PROGRAMMING

High-Speed Paper Tape System

Bi-Directional Paper-to-Magnetic Tape Converter

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SECTION I

Introduction

INPUT-OUTPUT AND THE FILE-COMPUTER

The UNIVAC High-Speed Paper Tape System is a modern data-handling device that has been developed primarily for use with the UNIVAC File-Computer. Because of its extreme versatility, some of its components may be used as constituent parts of an off-line tape-to-tape converter, such as the UNIVAC Bi-Directional Perforated-to-Magnetic Tape Converter, commonly known as the BPTM-Tape Converter. The plugboard for the High-Speed Paper Tape System is the same as the plugboard for the BPTM-Tape Converter, therefore programmers of the latter device may use the programming information given in Section III of this manual. The manual as a whole, however, deals with the integrated units of the High-Speed Paper Tape System as an on-line, computer-connected input-output device, for which purpose it forms a valuable addition to the many pieces of peripheral equipment available for use with the UNIVAC File-Computer.

The UNIVAC File-Computer, an important member of the Remington Rand family of electronic computers, is distinguished by its building-block versatility. A single installation of a computing system may combine one input-output unit with a central computer or may add any number of input-output units up to a maximum of ten. Each unit has been designed by Remington Rand engineers to serve a specific purpose.

One of the most important features of each UNIVAC File-Computer input-output unit is its ability to share operating time with the central computer and the storage drums so that all units may operate simultaneously under control of a single program. An instruction to an input-output unit or instructions to several input-output units may be initiated without causing delay in the computer's execution of logical or arithmetic operations. A program from any source is, therefore, available in the operating memory of the computer at any required time, and all data processed by the program is either stored in the control computer or sent to an output device.

PERFORATED PAPER TAPE

The desire to use perforated paper tape as an input-output medium to an electronic computer has been expressed by many commercial and governmental firms and agencies. Its increasing popularity stems primarily from its versatility as an inter-communication medium among a wide variety of information-conveying implements and machines such as computers, calculators, typewriters,

teletypewriter systems, or other control systems located either in a central office or in widely scattered areas. In fact, the highly desirable common language functions of punched paper tape have spurred a faster growth to its usage in a comparable period of time than occurred even in the expansion of punched-card usage.

Beyond its versatility, paper tape has other advantages that cost-conscious management is seeking. It is an inexpensive storage medium with unlimited storage capacity. It requires less storage space than many other media and is convenient and inexpensive to mail or otherwise transport between departments, plants, or agencies; moreover, the information punched on paper tape may be transmitted directly by wire communications systems.

The paper used for punched tape is an oiled paper or parchment and has a greater durability than ordinary pulp paper, but many firms use, for data storage, both perforated paper tape and metallic or plastic magnetic tape, in order to secure the utmost efficiency in rapid maneuverability and durability.

THE HIGH-SPEED PAPER TAPE SYSTEM

The UNIVAC High-Speed Paper Tape System, for which programming procedures are described in this manual, was designed to fill the need of firms or agencies which use or desire to use punched paper tape for part or all of their data-processing operations. Its engineering is based on user experience gained on other UNIVAC paper tape conversion units.

The High-Speed Paper Tape System is a flexible instrument, capable of being adapted to many uses and ideally suited to the characteristics of its medium: punched paper tape. Primarily, it is an electronic machine with the ability to assume data-handling burdens that simple Read-Punch translators cannot perform; it conserves the more valuable capabilities of its companion computer, for it acts as a rapid-action communications link between paper tape and the high speed drum tracks of a UNIVAC File-Computer. Its solid-state design permits compact construction requiring far less space in a plant or office than many other machines while providing the benefits of greatly increased speed and efficiency. The term "solid-state" refers to the fact that a variety of newly developed devices, such as transistors, magnetic cores, and printed circuitry replace older components of more bulky design.

Maintenance problems are significantly reduced; installation costs are low, and power and cooling requirements are minimized; thus considerable savings are realized in basic costs.

UNITS

The High-Speed Paper Tape System is composed of three major units:

- A Read-Punch Unit
- A Translation and Format Control Unit
- An Input-Output Control Unit

The standard system joins the three module cabinets to form a single system, but each unit contains its own operation and maintenance controls, with hinged doors for easy access to the equipment interior. A blower at the bottom of each cabinet forces air through the components for cooling requirements; warm air is exhausted at the top of the cabinets. The system's over-all dimensions are: 81" width x 27" depth x 60" height. It is compactly built to allow easy transportation and relocation.

FEATURES

Special features of the High-Speed Paper Tape System provide for great flexibility of programming procedures. In general, the system possesses:

1. The ability to read input data recorded on 5, 6, 7, or 8-level[1] punched paper tape, to translate the paper tape code into UNIVAC 7-level code, and to record the data in any desired format in the computer memory.

2. The ability to accept data in UNIVAC 7-level code from the computer, and to translate and punch this data in any desired format on 5, 6, or 7-level punched paper tape.

3. The ability to read data recorded on 5, 6, 7, or 8-level punched paper tape, to translate the paper tape code into 5, 6, or 7-level code, to arrange the incoming information in any desired format in the 120-character buffer, and to punch the translated information into 5, 6, or 7-level paper tape. These off-line operations may be performed independent of central computer operations and control.

Seven special features ensure accuracy and facility of data transmission and control of program path:

1. Dual-read tape checking, by which the tape is read twice for comparison purposes.

2. Detecting control punches to facilitate control and selection of format and program path.

3. Performing control and selection of format and program path in the absence of function codes by a unique "position-stepping" feature.

4. Deleting information not required for further processing.

5. Inserting additional information, such as characters desirable for format control in further processing of information, either for input or output.

6. Checking at various stages of processing.

7. Correction features that instruct the system to ignore erroneous input information, such as may occur during tape preparation.

VERSATILITY

The units of the High-Speed Paper Tape System may be used in two ways:

1. The complete system may be used with the UNIVAC File-Computer System
   - as a punched paper tape input device;
   - as a punched paper tape output device;
   - as a combined Input-Output System;
   - as an off-line paper tape-to-paper tape converter.

2. The Translation and Format Control Unit may also be used as an integral part of the Bi-Directional Paper-to-Magnetic Tape Converter. In this System, a UNIVAC Magnetic Tape Servo Unit is added, and the Input-Output Control Unit is replaced by a Magnetic Tape Control Unit.

[1]The HSPT System can *read* most 8-level "chad" punched paper tapes (tapes punched clean with no flaps), and can *punch* 7-levels.

CONTROL

The High-Speed Paper Tape System, as a part of a UNIVAC File-Computer installation, is controlled primarily by computer commands transmitted over the Computer-to-Input-Output control lines. The Paper Tape System may alter a program by sending signals to the computer over Input-Output-to-Computer control lines when control punches in the tape or "position-stepping" demand program changes, or when special conditions arise. Such conditions might be end of tape, end of file, or end of data.

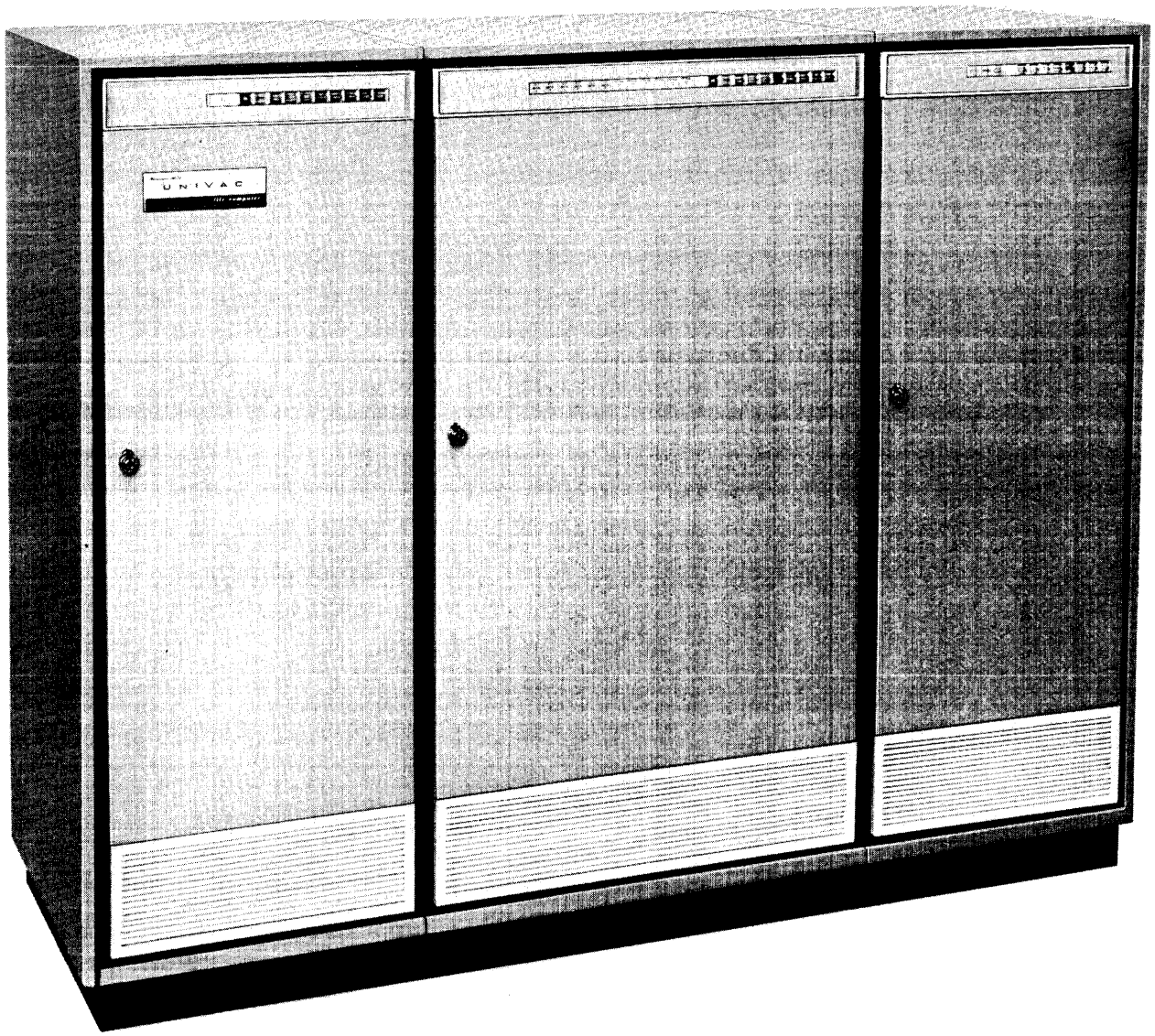


FIGURE 1. HIGH-SPEED PAPER TAPE SYSTEM

SECTION II

The Units – General Description

READ-PUNCH UNIT

As the name implies, the Read-Punch Unit may be used to read information from paper tape or to punch information into paper tape, depending upon whether the system is being utilized as an input or an output device.

During input operations, data are read from 5, 6, 7, or 8-level tape one character at a time, in parallel character bits, all holes read simultaneously, by a modified Ferranti Photoelectric Tape Reader capable of operating at the rate of 240 characters per second. The Reader contains two adjacent stations that read the same code in the tape consecutively. Information read by the first sensing station is transferred to a one-character buffer register and stored, and the contents of the register are then compared with the subsequent reading from the second sensing station. The Reader stops if the readings are not identical. The Reader also checks the physical condition of the tape and the punching tolerances within the tape. The presence of an abnormal tape condition stops the High-Speed Paper Tape System and lights a tape error light.

Power-operated supply and take-up reels are provided for long tapes; however, short lengths of tape can be handled without the reels. When tape reels are being used in reading operations, approximately three feet at the front end of the tape are used as a leader and two feet at the back are used as a trailer. The tape supply reel holds a standard 1,000-foot roll of paper tape. An adjustable guide on the Reader changes the tape guides to accommodate various tape widths up to 1". Through the use of the maintenance section pinboard, wired only by maintenance personnel, the Reader can be wired to generate a check bit for paper tape codes without parity to provide internal checking throughout the system or the Reader can be wired to overlook parity and suppress checking.

During output operations, the Read-Punch Unit receives data one character at a time from the Translation and Format Control Unit for storage in the buffer register, where a parity check can be performed prior to the punching operation. Punching is performed by a modified TELETYPE[1] Model BRPE-2 Punch capable of punching ten characters per inch, at the rate of 60 characters per second in 5, 6, or 7 levels on 11/16" or 7/8" paper tape. A friction-brake controlled supply reel and a power operated take-up reel are provided with the Punch Unit.

[1]TELETYPE is the registered trade name of the Teletype Corporation.

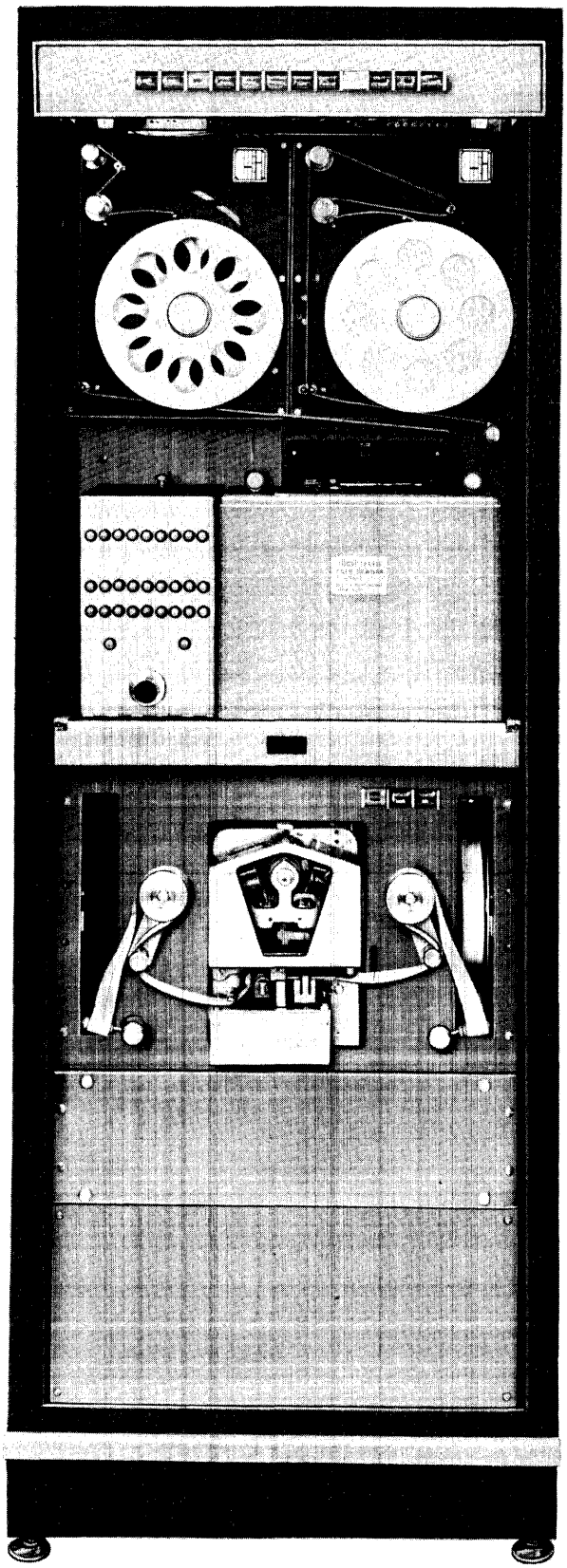


FIGURE 2. READ-PUNCH UNIT

TRANSLATION AND FORMAT CONTROL UNIT

The Translation and Format Control Unit (T and FC Unit) is the heart of the High-Speed Paper Tape System. When the system is being used as an input device, the T and FC Unit translates incoming information from 5, 6, 7, or 8-level paper tape code into UNIVAC code and controls the format of the information to be recorded in the central computer. As an output device, the T and FC Unit translates information received from the central computer in UNIVAC code into the desired 5, 6, or 7-level paper tape code and controls the format of the information to be punched on paper tape.

Specifically, the T and FC Unit:

1. controls the translation of input information, punched on paper tape, and its conversion to a computer code;
2. controls translation of output information and its conversion to an putput code;
3. controls the format of both input and output information, arranging data in any desired order and sequence;
4. can be used by itself for translating and editing data transferred from one paper tape to another.

Depending upon the direction of data flow, the T and FC Unit receives characters one at a time in parallel bits either from the Read-Punch Unit or the Input-Output Control Unit. The incoming character is held in a one-character translator buffer where a parity check may be made at the programmer's discretion. A decoder converts the character in the buffer to a signal on one of 128 decoder output lines. The decoder output lines are cross-connected by plugboard wiring to 128 encoder input lines and the encoder produces coded characters on eight parallel output lines. Encoded characters are sent to the punch for seven level punching plus parity check or to the Input-Output Control Unit for UNIVAC File-Computer input operation.

If a user's applications of a High-Speed Paper Tape System do not require both input and output during the same processing run, the Decoder and Encoder groups III and IV may be considered optional for 5 or 6-level codes. Also Channel Parity Checking is optional with any System, although its accuracy factor makes it invaluable in the large majority of operations.

Translation, format control, and other functions performed by the High-Speed Paper Tape System are accomplished by means of the program plugboard located on the T and FC Unit, a facsimile of the plugboard is shown at the end of this manual.

INPUT-OUTPUT CONTROL UNIT

Each Input-Output device connected to the UNIVAC File-Computer must provide for the exchange of data and control information between the computer and the Input-Output device. The Input-Output Control Unit for the High-Speed Paper Tape System is the communication link between the computer and the Translation and Format Control Unit.

Exchange of control information between the UNIVAC File-Computer and the High-Speed Paper Tape System is accomplished through a Demand Station. A complete exposition of the Demand Station concept is included in the "UNIVAC File-Computer, Model 1, Basic Programming Manual."

FIGURE 3. TRANSLATION AND FORMAT CONTROL UNIT

In the UFC Model 1 System, three sets of control lines are used: Input-Output-to-Computer control lines, Computer-to-Input-Output control lines, and High-Speed Input-Output-to-Computer (HS I/O-to-C) control lines. The UFC Model 0 System does not have high speed line storage but uses two sets of control lines: Input-Output-to-Computer (I/O-to-C) control lines and Computer-to-Input-Output (C-to-I/O) control lines.

INPUT-OUTPUT-TO-COMPUTER CONTROL LINES

Input-Output-to-Computer (I/O-to-C) control lines are used to send continuous current signals from the Input-Output Unit to the Computer plugboard. This current lasts until the end of the tape cycle in which it was initiated and is used as a signal to vary the computer program or stop the computer. The I/O-to-C control line signal on the computer plugboard lasts until the High-Speed Paper Tape System goes Not Ready.

These lines are sometimes called "Low Speed" I/O-to-C, in order to differentiate them from the I/O-to-C High Speed Control Lines. Low Speed I/O-to-C lines are active whenever the I/O Unit is On Demand and the I/O-to-C hubs have been activated, regardless of whether the unit is ready or not. For example, assume that the High-Speed Paper Tape System is On Demand during an input operation, and at PD2, a Low Speed I/O-to-C line is activated. Since the unit is On Demand, the High-Speed Paper Tape System will send computer B+ power to the computer as soon as the relay in the High-Speed Paper Tape System associated with that I/O-to-C line is activated, even though the High-Speed Paper Tape System may not go Ready until several hundred milliseconds later.

INPUT-OUTPUT-TO-COMPUTER HIGH-SPEED CONTROL LINES

Input-Output-to-Computer High-Speed Control Lines (I/O-to-HSCL) notify the computer when a special condition, such as a control hole, sensing an end of file, end of data, end of tape, or an error condition, is detected by the High-Speed Paper Tape System. In the demand circuitry of the UFC Model 1, there are four HSCL's over which program-altering signals may be sent from an I/O unit to the computer. Circuits in the High-Speed Paper Tape System remember these signals until it is time to send them to the computer, and similar circuits in the computer remember the signals received.

COMPUTER-TO-INPUT-OUTPUT CONTROL LINES

The Input-Output Control Unit of the High-Speed Paper Tape System not only communicates with the computer over its I/O-to-C lines but it also acts as a medium of communication in transferring control information from the computer to the High-Speed Paper Tape System. Control signals from the computer to the High-Speed Paper Tape System are received over Computer-to-Input-Output (C-to-I/O) control lines. For these signals to be received, the High-Speed Paper Tape System must be "On Demand." When the signals are received on the High-Speed Paper Tape System plugboard, they may be wired to an appropriate command hub.

READY OR NOT READY STATUS

The High-Speed Paper Tape System operates in a cyclical manner with each cycle initiated by a command signal received over a C-to-I/O control line or a combination of C-to-I/O control lines. This signal can be acted upon only when the High-Speed Paper Tape System is in a Ready Status. When the High-Speed

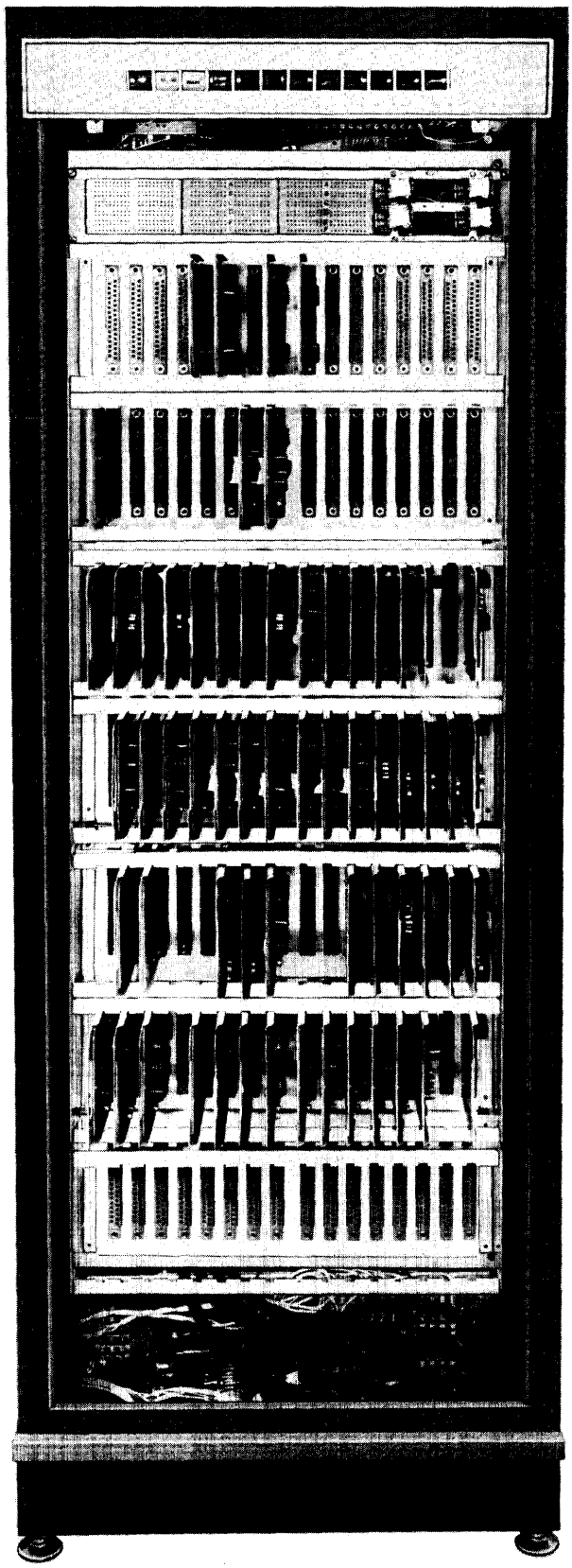


FIGURE 4. INPUT-OUTPUT CONTROL UNIT

Paper Tape System is in a Ready status, receipt of the command signal initiates operation, and the operating condition immediately causes the System to assume the Not Ready status. The System remains in the Not Ready status until it reaches the point in the tape cycle where the input or output transfer is complete. At this point, the system assumes the Ready status and remains in that status until the next signal is received over a C-to-I/O control line or a combination of C-to-I/O control lines.

DEMAND IN

Whether the High-Speed Paper Tape System is Ready or Not Ready, it can receive a Demand signal from the central computer via C-to-I/O control lines. It remains "On Demand" until another I/O unit is demanded or until a Master Clear signal is given.

The High-Speed Control line memory in the High-Speed Paper Tape System is cleared by a signal over C-to-I/O line A. At such time as the Paper Tape system assumes a Ready status, the Demand signal probes the high-speed control lines to determine whether any of them are active. If any of the lines are active, a Demand Out is inhibited and a Special Out results. The resulting Special Out may then be used to instruct the computer program to examine High Speed Control Line memory in order to determine which line or lines were activated.

DEMAND OUT

A Demand Out pulse requires three conditions:

1. a Demand In pulse;
2. a Ready Status of the High-Speed Paper Tape System; and
3. no special conditions present in the High-Speed Control lines.

SPECIAL OUT

A Special Out, like a Demand Out, requires three conditions:

1. a Demand In pulse;
2. a Ready Status of the High-Speed Paper Tape System; and
3. a special condition present in the (HS) I/O-to-C control lines.

The (HS) I/O-to-C control lines are available only in the UNIVAC File-Computer Model 1. Part of the demand station circuitry consists of four (HS) I/O-to-C control lines, designated as W, X, Y, and Z, over which control signals can be sent from the High-Speed Paper Tape System to the computer.

(HS) I/O-to-C control lines may be activated by signals resulting from the sensing of control holes in the tape or from plugboard-wired decisions based on character position-stepping. These signals may indicate special conditions such as end of file, end of data, end of tape, or error conditions. If an (HS) I/O-to-C control line has been activated, the regular Demand Out is inhibited, and a Special Out signal results, notifying the computer to test W, X, Y, Z storage in order to determine which high speed control lines were activated and which special condition existed in the High-Speed Paper Tape System.

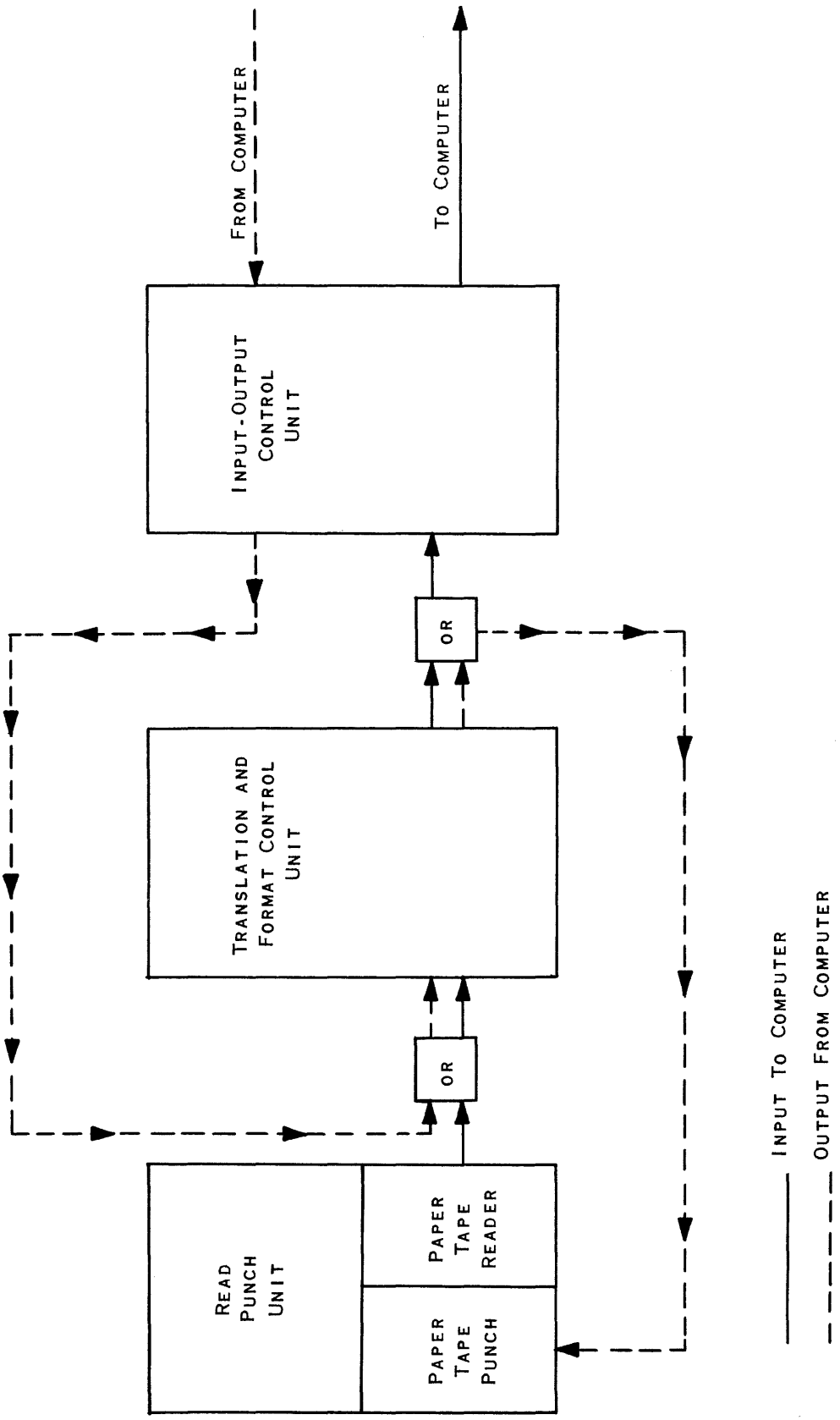


FIGURE 5. GENERAL FLOW OF DATA IN HIGH-SPEED PAPER TAPE SYSTEM

SECTION III

Plugboard Hubs – Description and Functions

Programming the High-Speed Paper Tape System is accomplished through wiring a plugboard located on the Translation and Format Control Unit (T and FC Unit). This plugboard is the sole programming medium with which the programmer is concerned.

Whether the High-Speed Paper Tape System is used for input or for output, the flow of information through the T and FC Unit is the same, and the programming procedures are similar. Specifically, both input and output data require the following procedures:

1. The multi-level information code of the source must be translated into the multi-level information code of the destination.
2. The flow of information must be handled one character at a time.

Two additional procedures are optional:

1. At the option of the programmer, specific characters or position steps can be used to initiate and control certain functions of the system. These functions will be discussed later.
2. Information flowing in either direction may be edited by deletion, insertion, or change of format.

For purposes of explanation, the hubs of the T and FC plugboard are divided, in this manual, into five classifications:

Translation Hubs
Format Control Hubs
Program Control Hubs
Operator Control Hubs
Communication Hubs

A facsimile of the T and FC plugboard is shown at the end of the manual. The programmer will need to refer to this plugboard during his reading of the remainder of this manual in order to visualize clearly the placement of the hub groups and to note their relationships.

TRANSLATION HUBS

INCOMING BUFFER OUTPUT

All source data to the system, whether from paper tape or from the high speed drum, must come through the Incoming Buffer, one character at a time. The incoming Buffer, is, in purpose, a translator buffer, translating the binary bit representation of the incoming character. The INCOMING BUFFER OUTPUT section of the plugboard contains sixteen pairs of bussed hubs - two pairs for such possible level of the source character. The two leftmost pairs, labeled PAR (parity) "0" and "1", represent the absence or presence of a bit in the parity level of the character, or in the 8th level of an 8-level tape. The remaining pairs, labeled "0-1", "0-2", "0-4", ...up to "0-64", represent the presence or absence of a bit in the information levels of the character. The "0-1" hubs represent the lowest order information level, and the "0-64" hubs represent the highest order level.

If a level contains a zero, or no hole as in the case of paper tape, the "0" hub for that level will emit a signal. If the level contains a "1" (or a hole), the other hub for that level will emit a signal. If a level is not being used, the "0" hub will always emit the signal. Thus, if a UNIVAC code from the high speed drum is in the Incoming Buffer, the parity bit will be represented in the parity level, the six information bits will be represented in levels 0-1 through 0-32, and the unused 0-64 level will emit a signal from the "0" hub.

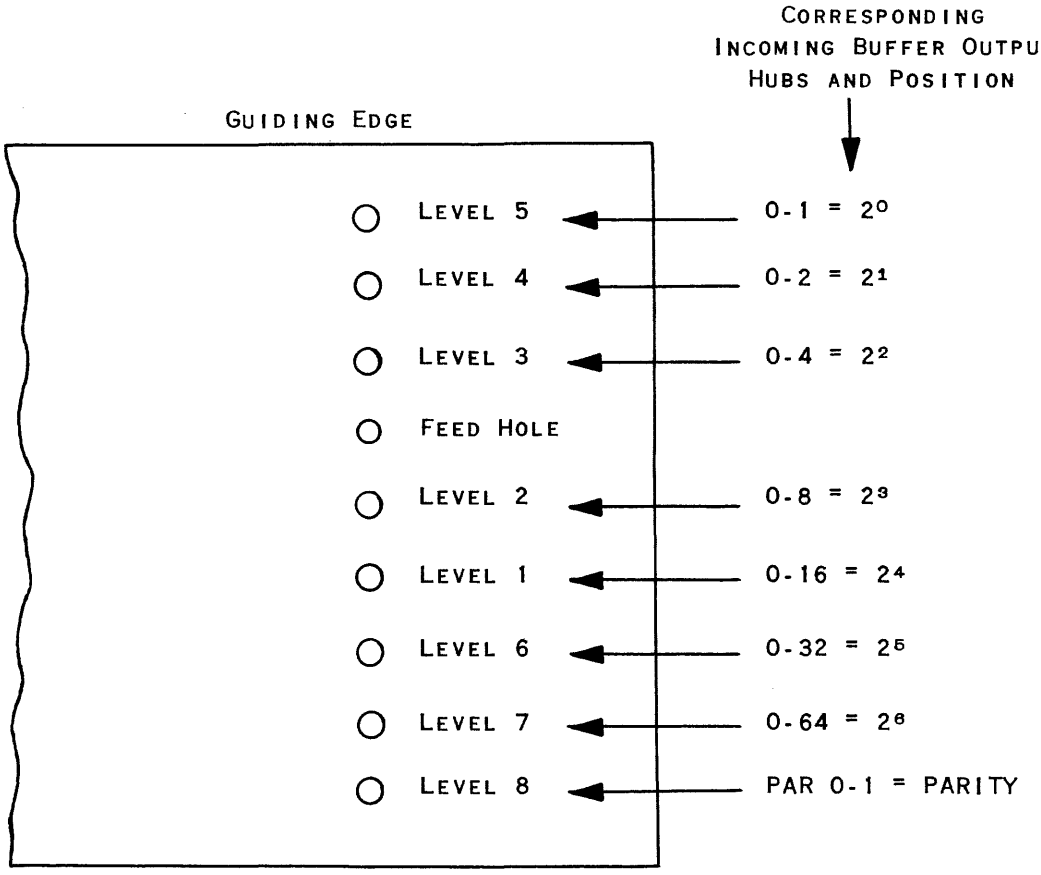
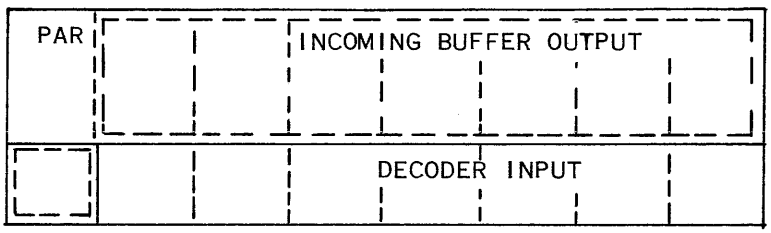


FIGURE 6. SEGMENT OF PAPER TAPE SHOWING TRANSLATION LEVELS AT INCOMING BUFFER OUTPUT POSITIONS

Ordinarily, the wiring from the INCOMING BUFFER OUTPUT section is very simple: both hubs in each level used are wired to the adjacent hubs in the same level of DECODER INPUT. Although this procedure is flexible (See wiring under "Example 1"), a check for parity may be made while the character is in the translator buffer. If the INCOMING BUFFER OUTPUT "PAR" hubs are wired to the adjacent DECODER INPUT hubs, the parity check will include all eight levels.

The following diagram and description may help the programmer to understand how the parity check is made on the character in the Incoming Buffer.



a. If the Incoming Buffer Output Parity hubs are not wired to adjacent hubs at the Decoder Input, the parity check for odd or even parity is made on the 7 levels of the Incoming Buffer outlined by a broken line.

b. If the Incoming Buffer Output Parity hubs are wired to adjacent hubs at the Decoder Input, the parity check for odd or even parity is made on the 7 levels of the Incoming Buffer outlined by a broken line plus the level outlined by a broken line at the Decoder Input.

DECODER INPUT

Now that a character has come from a source into the T and FC Unit as a multi-level code, it must be reduced to a single identifiable signal which uniquely represents that code. The Decoder performs this task. Fourteen DECODER INPUT hubs accept signals from the translator buffer. Each of the seven levels has two hubs. The Decoder interprets a signal at the right hub as a "one" and a signal at the left hub as a "zero." Each level of DECODER INPUT may have:

1. both its hubs plugged, or
2. neither of its hubs plugged.

In the latter case, the Decoder will always interpret a zero at that level. *The programmer should never wire only one hub of a pair at any level.*

Occasionally, special circumstances may dictate wiring the INCOMING BUFFER OUTPUT hubs of one level to the DECODER INPUT hubs of a different level. For that matter, the programmer may want to wire zero to one and one to zero instead of zero to zero and one to one. These methods must be used with care, since either one will cause a permutation in the decoding operation.

The 0-32 or the 0-64 hubs may also receive signals from the IN PREC, Input Precedence, section of the plugboard. This will be discussed fully under the heading "Input Precedence."

EXAMPLE 1A

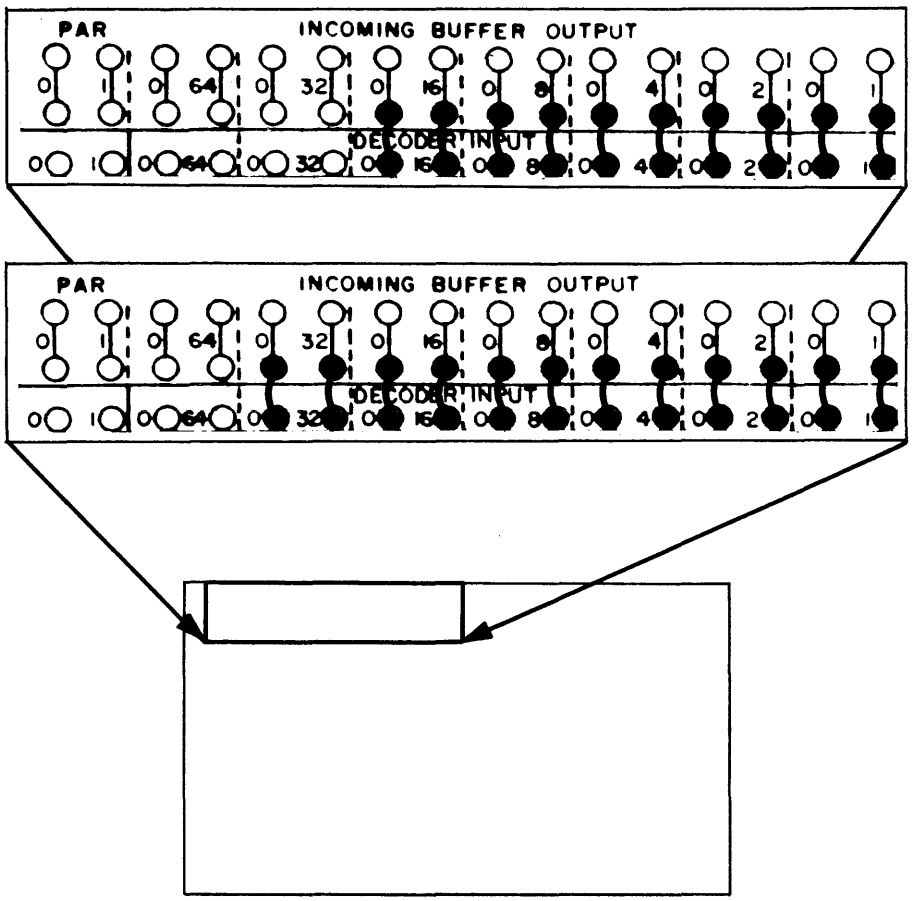


FIGURE 7. WIRING FOR TRANSLATION OF 5 AND 6-LEVEL CODES

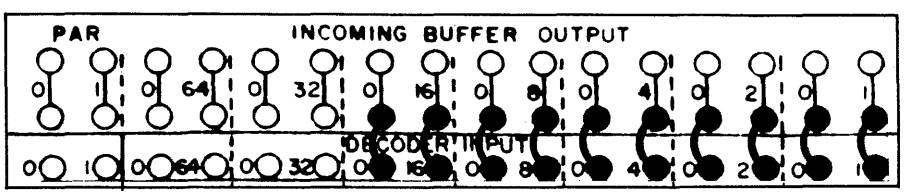
EXAMPLE 1

Wiring from INCOMING BUFFER OUTPUT to DECODER INPUT

Mode: Input

Problem: To translate input data to the UNIVAC File-Computer from 5, 6, 7, or 8-level punched paper tape. This wiring is of constant recurrence, as input data must first be translated to UNIVAC code before it is ready for use by the UNIVAC File-Computer.

Procedure: A. *For 5-level punched paper tape,* wire the 0-1, 0-2, 0-4, 0-8, and 0-16 hubs of the INCOMING BUFFER OUTPUT group to the corresponding hubs of the DECODER INPUT group, as shown



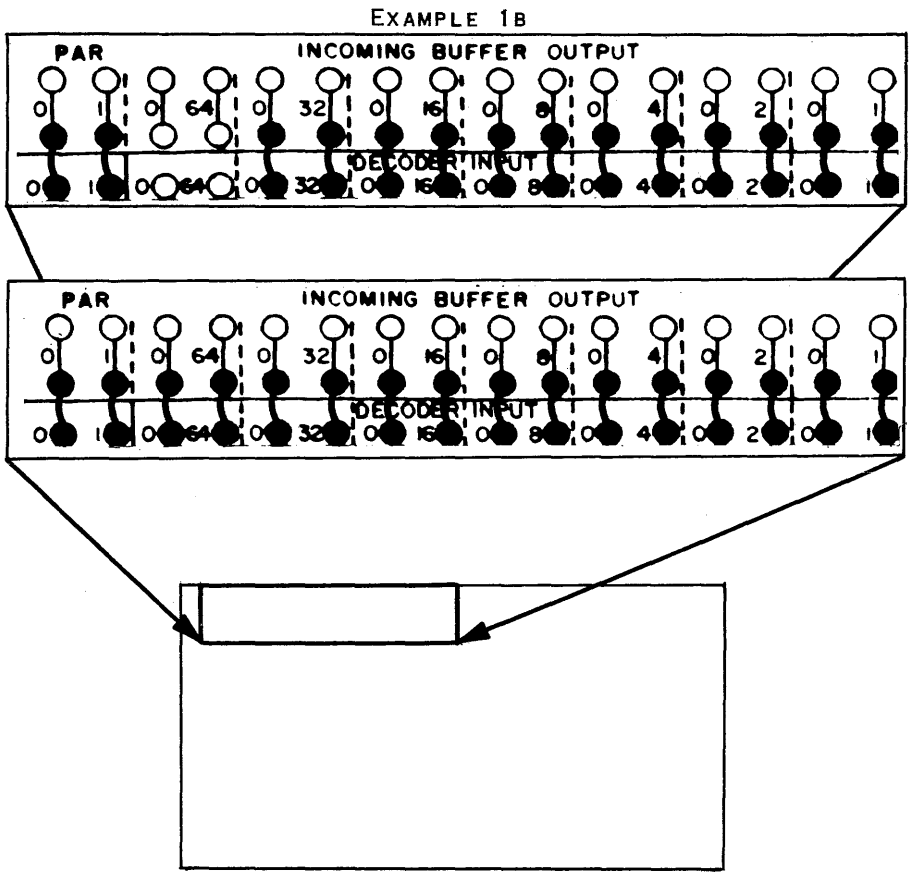
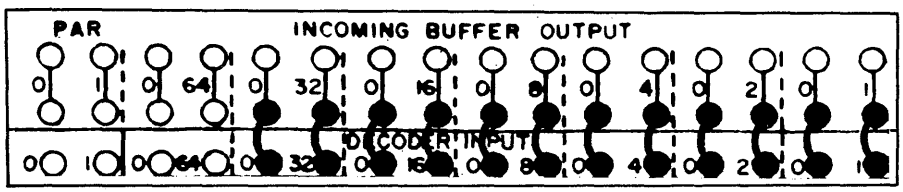
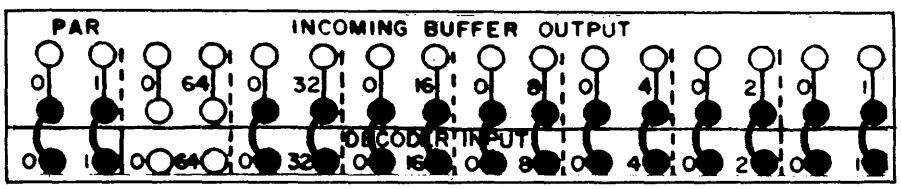


FIGURE 8. WIRING FOR TRANSLATION OF 7 AND 8-LEVEL CODES

B. *For 6-level punched paper tape,* wire the same hubs as listed for the fifth level and add 0-32, as shown



C. *For 7-level punched paper tape,* wire the same hubs as listed for the sixth level and wire the parity level of the INCOMING BUFFER OUTPUT to the PAR 0-1 hubs of the DECODER INPUT.



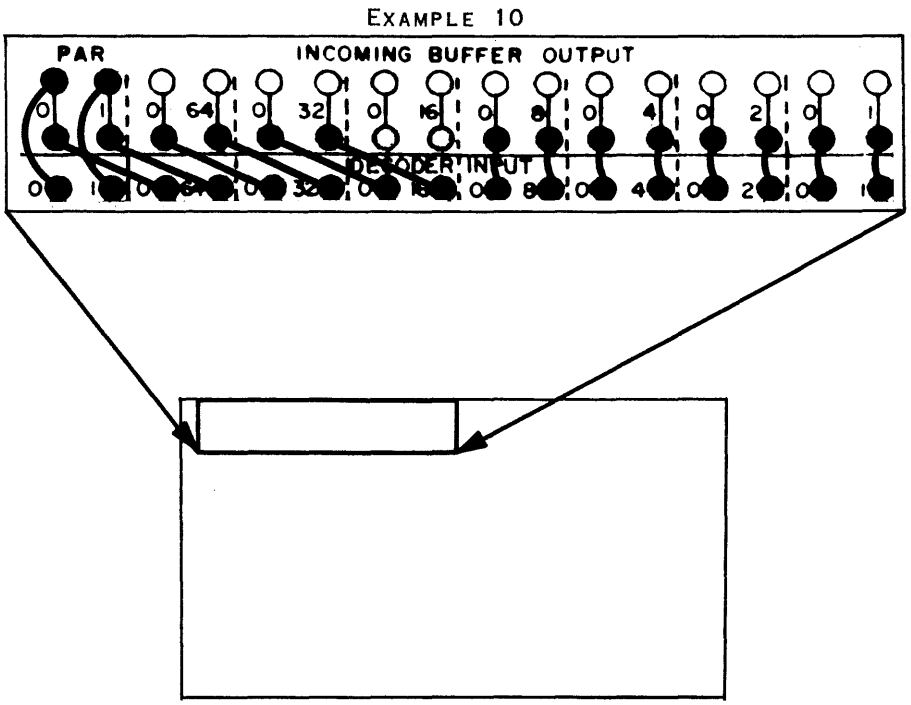
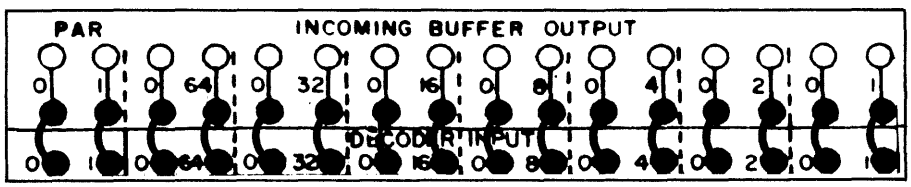
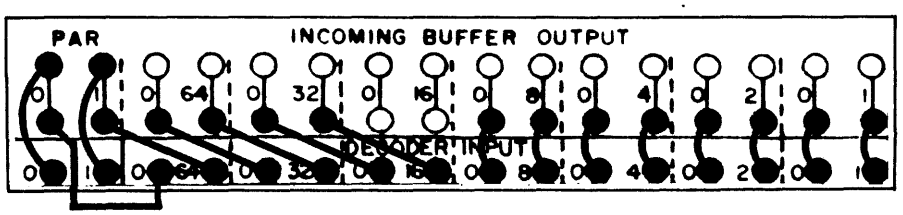


FIGURE 9. WIRING FOR TRANSLATION OF 8-LEVEL CODE (WITH PARITY AT 0-16 INCOMING BUFFER LEVEL)

D. *For 8-level punched paper tape,* wire hubs from 0-1 through 0-64 to adjacent DECODER INPUT hubs. Wire the two hubs under "Parity" to adjacent hubs at the extreme left of the DECODER INPUT group, if the paper tape has a parity level.



E. *For 8-level punched paper tape,* wire parity at 0-16 in the Incoming Buffer level, wire hubs from 0-1 through 0-8 to adjacent DECODER INPUT hubs. Wire hubs 0-32, 0-64, and PAR 0-1 to DECODER INPUT hubs adjacent to 0-16, 0-32, and 0-64 respectively. In addition, wire hubs PAR 0-1 to adjacent DECODER INPUT hubs.



DECODER GROUP OUT (I, II, III, AND IV)

The DECODER GROUP OUT section of the plugboard contains 128 bussed pairs of hubs. A signal emitted from any pair represents a unique combination of the seven "ones" and "zeros" interpreted by the Decoder at the DECODER INPUT hubs. For convenience in programming, the 128 pairs have been divided into groups I, II, III, and IV, with each group containing 32 bussed pairs of hubs numbered 0 through 31. A binary system is used to determine which pair of hubs will emit the signal. The combination of ones and zeros interpreted at the 0-32 and 0-64 levels of DECODER INPUT determines which group will contain the emitting hubs, and the combination of ones and zeros interpreted at the five low-order levels determines which pair of the 32 bussed pairs in that group will emit the signal. Table 1 shows binary values of DECODER GROUP OUT hubs. As will be seen in this table, if the code 1001111 were received at DECODER INPUT it would cause a signal to be emitted at hub 15, Group III.

Table 2 shows tape codes in terms of T and FC Unit Translator hubs. Three commonly used codes are listed in the table; others may be developed to conform with installation requirements.

At this point, a character has been brought into the system and decoded into a single, easily handled signal. This signal must be delivered to at least one of the following three hub groups:

1. INCOMING PRECEDENCE
2. DELETE CHARACTER IN
3. ENCODER GROUP IN

If a signal is emitted from a DECODER GROUP OUT hub which is not wired to any of the above three hub groups, the system will signal the error and stop operation.

If a particular DECODER GROUP OUT hub is wired to both a DELETE CHARACTER IN *and* an ENCODER GROUP IN hub, the wiring to the DELETE CHARACTER IN hub will be ignored.

ENCODER GROUP IN (I, II, III, AND IV)

The ENCODER GROUP IN section of the plugboard contains 128 hubs divided into four groups of 32 hubs each, numbered 0 through 31. A signal applied to any of these hubs will cause signals to be emitted from a unique combination of hubs in the ENCODER OUTPUT section of the plugboard. The encoding system is the reverse of the decoding system. The only difference is that the DECODER INPUT uses both a "zero" receiving hub and "one" receiving hub for each level. ENCODER OUTPUT, on the other hand, uses only one emitting hub for each level. Each hub emits a signal to represent a one and does not emit a signal to represent a zero.

Several kinds of hubs may send signals to ENCODER GROUP IN hubs. The kind most commonly used is the DECODER GROUP OUT, since it wires the key step in the process of translating a source character into a destination character.

Through the use of a unibus, more than one source character may be encoded as the same destination character.

GROUP SELECTION:

VALUES 2^6	BINARY 2^5	GROUP NUMBER
0	0	I
0	1	II
1	0	III
1	1	IV

HUB SELECTION:

BINARY VALUES					HUB
2^4	2^3	2^2	2^1	2^0	NUMBER
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	11	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	0	1	1	0	22
1	0	1	1	1	23
1	1	0	0	0	24
1	1	0	0	1	25
1	1	0	1	0	26
1	1	0	1	1	27
1	1	1	0	0	28
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

TABLE 1. DECODER GROUP OUT HUB SELECTION

TABLE 2. RELATIONSHIP OF T AND FC TRANSLATOR HUBS TO SAMPLE CODES

UNIVAC CODE				STANDARD TELETYPEWRITER CODE		FLEXOWRITER CODE			
HUBS	CHARACTER BITS	GPS I AND III	GPS II AND IV	GPS I AND III	GPS II AND IV	GROUP I	GROUP II	GROUP III	GROUP IV
0	00000	i	t	unused	unused	unused	unused	unused	unused
1	00001	Space	n	T	5	t	unused	T	unused
2	00010	-	l	CR	CR	CR	.	CR	.
3	00011	Ø	)	0	9	o	stop	0	stop
4	00100	1	J	Space (Δ)	Space (Δ)	Space	;	Space	:
5	00101	2	K	H	£	h	CR/LF	H	CR/LF
6	00110	3	L	N	, (comma)	n	, (comma)	N	, (comma)
7	00111	4	M	M	.	m	UC	M	UC
8	01000	5	N	LF	LF	LF	/	LF	?
9	01001	6	O	L	)	l	tab	L	tab
10	01010	7	P	R	4	r	½	R	¼
11	01011	8	Q	G	&	g	unused	G	unused
12	01100	9	R	I	8	i	' (apos.)	I	"
13	01101	' (apos.)	$	P	Ø	p	unused	P	unused
14	01110	&	*	C	:	c	-	C	-
15	01111	(	?	V	;	v	LC	V	LC
16	10000	r		E	3	e	8	E	*
17	10001	, (comma)	β	Z	=	z	Back Space	Z	Back Space
18	10010	.	:	D	$	d	5	D	%
19	10011	;	+	B	?	b	unused	B	unused
20	10100	A	/	S	Bell	s	4	S	$
21	10101	B	S	Y	6	y	unused	Y	unused
22	10110	C	T	F	!	f	6	F	¢
23	10111	D	U	X	/	x	unused	X	unused
24	11000	E	V	A	-	a	3	A	#
25	11001	F	W	W	2	w	unused	W	unused
26	11010	G	X	J	' (apos.)	j	7	J	&
27	11011	H	Y	Figs	Figs	9	unused	(	unused
28	11100	I	Z	U	7	u	2	U	@
29	11101	#	%	Q	1	q	unused	Q	unused
30	11110	¢	=	K	½	k	unused	K	unused
31	11111	@	Illegal	Ltrs	Ltrs	Ø	delete	)	delete

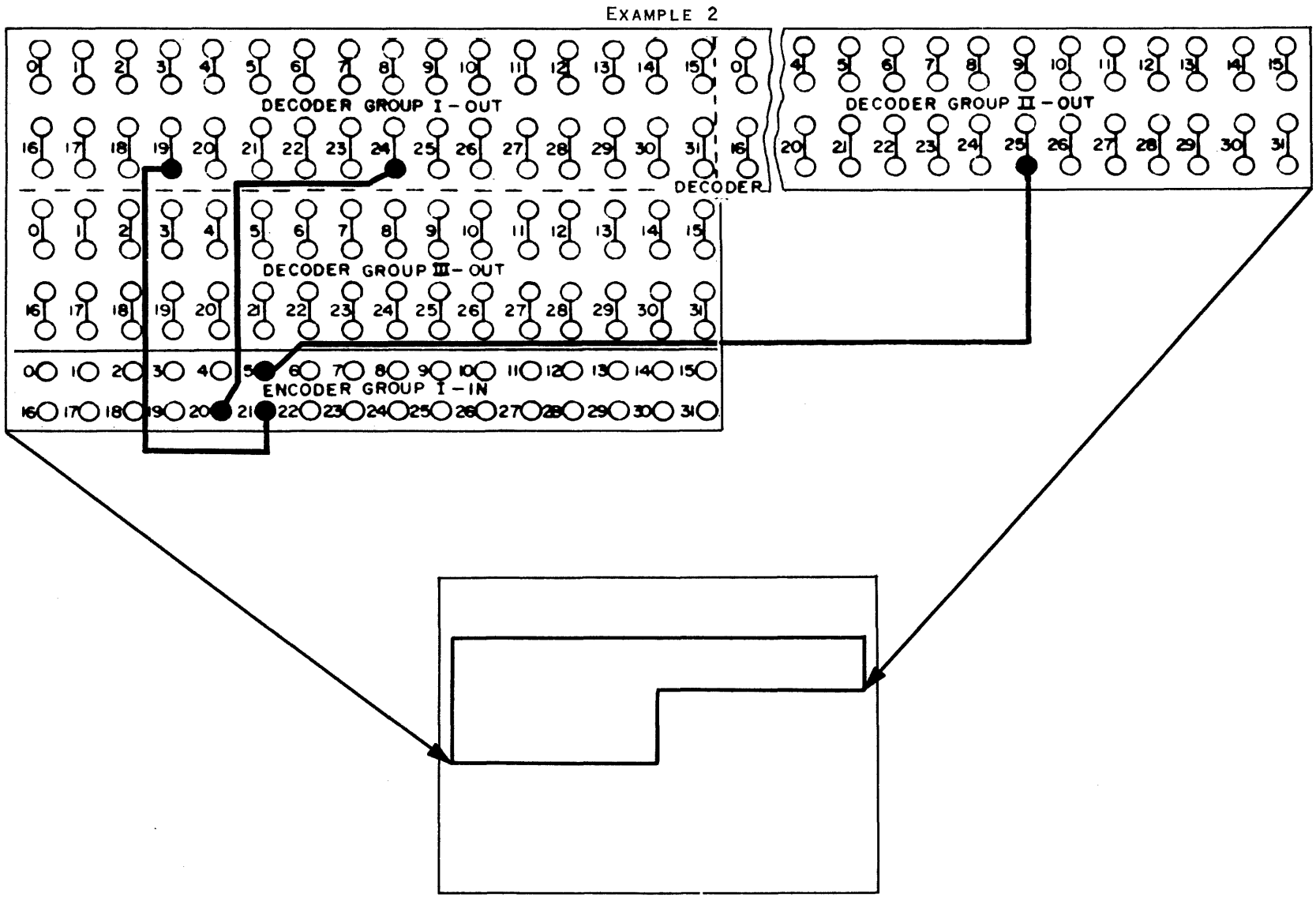


FIGURE 10. WIRING DECODER-ENCODER INPUT MODE

The following two examples show the wiring from DECODER GROUP OUT hubs to ENCODER GROUP IN hubs, for the Input Mode (Ex. 2) and Output Mode (Ex. 3).

EXAMPLE 2

Wiring DECODER GROUP OUT to ENCODER GROUP IN

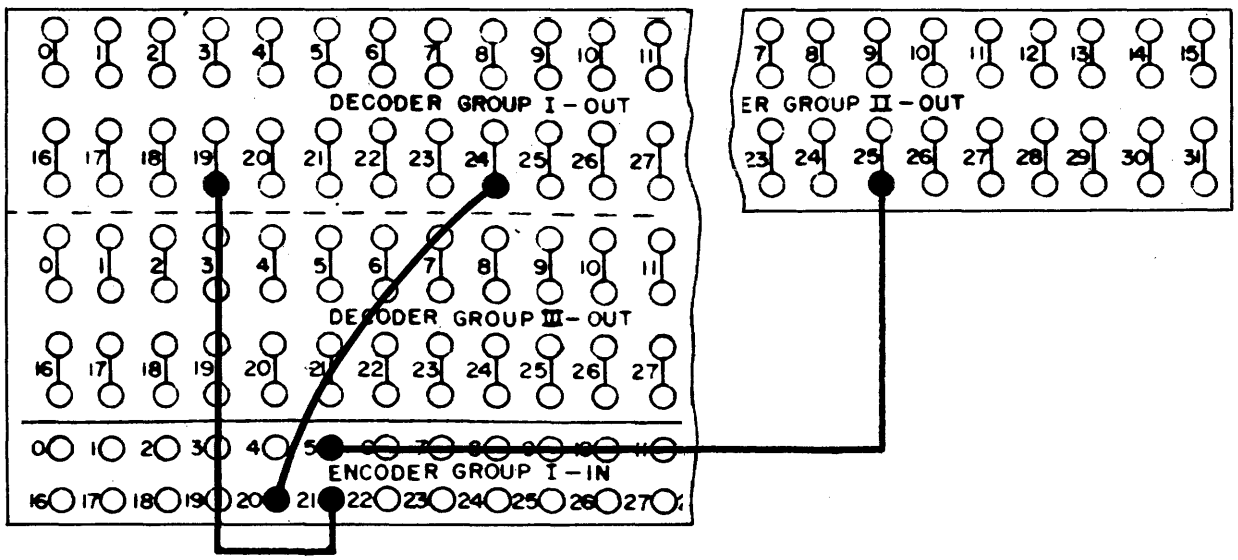
(Conversion from Input Code to Output Code)

Input Mode

Problem: To convert 5-level, standard teletypewriter, punched paper tape, character codes into UNIVAC 7-level character codes. Codes A, B, and 2 are selected for this problem.

Procedure: Wire from the DECODER GROUP OUT hubs representing the 5-level teletypewriter codes for A, B, and 2 to the ENCODER GROUP IN hubs representing the 7-level UNIVAC codes for A, B, and 2. Table 2 gives group and hub selection.

Result: As each teletypewriter character code is translated, a signal will emit from the DECODER GROUP OUT hub or hubs representing that character. This signal will be transmitted, via plugboard wiring, to the ENCODER GROUP IN hub which represents the desired UNIVAC character.



EXAMPLE 3

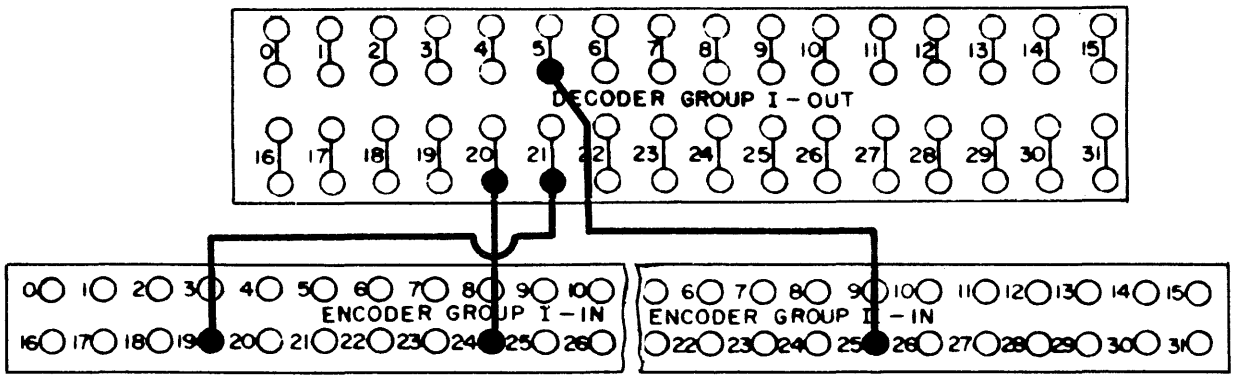
Wiring DECODER GROUP OUT to ENCODER GROUP IN

Output Mode

Problem: To convert the 7-level UNIVAC character codes used by the UNIVAC File-Computer for the characters A, B, and 2 into the 5-level teletypewriter character codes for A, B, and 2.

Procedure: Wire from the DECODER GROUP OUT hubs representing the 7-level UNIVAC codes for A, B, and 2 to the ENCODER GROUP IN hubs representing the 5-level teletypewriter punched paper tape codes for A, B, and 2 (see Table 2 for group and hub selections).

Result: The DECODER GROUP OUT hubs representing each character will emit a signal when the incoming character is recognized. This signal will be transmitted, via plugboard-wiring, to the ENCODER GROUP IN hub which represents the desired teletypewriter character.



ENCODER OUTPUT

The ENCODER OUTPUT section contains eight hubs, labeled PAR 64, 32, 16, 8, 4, 2, and 1. A signal applied to any ENCODER GROUP IN hub will cause a special combination of the seven numbered hubs in the ENCODER OUTPUT section to emit signals. The PAR hub will always contain a "1" bit or "0" bit to make this total number of bits on all eight hubs odd.

Ordinarily, each hub in this section is wired to the nearest hub in the PUNCH/COMP. (Computer) INPUTS section. This wiring will send a character to its destination exactly as coded by the Encoder. In some cases, the programmer may find it convenient or necessary to wire from one level of ENCODER OUTPUT to a different level of PUNCH/COMP. INPUTS.

The signal from one ENCODER OUTPUT hub may also be sent to the OUTPUT PREC section of the plugboard (see "Output Precedence" section).

PUNCH/COMP. INPUTS (PUNCH/COMPUTER)

The sixteen hubs in the PUNCH/COMP. INPUTS section have the same labels as the adjacent ENCODER OUTPUT hubs. Signals sent to these hubs will be interpreted at the destination as shown in the following table.

	Hub Label							
Destination	PAR	64	32	16	8	4	2	1
High Speed Drum	Parity Bit	Not Used	Zone Bit	Zone Bit	Numeric Bit	Numeric Bit	Numeric Bit	Numeric Bit
Paper Tape Punch	Parity* Hole	7th* Channel Hole	6th* Channel Hole	5th Channel Hole	4th Channel Hole	3rd Channel Hole	2nd Channal Hole	1st Channel Hole

*With the present seven-level punch equipment, one of these lines must necessarily be disconnected at the punch unit.

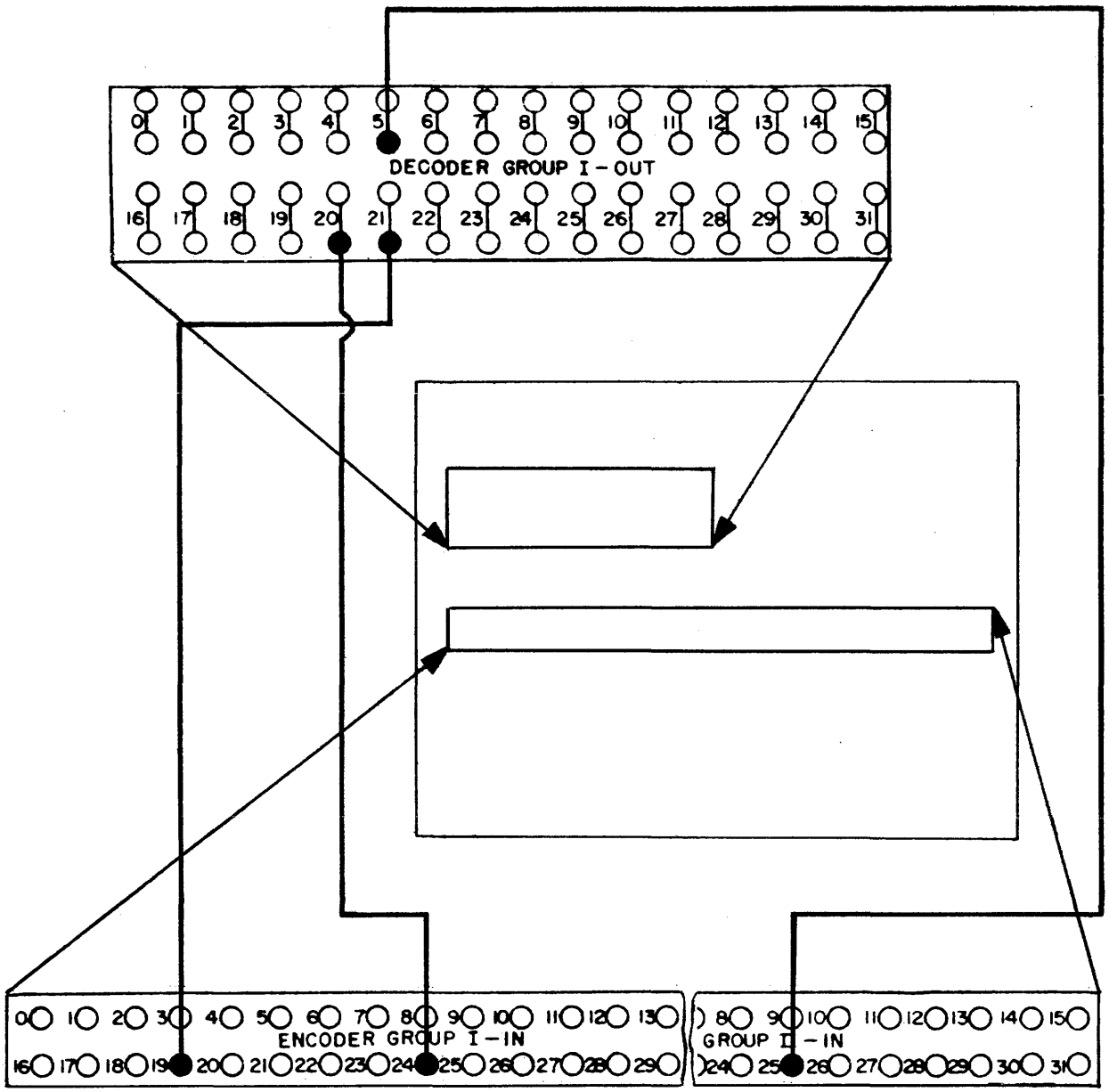


FIGURE 11. WIRING DECODER-ENCODER OUTPUT MODE

Internally, the paper tape punch receives the signals fed to the PUNCH/COMP. INPUT hubs and stores them in an 8-level register where, depending on the setting of a switch at the punch unit:

1. an odd parity check may be made;
2. an even parity check may be made; or
3. parity may be ignored.

A pinboard in the punch maintenance section provides the final connection between this register and the punching relays. Only 5, 6, or 7 of the 8 levels may be connected, and the connection is made by the installation crew. Although the wiring of this pinboard may be changed by field service personnel, frequent changes are not recommended.

EXAMPLE 4

Wiring PUNCH/COMP. INPUTS

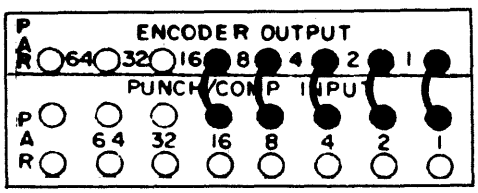
Output Mode

Discussion: We have shown by the first three examples that all data processed by the High-Speed Paper Tape System, whether it be input from punched paper tape to the computer or output from the computer to punched paper tape, must pass through the decoder to the encoder. In addition, the data will pass through the encoder to ENCODER OUTPUT hubs and to PUNCH/COMP. INPUT hubs in order to set punching dies for punching paper tape.

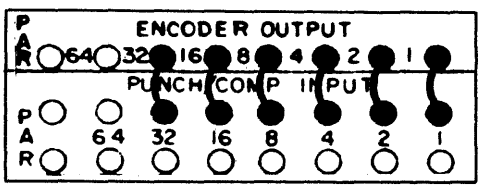
The following example shows the wiring necessary to continue the sequence of operations that have been previously described.

Problem: To punch data from the UNIVAC File-Computer into 5, 6, or 7-level paper tape.

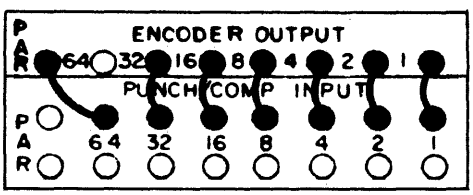
Procedure: A. *For 5-level paper tape,* wire the five low order ENCODER OUTPUT hubs labeled 1, 2, 4, 8, 16 to adjacent PUNCH/COMP. INPUT hubs numbered 1, 2, 4, 8, 16.



B. *For 6-level paper tape,* wire the same hubs as for the 5-level and add hubs labeled 32.



C. *For 7-level paper tape,* wire the same hubs as for the 6-level. The seventh level is the parity level, therefore for the 7-level paper tape, wire the PAR (Parity) hub of ENCODER OUTPUT to the 7-level (No. 64) hub of PUNCH/COMP. INPUTS.



EXAMPLE 4

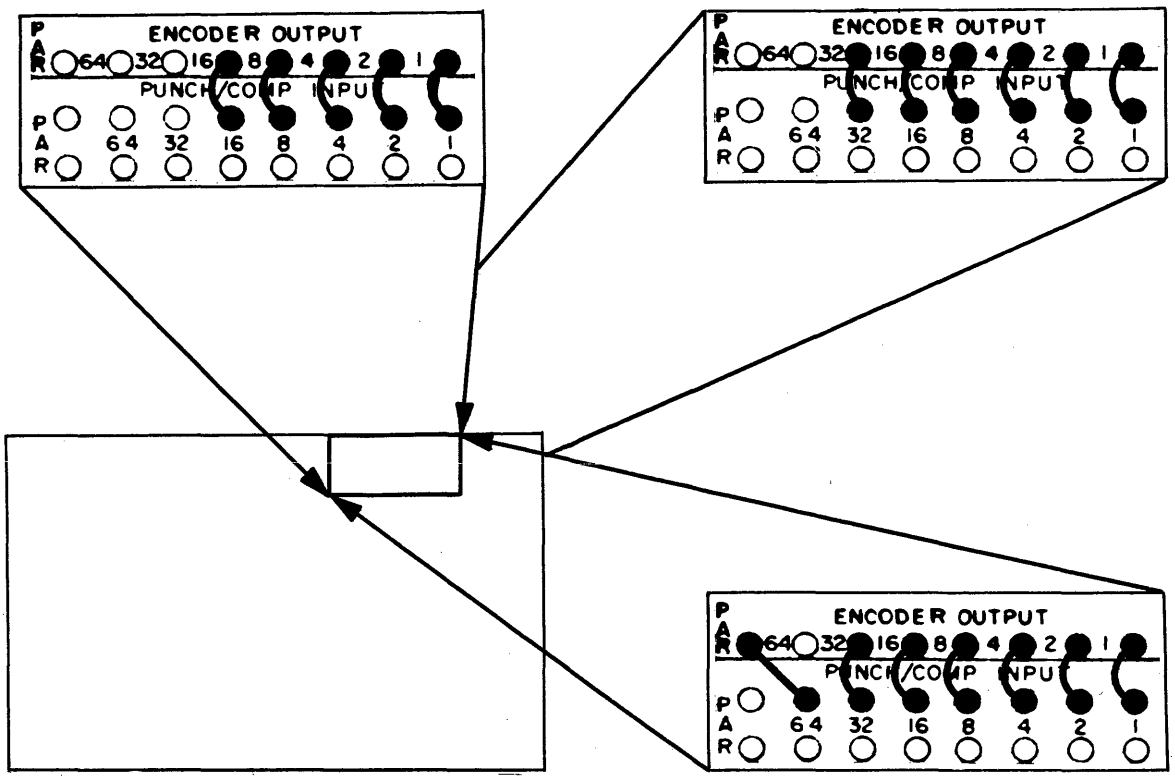


FIGURE 12. WIRING PUNCH/COMPUTER INPUTS

DELETE CHARACTER IN

If a signal is emitted from a DECODER GROUP OUT hub that is not wired to an Input Precedence hub or an ENCODER GROUP IN hub, that hub should be wired to one of the sixteen hubs labeled DELETE CHARACTER IN. When this is done, there will be no destination character encoded as a direct result of the DECODER GROUP OUT signal, and no error condition arising from failure to encode a decoded character.

EXAMPLE 5
Wiring for Character Deletion
Input or Output Mode

Problem: To delete any character or multiple characters from punched paper tape.

Assumption: Assume that valid information is punched on 5-level standard teletypewriter tape, and space codes (Δ's) separate the units of the message, as they do in the following: ABCΔ1Δ2Δ3. The teletypewriter tape is to be used as input to the computer, but it is desirable to delete all space codes.

Procedure: Wire all DECODER GROUP OUT hubs whose emitting signals represent space codes on 5-level punched paper tape (see Table 2), to the IN hubs of a UNIBUS (see section on "Unibus," following). Wire the OUT hub of the Unibus to a DELETE CHARACTER IN hub.

Result: Each time a space code appears in a message, the appropriate DECODER GROUP OUT hub will emit a signal. The signal will travel through the Unibus to the DELETE CHARACTER IN hub, and the character will be deleted. The encoded message, as given in the above assumption, will now appear as ABC123.

EXAMPLE 5

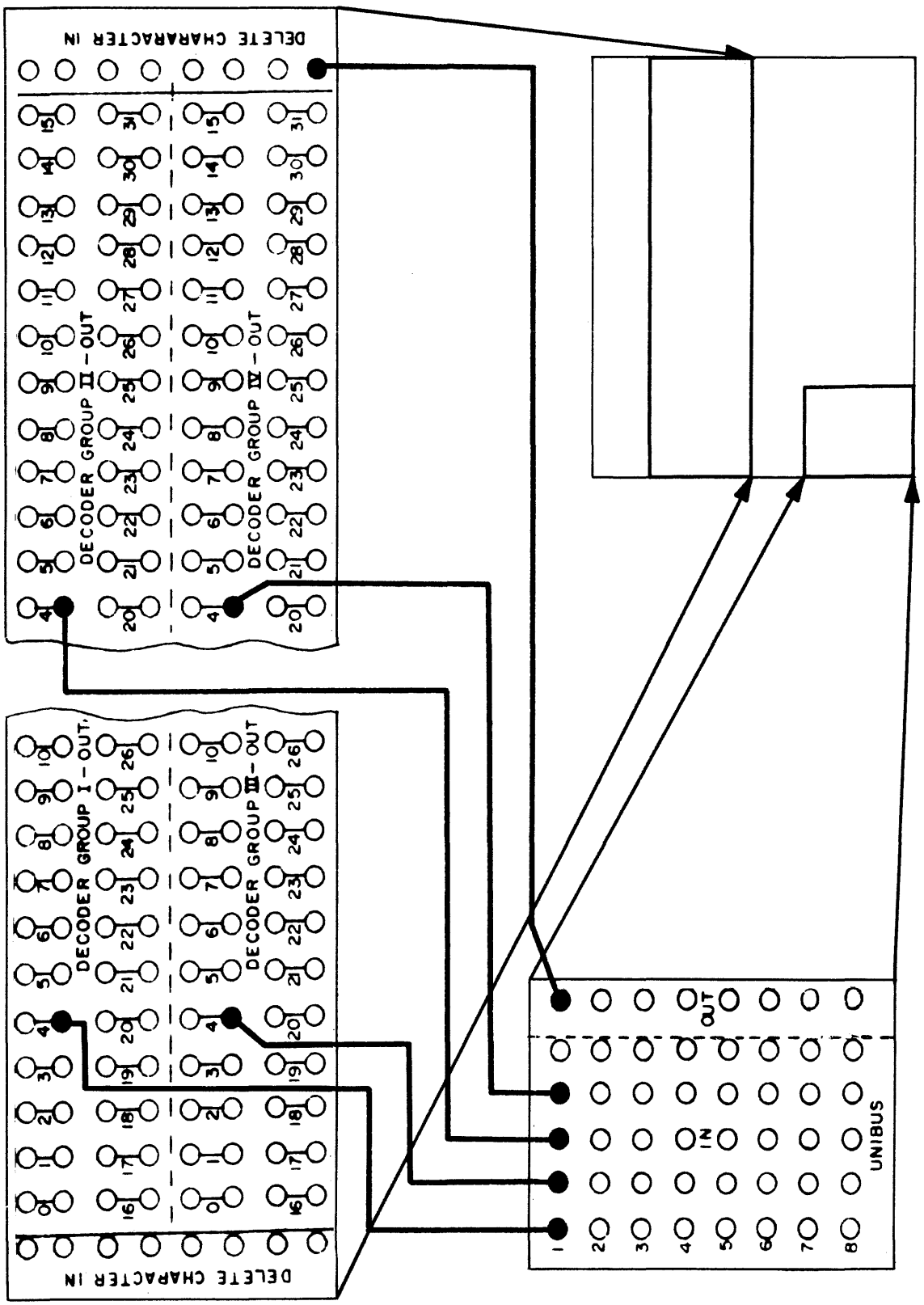


FIGURE 13. WIRING FOR DELETE CHARACTER IN

PRECEDENCE

There are two sections on the plugboard dealing with precedence. One is labeled IN PREC and the other is labeled OUTPUT PREC. In order to understand the functions of these sections more easily, the necessity of the precedence feature must first be understood.

In the following discussion of precedence, 5-level paper tape is used for purposes of illustration, but the explanation can be applied to 6-level paper tape as well.

In a five-channel (level) paper tape, the maximum number of different combinations of channels containing holes is 32 (2^5). Of course, this is not enough to accommodate 26 letters and 10 figures, plus special characters and punctuation. The precedence character or precedence code system allows two meanings for every code punched, thereby doubling the number of different characters available from the tape.

The precedence code can be compared with the SHIFT KEY of a typewriter. Each typewriter key can type either upper or lower case, depending on the position of the shift key. In the same manner, each code on tape can have either an upper case meaning or a lower case meaning, depending on which of two precedence codes was the last to precede the code in question. This coding method, therefore, is aptly named "precedence."

Precedence characters may be given different names in different systems: "shift and unshift," "letters and figures," or "upper case and lower case." For consistency, the abbreviations of the third pair of names, UC and LC, will be used in this manual.

Assume that a paper tape unit is reading a length of tape. As soon as the Reader senses a UC precedence code, it conditions the unit to interpret each of the characters following the code as upper case characters until the Reader senses an LC precedence code. At that point the Reader instructs the unit to interpret as LC characters each of the characters following the LC code, until the Reader senses a UC precedence code. This process continues throughout the entire operation.

IN PREC (INPUT PRECEDENCE)

If a five-channel (level) paper tape is being read, five signals will come from the translator buffer to the Decoder to select one hub from a group of 32 hubs. One group is sufficient to represent the LC characters; another group must be used to represent the UC characters. The precedence characters provide the signal to select the appropriate group. The section labeled IN PREC gives this power to the precedence character. It contains two input hubs labeled UC, two input hubs labeled LC, and two output hubs labeled PREC OUT, "0" and "1"; these latter hubs will be discussed below.

Every time a character is read, a signal is emitted from one of the PREC OUT hubs. As was stated above, the precedence code instructs the High-Speed Paper Tape System to interpret the characters following the code as either upper or lower case, depending on the code used. Wiring the "0" and "1" hubs to the 6th or the 7th level of DECODER INPUT will provide the group selection necessary when the precedence code system is used. For example: Assume that PREC OUT "0" and "1" are wired to DECODER INPUT "0" and "32" (6th level), and nothing is wired to DECODER INPUT "0" and "64" (7th level). As long as PREC

OUT "0" is emitting the signal, the Decoder will emit from Group I. As soon as PREC OUT "1" begins emitting the signal, the Decoder will emit from Group II.

While PREC OUT "0" is emitting, a signal delivered to an LC hub will have no effect, but a signal delivered to a UC hub will start PREC OUT "1" emitting.

While PREC OUT "1" is emitting, a signal delivered to a UC hub will have no effect, but a signal delivered to an LC hub will start PREC OUT "0" emitting.

To achieve the desired result, the DECODER GROUP I hub representing the UC precedence character should be wired to a UC hub, and the DECODER GROUP II hub representing the LC precedence character should be wired to an LC hub.

When the Reader is started, the PREC OUT "0" hub is the one that emits. With the above wiring, the unit will continue in the LC (Group I) mode until a UC precedence character is read. As this character is decoded, the DECODER OUT signal will be delivered to an IN PREC UC hub, and the unit will be put into the UC (Group II) mode. Now the unit will continue in the UC mode until an LC precedence character is read.

Since the tape reader may encounter a UC precedence character when the system is already in the UC mode, the Group II hub, representing the UC precedence code, should also be wired from a UC hub. For the same reason, the Group I hub representing the LC precedence code, should be wired from an LC hub. This will ensure that the unit will operate in the proper mode.

With appropriate wiring, any two of the four groups may represent the upper and lower case characters. One rule to remember, however, is that *within any level of Decoder Input, 1) both of the hubs must be wired, or 2) neither hub may be wired. There should never be a wire to one hub and no wire to the other.*

EXAMPLE 6

Input Precedence Wiring

Input Mode

Problem: To use UC and LC precedence codes to select the appropriate DECODER GROUP OUT section that will emit signals representing alphabetic and numeric characters.

Discussion: As described in the Input Precedence section above, precedence codes are used to select the appropriate DECODER GROUP OUT section from which the translated character signal will emit. Through the use of Upper Case (UC) and Lower Case (LC) precedence characters, all possible character signals utilized by the UNIVAC File-Computer may be decoded from two DECODER GROUP OUT sections. Let us assume in this example that we are reading 5-level standard teletypewriter tape containing both alphabetic and numeric input information for the File-Computer. Since there are only 32 hubs in one DECODER GROUP OUT section, and our minimum character signal requirements must provide for 26 alphabetic and 10 numeric characters, we must use two DECODER GROUP OUT sections. For this particular 5-level input code we desire that DECODER GROUP OUT I emit signals representing alphabetic characters, and DECODER GROUP II emit signals representing numeric characters. The alphabetic

EXAMPLE 6

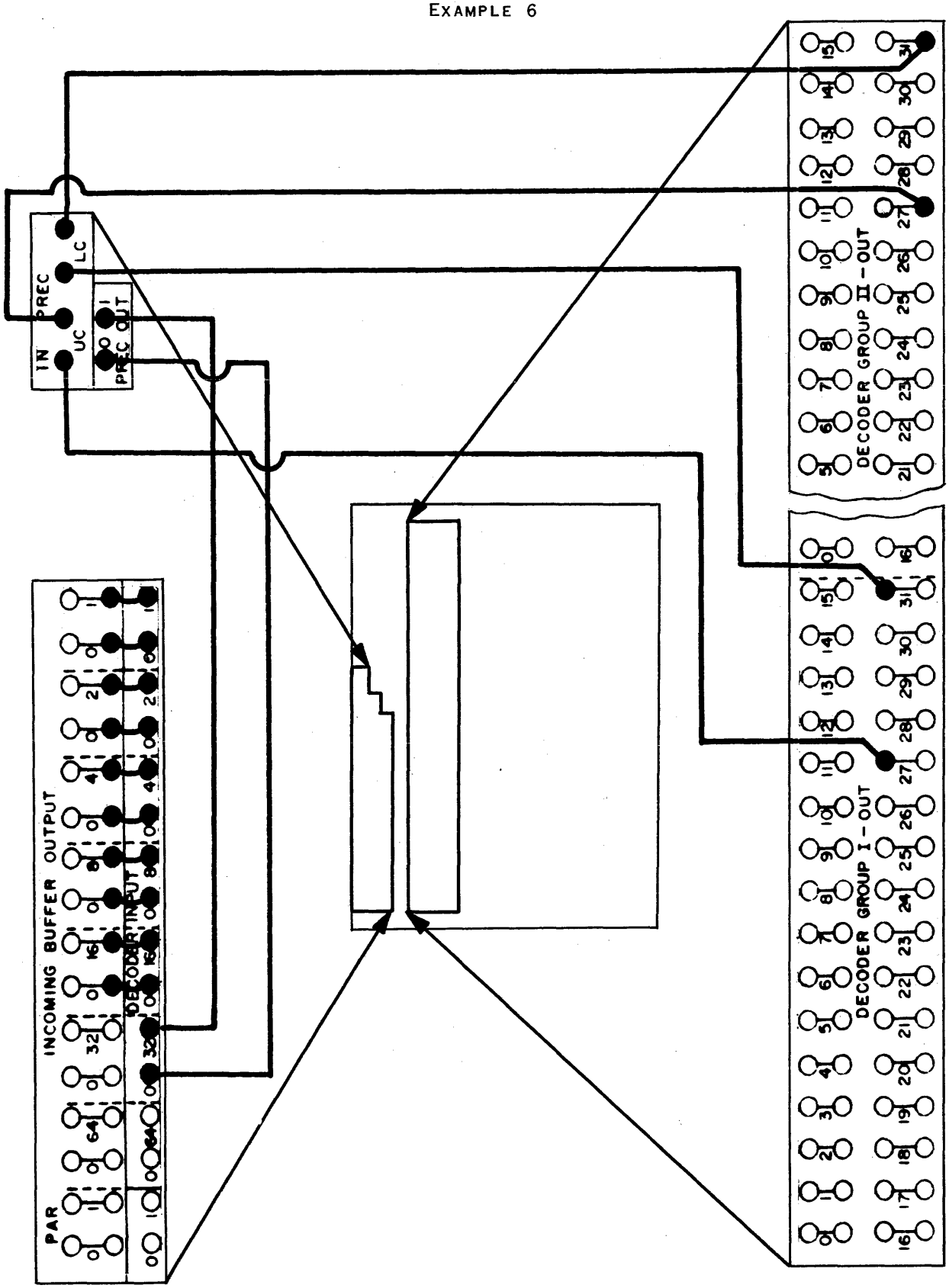


FIGURE 14. WIRING INPUT PRECEDENCE

characters in this code are LC characters and the LC precedence code selected is the "Letters" code. The numeric characters are UC characters and the UC precedence code selected is the "Figures" code.

Procedure: Wire the First 5 levels of the INCOMING BUFFER OUTPUT for normal 5-level translation. A signal received at the 6th level of the DECODER INPUT will select the appropriate DECODER GROUP OUT section to emit the signal representing each LC or UC character. PREC OUT hub "0" is wired to DECODER INPUT hub "0" and PREC OUT hub "1" is wired to DECODER INPUT hub "32." The selected LC and UC precedence character hubs in DECODER GROUP OUT I and II are wired to IN PREC LC and UC. (See Table 2 for selection of proper hubs for "Letters" and "Figures" codes.)

OUTPUT PREC

While the IN PREC section handles the precedence codes when the unit is reading tape, the OUTPUT PREC section provides precedence codes when the unit is punching tape.

Every time the punch changes its output from LC to UC, an *extra* character, the UC precedence character, must be punched. In the same manner, every time the punch changes its output from UC to LC, an extra character, the LC precedence character, must be punched.

The OUTPUT PREC section consists of two input hubs, labeled IN and INH (inhibit) and two output hubs, labeled LC and UC. The function of the IN hub is to detect the change in the encoded characters from the UC mode to the LC mode, or vice versa. The function of the LC and UC hubs is to provide a signal which will encode the appropriate precedence character at the right time. Thus, the LC and UC hubs are the second type of hub eligible to send signals to ENCODER GROUP IN hubs (see "ENCODER GROUP IN" section of this manual).

Without going into *how* the OUTPUT PREC section works, this is *what* it does:

1. When the first "signal" is received by the IN hub from an ENCODER GROUP IN hub, the UC (upper case) hub will emit a signal.
2. When the first "no signal" is received by the IN hub from an ENCODER GROUP IN hub, the LC (lower case) hub will emit a signal.

Assume that Group I encodes LC characters and Group II encodes UC characters. Remembering that hubs 32 and 64 define the groups concerned, note that hub 32 (in the ENCODER OUTPUT section) emits a signal with each UC character, and does not emit for an LC character. Wiring hub 32 to the OUTPUT PREC IN hub provides the input signals discussed in the preceding paragraph. The resulting output signals from the UC and LC hubs should be delivered to the ENCODER GROUP IN hubs that encode the appropriate precedence character. In this case, UC should be wired to the ENCODER GROUP II IN hub that encodes that UC precedence character, and LC should be wired to the ENCODER GROUP I IN hub that encodes the LC precedence character.

The High-Speed Paper Tape System assumes that the characters at the beginning of a run are LC unless otherwise specified. The Master Clear automat-

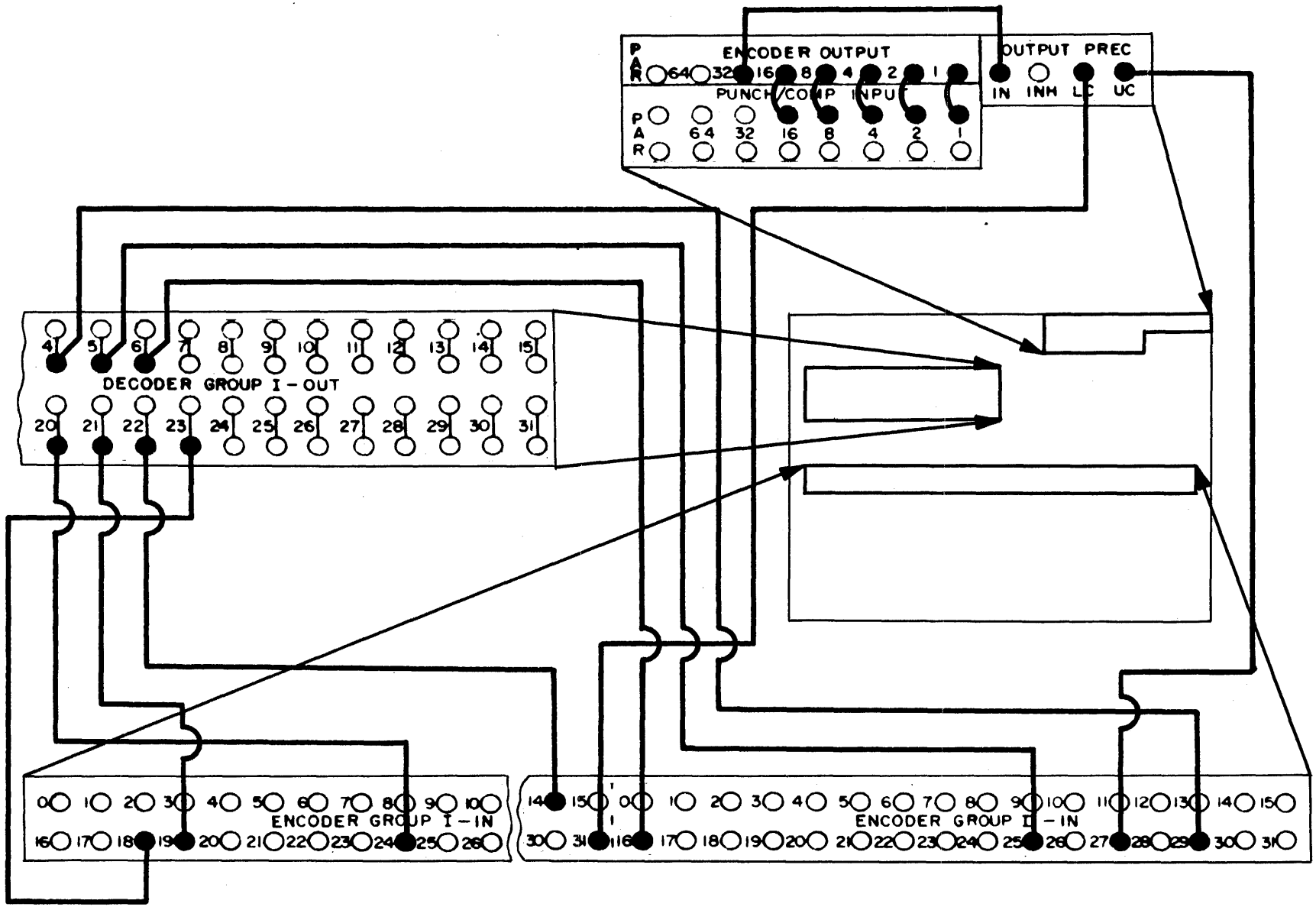


FIGURE 15. WIRING OUTPUT PRECEDENCE

ically clears the system to LC, therefore a UC character at the beginning of a run is interpreted as an LC character unless programming provisions are made for checking of the first outgoing character. See Figure 27, Example 14.

The fourth hub, labeled INH (Inhibit), when wired, inhibits the function of this section. Some paper tape handling systems use codes that mean the same thing in both the UC and the LC modes. For these codes, there is no need to punch precedence characters, and the precedence operation may be inhibited by wiring via bus from the specific DECODER GROUP OUTPUT hub to *both* the appropriate ENCODER GROUP IN hub *and* the OUTPUT PREC INH hub. Inhibiting the OUTPUT PREC operation merely allows that section to ignore the current encoding cycle. In the next noninhibit encoding cycle, the OUTPUT PREC section will perform normally just as though the special (inhibiting) character had never been encountered.

The space code is generally one of these special characters. The analogy holds true on a typewriter: the space bar always represents a space, regardless of the position of the shift key.

EXAMPLE 7

Use of Output Precedence for Punching Characters

Problem: To punch precedence characters into tape, using Output Precedence.

Assumption: Assume that the High-Speed Paper Tape System has just punched a number and is now going to punch ABC12D3 (letters are LC and figures are UC).

Procedure: Wire from DECODER GROUP OUT hubs representing character signals in UNIVAC 7-level code for the characters "ABC12D3" to ENCODER GROUP IN hubs representing 5-level standard teletypewriter characters "ABC12D3." (See Table 2.) Wire ENCODER OUTPUT hub 32 (6th level) to the "IN" hub of OUTPUT PREC. Wire the LC and UC hubs of OUTPUT PREC to the specific ENCODER IN character assigned to represent the LC or UC precedence punch.

Operation Sequence

	Resulting Punch
The "A" is encoded.	
OUTPUT PREC IN now 1. detects a change from UC to LC; 2. inhibits punching of the "A"; and 3. causes the LC hub to emit a signal.	
The LC signal is delivered to the appropriate Group I hub, and the LC precedence character is encoded. Since the "A" and the LC precedence character are from the same group, no change is detected. LC is punched.	LC prec code
The T and FC Unit remembers the "A", and encodes it again. No change is detected this time; therefore, the "A" is punched. . .	A
The "B" is encoded. No change is detected, and the "B" is punched	B
The "C" is encoded. No change is detected, and the "C" is punched	C
The "1" is encoded.	

OUTPUT PREC IN now 1. detects a change from LC to UC;
2. inhibits punching of the "1"; and
3. causes the UC hub to emit a signal.

The UC signal is delivered to the appropriate Group II hub, and the UC precedence character is encoded. Since the "1" and the UC precedence character are from the same group, no change is detected. UC is punched . . . . . UC prec code

The T and FC Unit remembers the "1" and encodes it again. No change is detected this time; therefore, the "1" is punched. . . 1

The "2" is encoded. No change is detected, and the "2" is punched 2

. . . . . LC prec code

. . . . . D

. . . . . UC prec code

. 3

EXAMPLE 8

Wiring Inhibit Precedence

Output Mode

Discussion: In Example 7 we discussed LC and UC precedence punching for the standard teletypewriter tape output message "ABC12D3." Let us assume that this message is followed by space codes. Space codes mean the same thing in both the LC and UC modes. (See Table 2.)

Problem: To inhibit precedence character punching in a 5-level teletypewriter tape upon detection of space codes.

Procedure: Wire from the DECODER GROUP OUT hub that emits the UNIVAC 7-level signal representing a space code to the "INH" hub of OUTPUT PREC and to the ENCODER GROUP IN hub representing a space code. (See Example 7 for message and precedence wiring.)

DEC (DECODER) IN

DEC IN (Decoder IN) is a single hub that may be used to turn on the decoder during the function detector cycle, after the character has been encoded. This feature can be utilized to encode a character several times after the decoded character has been sensed during a particular program distributor step. The principal use of the DECODER GROUP IN hub is to determine the value of the first decoded character entering the T and FC Unit when the unit is started. Precedence is set to lower case (LC) when the T and FC Unit is turned off or cleared; therefore the LC precedence character required by the tape-punching equipment would not be encoded without provision via plugboard wiring for resensing the decoded character to determine its true significance and precedence value. (See Example 14, Figure 27, for DEC IN wiring.)

DEC OUT

DEC OUT (Decoder Out) is a single hub that emits a signal when the decoder is turned on.

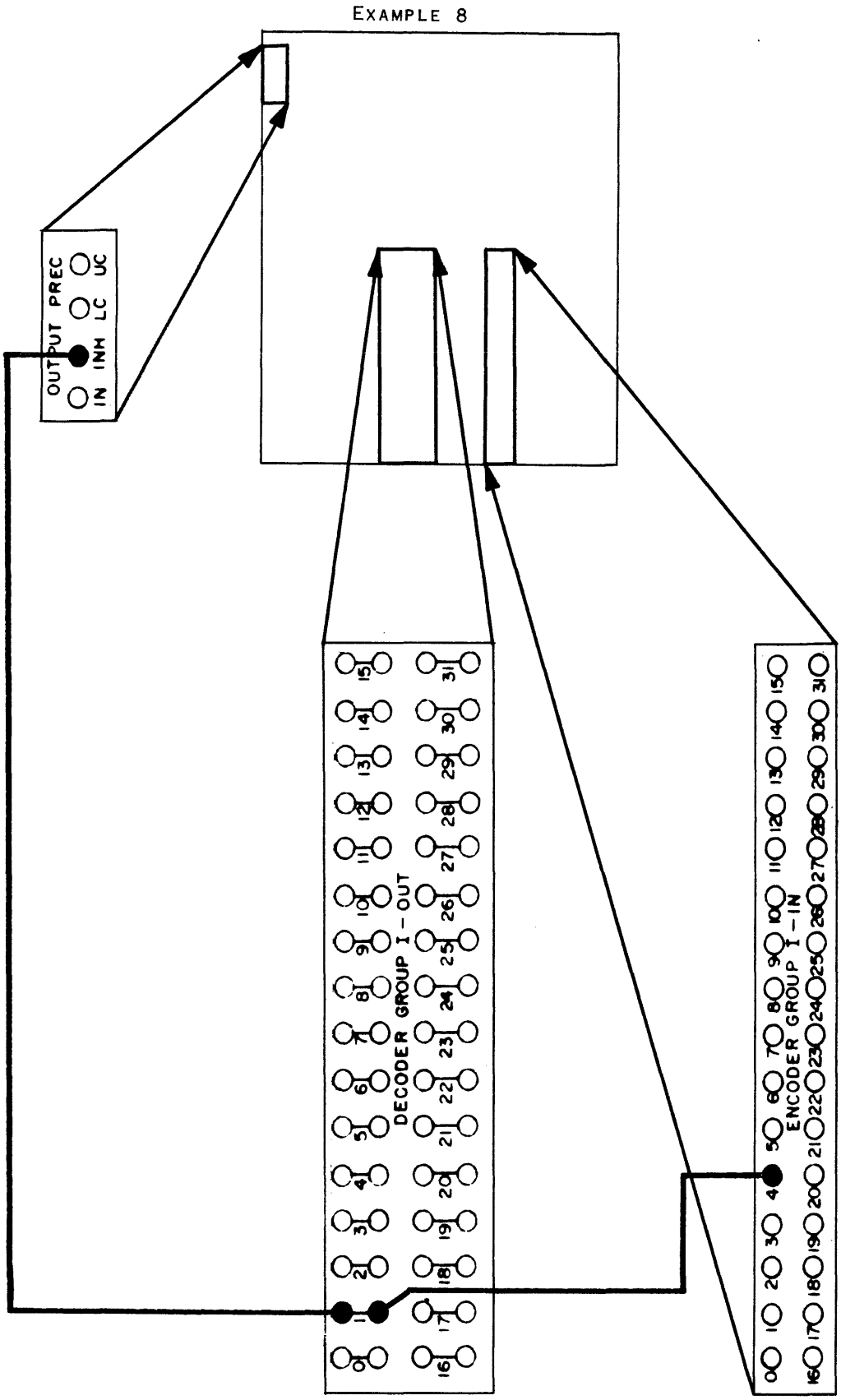


FIGURE 16. WIRING INHIBIT PRECEDENCE

STOP OUT

The STOP OUT hub is a general purpose hub that emits a signal during the entire time that the T and FC Unit is performing the OUTPUT STOP function.

INVERTERS

There are seven INVERTERS on the T and FC plugboard. Each inverter consists of one input hub and one output hub. If the input hub of an inverter does not receive a signal, the output hub of that inverter will emit a signal. If the input hub receives a signal, the output hub will not emit a signal. The primary purpose of inverters, therefore, is to provide a signal source when no signal from an input hub is present. (See Figure 17.)

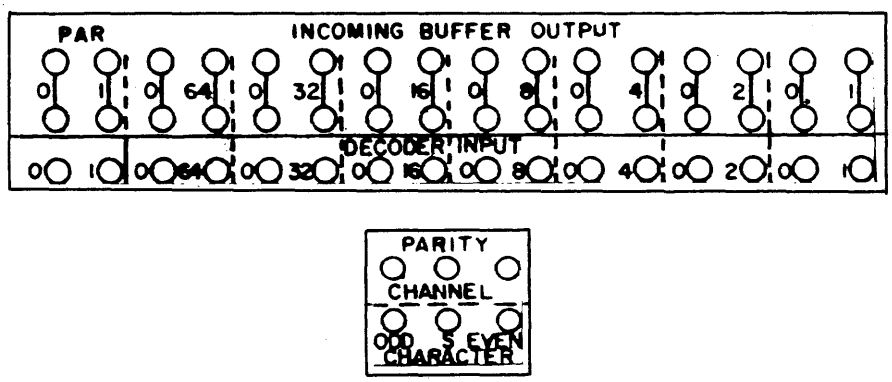
REVERSE

The two hubs labeled REVERSE provide a means by which data may be read into the High-Speed Paper Tape I/O buffer in reverse order from normal data transmission. In a normal Tape Read operation, data is read into the buffer from the most significant position of word 0 to the least significant (S) position of word 9. If the two REVERSE hubs are jackplugged, normal reading is suppressed and data is read into the buffer from the least significant (S) position of word 9 to the most significant position of word 0. (See "Basic Programming Manual - Model 1, UNIVAC File-Computer" for word and character positions.) This reverse feature facilitates the reading of tape without rewind. The Reverse feature used in conjunction with the DELETE CHARACTER IN hubs also provides for better control of the computer input format.[1] (See Figure 17.)

PARITY

Parity hubs, located at the bottom of the plugboard to the left, are divided into two sections labeled CHANNEL and CHARACTER. Three hubs are used for checking *Channel* Parity and three for checking *Character* Parity. The first of each three is for checking ODD parity, the third hub is for checking EVEN parity, and the middle hub, labeled S, is used to select either ODD or EVEN for wiring to determine whether the check will be for ODD or EVEN parity.

Character parity is checked while the incoming character is held in the incoming buffer register. The INCOMING BUFFER OUTPUT hubs on the T and FC plugboard corresponds to the incoming buffer register in the T and FC Unit. The wiring of these hubs and the CHANNEL and CHARACTER PARITY hubs determines the manner in which parity is checked.



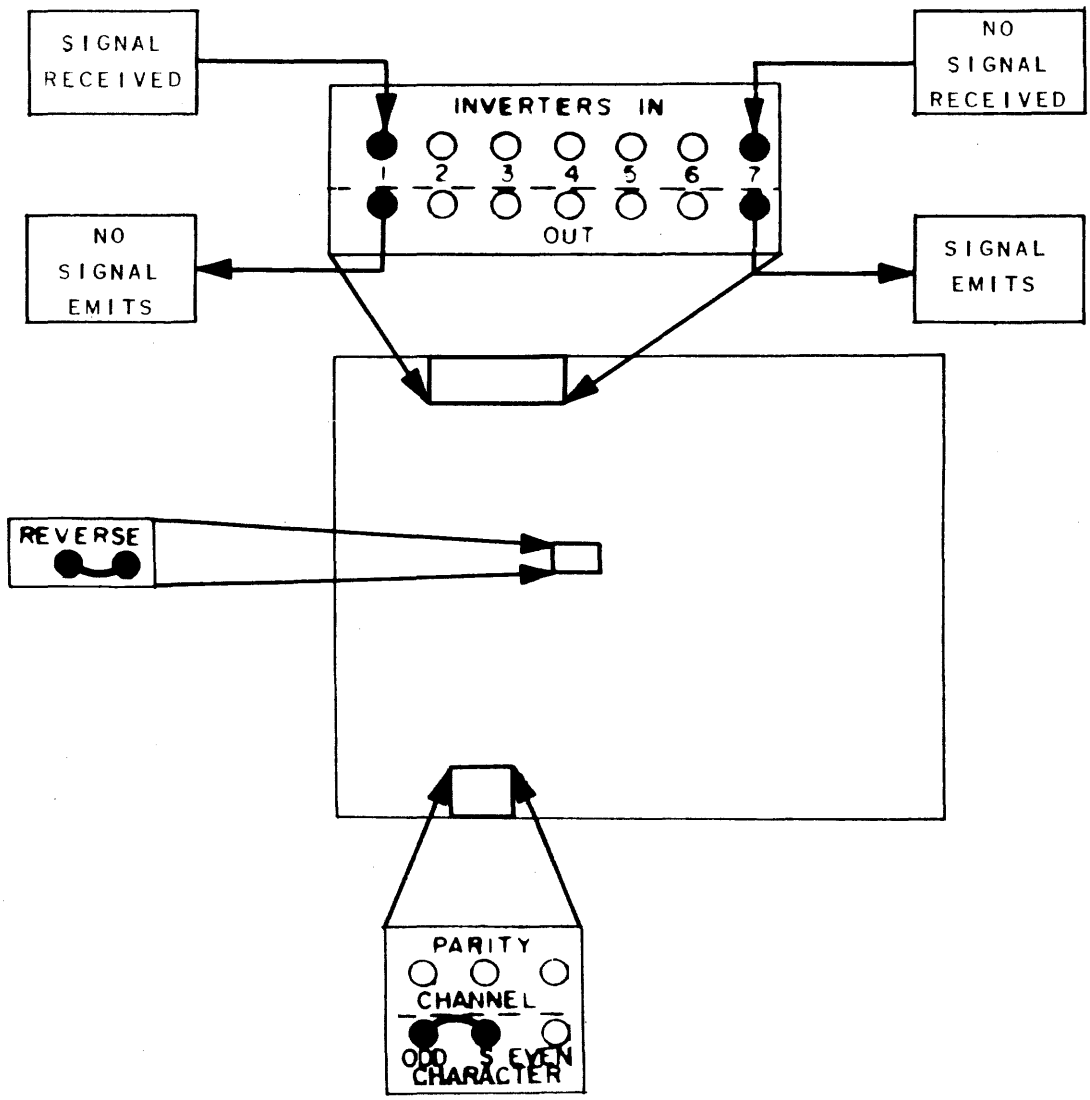


FIGURE 17. WIRING PARITY, INVERTERS, AND REVERSE

Let us discuss CHARACTER Parity first. The three CHARACTER hubs provide for parity checking of every input character. by jackplugging (bottleplugging) from the S hub to the EVEN, a parity check for even parity is made on each input character. If the input character parity is even, decoding is continued; if the input character parity is odd, the decoding of characters will stop and an incorrect parity indicator will light at the operator's control panel. Similarly, plugging from the S hub to the Odd hub will check for Odd parity. If the S hub is left unwired, character parity will be ignored. (See Figure 17.)

The three hubs labeled CHANNEL are used for systems, such as teletypewriter systems, that insert a check character to designate Even or Odd Parity. The check character is the result of channel-by-channel addition of the character bits making up the message. (See Figure 18.)

[1]This feature is available only in the High-Speed Paper Tape System and not in the BPTM Tape Converter.

CHANNEL PARITY CHECKING FOR EVEN PARITY

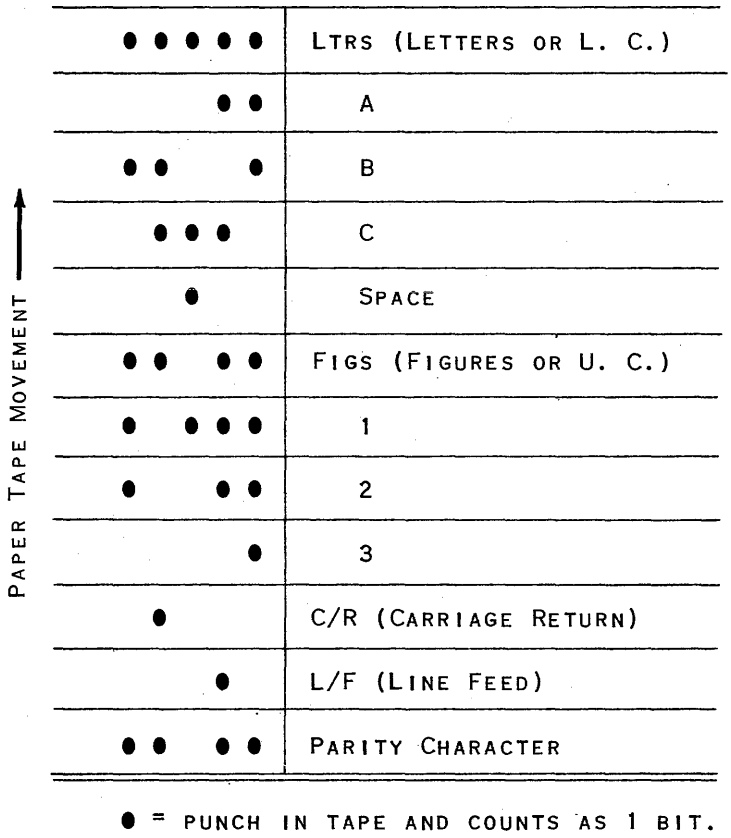


FIGURE 18. SAMPLE OF EVEN CHANNEL PARITY-CHECKING (LINE TECHNIQUE)

CHANNEL PARITY REG INPUT AND CHANNEL PARITY REG OUTPUT

Channel Parity checking is an optional feature of the High-Speed Paper Tape System. Two groups of "channel parity" hubs on the T and FC Unit plugboard labeled CHANNEL PARITY REGISTER INPUT and CHANNEL PARITY REGISTER OUTPUT, provide for 1) a *channel* parity check on information transferred from paper tape to the computer and 2) the insertion of channel parity check characters onto paper tape whenever information is transferred from the computer to paper tape. Only one of these operations can be accomplished in a single program.

The channel parity register and associated circuitry perform as an adder. During checking operations in the paper tape-to-computer mode, the channel parity register receives its inputs from the incoming buffer register; therefore, the INCOMING BUFFER OUTPUT hubs are wired to correspondingly numbered CHANNEL PARITY REGISTER IN hubs at all levels of the incoming code. During the computer-to-paper tape mode, the channel parity registers receive information from Encoder Output hubs; therefore, the ENCODER OUTPUT hubs are wired to correspondingly numbered CHANNEL PARITY REGISTER IN hubs at all levels of the output code.

If channel parity checking facilities are used to check parity on information derived from an input tape, the programmer wires the IN hub via an HS selector to the STEP hub in the CHANNEL PARITY REGISTER INPUT hub group. The use of a selector is necessary to prevent the check character in the INCOMING BUFFER OUTPUT from entering the channel parity register.

During checking operations for channel parity on data transferred from tape to the T and FC Unit, information contained in a check character is compared with information collected in the channel parity register. A method of detecting the check character in the incoming data is necessary when a parity check is made. One method of detection is to utilize the program distributor which keeps track of the number of characters entering or leaving the T and FC Unit. Another method of detection is the existence of special characters or character sequences in character positions immediately *preceding* the channel check character.

If channel checking facilities are used to insert a channel parity character in punched tape, Output Mode, the programmer wires the ENCODER OUTPUT hubs to the CHANNEL PARITY REGISTER INPUT hubs and wires the CHANNEL PARITY REGISTER OUTPUT hubs to the PUNCH/COMPUTER INPUT hubs. These plugboard connections route information sent from the computer to the T and FC Unit's channel parity register and route the channel parity character generated in the channel parity register to the paper punch. For insertion of channel parity characters in the output tape, the OUT hub is wired to STEP. As information characters are fed to the paper tape punch from the T and FC Unit, they generate channel parity check characters in the channel parity register. The T and FC Unit, therefore, must have some means of detecting *when* to insert the check character in the output tape. A signal may be used to activate a function detector when a certain character position in the outgoing data is reached or when an "end of message" (Space, CR/LF, etc.) character in the outgoing data is detected. FUNCTION DETECTOR OUT hubs No. 1 and No. 2 may be used to encode special control characters in the output tape such as carriage return and line feed. When FUNCT DET No. 3 is reached, a signal is applied to the Activate hub. When a signal is applied to the ACT hub, character encoding signals corresponding to the channel parity check character are applied by the CHANNEL PARITY REGISTER OUTPUT hubs to the PUNCH/COMPUTER INPUT hubs, and the channel check character is recorded on the output tape. If the message is complete after the recording of the channel parity check character, FUNCTION DETECTOR OUT No. 4 may be wired to the END OF MESSAGE hub to signify that the Paper Tape System has completed its operation until further instructions are given by the central computer.

EXAMPLE 9

Channel Parity Check for Even Parity

Input Mode (Tape-to-Computer)

Discussion: To ensure the accuracy of data transmission, a channel parity check for odd or even parity may be made on each message entering the High-Speed Paper Tape System. A method of determining when the check is to be made is required to initiate action on the check character generated in the Channel Parity Register Input. Such a method may be the use of a special character, a sequence of two characters, or a particular program step. Any time action of the Channel Parity check is initiated by the ACT hub, the register is reset to its original position.

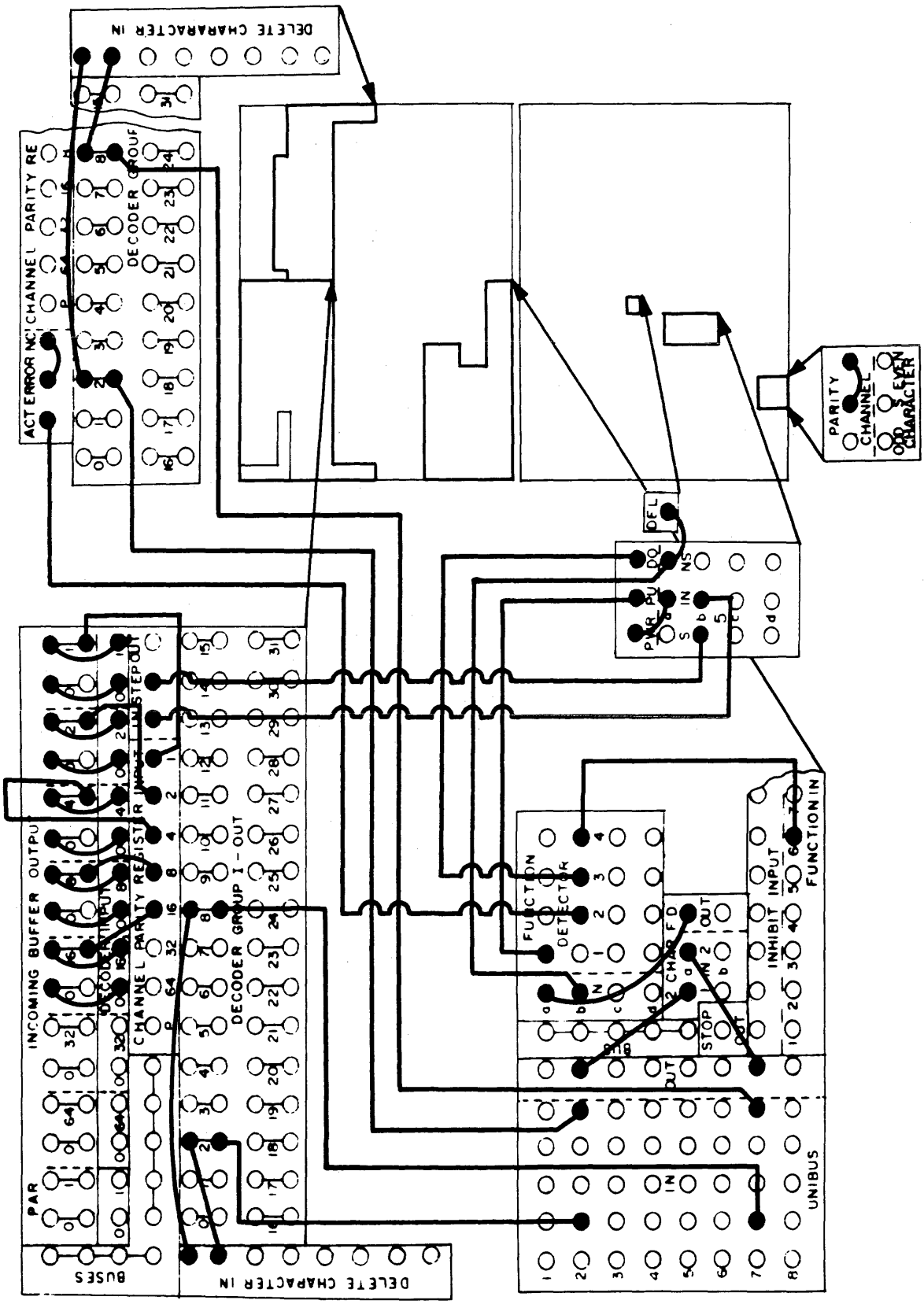


FIGURE 19. CHANNEL PARITY CHECKING FOR EVEN PARITY INPUT MODE

Problem: To initiate an Even check on the Channel Parity Check Character generated in the Channel Parity Register Input when the High-Speed Paper Tape System reads a two-character sequence: carriage return (CR) and line feed (LF) punched in a 5-level standard teletypewriter tape.

Procedure: Wire the Incoming Buffer Output hubs 0-1 through 0-16 to adjacent Decoder Input hubs.

Wire Incoming Buffer Output hubs 1, 2, 4, 8, and 16 to Channel Parity Register Input hubs 1, 2, 4, 8, and 16 respectively.

Wire the Decoder Group I and II Out hubs representing the CR signal to the Delete Character In and to a Unibus.

Wire the LF signal from the Decoder Group I and II Out hubs in the same manner as the CR signal.

Wire the Out hub of the Unibus emitting the CR signal to one IN hub of a 2-Character Function Detector, and the Out hub of the Unibus emitting the LF signal to the other IN hub of the same 2-Character Function Detector.

Wire the Out hub of the 2-Character Function Detector to the IN hub of a Function Detector (FD), and the cycle 1 hub of the FD to the pickup (PU) hub of a High Speed Selector (HSS).

Wire the power (PWR) hub of the selector to the IN hub of the selector and the select (S) hub of the selector to the IN hub of another FD and also to Unconditional Delete.

Wire the IN hub of the Channel Parity Register to another IN hub of the selector, and the NS hub of the selector to the Step hub of the Channel Parity register.

Wire the first output cycle wired from the FD to the Activate (ACT) hub of the Channel Parity Register Output, and the second output cycle wired from the FD to the Drop Out (DO) of the selector.

Wire the third output cycle from the FD to the End of data hub of the Function Inputs.

Wire the No Comparison (NC) hub of the Channel Parity Output Register to the Error hub of the same register.

Since the Channel parity check character will look like a normal information character to the Decoder, the Unconditional Delete (DEL) hub must be used to inhibit decoding after CR/LF is sensed. This could be done with the selector.

Finally, wire the S hub of Channel Parity to the Even hub.

Result: On detecting the CR and LF characters in sequence, the High-Speed Paper Tape System compares the character in the Incoming Buffer Output (the punched paper tape check character immediately following the LF character) with the character generated in the Channel Parity Register. If the characters compare, processing is continued. If the characters do not compare, an error is indicated and processing stops.

EXAMPLE 10

Channel Parity Check for Odd Parity

Output Mode (Computer-to-Paper Tape)

Discussion: When desired, channel checking facilities may be used to insert an Odd or Even channel parity check character into the punched paper tape in order to ensure the accuracy of data transmission. A method of determining when to punch the check character into tape is required to initiate the punching of the character generated in the Channel Parity Register. Such a method might be the use of a special character, a sequence of two characters, or a particular program step.

Problem: To make an Odd Channel Parity Check on messages being transmitted from the UNIVAC File-Computer to 5-level standard teletypewriter punched paper tape and to punch the check character into the tape when a special character is received by the High-Speed Paper Tape System from the computer. Also, to encode the carriage return character (CR), the line feed character (LF), and the end of message character, when the special character is received.

Procedure: Wire Encoder Output hubs 1 through 16 via buses to Punch/Comp Input hubs 1 through 16 and to Channel Parity Register Input hubs 1 through 16. The Out hub of Channel Parity Register Input is wired to the Step hub of the same register.

Wire the Decoder Group Out Hub, that emits the signal representing the special character used to initiate punching of the channel check character into the tape, to the IN hub of a Function Detector, and to a Delete Character In Hub.

Wire the first cycle Out hub of the FD to encode the CR character.

Wire the second cycle Out hub to encode the LF character.

Wire the third cycle Out hub to the Activate (ACT) hub of the Channel Parity Register Output to initiate punching of the check character.

Wire the fourth FD cycle Out hub to encode the character signifying "End of Message."

Wire the Channel Parity Register Output hubs 1 through 16 to Punch/Comp Input (b) hubs 1 through 16 to provide a path to the punch for the signals representing the check character.

Wire the Channel Parity S hub to the Odd hub, to check for odd channel parity.

FORMAT CONTROL HUBS

The Format Control function of the T and FC Unit is to control and select the organization of translated information. Whenever data flows between the High-Speed Paper Tape System and the input-output tracks of the high speed drum, in either direction, it is held temporarily in a 120-character core buffer, which is physically located in the Input-Output Control Unit but in which data is arranged in the format selected and controlled by the T and FC Unit.

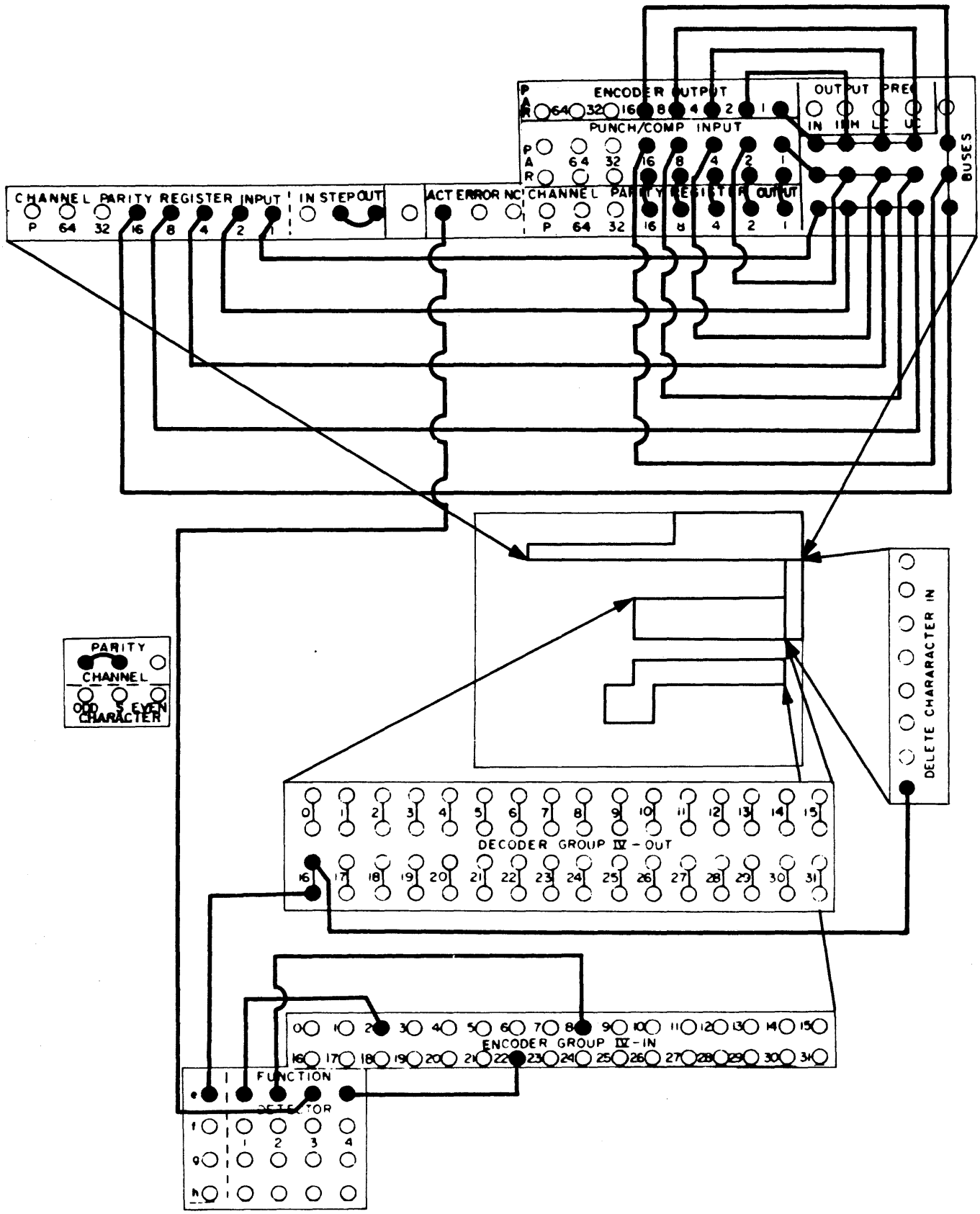


FIGURE 20. CHANNEL PARITY CHECKING FOR ODD PARITY OUTPUT MODE

During input operations, information flows from the Reader through the T and FC Unit, which selects the correct word and character positions at which data will be placed in the buffer. From there, it is transferred to the I/O track of the high speed drum. During output operations, information flows from the I/O track into the buffer. Information may be selected from desired word and character positions in the buffer, processed through the T and FC Unit and punched into paper tape. Note that the buffer is *not* cleared automatically after an input or output transfer.

PROGRAM DISTRIBUTOR OUT

The PROGRAM DISTRIBUTOR OUT section is simply a 132=step counter which may by advanced on every decoding cycle, or on every encoding cycle, or on both decoding and encoding. It enables the program to perform certain operations based on the number of characters that have been processed. PROGRAM DISTRIBUTOR OUT hubs are always wired in conjunction with PD STEP IN hubs (see below); they are versatile in the accomplishment of varied format control operations when wired through selectors, function detectors, or other general utility hubs.

PD STEP IN

Wiring the four hubs of the PD (Program Distributor) STEP IN section determines when the Program Distributor will be stepped, or whether it will be stepped at all. Hubs 1 and 3 step the Program Distributor; hubs 2 and 4 inhibit stepping. PD STEP IN hubs are always wired from power sources, each PD STEP IN hub serving a different purpose.

When wired from POWER HUBS:

Hub #1. - instructs the Program Distributor to step with each character decoded.

Hub #2. - inhibits the stepping of the Program Distributor with each character decoded.

Hub #3. - instructs the Program Distributor to step with each character encoded.

Hub #4. - inhibits the stepping of the Program Distributor with each character encoded.

Only one PD STEP IN hub, wired from a POWER hub, may be active at any one time during a program. If none of the hubs are wired, the Program Distributor will step on both the decoding and encoding of characters. (See Figure 21 for example of wiring a PD STEP IN hub.)

SET IN - CHARACTER ADDRESS COUNTER AND SET IN - WORD ADDRESS COUNTER

The SET IN CHARACTER ADDRESS COUNTER and SET IN WORD ADDRESS COUNTER hubs provide for the selection of the position in the 120-character core buffer in which a character is stored or from which a character is read, depending upon the direction of data flow. These counters are the primary tools used in format editing. If PD STEP IN hub #1 is wired, the CHARACTER ADDRESS COUNTER and WORD ADDRESS COUNTER hubs may be wired directly from a PROGRAM DISTRIBUTOR OUT hub. If the PD STEP IN hub #3 is wired, CHARACTER ADDRESS COUNTER and WORD ADDRESS COUNTER may be wired from either a PD OUT hub or a FUNCTION DETECTOR OUT hub. Editing for any desired format of characters or words may thus be accomplished by starting the addressing system at the correct word or character. When the beginning character has been selected, subsequent characters are stored in or selected from sequential locations, unless the operation is interrupted by program modification. (See Example 11, Figure 21.)

WORD NUMBER	WORD CHARACTER POSITION
9	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
8	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
7	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
6	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
5	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11

WORD NUMBER	WORD CHARACTER POSITION
4	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
3	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
2	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
1	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
0	±
	1
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11

TABLE 3. WORD AND CHARACTER POSITIONS IN 120 CHARACTER CORE BUFFER (THE SAME WORD AND CHARACTER RELATIONSHIPS EXIST IN THE HIGH SPEED DRUM TRACKS AND 120 CHARACTER BUFFERS OF THE UNIVAC FILE-COMPUTER.)

SET PD CHAR IN AND SET PD WORD IN

The SET PD CHAR IN and SET PD WORD IN sections provide for "jumping" the Program Distributor; that is, interrupting the sequential stepping of the PD, and restarting from a different value. The four hubs in the SET PD CHAR IN group and the four hubs in the SET PD WORD IN group are labeled 1, 2, 4, and 8. To select any numbered character or word position other than 1, 2, 4, or 8, the programmer combines these numbers. For example, wiring SET PD WORD IN hubs 8 and 1 will select word 9; wiring SET PD CHAR IN hubs 2 and 1 selects character 3 (see Example 11, Figure 21).

The programmer should take special note of the fact that when the Program Distributor is "jumped" by the wiring of SET PD CHAR IN or SET PD WORD IN, the PROGRAM DISTRIBUTOR is *first* set to position 1, and a signal is emitted from PD OUT hub 1. *Then* the Program Distributor jumps to the position selected by SET PD CHAR IN or SET PD WORD IN and processing continues. Any operation which is wired to occur when PD OUT 1 emits will therefore be initiated whenever the Program Distributor is "jumped."

EXAMPLE 11

Wiring Through the PROGRAM DISTRIBUTOR

Input or Output

Discussion: Assume for the problem below that we are reading an input tape and storing the input information on the I/O track of the UNIVAC File-Computer. In order to do this, we must first arrange the format of information in the 120-character core buffer.

Problem:

1. To send the first encoded character to the most significant position of word 3 on the buffer and the next eleven encoded characters to consecutive positions of the same word in descending order.
2. To send the thirteenth encoded character to the most significant position of word 6 and the following characters for the same word to consecutive positions in descending order.
3. On Program Distributor step 25, to jump the Program Distributor to step 98.

Procedure: Wire Program Distributor (PD) step 1 to the IN of a high speed selector.

Wire the NS hub of the selector to a bus, and one hub of the bus to the IN of a Unibus and another hub of the bus to SET IN. WORD ADDRESS COUNTER (WAK) word 3. Wire the OUT of the Unibus to SET IN CHARACTER ADDRESS COUNTER (CAK) position 11.

Wire PD step 13 to WAK word 6 and to CAK position 11 via the Unibus wiring. Wire PD step 25 to pick up the High Speed Selector (HS). Wire the POWER hub of the HS selector to the IN of the selector and the select side of the selector via a bus to SET PD WORD IN #8 and SET PD CHARACTER IN #2. Wire PD step 98 to the selector drop out (DO).

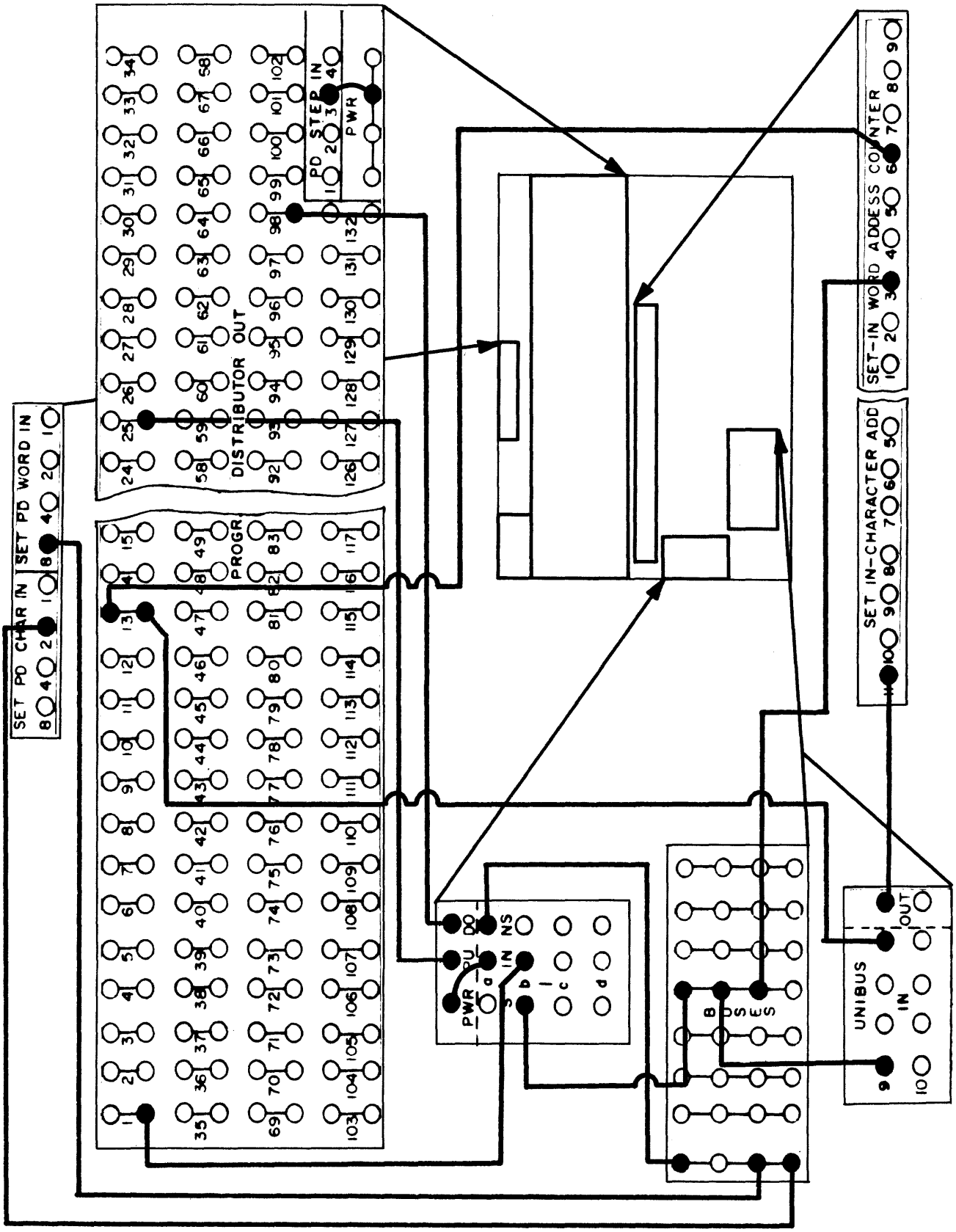


FIGURE 21. WIRING PROGRAM DISTRIBUTOR OUT

MOD 12 PDK OUT (MODULUS - 12 PROGRAM DISTRIBUTOR COUNTER OUT)

The MOD 12 PDK OUT is a 12-count stepper that is actually part of the Program Distributor. Each hub in this section will emit a signal simultaneously with the same numbered PD hub and every 12th PD hub thereafter. This stepper is a convenient device that provides the programmer with a means of performing the same operations on a number of words with the same wiring. It also provides a means of editing information in convenient 12-character format in order to have the information conform in format with the 12-character word of the central computer. (See Figure 22 for wiring example.)

FILL

Depending upon the wiring of certain other sections of the plugboard, the FILL section will start encoding repeatedly any characters of the programmer's choice. The Fill function will end when a hub is energized, as explained below. There are four hub groups within the FILL section: INHIBIT, START, END, and OUT.

The Inhibit hubs, when energized from Program Distributor hubs or MOD 12 PDK OUT, inhibit the fill function. The Inhibit hubs take precedence over the Start hubs.

The Start hubs are diode protected (see "BUS"), and each one, when energized from a FUNCTION DETECTOR OUT hub, causes a character fill operation to be started.

The End hubs are also diode protected, and each one, when energized from one of the following sources, terminates the fill operation:

1. A character position hub terminates the fill when the corresponding position of the Program Distributor Character Counter (Mod-12 PDK) is reached.
2. A Program Distributor hub terminates the fill when the Program Distributor position is reached.

The Out hub, when wired to an Encoder hub, designates the character to be filled. (See Figure 22 for wiring example.)

EXAMPLE 12

Wiring of FILL and MOD 12 PDK OUT

Problem: To encode a complete word of spaces when an apostrophe (') sign is found in the first character position of a word.

Procedure: Wire the DECODER GROUP I OUT hub 26 (') (see Table 2 "Standard Teletypewriter Code") to the IN hub of an AND-IN group, and also to a Delete Character IN hub.

Wire character position 1 of MOD 12 PDK OUT to the IN hub of the same AND-IN group. Wire the OUT hub of the AND-IN group to the IN hub of a function detector. Wire the OUT hub of the function detector to the START hub of FILL and the OUT of the FILL group to ENCODER GROUP IN hub 1 (space). Wire hub 12 of MOD 12 PDK OUT to END of the FILL group.

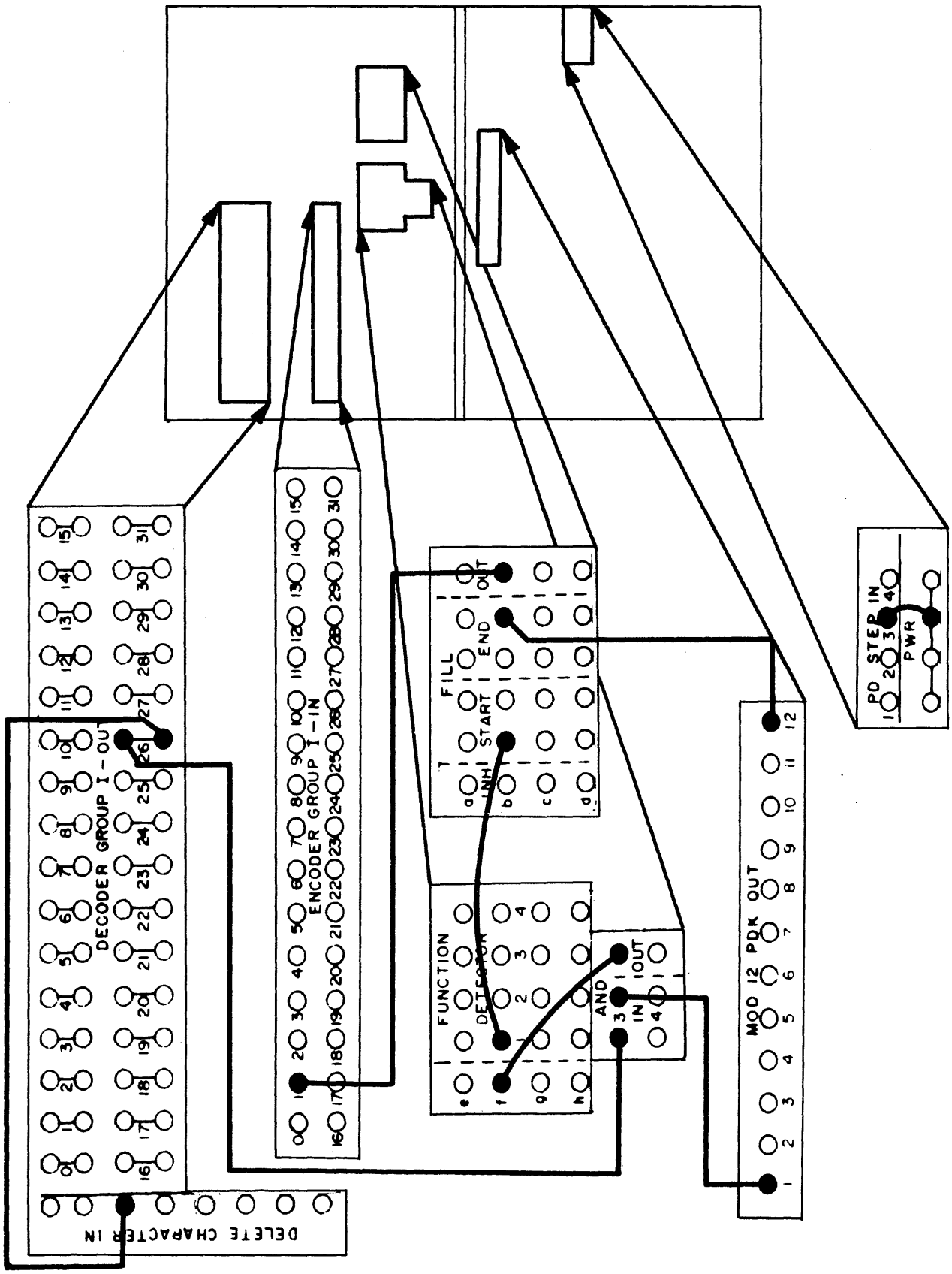


FIGURE 22. WIRING MOD 12 PDK AND FILL

Result: When both the apostrophe (') sign and the signal from the 1 hub of MOD 12 PDK OUT are received by the AND-IN group, a signal is emitted by the OUT hub which causes the function detector to start the FILL function. The OUT hub of the FILL group encodes a series of spaces, stopping only when the END signal is received from the hub #12 of MOD 12 PDK OUT.

PROGRAM CONTROL HUBS

The following hubs are used by the programmer to vary the program path when specific control characters are detected. These hubs may be used either singly or in various combinations.

FUNCTION DET. (DETECTOR)

There are eight Function Detectors labeled a through h, and each Detector has one IN and four CYCLE OUT hubs. Upon receipt of signals from certain other sections of the plugboard, such as DECODER GROUP OUT or PD OUT, a Function Detector will emit four special signals, one at a time, that are capable of initiating functions, encoding characters, or performing other operations. Each Function Detector has four cycles: at the end of the first cycle, cycle 2 begins; at the end of the second cycle, cycle 3 begins; at the end of cycle 3, cycle 4 begins. Each cycle lasts 84 microseconds plus character transfer time; 336 microseconds are required to complete the four cycles. The initiating signal for the use of the Function Detector can originate from multiple sources, mainly DECODER GROUP OUT hubs or PROGRAM DISTRIBUTOR OUT hubs. A special characteristic of function detectors should be noted: when the End of Data function is executed from Function Detector Cycle Out 1, 2, or 3, the remaining function detector cycle or cycles are inhibited (prevented from emitting) until another demand signal is given by the computer program. Under this condition, the High-Speed Paper Tape System will resume operations at the next function detector cycle rather than at the normal resume point.

Example:

1. In a given application, it is desirable to clear the 120 = character buffer before reading the next message.
2. Assume that Function Detector Cycle Out 1 is wired to the End of Data function input, and that Cycle Out 2 is wired to the Buffer Clear function input.
3. With the plugboard wired in this manner, the High-Speed Paper Tape System, upon receiving the next Demand signal from the computer, would resume operations at Cycle Out 2 and clear the buffer before the next character was read in.

See Figures 24 and 27 for wiring of FUNCTION DETECTOR hubs

TWO-CHARACTER FUNCTION DETECTOR

The 2-Character Function Detector (2 Char. F.D.) has the capability of emitting a signal only when two specific decoded characters of the programmer's choice have been detected. These characters must appear in consecutive order or have only a precedence code between them. Upon receipt of the first character, this detector will remember the character and perform its function at the time that the second character is received. The function, for example, may be to alter the program in some way. The Out of the 2-Character Function Detector would normally be wired to the In of a Function Detector.

FUNCTION INPUTS

The Function Inputs section of the plugboard contains 12 receiving hubs which are used to initiate the various control functions described below. All of these functions are activated by signals from FUNCTION DETECTOR OUT hubs, except for functions No. 10, (STOP #1) and No. 11, (STOP #2). These latter 2 function inputs will immediately stop the system when a signal is received from *any* plugboard hub. In wiring for the use of function inputs No. 4 (CORRECTION), No. 5 (VOID), No. 8 (BUFFER CLEAR), and No. 9 (WORD CLEAR), the programmer must be certain that the function detector OUT hub wired to one of these hubs is also wired (via a bus) to the ENCODER GROUP OUT hub corresponding to the character to which the buffer or word position is to be cleared.

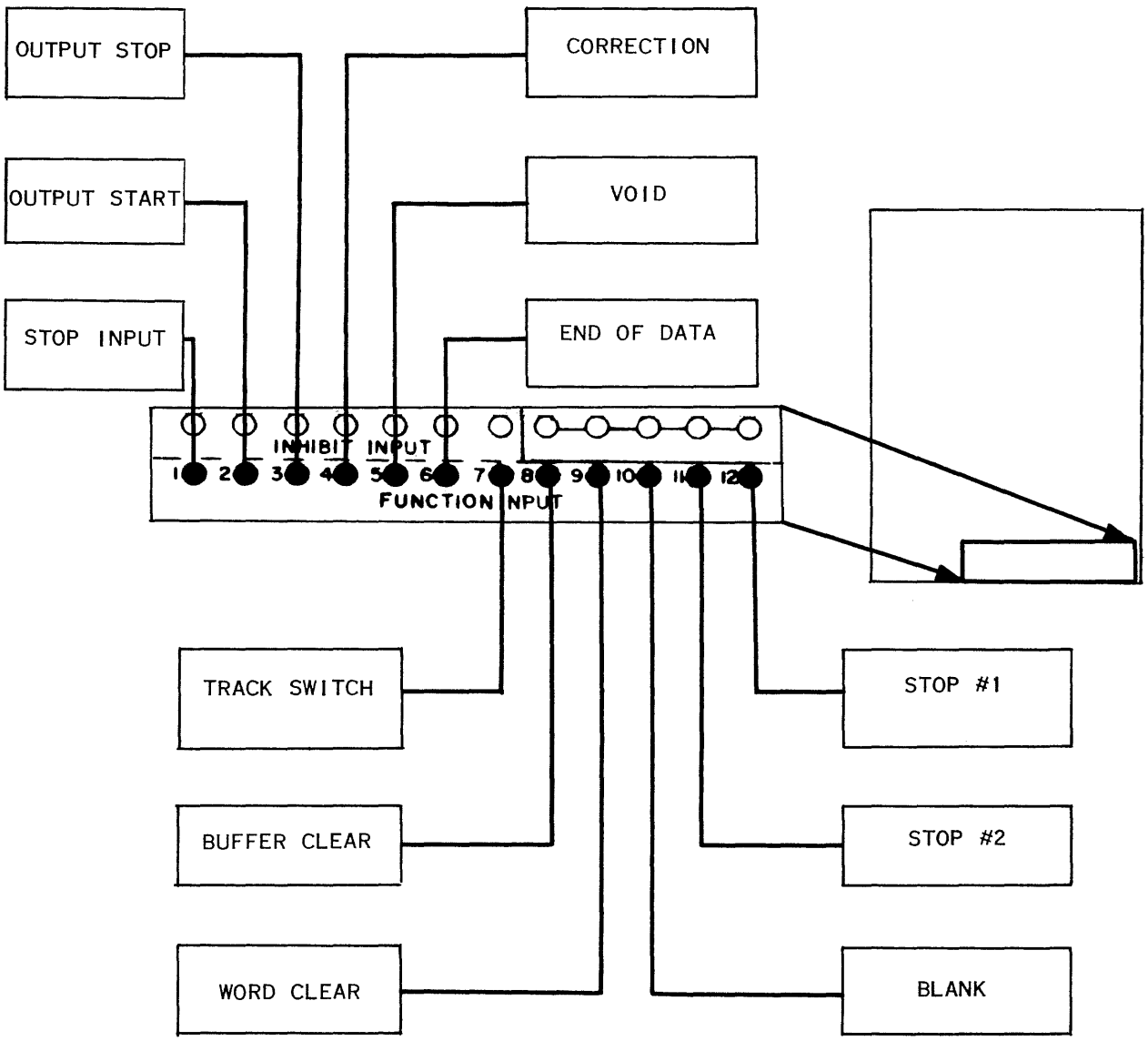


FIGURE 23. WIRING FUNCTION INPUTS

Hub Number	Name of Hub	Function of Hub
1	Output Stop	Stops the *Encoding* of characters until an Output Start signal is detected; *reading* and *decoding* of characters continue, and thus function detecting also continues.
2	Output Start	Starts the encoding of characters again after the "Output Stop" signal is received. The encoding of characters is continued until another "Output Stop" is detected.
3	Stop Input	Stops the reading and encoding of characters until restarted by external control.
4	Correction	Returns the character counter section of the Program Distributor and the Character Address Counter to the beginning of the current word and fills the word address of the 120 - character core buffer with a plugboard designated code. Erroneous information up to one word in length, therefore, may be ignored and proper information inserted in the tape. When an operator detects an erroneous punch in tape preparation, he punches the Correction code, then punches the correct version of the erroneous word. The Correction code may be used only if the operator detects the error before the twelfth character position has been punched. If the twelfth character position of the word is punched before the correction code is punched, the Program Distributor character counter and the Character Address Counter will clear to the beginning of the next word and the correction will not be made in the desired word. The Correction symbol can be any character, numeral, punctuation mark, etc., or two consecutive symbols. The characters chosen are those which would never appear in the data message, such as "Back-Space."
5	Void	Returns the character counter section of the Program Distributor and Character Address Counter to the *first character position of the blockette* and fills the entire 120 - character buffer with a plugboard designated code, so that erroneous information up to one blockette in length may be ignored and proper information inserted in the tape. When an operator notices an error in a word previously punched in the current blockette, he punches the Void code, then repunches the correct version of the entire blockette.
6	End of Data	Stops character processing and, if operation is in the input mode, transfers buffer contents to the I/O track. The Demand Station is then set to Ready. Operation will not be resumed until another instruction is received from the UNIVAC File-Computer.

7	Track Switch	Allows the High-Speed Paper Tape System to transfer data to or process data from both computer I/O tracks without intervention by the computer program. On input, the Character and Word Address Counters and the Program Distributor are set to the first character processing position, a track switch signal is sent from the HSPTS to the UNIVAC File-Computer, and a signal is sent to the Stop Input hub. When the track switch is accomplished, the HSPTS has access to the other I/O track and character processing continues. The T and FC Unit will be restarted by I/O Control Unit. On output, the same wiring applies, except that only the Track Switch wiring is required.
8	Buffer Clear	Clears the entire 120-character buffer to space codes (or other appropriate codes). The Buffer Clear Function Input is used in the Input Mode only and the signal to "Buffer Clear" will initiate from the Program Distributor or from Function Detector Cycle Out 1, 2, 3, or 4.
9	Word Clear	Clears the designated word address of the 120-character buffer to space codes, or other appropriate codes, prior to the storage of data in the word address. Like the Buffer Clear Function Input above, the Word Clear function is used *only in the input mode* and the initiating signal will come from the Program Distributor or from Function Detector Cycle Out 1, 2, 3, or 4.
10	Stop #1	An emergency stop used primarily by technicians for testing purposes. The programmer may utilize the stop upon detecting some special condition such as End of File, End of Data, End of Tape, or Broken Tape. Stop #1 may also be used via Function Detector wiring to inch through the tape, character by character, for testing purposes.
11	Stop #2	Same as Stop #1 above.
12		Blank hub, not used in plugboard wiring.

INHIBIT INPUTS

The Inhibit Input hubs are utilized in conjunction with Decoder Group Out, Function Detector, Selectors, and Program Distributor Out hubs to inhibit, under given conditions, the function demanded by plugboard wiring to Function Input hubs. Each of the Inhibit Input hubs can be used to inhibit only that function demanded by the adjacent Function Input hub 1-7. Plugboard wiring of an Inhibit Input sets up an "AND NOT" circuit; i.e., if a signal is received by the Function Input and a signal is *not* received by Inhibit Input, the Function Input will become active. If a signal is received at both the Function Input and Inhibit Input, Inhibit Input takes precedence and the function is inhibited.

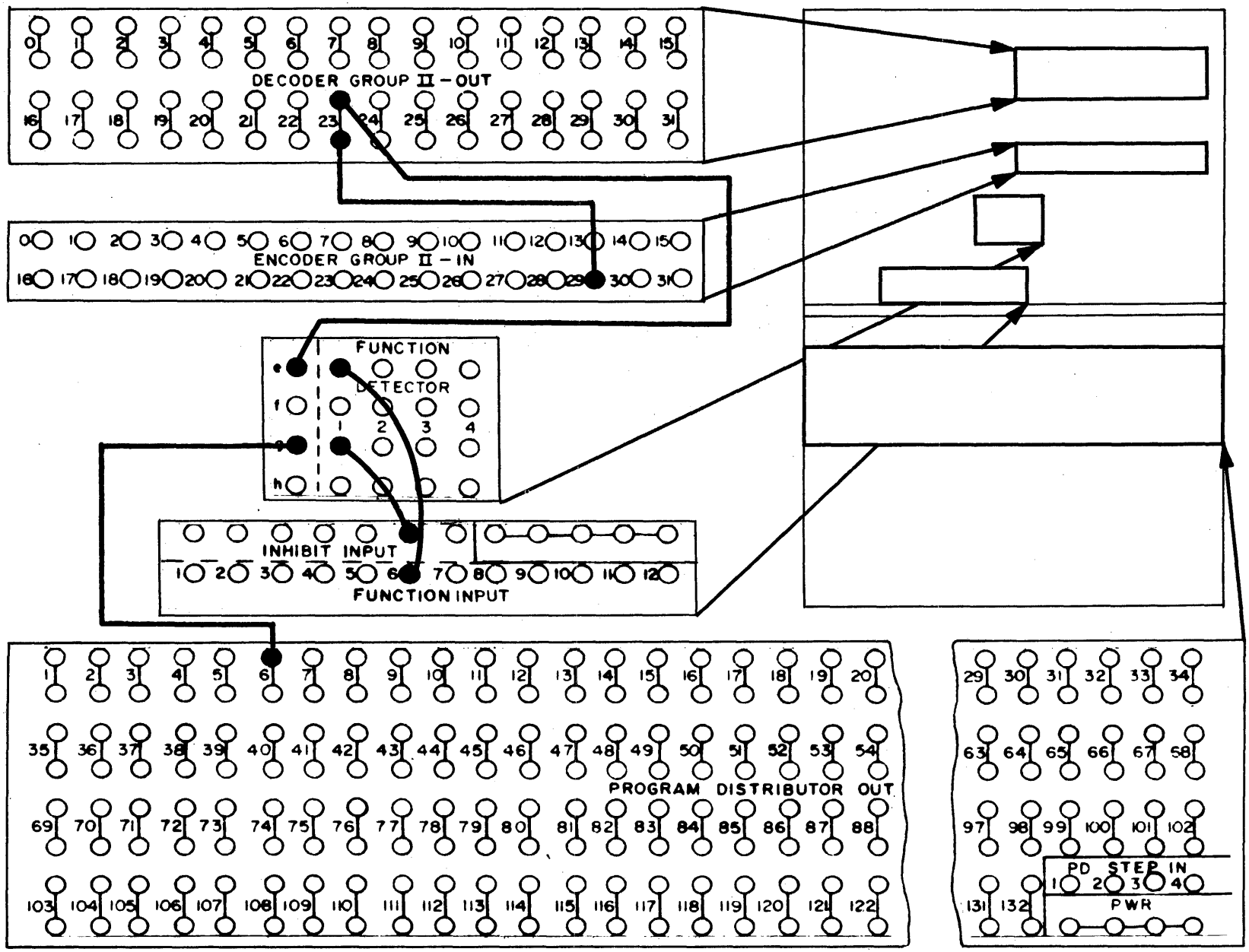


FIGURE 24. WIRING INHIBIT INPUTS

Inhibit Input hubs are extremely useful to the programmer. By their use, he can inhibit any of the following internal control signals initiated by the Input-Output Unit: Output Start, Output Stop, Stop Input, Correction, Void, End of Data, and Track Switch. One use of Inhibit Inputs is given in the following wiring example.

EXAMPLE 13

Wiring to Inhibit a Function Command

Input or Output

Problem: To encode an end of data character each time it appears, but inhibit the end of data function if the character is either decoded or encoded in step 6.

Procedure: Wire the DECODER GROUP OUT hub 23 (/) which emits the character signal to both the ENCODER GROUP IN hub 29 (%) receiving the signal and to the "In" hub of a Function Detector. The cycle "Out" hub number 1 of the Function Detector is wired to the end of data function input hub #6. Wire the PROGRAM DISTRIBUTOR OUT hub #6 to the "In" hub of another Function Detector and the cycle "Out" hub number 1 of the second Function Detector to the INHIBIT INPUT hub adjacent to the end of data function input hub.

SELECT HS AND SELECT LS (HIGH SPEED AND LOW SPEED)

A selector is an important decision-making device that can receive a signal and re-route it in either of two directions, i.e., from either of two hubs. Signals received at Selector control hubs determine which hub will emit the re-routed signal. Most external (plugboard) programs utilize the Selector for self-modification.

To utilize a selector in the non-select position, a signal source is wired to the IN (or C) hub of the selector; this signal goes out on the non-select side to continue the program.

To utilize a selector in the select position, a source signal must be wired to Selector Pickup. The POWER hub of the selector or other signal source is wired to the IN (or C) hub to provide power to the S hub, and the select side is wired to the program change.

Once the selector is picked up by a source signal, it will remain picked up until it is dropped out by a signal to the drop-out hub. (Selectors are used in Figures 21 and 27.)

The High Speed selectors used in the HSPT System are aptly named, for they require only 42 *microseconds* to move from the Non-Select to the Select position. Where quick decisions are desired to modify a program path rapidly, the high speed selectors should be used. However, when extremely high speed is not necessary, lower speed selectors are available - for example, where, on input, a source signal to pick up a selector can be initiated at least five characters before the selected program path is to be used. Low Speed selectors require 20 milliseconds to move from Non-Select to Select, although the Pick-up and Dropout hubs require power for only 50 microseconds to initiate the switching.

AND IN/AND OUT

There are eight "AND" circuits, each consisting of two input hubs and one common output hub. Both input hubs of a circuit must receive a signal before a signal will emit from the output hub. The input signals must be present at the same time, but do not have to arrive simultaneously. The first signal received must be programmed to apply a continuous current to the "AND" circuit until a signal is received at the other input hub. When the second signal arrives, a signal is emitted from the Out hub of the "AND" circuit. Power amplification is provided on the output hub. (See Figure 25.)

BUS

A bus is a group of common internally-connected hubs used to direct signals from one source to one or more destinations. The bus is not diode-protected, therefore current flows in both directions. Care should be exercised in using a bus when a back circuit could produce undesirable results. As a general rule, use a bus when one source and multiple destinations are wired. Use a unibus when multiple sources and one destination are wired. Wire multiple source and multiple destination problems to a bus via a unibus. For wiring convenience several groups of bus hubs are strategically located on the T and FC plugboard.

UNIBUS

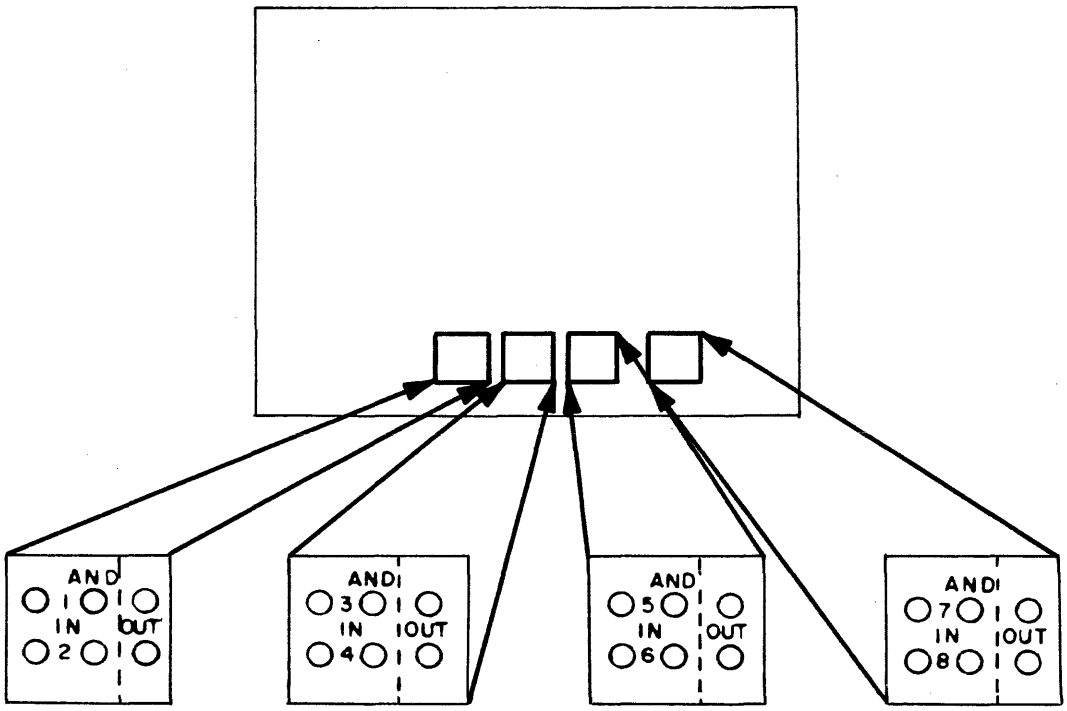
The unibus circuits on the T and FC plugboard consist of either four or five diode-protected input hubs with one common output hub per unibus. A signal received at any one of the input hubs will cause a signal to emit at the output hub of that unibus. Each output hub receives power amplification so that the unibus may be used to provide an input signal to some other section of the plugboard.

DEL

DEL (Unconditional Delete) is a single hub that may be utilized to inhibit decoding of a character in a specific Program Distributor step. In the Computer-to-Paper Tape (Output) Mode, when PD STEP IN #1 is wired to step with the decoding of each character, the PD OUT hub may be wired directly to the DEL hub. In the Paper Tape-to-Computer (Input) Mode, when the PD STEP IN #3 is wired to step with the encoding of each character, the PD OUT hub will be wired to the IN of a function detector and also to the IN of a high speed selector. The NS (non-select) hub of the selector will be wired to the DEL hub. One of the function detector Out hubs will be wired to the selector pickup and the next PD OUT hub will be wired to the selector drop out (DO) hub. Normally the "Output Stop" function hub will be used to delete characters in the Paper Tape-to-Computer (Input) Mode. Another method of wiring the DEL hub is shown in Figure 27. Note: As long as the DEL is energized, it inhibits all control functions initiated by decoded characters.

POWER

Power Output hubs emit a continuous DC current. The signal emitting from a POWER hub is used to select the input mode, the output mode, or the stepping of the Program Distributor, and may be used, under selector control, to 1) jump the Program Distributor, 2) pick up a low speed selector or alternate switch, or 3) turn on an Indicator Light.



"AND - IN" LOGIC

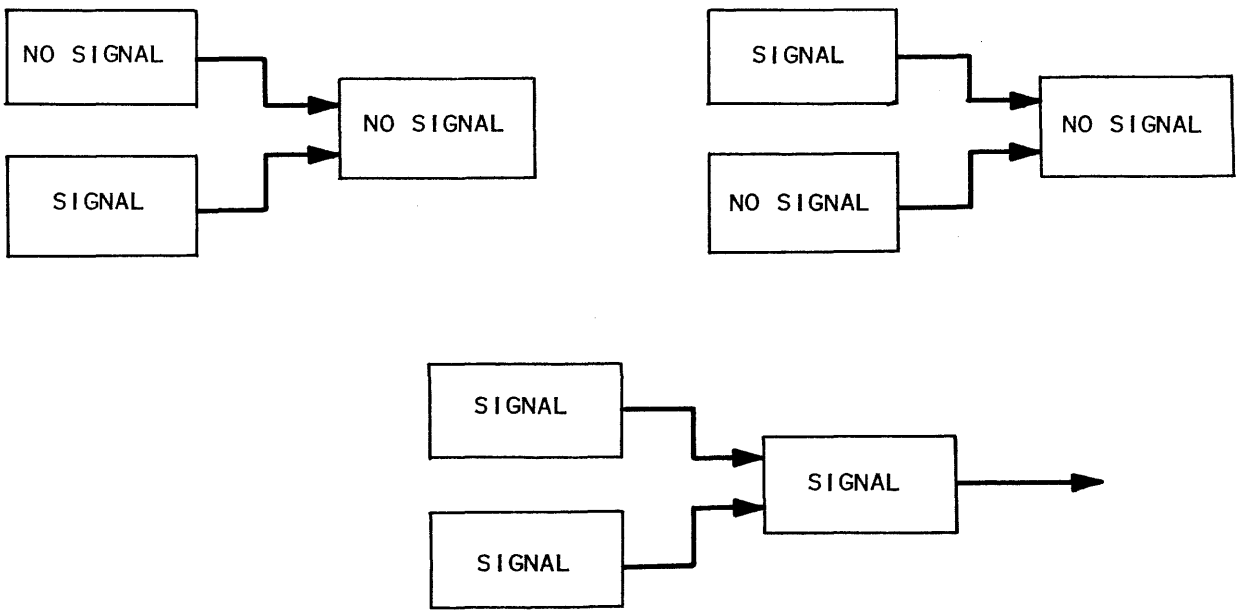


FIGURE 25. WIRING FOR AND-INS

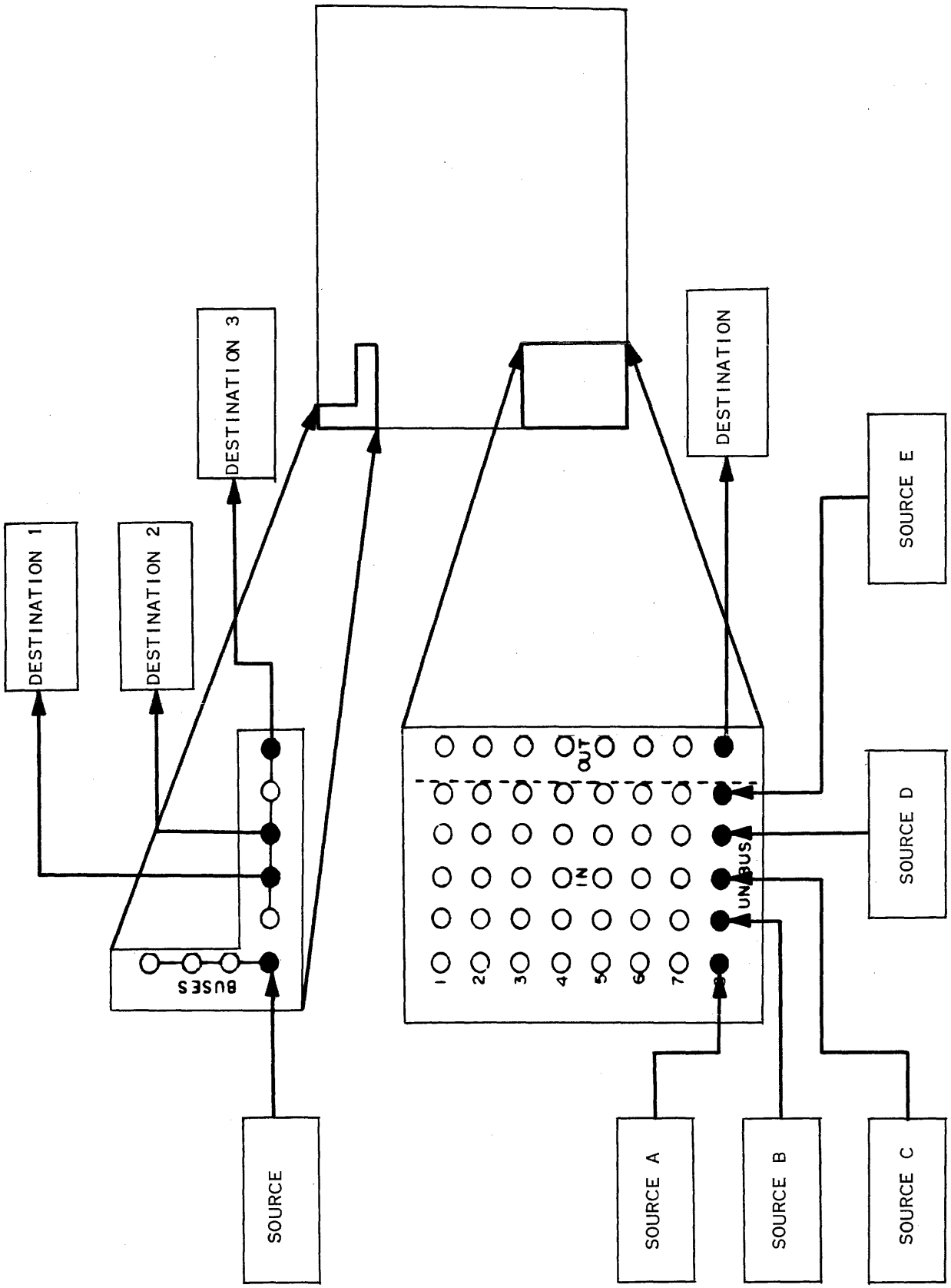


FIGURE 26. WIRING BUS AND UNIBUS

EXAMPLE 14

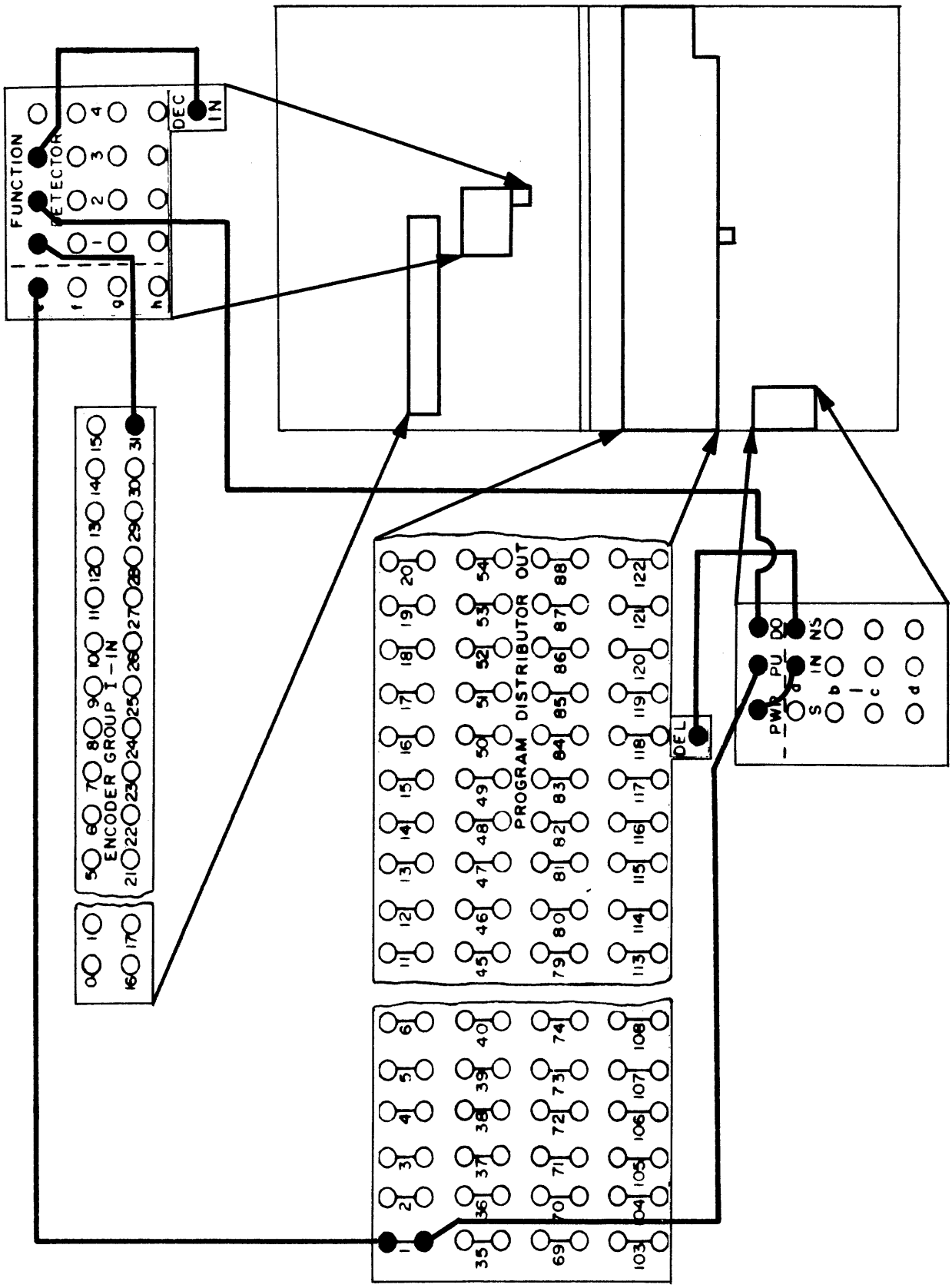


FIGURE 27. DECODER IN, UNCONDITIONAL DELETE, FUNCTION DETECTOR, POWER

EXAMPLE 14

Punching LC Precedence Character Into Output Tape

Discussion: The High-Speed Paper Tape System is cleared to (LC) Precedence at the beginning of a run by a master clear. Most tape-processing equipment, such as the teletypewriter, which receives output tape from the HSPTS, has LC and UC shifting that is controlled by LC and UC precedence punches in the tape. For this example, we will assume the first output character from the HSPTS is an alphabetic character. We want to ensure that the first character received by the off-line equipment is an LC precedence code so that the machine will operate in the proper mode: for instance, will print the proper character.

Problem: To punch into the Output tape, the LC precedence character required by teletypewriter equipment, even though the HSPTS detects no precedence change.

Procedure: Wire the PROGRAM DISTRIBUTOR OUT hub of step 1 to the IN hub of a Function Detector and to the Pickup (PU) of a High Speed (HS) Selector. The POWER (PWR) hub of the selector is wired to the IN hub of the selector, and the SELECT (S) hub of the selector is wired to the UNCONDITIONAL DELETE (DEL) hub. The FUNCTION DETECTOR OUT hub of cycle 1 is wired to the ENCODER GROUP IN precedence character hub. Cycle 2 is wired to the selector drop (DO), and cycle 3 is wired to DEC IN.

Result: On decoding the first output character from the UNIVAC File-Computer, the HSPTS 1) deletes the character, 2) initiates Function Detector cycling that drops out the (HS) Selector, 3) encodes the proper precedence character, and 4) turns on the decoder again to encode the character that was deleted.

OPERATOR CONTROL HUBS

Three groups of hubs on the T and FC plugboard may be wired to provide special operating aids:

1. to notify the operator of a specific program condition;
2. to provide the operator a means of manual control within a program.

Other operating controls and signal lights are available on the operator's control panel, but the following three, classified as "Operator Control," allow the operator to select specific points of program control via the plugboard.

INDICATORS IN

Six "Indicator In" hubs may be wired from a DC power source (any hub emitting signals on the plugboard) to light the correspondingly numbered Program Indicator lights on the operator's control panel. Program Indicator lights are used to notify the operator that a particular condition is present in the program, such as broken tape, etc.

ALTERNATE SWITCH

Alternate Switches, like selectors, consist of a common (C) hub, a select (S) and a non-select (NS) hub. Six Alternate Switches labeled A-F are on the

T and FC plugboard and are associated with six manual switches on the operator's control panel. When the operator's control switch is open, current flows through the C hub and out the NS hub of the Alternate Switch. When the operator's switch is locked closed, the indicator is on, and the current path is through the C hub and out the S hub. The use of Alternate Switches provides a means for manual alteration of program path.

FILL (MANUAL)

A single hub labeled "FILL" allows for manual control of the fill function. This hub is primarily for use in the BPTM-Tape System.

In the section on "Format Control Hubs," another group of hubs also labeled "Fill" was discussed. The Format Control "Fill" hubs, which function automatically as previously described, are located in the upper section of the plugboard. The one specific "Fill" hub classified under "Operator Control" is for *manual* control of the fill function and is located in the middle lower section of the plugboard.

COMMUNICATION HUBS

Communication hubs provide a path for the flow of information between the computer and the High-Speed Paper Tape System. Three hub groups are included in this classification.

I/O-TO-C (a, b, c, d)

Four hubs in the I/O-to-C section, labeled a, b, c, d, are wired to send signals from the HSPTS to the computer plugboard. Their primary use is to pick up selectors to vary the path of the computer program. See Section II for discussion of I/O-to-C control lines.

I/O-TO-C (W, X, Y, Z)

Four hubs in the I/O-to-C section labeled W, X, Y, Z, are used primarily to notify the computer of a special condition in the HSPTS, but they may also be used for the same purposes as I/O-to-C a, b, c, and d. See Section II for discussion of I/O-to-C High Speed control lines.

C-TO-I/O LINE

The Computer to I/O Line consists of four individual lines that have hubs on the plugboard labeled A, B, C, and D. These lines receive information transmitted from the computer. The lines are energized individually or in combinations by computer demands representing commands from the Computer to the Paper Tape System. Each line has a 2-state output, either a "1" or a "0", and all the lines will be in one or the other of these states during operation.

On the T and FC plugboard, the "1" hub of each register will emit a signal when a signal is received from the computer by that particular register, and the "0" hub of the register will emit a signal when no signal is received.

The UNIVAC File-Computer C-to-I/O Control Line "A" is internally connected to the T and FC C-to-I/O Reg. "A" and is reserved for sending the initiating signal which will start the I/O unit in either on-line mode of operation: input or output. Assignment of other instructions for the High-Speed Paper Tape

System is made by T and FC plugboard wiring from C-to-I/O Registers B, C, or D. A programmer's choice of one or more of these registers depends upon the requirements of the program.

When the High-Speed Paper Tape System is used in the off-line mode for paper tape-to-paper tape conversion or editing, the start signal is initiated from the operator's start switch.

INPUT, OUTPUT (OPERATION MODE SELECTION)

The Input-Output mode selection hubs (in the lower left-hand corner of the plugboard) provide a control signal path for selection of the desired mode of operation. "Input" refers to the transfer of information from Paper Tape to the Computer. The three INPUT hubs have the following functions:

Hub 1. - Controls transfer of data from 120-character buffer to I/O track.
Hub 2. - Controls transfer of data to 120-character buffer.
Hub 3. - Controls transfer of data from the Reader.

"Output" refers to the transfer of information from the Computer to Paper Tape. The three OUTPUT hubs have the following functions:

Hub 1. - Controls transfer of data from I/O track to 120-character buffer.
Hub 2. - Controls transfer of data from the 120-character buffer to the F and FC Unit.
Hub 3. - Controls transfer of information to Punch.

To select either of the on-line modes of operation, all three hubs of the selected group must be wired. When the Paper Tape System is to operate in only one on-line mode during the operating period, hubs 1, 2, and 3 of the selected group can be wired from adjacent Power Output hubs. If one plugboard is to be utilized for both input and output and also to switch from input to output in the same program, the programmer must assign specific C-to-I/O Reg. signals to initiate the input or output mode of operation. When one plugboard is to be used for both input and output and switching is not desired in the program, wiring is accomplished through the use of an alternate switch allowing for manual control of the operation mode. To utilize the alternate switch, a Power Output hub is wired to the C hub of the switch, one of the output hubs of the alternate switch is wired to Input, and the other is wired to Output. The mode of operation will depend upon the manual setting of the switch on the control panel.

To utilize the system in the off-line paper tape-to-paper tape mode, the programmer need only wire hub 3 of each group to adjacent Power Output hubs, unless format control, including rearrangement of the data, is required. In the latter case, hub 2 in each group, as well as hub 3, is wired to adjacent Power Output hubs, and an HS selector controls all four hubs.

PUNCH INTERLOCK

The Punch Interlock hubs (NS, C, and S) are used to notify the T and FC Unit that an interlock condition exists in the Punching Unit of the High-Speed Paper Tape System. The interlock condition might be caused by a broken tape or a supply of blank tape that has reached a predetermined level. The hubs may be wired to light an indicator, to pick up a selector, or to stop the tape operation. DC power may be wired through the C (Common) hub to the S select hub when an abnormal condition is detected, or through the C hub to the NS (non-select) hub when no abnormal condition is present.

NAME	PB LOCATION	INPUT SIGNAL SOURCE	OUTPUT SIGNAL DESTINATION	COMMENTS
INCOMING BUFFER OUTPUT	(2-17) (X-W)	NONE	DECODER INPUTS. CHANNEL PARITY REGISTER INPUTS.	PARITY HUB LEVEL MAY BE WIRED TO 8TH LEVEL CHECK HUBS OR TO HSS PICKUP HUB, OR FD IN.
DECODER INPUT	(4-17) (V)	INCOMING BUFFER OUTPUT. INCOMING PRECEDENCE OUTPUT. C-TO-I/O REGISTER.	NONE	HUB PAIRS LEFT UNWIRED APPEAR AS "0'S" TO DECODING CIRCUITRY. BOTH HUBS OF ANY PAIR IN USE MUST BE WIRED; A WIRE TO ONLY ONE HUB OF ANY PAIR WILL RESULT IN INCORRECT DECODER OPERATION.
DECODER GROUP	(2-33) (T-M)	NONE	ENCODER, GROUPS I-IV DELETE CHARACTER IN. FUNCTION DETECTOR. TWO-CHARACTER FUNCTION DETECTOR. FUNCTION INPUTS 10 AND 11 (STOPS).	
IN PREC COMING PRECEDENCE)				
A) UC (UPPER CASE)	(18-21) (X)	DECODER OUT	NONE	CORRESPONDS TO "1" PREC. OUT.
B) LC (LOWER CASE)		DECODER OUT	NONE	CORRESPONDS TO "0" PREC. OUT.
C) "0"		NONE	DECODER INPUT	TO EXPAND FROM A FIVE-LEVEL CODE TO A SIX-LEVEL CODE, WIRE THESE OUTPUTS TO THE DECODER INPUT HUBS LABELED "0-32."
D) "1"		NONE	DECODER INPUT	
DELETE CHARACTER IN	(1) (T-M) (34) (T-M)	DECODER OUT	NONE	
ENCODER GROUP IN I-IV	(2-33) (L-I)	DECODER OUTPUT OUTPUT PRECEDENCE (LC AND UC) FUNCTION DETECTOR OUT 1, 2, 3, 4 FILL (OUT)	NONE	
ENCODER OUTPUT	(22-29) (X)	NONE	PUNCH/COMPUTER INPUTS CHANNEL PARITY REGISTER INPUTS OUTPUT PRECEDENCE INPUTS	
OUTPUT PRECEDENCE				
A) IN	(30-33) (X)	ENCODER OUT		
B) INH (INHIBIT)		ENCODER OUT		
C) LC			ENCODER GROUP IN	CORRESPONDS TO PREC. CODE MEANING "0."
D) UC			ENCODER GROUP IN	CORRESPONDS TO PREC. CODE MEANING "1."

TABLE 4. NORMAL SIGNAL SOURCE AND DESTINATION FOR T AND FC PLUGBOARD HUB GROUPS

NAME	PB LOCATION	INPUT SIGNAL SOURCE	OUTPUT SIGNAL DESTINATION	COMMENTS
H) No. 8 (Buffer Clear)		Function detector outputs 1, 2, 3, 4. Program Distributor		Function detector output wired to "Buffer Clear" hub must also be wired to ENCODER GROUP IN hub corresponding to clear character.
I) No. 9 (Word Clear)		Function detector outputs 1, 2, 3, 4. Program Distributor		Function detector output wired to "Word Clear" hub must also be wired to ENCODER GROUP IN hub corresponding to clear character.
J) No. 10 Stop #1		Any plugboard hub emitting a signal		
K) No. 11 Stop #2		Any plugboard hub emitting a signal		
L) No. 12 Blank				
AND IN/OUT	(12-27)	General purpose	General purpose	
DEC IN (Single "decoder in" hub)	(19) (D)	Function detector outs 1, 2, 3, 4.		
STOP OUT	(7)	None (C)	General purpose	
DEC OUT (Single "decoder out" hub)	(19) (A)	None	General purpose	
UNIBUS	(1-6) (H-W) and (29-34) (H-W)	General purpose	General purpose	
BUSES		General purpose	General purpose	
PROGRAM DISTRIBUTOR OUT	(1-34) (X-0)	None	Function detector Two character function detector. End fill. Inhibit fill. Inhibit output precedence.	
P.D. STEP IN (Program Distributor In)	(31-34) (P)			
A) STEP IN No. 1 (step during I/O-to paper tape transfer)		Power (or power via selector output)	None	
B) STEP IN No. 2 (inhibit "Step In" No. 1)		Decoder Group Out. Incoming buffer output.		
C) STEP No. 3 (step during paper tape-to-I/O transfer)		Power (or power via selector output)	None	

Table 4. Normal Signal Source and Destination for T and FC Plugboard Hub Groups (continued)

NAME	PB LOCATION	INPUT SIGNAL SOURCE	OUTPUT SIGNAL DESTINATION	COMMENTS
D) STEP No. 4 (INHIBIT "STEP IN" No. 3)		DECODER GROUP OUT. (SOURCE OF ENCODING SIGNAL) FUNCTION DETECTOR 1, 2, 3, 4 ETC.	NONE	
MOD 12 PDK OUT (MODULUS 12, PROGRAM DISTRIBUTOR COUNTER OUT)	(13-24) (W)	NONE	FUNCTION DETECTOR. TWO-CHARACTER FUNCTION DETECTOR. END FILL. INHIBIT FILL. INHIBIT OUTPUT PRECEDENCE.	
SET PD WORD IN SET CHARACTER IN	(13-20) (X)	HIGH SPEED SELECTOR "S" (SELECTOR ENERGIZED FROM A PD OUT HUB) FUNCTION DETECTOR OUTS, 1, 2, 3, 4.		
REVERSE	(13-14) (N)			FOR REVERSING BUFFER ADDRESSING MECHANISM, BOTTLE-PLUG REVERSE HUBS
FILL (SINGLE HUB)	(15) (N)			NOT USED IN FILE COMPUTER APPLICATIONS.
DEL (SINGLE HUB FOR UNCONDITIONALLY DELETING A CHARACTER)	(16) (N)	GENERAL PURPOSE	NONE	
INVERTERS	(6-12) (X-W)	GENERAL PURPOSE	GENERAL PURPOSE	
SET IN CHARACTER ADDRESS COUNTER SET IN WORD ADDRESS COUNTER	(2-23) (M)	FUNCTION DETECTOR OUT PD OUT	NONE	
SELECT HS (1-5) (HIGH SPEED SELECTORS)	(1-15) (K-G)	GENERAL PURPOSE	GENERAL PURPOSE	
SELECT LS (6-10) (LOW SPEED SELECTORS)	(16-30) (K-G)	GENERAL PURPOSE	GENERAL PURPOSE	
ALTERNATE SWITCH	(15-20) (C-A)	GENERAL PURPOSE	GENERAL PURPOSE	
C-TO-I/O LINE	(23-26) (B-A)	NONE	INPUT 1, 2, 3. OUTPUT 1, 2, 3. PD STEP 1 OR 3. DECODER INPUT (NORMALLY SEVENTH LEVEL)	
I/O TO C (A-D) (LOW SPEED)	(27-30) (A)	HIGH SPEED SELECTOR "S" OR "NS". POWER ANY HUB SUPPLYING A SIGNAL FOR 50 MICRO SECONDS		
I/O TO C (W-Z) (HIGH SPEED)	(31-34)	FUNCTION DETECTOR OUT 1, 2, 3, 4 (OR OTHER HUBS EMITTING SIGNALS DURING FUNCTION CONTROL CYCLE.	NONE	

TABLE 4. NORMAL SIGNAL SOURCE AND DESTINATION FOR T AND FC PLUGBOARD HUB GROUPS (CONTINUED)

NAME	PB LOCATION	INPUT SIGNAL SOURCE	OUTPUT SIGNAL DESTINATION	COMMENTS
PUNCH/COMP. INPUTS	(22-29) (W-V)	ENCODER OUTPUT. CHANNEL PARITY REGISTER OUTPUTS	NONE	LEAVING PUNCH/COMPUTER HUBS UNWIRED MAKES THEM APPEAR TO HAVE "0" INPUTS.
FUNCTION DET (DETECTOR)	(8-19) (H-E)	DECODER GROUP OUT. PROGRAM DISTRIBUTOR OUT. TWO CHARACTER FUNCTION DETECTOR. INCOMING BUFFER OUTPUT AND - OUT.	ENCODER GROUP IN FILL. FUNCTION INPUTS. 1. OUTPUT STOP 2. OUTPUT START 3. INPUT STOP 4. CORRECTION 5. VOID 6. END OF DATA 7. TRACK SWITCH 8. BUFFER CLEAR 9. WORD CLEAR. 10. STOP #1 11. STOP #2 HSC I/O-TO-C DECODER IN (SINGLE HUB)	OTHER PLUGGING NECESSARY OTHER PLUGGING NECESSARY OTHER PLUGGING NECESSARY OTHER PLUGGING NECESSARY
2 CHAR. F.D. (TWO-CHARACTER FUNCTION DETECTOR)	(8-10) (D-C)	DECODER OUT. PROGRAM DISTRIBUTOR OUT. INCOMING BUFFER OUTPUT.	FUNCTION DETECTOR IN	
FILL				
A) START	(22-27) (H-E)	FUNCTION DETECTOR OUT 1, 2, 3, 4.		
B) INH		FUNCTION DETECTOR OUT 1, 2, 3, 4. PROGRAM DISTRIBUTOR OUT. MOD 12 PDK OUT.		
C) END		PROGRAM DISTRIBUTOR OUT. MOD 12 PDK OUT.		
D) OUT			ENCODER	
FUNCTION INPUTS	(7-18) (A)			
A) NO. 1 (OUTPUT STOP)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		
B) NO. 2 (OUTPUT START)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		
C) NO. 3 (INPUT STOP)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		
D) NO. 4 (CORRECTION)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		FUNCTION DETECTOR OUTPUT WIRED TO "CORRECTION" HUB MUST ALSO BE WIRED TO ENCODER GROUP IN HUB CORRESPONDING TO CLEAR CHARACTER.
E) NO. 5 (VOID)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		FUNCTION DETECTOR OUTPUT WIRED TO "VOID" HUB MUST ALSO BE WIRED TO ENCODER GROUP IN HUB CORRESPONDING TO CLEAR CHARACTER.
F) NO. 6 (END OF MESSAGE)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		
G) NO. 7 (TRACK SWITCH)		FUNCTION DETECTOR OUTPUTS 1, 2, 3, 4.		ON COMPUTER INPUT, FUNCTION DETECTOR OUTPUT WIRING TO BUFFER SWITCH MUST ALSO BE WIRED TO INPUT STOP.

TABLE 4. NORMAL SIGNAL SOURCE AND DESTINATION FOR T AND FC PLUGBOARD HUB GROUPS (CONTINUED)

NAME	PB LOCATION	INPUT SIGNAL SOURCE	OUTPUT SIGNAL DESTINATION	COMMENTS
INPUT, OUTPUT (MODE SELECTION)	(1-6) (B-A)	POWER. C-TO-I/O REGISTER. A, B, C, D.	NONE	
ODD-EVEN PARITY SELECTION A) CHANNEL	(7-9) (B-A)	BOTTLE-PLUG BETWEEN HUB "S" AND "ODD" OR "EVEN", DEPENDING UPON THE TYPE OF CHANNEL PARITY CHECK DESIRED. IF CHANNEL CHECK IS NOT USED LEAVE UNPLUGGED		
B) CHARACTER		IF STOPPAGE OF T AND FC UNIT OPERATION IS DESIRABLE UPON ENCOUNTERING A CHARACTER PARITY ERROR, BOTTLE-POUG BETWEEN HUB "S" AND "ODD" OR "EVEN", DEPENDING UPON THE TYPE OF CHARACTER PARITY CHECK DESIRED. IF, INSTEAD OF STOPPING T AND FC UNIT OPERATION, IT IS DESIRED THAT THE CENTRAL COMPUTER BE INFORMED OF THE PARITY ERROR, PLUG "ODD" OR "EVEN," DEPENDING UPON THE TYPE OF PARITY CHECKCCHOSEN, TO ONE OF THE HSL I/O-TO-C HUBS. IT IS ALSO POSSIBLE TO INFORM THE CENTRAL COMPUTER OF A CHARACTER PARITY ERROR BY USE OF A LS I/O-TO-C LINE. ON UFC INPUT, ANOTHER APPLICATION WOULD BE THE INSERTION OF A CHARACTER DESIGNATED AS A "PARITY ERROR," CHARACTER INTO INPUT DATA. FOR THIS FUNCTION, WIRE THE "ODD" HUB TO AN FD IN AND A FD OUT HUB TO THE CHARACTER TO BE ENCODED.		
PUNCH INTLK (PUNCH INTERLOCK)	(10-12) (A)	GENERAL PURPOSE	GENERAL PURPOSE	
INDICATORS IN	(15-20) (E)	GENERAL PURPOSE	NONE	INDICATOR REMAINS LIGHTED ONLY AS LONG AS POWER IS APPLIED TO THE INPUT HUB.
POWER	(31-34) (O) AND (1-6) (A)	NONE	GENERAL PURPOSE	POWER HUBS SUPPLY CONTINUOUS SIGNALS AS LONG AS POWER IS SUPPLIED TO THE T AND FC UNIT.

TABLE 4. NORMAL SIGNAL SOURCE AND DESTINATION FOR T AND FC PLUGBOARD HUB GROUPS (CONTINUED)

SECTION IV

Application Timing

OPERATING TIMES FOR THE HIGH-SPEED PAPER TAPE SYSTEM

The HSPTS, which is almost exclusively a solid-state device, features fast internal operating speeds. In most programs, the speed at which paper tape can be read and/or punched is the major factor in estimating the time required to process various message lengths on paper tape.

Paper tape characters are read at a maximum speed of 240 characters per second. At this speed, approximately 4.17 milliseconds are available for the processing of each character.

Paper tape characters are punched at a maximum speed of 60 characters per second. At this speed approximately 16.7 milliseconds are available for the processing of each character.

Five timing formulas are given below. In these formulas:

T	= Time required to process the message.
N	= Number of characters read from or punched into paper tape.
Character Read Time	= Time required to read n characters at 240 characters per second.
Character Punch Time	= Time required to punch n characters at 60 characters per second.
Average Access Time	= Average time required to gain access to the I/O track of the high speed drum in the UFC.
Buffer Load Time) Buffer Unload Time)	= Time required to transfer contents of 120-character buffer to the I/O track or contents of the I/O track to the buffer.
Buffer Clear Time	= Time required to clear the 120-character buffer to a designated code.

Formulas:

1. Message Processing Time: *Input Mode with Buffer Clear*

$$T = \text{Character Read Time} + \text{Average Access Time} + \text{Buffer Unload Time} + \text{Buffer Clear Time} \pm 2.5 \text{ milliseconds}$$

$$T = \left[\left(\frac{N}{240} \times 10^3\right) + 2.5 + 5.0 + 5.0\right] \pm 2.5 \text{ milliseconds}$$

2. Message Processing Time: *Input Mode without Buffer Clear*

$$T = \begin{matrix}\text{Character}\\ \text{Read Time}\end{matrix} + \begin{matrix}\text{Average}\\ \text{Access Time}\end{matrix} + \begin{matrix}\text{Buffer}\\ \text{Unload}\\ \text{Time}\end{matrix} \pm 2.5 \text{ milliseconds}$$

$$T = \left[\left(\frac{N}{240} \times 10^3\right) + 2.5 + 5.0\right] \pm 2.5 \text{ milliseconds}$$

3. Message Processing Time: *Output Mode from UFC*

$$T = \begin{matrix}\text{Character}\\ \text{Punch Time}\end{matrix} + \begin{matrix}\text{Average}\\ \text{Access Time}\end{matrix} + \begin{matrix}\text{Buffer}\\ \text{Load Time}\end{matrix} \pm 2.5 \text{ milliseconds}$$

$$T = \left[\left(\frac{N}{60} \times 10^3\right) + 2.5 + 5.0\right] \pm 2.5 \text{ milliseconds}$$

4. Message Processing Time: *Off-Line Paper Tape-to-Paper Tape Conversion with Editing*

$$T = \begin{matrix}\text{Character}\\ \text{Read Time}\end{matrix} + \begin{matrix}\text{Character}\\ \text{Punch Time}\end{matrix}$$

$$T = \left[\left(\frac{N}{240} \times 10^3\right) + \left(\frac{N}{60} \times 10^3\right)\right] \text{milliseconds}$$

5. Message Processing Time: *Off-Line Paper Tape-tp-Paper Tape Conversion* (one-to-one conversion)

$$T = \begin{matrix}\text{Character}\\ \text{Punch Time}\end{matrix}$$

$$T = \left(\frac{N}{60} \times 10^3\right) \text{ milliseconds}$$

HSPTS AS INPUT-OUTPUT WITH UFC-1

Operating Times (Message Time in Milliseconds)

Message Length In Characters	Input		Output
	With Buffer Clear	Without Buffer Clear	Without Buffer Clear
10	54.2 ± 2.5	49.2 ± 2.5	174.2 ± 2.5
20	95.8 ± 2.5	90.8 ± 2.5	340.8 ± 2.5
30	137.5 ± 2.5	132.5 ± 2.5	507.5 ± 2.5
40	179.2 ± 2.5	174.2 ± 2.5	674.2 ± 2.5
50	220.8 ± 2.5	215.8 ± 2.5	840.8 ± 2.5
60	262.5 ± 2.5	257.5 ± 2.5	1007.5 ± 2.5
80	345.8 ± 2.5	340.8 ± 2.5	1340.8 ± 2.5
100	429.2 ± 2.5	424.2 ± 2.5	1674.2 ± 2.5
120	512.5 ± 2.5	507.5 ± 2.5	2007.5 ± 2.5
140	608.3 ± 5.0	598.3 ± 5.0	2348.3 ± 5.0
160	691.6 ± 5.0	681.6 ± 5.0	2681.7 ± 5.0
180	775.0 ± 5.0	765.0 ± 5.0	3015.0 ± 5.0
200	858.3 ± 5.0	848.3 ± 5.0	3348.3 ± 5.0
220	941.7 ± 5.0	931.7 ± 5.0	3681.7 ± 5.0
240	1025.0 ± 5.0	1015.0 ± 5.0	4015.0 ± 5.0

HSPTS - OFF-LINE TAPE-TO-TAPE CONVERSION WITH AND WITHOUT EDITING

Off-Line Operating Time (Message Time in Milliseconds)

Message Length In Characters	Conversion With Editing	Conversion Without Editing
1	20.83	16.66
5	104.16	83.33
10	208.33	166.66
20	416.66	333.33
30	625.00	500.00
40	833.33	666.66
50	1041.66	833.33
60	1250.00	1000.00

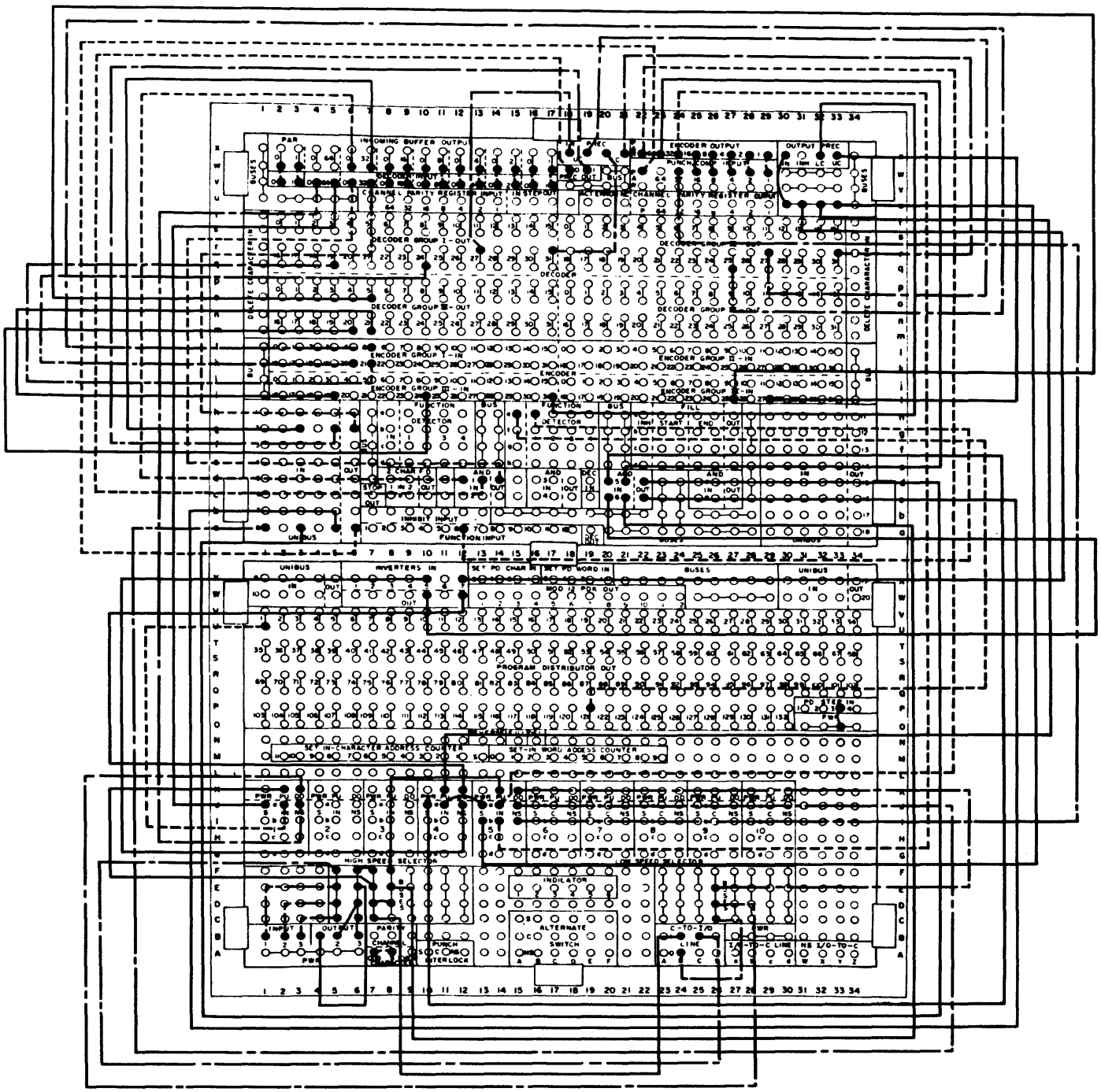


FIGURE 28. WIRING FOR SAMPLE PROGRAM PLUGBOARD FOR COMBINED INPUT/OUTPUT OPERATION

SECTION V

Sample Program

In this section, a sample program is developed to illustrate a typical use of the High-Speed Paper Tape System. Although the program selected for this example is greatly simplified for purposes of illustration, the problem is one that users of the High-Speed Paper Tape System will always face when wiring one plugboard for both input and output.

Discussion:

To use one program plugboard for both the paper tape-to-computer (PTC) and computer-to-paper tape (CTP) modes of operation, it must be predetermined which two Decoder and Encoder groups will be used in the PTC mode and which two will be used in the CTP mode. Also, it is necessary to provide sufficient Encoder Output signal representations at all levels of the UNIVAC character codes in the PTC mode and at all levels to be punched in paper tape in the CTP mode. When the Encoder Output signals represent the levels of codes other than UNIVAC, or possibly some other seven level code in the CTP mode, High Speed Selectors (HSS) are used in controlling signal paths.

In the following problem, we have selected Decoder and Encoder Groups I and II for the PTC (input) mode, and Decoder and Encoder Groups III and IV for the CTP (output) mode.

Problem:

Input Mode: (PTC) To convert 5-level standard teletypewriter punched Paper tape character codes into UNIVAC 7-level character codes. The Figures and Letters codes have been selected as UC and LC Incoming Precedence codes respectively.

Output Mode: (CTP) To convert UNIVAC 7-level File-Computer character codes into 5-level standard teletypewriter punched paper tape character codes: and to send the correct parity to the punch while using Output Prec., but not to send the precedence level to the punch.

Characters A, B, and 2 have been selected for both modes, and Program Distributor Step 121 is used to initiate the "End of Message" signal to stop HSPTS operation.

Procedure:

Wire C-to-I/O REG C (1) via a bus to the Input Mode hubs 1, 2, and 3.

Wire C-to-I/O B (1) via a bus to the Output Mode hubs 1, 2, and 3, and to pick up HS selectors 1 and 5 as well as to provide a signal at one IN hub of AND circuit 6.

Wire Program Distributor OUT hub 1 to the IN Hub of HSS 1.

Wire the non-select hub of HSS 1 to the 0 hub at the 0-64 level of the Decoder Input in order to ensure that a 0 signal will always be received at the 0-64 level while the HSPTS is operating in the PTC (input) mode.

Wire the select hub of HSS 1 to the 64 hub of the Decoder Input to ensure that a 1 signal will always be received at that level when the HSPTS is in the CTP (output) mode.

Wire C-to-I/O B(0) via a bus to the selector drop out (DO) of HS selectors 1 and 5 so that any signal received during the input mode of operation will be routed through the non-select (NS) hubs of the selectors.

Wire Incoming Buffer Input hubs 0-1 through 0-16 to adjacent Decoder Input hubs 0-1 through 0-16.

Wire the 0 hub of the 0-32 Incoming Buffer Output to "And-In" Circuit 1 and the 32 hub to Unibus 2. Since the 0-32 level of the Incoming Buffer Output will always emit a 0 signal when the HSPTS is reading a 5-level punched paper tape and the Incoming Prec. Out can send either a 0 or 1 to this level of the Decoder Input, the "And" circuit is used at the 0 hub of the 0-32 level to insure that the Decoder Input cannot become confused by receiving both a 0 signal from Incoming Buffer Output and a 1 signal from Incoming Prec. Out.

Wire the 0 hub of Incoming Prec. Out to the other IN hub of "And" circuit 1.

Wire the OUT hub of AND circuit 1 to the 0 hub of the 0-32 Decoder Input level.

Wire the 1 hub of Prec. Out to another In hub of Unibus 2.

Wire the OUT hub of Unibus 2 to Decoder Input hub 32.

Wire the 0-1 Parity hubs at the Incoming Buffer Output to adjacent 0-1 hubs at the Decoder Input.

Wire from the Decoder Group I and II OUT hubs representing the 5-level teletypewriter codes for A, B, and 2 to the Encoder Group I and II IN hubs representing the 7-level UNIVAC codes for A, B, and 2.

Wire the selected LC (Letters) and UC (Figures) precedence character hubs in Decoder Group Out I and II to In Prec. LC and UC (see Table 2 for group and hub selection).

Wire from the Decoder Group III and IV OUT hubs representing the 7-level UNIVAC codes for A, B, and 2 to the Encoder Group III and IV IN hubs representing the 5-level teletypewriter punched paper tape codes for A, B, and 2.

Wire levels 1 through 16 of the Encoder Output to adjacent Punch/Comp. Input hubs.

Wire Encoder Output hub 32 to an IN hub of HSS5. The NS hub is wired to Punch/Comp. Input level 32 providing a one-to-one path between Encoder Output level 32 and Punch/Comp. Input level 32 during the (PTC) input mode. The S hub is wired via a bus to Output Prec. In, to pickup (PU) Selector 4, and to the IN hub of Inverter 7.

Wire the OUT hub of Inverter 7 to dropout (DO) Selector 4 if there is no code bit at the 32 level of the Encoder Output during the (CTP) output mode.

Wire Encoder Output hub 64 to one IN hub of AND circuit 5.

Wire the Encoder Output Parity hub to another IN hub of HSS5. The NS hub is wired to one IN hub of Unibus 8. The OUT hub of Unibus 8 is wired to the Parity level at the Punch/Comp. Input to provide for a parity check in either the input (PTC) or output (CTP) mode of operation. The S hub is wired to an IN hub of HSS4 to select the desired path that Parity should take during the output (CTP) mode of operation.

Wire the NS hub of HSS4 to the IN hub of Inverter 5. The OUT hub of Inverter 5 is wired to the other IN hub of AND circuit 6 where a signal is also being received from C-to-I/O (1) during the Output mode.

Wire the OUT hub of AND circuit 6 to another IN hub of Unibus 8.

Wire the S hub of HSS4 to the other IN hub of AND circuit 5 where a signal is being received from the 64 level of Encoder Output.

Wire the OUT hub of AND circuit 5 to another IN hub of Unibus 8.

The wiring of HSS5 and HSS4 provides seven Punch/Comp. Input levels for the 7-level Univac code during the PTC (Input) mode of operation and provides for the sending of the correct parity to the Punch/Comp. Inputs while using Output Prec. in the CTP (output) mode, but does not send the Precedence level to the Punch/Comp. Inputs in the CTP mode.

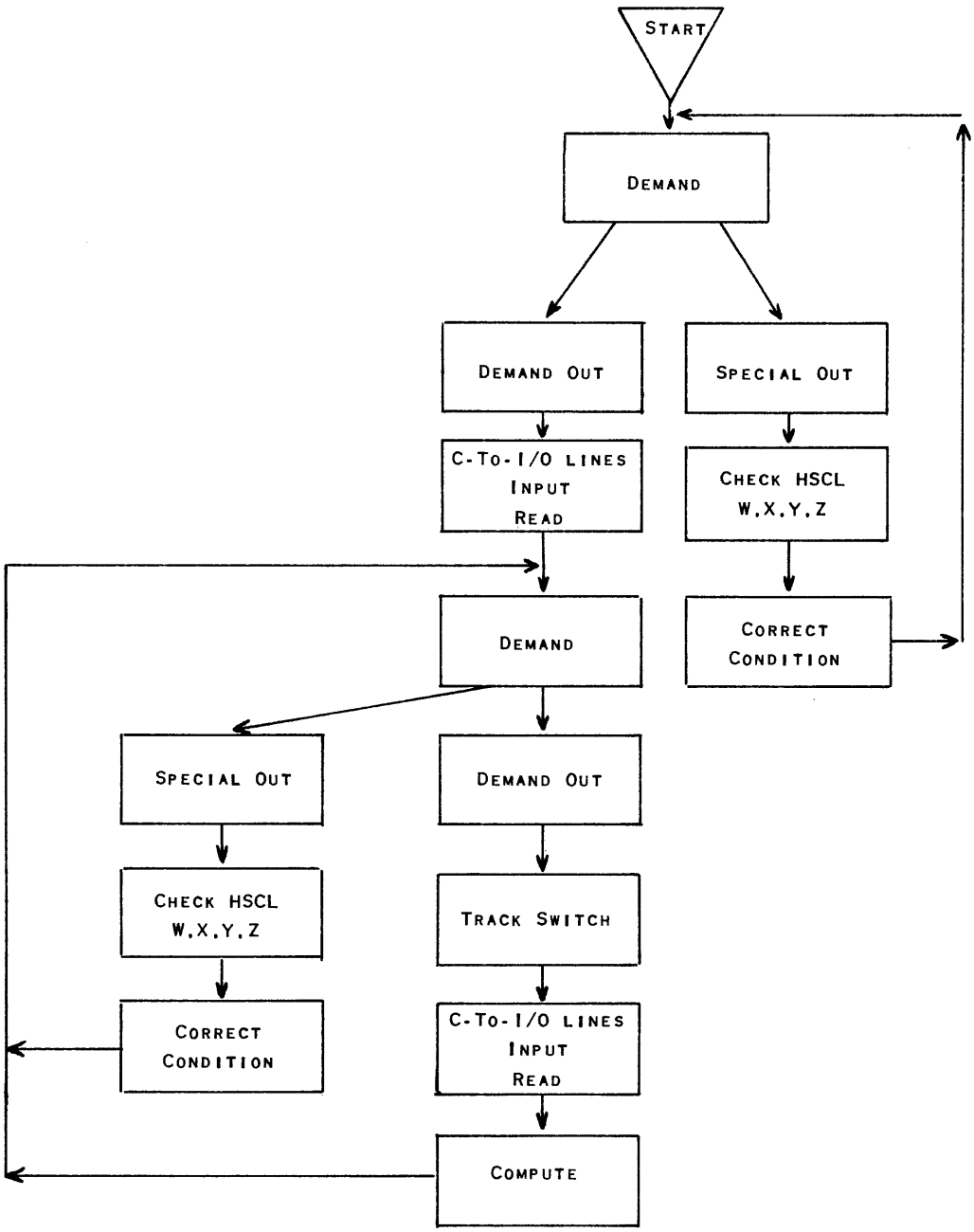
Wire the LC and UC hubs of Output Prec. to the specific Encoder Group III and IV IN hubs assigned to represent the LC (Letters) and UC (Figures) precedence punch on the paper tape.

Wire the power (PWR) hub adjacent to PD Step In 3 hub to the PD Step In 3 hub in order to step the Program Distributor with the encoding of each character.

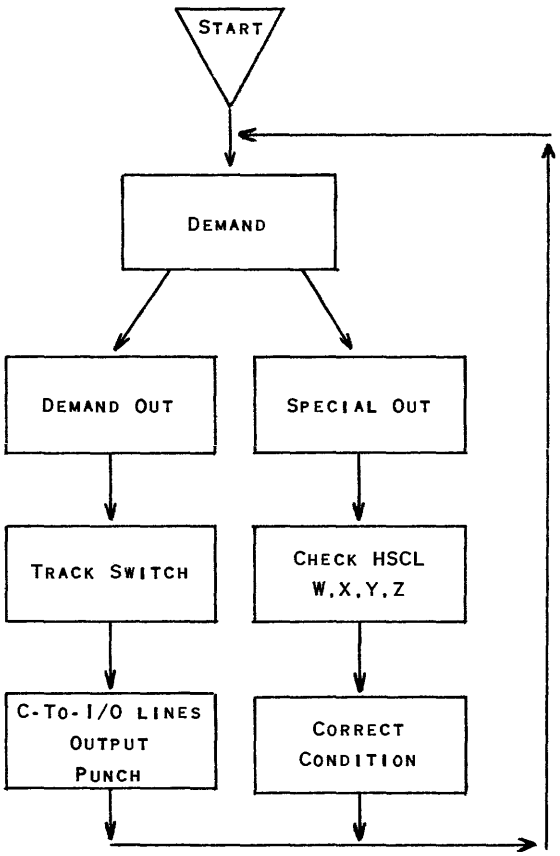
Wire the Program Distributor OUT hub 121 to the IN hub of a Function Detector and a cycle OUT hub of the FD to Function Inputs hub 6 in order to send an "End of Data" signal to stop HSPTS operation.

Operation will not be resumed until another Start signal is received by the HSPTS.

UFC Flow Chart For 120 Character Input Message Initiated Under Computer Control



UFC Flow Chart for 120 Character Output Message Initiated Under Computer Control



SECTION VI

Programming Forms and Charts

For Use With The High-Speed Paper Tape System

T AND FC UNIT - DECODER/ENCODER WIRING

PROGRAM_____

INCOMING BUFFER OUTPUT		
HUB	WIRED TO	PURPOSE
1		
0		
2		
0		
4		
0		
8		
0		
16		
0		
32		
0		
64		
0		
PAR		
0		

ENCODER OUTPUT		
HUB	WIRED TO	PURPOSE
1		
2		
4		
8		
16		
32		
64		
PAR		

INCOMING PRECEDENCE OUTPUT		
HUB	WIRED TO	PURPOSE
1		
0		

OUTGOING PRECEDENCE OUTPUT		
HUB	WIRED TO	PURPOSE
LC		
UC		

DECODER INPUT	
HUB	WIRED FROM
1	
0	
2	
0	
4	
0	
8	
0	
16	
0	
32	
0	
64	
0	
PAR	
0	

PUNCH/COMP. INPUT	
HUB	WIRED FROM
1A	
1B	
2A	
2B	
4A	
4B	
8A	
8B	
16A	
16B	
32A	
32B	
64A	
64B	
PAR A	
PAR B	

INC. PREC. IN	
HUB	WIRED FROM
UC	
UC	
LC	
LC	

OUT. PREC. IN	
HUB	WIRED FROM
IN	
INH.	

DELETE
WIRED FROM

DELETE
WIRED FROM

T AND FC UNIT - DECODER WIRING

PROGRAM_____

DECODER OUTPUT, GP, CODE			
HUB	WIRED TO	CHAR.	PURPOSE
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

DECODER OUTPUT, GP, CODE			
HUB	WIRED TO	CHAR.	PURPOSE
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

T AND FC UNIT - ENCODER WIRING

PROGRAM_____

ENC. OUTPUT, GP I	
HUB	WIRED FROM
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

ENC. OUTPUT, GP II	
HUB	WIRED FROM
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

ENC. OUTPUT, GP III	
HUB	WIRED FROM
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

ENC. OUTPUT, GP IV	
HUB	WIRED FROM
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	

T AND FC UNIT - PROGRAM DIST. AND ADDRESS WIRING

PROGRAM_____

PROGRAM DISTRIBUTOR OUT		
HUB	WIRED TO	PURPOSE

MOD 12 PDK OUT		
HUB	WIRED TO	PURPOSE
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

ADVANCE PD	
HUB	WIRED FROM
1. STEP-DECODE	
2. VOID STEP-DECODE	
3. STEP-ENCODE	
4. VOID STEP-ENCODE	

SET IN-CHAR. ADD.	
HUB	WIRED FROM
11	
10	
9	
8	
7	
6	
5	
4	
3	
2	
1	
S	

SET IN-WORD ADD.	
HUB	WIRED FROM
00	
1	
2	
3	
4	
5	
6	
7	
8	
9	

SET PD CHAR. IN	
HUB	WIRED FROM
8	
4	
2	
1	

SET PD WORD IN	
HUB	WIRED FROM
8	
4	
2	
1	

T AND FC UNIT - FUNCTION DETECTOR WIRING

PROGRAM_____

FUNCTION DETECTOR A		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR E		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR B		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR F		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR C		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR G		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR D		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

FUNCTION DETECTOR H		
PURPOSE:		
INPUT HUB WIRED FROM:		
OUT HUB	WIRED TO	PURPOSE
1		
2		
3		
4		

T AND FC UNIT - FUNCTION WIRING

PROGRAM_____

FILL					
FILL	INHIBIT HUB WIRED FROM	START HUBS WIRED FROM	END HUBS WIRED FROM	OUT HUB WIRED TO	PURPOSE
A					
B					
C					
D					

FUNCTION INPUTS		
FUNCTION	INPUT HUB WIRED FROM	INHIBIT HUB WIRED FROM
1. OUTPUT STOP		
2. OUTPUT START		
3. INPUT STOP		
4. CORRECTION		
5. VOID		
6. END OF DATA		
7. TRACK SWITCH		
8. TRACK CLEAR		
9. WORD CLEAR		
10. STOP		
11. STOP		

STOP OUTPUT	
WIRED TO	PURPOSE

DECODER OUT	
WIRED TO	PURPOSE

DECODER IN HUB WIRED FROM:

2-CHAR. FUNC. DET. A		
PURPOSE:		
IN 1 HUB WIRED FROM	IN 2 HUB WIRED FROM	OUT HUB WIRED TO

INVERTERS			
INV.	IN HUB WIRED FROM	OUT HUB WIRED TO	PURPOSE
1			
2			
3			
4			
5			
6			
7			

2-CHAR. FUNC. DET. B		
PURPOSE:		
IN 1 HUB WIRED FROM	IN 2 HUB WIRED FROM	OUT HUB WIRED TO

T AND FC UNIT - SELECTOR WIRING

PROGRAM_____

HIGH-SPEED SEL. 1

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	IN HUB FROM	S HUB TO
A			
B			
C			
D			

HIGH-SPEED SEL. 2

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	IN HUB FROM	S HUB TO
A			
B			
C			
D			

HIGH-SPEED SEL. 3

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	IN HUB FROM	S HUB TO
A			
B			
C			
D			

HIGH-SPEED SEL. 4

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	IN HUB FROM	S HUB TO
A			
B			
C			
D			

HIGH-SPEED SEL. 5

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	IN HUB FROM	S HUB TO
A			
B			
C			
D			

LOW-SPEED SEL. 6

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	C HUB FROM	S HUB TO
A			
B			
C			
D			

LOW-SPEED SEL. 7

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	C HUB FROM	S HUB TO
A			
B			
C			
D			

LOW-SPEED SEL. 8

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	C HUB FROM	S HUB TO
A			
B			
C			
D			

LOW-SPEED SEL. 9

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	C HUB FROM	S HUB TO
A			
B			
C			
D			

LOW-SPEED SEL. 10

PURPOSE:

PU HUB WIRED FROM	DO HUB WIRED FROM

ELEMENT	NS HUB TO	C HUB FROM	S HUB TO
A			
B			
C			
D			

T AND FC UNIT - UNIBUS, "AND", WIRING

PROGRAM_____

UNIBUSES							
UNIBUS	INPUT HUBS WIRED FROM					OUTPUT HUB WIRED TO	PURPOSE
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

"AND"'s				
"AND"	INPUT HUBS WIRED FROM		OUTPUT HUB WIRED TO	PURPOSE
1				
2				
3				
4				
5				
6				
7				
8				

T AND FC UNIT - MISCELLANEOUS CONTROL WIRING

PROGRAM _____

CHANNEL PAR. REG. INPUT	
HUB	WIRED FROM
1	
2	
4	
8	
16	
32	
64	
P	

CHANNEL PAR. REG. OUTPUT	
HUB	WIRED TO
1	
2	
4	
8	
16	
32	
64	
P	

CHANNEL PARITY CONTROL		
HUB	WIRED TO/FROM	PURPOSE
ACT.		
ERROR		
N C		

SELECT CHARACTER PARITY		
HUB	WIRED TO/FROM	PURPOSE
ODD		
C		
EVEN		

ADVANCE CHANNEL PAR.	
HUB	WIRED TO/FROM
IN	
STEP	
OUT	

SELECT CHANNEL PARITY	
HUB	WIRED TO/FROM
ODD	
C	
EVEN	

COMPUTER → I/O REGISTER		
HUB	WIRED TO	PURPOSE
A-1		INIT. I/O CYCLE
A-0		
B-1		
B-0		
C-1		
C-0		
D-1		
D-0		

MODE SELECTION	
HUB	WIRED FROM
IN-1	
IN-2	
IN-3	
OUT-1	
OUT-2	
OUT-3	

I/O → COMPUTER	
HUB	WIRED FROM
A	
B	
C	
D	

HIGH-SPEED I/O → COMP	
HUB	WIRED FROM
W	
X	
Y	
Z	

MISCELLANEOUS HUBS	
HUB	WIRED FROM
FILL	
DEL.	
REVERSE HUBS	

PUNCH INT'L'K. PURPOSE:		
NS HUB WIRED TO	C HUB WIRED FROM	S HUB WIRED TO

ALTERNATE SWITCHES				
SWITCH	PURPOSE	NS HUB WIRED TO	C HUB WIRED FROM	S HUB WIRED TO
A				
B				
C				
D				
E				
F				

PROGRAM INDICATORS	
IND.	WIRED FROM
1	
2	
3	
4	
5	
6	

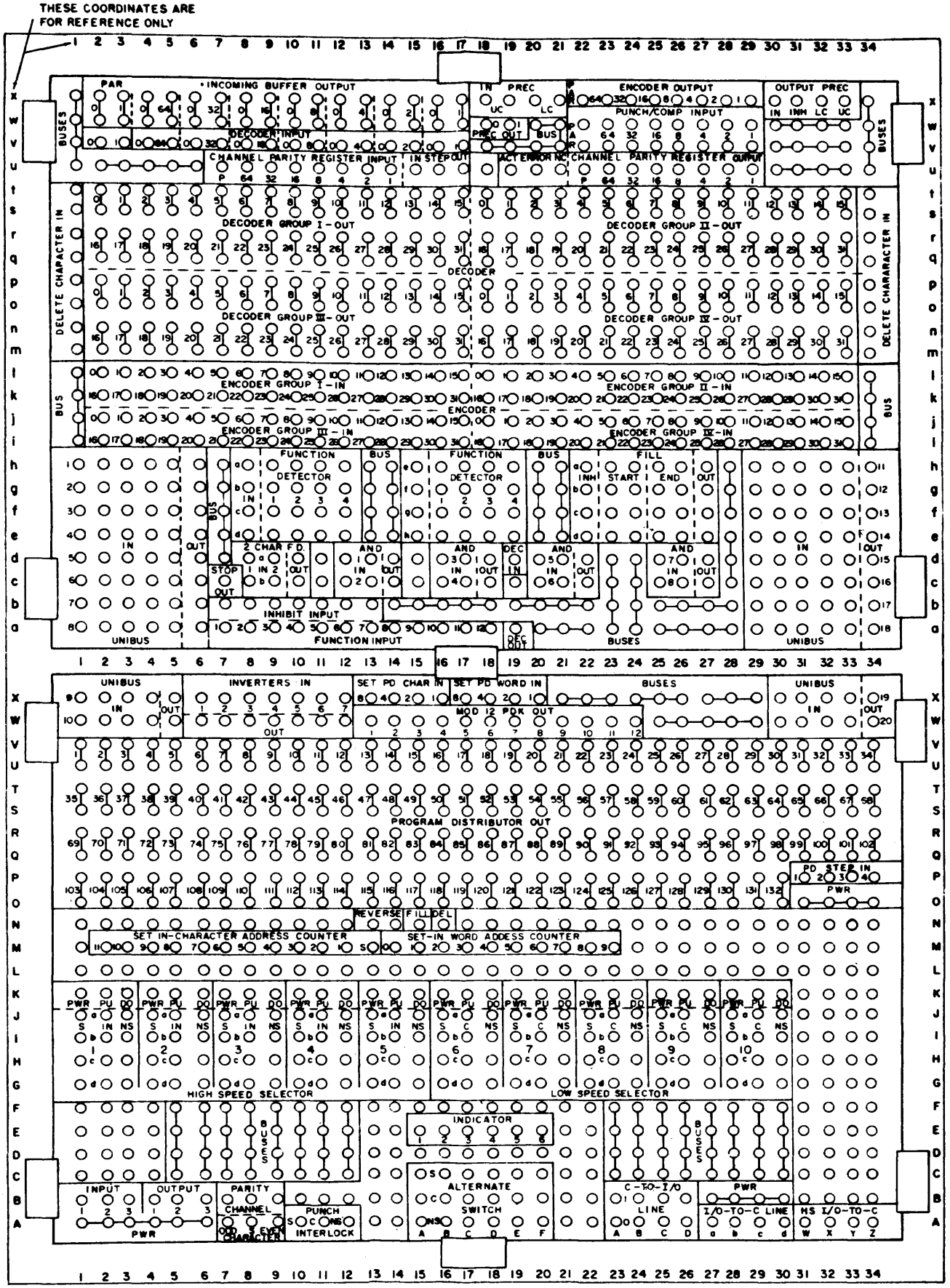
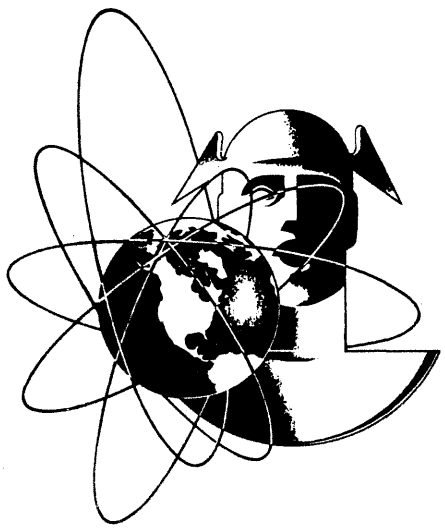


FIGURE 29. T AND FC PLUGBOARD HIGH-SPEED PAPER TAPE SYSTEM



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