

# TECHNICAL MANUAL

INSTALLATION & CHECKOUT INSTRUCTIONS

PDP-8/E SERIES READER/PUNCH

MODEL RIXXXXXXXXXX/DE0/8XX/-000

INTERFACE CARD ASSEMBLY 109881

# REMEX

A UNIT OF EX-CELL-O CORPORATION

1733 ALTON STREET  
SANTA ANA, CALIFORNIA 92705  
(714) 557-6860



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\*(Excludes lamps and fuses in all products. Excludes all perforator punch/die sets and associated mechanical linkage after a period of ninety days for labor.)

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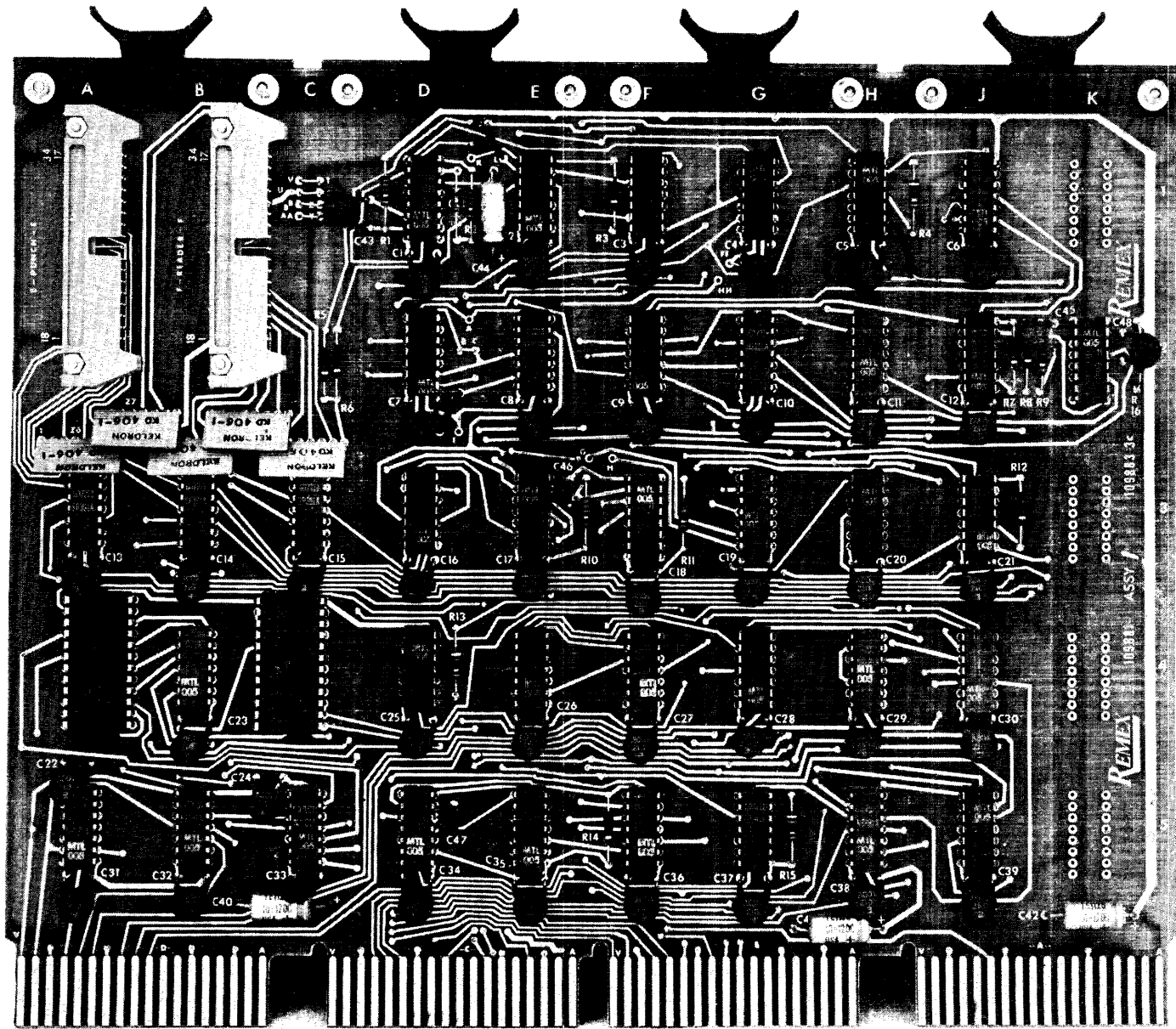


Figure 1. REMEX Interface Card 109881.

## REMEX READER/PUNCH INTERFACE ASSEMBLY

### INSTALLATION AND CHECKOUT INSTRUCTIONS

#### 1.0 GENERAL DESCRIPTION

This document describes the installation and checkout of the REMEX Interface Assembly model number RIXXXXXXXXXX/DE0/8XX/-000. See Figure 2 for model number explanation. The card (see Figure 1) interfaces the REMEX reader and/or perforator system with a standard PDP-8E Series of Computers with Teletype. REMEX Diagnostic Program number 109900-2 contains several tests to check out the card, reader and/or perforator system and to exercise the reader and perforator so that both an electronic and a visual verification can be made of the operation of these units.

#### 2.0 EQUIPMENT USED

The following equipment and software are used in these procedures:

- a. Standard PDP-8/E Series of Computers with Teletype
- b. REMEX Reader or Reader Spooler Combination and/or REMEX Tape Perforator System
- c. REMEX Diagnostic Program No. 109900-2
- d. REMEX Test Tape No. 109901-1
- e. REMEX Interface Card No. 109881-XXX (See Figure 1)
- f. Low Speed RIM Loader (DEC)
- g. Binary Loader Program (DEC-08-LBAA-PM)
- h. REMEX Interconnection Cables No. 109834-X (reader) and No. 109834-1 (perforator system)

#### 3.0 SYSTEM CONNECTIONS

### **CAUTION**

The following installation instructions should be performed only by persons familiar with the computer operation and layout. Improper installation could result in damage to the reader, punch, computer, or interface card. Individual manuals should be consulted for the operation of the computer, punch, reader, and teletype. This entire document should be read and understood before attempting any installation or checkout procedures.





The following instructions describe the interconnection of the reader, punch, interface card and computer.

- a. Turn computer, punch and reader ac power off.
- b. Insert REMEX Interface Card No. 109881 into any available slot on the omnibus in the computer.
- c. Connect one end of reader cable to the reader input connector and the other end to connector F on the card.
- d. Connect one end of the punch cable to the punch input connector and the other end to connector E on the card.
- e. Turn computer, punch and reader ac power on.

#### 4.0 PROGRAM LOADING

Load the following programs into the computer:

- a. Load Low Speed RIM Loader program into computer.
- b. Load Binary Loader program into computer using Teletype.
- c. Load REMEX Diagnostic Program No. 109900-2 into the computer using the Teletype (load time approximately 8 minutes). See Figure 3 for Programming Flow Chart.
- d. Load REMEX Test Tape No. 109901-1 into the reader.

#### 5.0 COMPUTER SWITCH POSITIONS

5.1 Place switches 11, 10, 09 and 08 in the down position. These switches allow for exercising the reader and/or perforator system independent of one another. This can be most useful when trying to trouble shoot just one phase of the program without cycling the whole program.

5.2 The following table describes the function of each switch.

SWITCH	POSITION	FUNCTION
11	UP	Computer will continue in test loop until stopped by this switch or a programmed halt.
	DOWN	Computer will halt at location 1200 at completion of each test loop.
10	UP	Removes perforator system from test loop.
	DOWN	Places perforator system in test loop.
09	UP	Removes reader from test loop.
	DOWN	Places reader in test loop.
08	UP	Inhibits TTY printout of RDR read error.



At any error printout location, the operator can also depress the "LF" key on the teletype after an error message printout. This is an oscilloscope loop which will send a repeating pattern to the Interface Board to assist in tracking down component failures not readily found. To leave a scope loop, depress the CR or RUBOUT key as desired.

A list of error message printouts and possible causes and remedies (Table 1) is enclosed at the end to expedite trouble shooting. Figure 3 which shows the main program flow diagram is included and may be useful during trouble shooting. Also see Block Diagram, Figure 4 and Schematic, Figure 5.

- 6.6 Once the program has been loaded, restarting of testing is at location 1200. To change reader/punch codes, initial dialogue can be reprinted by restarting at location 0200.

## 7.0 READER AND/OR PUNCH EXERCISE

At the completion of the Interface Board Test (Section 6), the computer will exercise the reader and/or perforator system.

- 7.1 The reader exercise consists of a loop of tape with an increasing binary pattern which it compares with a similar count in the computer.
- 7.2 In the event of an error, the computer responds on the teletype with a printout similar to the following example:

Read Data Error:

CDB = 141  
RRB = 140 [

This indicates the reader buffer somehow dropped a bit in the process of reading the tape. The only key that means anything to the computer for this type of error is to depress the CR key which will cause the reader to read the next character. If this character is correct, the tape continues.

If there is another error, the computer will again print the message on the teletype. If for some reason the "Computer Data Buffer" and "Paper Reader Buffer" get out of synchronization, the only way to re-synchronize is to continue to print errors until a blank leader of tape is encountered or to physically move the tape to the blank leader portion of the test tape. To resume test after moving tape, depress the "CR" key on the teletype.

- 7.3 In the event the error rate for the read error test is excessive and warrants an oscilloscope observation of transmitted data or related areas, raise switch 08 of switch register and depress "CR." This will inhibit error printout and allow the exercise to run to completion without any interruptions.
- 7.4 The perforator system exercise routine consists of a series of four records of 3778 characters (256 decimal characters) each punched onto the tape. Each record is an incrementing binary pattern and each file is preceded by eight RUBOUTS. After first block is punched, the tape may be looped into the reader with RUBOUT portion at least 6 characters before read station. The reader will then verify punched data is correct. In order to run continuously in this manner, raise switch 11.

MAIN PROGRAM

NOTE: Program occupies locations 0 thru 3220.

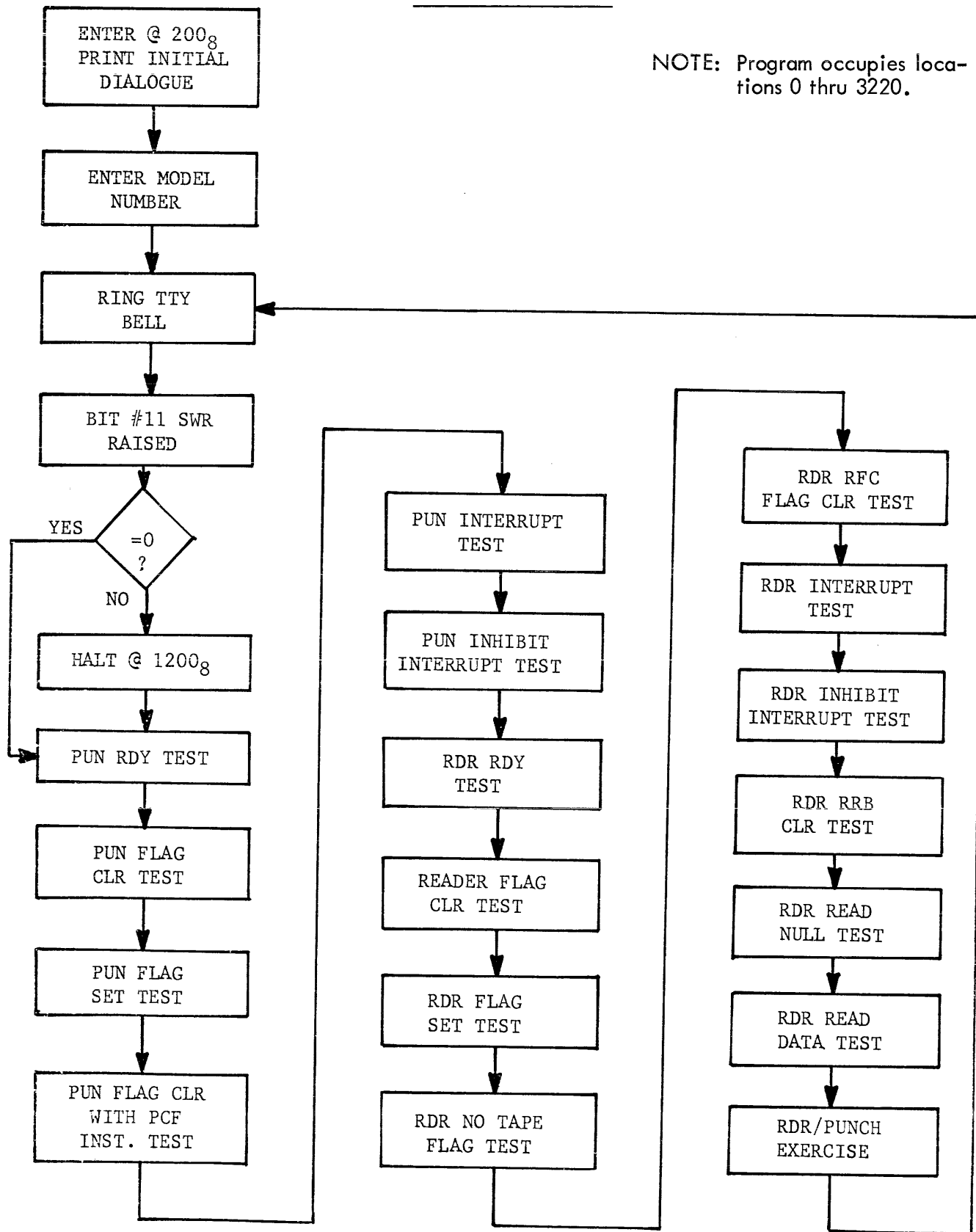


Figure 3. Programming Flow Chart

8.0 PROGRAMMING INFORMATION FOR REMEX INTERFACE

8.1 SPECIAL FEATURES

The design philosophy used in the development of the hardware for the REMEX Interface Card is to be completely compatible with all the existing DEC software. An exception is the individual diagnostic routines for the reader and punch.

This section provides information for programming additional features offered with the REMEX Interface Card that are not presently available with any other interfaces. The intent is to offer to the programmer the spooling and direction capabilities of REMEX Reader/Spooler combinations and place them under computer program control. The following new instruction set will allow this.

Table 1. Reader Mnemonics and Description

Mnemonic	Octal	Description
RPE	6010	Set RDR/PUN Interrupt Enable
RSF	6011	Skip on RDR Flag
RRB	6012	Read Reader Buffer
*RCW	6013	Set RDR DIR/RWD Control Bits AC <div style="text-align: center;"> <p style="margin-left: 100px;">← Direction</p> <p style="margin-left: 100px;">← Rewind</p> </div> 0001 = Set Direction Left 0002 = Set RWD Right 0003 = Set RWD Left 0000 = Clear Control Bits
RFC	6014	Fetch Character.
RRB, RFC	6016	Read Buffer, Fetch Character
*RSR	6017	Skip on Reader Ready (Power On $\wedge$ $\overline{\text{Load}}$ $\wedge$ $\overline{\text{No Tape}}$ )

\* New Instructions

Table 2. Punch Mnemonics and Description

Mnemonic	Octal	Description
PCE	6020	CLR RDR/PUN Interrupt Enable
PSF	6021	Skip on Punch Flag
PCF	6022	CLR PUN Flag
PPC	6024	Load PUN Buffer, Punch Char.
PLS	6026	Load PUN Buffer Sequence
*PSR	6027	Skip on PUN Ready (Power on $\wedge$ No Tape

\*New Instruction

RCW instruction will not cause any tape movement. It only sets up control bits.  
RFC is used for this in the normal programming manner.

## 8.2 SAMPLE PROGRAM USING DIRECTION CONTROL

The following is a program example utilizing the direction control feature of the REMEX Interface and readers. This program will move tape alternately left and right between end of text codes on paper tape providing the reader is bidirectional.

```

ENTER      RSR          /TEST IF RDR RDY
           JMP ERROR    /JMP TO ERROR PRINTOUT
           CLA          /CLEAR AC
           TAD DIRL     /GET DIRL
           RCW          /OUTPUT TO RDR
FETCH LF   RFC          /FETCH CHAR
           RSF          /SKIP IF RDY
           JMP-1        /LOOP
           CLA          /CLEAR AC
           RRB          /READ DATA
           TAD LEFT CODE /ADD LEFT LIMIT
           SZA          /SKIP IF LIMIT
           JMP FETCH LF /JMP TO FETCH NEW CHAR
           RCW          /OUTPUT DIRR = 0000
FETCH RT   RFC          /FETCH CHAR
           RSF          /SKIP IF FLAG SET
           JMP-1        /LOOP
           CLA          /CLEAR AC
           RRB          /READ DATA
           TAD RIGHT CODE /ADD RIGHT LIMIT
           SZA          /SKIP IF LIMIT
           JMP FETCH RT /JMP TO FETCH NEW CHAR
           JMP ENTER+2  /JMP TO CHANGE DIR LF

```

```

DIRL = 0001
RCW = 6013
LEFT CODE = #ETX+1
RIGHT CODE = #ETX+1
RSR = 6017

```

Utilization of the rewind feature on readers containing this feature can be done in a similar manner. It should be cautioned, however, that at the end of rewind, the reader does not stop on character.

An important point to remember with RCW is that the additions made are of the nature to increase program control of certain functions not previously available but not hamper or change any previous programs or techniques.

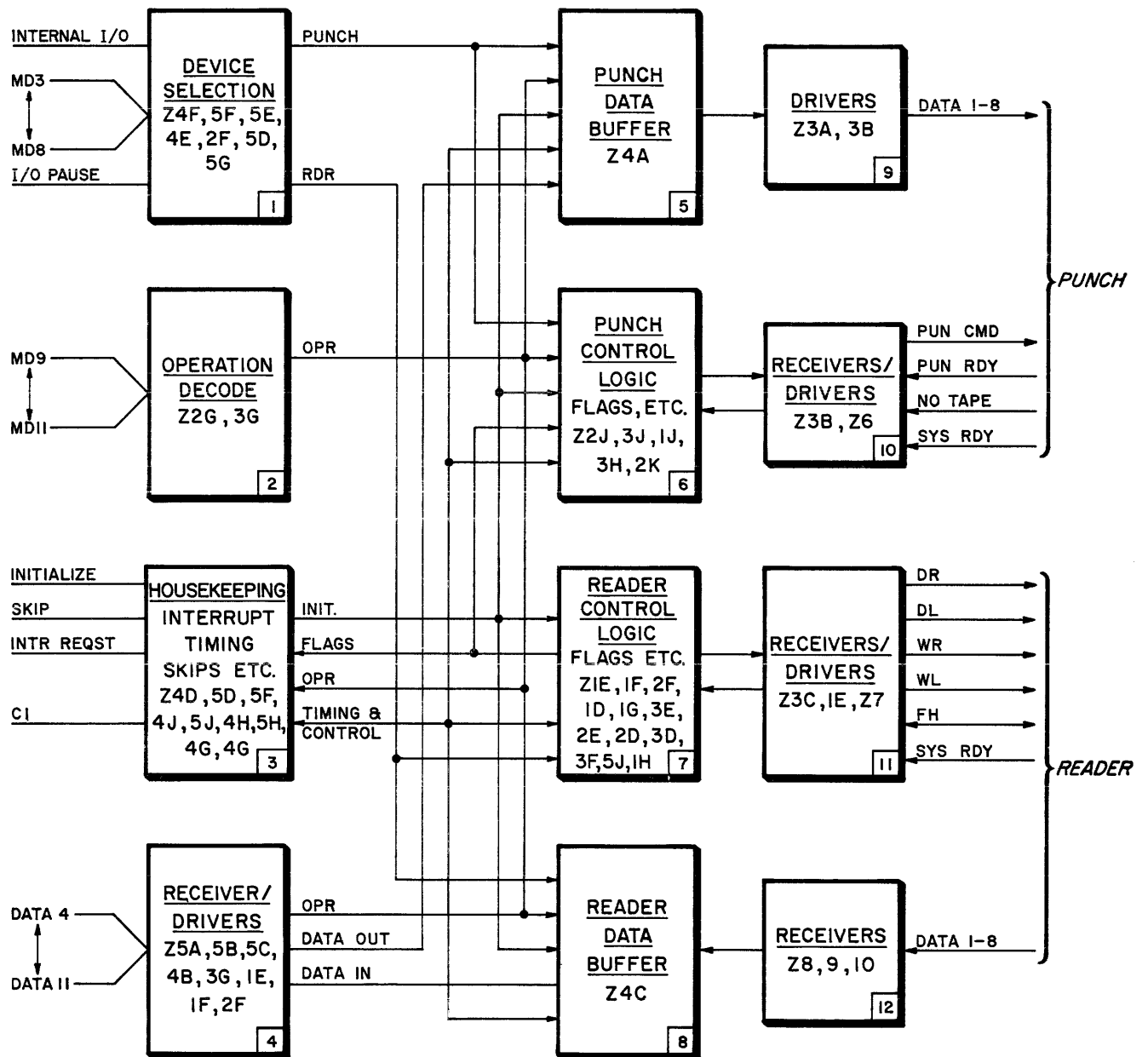


Table 3. Possible Sources of Malfunction

No.	Error Printout	Possible Sources of Malfunction
1	PUN NOT RDY	PERR: is punch power on? PERR: is punch out of tape? Check portions of <b>6</b> , <b>10</b> & <b>3</b> for PERR. Depress "LF" - Monitor $\overline{CD7}$ of <b>2</b> and portion of <b>3</b> . Faulty punch?
2	PUN FLAG DID NOT CLEAR	$\overline{PFG}$ did not clear with initialize. Portions of <b>6</b> or <b>3</b> . Depress "LF" - Monitor reset path to PFG toggle <b>6</b> . Check skip drivers of <b>3</b> .
3	PUN FLAG ERR	PFG did not set after PLS. Portions <b>10</b> , <b>6</b> or <b>3</b> . Depress "LF" - Monitor $\overline{PUN RDY}$ path to <b>6</b> . Faulty Punch?
4	PUN PCF ERR	PCF did not clear flag. Portions of <b>2</b> , <b>6</b> or <b>3</b> . Depress "LF" - Monitor $\overline{CD2}$ from <b>2</b> to <b>6</b> through <b>3</b> .
5	PUN DID NOT INTERRUPT	PUN flag did not cause interrupt. Portions of <b>2</b> or <b>3</b> . Depress "LF" - Monitor $\overline{CD0}$ and $\overline{PTR PULS}$ from <b>2</b> and <b>3</b> . Did you push rubout No. 3 error?
6	PUN PCE ERR	PCE did not clear INTENB. Portions of <b>2</b> or <b>3</b> . Depress "LF" - Monitor $\overline{CD0}$ and $\overline{PTP PULS}$ from <b>2</b> and <b>3</b> .
7	RDR NOT RDY	PERR: is RDR power on? PERR: is RDR in load? Check portions of <b>11</b> , <b>7</b> and <b>3</b> for PERR. Depress "LF" - Monitor $\overline{CD7}$ of <b>2</b> & portions of <b>3</b> . Faulty reader?
8	RDR FLAG NOT CLEAR	$\overline{RFG}$ did not clear with initialize. Portions of <b>6</b> or <b>3</b> . Depress "LF" and Monitor reset path to RFG toggle <b>6</b> . Check skip drivers of <b>3</b> .

Table 3. Possible Sources of Malfunction

No.	Error Printout	Possible Sources of Malfunction
9	RDR FLAG ERR	RFG did not set after RFC. Portions of $\overline{11}$ , $\overline{7}$ or $\overline{3}$ . Depress "LF" - Monitor FH path to $\overline{7}$ . Depress "LF" - Monitor CD1 of $\overline{2}$ & $\overline{3}$ or DR of $\overline{7}$ . Check skip driver of $\overline{3}$ . Did RDR step?
10	RDR NO TAPE FLAG ERR	No tape sensor set 40 m/sec after RFC. No tape in RDR; did RDR step? Depress "LF" - Monitor RNOT of $\overline{7}$ . Depress "LF" - Monitor DR of $\overline{7}$ .
11	RFC FLAG CLR ERR	RFC did not clear flag. Portions of $\overline{2}$ , $\overline{3}$ , or $\overline{7}$ . Depress "LF" - Monitor ST of $\overline{7}$ .
12	RDR DID NOT INTERRUPT	Reader flag did not cause interrupt. Portions of $\overline{2}$ , $\overline{3}$ , or $\overline{7}$ . Depress "LF" - Monitor $\overline{CD0}$ and INTENB of $\overline{3}$ . Did you push rubout No. 9 or 11 error?
13	RDR PCE ERR	PCE did not clear INTENB. Portions of $\overline{2}$ and $\overline{3}$ . Depress "LF" - Monitor $\overline{CD0}$ and $\overline{PTP PULS}$ from $\overline{2}$ and $\overline{3}$ .
14	RDR CAF RRB ERR	CAF did not clear RRB. Portions of $\overline{3}$ or $\overline{8}$ . Depress "LF" - Monitor reset to $\overline{8}$ . Check output lines of $\overline{8}$ . Did you get here as result of rubout?
15	RDR RRB N ERR	No nulls on input loop. Data never equals zero. Portions of $\overline{12}$ , $\overline{8}$ , or $\overline{4}$ . Depress "LF" - Monitor input data at $\overline{8}$ and $\overline{4}$ . Faulty RDR?
16	READ DATA ERR CDB = XXX RRB = YYY	Data read into RRB does not equal computer data buffer. Tape not inserted with nulls under readhead (min. 6 before data). Raise switch 8 and 11 and check $\overline{8}$ for stable data. One can insert any tape into RDR: all deletes, etc., for this test. Faulty RDR - dirty head assy.?
17	RDR RRB D ERR	No data on input loop. Portions of $\overline{12}$ , $\overline{8}$ or $\overline{4}$ . Depress "LF" - Monitor input data at $\overline{8}$ and $\overline{4}$ . Faulty RDR?



MMC 367

Figure 4. Block Diagram of Card Assembly 109881

SEE ENCLOSED COPY OF DRAWING 109882

Figure 5. Schematic of Card Assembly 109881

## ADDENDUM SHEET

### OPERATING INSTRUCTIONS FOR THE PTE 300 (RCS 1300).

The following procedure should be substituted in place of Sections 3.0 and 4.0, Systems Connections and Program Loading, when operating with a PTE 300 (RCS 1300).

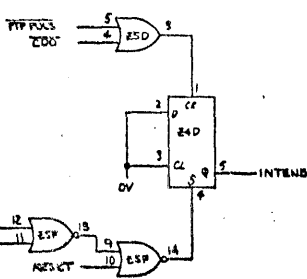
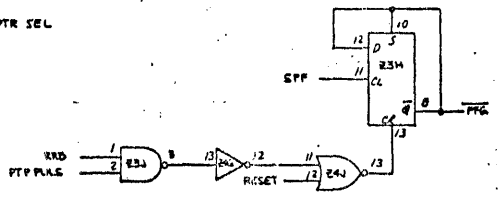
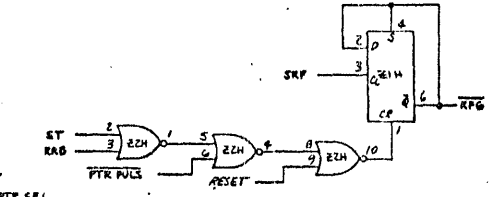
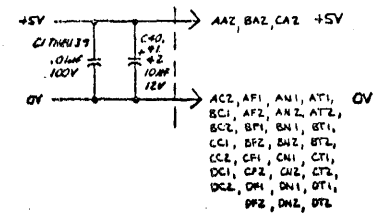
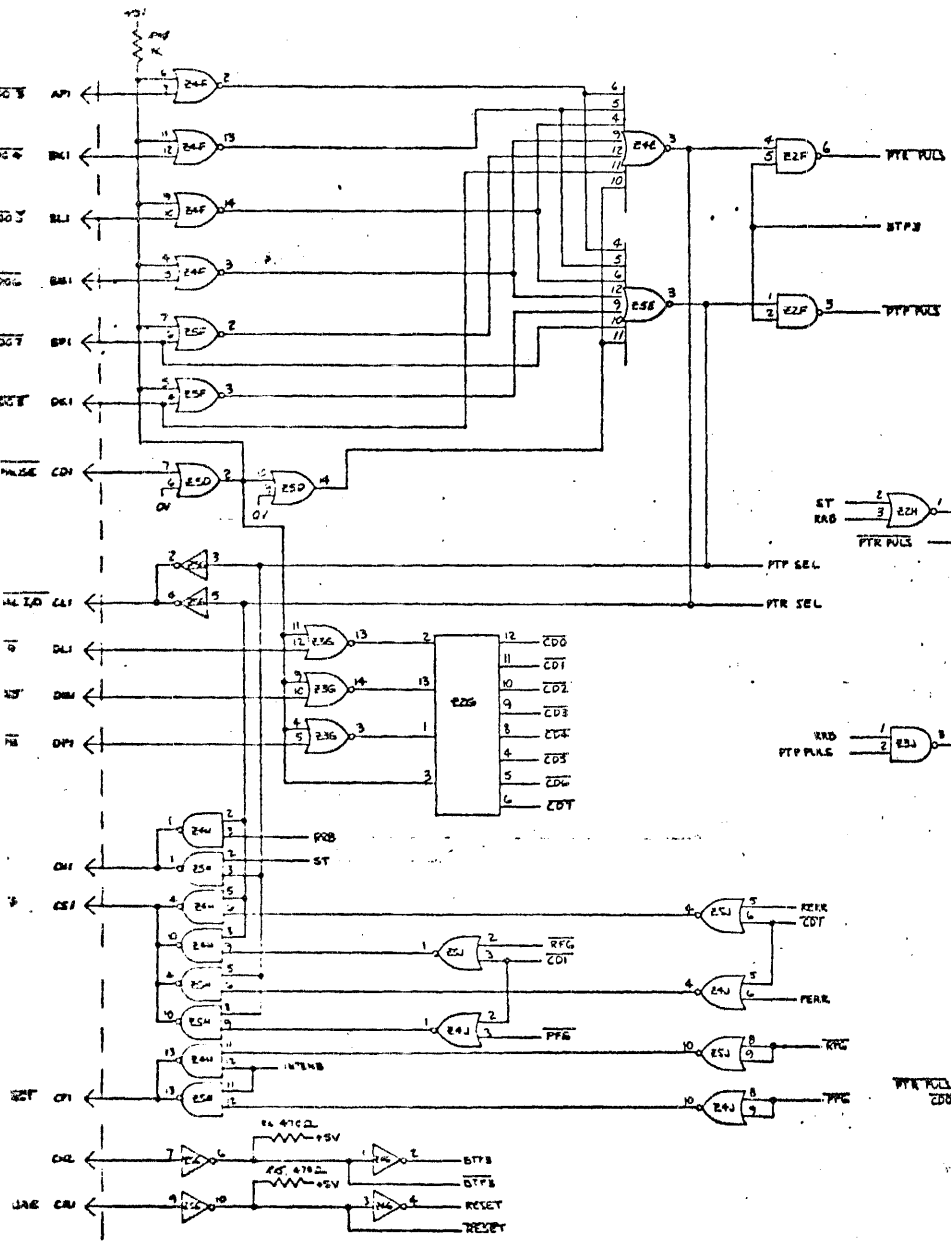
- a. Turn computer and PTE power off.
- b. Insert REMEX Interface Card No. 109881 into any available slot on the Omnibus in the computer.
- c. Connect one end of the reader cable to the reader connector on the PTE and the other end to the connector on the interface card. Repeat for the punch cable.
- d. Turn computer and PTE power on. Both doors on the PTE should open automatically.
- e. Load LOW SPEED RIM Loader program into computer.
- f. Load Binary Loader program into computer using Teletype.
- g. Load Remex Diagnostic Program No. 109900-2 into the computer using the Teletype (load time approximately 8 minutes).
- h. Read sections 5.0, 6.0, and 7.0 before continuing. Do not enter any data from the teletype keyboard until step i is read.
- i. A test pattern will have to be first generated on a cassette cartridge that will later be used by the record section for the diagnostic. Referring to section 6.1, enter a "P" in the first space of the model number. Continue to enter the correct model number and allow the initial printout to be completed, as described in 6.0.
- j. If not already open, release the door on the recorder section by depressing the "Unload" button on the PTE front panel, insert a cassette cartridge, and close the door. The mechanism should advance the tape to a load point and stop. At this time, the "File Mark" indicator should be on.
- k. Once the PTE has been initialized, the diagnostic may be run by setting switch 11 on the computer front panel up and all others down. Refer to Section 5.2. Depress the "Continue" switch on the computer front panel to start the diagnostic. Records of an incrementing binary pattern will be written on the tape until switch 11 is lowered. Allow the diagnostic to run in this mode for a few feet of tape.
- l. After the computer has halted, unload the recorder by depressing the "UNLOAD" pushbutton and unload the reader by depressing its respective "UNLOAD" button. Remove the newly recorded cartridge from the recorder and place it in the reader. Insert a new cartridge into the recorder. Close both doors. The recorder should advance the tape to the load point and the reader should move the tape to its load point and stop. The "FILE INDICATOR" should be equal to a 1 and the FILE/RUN indicator should be on. Depress the FILE/RUN switch/indicator

and the tape should advance a short distance. This action places the first 64 characters on the tape in a buffer ready to be read out by the program.

- m. Restart the diagnostic at location 200g and instead of entering a "P" in the model number, enter on "A", which will allow the program to test both the reader and the recorder. Continue as before, allowing the printout to finish. Set up the computer front panel switches as desired and press "Continue" to start the diagnostic. If switch 11 is down, the diagnostic will halt after one pass. If switch 11 is up, it will continue until the switch is lowered or until it runs out of data previously recorded on the cartridge. The latter case will result in an error printout on the teletype. Refer to figure 3 for a flowchart of the program and Table 3 for aid in diagnosing errors.



REV	ECO	EFFECT	REVISIONS	DATE	APP
1		INITIAL DESIGN			
2		REVISED FOR COST			
3		REVISED FOR COST			
4		REVISED FOR COST			
5		REVISED FOR COST			
6		REVISED FOR COST			
7		REVISED FOR COST			
8		REVISED FOR COST			



LAST DESIGNATION USED	
RESISTOR	R16
CAPACITOR	C49
DIODE	CR1

- NOTE: UNLESS OTHERWISE SPECIFIED
- RESISTORS ARE 1/4W, 5%.
  - CAPACITORS ARE 100V DC.
  - 2LT THROUGH 20 ARE 70950-002 (M4000-1) 0V-1 +5V-8
  - 22E, 2D, 3D, F, 3J ARE 70400-01 (SN7400N) 0V-7 +5V-14
  - 24G, 2E, 2E1 ARE 70400-110 (SN7400AN) 0V-7 +5V-14
  - 24F, 3G, 5F, 4S, 5A ARE 70400-023 (SP300A) 0V-1 +5V-8
  - 25D IS 70400-124 (SP314A) 0V-1 +5V-8
  - 24E, 25E ARE 70400-125 (SP314A) 0V-1 +5V-8
  - 20G, 25C ARE 70400-126 (N2LS0A) 0V-7 +5V-14
  - 24G/16, 24J, 25E, 25F ARE 70400-110 (SN7400N) 0V-7 +5V-14
  - 25C, 3C, 3A, 25B ARE 70400-117 (SP314A) 0V-1 +5V-8
  - 24C, 3C, 3A, 25B ARE 70400-125 (SN7400AN) 0V-7 +5V-14
  - 22K, 25F ARE 70400-127 (SN7400AN) 0V-1 +5V-14
  - 24D IS 70400-119 (SN7400AN) 0V-1 +5V-14
  - 24T IS 70400-117 (SN7400AN) 0V-7 +5V-14
  - 25B, 3C, 4A, 25H ARE 70400-22 (N2RE1A) 0V-7 +5V-14
  - 25J, 24, 24A ARE 70400-104 (SN7402AN) 0V-7 +5V-14

REVISION STATUS		
REP	SN	ASSY
A	A	A
B	B	B
C	C	C
D	D	D
E	E	E
F	F	F
G	G	G
H	H	H
I	I	I
J	J	J
K	K	K
L	L	L
M	M	M
N	N	N
O	O	O
P	P	P
Q	Q	Q
R	R	R
S	S	S
T	T	T
U	U	U
V	V	V
W	W	W
X	X	X
Y	Y	Y
Z	Z	Z

SCHEMATIC - INTERPACK CARD / PDP-9E / REMEX

REMEX 109832

103 ALTON STREET  
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109832 0

REM ENG