

1041 PRELIMINARY PROGRAMMING MANUAL



INTRODUCTION TO PUNCHED PAPER TAPE

Paper tape, as we know it today has come a long way from its conception in 1870 by Emile Baudat. Paper tape in five level (channels) was the "common language" for tele-typewriters all over the world for many years. Today, punched paper tape is not only used on tele-typewriters, but for numerical control equipment, computers, letter writing, typing pools, billing, purchase order writing, etc. Paper tape equipment today uses five, six, seven, or eight channel coding. The coding for each level of tape whether it is five or eight level is different in its coding structure. The number of levels does not indicate the code configuration. An eight level tape may have different code structures. The two most common eight channel Dura manufactured code structures are Selectric code, and BCD (Binary Coded Decimal) coding. The newest 8 level tape coding is called ASA or ASCII (American Standard Code for Information Interchange).

CODE COMBINATIONS

There could be only two possible code combinations, either the presence or the absence of a hole or (bit), if a one-channel tape existed. A two channel tape would have four possible code combinations; three channel tape would have eight possible code combinations; four channel would have sixteen; five channel, thirty-two; seven channel, 128; and in eight channel there are 256 code combinations.

DIFFERENCE IN LEVELS OF PUNCHED TAPE

DURA[®]MACH 10[®] FIVE CHANNEL CODE

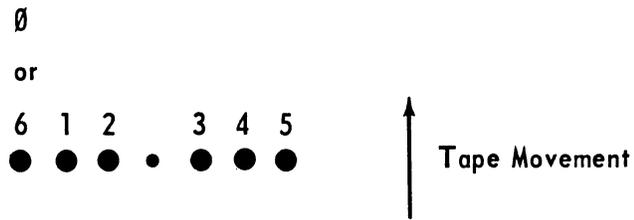
CHANNEL NO.					MACH. 10 - FIVE CHANNEL		
1	2	•	3	4	5	LETTERS	FIGURES
1	2	•				A	-
1		•		4	5	B	5
	2	•	3	4		C	NON-PRINT*
1		•		4		D	TAB*
1		•				E	3
1		•	3	4		F	
	2	•		4	5	G	&
		•	3		5	H	(
	2	•	3			I	8
1	2	•		4		J	SKIP RESTORE*
1	2	•	3	4		K	PRINT RESTORE*
	2	•			5	L)
		•	3	4	5	M	
		•		4	5	N	
		•		4	5	O	9
	2	•	3		5	P	0
1	2	•	3		5	Q	1
	2	•		4		R	4
1		•	3			S	/
		•			5	T	5
1	2	•	3			U	7
	2	•	3	4	5	V	PUNCH OFF*
1	2	•			5	W	2
1		•	3	4	5	X	PUNCH 2 ON*
1		•	3		5	Y	6
1		•			5	Z	PUNCH ON*
		•		4		CARRIER RETURN	
1	2	•	3	4	5	DELETE, LETTERS	
		•				STOP	
	2	•				LINE FEED	
1	2	•		4	5	FIGURES	
		•	3			SPACE	
						*INTERCHANGEABLE CODES	

FIVE CHANNEL (TELETYPE)

Five channel tape requires the reading/punching of either a Letters/Figures code. The Letters and Figures code is called a "precedence code." Five channel tape has a maximum of 32 code combinations. The alphabetic and numeric characters require 26 of these codes. The remaining six codes are used to control machine functions: space, carrier return, etc. A teletype machine operates similar to a standard typewriter in that both machines are required to shift. The LETTERS code is lower case, and the FIGURES code is upper case. When reading five channel tape, a precedence code, LETTERS or FIGURES, will precede all alphanumeric information. Once a Letters code is read in the tape, the machine will shift to lower case and remain in a letters mode until such time as a Figures code is read, etc.

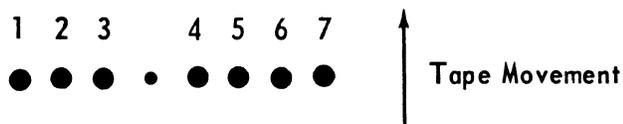
SIX CHANNEL

Six channel tape does not require the reading/punching of a SHIFT code (Letters/Figures) to condition the machine to read/punch alpha or numeric information. Shift codes will be present in the tape; however, in double case machines, six channel may or may not have a parity channel. There are 64 code combinations in this coding.



SEVEN CHANNEL

The seven channel tape is similar to six channel tape in that the code configuration does not require a machine to perform a shift operation for alpha and numeric information. The number of codes available is double that of six channel tape – 128 code combinations. The seventh channel, for the most part, will usually be used for parity checking to insure accuracy.



EIGHT CHANNEL

With the advent of eight channel tape, the total code combinations possible were double that of the seven channel code or 256 characters. The eighth channel is used mainly for machine functions. The eighth channel in BCD coding is the carriage return, whereas in MACH 10 coding, the eighth channel is the delete code. The eighth channel also gives a visual mark or starting point in reading the tape. Eight channel BCD coding is derived from Hollerith coding.

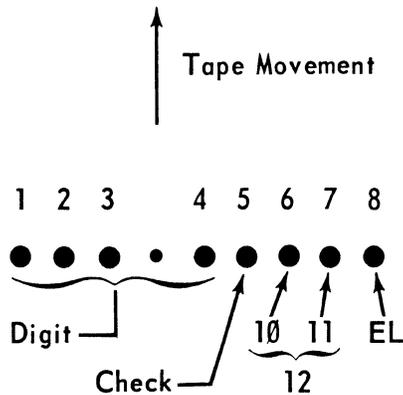
The first four channels represent the digits 1 through 9. The fifth channel is the check channel used in parity.

The sixth channel represents the 0 or 10 in card coding.

The seventh channel represents the 11 or X in card coding.

The combination of the sixth and seventh channel represents the 12 in card code.

The eighth channel is the carrier return code.



**DURA MACH 10-B
8-CHANNEL BINARY CODE**

STD. CHANNEL NO.								MACH 10 L.C.	B.C.D. U.C.
8	7	6	5	4	3	2	1		
								0	b
								1	
								2	
								3	
								4	:
								5	@
								6	∇
								7	>
								8	
								9	
								A	
								B	
								C	
								D	(
								E	⊞
								F	≠
								G	<
								H	
								I	
								J	
								K	
								L	
								M)
								N	*
								O	△
								P	!
								Q	
								R	
								S	
								T	
								U	=
								V	%
								W	"
								X	'
								Y	
								Z	
								-	-
								/	
								\$	
								,	
								.	∇
								&	&
								#	#
								*	*
								STOP	
								BACKSPACE	
								UPPER CASE	
								LOWER CASE	
								DELETE	
								CARRIER RETURN	
								SPACE	
								TAB	
								NONPRINT	
								PRINT RESTORE	
								SKIP STOP RESTORE	
								FIRST LINE	
								PUNCH ON	
								PUNCH 2 ON	
								PUNCH OFF	
								TRANSFER READ	
								PI - 1	
								PI - 2	
								PI - 3	
								PI - 4	
								PI - 5	
								PI - 6	
								PI - 7	

INTRODUCTION TO PUNCHED CARDS

The basic machine in any punch card accounting system is the card punch. The card punch is a machine that will punch coded information into a tab card. The information punched into the card is in machine language. The two most common coding systems used today are the Hollerith and Remington Rand Univac. The I.B.M. card punch punches Hollerith coding. The holes punched are rectangular. The I.B.M. card is 80 card columns long. Univac punches are round and the card is 90 card columns long. Univac utilizes the upper half of the card for card columns 1 through 45, the lower half for card columns 46 through 90. Both cards are the same length.

In addition to the card punch and the tape-to-card converter equipment other means of punching cards include (1) reproducer, (2) computer, (3) summary punch. The cards punched by these various machines are used for:

Checks,
Inventories, and
Various billings to customers, such as gas and
electric – gasoline, and other purchases.

The punched cards provide permanent records to many companies. Merely by rearrangement of the punched card, a company can produce such sundry reports as sales, accounts receivable, payroll, and statistical reports, to mention but a few.

Tab cards may contain both alphabetic and numeric information and certain special characters. The coded information in the cards can be interpreted (decoded from machine language to English language) at the time of punching as in the case of the I.B.M. 026 card punch, or by the use of a card interpreter which receives cards after they have been punched. The printing will appear on the top (12) edge of the card.

The card coding which is read and punched on the Dura Tape-to-Card and Card-to-Tape Converters is the Hollerith code.

The tab card is comprised of 80 card columns. In each of these card columns the maximum number of punches that occur in a card column will be three. The alphabetic card code will almost always contain a maximum of two punches: one zone punch and one numeric (digit) punch. (There will never be two zone punches 12, 11, or 0 in any card column.) The numeric information will always have a single punch from 0 to the number 9 position in the card column. The only time that three punches occur in a card column is when a special character is used, such as the (\$), (.), (,) and (%). The dollar sign (\$) uses the 11-3&8 punches. The zone punches are the 12 or R, 11 or X, 0 or 10 – not alphabetic O as in OPEL.

I.B.M. CARD CODING

1 -- 1	A -- 12 & 1	J -- 11 & 1	S -- 10 & 2	ALPHA Shift @ -- 4 & 8 % -- 0 & 4 & 8 (*) -- 11 & 4 & 8 ☒ -- 12 & 4 & 8 / -- 10 & 1	NUM. Shift # -- 3 & 8 , -- 0 & 3 & 8 \$ -- 11 & 3 & 8 . -- 12 & 3 & 8 (-) -- 11 & -- 12
2 -- 2	B -- 12 & 2	K -- 11 & 2	T -- 10 & 3		
3 -- 3	C -- 12 & 3	L -- 11 & 3	U -- 10 & 4		
4 -- 4	D -- 12 & 4	M -- 11 & 4	V -- 10 & 5		
5 -- 5	E -- 12 & 5	N -- 11 & 5	W -- 10 & 6		
6 -- 6	F -- 12 & 6	O -- 11 & 6	X -- 10 & 7		
7 -- 7	G -- 12 & 7	P -- 11 & 7	Y -- 10 & 8		
8 -- 8	H -- 12 & 8	Q -- 11 & 8	Z -- 10 & 9		
9 -- 9	I -- 12 & 9	R -- 11 & 9			
0 -- 0					

012345678	ABCDEFGHI	JKLMNOP	STUVWXYZ	@*%&/'	#\$.-.
000000000000	000000000000	000000000000	000000000000	00000000	000000000000000000
111111111111	111111111111	111111111111	111111111111	11111111	11111111111111111111
222222222222	222222222222	222222222222	222222222222	22222222	22222222222222222222
333333333333	333333333333	333333333333	333333333333	33333333	33333333333333333333
444444444444	444444444444	444444444444	444444444444	44444444	44444444444444444444
555555555555	555555555555	555555555555	555555555555	55555555	55555555555555555555
666666666666	666666666666	666666666666	666666666666	66666666	66666666666666666666
777777777777	777777777777	777777777777	777777777777	77777777	77777777777777777777
888888888888	888888888888	888888888888	888888888888	88888888	88888888888888888888
999999999999	999999999999	999999999999	999999999999	99999999	99999999999999999999



DURA[®]
1041

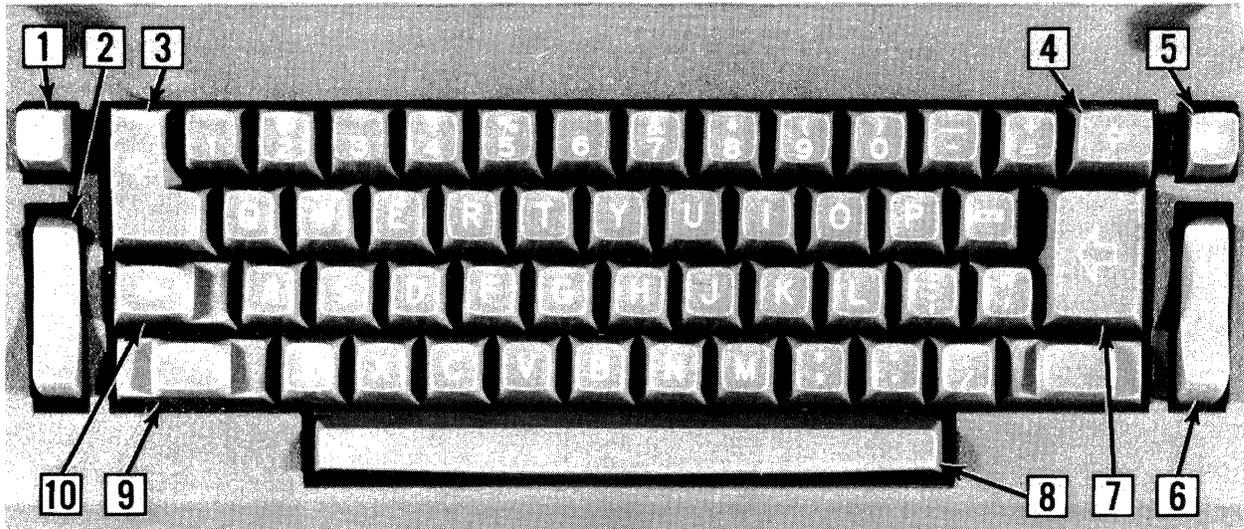
MAXIMUM SPEEDS

READER 30 CPS
PUNCH 18 CPS
PRINTER 15.4 CPS

**STANDARD
CONFIGURATION**

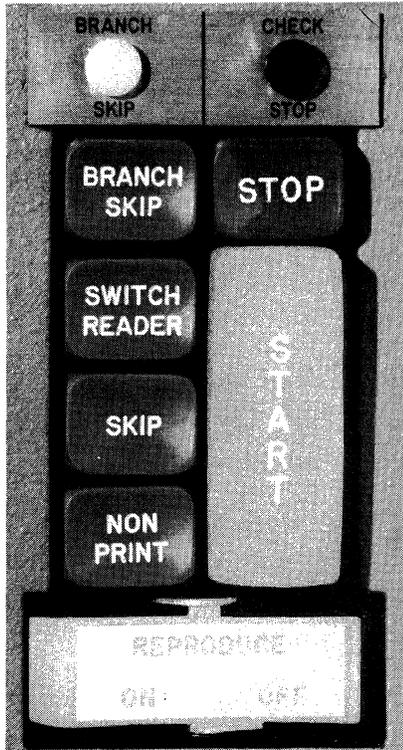
- 15 INCH CARRIAGE
- 10 OR 12 PITCH
- ANY CODING CONFIGURATION
CONTAINING 6 INFORMATION
BITS (CHANNELS) PARITY
OPTIONAL (AND LIMITED ASCII)
- COLOR- ACCENT GRAY
- SELECTRIC SPHERES
AND KEYBOARDS
- TAPE READER
- TAPE PUNCH
- INPUT CONNECTOR
- OUTPUT CONNECTOR

TYPEWRITER CONTROLS



- | | |
|-----------|---------------------------|
| 1 | MARGIN RELEASE KEY |
| 2 | TAB STOP CONTROL |
| 3 | TAB KEY |
| 4 | BACKSPACE KEY |
| 5 | INDEX KEY |
| 6 | POWER ON-OFF |
| 7 | RETURN KEY |
| 8 | SPACE BAR |
| 9 | SHIFT KEY |
| 10 | SHIFT LOCK |

PUNCH CONTROL



ENCODE BUTTERFLY SWITCH

ENCODE OFF **OFF** **ON**

ENCODE ON
PUNCH ON

DEPRESSION OF ANY CONTROL KEY SHOWN ABOVE INITIATES THE RESPECTIVE MACHINE FUNCTION, WITH THE EXCEPTION OF DELETE, FEED, FIELD CONTROL, PRINT RESTORE, AND SKIP RESTORE

DEPRESSION OF ANY CONTROL KEY SHOWN ABOVE PUNCHES THE DESIGNATED CODE INTO THE OUTPUT MEDIA

ENCODE BUTTERFLY SWITCH

The DURA 1041 is programmed through the use of a tape known as the PROGRAM TAPE. The program tape is a punched paper tape prepared on a Dura 1041, containing sequential instructional codes to complete each specific application.

The preparation of the program tape is punched on the Dura 1041 with Reproduce "OFF", and the Encode and Punch switch both conditioned "ON". All printing and functional typewriter keys, and the control keys on each side of the typewriter keyboard will be conditioned to punch their respective code.

Under no circumstances is the ENCODE switch ever to be conditioned "ON" at any time other than for the initial preparation of a program.

When the Punch is "ON" and both Encode, Reproduce is "OFF", only the typewriter keys (functional and printing) will print and punch their respective codes. The following control keys will only initiate their respective function and will not punch their designated code.

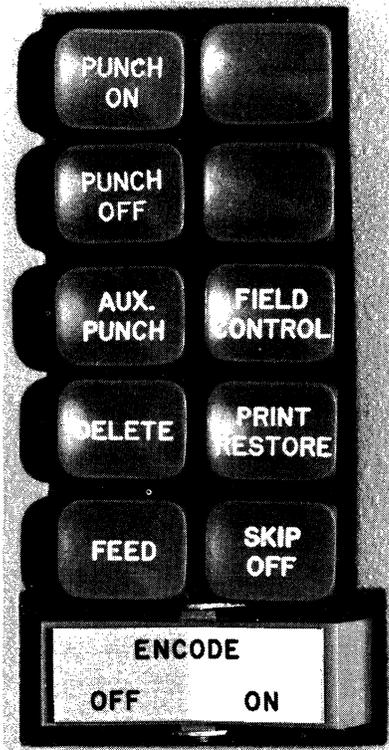
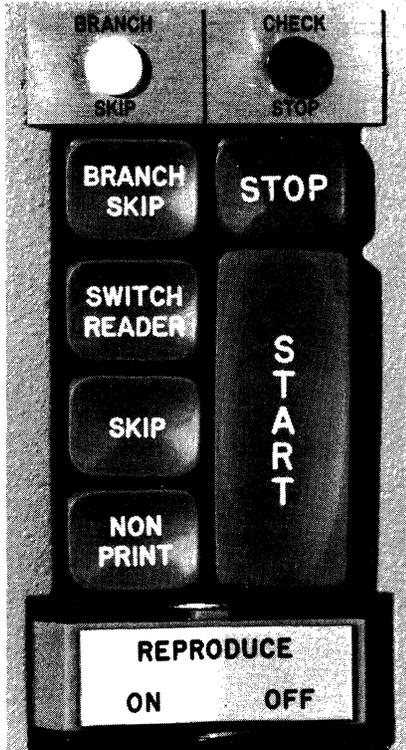
- | | |
|------------------|---|
| 1. Branch Skip | 6. Start |
| 2. Switch Reader | 7. Punch On |
| 3. Skip | 8. Punch Off |
| 4. Non Print | 9. Aux. Punch |
| 5. Stop | 10. Skip Off (discontinues Branch Skip) |

THE FUNCTIONS OF THE PROGRAM TAPE

The Program Tape usually contains the following kinds of codes or instructions.

1. Codes to space the carriage of the Dura 1041.
2. Codes to turn the Punch ON and OFF.
3. Codes for the control of other equipment, such as the Tape-to-Card punch.

PUNCH CONTROL



REPRODUCE BUTTERFLY SWITCH

REPRODUCE ON
PUNCH ON ENCODE OFF



1. DEPRESSION OF THE START KEY WILL CAUSE ALL CODES READ, TO BE REPRODUCED INTO THE OUTPUT MEDIA; PRINTING WILL OCCUR AS APPLICABLE.
2. DEPRESSION OF THE NON PRINT KEY WILL CAUSE ALL CODES READ, TO BE REPRODUCED INTO THE OUTPUT MEDIA; PRINTING FUNCTION WILL BE SUPPRESSED.

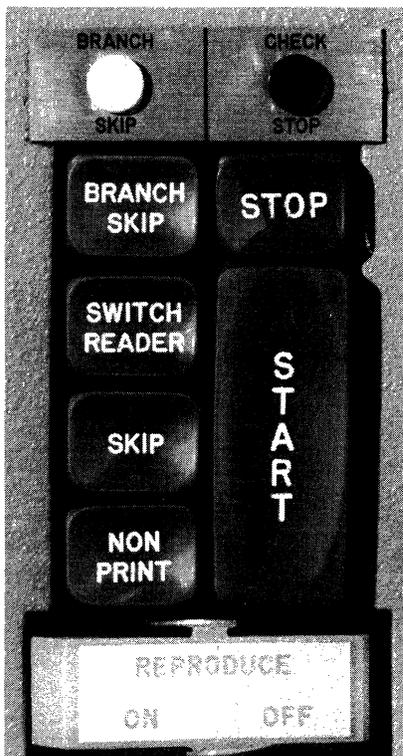
REPRODUCE BUTTERFLY SWITCH

When an exact duplicate of an existing program tape or edge-punched card is required, the Reproduce key is employed.

To reproduce a tape or card the Reproduce switch is conditioned "ON", the punch is "ON", and the Encode switch is in the "OFF" position.

Normal Read mode or manual non print mode may be used to activate the Reader.

READER CONTROLS



- **START**
INITIATES READER ACTION
- **STOP**
STOPS READER ACTION
- **BRANCH SKIP**
CONDITIONS BRANCH SKIP MODE
- **SWITCH READER**
ALTERNATES READER ACTION WHEN AN AUXILIARY READER IS CONNECTED
- **SKIP**
INITIATES SKIPPING IN READER
- **NON PRINT**
INITIATES READER IN NON PRINT MODE
- **BRANCH SKIP INDICATOR**
AMBER LIGHT WILL GLOW WHEN 1041 IS IN A BRANCH SKIP MODE
- **CHECK STOP**
RED LIGHT WILL GLOW WHEN THE SYSTEM IS IN A CHECK STOP CONDITION, KEYBOARD IS LOCKED

Tape Skip

- A. This gives the machine the ability to cycle or skip through the tape in the Reader. During the skip function no punching in the by-product nor printing on the document occurs.
- B. Example:
 - 1. If on a form there is a choice of three programs to complete the form and provisions for all three in the program tape, Tape Skip would give the ability to skip or cycle past the 2 remaining programs regardless of their position on the program tape.

Skip Off or Tape Skip Restore:

- A. When the machine is in a tape skip mode the skipping action can be stopped by depressing the stop key or by reading the tape code called Skip Off or Tape Skip Restore. When the skip off code is read in the Reader the machine immediately comes out of the skip mode and resumes and responds in a normal read mode to the next code in the tape.
- B. Example:

In the above example (B-1) there are three programs to choose from. A stop code is programmed at the beginning of each of the possibilities to permit the operator to read or skip each program accordingly. A skip off code follows each program.

Field Control

- A. Field Control code is a code in the tape which gives the ability to actually control the number of digits that are to be entered in a designated field.

B. Example:

1. If on a form ten digits or alpha characters are required for a given field, ten field control codes are programmed in the program tape. When a field control code is read in the Reader the reading action stops. Upon each depression of a typewriter keylever the Reader advances one cycle at a time in direct unison with the keystrokes until the remainder of the field control codes are used up. As soon as the last field control code is used the last field control code is used the Reader automatically resumes normal read mode. If the operator attempts to tab or carrier return out of the field before she has used the designated number of digits, which is pre-determined by the number of field control codes, the red check light will glow and the keyboard will lock. Nothing on the keyboard is operational until it has been reset and released. Reset the 1041 by touching the "RED STOP" control key, the keyboard will unlock and become operative.

Branch Skip

- A. Branch Skip provides two additional programming features.
 1. It is another form of tape skip.
 2. It provides a method of getting an automatic start read as a direct result of a normal operator function.

The Branch Skip code is programmed just before a stop code or field control codes. When it is used in conjunction with field control codes the operator has three alternatives:

- a. Filling the entire field.
- b. Skipping an entire field.
- c. Partially filling a field.

Filling the field will result in an automatic start read. Partially filling the field or skipping the entire field will result in a tape skip and an automatic Start Read when the operator either touches the Tab or Carrier Return key to appropriately position the carrier to the next field on the document for the next entry.

B. Branch Skip with Field Control Example

1. The Branch Skip code is programmed at the beginning of the field.
2. The desired number of Field Control codes follows the Branch Skip code.
3. A tab or a carrier return code follows the Branch Skip code, which would be dictated by the document format.

When the Branch Skip is read in the Reader the DURA 1041 is then conditioned in a Branch Skip mode. The yellow light above the Branch Skip key turns on and remains on until Branch Skip mode is discontinued by reading a tab or carrier return code.

When the Field Control and Branch Skip codes are followed by a tab code and all of the Field Control codes are not used the operator may then depress the Tab key and the machine will skip the remaining Field Control codes and the skipping action will stop, the Reader will resume normal operation when the tab code is read in the tape.

When the Field Control and Branch Skip codes are followed by a carrier return code and the operator has not used all of the Field Control codes, by depressing the Carrier Return key the Reader will skip through the remaining Field Control codes, return the carrier, stop skipping and resume normal reading operation when the carrier return code is read in the Reader.

The Branch Skip gives us greatest program flexibility and is used mostly in data processing in varied applications, i.e., invoicing and order entry systems. When fields that can vary in length but cannot exceed a fixed number of digits Field Control is used to insure that that the fixed number is not exceeded and the Branch Skip gives the ability to make a fixed field variable and still retain the maximum length of the fixed field.

Reproducing and Non-Reproducing Codes

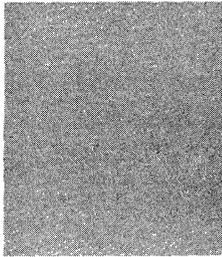
A code must be on the typewriter keyboard of the DURA 1041 if it is to reproduce, or punch into a by-product tape, when read. Codes not represented on the keyboard will not reproduce when read under NORMAL READ mode. The automatic NON PRINT feature of the DURA 1041 allows the reproduction of any code. (See automatic Non Print explanation.)

Non-Print

- A. Manual non print means to suppress printing. If an exact duplicate of a tape or card is to be punched, and a written document is not required turn the punch on and depress the Non Print key and the tape or card will be reproduced code for code.
- B. Automatic non print is initiated when the non print code is read in the Reader, the 1041 will go into a non print mode. With the punch on, all codes read in the Reader will be reproduced in the punch, except for the non print code which originated the condition. Printing, and carrier functions are suppressed. Automatic non print is used to reproduce codes for a latter operation, and also non-reproducing codes which would not be punched under a normal read condition.

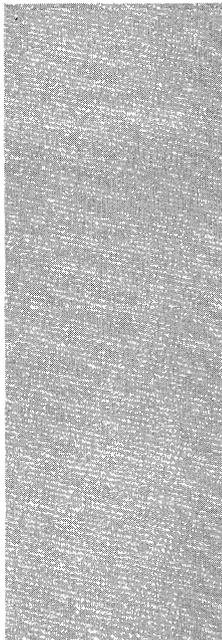
Print Restore:

- A. Print Restore is a code in the tape which is used to restore the 1041 to a normal read condition from an automatic non print condition.



READER CONTROL NOTES

CHECK STOP CONDITION:



**OPERATOR CARRIER RETURNS OR
TABS DURING FIELD CONTROL,
EXCEPT DURING BRANCH SKIP MODE.**

**TO UNLOCK THE KEYBOARD AND
CONTINUE PRINTER OPERATION
AFTER A CHECK STOP, TOUCH THE
STOP CONTROL KEY.**



**WHEN A TWO READER
SYSTEM IS INITIALLY
TURNED ON, TOUCHING
THE GREEN START KEY
WILL ACTIVATE THE
AUXILARY READER.**

BRANCH SKIP

BRANCH SKIP PROVIDES THE OPERATOR WITH THE MEANS TO CAUSE AN AUTOMATIC SKIP OUT OF A VARIABLE LENGTH FIELD, A COMPLETE OR PARTIAL FORMAT CONTROLLED FIELD BY A MANUAL TAB OR CARRIER RETURN.

BRANCH SKIP IS RESET MANUALLY BY TOUCHING THE SKIP RESTORE CONTROL KEY.

EXAMPLE

INDICATE IN THE READING BLOCKS AND OUTPUT UNITS USED IN THIS PRO

READER	PUNCH	I/O	
		PUNCH	PRINTER
ONI			
BS			
FC	X	X	
FC	X	X	
TAB	TAB	TAB	
BS			
FC	X	X	
FC	X	X	
CR	CR	CR	