212	0	D	4	244	0	F	4
149	0		9	5	181	0	B	5	213	0	D	5	245	0	F	5
150	0		9	6	182	0	B	6	214	0	D	6	246	0	F	6
151	0		9	7	183	0	B	7	215	0	D	7	247	0	F	7
152	0		9	8	184	0	B	8	216	0	D	8	248	0	F	8
153	0		9	9	185	0	B	9	217	0	D	9	249	0	F	9
154	0		9	A	186	0	B	A	218	0	D	A	250	0	F	A
155	0		9	B	187	0	B	B	219	0	D	B	251	0	F	B
156	0		9	C	188	0	B	C	220	0	D	C	252	0	F	C
157	0		9	D	189	0	B	D	221	0	D	D	253	0	F	D
158	0		9	E	190	0	B	E	222	0	D	E	254	0	F	E
159	0		9	F	191	0	B	F	223	0	D	F	255	0	F	F

## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO OP		PARAMETER FIELD		DEC. EQUIV.	ADD TO OP		PARAMETER FIELD		DEC. EQUIV.	ADD TO OP		PARAMETER FIELD					
	L	U	L	L		U	L	L	U		L	L	U	L				
256	1	0	0		288	1	2	0		320	1	4	0		352	1	6	0
257	1	0	1		289	1	2	1		321	1	4	1		353	1	6	1
258	1	0	2		290	1	2	2		322	1	4	2		354	1	6	2
259	1	0	3		291	1	2	3		323	1	4	3		355	1	6	3
260	1	0	4		292	1	2	4		324	1	4	4		356	1	6	4
261	1	0	5		293	1	2	5		325	1	4	5		357	1	6	5
262	1	0	6		294	1	2	6		326	1	4	6		358	1	6	6
263	1	0	7		295	1	2	7		327	1	4	7		359	1	6	7
264	1	0	8		296	1	2	8		328	1	4	8		360	1	6	8
265	1	0	9		297	1	2	9		329	1	4	9		361	1	6	9
266	1	0	A		298	1	2	A		330	1	4	A		362	1	6	A
267	1	0	B		299	1	2	B		331	1	4	B		363	1	6	B
268	1	0	C		300	1	2	C		332	1	4	C		364	1	6	C
269	1	0	D		301	1	2	D		333	1	4	D		365	1	6	D
270	1	0	E		302	1	2	E		334	1	4	E		366	1	6	E
271	1	0	F		303	1	2	F		335	1	4	F		367	1	6	F
272	1	1	0		304	1	3	0		336	1	5	0		368	1	7	0
273	1	1	1		305	1	3	1		337	1	5	1		369	1	7	1
274	1	1	2		306	1	3	2		338	1	5	2		370	1	7	2
275	1	1	3		307	1	3	3		339	1	5	3		371	1	7	3
276	1	1	4		308	1	3	4		340	1	5	4		372	1	7	4
277	1	1	5		309	1	3	5		341	1	5	5		373	1	7	5
278	1	1	6		310	1	3	6		342	1	5	6		374	1	7	6
279	1	1	7		311	1	3	7		343	1	5	7		375	1	7	7
280	1	1	8		312	1	3	8		344	1	5	8		376	1	7	8
281	1	1	9		313	1	3	9		345	1	5	9		377	1	7	9
282	1	1	A		314	1	3	A		346	1	5	A		378	1	7	A
283	1	1	B		315	1	3	B		347	1	5	B		379	1	7	B
284	1	1	C		316	1	3	C		348	1	5	C		380	1	7	C
285	1	1	D		317	1	3	D		349	1	5	D		381	1	7	D
286	1	1	E		318	1	3	E		350	1	5	E		382	1	7	E
287	1	1	F		319	1	3	F		351	1	5	F		383	1	7	F

## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO OP		PARAMETER FIELD			DEC. EQUIV.	ADD TO OP		PARAMETER FIELD			DEC. EQUIV.	ADD TO OP		PARAMETER FIELD		
	L	U	L	L	U		L	L	U	L	L		U	L			
384	1	8	0	416	1	A	0	448	1	C	0	480	1	E	0		
385	1	8	1	417	1	A	1	449	1	C	1	481	1	E	1		
386	1	8	2	418	1	A	2	450	1	C	2	482	1	E	2		
387	1	8	3	419	1	A	3	451	1	C	3	483	1	E	3		
388	1	8	4	420	1	A	4	452	1	C	4	484	1	E	4		
389	1	8	5	421	1	A	5	453	1	C	5	485	1	E	5		
390	1	8	6	422	1	A	6	454	1	C	6	486	1	E	6		
391	1	8	7	423	1	A	7	455	1	C	7	487	1	E	7		
392	1	8	8	424	1	A	8	456	1	C	8	488	1	E	8		
393	1	8	9	425	1	A	9	457	1	C	9	489	1	E	9		
394	1	8	A	426	1	A	A	458	1	C	A	490	1	E	A		
395	1	8	B	427	1	A	B	459	1	C	B	491	1	E	B		
396	1	8	C	428	1	A	C	460	1	C	C	492	1	E	C		
397	1	8	D	429	1	A	D	461	1	C	D	493	1	E	D		
398	1	8	E	430	1	A	E	462	1	C	E	494	1	E	E		
399	1	8	F	431	1	A	F	463	1	C	F	495	1	E	F		
400	1	9	0	432	1	B	0	464	1	D	0	496	1	F	0		
401	1	9	1	433	1	B	1	465	1	D	1	497	1	F	1		
402	1	9	2	434	1	B	2	466	1	D	2	498	1	F	2		
403	1	9	3	435	1	B	3	467	1	D	3	499	1	F	3		
404	1	9	4	436	1	B	4	468	1	D	4	500	1	F	4		
405	1	9	5	437	1	B	5	469	1	D	5	501	1	F	5		
406	1	9	6	438	1	B	6	470	1	D	6	502	1	F	6		
407	1	9	7	439	1	B	7	471	1	D	7	503	1	F	7		
408	1	9	8	440	1	B	8	472	1	D	8	504	1	F	8		
409	1	9	9	441	1	B	9	473	1	D	9	505	1	F	9		
410	1	9	A	442	1	B	A	474	1	D	A	506	1	F	A		
411	1	9	B	443	1	B	B	475	1	D	B	507	1	F	B		
412	1	9	C	444	1	B	C	476	1	D	C	508	1	F	C		
413	1	9	D	445	1	B	D	477	1	D	D	509	1	F	D		
414	1	9	E	446	1	B	E	478	1	D	E	510	1	F	E		
415	1	9	F	447	1	B	F	479	1	D	F	511	1	F	F		

## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO		PARAMETER			DEC. EQUIV.	ADD TO		PARAMETER			DEC. EQUIV.	ADD TO		PARAMETER			
	OP		FIELD				OP		FIELD				OP		FIELD			
	L	U	L			L	U	L			L	U	L			L	U	L
512	2	0	0		544	2	2	0		576	2	4	0		608	2	6	0
513	2	0	1		545	2	2	1		577	2	4	1		609	2	6	1
514	2	0	2		546	2	2	2		578	2	4	2		610	2	6	2
515	2	0	3		547	2	2	3		579	2	4	3		611	2	6	3
516	2	0	4		548	2	2	4		580	2	4	4		612	2	6	4
517	2	0	5		549	2	2	5		581	2	4	5		613	2	6	5
518	2	0	6		550	2	2	6		582	2	4	6		614	2	6	6
519	2	0	7		551	2	2	7		583	2	4	7		615	2	6	7
520	2	0	8		552	2	2	8		584	2	4	8		616	2	6	8
521	2	0	9		553	2	2	9		585	2	4	9		617	2	6	9
522	2	0	A		554	2	2	A		586	2	4	A		618	2	6	A
523	2	0	B		555	2	2	B		587	2	4	B		619	2	6	B
524	2	0	C		556	2	2	C		588	2	4	C		620	2	6	C
525	2	0	D		557	2	2	D		589	2	4	D		621	2	6	D
526	2	0	E		558	2	2	E		590	2	4	E		622	2	6	E
527	2	0	F		559	2	2	F		591	2	4	F		623	2	6	F
528	2	1	0		560	2	3	0		592	2	5	0		624	2	7	0
529	2	1	1		561	2	3	1		593	2	5	1		625	2	7	1
530	2	1	2		562	2	3	2		594	2	5	2		626	2	7	2
531	2	1	3		563	2	3	3		595	2	5	3		627	2	7	3
532	2	1	4		564	2	3	4		596	2	5	4		628	2	7	4
533	2	1	5		565	2	3	5		597	2	5	5		629	2	7	5
534	2	1	6		566	2	3	6		598	2	5	6		630	2	7	6
535	2	1	7		567	2	3	7		599	2	5	7		631	2	7	7
536	2	1	8		568	2	3	8		600	2	5	8		632	2	7	8
537	2	1	9		569	2	3	9		601	2	5	9		633	2	7	9
538	2	1	A		570	2	3	A		602	2	5	A		634	2	7	A
539	2	1	B		571	2	3	B		603	2	5	B		635	2	7	B
540	2	1	C		572	2	3	C		604	2	5	C		636	2	7	C
541	2	1	D		573	2	3	D		605	2	5	D		637	2	7	D
542	2	1	E		574	2	3	E		606	2	5	E		638	2	7	E
543	2	1	F		575	2	3	F		607	2	5	F		639	2	7	F



## DECIMAL TO HEXADECIMAL CONVERSION TABLE

DEC. EQUIV.	ADD TO		PARAMETER FIELD	DEC. EQUIV.	ADD TO		PARAMETER FIELD	DEC. EQUIV.	ADD TO		PARAMETER FIELD	DEC. EQUIV.	ADD TO		PARAMETER FIELD
	OP				OP				OP				OP		
	L	U	L		L	U	L		L	U	L		L	U	L
640	2	8	0	672	2	A	0	704	2	C	0	736	2	E	0
641	2	8	1	673	2	A	1	705	2	C	1	737	2	E	1
642	2	8	2	674	2	A	2	706	2	C	2	738	2	E	2
643	2	8	3	675	2	A	3	707	2	C	3	739	2	E	3
644	2	8	4	676	2	A	4	708	2	C	4	740	2	E	4
645	2	8	5	677	2	A	5	709	2	C	5	741	2	E	5
646	2	8	6	678	2	A	6	710	2	C	6	742	2	E	6
647	2	8	7	679	2	A	7	711	2	C	7	743	2	E	7
648	2	8	8	680	2	A	8	712	2	C	8	744	2	E	8
649	2	8	9	681	2	A	9	713	2	C	9	745	2	E	9
650	2	8	A	682	2	A	A	714	2	C	A	746	2	E	A
651	2	8	B	683	2	A	B	715	2	C	B	747	2	E	B
652	2	8	C	684	2	A	C	716	2	C	C	748	2	E	C
653	2	8	D	685	2	A	D	717	2	C	D	749	2	E	D
654	2	8	E	686	2	A	E	718	2	C	E	750	2	E	E
655	2	8	F	687	2	A	F	719	2	C	F	751	2	E	F
656	2	9	0	688	2	B	0	720	2	D	0	752	2	F	0
657	2	9	1	689	2	B	1	721	2	D	1	753	2	F	1
658	2	9	2	690	2	B	2	722	2	D	2	754	2	F	2
659	2	9	3	691	2	B	3	723	2	D	3	755	2	F	3
660	2	9	4	692	2	B	4	724	2	D	4	756	2	F	4
661	2	9	5	693	2	B	5	725	2	D	5	757	2	F	5
662	2	9	6	694	2	B	6	726	2	D	6	758	2	F	6
663	2	9	7	695	2	B	7	727	2	D	7	759	2	F	7
664	2	9	8	696	2	B	8	728	2	D	8	760	2	F	8
665	2	9	9	697	2	B	9	729	2	D	9	761	2	F	9
666	2	9	A	698	2	B	A	730	2	D	A	762	2	F	A
667	2	9	B	699	2	B	B	731	2	D	B	763	2	F	B
668	2	9	C	700	2	B	C	732	2	D	C	764	2	F	C
669	2	9	D	701	2	B	D	733	2	D	D	765	2	F	D
670	2	9	E	702	2	B	E	734	2	D	E	766	2	F	E
671	2	9	F	703	2	B	F	735	2	D	F	767	2	F	F

USASCI						EBCDIC				BCL			
PAPER TAPE CODE			USASCII CHARACTER	7 BIT IN-TERNAL CODE		L & TC GRAPHIC	INDEX REGISTER VALUE	GRAPHIC CHARACTER	CARD CODE	KEY	GRAPHIC CHARACTER	CARD CODE	KEY
P	7	5		COL.	ROW								
		•	NUL	0	0	End of Alpha	00	NUL	12-0-9-8-1	m			
•		•	SOH	0	1		01	SOH	12-9-1	m			
•		•	STX	0	2		02	STX	12-9-2	m			
•		•	ETX	0	3		03	ETX	12-9-3	m			
•		•	EOT	0	4		04	EOT	9-7	m			
		•	ENQ	0	5		05	ENQ	0-9-8-5	m			
		•	ACK	0	6		06	ACK	0-9-8-6	m			
•		•	BEL	0	7		07	BEL	0-9-8-7	m			
•		•	BS	0	8		08	BS	11-9-6	m			
		•	HT	0	9		09	HT	12-9-5	m			
		•	LF	0	A		10	LF	0-9-5	m			
•		•	VT	0	B		11	VT	12-9-8-3	m			
		•	FF	0	C		12	FF	12-9-8-4	m			
•		•	CR	0	D		13	CR	12-9-8-5	m			
•		•	SO	0	E		14	SO	12-9-8-6	m			
•		•	SI	0	F		15	SI	12-9-8-7	m			
•		•	DLE	1	0		16	DLE	12-11-9-8-1	m			
		•	DC1	1	1		17	DC1	11-9-1	m			
		•	DC2	1	2		18	DC2	11-9-2	m			
•		•	DC3	1	3		19	DC3	11-9-3	m			
		•	DC4	1	4		20	DC4	9-8-4	m			
•		•	NAK	1	5		21	NAK	9-8-5	m			
•		•	SYN	1	6		22	SYN	9-2	m			
		•	ETB	1	7		23	ETB	0-9-6	m			
		•	CAN	1	8		24	CAN	11-9-8	m			
•		•	EM	1	9		25	EM	11-9-8-1	m			
•		•	SUB	1	A		26	SUB	9-8-7	m			
		•	ESC	1	B		27	ESC	0-9-7	m			
•		•	FS	1	C		28	FS	11-9-8-4	m			
		•	GS	1	D		29	GS	11-9-8-5	m			
		•	RS	1	E		30	RS	11-9-8-6	m			
		•	US	1	F		31	US	11-9-8-7	m			

KEY: \* - Keys Punch Correct Card Code  
 † - Keys on EBCDIC Keypunch Punch Correct Code Multipunch on BCL Keypunch  
 M - Multipunch on BCL and EBCDIC Keypunch

PAPER TAPE CODE						USASCII				EBCDIC			BCL						
						USASCII CHARAC-TER	7 BIT IN-TERNAL CODE		L & TC GRAPHIC	INDEX REGISTER VALUE	GRAPHIC CHARAC-TER	CARD CODE	KEY	GRAPHIC CHARAC-TER	CARD CODE	KEY			
P	7	6	5	4	F	3	2	1	TER	COL.	ROW	GRAPHIC	TER	CARD CODE	KEY	GRAPHIC	TER	CARD CODE	KEY
●	●	●	●	●	●				SP	2	0	SP	32	SP	Blank	*	SP	Blank	*
	●	●	●	●	●				!	2	1	!	33	!	11-0	m	x	11-0	m
	●	●	●	●	●				"	2	2	"	34	"	8-7	‡	"	0-8-7	m
●	●	●	●	●	●				#	2	3	#	35	#	8-3	*	#	8-3	*
●	●	●	●	●	●				S	2	4	S	36	S	11-8-3	*	S	11-8-3	*
●	●	●	●	●	●				%	2	5	%	37	%	0-8-4	*	%	0-8-4	*
●	●	●	●	●	●				&	2	6	&	38	&	12	*	&	12	*
	●	●	●	●	●				'	2	7	'	39	'	8-5	‡	≥	8-7	m
●	●	●	●	●	●				(	2	8	(	40	(	12-8-5	‡	(	12-8-5	‡
●	●	●	●	●	●				)	2	9	)	41	)	11-8-5	‡	)	11-8-5	‡
●	●	●	●	●	●				*	2	A	*	42	*	11-8-4	*	*	11-8-4	*
●	●	●	●	●	●				+	2	B	+	43	+	12-0	m	+	12-0	m
●	●	●	●	●	●				.	2	C	.	44	.	0-8-3	*	.	0-8-3	*
	●	●	●	●	●				-	2	D	-	45	-	11	*	-	11	*
	●	●	●	●	●				.	2	E	.	46	.	12-8-3	*	.	12-8-3	*
●	●	●	●	●	●				/	2	F	/	47	/	0-1	*	/	0-1	*
●	●	●	●	●	●				0	3	0	0	48	0	0	*	0	0	*
●	●	●	●	●	●				1	3	1	1	49	1	1	*	1	1	*
●	●	●	●	●	●				2	3	2	2	50	2	2	*	2	2	*
●	●	●	●	●	●				3	3	3	3	51	3	3	*	3	3	*
●	●	●	●	●	●				4	3	4	4	52	4	4	*	4	4	*
	●	●	●	●	●				5	3	5	5	53	5	5	*	5	5	*
	●	●	●	●	●				6	3	6	6	54	6	6	*	6	6	*
●	●	●	●	●	●				7	3	7	7	55	7	7	*	7	7	*
●	●	●	●	●	●				8	3	8	8	56	8	8	*	8	8	*
●	●	●	●	●	●				9	3	9	9	57	9	9	*	9	9	*
	●	●	●	●	●				:	3	A	:	58	:	8-2	‡	:	8-5	m
●	●	●	●	●	●				:	3	B	:	59	:	11-8-6	‡	:	11-8-6	‡
●	●	●	●	●	●				<	3	C	< or ½	60	<	12-8-4	‡	<	12-8-6	m
●	●	●	●	●	●				=	3	D	=	61	=	8-6	‡	=	0-8-5	m
●	●	●	●	●	●				>	3	E	> or ¼	62	>	0-8-6	‡	>	8-6	m
●	●	●	●	●	●				?	3	F	?	63	?	0-8-7	‡	?	All Other Codes	

KEY: \* - Keys Punch Correct Card Code  
‡ - Keys on EBCDIC Keypunch Punch Correct Code Multipunch on BCL Keypunch  
M - Multipunch on BCL and EBCDIC Keypunch

PAPER TAPE CODE							USASCII				EBCDIC			BCL					
P	7	6	5	4	F	3	2	1	USASCII CHARACTERS	7 BIT INTERNAL CODE		L & TC GRAPHIC	INDEX REGISTER VALUE	GRAPHIC CHARACTER	CARD CODE	KEY	GRAPHIC CHARACTER	CARD CODE	KEY
								COL.		ROW									
•	•				•				U	4	0	U	64	U	8-4	*	U	8-4	*
	•				•			•	A	4	1	A	65	A	12-1	*	A	12-1	*
		•			•			•	B	4	2	B	66	B	12-2	*	B	12-2	*
•	•				•			•	C	4	3	C	67	C	12-3	*	C	12-3	*
	•				•			•	D	4	4	D	68	D	12-4	*	D	12-4	*
•	•				•			•	E	4	5	E	69	E	12-5	*	E	12-5	*
•	•				•			•	F	4	6	F	70	F	12-6	*	F	12-6	*
	•				•			•	G	4	7	G	71	G	12-7	*	G	12-7	*
		•			•			•	H	4	8	H	72	H	12-8	*	H	12-8	*
•	•				•			•	I	4	9	I	73	I	12-9	*	I	12-9	*
•	•				•			•	J	4	A	J	74	J	11-1	*	J	11-1	*
	•				•			•	K	4	B	K	75	K	11-2	*	K	11-2	*
•	•				•			•	L	4	C	L	76	L	11-3	*	L	11-3	*
	•				•			•	M	4	D	M	77	M	11-4	*	M	11-4	*
		•			•			•	N	4	E	N	78	N	11-5	*	N	11-5	*
•	•				•			•	O	4	F	O	79	O	11-6	*	O	11-6	*
	•				•			•	P	5	0	P	80	P	11-7	*	P	11-7	*
•	•				•			•	Q	5	1	Q	81	Q	11-8	*	Q	11-8	*
•	•				•			•	R	5	2	R	82	R	11-9	*	R	11-9	*
	•				•			•	S	5	3	S	83	S	0-2	*	S	0-2	*
•	•				•			•	T	5	4	T	84	T	0-3	*	T	0-3	*
	•				•			•	U	5	5	U	85	U	0-4	*	U	0-4	*
		•			•			•	V	5	6	V	86	V	0-5	*	V	0-5	*
•	•				•			•	W	5	7	W	87	W	0-6	*	W	0-6	*
•	•				•			•	X	5	8	X	88	X	0-7	*	X	0-7	*
	•				•			•	Y	5	9	Y	89	Y	0-8	*	Y	0-8	*
		•			•			•	Z	5	A	Z	90	Z	0-9	*	Z	0-9	*
•	•				•			•	[	5	B	[ or ¼	91	[	12-8-2	m	[	12-8-4	m
	•				•			•	\	5	C	\ or ø	92	⌋	11-8-7	‡	≤	11-8-7	m
•	•				•			•	]	5	D	] or CR	93	]	11-8-2	m	]	0-8-6	m
•	•				•			•	^	5	E	^ or °	94	+	12-8-6	‡			
	•				•			•	_	5	F	_	95	-	0-8-5	‡	≠	0-8-2	m

KEY: \* - Keys Punch Correct Card Code  
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M - Multipunch on BCL and EBCDIC Keypunch

PAPER TAPE CODE						USASCII				EBCDIC			BCL						
P	7	6	5	4	F	3	2	1	USASCII CHARAC-TER	7 BIT INTERNAL CODE COL.	7 BIT INTERNAL CODE ROW	L & TC GRAPHIC	INDEX REGISTER VALUE	GRAPHIC CHARAC-TER	CARD CODE	KEY	GRAPHIC CHARAC-TER	CARD CODE	KEY
•••••	•								\	6	0	\	96	\	8-1	m			
•••••	•							•	a	6	1	a	97	a	12-0-1	m			
•••••	•	•						•	b	6	2	b	98	b	12-0-2	m			
•••••	•	•	•					••	c	6	3	c	99	c	12-0-3	m			
•••••	•	•	•	•				•••	d	6	4	d	100	d	12-0-4	m			
•••••	•	•	•	•	•			••••	e	6	5	e	101	e	12-0-5	m			
•••••	•	•	•	•	•	•		•••••	f	6	6	f	102	f	12-0-6	m			
•••••	•	•	•	•	•	•		•••••	g	6	7	g	103	g	12-0-7	m			
•••••	•	•	•	•	•	•		•••••	h	6	8	h	104	h	12-0-8	m			
•••••	•	•	•	•	•	•		•••••	i	6	9	i	105	i	12-0-9	m			
•••••	•	•	•	•	•	•		•••••	j	6	A	j	106	j	12-11-1	m			
•••••	•	•	•	•	•	•		•••••	k	6	B	k	107	k	12-11-2	m			
•••••	•	•	•	•	•	•		•••••	l	6	C	l	108	l	12-11-3	m			
•••••	•	•	•	•	•	•		•••••	m	6	D	m	109	m	12-11-4	m			
•••••	•	•	•	•	•	•		•••••	n	6	E	n	110	n	12-11-5	m			
•••••	•	•	•	•	•	•		•••••	o	6	F	o	111	o	12-11-6	m			
•••••	•	•	•	•	•	•		•••••	p	7	0	p	112	p	12-11-7	m			
•••••	•	•	•	•	•	•		•••••	q	7	1	q	113	q	12-11-8	m			
•••••	•	•	•	•	•	•		•••••	r	7	2	r	114	r	12-11-9	m			
•••••	•	•	•	•	•	•		•••••	s	7	3	s	115	s	11-0-2	m			
•••••	•	•	•	•	•	•		•••••	t	7	4	t	116	t	11-0-3	m			
•••••	•	•	•	•	•	•		•••••	u	7	5	u	117	u	11-0-4	m			
•••••	•	•	•	•	•	•		•••••	v	7	6	v	118	v	11-0-5	m			
•••••	•	•	•	•	•	•		•••••	w	7	7	w	119	w	11-0-6	m			
•••••	•	•	•	•	•	•		•••••	x	7	8	x	120	x	11-0-7	m			
•••••	•	•	•	•	•	•		•••••	y	7	9	y	121	y	11-0-8	m			
•••••	•	•	•	•	•	•		•••••	z	7	A	z	122	z	11-0-9	m			
•••••	•	•	•	•	•	•		•••••	{	7	B	{	123						
•••••	•	•	•	•	•	•		•••••		7	C		124						
•••••	•	•	•	•	•	•		•••••	}	7	D	}	125						
•••••	•	•	•	•	•	•		•••••	~	7	E	~ or ◊	126	l	12-8-7	#	←	12-8-7	m
•••••	•	•	•	•	•	•		•••••	DEL	7	F		127	DELETE	12-9-7	m			m

KEY: \* - Keys Punch Correct Card Code  
 ‡ - Keys on EBCDIC Key punch Punch Correct Code Multipunch on BCL Key punch  
 M - Multipunch on BCL and EBCDIC Key punch

# USASCII CHART AND CHARACTER SETS

Bits					Column	0	0	0	0	1	1	1	1		
b <sub>7</sub>	b <sub>6</sub>	b <sub>5</sub>	b <sub>4</sub>	b <sub>3</sub>	b <sub>2</sub>	b <sub>1</sub>	Row	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	NUL	DLE	SP	0	@	P	\	p
0	0	0	0	1	0	0	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	0	0	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	0	0	0	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	0	0	0	4	EOT	DC4	\$	4	D	T	d	t
0	1	0	1	0	0	0	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	0	0	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	0	0	0	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	0	0	0	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	0	0	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	0	0	0	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	0	0	0	12	FF	FS	,	<	L	\	l	
1	1	0	1	0	0	0	13	CR	GS	-	=	M	]	m	}
1	1	1	0	0	0	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	0	0	0	15	SI	US	/	?	O	—	o	DEL

USA Standard Code for Information Interchange

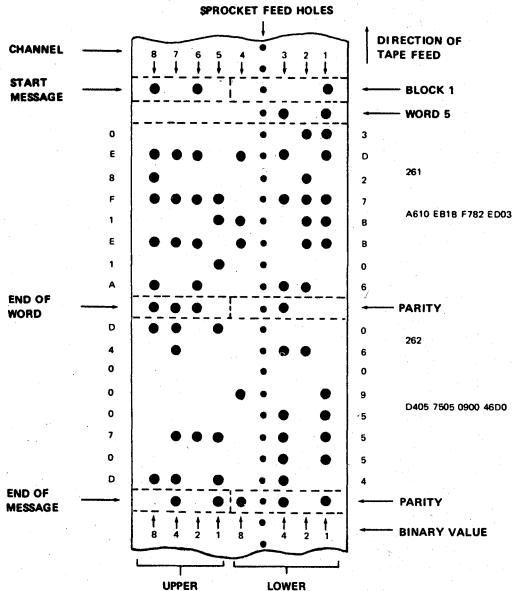
## FIELD IDENTIFIER (TERMINATION) CODES

		USASCII COLUMN 0 FIELD IDENTIFIER CODES					USASCII COLUMN 1 FIELD IDENTIFIER CODES							
				FLAG PATTERN SET BY CODE*					FLAG PATTERN SET BY CODE*					
Row Number	CODE	PAPER TAPE VALUE	Y	FLAG NUMBER				K	FLAG NUMBER				Row Number	
			3	2	1	4		3	2	1	4			
0	NUL	0,0	0	0	0	0		DLE	9,0	0	0	0	0	0
1	SOH	8,1	0	0	0	1		DC1	1,1	0	0	0	1	1
2	STX	8,2	0	0	1	0		DC2	1,2	0	0	1	0	2
3	ETX	0,3	0	0	1	1		DC3	9,3	0	0	1	1	3
4	EOT	8,4	0	1	0	0		DC4	1,4	0	1	0	0	4
5	ENQ	0,5	0	1	0	1		NAK	9,5	0	1	0	1	5
6	ACK	0,6	0	1	1	0		SYN	9,6	0	1	1	0	6
7	BEL	8,7	0	1	1	1		ETB	1,7	0	1	1	1	7
8	BS	8,8	1	0	0	0		CAN	1,8	1	0	0	0	8
9	HT	0,9	1	0	0	1		EM	9,9	1	0	0	1	9
A	IF	0,A	1	0	1	0		SUB	9,A	1	0	1	0	A
B	VT	8,B	1	0	1	1		ESC	1,B	1	0	1	1	B
C	FF	0,D	1	1	0	0		FS	9,C	1	1	0	0	C
D	CR	8,D	1	1	0	1		GS	1,D	1	1	0	1	D
E	SO	8,E	1	1	1	0		RS	1,E	1	1	1	0	E
F	SI	0,F	1	1	1	1		US	9,F	1	1	1	1	F

\* 0 = flag is reset

1 = flag is set

# SERIES L PUNCH PAPER TAPE COMPACT OBJECT CODE





SERIES L PUNCH CARD COMPACT OBJECT CODECOMPRESSED CARD CODE

## Card-Column

1 - 6      Program Identification

9          Beginning Word Number

10        Number of Words on Card

11 - 15    No Significance

16        Block Number

17 - 24

25 - 32

33 - 40

41 - 48

49 - 56

57 - 64

65 - 72

73 - 80

 Up to 8 Words per Card  
 8 Columns per Word  
 2 Hexadecimal Digits  
 per Column

## 8 Bit Card Buffer Representation

## Upper Digit

## Lower Digit

Card Code8 4 2 18 4 2 1

X

X

X

X

X

X X

X

X

X

X

X

X

X

X

X

X

## DATA COMM REGISTERS

### 1. Character Pointer Register . . . . . Word 586

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
WORD	RCP	BK	BK	WORD	WORD	SCP	BK	BK	WORD						
WORKING LRBR				BASE LRBR		WORKING LKBR				BASE LKBR					

### 2. Received Header Register . . . . . Word 1184

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AD1		AD2		TR #	TR #	TR #	STX	TEXT DATA							

3 Digit Transmission Number

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AD1		AD2		TR #	TR #	STX	TEXT DATA								

2 Digit Transmission Number

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AD1		AD2		TR #	STX	TEXT DATA									

1 Digit Transmission Number

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AD1		AD2		STX	TEXT DATA										

No Transmission Number

### 3. Terminal Address Registers

Permanent Address Register . . . . . Word 1064  
 Receive Address Register . . . . . Word 1201  
 Send Address Register . . . . . Word 1202

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
AD1		AD2		GSL											

### 4. Transmission Numbers

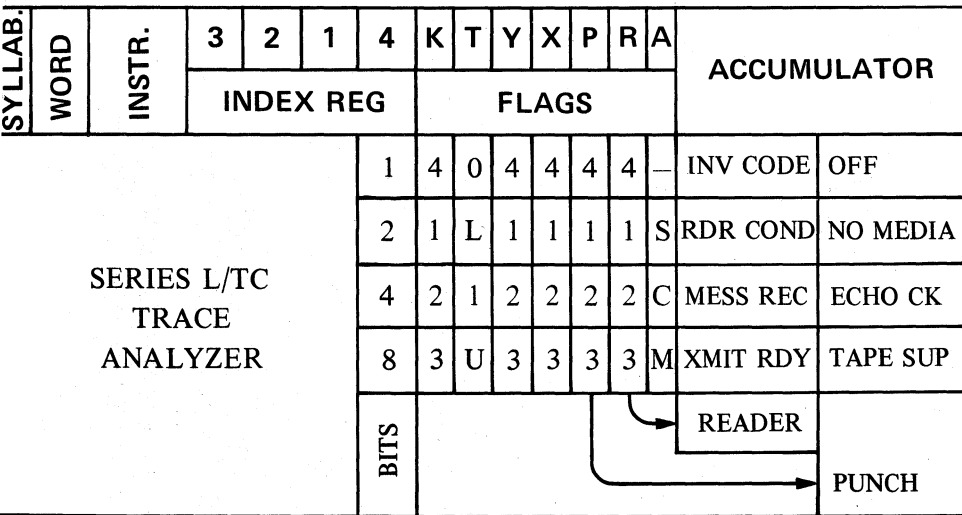
Send Transmission Number . . . . . Word 1191  
 Expected Normal/Fast Number . . . . . Word 1190  
 Expected Group TR Number . . . . . Word 1192  
 Expected Broadcast Number . . . . . Word 1193

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
TR # 1		TR # 2		TR # 3											
1 Digit TR #															
2 Digit TR #															
3 Digit TR #															

### 5. Two-Wire/Four-Wire Register . . . . . Word 1188

Digit Pos 15-8 Bit Set = Two-Wire  
 Digit Pos 15-8 Bit Reset = Four-Wire & TDI

### 6. DCP Receive Buffer . . . Words 1247, 1216 thru 1246 DCP Transmit Buffer . . . Words 1249 thru 1279, 1248



TRACE ANALYZER, Use with Trace 1 Printout

## NOTES

LSR: MUL, MULR = MULTIPLIER + MULTIPLICAND - PRODUCT

DIV = DIVISOR + QUOTIENT - DIVIDENDS

## NOTES

## NOTES

