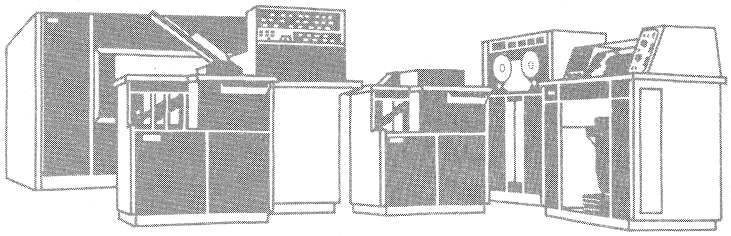

GENERAL REFERENCE MANUAL

UNIVAC 1050 SYSTEMS

CARD SYSTEM

UP-3913

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To be provided in a future release

ILLUSTRATIONS

**To be provided in a future release*

2. UNIVAC 1050 CARD SYSTEM

A. GENERAL DESCRIPTION

The UNIVAC 1050 Card System is available in these configurations:

Central Processor	– 4.5 microsecond cycle time per character – 4096 to 32,768 characters of storage in increments of 4096.
Card Reader	– 600 or 800/900 cards per minute.
Card Punch	– 200 or 300 cards per minute.
Printer	– 600/750 or 700/922 lines per minute.

Card systems with less than 8192 character storage capacity are provided with the PAL Jr. Assembler (See UP 3912, Section 3 –D), others are provided with the card PAL Assembler. Programs written for card PAL are applicable without change to any card system with 8192 or more characters of storage. The maximum number of labels used with any UNIVAC 1050 System is dependent on the size of the Central Processor storage.

STORE SIZE	MAXIMUM ALLOWABLE LABELS
8,192 Characters	280
12,288 Characters	680
16,384 Characters	1080
32,768 Characters	2680

The input/output routines permit full advantage to be taken of the capabilities of the system without sacrifice of the simplicity of the PAL language. These routines are easily modified by the Input/Output Specializer described later in this document. Also provided are a loader, a report program generator, and, for changing or correcting programs, the PATCH Assembler.

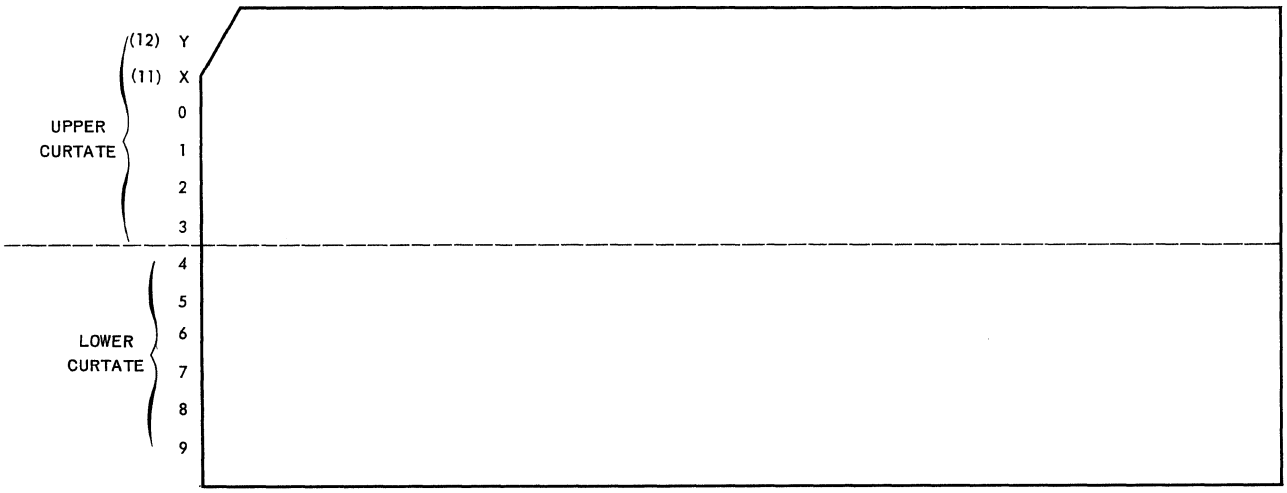
The immediately following paragraphs provide basic information concerning punched cards as employed by the UNIVAC 1050 System. Information concerning programming begins at Section C, ASSEMBLER DIRECTIVES.

B. PUNCHED CARD FORMATS

1. 80 Column Cards

The 80 column card contains 960 possible punch positions (12 rows, 80 columns). Each punch is represented in store as a 1 bit and the absence of a punch as a 0 bit. See Table 2-1.

The card (and each column) is logically divided into two portions: upper curtate and lower curtate.



Each column contains 12 punch positions. Two character locations are used to store one column of *untranslated* information, and one character location is required to store one column of *translated* information. See Figure 2-1.

When using the untranslated mode, the punch-no-punch combination in the upper curtate of the column is stored in the first designated location (the address of which must be a multiple of 64); that of the lower curtate is stored in the next contiguous location. The data from the next column are stored contiguously in the same manner until 160 locations are used to store the 80 columns of information in the card image area.

When using the translated mode, the punch-no-punch combination in the upper *and* lower curtates is translated into UNIVAC 1050 six bit (excess three) code. The data in column 1 are stored in the first designated location (the address of which must be a multiple of 64); the data from the next column are stored in the next location, and so forth, until 80 contiguous locations are used to store the 80 columns of information in the card image area.

80 column cards are read and punched face down with the nine edge leading.

Binary data may be punched on an 80 column card as shown in Figure 2-2, which illustrates the relationship between data on the card and in store. The card is read untranslated into store. The PAL Assembler produces output in binary format with the exception of the card sequence number and the program identification, which are punched in the untranslated mode.

The use of this format permits 160 unique characters to be punched on one card. The upper curtate of column 1 contains the first character, the lower curtate contains the second character, and so forth. The lower curtate of the eightieth column contains the 160th character of information.

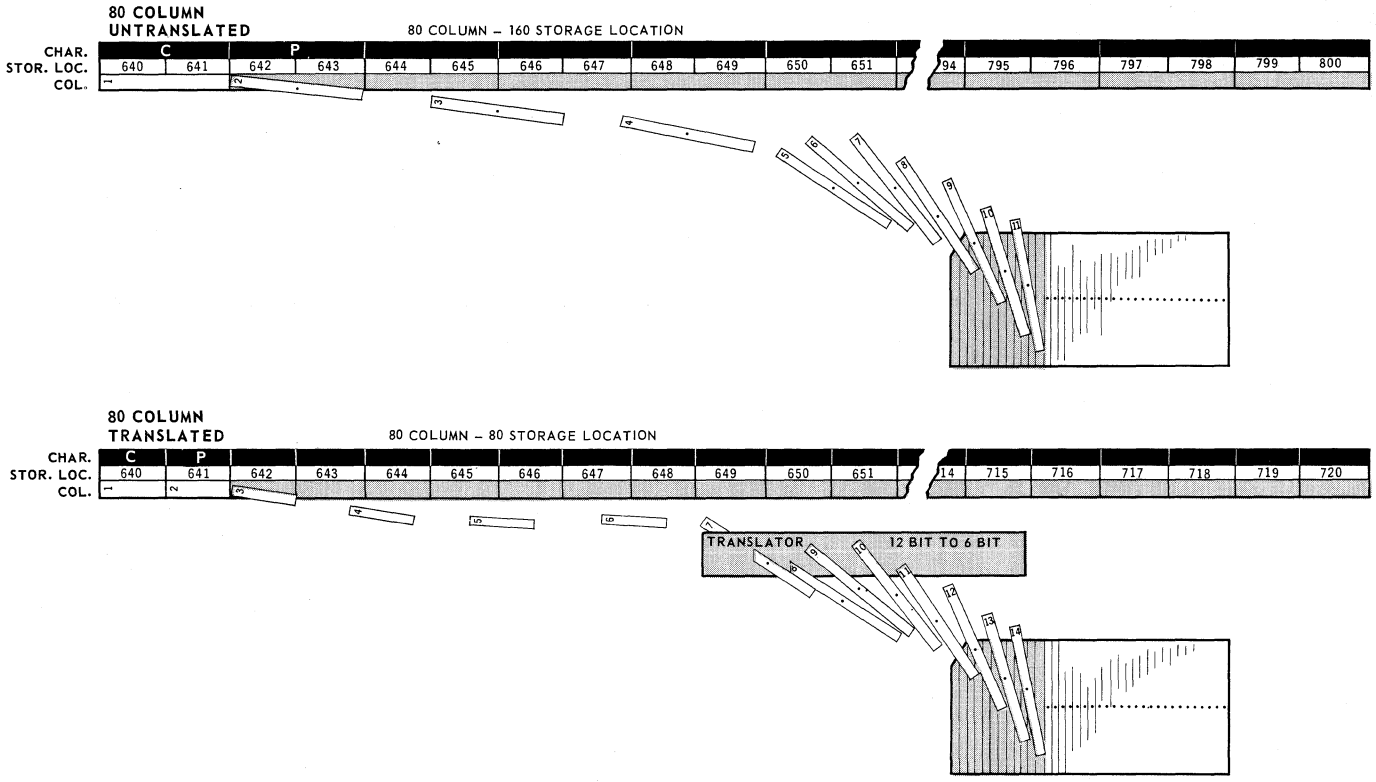


Figure 2-1. 80 Column Punched Card Data – Untranslated and Translated

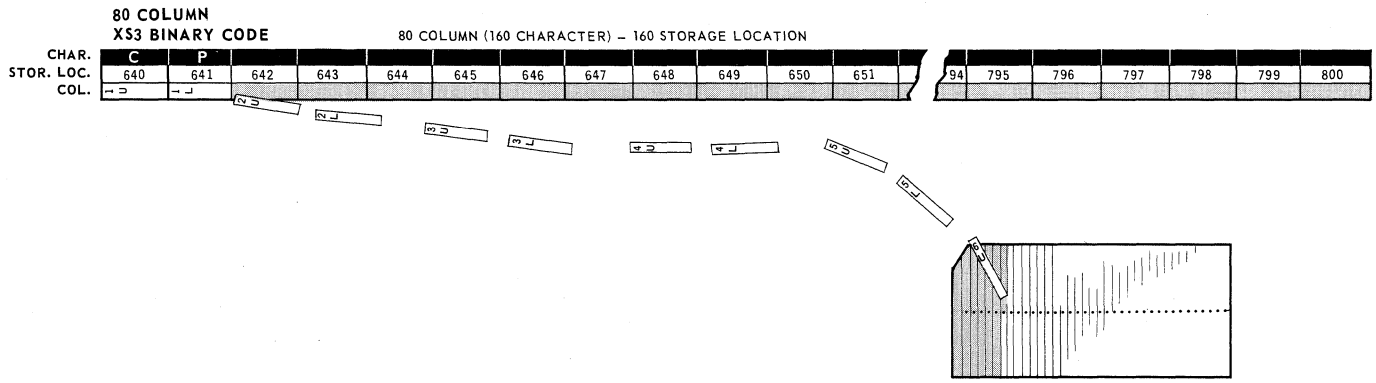


Figure 2-2. 80 Column XS3 Binary Card Data

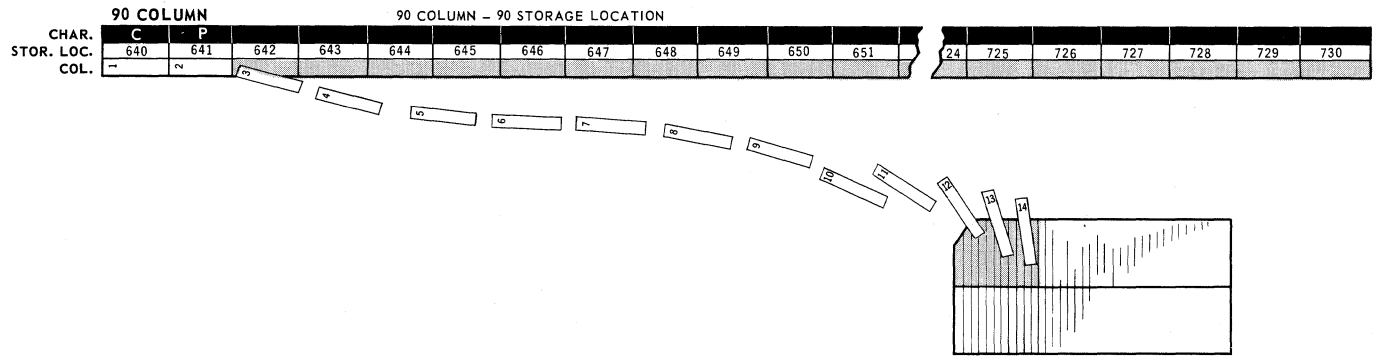


Figure 2-3. 90 Column Punched Card Data

CARD CODES		BINARY CODE (Machine Collating Sequence)	HIGH-SPEED PRINTER CHARACTER		OCTAL	NUMBER
80 COLUMN	90 COLUMN		STANDARD	OPTIONAL		
NO PUNCH	NO PUNCH	000000	Space (Non-Printing)		00	0
11-5-8	1-3-5-7	000001	]		01	1
11	0-3-5-7	000010	– (minus or hyphen)		02	2
0	0	000011	0		03	3
1	1	000100	1		04	4
2	1-9	000101	2		05	5
3	3	000110	3		06	6
4	3-9	000111	4		07	7
5	5	001000	5		10	8
6	5-9	001001	6		11	9
7	7	001010	7		12	10
8	7-9	001011	8		13	11
9	9	001100	9		14	12
0-6-8	0-1-3-7-9	001101	\		15	13
11-6-8	1-3-5-7-9	001110	;		16	14
12-5-8	0-5-7-9	001111	[		17	15
12	0-1-3-5-7	010000	+	&	20	16
5-8	1-3-7-9	010001	: (colon)		21	17
12-3-8	1-3-5-9	010010	. (period)		22	18
12-0	0-1-3	010011	?		23	19
12-1	1-5-9	010100	A		24	20
12-2	1-5	010101	B		25	21
12-3	0-7	010110	C		26	22
12-4	0-3-5	010111	D		27	23
12-5	0-3	011000	E		30	24
12-6	1-7-9	011001	F		31	25
12-7	5-7	011010	G		32	26
12-8	3-7	011011	H		33	27
12-9	3-5	011100	I		34	28
3-8	0-1-5-7	011101	=	#	35	29
12-6-8	0-1-5-9	011110	<		36	30
12-7-8	0-1-3-5-7-9	011111	#	=	37	31
7-8	0-1-5-7-9	100000	@	' (apostrophe)	40	32
11-4-8	0-1	100001	*		41	33
11-3-8	0-1-3-5-9	100010	$		42	34
11-0	0-3-7-9	100011	!		43	35
11-1	1-3-5	100100	J		44	36
11-2	3-5-9	100101	K		45	37
11-3	0-9	100110	L		46	38
11-4	0-5	100111	M		47	39
11-5	0-5-9	101000	N		50	40
11-6	1-3	101001	O		51	41
11-7	1-3-7	101010	P		52	42
11-8	3-5-7	101011	Q		53	43
11-9	1-7	101100	R		54	44
0-5-8	0-1-9	101101	%	(	55	45
4-8	0-1-3-7	101110	' (apostrophe)	@	56	46
11-7-8	0-1-7	101111	△		57	47
0-2-8	0-1-7-9	110000	≠		60	48
0-4-8	0-1-5	110001	(	%	61	49
0-3-8	0-3-5-9	110010	, (comma)		62	50
2-8	1-5-7-9	110011	&	+	63	51
0-1	3-5-7-9	110100	/		64	52
0-2	1-5-7	110101	S		65	53
0-3	3-7-9	110110	T		66	54
0-4	0-5-7	110111	U		67	55
0-5	0-3-9	111000	V		70	56
0-6	0-3-7	111001	W		71	57
0-7	0-7-9	111010	X		72	58
0-8	1-3-9	111011	Y		73	59
0-9	5-7-9	111100	Z		74	60
12-4-8	0-1-3-9	111101	)	¤	75	61
6-8	0-3-5-7-9	111110	>		76	62
0-7-8	0-1-3-5	111111	¤	)	77	63

***NOTE:** Only the characters that differ from the standard are listed for the optional print drum.

Table 2-1. UNIVAC 1050 System Character Set

2. 90 Column Cards

The 90 column card is divided into two parts: the upper curtate and the lower curtate. Each curtate contains 270 punch positions (6 rows, 45 columns). Within a column information is punched into a pattern indicated by Table 2-1.

A punch is considered to be registered internally as a one bit and the absence of a punch as a zero bit. Since each column contains six possible punch positions, one six bit location is required to store one column of information. The data in column 1 are stored in the first designated location (the address of which is a multiple of 64); the data from the next column are stored in the next location, and so forth, until 90 contiguous locations are used to store the 90 columns of information in the card image area. Each of the rows has been given a number: 0, 1, 3, 5, 7, or 9. Figure 2-3 illustrates how the data on a 90 column card are stored in the card image area.

Automatic translation is not provided on a 90 column system. See UP-3912 UNIVAC 1050 Central Processor for the Translate instruction. 90 column cards are read and punched face up with the nine edge leading.

C. ASSEMBLER DIRECTIVES

Assembler directives are communication devices used by the programmer to supply information to the PAL assembler. The information supplied by means of these directives controls the disposition of the program, program instructions, or storage areas required by the program. Although they may affect the assembly of program instructions, the lines in which these assembler directives appear are not assembled as program instructions.

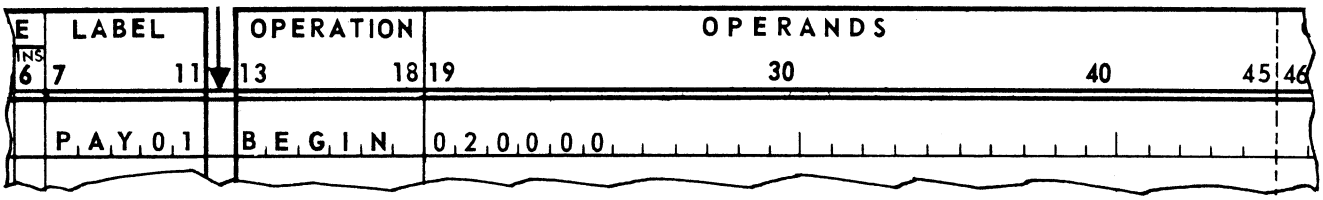
Assembler directives are programming aids that effect operations such as the start and end of the actual assembly process; the interrelation of different segments of a program which do not occupy contiguous locations, and the location of input/output and working storage areas relative to program instructions.

1. BEGIN and END

Every program to be assembled must have the assembler directive BEGIN in the operation field of its first line and the assembler directive END in the operation field of its last line. The directives BEGIN and END cause the start and termination, respectively, of the assembly process.

Columns 7 through 12 of the BEGIN line may contain the program name. If this is done, the program name will be punched in columns 75 through 80 of the output object code deck.

The operand field of the BEGIN line must contain a single octal or decimal integer. For example, if the programmer writes



the address of the first character of the program called PAY01 is octal 20000.

The assembler directive END must appear in the operation field of the last line of the program. This directive terminates the assembly.

The operands field of the END line must contain the label of the first object program instruction to be executed when the program is loaded. The assembled object program deck will have, on the last card, a jump to the address generated from the label.

2. ORIG

When the programmer wishes to assign sections of a program to noncontiguous areas of computer store, an ORIG assembler directive is used. The ORIG directive requires at least one expression in the operands field. A second expression is optional.

The first expression must be

- a previously defined label, with or without an address modifier,
- $, the current value of the location counter, with or without an address modifier, or
- an octal or decimal address.

This expression is the address of the next character of the program.

The second expression, which may appear in the operands field, is 64. If the second expression is present, the address of the next character in the program is the smallest number, not less than the first expression, which is an integral multiple of 64.

To illustrate the ORIG directive, assume that the programmer wishes to leave 128 locations free between two coded lines. The ORIG line is written as follows:

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
	LOOP	J	START
		ORIG	$+128
	PUNCH	BD1	INDIC, 1

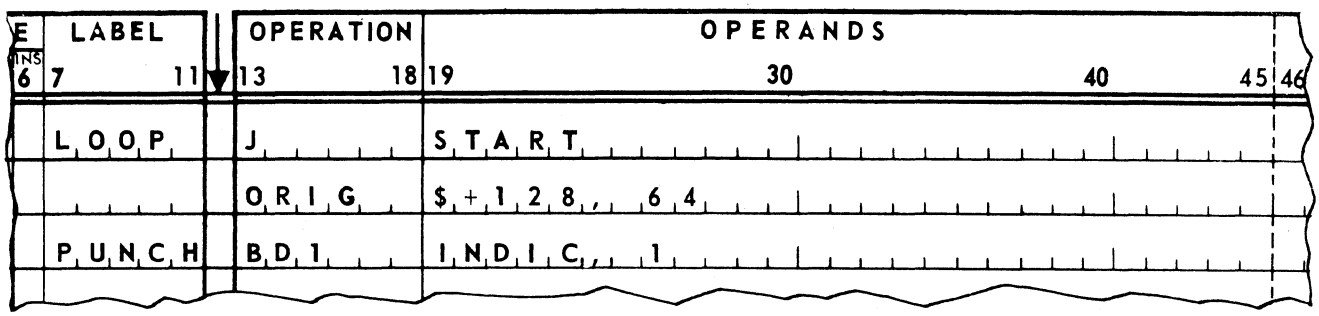
The label PUNCH is 128 positions beyond the address of the last character of the line LOOP.

The same lines may be written as follows:

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
	LOOP	J	START
		ORIG	LOOP+133
	PUNCH	BD1	INDIC, 1

Since the label LOOP names the first character of the line on which it appears, and since the line labeled LOOP is a five character instruction, the expression LOOP + 5 written on the next line would be equivalent to $. To allow 128 positions between the two lines LOOP and PUNCH, therefore, the programmer must write either $+128 or LOOP + 5 + 128 or LOOP + 133.

If the programmer writes



the label PUNCH will be at least 128 positions beyond the last character of the line LOOP and will have an address that is an integral multiple of 64.

3. EQU

The EQU directive equates the symbol in the label field to the value of the expression or expressions in the operands field. There must be at least one expression in the operands field; two additional expressions are optional.

The first expression may be

- a previously defined label, with or without a modifier,
- $, the current value of the location counter,
- a decimal or octal absolute address, or
- a decimal or octal constant (with a maximum value of 65, 535).

The second expression is a decimal or octal number specifying the number of characters in the field being defined. The value of this expression may not exceed 16.

The third expression is an index register expression (a value from 1 to 7) associated with the defined label. The value of this expression is inserted into the index register portion of an instruction referencing the defined label, unless an index register expression is supplied by the programmer in such an instruction.

The EQU directive is useful both as an aid to good documentation and as a programming convenience. For example, the index registers may be assigned symbolic names as follows:

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
	X 1	E Q U	3 9
	X 2	E Q U	X 1 + 4
	X 3	E Q U	X 2 + 4
	X 4	E Q U	X 3 + 4
	X 5	E Q U	X 4 + 4
	X 6	E Q U	X 5 + 4
	X 7	E Q U	X 6 + 4

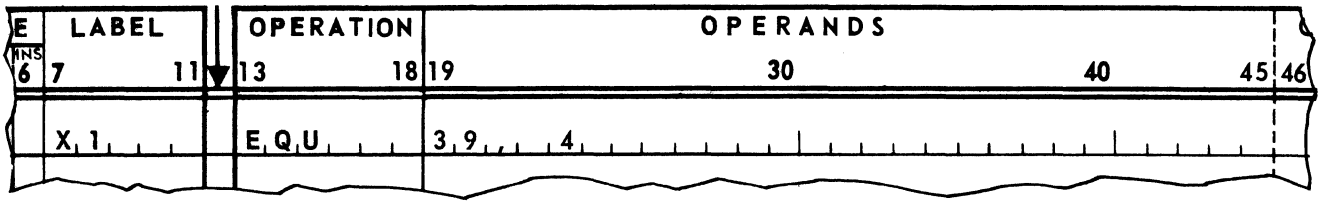
Index register one is tetrad nine, the least significant character of which is absolute location 39. Regardless of whether the symbolic names defined above will be used as M, T, or X expressions, the EQU directive or directives must equate the symbolic names to the absolute addresses of the fields. The assembler makes the necessary adjustments to convert these symbols into their appropriate values. For example, writing

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
		F T	6 , X 1 , X 1

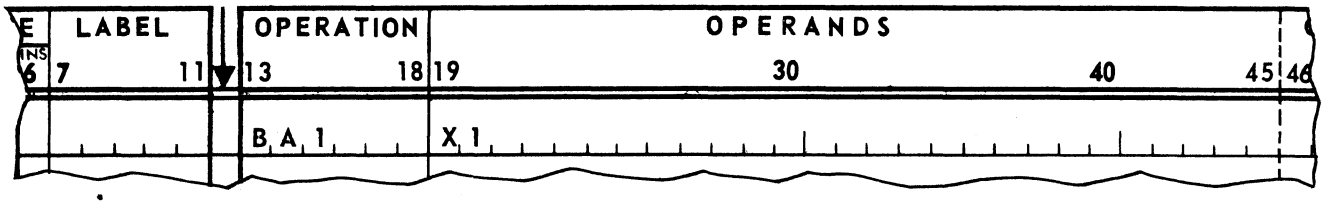
is equivalent to writing

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
		F T	6 , 9 , 1

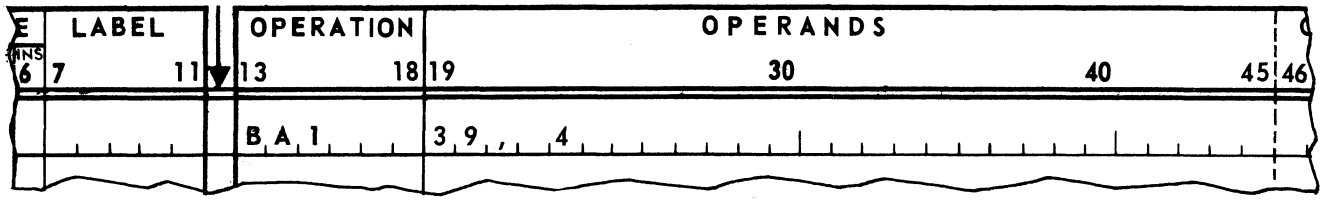
The second expression on an EQU line allows the programmer to supply the assembler with a predefined field length. In every subsequent instruction that addresses this field and which requires that the field length be specified, the assembler automatically inserts field length. For example, if the index register definition for index register 1 were written as follows:



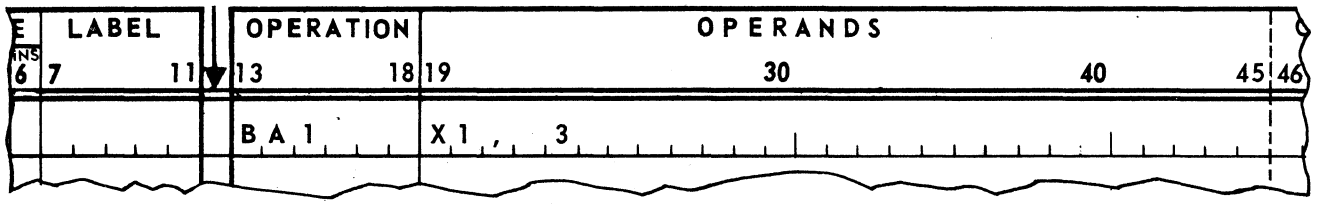
the line



is assembled as though it had been written



The programmer has the option to override the directive supplied field length by specifying another field length. If he writes



the assembler will place a 3 only in the field length portion of this instruction. Subsequent instructions that reference X1 without specifying field length will still be assembled with a 4 in the field length portion.

4. AREA

Working storage and input/output areas are mapped by means of an AREA directive. The label of an AREA line names the leftmost character of the area.

The operands field of an AREA line contains from one to four parameters:

- Parameter 1 is a decimal or octal number specifying the size of the area in terms of number of characters. It must always be present.

- Parameter 2 is

  A for an area containing alphanumeric data,

  B for an area containing binary data, or

  I for an area containing instructions.

  If Parameter 2 is not supplied, the area is assumed to be alphanumeric.

- Parameter 3 is a single character, other than a comma, to which every character of the area is to be preset when the object program is loaded. If Parameter 3 is not supplied, the area is not to be preset. Parameter 3 may also be a decimal number ranging from 0 through 63, or an octal number ranging from 0 through 077, or any single character written within apostrophes.

- Parameter 4 is a number from 1 to 7, specifying an index register*, which the assembler is to insert into the index register portion of any instruction referencing the area or any field within the area, unless the programmer elects to override it by specifying another index register. If it is not supplied, any instruction referencing the area is assembled normally, i.e., a coding line without an index register expression is assembled with zeros in the index register portion.

Fields within the area are defined in the lines immediately following the AREA line. They are defined by writing a minus sign (-) in column 13. One or two expressions are entered in the operands field.

The first expression is a decimal or octal number specifying the length of the field.This expression must always be present.

The second expression is a decimal or octal number specifying the position of the field within the area. This number specifies the position of the rightmost character of the field relative to the first character of the area. For example, if the rightmost character of a field is the twenty-fifth character of the area, the second expression would be 25.

The second expression may be omitted if the first character of the field immediately follows that last character of the last field defined.

The label of a line defining a field is the address of the rightmost character of the field.

** This must be written as a number, e.g., 1, 2, or 7, not as X.*

An example of an AREA definition is

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
	CARD	AREA	80,A,,,3
	CSECT	-	2
	CACNO	-	4
	CNAME	-	13,23
	CAMNT	-	5,35
	CACTN	-	1

The first line is the AREA definition, defining 80 consecutive positions, the leftmost of which is labeled CARD. The area is defined as being alphanumeric and is not to be preset to any value. All instructions referencing this area which do not have index register expressions are to have 3 inserted in the index register portion.

CSECT is the name of a two character field whose rightmost character is the second character of the area.

CACNO is a label assigned to the rightmost character of a four character field. CACNO names the fourth character beyond CSECT.

CNAME is the label of a 13 character field whose rightmost character is the twenty third character of the area.

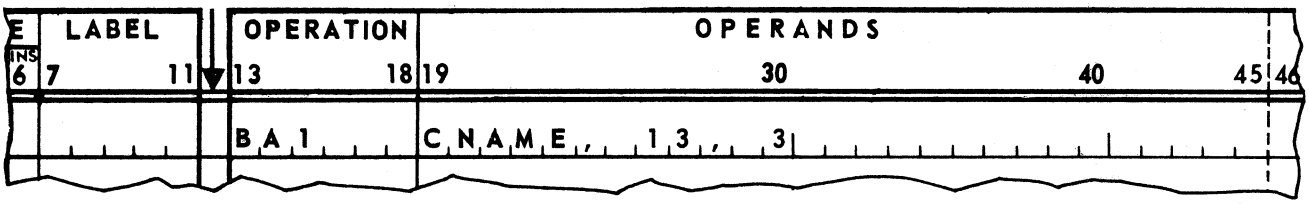
CAMNT is the label of the thirty fifth character of the area, which is the rightmost character of a five character field.

CACTN is the label of the thirty sixth character of the area. The field CACTN is one character in length.

As a result of this definition, the programmer may write

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
		BA1	CNAME

which is assembled as though he had written



The definition directs the assembler to supply field length and index register expressions automatically, unless the programmer chooses to override this automatic action by supplying different field length and index register expressions.

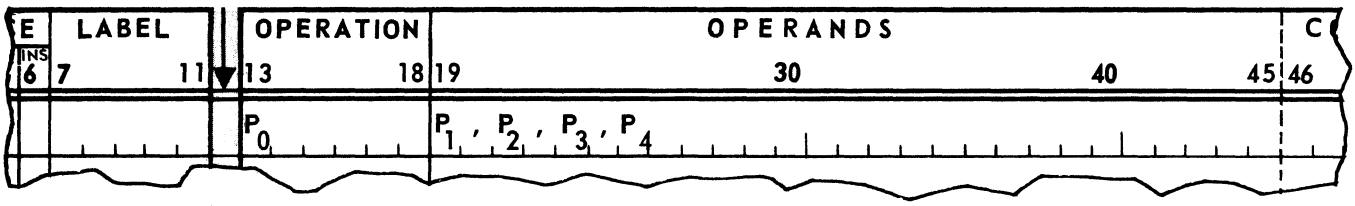
D. INPUT/OUTPUT SPECIALIZER

The I/O Specializer produces the source deck for the reader, punch, and/or printer routines as specified in the call directives. This is explained in detail in the following pages.

1. Input

The input deck consists of two parts. The first part consists of the call directive cards for the reader, punch, and/or printer routines. The second part is the PAL source code library deck. A blank card must be placed behind the last card of the second part.

Call Directive Card



P_0 = RDR, PCH, or PRNT.

P_1 = Label of the area into which data are to be placed.

P_2 = Number of reserve areas.

P_3 = Index register to contain the base address (a value from 1 to 7).

P_4 = UNTRN for untranslated reader or punch operation
HALF for print a half line.
Omission of P_4 stands for TRNSL or FULL (normal mode of operation).

2. Output

The specialized source deck is produced by the punch unit. The same data are duplicated on the printer.

3. Operating Instructions

Place the specializer deck, the call directive cards, and the library deck in the card reader.

To load the specializer:

1. Depress ONE CARD LOAD and RUN buttons on the console.
2. Intermediate stop: 30 010000 60
3. Depress RUN button
4. Successful stop: 30 010077 60
5. Error stop: 30 010001 60
   (Error in call card)

Correct the mistake and begin again.

Place the specializer deck before the END card of the program deck and assemble the program.

E. CARD READER ROUTINE

1. Description

This routine controls the operation of the Reader when reading cards in the translated or untranslated mode. The reserve areas are aligned consecutively in main store. The index register specified in the calling statement is used to address the current card image area. Programmed error recovery will take place where possible; otherwise coded stops will be used, which together with specific operator instructions will make for efficient error recovery. These coded stops and error recovery procedures are described in Section 2-I. The programmer should familiarize himself with these coded stops, so that he does not duplicate them in his program.

2. Programming Procedures

The Card Reader Routine is provided by the I/O Specializer by means of a call line.

The call line contains

- a blank label field,
- the entry RDR in the operation field, and
- three or four parameters in the operands field.

The parameters that appear in the operands field are described below.

PARAMETER

1 is the name of the area into which the cards are to be read. This name is a label that must appear in the label field of an AREA directive of the program. The size of the area must be large enough to contain all reserve areas. The first character of the area must be assigned an address that is a multiple of 64.

Since each card must be read into an area the starting address of which must be a multiple of 64, a reserve area for each 80 column card read in the translated mode or each 90 column card must be 128 characters; a reserve area for each 80 column card read in the untranslated mode must be 192 characters.

2 is the number of reserve storage areas to be serviced by the routine. The programmer must specify a minimum of three areas. The maximum number of reserve areas which may be specified is 21. However, the programmer should limit the number of reserve areas required to a practical maximum set by such considerations as total store available and program running time.

3 is the index register number (1-7) assigned to the area. An index register must be assigned, and its number must be identical to the index register number specified by parameter 4 of the AREA directive associated with the routine.

4 is required only when reading 80 column cards in the untranslated mode, in which case the symbol UNTRN is entered as parameter 4.

An example of the call line for the Card Reader Routine follows. The programmer wishes to obtain a routine that uses four reserve areas; the routine is to supply the base address of the current card image in index register 3. The system for which the program is written is an 80 column system, and the cards are to be read in the translated mode.

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
		RDR	CDIN, 4, 3

NOTE: RDR may not be the name of the area, parameter one.

Elsewhere in the program, CDIN must be defined in an AREA directive, as for example,

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
		ORIG	$, 64
	CDIN	AREA	512,,,3
	CSECT	-	2
	CACNO	-	4
	CNAME	-	13, 23
	CAMNT	-	5, 35
	CACTN	-	1

Parameter 3 of the call line must be identical with parameter 4 of the AREA directive; parameter 1 of the AREA directive must be 128 x 4, because four reserve areas are requested.

a. Initialization

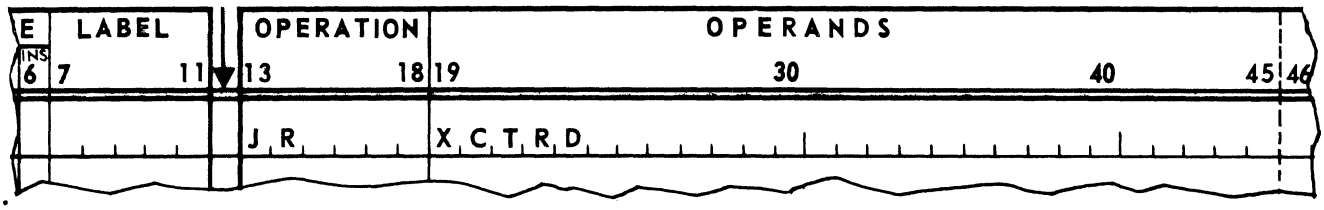
The routine must be initialized at the start and restart of a program. This is accomplished by writing the line:

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
		JR	XINRD

This sets all indicators and counters used by the routine to their initial conditions. The address of the first card image is not supplied at the time that XINRD is executed.

b. Execute Read*

The worker program requests a card image by means of the line:

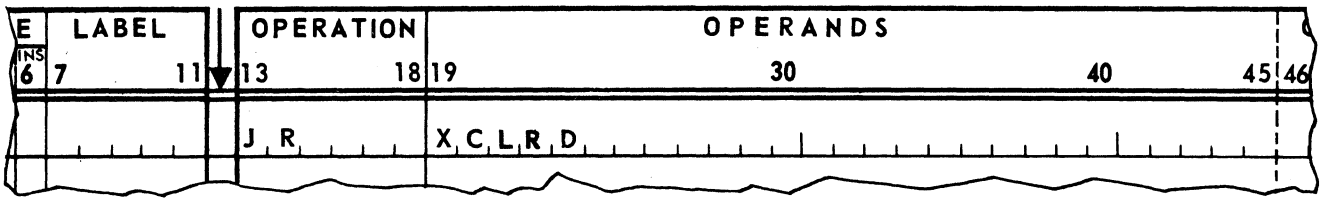


The relative starting address (column 1) of the currently available card image is supplied to the worker program in the index register specified in the call line. When this section is accessed, the routine assumes that the worker program no longer needs the previously supplied card image.

If the program requires two or more images in store at one time, all images except the last must be transferred to a working storage area.

c. Close Read

When the program recognizes the end of an input card file, and no more card images are expected, the routine is brought to a stop by writing



3. Programming Own Card Reader Routine

This section, which will be provided in a future release, will give the necessary information for the programmer who wishes to prepare his own reader routine.

* *The contents of AR_1 and AR_2 are not preserved when this routine is executed.*

F. PRINTER CONTROL ROUTINE

1. Description

This routine controls the operation of the Printer. Reserve areas are aligned in consecutive store positions; the index register specified in the calling statement is used to address the current print area. Programmed error recovery takes place where possible; otherwise coded stops are used, which together with specific operator instructions will make for efficient error recovery. These error stops and error recovery procedures are described in Section 2-I.

2. Programming Procedures

The Printer Control Routine is provided by the I/O Specializer by means of a call line.

The call line contains.

- a blank label field,
- the entry PRNT in the operations field, and
- three or four parameters in the operands field.

The parameters that appear in the operands field are described below.

PARAMETER

1 is the name of the area which is to be printed. This name is a label that must appear elsewhere in the program in the label field of an AREA directive. The size of the area must be large enough to contain all reserve areas.

2 is the number of reserve areas to be serviced by the routine. The programmer must specify a minimum of two areas and a maximum of 21.

3 is the index register number (1-7) assigned to the area. An index register must be assigned, and its number must be identical to the index register number specified by parameter 4 of the AREA directive associated with the routine (cf. page 2-C-6).

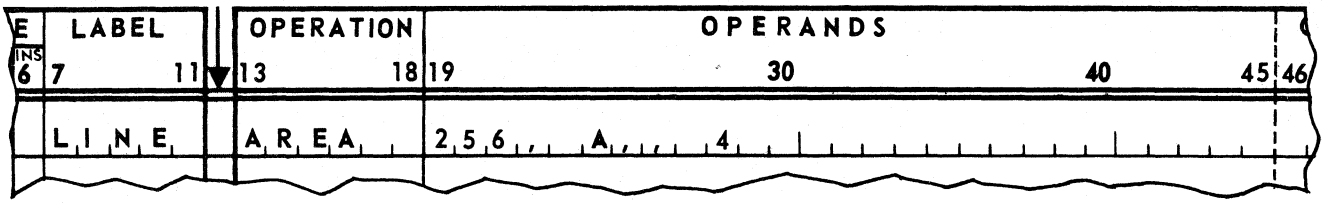
4 is the symbol FULL if full line printing is desired, or HALF if half line printing is desired. If parameter 4 is not supplied, full line printing is assumed.

An example of the call line for the Printer Control routine follows:

E INS 6	LABEL 7 ... 11	OPERATION 13 ... 18	OPERANDS 19 ... 30 ... 40 ... 45 46
		PRNT	LINE, 2, 4

NOTE: PRNT may not be the name of the area.

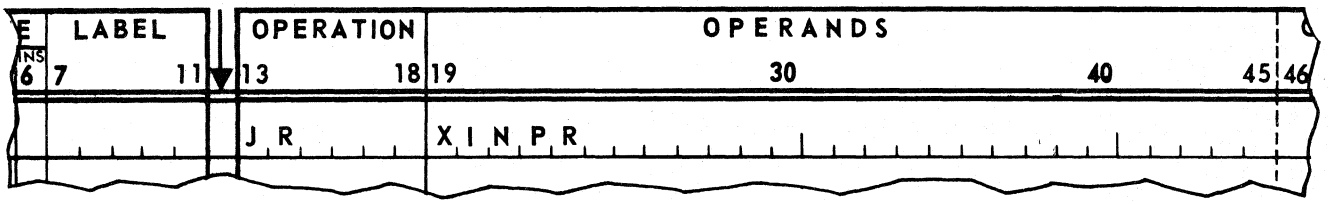
Elsewhere in the program, LINE must be defined in an area directive, as for example,



The assembler automatically provides an index register expression of 4 in every instruction that references a field in this area.

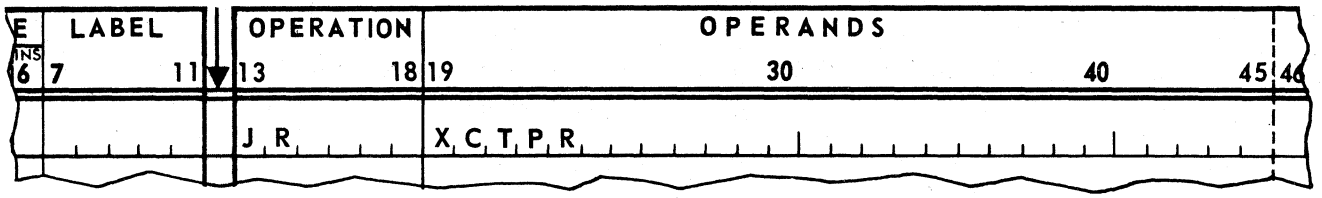
a. Initialization

At the start or restart of a program, the routine must be initialized before any attempt to produce printed output. This section of the routine sets all counters and indicators to their initial condition, clears the print areas to blanks, and provides the worker program with the address of the first print area. The routine is initialized by writing the line



b. Execute Print*

When the worker program has filled a print area and is ready to release the area for printing, the programmer writes



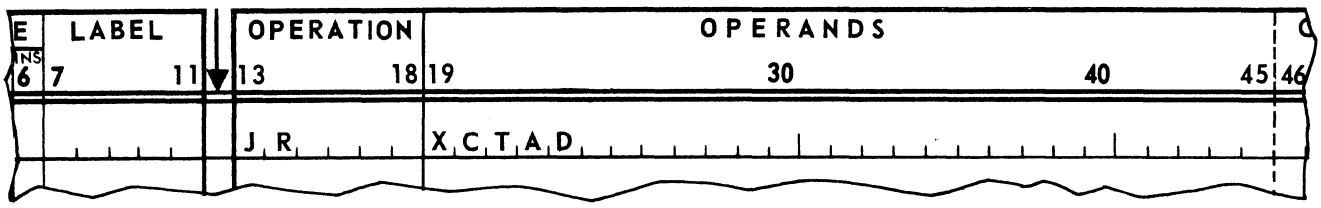
Prior to entering the Execute Print section, the program must place the number of lines of advance in a location labeled XADVC, which is defined in the library routine, by means of an SC (Store Character) instruction. The number of lines of advance between print lines remains constant until it is changed by the worker program.

c. Execute Advance

Whenever it is desired to advance the paper without printing, the Execute Advance section is entered. As in the Execute Print function, the worker program must have placed the number of lines of advance in XADVC before entering the section.

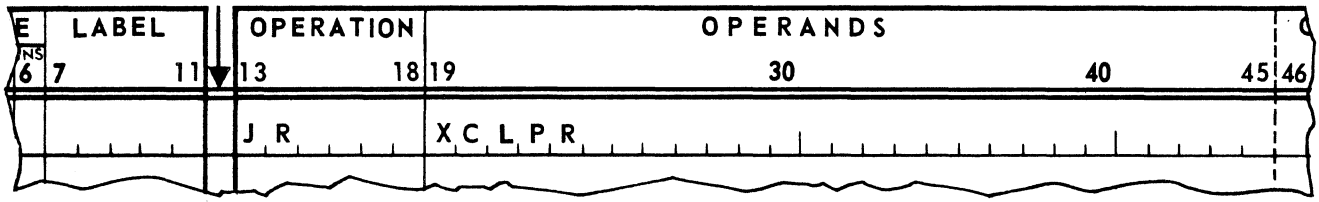
* *The contents of AR_1 and AR_2 are not preserved when this routine is executed, and the print area is not cleared after a line is printed.*

This section is entered by writing the line



d. Close

At the end of a run, the program must enter the Close section in order that all remaining print images, which have not yet been printed, are printed. The section is entered by writing the line



e. Remote Print Areas

When a "remote" area (an area not included in the reserve areas) is to be printed, the routine XCTQL is entered. Any number of remote areas may be placed anywhere in storage. XCTQL is useful for printing of such things as header lines and page numbers as it eliminates the necessity of transferring constants to reserve areas. Prior to entering XCTQL, the address of the most significant character of the remote area must be loaded into the three character field at XRMAR. Also, the number of lines to be advanced must be loaded into XADVC. The size of a remote area must be the same as that of a reserve area: 128 characters for a full line and 64 characters for a half line. See Page 2-M-5 for an example of how a remote print area is constructed and then printed.

3. Programming Own Printer Routine

This section, which will be provided in a future release, will give the necessary information for the programmer who wishes to prepare his own printer routine.

G. CARD PUNCH UNIT ROUTINE

1. Description

This routine controls the operation of the Card Punch Unit when punching in the translated or untranslated mode. The reserve areas are aligned consecutively in main store. The index register specified in the calling statement is used to address the current output card image. Programmed error recovery will take place wherever possible; otherwise coded stops will be used, which together with specific operator instructions will make for efficient error recovery. These coded stops and error recovery procedures are described in Section 2-I. The programmer should familarize himself with these coded stops in order that he does not duplicate them in his program.

2. Programming Procedures

The Card Punch Unit Routine is provided by the I/O Specializer by means of a call line.

The call line contains

- a blank label field,
- the entry PCH in the operation field, and
- three or four parameters in the operands field.

The parameters that appear in the operands field are described below.

PARAMETER

1 is the name of the area from which the cards are to be punched. This name is a label which must appear elsewhere in the program in the label field of an AREA directive. The size of the area must be large enough to contain all reserve areas. The first character of the area must be assigned an address that is a multiple of 64.

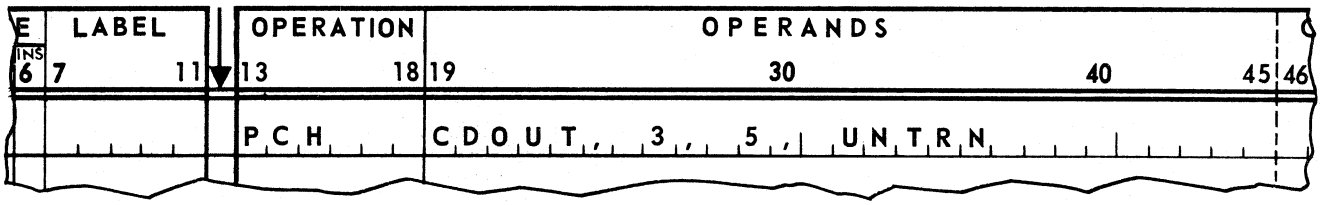
Since each card must be punched from an area the starting address of which must be a multiple of 64, a reserve area for each 80 column card punched in the translated mode or each 90 column card must be 128 characters; a reserve area for each 80 column card punched in the untranslated mode must be 192 characters.

2 is the number of reserve storage areas to be serviced by the routine. The programmer must specify a minimum of three areas. The maximum number of reserve areas that may be specified is 21. However, the programmer should limit the number of reserve areas required to a practical maximum set by such considerations as total store available and program running time.

3 is the index register number (1-7) assigned to the area. An index register must be assigned, and its number must be identical to the index register number specified by parameter 4 of the AREA directive associated with the routine.

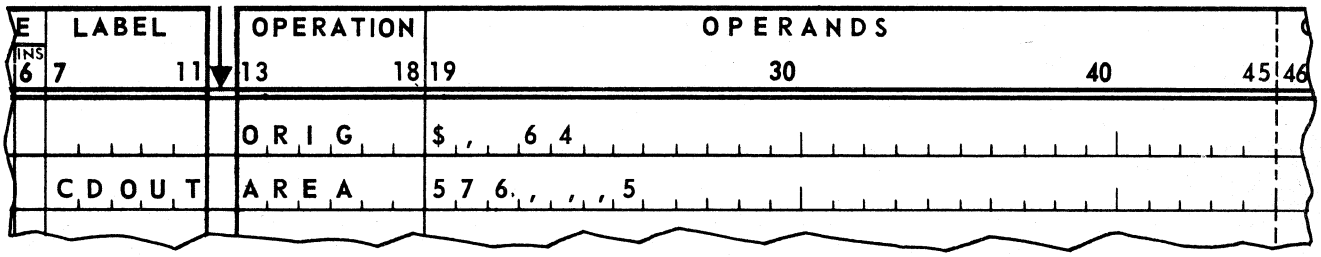
4 is required only when punching 80 column cards in the untranslated mode, in which case the symbol UNTRN is entered as parameter 4.

An example of the call line for the Card Punch Unit Routine follows. The programmer wishes to obtain a routine that uses three reserve areas; the routine is to supply the base address of the current punch area in index register 5. The system for which the program is written is an 80 column system, and the cards are to be punched in the untranslated mode.



Note: PCH may not be the name of the area.

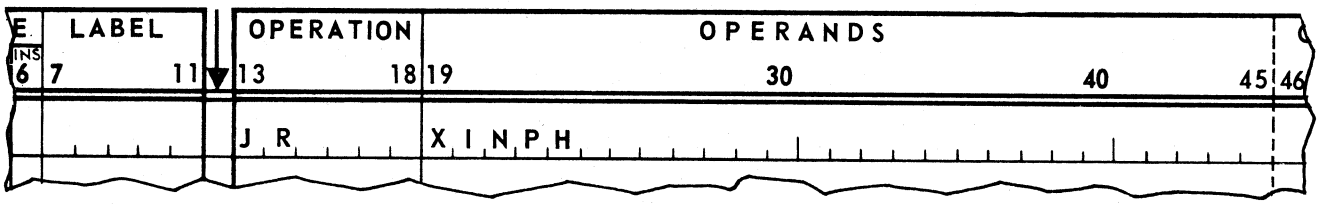
Elsewhere in the program, CDOUT must be defined in an AREA directive, as, for example,



The assembler is to provide, automatically, an index register expression of 5 in every instruction that references a field within the area.

a. Initialization

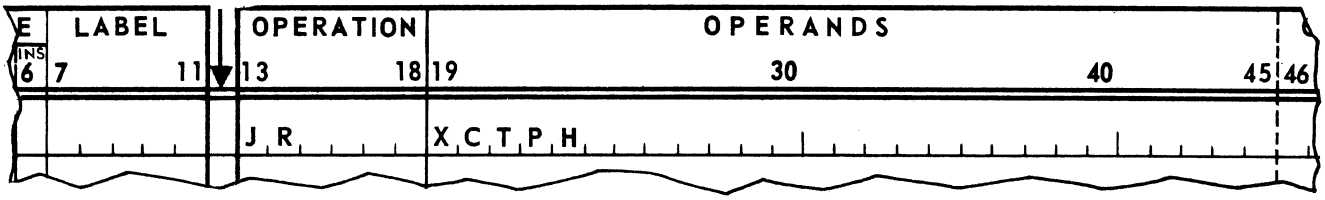
This routine must be initialized at the start and restart of a program. This is accomplished by writing the line



This sets all indicators and counters used by the routine to their initial conditions, clears the punch areas to blanks, and provides the worker program with the base address of the first punch area in the index register specified by the call line and the AREA directive.

b. Execute Punch*

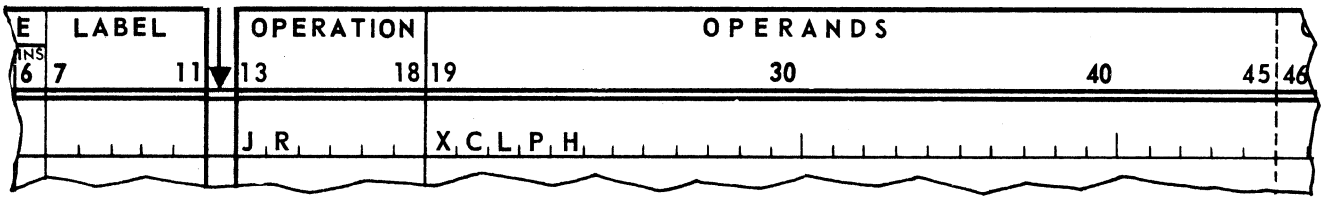
When a punch area is filled with data and is ready to be released for output, the worker program turns control over to the Executive Punch section by means of the line



This advances the setting of the index register.

c. Close Punch

At the conclusion of a run, the worker program must execute the Close section of the routine. This section punches all remaining images that have not yet been punched and clears the Card Punch Unit card transport mechanism of data cards. The Close section is executed by writing the line



3. Programming Own Punch Routine

This section, which will be provided in a future release, will give the necessary information for the programmer who wishes to prepare his own punch routine.

H. PROGRAM TESTING

Procedures are provided with the UNIVAC 1050 Card System which enable the programmer to obtain printouts of desired areas of memory. These will be described, in detail, in future editions of this manual.

* *The contents of AR1 and AR2 are not preserved when this routine is executed.*

I. OPERATING THE CARD SYSTEM

1. Central Processor Console

■ SYSTEM ON – SYSTEM OFF (Red)

The SYSTEM ON and SYSTEM OFF button/lights, located in the lower lefthand corner of the console, control the application and removal, respectively, of power to the UNIVAC 1050 System.

Depression of the SYSTEM ON button/light turns power on. When the system is receiving full operating power (approximately 45 seconds after the button/light is depressed), the SYSTEM ON button/light is illuminated and remains illuminated until the system is turned off.

Depression of the SYSTEM OFF button/light extinguishes the SYSTEM ON light, switches off the input/output units, and removes power from the system in an orderly sequence.

■ CLEAR (White)

The CLEAR button/light, located directly below the SYSTEM ON button/light, when depressed, resets all interrupts, resets all testable jump indicators associated with the JC instruction, and extinguishes the Decimal Overflow, Class III Interrupt Inhibited, and Abnormal Channel indicators and the PROC Abnormal light.

The depression of the CLEAR button/light also initiates a console lamp test. The following lights and button/lights on the console are illuminated and will remain so until the CLEAR button/light is released:

PROC ABNORMAL light

PARITY light

CLASS III INHIBITED light

OVERFLOW INHIBITED light

CHANNEL ABNORMAL button/lights

OPERATOR REQUEST button/light

NEXT INSTRUCTION (M and CC) button/lights

PROGRAM START and PROGRAM STOP button/lights

Display Lights

The TRACE STOP button/light is tested only if it is depressed at the time that the CLEAR button/light is depressed.

Important Note: The use of the CLEAR button/light must be clearly defined in, and governed by, the operating instructions for all programs. Indiscriminate clearing of indicators can easily cause the loss of indicators as yet unprocessed at the time a program comes to a stop.

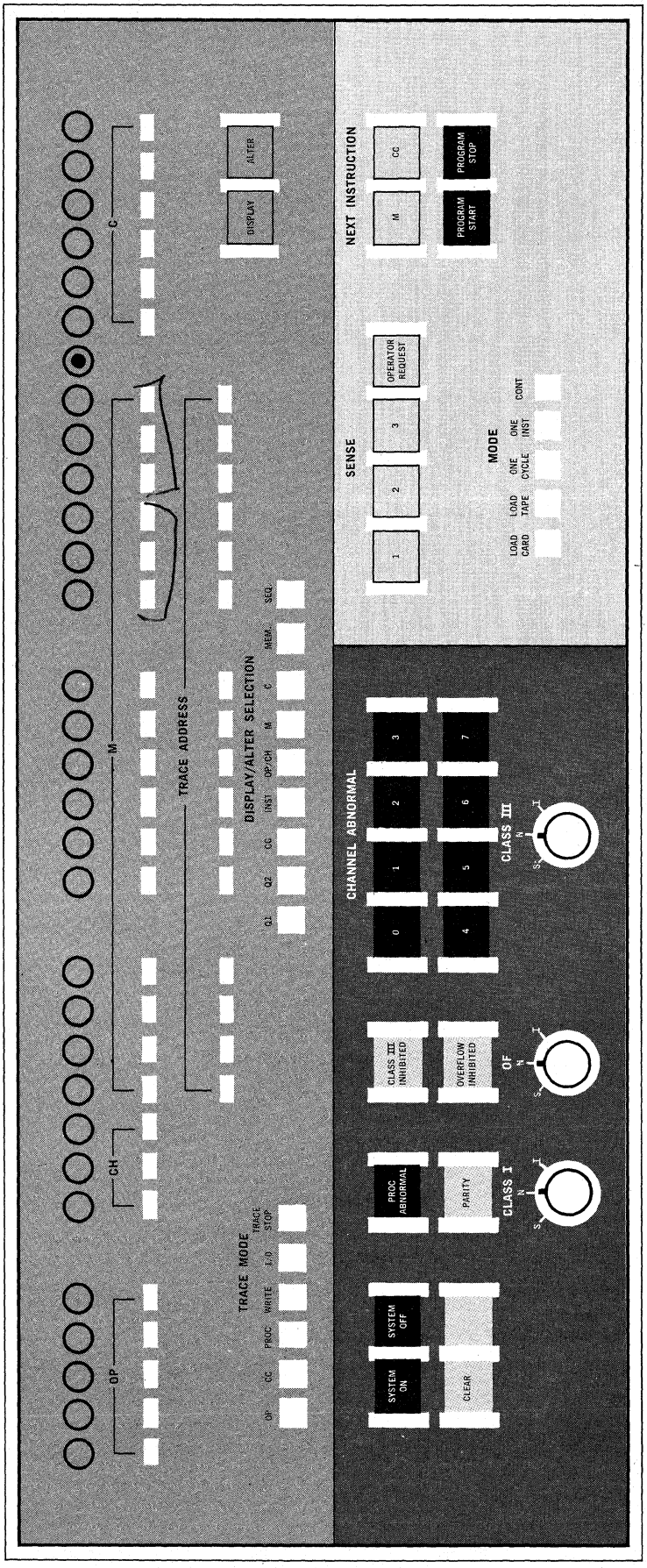


Figure 2-5. Central Processor Console.

- Interrupt Switches

There are three three-position switches in the lower lefthand section of the console, labeled CLASS I, OF (for Overflow), and CLASS III. Each of these switches has three settings: S (Stall), N (Normal), and I (Inhibit). During normal computer operation, these switches must be set at N. The S and I settings are for engineering use only.

- PROGRAM START (Green) – PROGRAM STOP (Red)

The PROGRAM START and PROGRAM STOP button/lights, located in the lower righthand corner of the console, control the initiation and termination, respectively, of program instruction execution.

Depression of the PROGRAM START button/light illuminates the button/light, extinguishes the PARITY and PROGRAM STOP lights, and allows the Central Processor to execute program instructions under control of the Mode buttons (see below).

Depression of the PROGRAM STOP button/light illuminates the button/light and extinguishes the PROGRAM START button/light. The Central Processor halts after completing the instruction in process and accessing the next instruction. Input/output functions in progress are completed, and interrupt requests are stored.

If neither the PROGRAM START nor the PROGRAM STOP button/lights are lit, the Central Processor is in a stall condition. The stall condition may be due to

- Program error. An improper MPN, MPC, or DV instruction causes the Central Processor to stall. Follow established installation or run procedures for analyzing and recovering from program error.

- System malfunction. This will be indicated in one or more of the various abnormal indicators on the console. Correction of the abnormal condition should be attempted; if the operator cannot correct the abnormal condition, the Confidence routine supplied by UNIVAC is to be run. The Confidence routine is a diagnostic routine which ensures that the system is functioning properly. If the Confidence routine does not run to successful completion, or if the operator is certain that the stall condition was not due to program error, contact the UNIVAC Field Engineer for further instructions.

- Mode Buttons

In the lower righthand section of the console is a group of five mutually exclusive mode control buttons used to control the operation of the Central Processor in conjunction with the PROGRAM START button/light.

LOAD CARD

One card is read in the Reader, in the untranslated mode, into consecutive store locations starting at location 256 when the following sequence of operations is executed:

1. *Depression of the CLEAR button/light.*
2. *Depression of the LOAD CARD button.*
3. *Depression of the PROGRAM START button/light.*

LOAD TAPE*

One block of data is read from Tape Handler 0 into consecutive store locations starting at location 256 when the following sequence of operations is executed:

1. *Depression of the CLEAR button/light.*
2. *Depression of the LOAD TAPE button.*
3. *Depression of the PROGRAM START button/light.*

ONE CYCLE

The ONE CYCLE button is reserved for engineering use only.

ONE INSTR

Depression of the PROGRAM START button/light while the ONE INSTR button is depressed causes the execution of the instruction currently contained in the instruction register and the accessing of the next instruction. If the ONE INSTR button is depressed while a program is being executed in the continuous mode, the Central Processor halts after an instruction has been accessed but before it is executed.

CONT

Depression of the PROGRAM START button/light while the CONT button is depressed causes the execution of instructions in the continuous mode.

■ NEXT INSTRUCTION Button/Lights

The NEXT INSTRUCTION button/lights are located directly above the PROGRAM START and PROGRAM STOP button/lights. The M button/light is illuminated when the Central Processor transfers control to the instruction designated by the M portion of the instruction register. The CC button/light is illuminated when the Central Processor transfers control to the next instruction in sequence.

When the PROGRAM STOP button/light is illuminated, depression of the M button/light causes the transfer of the M portion of the instruction in the instruction register to the control counter. When the Central Processor is restarted, the instruction at M will be executed. Depression of the CC button/light forces a skip instruction (a JC instruction with an I portion of 32) into the instruction register. When the Central Processor is restarted, the skip is executed and control is transferred to the instruction whose address is in the control counter.

■ OPERATOR REQUEST (Red)

The OPERATOR REQUEST button/light, located to the left of the NEXT INSTRUCTION button/lights, remains illuminated until depressed. When it is depressed, the OPERATOR REQUEST button/light is extinguished, a Class II Interrupt request is stored, and further operator requests are automatically inhibited. Program testing by the Cordinator* (or a

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* *Applicable to UNIVAC 1050 Magnetic Tape Systems only.*

** *Applicable to systems with two or more magnetic tapes.*

similar routine) identifies the cause of the Class II Interrupt. The Coordinator brings the program or programs currently operating to an orderly halt, at which point the operator is free to perform the function or functions which provided him with the reason for depressing the OPERATOR REQUEST button/light.

When the Central Processor is restarted, programmed release of the operator interrupt inhibit by the Coordinator permits subsequent operator requests and illuminates the OPERATOR REQUEST button/light. Programmed inhibit of operator interrupt extinguishes the button/light.

- SENSE Button/Lights (Red)

The SENSE button/lights, located immediately to the left of the OPERATOR REQUEST button/light, are labeled 1, 2, and 3. When they are illuminated, the associated program testable Sense Indicators are in the "Set" or "On" condition; when they are extinguished, the associated Sense Indicators are in the "Reset" or "Off" condition.

Depression of a SENSE button/light when it is illuminated extinguishes the button/light and places the associated Sense Indicator in the "Reset" or "Off" condition. Depression of a SENSE button/light when it is extinguished lights the button/light and places the associated Sense Indicator in the "Set" or "On" condition.

- Display Lights and Display/Alter Selection Buttons (Yellow)

Across the top of the console is a horizontal row of 31 display lights associated with the Display/Alter Selection Buttons located at the center of the console. The seventh light from the right differs physically from the rest of the display lights and is used to display a parity bit associated with the information being displayed.

When the Display/Alter Selection Button labeled CC is depressed, the current reading of the control counter is displayed in the 15 lights immediately to the left of the parity bit display light.

When the Display/Alter Selection Button labeled INST is depressed, the current contents of the instruction register are displayed in the display lights.

The CC and INST buttons are the only Display/Alter Selection Buttons used in normal computer operation. The other buttons are reserved for engineering use.

- Abnormal Indicators (Red)

In the lower left center of the console a series of indicator lights are located which indicate to the operator the nature of any abnormal conditions that may arise in the Central Processor as well as the existence of abnormal conditions in the rest of the system.

The PARITY Class I Interrupt indicator lights when the parity error check circuits detect an even parity in a character read from store while an instruction is being accessed or executed. This excludes parity errors occurring while the input/output devices access main store, in which case parity error recognition is handled by the input/output devices.

The PROC ABNORMAL indicator lights when the parity error check circuits detect an even parity in a character read from store while the PARITY indicator is illuminated.

The OVERFLOW INHIBITED indicator lights when Decimal Overflow Interrupt Inhibit has been set by program instruction. The indicator is extinguished when the inhibit has been released by program instruction.

The CLASS III INHIBITED indicator lights when Class III Interrupt Inhibit has been set by program instruction. The indicator is extinguished when the inhibit has been released by program instruction.

The CHANNEL ABNORMAL button/lights are illuminated when fault conditions arise in the associated channels. Depression of an illuminated CHANNEL ABNORMAL button/light extinguishes the light and clears the fault condition(s) occurring in the associated Synchronizer. Those fault conditions arising at the associated input/output device must be cleared at the unit as well. All fault clearing must be accompanied by program correction or resetting of fault indicators.

Important Note: Use of the CHANNEL ABNORMAL button/lights must be clearly defined in, and governed by, the operating instructions for all programs. Indiscriminate clearing of indicators can easily cause the loss of indicators as yet unprocessed at the time the abnormal or fault conditions arose.

- Reserved Buttons, Lights, and Switches

All buttons, lights, and switches appearing on the console which have not been described here are reserved for engineering use only.

2. Reader Control Panel

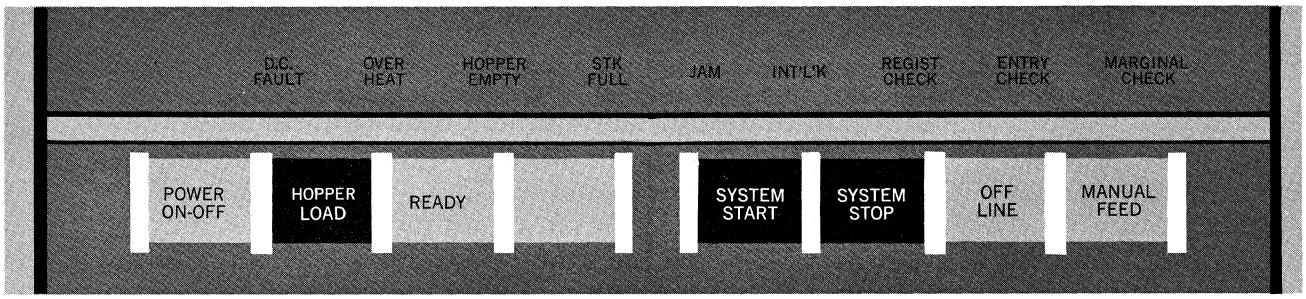

Figure 2-6. Reader Control Panel.

a. Button/Lights

POWER ON-OFF (White)

- This button/light is illuminated when the unit is receiving a.c. operating power.
- Depression of this button/light when it is illuminated extinguishes it and removes a.c. operating power except the power for the blowers and indicators.
- Depression of this button/light when it is extinguished illuminates it and applies a.c. operating power to the unit.

HOPPER LOAD (White)

- This button/light is normally extinguished.
- This button/light is depressed when cards are initially loaded. Cards are placed in the reserve magazine, resting on the rollers at the bottom of the magazine. 80 column cards are loaded face down with the 9 edge leading; 90 column cards are loaded face up with the 9 edge leading. Depression of this button/light illuminates it, starts the drive motor, and causes cards to feed from the reserve magazine into the primary magazine. As soon as the primary magazine contains sufficient cards for normal operation of the Reader, card feeding ceases, the button/light is extinguished, and the READY button/light (see below) is illuminated. Subsequent card feeding is under Central Processor control.

READY (Green)

- This button/light is illuminated when all conditions necessary for the operation of the Reader have been satisfied.
- When an abnormal condition is detected, the button/light is extinguished. After the abnormal condition is corrected, depression of the button/light illuminates it and makes the unit available to the system, and it starts the drive motor if the motor is not running.

SYSTEM START (Green)

- Depression of this button/light initiates the execution of program instructions from the Reader location.
- This button/light is illuminated when the UNIVAC 1050 System is operating under control of the Central Processor.

SYSTEM STOP (Red)

- Depression of this button/light stops the UNIVAC 1050 System from the Reader location.
- This button/light is illuminated when the UNIVAC 1050 System is not executing program instructions.

OFFLINE (White)

- This button/light is normally extinguished.
- Depression of this button/light when it is extinguished illuminates it and makes the unit unavailable to the Central Processor.
- Depression of this button/light when it is illuminated extinguishes it and makes the unit available to the Central Processor.

MANUAL FEED (White)

- This button is reserved for engineering use only.

b. Abnormal Indicators (Red)

The abnormal indicators are located in a horizontal row above the button/lights. When no abnormal conditions exist, the indicators are not visible. When an abnormal condition exists, the appropriate indicator is illuminated and becomes visible through the screened panel.

D.C. FAULT

This indicator lights when a d.c. power failure occurs. This abnormal condition stops the drive motor.

OVERHEAT

This indicator lights when an abnormal temperature condition exists. The drive motor is stopped and all power is removed, with the exception of the power required for the blowers and indicators.

HOPPER EMPTY

This indicator lights when there are no cards in the primary magazine.

STK FULL

This indicator lights when any one of the output stackers is filled to capacity.

JAM

This indicator lights when a card jam occurs in the stacker transport section. The drive motor is stopped.

INT'L'K

This indicator lights if the read assembly is raised or improperly seated, or if the protective covers are not in place. All power is removed from the unit except that for blowers and indicators.

REGIST CHECK

This indicator lights when a card is not properly aligned at the read station. An abnormal indication is sent to the Central Processor; interruption of machine operation is dependent upon Central Processor control.

ENTRY CHECK

This indicator lights when a card which has been ordered to be fed has failed to reach the read station, or if a card jam has occurred in the read station. The drive motor is stopped.

MARGINAL CHECK

This indicator lights when the sensing mechanism of the unit is not operating normally. A maintenance check must be performed before any further reading is attempted.

3. Printer Control Panels

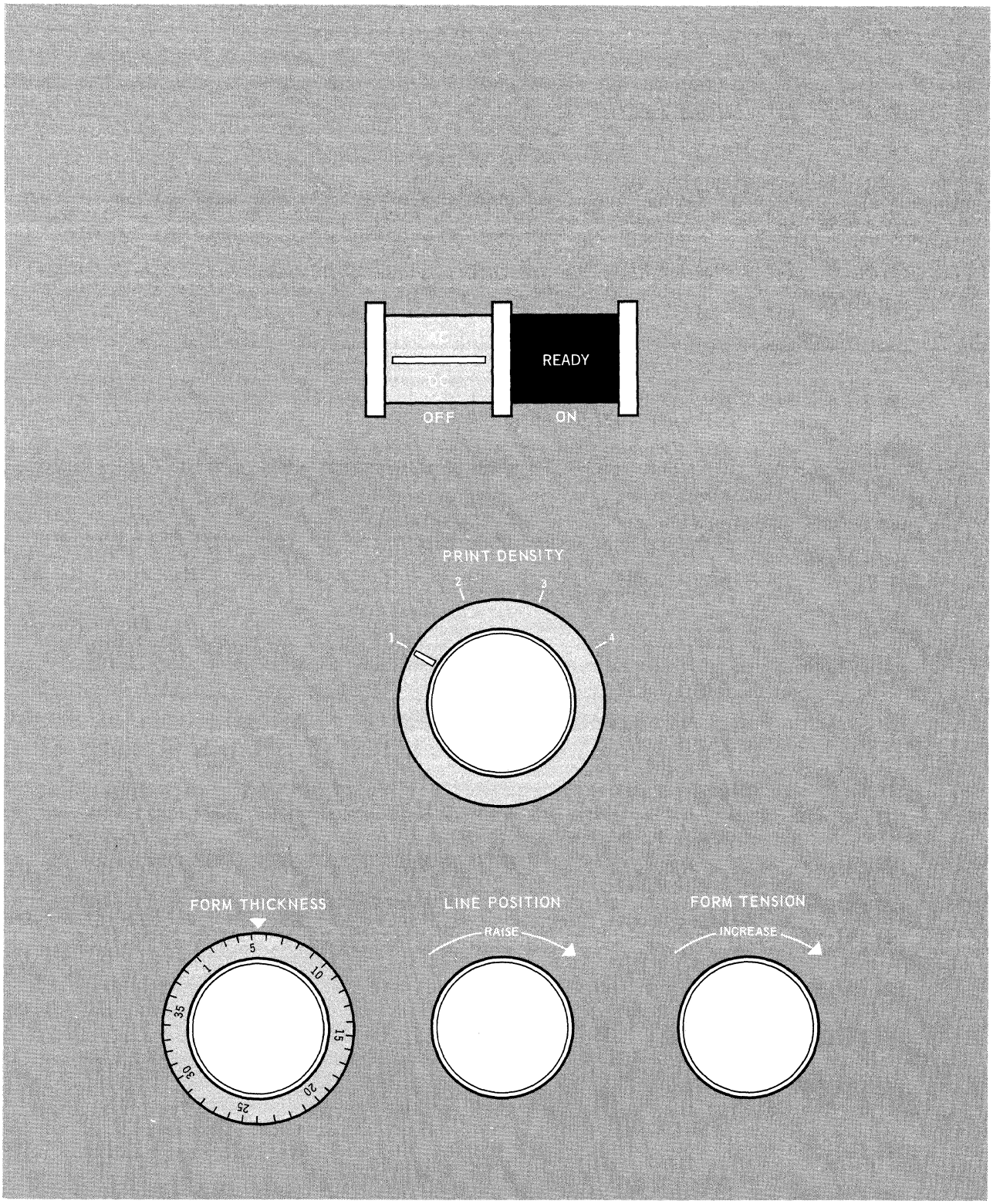

Figure 2-7. Printer Controls, Left Panel

a. Button/Lights

(1) Left Panel

AC/DC (White)

- Depression of this button/light turns power on or off to the Printer.
- The ac and dc indicators light when power is completely on to the unit.
- The dc indicator portion does not light if fuses or circuit breakers (other than the main circuit breaker) are open.
- Neither the ac nor the dc indicator lights if the main circuit breaker or interlocks are open.

READY (Green)

- This button/light lights automatically when power is applied and when all printer conditions are satisfactory for printing.
- The indicator does not light or it is extinguished if any of the fault conditions shown on the diagnostic panel occur.
- It is also extinguished if depressed when lit.

PRINT DENSITY

- This four position rotary switch adjusts the striking force of the print hammer; it is used in multi-copy printing to control quality of carbon copies. Force increases from position 1 (least) to position 4 (most).

FORM THICKNESS

- This knob adjusts the space between the type drum and print hammers for the best printing impression. Turn counterclockwise to increase space (approximately 0.001 inch for each graduation on the knob).

LINE POSITION

- This knob adjusts placement of vertical printing by raising or lowering the form slightly.

FORM TENSION

- This knob adjusts the vertical tension of the form between the upper and lower paper-feed tractors.

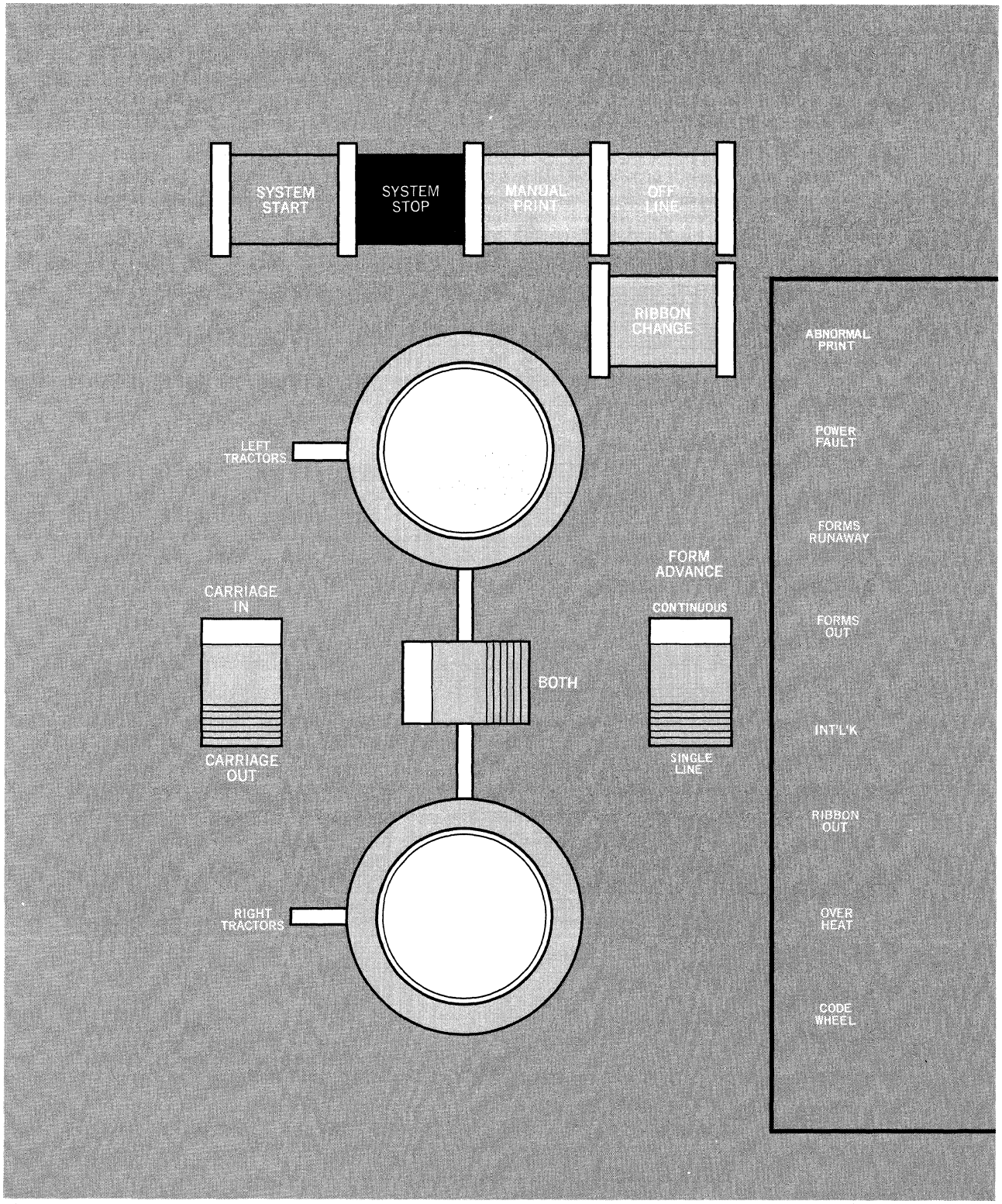

Figure 2-8. Printer Controls, Right Panel

(2) Right Panel

SYSTEM START (Green)

- Depression of this button/light initiates the execution of program instructions from the Printer location.
- This button/light is illuminated when the UNIVAC 1050 System is operating under control of the Central Processor.

SYSTEM STOP (Red)

- Depression of this button/light stops the UNIVAC 1050 System from the Printer unit.
- This button/light is illuminated when the UNIVAC 1050 System is not executing program instructions.

MANUAL PRINT (White)

- This button/light is normally extinguished and is illuminated only when it is depressed.
- Depression of this button/light, together with a programmed manual print operation, allows the printing of a single line of information when there is FORMS OUT indication.

OFFLINE (White)

- This button/light is normally extinguished.
- Depression of this button/light when it is extinguished illuminates it and makes the unit unavailable to the Central Processor.
- Depression of this button/light when it is illuminated extinguishes it and makes the unit available to the Central Processor.

RIBBON CHANGE (White)

- This button/light is normally extinguished.
- Depression of this button/light illuminates it and causes the ribbon to be wound past the automatic ribbon reverse position on the take-up shaft. When the ribbon is wound past the reversing position, the printer is placed in the nonready condition. The RIBBON OUT indicator (see below) is then illuminated. The operator can change the ribbon at this point.
- After the ribbon is changed, depressing the lighted RIBBON CHANGE button/light extinguishes it. Depression of the READY button/light extinguishes the RIBBON OUT indicator and makes the unit available to the system.

LEFT TRACTORS Dial

- This is a mechanical control which enables the operator to adjust the lefthand printer tractors to take forms of various width.
- When the dial is operated, both upper and lower lefthand tractors are moved.
- Before this dial may be operated, the tractor locks must first be released by pressing them in towards the tractor shafts. Also, the switch labeled BOTH (see below) must first be depressed away from the BOTH position.
- Clockwise rotation of the dial moves the lefthand tractors to the right, and counterclockwise rotation moves them to the left.

RIGHT TRACTORS Dial

- This dial is similar to the LEFT TRACTORS dial except that control is maintained over the right set of tractors.

BOTH Switch (White)

- This is an alternate action toggle switch. When it is depressed on the side labeled BOTH, both left and right sets of tractors are moved simultaneously using either dial. Clockwise rotation of either dial, when this switch is in the BOTH position, moves all tractors to the right; counterclockwise rotation moves them to the left. This allows the operator to adjust the paper in such a fashion as to position a specific location on the paper over a specific printing position.
- When this switch is depressed on the side away from BOTH, only the left tractors are moved when the LEFT TRACTORS dial is operated, and only the right tractors are moved when the RIGHT TRACTORS dial is operated.

CARRIAGE IN/CARRIAGE OUT Switch (White)

- This is an alternate action toggle switch. When the carriage is out, depressing the switch to CARRIAGE IN causes the carriage to move towards the paper and into printing position. When the carriage is in, depression of the switch to CARRIAGE OUT causes the carriage to move away from the paper, which lights the CARRIAGE OUT indicator (see below) and extinguishes the READY button/light; the printer is in a nonready condition.

FORM ADVANCE Switch (White)

- This rocker type switch is pivoted at its center. It is used to advance paper through the tractors while the Printer is in the offline condition. Depressing the switch below the center advances paper one line, and depressing it above the center advances paper continuously until it is released. It returns automatically to the unactivated position upon release.

b. Abnormal Indicators (Red)

The abnormal indicators are located in a vertical row in the lower right section of the right panel. When no abnormal conditions exist, the indicators are not visible. When an abnormal condition exists, the appropriate indicator is illuminated and becomes visible through the screened panel.

ABNORMAL PRINT

Lights when a fuse opens on a circuit card or when a circuit card is missing.

POWER FAULT

This indicator lights when there is either an a.c. or d.c. fault. After correction of the fault, the READY button/light must be depressed to clear the indication. Forty seconds after depressing the READY button/light, it will be illuminated.

FORMS RUNAWAY

This indicator lights when the paper has advanced continuously for more than 22 inches through the tractors. The printer is placed in a nonready condition.

FORMS OUT

This indicator lights when there is a maximum of 2½ inches of paper remaining below the print line. The printer is placed in a nonready condition.

INT'L'K

This indicator lights when the left, right, or rear cover of the printer is removed. The printer is placed in a nonready condition.

RIBBON OUT

This indicator lights only after the operator has previously depressed the RIBBON CHANGE button/light and when the ribbon is just switching from the upper take up shaft and preparing to wind down onto the lower shaft (see RIBBON CHANGE above). The printer is placed in a nonready condition. After the ribbon has been changed, the RIBBON CHANGE button/light must be depressed to extinguish the RIBBON CHANGE indicator, and then depression of the

READY button/light extinguishes the RIBBON OUT indicator and restores the printer to the ready condition.

OVERHEAT

This indicator lights when an abnormal temperature condition exists in the printer. After the abnormal condition has been corrected, depression of the READY button/light makes the printer available to the system after a 40 second interval.

CODE WHEEL

This indicator lights when a parity error has been detected in the code wheel signals arriving at the Synchronizer. A maintenance check must be performed before further printing is attempted.

4. Punch Control Panel

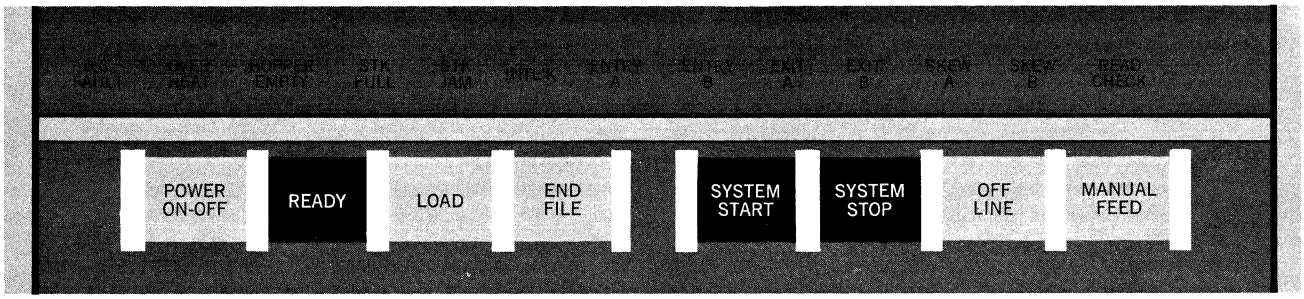

Figure 2-9. Punch Control Panel.

a. Button/Lights

POWER ON-OFF (White)

- This button/light is illuminated when the d.c. power supplies in the unit are energized.
- Depression of this button/light when it is illuminated extinguishes it and removes a.c. operating power except the power for the blowers and indicators.
- Depression of this button/light when it is extinguished illuminates it and applies a.c. power to the power supplies.

READY (Green)

- This button/light is illuminated when all conditions necessary for the operation of the Card Punch Unit have been satisfied.
- When an abnormal condition is detected, the button/light is extinguished. After the abnormal condition is corrected, depression of the button/light illuminates it and makes the unit available to the system.

LOAD (White)

- Depression of this button/light permits the loading of cards without the generation of errors that would normally occur due to the absence of cards.

END FILE (White)

- Depression of this button/light permits end file clearing of cards out of the card transport mechanism of the unit without generating the errors that would normally occur due to the absence of cards.

SYSTEM START (Green)

- Depression of this button/light initiates the execution of program instructions from the Card Punch Unit location.
- This button/light is illuminated when the UNIVAC 1050 System is operating under control of the Central Processor.

SYSTEM STOP (Red)

- Depression of this button/light stops the UNIVAC 1050 System from the Card Punch Unit location.
- This button/light is illuminated when the UNIVAC 1050 System is not executing program instructions.

OFFLINE (White)

- This button/light is normally extinguished.
- Depression of this button/light when it is extinguished illuminates it, makes the unit unavailable to the Central Processor, and allows the operation of the MANUAL FEED button/light (see below).
- Depression of this button/light when it is illuminated extinguishes it and makes the unit available to the Central Processor.

MANUAL FEED (White)

- Depression of this button while the OFFLINE button/light is illuminated causes all cards in the card transport mechanism to be advanced one station.
- Depression of the button/light while the OFFLINE button/light is extinguished has no effect.

b. Abnormal Indicators (Red)

The abnormal indicators are located in a horizontal row above the button/lights. When no abnormal conditions exist, the indicators are not visible. When an abnormal condition exists, the appropriate indicator is illuminated and becomes visible through the screened panel.

D.C. FAULT

This indicator lights when a d.c. power failure occurs. The drive motor is stopped.

OVERHEAT

This indicator lights when an abnormal temperature condition exists. The drive motor is stopped and all power is removed, with the exception of the power required for the blowers and indicators.

HOPPER EMPTY

This indicator lights when there are no cards in the input magazine. The drive motor is stopped.

STK FULL

This indicator lights when either of the two output stackers is filled to capacity. The drive motor is stopped.

STK JAM

This indicator lights when a card jam occurs in the stacker transport mechanism. The drive motor is stopped.

INT'L'K

This indicator lights when the punch assembly and upper card feed is raised or improperly seated; when the post-punch check reading brushes are not in place; or when the protective machine covers are not in place. The drive motor is stopped.

ENTRY A

This indicator lights when there is a late or missing card at Wait Station 2. The drive motor is stopped.

ENTRY B

This indicator lights when there is a late or missing card at the Post-Punch Check Station. The drive motor is stopped.

EXIT A

This indicator lights when the card at Wait Station 2 exits late or fails to exit from the station. The drive motor is stopped.

EXIT B

This indicator lights when the card at the Post-Punch Check Station exits late or fails to exit from the station. The drive motor is stopped.

SKEW A

This indicator lights when a transverse card misalignment occurs while entering or exiting Wait Station 1. The drive motor is stopped.

SKEW B

This indicator lights when a transverse card misalignment occurs while a card is exiting from the Post-Punch Check Station. The drive motor is stopped.

READ CHECK

This indicator lights when the check circuitry detects an incorrect data comparison. The drive motor is not stopped; the Central Processor must bring the unit to a stop.

5. Card System Operating Procedures

a. Normal Procedures

(1) Console Sense Switches

- Sense switch 1 controls punching of object deck.

  OFF – Object deck will be punched.
  ON – Object deck will not be punched.

- Sense switch 2 controls printing of assembly listing.

  OFF – Listing will be printed.
  ON – No printing.

- Sense switch 3 controls punching of label table.

  OFF – Label table will not be punched.
  ON – Label table will be punched.

(2) Punch

- Turn punch on (depress power on button until light is on).
- Turn punch offline (depress offline button until light is off).
- Depress clear – manually feed card(s) until card appears in output stacker (remove card(s) from output stacker).
- Turn punch online (depress offline button).

(3) Printer

- Depress offline button until light is on.
- Set paper 3 holes above sprocket.
- Depress offline button until light is off.

(4) Reader

- Place program to be assembled including Input/Output Specializer cards,* behind first pass assembler deck.
- Place cards in reader face down, 9 edge leading.
- Depress power on button until light is on.
- Depress magazine load button.
- Depress clear button after magazine load light is off.

(5) Console

- Depress clear button.
- Depress load card mode button.
- Depress program start button.
- Depress continuous mode button.
- Depress program start button (assemble first pass).

  STOP $(30\ 01777760)_8$.

(6) Reader

- Remove cards from output stacker, separating source code from first pass assembler deck.
- Place source code behind second pass assembler deck in the input magazine, 9 edge leading.
- Depress magazine load button.
- Depress clear button after magazine load light is off.

(7) Console

- Depress program start button (assemble second pass).

  Program Stop $(30\ 017777\ 60)_8$.

  End of Assembly.

(8) Output

- Object code – output punch stacker.

  Listing – printer.

---

* *See Input/Output Specializer, page 2-D-1.*

b. Abnormal Procedures

ERROR STOPS	DISPLAY	PASS	DESCRIPTION	RECOVERY
1.	30 017771 60	1 & 2	No Begin Card	Refeed source deck with valid Begin card. Depress program start to continue assembly.
2.	30 010077 60	1	Label Table Exceeded	Depress program start to continue assembly. All labels that exceed the table limit will appear on the output listing with "L" errors. After assembly is finished use $ option to reduce number of labels.
3.	30 110000 60	2	Reader Error	Refeed cards in error stacker. Depress clear on READER. Depress program start.
4.	30 11000X 60	1	Reader Error	Replace "X" cards in the input magazine. Depress clear on READER. Depress program start. Note: "X" does not always match the number of cards in the error stacker. Remove excess cards from the normal stacker.
5.	30 120002 60	Label Table Print & Punch	Punch Error a) No card in error stacker. b) 1 card in error stacker.	a) Remove last card in normal stacker. b) Last card in normal stacker will be followed by the next proper card. Note: All cards selected into error stacker may be discarded.
6.	Channel 2 Abnormal on console will be lit.	2	Punch Error	Clean all cards out of punch. Turn punch offline; manually feed cards until blank card appears in output stacker. Depress clear on PUNCH. Depress program start. Remove any blank cards from output stacker.
7.	Channel 0 Abnormal on console will be lit.	Label Table Punch & Print, 2	Printer Error	Turn printer offline. Return printer to normal condition. Depress clear on PRINTER. Turn PRINTER online. Assembly will continue.

6. PAL Assembly Errors

ERROR CODE	DESCRIPTION
L	Duplicate or Undefined Label.
E	Expression is too large or has been omitted.
O	Unrecognizable OP code.
S	Card sequence error
C	Number of cards processed in the first pass does not agree with the number of cards processed in the second pass. (Can appear only on same line as "END" card.)

J. SUMMARY OF JUMP INDICATORS

The indicators in the table below are divided into two groups: testable and nontestable. The nontestable indicators (00-31) cause a certain function to be performed and an unconditional jump. The conditional jump indicators (32-63) are testable and cause a jump only if the indicator has been set by a certain condition.

Table 2-5 lists the most frequently used indicators (33-40) and all of the instructions which make use of them. For a complete description of the use of any indicator, refer to the instruction involved.

00-31 Unconditional Jump to M Address

00	Unconditional Jump
14	Release Operator Interrupt Inhibit and jump.
15	Set Operator Interrupt Inhibit and jump.
16	Stop, Jump when Console Restart (See 25) Button is depressed.
17	Set Tracing Stall and Jump.
18	Set Sense Indicator 1 to 1 and jump.
19	Set Sense Indicator 2 to 1 and jump.
20	Set Sense Indicator 3 to 1 and jump.
21	Set Sense Indicator 1 to 0 and jump.
22	Set Sense Indicator 2 to 0 and jump.
23	Set Sense Indicator 3 to 0 and jump.
24	Unconditional Jump.
*25	Release Class 3 Interrupt Inhibit.
26	Set I/O Interrupt Inhibit and jump (Class 3).
27	Release I/O Interrupt Inhibit and jump (Class 3) (Resets Programmed Inhibit Only).
28	Set Decimal Overflow Interrupt Inhibit and jump (Class 2).
*29	Release Class 2 Interrupt Inhibit.
*30	Release Processor Parity or Abnormal Interrupt Inhibit and jump (Class 1).
31	Release Decimal Overflow Interrupt Inhibit and jump (Class 2) (Resets Programmed Inhibit Only).

*RESETS the inhibit automatically generated when the interrupt occurred.

32-63 Conditional Jump

Exceptions to conditional jump are 32, 41, 42, 48, and 56. The status of the indicators is unaltered by the JC and JR instructions except as shown.

32	(KNO)	NOOP
33	(KHI)	High
34	(KEQ)	Equal
35	(KUQ)	Unequal
36	(KLO)	Low

These four indicators are affected by the comparison instructions: CC, LC, CD, CB, CT.

37	(KZR)	Result of last arithmetic operation was zero.
38	(KM)	Result of last decimal arithmetic operation was negative.
39	(KNB)	No overflow in last binary add operation or overflow did occur in the last binary subtract operation.
40	(KDF)	Decimal Overflow occurred since last test. If the indicator is set to 1, reset it to 0 and jump.
41		Store Indicators 33-40 in M_X memory position and proceed to next instruction.
42		Set Indicators 33-40 from M_X memory position and proceed to next instruction.
43		Input/Output status test found indicator(s) set to 1.
44		Test and reset operator interrupt request.
45		Input/Output Interrupt is inhibited (Class 3).
47		Decimal Overflow Interrupt is inhibited (Class 2).
48		Stop/Go to control counter when console start is depressed, ignore M used for display.
49		Processor Parity and Abnormal Interrupt is inhibited (Class 1) (Manual Switch Only).
50		Sense Switch 1 on console is ON.
51		Sense Switch 2 on console is ON.
52		Sense Switch 3 on console is ON.
53		Sense Indicator 1 is set (to 1).
54		Sense Indicator 2 is set (to 1).
55		Sense Indicator 3 is set (to 1).
56		Skip (no operation).
57		If Trace Indicator is set to 1, reset Trace Indicator and Trace Stall to 0 and jump.
58		Operator Interrupt is inhibited.

INSTRUCTIONS	INDICATORS							
	33 KHI	34 KEQ	35 KUQ	36 KLO	37 KZR	38 KM	39 KNB	40 KDF
AT							■	
CT	■	■	■	■				
AD					■	■		■
SD					■	■		
AM					■	■		■
SM					■	■		
MPN					■	■		
MPC					■	■		■
DV								■
AB					■		■	
SB					■		■	
AC							■	
CD	■	■	■	■				
CB	■	■	■	■				
CC	■	■	■	■				
LC	■	■	■	■				
JG	■							
JE		■						
JU			■					
JS				■				
*JC					■	■	■	■
**JR	■	■	■	■	■	■	■	■

* *The JC instruction may use any indicator.*

** *The JR instruction may test any indicator.*

Table 2-5. Frequently used indicators.

K. SUMMARY OF INSTRUCTION FORMATS

The general UNIVAC 1050 instruction format is shown as follows:

1st CHARACTER	2nd CHARACTER			3rd CHARACTER	4th CHARACTER	5th CHARACTER
OPERATION CODE	INDEX REGISTER		RESERVED	MAIN STORE ADDRESS		DETAIL
30 26	25 23		22	21 19	18 13	12 7	6 1

The following foldout presents a description of each instruction and the content of each field in the instruction. These instructions are grouped according to type for easy reference.

As presented in the foldout the octal operation code is an octal number. The binary representation consists of a five bit field (Positions 30-26) with a sixth (zero bit) implied to the right of the least significant position; for example, the binary operation code 11011 becomes 11011(0), or octal 66. It is in this fashion that the octal operation codes are derived. The reason for so doing is that an octal printout of store produced by the diagnostic procedures does not attempt to differentiate between data and instructions; this is the programmer's concern, as only he knows which areas of store contain instructions and which areas contain data. Any instructions with a binary operation code of 11011 that have a binary zero in the most significant bit position of the index register field will print as a 66, and any such instructions with a 1 bit in that bit position will print as a 67. The derivation of an octal operation code in the fashion described renders instructions much more easily identifiable than they would be if the implied zero bit were in the most significant bit position.

		WRITTEN FORM					DEC. IND. NO.	INTERNAL FORM (OCTAL) 25 23 | 22 | 21 7 | 6 1
TYPE	MNEM CODE	30-26 OP CODE	INSTRUCTION	DESCRIPTION	LSD MSD	OPERANDS		X | | M | DETAIL
TRANSFERS	BDa	56	BRING DECIMAL	$(M)_L \rightarrow$ AR, DECIMAL + &	L	M, L, X		0 7 | 0 | 0—77777 | 1/6 0/1*/5 4 0—L 17**
	BAa	56	BRING ALPHANUMERIC	$(M)_L \rightarrow$ AR, BINARY	L	M, L, X		0/6 0/1*/5 4 0—L 17**
	BT	46	BRING TETRAD	$(M) \rightarrow T$	L	M, T, X		0—T 77
	SAa	52	STORE ARITHMETIC REG.	$(AR)_L \rightarrow M_L$	L	M, L, X		0/1*/5 4 0—L 17**
	SAR	52	STORE BOTH ARITHMETIC REGISTERS	(AR1, AR2)→M→M−31	L	M , , X		61(110001)
	ST	42	STORE TETRAD	$(T) \rightarrow M$	L	M, T, X		0—T 77
	SC	44	STORE CHARACTER	$C_I \rightarrow M$	L	M, C, X		0—C 77
	FT	20	FIX TETRAD	$M_I \rightarrow T$	L	M, T, X		0—T 77
	TFI	24	TRANSFER BLOCK FROM STORE, INCREMENT	(M, M+1, M + ---) DST (TET 16)	M	M , , X		20(010000)
	TFR	24	TRANSFER BLOCK FROM STORE, RESET	(M, M+1, M + ---) DST (TET 16)	M	M , , X		0
	TTI	24	TRANSFER BLOCK TO STORE, INCREMENT	(ORIGIN)→M, M + 1, M + ---	M	M , , X		60(110000)
	TTR	24	TRANSFER BLOCK TO STORE, RESET	(ORIGIN)→M, M + 1, M + ---	M	M , , X		40(100000)
ARITHMETIC	ADa	66	ADD DECIMAL	$(AR) + (M)_L \rightarrow AR$	L	M, L, X	37, 38	0/6 0/1*/5 4 0—L 17**
	ABa	72	ADD BINARY	$(AR)_L + (M)_L \rightarrow M_L$	L	M, L, X	37, 39	0/6 0/1*/5 4 0—L 17**
	AMa	62	ADD TO MEMORY	$(AR)_L + (M)_L \rightarrow M_L$, DECIMAL	L	M, L, X	37, 38	0/6 0/1*/5 4 0—L 17**
	AT	76	ADD TO TETRAD	$(M) + (T) \rightarrow T$	L	M, T, X	39	0—T 77
	AC	60	ADD CHARACTER	$C + (M) \rightarrow M$, CARRIES	L	M, C, X	39	0—C 77
	SDa	66	SUBTRACT DECIMAL	$(AR) - (M)_L \rightarrow AR$	L	M, L, X	37, 38	1/6 0/1*/5 4 0—L 17**
	SBa	72	SUBTRACT BINARY	$(M)_L - (AR)_L \rightarrow M_L$	L	M, L, X	37, 39	1/6 0/1*/5 4 0—L 17**
	SMa	62	SUBTRACT FROM MEMORY	$(M)_L - (AR)_L \rightarrow M_L$, DECIMAL	L	M, L, X	37, 38	1/6 0/1*/5 4 0—L 17**
	MPN	50	MULTIPLY NON-CUMULAT.	(AR2) x (T20, 21)→AR1		, L	37,	0 | 0 | 0/6 0/5 0/4 3 0—L 7§
	MPC	50	MULTIPLY CUMULATIVE	(AR2) x (T20, 21)→AR1 CUM.		, L	38, 40	0/6 1/5 0/4 3 0—L 7§
	DV	50	DIVIDE	(AR1) ÷ (AR2)→QTN (TET 20, 21); REMAIN.→AR1		, L	40	1/6 0/5 0/4 3 0—L 7§
COMPARISON	CDa	26	COMPARE DECIMAL	$(AR) : (M)_L$	L	M, L, X	33-36	0—7 | 0—77777 | 1/6 0/1*/5 4 0—L 17**
	CBa	70	COMPARE BINARY	$(AR)_L : (M)_L$	L	M, L, X		1/6 0/1*/5 4 0—L 17**
	CC	34	COMPARE CHARACTER	$C_I : M$	L	M, C, X		0—C 77
	CT	74	COMPARE TETRAD	$(T) : (M)$	L	M, T, X		0—T 77
	LC	14	LOGICAL COMPARE	IF M_X HAS A 1 BIT FOR EVERY 1 BIT IN C THEN =	L	M, C, X		0—C 77
SEQUENCE CONTROL	JE	30	JUMP EQUAL	IF I 34 IS SET, M→CC		M, X	34	42(100010)
	JG	30	JUMP GREATER	IF I 33 IS SET, M→CC		M, X	33	41(100001)
	JS	30	JUMP SMALLER	IF I 36 IS SET, M→CC		M, X	36	44(100100)
	JU	30	JUMP UNEQUAL	IF I 35 IS SET, M→CC		M, X	35	43(100011)
	J	30	JUMP	M→CC		M, X		0
	JC	30	JUMP CONDITIONAL	IF $I_n = 1$, M→CC (SEE INDICATOR LIST)		M, I, X	ALL	1—I 0—77
	JL	32	JUMP LOOP	IF (N) − 1 ≠ 0, M→CC		M, N, X		0—N 77
	JR	10	JUMP RETURN	IF $I_n = 1$, CC→M; M + 5→CC		M, I, X	ALL	0—I 77
	JD	30	JUMP DISPLAY	STOP, DISPLAY M, NEXT INSTR. ON RESTART		M, X		60(110000)
	JHJ	30	HALT, THEN JUMP	STOP, M→CC ON RESTART		M, X		20(010000)
SHIFT	BCn	16	BIT CIRCULATE	CIRCULATE n CHAR., S BIT POS. LEFT MAX. 7 BIT POS.	L	M, S, X		1/6 5 0—n 3† 4 3 0—S 7
	BSn	16	BIT SHIFT	SHIFT n CHAR., S. BIT POS. LEFT MAX. 4 CHAR. AND 7 POS.	L	M, S, X		0/6 5 0—n 3† 4 3 0—S 7
EDIT	LS	64	LOGICAL SUM	$(M_X) \vee C \rightarrow M_X$	L	M, C, X		0—C 77
	LP	54	LOGICAL PRODUCT	$(M_X) \wedge C \rightarrow M_X$	L	M, C, X		0—C 77
	PD	26	PAD BLANKS	BINARY ZEROS→M_L	L	M, L, X		0/6 0/5 | 0—L 17**
	PD0	26	PAD ZEROS	XS-3 ZEROS→M_L	L	M, L, X		0/6 1/5
	ZS	22	ZERO SUPPRESS	FROM MSD CHANGE PRECEDING 0'S, , 'S AND BLANKS TO BLANKS	M	M, L, X		1/6 0/5
	ZS$	22	ZERO SUPPRESS AND FLOATING $ SIGN	TO $'S	M	M, L, X		0/6 0/5
	ZS*	22	ZERO SUPPRESS WITH ASTERISK FILL	TO *'S	M	M, L, X		1/6 1/5
	ED	52	EDIT	$(AR1) \rightarrow M_L$ CONTROLLED BY (AR2)	L	M, L, X		1/6 0/5 4
	TR	12	TRANSLATE	$(M)_{JL} \rightarrow M_{JL}$ (T18 = ROW ADD.)	L	M, L, X		L—77

∧ = LOGICAL AND & = SENTINEL
∨ = LOGICAL OR

† 00 IS INTERPRETED BY THE CIRCUITRY AS 04.
§ 000 IS INTERPRETED BY THE CIRCUITRY AS 010.
** 0000 IS INTERPRETED BY THE CIRCUITRY AS 020.

* IF a = 1, BIT 5 = 0; IF a = 2, BIT 5 = 1.

N. B. SUBSCRIPT I INDICATES IMMEDIATE DATA

L. OCTAL-DECIMAL CONVERSION TABLE

OCTAL 0000 to 0777	DECIMAL 0000 to 0511

	0	1	2	3	4	5	6	7
0000	0000	0001	0002	0003	0004	0005	0006	0007
0010	0008	0009	0010	0011	0012	0013	0014	0015
0020	0016	0017	0018	0019	0020	0021	0022	0023
0030	0024	0025	0026	0027	0028	0029	0030	0031
0040	0032	0033	0034	0035	0036	0037	0038	0039
0050	0040	0041	0042	0043	0044	0045	0046	0047
0060	0048	0049	0050	0051	0052	0053	0054	0055
0070	0056	0057	0058	0059	0060	0061	0062	0063
0100	0064	0065	0066	0067	0068	0069	0070	0071
0110	0072	0073	0074	0075	0076	0077	0078	0079
0120	0080	0081	0082	0083	0084	0085	0086	0087
0130	0088	0089	0090	0091	0092	0093	0094	0095
0140	0096	0097	0098	0099	0100	0101	0102	0103
0150	0104	0105	0106	0107	0108	0109	0110	0111
0160	0112	0113	0114	0115	0116	0117	0118	0119
0170	0120	0121	0122	0123	0124	0125	0126	0127
0200	0128	0129	0130	0131	0132	0133	0134	0135
0210	0136	0137	0138	0139	0140	0141	0142	0143
0220	0144	0145	0146	0147	0148	0149	0150	0151
0230	0152	0153	0154	0155	0156	0157	0158	0159
0240	0160	0161	0162	0163	0164	0165	0166	0167
0250	0168	0169	0170	0171	0172	0173	0174	0175
0260	0176	0177	0178	0179	0180	0181	0182	0183
0270	0184	0185	0186	0187	0188	0189	0190	0191
0300	0192	0193	0194	0195	0196	0197	0198	0199
0310	0200	0201	0202	0203	0204	0205	0206	0207
0320	0208	0209	0210	0211	0212	0213	0214	0215
0330	0216	0217	0218	0219	0220	0221	0222	0223
0340	0224	0225	0226	0227	0228	0229	0230	0231
0350	0232	0233	0234	0235	0236	0237	0238	0239
0360	0240	0241	0242	0243	0244	0245	0246	0247
0370	0248	0249	0250	0251	0252	0253	0254	0255
0400	0256	0257	0258	0259	0260	0261	0262	0263
0410	0264	0265	0266	0267	0268	0269	0270	0271
0420	0272	0273	0274	0275	0276	0277	0278	0279
0430	0280	0281	0282	0283	0284	0285	0286	0287
0440	0288	0289	0290	0291	0292	0293	0294	0295
0450	0296	0297	0298	0299	0300	0301	0302	0303
0460	0304	0305	0306	0307	0308	0309	0310	0311
0470	0312	0313	0314	0315	0316	0317	0318	0319
0500	0320	0321	0322	0323	0324	0325	0326	0327
0510	0328	0329	0330	0331	0332	0333	0334	0335
0520	0336	0337	0338	0339	0340	0341	0342	0343
0530	0344	0345	0346	0347	0348	0349	0350	0351
0540	0352	0353	0354	0355	0356	0357	0358	0359
0550	0360	0361	0362	0363	0364	0365	0366	0367
0560	0368	0369	0370	0371	0372	0373	0374	0375
0570	0376	0377	0378	0379	0380	0381	0382	0383
0600	0384	0385	0386	0387	0388	0389	0390	0391
0610	0392	0393	0394	0395	0396	0397	0398	0399
0620	0400	0401	0402	0403	0404	0405	0406	0407
0630	0408	0409	0410	0411	0412	0413	0414	0415
0640	0416	0417	0418	0419	0420	0421	0422	0423
0650	0424	0425	0426	0427	0428	0429	0430	0431
0660	0432	0433	0434	0435	0436	0437	0438	0439
0670	0440	0441	0442	0443	0444	0445	0446	0447
0700	0448	0449	0450	0451	0452	0453	0454	0455
0710	0456	0457	0458	0459	0460	0461	0462	0463
0720	0464	0465	0466	0467	0468	0469	0470	0471
0730	0472	0473	0474	0475	0476	0477	0478	0479
0740	0480	0481	0482	0483	0484	0485	0486	0487
0750	0488	0489	0490	0491	0492	0493	0494	0495
0760	0496	0497	0498	0499	0500	0501	0502	0503
0770	0504	0505	0506	0507	0508	0509	0510	0511

OCTAL 1000 to 1777	DECIMAL 0512 to 1023

	0	1	2	3	4	5	6	7
1000	0512	0513	0514	0515	0516	0517	0518	0519
1010	0520	0521	0522	0523	0524	0525	0526	0527
1020	0528	0529	0530	0531	0532	0533	0534	0535
1030	0536	0537	0538	0539	0540	0541	0542	0543
1040	0544	0545	0546	0547	0548	0549	0550	0551
1050	0552	0553	0554	0555	0556	0557	0558	0559
1060	0560	0561	0562	0563	0564	0565	0566	0567
1070	0568	0569	0570	0571	0572	0573	0574	0575
1100	0576	0577	0578	0579	0580	0581	0582	0583
1110	0584	0585	0586	0587	0588	0589	0590	0591
1120	0592	0593	0594	0595	0596	0597	0598	0599
1130	0600	0601	0602	0603	0604	0605	0606	0607
1140	0608	0609	0610	0611	0612	0613	0614	0615
1150	0616	0617	0618	0619	0620	0621	0622	0623
1160	0624	0625	0626	0627	0628	0629	0630	0631
1170	0632	0633	0634	0635	0636	0637	0638	0639
1200	0640	0641	0642	0643	0644	0645	0646	0647
1210	0648	0649	0650	0651	0652	0653	0654	0655
1220	0656	0657	0658	0659	0660	0661	0662	0663
1230	0664	0665	0666	0667	0668	0669	0670	0671
1240	0672	0673	0674	0675	0676	0677	0678	0679
1250	0680	0681	0682	0683	0684	0685	0686	0687
1260	0688	0689	0690	0691	0692	0693	0694	0695
1270	0696	0697	0698	0699	0700	0701	0702	0703
1300	0704	0705	0706	0707	0708	0709	0710	0711
1310	0712	0713	0714	0715	0716	0717	0718	0719
1320	0720	0721	0722	0723	0724	0725	0726	0727
1330	0728	0729	0730	0731	0732	0733	0734	0735
1340	0736	0737	0738	0739	0740	0741	0742	0743
1350	0744	0745	0746	0747	0748	0749	0750	0751
1360	0752	0753	0754	0755	0756	0757	0758	0759
1370	0760	0761	0762	0763	0764	0765	0766	0767
1400	0768	0769	0770	0771	0772	0773	0774	0775
1410	0776	0777	0778	0779	0780	0781	0782	0783
1420	0784	0785	0786	0787	0788	0789	0790	0791
1430	0792	0793	0794	0795	0796	0797	0798	0799
1440	0800	0801	0802	0803	0804	0805	0806	0807
1450	0808	0809	0810	0811	0812	0813	0814	0815
1460	0816	0817	0818	0819	0820	0821	0822	0823
1470	0824	0825	0826	0827	0828	0829	0830	0831
1500	0832	0833	0834	0835	0836	0837	0838	0839
1510	0840	0841	0842	0843	0844	0845	0846	0847
1520	0848	0849	0850	0851	0852	0853	0854	0855
1530	0856	0857	0858	0859	0860	0861	0862	0863
1540	0864	0865	0866	0867	0868	0869	0870	0871
1550	0872	0873	0874	0875	0876	0877	0878	0879
1560	0880	0881	0882	0883	0884	0885	0886	0887
1570	0888	0889	0890	0891	0892	0893	0894	0895
1600	0896	0897	0898	0899	0900	0901	0902	0903
1610	0904	0905	0906	0907	0908	0909	0910	0911
1620	0912	0913	0914	0915	0916	0917	0918	0919
1630	0920	0921	0922	0923	0924	0925	0926	0927
1640	0928	0929	0930	0931	0932	0933	0934	0935
1650	0936	0937	0938	0939	0940	0941	0942	0943
1660	0944	0945	0946	0947	0948	0949	0950	0951
1670	0952	0953	0954	0955	0956	0957	0958	0959
1700	0960	0961	0962	0963	0964	0965	0966	0967
1710	0968	0969	0970	0971	0972	0973	0974	0975
1720	0976	0977	0978	0979	0980	0981	0982	0983
1730	0984	0985	0986	0987	0988	0989	0990	0991
1740	0992	0993	0994	0995	0996	0997	0998	0999
1750	1000	1001	1002	1003	1004	1005	1006	1007
1760	1008	1009	1010	1011	1012	1013	1014	1015
1770	1016	1017	1018	1019	1020	1021	1022	1023

OCTAL 2000 to 2777	DECIMAL 1024 to 1535

	0	1	2	3	4	5	6	7
2000	1024	1025	1026	1027	1028	1029	1030	1031
2010	1032	1033	1034	1035	1036	1037	1038	1039
2020	1040	1041	1042	1043	1044	1045	1046	1047
2030	1048	1049	1050	1051	1052	1053	1054	1055
2040	1056	1057	1058	1059	1060	1061	1062	1063
2050	1064	1065	1066	1067	1068	1069	1070	1071
2060	1072	1073	1074	1075	1076	1077	1078	1079
2070	1080	1081	1082	1083	1084	1085	1086	1087
2100	1088	1089	1090	1091	1092	1093	1094	1095
2110	1096	1097	1098	1099	1100	1101	1102	1103
2120	1104	1105	1106	1107	1108	1109	1110	1111
2130	1112	1113	1114	1115	1116	1117	1118	1119
2140	1120	1121	1122	1123	1124	1125	1126	1127
2150	1128	1129	1130	1131	1132	1133	1134	1135
2160	1136	1137	1138	1139	1140	1141	1142	1143
2170	1144	1145	1146	1147	1148	1149	1150	1151
2200	1152	1153	1154	1155	1156	1157	1158	1159
2210	1160	1161	1162	1163	1164	1165	1166	1167
2220	1168	1169	1170	1171	1172	1173	1174	1175
2230	1176	1177	1178	1179	1180	1181	1182	1183
2240	1184	1185	1186	1187	1188	1189	1190	1191
2250	1192	1193	1194	1195	1196	1197	1198	1199
2260	1200	1201	1202	1203	1204	1205	1206	1207
2270	1208	1209	1210	1211	1212	1213	1214	1215
2300	1216	1217	1218	1219	1220	1221	1222	1223
2310	1224	1225	1226	1227	1228	1229	1230	1231
2320	1232	1233	1234	1235	1236	1237	1238	1239
2330	1240	1241	1242	1243	1244	1245	1246	1247
2340	1248	1249	1250	1251	1252	1253	1254	1255
2350	1256	1257	1258	1259	1260	1261	1262	1263
2360	1264	1265	1266	1267	1268	1269	1270	1271
2370	1272	1273	1274	1275	1276	1277	1278	1279
2400	1280	1281	1282	1283	1284	1285	1286	1287
2410	1288	1289	1290	1291	1292	1293	1294	1295
2420	1296	1297	1298	1299	1300	1301	1302	1303
2430	1304	1305	1306	1307	1308	1309	1310	1311
2440	1312	1313	1314	1315	1316	1317	1318	1319
2450	1320	1321	1322	1323	1324	1325	1326	1327
2460	1328	1329	1330	1331	1332	1333	1334	1335
2470	1336	1337	1338	1339	1340	1341	1342	1343
2500	1344	1345	1346	1347	1348	1349	1350	1351
2510	1352	1353	1354	1355	1356	1357	1358	1359
2520	1360	1361	1362	1363	1364	1365	1366	1367
2530	1368	1369	1370	1371	1372	1373	1374	1375
2540	1376	1377	1378	1379	1380	1381	1382	1383
2550	1384	1385	1386	1387	1388	1389	1390	1391
2560	1392	1393	1394	1395	1396	1397	1398	1399
2570	1400	1401	1402	1403	1404	1405	1406	1407
2600	1408	1409	1410	1411	1412	1413	1414	1415
2610	1416	1417	1418	1419	1420	1421	1422	1423
2620	1424	1425	1426	1427	1428	1429	1430	1431
2630	1432	1433	1434	1435	1436	1437	1438	1439
2640	1440	1441	1442	1443	1444	1445	1446	1447
2650	1448	1449	1450	1451	1452	1453	1454	1455
2660	1456	1457	1458	1459	1460	1461	1462	1463
2670	1464	1465	1466	1467	1468	1469	1470	1471
2700	1472	1473	1474	1475	1476	1477	1478	1479
2710	1480	1481	1482	1483	1484	1485	1486	1487
2720	1488	1489	1490	1491	1492	1493	1494	1495
2730	1496	1497	1498	1499	1500	1501	1502	1503
2740	1504	1505	1506	1507	1508	1509	1510	1511
2750	1512	1513	1514	1515	1516	1517	1518	1519
2760	1520	1521	1522	1523	1524	1525	1526	1527
2770	1528	1529	1530	1531	1532	1533	1534	1535

OCTAL 3000 to 3777	DECIMAL 1536 to 2047

	0	1	2	3	4	5	6	7
3000	1536	1537	1538	1539	1540	1541	1542	1543
3010	1544	1545	1546	1547	1548	1549	1550	1551
3020	1552	1553	1554	1555	1556	1557	1558	1559
3030	1560	1561	1562	1563	1564	1565	1566	1567
3040	1568	1569	1570	1571	1572	1573	1574	1575
3050	1576	1577	1578	1579	1580	1581	1582	1583
3060	1584	1585	1586	1587	1588	1589	1590	1591
3070	1592	1593	1594	1595	1596	1597	1598	1599
3100	1600	1601	1602	1603	1604	1605	1606	1607
3110	1608	1609	1610	1611	1612	1613	1614	1615
3120	1616	1617	1618	1619	1620	1621	1622	1623
3130	1624	1625	1626	1627	1628	1629	1630	1631
3140	1632	1633	1634	1635	1636	1637	1638	1639
3150	1640	1641	1642	1643	1644	1645	1646	1647
3160	1648	1649	1650	1651	1652	1653	1654	1655
3170	1656	1657	1658	1659	1660	1661	1662	1663
3200	1664	1665	1666	1667	1668	1669	1670	1671
3210	1672	1673	1674	1675	1676	1677	1678	1679
3220	1680	1681	1682	1683	1684	1685	1686	1687
3230	1688	1689	1690	1691	1692	1693	1694	1695
3240	1696	1697	1698	1699	1700	1701	1702	1703
3250	1704	1705	1706	1707	1708	1709	1710	1711
3260	1712	1713	1714	1715	1716	1717	1718	1719
3270	1720	1721	1722	1723	1724	1725	1726	1727
3300	1728	1729	1730	1731	1732	1733	1734	1735
3310	1736	1737	1738	1739	1740	1741	1742	1743
3320	1744	1745	1746	1747	1748	1749	1750	1751
3330	1752	1753	1754	1755	1756	1757	1758	1759
3340	1760	1761	1762	1763	1764	1765	1766	1767
3350	1768	1769	1770	1771	1772	1773	1774	1775
3360	1776	1777	1778	1779	1780	1781	1782	1783
3370	1784	1785	1786	1787	1788	1789	1790	1791
3400	1792	1793	1794	1795	1796	1797	1798	1799
3410	1800	1801	1802	1803	1804	1805	1806	1807
3420	1808	1809	1810	1811	1812	1813	1814	1815
3430	1816	1817	1818	1819	1820	1821	1822	1823
3440	1824	1825	1826	1827	1828	1829	1830	1831
3450	1832	1833	1834	1835	1836	1837	1838	1839
3460	1840	1841	1842	1843	1844	1845	1846	1847
3470	1848	1849	1850	1851	1852	1853	1854	1855
3500	1856	1857	1858	1859	1860	1861	1862	1863
3510	1864	1865	1866	1867	1868	1869	1870	1871
3520	1872	1873	1874	1875	1876	1877	1878	1879
3530	1880	1881	1882	1883	1884	1885	1886	1887
3540	1888	1889	1890	1891	1892	1893	1894	1895
3550	1896	1897	1898	1899	1900	1901	1902	1903
3560	1904	1905	1906	1907	1908	1909	1910	1911
3570	1912	1913	1914	1915	1916	1917	1918	1919
3600	1920	1921	1922	1923	1924	1925	1926	1927
3610	1928	1929	1930	1931	1932	1933	1934	1935
3620	1936	1937	1938	1939	1940	1941	1942	1943
3630	1944	1945	1946	1947	1948	1949	1950	1951
3640	1952	1953	1954	1955	1956	1957	1958	1959
3650	1960	1961	1962	1963	1964	1965	1966	1967
3660	1968	1969	1970	1971	1972	1973	1974	1975
3670	1976	1977	1978	1979	1980	1981	1982	1983
3700	1984	1985	1986	1987	1988	1989	1990	1991
3710	1992	1993	1994	1995	1996	1997	1998	1999
3720	2000	2001	2002	2003	2004	2005	2006	2007
3730	2008	2009	2010	2011	2012	2013	2014	2015
3740	2016	2017	2018	2019	2020	2021	2022	2023
3750	2024	2025	2026	2027	2028	2029	2030	2031
3760	2032	2033	2034	2035	2036	2037	2038	2039
3770	2040	2041	2042	2043	2044	2045	2046	2047

OCTAL 4000 to 4777	DECIMAL 2048 to 2559

	0	1	2	3	4	5	6	7
4000	2048	2049	2050	2051	2052	2053	2054	2055
4010	2056	2057	2058	2059	2060	2061	2062	2063
4020	2064	2065	2066	2067	2068	2069	2070	2071
4030	2072	2073	2074	2075	2076	2077	2078	2079
4040	2080	2081	2082	2083	2084	2085	2086	2087
4050	2088	2089	2090	2091	2092	2093	2094	2095
4060	2096	2097	2098	2099	2100	2101	2102	2103
4070	2104	2105	2106	2107	2108	2109	2110	2111
4100	2112	2113	2114	2115	2116	2117	2118	2119
4110	2120	2121	2122	2123	2124	2125	2126	2127
4120	2128	2129	2130	2131	2132	2133	2134	2135
4130	2136	2137	2138	2139	2140	2141	2142	2143
4140	2144	2145	2146	2147	2148	2149	2150	2151
4150	2152	2153	2154	2155	2156	2157	2158	2159
4160	2160	2161	2162	2163	2164	2165	2166	2167
4170	2168	2169	2170	2171	2172	2173	2174	2175
4200	2176	2177	2178	2179	2180	2181	2182	2183
4210	2184	2185	2186	2187	2188	2189	2190	2191
4220	2192	2193	2194	2195	2196	2197	2198	2199
4230	2200	2201	2202	2203	2204	2205	2206	2207
4240	2208	2209	2210	2211	2212	2213	2214	2215
4250	2216	2217	2218	2219	2220	2221	2222	2223
4260	2224	2225	2226	2227	2228	2229	2230	2231
4270	2232	2233	2234	2235	2236	2237	2238	2239
4300	2240	2241	2242	2243	2244	2245	2246	2247
4310	2248	2249	2250	2251	2252	2253	2254	2255
4320	2256	2257	2258	2259	2260	2261	2262	2263
4330	2264	2265	2266	2267	2268	2269	2270	2271
4340	2272	2273	2274	2275	2276	2277	2278	2279
4350	2280	2281	2282	2283	2284	2285	2286	2287
4360	2288	2289	2290	2291	2292	2293	2294	2295
4370	2296	2297	2298	2299	2300	2301	2302	2303
4400	2304	2305	2306	2307	2308	2309	2310	2311
4410	2312	2313	2314	2315	2316	2317	2318	2319
4420	2320	2321	2322	2323	2324	2325	2326	2327
4430	2328	2329	2330	2331	2332	2333	2334	2335
4440	2336	2337	2338	2339	2340	2341	2342	2343
4450	2344	2345	2346	2347	2348	2349	2350	2351
4460	2352	2353	2354	2355	2356	2357	2358	2359
4470	2360	2361	2362	2363	2364	2365	2366	2367
4500	2368	2369	2370	2371	2372	2373	2374	2375
4510	2376	2377	2378	2379	2380	2381	2382	2383
4520	2384	2385	2386	2387	2388	2389	2390	2391
4530	2392	2393	2394	2395	2396	2397	2398	2399
4540	2400	2401	2402	2403	2404	2405	2406	2407
4550	2408	2409	2410	2411	2412	2413	2414	2415
4560	2416	2417	2418	2419	2420	2421	2422	2423
4570	2424	2425	2426	2427	2428	2429	2430	2431
4600	2432	2433	2434	2435	2436	2437	2438	2439
4610	2440	2441	2442	2443	2444	2445	2446	2447
4620	2448	2449	2450	2451	2452	2453	2454	2455
4630	2456	2457	2458	2459	2460	2461	2462	2463
4640	2464	2465	2466	2467	2468	2469	2470	2471
4650	2472	2473	2474	2475	2476	2477	2478	2479
4660	2480	2481	2482	2483	2484	2485	2486	2487
4670	2488	2489	2490	2491	2492	2493	2494	2495
4700	2496	2497	2498	2499	2500	2501	2502	2503
4710	2504	2505	2506	2507	2508	2509	2510	2511
4720	2512	2513	2514	2515	2516	2517	2518	2519
4730	2520	2521	2522	2523	2524	2525	2526	2527
4740	2528	2529	2530	2531	2532	2533	2534	2535
4750	2536	2537	2538	2539	2540	2541	2542	2543
4760	2544	2545	2546	2547	2548	2549	2550	2551
4770	2552	2553	2554	2555	2556	2557	2558	2559

OCTAL 5000 to 5777	DECIMAL 2560 to 3071

	0	1	2	3	4	5	6	7
5000	2560	2561	2562	2563	2564	2565	2566	2567
5010	2568	2569	2570	2571	2572	2573	2574	2575
5020	2576	2577	2578	2579	2580	2581	2582	2583
5030	2584	2585	2586	2587	2588	2589	2590	2591
5040	2592	2593	2594	2595	2596	2597	2598	2599
5050	2600	2601	2602	2603	2604	2605	2606	2607
5060	2608	2609	2610	2611	2612	2613	2614	2615
5070	2616	2617	2618	2619	2620	2621	2622	2623
5100	2624	2625	2626	2627	2628	2629	2630	2631
5110	2632	2633	2634	2635	2636	2637	2638	2639
5120	2640	2641	2642	2643	2644	2645	2646	2647
5130	2648	2649	2650	2651	2652	2653	2654	2655
5140	2656	2657	2658	2659	2660	2661	2662	2663
5150	2664	2665	2666	2667	2668	2669	2670	2671
5160	2672	2673	2674	2675	2676	2677	2678	2679
5170	2680	2681	2682	2683	2684	2685	2686	2687
5200	2688	2689	2690	2691	2692	2693	2694	2695
5210	2696	2697	2698	2699	2700	2701	2702	2703
5220	2704	2705	2706	2707	2708	2709	2710	2711
5230	2712	2713	2714	2715	2716	2717	2718	2719
5240	2720	2721	2722	2723	2724	2725	2726	2727
5250	2728	2729	2730	2731	2732	2733	2734	2735
5260	2736	2737	2738	2739	2740	2741	2742	2743
5270	2744	2745	2746	2747	2748	2749	2750	2751
5300	2752	2753	2754	2755	2756	2757	2758	2759
5310	2760	2761	2762	2763	2764	2765	2766	2767
5320	2768	2769	2770	2771	2772	2773	2774	2775
5330	2776	2777	2778	2779	2780	2781	2782	2783
5340	2784	2785	2786	2787	2788	2789	2790	2791
5350	2792	2793	2794	2795	2796	2797	2798	2799
5360	2800	2801	2802	2803	2804	2805	2806	2807
5370	2808	2809	2810	2811	2812	2813	2814	2815
5400	2816	2817	2818	2819	2820	2821	2822	2823
5410	2824	2825	2826	2827	2828	2829	2830	2831
5420	2832	2833	2834	2835	2836	2837	2838	2839
5430	2840	2841	2842	2843	2844	2845	2846	2847
5440	2848	2849	2850	2851	2852	2853	2854	2855
5450	2856	2857	2858	2859	2860	2861	2862	2863
5460	2864	2865	2866	2867	2868	2869	2870	2871
5470	2872	2873	2874	2875	2876	2877	2878	2879
5500	2880	2881	2882	2883	2884	2885	2886	2887
5510	2888	2889	2890	2891	2892	2893	2894	2895
5520	2896	2897	2898	2899	2900	2901	2902	2903
5530	2904	2905	2906	2907	2908	2909	2910	2911
5540	2912	2913	2914	2915	2916	2917	2918	2919
5550	2920	2921	2922	2923	2924	2925	2926	2927
5560	2928	2929	2930	2931	2932	2933	2934	2935
5570	2936	2937	2938	2939	2940	2941	2942	2943
5600	2944	2945	2946	2947	2948	2949	2950	2951
5610	2952	2953	2954	2955	2956	2957	2958	2959
5620	2960	2961	2962	2963	2964	2965	2966	2967
5630	2968	2969	2970	2971	2972	2973	2974	2975
5640	2976	2977	2978	2979	2980	2981	2982	2983
5650	2984	2985	2986	2987	2988	2989	2990	2991
5660	2992	2993	2994	2995	2996	2997	2998	2999
5670	3000	3001	3002	3003	3004	3005	3006	3007
5700	3008	3009	3010	3011	3012	3013	3014	3015
5710	3016	3017	3018	3019	3020	3021	3022	3023
5720	3024	3025	3026	3027	3028	3029	3030	3031
5730	3032	3033	3034	3035	3036	3037	3038	3039
5740	3040	3041	3042	3043	3044	3045	3046	3047
5750	3048	3049	3050	3051	3052	3053	3054	3055
5760	3056	3057	3058	3059	3060	3061	3062	3063
5770	3064	3065	3066	3067	3068	3069	3070	3071

OCTAL 6000 to 6777	DECIMAL 3072 to 3583

	0	1	2	3	4	5	6	7
6000	3072	3073	3074	3075	3076	3077	3078	3079
6010	3080	3081	3082	3083	3084	3085	3086	3087
6020	3088	3089	3090	3091	3092	3093	3094	3095
6030	3096	3097	3098	3099	3100	3101	3102	3103
6040	3104	3105	3106	3107	3108	3109	3110	3111
6050	3112	3113	3114	3115	3116	3117	3118	3119
6060	3120	3121	3122	3123	3124	3125	3126	3127
6070	3128	3129	3130	3131	3132	3133	3134	3135
6100	3136	3137	3138	3139	3140	3141	3142	3143
6110	3144	3145	3146	3147	3148	3149	3150	3151
6120	3152	3153	3154	3155	3156	3157	3158	3159
6130	3160	3161	3162	3163	3164	3165	3166	3167
6140	3168	3169	3170	3171	3172	3173	3174	3175
6150	3176	3177	3178	3179	3180	3181	3182	3183
6160	3184	3185	3186	3187	3188	3189	3190	3191
6170	3192	3193	3194	3195	3196	3197	3198	3199
6200	3200	3201	3202	3203	3204	3205	3206	3207
6210	3208	3209	3210	3211	3212	3213	3214	3215
6220	3216	3217	3218	3219	3220	3221	3222	3223
6230	3224	3225	3226	3227	3228	3229	3230	3231
6240	3232	3233	3234	3235	3236	3237	3238	3239
6250	3240	3241	3242	3243	3244	3245	3246	3247
6260	3248	3249	3250	3251	3252	3253	3254	3255
6270	3256	3257	3258	3259	3260	3261	3262	3263
6300	3264	3265	3266	3267	3268	3269	3270	3271
6310	3272	3273	3274	3275	3276	3277	3278	3279
6320	3280	3281	3282	3283	3284	3285	3286	3287
6330	3288	3289	3290	3291	3292	3293	3294	3295
6340	3296	3297	3298	3299	3300	3301	3302	3303
6350	3304	3305	3306	3307	3308	3309	3310	3311
6360	3312	3313	3314	3315	3316	3317	3318	3319
6370	3320	3321	3322	3323	3324	3325	3326	3327
6400	3328	3329	3330	3331	3332	3333	3334	3335
6410	3336	3337	3338	3339	3340	3341	3342	3343
6420	3344	3345	3346	3347	3348	3349	3350	3351
6430	3352	3353	3354	3355	3356	3357	3358	3359
6440	3360	3361	3362	3363	3364	3365	3366	3367
6450	3368	3369	3370	3371	3372	3373	3374	3375
6460	3376	3377	3378	3379	3380	3381	3382	3383
6470	3384	3385	3386	3387	3388	3389	3390	3391
6500	3392	3393	3394	3395	3396	3397	3398	3399
6510	3400	3401	3402	3403	3404	3405	3406	3407
6520	3408	3409	3410	3411	3412	3413	3414	3415
6530	3416	3417	3418	3419	3420	3421	3422	3423
6540	3424	3425	3426	3427	3428	3429	3430	3431
6550	3432	3433	3434	3435	3436	3437	3438	3439
6560	3440	3441	3442	3443	3444	3445	3446	3447
6570	3448	3449	3450	3451	3452	3453	3454	3455
6600	3456	3457	3458	3459	3460	3461	3462	3463
6610	3464	3465	3466	3467	3468	3469	3470	3471
6620	3472	3473	3474	3475	3476	3477	3478	3479
6630	3480	3481	3482	3483	3484	3485	3486	3487
6640	3488	3489	3490	3491	3492	3493	3494	3495
6650	3496	3497	3498	3499	3500	3501	3502	3503
6660	3504	3505	3506	3507	3508	3509	3510	3511
6670	3512	3513	3514	3515	3516	3517	3518	3519
6700	3520	3521	3522	3523	3524	3525	3526	3527
6710	3528	3529	3530	3531	3532	3533	3534	3535
6720	3536	3537	3538	3539	3540	3541	3542	3543
6730	3544	3545	3546	3547	3548	3549	3550	3551
6740	3552	3553	3554	3555	3556	3557	3558	3559
6750	3560	3561	3562	3563	3564	3565	3566	3567
6760	3568	3569	3570	3571	3572	3573	3574	3575
6770	3576	3577	3578	3579	3580	3581	3582	3583

OCTAL 7000 to 7777	DECIMAL 3584 to 4095

	0	1	2	3	4	5	6	7
7000	3584	3585	3586	3587	3588	3589	3590	3591
7010	3592	3593	3594	3595	3596	3597	3598	3599
7020	3600	3601	3602	3603	3604	3605	3606	3607
7030	3608	3609	3610	3611	3612	3613	3614	3615
7040	3616	3617	3618	3619	3620	3621	3622	3623
7050	3624	3625	3626	3627	3628	3629	3630	3631
7060	3632	3633	3634	3635	3636	3637	3638	3639
7070	3640	3641	3642	3643	3644	3645	3646	3647
7100	3648	3649	3650	3651	3652	3653	3654	3655
7110	3656	3657	3658	3659	3660	3661	3662	3663
7120	3664	3665	3666	3667	3668	3669	3670	3671
7130	3672	3673	3674	3675	3676	3677	3678	3679
7140	3680	3681	3682	3683	3684	3685	3686	3687
7150	3688	3689	3690	3691	3692	3693	3694	3695
7160	3696	3697	3698	3699	3700	3701	3702	3703
7170	3704	3705	3706	3707	3708	3709	3710	3711
7200	3712	3713	3714	3715	3716	3717	3718	3719
7210	3720	3721	3722	3723	3724	3725	3726	3727
7220	3728	3729	3730	3731	3732	3733	3734	3735
7230	3736	3737	3738	3739	3740	3741	3742	3743
7240	3744	3745	3746	3747	3748	3749	3750	3751
7250	3752	3753	3754	3755	3756	3757	3758	3759
7260	3760	3761	3762	3763	3764	3765	3766	3767
7270	3768	3769	3770	3771	3772	3773	3774	3775
7300	3776	3777	3778	3779	3780	3781	3782	3783
7310	3784	3785	3786	3787	3788	3789	3790	3791
7320	3792	3793	3794	3795	3796	3797	3798	3799
7330	3800	3801	3802	3803	3804	3805	3806	3807
7340	3808	3809	3810	3811	3812	3813	3814	3815
7350	3816	3817	3818	3819	3820	3821	3822	3823
7360	3824	3825	3826	3827	3828	3829	3830	3831
7370	3832	3833	3834	3835	3836	3837	3838	3839
7400	3840	3841	3842	3843	3844	3845	3846	3847
7410	3848	3849	3850	3851	3852	3853	3854	3855
7420	3856	3857	3858	3859	3860	3861	3862	3863
7430	3864	3865	3866	3867	3868	3869	3870	3871
7440	3872	3873	3874	3875	3876	3877	3878	3879
7450	3880	3881	3882	3883	3884	3885	3886	3887
7460	3888	3889	3890	3891	3892	3893	3894	3895
7470	3896	3897	3898	3899	3900	3901	3902	3903
7500	3904	3905	3906	3907	3908	3909	3910	3911
7510	3912	3913	3914	3915	3916	3917	3918	3919
7520	3920	3921	3922	3923	3924	3925	3926	3927
7530	3928	3929	3930	3931	3932	3933	3934	3935
7540	3936	3937	3938	3939	3940	3941	3942	3943
7550	3944	3945	3946	3947	3948	3949	3950	3951
7560	3952	3953	3954	3955	3956	3957	3958	3959
7570	3960	3961	3962	3963	3964	3965	3966	3967
7600	3968	3969	3970	3971	3972	3973	3974	3975
7610	3976	3977	3978	3979	3980	3981	3982	3983
7620	3984	3985	3986	3987	3988	3989	3990	3991
7630	3992	3993	3994	3995	3996	3997	3998	3999
7640	4000	4001	4002	4003	4004	4005	4006	4007
7650	4008	4009	4010	4011	4012	4013	4014	4015
7660	4016	4017	4018	4019	4020	4021	4022	4023
7670	4024	4025	4026	4027	4028	4029	4030	4031
7700	4032	4033	4034	4035	4036	4037	4038	4039
7710	4040	4041	4042	4043	4044	4045	4046	4047
7720	4048	4049	4050	4051	4052	4053	4054	4055
7730	4056	4057	4058	4059	4060	4061	4062	4063
7740	4064	4065	4066	4067	4068	4069	4070	4071
7750	4072	4073	4074	4075	4076	4077	4078	4079
7760	4080	4081	4082	4083	4084	4085	4086	4087
7770	4088	4089	4090	4091	4092	4093	4094	4095

M. PROGRAMMING TECHNIQUES

These techniques have been developed in the course of programming the UNIVAC 1050 system and are given here as helpful hints for general use.

1. Half Adjust an *n* digit field and Shift Right 1 Position retaining original sign, reducing the size of the field, and retaining arithmetic sentinel.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
		SA1	$+29,1
		LP	15,017
		AD1	FIVE,1
		BA1	14,N+1
		LP	$+9,040
		LS	15,0
	FIVE	+1	'5'

2. Half Adjust an *n* digit field and Shift Right 1 Position retaining original sign and field size.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
		SA1	$+29,1
		LP	15,017
		AD1	FIVE,1
		BA1	14,N
		LP	$+9,040
		LS	15,0
		PD0	16-N,1
	FIVE	+1	'5'

3. Shift an *n* digit field right L places retaining original sign, reducing size of field, and retaining arithmetic sentinel.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–30–40–45
		SA 1	$+19,1
		BA 1	15-L,N+1-L
		LP	$+9,040
		LS	15,0

4. Shift an *n* digit field right L places retaining original sign and field size.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–30–40–45
		SA 1	$+19,1
		BA 1	15-L,N-L
		LP	$+9,040
		LS	15,0
		PD 0	15-N+L,L

5. Shift an *n* digit field left L places retaining original sign and sentinel.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–30–40–45
		SA 1	$+29,1
		BA 2	15,N+1
		SA 2	15-L,N+1
		PD 0	15,L
		LP	$+9,040
		LS	15,0

6. Convert the decimal value of seven characters in the seven LSD positions of AR1 to its binary equivalent. The result is in the four LSD of AR1.

E INS 6	LABEL 7–11	OPERATION 13–18	OPERANDS 19–46
		S C	B+24,7
		P D	7,7
		A D 1	7,7
		J	B
	A	B A 1	7,4
		A B 1	7,4
		B S 4	15,3
		A B 1	7,4
		B A 1	22,7
	B	S A 1	21,7
		A C	15,61
		P D	14,3
		A B 1	7,4
		J L	A,7
		B A 1	7,4

7. Convert a three character binary field in AR1 to its decimal equivalent. The result is in AR1.

E INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45 46
		PD0	30,,11
		SC	A+14,,3
		PD	X1,,3
		SC	31,,'1'
		SC	A+4,,6
		LC	15,,1,X1
		JU	$+10
		AM2	26,,5
		AD2	31,,5
		BS1	$-16,,1
	A	JL	$-25,,6
		FT	-1,,X1,,X1
		JL	$-40,,3
		BA1	26,,5

8. Construct a 'remote area' containing a page heading and a routine to print the contents of the 'remote area'. This routine will be entered with a Jump Return instruction.

CE INS 6	LABEL 7 11	OPERATION 13 18	OPERANDS 19 30 40 45	COMMENTS 46 50 60 70
	LINE	AREA	128,,,00	REMOTE AREA DEFINED
		ORIG	$-71	POSITION THE HEADING
		+15	EXAMPLE HEADING'	WITHIN THE AREA
		ORIG	$+57	
	REMOT	J		JR ENTRY FOR REMOTE ROUTINE
		FT	LINE,3	LOAD BASE ADDRESS OF REMOTE
		SA1	XRMAR,3	AREA INTO FIELD XRMAR.
		SC	XADVC,4	NUMBER OF LINES TO ADVANCE
		JR	XCTQL	PRINT REMOTE AREA
		J	REMOT	RETURN

UNIVAC

DIVISION OF SPERRY RAND CORPORATION

UP-3913