

**26099A PRINTER
INTERFACE KIT
INSTALLATION AND SERVICE
MANUAL**

• MANUAL PART NUMBER 26099-90901
MICROFICHE PART NUMBER 26099-90801



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GENERAL INFORMATION

1-1 INTRODUCTION

This installation and service manual covers general information on installation, programming, theory of operation, maintenance, and replaceable parts for the HP 26099A Printer Interface Kit.

1-2 GENERAL DESCRIPTION

The HP 26099A Printer Interface Kit provides the necessary equipment to interface specific Hewlett-Packard printers with Hewlett-Packard 21XX-series computers. The kit contains the following items:

- One interface printed-circuit assembly, part no. 26099-60001
- One interface cable, part no. 26099-60002
- One installation and service manual, part no. 26099-90901

The printer interface kit uses a printed circuit assembly (PCA) which contains the circuitry required to control the transfer of data and control information between computer and printer. The interface PCA contains register circuits for output from the computer to the printer and buffer circuits for status input from the printer to the computer. Eight data bits and four control bits are transferred from the computer to the printer and up to eight status bits are returned to the computer from the printer. The interface PCA also contains interrupt and service request logic circuits that permit programming of the input/output functions.

1-3 IDENTIFICATION

Printed-circuit assembly revisions are identified by a letter, a series code, and a division code marked below the part number on the PCA. The letter identifies the revision of the etched-trace

General Information

pattern on the unloaded PCA. The four-digit series code pertains to the electrical characteristics and the physical positions of the components. The two-digit division code identifies the division of Hewlett-Packard that manufactured the PCA. If the series number does not correspond exactly with the series numbers listed on the title page of this manual, the PCA differs from the one described in this manual. These differences are covered in manual supplements available from the nearest Hewlett-Packard Sales Office listed in the back of this manual.

1-4 SPECIFICATIONS

Specifications for the 26099A printer interface are given in table 1-1.

Table 1-1 26099A Specifications

Supply Current:		
	+4.85 v supply	.75 amps
	-2 v supply	25 milliamps
Logic Voltage Levels:		
	Logic 1	+2.7 vdc (min)
	Logic 0	+0.4 vdc (max)
PC Board Dimensions:		
	Width	196.8 mm (7.75 in)
	Length	220.7 mm (8.69 in)
PC Board Weight:		
	Net	227 gm (8 oz)
	Shipping	454 gm (1 lb)
Shipping Weight of 26099A Kit		2.8 kg (6 lb)

INSTALLATION AND PROGRAMMING

2-1 INTRODUCTION

This section provides information on unpacking, inspection, installation, reshipment, and programming for the HP 26099A Printer Interface Kit.

2-2 UNPACKING AND INSPECTION

If the shipping carton is damaged upon receipt of the kit, request that the carrier's agent be present when the kit is opened. Inspect the kit for damage (cracks, broken parts, etc.). If the kit is damaged and fails to meet specifications, notify carrier and the nearest Hewlett-Packard Sales and Service Office immediately. (Sales and Service Offices are listed in the back of this manual.) Retain the shipping container and the packing material for the carrier's inspection.

2-3 INSTALLATION

Before installing the interface PCA in the computer, ensure that the additional power consumed by the PCA will not overload the computer power supply. Power requirements of the PCA are given in table 1-1; instructions for calculating available power are given in the applicable computer manual. If it is determined that sufficient power is available, install the interface kit as follows:

- a. Ensure that jumper W1 is positioned properly as described in paragraph 3-7.
- b. Turn off power to computer and printer.

Installation and Programming

- c. Gain access to the computer I/O card cage and insert the interface PCA in the slot corresponding to the desired select code.
- d. Connect the 100-pin connector (P1) of the interface cable to the 100-pin edge connector of the interface PCA.
- e. Connect the other end of the interface cable to the mating connector of the printer.
- f. Verify proper operation of the system by performing the appropriate diagnostic test. (Operation may also be checked by exercising the Auto-Print feature of the 26099A Interface which tests the Strobe-Demand handshake and provides a good indication of proper operation of the interface and printer - see Section 3-14).

2-4 RESHIPMENT

If an item of the kit is to be shipped to Hewlett-Packard for service or repair, attach a tag to the item identifying the owner and indicating the service or repair required. Include the model number of the kit.

Package the item in the original factory packing material, or, if unavailable, use standard factory packaging material available from a local Hewlett-Packard Sales and Service Office.

Note: In any correspondence, identify the kit by number. Refer any questions to the nearest Hewlett-Packard Sales and Service Office.

2-5 PROGRAMMING

This section covers general information for programming the operation of the printer interface. This information consists of printer characteristics, computer data and control signals to the printer, and status signals from the printer.

2-6 Printer Characteristics

Hewlett-Packard printers receive data in the form of 8-bit words from the computer. In addition, control information can be accepted from the interface in the form of one to four bits, depending on the printer model. The printer also sends data back over the eight data lines to give the computer information about the status of the printer.

The printer accepts ASCII coded data over eight pairs of lines from the interface. It also receives a control word in code over four pairs of lines. The control word specifies what information is contained in the data word. Depending on the specific control word, the data may be an ASCII character transfer, vertical forms control, information, etc. To determine the effect of the control word on the printer, consult the specific Operator and/or Service manual for the printer in use.



2-7 Computer Output Format

Each word of data transferred to the printer from the interface contains both control information and data. The format for this output is shown in figure 2-1. The data bits (0 through 7) contain the data that the computer will transfer. Since this data occupies only the lower eight bits of the 16-bit computer word, data may be stored "packed" in memory; however, it must be unpacked and right-justified before being sent to the printer. The control bits (12 through 15) contain information needed to establish the operating mode of the printer. This information tells the printer to print characters, do vertical formatting, use alternate character sets, read back status data, etc. To determine what each control function does, it is necessary to consult the specific printer manual for the printer being used.

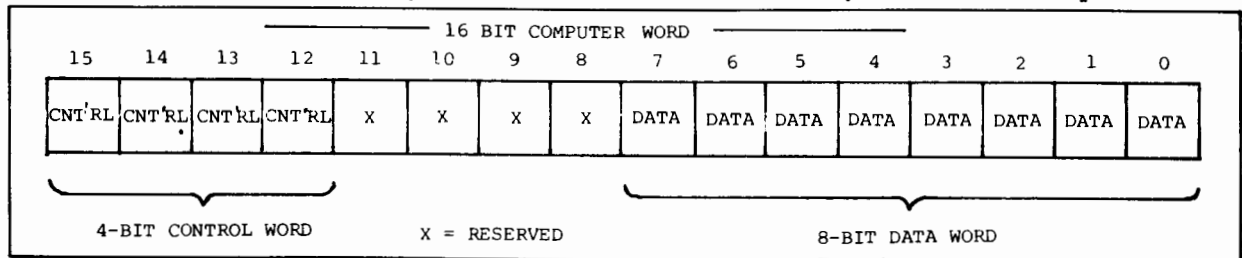


Figure 2-1 Data and Control Word Format

Installation and Programming

2-8 Computer Input Format

Printer status is continuously available at the input status buffers under normal conditions. Other information can be made available (depending on printer model) by sending the appropriate control and data words to the printer. Refer to your printer's Reference manual for details.

Printer status bits 0-7 are available in the 16 bit computer word in bits 8-15. DEMAND is available in bit 0 and is used to instruct the computer to send more information.

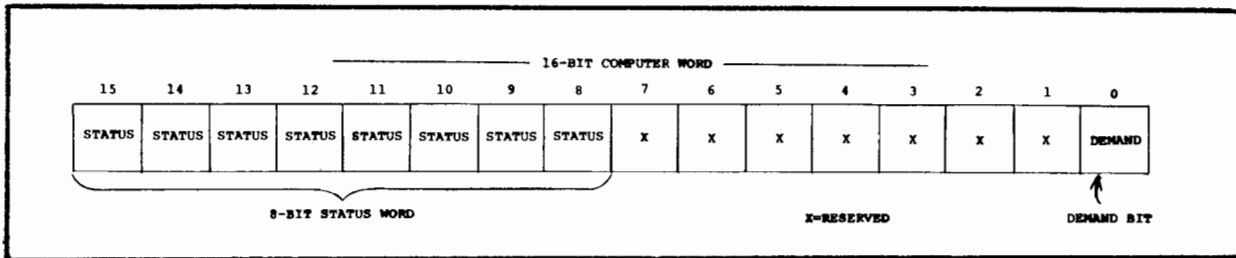


Figure 2-2 Status Word Format

2-9 Programming the Interface

Data and control words are transferred from the computer to the interface on the I/O output bus. Data is transferred on IOBO 0-7 and control words are transferred on IOBO 12-15. Normally a character to be printed would be transferred from the interface to the printer. However, by sending the appropriate control word, other information can be made available to the printer or information (such as printer status) can be transferred from the printer back to the interface.

2-10 STROBE AND DEMAND SIGNALS. The Strobe signal (leaving the interface card) occurs when the computer executes a Set Control instruction addressed to the printer interface. Strobe causes the printer to load the contents of the output data register into its buffer. Strobe occurs once for every data and control word transferred to the printer. The Demand signal (from the printer) triggers the interface flag logic. When the printer is busy, Demand is false. When the printer is ready to accept data, Demand is true. If the interface flag logic is enabled (cleared), the transition from busy to idle sets the flag logic, which signals the computer program that another word can be transferred. A transition from idle to busy terminates the Strobe signal (See figure 3-3).

2-11 INPUT/OUTPUT. The names of the input and output lines associated with the 26099A Printer Interface are as follows:

IOBO 0-7 - Data word from the computer to the interface
 IOBO 12-15 - Control word from the computer to the interface
 DBO 0-7 - Data word from the interface to the printer
 CBO 0-3 - Control word from the interface to the printer
 DBI 0-7 - Status word from the printer to the interface
 IOBI 0 - Demand data bit from the interface to the computer
 IOBI 8-15 - Status word from the interface to the computer
 STROBE - Strobe signal from the interface to the printer
 DEMAND - Demand signal from the printer to the interface

To fully understand the use of each of these sets of data and control lines, consult the operating and/or service manual for the printer in your system.

2-11 Direct Memory Access Operation

The HP 26099A Printer Interface is capable of operating under control of DMA (Direct Memory Access), a large amount of processing time. Programming the operation of DMA is described in the applicable DMA or computer manuals depending on the Hewlett-Packard model computer in use. Following are considerations required for operation of the printer interface under control of DMA:

- a. Set Control. The DMA channel must be programmed during initialization to issue an STC (Set Control) signal to the printer interface during each DMA output cycle. This initiates a Strobe signal to the printer.
- b. Set Flag Instruction. After DMA is initialized, it is turned on by an STC instruction addressed to the DMA channel. Just prior to this, an STF (Set Flag) instruction must be issued to the printer interface. This forces the interface to request service (SRQ signal) of DMA. For the remainder of the data block transfer, Service Request is issued automatically each time the printer becomes idle.

THEORY OF OPERATION

3-1 INTRODUCTION

This section provides a brief overall description of the 26099A Printer Interface and a detailed description of the operation of the printer interface functions.

3-2 GENERAL DESCRIPTION

Figure 3-1 is a block diagram showing the relationship of the printer interface to the computer and the printer. The interface circuitry provides an output register to transfer data and control words to the printer; control logic to signal the printer when data is available; flag logic to signal the computer when more data can be sent; and input buffers to provide printer information to the computer. In addition, the printer interface provides an autoprint feature which, for servicing purposes, allows the printer to be exercised independent of the computer. This feature is enabled by a switch on the printer interface PCA.

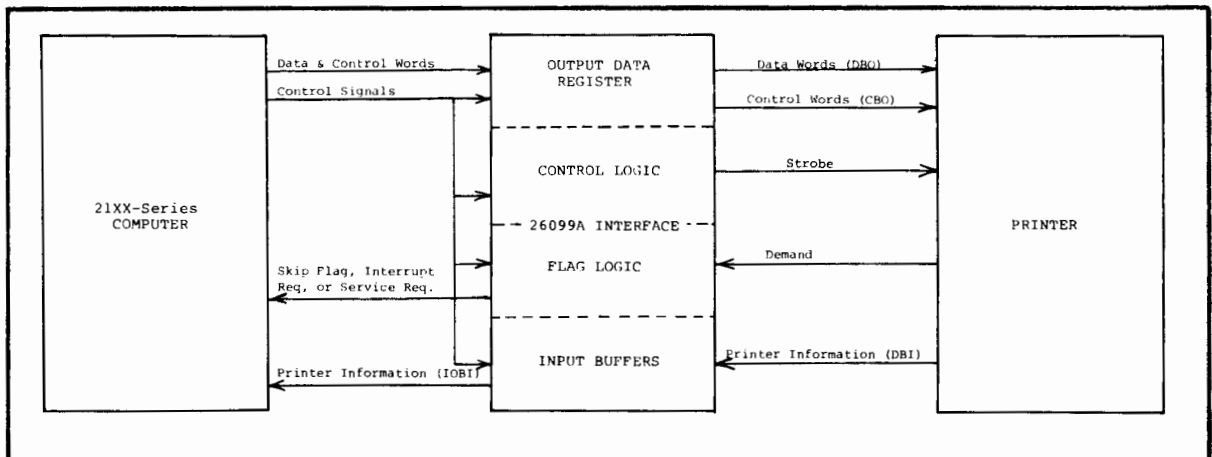


Figure 3-1 Simplified Block Diagram

Theory of Operation

Four-bit control words are transferred from the computer to the interface on the I/O output bus (IOBO 12-15). Eight-bit data words are also transferred from the computer to the interface on the I/O output bus (IOBO 0-7). Programmed instructions executed by the computer cause a control and data word to be put on the I/O output bus (IOBO), and provide control signals which allow the interface to load this word into the output register (DBO 0-7 and CB 0-3). Additional control signals from the computer set the interface control logic which in turn tells the printer that a word is available.

When the printer is ready for another word, it sets the interface flag logic initiating either a skip flag, interrupt request, or service request depending on the method of programming involved.

Depending on the printer, the control word will make other information available at the input status buffers and at the input of the printer. To determine what status information and functions are available, consult the specific printer operating and/or service manual.

3-3 DETAILED DESCRIPTION

For the purpose of this discussion, the printer interface is divided into the following functions:

- Power-on and Preset
- Select Code Detector
- Flag Logic
- Control Logic
- Interrupt Request
- Service Request
- Skip Flag Logic
- Output Register
- Input Buffer
- Auto Print

Figure 3-2 is a block diagram of the interface showing these functions and significant signals. The schematic diagram for this interface is shown in figure 4-1 in section 4 of this manual.

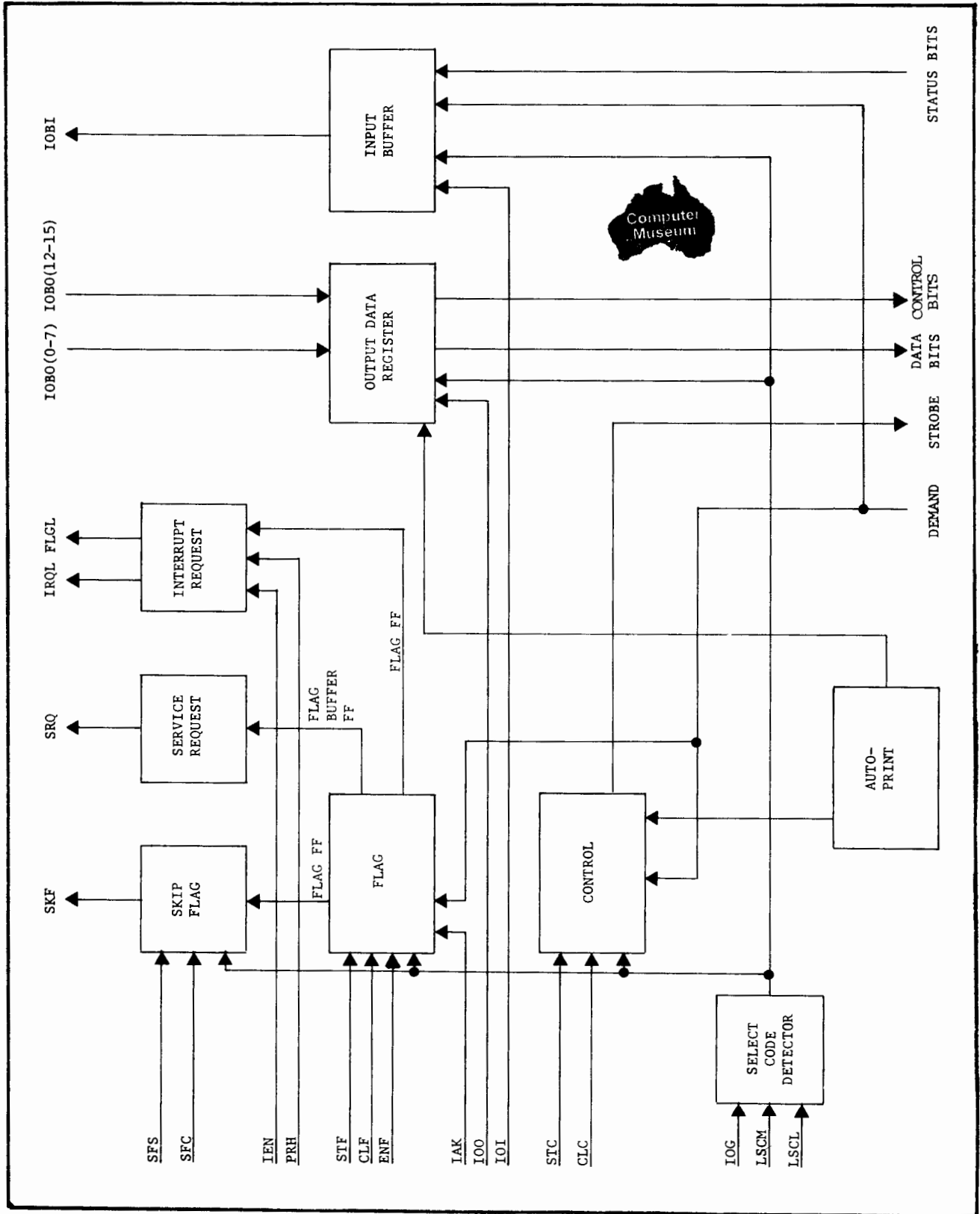


Figure 3-2 Functional Block Diagram

3-4 Power-On and Preset

The power-on and preset function establishes the initial operating conditions for the interface circuits. When the computer is turned on, signals CRS (Control Reset) and POPIO (Power On Preset I/O) are sent to the interface. CRS clears the Control and Information Ready flip-flops. POPIO clears the output data register and sets the Flag Buffer flip-flop. At computer time T2 (see appropriate computer manual), the Flag Buffer FF (flip-flop) output gates ENF (Enable Flag) to set the Flag FF. This is the initial operating state of the printer interface. CRS is also generated by the computer when EXT PRESET on the computer front panel is pressed and by executing a CLC (Clear Control) instruction addressed to select code 00.

3-5 Select Code Detector

The select code detector function allows the printer interface to be exclusively addressed by computer instructions specifically intended for the printer. The select code number (address) of the printer is dependent on the I/O slot in the computer into which the interface is installed. To determine this address, consult the computer programming manual for the computer in use.

When an I/O group instruction is executed by the computer, an IOG (Input/Output Group) signal is sent to all interface PCA's installed in the computer. If the instruction is addressed to the printer interface, LSCM (Lower Select Code Most Significant) and LSCL (Lower Select Code Least Significant) at the interface are also true. The select code detector logically "ands" these signals to provide an enabling signal to the skip flag, flag, control, output register, and input buffer functions. All three signals (IOG, LSCM, and LSCL) must be true for the interface to execute a programmed I/O instruction.

3-6 Flag Logic

The flag function provides the initial indication to the computer that the interface is ready to accept data. This function consists of the Flag Buffer FF, the Flag FF, the Flag one-shot, and

associated logic. The Flag Buffer FF is set by any one of three actions: during power-on or preset by the signal POPIO; by a programmed STF (Set Flag) instruction addressed to the printer interface by the signal STF; or by the output of the flag one-shot as described in the following paragraph.

When the printer buffer is ready to accept a data word, Demand from the printer is true. When this condition is met (ie. on transition from "busy" to "idle") the Flag one-shot is triggered generating a 90-nanosecond pulse which, gated with the clear side output of the Flag FF, sets the Flag Buffer FF. If data transfers are under control of DMA (Direct Memory Access), the output of the Flag Buffer FF is sent to the DMA circuits as an SRQ (Service Request) signal. At the next computer time T2, the Flag Buffer FF output gates signal ENF to set the Flag FF. The Flag FF output is used by the skip-flag function or interrupt function to inform the computer that a data transfer is in order.

Both the Flag Buffer FF and the Flag FF are cleared by a programmed CLF (Clear Flag) instruction addressed to the printer interface. When operating under control of DMA, the DMA circuits provide the CLF signal. The Flag Buffer FF is also cleared by an IAK (Interrupt Acknowledge) from the computer as described later in Section 3-8.

3-7 Control Logic

The control function provides signals to the printer to indicate that data is in the output register and ready for transfer. The control function consists of the Control FF, the Information Ready FF, the Strobe one-shot, and associated logic.

Both the Control and Information Ready flip-flops are set by a programmed STC (Set Control) instruction addressed to the printer interface. When the Control FF is set, the output provides one condition for enabling the interrupt function (described in Section 3-8). The Control FF remains set until a programmed CLC (Clear Control) instruction addressed to the printer interface is executed or a CRS signal is issued as described in a preceding paragraph in Section 3-4.

The output of the Information Ready FF, when set, provides a high input for the Strobe FF. At the end of the next computer cycle time T5, the trailing edge of SIR (Set Interrupt Request) clocks the Strobe FF to the set state. A jumper is provided on the PCA

tion addressed to the printer interface results in a true SKF if the Flag FF is clear. The SKF signal causes the computer to skip the instruction following the SFS or SFC instruction. This method of operation requires that the computer interrupt system be disabled by a CLF instruction addressed to select code 00.

3-11 Output Register

The output register function provides one-word storage for control and data words transferred to the printer. It consists of three 4-bit registers and twelve differential line drivers. Data inputs to the register are bits 0 through 7 and control word inputs are bits 12 through 15. At the output side of the interface, I/O output bits 0 through 7 become Data Bits 0 through 7 and I/O output bits 12 through 15 become Control bits 0 through 3.

An OTA (Output from A-Register) instruction, OTB (Output from B-Register) instruction, or a DMA output cycle addressed to the printer interface results in a true IOO (I/O Output) signal. The trailing edge of IOO, when gated by the select-code detector, clocks the I/O Output bus into the output register. The output of this register is immediately available, via the differential line drivers, on the Control and Data Bit Lines. The printer accepts this output when it receives a Strobe signal as described in Section 3-7. The output data register is cleared by a POPIO signal described earlier, or by the auto-print function when enabled (as described in Section 3-14).

3-12 Input Buffer

Under normal operating conditions, printer status information is continuously available at the input status buffers. Other information can be made available to the interface by outputting the appropriate control and data words to the printer. The functions of the control and data words are discussed in the appropriate manual for the specific printer in use.

An LIA (Load Into A-Register) instruction, LIB (Load Into B-Register) instruction, or a DMA input cycle addressed to the printer interface results in a true IOI signal (I/O Input) which, when gated by the select code detector, enables the printer

information onto the I/O Input bus.

3-13 Timing

Figure 3-3 shows the signal sequence between the interface and the printer during normal operation. The signals shown are not drawn to scale. It is important to realize that signals from the interface to the printer (ie. Control Bits 0-3 and Bits 0-7) are the result of the computer executing programmed I/O instructions and that exact timing is controlled by the computer and the computer program.

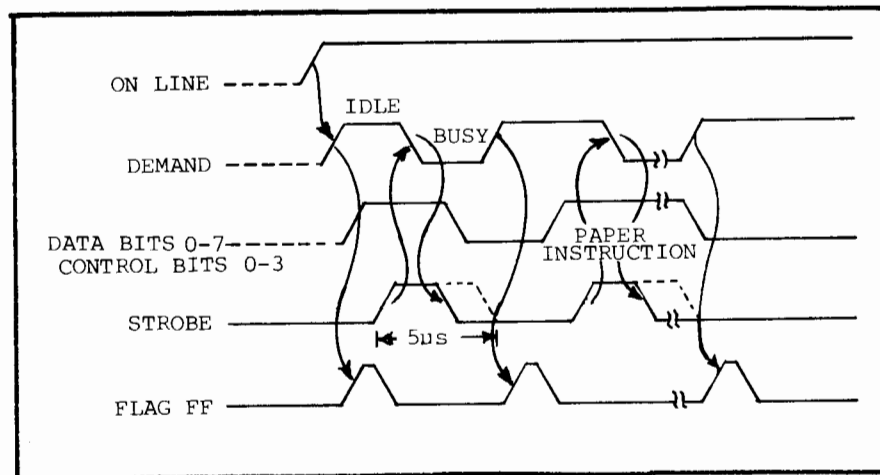


Figure 3-3 Timing Diagram

3-14 Auto-Print

Auto-print is a service function which allows the printer to be operated by the interface without intervention from the computer. This function consists of the Print Counters, Test one-shot, and associated logic. Auto-print is enabled by placing switch S1 on the interface PCA in the TEST position.

Theory of Operation

Initially, with switch S1 in the NORMAL position, the Print Counters are inhibited from issuing a Print Command. When switch S1 is moved to the TEST position, the Print Counters and Test one-shot are enabled, and the Output Data Registers are cleared to the low state. The test one-shot triggers and sets the Information Ready FF. A Strobe signal is generated on the trailing edge of signal SIR (Set Interrupt Request) at cycle T5. The printer returns a false Demand signal indicating that it is busy and loads the first ASCII character (octal 100) into its buffer. The negative transition of Demand increments the Print Counters. When Demand returns to its idle state, the Test one-shot is triggered again initiating another Strobe and data transfer, this time transferring an ASCII character with the code 101 octal. This handshake process continues with ASCII characters 100 to 177 octal being transferred and rolling over, until 256 such transfers are complete. At this time, the carry-out of the Print Counter disables the ASCII character and enables a Print Command. The line is printed and the ASCII data transfer begins again. The printer will continue to print in this mode until the Auto-Print function is disabled by placing S1 in the NORMAL position.

MAINTENANCE

4-1 INTRODUCTION

This section provides maintenance information for the HP 26099A Printer Interface Kit. Included is an interconnecting cable wire list, illustrated parts breakdown for the cable assembly, schematic and parts location diagrams for the interface PCA and replaceable parts lists.

4-2 PREVENTIVE MAINTENANCE

Detailed preventive maintenance procedures and schedules are given in the computer system documentation. There are no separate preventive maintenance schedules for the printer interface kit; however, it is good practice to remove dust and visually inspect the interface PCA and cable for damage whenever the interface PCA is removed from the computer.

4-3 TROUBLESHOOTING

Troubleshooting the interface kit is accomplished by performing the tests in the diagnostic program and analyzing the errors that occur as the test is being run. Continuity tests of the interface cable can be made using table 4-1. To isolate troubles to a replaceable component, refer to the parts location diagram, (figure 4-1), the schematic diagram (figure 4-2), and the replaceable parts list (table 4-2).

Maintenance

4-4 Diagnostics

Diagnostic programs for the printer interface are tailored to the particular model printer used with the interface. These diagnostics test printer functions as well as interface functions. For instructions on running the diagnostic tests, refer to the appropriate diagnostic operating procedure.

4-5 Auto-Print

The HP 26099A Printer Interface Kit provides an auto-print feature that is useful primarily to test the operation of the printer. To enable the auto-print function, put switch S1 (on the interface PCA) in the TEST position. When enabled, the auto-print function will cause the printer to print lines of ASCII characters 100 through 177 octal. The printer will continue printing until the auto-print switch (S1) is returned to the NORMAL position.

4-6 REPLACEABLE PARTS

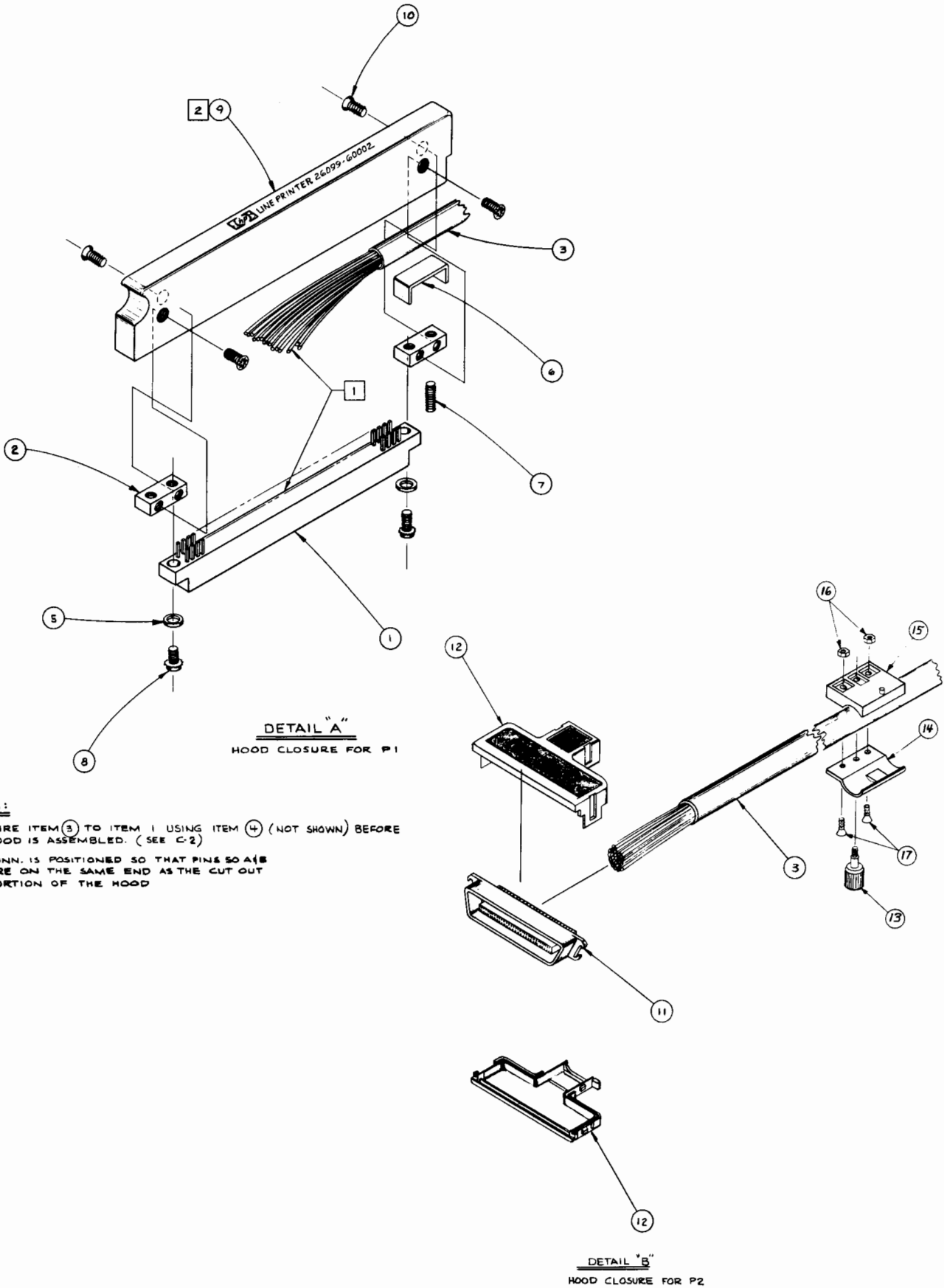
Table 4-2 lists the replaceable parts for the HP 26099A Interface Kit. Components located on the interface PCA are listed by reference designation.

When ordering replacement parts from Hewlett-Packard, address the order to the nearest HP Sales and Service Office (listed at the back of this manual) and specify the following information for each part ordered:

- a. Identification of instrument, kit, or assembly containing the part.
- b. Hewlett-Packard part number for each part.
- c. Description of each part.
- d. Circuit reference designation for each part (if applicable).

Table 4-1 26099-60002 INTERFACE CABLE SIGNAL INDEX

P1 (Computer End)	Wire Color Code	Signal Name	P2 (Printer End)
1A	wht/brn/vio	<u>CB03</u>	17
1B	wht	<u>CB03</u>	42
2A	wht/brn/blu	<u>CB02</u>	18
2B	wht	<u>CB02</u>	43
3A	wht/brn/grn	<u>CB01</u>	19
3B	wht	<u>CB01</u>	44
4A	wht/brn/yel	<u>CB00</u>	20
4B	wht	<u>CB00</u>	45
9A	wht/vio	<u>DB07</u>	8
9B	wht	<u>DB07</u>	33
10A	wht/blu	<u>DB06</u>	7
10B	wht	<u>DB06</u>	32
11A	wht/grn	<u>DB05</u>	6
11B	wht	<u>DB05</u>	31
12A	wht/yel	<u>DB04</u>	5
12B	wht	<u>DB04</u>	30
13A	wht/orn	<u>DB03</u>	4
13B	wht	<u>DB03</u>	29
14A	wht/red	<u>DB02</u>	3
14B	wht	<u>DB02</u>	28
15A	wht/brn	<u>DB01</u>	2
15B	wht	<u>DB01</u>	27
16A	wht/blk	<u>DB00</u>	1
16B	wht	<u>DB00</u>	26
24A	wht/brn/orn	<u>STROBE</u>	21
24B	wht	<u>STROBE</u>	46
26A	wht/blk/gry	<u>DBI7</u>	16
26B	wht	<u>DBI7</u>	41
27A	wht/blk/vio	<u>DBI6</u>	15
27B	wht	<u>DBI6</u>	40
28A	wht/blk/blu	<u>DBI5</u>	14
28B	wht	<u>DBI5</u>	39
29A	wht/blk/grn	<u>DBI4</u>	13
29B	wht	<u>DBI4</u>	38
30A	wht/blk/yel	<u>DBI3</u>	12
30B	wht	<u>DBI3</u>	37
31A	wht/blk/orn	<u>DBI2</u>	11
31B	wht	<u>DBI2</u>	36
32A	wht/blk/red	<u>DBI1</u>	10
32B	wht	<u>DBI1</u>	35
33A	wht/blk/brn	<u>DBI0</u>	9
33B	wht	<u>DBI0</u>	34
49A	wht/brn/red	<u>DEMAND</u>	22
49B	wht	<u>DEMAND</u>	47
50A	wht/gry	<u>GROUND</u>	25
50B	wht	<u>GROUND</u>	50



NOTES:

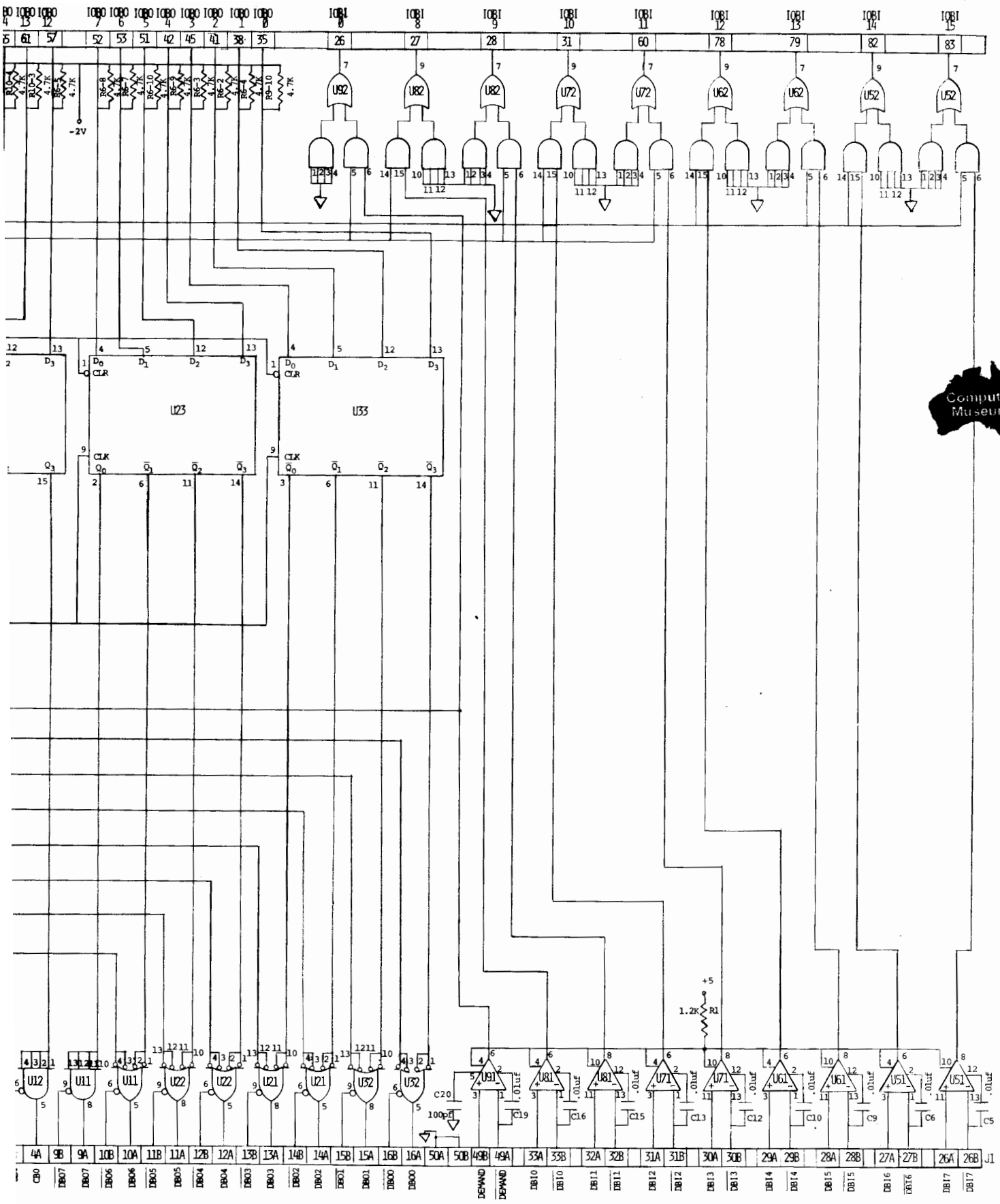
1. WIRE ITEM (3) TO ITEM 1 USING ITEM (4) (NOT SHOWN) BEFORE HOOD IS ASSEMBLED. (SEE C-2)
2. CONN. IS POSITIONED SO THAT PINS SO A (B) ARE ON THE SAME END AS THE CUT OUT PORTION OF THE HOOD

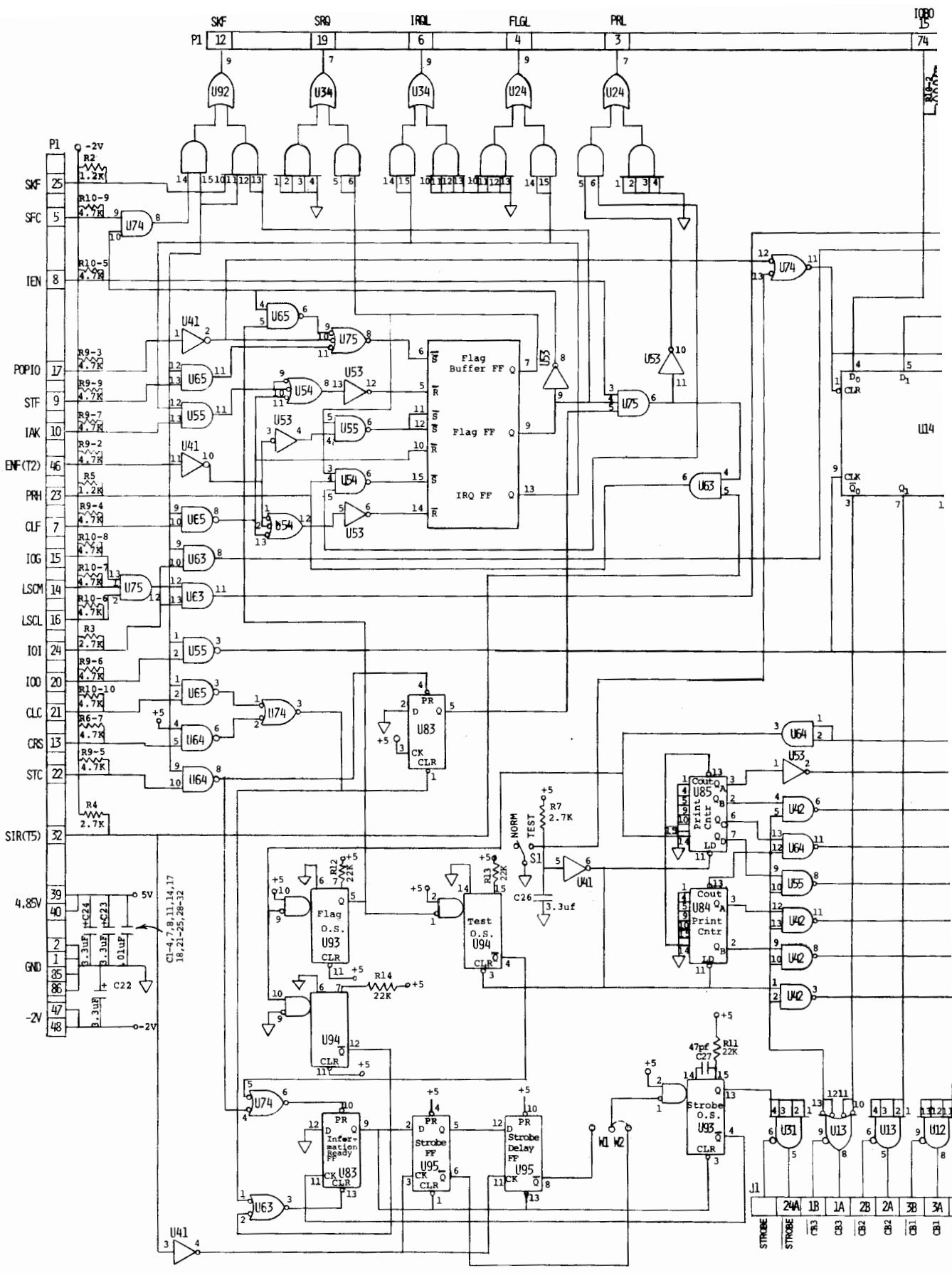
Figure 4-1 26099-60002 Parts Breakdown



26099-60002 INTERFACE CABLE

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
1	CONN:100 PIN	1251-2658
2	CONN MTG BLOCK	5020-7319
3	CABLE:24 PAIR 26 GA	8120-1859
4	TUBING:HEAT SHRINK	0890-0870
5	WASHER:FLAT #4	3050-0229
6	CLAMP:CABLE	5000-8038
7	SCR:SET 4-40X.5	3030-0144
8	SCR:EXT LOCK	2200-0111
9	HOOD:CONN	26099-00001
10	SCR:4-40X.375	2200-0144
11	CONN:50 PIN	1251-5656
12	CONN:HOOD, 2 PIECE	1251-4361
13	FASTENER:CAPTIVE	1390-0425
14	RFI CLAMP:UPPER	5021-1601
15	RFI CLAMP:LOWER	5021-1602
16	NUT:6-32	2420-0003
17	SCR:6-32X.250 FLT	2360-0181





MNEMONICS

Following is a list of the mnemonics used in this manual. They are listed in alphabetical order.

CBO	Control Bit (Output)
CLC	Clear Control (Computer Instruction)
CLF	Clear Flag (Computer Instruction)
CRS	Control Reset
DBI	Data Bit (Input)
DBO	Data Bit (Output)
ENF	Enable Flag
FLGL	Flag Low
IAK	Interrupt Acknowledge
IEN	Interrupt Enable
IOBI	I/O Bit (Input)
IOBO	I/O Bit (Output)
IOG	I/O Group
IOI	I/O Input
IOO	I/O Output
IRQ	Interrupt Request
IRQL	Interrupt Request Low
LIA	Load Into A-Register (Computer Instruction)
LIB	Load Into B-Register (Computer Instruction)
LSCB	Lower Select Code (Least Significant)
LSCM	Lower Select Code (Most Significant)
OTA	Output From A-Register (Computer Instruction)
OTB	Output From B-Register (Computer Instruction)
POPIO	Power-On, Preset I/O
PRH	Priority High
PRL	Priority Low
SFC	Skip if Flag Clear (Computer Instruction)
SFS	Skip if Flag Set (Computer Instruction)
SIR	Set Interrupt Request
SKF	Skip FLag
SRQ	Service Request
STC	Set Control (Computer Instruction)
STF	Set Flag (Computer Instruction)



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