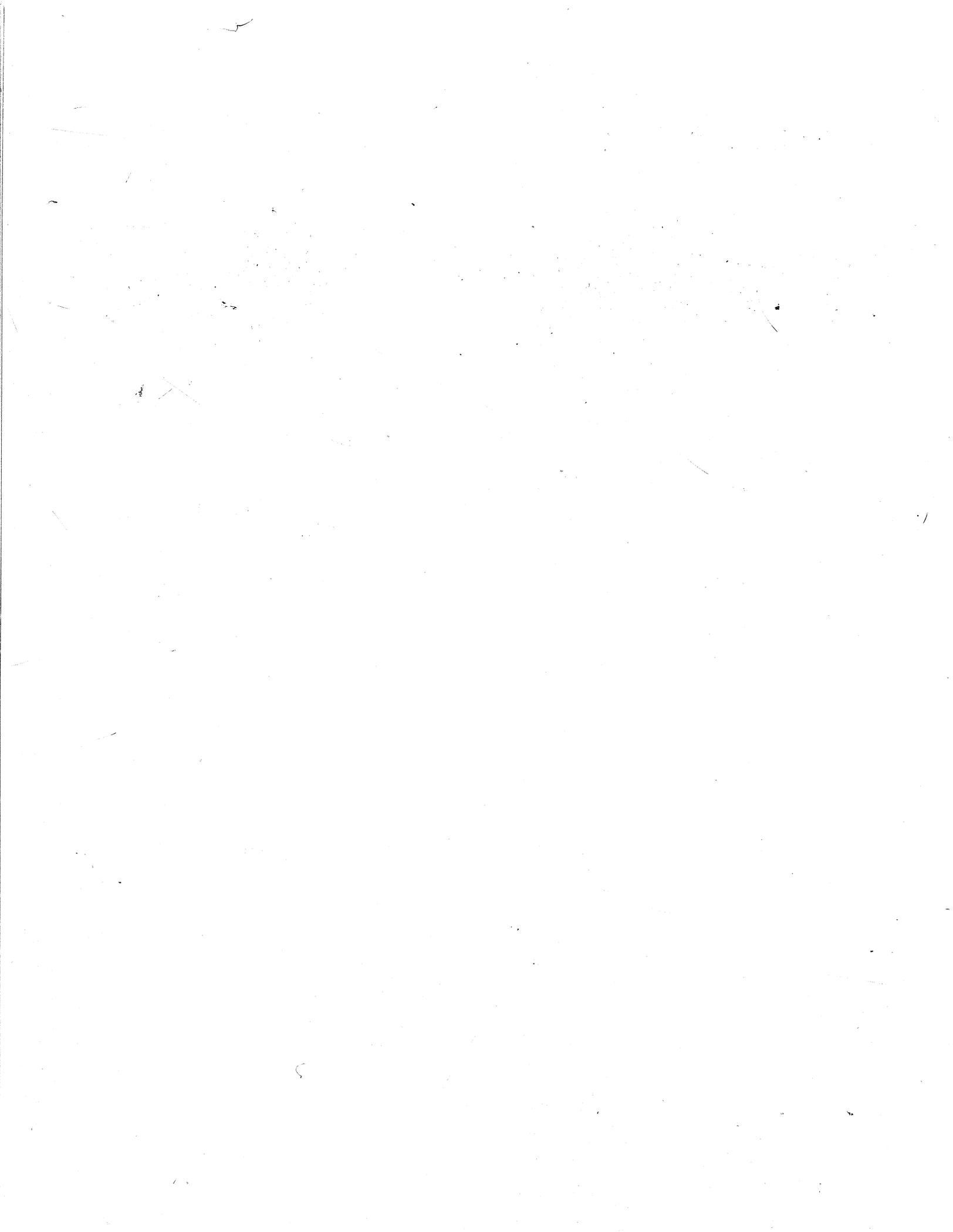


DIGITAL EQUIPMENT CORPORATION

**typeset**8  
...dedicated to the  
future of Graphic Arts

**typeset-8 systems –  
negative logic  
maintenance manual**

---



**typeset-8 systems –  
negative logic  
maintenance manual**

DEC-08-17TA-D

1st Edition February 1967  
2nd Printing October 1968  
2nd Edition August 1972

Copyright © 1967, 1968, 1972 by Digital Equipment Corporation

The material in this manual is for informational purposes and is subject to change without notice.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

DEC

FLIP CHIP

DIGITAL

PDP

FOCAL

COMPUTER LAB

# CONTENTS

	Page
<b>CHAPTER 1 INTRODUCTION</b>	
<b>CHAPTER 2 SCOPE</b>	
<b>CHAPTER 3 OPERATION</b>	
3.1 General . . . . .	3-1
3.2 Program Instructions . . . . .	3-2
<b>CHAPTER 4 THEORY OF OPERATION</b>	
4.1 Introduction . . . . .	4-1
4.2 IOT Decoder . . . . .	4-1
4.3 Tape Reader Operation . . . . .	4-2
4.3.1 PR68A High-Speed Paper-Tape Reader . . . . .	4-2
4.3.2 Reader Selection . . . . .	4-3
4.3.3 Control and Timing . . . . .	4-4
4.3.4 Tape Feeding . . . . .	4-6
4.3.5 Tape Reading . . . . .	4-6
4.3.6 Data Transfer . . . . .	4-6
4.4 Tape Punch Operation . . . . .	4-6
4.4.1 PP67A High-Speed Paper-Tape Punch . . . . .	4-6
4.4.2 PR67A Punch Control . . . . .	4-7
4.4.3 Punch Selection . . . . .	4-10
4.4.4 Control and Timing . . . . .	4-10
4.4.5 Data Transfer . . . . .	4-10
4.4.6 Motor Control . . . . .	4-12
4.4.7 Tape Punching . . . . .	4-12
4.5 PA60B Reader/Punch Control Extension . . . . .	4-14
4.6 PA60C NTTA Reader Control Unit . . . . .	4-14
4.6.1 Power Up . . . . .	4-14
4.6.2 Reader Selection . . . . .	4-14
4.6.3 Inhibit Facility . . . . .	4-17
4.7 PA68A Reader/Punch Control Unit . . . . .	4-17
4.8 PP67B High-Speed Paper-Tape Punch . . . . .	4-17
<b>CHAPTER 5 INTERFACE</b>	
<b>CHAPTER 6 MAINTENANCE</b>	
6.1 Test Equipment and Diagnostic Programs . . . . .	6-1
6.2 Preventive Maintenance . . . . .	6-3
6.3 Adjustments . . . . .	6-3
6.3.1 R401 Clock . . . . .	6-4
6.3.2 10 ms Change Reader Delay . . . . .	6-4
6.3.3 2.0 ms and 2.5 ms Delay . . . . .	6-4

## CONTENTS (Cont)

		Page
6.3.4	1 Second and 5 Second Delays . . . . .	6-5
6.3.5	PR68A High-Speed Paper-Tape Reader . . . . .	6-6
6.3.5.1	Static Adjustment . . . . .	6-6
6.3.5.2	Dynamic Adjustment . . . . .	6-11
6.3.5.3	Mixed Tape Level . . . . .	6-11
6.3.6	PP67A/B High-Speed Paper-Tape Punch . . . . .	6-12
6.3.6.1	Punch Mechanism Adjustment . . . . .	6-12
6.3.6.2	Low Tape Adjustment . . . . .	6-13

### CHAPTER 7 PARTS LIST

### CHAPTER 8 GLOSSARY OF TERMS

### CHAPTER 9 ENGINEERING DRAWINGS LIST

9.1	Semiconductor Substitution . . . . .	9-4
-----	--------------------------------------	-----

## ILLUSTRATIONS

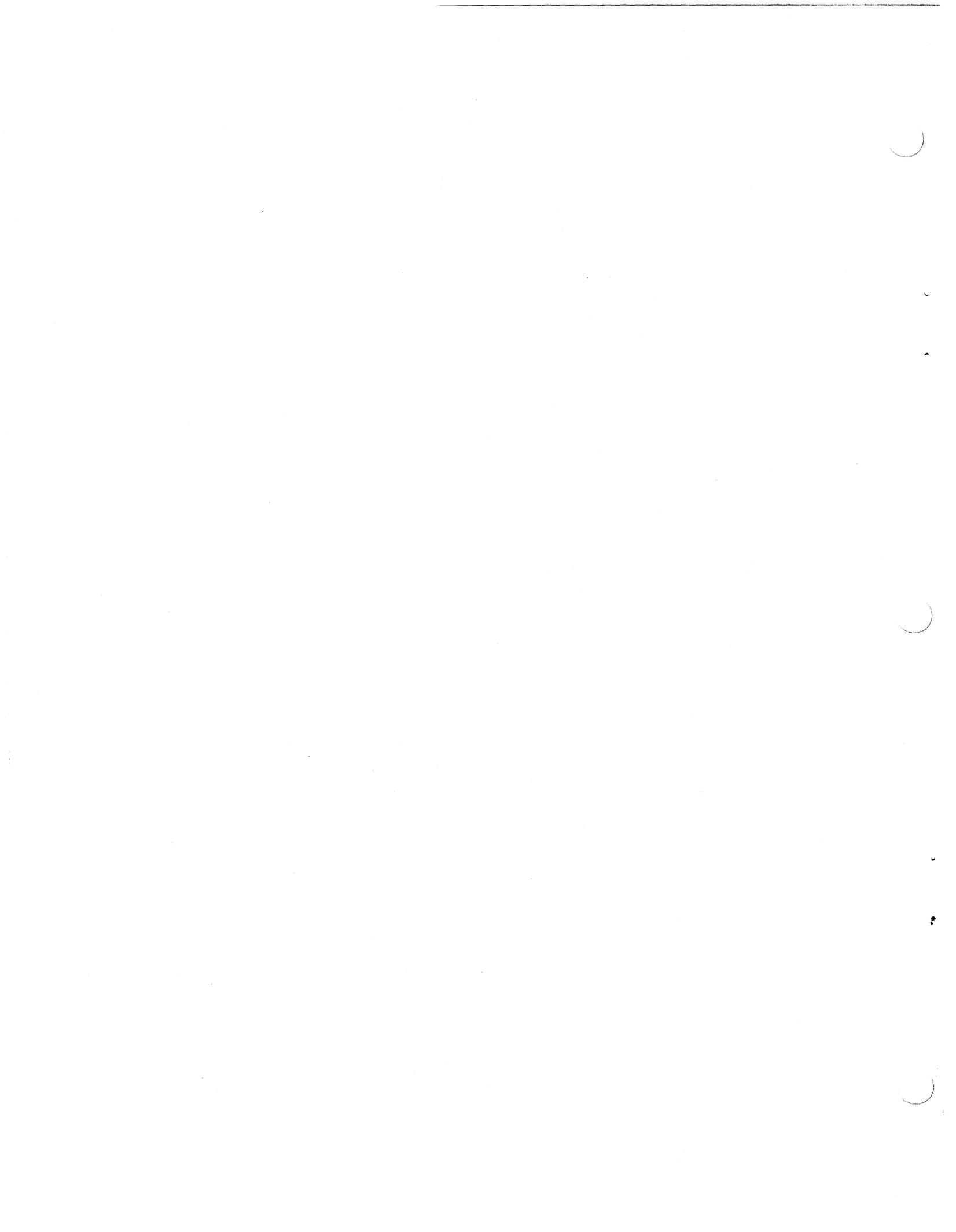
Figure No.	Title	Page
1-1	PR68A High-Speed Paper-Tape Reader . . . . .	1-1
1-2	PP67A/B High-Speed Paper-Tape Punch . . . . .	1-2
3-1	Configuration of Typeset-8 System . . . . .	3-2
3-2	Multi-Reader/Punch Configuration with NTTA Option . . . . .	3-3
3-3	Single Reader/Punch Configuration . . . . .	3-3
4-1	Tape Reader Timing Sequence, PA60A Reader/Punch Control Unit . . . . .	4-5
4-2	PP67A Paper-Tape Punch, Control Switch . . . . .	4-8
4-3	PR67A Paper-Tape Punch Control, Simplified Functional Diagram . . . . .	4-9
4-4	Tape Punch Timing Sequence, PA60A Reader/Punch Control Unit . . . . .	4-11
4-5	Punch Solenoid and Reluctance Pick-up Circuits, Simplified Diagram . . . . .	4-13
4-6	PR68A Paper-Tape Reader, Control Switch and Indicator . . . . .	4-15
4-7	Typical NTTA Logic Diagram . . . . .	4-16
4-8	Tape Reader Timing Sequence, PA68A Reader/Punch Control Unit . . . . .	4-18
4-9	Tape Punch Timing Sequence, PA68A Reader/Punch Control Unit . . . . .	4-19
5-1	Interface, PDP-8 to PA60A Reader/Punch Control Unit . . . . .	5-2
5-2	Interface, PR68A High-Speed Paper-Tape Reader to PA61A Reader/ Punch Interface Unit . . . . .	5-3
5-3	Interface, PR68A/B Paper-Tape Reader to PA61A Reader/Punch Interface Unit . . . . .	5-4
5-4	Cable Interconnection, PA60A, PA60B and PA60C to PA61A . . . . .	5-4
6-1	R401 Clock Pulse Waveform . . . . .	6-4
6-2	10 ms Change Reader Delay Waveform . . . . .	6-4
6-3	2 ms Delay, 2.5 ms Delay and Enable Punch Waveforms . . . . .	6-5
6-4	1 Second and 5 Second Delay Waveform Relationship . . . . .	6-6

## ILLUSTRATIONS (Cont)

Figure No.	Title	Page
6-5	PR68A Reader Adjustment Location . . . . .	6-7
6-6	6-Level Guide and Reader Head Adjustment . . . . .	6-8
6-7	Reader Lamp and Condensing Lens Adjustment . . . . .	6-9
6-8	Lateral Adjustment of Sprocket Wheel . . . . .	6-10
6-9	Axial Adjustment of Sprocket Wheel . . . . .	6-10
6-10	Spring Arm Adjustment . . . . .	6-10
6-11	Relationship of Reader Data Pulse and Strobe Pulse . . . . .	6-11
6-12	Punch Solenoid Waveform . . . . .	6-13

## TABLES

Table No.	Title	Page
4-1	Program Instructions . . . . .	4-2
6-1	Test Equipment and Tools . . . . .	6-1
6-2	Diagnostic Programs . . . . .	6-1
6-3	Typesetting Configuration Test Programs . . . . .	6-2
6-4	System Exerciser Overlays . . . . .	6-3
7-1	Parts List for PR68A . . . . .	7-1
7-2	Negative Logic Typesetting Hardware Spares . . . . .	7-3
9-1	Typeset-8 Systems, Negative Logic Engineering Drawings . . . . .	9-1
9-2	Semiconductor Substitution . . . . .	9-4



## CHAPTER 1 INTRODUCTION

The Typeset-8 System is a combined software-hardware system providing high-speed perforated-tape production capability to the composing room of a newspaper, book publisher, or typesetting company. The system consists of Digital Equipment Corporation's PDP-8 Computer\* equipped with a Teletype<sup>®</sup> keyboard, and up to sixteen paper-tape readers (Figure 1) and punches (Figure 2).

The system converts unjustified, unhyphenated 6- or 8-level perforated paper tape to formatted, justified paper tape. The output tape produced operates hot-metal linecasting machines or photocomposition machines.



Figure 1-1 PR68A High-Speed Paper-Tape Reader

\*Any negative bus PDP-8 may be used in the negative logic systems.

<sup>®</sup>Teletype is a registered trademark of Teletype Corporation.

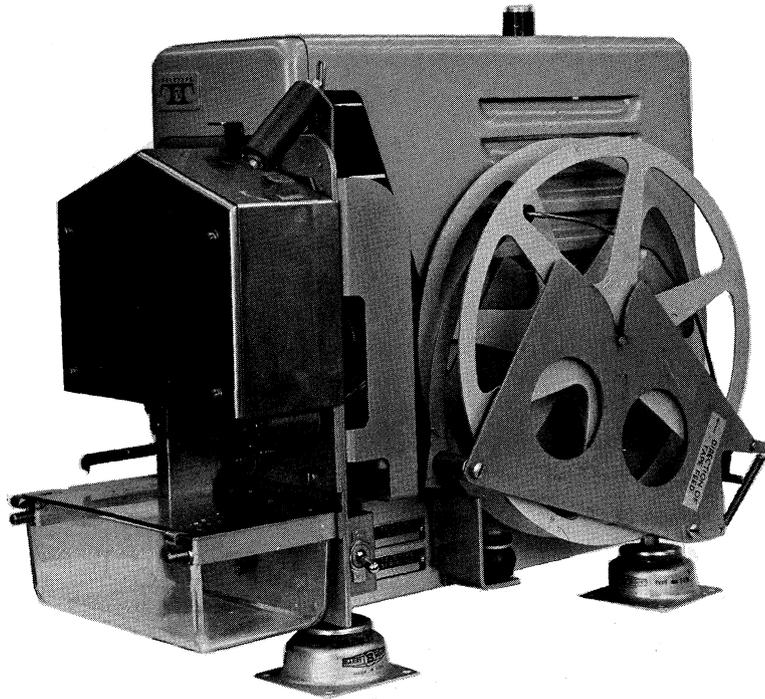


Figure 1-2 PP67A/B High-Speed Paper-Tape Punch

## CHAPTER 2

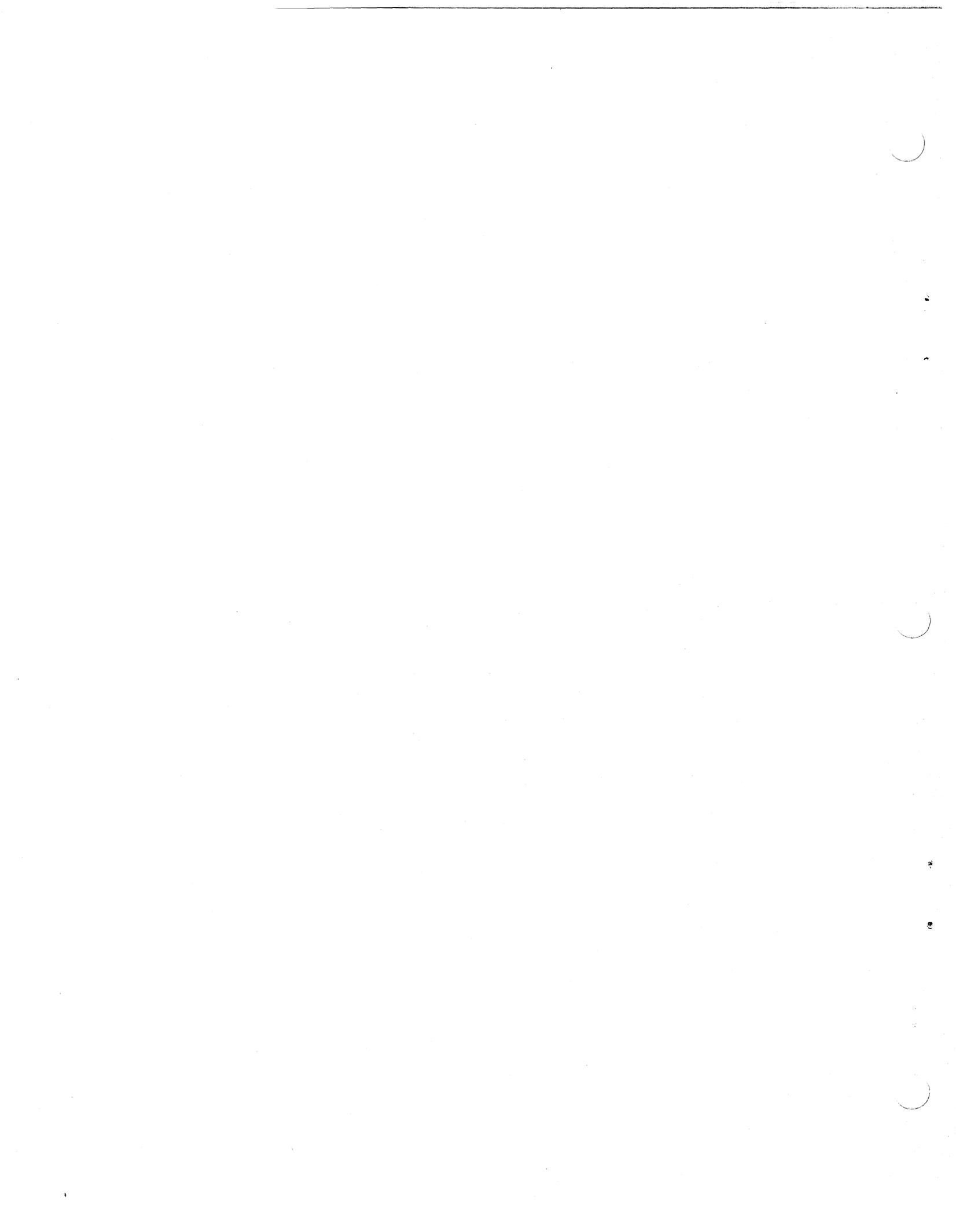
### SCOPE

This manual provides maintenance information primarily for use by DEC personnel servicing the system at customer installations. The information provided is sufficient for a technician or engineer familiar with the operation, programming, and maintenance of this general type of equipment, and presupposes a thorough understanding of DEC logic.

This text furnishes a general discussion of overall system operation, as well as a detailed logic description of portions of the system unique to typesetting operation. The major portion of this document describes operation of the logic circuits interfacing the high-speed paper-tape readers and punches with the processor, and the operation of the DEC-produced PR68A High-Speed Paper-Tape Reader. The following supplemental documents, together with this manual, cover complete documentation for this system.

- PDP-8 Maintenance Manual (F-87A), January 1971
- DEC Logic Handbook (C-105), 1968 Edition
- Small Computer Handbook (C-800), 1967–1968 Edition
- Teletype Bulletin 215B; Technical Manual, High-Speed Tape Punch Set
- Teletype Bulletin 1154B; High-Speed Tape Punch Set, Parts
- Teletype Bulletin 295B, Technical Manual Motor Units
- PDP-8S Maintenance Manual; F-87S
- DC04N Wire Service Interface Maintenance Manual; Volumes 1 and 2
- LPC-8 On-line Photocomp Interface Maintenance Manual; Volumes 1 and 2
- Typesetting Tech Tips
- PDP-8/I Maintenance Manual

This manual supersedes the preliminary *PDP-8 Basic Typesetting System Instruction Manual*, dated October 1968. The manual has been edited to remove typographical and theoretical errors found in the preliminary edition. Chapters 2 through 5 have been expanded to include new hardware. Chapter 6 has been replaced completely to reflect current Field Service maintenance philosophy and to provide accurate adjustment procedures. Chapter 7 has been revised and modified to reference the latest parts location drawings and provide the correct part numbers for ordering replacement parts. Chapter 8 has been expanded to include new terms and to omit terms which were not applicable. Chapter 9 has been completely revised and a second volume has been added to the manual to include applicable engineering drawings.



# CHAPTER 3

## OPERATION

### 3.1 GENERAL

The basic Typeset-8 System consists of the following major components, interconnected as shown in Figures 3-1, 3-2, and 3-3.

- PDP-8 Computer
- PA60A Reader/Punch Control Unit
- PA61A Reader/Punch Interface Unit
- PP67A High-Speed Paper-Tape Punches (1-4)
- PR68A High-Speed Paper-Tape Readers (1-4)
- PDP-8/I Computer
- PDP-8/S Computer
- PA60B Reader/Punch Control Extension
- PA60C NTTA Reader Control Unit
- PP67B High-Speed Paper-Tape Punch

The addition of a second PA61A Reader/Punch Interface Unit permits system operation with four additional sets of paper-tape readers and punches, for a total of eight of each.

The basic PDP-8 contains a 4096 12-bit word ferrite-core memory. The memory serves as an operating area where input data from the unjustified tape is stored and assembled into justified lines. Portions of the memory are also set aside as storage for program instructions, and as a hyphenating dictionary. Expanded memory options are available, to permit the storage of larger dictionaries, if desired.

A system tape (6-level binary perforated-paper tape) loads this data into memory prior to system use. The system tape also furnishes a glossary of the specific control codes used by the operator to specify the desired type style, type size, column indentions, line length, and special formatting instructions.

A RIM (Readin Mode) program is set into the processor through the PDP-8 control panel toggle switches. This program loads the system tape. The 6-level RIM Loader is described, in full, later in this chapter.

Loading the RIM Loader and, subsequently, the system tape prepares the typesetting system to process input tapes. Operators using keyboard-controlled paper-tape perforators generate input tapes, also called unjustified, unhyphenated tapes, from final copy.

The input tape contains the material to be printed punched in 6- or 8-level codes, without regard for line endings or hyphenations. The operator punches the initial portion of the input tape with control codes, which notify the PDP-8 of the typeface, type size, and column indentation required for the material which follows. The operator then punches the material to be printed into the tape without regard for line endings.

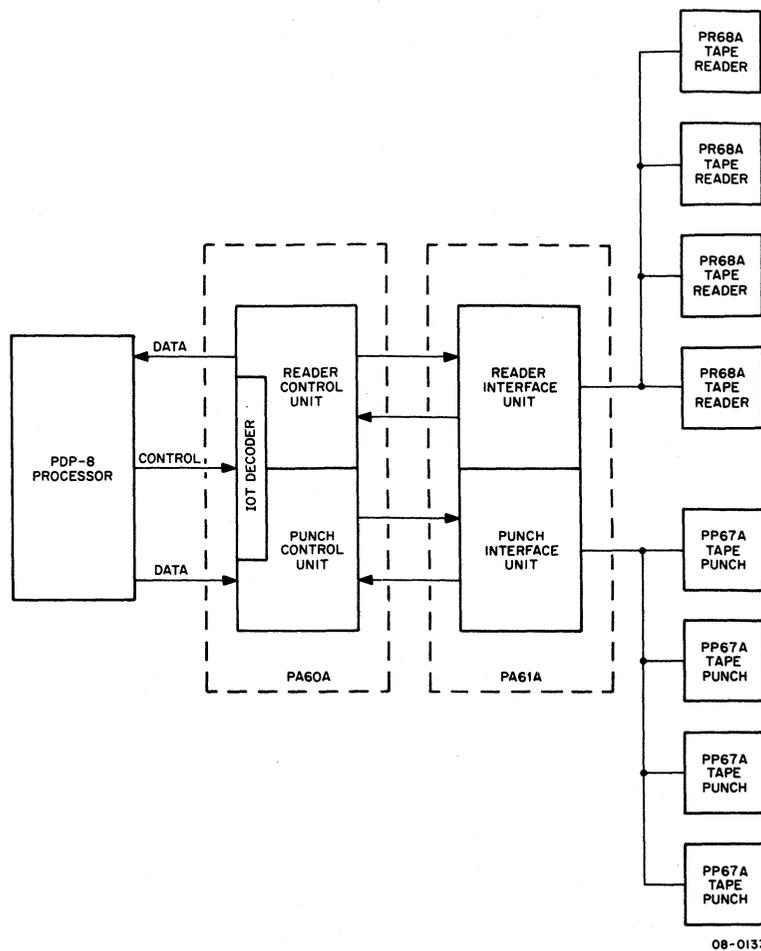


Figure 3-1 Configuration of Typeset-8 System

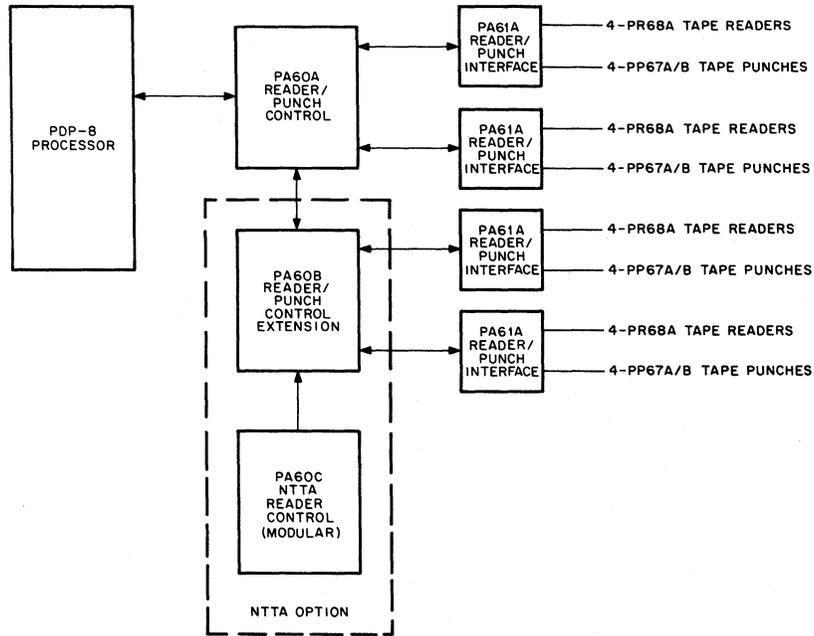
Upon completion of punching, the input tape is loaded into the PR68A Paper-Tape Reader. When the tape spring is lowered, tape reading commences. The PDP-8 senses a READER FLAG output and starts the data transfer process.

The processor assembles the material into lines, as specified by the line-length codes, determines the line-end point, hyphenates and/or inserts additional space codes between words and, if necessary, between letters, and retransmits the data to a PP67A/B Paper-Tape Punch. This process produces an output tape used by hot-metal linecasting or photocomposition machines.

The system simultaneously reads and punches tapes at a rate of 110 characters per second. This provides a throughput corresponding to approximately 12,000 lines per hour.

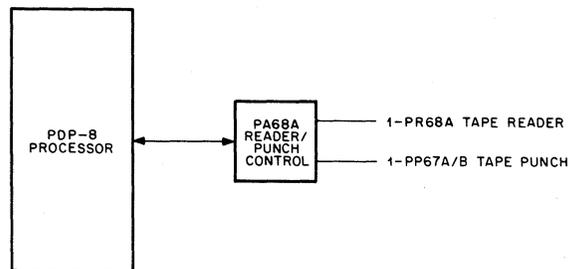
### 3.2 PROGRAM INSTRUCTIONS

The RIM Loader program listing provided in this paragraph is sufficiently detailed to permit its use with any system. The system tape differs in each installation, however, because of format and type style differences. For this reason, the customer's own system tape must be used.



08-0770

Figure 3-2 Multi-Reader/Punch Configuration with NTTA Option



08-0754

Figure 3-3 Single Reader/Punch Configuration

The system tape contains all information needed by the processor to translate unjustified, unhyphenated tapes into justified, hyphenated, formatted tapes. This information includes format codes, type style and size codes, special instruction codes, a hyphenating dictionary, and a set of hyphenating rules for use if the word ending the line is not in the dictionary.

Before the information contained in the perforated system tape can be used by the PDP-8, however, it must be loaded into the proper PDP-8 memory locations. This task is performed by the RIM loader. The RIM Loader is a short program toggled into the processor through the switches and controls located on the PDP-8 control panel. The following table shows the RIM Loader and its method of insertion into the PDP-8.

## RIM LOADER

S.A. = 7770

Memory Address	Instruction
7757	6014
7760	6011
7761	5360
7762	7106
7763	7106
7764	6012
7765	7420
7766	5357
7767	5756
7770	4356
7771	3373
7772	4356

Entering the RIM Loader permits loading of the instructions punched in the system tape into memory through the tape reader. The starting point of the RIM Loader is then entered into the program counter, and the START key of the processor is actuated. This feeds the entire system tape into the processor memory and prepares the system for processing input tapes.

# CHAPTER 4

## THEORY OF OPERATION

### 4.1 INTRODUCTION

This chapter contains detailed information on the theory of operation of the Typeset-8 hardware produced by DEC. Teletype Bulletins 215B and 1154B provide this data for the PP67A/B High-Speed Paper-Tape Punch.

The information presented in this chapter attempts to ensure the full understanding, by DEC-trained maintenance personnel, of all operational characteristics of the system. This permits on-site maintenance of typesetting systems by maintenance personnel, who, although qualified to service the PDP-8 itself, have not been formally trained in the operation, theory, and maintenance procedure of the PDP-8 in its typesetting configuration.

The engineering drawings referenced in Chapter 9 represent the system configuration as it existed at the time of writing. Electronic systems such as this one, are subject to continuing programs of change, however, for the sake of improving operation and satisfying particular customer requirements. The Typeset-8 System is no exception. For this reason, the engineering drawings and detailed operational discussions provided in this manual provide only a guide to understanding the operation of this type of system. For actual troubleshooting of an installed system, the DEC drawings provided for that purpose with the system must be used exclusively.

This chapter is divided into three major parts: IOT Decoder, Tape Reader Operation, and Tape Punch Operation. The IOT decoder section describes the operation of this portion of the system in terms of its generation of operational pulses used elsewhere in the control circuitry. The sections pertaining to tape reader and punch operation are oriented functionally, in that the presentation of data conforms to the operational sequence of the system. This permits direct reference to areas of immediate interest. For instance, if a tape-feeding problem occurs in the tape reader, the individual concerned with maintenance need not know which portion of the circuitry controls this function. The paragraph on tape feeding in the tape reader section provides this information along with a full description of the operation of the circuit, including drawing references.

### 4.2 IOT DECODER

The IOT decoder, shown in DEC drawing BS-D-PA60-A-3, performs the basic reader/punch addressing function. When properly addressed, these circuits admit IOP pulses, generated in the PDP-8, for translation into IOT pulses used within the reader and punch control circuits.

The IOT decoder connects to the bit 3 through bit 8 memory buffer (MB) outputs of the PDP-8 through W028 Connectors at B3 and B4, shown on the lower left of drawing BS-D-PA60-A-3. These inputs parallel-connect to three W103 Device Selectors at AB7, AB8, and AB9. The 6-bit binary code configuration representing the number 01 ( $000001_2$ ) activates the inverter gate of AB7 W103 Device Selector through the input diode gate of the selector. The receipt of the 6-bit binary code configuration representing the numbers 31 ( $011111_2$ ) and 02 ( $000010_2$ ), respectively, activates the two remaining device selectors (AB8 and AB9).

Each device selector contains three pulse amplifiers (PAs) with inverter-controlled inputs. Activation of a device selector by its particular code configuration enables the inputs of these inverters, permitting the passage of IOP pulses through pins K, M, and P of the W028 Connector at B2 from the PDP-8.

Each of the three device selectors generates a particular group of IOT pulses used by the control circuits. The PDP-8, under program control, determines which of the device selectors is to be activated. When activated, the W103 Device Selector at AB7 generates IOT011, 012, and 014 pulses to control operation of the PR68A Paper-Tape Readers. The device selector at AB8, when activated, generates IOT311, 312, and 314 pulses to control the selection of the particular reader or punch desired. The device selector at AB9 generates IOT021, 022, and 024 pulses to control operation of the PP67A/B Paper-Tape Punches.

Table 4-1 shows the applicable program instructions, their mnemonic codes, and the IOT pulses generated and their functions for each of the three device selectors.

All IOT pulses generated in the IOT decoder are transmitted to the reader and punch control circuits for further use.

**Table 4-1**  
**Program Instructions**

Mnemonic	Instruction	IOT Pulse	Function
RSF	6011	IOT011	Skip if Reader Flag is 1
RRB	6012	IOT012	Read Reader Buffer and Clear Reader Flag
RFC	6014	IOT014	Clear Flag and Buffer, Fetch and Load Character
SKNPA	6311	IOT311	Skip on Punch Not Available
RSC	6312	IOT312	Clear and Load Reader Selector
PSC	6314	IOT314	Clear and Load Punch Selector
PSF	6021	IOT021	Skip if Punch Flag is 1
PCF	6022	IOT022	Clear Punch Buffer and Clear Punch Flag
PPC	6024	IOT024	Load Punch Buffer and Punch Character
PLS	6026	IOT022/024	Clear and Load Punch Buffer, Clear Punch Flag and Punch Character

### 4.3 TAPE READER OPERATION

#### 4.3.1 PR68A High-Speed Paper-Tape Reader

The PR68A Paper-Tape Reader performs the basic functions of feeding and reading perforated 6- or 8-channel paper tape. The tape-reading function is performed by a photoelectric read head, containing nine light-sensitive semiconductors, and by associated amplifier circuits. A tape-drive sprocket, rotated by a 4-pole, dc-operated synchronous motor, performs the tape-feeding function. Pins on this wheel engage feed holes in the tape to transport the tape past the read station. High-current drive pulses, generated by solenoid drivers in the reader interface unit, produce the required torque in the motor.

Two switch-tail-connected flip-flops (A and B) in the PA60A Reader/Punch Control Unit provide the pair-sequential triggering outputs controlling the solenoid drivers. Four feed cycles are required to move the tape a distance equal to one character position. Switching the activation of the solenoid pairs at 2.3 ms intervals produces a tape-feeding rate of 110 characters per second.

The photoelectric tape reader consists of a light source, a photovoltaic read head, and amplifier circuits for the photocell outputs. The read head, located below the tape, contains nine photovoltaic cells physically arranged to sense or read perforations in the eight data tracks or channels of the tape and in the tape feed-hold track. The light source is directly above the photocells.

Light passing through a hole in the tape activates an appropriate photocell. A photoamplifier produces a  $-3V$  output for transmission to the PA61A Reader/Punch Interface Unit. The reader control and reader interface circuits control the transmission of the data read from the tape. The tape position is determined by monitoring the states of the A and B flip-flops.

The outputs of the tape-reading photocells change between the light and no-light conditions. Nine photoamplifier circuits, located on two G900 modules in the tape reader, continuously monitor the outputs of the photocells. The amplifiers generate a 0V output level when a hole is sensed, and a  $-3V$  output level when no hole is sensed.

DEC drawing CS-B-G900-0-1 shows the circuit configuration of the photoamplifier. The channel 3 circuit, consisting of transistors Q1 and Q3, is used for the purpose of this discussion.

With the photocell in the "no hole" condition, the voltage drop across R6 permits Q1 to conduct. The conducting current through the Q1 collector develops sufficient voltage across R7 ( $10\text{ k}\Omega$ ) to hold Q3 cut off. With Q3 cut off, D3 clamps terminal N to  $-3V$ .

When the photocell senses light, the current flow across R6 increases, applying a more positive voltage to the base of Q1. This cuts off Q1, permitting the voltage at its collector to revert to the level preset by the R1 trimpot. This level, which determines the sensitivity of the amplifier, drives Q3 into conduction. With Q3 conducting, D3 is cut off, and a 0V level is applied to terminal N.

In summary, a hole in a tape channel generates a 0V level at its particular output terminal of the G900 Photo-amplifier Module. The lack of a hole in a tape channel generates a  $-3V$  level at its particular output terminal on the corresponding G900.

#### NOTE

**A new amplifier circuit can be obtained for every channel except 1 and 5 by interchanging the G900 modules. This is possible because different amplifier circuits are used on each module.**

#### 4.3.2 Reader Selection

The reader control unit, shown in DEC drawing BS-D-PA60-A-2, controls all phases of tape reader operation, including the implementation of reader selection, tape feeding, and data transfer both from the reader and to the accumulator of the PDP-8. The PDP-8 controls reader selection.

In the select mode, under program control, accumulator bits 9 through 11 contain the 3-bit binary equivalent of any one of eight tape readers from which data is desired. These three bits of the accumulator connect to the reader control through pins D, E, and H of the W028 Connector at A2.

The select register receives both positive and negative IOT312 pulses generated in the IOT decoder. The positive-going IOT312 pulse clears the select register. The positive transition of the negative-going IOT312 pulse transfers the desired accumulator bits into the select register.

The outputs of the register produce a single ground level select signal from the decoder. The particular output activated determines which of eight readers is selected for operation. The ground level output of the decoder activates one of eight inverter-drivers. The activated driver generates a -3V SELECT READER level for transmission to a PA61A Reader/Punch Interface Unit. If a reader in the group consisting of readers 1 through 4 is selected, the -3V level is transmitted through the W991 Connector at AB31. If the selected reader is in the group consisting of readers 5 through 8, however, the -3V level is transmitted through the W991 Connector at AB32.

#### NOTE

If the system in use contains from one to four tape readers, only one PA61A Reader/Punch Interface Unit is provided. It interfaces with the control unit through the W991 Connector at AB31. The output circuits of the control unit are configured, however, for a system containing eight tape readers. This facilitates system expansion at a later date. All tape readers assigned to a particular system must be connected, however, to ensure proper system operation.

System POWER CLEAR pulses, generated by the PDP-8, both at turn-on and when the START key is operated, are inverted from their -3V level to 0V, and activate R602 PA at A22. The ground level output pulses of the PA clear the select register.

#### 4.3.3 Control and Timing

POWER CLEAR pulses, generated both at power turn-on in the PDP-8 and when the START key is actuated, perform three functions in the reader control unit (Figure 4-1). They clear the reader select buffer, activate the change reader unit 10-ms delay, and clear the RUN flip-flop.

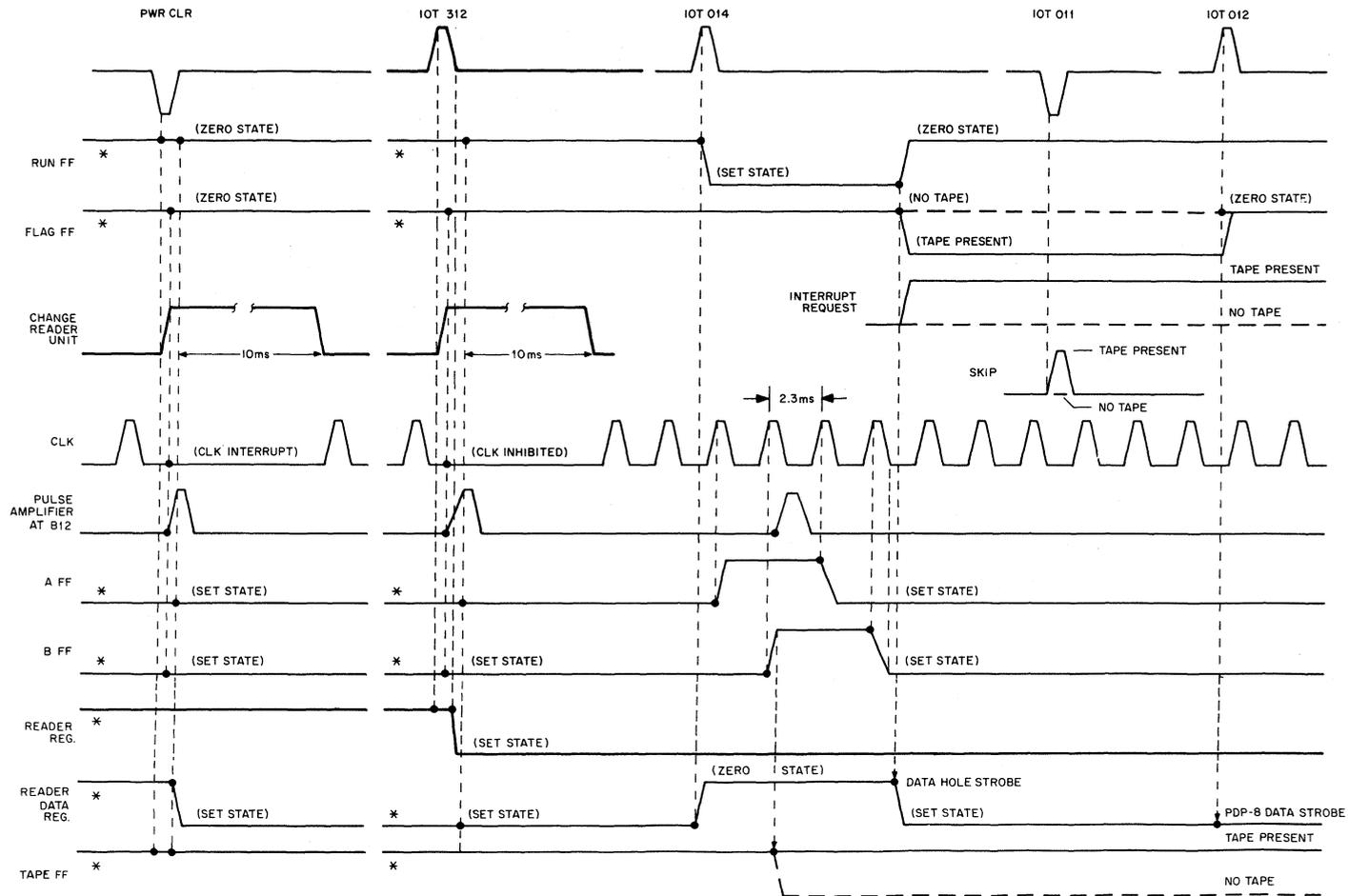
The 0V change reader unit (1) output disables the 2.3-ms clock, clears the FLAG flip-flop, sets the B flip-flop to the 1 state, and activates the pulse amplifier at A22. The output of this pulse amplifier assures that the RUN flip-flop is cleared and sets the A flip-flop to the 1 state. The 0V RUN (0) output then holds the A flip-flop in the 1 state.

The change reader unit delay times out in 10 ms, applying the -3V activating level to the reader clock. If, at this time, a 6014 program instruction is implemented in the processor, the RUN flip-flop is in the set (1) state, permitting the A and B flip-flops to react to the clock output. This starts the tape-feeding sequence.

Upon the completion of one full cycle of the A/B flip-flops, signified by the next 0-to-1 transition of the B flip-flop, the 0V B (1) output is applied to the DCD (diode-capacitor-diode) gate input of the A22 pulse amplifier. The 0V RUN (1) level enables this DCD gate. The output of this pulse amplifier strobes data into the reader buffer, output clears the RUN flip-flop, direct clears the FEED HOLE SEEN (no tape) flip-flop, and attempts to set the FLAG flip-flop. If the FEED HOLE SEEN flip-flop is not set by the appearance of a feed-hole output, the FLAG flip-flop is set, activating the INTERRUPT output and half-enabling the SKIP output.

The feed-hold output of the G900 module is gated into the set input of the FEED HOLE SEEN (no tape) flip-flop at a time (A = 0, B = 0), when no feed-hole output is available. Its appearance, therefore, indicates that tape is not present in the selected reader. The lack of tape, accordingly, sets the FEED HOLE SEEN (no tape) flip-flop, preventing the setting of the flag. The lack of a -3V FLAG (1) output prevents the setting of both the INTERRUPT REQUEST and SKIP outputs.

This permits the processor to select another reader and, through the generation of an IOT312 pulse, activate the change reader unit delay to restart the reader operation sequence.



## NOTES:

1. NO HORIZONTAL SCALE - DASHED LINES CONNECT END OF TRANSITION CAUSING CHANGE TO DOTTED WAVE FORM BEING CHANGED. NO CHANGE IS SHOWN IF WAVEFORM IS CORRECT.
2. \* - EITHER STATE OF FF POSSIBLE BEFORE SET OR CLEAR PULSE.
3. † - STROBES
4. VERTICAL SCALE - 0V AND -3V LEVELS REPRESENTED, WITH 0V UP.

Figure 4-1 Tape Reader Timing Sequence, PA60A Reader/Punch Control Unit

#### 4.3.4 Tape Feeding

The SELECT READER output from the W991 Connector at AB31 enables the desired pair of solenoid drivers in the interface unit. For example, if the reader buffer receives the code to select Reader 1, a -3V level half-enables the B3 and B4 W040 Solenoid Drivers in the interface. The outputs of the A/B flip-flops provide the second required half-enabled inputs to the solenoid drivers.

The drivers are sequentially actuated in pairs to provide drive current to the stepping motor tape drive. Their outputs exit the interface and activate the coils of the synchronous dc stepping motor.

#### 4.3.5 Tape Reading

The SELECT READER level half-enables the associated R141 gate inputs. The second half-enable inputs are supplied by the amplified outputs of each of the nine photodiodes (8 data, 1 feed hole) when no hole is sensed.

##### NOTE

In systems that use 6-channel, advanced-feed-hole tape, channels 7 and 8 (holes 6 and 7) are disabled. These channels are disabled on the PA60A by jumpering pins D and E in slot A25. On the PA68A, these channels are disabled by grounding pins F and M in slot B13.

For example, the SELECT READER 1 -3V output level half-enables the two-input EF NAND gate of NOR R141 at A3. When no hole is sensed at channel 0, a -3V level from the G900 module fulfills the NAND gate through pin D of the W990 Connector at A1. This produces a 0V output from R141. The sensing of a hole in channel 0 produces a 0V output from the photocell amplifier, which disables the EF NAND gate input or R141. This produces a -3V output from R141 during the time the hole is sensed. This -3V output is transmitted to the reader control for storage and subsequent transfer to the PDP-8.

#### 4.3.6 Data Transfer

The W991 Connector at AB31 couples the outputs of the R141 gate, previously described, to the level inputs of the reader buffer. A positive-going transition from R602 PA at A22 strobes the data into the reader buffer.

The sensing of a hole in the tape generates a -3V level at the level input of its respective DCD gate. This -3V level prevents the enabling of the gate, ensuring that each READER BUFFER flip-flop, which is to contain a true bit (hole in tape), remains in the clear state previously produced by the receipt of the IOT014 pulse.

Each flip-flop in the reader buffer containing a true bit applies a -3V half-enable level to its respective inverter gate. The second half-enable input to all of the inverter gates is supplied by the IOT012 pulse.

Upon the receipt of the IOT012 pulse, each gate, which has been half-enabled by the reader buffer outputs, transmits a ground level output to the PDP-8 accumulator.

### 4.4 TAPE PUNCH OPERATION

#### 4.4.1 PP67A High-Speed Paper-Tape Punch

Teletype Bulletins 215B and 1154B contain all required maintenance information on the tape punch. This paragraph, therefore, furnishes information only on the logic operation of the punch control and interface circuits.

The BRPE-18 is a 6-level punch originally built to operate at 50 characters per second and modified by DEC to operate at 110 characters per second. The addition of a DEC assembly (part no. 70-5095, control assembly) converts the punch to a PP67A.

On top of the punch is a four position switch (Figure 4-2). The four positions have the following significance:

**AVAILABLE** – In this position, the switching on or off of the punch motor is under processor control. On the side of the punch is an adjustable microswitch operated by an arm which rests on the tape spool. When the spool is reduced to a certain diameter (TAPE LOW), dependent on the setting of the microswitch, the arm operates the microswitch and signals a PUNCH NOT AVAILABLE condition which can be gated into the processor using an IOT instruction.

**STOP WHEN DONE** – In this position it simulates a TAPE LOW condition. Since the typesetting program only checks for availability before starting to punch, it would be possible to commence a “take” punch out just before the tape low condition and then run out of tape, if the “take” was a long one. If a monitor should notice that this condition may occur shortly, he can switch the punch from AVAILABLE to STOP WHEN DONE *while a tape is being punched*, which would allow the “take” to be finished, but then prevent any further “takes” from being routed to this punch.

**CONTINUOUS** – In this position, the punch motor is turned *on* but the punch is inhibited from processor control; PUNCH NOT AVAILABLE condition is signaled.

**OFF** – In this condition, the punch motor is turned *off* and the PUNCH NOT AVAILABLE condition is signaled.

#### NOTE

On the side of the punch is a toggle switch that can be used to switch on the motor, irrespective of the position of the switch on the top of the punch. This switch is for maintenance purposes only; it is recommended that the customer be advised to use the switch on top of the punch when replacing tape in the punch since, if the switch is left in the AVAILABLE position, a “take” could still be routed to the punch and lost if the customer is in the process of changing tape.

#### 4.4.2 PR67A Punch Control

The PR67A Punch Control circuits are mounted on the chassis of the Teletype BRPE-18 Punch. These circuits provide the interfacing point between the punch mechanism and the control logic circuits. DEC drawing D-CS-7005095-0-1 shows these circuits. As shown in the drawing, only punch status and motor control signals are processed in these circuits. Drive current to the punch solenoids is coupled to the punch independently.

A simplified diagram of the control circuit is shown in Figure 4-3.

Point A, the junction of R3, R4 is at  $-3V$ . Assuming that the switch is in the AVAILABLE position, before the MOTOR START signal is sent to the punch, point B is also at  $-3V$ ; hence, the transistor is cut off and there is no voltage drop applied across the wheelock relay. The SCR in the motor circuit has no control voltage applied to it and is, therefore, turned “off”. When a MOTOR START signal is sent to the punch, point B goes to ground, the transistor turns on and the wheelock relay operates, closing point D. As the first half-cycle of the 110V supply builds up across R1/R2, a voltage develops at point C, which is applied as a control voltage to the SCR. The SCR turns “on” and current flows in the motor circuit driving the motor. As the first half-cycle finishes, the anode voltage of the SCR reduces to 0; hence, the SCR turns off, but the second half-cycle again develops a control voltage at point C and, hence, the SCR turns on again. Thus, while the wheelock switch is operated, the motor runs. When the MOTOR START signal is removed, the transistor cuts off, the wheelock switch opens and, hence, no further control voltage can be applied to the SCR. The SCR, therefore, turns off and remains off until the next MOTOR START signal is applied.

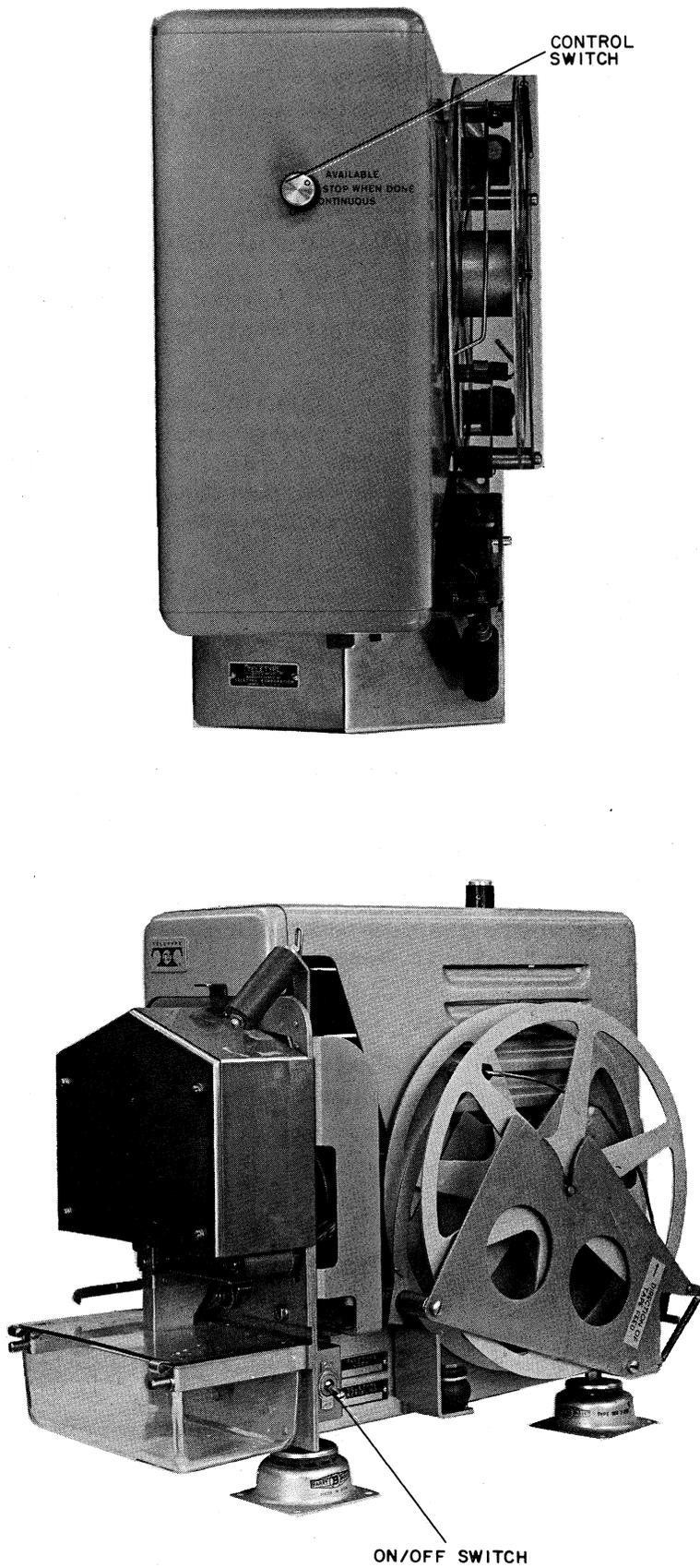


Figure 4-2 PP67A Paper-Tape Punch, Control Switch

The BRPE-18 is a 6-level punch originally built to operate at 50 characters per second and modified by DEC to operate at 110 characters per second. The addition of a DEC assembly (part no. 70-5095, control assembly) converts the punch to a PP67A.

On top of the punch is a four position switch (Figure 4-2). The four positions have the following significance:

**AVAILABLE** – In this position, the switching on or off of the punch motor is under processor control. On the side of the punch is an adjustable microswitch operated by an arm which rests on the tape spool. When the spool is reduced to a certain diameter (TAPE LOW), dependent on the setting of the microswitch, the arm operates the microswitch and signals a PUNCH NOT AVAILABLE condition which can be gated into the processor using an IOT instruction.

**STOP WHEN DONE** – In this position it simulates a TAPE LOW condition. Since the typesetting program only checks for availability before starting to punch, it would be possible to commence a “take” punch out just before the tape low condition and then run out of tape, if the “take” was a long one. If a monitor should notice that this condition may occur shortly, he can switch the punch from AVAILABLE to STOP WHEN DONE *while a tape is being punched*, which would allow the “take” to be finished, but then prevent any further “takes” from being routed to this punch.

**CONTINUOUS** – In this position, the punch motor is turned *on* but the punch is inhibited from processor control; PUNCH NOT AVAILABLE condition is signaled.

**OFF** – In this condition, the punch motor is turned *off* and the PUNCH NOT AVAILABLE condition is signaled.

#### NOTE

On the side of the punch is a toggle switch that can be used to switch on the motor, irrespective of the position of the switch on the top of the punch. This switch is for maintenance purposes only; it is recommended that the customer be advised to use the switch on top of the punch when replacing tape in the punch since, if the switch is left in the AVAILABLE position, a “take” could still be routed to the punch and lost if the customer is in the process of changing tape.

#### 4.4.2 PR67A Punch Control

The PR67A Punch Control circuits are mounted on the chassis of the Teletype BRPE-18 Punch. These circuits provide the interfacing point between the punch mechanism and the control logic circuits. DEC drawing D-CS-7005095-0-1 shows these circuits. As shown in the drawing, only punch status and motor control signals are processed in these circuits. Drive current to the punch solenoids is coupled to the punch independently.

A simplified diagram of the control circuit is shown in Figure 4-3.

Point A, the junction of R3, R4 is at  $-3V$ . Assuming that the switch is in the AVAILABLE position, before the MOTOR START signal is sent to the punch, point B is also at  $-3V$ ; hence, the transistor is cut off and there is no voltage drop applied across the wheelock relay. The SCR in the motor circuit has no control voltage applied to it and is, therefore, turned “off”. When a MOTOR START signal is sent to the punch, point B goes to ground, the transistor turns on and the wheelock relay operates, closing point D. As the first half-cycle of the 110V supply builds up across R1/R2, a voltage develops at point C, which is applied as a control voltage to the SCR. The SCR turns “on” and current flows in the motor circuit driving the motor. As the first half-cycle finishes, the anode voltage of the SCR reduces to 0; hence, the SCR turns off, but the second half-cycle again develops a control voltage at point C and, hence, the SCR turns on again. Thus, while the wheelock switch is operated, the motor runs. When the MOTOR START signal is removed, the transistor cuts off, the wheelock switch opens and, hence, no further control voltage can be applied to the SCR. The SCR, therefore, turns off and remains off until the next MOTOR START signal is applied.

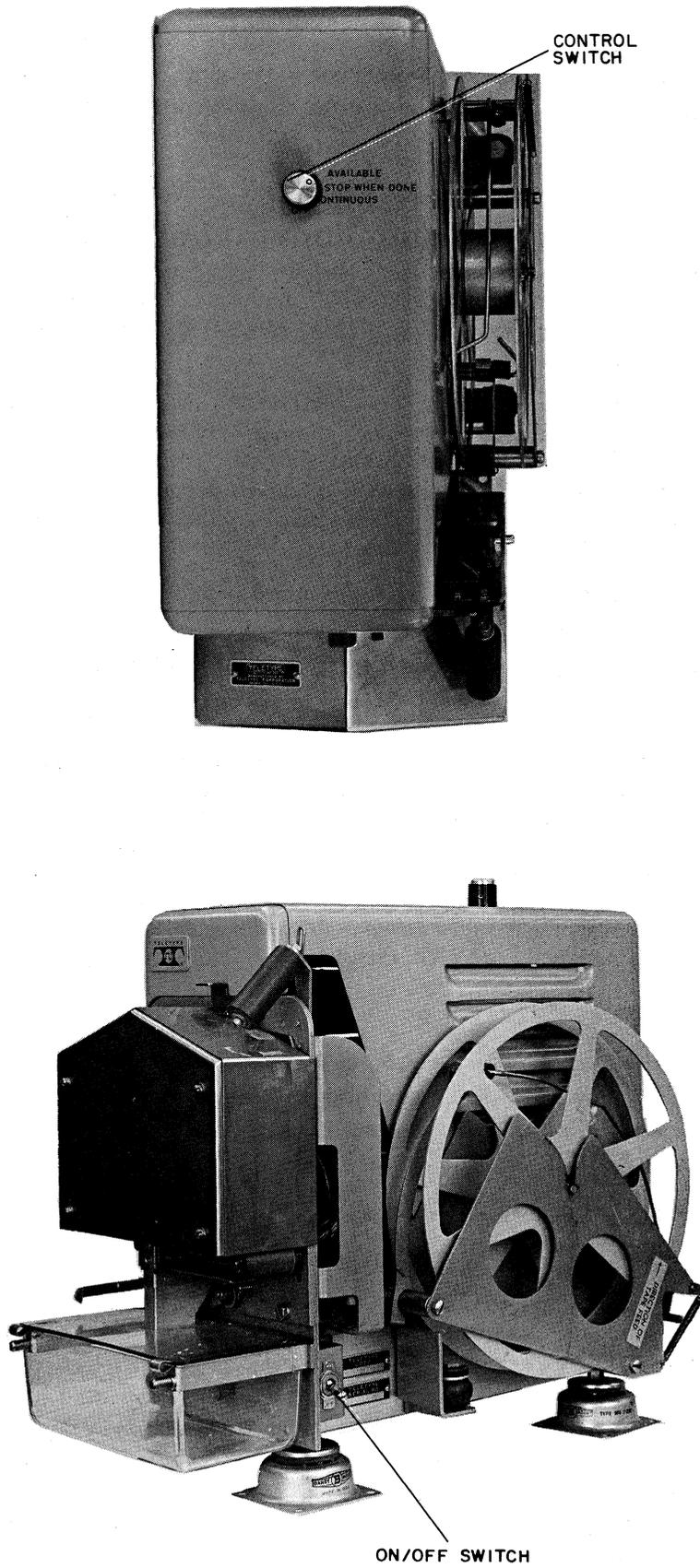
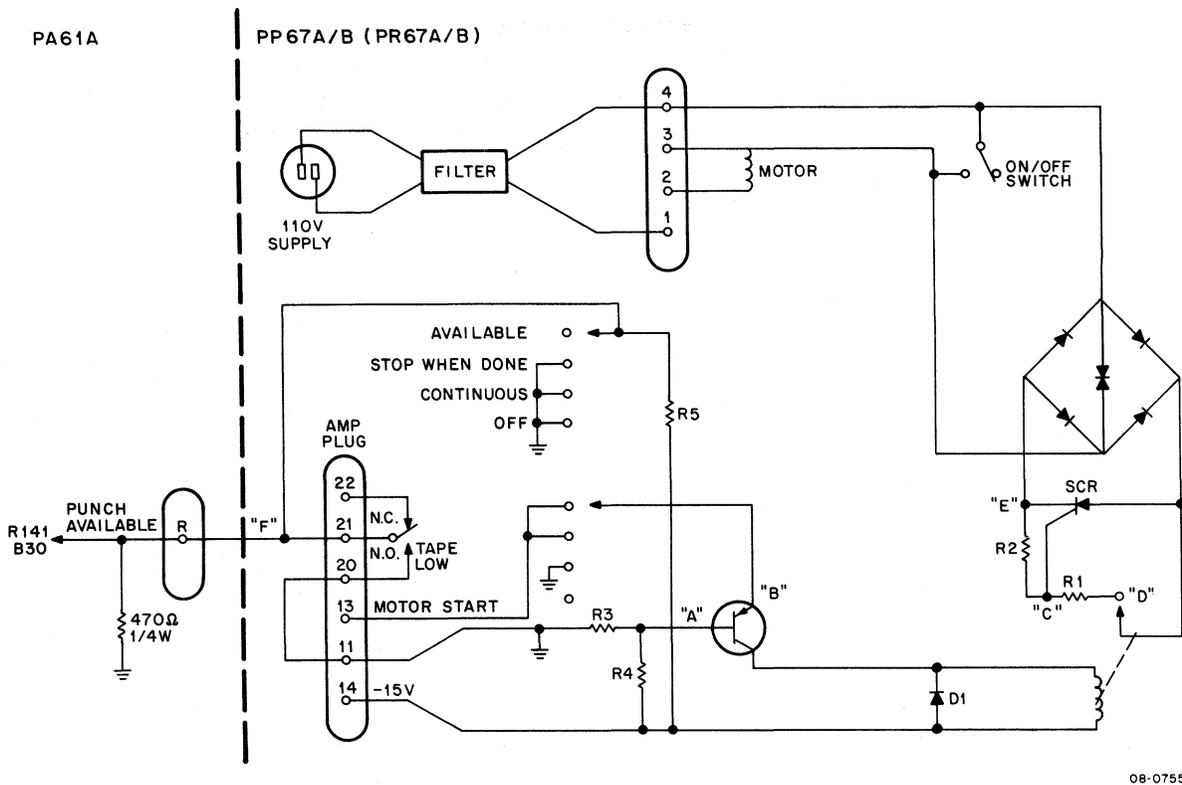
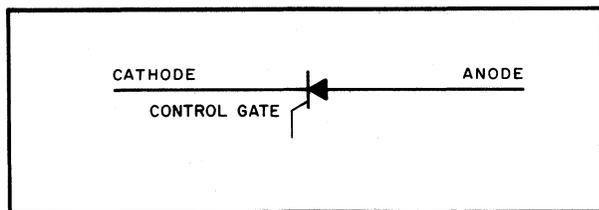


Figure 4-2 PP67A Paper-Tape Punch, Control Switch



08-0755

Figure 4-3 PR67A Paper-Tape Punch Control, Simplified Functional Diagram



11-1164

In the OFF condition, an SCR has a high resistance in both directions (for example, 100,000 ohm), the gate to cathode being equivalent to a small diode. Providing the anode voltage is positive with respect to the cathode, if a small positive voltage is applied to the gate, the forward resistance of the SCR will be greatly reduced and current will flow

through the SCR. Once current is flowing, the SCR can only be turned off by removing the anode voltage.

While the punch has sufficient tape in it, point F is at approximately  $-3.4V$  because R5 is connected in series with a 470 ohm resistor in the interface. In this condition, PUNCH AVAILABLE is signaled via pin 21 of the AMP plug. When the TAPE LOW switch operates, a ground is applied at point F; hence, the PUNCH NOT AVAILABLE condition is signaled. This condition is also signaled by turning the punch switch to STOP WHEN DONE, CONTINUOUS, or OFF. In the CONTINUOUS position, though, a ground is also applied to the transistor, point B; thus, the motor runs continuously.

Operation of the toggle switch provides a direct supply to the motor; thus, the motor runs continuously, irrespective of the punch switch position.

#### 4.4.3 Punch Selection

The PA60A Reader/Punch Control circuits, shown in DEC drawing BS-D-PA60-A-4, control all phases of tape punch operation, including the implementation of punch selection, tape feeding, and data transfer to the punch from the PDP-8. The PDP-8 controls punch selection.

In the select mode, under program control, accumulator bits 9 through 11 contain the 3-bit binary equivalent of any one of eight tape punches into which data is to be transmitted for punching. These three bits of the accumulator connect to the punch control select register.

The select register receives both positive and negative IOT314 pulses generated in the IOT decoder. The positive-going IOT314 pulse clears the select register. The positive transition of the negative-going IOT314 pulse transfers the desired accumulator bits into the select register.

The outputs of the register produce a single ground level select signal from the decoder. The particular output activated determines which of eight (8) punches is to be selected for operation. The ground level output of the decoder activates one of eight inverter-drivers. The activated driver generates a -3V SELECT PUNCH level for transmission to a PA61A interface. If a punch in the group, consisting of punches 1 through 4, is selected, the -3V level is transmitted through the W991 Connector at AB31. If the selected punch is in the group consisting of punches 5 through 8, however, the -3V level is transmitted through the W991 Connector at AB32.

#### NOTE

**If the system in use contains one to four tape punches, only one PA61A Reader/Punch Interface Unit will be provided. The output circuits of the control unit are configured, however, for eight punches. This facilitates system expansion at a later date.**

#### 4.4.4 Control and Timing

Whenever power is turned on in the PDP-8, and each time the START key is operated, POWER CLEAR pulses are transmitted to the reader control unit. These pulses are inverted and shaped in the reader control unit, and coupled to the punch control unit as positive-going pulses.

These pulses clear the PUNCH SELECT buffer flip-flops at their outputs (Figure 4-4), and clear the PUNCH ACTIVE and PUNCH FLAG flip-flops. This sequence clears the punch control unit for operation, and prepares it to receive function commands from the IOT decoder.

The output of a Tape-Out switch in the selected punch ANDs with the SELECT PUNCH level produced in the IOT decoder. If the punch is found to be available, the SELECTED AVAILABLE level disables the SKIP-IF-NOT-AVAILABLE output. To find a punch available, the Available switch on the punch must be in the AVAILABLE position, and tape must be present in the punch. If a no-tape-condition exists, a SKIP-IF-NOT-AVAILABLE pulse is generated. The PDP-8 can then select a new tape punch and repeat the process to check its availability.

An IOT024 pulse, generated by the IOT decoder, sets the PUNCH ACTIVE flip-flop and starts the punching sequence described in detail in Paragraph 4.4.7.

#### 4.4.5 Data Transfer

The IOT decoder generates the IOT pulses that control the transfer of data from the accumulator to the punch buffer in the punch control.

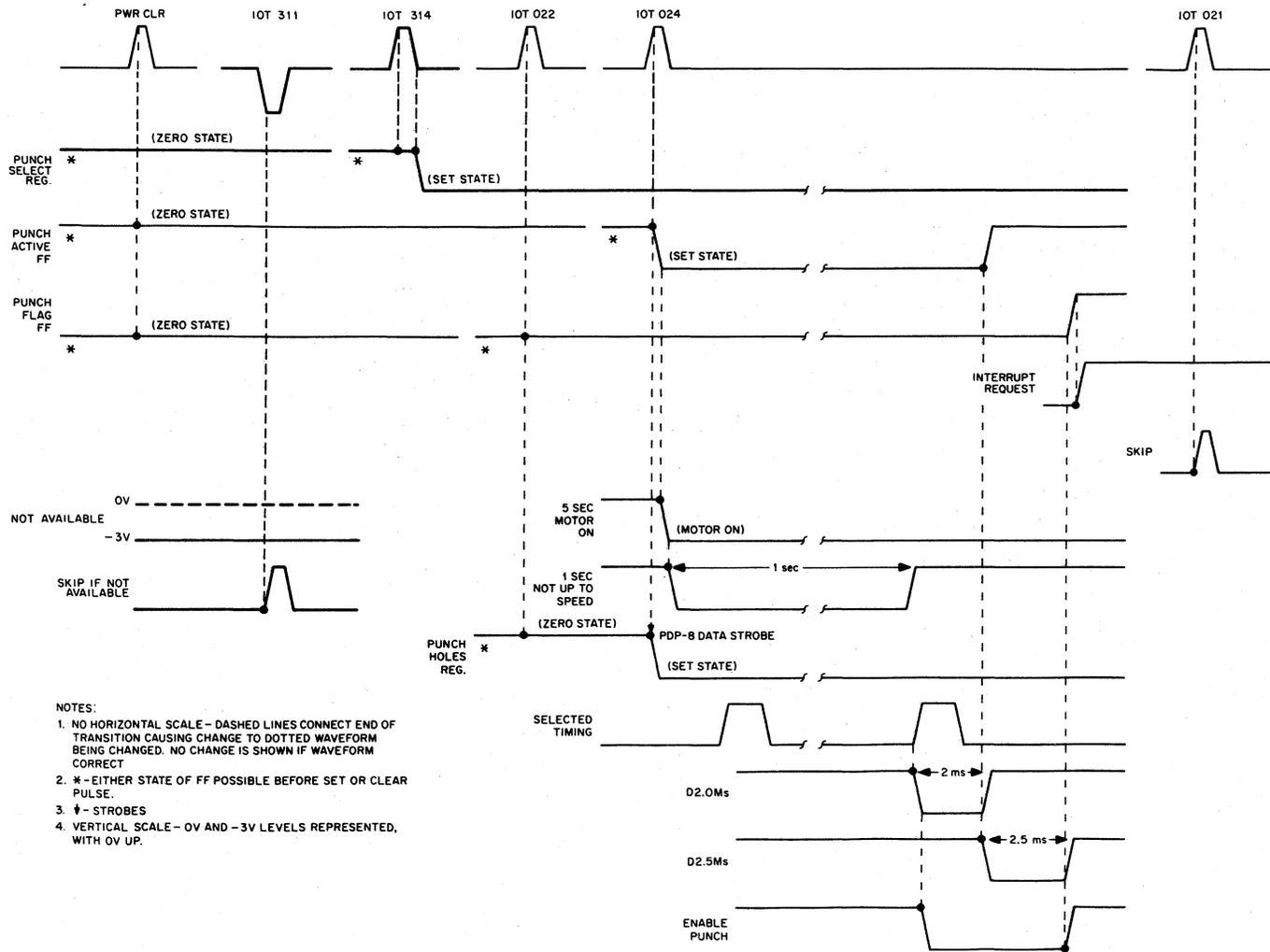


Figure 4-4 Tape Punch Timing Sequence, PA60A Reader/Punch Control Unit

An IOT022 pulse, generated as a result of a 6022 program instruction, direct clears the punch buffer and the punch flag.

An IOT024 pulse, generated as a result of a 6024 program instruction, strobos the desired data into the punch buffer.

The PUNCH HOLE (1) ground level output of each flip-flop activates an inverter driver, producing a  $-3V$  level output for transmission to the punch interface. This output half-enables solenoid drivers in the punch interface unit which provide the drive current to the tape punch solenoids.

#### 4.4.6 Motor Control

In combination with the START MOTOR output of the 5-second motor-on delay, the SELECT PUNCH level activates one of four inverter gates. The output of the selected inverter gate enables the motor start circuit in the desired punch. This circuit remains active and the punch motor runs, until either the punch is no longer selected or no punch commands are received for a period longer than 5 seconds. The lack of punch commands permits the 5-second motor-on delay to time out. This disables the motor start circuit in the selected punch.

#### 4.4.7 Tape Punching

The selected punch generates the basic timing standard to which the punching operation is synchronized. A reluctance pickup, located in proximity to a punch-motor-driven cam, is activated during each punch cycle. The output of this reluctance pickup, developed across a  $1\text{ k}\Omega$ ,  $1/4W$  resistor in the punch interface circuits, provides a  $-3V$  half-enable input to an R141 Gate. This R141 Gate receives its second half-enable input from the SELECT PUNCH levels. The PUNCH SYNC output of a particular punch NAND's with its own SELECT PUNCH level to activate the R141 Gate. The ground level selected timing output produced by this gate activates a Schmitt trigger in the punch control.

The positive-going transition created by the initial setting of the 5-second motor-on-delay sets the not-up-to-speed delay to the 1 state. This sequence ensures that the selected punch motor is in fact rotating at its proper operational speed before tape punching is attempted. The  $-3V$  outputs of the Schmitt trigger, the 5-second motor-on-delay (1), and the not-up-to-speed delay (0) AND to provide a pulse input to the 2.0-ms delay at A16.

The ground level output of the PUNCH ACTIVE flip-flop (1) provides the level input to this delay. Since the PUNCH ACTIVE flip-flop is set to the 1 state by an IOT024 pulse, this ensures that the system is indeed in a punching mode of operation.

When activated, the 2.0-ms delay output will switch from its normal ground level to a  $-3V$  level for a period of 2.0 ms. This provides the enabling level needed for the clear input of the PUNCH ACTIVE flip-flop. The positive-going transition, generated by the delay timing out after 2.0 ms, provides the pulse input required to clear the PUNCH ACTIVE flip-flop. This assures that only one punch cycle can be performed for each data-transfer operation initiated by the PDP-8.

The 0V level of the 2.5-ms delay at R16 enables its own input when the delay is inactive. The positive-going transition produced by the runout of the 2.0-ms delay provides the required pulse input to activate the 2.5-ms delay.

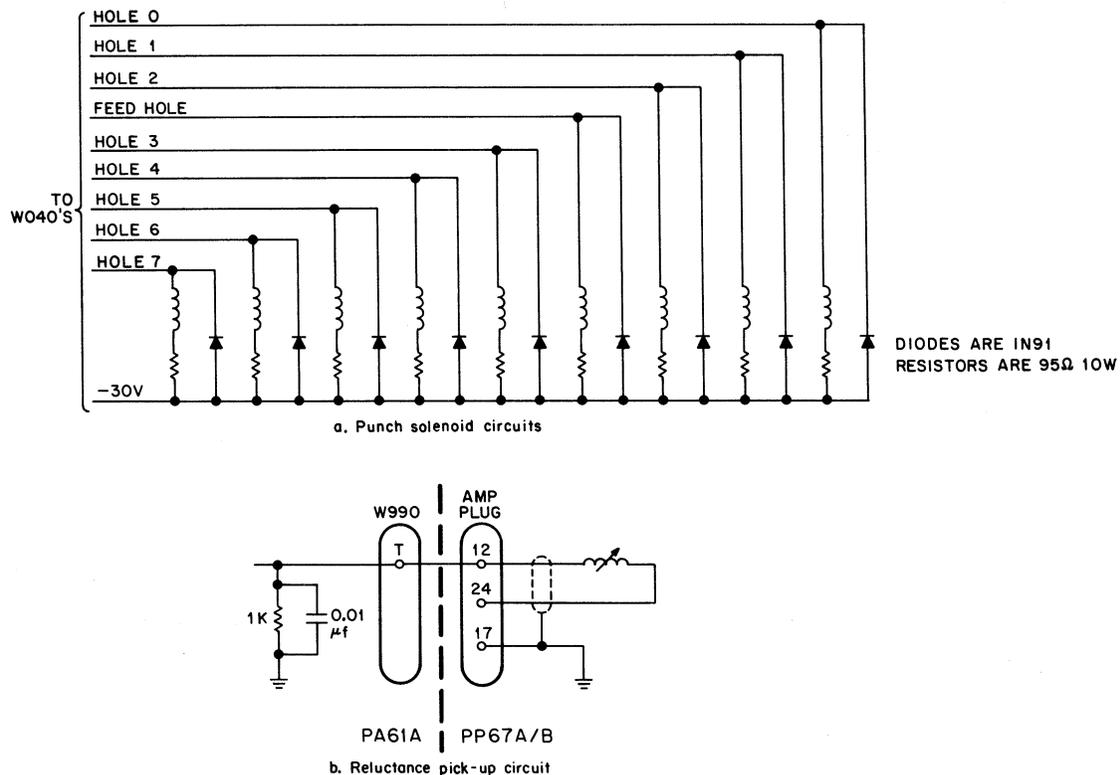
The double-inverted output of the 2.5-ms delay half-enables all eight (8) R123 Inverter Gates in the enable punch circuits.

The -3V output of the select punch decoder (previously discussed) provides the second half-enable input to one of these inverters. The 0V output of the activated inverter gate triggers a W051 Inverter-Driver corresponding to the selected punch. A W991 Connector at AB31 (punches 1-4) or AB32 (punches 5-8) couples the output of the inverter-driver to the punch interface.

The punch interface unit contains seven (7) W040 Solenoid Drivers for each of four punches, for a total of 28 drivers per interface unit. Six drivers in each group actuate solenoids producing data holes in the tape. The seventh driver in each group (A15 in Punch 1 group) provides current to actuate the feed-hole and tape-feed solenoid.

This configuration applies to a system using a 6-level high-speed BRPE punch. As indicated by the drawings, a high-speed 8-level BRPE punch can also be used.

The -3V ENABLE PUNCH output, coupled from the punch control unit through the W991 Connector at AB31, half-enables all seven solenoid drivers in the group serving its particular punch. The 8-bit punch buffer in the punch control provides, through the same connector, the second half-enable input needed to activate the data-hole drivers. The second half-enable input to the feed-hole and tape-feed solenoid driver is provided as a constant bias voltage to the driver inputs. A simplified diagram of the punch solenoid circuit is shown in Figure 4-5.



08-0756

Figure 4-5 Punch Solenoid and Reluctance Pick-up Circuits, Simplified Diagram

Punch solenoids are driven from W040 Solenoid Drivers. One side of each solenoid is taken to  $-30V$ , the other side is taken to a W040. When a solenoid driver is selected, it lifts the discrete solenoid feed from  $-30V$  to ground, thus energizing the punch solenoid. In order that the solenoid drives are only driven at the correct point in the punch cycle, a reluctance pick-up situated on the brass disk forward of the motor shaft provides an output which is developed across a  $1K\ 1/4W$  resistor with an  $0.01\ \mu F$  capacitor in parallel, in the punch interface, to supply a half-enable input, to gate through the respective SELECT PUNCH level. The point in the punch cycle at which the output from the reluctance pick-up is provided can be varied by means of the "range-finder" (timing scale) situated at the front of the punch above the brass disk. This variation is provided to compensate for lengths of cable, signal delay, etc. The diode across the solenoid is used for damping and the resistor is used to limit the current through the solenoid.

#### 4.5 PA60B READER/PUNCH CONTROL EXTENSION

The PA60B Reader/Punch Control Extension expands the system to control up to eight additional readers and punches. The PA60B control logic, shown in drawings D-BS-PA60-B-2 and D-BS-PA60-B-3, provides the necessary decoders and flip-flops to permit selection of the added readers and punches (9–16).

Functionally, the operation of the decoder logic is identical to that described in Paragraphs 4.3.2 and 4.4.3. The READER SEL and PUNCH SEL flip-flops select the proper decoder, depending on the state of accumulator bit 8. Accumulator bits 9 through 11 are paralleled between the PA60A and the PA60B via W991.

#### NOTE

The ground connection on pin D of the decoders in the PA60A is removed to establish flip-flop control of decoder selection.

#### 4.6 PA60C NTTA READER CONTROL UNIT

The PA60C NTTA Reader Control converts the system to non-torn tape operation. Up to 16 readers can be controlled by the logic, which is shown in drawing D-BS-PA60-C-1. The paper tape (input tape) that is output by the keyboard perforator is left in the reader and the tape arm is lowered and left in that position.

Initiation of reader selection is made by pressing the reader select switch. This turns off the available/error lamp (Figure 4-6) on the tape reader and activates the control logic. The reader starts the next time it is scanned by the program. The tape is read and processed until a stop code (punched in the tape by the perforator operator) is encountered. When this code is sensed by the program, reading is discontinued and scanning is resumed. Selection of another reader by the program deselects the current reader and the available/error lamp on the reader lights again. Consequently, the operator is free to perforate tape continuously, except for pressing the reader control switch between takes.

##### 4.6.1 Power Up

A POWER CLEAR pulse is generated by the processor when the power is turned on and also when the START key is pressed. This pulse sets all of the R202 flip-flops in the PA60C. As a result, all readers are deselected except reader 0, which must be selected for reading typesetting programs and the Typesetting Bootstrap Loader.

##### 4.6.2 Reader Selection

Normally, reader selection is controlled as described in Paragraph 4.3.2. However, the PA60C assumes control of reader selection by producing RS XX H to inhibit SELECT READER XX L when no input tape is ready for processing. Conversely, SELECT READER XX H inhibits RS XX L when a reader is selected while another reader is in use. The PA60C has a separate R202 flip-flop with an associated logic circuit for each reader in the system. A typical logic circuit is shown in Figure 4-7.

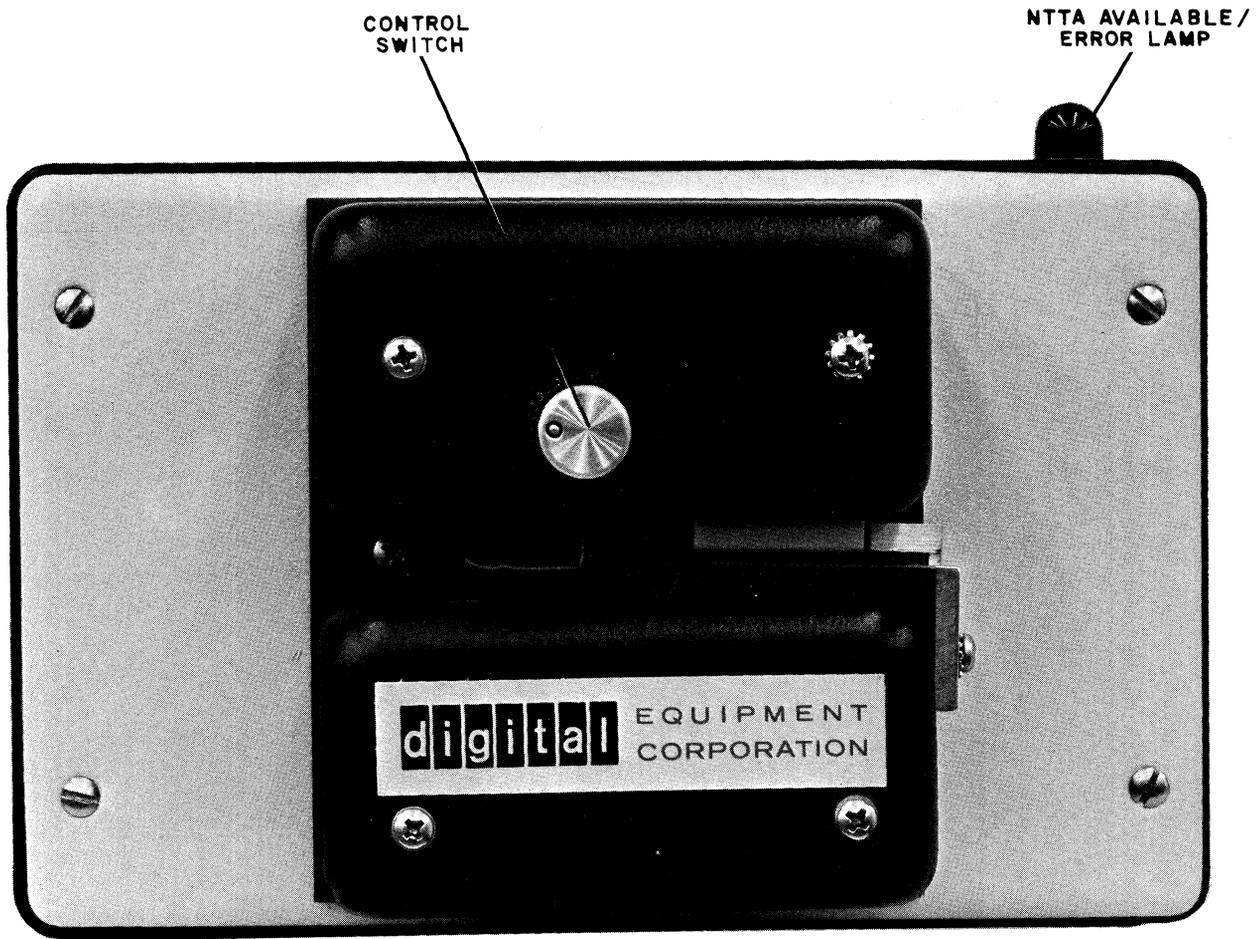


Figure 4-6 PR68A Paper-Tape Reader, Control Switch and Indicator

Notice that reader 0 is controlled by the opposite state of the flip-flop. Since all flip-flops are set initially, reader 0 is automatically selected and remains selected until the typesetting program is started. Therefore, the available/error lamp on reader 0 is off because it is not grounded and the available/error lamps on all other readers are on because they are grounded. The first IOT312 that occurs after the program is started clears the corresponding flip-flop, deselecting reader 0.

**NOTE**

**After the typesetting program is started, reader 0 is not normally reselected until all other readers in the system have been scanned.**

Since all remaining flip-flops in the PA60C are set, none of the readers are initially available for selection. When the program is started, RS XX H holds SELECT READER XX L at ground as the PA60A/B sequentially steps through each reader in the normal manner, searching for one that is available for selection. The reason that RS XX H holds READER SELECT XX L at ground is because the W051 driver in the PA60C, and the corresponding W051 driver in the PA60A/B, are both connected to the -3 Vdc source through the same resistor. Consequently, neither signal can go down to that level unless the other signal is already there.

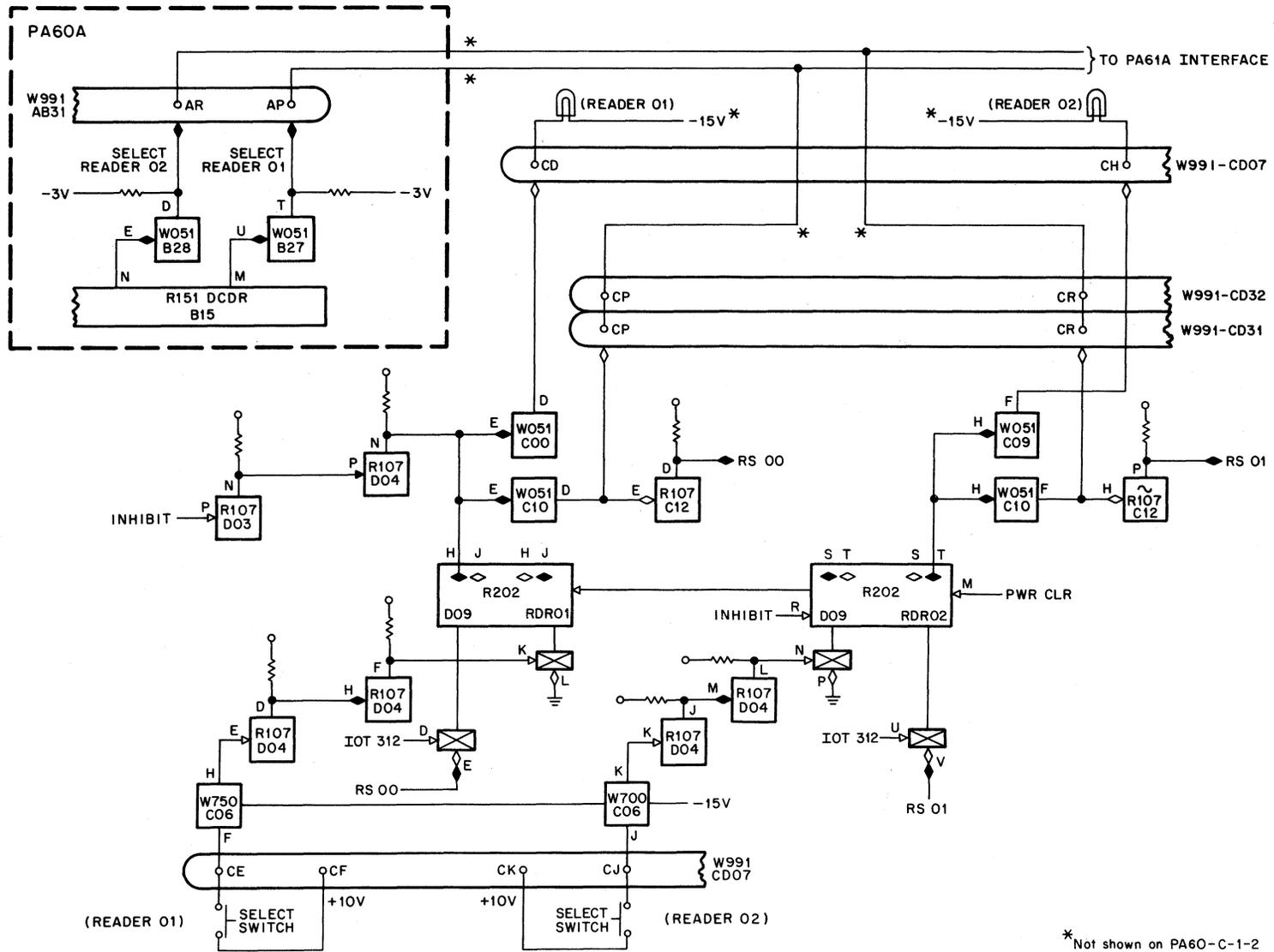


Figure 4-7 Typical NTA Logic Diagram

When the select switch on a reader is closed, +10 Vdc is applied to the switch filter in W700, generating a positive-going transition that clears the corresponding flip-flop. Consequently, the lamp on the reader goes off because it is not grounded. More importantly, RS XX L is applied to the PA61A Interface and RS XX H is applied to the DCD gate at the data input of the flip-flop. Thus, the reader is ready for program selection, but it is not selected because SELECT READER XX H from the PA60A/B holds the logic level to the PA61 Interface at ground.

When the PA60A/B produces SELECT READER XX L for the available reader, the reader is selected and input tape processing begins. The first IOT312 that occurs after the stop code is read at the end of the tape sets the flip-flop. This deselects the reader and lights the available/error lamp, indicating that tape processing is complete. While the input tape is being processed the PA60A does not generate any more SELECT READER pulses. Searching is resumed after the input tape has been processed.

#### 4.6.3 Inhibit Facility

A switch in the PA60C produces INHIBIT L when it is closed. This signal clears all R202 flip-flops except the one for reader 0, eliminating the need to press the switch on the reader to make it available for selection. Thus, the readers are available for selection when the tape is placed in the reader and the tape arm is lowered. The flip-flop for reader 0 is set by INHIBIT L because the opposite state is used.

#### 4.7 PA68A READER/PUNCH CONTROL UNIT

The PA68A Reader/Punch Control Unit is used in single reader/punch systems. The PA68A control logic is shown in drawings D-BS-PA68-A-1 and D-BS-PA68-A-2.

Functionally, the logic in the PA68A is identical to that of the PA60A, which is described in Paragraphs 4.3 and 4.4. However, the punch control does not have any out-of-tape (punch not available) detection logic. Since the PA68A is a single reader/punch control, no selection logic is provided and the 2.3-ms reader clock is free running. As a result, drive current is always applied to the reader and the reader is always selected.

#### NOTE

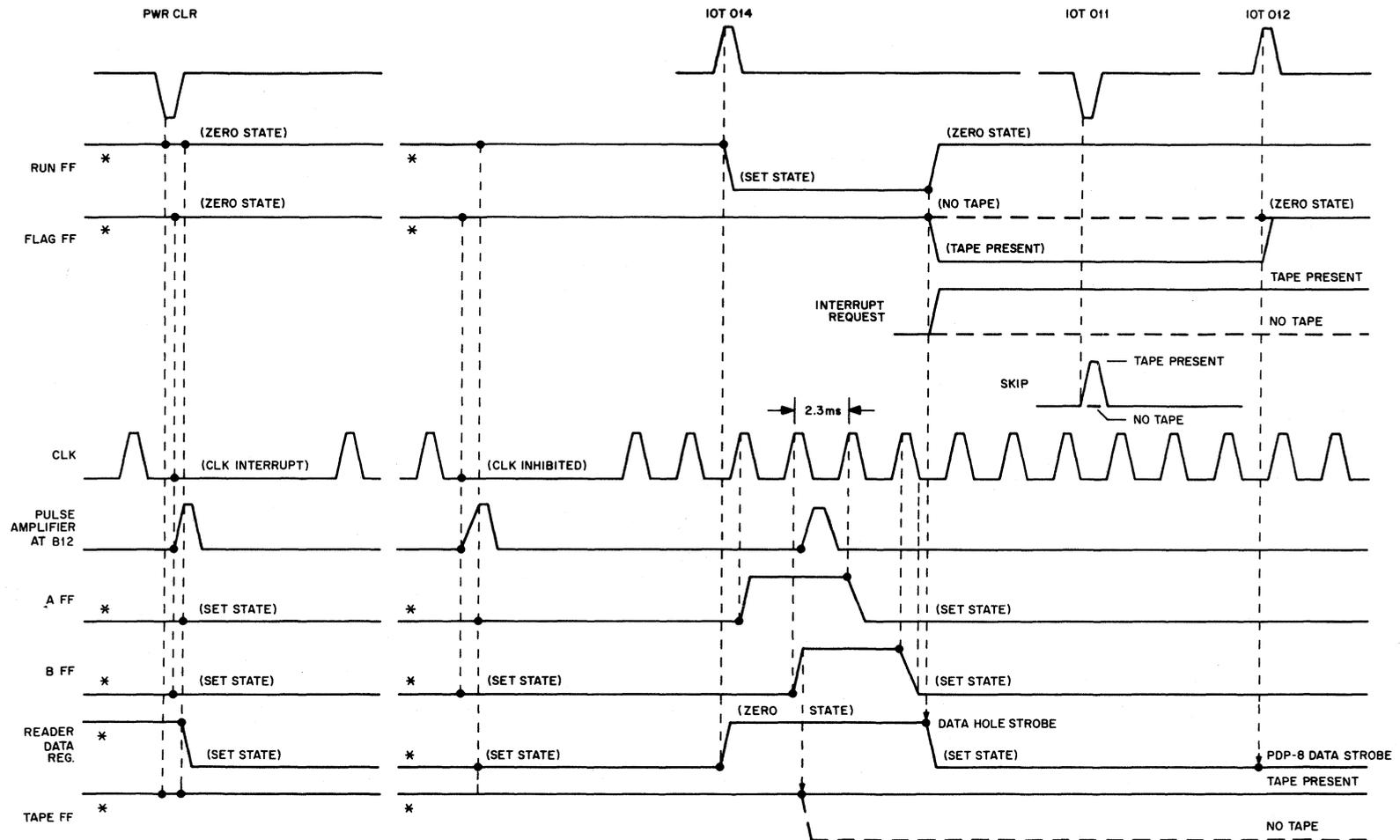
**If the reader exhibits signs of overheating, ECO No. PA68A-0005 can be incorporated. This ECO modifies the motor drive logic to keep the reader deselected until a tape has been inserted and the tape arm is lowered. The feed hole is used to sense this condition.**

The timing sequence for the reader and punch is shown in Figures 4-8 and 4-9, respectively.

#### 4.8 PP67B HIGH-SPEED PAPER-TAPE PUNCH

The PP67B High-Speed Paper-Tape Punch is an 8-level version of the PP67A. An 8-level punch block and two additional solenoids are installed in a Teletype BRPE-1 1 Punch to provide the additional channels.

If a PP67B is installed in place of a PP67A, two additional W040 modules must be installed in the PA61A.



## NOTES:

1. NO HORIZONTAL SCALE - DASHED LINES CONNECT END OF TRANSITION CAUSING CHANGE TO DOTTED WAVE FORM BEING CHANGED. NO CHANGE IS SHOWN IF WAVEFORM IS CORRECT.
2. \* - EITHER STATE OF FF POSSIBLE BEFORE SET OR CLEAR PULSE.
3. † - STROBES
4. VERTICAL SCALE - 0V AND -3V LEVELS REPRESENTED, WITH 0V UP.

Figure 4-8 Tape Reader Timing Sequence, PA68A Reader/Punch Control Unit

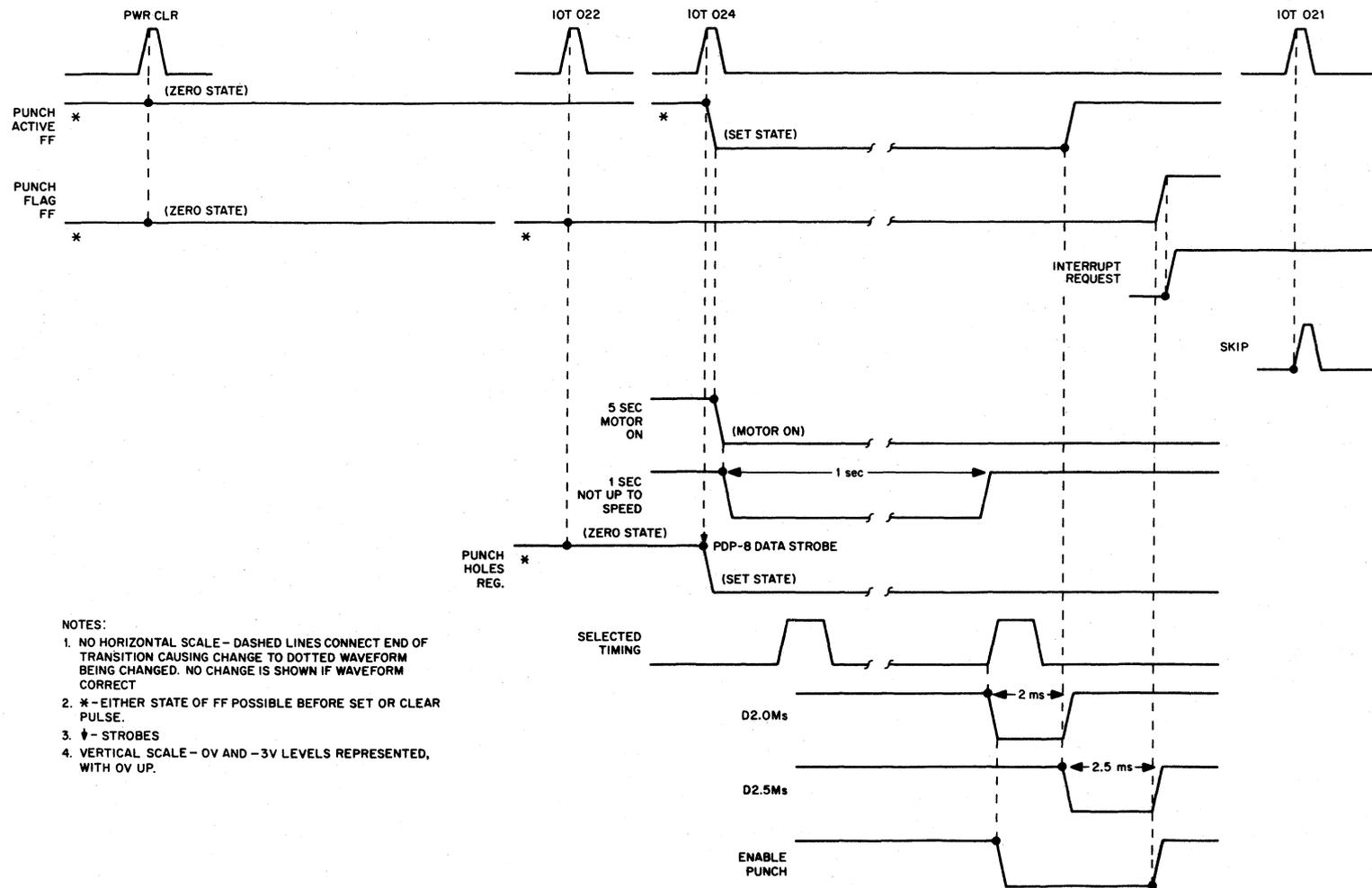
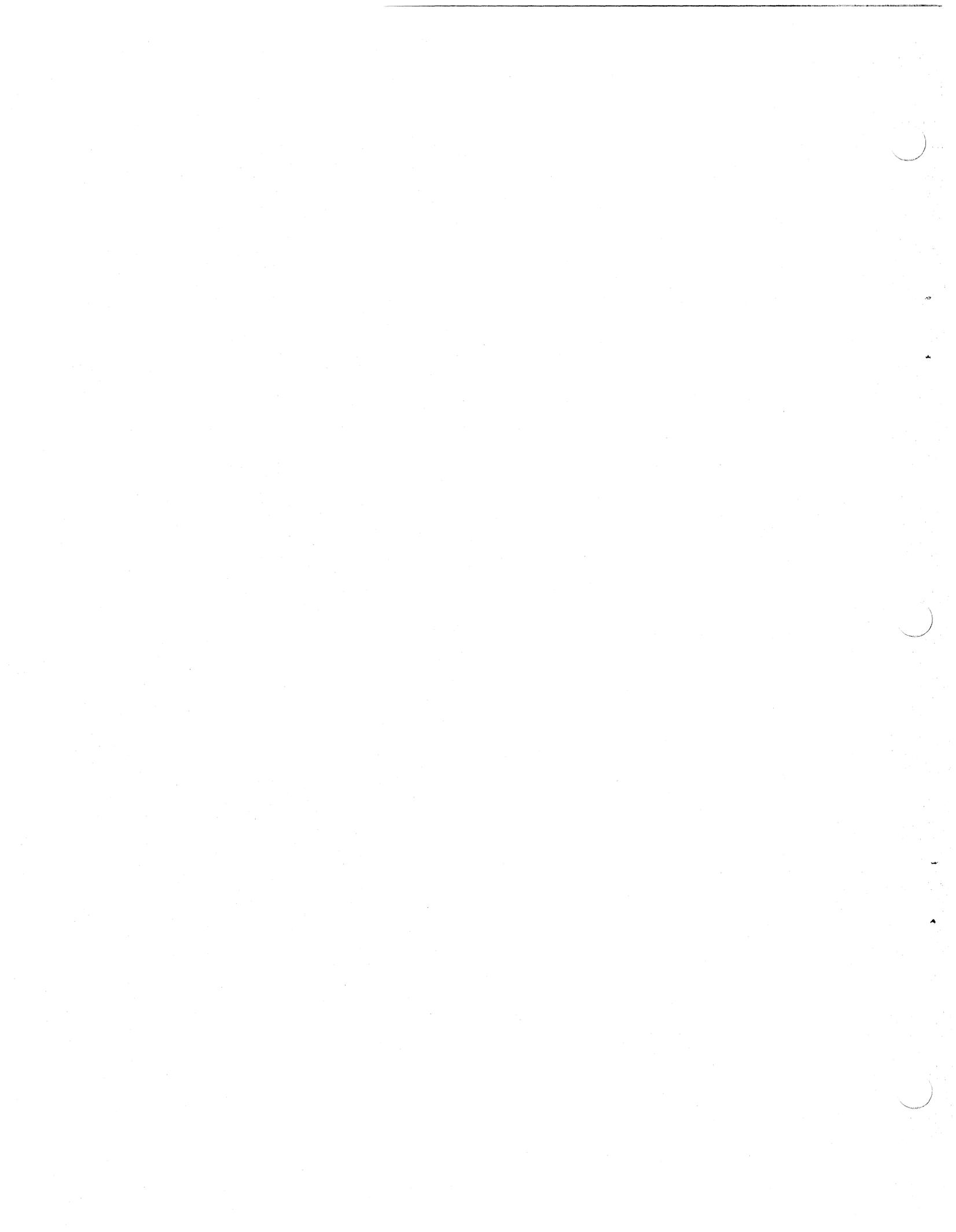


Figure 4-9 Tape Punch Timing Sequence, PA68A Reader/Punch Control Unit



## CHAPTER 5 INTERFACE

This chapter shows the interface connections and signals between the PDP-8 and the tape readers and punches, including the reader and punch control and interface units (Figures 5-1 through 5-3). All hardware that is equipped for 50 Hz power is identified by the suffix A in the type number, e.g., PP67AA.

### NOTE

**Pins A, B, C, and V in Reader Cable 70-5063 are parallel-wired (dual-wires) to provide increased current capacity.**

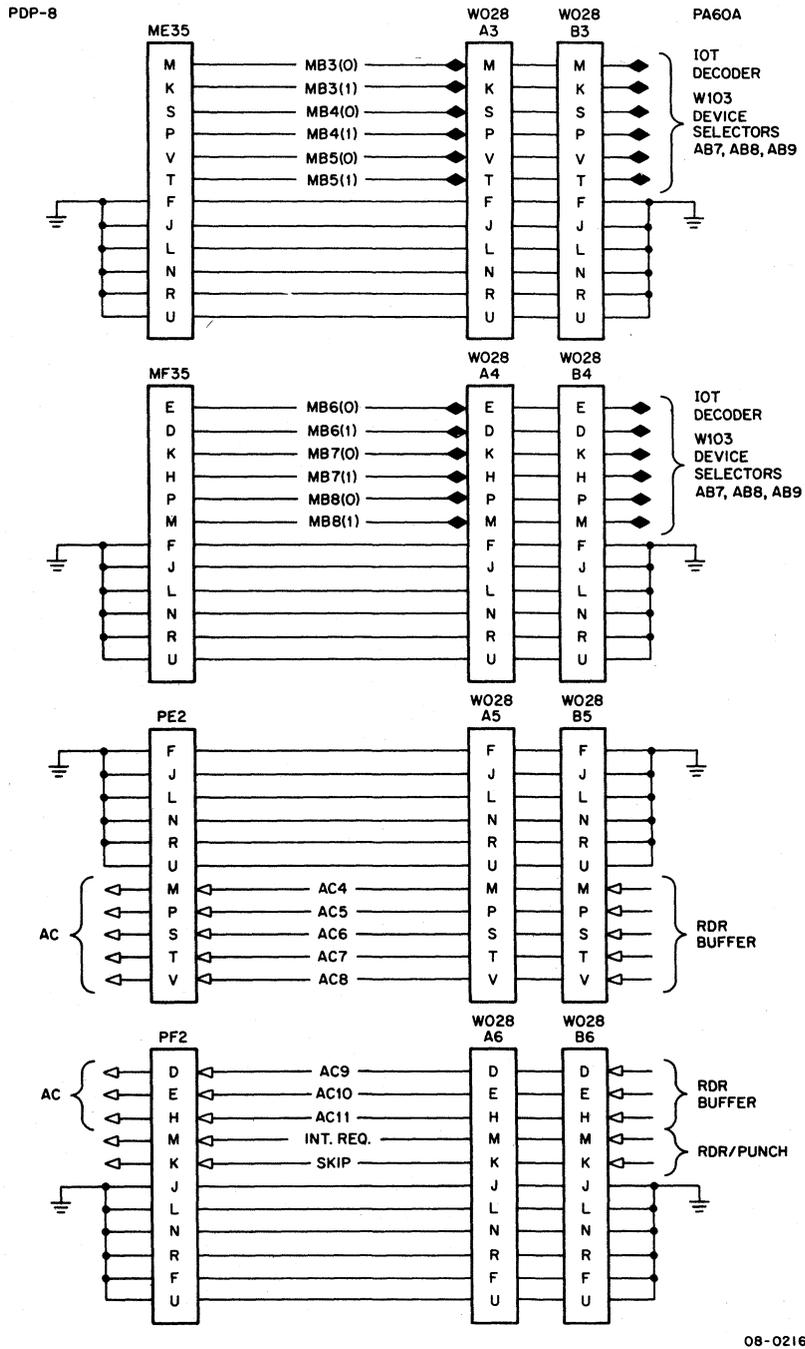


Figure 5-1 Interface, PDP-8 to PA60A Reader/Punch Control Unit (Sheet 1 of 2)

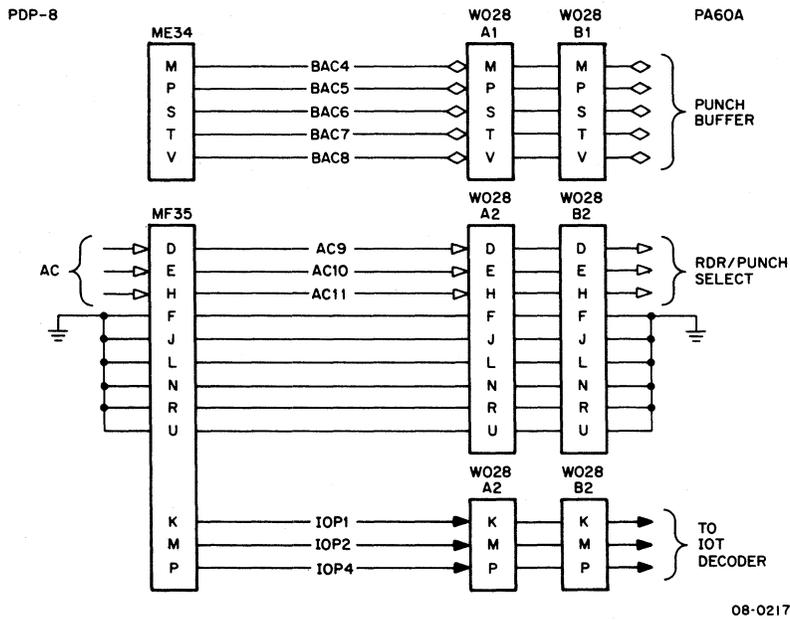


Figure 5-1 Interface, PDP-8 to PA60A Reader/Punch Control Unit (Sheet 2 of 2)

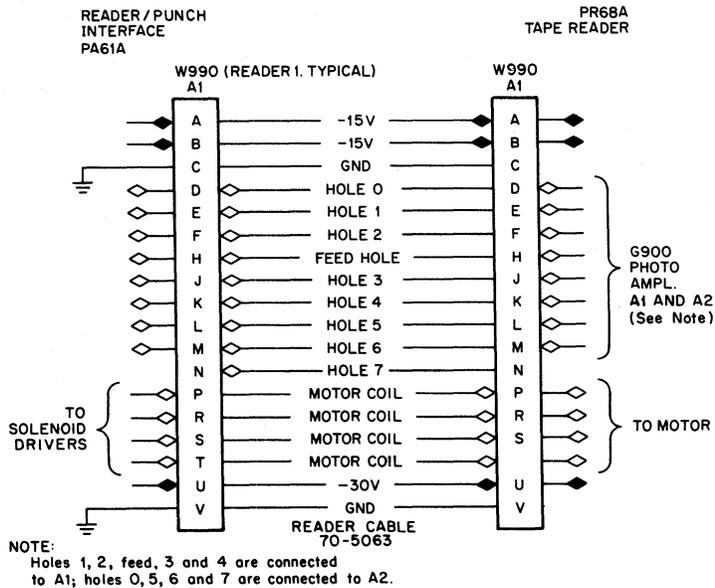


Figure 5-2 Interface, PR68A High-Speed Paper-Tape Reader to PA61A Reader/Punch Interface Unit

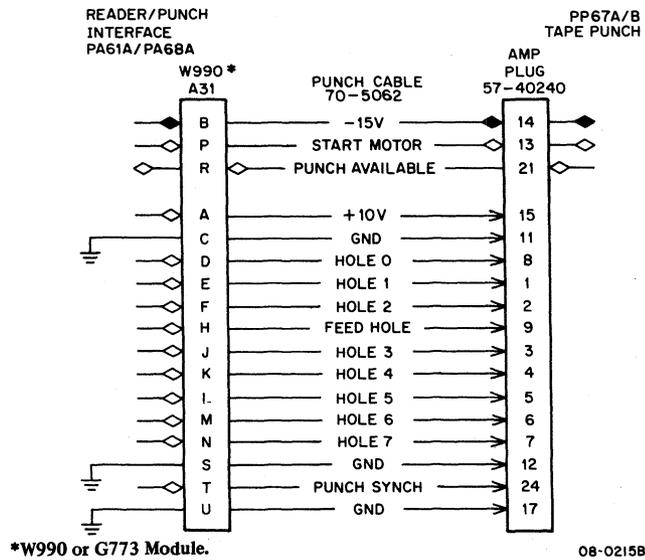


Figure 5-3 Interface, PR68A/B Paper-Tape Reader to PA61A Reader/Punch Interface Unit

The PA60B is a two-rack control that is pre-wired to include the PA60C option. The PA60C option is implemented by inserting extra modules in the PA60B Interface per UML-PA60B-1. If a PA60B or PA60C is being added in the field, cable interconnections are as shown in Figure 5-4.

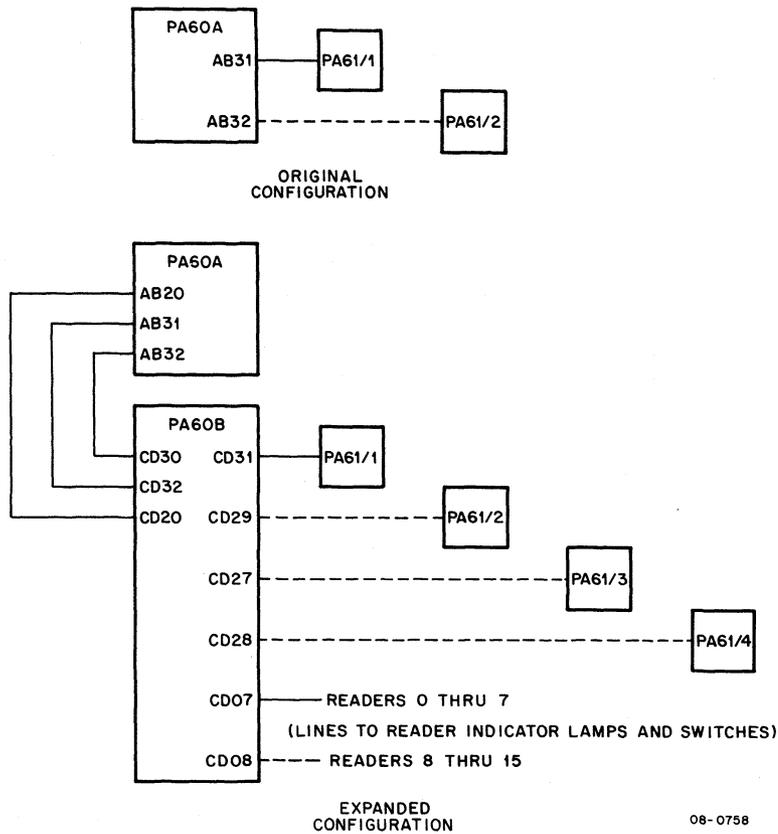


Figure 5-4 Cable Interconnection, PA60A, PA60B and PA60C to PA61A

# CHAPTER 6

## MAINTENANCE

### 6.1 TEST EQUIPMENT AND DIAGNOSTIC PROGRAMS

The tools and test equipment required to test and repair the hardware are listed in Table 6-1.

**Table 6-1**  
**Test Equipment and Tools**

Equipment	Item	Type
Test Equipment	Oscilloscope Volt-Ohmmeter	Tektronix Model 453 (or equivalent)
Devices	Extender Boards	One W985 double-extender board Two W980 single-extender boards
Tools	Tool Box Paper-Tape Gauge	DEC Field Service DEC Part No. 18-09211

The maintenance philosophy for Negative Logic Typeset-8 Systems is based on system checkout using test programs and manual adjustments. The diagnostic programs supplied by DEC can be used to verify normal hardware operation or to indicate possible causes of malfunction. These programs and their corresponding documents are listed in Table 6-2.

**Table 6-2**  
**Diagnostic Programs**

Program No.	Document No.	Title
DEC-08-D2HC-PB	DEC-08-D2HC-D	Family of 8 Typesetting Configuration Test
DEC-08-D7CA-PB1 DEC-08-D7CA-PB2	DEC-08-DC7A-D	Typeset-8 System Exerciser (TSCE)
MAINDEC-X8- Module No.-Rev. No.- PB	MAINDEC-X8-DIQAB-A-D	Family of Eight Systems Exerciser
MAINDEC-08-D2UA-PB	MAINDEC-08-D2UA-D	PA60 Diagnostic

The Family of 8 Typesetting Configuration Test consists of a package of programs used to test and adjust, individually and together, the PP67A High-Speed Paper-Tape Punch, the PR68A High-Speed Paper-Tape Reader, and the associated control logic. Any one of up to 16 readers or up to 16 punches can be tested. There are 14 individual programs in the package. These programs and their suggested uses are listed in Table 6-3.

**Table 6-3**  
**Typesetting Configuration Test Programs**

Program No.	Title	Suggested Use
PRG0	Basic Reader and Reader Control Logic Test	Preliminary Test
PRG1	Basic Punch and Punch Control Logic Test	Preliminary Test
PRG2	Reader Test. Binary Count Pattern	Preliminary Test
PRG3	Punch Test. Binary Count Pattern	Preliminary Test
PRG4	Punch Verify. Binary Count Pattern	Preliminary Test
PRG5	Punch Test. Random Characters	Final Test
PRG6	Punch Verify. Random Characters	Final Test
PRG7	Combined Reader and Punch Test. Binary Count Pattern	Preliminary Test Only
PRG10	Read Amplifier Adjustment Loop	Preliminary Test
PRG11	Read 6, Stall 40 ms, Reader Adjustment Loop	Preliminary Timing Test
PRG12	"Change Reader Unit" Delay Adjustment Loop	Preliminary Adjustment
PRG13	Continuous Punch Loop	Preliminary Data Transfer Test
PRG14	1s and 0s Test Tape Generator	Generate Test Tape for PRG10
PRG15	"Punch Out of Tape" Switch Adjustment Loop	Preliminary Adjustment

The Typeset-8 System Exerciser (TSCE) is intended as a tool for verifying the operating ability of the hardware in a typesetting system. It also serves as the normal means of determining system acceptance.

The TSCE program exercises the system hardware simultaneously. It is not intended for use as a diagnostic program for individual peripherals. The purpose of the program is to ensure proper system interaction between peripherals that have previously been tested using the individual diagnostics, thus ensuring proper performance of the complete system configuration. The program overlays and intended use of each overlay are listed in Table 6-4.

**Table 6-4**  
**System Exerciser Overlays**

Overlay	Intended Use
0	Preliminary check of reader/punch selection logic
1	Preliminary check of reader/punch data logic
2	Preliminary check of DECTape/DECdisk interaction
3	Final check of system performance, including line printer

The Family-of-8 Systems Exerciser (DEC-X8) is a powerful expandable modular software system dedicated to testing Family of 8 hardware in a system environment. The structure of DEC-X8 enables the user to design a unique operational exerciser consistent with his needs and the hardware configuration.

A minimum of 4K of memory is required; however, certain capabilities cannot be used unless the system is equipped with at least 8K of memory. The unusable features are noted in the program document. DEC-X8 can be used with up to 32K of memory.

**NOTE**

**DEC-X8 does not currently (August 1972) have a specific module for Typeset-8 Systems. However, existing modules can be used to verify the performance of Typeset-8 Systems. These modules are described in the program document.**

## 6.2 PREVENTIVE MAINTENANCE

Preventive maintenance comprises tasks performed at periodic intervals to ensure proper equipment operation and minimum unscheduled downtime. These tasks consist of visual inspection, operational checks, cleaning, lubrication, adjustment, and replacement of borderline or partially defective parts.

Preventive maintenance procedures for all Typeset-8 Systems are provided in a separate document published by Field Service. Refer to the current document to obtain the latest policies and procedures.

## 6.3 ADJUSTMENTS

This paragraph covers the adjustment procedures for the R401 Clock module in the PA60A Reader/Punch Control and the PA68A Reader/Punch Control, the R302 Delay One-Shots in the PA60A and the PA68A, the PR68A High-Speed Paper-Tape Reader, and the PP67A/B High-Speed Paper-Tape Punch.

A complete system, including a processor and a Teletype, are required to make the adjustments using these procedures. The procedures should be followed as closely as possible in the order in which they are presented. Processor power must be turned on and off as necessary, throughout the adjustments.

### 6.3.1 R401 Clock

The purpose of the clock adjustment is to set the period of the clock pulses that determine the operating speed (running rate) of the reader. An oscilloscope is required to make this adjustment. The adjustment procedure is:

1. Connect the oscilloscope to A23D on the PA60A or A09D on the PA68A.
2. Adjust potentiometer R11 to obtain the waveform shown in Figure 6-1.

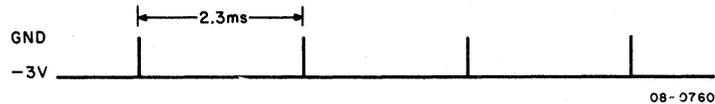


Figure 6-1 R401 Clock Pulse Waveform

### 6.3.2 10 ms Change Reader Delay

The purpose of the 10 ms change reader delay adjustment is to set the period of delay between reader selection and the time that the first character is read. An oscilloscope is required to make this adjustment. The adjustment procedure is:

1. Load the following program into location 0200:

0200/	7200	CLA
	6312	RSC
	2220	ISZ TEMP
	5202	JMP.-1
	2220	ISZ TEMP
	5204	JMP.-1
	7040	CMA
	5201	JMP.-6

2. Set SR to starting address (0200), depress LOAD ADD and START.
3. Connect the oscilloscope to AB19E on the PA60A.
4. Adjust potentiometer R9 on R303 to obtain the waveform shown in Figure 6-2.

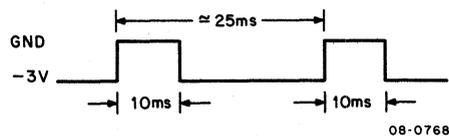


Figure 6-2 10 ms Change Reader Delay Waveform

### 6.3.3 2.0 ms and 2.5 ms Delay

The purpose of this adjustment is to set the 2.0 ms and 2.5 ms delays that control the width of the ENABLE PUNCH pulse. An oscilloscope is required to make this adjustment. The adjustment procedure is:

1. Load the following program into location 0200:

```

0200/ 6026 PLS
      2220 ISZ TEMP
      5201 JMP.-1
      2220 ISZ TEMP
      5203 JMP.-1
      5200 JMP.-6
  
```

**NOTE**

The delays incorporated in this program prevent it from hanging up if the timing is incorrect and the flag never gets set.

2. Set SR to starting address (0200), depress LOAD ADD and START.
3. Connect the oscilloscope as follows:

Channel	Connection		Signal
	PA60A	PA68A	
1	A16M	A26M	D2.0 ms
2	A16V	A26V	D2.5 ms

4. Adjust potentiometers R11 and R25 to obtain the waveforms shown in Figure 6-3.
5. Connect the oscilloscope to AB31BN on the PA60A or A11R on the PA68A and check the ENABLE PUNCH pulse width. If it is not 4.5 ms, repeat Steps 3 and 4.

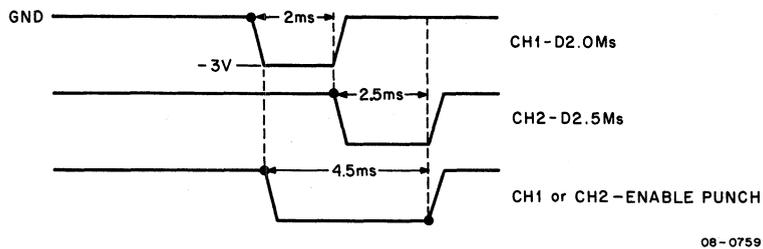


Figure 6-3 2 ms Delay, 2.5 ms Delay and Enable Punch Waveforms

### 6.3.4 1 Second and 5 Second Delays

The purpose of this adjustment is to set the 1 SEC NOT UP TO SPEED delay and the 5 SEC MOTOR ON delay. An oscilloscope is required to make this adjustment. The adjustment procedure is:

1. Load the following program into location 0200:

```

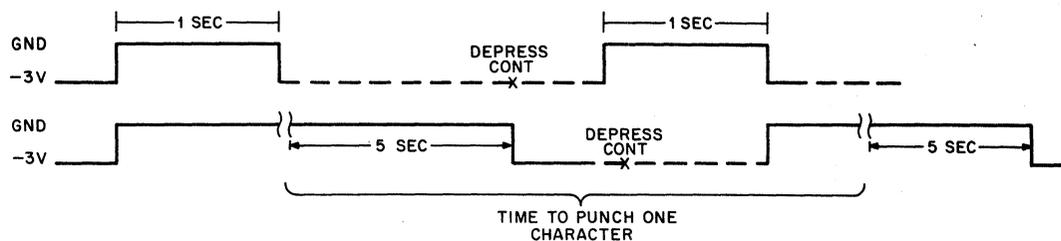
0200/ 6026 PLS
      7402 HLT
      5200 JMP.-2
  
```

2. Set SR to starting address (0200), depress LOAD ADD and START.

Connect the oscilloscope as follows:

Channel	PA60A Connection	Signal
1	AB17E	1 SEC DELAY
2	AB18E	5 SEC DELAY

- Adjust potentiometer R9 on both R303 modules to obtain the waveform relationship shown in Figure 6-4. Depress CONT when the program halts to keep the punch running until the adjustment is completed.



NOTE:  
On controls used with 50~ punches, set the 1 second delay to 2 seconds.

08-0769

Figure 6-4 1 Second and 5 Second Delay Waveform Relationship

### 6.3.5 PR68A High-Speed Paper-Tape Reader

The mechanical, electrical, electronic, and optical mechanisms of the PR68A can be adjusted if they are causing data errors. A multimeter and an oscilloscope are required to make the adjustments. Static adjustments of the mechanical, electrical, and optical mechanisms must be made before the G900 Amplifiers can be adjusted. The G900 adjustment can be made without an oscilloscope, if necessary.

**6.3.5.1 Static Adjustment** – Before making any adjustments to the PR68A, ensure that the reader has been modified as described in the Typesetting Field Service Technical Manual, Section 4, pages 1 and 2. If not, appropriate modifications must be made before any adjustments are attempted. Adjustable mechanisms are shown in Figure 6-5. This static adjustment procedure is:

- Measure the voltage across the reader lamp. This should be 10 Vdc. If it is not, loosen the clamp connector on the 7.5 ohm resistor in the reader and move the clamp until 10 Vdc is obtained (Figure 6-5). Tighten the clamp, then recheck voltage. If cables are over 150 ft, the -15V and ground lines must have dual wires in the cable.
- Release the screw holding the 6-level guide and, if the reader is to be used for 8 level, drop the guide to its lowest position and tighten the screw. If the reader is to be used for 6 level, move the guide up until its surface is flush with the surface of the reader head. Tighten the screw.
- Take a short piece of tape, 6- or 8-level appropriate to the reader in use, and place it in the reader. Adjust the cell block, with the two screws shown, so that the tape lies flat across the sprocket wheel and the cell block surface (Figure 6-6). Tighten the screws.
- Place 3 thicknesses of tape between the tape bed and tape hold-down weight and tighten the screw that connects it to the back plate. The weight should now be secured.
- Rotate the reader lamp so that the filament produces an even beam of light and casts no shadow, from the bulb's seam, over the photocell apertures (Figure 6-7).

#### NOTE

Inspect the bulb for filament sag, if present replace the bulb.

Adjust the condensing lens so that the flat portion is parallel with the cell block. Loosen the two set screws on the bracket assembly and move it forward or backward to make the light beam cut across the right-hand edge of the apertures.

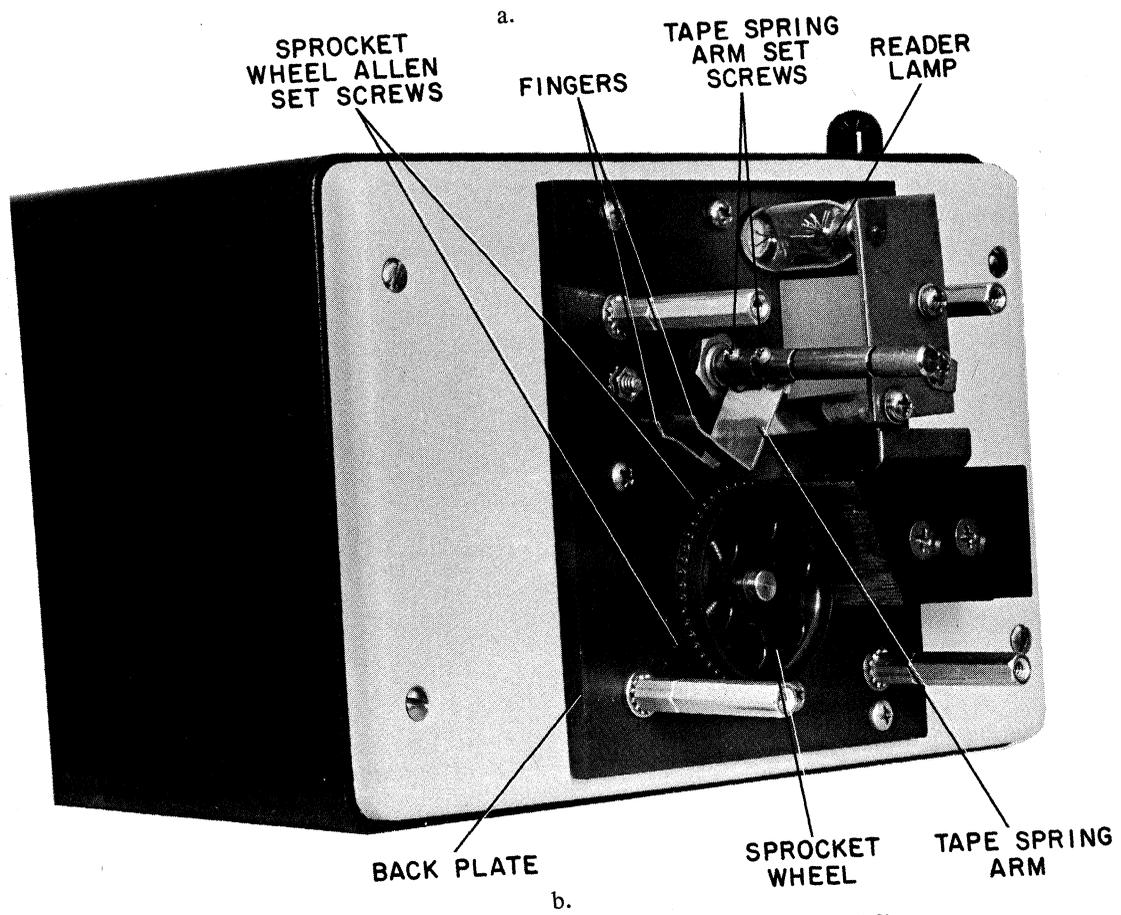
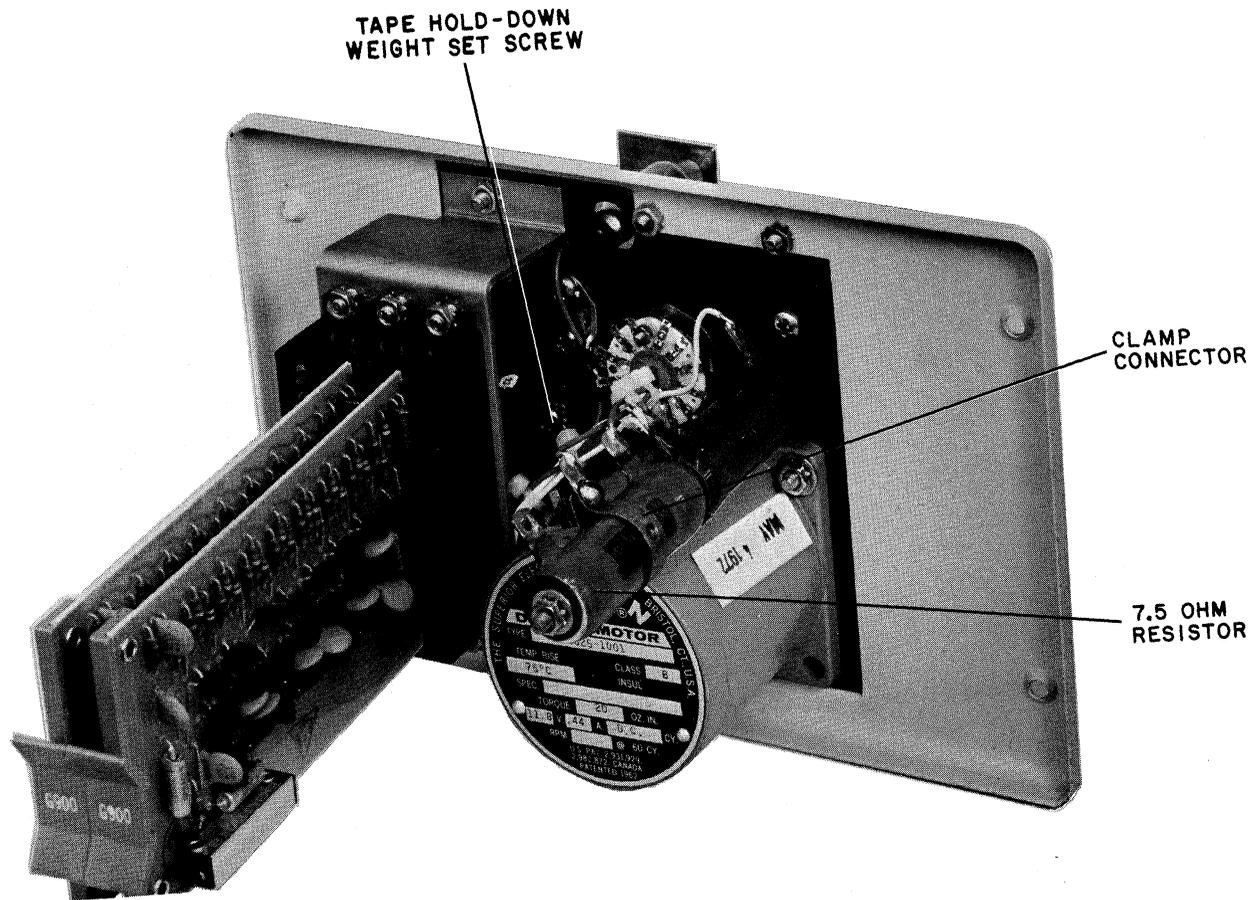
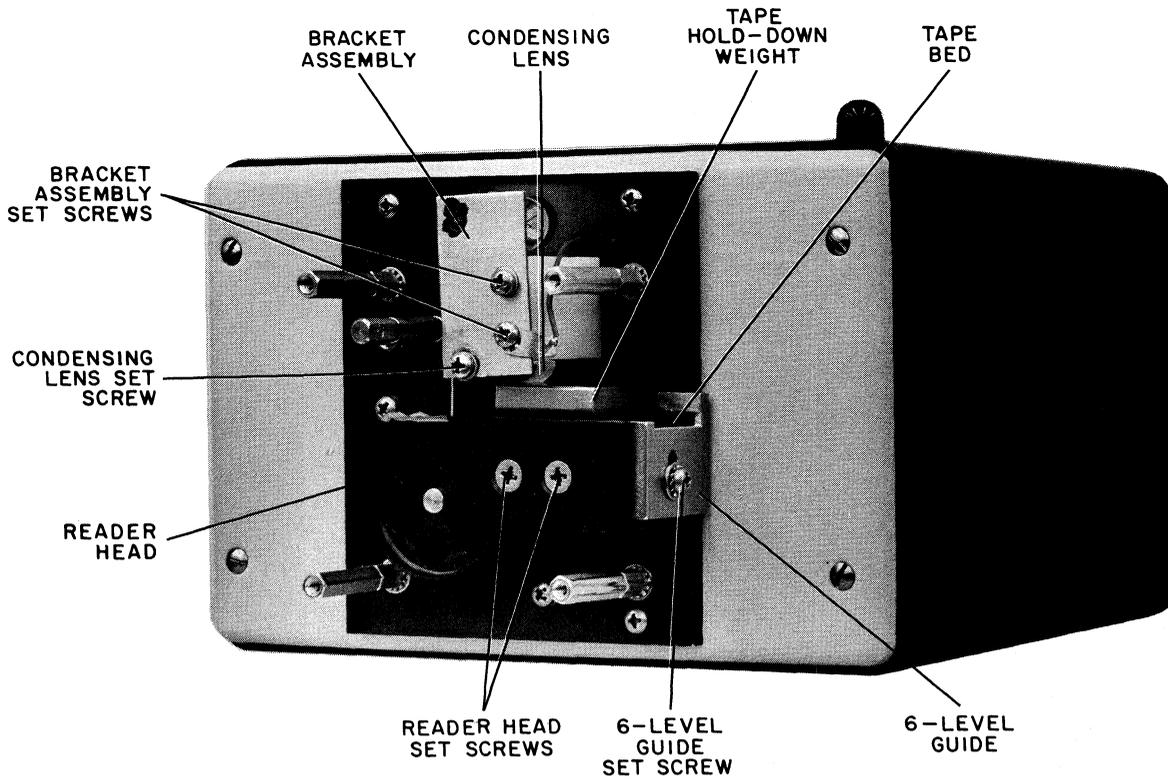
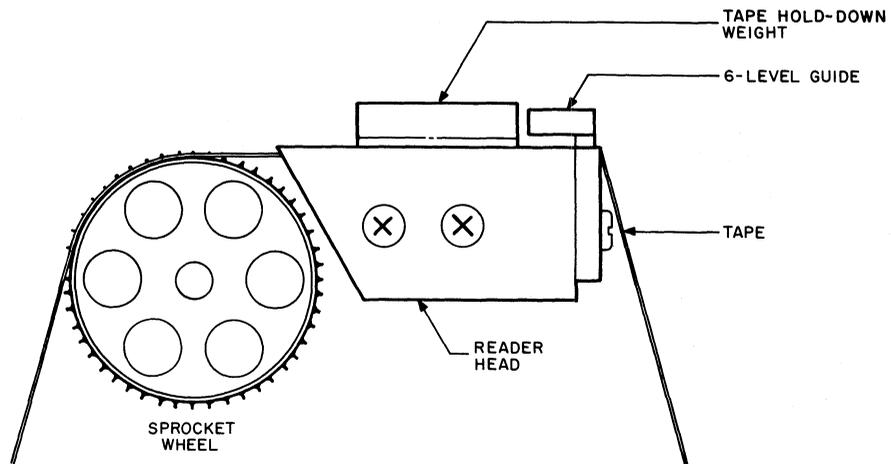


Figure 6-5 PR68A Reader Adjustment Location (Sheet 1 of 2)



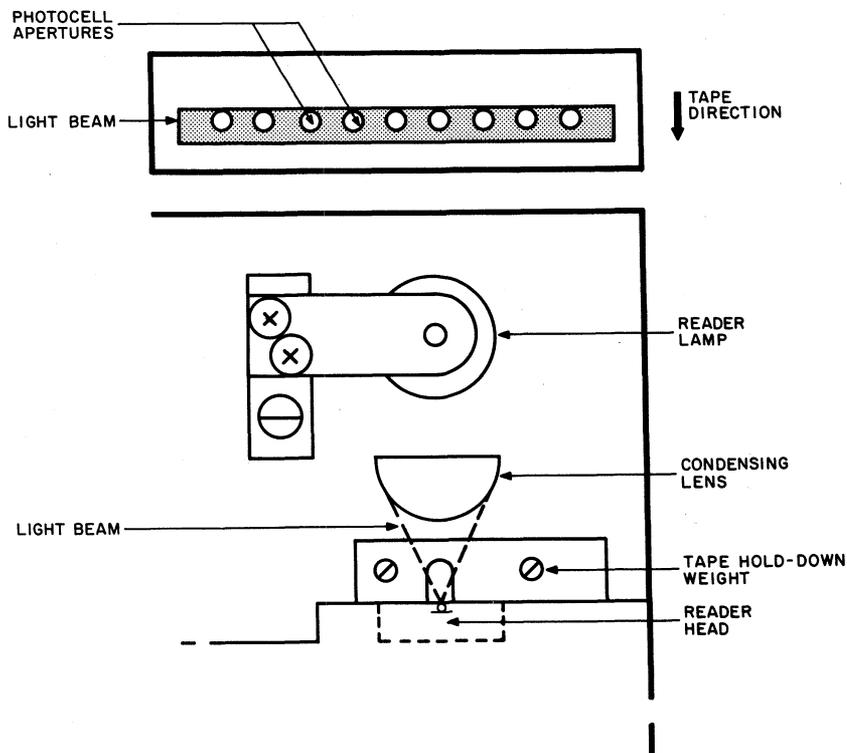
c.

Figure 6-5 PR68A Reader Adjustment Location (Sheet 2 of 2)



08-0761

Figure 6-6 6-Level Guide and Reader Head Adjustment



08-0762

Figure 6-7 Reader Lamp and Condensing Lens Adjustment

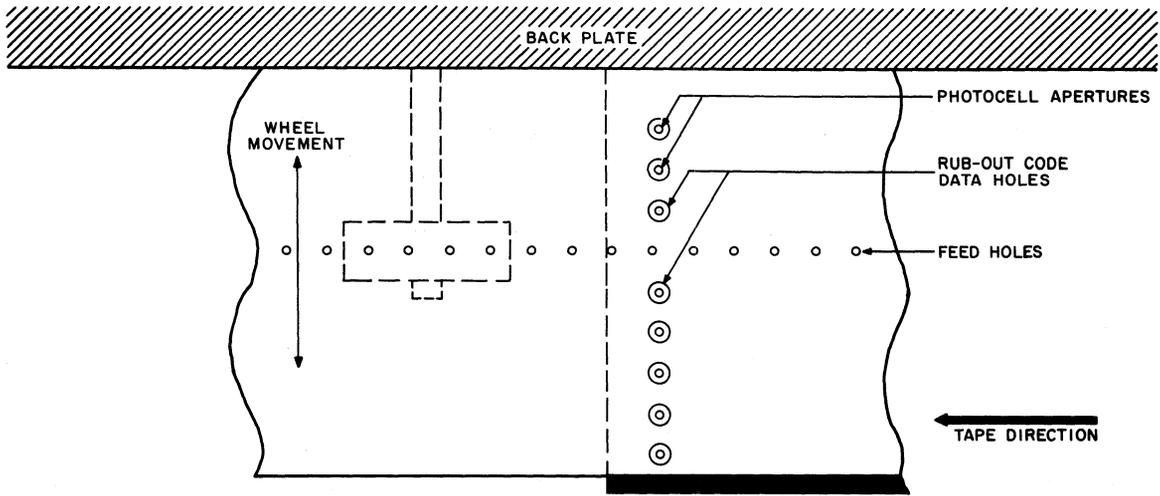
6. Take a short piece of tape with a rub-out code perforated about half way along the tape and place it in the reader. Loosen the two Allen set screws in the sprocket wheel and, while holding the tape taut across the cell block and wheel, move the sprocket wheel laterally so that the holes in the tape are centered over the photocell apertures (Figure 6-8). Be sure that the tape is not curled up against the reader plate. Partially tighten one of the screws.
7. Select the required reader via the PA60A/B control by loading the following program:

```

0 /   7604   LAS
      6312   RSC
      7402   HLT
  
```

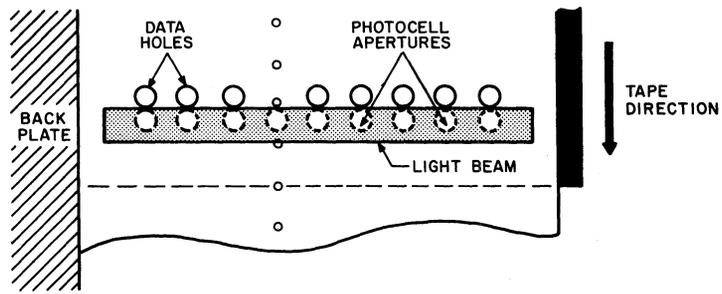
Load ADD 0, set the reader number in SR bits 8-11, then depress START.

8. Release the screw in the wheel and, keeping the lateral position fixed, rotate the wheel axially until the leading edge of the tape holes is just touching the right-hand edge of the light beam (Figure 6-9). Tighten the Allen set screws in the wheel.
9. Put the spring arm down and check that the straight part of the fingers are horizontal and just touching the wheel (Figure 6-10). Also, check that the fingers are centered over the sprockets on the wheel, sighting from the top of the reader. Adjustment can be made by carefully bending the spring arm and the fingers, if necessary, using a pair of long nose pliers.



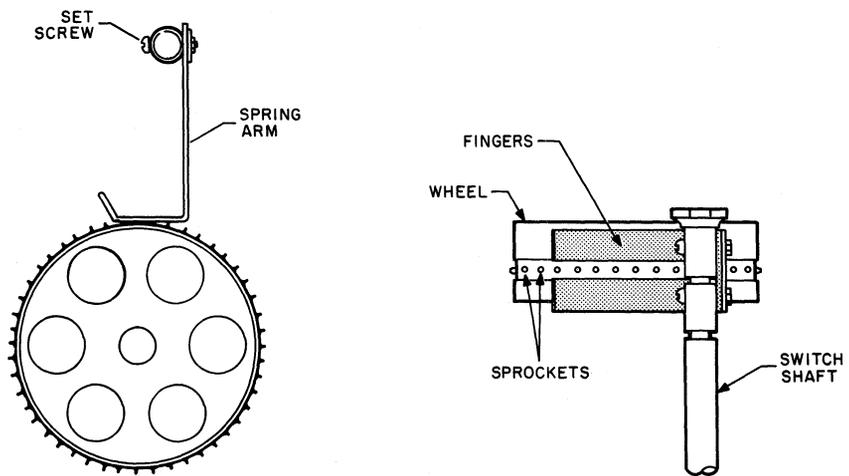
08-0763

Figure 6-8 Lateral Adjustment of Sprocket Wheel



08-0764

Figure 6-9 Axial Adjustment of Sprocket Wheel



08-0765

Figure 6-10 Spring Arm Adjustment

**6.3.5.2 Dynamic Adjustment** — After all preliminary static adjustments have been made, the reader should be margined. There are two methods of doing this, depending on the available test equipment.

**Method 1**

1. Using a short program or Typesetting Configuration Test Program 10, read a 1's and 0's test tape loop. Observe the AC for data and adjust the potentiometers on the G900s through their entire range, from the point where bits are picked up to the point where bits are dropped, counting the number of full turns required.
2. Set the potentiometers back 40 percent from the point where bits are picked up; for example: if ten turns are counted, set the potentiometer back 4 turns from the pickup point. The feed hole will probably be picked up first when checking bits 1, 2, 3, and 4, causing the program to hang up on the flag. This is the end of the range in that direction.

**NOTE**

The minimum range that should be obtained for either potentiometer is 6 turns.

**Method 2**

1. Using an oscilloscope, read a 1's and 0's test tape loop at full speed and monitor A29J on the PA60A data hole 0 or B15P on the PA68A and A24J on the PA60A or B12E on the PA68A. Observe the relationship between the data and the "strobe" output of the B flip-flop.
2. Adjust potentiometer R1 and, if necessary, the sprocket wheel to obtain the timing shown in Figure 6-11.

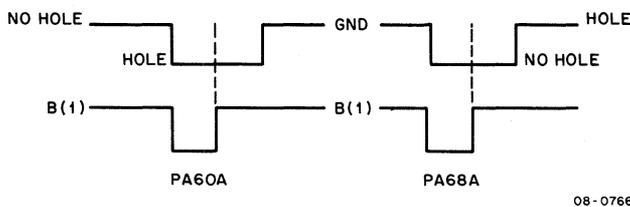


Figure 6-11 Relationship of Reader Data Pulse and Strobe Pulse

3. Repeat Steps 1 and 2 for the other potentiometer, monitoring A28J on the PA60A (data hole 3) or B14P on the PA68A. To check for skew, compare data hole 0 and data hole 5 (A28V on the PA60A or B13V on the PA68A).
4. After the margins have been set up correctly, read a short piece of tape to ensure that the PA60A recognizes the "out-of-tape" condition as the tape runs out. A slight readjustment of the G900 may be necessary, but the change should not be too far from the 40/60 setting, if Method 1 was used. Also, check that the "out-of-tape" condition is recognized when the tape spring arm is raised.

**6.3.5.3 Mixed Tape Level** — Some systems must be capable of reading both 6- and 8-level tape. Where both tapes are advanced feed hole, the procedure is the same as described above except that the check for skew should be made between hole 0 and hole 7 (A27P on the PA60A or B13J on the PA68A).

When the 8-level tape is center feed hole, it has been found to be better, where possible, to reserve a reader for reading 8-level tape only. If this is not practical, the readers should be set up for 6-level tape and then a marginal re-adjustment of the sprocket wheel should be made, together with re-margining of the potentiometers, to accommodate both tape levels.

When all readers have been set up satisfactorily, perform a final check, using either the Typesetting Configuration MAINDEC-08-D2HB or the TCSE.

### 6.3.6 PP67A/B High-Speed Paper-Tape Punch

All mechanical adjustments for the PP67A/B Punch are provided in Teletype Corporation Bulletin 215B. After these adjustments have been made, operational adjustments can be made. Operational adjustment procedures are provided in the following paragraphs for the punch mechanism and the low tape indicator arm.

**6.3.6.1 Punch Mechanism Adjustment** – The punch mechanism can be adjusted if it is causing perforation of incorrect data. An oscilloscope is required to make the adjustment. The adjustment procedures is:

1. Load the following program:

**NOTE**

**The program contains a stall to check the feed hole solenoid so that the solenoid is de-energized between character punching.**

0200/	7604	OSR
	6314	PSC
	7200	CLA
	6026	PLS
	6021	PSF
	5204	JMP.-1
	2220	ISZ TEMP
	5206	JMP.-1
	7040	CMA
	5203	JMP.-6

2. Set SR to starting address 0200 depress LOAD ADD; change SR bits 8-11 to punch N° and depress START.
3. As the punch perforates alternate 0s and 1s, check each solenoid by connecting the oscilloscope probe to the tab that comes from the solenoid driver via J1-L through J1-9 (usually the solid color wire). Use channel 2 of the oscilloscope.
4. The “glitch” in the sawtooth waveform (Figure 6-12) should be positioned at the trailing edge of the waveform as shown. If it is not, loosen the two screws holding the punch solenoid clamp and adjust the solenoid.

**NOTE**

**Move the solenoid squarely in the vertical direction when making this adjustment. Tilting the solenoid may cause the armature to slip out of the blocking pawl.**

5. Loosen the screw holding the range finder and move the slide until punching begins to deteriorate. Note the position on the scale.

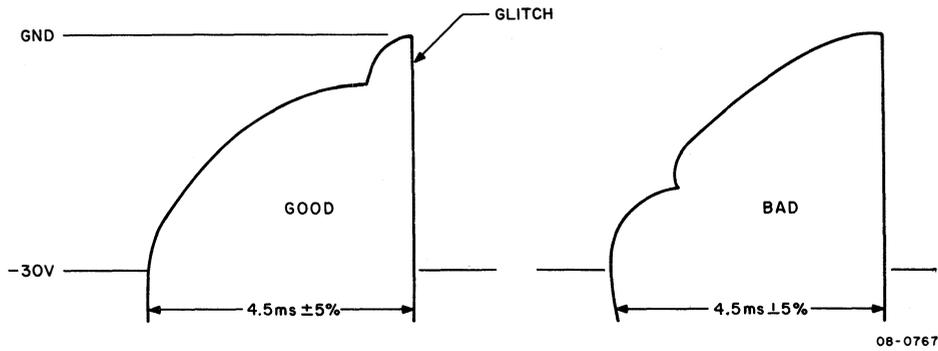


Figure 6-12 Punch Solenoid Waveform

6. Move the slide in the opposite direction until punching begins to deteriorate again. Note the position on the scale.
7. Set the range finder midway between the two positions and tighten the screw.

**NOTE**

On a new or rebuilt punch the normal setting is 30°.

**6.3.6.2 Low Tape Adjustment – The low tape adjustment procedure is:**

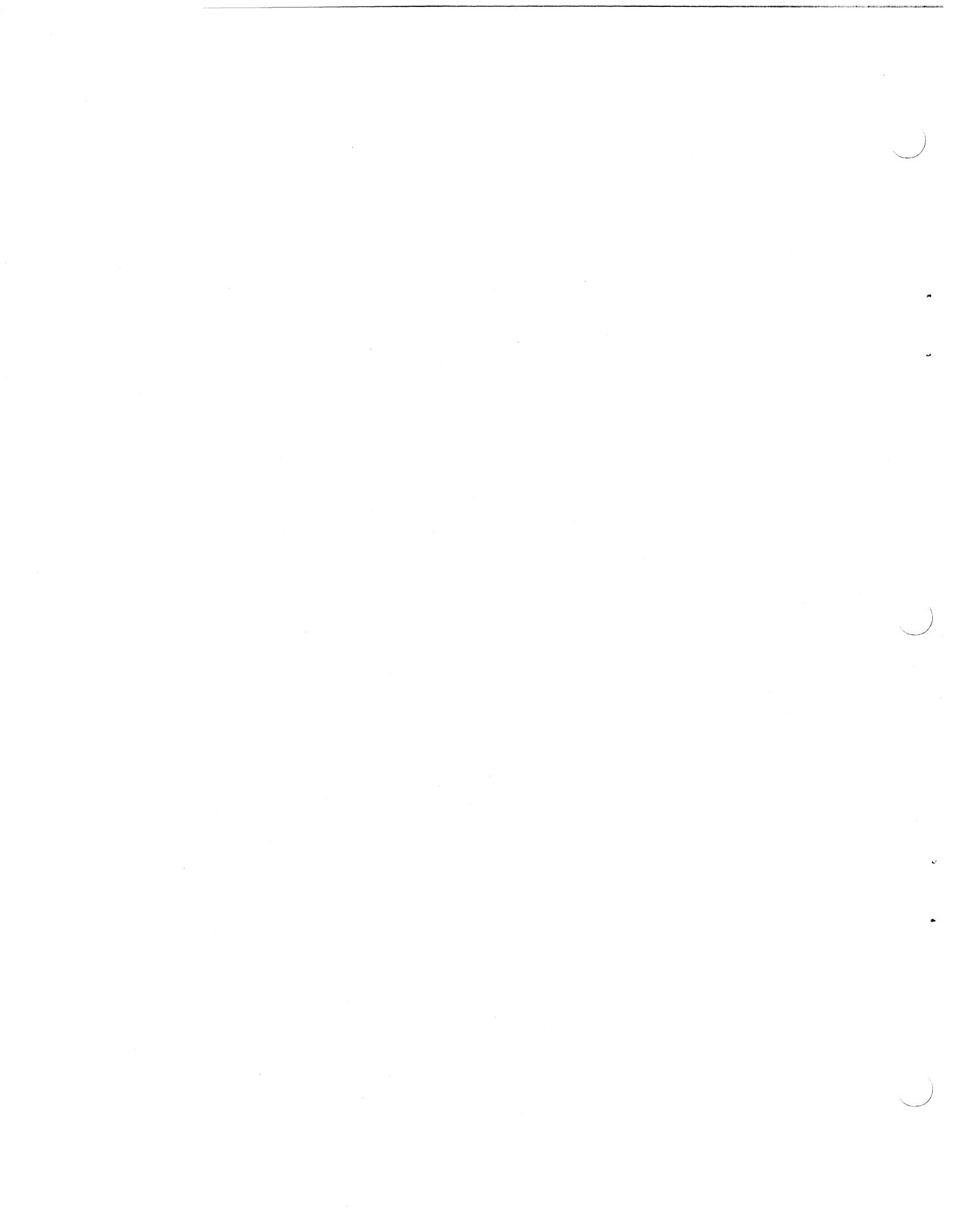
1. Load the following program:

0200/	7604	OSR
	6314	PSC
	7300	CLA CLL
	6311	SKPNA
	7410	SKP
	5202	JMP.-3
	6026	PLS
	6021	PSF
	5207	JMP.-1
	5202	JMP.-7

2. Set SR to 7000 and depress LOAD ADD; change SR bits 8-11 to punch N° and depress START.
3. Install a tape spool on the punch, containing approximately 114 in. of paper tape left on the core.
4. Loosen the two screws holding the low tape switch and move the switch until the punch stops perforating tape. The left and center contacts on the switch should be just breaking contact. Tighten the screws and check that the punch is still not punching.
5. Lift the arm until the punch starts. The clearance between the tape and arm should not be greater than 1/8 in. If necessary, readjust the switch.

**NOTE**

The low tape adjustment is not required when the system is equipped with a PA68A Reader/Punch Control.



## CHAPTER 7 PARTS LIST

Drawing MA-E-PR68A-0-1 in Volume II presents a breakdown of the replaceable parts of the PR68A High-Speed Paper-Tape Reader. These parts are listed in Table 7-1. Recommended spare parts for all negative logic type-setting hardware are listed in Table 7-2.

**Table 7-1  
Parts List for PR68A**

Item Number	Part	Part Number	Quantity
1	Back Plate	7404983	1
2	Phillips Pan Head Mach. Screw- #6-32 X 3/8 Lg. Sst.	9006022-1	13
3	Keys Hex Nuts #6-32 Sst.	9006560	13
4	Switch	74-4992	1
5	Tape Spring Arm	74-4984	1
6	Instrument Knob	12-4747	1
7	Phillips Pan Head Mach. Screw- #2-56-3/8 Lg. Sst.	9006003-1	2
8	Hex Nuts #2-56 Sst.		2
9	External Tooth Lock Washer #2 Hole		2
10	Phillips Pan Head Mach. Screw- #6-32 X 7/8 Lg. Sst.	9006027-1	1
11	Belvell Washer Type Dip Sprint #6 Hole Sst.		1
12	6-level Guide	7404976	1
13	Bushing	7404991	2
14	Phillips Flat Head Mach. Screw- #8-32 X 1-1/2 Lg. Sst.	9006046-2	2
15	Sprocket Wheel	74-4975	1
16	Front Guide	7404982	1
17	Reader Head	74-4988	1

**Table 7-1 (Cont)**  
**Parts List for PR68A**

<b>Item Number</b>	<b>Part</b>	<b>Part Number</b>	<b>Quantity</b>
18	Shim Reader Head	7404978	1
19	Driving Motor	12-3530	1
20	Phillips Pan Head Mach. Screw- #6-32 X 1/2 Lg. Sst.	9006024-1	8
21	Mtg. Brkt. Connector	74-4985	1
22	Connector	12-2625	2
23	Cover Panel		1
24	Cover Box (Bottom)	7404981	1
25	Control Box Logo	7404974	1
26	Tape Hold-Down Weight	7404990	1
27	Plain Washer (Medium) 5/16 O.D. X 5/32 I.D. X 1/16 Thk Sst.	9006656	5
28	External Tooth Lock Washer, #6 Hole Sst.	9007649	10
29	Threaded Standoffs #6-32 X 1-3/8 Lg.		4
30	Cover Box (Top)	7404977	1
31	Utility Cabinet	7404986	1
32	Louvered Rear Panel	7005651	1
33	Phillips Pan Head Mach. Screw- #6-32 X 1/4 Lg. Sst.	9006020-1	1
34	Condensing Lens	74-4989	1
35	Terminal		2
36	Standoff	7404989	1
37	Brkt., Front Light	7404979	1
38	Light Bulb 12V-10W	12-4734	1
39	Brkt. Rear Light	7404980	1
40	Cover Glass #1 Thk X 24 X 40 MM	12-4614	1
41	Photosensing Cell #HPC-9-01 Hoffman	12-4713	1
42	Strain Relief Bushing #SR-8P-1 Heyco		1
43	Rubber Extr. Channel		1
44	FLIP CHIP #G900		1
45	Phillips Flat Head Mach. Screw- #6-32 X 3/8 Lg., Sst.	9006022-2	1
46	Phillips Pan Head Mach. Screw- #6-32 X 3/4 Lg.	9006026-1	1

**Table 7-1 (Cont)**  
**Parts List for PR68A**

Item Number	Part	Part Number	Quantity
47	Fixed Resistor #0200R 25 Watt, 1.290 Amp; 15 ohms Ohmite		1
48	Fiber Shoulder Washer		4
49	Threaded Rod 6-32 X 4-7/8		1
50	Shim Corrugated		1
51	7.5 ohm 25W Resistor		1
52	Support Shim	7406675	1
53	Reader Lamp	12-2986	1
54	Dialco IO1R Light	12-4628	1
55	Jones Terminal Strip #4-140	90-06901	1
56	Wire #22 Standard Tef (ORN)	91-07350-4	1
57	Wire #22 Standard Tracer (Yellow and White)	91-07400-5	1

**Table 7-2**  
**Negative Logic Typesetting Hardware Spares**

Part	DEC No.	Quantity
<b>PR68A Reader</b>		
Condensing Lens 1-3/16 in.	74-4989	2
Photocell Head Assembly	29-15961	1
Switch	74-4992	1
Tape Depressor Spring	74-4984	2
Osram Bulbs 12V, 10W	12-4734	4
Light Bulb 330	12-2986	4
Toggle Switch (Subminiature)	12-1168	2
G900 (PR68A)		1
or G908 (PR68B)		1
<b>PP67A/B Punches</b>		
Diode Pack MDA952-5	11-5280	1
Switch T206	12-3374	1
Thyrector 6RS 20S94-B4	11-0106	1
SCR C20B	11-1820	2
Diode MR2064	11-3183	2
Resistor 25Ω 10W	29-13340	2
Solenoid Magnets	29-16402	2

**Table 7-2 (Cont)**  
**Negative Logic Typesetting Hardware Spares**

Part	DEC No.	Quantity
<b>Punch Block</b>		
6-level (PP67A)	29-11210	1
8-level (PP67B)	29-11199	1
SCR Driver 823B	54-3858	1
Part	Module	Quantity
<b>Interface</b>		
<b>PA60A/B</b>	R401	1
	R203	1
	R602	1
	R303	1
	R302	1
	W051	1
	R123	1
	R151	1
	W501	1
<b>PA60/C</b>	W700	1
<b>PA61A</b>	R141	2
	W040	2
<b>PR68A</b>	R401	1
	W051	1
	R203	1
	R303	1
	W040	2
	W501	1
	R602	1
	R123	1

## CHAPTER 8

# GLOSSARY OF TERMS

The following pages contain a glossary of terms commonly used in the printing, graphic arts, and newspaper fields. This glossary is designed to provide DEC maintenance personnel with a basic understanding of the terminology used in these areas. Hopefully, this may lead to improved communication and a better understanding of the problems encountered in those areas using the Typeset-8 System.

Agate line	A standard of measurement for depth of columns of advertising space. Fourteen agate lines make one column inch.
Alterations	In composition, changes made in the copy after it has been set in type.
Ascender	That part of the letter which rises above the main body, as in "b".
Automatic allotting	Distribution of output tape codes to punches according to copy style.
Backing up	Printing the reverse side of a sheet already printed on one side. In electrotyping, backing a copper shell with metal to make the plate the required thickness.
Bad break	In composition, the setting of a hyphenated line as the first line of a page. Also, incorrect word division.
Bands program	A program that uses space bands to justify lines of hot type.
Base	In composition, all the metal below the shoulder of a piece of type. In letterpress, the metal or wood block on which printing plates are mounted to make them type high.
Base line	An imaginary line used as a reference in the measurement of leading. Alphanumeric characters sit on this line, descenders go below this line for example: <u>Quertyoip; p's are queueing for signatures.</u>
Basis weight	The weight in pounds of a ream (500 sheets) of paper cut to a given standard size for that grade: 25 × 38 for book papers, 20 × 26 for cover papers, 22 1/2 × 28 1/2 or 22 1/2 × 35 for bristols, 25 1/2 × 30 1/2 for index, e.g., 500 sheets 25 × 38 of 80-lb coated will weigh eighty pounds.
Bearer	In photoengraving, the dead metal left on a plate to protect the printing surface while molding. In composition, type-high slugs locked up inside a chase to protect the printing surface. In presses, the surface-to-surface ends of cylinders that come in contact with each other.
Benday	A method of laying a screen (dots, lines and other textures) on artwork or plates to obtain various tones and shadings.

<b>Bite</b>	In photoengraving, the various stages of standard etching accomplished through the action of acid, the depth increasing after each bite.
<b>Blanket</b>	In offset-lithography, a rubber-surfaced sheet clamped around the cylinder, which transfers the image from plate to paper.
<b>Blueprint</b>	In offset-lithography and photoengraving, a photoprint made from negatives or positives, used as a proof.
<b>Body</b>	A term referring to the viscosity, consistency, or covering power of an ink or vehicle.
<b>Bold-face type</b>	A name given to type that is heavier than the text type with which it is used.
<b>Break for color</b>	In artwork and composition, to separate the parts to be printed in different colors.
<b>Bulk</b>	The degree of thickness of paper.
<b>Burnishing</b>	In photoengraving, the corrective treatment of a printing plate to darken local areas by spreading the printing surface of lines and dots.
<b>Burr</b>	Rough edges of metal caused by routing or cutting.
<b>Caliper</b>	The thickness of paper, usually expressed in thousandths of an inch.
<b>Caps and small caps</b>	Two sizes of capital letters made in one size of type, commonly used in most roman type faces.
<b>Carbro</b>	A photograph in full color, frequently used for process color reproduction.
<b>Chase</b>	A rectangular metal frame in which type and plates are locked up for printing.
<b>Chicken plucker</b>	Small hand tool for modifying or correcting paper tape codes.
<b>Cold type</b>	See photocomposition.
<b>Collate</b>	In binding, the assembling of sheets or signatures.
<b>Combination plate</b>	In photoengraving, halftone and line work combined on one plate; etched for both halftone and line depth.
<b>Column indent</b>	A format in which all lines in a column are indented from the flush position.
<b>Comet</b>	Trade name linecaster (See Electron)
<b>Composing stick</b>	In composition, a hand tool in which type is assembled and justified.
<b>Condensed type</b>	A narrow or slender type face.
<b>Continuous tone</b>	A photographic image which has not been screened and contains gradient tones from black to white.
<b>Copy</b>	Any furnished material (typewritten manuscript, pictures, artwork) used in the production of printing.
<b>Curved plate</b>	In letterpress, an electrotype or stereotype which is backed up and pre-curved to fit the cylinder of a rotary press.
<b>Cut</b>	In letterpress, a photoengraving of any kind.

Cutscore	In die-cutting, a sharp-edged knife, usually several thousandths of an inch lower than the cutting rules in a die, made to cut part way into the paper or board for folding purposes.
Densitometer	A sensitive photoelectric instrument which measures the density of photographic images, or of colors in color printing. Used in quality control to determine accurately whether color is consistent throughout the run.
Descender	That part of the letter which extends below the main body, as in "p".
Display type	In composition, type set larger than the text, used to attract attention.
Distribution	In composition, the act of returning type, rules, leads, slugs, furniture, and other printing materials to their proper places after use.
Doctor blade	In gravure, a knife-edge blade pressed against the engraved printing cylinder which wipes away the excess ink from the non-printing area.
Dot	The individual element of a halftone.
Double dot halftone	Two halftone negatives combined into one printing plate, having greater tonal range than a conventional halftone. One negative reproduces the highlights and shadows; the other reproduces middletones. Used primarily in offset-lithography.
Drier	In inkmaking, any substance added to hasten drying.
Dropout	A halftone with no screen dots in the highlights.
Dummy	A "preview" of a proposed piece of printing.
Duotone	In photomechanics, a term for a two-color halftone reproduction from a one-color photograph.
Dump punch	A tape punch used to output a tape when the allotted punch cannot be used.
Dropped rule	A straight type-high ruling slug often used to separate classified advertisements. See example below.
	<p><b>BABYSITTER</b> needed. Once a week on Thursday 11 a.m. to 11 p.m. for one 6 yr. old girl. Agency fee rate paid + transportation. Call PL 54221 bef. 9 a.m. any morning.</p> <p><b>HOUSEKEEPER</b>, steady &amp; dependable, short hours, 5 days per week. Weekly salary. Must have car. 791-8762.</p> <p><b>BABYSITTER</b> needed nites. 5 days a week, 3:15 - 12:30. Call 365-6605.</p> <p><b>LIGHT</b> housekeeping &amp; some cooking for elderly people. Live in. Los Altos. \$150 month. 948-4598 or 812-7649.</p>
	Reprinted by permission of the Worcester Telegram and Gazette.
Electron	Trade name for a linecaster similar to the Linotype; operates in the 6 to 9 pt range.
Electron mixer	Same as Electron but capable of mixing up to four fonts in the 6 to 24-point range.
Em	In composition, the square of a type body. So named because the letter "M" in early fonts was usually cast on a square body.
En	One-half the width of an em.
Engraving	A general term applied to any printing plate produced by an etching or cutting process.

Escapement	The distance that a carriage or lens mechanism moves for a character.
Etch	In photoengraving, to produce an image on a plate by chemical or electrolytic action. In offset-lithography, an acidified gum solution used to desensitize the non-printing areas of the plate; also, an acid solution added to the fountain water to help keep non-printing areas of the plate free from ink.
Expanded type	Type whose width is greater than normal; also called extended type.
Face	The printing surface of a piece of type.
Feeder	The section of a press which separates the sheets and feeds them in position for printing.
Filling in (or filling up)	A condition in letterpress or offset-lithography where ink fills the area between the halftones dots or plugs up the type.
Flat	In offset lithography, the assembled composite of negatives or positives, ready for platemaking. Also, a picture that is lacking in contrast.
Flow	The ability of an ink to spread over a surface or into a thin film.
Flush and Hang	A printing format in which the first line of text is set flush with the left margin with all following lines indented. See example below.
	<p style="text-align: center;">WSRS-FM WORCESTER-96.1 mcs</p> <p>A.M.</p> <p>6:00—STEREO AT DAYBREAK: Claus Ogerman; Andre Kostelanetz; Howard Roberts Quartet; Anthony Newley; Enoch Light; Norman Luboff Choir.</p> <p>9:00—STEREO MAGIC: Tony Bennett; Edmundo Ros; Peter Nero; Doris Day; Andre Kostelanetz; Ray Conniff.</p> <p>P.M.</p> <p>12:00—STEREO SHOWCASE: Peter Nero; Matt Monro; Werner Muller; Rodgers and Hart; Ronnie A. drich; Teresa Brewer; Henry Mancini; 101 Strings; Enoch Light; Mel Davis.</p> <p>5:00—STEREO SPECTRUM: Andre Previn; Jackie Gleason; Anita Bryant; George Shearing; Mantovani; Edmundo Ros.</p> <p>8:00—BEST OF BROADWAY: Ray Conniff; Andre Previn; 101 Strings; Living Strings.</p> <p>10:00—TONIGHT ON POPS: Richard Tucker; A Pops Concert with various artists; Eugene Ormandy; Athens.</p> <p>12:00—STEREO TILL SIX: Living Trio; Hollywood Bowl Symphony; Glen Gray; Nat King Cole; Frankie Carle; Enoch Light; Bob Eberly and Helen O'Connell; Exodus (soundtrack); Webley Edwards; Aretha Franklin; Cozy Cole; McGuire Sisters.</p>
	Reprinted by permission of the Worcester Telegram and Gazette.
Flush blocking	Mounting a plate so that the printing surface is flush with the edge of the block.
Flush left (or right)	In composition, type set to line up at the left (or right). This glossary of terms is set flush left.
Flush paragraph	A paragraph with no indentation.
Flying paster	In web printing, an automatic pasting device that splices a new web of paper onto an expiring roll, without stopping the press.
Font	A complete assortment of type of one size and face. In hot metal, a font is stored in a magazine. In photocomposition, a font is stored in a masking device such as a disk, film strip or grid; or digitized and stored on disks, in core memory, magnetic tape, etc., as in video display photocomposition machines.

Form	Type and other matter locked in a chase ready for printing.
Form rollers	The rollers, either ink or dampening, which contact the plate.
Format	The size, style, type page, margins, printing requirements, etc., of any magazine, catalog, book, or printed piece. Also, a predefined sequence of codes or code strings used to simplify mark-up and or reduce key-strokes.
Furniture	In lockup, wood or metal blocks used to fill the blank spaces in a form.
Fuzz	Fibers projecting from the surface of a sheet of paper.
Galley	A shallow metal tray used to hold type.
Galley proof	A proof taken of type standing in a galley, before being made up into pages.
Gathering	The assembling of folded signatures in proper sequence.
Grippers	Metal fingers which hold the paper in place to the delivery end of a press.
Gripper edge	The leading edge of paper as it passes through a printing press.
Gripper margin	Unprintable blank edge of paper on which grippers bear, usually 1/2 inch or less.
Gutter	The blank space or inner margin, from printing area to binding.
Half-column cut	A photoengraved illustration, one-half column in width, inserted into a column of text. Also called a run-around. See example below.

Dr. Andras Fabry, a member of the Royal College of Veterinary Surgeons, has been appointed to the department of pharmacology and toxicology of Mason Research Institute, 21 Harvard St., it has been announced.



Dr. Fabry studied veterinary medicine in Liverpool, England, from 1956 to 1962 and did postgraduate work anaesthetics at the University of Glasgow.

Reprinted by permission of the Worcester Telegram and Gazette.

Halftone	A reproduction of continuous tone artwork, such as a photograph, with the image formed by dots of various sizes.
Head margin	The white space above the first line on the page.
Hickeys	In offset-lithography, an imperfection in presswork due to many things such as dirt on the press, hardened by specks of ink, etc.
Highlight	The lightest or whitest parts in a printed picture, represented in a halftone by the smallest dots or the absence of all dots.
Hot-metal equipment	A class of machines producing lines of type (slugs) used in the making of type cylinders for newspaper printing.
Imposition	The laying out of type pages in a press form so that they will be in the correct order after the printed sheet is folded.

Impression	In printing, the pressure of type or plate as it comes in contact with the paper.
Ink fountain	The container which supplies ink to the inking rollers.
Insert	A specially printed piece usually prepared for insertion in a publication.
Intaglio printing	Printing from plates in which the image is in intaglio or sunken below the surface, such as in steel-plate engraving or gravure.
Justify	In composition, to space out lines uniformly to the correct length.
Kerning	Reduction of character escapement in order to condense words or lines of text—used primarily in conjunction with larger point sizes.
Key	To code copy to a dummy by means of symbols, usually letters. Insertions are sometimes “keyed” in a like manner. In lockup, a device for operating quoins.
Key plate	In color printing, the plate used as a guide for the register of other colors. It normally contains the most detail.
Layout	The drawing or sketch of a proposed printed piece.
Leaders	In composition, rows of dashes or dots used to guide the eye across the page. Used in tabular work, programs, tables of contents, etc.
Leads	Thin strips of metal placed between lines of type to separate them vertically.
Leading	The amount of vertical space from baseline to base—in typeset copy.
Letterspacing	The spacing between each letter of a word.
Letter press	The process of printing directly from an inked raised surface upon which the paper is impressed.
Linecasting machines	Any of a group of keyboard and/or perforated-tape controlled devices which cast lines of lead type (slugs) using brass mats (matrices) as molds.
Linotype	Trade name for a hot-metal linecasting machine controlled from a keyboard or paper tape; operates in the 6 to 14 pt range.
Lockup	In letterpress, to position a form in a chase for printing.
Logotype (or logo)	Name of a company or product in a special design used as a trademark in advertising.
Long ink	An ink that has good flow in the fountain.
Loose lines	Lines in which the total width of the mats used is less than the preset line length. When this occurs, the linecaster will not mold a slug.
Lower case	The small letters in type, as distinguished from the capital (upper case) letters.
Ludlow	Trade name for a manually operated linecaster which produces type slugs from hand-set type mats.
Magazine	In hot-metal typesetting equipment, a container, usually mounted at the top of the equipment, from which type-molding mats are automatically drawn to produce type slugs.
Makeready	In letterpress, the building up of the press form so that heavy and light areas print with the correct impression.

<b>Makeup</b>	In composition, the arrangement of lines of type and illustrations into pages of proper length.
<b>Mask</b>	In color separation photography, an intermediate photographic negative or positive used in color correction. In offset-lithography, opaque material used to protect open or selected areas of printing plates during exposure.
<b>Masking paper</b>	In offset-lithography, goldenrod paper to which negatives are fastened in stripping to produce a flat.
<b>Mat</b>	Newspaper term for a matrix.
<b>Matrix</b>	A mold in which type is cast in linecasting machines. In stereotyping, the paper mold made from a type form.
<b>Measure</b>	In composition, the width of type, usually expressed in picas.
<b>Middletones</b>	The tonal range between highlights and shadows of a photograph or reproduction.
<b>Mixing</b>	The process by which mats are drawn from different magazines on a single linecaster to produce distinctive printing formats; as in advertisements. See example of four-magazine mixing below.



Reprinted by permission of the Worcester Telegram and Gazette.

<b>Moire</b>	Undesirable screen pattern in color process printing caused by incorrect screen angles of halftones.
<b>Mottle</b>	The spotty or uneven appearance of printing. Most pronounced in solid areas.
<b>Newsprint</b>	A generic term used to describe the kind of paper generally used in the publication of newspapers.
<b>Nickeltype</b>	In electrotyping, a plate on which the first deposit is of nickel and the remainder of the shell is copper. Nickeltypes give sharper definition in printing and are more durable than copper.
<b>No-Bands program</b>	A program that uses fixed spacing and the auto-quadding features of a linecaster to justify lines of hot type.
<b>Offset printing</b>	A printing process in which an inked impression from a planographic surface is first made on a rubber-blanketed cylinder and then transferred to the paper being printed.
<b>Opaque</b>	In photoengraving and offset-lithography, to paint out areas on a negative not wanted on the plate. In paper, the property which makes it less transparent.

Overlay	In letterpress makeready, a piece of paper placed in the packing to make that part of the form print more heavily. In artwork, a transparent or translucent covering over copy where color break, instructions, or corrections are marked.
Overprinting	Double printing; printing over an area that already has been printed.
Overset	In composition, type set in excess of space needs in publications.
Paragraph indent	A format in which the initial line of a paragraph is indented with the balance of lines flush left.
Pasteup	The preparation of copy for photographic reproduction by putting all elements in the proper position.
Patent base	In letterpress, a slotted metal base on which unmounted electrotypes are secured.
Perfecting press	A press which prints both sides of paper at one time.
Photocomposition	A process by which reproducible page masters are photographically produced.
Photocomposition machine	A device that produces and composes type photographically. See following: <p><u>C/A/T</u> – Used for on-line text and limited display composition with direct computer drive; operating range is 6 to 36 pt in 15 sizes. It contains four completely independent font segments at a time. Each font contains up to 102 characters.</p> <p><u>Compugraphic 4962</u> – Used for mixed text and display composition. Type can be set from a film strip containing four 90-character fonts.</p> <p><u>Compstar 191</u> – Used for high-speed text and display composition; operates in the 5 1/2 to 48 pt range. Machine has eight lenses and a dual lensing feature that produces 15 point sizes.</p> <p><u>Fototronic 480/1200</u> – Text and display composition. Type Sizes range from 5 to 72 pt depending upon disk size, in 19 sizes. Each type disk contains two, 120-character fonts, with five disks on the machine at one time. Font capacity leaves 30 extra locations for storing pi characters, accents, or other special characters.</p> <p><u>Fototronic TxT</u> – Similar to the Fototronic 480/1200. The differences are:</p> <ol style="list-style-type: none"> <li>1. It is primarily a text-oriented machine with some display capabilities. Type size range is from 5 to 36 pts in 15 sizes.</li> </ol>

2. It uses a 12-position lens turret that puts up to 12 sizes of type on a line at the same time, instead of the zoom lens optical system used in the 480/1200.
3. Light source is an xenon lamp instead of a plasma jet.

Photon 513 – Used in display composition; operates in the 6 to 72 pt range.

Photon 532 – Computer slave used in text and display composition; operates in the 4 1/2 to 72 pt range, in 23 sizes from two matrix disks containing 32 90-character type faces (16 per disk).

Photon 560 – Similar to the 513.

Photon 561 – Similar to the 532. The 561 has only one glass matrix disk instead of two. It holds 16 90-character typefaces rather than 32. It can produce 12 type sizes for each face from the lens turret which does not have the minifier lens that gives the 532 23 sizes. Type size range is 5 to 72 pts.

Photon 713-5 – Used in text and limited display composition; operates in the 5 to 18 pt range, with two sizes and four faces. A single film strip contains four 96-character fonts.

Photon 713-10 – Used in straight text and limited display composition; operates in 5 to 36 pt range, with font strips carrying 8 96-character type faces in 8 sizes. Strips can be arranged singly or in duplexed pairs.

Photon 713-20 – Similar to 713-10.

Photon 713-100 – Similar to 713-10, but faster.

Photon 713-200 – Similar to 713-100, but even faster. It has a 4K mini-computer for memory.

Pacesetter – Used in high-speed text and display composition. Operates in 5 to 72 pt range. The number of typefaces and sizes depends on the model, e.g., Pacesetter 45 has four faces in five sizes. Customer selects up to 16 sizes, depending on specific requirements. A fully programmable 8K mini-computer provides the control logic and gives the Pacesetter far greater format storage capacity than the 713 series.

Linofilm – Used in text and display composition. Operates in the 6 to 54 pt range in five grid ranges. Enlargement and reduction capabilities extend the range from 4 to 216 points. Each grid contains 88 characters.

Linofilm Quick – Used in straight text composition; operates in the 6 to 18 pt range.

Linofilm Superquick – There are three versions of this machine; two standard models and a wide range model. Standard models are available in two or four-grid configurations; operating range is 5 to 18 pt. The wide-range model has four grids with an operating range from 5 to 72 pts, making it both a text and display composition machine.

V-I-P – Primarily a text composition machine; operates in the 6 to 48 pt range. It can mix up to 6 96-character fonts in 16 sizes. A display attachment extends the range to 96 pts.

Pi	Type mixed and in an unusable condition.
Pica	Printer's unit of measurement used principally in measuring lines. One pica equals 1/6 of an inch.
Pica pole	See type gauge.
Picking	The lifting of the paper surface during printing. It occurs when pulling force (tack) of ink is greater than surface strength of paper.
Piling	The building up or caking of ink on rollers, plate or blanket; will not transfer readily.
Point	Printer's unit of measurement, used principally for designating type sizes. There are 12 points to a pica; 72 points to an inch.
Primary colors	In printing inks, yellow, magenta (process red) and cyan (process blue). In light, the primary colors are red, green, and blue.
Process printing	The printing from a series of two or more halftone plates to produce intermediate colors and shades. Usually in four-color process: yellow, red, blue, and black.
Progressive proofs	Proofs of each individual plate in a set of color process plates, pulled in the proper colored inks, and also showing the results of adding each color.
Quad	In composition, blank spacing material less than type high used to fill out lines.
Quoin	In letterpress, steel wedge-shaped or expanding devices used in lockup.
Register	Fitting of two or more printing images upon the same sheet of paper in exact alignment with each other.
Register marks	Crosses or other devices applied to original copy prior to photography. Used for positioning negatives in perfect register, or for color register of two or more colors in printing.
Reproduction proof	In composition, the proof of a type form for photographic reproduction.
Reverse plate	A printing plate in which the parts that are usually black or shaded are reversed, so as to appear white or grey.
Routing	Cutting away the non-printing areas of a letterpress plate.
Sans-serif	A typeface having no serifs.
Scale	The proportion between dimensions of an original and its reproduction. Degree of enlargement or reduction.
Scanner	Electronic device designed to read typewritten copy optically.
Score	To impress or indent a mark with a string or rule in the paper to make folding easier.
Screen	In photoengraving and offset-lithography, glass or film with cross-ruled opaque lines or vignetted dots used to reproduce continuous tone artwork such as photographs. Also, the number of lines or dots to the linear inch on printed illustration.
Serif	The short cross-lines at the ends of the main strokes in roman type faces.
Set-off	In presswork, when the ink of a printed sheet rubs off or marks the next sheet as it is being delivered. Formerly called offset.

Set size	An increase or decrease in character escapement to expand or condense words or lines of text.
Shadow	The darkest parts in a photograph, represented in a halftone by the largest dots.
Short ink	An ink that does not flow freely.
Signature	In book, magazine and catalog work, the name given to a large printed sheet after it has been folded to the required size.
Slitting	Cutting printed sheets or webs into two or more sections by means of cutting wheels on the press or folding machine.
Slug	In composition, a one-piece line of type. Also a strip of metal, usually 6 points, used for spacing.
Small caps	An alphabet of small capital letters available in most roman type faces approximately the size of the lower case letters. Used in combination with larger capital letters.
Space band	A unit of two thin wedge-shaped pieces of metal used as spacers between the words of a line of hot type. Expandable from approximately a thin space to an En space plus a thin space.
Stet	A proofreader's mark, written in the margin, signifying that copy previously marked for corrections should stand as printed and not be corrected.
Straight matter	Columns of printing containing continuous text matter using the same type style and size. See example below.

The Worcester Chapter of the Administrative Management Society will hold "Education Night" tomorrow at 6:45 p.m. in the Coach and Six Restaurant.

Highlighting the evening's activities will be the awarding of a scholarship to a Worcester area high school student, a panel discussion on "How Are We Preparing Our Young People For Business?", and installation of new officers for the coming year.

Reprinted by permission of the Worcester Telegram and Gazette.

Strike-through	The penetration of ink through paper.
Stripping	In offset-lithography, the arranging of negatives (or positives) in their proper position on a flat prior to platemaking.
Substance	The weight in pounds of a ream (500 sheets) of paper cut to the standard size (17 X 22) for business papers (bond, ledger, mimeograph, duplicator, and manifold); e.g., 500 sheets of 20-lb bond cut to the standard size will weigh 20 lb.

Tabular matter

Tabulated lists of data, often statistical. See examples of single-, and half-column tabular matter below.

American				National			
	W.	L.	Pct. GB		W.	L.	Pct. GB
Chicago	18	7	.720 ...	Cincinnati	21	10	.677 ...
Detroit	17	9	.654 1½	Pittsburgh	16	9	.640 2
Kansas City	13	14	.481 6	St Louis	15	11	.577 3½
Boston	13	14	.481 6	Chicago	15	11	.577 3½
Cleveland	12	13	.480 6	Atlanta	14	14	.500 5½
New York	12	13	.480 6	San Francisco	14	14	.500 5
Washington	12	15	.444 7	Philadelphia	13	14	.481 6
California	13	17	.433 7½	New York	10	15	.400 8
Minnesota	11	15	.423 7½	Los Angeles	10	17	.370 9
Baltimore	11	15	.423 7½	Houston	8	21	.276 12

FIFTH — \$2,800, Claiming, 3 and 4 year-olds, 6 furlongs.

Blenham	111	Merry Flight	113
Broken Note	113	County C.	111
Ala Tarrán	111	Henry W.	107
Mr. Peppercorn	109	Abdicat	116
Madre To M'ket	104	Alex The Fox	116
Winged Action	123	Interstate	118

Thirty

Reprinted by permission of the Worcester Telegram and Gazette

Used in newspapers, the symbol “-30-” means the end of the story.

Thin space

One-quarter to two-thirds the width of En space.

Tight lines

Lines in which the total width of the mats used is too great to fit within the jaws of the linecaster. Often produces a jam.

Transpose

To exchange the position of a letter, word, or line with another letter, word, or line.

Type gauge

A printer's tool calibrated in picas used to measure the various sizes of types.

Type high

0.918 inch; the standard in letterpress printing.

Vacuum frame

In photoengraving and offset-lithography, a printing frame used in plate-making. The negative (or positive) is held in close contact with the plate by vacuum.

Vehicle

The fluid component of printing ink which acts as a carrier for the pigment.

Vignette

An illustration in which the background fades gradually until it blends into the unprinted paper.

Washup

The process of cleaning the rollers, form or plate, and sometimes the fountain of a press.

Web

A roll of paper used in web or rotary presses, printed, and most often folded, pasted and counted in one continuous operation.

Web press

A general term applied to high-speed presses which print from continuous rolls of paper.

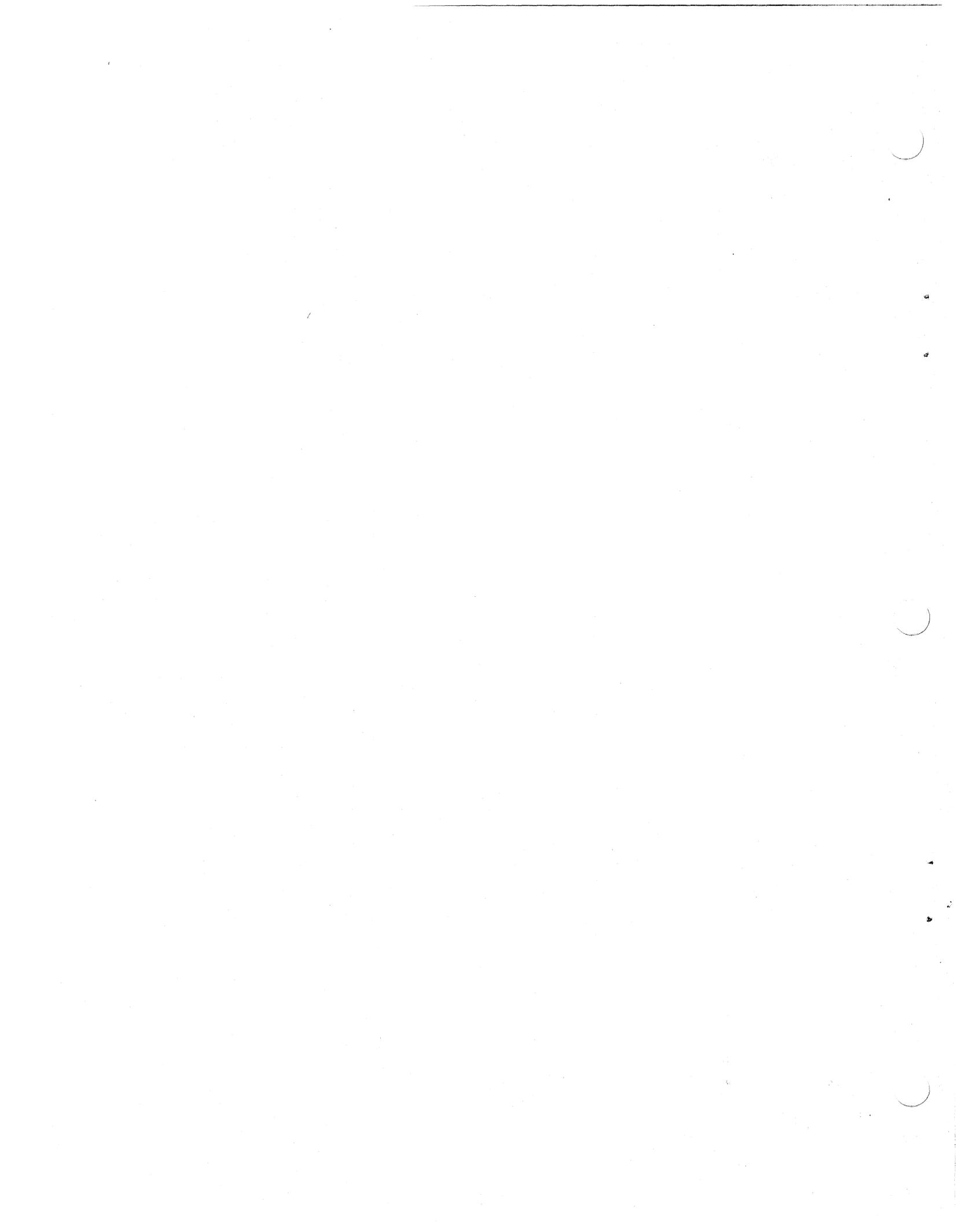
Web tension

The amount of pull or tension applied in the direction of travel of a web of paper by the action of a web-fed press.

White space reduction

A technique used on Photon 713 machines to reduce escapement of larger point sizes.

<b>Widow</b>	In composition, a single word in a line by itself, ending a paragraph; frowned upon in good typography.
<b>Wirestripping</b>	The removal and/or conversion of justification and hyphenation codes in wire service tapes to meet the requirements of individual users.
<b>Work-up</b>	In letterpress, a space, lead, or other spacing material which works itself to the surface during printing, normally caused by poor lockup.
<b>Wrap-around plate</b>	In rotary letterpress, a thin one-piece relief plate which is wrapped around the press cylinder; similar in appearance to an offset plate.
<b>Wrong font</b>	In proofreading, the mark "WF" indicates a wrong letter or character in a line.



## CHAPTER 9

# ENGINEERING DRAWINGS LIST

A complete set of engineering drawings and circuit module schematics is provided with each typesetting system in a companion volume entitled, *Typeset-8 Systems - Negative Logic, Engineering Drawings*. Table 9-1 is a list of the engineering drawings contained in this second volume.

**Table 9-1**  
**Typeset-8 Systems, Negative Logic Engineering Drawings**

Dwg. No.	Title	Sheet
<b>Circuit Schematics</b>		
B-CS-G900-0-1	Photo Amplifier*	1
B-CS-R001-0-1	Diode Network	1
B-CS-R001-0-1	Diode Network Replacement Schematic	1
B-CS-R107-0-1	Inverter	1
B-CS-R111-0-1	Diode Gate	1
B-CS-R113-0-1	Diode Gate	1
B-CS-R123-0-1	Diode Gate	1
B-CS-R141-0-1	Diode Gate	1
B-CS-R151-0-1	Binary to Octal Decoder	1
B-CS-R202-0-1	Dual Flip-Flop	1
B-CS-R203-0-1	Triple Flip-Flop	1
B-CS-RS-R203	Triple Flip-Flop Replacement Schematic	1
B-CS-R302-0-1	Delay One Shot	1
B-CS-R401-0-1	Clock	1
B-CS-R602-0-1	Pulse Amplifier	1
B-CS-W005-0-1	Clamp Loads	1
B-CS-W028-0-1	Terminated Cable Connector	1
B-CS-W040-0-1	Solenoid Driver	1
B-CS-RS-W040-0-1	Solenoid Driver Replacement Schematic	1

\*Drawing error - Hole = ground not -3V as indicated on drawing.

**Table 9-1 (Cont)**  
**Typeset-8 Systems, Negative Logic Engineering Drawings**

Dwg. No.	Title	Sheet
<b>Circuit Schematics (Cont)</b>		
B-CS-W051-0-1	100 MA Indicator and Relay Driver	1
B-CS-W050-0-1	100 MA Indicator & Relay Driver Replacement Schematic	1
C-CS-W103-0-1	Device Selector	1
B-CS-W501-0-1	Schmitt Trigger	1
B-CS-W700-0-1	Switch Filter	1
B-CS-W773-0-1	Cable Connector Module	1
B-CS-W990-0-1	Cable Connector Module	1
B-CS-823B-0-1	SCR Driver	1
<b>PA61</b>		
A-ML-PA61-A-0	Paper Tape Driver Type PA61A	1
A-PL-PA61-A-4	PA61A Module Parts List	1
D-BS-PA61-A-2	Punch Interface	1
D-BS-PA61-A-3	Reader Interface	1
D-MU-PA61-A-4	Module Utilization List	1
D-AD-7005064-0-0	Bus Schedule	1
K-WL-PA61-A-6	Complete Wiring List	1
D-AD-7005061-0-0	Cable Assembly	1
D-AD-7005062-0-0	Punch Cable Assembly	1
D-AD-7005063-0-0	Reader Cable Assembly	1
A-CP-PA61-A-10	Paper Tape Drive Component List	1
D-IC-PA61-A-11	AC-DC Power Wiring Diagram	1
D-AD-7005240	6-ft. Power Cable (AC Power Cord)	1
<b>PA68</b>		
A-ML-PA68-A-0	Reader and Punch Control	1
A-PL-PA68-A-0	Reader and Punch Control	1
A-AL-PA68-A-12	Reader and Punch Control	1
D-BS-PA68-A-1	Reader Control PA68A	1
D-BS-PA68-A-2	Punch Control	2
D-BS-PA68-A-3	IOT Decode	1
D-MU-PA68-A-4	Module Utilization	1
K-WL-PA68-A-6	Complete PA68A Wiring	1
A-CP-PA68-A-7	External Component List for PA68-A	1
D-IC-PA68-A-8	AC-DC Power Wiring Diagram	1
D-IC-PA68-A-9	I/O Connectors	1

**Table 9-1 (Cont)**  
**Typeset-8 Systems, Negative Logic Engineering Drawings**

Dwg. No.	Title	Sheet
	<b>PA60</b>	
A-ML-PA60-A-0	Paper Tape Control Type PA60-A	1
A-PL-PA60-A-0	Reader Control PA60A	1
D-BS-PA60-A-2	Reader Control	1
D-BS-PA60-A-3	IOT Decode	1
D-BS-PA60-A-4	Punch Control	1
D-AD-7005059-0-0	Bus Schedule	1
D-MU-PA60-A-6	Module List	1
K-WL-PA60-A-7	Complete Wiring List	1
D-IC-PA60-A-8	Cable Interconn Diagram	1
A-CP-PA60-A-9	PA60A Components List	1
A-AL-PA60-A-10	Accessory List	1
D-DI-PA60-B-5	Reader and Punch Control Extension	1
A-ML-PA60-B-0	Reader and Punch Control Extension	1
C-UA-PA60-B-0	Reader and Punch Control Extension	1
A-PL-PA60-B-0	Reader and Punch Control Extension	1
D-MU-PA60-B-1	Module Utilization List	1
D-BS-PA60-B-2	Punch Select	1
D-BS-PA60-B-3	Decoder Logic	1
K-WL-PA60-B-4	Complete Control Extension Wire List	1
D-AD-7005673-0-0	PA60B Cable Assembly	1
C-AD-7005594-0-0	PA60B Wired Assembly	1
A-ML-PA60-C-0	NTTA Reader Control	1
D-BS-PA60-C-1	NTTA 1-16 Reader Control	1
A-PL-7605425-0-0	Switch Box Assembly	1
C-WD-PA60-C-2	Switch Wiring Diagram	1
A-PL-PA60-C-0	NTTA Reader Control PA60-C	1
C-UA-PA60-C-0	NTTA Reader Control PA60-C	1
A-AL-PA60-C-3	Non-Torn Tape Allotment	1

**Table 9-1 (Cont)**  
**Typeset-8 Systems, Negative Logic Engineering Drawings**

Dwg. No.	Title	Sheet
	<b>PP67 A/B</b>	
D-DI-PP67-A-2	Drawing Index List PP67A	1
D-UA-PP67-A-0	Paper Tape Punch PP67A	2
A-ML-PP67-A	Master Drawing List	2
A-PL-PP67-A-0	Parts List	1
D-CS-7005095-0-1	Punch Control Circuit Schematic	1
D-AD-7005095-0-0	Punch Control (PR67A)	1
A-PL-7005095-0-0	Punch Control (PR67A)	1
	<b>PR68A</b>	
E-MA-PR68A-0-1	Reader (Typesetting System)	1
D-CS-PR68A-0-3	Reader Wiring	1

**9.1 SEMICONDUCTOR SUBSTITUTION**

Standard EIA components specified in Table 9-2 can replace the majority of DEC semiconductors used in modules of the interface, control and tape reader units and shown on the RS drawings. Exact replacement is recommended for semiconductors not listed.

**Table 9-2**  
**Semiconductor Substitution**

DEC	EIA
D-662	1N645
D-664	1N3606
D-664	1N645
DEC2219	2N2219
DEC3009	2N3009
DEC3009B	2N3009
DEC3494	2N3494
DEC3639	2N3639
DEC3639-0	2N3639
DEC3790	2N3790
DEC6534B	MPS6534
MR2066	1N4003

**READER'S COMMENTS**

**TYPESET-8 SYSTEMS**  
**Negative Logic Maintenance Manual**  
**DEC-08-17TA-D**

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written, etc.? Is it easy to use? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What features are most useful? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

What faults do you find with the manual? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Does this manual satisfy the need you think it was intended to satisfy? \_\_\_\_\_

Does it satisfy *your* needs? \_\_\_\_\_ Why? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Would you please indicate any factual errors you have found. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Please describe your position. \_\_\_\_\_

Name \_\_\_\_\_ Organization \_\_\_\_\_

Street \_\_\_\_\_ Department \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip or Country \_\_\_\_\_

-----  
Fold Here  
-----

-----  
Do Not Tear - Fold Here and Staple  
-----

**FIRST CLASS  
PERMIT NO. 33  
MAYNARD, MASS.**

**BUSINESS REPLY MAIL  
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES**

Postage will be paid by:

Digital Equipment Corporation  
Technical Documentation Department  
146 Main Street  
Maynard, Massachusetts 01754



