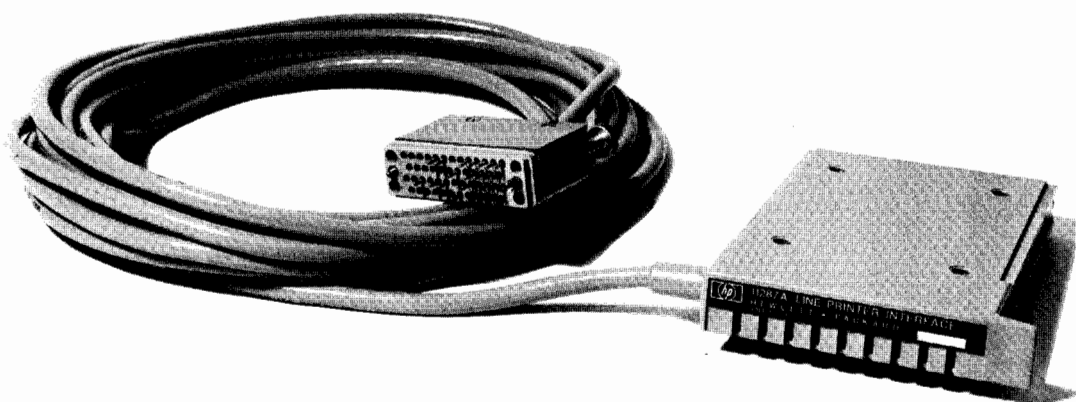


 **HEWLETT-PACKARD**
11287A LINE PRINTER INTERFACE
OPERATING AND SERVICE MANUAL

OPERATING and SERVICE MANUAL



11287A LINE PRINTER INTERFACE



HEWLETT-PACKARD CALCULATOR PRODUCTS DIVISION

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(For World-wide Sales and Service Offices see rear of manual.)

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TABLE OF CONTENTS

CHAPTER 1: GENERAL INFORMATION

INTRODUCTION	1-1
GENERAL DESCRIPTION	1-1
EQUIPMENT SUPPLIED	1-2
INSTALLATION	1-2
ELECTRICAL INSPECTION	1-4

CHAPTER 2: MODEL 10 SYSTEM OPERATION

INTRODUCTION	2-1
PRINTER SET-UP	2-1
PRINTER OPERATIONS	2-2
PRINTING DATA	2-3
VERTICAL FORMAT CONTROL	2-5
PRINTING MESSAGES	2-6
PRINTER STATUS (PC 2 only)	2-6
9810A/2607A PRINTER USER'S GUIDE	2-7

CHAPTER 3: MODEL 20 AND 21 SYSTEM OPERATION

INTRODUCTION	3-1
PRINTER SET-UP	3-1
PRINTING DATA	3-1
PRINTING MESSAGES	3-5
PRINTER STATUS (PC 2 only)	3-7
VERTICAL FORMAT CONTROL	3-8

CHAPTER 4: MODEL 30 SYSTEM OPERATION

INTRODUCTION	4-1
PRIMARY PRINTER	4-1
PRINTER SET-UP	4-1
PRINTER OPERATIONS	4-2
PRINTER STATUS	4-3
VERTICAL FORMAT CONTROL	4-3
MASTER CLEAR	4-5
PRINTER CHARACTER CODES	4-6

CHAPTER 5: SERVICING THE INTERFACE

INTRODUCTION	5-1
THEORY OF OPERATION	5-1
TROUBLESHOOTING	5-2
REPLACEABLE PARTS	5-6

FIGURES

Setting the Interface Select Code	1-3
Printer Interface Connections	1-3
The Redefined Keyboard	2-2
Printer Character Control Keys	3-5
VFU Tape Channels	4-5
11287A Block Diagram	5-0
Interface Test Set-up	5-2
11287A Timing Diagram	5-7
11287A Schematic Diagram	5-7

TABLES

Equipment Supplied	1-2
Printer Operation	4-2
VFU Codes	4-3
Line Count Codes	4-4
Printer Character Codes	4-6
I/O Characters and Equivalent Forms	5-5
Replaceable Parts	5-6

Chapter 1



GENERAL INFORMATION

INTRODUCTION

The -hp- 11287A Line Printer Interface enables the -hp- 2607A Line Printer to be used with the 9810A, 9820A, 9821A, or 9830A Calculator.

The 2607A Line Printer is compatible with the -hp- 9866A printer software, and may be used as a 9866A replacement. The 2607A provides the added capabilities of increased line width, printing forms, and multiple copies. The 2607A Option 001 provides the capability of printing lower case alpha characters.

The 9810A, 9820A, and 9821A Calculators must have an appropriate peripheral control block installed when using this interface. The 9830A does not need a peripheral control ROM to control the interface.

GENERAL DESCRIPTION

The interface consists of a circuit board inside a case (which plugs into any one of the calculator I/O connectors) and a twenty-five foot (7.6 metre) shielded cable. One end of the cable is connected to the interface card and the other is wired to a 50-pin connector which connects to the printer.

The interface transfers ASCII-coded characters from the calculator to the printer in 7-bit parallel form, and monitors the printer status lines. The printer uses the 64 character US ASCII code. A complete table of the character set used by the printer can be found in Chapter 5 of this manual.

◆◆◆◆◆ EQUIPMENT SUPPLIED ◆◆◆◆◆

The items supplied with each 11287A Interface are listed in Table 1.

Table 1. Equipment Supplied

<u>Description</u>	<u>Quantity</u>	<u>-hp- Part No.</u>
Standard Accessories		
Oper. & Serv Manual	1	11287-90000
Select Code Labels	1 pkg	7120-2940
Opt. 10 Accessories (9810)		
2607A Test Program	1	09810-90090
Test Instructions	1	09810-90094
Opt. 20 Accessories (9820)		
2607A Test Program	1	09820-90090
Test Instructions	1	09820-90092
Opt. 21 Accessories (9821)		
2607A Test Cassette	1	11287-90001
Test Instructions	1	11287-90003
Opt. 30 Accessories (9830)		
2607A Test Cassette	1	11287-90001
Test Instructions	1	11287-90004

NOTE

All the optional accessories listed in Table 1 are shipped with the interface. You may discard the items that are not required for your particular system.

◆◆◆◆◆ INSTALLATION ◆◆◆◆◆

Prior to installing the interface, ensure that the printer has been properly installed. Refer to the Operating Instructions in the 2607A Operator's manual (-hp- Part No. 02607-90005).

SELECT CODE

Each device connected to the calculator must have a unique address so that the calculator can specify which device must respond to each operation. This address, or select code, must be set on the interface card. The interface card is preset at the factory to select code 15, which corresponds to 0 on the select code switch. If you wish, the select code can also be set to codes 1 through 9 by following this procedure:

1. Switch the calculator and printer OFF.
2. Disconnect the interface from the calculator. Remove the four screws located on the top of the interface card; turn the card over and lift off the bottom cover.

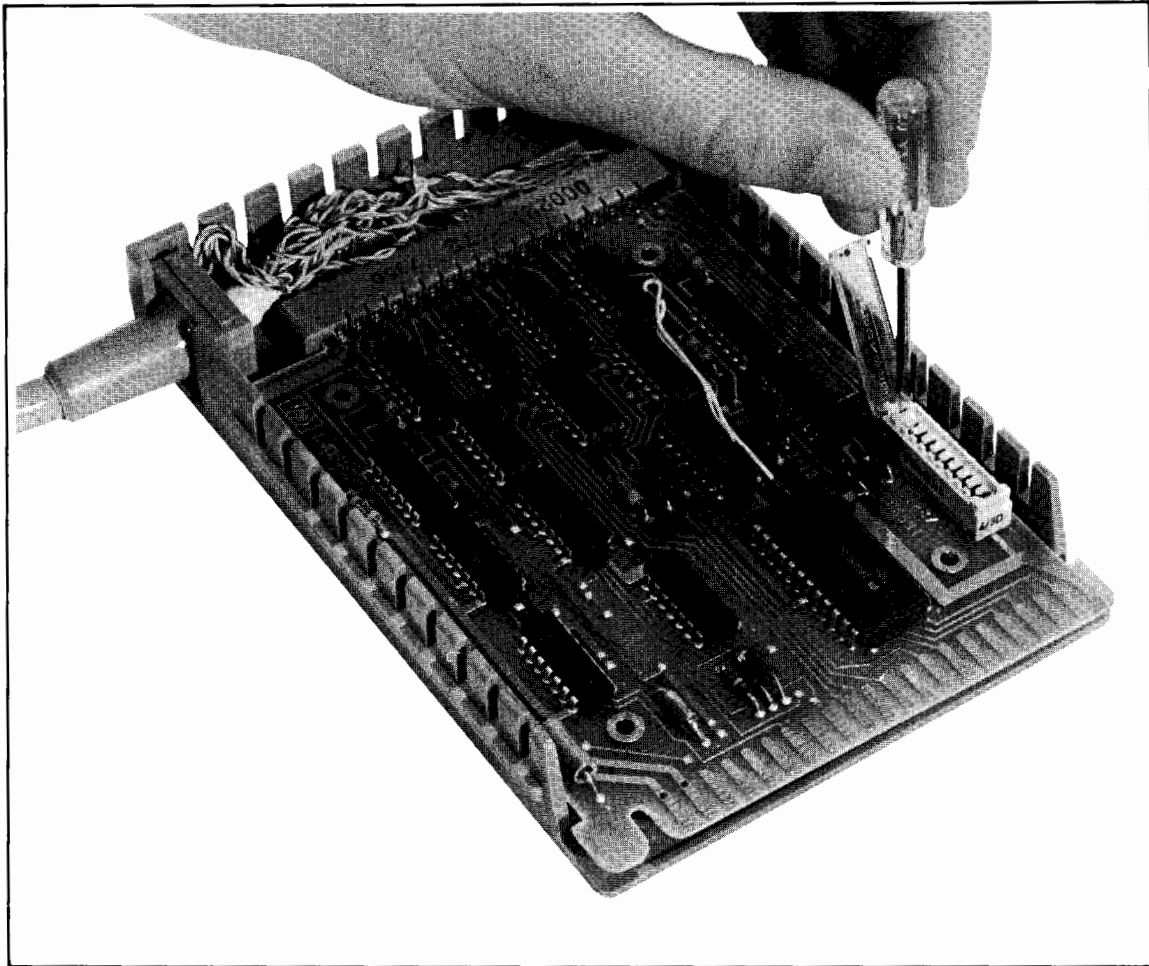


Figure 1. Setting the Interface Select Code

3. Raise the hinged cover on the select code switch (see Figure 1). Using a small flat-blade screwdriver, carefully rotate the selector tab until it is positioned at the desired select code number. Numbers are printed on the top cover of the switch (0 corresponds to select code 15). Before closing the cover, be sure the slot in the selector tab is at a right angle to the length of the switch.
4. Close the switch cover and replace the interface card bottom cover. Secure the cover with the four screws which were removed in Step 2.
5. Place a select code label on the interface card to indicate the new select code.

Connect the interface to the printer and to any one of the calculator I/O slots (see Figure 2); then switch the calculator and printer ON.

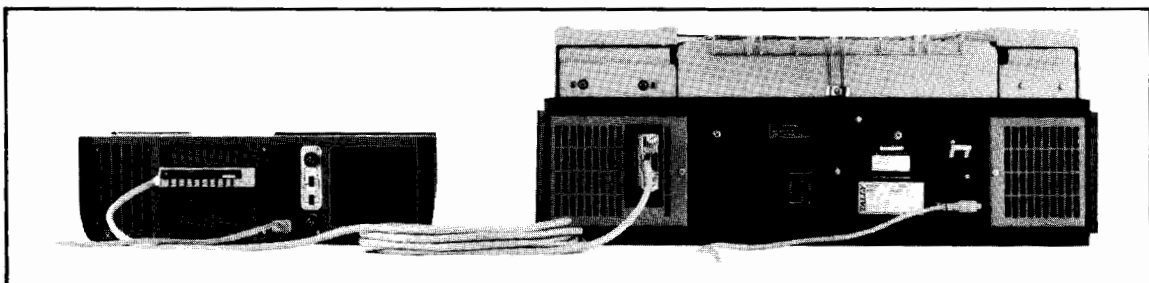


Figure 2. Printer Interface Connections.

 **ELECTRICAL INSPECTION** 

The printer and interface can be checked for proper operation by using the printer test program supplied with the interface. Check the optional accessories listed in Table 1 for the proper program used with each option.

The following chapters of this manual describe printer operation with the 9810A, 9820A, 9821A, and 9830A Calculators.

Chapter 2

MODEL 10 SYSTEM OPERATION

INTRODUCTION

The 11287A Line Printer Interface can be used with a 9810A calculator and an appropriate peripheral control block* to control the 2607A Line Printer. This chapter describes how to print data and messages with the Model 2607A Printer. For more information on the peripheral control block operations, see Chapter 2 or your Peripheral Control Block operating manual.

This information is presented assuming that the reader is familiar with the 9810A operation and the use of the peripheral control block. The examples in this chapter assume that the 11287A Interface is set to select code 15 (0).

PRINTER SET-UP

Before printing, check to be sure the printer is properly set up.

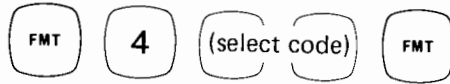
- Paper loaded and properly positioned.
- Print switch ON.
- Lines per inch switch in desired position.



* Either an 11252A, 11262A, 11264A or 11266A PC Block can be used.

PRINTER OPERATIONS

All printer operations must be prefixed by a "call sequence":



After pressing these keys, the "print" mode is established so you can print data or messages. The keyboard is redefined as shown in Figure 2-1.

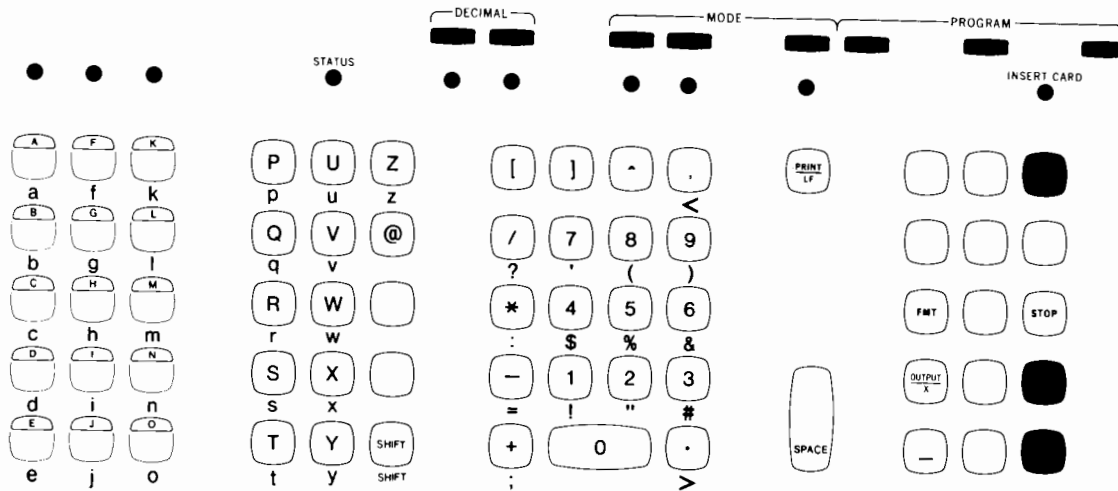


Figure 2-1. The Redefined Keyboard

THE SHIFTED KEYBOARD



Press SHIFT to print the character shown below each key in Figure 2-1. Return to the redefined keyboard by again pressing SHIFT. The printer must have Option 001 installed to be able to print lower case alpha characters.

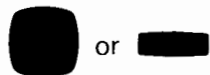
TERMINATING THE "PRINT" MODE



To terminate print operations and return the redefined keyboard to normal calculator operation, press FMT.



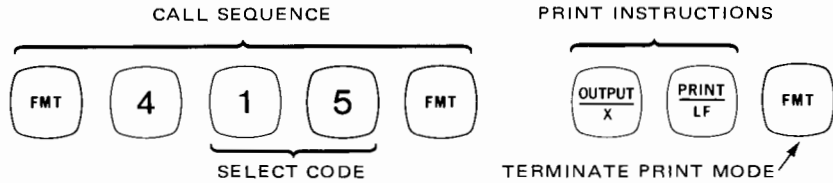
STOP terminates the print operation, stops a program, and returns the keyboard to normal calculator operation.



Pressing any of the keys darkened in Figure 2-1 will terminate the printer operation, reset the keyboard, and perform the key's normal function.

PRINTING DATA

To print data PRESS:



Characters are stored in the printer up to 132 characters at a time. When PRINT/LF (clear) is pressed, the stored characters are printed and a line feed is performed (i.e. the paper is advanced one line). The data is also printed when more than 132 characters are sent to the printer. The printer line feeds automatically when the 133rd character is received. Characters entered after the first 132 will be printed on the next line.



The OUTPUT/X key transfers the contents of the X-register to the printer, but does not print the data until the Print Line Feed instruction is received.



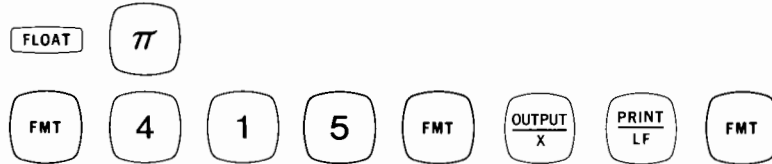
Causes the printer to print the contents of the printer buffer and to do a Line Feed (i.e. advance the paper one line).



Pressing FMT after the PRINT/LF returns the redefined keyboard to normal operation.

EXAMPLE:

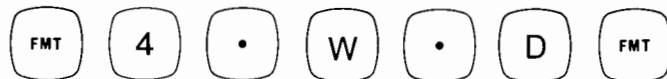
PRESS:



The printout should appear as shown below:

3.141592654+00

The data is printed exactly as it appears in the display. However, the form of the data can be controlled using the general key sequence:



where the data field width (w) = 1 to 63 and the display format (D) = 1 to 9.

If any non-numeric key is pressed for D , FLOAT format will be set. The data field width is automatically set to 20 when the calculator is switched ON.

PRINTING DATA

(continued)

The printout is right-justified within the specified field width. For example, if a width of 10 is specified and the number 3.1416 is printed, there will be four spaces to the left of the number. The example sequence and printout is shown below.



If the data to be printed contains more digits than the width specified, "\$" characters will be printed to fill the field. For example if a width of 5 were specified above, the printout would be \$\$\$\$\$.

EXAMPLE

Load and run the following program:

<pre> 0000-- π ---56 ENTERπ 0001--FMT---42 } 0002-- 4 ---04 } 0003-- . ---21 } 0004-- 2 ---02 } SPECIFY FORMAT 0005-- 0 ---00 } 0006-- . ---21 } 0007-- 5 ---05 } 0008--FMT---42 } 0009-- 4 ---04 } 0010-- 1 ---01 } 0011-- 5 ---05 } OUTPUT DATA 0012--FMT---42 } TO PRINTER 0013--PNT---45 } 0014--FMT---42 } 0015--XSQ---12 } π² 0016--FMT---42 } 0017-- 4 ---04 } 0018-- . ---21 } 0019-- 2 ---02 } CHANGE FORMAT 0020-- 0 ---00 } 0021-- . ---21 } 0022-- 0 ---00 } 0023--FMT---42 } 0024-- 4 ---04 } 0025-- 1 ---01 } 0026-- 5 ---05 } OUTPUT DATA 0027--FMT---42 } TO PRINTER 0028--PNT---45 } 0029--FMT---42 } </pre>	<pre> 0030--XSQ---12 } π³ 0031--FMT---42 } 0032-- 4 ---04 } 0033-- . ---21 } 0034-- 2 ---02 } CHANGE FORMAT 0035-- 0 ---00 } 0036-- . ---21 } 0037-- . ---21 } 0038--FMT---42 } 0039-- 4 ---04 } 0040-- 1 ---01 } 0041-- 5 ---05 } OUTPUT DATA 0042--FMT---42 } TO PRINTER 0043--PNT---45 } 0044--FMT---42 } 0045--XSQ---12 } π⁴ 0046--FMT---42 } 0047-- 4 ---04 } 0048-- . ---21 } 0049-- 6 ---06 } CHANGE FIELD WIDTH 0050-- . ---21 } & DISPLAY 0051-- 3 ---03 } 0052--FMT---42 } 0053-- 4 ---04 } 0054-- 1 ---01 } 0055-- 5 ---05 } 0056--FMT---42 } 0057--CNT---47 } OUTPUT SPACES 0058--CNT---47 } & DATA 0059--CNT---47 } 0060--CNT---47 } 0061--CNT---47 } 0062--CNT---47 } 0063--PNT---45 } PRINT ALL DATA 0064--CLR---20 } 0065--FMT---42 } 0066--END---46 } </pre>
---	---

The printout should appear as shown below:

```

  3.14159      10      9.740909104+01      $$$$$$
  _____  _____  _____  _____  _____
    w=20      w=20      w=20      6 SPACES  w=6

```

ANALYSIS OF THE PROGRAM

Here is a brief analysis of the program.

Steps 0 through 14 – π is entered into the X-register. Then the data field width (20) and display format (FIXED 5) are specified. Finally, the number is output to the printer. Note that the number when printed takes up only seven spaces and appears right-justified in the field.

Steps 15 through 29 – The number in X-register is squared and a new display format is set. Then this second number is output to the printer. Notice that the decimal point is not printed when D=0.

Steps 30 through 44 – The number in the X-register is squared again and FLOAT format is specified by using a non-numeric key for *D*. This third number is then output.

Steps 45 through 66 – The number in the X-register is squared again and both the data field width and the display format are changed. Six spaces and the number are output; then all four numbers are printed. Notice that the fourth number was larger than the field width, causing \$'s to fill the field. Notice also that four columns have been printed (72 characters all together).

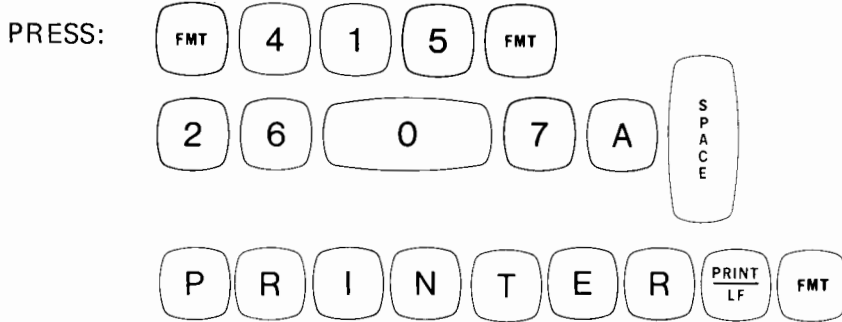
◆◆◆ VERTICAL FORMAT CONTROL ◆◆◆

When using the 2607A with the 9810A to print forms, the forms are moved vertically by including Line Feeds in the program. The Vertical Format Unit control codes described in the 2607A Operator's Manual, are not available with the 9810A Calculator.

PRINTING MESSAGES

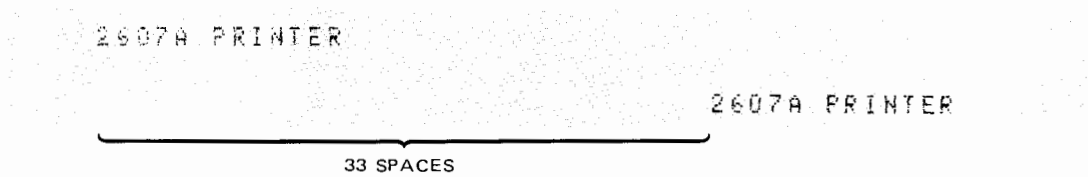
Up to 64 alphanumeric characters (including space) are available for printing messages, labels, etc. (Refer to Figure 2-1.) Option 001 provides the capability of printing the lower case alpha characters. Messages, like data, must be preceded by the 'call sequence' FMT 4 15 FMT. A message is printed by pressing PRINT LF, and the 'print' mode is terminated by pressing FMT or any of the keys discussed previously.

EXAMPLE: To print "2607A PRINTER",



To center the title on the paper, press the SPACE (CNT) key the required number of times between the call sequence and the title.

The printout with no spaces and the printout with 33 spaces are shown below:



PRINTER STATUS (PC 2 only)

The status of the printer may be checked by using the following 11264A PC 2 Block command.



This checks the interface status lines and enters a decimal code into the X-register to indicate the current status of the peripheral device specified by the select code. The status codes and definitions are listed below.

Status Code	Meaning
0	Interface not connected to calculator or printer not ready
3	Printer ready to accept data (assumes power switch ON)

◀ 9810A / 2607A PRINTER USER'S GUIDE ▶



Redefines the keyboard to the printer mode. A total of 64 characters (including space) are available in this mode. Option 001 also provides lower case alpha characters.



Enters a space into the printer storage register.



Causes a line print and a line feed.



Returns the keyboard to normal mode and clears the printer storage register.

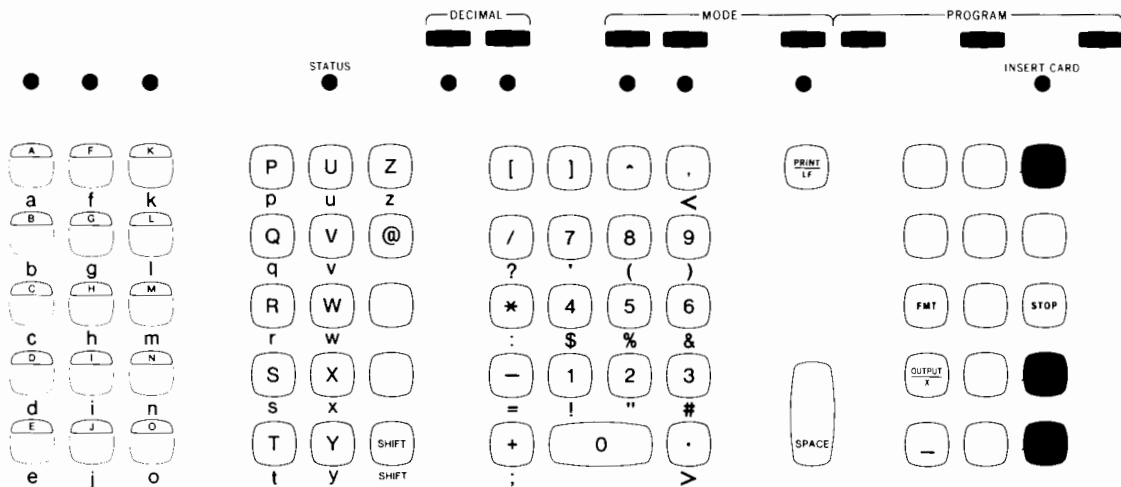


Returns the keyboard to normal mode without clearing the printer storage register.



Transfers the contents of the X-register to the printer storage register but does not print.

PRINTER KEYBOARD



NOTE

Characters and data are not printed until PRINT/LF (CLEAR) is pressed or the printer storage register is full. Printer Line Width is 132 characters.

3-0



NOTES

Chapter 3

MODEL 20 AND 21 SYSTEM OPERATION

◆◆◆◆◆◆◆◆◆◆ INTRODUCTION ◆◆◆◆◆◆◆◆◆◆

The 11287A Line Printer Interface can be used with a 9820A or 9821A Calculator and an 11220A or 11224A Peripheral Control Block to control the 2607A Line Printer. This chapter describes how to print data and messages using the 2607A Line Printer. For more information on the peripheral control block operations, see Chapter 2 of your Peripheral Control Block operating manual.

This information is presented assuming that the reader is familiar with the 9820A or 9821A operation and the use of the peripheral control block.

The examples in this chapter assume that the 11287A Interface select code is set to 15 (0).

Data and messages are transferred to the printer by the interface. The printer stores the characters in a buffer until either a Line Feed command is given or the buffer is full (132 characters).

◆◆◆◆◆◆◆◆◆◆ PRINTER SET-UP ◆◆◆◆◆◆◆◆◆◆

Before printing, check to be sure the printer is properly set-up.

- Paper loaded and properly positioned.
- Print switch ON.
- Lines per inch switch in desired position.

◆◆◆◆◆◆◆◆◆◆ PRINTING DATA ◆◆◆◆◆◆◆◆◆◆

The printer is controlled by using the PC Block WRITE statement, which is usable with or without a FORMAT statement.

The Print Data Syntax:

WRT (select code), (data item₁), (data item₂),.
e.g., WRT 15,A,B

Each data item can consist of any value, a register name, or an expression. A carriage-return/line-feed operation (CR/LF) is automatically given after all data items in the list have been printed, unless a FORMAT statement indicates otherwise (see 'Using FORMAT Statements' in this Chapter).

(continued)

PRINTING DATA

(continued)

USING THE FREE-FIELD FORMAT

When the free-field format is used, the printing format consists of four columns of 18 spaces each. The four columns are adjacent to each other, and the left edge of the left-most column begins at the left margin.

When the WRITE statement is encountered, the first data item is printed (right-justified) in the left column, the second data item is printed in the next column, etc. After each group of four items has been printed, a CR/LF is automatically executed.

The printed appearance of each data item is controlled by the current settings established by the FIXED N and FLOAT N keys (N refers to the number of digits to be printed after the decimal point). No decimal point is printed if 'FIXED 0' is set. Also, if a number is too large to be printed under the current fixed-point setting, the number is printed under the previous floating-point setting.

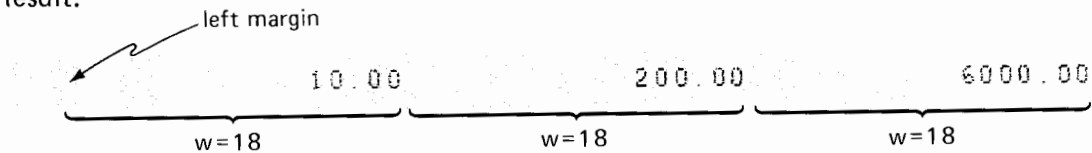
EXAMPLE:

Press ERASE, then load and run the following program:

```

0:
FXD 2F
1:
10→A|200→B|6000→
CF
2:
WRT 15,A,B,CF
3:
END F
    
```

Result:



Now execute this line:

```
WRT 15,A,5B,A+C,ABC,A/1E-7F
```

Result:

```

10.00      1000.00      6010.00      12000000.00
1.00000000E 08
    
```

Notice that a CR/LF is given after four data items are printed; then another CR/LF is given after the last data-item in the list is printed. Also, note that the printing format switches to 'floating point' when the data item is too large for the 'fixed-point' field.

 USING FORMAT STATEMENTS

Using FORMAT statements with WRITE statements allows more complete and flexible control than is possible with Write only. Printing is under the control of a FORMAT statement when a WRITE statement is encountered and when a FORMAT statement has been encountered previously. Under these conditions, a one-to-one correspondence is formed between the list of data items in the Write statement and the list of specifications in the FORMAT statement. As the items are printed, each specification determines the format of the corresponding item.

The Format Syntax:

$$\text{FMT } r \text{ FXD } w.d$$

i.e., $\text{FMT } \langle \text{integer} \rangle \text{ FXD } \langle \text{integer} \rangle . \langle \text{integer} \rangle$

r is the number of consecutive times the specification is to be used (if r is 1 it may be omitted).

w is the width of the data field to be read.

d (0-9, inclusive) is the number of digits to appear to the right of the decimal point.

EXAMPLE:

1. Execute the lines:

```
10→A;200→B;6000→C# FMT FXD 10.2;WRT 15,A,B,C#
```

Result:

```

  10.00
  200.00
 6000.00
  ────
    w=10
```

Since there was only one conversion specification (FXD 10.2), a CR/LF was given after each parameter was printed; thus, the use of one specification results in a one-column printout.

2. Now execute the line:

```
FMT FXD 6.2;WRT 15,A,B,C#
```

Result:

```

  10.00
  200.00
  #####
  ────
    w=6
```

Since the field width specified was too small to allow parameter C to be printed, '\$' characters were printed.

(continued)

PRINTING DATA

(continued)

3. Now execute the line:

```
FMT FLT 10.2,2FXD 10.2;WRT 15,A,B,C,ABF
```

Result:

```

1.00E 01      200.00      6000.00
2.00E 03
-----
      w=10      w=10      w=10

```

After all specifications are used in a FORMAT statement, a CR/LF is given and the next data item is printed using the first specification again. Thus, the sequence of instructions in a FORMAT statement determines the exact printing format.

4. Now execute these lines separately from the keyboard:

```
FMT FLT 2.0F      WRT 15,A,B,C,ABF
```

Result:

```
10.00      200.00      6000.00      2000.00
```

Display:

NOTE 22

Since the FORMAT statement is not included in the same line as the WRITE statement, the data items are printed in the free-field format and NOTE 22 appears to remind the operator of the error.

In this case, even if both statements were executed in one line or if the lines were executed in a program, the FLT 2.0 specification would have been out of range (see step 2), thus causing '\$' characters to be printed for each data item.

◆◆◆◆◆ PRINTING MESSAGES ◆◆◆◆◆

Up to 64 alphanumeric characters (including 'spaces') are available for printing messages, labels, etc. A message is printed by including the appropriate keys shown in Figure 3-1 in a 'literal' within a FORMAT statement and then referencing that statement while executing a WRITE statement. The 2607A Option 001 provides the lower case alpha characters. To print the lower case characters, press 'shift' (display) before the text.

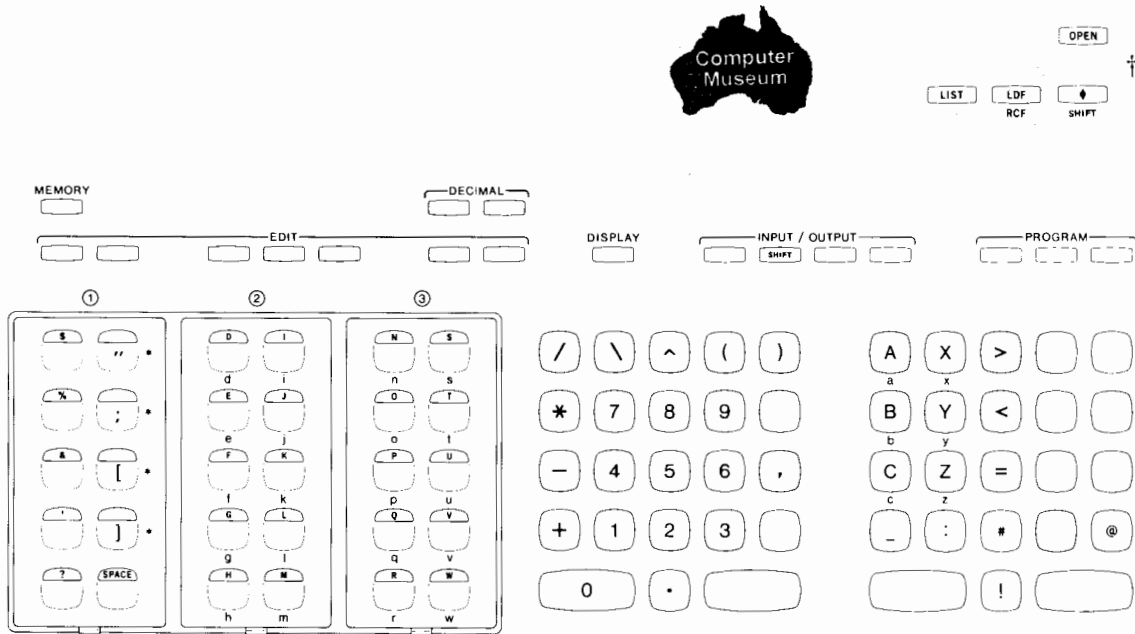


Figure 3-1. Printer Character Control Keys

*These characters are not available when using the PC 1 Block.

† Shaded block indicates the location of the shift key on the 9821A Calculator. All other character control keys for the 9821A are identical to the 9820A control keys.

(continued)

PRINTING MESSAGES

(continued)

EXAMPLE:

1. The following printout was obtained by running the program listed* below. See the program analysis on the following page.

```

0:          B;C+1;CF
0+X;A;10+B;20+CF
1:          5:
          X+1;X;IF X=3;0+X
          ;WRT 15F
          6:
          IF A<9;JMP -3F
          7:
          FMT 5;WRT 15F
          8:
          END F
          FMT 3"      REG.
          CONTENTS
          ";WRT 15F
          3:
          FMT FXD 6.0,FLT
          18.8,FXD 8.0,
          FLT 18.8,FXD 8.0
          ,FLT 18.8F
          4:
          WRT 15,A,RA,B,RB
          ,C,RC;A+1;A;B+1;
    
```

PRINTOUT†:

DATA REGISTER LISTING					
REG.	CONTENTS	REG.	CONTENTS	REG.	CONTENTS
0	0.00000000E 00	10	0.00000000E 00	20	0.00000000E 00
1	0.00000000E 00	11	0.00000000E 00	21	0.00000000E 00
2	0.00000000E 00	12	0.00000000E 00	22	0.00000000E 00
3	0.00000000E 00	13	0.00000000E 00	23	0.00000000E 00
4	0.00000000E 00	14	0.00000000E 00	24	0.00000000E 00
5	0.00000000E 00	15	0.00000000E 00	25	0.00000000E 00
6	0.00000000E 00	16	0.00000000E 00	26	0.00000000E 00
7	0.00000000E 00	17	0.00000000E 00	27	0.00000000E 00
8	0.00000000E 00	18	0.00000000E 00	28	0.00000000E 00
9	0.00000000E 00	19	0.00000000E 00	29	0.00000000E 00

*The ̄ symbol represents a blank space.

†See the program analysis on the following page.

Here is a brief analysis of the program:

- Line 1 – causes the printer to advance paper five lines and print the program title. Notice that the title is centered on the listing by ‘printing’ a block of 30 spaces before the title.
- Line 2 – causes the column headings to be printed. Here, spacing is achieved by programming spaces within the literal format specifications.
- Lines 3 and 4 – specify the form of each table entry and which numbers (register contents) are printed in each line of the table. The magnitude of each width (w) parameter in the FORMAT statement (line 3) was selected to position the corresponding table column under the appropriate heading.
- Line 5 – causes the printer to space one line after each three lines printed.
- Line 6 – determines the maximum number of table entries.
- Line 7 – causes the printer to space five lines.

▶ **MAXIMUM LINE WIDTH**

The printer line width is 132 characters. If a line feed is not given, the printer will line feed automatically on receiving the 133RD character. For example, if the FORMAT statement in line 1 of the foregoing program appeared as this:

```
FMT 5/,125X,'DATA REGISTER LISTING',/;WRT 15
```

then the title would be printed (incorrectly), like this:

```
DATA REGISTER LISTING
```

```
DATA RE
```

◆◆◆ **PRINTER STATUS (PC 2 only)** ◆◆◆

The status of the printer may be checked by using the following 11224A PC 2 block syntax:

```
RDS (select code) → [register name]
```

└──
read
status

e.g., RDS 15→A

This checks the current status of the printer specified by the select code. A decimal code is returned to indicate the status. The code is stored in the specified register. If the “→ register name” is omitted, the status code is stored in the Z-register.

The status codes and definitions are listed below.

Status code	Meaning
0	Interface not connected to calculator or printer not ready
3	Printer ready to accept data (assumes power switch ON)

 **VERTICAL FORMAT CONTROL** 

When using the 2607A with the 9820A or 9821A to print forms, the forms must be moved vertically by using format and write statements that specify the required number of line feeds. The paper positioning codes are not available on the 9820A or 9821A.

Chapter 4

MODEL 30 SYSTEM OPERATION

INTRODUCTION

The -hp- 11287A Line Printer Interface can be used with the 9830A Calculator to control the 2607A Line Printer. Much of the operating information is contained in the 9830A Operating and Programming Manual (-hp- Part No. 09830-90001). This chapter provides a quick reference to the statements and commands covered in the calculator manual and describes the functions and codes unique to the 2607A.

The 2607A is controlled by the same statements as the 9866A printer. Thus a program that uses the 9866A may be used with the 2607A, provided that the select code used is the same.*

PRIMARY PRINTER

The "primary printer" for the 9830A is the printer which is set to select code 15. Some of the 9830A statements (such as LIST) assume a select code of 15, thus the full capabilities of the 2607A are realized when the 11287A Interface select code is set to 15. If the 2607A is set to select code 15, any other printer connected to the 9830A must be set to a select code other than 15.

PRINTER SET-UP

Before printing, check to be sure the printer is properly set up.

- Paper loaded and properly positioned
- Print switch ON
- Lines per inch switch in desired position

*If you are familiar with the 9830A and 9866A operation, the 2607A will be very similar to operate. If you are not familiar with the 9830A or printer, simply following the 9830 manual will introduce you to printer operations.

PRINTER OPERATIONS

Data and messages are transferred to the printer by the interface. The printer stores the characters in a buffer until a line feed command is given or the buffer is full (132 characters). The statements and commands used to control the printer are fully described in the 9830A Operating and Programming Manual. Table 4-1 lists each operation with a brief description, and tells you in which chapter of the 9830 Manual to look for its explanation. You may also wish to refer to "Printer Character Codes" later in this chapter for a complete list of the printer's character set and decimal codes. The 2607A Option 001 provides the lower case alpha characters.

Table 4-1. Printer Operations.

Unless otherwise noted, the operations listed assume a select code of 15.

COMMAND OR STATEMENT	DESCRIPTION	9830A MANUAL CHAPTER
PRINT	The standard print statement. Line width with this statement is restricted to 72 characters.	} FOUND IN CHAPTER 3
PRINT with TAB	Same as the PRINT statement, except messages may be moved on a line by a TAB specification.	
WRITE	Enables more flexible printing; a full 132 character line width can be used. WRITE may reference any select code.	
FORMAT	Used with the WRITE statement to control the form and appearance of data and messages.	} FOUND IN CHAPTER 4
LIST	Lists program lines stored in calculator memory.	
PRINT ALL	Prints each operation as executed.	
TRACE	Prints line numbers as line is executed.	
NORMAL	Cancels Trace	} FOUND IN CHAPTER 5
T LIST	Lists information from a tape cassette.	

◆◆◆◆◆ PRINTER STATUS ◆◆◆◆◆

The 11272B Extended I/O ROM is required if you wish to check the printer status. The ROM's STAT syntax is used as follows.

STAT Select Code

This function returns a decimal code indicating the current status of the printer. The status codes and definitions are listed below.

Status Code	Meaning
0	Interface not connected to calculator or Printer not ready
3	Printer ready to accept data (assumes power switch ON)

◆◆◆◆◆ VERTICAL FORMAT CONTROL ◆◆◆◆◆

Special paper instructions from the 9830A can be used to control the movement (slew) of paper. When a paper instruction command is received, a print cycle will occur if at least one printable character was received by the printer since the previous print cycle. If no print cycle is pending, paper movement will commence immediately.

Two sets of paper instructions are available, the Vertical Format Unit control and the Line Count control.

◆ VERTICAL FORMAT UNIT CONTROL

This set of paper instruction commands is used to control the duration of movement according to the punches in the printer's Vertical Format Unit (VFU) tape. The paper will move until a hole is sensed on the VFU tape in the channel specified by the paper instruction (see Figure 4-1).

Refer to the 2607A Operator's Manual (-hp- Part No. 02607-90005) for information to construct the format control loop tape.

The decimal codes used to select the various VFU channels are listed in Table 4-2.

9830A Decimal Code	VFU Channel Selected
320	1
321	2
322	3
323	4
324	5
325	6
326	7
327	8

(continued)

VERTICAL FORMAT CONTROL

(continued)

LINE COUNT CONTROL

This set of paper instructions is used to control the duration of movement according to the number of lines specified in the command. Since paper advance is an integral part of the printing process, a movement of one line occurs as part of every print cycle. The action taken upon receipt of a movement command, as shown in Table 4-3, depends upon whether or not printable characters have been sent to the printer since the last paper instruction. Table 4-3 lists the decimal codes used to move the paper, and the number of lines skipped.

Table 4-3. Line Count Codes

9830A Decimal Code	Number of lines skipped	
	No Print Cycle	With Print Cycle
256	0	0
257	1	0
258	2	1
259	3	2
260	4	3
261	5	4
262	6	5
263	7	6
264	8	7
265	9	8
266	10	9
267	11	10
268	12	11
269	13	12
270	14	13
271	15	14

All the paper instruction codes listed in Tables 4-2 and 4-3 are used by including the decimal code in a WRITE statement, and referencing the WRITE statement to a FORMAT B statement. FORMAT B is used to output codes not otherwise available on the Model 30.

Here is an example of a paper instruction as it might be used in a program.

EXAMPLE

The following program segment outputs the decimal code 263, which will cause the paper to skip 7 lines (6 with a print cycle).

```
80  FORMAT B
90  WRITE (15, 80) 263
```

FORMAT TAPE

The standard vertical format tape shipped with the printer, provides a format for two, 11 inch forms at 6 lines per inch. This tape is punched as follows:

Channel	Function	Hole Positions
1	Move to top of next form	1 and 67
2	Move to bottom of form	60 and 126
3	Single space	1,2,3...60; 67,68...126
4	Double space	1,3,5...59; 67,69...125
5	Triple space	1,4,7...58; 67,70...124
6	Move to half page line	1,31; 67,97
7	Move to next quarter page	1,16,31,46; 67,82,97,112
8	Move to next sixth page	1,11,21...51; 67,77,87...117

Refer to Figure 4-1 for the VFU channel positions.

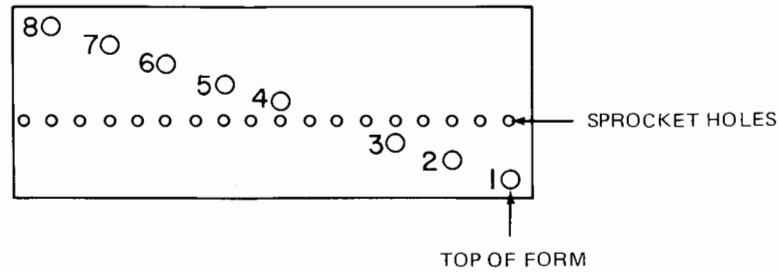


Figure 4-1. VFU Tape Channels

MASTER CLEAR

The printer circuits can be reset by sending a master clear code to the printer. The master clear decimal code (512) is sent to the printer in the same manner as the paper instructions. The master clear will clear the printer's input buffer, and terminate any paper movement or VFU operation in progress. If a print cycle is in progress, it will be completed.

◆◆◆ PRINTER CHARACTER CODES ◆◆◆

Table 4-4 lists the printers character set, and the decimal code for each character.

Table 4-4. Printer Character Codes

Decimal Code	2607A Character	Decimal Code	2607A Character	Decimal Code	2607A Character	2607A Opt-001 Character
32	SPACE	60	<	90	Z	
33	!	61	=	91	[
34	"	62	>	92	\	
		63	?	93]	
35	#	64	@	94	^	
36	\$					
37	%	65	A	95	—	
38	&	66	B	96	@	
39	'	67	C	97	A	a
		68	D	98	B	b
40	(	69	E	99	C	c
41)					
42	*	70	F	100	D	d
43	+	71	G	101	E	e
44	,	72	H	102	F	f
		73	I	103	G	g
45	—	74	J	104	H	h
46	.					
47	/	75	K	105	I	i
48	0	76	L	106	J	j
49	1	77	M	107	K	k
		78	N	108	L	l
50	2	79	O	109	M	m
51	3					
52	4	80	P	110	N	n
53	5	81	Q	111	O	o
54	6	82	R	112	P	p
		83	S	113	Q	q
55	7	84	T	114	R	r
56	8					
57	9	85	U	115	S	s
58	:	86	V	116	T	t
59	;	87	W	117	U	u
		88	X	118	V	v
		89	Y	119	W	w
				120	X	x
				121	Y	y
				122	Z	z
				123	[{
				124	\	|
				125]	}
				126	^	~
				127	—	⋯



NOTES

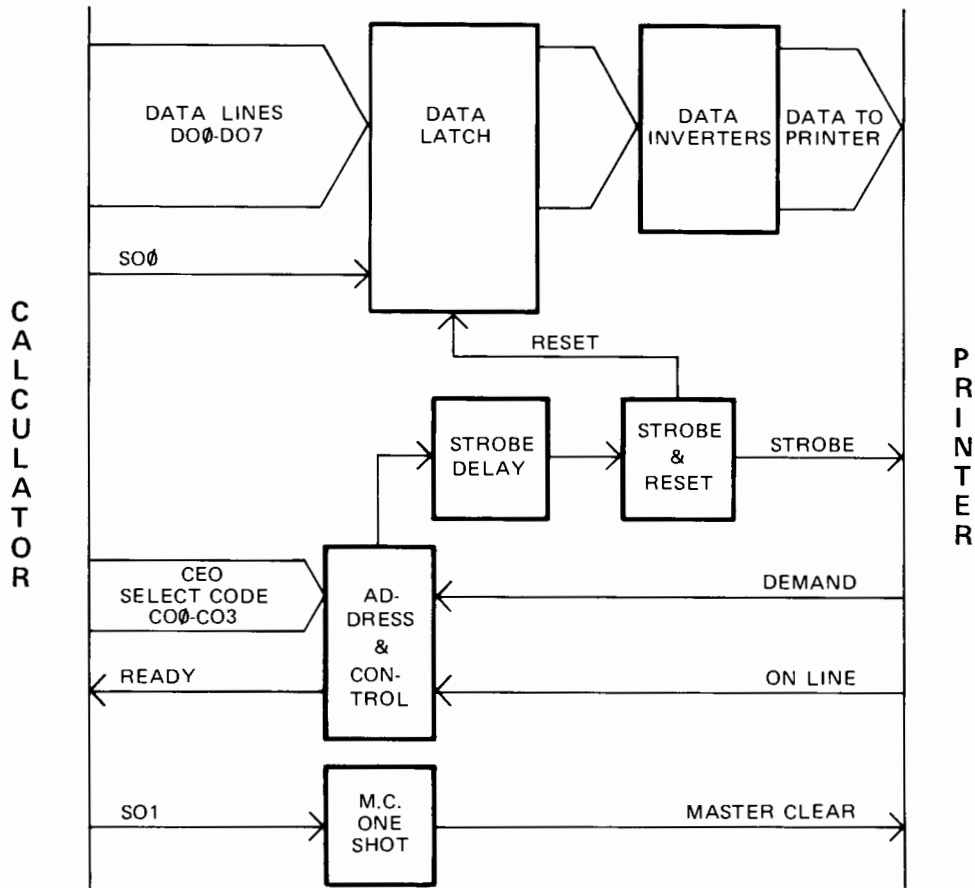


Figure 5-1. 11287A Block Diagram

Chapter 5

SERVICING THE INTERFACE

INTRODUCTION

This chapter provides information to service the 11287A Interface. This information includes the interface theory of operation, troubleshooting hints and schematic diagram.

THEORY OF OPERATION

The 11287A Interface transfers 7-bit ASCII character codes from the calculator DO lines, to the 7 data input lines of the printer. Printer status is returned to the calculator on the SIO and SI1 lines. The interface logic levels are nominally 0V or +5V; 0 volts is referred to as the "high" state. Refer to the interface timing diagram and schematic diagram (Figures 5-3 and 5-4) when reading the theory of operation.

A character to be output to the printer is first placed on the data output lines (DO0 through DO6), accompanied by the select code signal (CO0 through CO3) and a low CEO (calculator enable) signal. The select code and CEO signals enable a high signal to U15 pin 4. The positive edge of this high signal is applied to the clock inputs of U5, U6, U7 and U8, to latch the character bits into U5, U6, U7 and U8. The high U15 pin 4 signal is also applied to U12 pin 8, where it is delayed 1 μ s by U12. This delayed signal (strobe delay) from U12 pin 9 is applied to the clock input (pin 11) of U9. If the character being transferred is a printable character, U11 pin 8 will be high, setting U9B and sending a high strobe signal to the printer on U4 pin 6. The strobe signal enables the character to be received on the printer data lines. At the same time the strobe is sent to the printer, the Q output of U9B disables U15A which disables U14. Disabling U14 allows the SIO line to go high. The high SIO indicates that the printer is busy. The Strobe signal to the printer also causes the Demand signal to be low. Demand remains low for at least 2.2 ms to allow time for the character to be stored in the printer circuits. When the Demand signal again goes high, U13 pin 6 will be high indicating that the printer is ready for the next character. At this time the U13 pin 6 signal will enable U14C and the SIO line (busy) will go low. The low SIO signal indicates to the calculator that the printer and interface are now ready for the next character. This sequence is repeated for each character that is output to the printer.

When an invalid character "no-op" (codes 0000 through 0037) is sent to the interface, the character is processed by the interface in the same manner as a printable character, with the following exceptions. The output of U11 will be low, to prevent a strobe from being sent to the printer. The SIO line remains low (ready), and in this way the no-op character is ignored.

(continued)

◆◆◆◆◆ THEORY OF OPERATION ◆◆◆◆◆

(continued)

When a line feed character is sent to the interface, the line feed code is processed by the interface in the same manner as a printable character with the following exceptions. The line feed code on the latches enables U10, and U10 pin 8 goes low. This low is clocked through U9 by the strobe delay to provide a low Line Feed Reset to the latches (U5,U6,U7 and U8). The Line Feed Reset forces the latches to output a line feed code (11000010) on the data lines.

A paper instruction is processed in the same manner as a printable character. In addition to the seven DO lines, a paper instruction uses the SO0 line to indicate that the character is a paper instruction.

A master clear instruction is input on the SO1 line, and applied to the master clear one-shot U12 pin 4. The output of U12A is a 5 μ s pulse sent directly to the printer through U4E.

◆◆◆◆◆ TROUBLESHOOTING ◆◆◆◆◆

If the 11287A Interface is under warranty, it is recommended that the interface be serviced by an -hp- Customer Engineer. The following procedures will assist you in isolating a defective component on the interface circuit board (11287-6650I). First remove the circuit board from the I/O case. Install an I/O Extender (-hp- Part No. 5061-0726) in the top slot on the back of the calculator. Install the circuit board on the extender connector (refer to Figure 5-2). The circuit board can be checked using an -hp- 10525A Logic Probe. Connect the logic probe to the BNC connector on the I/O extender.

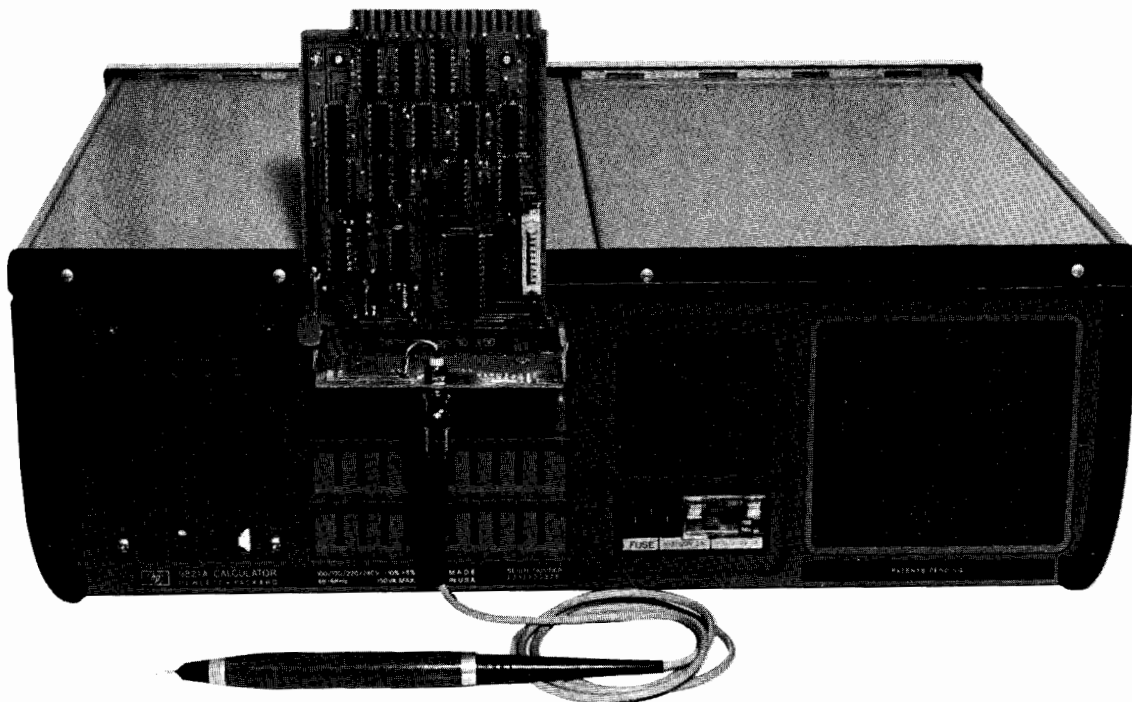


Figure 5-2. Interface Test Set-up

Switch the calculator ON. With the logic probe check for the following signals on the interface.

<u>Check</u>	<u>Should be</u>	<u>if not probable cause</u>
U15 pin 4	low	U15,U16,S1, signals from the calculator
U12 pin 9	high	U9
U13 pin 6	high	U13
U10 pin 8	high	U10
U11 pin 8	high	U11
U14 pin 8 and 12	pulsing	U14,U15

The data lines to the printer should have the ASCII code 11000010 on them,

i.e.,

	1	1	0	0	0	0	1	0
	PAPER	DATA	DATA	DATA	DATA	DATA	DATA	DATA
	INSTRUCTION	7	6	5	4	3	2	1

If no characters are transferred to the printer, the following checks can be made. When making these checks, the calculator should be outputting a character. It may be necessary to write a short program which outputs one character to the printer and then loops back to repeat the character.

<u>Check</u>	<u>Should be</u>	<u>if not probable cause</u>
Latch pulse U15 pin 4	high pulses	U15,U16, signals from calculator
Strobe delay U12 pin 9	low pulses	U12
Strobe pulse U4 pin 6	high pulses	U9,U4
SI0 U14 pin 12	low pulses	U14,U15
if the character is valid,		
U11 pin 8	low pulses	U11

**TROUBLESHOOTING**

If the wrong characters are being printed, the problem can be either in the printer or the interface. The interface can be checked for this condition by monitoring the data lines with the logic probe and outputting the specific character that does not print correctly.

To check the data lines for the proper codes, refer to the following procedure:

1. Place the circuit board on the I/O Extender as previously described.
2. Switch the calculator OFF; then disconnect the interface cable from the circuit board connector (XA1).
3. Switch the calculator ON.

Again, using a short program, output a single character to the interface. The character will be latched and appear on the output lines. The binary code can be checked with the logic probe. If the code for the character is incorrect, the data inverters or the data latches may be defective. The binary codes for the printer characters are shown in Table 5-1.

To reset the interface and output a different character, press STOP, and change the character in your program.

Next, momentarily apply +5V to the DEMAND line (XA1 pin 1).

Table 5-1. I/O Characters and Equivalent Forms

2607A Char	EQUIVALENT FORMS			2607A Char	EQUIVALENT FORMS			2607A Char	2607A -001 Char	EQUIVALENT FORMS		
	Binary	Octal	Dec		Binary	Octal	Dec			Binary	Octal	Dec
space	00100000	040	32	@	01000000	100	64	@		01100000	140	96
!	00100001	041	33	A	01000001	101	65	A	a	01100001	141	97
"	00100010	042	34	B	01000010	102	66	B	b	01100010	142	98
#	00100011	043	35	C	01000011	103	67	C	c	01100011	143	99
\$	00100100	044	36	D	01000100	104	68	D	d	01100100	144	100
%	00100101	045	37	E	01000101	105	69	E	e	01100101	145	101
&	00100110	046	38	F	01000110	106	70	F	f	01100110	146	102
'	00100111	047	39	G	01000111	107	71	G	g	01100111	147	103
(	00101000	050	40	H	01001000	110	72	H	h	01101000	150	104
)	00101001	051	41	I	01001001	111	73	I	i	01101001	151	105
*	00101010	052	42	J	01001010	112	74	J	j	01101010	152	106
+	00101011	053	43	K	01001011	113	75	K	k	01101011	153	107
,	00101100	054	44	L	01001100	114	76	L	l	01101100	154	108
-	00101101	055	45	M	01001101	115	77	M	m	01101101	155	109
.	00101110	056	46	N	01001110	116	78	N	n	01101110	156	110
/	00101111	057	47	O	01001111	117	79	O	o	01101111	157	111
∅	00110000	060	48	P	01010000	120	80	P	p	01110000	160	112
1	00110001	061	49	Q	01010001	121	81	Q	q	01110001	161	113
2	00110010	062	50	R	01010010	122	82	R	r	01110010	162	114
3	00110011	063	51	S	01010011	123	83	S	s	01110011	163	115
4	00110100	064	52	T	01010100	124	84	T	t	01110100	164	116
5	00110101	065	53	U	01010101	125	85	U	u	01110101	165	117
6	00110110	066	54	V	01010110	126	86	V	v	01110110	166	118
7	00110111	067	55	W	01010111	127	87	W	w	01110111	167	119
8	00111000	070	56	X	01011000	130	88	X	x	01111000	170	120
9	00111001	071	57	Y	01011001	131	89	Y	y	01111001	171	121
:	00111010	072	58	Z	01011010	132	90	Z	z	01111010	172	122
:	00111011	073	59	[	01011011	133	91	[	{	01111011	173	123
<	00111100	074	60	\	01011100	134	92	\	|	01111100	174	124
=	00111101	075	61	]	01011101	135	93	]	}	01111101	175	125
>	00111110	076	62	^	01011110	136	94	^	~	01111110	176	126
?	00111111	077	63	_	01011111	137	95	_	⊙	01111111	177	127

◆◆◆◆◆ REPLACEABLE PARTS LIST ◆◆◆◆◆

Table 5-2 lists the 11287A Interface replaceable parts. The parts are listed in alphameric order of their reference designators. Other columns in the table indicate the -hp- part number and a description of the part. The quantity (QTY) column indicates the total number of a particular part used on the interface.

Table 5-2. 11287A Replaceable Parts

REFERENCE DESIGNATOR	-hp- PART NUMBER	QTY	DESCRIPTION
A1	11287-66591	1	PC Assembly Line Printer Interface
C1-C5	0160-3847	5	C-F: .01UF 25V
C6	0160-0336	3	C-F: 100PF 300V
C7	0140-0234	1	C-F: 500PF 300V
C8,C9	0160-0336		C-F: 100PF 300V
C10	0180-0229	1	C-F: 33UF 10V
C11	0180-1701	1	C-F: 6.8UF 6V
CR1	1901-0028	1	DIO: SI .75A 400V
R1,R2	0698-4493	2	R-F: 34K 1% 1/8W
R3	0683-2735	1	R-F: 27K 5% 1/4W
R4	0683-2225	1	R-F: 2.2K 5% 1/4W
S1	3101-1677	1	SWITCH, SELECT CODE
U1-U4	1820-0174	4	IC: SN7404N
U5-U9	1820-0596	5	IC: DM74L74N
U10,U11	1820-0589	2	IC: DIGITAL
U12	1820-0730	1	IC: DIGITAL
U13	1820-0721	1	IC: LINE RECEIVER
U14	1820-0907	1	IC: SN7412N
U15	1820-0584	1	IC: SN74L02
U16	1820-0702	1	IC: SL17303
	11200-04101	1	COVER, I/O
	11287-61601	1	CABLE ASSEMBLY
	11287-90000	1	OPERATING MANUAL
	5040-5911	1	BOOT, BOTTOM
	7120-4032	1	I.D. PLATE
	11287-26591	1	PC BOARD, INTERFACE
	1251-0337	1	CONNECTOR BODY
	1251-0339	1	CONNECTOR HOOD
	1251-0190	25	PIN
	1251-2188	1	CONNECTOR - PC 36 (2x18)
	7120-2940	1	LABEL, SELECT CODE

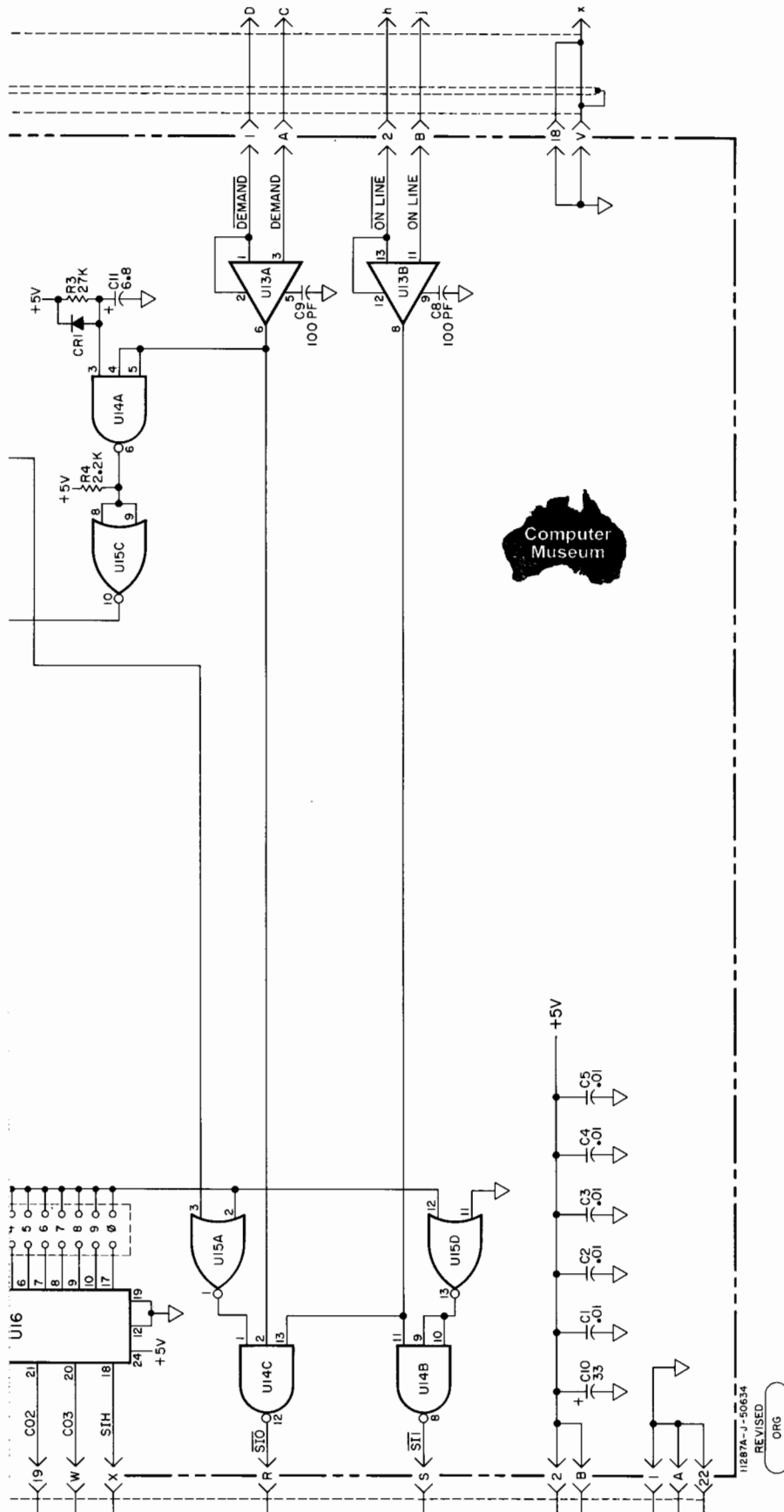
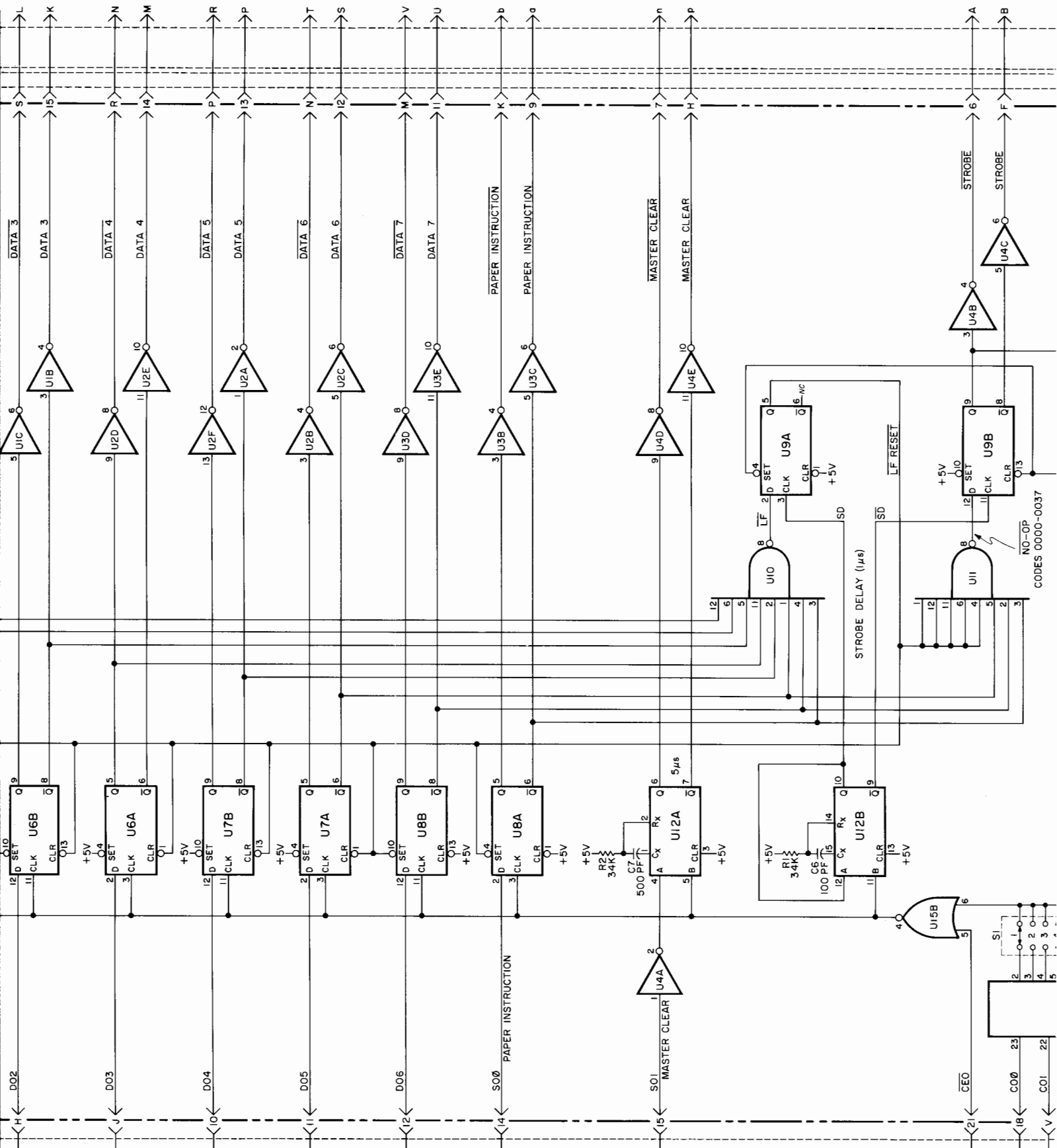
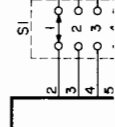
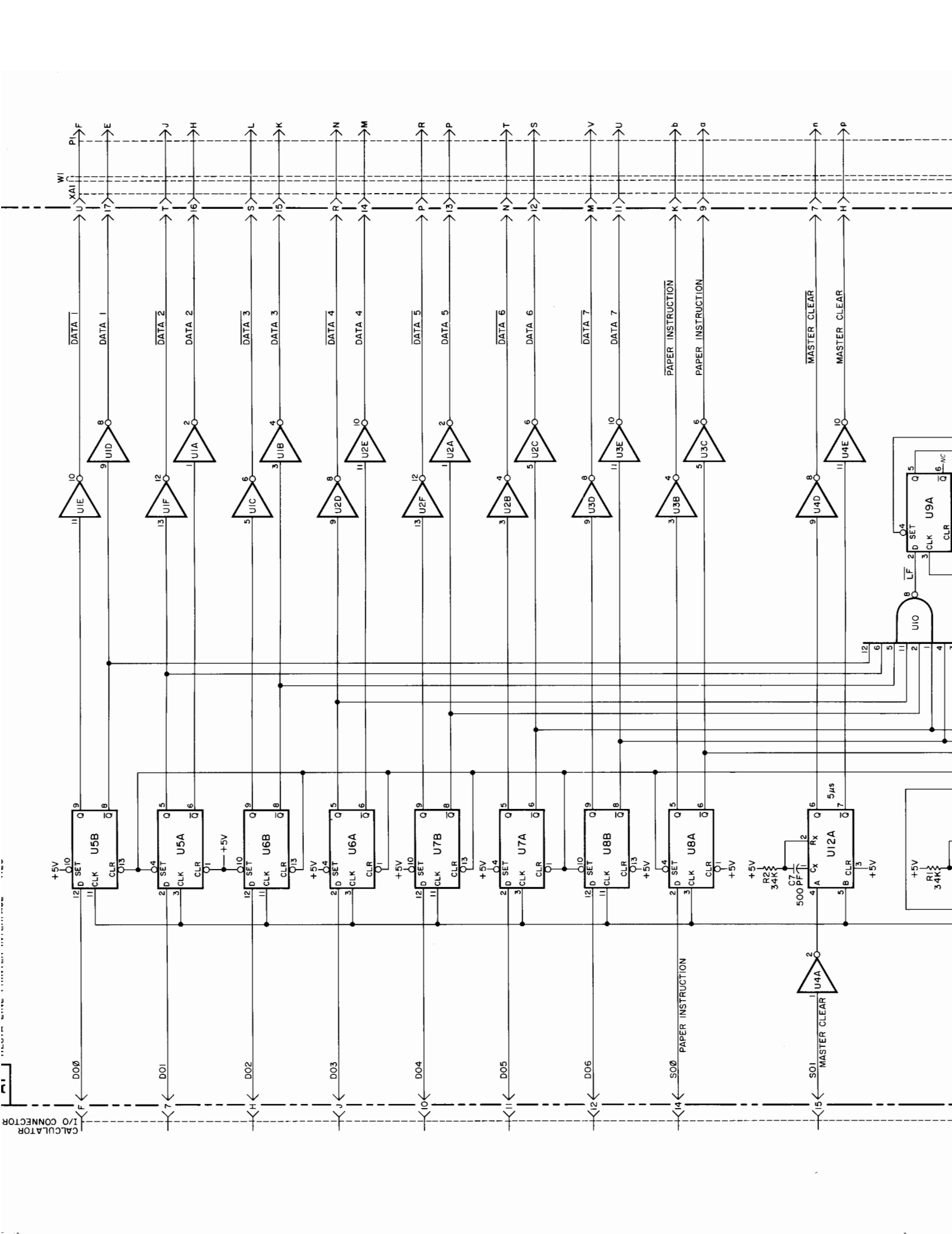


Figure 5-4. 11287A Line Printer Interface Schematic Diagram



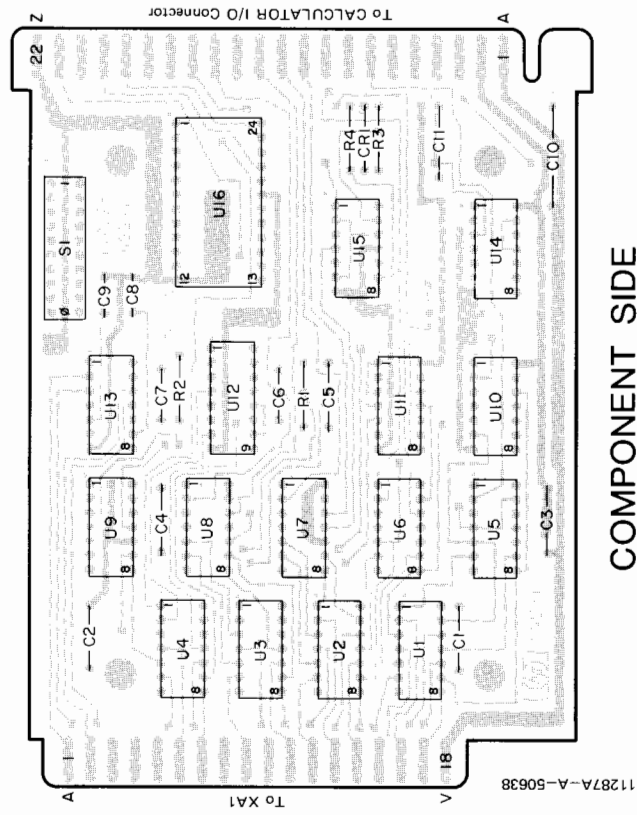
CODES 0000-0037





LF RESET

S01



COMPONENT SIDE

A1

-hp- Part No. 11287-66591 Rev A



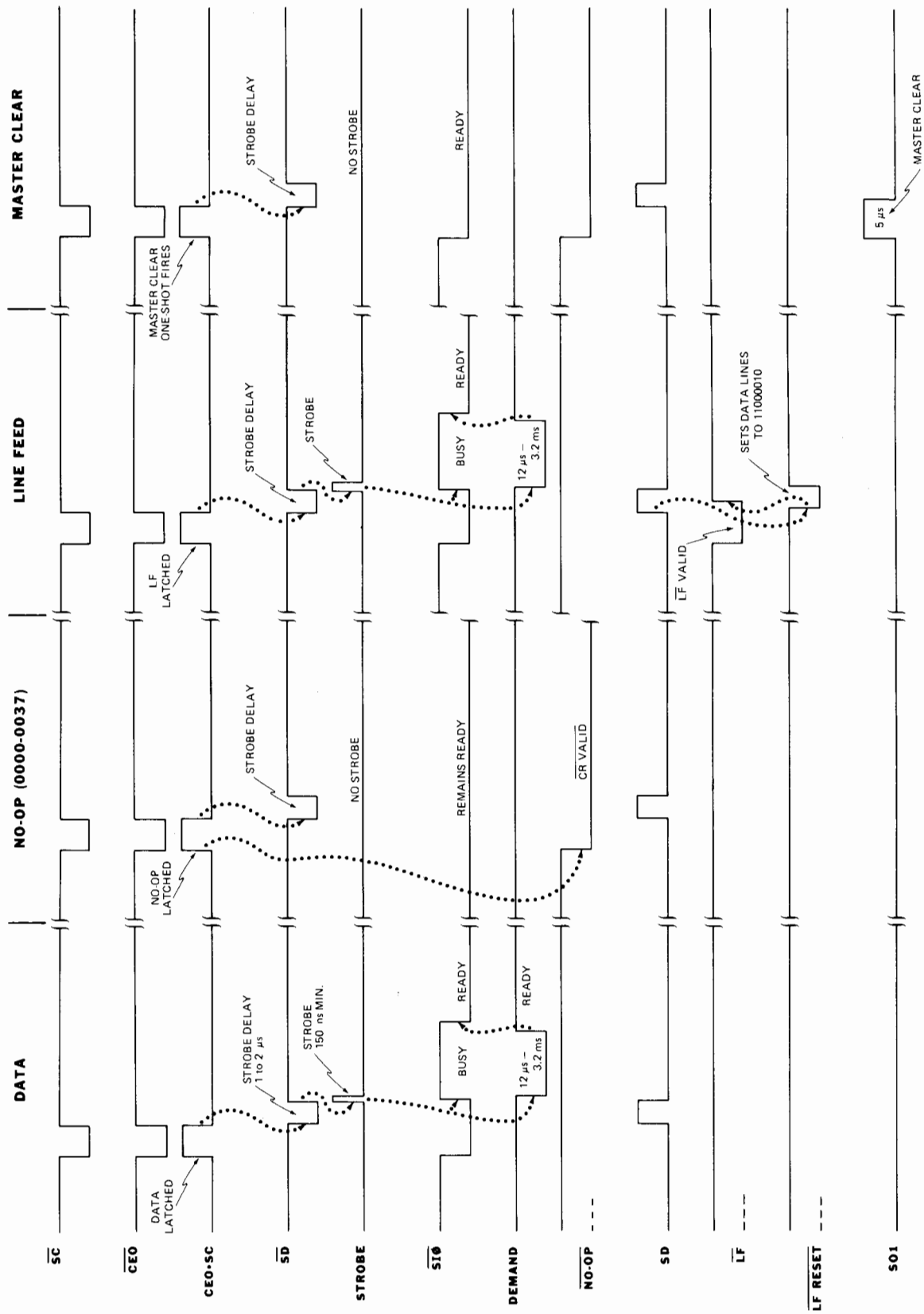


Figure 5-3. 11287A Timing Diagram

