Note

Title & Document Type: 10746A Binary Interface for 5501A
Manual Part Number: 10746-90006
Serial Prefixes: 1652A
Revision Date: Dec 1978

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies.

Changes to this Manual

No changes have been made to this manual. All pages are scanned at 300 DPI or greater.

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OPERATING AND SERVICE MANUAL

10746A

BINARY INTERFACE

(For 5501A Laser Transducer System and its Controller)

SERIES 1652A

This manual applies directly to Hewlett-Packard Model 10746A Binary Interface series number 1652A.

SERIES NUMBERS NOT LISTED

For series numbers after 1652A, a Manual Change sheet is included with this manual. Interface cards with series numbers before 1652A are covered in Section VII,

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Manual Part No. 10746-90004
Microfiche No. 10746-90005

Printed in U.S.A.

HEWLETT PACKARD

SAFETY

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section 1 for general safety considerations applicable to this product.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of 90 days from date of shipmcnt. During the warranty period, HP will, at its option, either repair or replace products which prove to be defective.

Warranty service of this product will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other cases, products must be returned to a service facility designated by HP.

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For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

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SECTION I
GENERAL INFORMATION

1-1. SCOPE OF THE MANUAL

1-2. This manual provides operating and service information for the 10746A Binary Interface (see Figure 1-1). The 10746A is an optional unit (printed circuit board) for a Hewlett-Packard Model 5501A Laser Transducer system. Refer to the 5501A operating and service manual for a description of the systems. The 10746A is designed to be installed in the 10740A Coupler.

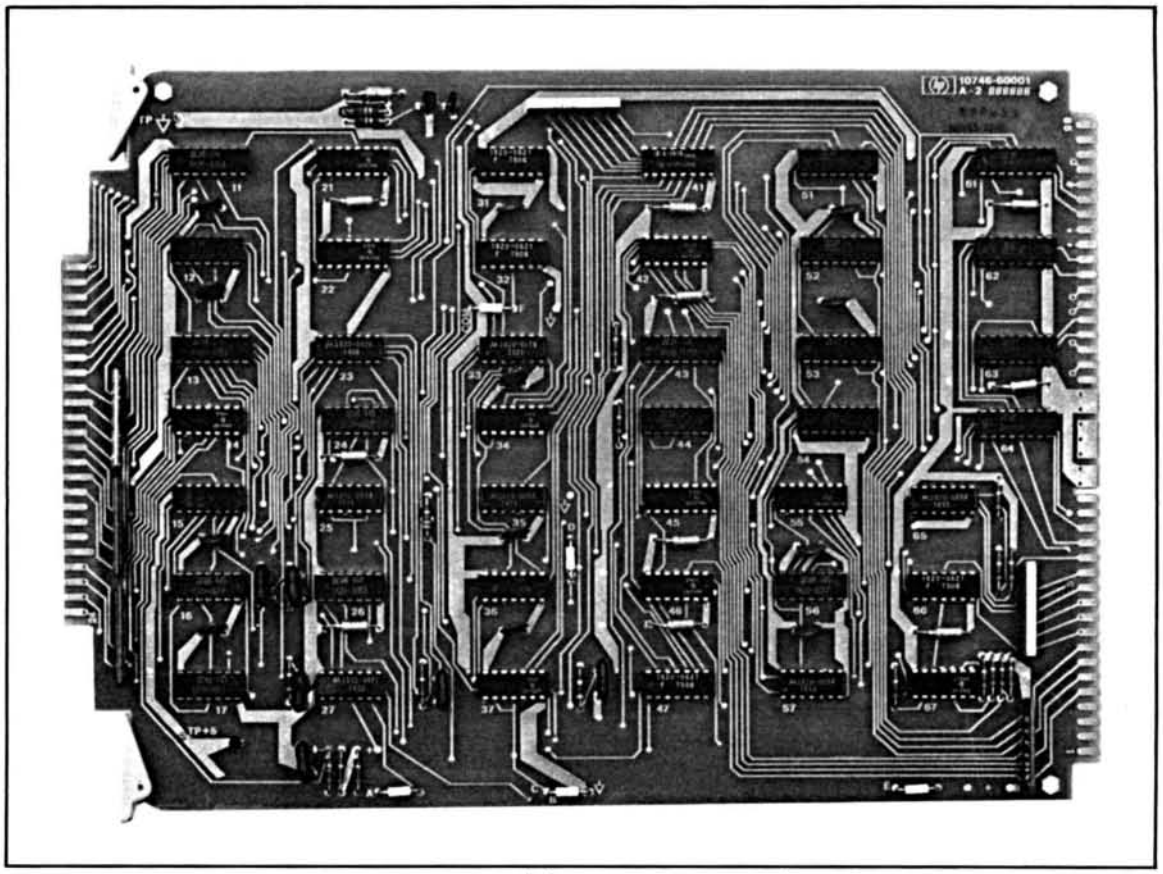


Figure 1-1. Model 10746A Binary Interface

1-3. MANUAL MICROFICHE

1-4. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4 x 6-inch microfilm transparencies of the manual. The microfiche package also includes the latest Manual Change supplement as well as all pertinent Service Notes.

1-5. PRINTED CIRCUIT BOARD IDENTIFICATION AND MANUAL CHANGES

1-6. Each model 10746A printed circuit board has a four-number series identification (e.g. 1504). The series number identifies a group of identical printed circuit boards. If the series number on your board is not the same as the series number on the title page of this manual, your board is different from this manual. A change sheet should be included that has the correct series number, and this change sheet describes the differences between series numbers. If the change sheet is missing, request one from the nearest Hewlett-Packard sales and service office. (See the HP offices listing at the back of this manual.)

1-7. DESCRIPTION OF 10746A

1-8. The 10746A Binary Interface allows transfer of commands from the system controller and two-way transfer of data to and from circuit cards such as the 10760A Counter, the 10755A Compensation Interface, or any other circuit card used with the 5501A Laser Transducer System.

1-9. The data format of the 10746A Binary Interface consists of a 32-bit binary word which can be accessed by a digital processor or controller as either two 16-bit words or four 8-bit bytes. All input commands for controlling the interface electronics are formatted as 8-bit bytes.

1-10. In addition to data and command transfer, certain system-oriented functions are available on the 10746A Binary Interface. System Reset initializes all circuit cards in the 10740A Coupler either on command or automatically when power is applied. An Error Reset is available to clear error bits which are generated by any of the circuit cards in the 10740A Coupler including the 10760A Counter and 10755A Compensation Interface. A System Sample function allows all 10760A Counters in the measurement system to be synchronously sampled. The function is very useful for applications where simultaneous, multiple-axis measurement information is desired.

Table 1-1. Equipment Supplied

Description	HP Part No.
Binary Interface Printed Circuit Board	10746-60001
Connector Kit, 48-Pin	5060-8339

1-11. The maximum data transfer rate of the 10746A Binary Interface is dependent on the measurement system configuration and the types of measurements being made. For position measurements using the 10760A Counter, the maximum data transfer rate is greater than 350 kHz for a single axis measurement configuration. For a three-axis measurement configuration using the 10760A Counter, the maximum data transfer would be 130 kHz for data from all three counters using the synchronous sample function.

Table 1-2. Available Accessories

Description	HP Part No.
Coupler	10740A
Extender Board (Service)	10743A

1-12. EQUIPMENT SUPPLIED AND AVAILABLE ACCESSORIES EQUIPMENT

1-13. Table 1-1 lists equipment supplied, and Table 1-2 lists available accessories.

1-14. SPECIFICATIONS

1-15. Table 1-3 lists the specifications for the standard 10746A.

1-16. SAFETY CONSIDERATIONS

1-17. The HP 10746A is a Safety Class I instrument. This instrument has been designed and tested in accordance with IEC Publication 348 Safety Requirements for Electronic Measuring Apparatus.

1-18. This manual contains information, cautions, and warnings which must be followed by the user to ensure safe operation and to retain the instrument in safe condition.

Table 1-3. 10746A Binary Interface Specifications

COMPATIBLITY: 10740A Coupler

INPUT POWER: +5 Volts @ 1.5 Amp

COMMAND TRANSFER MODE: 8-bit byte; TTL level, positive true.

DATA TRANSFER MODE:
32-bit word; formatted either four 8-bit bytes or two 16-bit words (user selectable). TTL level, positive true.

MAXIMUM DATA TRANSFER RATE:
350 kHz (32-bit word. Two 16-bit word output format in conjunction with 10760A Counter.)

FUNCTIONS:
System Reset; Error Reset; System Sample; Command Transfer; Two-Way Data Transfer.

WEIGHT: 0.45 Kg (1 lb.)

DIMENSIONS: 197 mm x 279 mm (7.75 inch x 11 inch)

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides instructions for unpacking, inspection, preparation for use, power requirements, operating environment, installation in 10740A Coupler, interconnecting cables, operational check and warranty claims, packaging for reshipment, storage, and field installation of options.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, inspect the 10746A for visible damage (scratches, cracks, etc.). If the 10746A is damaged, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Keep the shipping carton and packing material for the carrier's inspection. The HP Sales and Service Office will arrange for repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. Warranty Claims

2-6. Contact the nearest HP Sales and Service Office (see manual back cover) for information relative to warranty claims.

2-7. PACKAGING FOR RESHIPMENT

2-8. Original Packaging

2-9. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Sales/Service Offices listed at the rear of this manual.

2-10. If the 10746A is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, return address, model number and full serial number. Mark the container FRAGILE to assure careful handling.

2-11. In any correspondence refer to the instrument by model number and full serial number.

2-12. Other Packaging Methods

2-13. If it becomes necessary to reship an instrument, good commercial packing should be used. Contract packaging companies in many cities can provide dependable custom packaging on short notice. The following general instructions should be followed when repackaging with commercially available materials.

a. If shipping to a Hewlett-Packard Service Office or Center, attach a tag indicating the type of service required, return address, model number and full serial number.

b. Wrap the instrument in heavy paper or plastic.

c. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

d. Use enough shock-absorbing material (three to four inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

e. Seal the shipping container securely.

f. Mark the shipping container FRAGILE to assure careful handling.

2-14. STORAGE

2-15. If the 10746A is to be stored for an extended period of time, it should be enclosed in a clean, sealed container.

2-16. PREPARATION FOR USE

2-17. The following paragraphs provide information necessary to prepare the 10746A for use. Included are power requirements, operating environment, installation, interconnecting cables and warranty claims.

2-18. Power Requirements

2-19. The 10746A receives operating power from the 10740A Coupler. Power required by the 10746A is as follows:

Voltage	Current (Amperes)
+5	1.5

2-20. Operating and Non-Operating Environment

2-21. The 10746A can be used in the following environments:

OPERATION
Temperature: 32°F to 130°F (0°C to 55°C)
Relative Humidity: 0% to 95%

STORAGE
Temperature: -40°F to +167°F (-40°C to +75°C)
Relative Humidity: 0% to 95%

2-22. Installation

2-23. The 10746A is designed to be installed in the 10740A Coupler.

CAUTION

SWITCH OFF POWER TO THE 10740A COUPLER BEFORE INSTALLING OR REMOVING A CIRCUIT BOARD.

2-24. Refer to Figure 2-1 for installation of a circuit board in the 10740A Coupler.

2-25. Connectors

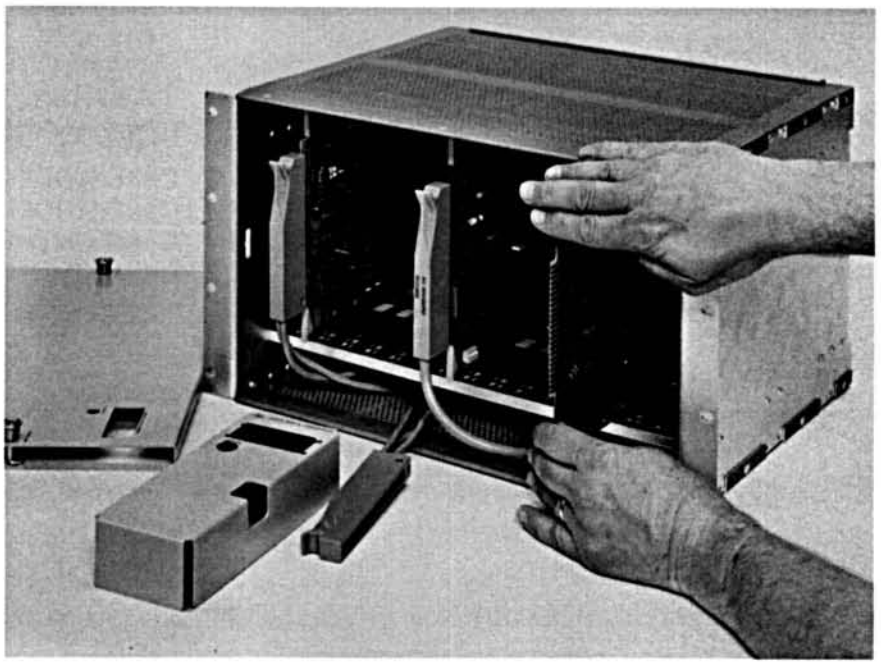
2-26. The dual 24-pin (48) connector edge of the 10746A board mates with the connector in an HP connector kit part number 02116-6178. The dual 43-pin (86) connector edge of the 10746A board mates with HP connector number 1251-3755.

2-27. 10740A COUPLER BUS

2-28. All of the printed circuit board units that plug in the 10740A Coupler interface in parallel at the 10740A backplane with the 10740A Coupler Bus. The Coupler bus consists of 86 lines. Table 2-1 lists the pin numbers and names of the Coupler Bus.

Table 2-1. 10740A Coupler Bus Lines

FUNCTION	PINS	NAMES	PINS	NAMES
POWER	1	+15 VOLTS	2	+15 VOLTS
	3	-15 VOLTS	4	-15 VOLTS
	5	±15 RETURN	6	±15 RETURN
INSTRUCTIONS	7	SPARE	8	SPARE
	9	CARD ADDRESS-A	10	CARD ADDRESS-B
	11	CARD ADDRESS-C	12	CARD ADDRESS-D
	13	CARD CMD-A	14	CARD CMD-B
	15	CARD CMD-C	16	CARD CMD-D
STATUS	17	$\overline{\text{DATA VALID}}$	18	$\overline{\text{DATA VALID}}$
	19	$\overline{\text{INSTRUCTION VALID}}$	20	$\overline{\text{INSTRUCTION VALID}}$
	21	$\overline{\text{OPERATION COMPLETE}}$	22	$\overline{\text{OPERATION COMPLETE}}$
	23	$\overline{\text{SAMPLE}}$	24	$\overline{\text{PWR-UP/SYSTEM RESET}}$
ERRORS	25	$\overline{\text{REF ERROR-BIT}}$	26	$\overline{\text{MEAS ERROR-BIT}}$
	27	$\overline{\text{V.O.L. ERROR-BIT}}$	28	$\overline{\text{OVFL-BIT}}$
DECIMAL POINT	29	D.P.-BIT-1	30	D.P.-BIT-0
	31	D.P.-BIT-3	32	D.P.-BIT-2
MODE-STATUS	33	λ-MODE BIT	34	SYSTEM NULLED
	35	SPARE	36	SPARE
	Key →		Key →	
POWER	37	+5V RETURN	38	+5V RETURN
	39	+5V RETURN	40	+5V RETURN
	41	+5 VOLTS	42	+5 VOLTS
	43	+5 VOLTS	44	+5 VOLTS
	45	+5 VOLTS	46	+5 VOLTS
	47	+5V RETURN	48	+5V RETURN
	49	+5V RETURN	50	+5V RETURN
	51	SPARE	52	SPARE
DATA	53	DATA BIT 1	54	DATA BIT 0
	55	DATA BIT 3	56	DATA BIT 2
	57	DATA BIT 5	58	DATA BIT 4
	59	DATA BIT 7	60	DATA BIT 6
	61	DATA BIT 9	62	DATA BIT 8
	63	DATA BIT 11	64	DATA BIT 10
	65	DATA BIT 13	66	DATA BIT 12
	67	DATA BIT 15	68	DATA BIT 14
	69	DATA BIT 17	70	DATA BIT 16
	71	DATA BIT 19	72	DATA BIT 18
	73	DATA BIT 21	74	DATA BIT 20
	75	DATA BIT 23	76	DATA BIT 22
	77	DATA BIT 25	78	DATA BIT 24
	79	DATA BIT 27	80	DATA BIT 26
	81, 83, 85	MAKE NO CONNECTION	82, 84, 86	MAKE NO CONNECTION



NOTE

When installed, the extractor tabs on the 10746A remain outside of the 10740A slide guides. Facing Coupler, IC's are on right hand side of board.

Figure 2-1. Installation of Circuit Board in 10740A Coupler

2-29. 10746A BINARY INTERFACE-TO-10740A COUPLER BUS ADDRESSES AND COMMANDS (INSTRUCTIONS)

2-30. The 10746A Binary Interface will respond to coded addresses and commands from the controller through the 10740A Coupler Bus. Table 2-2 lists the specific instructions and responses for the 10746A. (Note: the 10746A address is "P".)

2-31. JUMPER WIRES

2-32. There are six alphabetically identified pairs of holes in the 10746A circuit board for six jumper wires that may be installed on the board. Each jumper allows one of two mode or function choices to be selected for operation of the 10746A. The jumper-selectable choices are described in the following paragraphs.

2-33. Changing Jumper Wires

2-34. If it is desirable or necessary to change the position of a jumper wire, use the following lettered instruction steps:

CAUTION

Use a small soldering iron (35 watts or less) to heat the jumper wire connections. Larger wattage soldering irons may damage the printed-circuit board. The jumper wires in the printed-circuit board have metal plated-through walls to ensure good electrical contact. Apply heat sparingly and work carefully to avoid damaging the metal plated conductors and the insulating board.

a. Heat the jumper wire connections with a soldering iron and remove the solder with a solder removing tool.

b. Remove the loose jumper wire with pliers. It may be necessary to heat the connections with the soldering iron while pulling the wire with pliers.

c. Clean the excess solder from the wire ends with the soldering iron.

d. Put the jumper wire ends into the selected holes, and solder the connections carefully.

e. Clean the connection area on the board with a good commercial electronic solder flux solvent.

Table 2-2. 10746A Binary Interface Instructions and Responses

INSTRUCTION		RESPONSE	BINARY INSTRUCTION BYTE	APPROXIMATE EXECUTION TIME IN MICROSECONDS
COMMAND	ADDRESS			
Ø	P	Generate system, reset and clear error bit buffer	XXXX0000	.5
Ø	$\overline{P}$	Clear error bit buffer	XXXX0000	
1	P	Generate sample command to coupler bus	00000001	.5
2	P	Output data to coupler data bus from 10746A buffer	00000010	.8
2	$\overline{P}$	Load data from coupler data bus into 10746A buffer	XXXX0010	
3	$\overline{P}$	Load "P" -axis comparator with destination info via coupler bus data lines	XXXX0011	
3	P	Input data and/or error bits to calculator from 10746A buffer	00000011	.5
4	P	10746A in data receive mode to load data from controller into 10746A buffer	00000100	.5
All other instructions		Do nothing and handshake	XXXXXXXX	
NON-ADDRESSED INSTRUCTIONS				
INSTRUCTION		**RESPONSE**		
System Reset		Same as ØP	XXXXXXXX	
Synchronous Sample		Do nothing	XXXXXXXX	

X = DON'T CARE

2-35. Jumper C 8-Bit or 16-Bit Selection

2-36. The 8-bit mode of 10746A operation is selected with jumper "C" installed. The 16-bit mode is selected by removing one end of the jumper from the pad marked 8, and placing it in the pad marked 16. (Normally the 10746A is shipped set for the 8-bit mode.)

2-37. Jumper F (COM or ⏚)

2-38. If jumper F is in the COM (command) position all controller functions of the 10746A are useable. (Normally the 10746A is shipped set with jumper F set to COM.)

2-39. If jumper F is in the ⏚ position the 10746A can not drive the 10740A coupler bus instruction lines or the INSV line. The 10746A is only an input-output device. For example the 10746A could pass data from a tape reader to the 10740A coupler bus while a calculator was controlling the system through a 10745A HP-IB card.

2-40. Jumper A (COMMAND + Line or - True)

2-41. Jumper A allows the controller command line to be selected as + or - logic true. The + and - on the board by the A jumper indicate the COMMAND line logic truth selection. (Normally the 10746A is shipped set to negative (-) true.)

2-42. Jumper E (RESET Line + or - True)

2-43. Jumper E allows the controller RESET line to the 10746A selected as positive or negative logic true. If the E jumper is installed the controller RESET line is assumed to (must) be negative true. If the E jumper is not installed the controller RESET line is positive true. (Normally the 10746A is shipped with jumper E set negative (-) true.)

2-44. Jumper B (FLAG Line + or - True)

2-45. Jumper B allows the 10746A-to-controller FLAG line to be selected as positive or negative logic true. If the jumper is installed the line is positive true. If the jumper is removed the line is negative true. (Normally the 10746A is shipped with jumper B set negative (-) true.)

2-46. Jumper D (Controller Interface Selection)

2-47. Jumper D has two marked positions: one is I/O and the second is ⏚. When the jumper is in the I/O position, separate input and separate output line groups are activated for interface with the system controller. When jumper D is in the ⏚ position the previously used input lines are disabled and one set of bidirectional lines for input and output are used. The ⏚ mode bidirectional lines are the output only lines in the I/O mode. (Normally the 10746A is shipped with this jumper set at I/O.)

2-48. Data Format

2-49. Refer to Section IV for the 10746A data format.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains operation information for the 10746A Binary Interface card.

3-3. OPERATION

3-4. The 10746A does not have any operating controls. It is only used to interface a controller or other binary device with the 5501A Laser Trasnducer System. Operation of the system is described in the 5501A instruction manuals.

3-5. There are several jumper wires on the 10746A card that can be moved to change the 10746A operating characteristics. Refer to Section II for details of these jumper wires.

3-6. Light Emitting Diode Indicator

3-7. One light emitting diode indicator is on the 10746A. When illuminated, this LED indicates the 10746A is in the DATA mode.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section contains the theory of operation of the 10746A Binary Interface.

4-3. BLOCK DIAGRAM DESCRIPTION (Refer to Figure 8-2.)

4-4. The 10746A is a binary interface to link the 5501A Laser Transducer system to a digital computer or programmable calculator. The 10746A provides a channel to allow a computer or calculator to be the controller of a 5501A Laser Transducer system. Normally the 10746A will be installed in a 10740A Coupler, and data transfer between the 10746A interface and the 5501A system will be through the 10740A. Data transfer between the 10746A and the system controller normally will be through the 10746A front edge connector.

4-5. 10746A Operation Modes

4-6. Two modes of operation are possible with the 10746A: (a) Data Transfer and (b) Command. The operation modes are controlled by instructions on the 10740A coupler bus instruction lines. (The instructions may come through the 10746A.)

4-7. The data transfer mode has two sub-modes sending data to the controller or receiving data from the controller.

4-8. In the command mode the 10746A receives instructions from the controller and applies the instructions to the 10740A coupler bus.

4-9. Data Lines: 10746A ⟷ Controller

4-10. Two sets of 10746A-to-controller data communication lines are provided. Both sets of lines may be used in either 8- or 16-bit modes. One set of 16 lines is unidirectional: output from controller only (input to 10746A). The second set of lines is bidirectional; or if the first set of unidirectional lines is used, the bidirectional lines are used in only one direction: to output to the controller.

4-11. DATA WORD FORMAT AND LENGTH (8 BITS OR 16 BITS). Since the 10746A may be used with many types of controllers, either 8-bit or 16-bit data words may be used with the 10746A. Selection of 8-bit or 16-bit data words is with soldered wire jumpers as described in Section II. The data word format is shown in Figures 4-1 through 4-3.

4-12. Management Lines: 10746A ⟷ Controller (RESET, FLAG and COMMAND)

4-13. Three management lines between the 10746A and the controller are provided. These lines determine the operation of the 10746A with the controller. All three of these lines are optionally negative or positive true logic polarity. Refer to Section II for logic polarity selection.

4-14. COMMAND Line. In the 10746A Data Receive mode when the COMMAND line is set true by the controller, the 10746A assumes incoming data from the controller is valid.

4-15. COMMAND Line. In the 10746A Data Send mode when the COMMAND line is set true by the controller, the 10746A assumes the controller is ready for new data. When it is set false the controller is indicating data has been accepted.

4-16. RESET (PRESET or CLEAR) Line. When the RESET line is set true, the INSV line is set false on the 10740A Coupler Bus and the command mode is selected.

4-17. FLAG Line. When this line is true it signals the controller that the 10746A has responded to a command.

4-18. FLAG LINE. In Data Receive and Command modes when the FLAG line is set true, the 10746A is telling the controller that the data from the controller is latched into storage registers by the 10746A. The FLAG line follows the COMMAND line.

4-19. FLAG LINE. In Data Send mode when the FLAG line is set true, the 10746A is telling the controller that valid data is sent to the controller by the 10746A.

4-21. Figure 4-4 is a flow chart of operation of the 10746A and its controller.

4-22. Power On Reset

4-23. When power is applied to the 10746A a system reset signal is generated and applied to the 10740A Coupler Bus. A system reset signal can also be received by the 10746A.

4-24. Command and Flag Line Timing Relation

4-25. Figures 4-5 and 4-6 show the timing relationship of the COMMAND and FLAG lines.

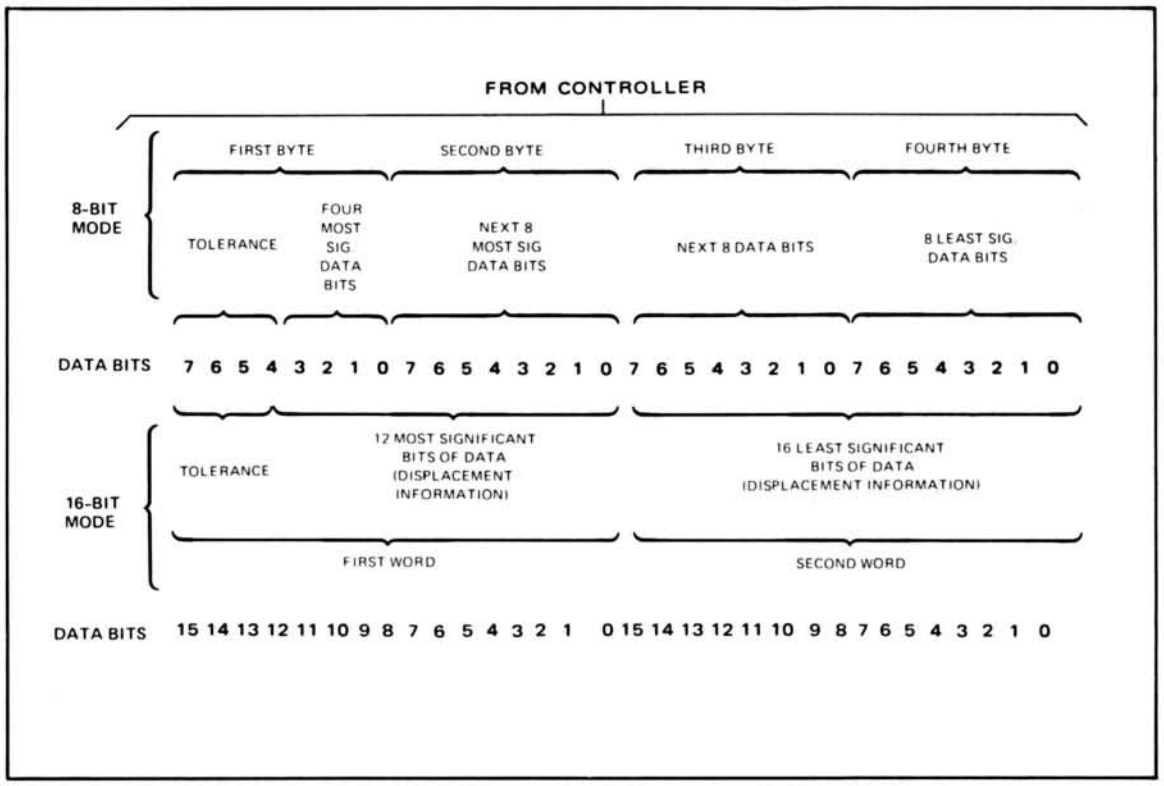


Figure 4-1. 10746A Data Word Format from Controller

	FIRST WORD															
	BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	PLACE VALUE					2^{27}	2^{26}	2^{25}	2^{24}	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
ERRORS	VOL	1	1	1	1	0	1	1	1	X	X	X	X	X	X	X	X
	OVERFLOW	1	1	1	1	1	0	1	1	X	X	X	X	X	X	X	X
	REFERENCE	1	1	1	1	1	1	0	1	X	X	X	X	X	X	X	X
	MEASUREMENT	1	1	1	1	1	1	1	0	X	X	X	X	X	X	X	X
DECIMAL POINT (MULTIPLICATION FACTOR)	1	0	0	1	0	X	X	X	X	X	X	X	X	X	X	X	X
	.1	0	0	1	1	X	X	X	X	X	X	X	X	X	X	X	X
	.0001	0	1	1	0	X	X	X	X	X	X	X	X	X	X	X	X
	.00001	0	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X
	.000001	1	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X
	SECOND WORD																
	BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	PLACE VALUE	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
	DATA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 4-2. Data Word Format to Controller (Two 16-Bit Words)

	FIRST WORD									SECOND WORD								
	BIT	7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0
	PLACE VALUE					2^{27}	2^{26}	2^{25}	2^{24}		2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
ERRORS	VOL	1	1	1	1	0	1	1	1	DATA	X	X	X	X	X	X	X	X
	OVERFLOW	1	1	1	1	1	0	1	1									
	REFERENCE	1	1	1	1	1	1	0	1									
	MEASUREMENT	1	1	1	1	1	1	1	0									
DECIMAL POINT (MULTIPLICATION FACTOR)	1	0	0	1	0	X	X	X	X									
	.1	0	0	1	1	X	X	X	X									
	.0001	0	1	1	0	X	X	X	X									
	.00001	0	1	1	1	X	X	X	X									
	.000001	1	0	0	0	X	X	X	X									
	THIRD WORD									FOURTH WORD								
	BIT	7	6	5	4	3	2	1	0		7	6	5	4	3	2	1	0
	PLACE VALUE	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}		2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
	DATA	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X

Figure 4-3. Data Word Format to Controller (Four 8-Bit Words)

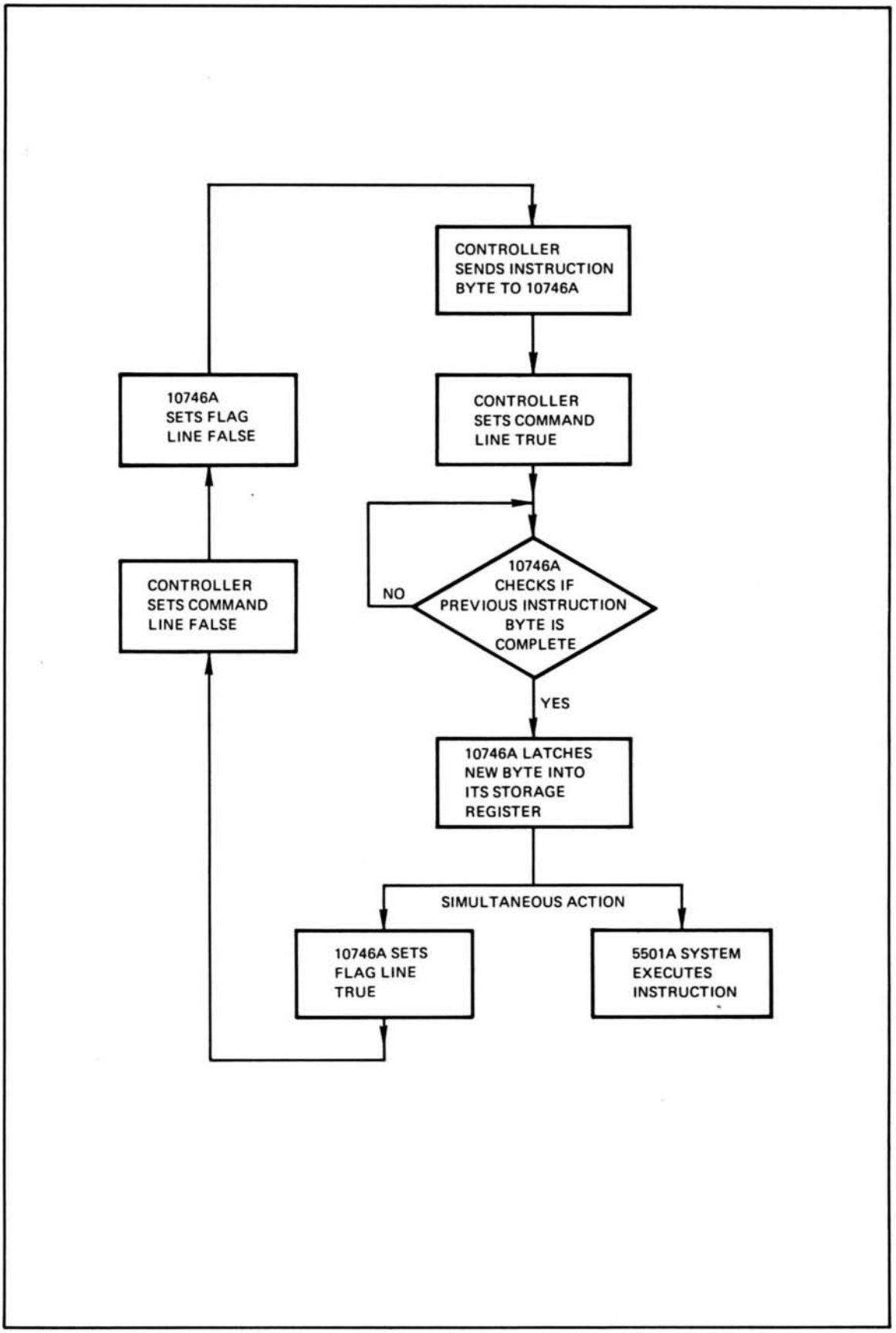


Figure 4-4. 10746A Controller Operation Flow Chart

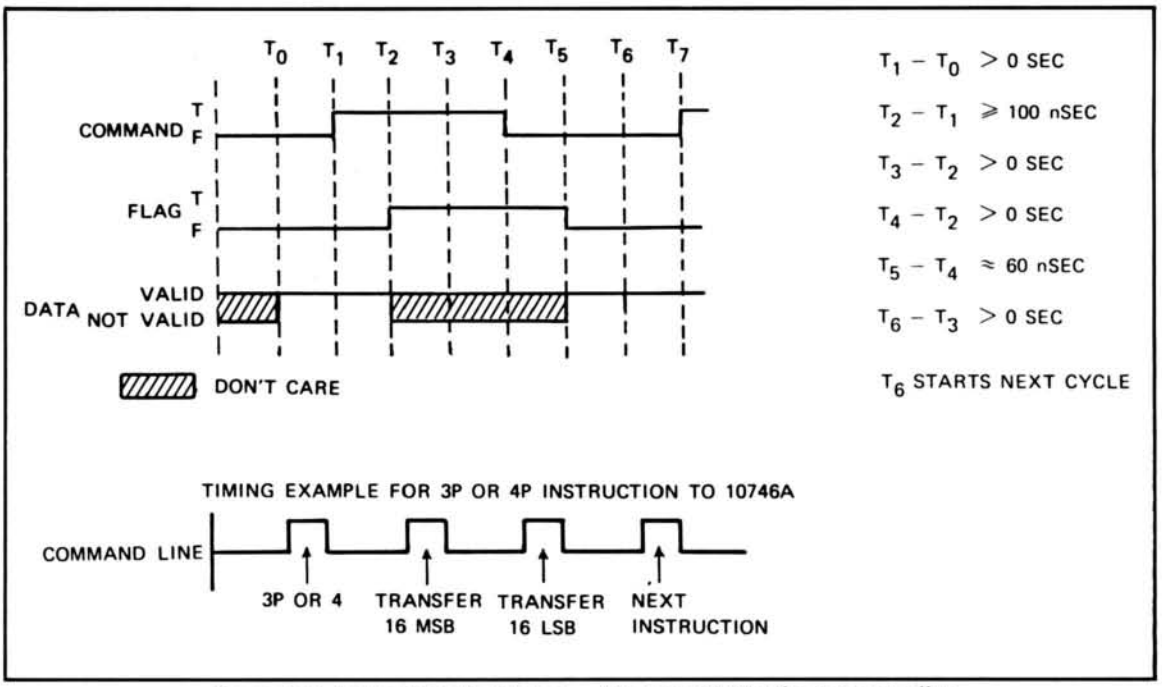


Figure 4-5. Instruction Sequence — Data to 10746A from Controller

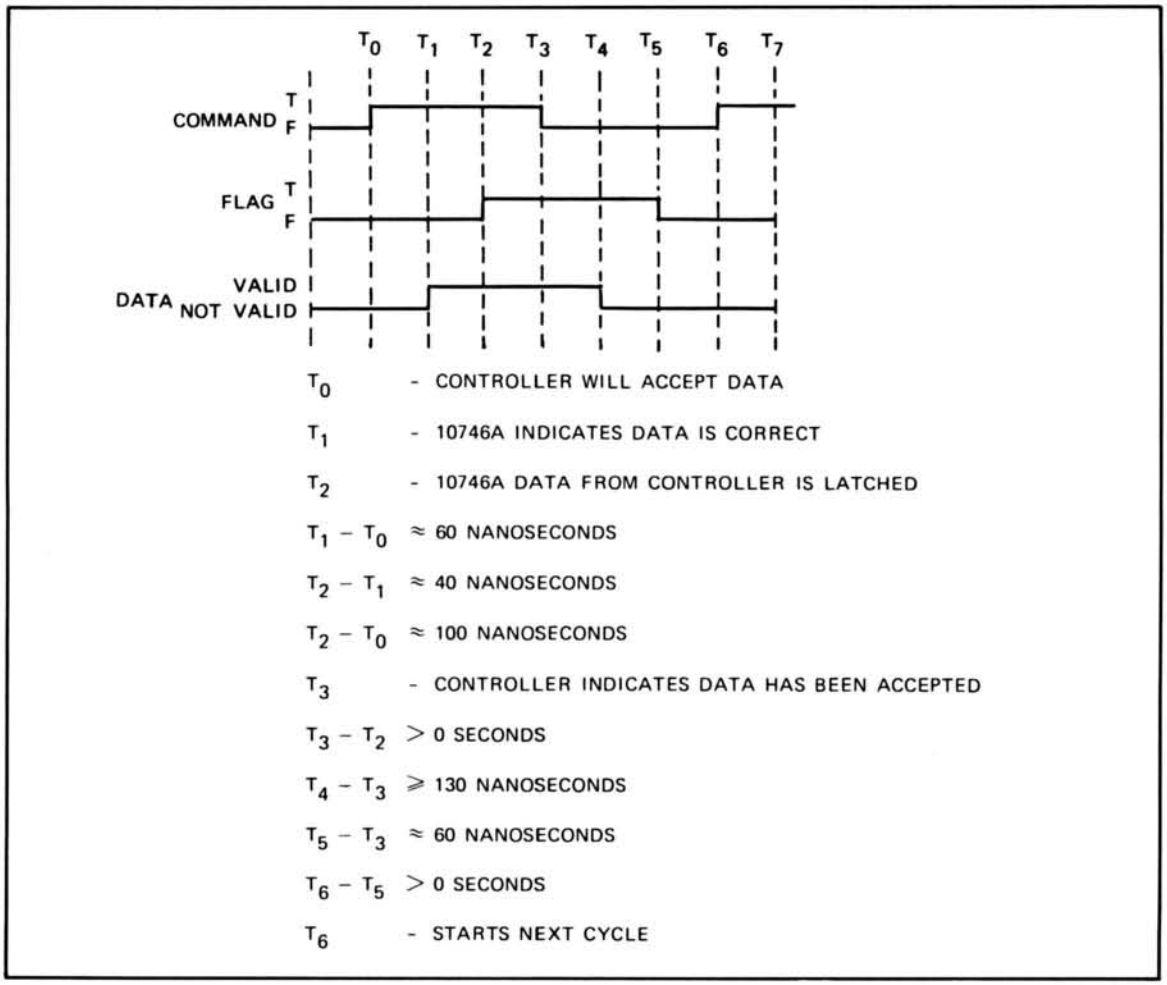


Figure 4-6. Instruction Sequence — Data to Controller from 10746A

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains maintenance and service information references for the 10746A.

5-3. MAINTENANCE AND TROUBLESHOOTING

5-4. The 10746A does not operate separately from a model 5501A Laser Transducer system and a 10740A Coupler. Procedures to isolate system troubles to this assembly are contained in the 5501A System Manual. Schematics, component location, and parts list are contained in this manual to aid in troubleshooting.

5-5. PREVENTIVE MAINTENANCE

5-6. The preventive maintenance procedures given in the following paragraphs are provided to help prolong the useful life of the model.

5-7. Visual Inspection

5-8. Inspect the unit for indications of mechanical and electrical defects. Look for signs of overheating, corrosion, accumulations of dust, oil, loose electrical connections, or broken parts.

5-9. Repair and Cleaning

5-10. Repair any obvious defects; and if necessary clean the unit with a brush, compressed clean dry air jet, or a vacuum cleaner, or a suitable liquid solvent.

5-11. EXTENDER BOARD 10743A

5-12. A 10746A can be operated out front of the 10740A Coupler using a printed-circuit extender board available from HP. Model 10743A is the extender designation. While plugged in the 10740A Coupler, the 10743A feeds all the 10740A back-plane bus lines out to the front of the cabinet, and a 10746A can be plugged into the 10743A.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alphanumerical order of their reference designators and indicates the description and HP Part Number of each part, together with any applicable notes. The table includes the following information.

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-2.

c. Manufacturer's part number.

d. Total quantity used in the instrument.

6-3. ORDERING INFORMATION

6-4. To obtain replacement parts, address order of inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers, and reference designation (including instrument model number).

6-5. To obtain a part that is not listed, include:

a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

REFERENCE DESIGNATIONS

A = assembly
AT = attenuator; isolator; termination
B = fan; motor
BT = battery
C = capacitor
CP = coupler
CR = diode; diode thyristor; varactor
DC = directional coupler
DL = delay line
DS = annunciator; signaling device (audible or visual); lamp; LED
E = miscellaneous electrical part
F = fuse
FL = filter
H = hardware
HY = circulator
J = electrical connector (stationary portion); jack
K = relay
L = coil; inductor
M = metre
MP = miscellaneous mechanical part
P = electrical connector (movable portion); plug
Q = transistor; SCR; triode thyristor
R = resistor
RT = thermistor
S = switch
T = transformer
TB = terminal board
TC = thermocouple
TP = test point
U = integrated circuit; microcircuit
V = electron tube
VR = voltage regulator; breakdown diode
W = cable; transmission path; wire
X = socket
Y = crystal unit-piezo-electric
Z = tuned cavity; tuned circuit

ABBREVIATIONS

A = ampere
ac = alternating current
ACCESS = accessory
ADJ = adjustment
A/D = analog-to-digital
AF = audio frequency
AFC = automatic frequency control
AGC = automatic gain control
AL = aluminum
ALC = automatic level control
AM = amplitude modulation
AMPL = amplifier
APC = automatic phase control
ASSY = assembly
AUX = auxiliary
AVG = average
AWG = american wire gauge
BAL = balance
BCD = binary coded decimal
BD = board
BE CU = beryllium copper
BFO = beat frequency oscillator
BH = binder head
BKDN = breakdown
BP = bandpass
BPF = bandpass filter
BRS = brass
BWO = backward-wave oscillator
CAL = calibrate
ccw = counterclockwise
CER = ceramic
CHAN = channel
cm = centimeter
CMO = coaxial
COEF = coefficient
COM = common
COMP = composition
COMPL = complete
CONN = connector
CP = cadmium plate
CRT = cathode-ray tube
CTL = complementary transistor logic
CW = continuous wave
cw = clockwise
D/A = digital-to-analog
dB = decibel
dBm = decibel referred to 1 mW
dc = direct current
deg = degree (temperature interval or difference)
... ° = degree (plane angle)
°C = degree Celsius (centrigrade)
°F = degree Fahrenheit
°K = degree Kelvin
DEPC = deposited carbon
DET = detector
diam = diameter
DIA = diameter (used in parts list)
DIFF AMPL = differential amplifier
div = division
DPDT = double-pole, double-throw
DR = drive
DSB = double sideband
DTL = diode transistor logic
DVM = digital voltmeter
ECL = emitter coupled logic
EMF = electromotive force
EDP = electronic data processing
ELECT = electrolytic
ENCAP = encapsulated
EXT = external
F = farad
FET = field-effect transistor
F/F = flip-flop
FH = flat head
FOL H = fillister head
FM = frequency modulation
FP = front panel
FREQ = frequency
FXD = fixed
g = gram
GE = germanium
GHz = gigahertz
GL = glass
GND = ground(ed)
H = henry
h = hour
HET = heterodyne
HEX = hexagonal
HD = head
HDW = hardware
HF = high frequency
HG = mercury
HI = high
HP = Hewlett-Packard
HPF = high pass filter
HR = hour (used in parts list)
HV = high voltage
Hz = hertz
IC = integrated circuit
ID = inside diameter
IF = intermediate frequency
IMPG = impregnated
in = inch
INCD = incandescent
INCL = include(s)
INP = input
INS = insulation
INT = internal
kg = kilogram
kHz = kilohertz
kΩ = kilohm
kV = kilovolt
lb = pound
LC = inductance-capacitance
LED = light-emitting diode
LF = low frequency
LG = long
LH = left hand
LIM = limit
LIN = linear taper (used in parts list)
lin = linear
LK WASH = lockwasher
LO = low; local oscillator
LOG = logarithmic taper (used in parts list)
log = logarithm(ic)
LPF = low pass filter
LV = low voltage
m = metre (distance)
mA = milliampere
MAX = maximum
MΩ = megohm
MEG = meg (10^6) (used in parts list)
MET FLM = metal film
MET OX = metal oxide
MF = medium frequency; microfarad (used in parts list)
MFR = manufacturer
mg = milligram
MHz = megahertz
mH = millihenry
mho = conductance
MIN = minimum
min = minute (time)
... ' = minute (plane angle)
MINAT = miniature
mm = millimetre
MOD = modulator
MOM = momentary
MOS = metal-oxide semiconductor
ms = millisecond
MTG = mounting
MTR = meter (indicating device)
mV = millivolt
mVac = millivolt, ac
mVdc = millivolt, dc
mVpk = millivolt, peak
mVp-p = millivolt, peak-to-peak
mVrms = millivolt, rms
mW = milliwatt
MUX = multiplex
MY = mylar
μA = microampere
μF = microfarad
μH = microhenry
μmho = micromho
μs = microsecond
μV = microvolt
μVac = microvolt, ac
μVdc = microvolt, dc
μVpk = microvolt, peak
μVp-p = microvolt, peak-to-peak
μVrms = microvolt, rms
μW = microwatt
nA = nanoampere
NC = no connection
N/C = normally closed
NE = neon
NEG = negative
nF = nanofarad
NI PL = nickel plate
N/O = normally open
NOM = nominal
NORM = normal
NPN = negative-positive-negative
NPO = negative-positive zero (zero temperature coefficient)
NRFR = not recommended for field replacement
ns = nanosecond
NSR = not separately replaceable
nW = nanowatt
OBD = order by description
OD = outside diameter
OH = oval head
OP AMPL = operational amplifier
OPT = option
OSC = oscillator
OX = oxide
oz = ounce
Ω = ohm
P = peak (used in parts list)
PAM = pulse-amplitude modulation
PC = printed circuit
PCM = pulse-code modulation; pulse-count modulation
PDM = pulse-duration modulation
pF = picofarad
PH BRZ = phosphor bronze
PHL = phillips
PIN = positive-intrinsic-negative
PIV = peak inverse voltage
pk = peak
PL = phase lock
PLO = phase lock oscillator
PM = phase modulation
PNP = positive-negative-positive
P/O = part of
POLY = polystyrene
PORC = porcelain
POS = positive; position(s) (used in parts list)
POSN = position
POT = potentiometer
p-p = peak-to-peak
PP = peak-to-peak (used in parts list)
PPM = pulse-position modulation
PREAMPL = preamplifier
PRF = pulse-repetition frequency
PRR = pulse repetition rate
ps = picosecond
PT = point
PTM = pulse-time modulation
PWM = pulse-width modulation
PWV = peak working voltage
RC = resistance capacitance
RECT = rectifier
REF = reference
REG = regulated
REPL = replaceable
RF = radio frequency
RFI = radio frequency interference
RH = round head; right hand
RLC = resistance-inductance-capacitance
RMO = rack mount only
rms = root-mean-square
RND = round
ROM = read-only memory
R&P = rack and panel
RWV = reverse working voltage
S = scattering parameter
s = second (time)
... " = second (plane angle)
S-B = slow-blow fuse (used in parts list)
SCR = silicon controlled rectifier; screw
SE = selenium
SECT = sections
SEMICON = semiconductor
SHF = superhigh frequency
SI = silicon
SIL = silver
SL = slide
SNR = signal-to-noise ratio
SPDT = single-pole, double-throw
SPG = spring
SR = split ring
SPST = single-pole, single-throw
SSB = single sideband
SST = stainless steel
STL = steel
SQ = square
SWR = standing-wave ratio
SYNC = synchronize
T = timed (slow-blow fuse)
TA = tantalum
TC = temperature compensating
TD = time delay
TERM = terminal
TFT = thin-film transistor
TGL = toggle
THD = thread
THRU = through
TI = titanium
TOL = tolerance
TRIM = trimmer
TSTR = transistor
TTL = transistor-transistor logic
TV = television
TVI = television interference
TWT = traveling wave tube
U = micro (10^{-6}) used in parts list)
UF = microfarad (used in parts list)
UHF = ultrahigh frequency
UNREG = unregulated
V = volt
VA = voltampere
Vac = volts ac
VAR = variable
VCO = voltage-controlled oscillator
Vdc = volts dc
VDCW = volts, dc, working (used in parts list)
V(F) = volts, filtered
VFO = variable-frequency oscillator
VHF = very-high frequency
Vpk = volts peak
Vp-p = volts peak-to-peak
Vrms = volts rms
VSWR = voltage standing wave ratio
VTO = voltage-tuned oscillator
VTVM = vacuum-tube voltmeter
V(X) = volts, switched
W = watt
W/ = with
WIV = working inverse voltage
WW = wirewound
W/O = without
YIG = yttrium-iron-garnet
Zo = characteristic impedance

NOTE

All abbreviations in the parts list will be in upper case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

6-6. HP PART NUMBER ORGANIZATION

6-7. Following is a general description of the HP part number system.

6-8. Component Parts and Materials

6-9. Generally, the prefix of HP part numbers identifies the type of device. Eight digit part numbers are used, where the four digit prefix identifies the type of component, part, or material and the four digit suffix indicates the specific type. Following is a list of some of the more commonly used prefixes for component parts. The list includes HP manufactured parts and purchased parts.

Prefix	Component/Part Material
0121-	Capacitors, Variable (mechanical)
0122-	Capacitors, Voltage Variable (semiconductor)
0140-	Capacitors, Fixed
0150-	Capacitors, Fixed Non-Electrolytic
0160-	Capacitors, Fixed
0180-	Capacitors, Fixed Electrolytic
0330-	Insulating Materials
0340-	Insulators, Formed
0370-	Knobs, Control
0380-	Spacers and Standoffs
0410-	Crystals
0470-	Adhesives
0490-	Relays
0510-	Fasteners
0674- thru 0778-	Resistors, Fixed (non wire-wound)
0811- thru 0831-	Resistors (wire-wound)
1200-	Sockets for components
1205-	Heat Sinks
1250-	Connectors (RF and related parts)
1251-	Connectors (non RF and related parts)
1410-	Bearings and Bushings
1420-	Batteries
1820-	Monolithic Digital Integrated Circuits
1826-	Monolithic Linear Integrated Circuits
1850-	Transistors, Germanium PNP
1851-	Transistors, Germanium NPN
1853-	Transistors, Silicon PNP
1854-	Transistors, Silicon NPN
1855-	Field-Effect-Transistors
1900-thru 1912-	Diodes
1920-thru 1952-	Vacuum Tubes
1990-	Semiconductor Photosensitive and Light-Emitting Diodes
3100-thru 3106-	Switches
8120-	Cables
9100-	Transformers, Coils, Chokes, Inductors, and Filters

6-10. For example, 1854-0037, 1854-0221, and 1851-0192 are all NPN transistors. The first two are silicon and the last is germanium.

6-11. General Usage Parts

6-12. The following list gives the prefixes for HP manufactured parts used in several instruments, e.g., side frames, feet, top and bottom covers, etc. These are eight-digit part numbers with the four-digit prefix identifying the type of parts as shown below:

Type of Part	Prefix
Sheet Metal	5000- to 5019-
Machined	5020- to 5039-
Molded	5040- to 5059-
Assemblies	5060- to 5079-
Components	5080- to 5099-

6-13. Specific Instrument Parts

6-14. These are HP manufactured parts for use in individual instruments or series of instruments. For these parts, the prefix indicates the instrument and the suffix indicates the type of part. For example, 10746-60001 is an assembly used in the 10746A. Following is a list of suffixes commonly used.

Type of Part	P/N Suffix
Sheet Metal	-00000 to -00499
Machined	-20000 to -20499
Molded	-40000 to -40499
Assembly	-60000 to -60499
Component	-80000 to -80299
Documentation	-90000 to -90249

Table 6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	10746-60001	1	BINARY INTERFACE CARD	28480	10746-60001
C1	0140-0198	2	CAPACITOR-FXD 200PF +-5% 300WVDC MICA	72136	DM15F201J0300WV1CR
C2	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
C3	0140-0193	3	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
C4	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
C5	0180-0197	11	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C6	0140-0193		CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
C7	0140-0198		CAPACITOR-FXD 200PF +-5% 300WVDC MICA	72136	DM15F201J0300WV1CR
C8	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C9	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C10	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C11	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C12	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C13	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C14	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C15	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C16	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C17	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
C18	0160-2055	8	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C19	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C20	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C21	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C22	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C23	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C24	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C25	0160-2055		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2055
C26	0160-20 5	4	CAPACITOR FXD .01UF +80 -20% 100WVDC CER	28480	0160-20 5
C27	0160-20 5		CAPACITOR FXD .01UF +80 -20% 100WVDC CER	28480	0160-20 5
C28	0160-20 5		CAPACITOR FXD .01UF +80 -20% 100WVDC CER	28480	0160-20 5
C29	0160-20 5		CAPACITOR FXD .01UF +80 -20% 100WVDC CER	28480	0160-20 5
CR1	1901-0040	1	DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
DS1	1990-0416	1	LED-VISIBLE	28480	1990-0416
Q1	1854-0215	2	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
Q2	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
R1	0683-5135	1	RESISTOR 51K 5% .25W FC TC=-400/+800	01121	CB5135
R2	0683-1015	1	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
R3	0683-1525	3	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
R4	0683-1025	9	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R5	0683-1525		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
R6	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R7	0683-2735	1	RESISTOR 27K 5% .25W FC TC=-400/+800	01121	CB2735
R8	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R9	0683-7515	2	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
R10	0683-3025	4	RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
R11	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
R12	0683-5115	2	RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
R13	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
R14	0683-3315	1	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
R15	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
R16	0683-1525		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
R17	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
R18	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R19	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
R20	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R21	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
R22	1810-0030	2	NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	28480	1810-0030
R23	1810-0075	1	NETWORK-RES 8-PIN-SIP .125-PIN-SPCG	28480	1810-0075
R25	1810-0136	3	NETWORK-RES 10-PIN-SIP .1-PIN-SPCG	28480	1810-0136
R26	1810-0080		NETWORK-RES 8-PIN-SIP .125-PIN-SPCG, 500 OHMS	28480	1810-0080
R27	1810-0136		NETWORK-RES 10-PIN-SIP .1-PIN-SPCG	28480	1810-0136
R28	1810-0136		NETWORK-RES 10-PIN-SIP .1-PIN-SPCG	28480	1810-0136
TP1	0360-0124	2	TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
TP2	0360-0124		TERMINAL-STUD SGL-PIN PRESS-MTG	28480	0360-0124
U11	1820-1254	3	IC DM80 95N BUFFER	27014	DM8095N
U12	1820-1121	2	IC DM80 93N DRIVER	27014	DM8093N
U13	1820-1254		IC DM80 95N BUFFER	27014	DM8095N
U14	1820-0511	2	IC:SN7408N	01295	SN7408N
U15	1820-1056	1	IC SN74 132 N COUNTER	01295	SN74132N
U16	1820-0077	4	IC:TTL DUAL D FLIP/FLOP	01295	SN7474N
U17	1820-0077		IC:TTL DUAL D FLIP/FLOP	01295	SN7474N
U21	1820-0839	3	IC SN74 175 N FLIP-FLOP	01295	SN74175N
U22	1820-0839		IC SN74 175 N FLIP-FLOP	01295	SN74175N
U23	1810-0584	1	IC: DM74L02N GATE	27014	DM74L02N

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
U24	1820-0077		IC:TTL DUAL D FLIP/FLOP	01295	SN7474N
U25	1820-0054	4	IC:SN7400N	01295	SN7400N
U26	1820-1053	1	IC SN74 14 N SCHMITT	01295	SN7414N
U27	1820-0471	1	IC:TTL HEX INVERTER	01295	SN7406N
U31	1820-0621	4	IC SN74 38 N BUFFER	01295	SN7438N
U32	1820-0621		IC SN74 38 N BUFFER	01295	SN7438N
U33	1820-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
U34	1820-0661	2	IC SN74 32 N GATE	01295	SN7432N
U35	1820-0054		IC:SN7400N	01295	SN7400N
U36	1820-1203	1	IC SN74LS 11 N GATE	01295	SN74LS11N
U37	1820-0661		IC SN74 32 N GATE	01295	SN7432N
U41	1816-0678	1	IC 256-BIT ROM TTL	28480	1816-0678
U42	1820-0655	1	IC SN74 25 N GATE	01295	SN7425N
U43	1820-1254		IC DM80 95N BUFFER	27014	DM8095N
U44	1820-1121		IC DM80 93N DRIVER	27014	DM8093N
U45	1820-0839		IC SN74 175 N FLIP-FLOP	01295	SN74175N
U46	1820-0511		IC:SN7408N	01295	SN7408N
U47	1820-0621		IC SN74 38 N BUFFER	01295	SN7438N
U51	1820-1468	8	IC DM85 42N	27014	DM8542
U52	1820-1468		IC DM85 42N	27014	DM8542
U53	1820-1468		IC DM85 42N	27014	DM8542
U54	1820-1468		IC DM85 42N	27014	DM8542
U55	1820-1205	1	IC SN74LS 21 N GATE	01295	SN74LS21N
U56	1820-0077		IC:TTL DUAL D FLIP/FLOP	01295	SN7474N
U57	1820-0054		IC:SN7400N	01295	SN7400N
U61	1820-1468		IC DM85 42N	27014	DM8542
U62	1820-1468		IC DM85 42N	27014	DM8542
U63	1820-1468		IC DM85 42N	27014	DM8542
U64	1820-1468		IC DM85 42N	27014	DM8542
U65	1820-0054		IC:SN7400N	01295	SN7400N
U66	1820-0621		IC SN74 38 N BUFFER	01295	SN7438N
U67	1820-0282	1	IC SN74 86 N GATE	01295	SN7486N
W1	8159-0005	5	WIRE 22AWG W PVC 1X22 80C	0073G	L-2007-I
W2	8159-0005		WIRE 22AWG W PVC 1X22 80C	0073G	L-2007-1
W3	8159-0005		WIRE 22AWG W PVC 1X22 80C	0073G	L-2007-1
W4	8159-0005		WIRE 22AWG W PVC 1X22 80C	0073G	L-2007-1
W5	8159-0005		WIRE 22AWG W PVC 1X22 80C	0073G	L-2007-1
			MISCELLANEOUS		
	5040-1464	2	EXTRACTOR:CARD	28480	5040-1464
	1480-0116	2	EXTRACTOR PIN:1/16" DIA	73957	GP24-063X250-I2
	5040-1464		EXTRACTOR:CARD	28480	5040-1464
	1480-0116		EXTRACTOR PIN:1/16" DIA	73957	GP24-063X250-12

See introduction to this section for ordering information

Table 6-2. Manufacturers Code List

Mfr No.	Manufacturer Name	Address	Zip Code
0073G	Gettig Engrg & Mfg Co Inc	Spring Mills, PA	16875
01121	Allen-Bradley Co	Milwaukee, WI	53212
01295	Texas Instr Inc Semicond Cmpnt Div	Dallas, TX	75231
04713	Motorola Semiconductor Products	Phoenix, AZ	85008
27014	National Semiconductor Corp	Santa Clara, CA	95051
28480	Hewlett-Packard Co Corporate Hq	Palo Alto, CA	94304
56289	Sprague Electric Co	North Adams, MA	01247
72136	Electro Motive Mfg Co Inc	Willimantic, CT	06226
73957	Groov-Pin Corp	Ridgefield, NJ	07657

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments.

7-3. MANUAL CHANGES

7-4. This manual applies directly to model 10746A with serial prefix 1516. See Section I for explanation of serial numbers.

7-5. Newer Instruments

7-6. If changes are made, newer instruments may have serial prefixes not listed in this manual. If necessary a manual change sheet with new information to describe newer instruments shoud accompany this manual. If the change sheet is missing ask for a copy from your nearest Hewlett-Packard Sales and Service office as listed at the end of this manual or the system manual.

7-7. Older Instruments

7-8. For Interface Cards with series numbers below that shown on the title page, make the following backdating changes to this manual.

If Your Instrument Has Series Number	Make the Following Changes to Your Manual
1632A	1
1516	1,2

CHANGE 1

Page 6-4, Table 6-1:

Change R12 and R13 from 0683-5115 to 0683-1025 RESISTOR 1K 5% .25W FC TC=-400/+600, 01121, CB1025.

Change R19 from 0683-7515 to 0683-1025 RESISTOR 1K 5% .25W FC TC=-400/+600, 01121, CB1025.

Change U23 from 1820-0584 to 1820-0328 IC: TTL QUAD 2-INPUT NOR GATE, 01295, SN7402N. Note that the 1820-0584 is the preferred replacement part.

Page 8-5, Figure 8-4:

On top of schematic, change series number from 1652 to 1632.

Change R12 and R13 values from 510 to 1K.

Change R19 value from 750 to 1K.

CHANGE 3

Page 6-5, Table 6-1:

Change R26 from 1810-0080 to 1810-0030, RESISTOR 1K, 28480, 1810-0030.

Page 8-5, Figure 8-4:

On top of schematic, change series number from 1632 to 1516.

Change R26 value from 500 to 1K.

CHANGE 3

Page 2-5, Paragraph 2-36, first sentence, change the following phrase:

FROM: "with the jumper removed"
TO: "by removing one end of the jumper from the pad marked 8, and placing it in the pad marked 16"

SECTION VIII
SCHEMATIC DIAGRAMS

8-1. INTRODUCTION

8-2. This section contains information for the schematic diagram, notes, reference designation system, identification markings on printed-circuit boards, schematic and component locators.

8-3. SCHEMATIC DIAGRAM NOTES

8-4. Figure 8-1 shows the symbols used on the schematic diagrams. Notes are also included on each schematic diagram.

8-5. REFERENCE DESIGNATOR SYSTEM

8-6. Figure 8-1 shows the method of assigning reference designations. Assemblies such as printed-circuit boards are assigned in sequence, A1, A2, etc. As shown in Figure 8-1, subassemblies within assemblies are given a subordinate A number. For example, rectifier assembly A1 has the complete designator of A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number if any. For example, CR1 on the rectifier assembly is designated A25A1CR1.

8-7. IDENTIFICATION MARKINGS ON PRINTED-CIRCUIT BOARDS

8-8. HP printed-circuit boards (see Figure 8-1) have four identification numbers; an assembly part number, a series number, a revision letter, and a production code.

8-9. The assembly part number has 10 digits (such as 10760-60001) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1248A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed-circuit board is lower than that on the schematic, refer to Section VII for back-dating information. If it is higher, refer to the loose-leaf manual change sheets for this manual. If the manual change sheets are missing, contact your local Hewlett-Packard Sales and Service Office. See the listing on the back cover of this manual.

8-10. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed-circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four digit, seven segment number used for production purposes.

8-11. Symbols are used on PC boards to aid in identifying pin numbers, diode elements, etc. as follows:

Δ OR □ IDENTIFIES:

Pin 1 of dip and flat-pack IC's.
Tab of TO cases.
+ side of electrolytic capacitors.
Pin 1 of resistor packs.
Cathode of diodes.
Section 1 of dip switches.

SYMBOLS

FRONT PANEL

REAR PANEL

INTERIOR AND PC BOARDS

WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE

POWER LINE GROUND

CIRCUIT COMMON GROUND

FLOATING GROUND

CHASSIS GROUND

KNOB CONTROL

SCREWDRIVER ADJUST

MAIN SIGNAL PATH

FEEDBACK PATH

TEST POINT

"AND" GATE

"OR" GATE

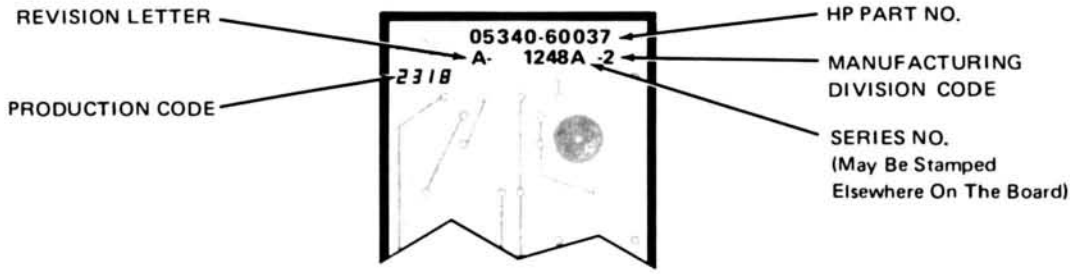
INVERTER

NAND GATE

NOR GATE

EXCLUSIVE NOR

PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION. JACKS ARE THE STATIONARY CONNECTORS AND PLUGS ARE THE MORE MOVEABLE OF TWO CONNECTORS.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

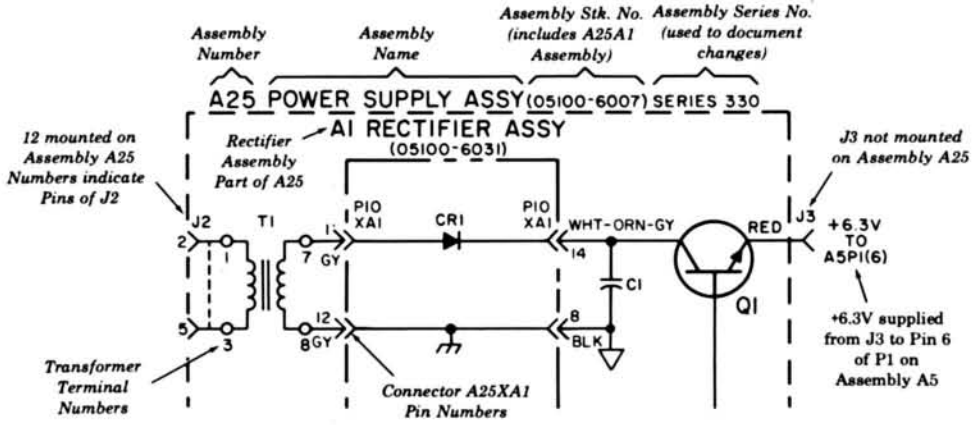


Figure 8-1. Schematic Diagram Notes

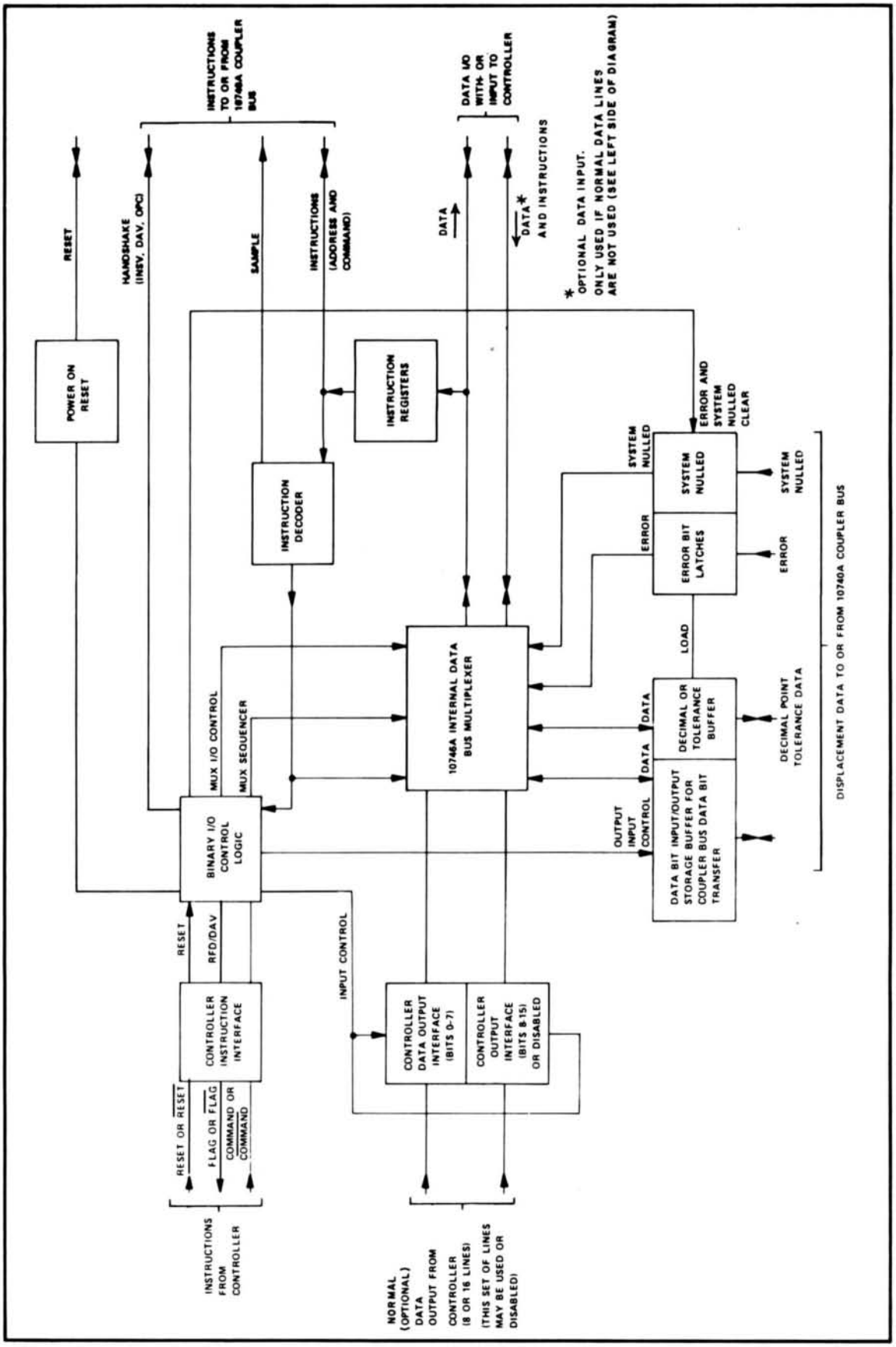


Figure 8-2. 10764A Block Diagram

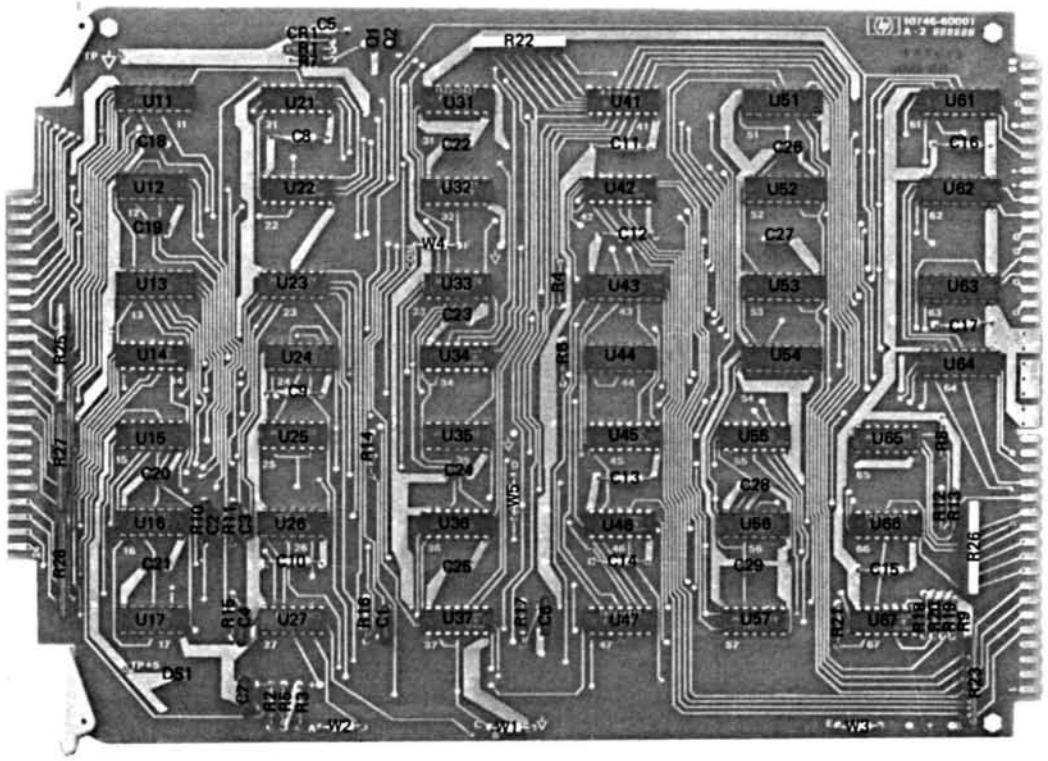
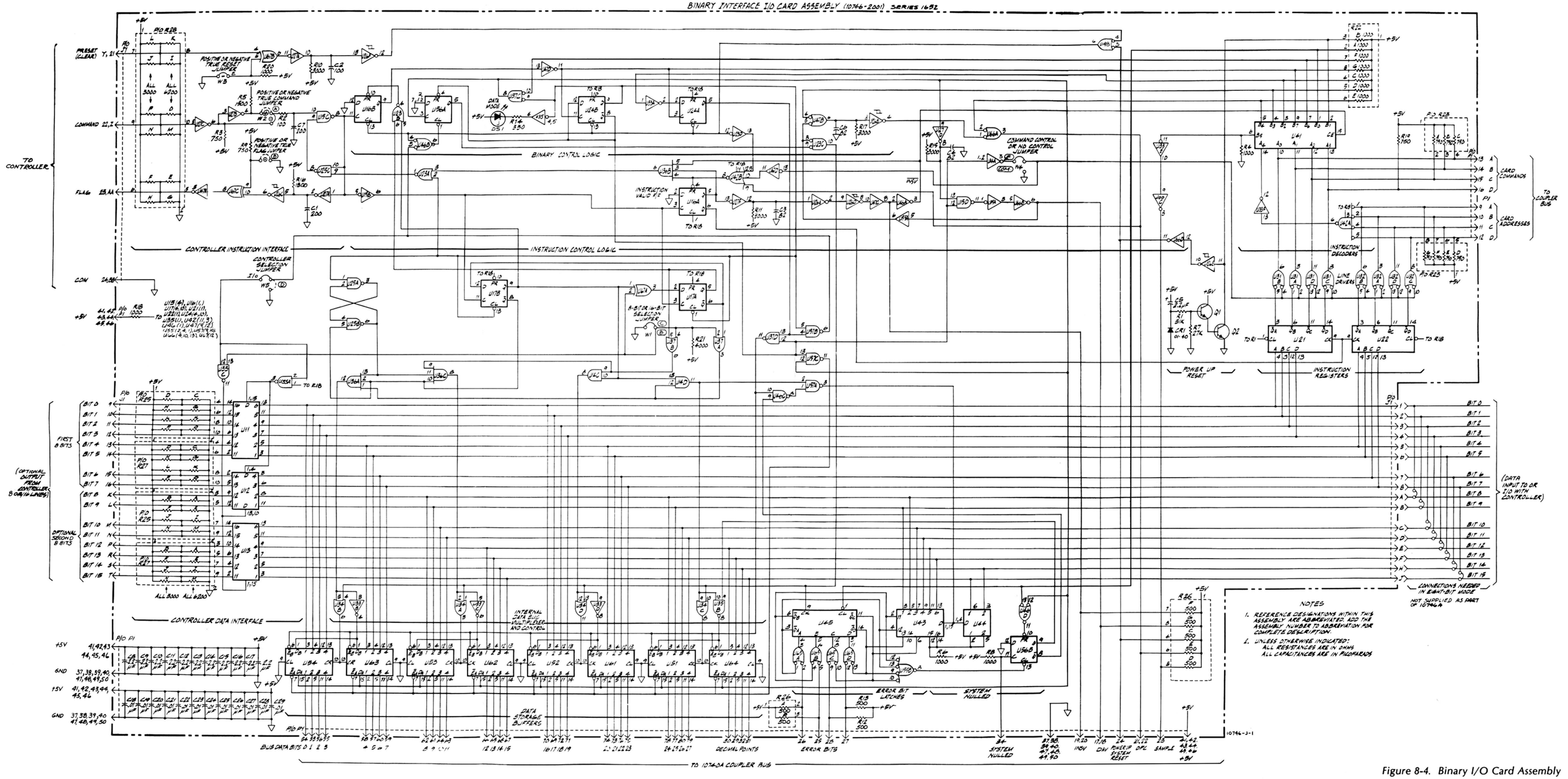


Figure 8-3. 10746A Component Locator



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD THE ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   ALL RESISTANCES ARE IN OHMS
   ALL CAPACITANCES ARE IN PICOFARADS

Figure 8-4. Binary I/O Card Assembly

Manual Part No. 10746-90004
Microfiche No. 10746-90005

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