

HEWLETT  PACKARD

BCD OUTPUT INTERFACE KIT
for
Model 2570A/75A Coupler/Controller

HP 12798B

OPERATING AND SERVICE MANUAL

MAY 1971



This manual applies directly to HP 12798B BCD Output Interface Kits having revision code number A 1108 6. Cards with later revision code numbers will be covered in an Updating Supplement at the front of this manual.

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard Model 12798B General Purpose 40-Bit Output Interface Kit is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. We will repair or replace products which prove to be defective during the warranty period, provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require on-site maintenance and repair.

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

MANUAL IDENTIFICATION

Manual Printed: May 1971
 Manual Part Number: 12798-90007

SUPPLEMENT DESCRIPTION

1. Changes and corrections.
2. Optional Applications Information.

INSTRUMENT CHANGES

Prefix-Serial	Changes
ALL	1
ALL	2

CHANGE

DESCRIPTION

- 1 Page 2-13, Figure 2-4. Change jumper W6 on card HP 12798-60011 from "A" position to "B" position.
- 2 Options 011 and 012 provide additional customer applications by interfacing the HP 12798B BCD Output Card to the following accessories, respectively:
 - a. HP 6936A Multiprogrammer
 - b. HP 3485A Scanning Unit

Make the following manual changes.

Page iv, List of Illustrations, after Figure 2-12 add:

Figure 2-12A, HP 6936A Programming Interface, Page US-5

Figure 2-12B, HP 3485A Scanning Unit Interface, Page US-6

Page iv, List of Tables, after Table 2-9 add:

Table 2-9A. Cable HP Stock No. 12798-60013 Wiring Information
 (Part of Option 011, HP 12798B - HP 6936A Interface) , Page US-3

Table 2-9B. Cable HP Stock No. 12798-60014 Wiring Information
 (Part of Option 012, HP 12798B - HP 3485A Interface) , Page US-4

Page 1-2, Table 1-1. After Option 010 add:

- | | |
|------------|--|
| Option 011 | HP 12798-60013 Cable to interconnect with HP 6936A Multiprogrammer. Includes logic compatibility (ground-true output). |
| Option 012 | HP 12798-60014 Cable to interconnect with HP 3485A Scanning Unit. Includes logic compatibility (ground-true output). |

CHANGEDESCRIPTION

2
(Continued)

Page 2-1, Paragraph 2-10. Change line 1 to:
"Tables 2-4 through 2-9B provide wiring in ..."

After Page 2-10, Table 2-9, add the following inserts:

Page US-3, Table 2-9A. Cable HP Stock No. 12798-60013 Wiring Information.

Page US-4, Table 2-9B. Cable HP Stock No. 12798-60014 Wiring Information.

After Page 2-22, Figure 2-12, add the following inserts:

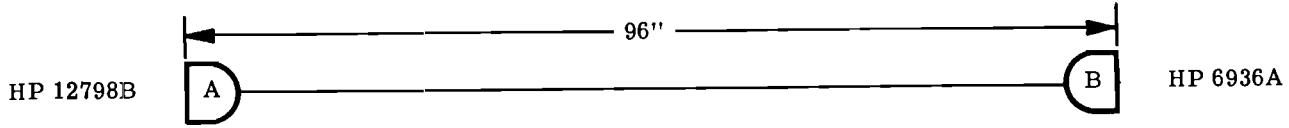
Page US-5, Figure 2-12A. HP 6936A Programming Interface.

Page US-6, Figure 2-12B. HP 3485A Scanning Unit Interface.

Page 5-4, Table 5-1. Replaceable Parts. After the HP 12798-60009 Cable components, add the following:

12798-60013	1	CABLE (PART OF OPTION 011)	04404	12798-60013
1251-0086	1	CONNECTOR:50 CONTACT R & P	28480	1251-0086
1251-0171	1	BUSHING:FOR AN TYPE CONNECTOR	28480	1251-0171
1251-2518	1	CONNECTOR:PC 48 (2x24) CONTACT	71785	251-24-30-261
8120-1041	8 FT	CABLE 36 COND	28480	8120-1041
02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003
12798-60014	1	CABLE (PART OF OPTION 012)	04404	12798-60014
1251-2518	1	CONNECTOR:PC 48 (2x24) CONTACT	71785	251-24-30-261
1251-2815	1	CONNECTOR KIT	28480	1251-2815
8120-0181	8 FT	CABLE SHIELDED	28480	8120-0181
02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003

Table 2-9A. Cable HP Stock No. 12798-60013 Wiring Information
(Part of Option 011, HP 12798B - HP 6936A Interface)



BCD OUTPUT SIGNALS

Pin Assignment		HP 12798B BCD Output		HP 6936A Control Signals	Pin Assignment		HP 12798B BCD Output		HP 6936A Control Signals
A	B	Character	BCD Weight		A	B	Character	BCD Weight	
19 20 W X	49 50	Most Significant Digit 9 (Loaded First)	{ 1 2 4 8	$\overline{B14}$ $\overline{B15}$	9 10 K L	39 40	4 	{ 1 2 4 8	$\overline{B04}$ $\overline{B05}$
17 18 U V	47 48	8	{ 1 2 4 8	$\overline{B12}$ $\overline{B13}$	7 8 H J	37 38	3 	{ 1 2 4 8	$\overline{B02}$ $\overline{B03}$
15 16 S T	45 46	7	{ 1 2 4 8	$\overline{B10}$ $\overline{B11}$	5 6 E F	35 36	2 	{ 1 2 4 8	$\overline{B00}$ $\overline{B01}$
13 14 P R	43 44	6	{ 1 2 4 8	$\overline{B08}$ $\overline{B09}$	3 4 C D		1 	{ 1 2 4 8	(Note 1)
11 12 M N	41 42	5	{ 1 2 4 8	$\overline{B06}$ $\overline{B07}$	1 2 A B		Least Significant Digit 0 (Loaded Last)	{ 1 2 4 8	(Note 1)

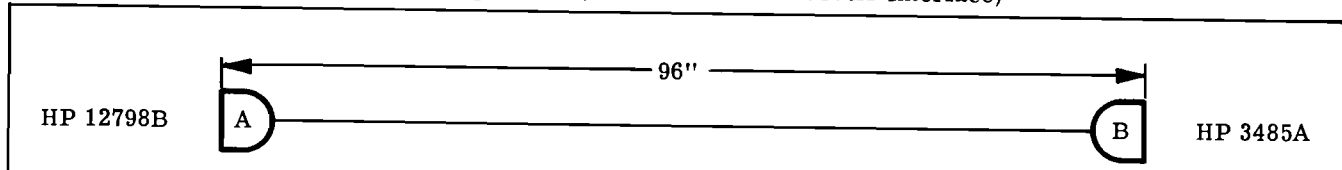
INTERFACE CONTROL SIGNALS

A	B	Signal
21	33	$\overline{\text{Busy}}$ - $\overline{\text{Flag}}$
22	32	$\overline{\text{Store Data}}$ - $\overline{\text{Gate}}$
BB	26	Ground
--	18 19	} Jumpered Together

NOTES

1. Not normally used.
2. A parts list for the cable is contained in Table 5-1.
3. Overscored signals are ground true.

Table 2-9B. Cable HP Stock No. 12798-60014 Wiring Information
(Part of Option 012, HP 12798B - HP 3485A Interface)



BCD OUTPUT SIGNALS

Pin Assignment		HP 12798B BCD Output		HP 3485A Control Signals	Pin Assignment		HP 12798B BCD Output		HP 3485A Control Signals
A	B	Character	BCD Weight		A	B	Character	BCD Weight	
19 20 W X		Most Significant Digit 9 (Loaded First)	{ 1 2 4 8		9 10 K L	N L	4	{ 1 2 4 8	1000 mV 10V
17 18 U V	H X J C	8	{ 1 2 4 8	STEP SINGLE SCAN CONTINUOUS SCAN HOME	7 8 H J	S	3	{ 1 2 4 8	FILTER ENABLE
15 16 S T	d	7	{ 1 2 4 8	RANDOM	5 6 E F		2	{ 1 2 4 8	(Note 1)
13 14 P R	V U T	6	{ 1 2 4 8	CH 10 CH 20 CH 40	3 4 C D		1	{ 1 2 4 8	(Note 1)
11 12 M N	Y R Z W	5	{ 1 2 4 8	CH 1 CH 2 CH 4 CH 8	1 2 A B		Least Significant Digit 0 (Loaded Last)	{ 1 2 4 8	(Note 1)

INTERFACE CONTROL SIGNALS

A	B	Signal
21	b	Busy (Program Acknowledge)
21	c̄	Busy (Initiate)
BB	p	Ground
BB	--	Shield
22	a	Store Data (Program Executive)

NOTES

1. Not normally used.
2. A parts list for the cable is contained in Table 5-1.

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SECTION I

INTRODUCTION AND DESCRIPTION

1-1. GENERAL INFORMATION

1-2. The HP 12798B BCD Output Interface Kit contains a general purpose 40-bit (10 BCD digit) parallel data output register as a means to allow the HP 2570A Coupler/Controller* to provide:

- a. 10-digit parallel data output for digital recorders and frequency synthesizer programmers.
- b. 40 bits of parallel programming information for programmable voltmeters, counters, digital voltage sources, etc.

1-3. The kit consists of a BCD output plug-in card with positive-true output and a connector for making an interconnecting cable to the interfacing device. An optional BCD output card with ground-true output is available. Also, the card may be ordered with interconnect cables to interface with certain HP instruments. Full details of all options available are listed in Table 1-1.

1-4. Sections II through V provide information on installation and operation, principles of operation, servicing, and replacement parts for the BCD output card.

1-5. EQUIPMENT SUPPLIED

1-6. The HP 12798B BCD Output Interface Kit consists of:

- a. BCD Output Card, positive-true output. HP Part No. 12798-60010.
- b. Connector Kit. HP Part No. 02116-6178.

NOTE

The connector kit is not supplied if HP 12798B is ordered with Options 001 through 010.

1-7. OPTIONS

1-8. The HP 12798B BCD Output Interface Kit may be ordered with the options listed in Table 1-1.

1-9. DESCRIPTION

1-10. The BCD Output Card permits transfer of information from the HP 2570A Coupler/Controller

to parallel entry digital devices. The card is jumper programmable to operate in either a record or program mode. When the record mode is chosen, for example, to interface an HP 5050B Digital Recorder, operation is as follows: The card converts, upon command from the HP 2570A, the ASCII signals on the backplane to 8421 BCD and these are sequentially clocked by a decade counter, digit by digit into a storage/output register on the card. (A typical source of data may be a digital voltmeter interfaced to the HP 2570A with an HP 12797A BCD Input Card.) A total of 10 4-bit data latches in the register permit up to 10 digits to be stored. The last digit in the word is accompanied with or followed by a signal that causes the card to initiate a Store Data command. When the recorder receives the Store Data command, it returns a Busy signal. The Busy signal activates a circuit on the card that halts the main instruction program on the HP 2570A if an attempt is made to output more data before the recorder has completed the printout. At the end of the printout action, the Busy signal is released, allowing the instruction program of the HP 2570A to continue. The number of characters accepted and their position in the output is determined by the sequence of the input data. The data register is returned to the preset value before new data is entered.

1-11. When the program mode is selected, for example, to program a DVM, operation of the card is basically similar to the record mode previously discussed. The card converts, upon command from the HP 2570A, the ASCII signals on the backplane to 8421 BCD, and these are sequentially clocked into the register. (A typical source of input data may be a teleprinter, tape reader, calculator, etc., interfaced with the appropriate I/O card; or the pinboard of the coupler/controller.) The last digit in the word is either accompanied with or followed by a signal that causes the card to initiate a Store Data command. This signal is interpreted by the programmed device as a program accept pulse and causes the program to be executed. When the device receives the Store Data command, it returns a Busy pulse to the card. Depending on the positions of jumpers W9 and W51, the card may halt the main instruction program of the HP 2570A until the instrument is programmed. In any event, if an attempt is made to alter the output register code before the Busy pulse is released, the HP 2570A is halted. If the programmed device is incapable of generating this signal, the BCD output card will allow the HP 2570A program to continue nominally 300 ms after the Store Data pulse. The information stored in the data register is retained until the card is addressed with another command from the HP 2570A.

1-12. SPECIFICATIONS

1-13. Input/output characteristics for the HP 12798B are given in Table 1-2.

*In general the information given in this manual also applies to the HP 2575A Coupler/Controller which is a four-slot version of the HP 2570A. Consult the HP 2575A Operating and Service Manual for the differences between the two instruments.

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Table 1-1. HP 12798B List of Options

Option 001	HP 02547-6040 Cable to interconnect with HP 5050A/B or HP 562A Digital Recorder. Includes logic compatibility (+12V-true output).	Option 005	HP 12798-60009 Cable to interconnect with HP 6130B or HP 6131B Voltage Source. Includes logic compatibility (ground-true output).
Option 002	HP 12798-60010 BCD Output Card (positive-true output) to interface with HP 2759B Synthesizer Programmer.	Option 007	HP 12798-60005 Cable to interconnect with HP 5325B Universal Counter. Includes logic compatibility (ground-true output).
NOTE			
The HP 2759B is supplied with an interconnecting cable assembly which mates with the BCD output card.			
Option 003	HP 12798-60002 Cable to interconnect with HP 3450A Multi-Function Meter. Includes logic compatibility (positive-true output).	Option 008	HP 12798-60006 Cable to interconnect with HP 5326A/B Timer/Counter/DVM. Includes logic compatibility (ground-true output).
Option 004	HP 12798-60003 Cable to interconnect with HP 3482A/84A Plug-In in an HP 3480B Digital Voltmeter. Includes logic compatibility (ground-true output).	Option 010	HP 02547-6040 Cable to interconnect with HP 5055A Digital Recorder. Includes logic compatibility (positive-true output).
		Option 020	a) BCD Output Card (ground-true output). HP Part No. 12798-60011. b) Connector Kit, HP Part No. 02116-6178.

Table 1-2. HP 12798B Specifications

DATA OUTPUT		STORE DATA (to external device)	
Number of Digits:	10	Amplitude:	+12V \pm 1V or +5V \pm 0.5V (Jumper selectable through 330 ohms)
Bit Voltage, HP 12798-60010 (Positive-true output):	Logic "1" +5V \pm 0.5V through 10K ohm resistor Logic "0" +0.4V \pm 0.4V (Logic "1" is jumper selectable through 10K ohm to +12V \pm 1V)	Duration:	400 ms max., controlled internally. Can be reset after 10 us via external Busy signal
Bit Voltage, HP 12798-60012 (+12V-true output):	Logic "1" +12V \pm 1.0V through 10K ohm resistor Logic "0" +0.4V \pm 0.4V (Logic "1" is jumper selectable through 10K ohm to +5V \pm 0.5V)	Rise Time:	>1V per μ s
Bit Voltage, HP 12798-60011 (Ground-true output):	Logic "1" +0.4V \pm 0.4V Logic "0" +5V \pm 0.5V through 10K ohm resistor (Logic "0" is jumper selectable through 10K ohm to +12V \pm 1V)	Coupling:	dc
		Output Impedance:	< 480 ohms
		Current Sink:	\leq 3.6 mA
REFERENCE VOLTAGES SUPPLIED			
		High Level:	+7.2V \pm 1.0V
		Low Level:	+0.7V \pm 0.3V

Table 1-2. HP 12798B Specifications (Continued)

BUSY (From external device)	"K"	(Continuous Output)
Amplitude: High: +10.0V±6.5V Low: <+0.8V		Input data words from the data bus and continue to output these words to an external device until commanded to stop by an "N" command. This command is not reset after one data word but is reset by an "N" command. The "K" command is inoperable in the PGM (program) mode of operation.
Duration: ≥20 μs		
Input Impedance: >1500 ohms		
Pull-Up Resistors: Space for pull-up resistors to +5V or +16V is provided. Minimum resistance: 100 ohms to ±5V or 3.9K ohms to ±16V	"N"	(Negate the "K" command.) Stops the output of data until another "I" or "K" command is issued.
COMMANDS	PHYSICAL COMPATIBILITY	The BCD Output Card plugs into any I/O slot in the HP 2570A or HP 2575A.
"I" (Single Word Output) Input one word of data from the data bus and output this data to an external device. This command is reset after one word is output.	WEIGHT	Net: 3 lbs (1,4 kg) Shipping: 5 lbs (2,5 kg)



SECTION II

INSTALLATION AND OPERATION

2-1. UNPACKING AND INSPECTION

2-2. If the shipping package is damaged, ask that the carrier's agent be present when the kit is unpacked. Carefully unpack the PC card and any accessories and inspect for damage (scratches, broken components, etc.) If the card is damaged or fails to meet specifications, notify the carrier and nearest Hewlett-Packard Sales and Service Office immediately (Sales and Service Offices are listed at the back of the manual). Retain the shipping material for the carrier's inspection.

2-3. ACCEPTANCE CHECK

2-4. Check the performance of the kit as soon as possible after receipt. The instructions provided in Paragraphs 2-38 through 2-49 will verify operation of the kit.

2-5. REPACKING FOR SHIPMENT

2-6. If the kit is to be shipped to Hewlett-Packard for service or repair, wrap carefully in heavy paper. Use adequate packing material around the PC card. Mark package with "Fragile", etc. Additional packing information can be found in Section II of the HP 2570A and HP 2575A Manuals.

NOTE

In any correspondence regarding the kit, identify the PC card by model number, revision code number, and serial number. See Figure 4-2 for the location of these numbers. If you have any questions, please contact your local Hewlett-Packard Sales and Service Office.

2-7. CABLE FABRICATION

2-8. Since the BCD output card is designed for use as an interface for a variety of equipment, it may be necessary to prepare an interconnecting cable for the particular device being used. Connector kit HP Part No. 02116-6178 is furnished as part of kit HP 12798B for this purpose. The 48-pin connector in the kit slides onto the front of the BCD output card containing 48 printed-circuit paths (24 on each side of the card). Table 2-1 lists the signals to and from the card as an aid in the preparation of the interconnecting cable. Table 2-2 explains how to fabricate the cable and Table 2-3 is a parts list for the connector kit. Figure 2-1 depicts details of cable assembly.

2-9. INTERCONNECTING CABLES

2-10. Tables 2-4 through 2-9 provide wiring information for interconnect cables available for use with the card. See Table 1-1. In each case connector A mates with the BCD output card and connector B mates with the interfaced device. The BCD output card has the capability of transmitting 10 digits of BCD information. The BCD output column in the tables identifies these digits. Note that the most significant character is loaded first and the least significant character is loaded last. The number of digits transmitted will depend on the character word output by the coupler/controller.

2-11. BCD OUTPUT CARD

2-12. GENERAL

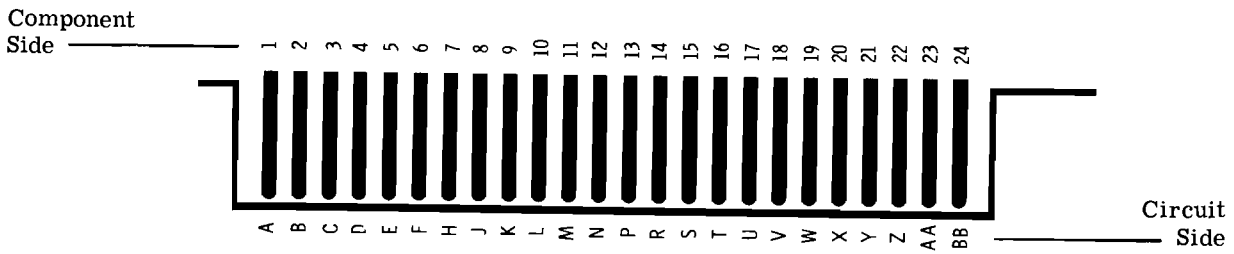
2-13. Paragraphs 2-14 through 2-21 in this section provide the user with an overall description of the BCD output card as an aid to interfacing a digital recorder (record mode) or programming an instrument (program mode) with the HP 2570A. Included are a basic description of the operating principles of the card, commands, and typical system operation.

2-14. OPERATING PRINCIPLES

2-15. Upon command from the HP 2570A Coupler/Controller, the BCD output card translates ASCII signals present at the backplane to 8421 BCD and these are sequentially clocked by a decade counter, digit by digit (most significant digit first) into a storage/output register on the card. The operation is controlled by strobe pulses generated by the HP 2570A control logic; one strobe signal pulses the first BCD digit into storage and at the end of the character, another pulse advances the decade counter. Successive cycles clock information into the register in a similar manner. A total of 10 4-bit data latches in the register permit up to 10 digits to be stored.

2-16. When the jumper programmable record mode is selected, the last digit in the word is accompanied with or followed by a command character which causes the BCD output card to initiate transfer of a Store Data command to the recording device. Attempts to input more than 10 digits will result in the 11th and succeeding digits being truncated provided all the characters are permissible characters (any number, a space, a minus sign, or the letter E). When the recording device receives the Store Data command, it returns a Busy signal to the BCD output card. If another command attempts to input data to the card, the Busy signal activates a circuit that halts the main control program of the HP 2570A, preventing the sampling of further data until the recording device has

Table 2-1. HP 12798B 48-Pin PC Connector Pin Assignment



BCD OUTPUT SIGNALS

Pin	Record/Program Character	BCD Weight	Pin	Record/Program Character	BCD Weight
19 20 W X	Most significant Digit 9 (Loaded First)	{ 1 2 4 8	9 10 K L	4	{ 1 2 4 8
17 18 U V	8	{ 1 2 4 8	7 8 H J	3	{ 1 2 4 8
15 16 S T	7	{ 1 2 4 8	5 6 E F	2	{ 1 2 4 8
13 14 P R	6	{ 1 2 4 8	3 4 C D	1	{ 1 2 4 8
11 12 M N	5	{ 1 2 4 8	1 2 A B	Least significant Digit 0 (Loaded Last)	{ 1 2 4 8

CONTROL SIGNALS

Pin	Signal
AA	Reference Voltage, High Level
23	Reference Voltage, Low Level
22	Store Data (To External Device)
BB	Ground
21	Busy (From External Device)

NOTE

48-pin PC connector illustrated above is shown viewed from the component side of the card.

Table 2-2. Cable Fabrication Instructions

STEP	INSTRUCTION
1.	Insert approximately 10 inches of cable into hood.
2.	Strip outer jacket of cable back five inches.
3.	Start making connections at the bottom of the connector by soldering first wire to pin BB (ground). Continue connecting successive wires to the next pins, following the order 24, AA, 23, Z, 22, etc.
4.	After all wires have been connected, carefully insert connector into hood and attach with self-tapping screws. See Figure 2-1. Install cable clamp

CAUTION

Hood is made of plastic. Do not force screws or cable clamp. Firm tightening is sufficient. Overtightening will split the connector hood.

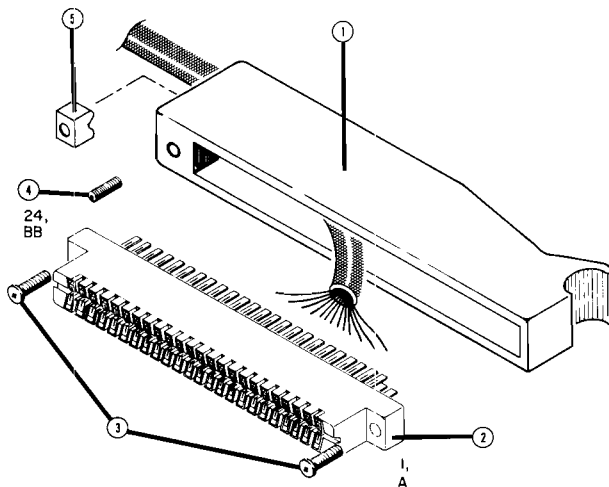


Figure 2-1. Cable Assembly Diagram

Table 2-3. Connector Kit, HP Part No. 02116-6178

ITEM	QTY	DESCRIPTION	PART NO.
1	1	Hood	02116-4001
2	1	Connector, 48 Pin	1251-0335
3	2	Tapping Screw	0624-0096
4	1	Set Screw	3030-0143
5	1	Cable Clamp	02116-4003

completed the printout. Thereafter, the Busy signal is released indicating that the device is ready for more data, and the main program of the HP 2570A can continue.

2-17. When the jumper programmable program mode is selected, a signal accompanying or following the last digit of the entered word initiates a Store Data command. This causes the programmed device to execute the program. Depending on the positions of jumpers W9 and W51, the card may halt the main instruction program of the HP 2570A until the instrument is programmed. If an attempt is made to alter the output register code before a Busy pulse is released, the HP 2570A is halted. If the programmed instrument is not capable of generating a Busy signal, the BCD output card will allow programming to resume approximately 300 ms after the Store Data pulse. The information stored in the data register is retained until the card is addressed with another command from the HP 2570A.

2-18. COMMANDS

2-19. The following three commands issued by the HP 2570A control card pinboard matrix (or any program source interfaced with the HP 2570A), are applicable to the BCD output card:

I Input one word of data (1 to 10 digits) from the data bus and output this data to an external device. This command is reset after one word is input.

K Input data words from the data bus and continue to output these words to an external device until commanded to stop by an N command. This command is not reset after one data word, but is reset by an N command. The K command is not operable for the program (PGM) mode of operation.

N Reset K command. Stops output of data to the external device.

2-20. TYPICAL SYSTEM APPLICATIONS

2-21. Figures 2-2 through 2-4 show three typical system applications of the BCD output card. The first example illustrates the card being operated in the record (RCD) mode; the remaining examples show the card set for the program (PGM) mode, and remotely programming instruments by means of their control lines. Each illustration includes: a description of the system, a block diagram of the coupler/controller showing slot location of the I/O cards, system programming and BCD output card jumper settings.

2-22. PROGRAMMING



When interfacing the coupler/controller with microcircuit devices, ensure that level select jumper W50 described in Table 2-10 is in the 5V position before applying power to the coupler/controller. Failure to do so may result in damage to the associated equipment.

2-23. GENERAL INFORMATION

2-24. The BCD output card has two basic operating modes - Record (RCD) and Program (PGM), selected by jumper W5 on the card. These modes are defined as follows:

Record (RCD)

Used when card is employed to interface a parallel input recording device such as a digital recorder. The card accepts space, minus and decimal point and outputs a modified 4-bit code for each character.

Program (PGM)

Used when card is required to program an instrument. The card ignores any space, minus or decimal point information.

2-25. Programming the BCD output card consists of choosing the desired mode of operation for the card and then placing the circuit board jumpers in the required positions for the desired operation. Table 2-10 defines the functions of the jumpers on the card. Consult Figures 2-5 through 2-12 for programming information required to interface HP instruments listed in Table 1-1. Information provided includes details of instrument programming or printout format, interface cable required, BCD output card jumper settings, and examples of typical programming.

2-26. CARD INSTALLATION



Always set the coupler/controller LINE ON/OFF switch to OFF before installing or removing cards. Failure to observe this precaution may result in damage to the equipment.

2-27. HP 2570A COUPLER/CONTROLLER

2-28. The HP 12798B BCD Output Card may be inserted into any one of the eight I/O slots in the HP 2570A; the choice is arbitrary and is determined by the person preparing the system program.

2-29. To install the card, proceed as follows:

- a. Set the LINE ON/OFF switch on the front of the HP 2570A cabinet to OFF and open the front panel of the HP 2570A.
- b. Hold the BCD output card vertical with the component side facing right and the plastic card extractors facing away from the HP 2570A mainframe.
- c. Carefully slide the card forward into the desired slot.
- d. Check that the card is fully inserted into the connector on the backplane by pressing on the card extractors.

2-30. HP 2575A COUPLER/CONTROLLER

2-31. The HP 12798B BCD Output Card may be inserted into any of the four I/O slots in the HP 2575A.

2-32. To install the BCD output card, carry out the following steps:

- a. Set the LINE ON/OFF switch on the front panel of the HP 2575A to OFF.
- b. Locate the rear cover on the back of the instrument. See Figure 2-3 in the HP 2575A Operating and Service Manual. Release the rear cover latches and remove the cover.
- c. Remove the I/O card retaining bracket.
- d. Hold the BCD output card horizontally with the component side facing upward and the plastic card extractors facing away from the HP 2575A.
- e. Carefully slide the card forward into the desired slot. The card I/O slot numbers ("Addresses") are marked on the rear panel.
- f. Check that the card is fully inserted into the connector on the mother board by pressing on the card extractors.
- g. Replace the I/O card retaining bracket.

2-33. CABLE INSTALLATION



Always set the coupler/controller LINE ON/OFF switch to OFF and de-energize all associated equipment before installing or removing cables. Failure to observe this precaution may result in damage to the equipment.

2-34. HP 2570A COUPLER/CONTROLLER

2-35. To connect a peripheral device to a BCD output card installed in the HP 2570A, carry out the following steps:

- a. Set the HP 2570A LINE ON/OFF switch to OFF and open front panel.
- b. Pass the cable connector which mates with the BCD output card forward through the slot at the rear of the HP 2570A cabinet.
- c. Carefully slide the cable connector onto the pin connections on the front of the BCD output card. Check that the card is firmly seated in the backplane connector.
- d. Pull back any excess cable from the rear of the HP 2570A and connect the other end of the cable to the input/output device.

Table 2-4. Cable HP Stock No. 02547-6040 Wiring Information
(Part of Option 001 and 010, HP 12798B - HP 5050A/B, HP 5055A, HP 562A Interface)

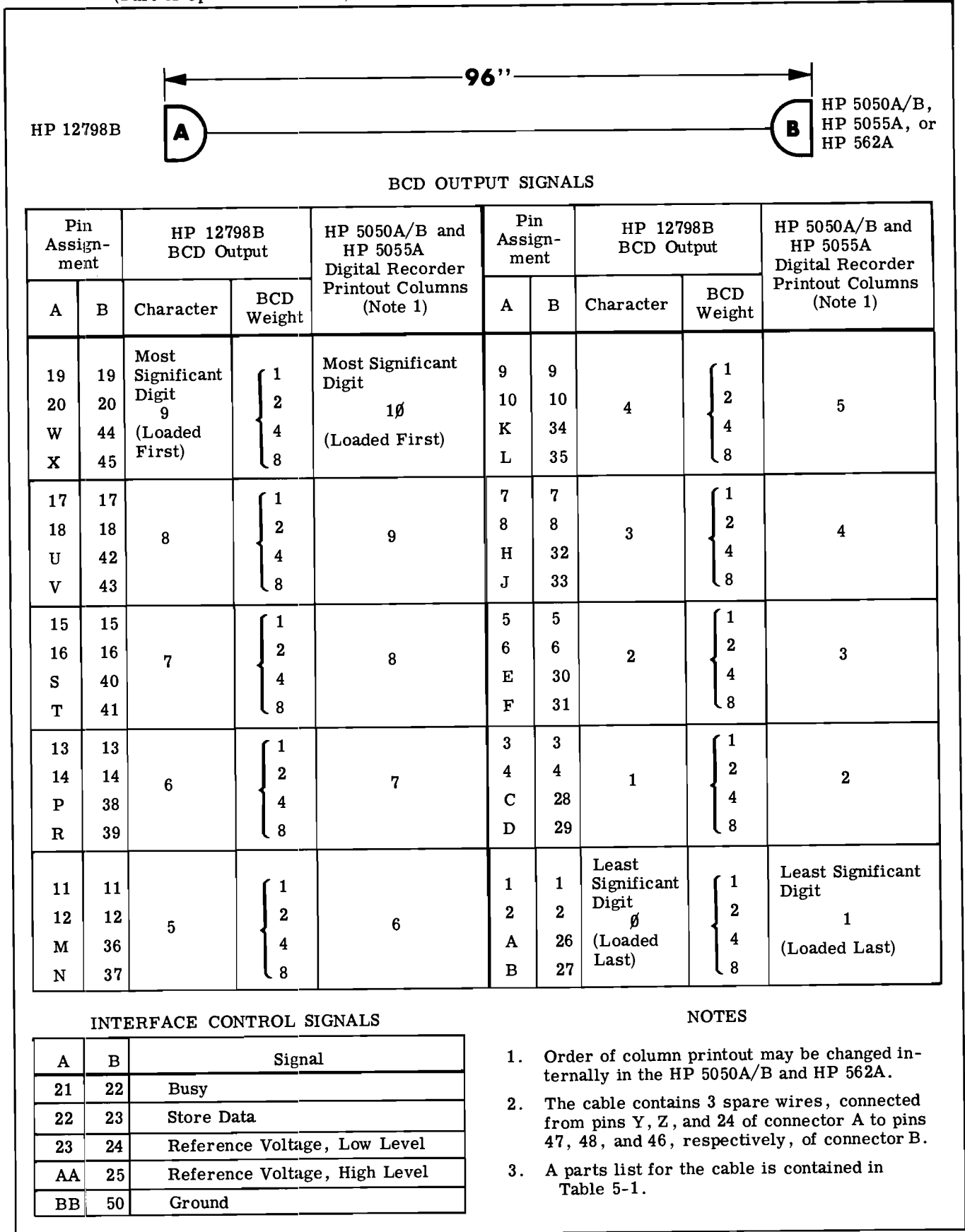
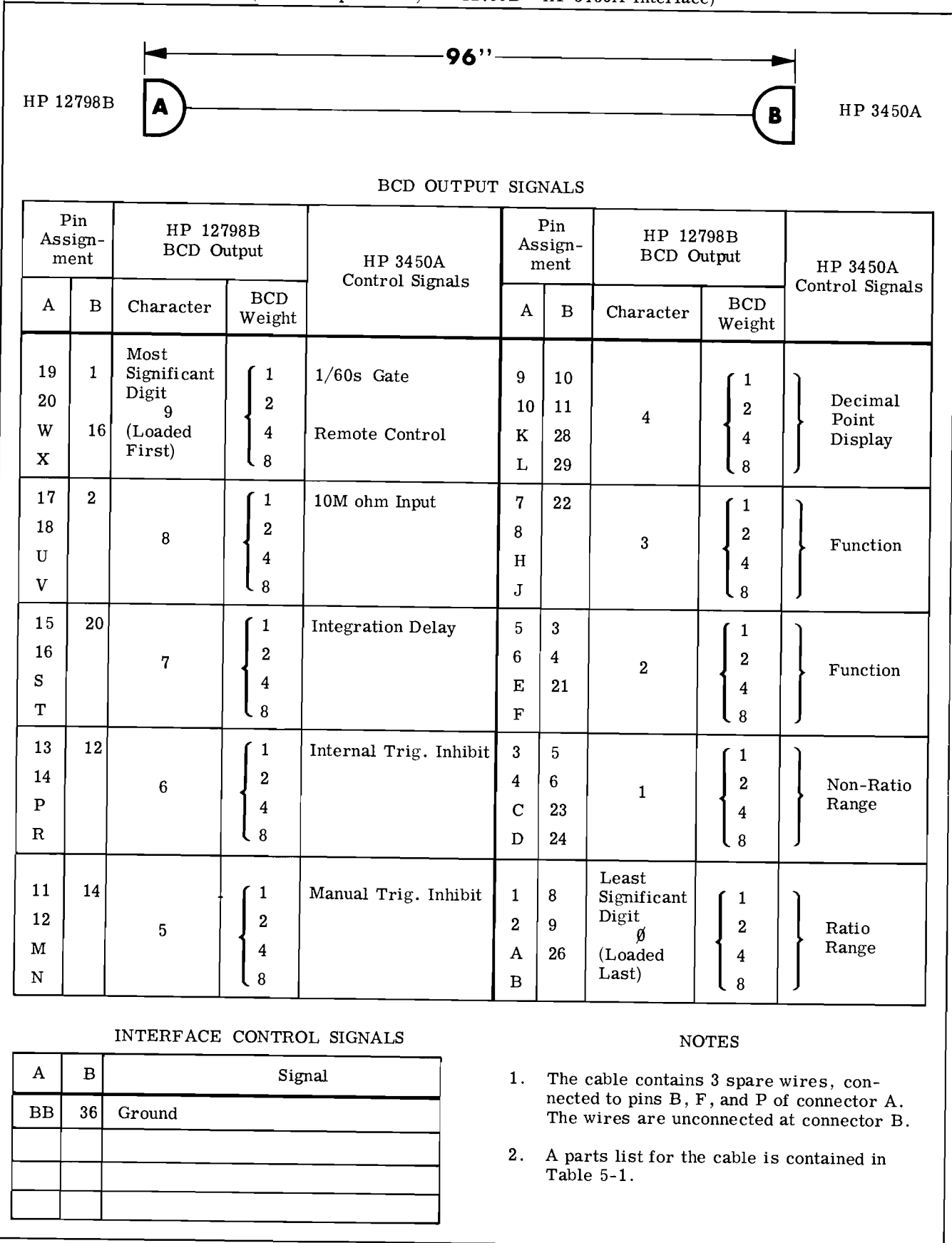


Table 2-5. Cable HP Stock No. 12798-60002 Wiring Information
(Part of Option 003, HP 12798B - HP 3450A Interface)



BCD OUTPUT SIGNALS

Pin Assignment		HP 12798B BCD Output		HP 3450A Control Signals	Pin Assignment		HP 12798B BCD Output		HP 3450A Control Signals
A	B	Character	BCD Weight		A	B	Character	BCD Weight	
19	1	Most Significant Digit 9 (Loaded First)	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	1/60s Gate	9	10	4	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Decimal Point Display
20				Remote Control	10	11			
W	16				K	28			
X					L	29			
17	2	8	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	10M ohm Input	7	22	3	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Function
18					8				
U					H				
V					J				
15	20	7	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Integration Delay	5	3	2	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Function
16					6	4			
S					E	21			
T					F				
13	12	6	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Internal Trig. Inhibit	3	5	1	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Non-Ratio Range
14					4	6			
P					C	23			
R					D	24			
11	14	5	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Manual Trig. Inhibit	1	8	Least Significant Digit ∅ (Loaded Last)	$\left\{ \begin{array}{l} 1 \\ 2 \\ 4 \\ 8 \end{array} \right.$	Ratio Range
12					2	9			
M					A	26			
N					B				

INTERFACE CONTROL SIGNALS

A	B	Signal
BB	36	Ground

NOTES

1. The cable contains 3 spare wires, connected to pins B, F, and P of connector A. The wires are unconnected at connector B.
2. A parts list for the cable is contained in Table 5-1.

Table 2-6. Cable HP Stock No. 12798-60003 Wiring Information
(Part of Option 004, HP 12798B - HP 3482A/84A Interface)

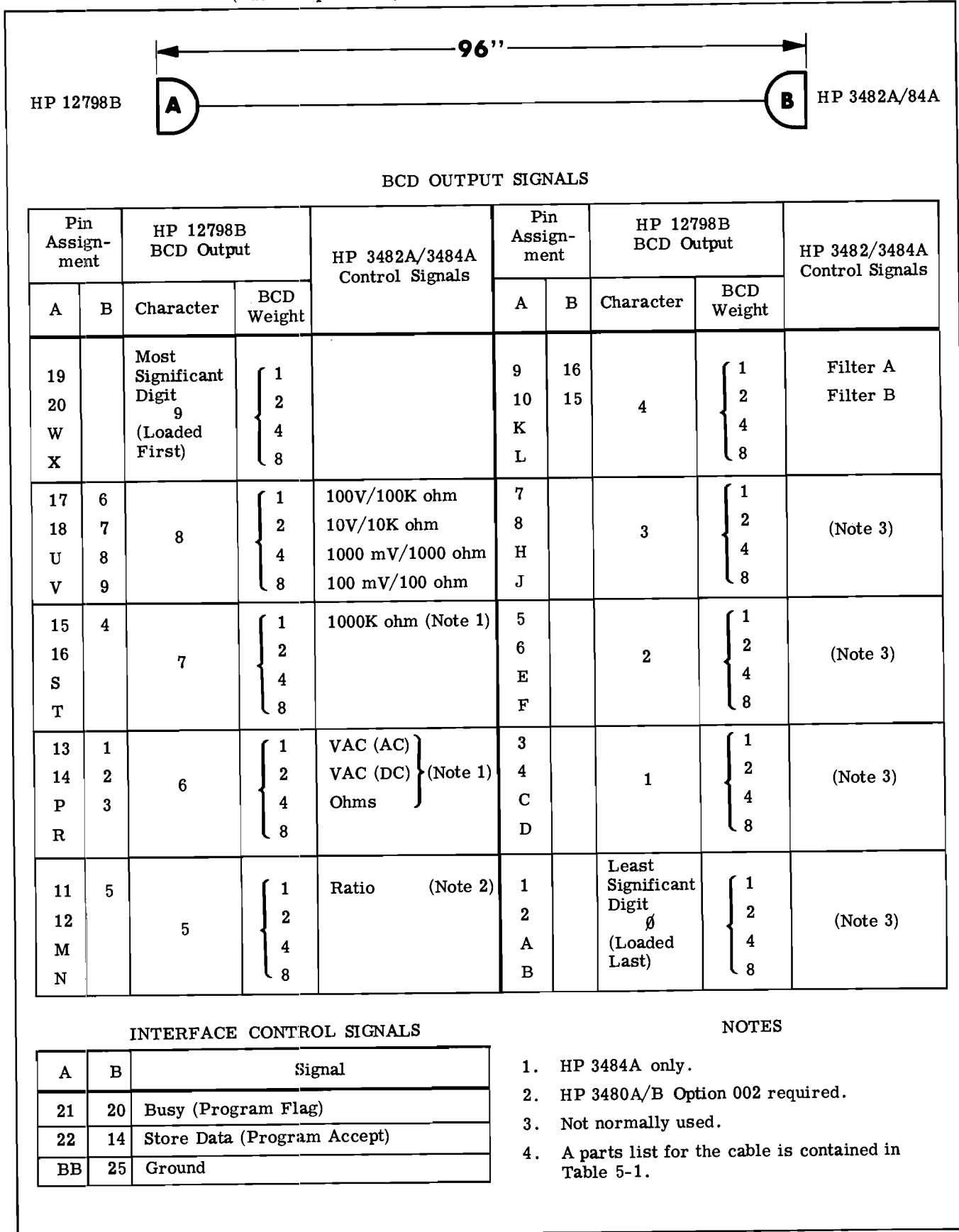


Table 2-7. Cable HP Stock No. 12798-60005 Wiring Information
(Part of Option 007, HP 12798B - HP 5325B Interface)

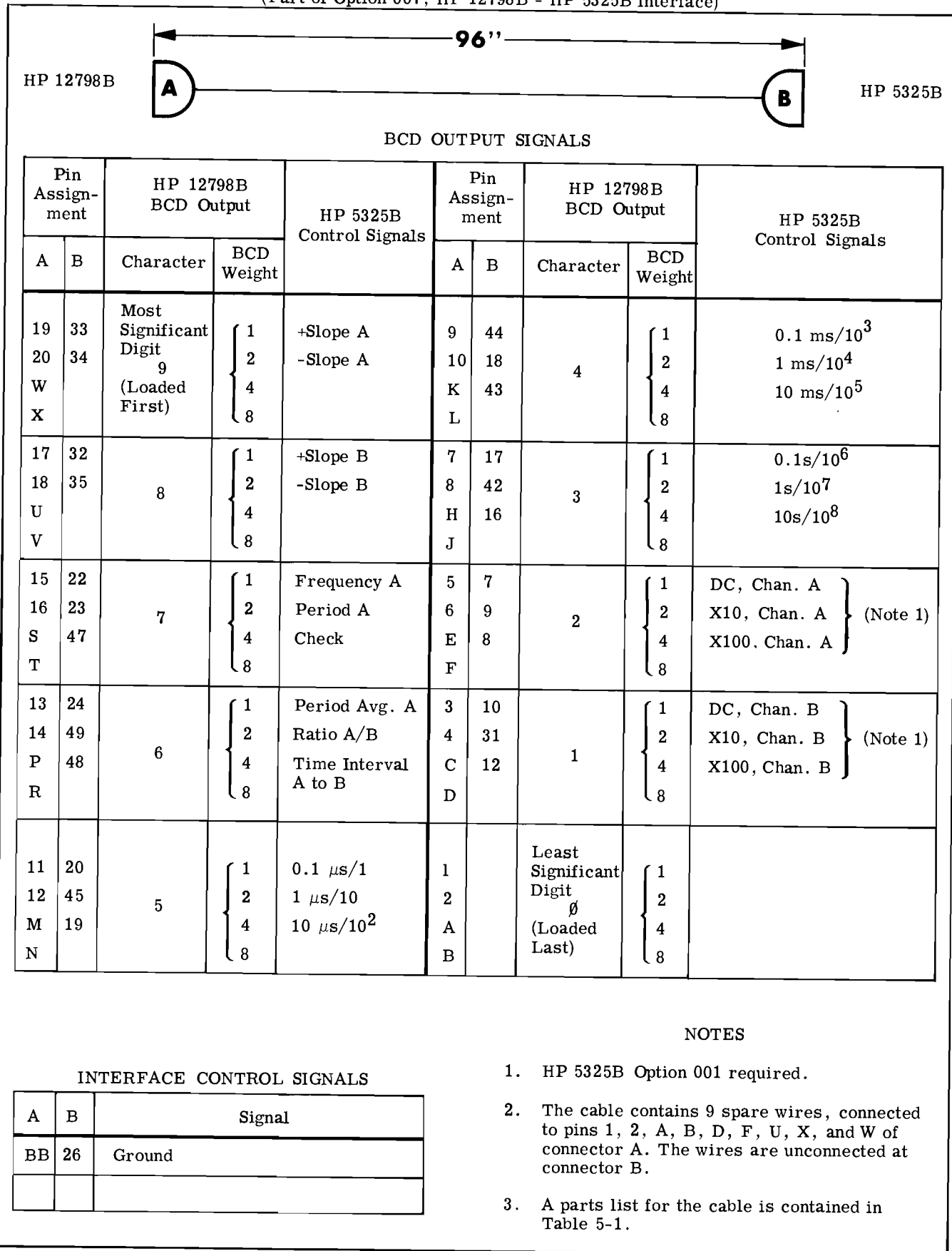
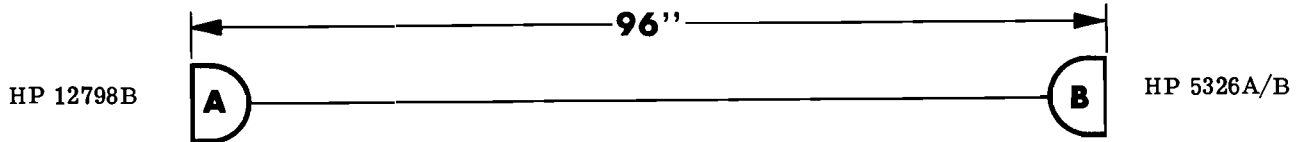


Table 2-8. Cable HP Stock No. 12798-60006 Wiring Information
(Part of Option 008, HP 12798B - HP 5326A/B Interface)



BCD OUTPUT SIGNALS

Pin Assignment		HP 12798B BCD Output		HP 5326A/B Control Signals	Pin Assignment		HP 12798B BCD Output		HP 5326A/B Control Signals								
A	B	Character	BCD Weight		A	B	Character	BCD Weight									
19 20 W X	17 14	Most Significant Digit 9 (Loaded First)	{ 1 2 4 8	External Check	9 10 K L	22 23 24	4	{ 1 2 4 8	0.1 ms/10 ³ 1 ms/10 ⁴ 10 ms/10 ⁵								
17 18 U V	6 7 5		8		{ 1 2 4 8	Frequency A Frequency C Period		7 8 H J		25 26 27	3	{ 1 2 4 8	0.1s/10 ⁶ 1s/10 ⁷ 10s/10 ⁸				
15 16 S T	2 4 3				7			{ 1 2 4 8		Period Average A Time Interval A to B Time Interval Avg.		5 6 E F		28	2	{ 1 2 4 8	-Slope A
13 14 P R	8 9 10							6				{ 1 2 4 8		Read A Read B DVM } (Note 1)		3 4 C D	
11 12 M N	19 20 21	5		{ 1 2 4 8			0.1 μs/1 1 μs/10 10 μs/10 ²		1 2 A B			11 12 13				Least Significant Digit ϕ (Loaded Last)	

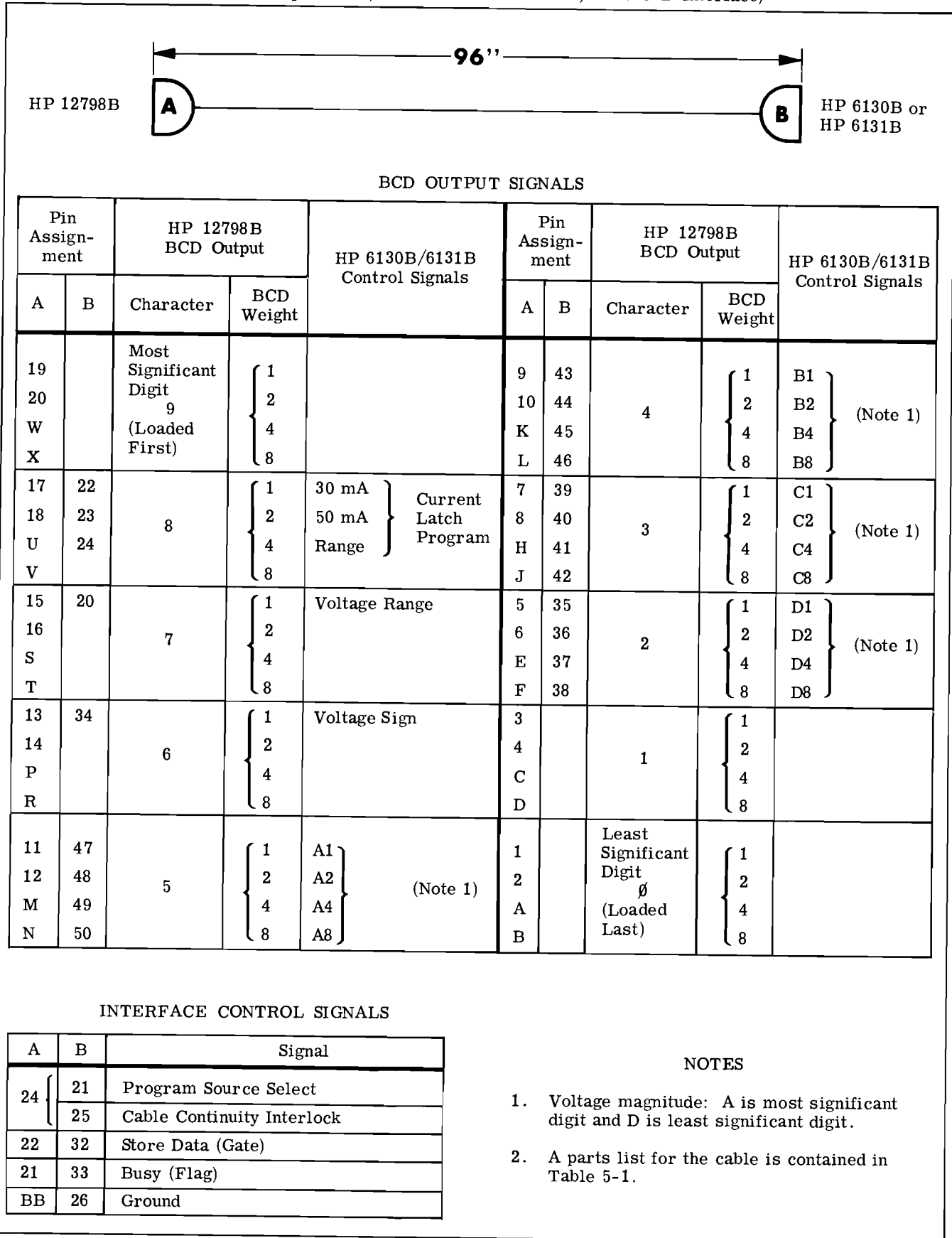
NOTES

1. HP 5326B only.
2. The cable contains 9 spare wires, connected to pins B, D, C, 4, F, E, 6, X, and W of connector A. The wires are unconnected at connector B.
3. A parts list for the cable is contained in Table 5-1.

INTERFACE CONTROL SIGNALS

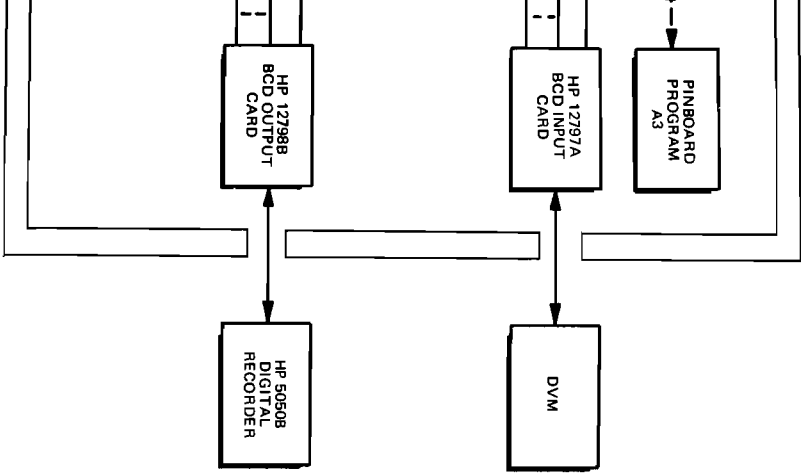
A	B	Signal
BB	18	Ground

Table 2-9. Cable Stock No. 12798-60009 Wiring Information
(Part of Option 005, HP 12798B - HP 6130B, HP 6131B Interface)



NOTES

1. Voltage magnitude: A is most significant digit and D is least significant digit.
2. A parts list for the cable is contained in Table 5-1.



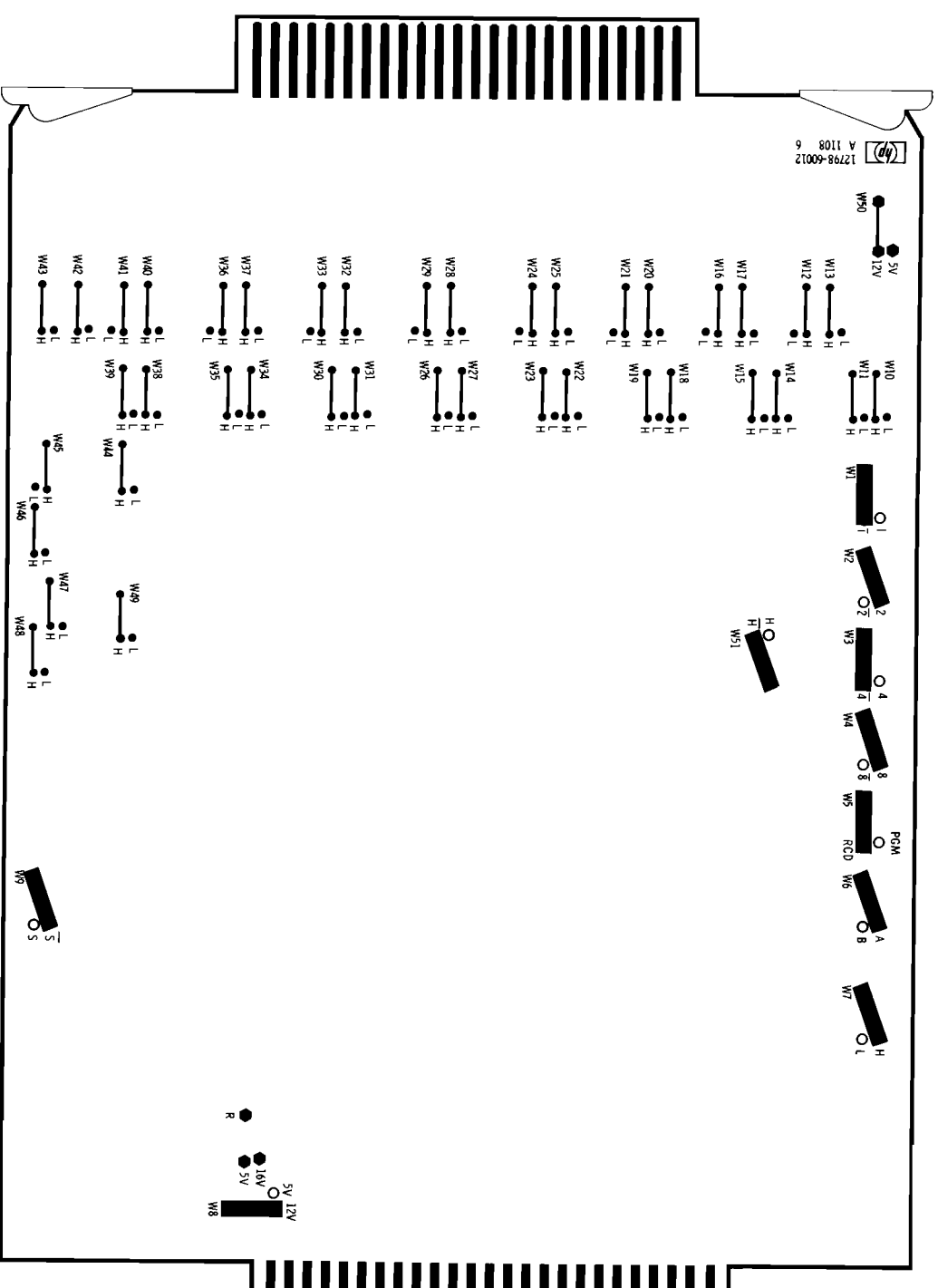
COUPLER/CONTROLLER PROGRAM

Step	Instruction	Function
0	@0E	Command DVM connected at slot 0 (HP 12797A) to encode (take reading).
1	@21	Command slot 2 (HP 12798B) to input data from the HP 2575A backplane and print this data on the digital recorder.
2	@00	Output data from slot 0 (HP 12797A) to the HP 2575A backplane. If no data is available, the main program will wait until data is available and then transmit to the backplane.

HP 2575A Coupler/Controller is a digital voltmeter and an HP 12797A BCD Input Card and is interfaced at I/O slot 2 with Output Card. It is desired to on the DVM and record the recorder.

ard matrix instruction program mper settings required to n are shown opposite. Note that am jumper is set to the SINGLE

HP 12798-60012 JUMPER SETTINGS



HP 2575A PINBOARD MATRIX

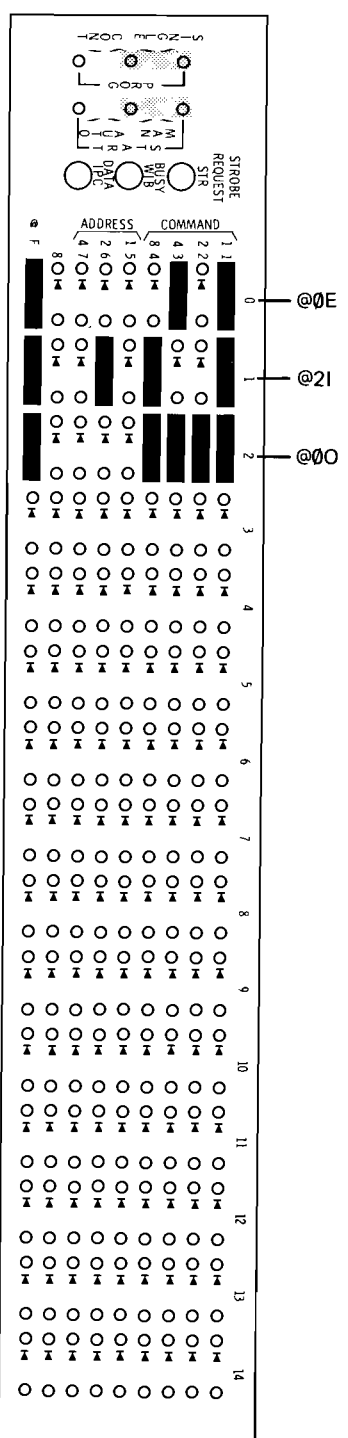
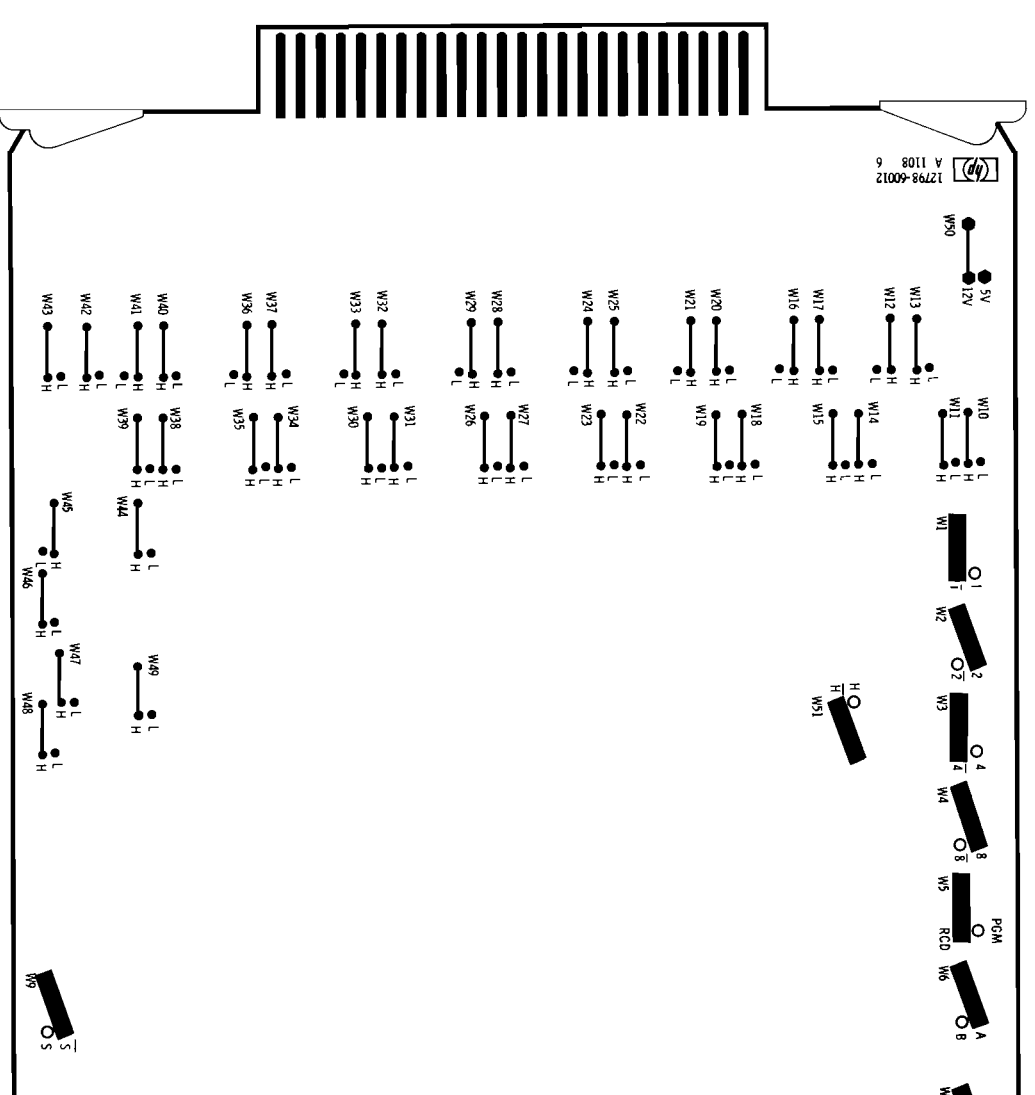
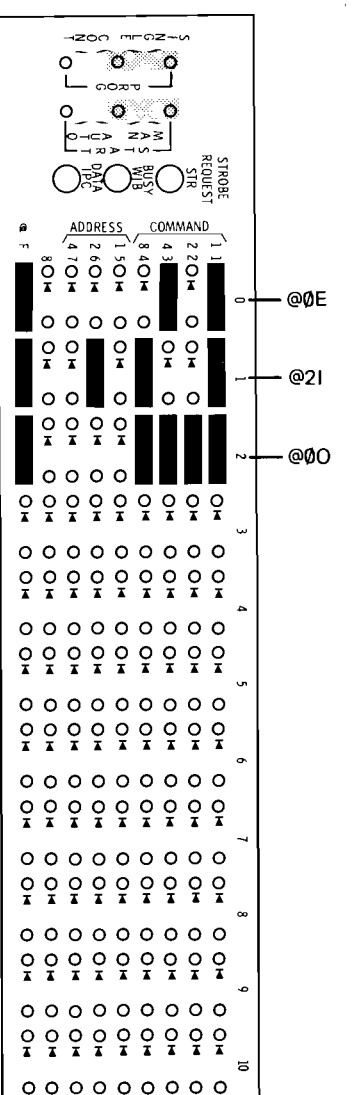


Figure 2-2. HP 12798B Application No. 1

HP 12798-60012 JUMPER SETTINGS

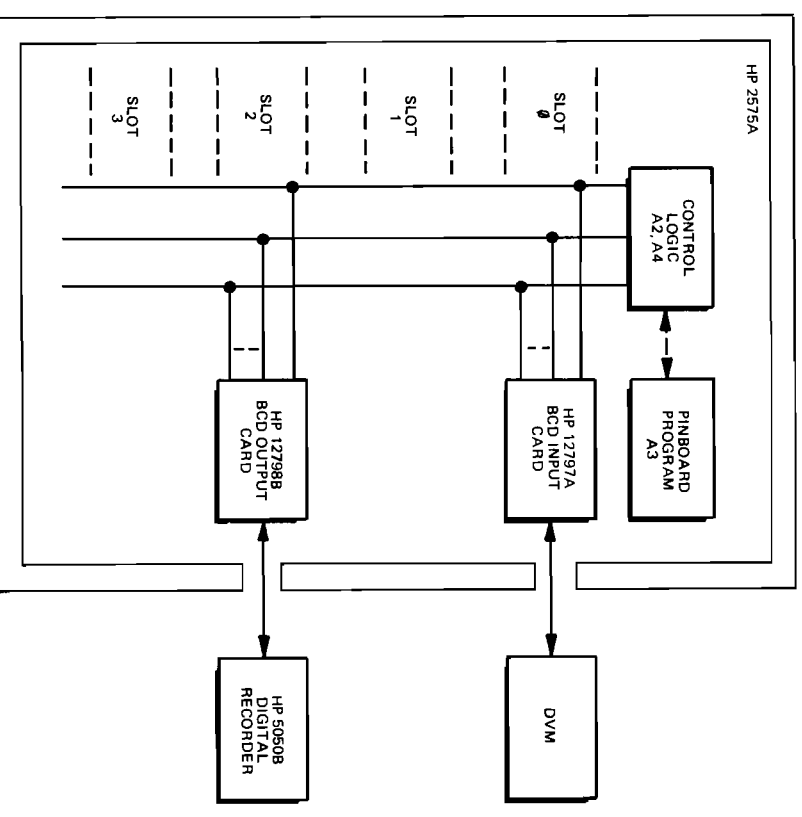


HP 2575A PINBOARD MATRIX



COUPLER/CONTROLLER PROGRAM

HP 2575A Pinboard Matrix		Function
Step	Instruction	
∅	@∅E	Command DVM connected at slot ∅ (HP 12797A) to encode (fake reading).
1	@21	Command slot 2 (HP 12798B) to input data from the HP 2575A backplane and print this data on the digital recorder.
2	@∅O	Output data from slot ∅ (HP 12797A) to the HP 2575A backplane. If no data is available, the main program will wait until data is available and then transmitted to the backplane.

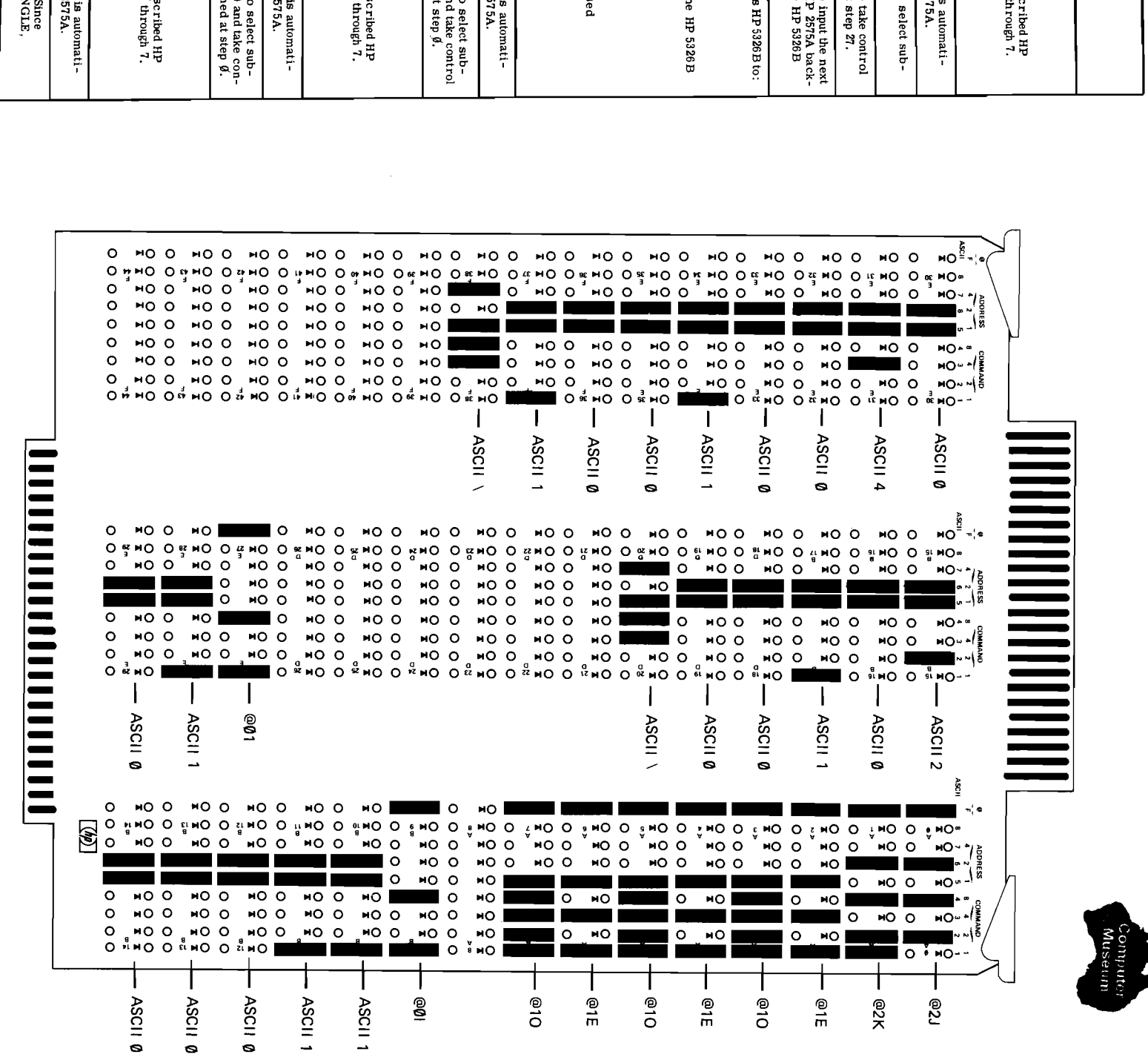


In this example, the HP 2575A Coupler/Controller is being used to control a digital voltmeter and an HP 5050B Digital Recorder. The DVM is interfaced at I/O slot ∅ with an HP 12797A BCD Input Card and the digital recorder is interfaced at I/O slot 2 with the HP 12798B BCD Output Card. It is desired to take a single reading on the DVM and record the result on the digital recorder.

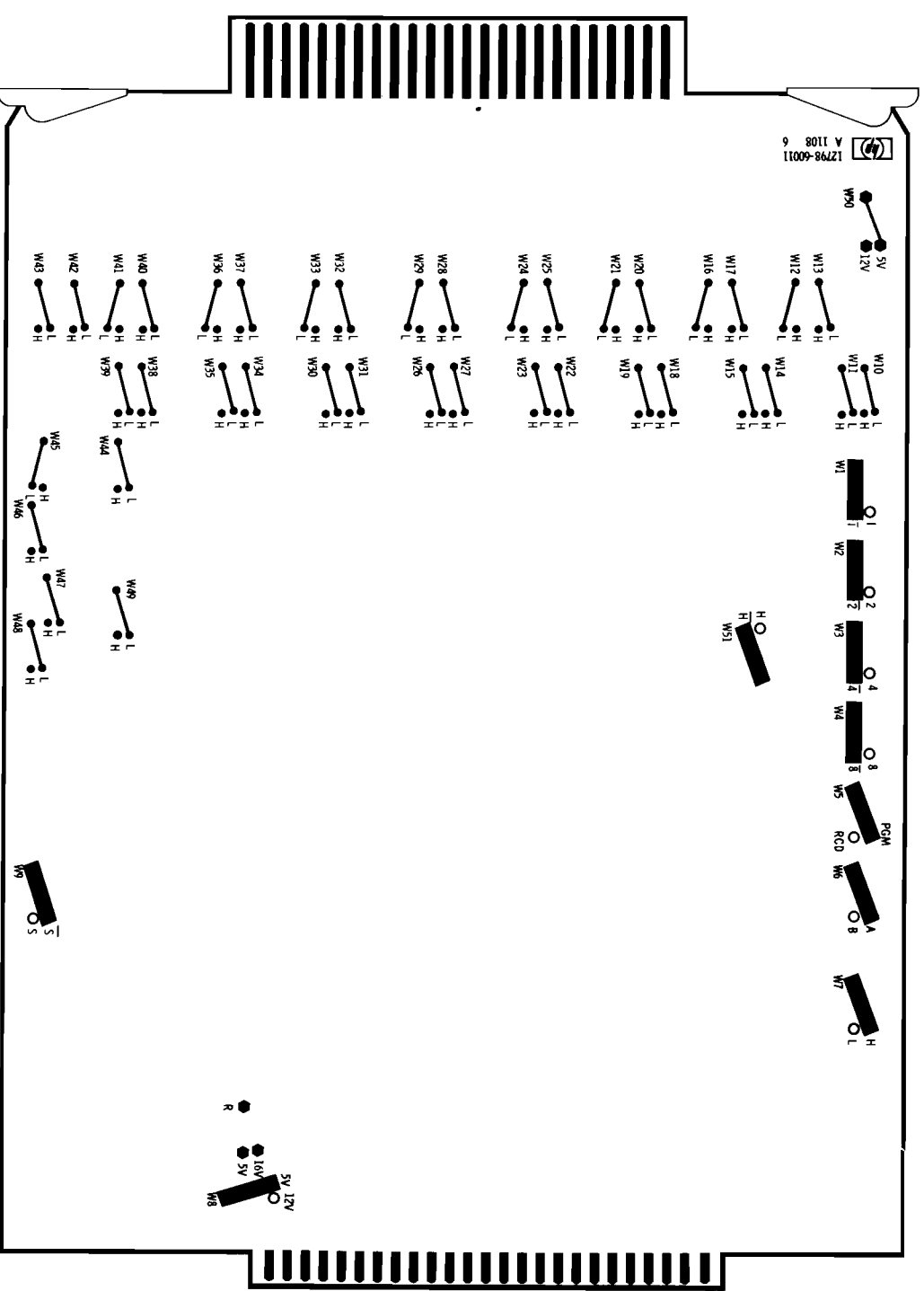
The HP 2575A pinboard matrix instruction program and the HP 12798B jumper settings required to achieve this operation are shown opposite. Note that the HP 2575A PROGRAM jumper is set to the SINGLE position.

Figure

HP 12807A PINBOARD PROGRAM CARD



HP 12798-60011 JUMPER SETTINGS



HP 2575A PINBOARD MATRIX

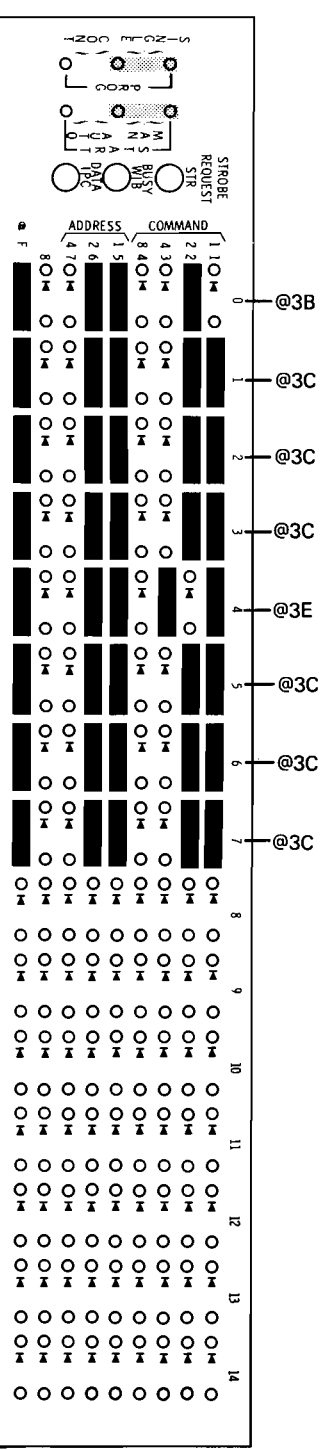
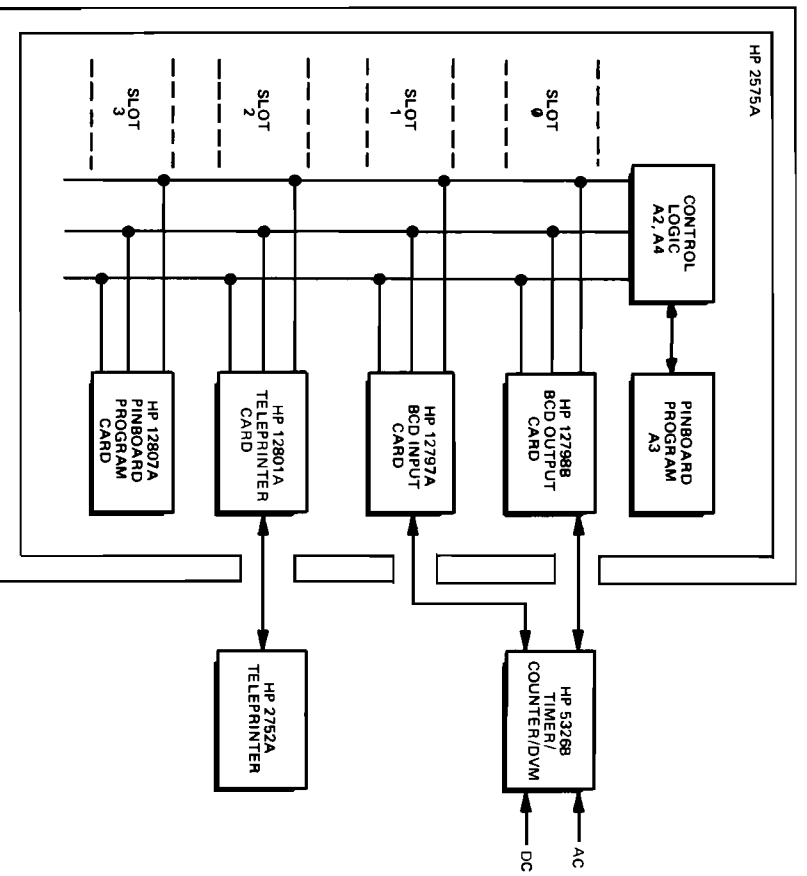


Figure 2-2. HP 12798B Application No. 1

Figure 2-3. HP 12798B Application No. 2

COUPLER/CONTROLLER PROGRAM



In this example, the HP 2575A is being used to control an HP 5326B Timer/Counter/DVM and an HP 2752A Teleprinter. The Timer/Counter/DVM is interfaced with an HP 12797A BCD Input Card (to input data) at I/O slot 1 and an HP 12798B BCD Output Card (for instrument programming) at I/O slot 0. The teleprinter is interfaced at I/O slot 2 with an HP 12801A Teleprinter Card and an HP 12807A Pinboard Program Card located in I/O slot 3 augments the programming capability of the HP 2575A.

It is desired to operate the system as follows:

- Program the Timer/Counter DVM to measure an external ac signal at input channel A using a 1ms time base and triggering on the negative slope of the input signal at channel A.
- Take six consecutive readings on the Timer/Counter/DVM and print out the test results in three lines on the teleprinter, as shown below:

```
0001873 0001874 0001874
0001871 0001871 0001872
```

c. Change the Counter/DVM program to measure a slowly changing voltage at the DVM input using a 0.1s time base and a range setting of 10V.

d. Take six consecutive readings on the Timer/Counter/DVM and print out the test results in three lines on the teleprinter, as shown below:

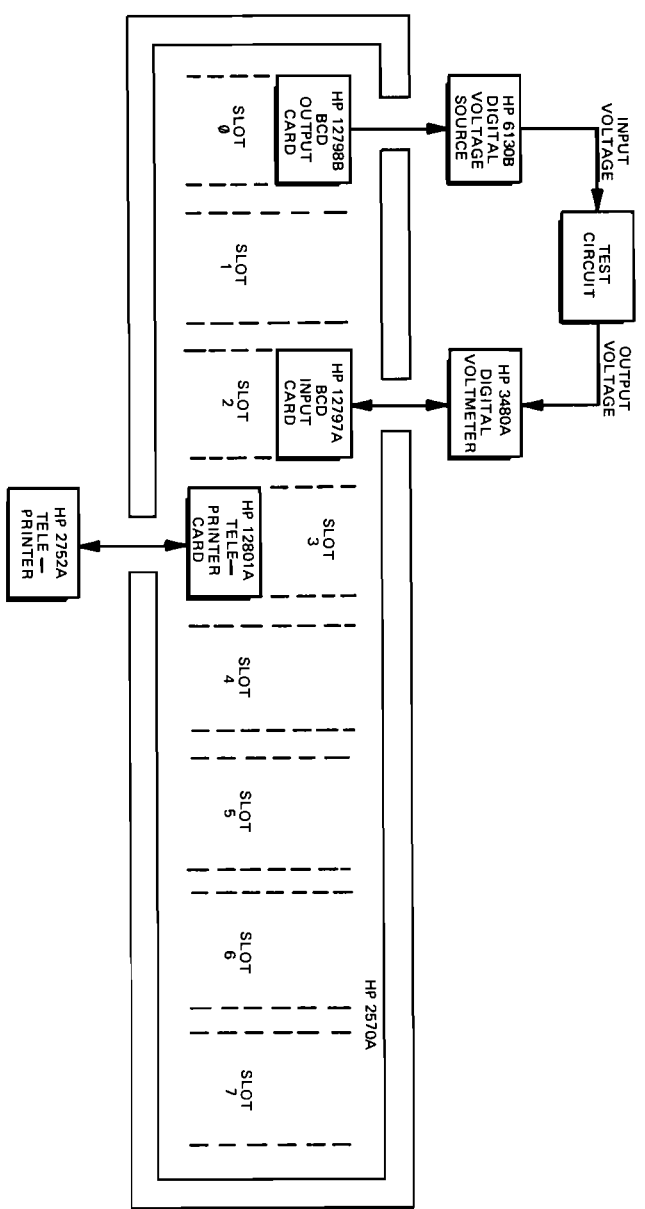
```
0002745 0001632 0000932
0000121 -0000654 -0001367
```

e. Return system to a system normalize (reset) condition.

The HP 2575A pinboard matrix instructions, HP 12807A Pinboard Program Card instructions, and HP 12798B BCD Output Card jumper settings required to achieve this operation are shown opposite. Note that the @ (flag) bit is set for instructions and not set for ASCII characters. Also, note that the HP 2575A PROGRAM Jumper is set to SINGLE.

HP 2575A Pinboard Matrix	Step	Instruction	HP 12807A Pinboard Card	Step	Instruction	Function
∅	@3B		9	@∅I	Command slot 3 (HP 12807A) to select sub-routine B (starting at step 9).	
1	@3C		∅		Command slot 3 (HP 12807A) to take control with instruction programmed at step 9.	
			∅		Command slot 0 (HP 12798B) to input the next data word that appears on the HP 2575A backplane and output that data to the HP 5326B Timer/Counter/DVM.	
			∅		Remote programming word instructs slot 0 (HP 5326B) to:	
			1∅	ASCII 1	1 measure external signal	
			11	ASCII 1	∅	
			12	ASCII 1	∅	
			13	ASCII 1	∅	
			14	ASCII 1	∅	
			15	ASCII 1	∅	
			16	ASCII 1	∅	
			17	ASCII 1	1 triggering on the negative slope of the signal on channel A	
			18	ASCII 1	∅ channel B trigger slope	
			19	ASCII 1	∅ and DVM range are not used	
			20	ASCII 1	∅ End of word character	
			21		Blank Program Step - control is automatically transferred back to the HP 2575A.	
2	@3C		1	@2K	Command slot 2 (HP 12801A) to input data from the HP 2575A backplane and print this data on the teleprinter.	
			2	@1E	Command Timer/Counter/DVM connected at slot 1 (HP 12797A) to encode (take a reading).	
			3	@1O	Output data from slot 1 (HP 12797A) to the HP 2575A backplane. If no data is available, the main program will wait until data is available and then transmitted to the backplane.	
			4	@1E	Command Timer/Counter/DVM connected at slot 1 (HP 12797A) to encode (take a reading).	
			5	@1O	Output data from slot 1 (HP 12797A) to the HP 2575A backplane. If no data is available, the main program will wait until data is available and then transmitted to the backplane.	
			6	@1E	Command Timer/Counter/DVM connected at slot 1 (HP 12797A) to encode (take a reading).	
			7	@1O	Output data from slot 1 (HP 12797A) to the HP 2575A backplane. If no data is available, the main program will wait until data is available and data transmitted to the backplane.	
			8		Blank Program Step - control is automatically transferred back to the HP 2575A.	
3	@3C				Command slot 3 (HP 12807A) to select sub-routine A (starting at step 0) and take control with instruction programmed at step 0.	
			4		Command slot 3 (HP 12807A) to take control with instruction programmed at step 27.	
			5	@3C	Command slot 3 (HP 12807A) to select sub-routine E (starting at step 27).	
			6	@∅C	Command slot 3 (HP 12807A) to select sub-routine A (starting at step 0) and take control with instruction programmed at step 0.	
			7	@3C	Command slot 3 (HP 12807A) to select sub-routine A (starting at step 0) and take control with instruction programmed at step 0.	
			8		Blank Program Step - control is automatically transferred back to HP 2575A.	
			∅	@2I	∅	} Similar to previously described HP 12807A Program Steps 0 through 7.
			1	@2K	∅	
			2	@1E	∅	
			3	@1O	∅	
			4	@1E	∅	
			5	@1O	∅	
			6	@1E	∅	
			7	@1O	∅	
			8		Blank Program Step - control is automatically transferred back to HP 2575A.	
			∅		Blank Program Step - control is automatically transferred back to HP 2575A.	
			∅		Blank Program Step - control is automatically transferred back to HP 2575A.	
			∅		HP 2575A assumes control. Since PROGRAM Jumper is set to SINGLE, system halts.	

COUPLER/CONTROLLER PROGRAM



The example shows the HP 2570A being used to control an HP 3480A Digital Voltmeter, an HP 6130B Digital Voltage Source, and an HP 2752A Teleprinter. The DVM is interfaced at I/O slot 2 with an HP 12797A BCD Input Card, the voltage source at I/O slot 0, with an HP 12798B BCD Output Card, and the teleprinter at I/O slot 3 with an HP 12801A Teleprinter Interface Card.

Using the teleprinter tape reader as a program source the following system operation is desired:

- a. Program the voltage source to apply + 5V to the test circuit.
- b. Carriage return and line feed the teleprinter.
- c. Print the heading "5V TEST" on the teleprinter. Carriage return and line feed the teleprinter.
- d. Take a DVM reading of the test circuit output voltage.
- e. Print the test result on the teleprinter.
- f. Change the voltage source output to + 6V.
- g. Carriage return and line feed the teleprinter.
- h. Print the heading "6V TEST" on the teleprinter. Carriage return and line feed the teleprinter.
- i. Take a DVM reading of the test circuit output voltage.
- j. Print the test result on the teleprinter. Carriage return and line feed the teleprinter.
- k. Print the heading "END OF TESTS" on the teleprinter. Carriage return and line feed the teleprinter.

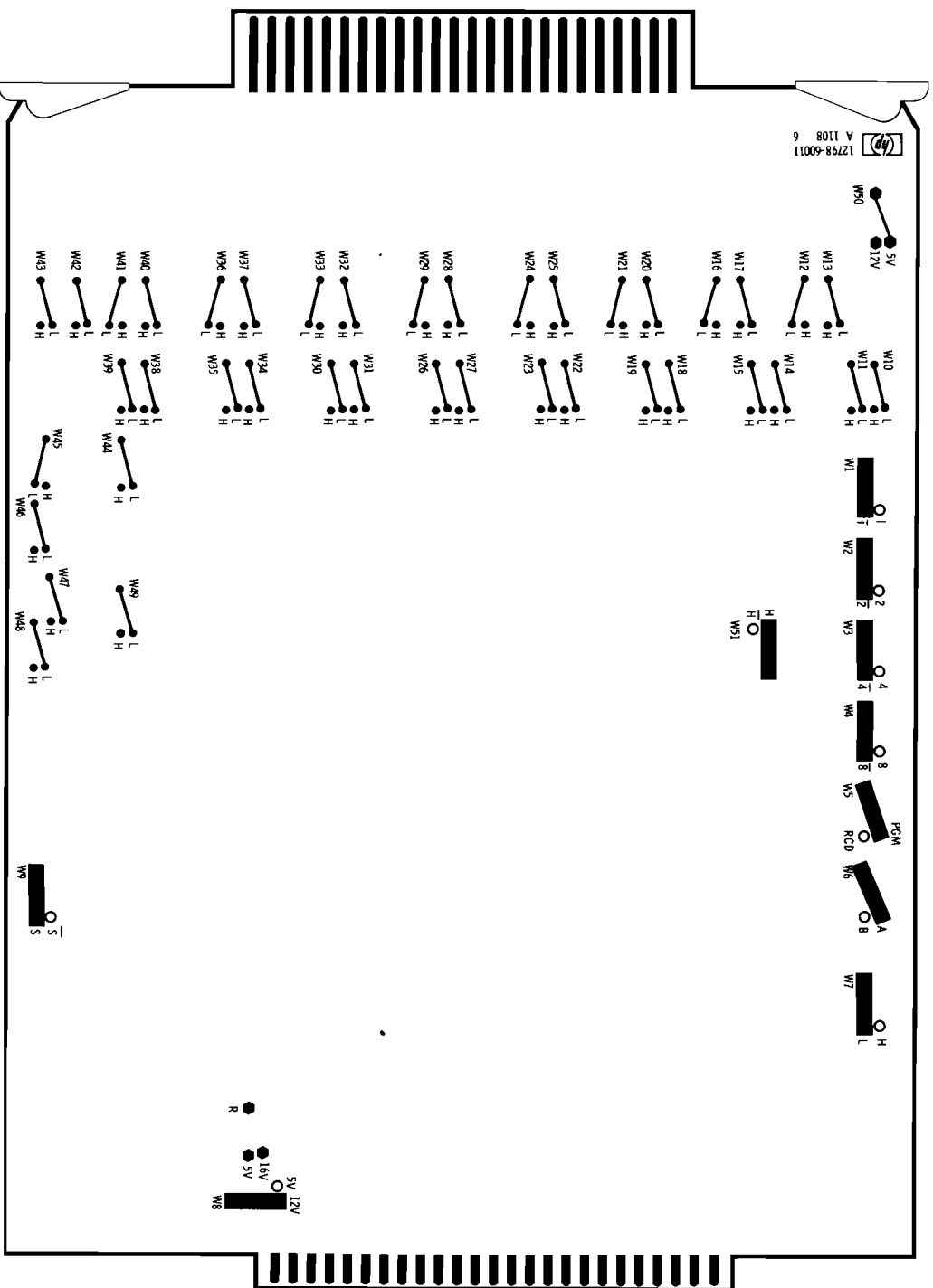
To prepare the system for operation, proceed as follows:

1. Set the teleprinter to LOCAL and energize the tape punch. Punch out the following tape with sufficient leader to form a loop:

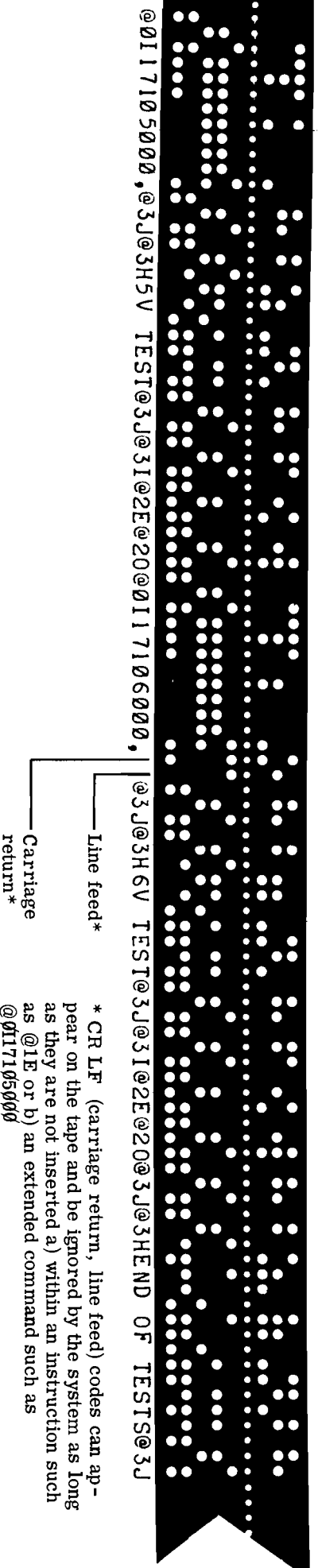

```
@0117105900, @31@3H5V TEST@3J @31@2E@20@0117106000,
@3J@3H6V TEST@3J @31@2E@0C@3J@3HEND OF TESTS @3J
```
2. The tape is shown opposite. Note that the teleprinter keyboard carriage return and line feed keys were activated following the second comma in the program, causing CR LF characters to be punched on the tape. These characters are ignored by the system provided the rules noted below the tape illustration are followed.
 - a. Splice the tape into a loop and install it on the teleprinter tape reader.
 - b. Energize the peripheral equipment and adjust it for correct operation. Set the HP 2570A LINE ON/OFF switch to ON.
 - c. Set the teleprinter to LINE and the tape reader to START.
 - d. Type @3C on the teleprinter keyboard. This instructs the teleprinter to take control and cause the next data word that appears on the HP 2570A backplane and output that data to the HP 6130B.

Instruction/ ASCII Character	Function	Instruction/ ASCII Character	
@01	Command slot 0 (HP 12798B) to input the next data word that appears on the HP 2570A backplane and output that data to the HP 6130B.		
1	Remote programming word instructs HP 6130B to: 1 Enable 7 1000 mA latch 1 X1 Range 0 Plus polarity 5 } Output 5000 mV (5V) 0 } 0 } 0 }	1	Enable
7		10	1000 mA latch
1		1	X1 Range
0		0	Plus polarity
5		0	Output 5000 mV (5V)
0			
,	End of word character	@3J	Command turn at
@3J	Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.	@3H	Command charac this da
@3H	Command slot 3 (HP 12801A) to input next characters as heading information and print the data on the teleprinter.	6V TEST	Headin
		@3J	Comm return
5V TEST	Heading information.	@31	Comm from t data on
@3J	Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.		
@31	Command slot 3 (HP 12801A) to input data from the HP 2570A backplane and print this data on the teleprinter.	@2E	Comm encode
@2E	Command HP 3480A connected at slot 2 to encode (take a reading).	@20	Output HP 2570A backplane and output that data to the HP 6130B.
@20	Output data from slot 2 (HP 12797A) to the HP 2570A backplane. If no data is available, the main program will wait until data is available, and then transmitted to the backplane.	@3J	Comm return
		@3H	Comm next cl and pr
@01	Command slot 0 (HP 12798B) to input the next data word that appears on the HP 2570A backplane and output that data to the HP 6130B.	END OF TESTS	Headin
		@3J	Comm return

HP 12798-60011 JUMPER SETTINGS



PROGRAM TAPE



* CR LF (carriage return, line feed) codes can appear on the tape and be ignored by the system as long as they are not inserted a) within an instruction such as @1E or b) an extended command such as @0117105000

Character/ Character	Function
Remote programming word instructs slot HP 6130B to:	
1	Enable
7	1000 mA latch
1	X1 Range
0	Plus Polarity
6	Output 6000 mV (6V)
0	
0	
,	End of word character
Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.	
Command slot 3 (HP 12801A) to input next characters as heading information and print this data on the teleprinter.	
Heading information.	
Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.	
Command slot 3 (HP 12801A) to input data from the HP 2570A backplane and print this data on the teleprinter.	
Command HP 3480A connected at slot 2 to encode (take a reading).	
Output data from slot 2 (HP 12797A) to the HP 2570A backplane. If no data is available, the main program will wait until data is available, and then transmitted to the backplane.	
Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.	
Command slot 3 (HP 12801A) to input next characters as heading information and print this data on the teleprinter.	
Heading information.	
Command slot 3 (HP 12801A) to carriage return and line feed the teleprinter.	

PROGRAM

Figure 2-4. HP 12798B Application No. 3

Table 2-10. HP 12798B Junction Functions

Jumper	Function	Jumper	Function	Jumper	Function	Jumper	Function																																																																																																																																																																								
W1 through W4	<p>Select a preset bit pattern for all BCD output digits as shown below:</p> <p>W1 = BCD bit 1, '0' level</p> <p>W1 = BCD bit 1, '1' level</p> <p>W2, W3, and W4 similarly program BCD bit 2, BCD bit 4, and BCD bit 8, respectively.</p> <p>BIT VOLTAGE</p> <table border="1"> <tr> <td>HP 12798-60010 (Positive-true Output card)</td> <td>HP 12798-60011 (Ground-true output card)</td> <td>HP 12798-60012 (+12V-true output card)</td> </tr> <tr> <td>'0' = +0.4V ±0.4V '1' = +5V ±0.5V</td> <td>'0' = +5V ±0.5V '1' = +0.4V ±0.4V</td> <td>'0' = +0.4V ±0.4V '1' = +12V ±1V</td> </tr> </table> <p>Note: Bit voltage level is selected by hard-wired jumper W50</p> <p>PROGRAMMING EXAMPLE</p> <p>Preset bit pattern <u>BCD 1248</u> 1100</p> <p>W1 1 W2 2 W3 4 W4 8</p>	HP 12798-60010 (Positive-true Output card)	HP 12798-60011 (Ground-true output card)	HP 12798-60012 (+12V-true output card)	'0' = +0.4V ±0.4V '1' = +5V ±0.5V	'0' = +5V ±0.5V '1' = +0.4V ±0.4V	'0' = +0.4V ±0.4V '1' = +12V ±1V	W10 through W49	<p>Control the bit voltage sense of the BCD output lines.</p> <p>Note: These jumpers are hard-wired in the factory and field changeover is not recommended.</p> <p>HP 12798-60010 and HP 12798-60012 CARDS</p> <p>All jumpers are set to:</p> <p> L H</p> <p>Output levels are:</p> <table border="1"> <tr> <td>12798-60010 Card</td> <td>12798-60012 Card</td> </tr> <tr> <td>Logic '1' = +5V ±0.5V Logic '0' = +0.4V ±0.4V</td> <td>Logic '1' = +12V ±1V Logic '0' = +0.4V ±0.4V</td> </tr> </table> <p>Note: Level is selected by hard-wired jumper W50.</p> <p>HP 12798-60011 CARD</p> <p>All jumpers are set to:</p> <p> L H</p> <p>Output Levels are:</p> <p>Logic '1' = +0.4V ±0.4V Logic '0' = +5V ±0.5V</p> <p>Note: Logic '0' = +12V ±1V may be selected by moving hard-wired jumper W50 to '12V'.</p> <p>The individual jumpers are identified in the table below:</p> <table border="1"> <thead> <tr> <th>Character</th> <th>BCD Weight</th> <th>Jumper</th> <th>Character</th> <th>BCD Weight</th> <th>Jumper</th> </tr> </thead> <tbody> <tr> <td>Most Significant Digit (Loaded first)</td> <td>1</td> <td>W46</td> <td>4</td> <td>1</td> <td>W26</td> </tr> <tr> <td></td> <td>2</td> <td>W47</td> <td></td> <td>2</td> <td>W27</td> </tr> <tr> <td></td> <td>4</td> <td>W48</td> <td></td> <td>4</td> <td>W28</td> </tr> <tr> <td></td> <td>8</td> <td>W49</td> <td></td> <td>8</td> <td>W29</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>W42</td> <td>3</td> <td>1</td> <td>W22</td> </tr> <tr> <td></td> <td>2</td> <td>W43</td> <td></td> <td>2</td> <td>W23</td> </tr> <tr> <td></td> <td>4</td> <td>W44</td> <td></td> <td>4</td> <td>W24</td> </tr> <tr> <td></td> <td>8</td> <td>W45</td> <td></td> <td>8</td> <td>W25</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>W38</td> <td>2</td> <td>1</td> <td>W18</td> </tr> <tr> <td></td> <td>2</td> <td>W39</td> <td></td> <td>2</td> <td>W19</td> </tr> <tr> <td></td> <td>4</td> <td>W40</td> <td></td> <td>4</td> <td>W20</td> </tr> <tr> <td></td> <td>8</td> <td>W41</td> <td></td> <td>8</td> <td>W21</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>W34</td> <td>1</td> <td>1</td> <td>W14</td> </tr> <tr> <td></td> <td>2</td> <td>W35</td> <td></td> <td>2</td> <td>W15</td> </tr> <tr> <td></td> <td>4</td> <td>W36</td> <td></td> <td>4</td> <td>W16</td> </tr> <tr> <td></td> <td>8</td> <td>W37</td> <td></td> <td>8</td> <td>W17</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>1</td> <td>W30</td> <td>Least Significant Digit (Loaded last)</td> <td>1</td> <td>W10</td> </tr> <tr> <td></td> <td>2</td> <td>W31</td> <td></td> <td>2</td> <td>W11</td> </tr> <tr> <td></td> <td>4</td> <td>W32</td> <td></td> <td>4</td> <td>W12</td> </tr> <tr> <td></td> <td>8</td> <td>W33</td> <td></td> <td>8</td> <td>W13</td> </tr> </tbody> </table>	12798-60010 Card	12798-60012 Card	Logic '1' = +5V ±0.5V Logic '0' = +0.4V ±0.4V	Logic '1' = +12V ±1V Logic '0' = +0.4V ±0.4V	Character	BCD Weight	Jumper	Character	BCD Weight	Jumper	Most Significant Digit (Loaded first)	1	W46	4	1	W26		2	W47		2	W27		4	W48		4	W28		8	W49		8	W29								1	W42	3	1	W22		2	W43		2	W23		4	W44		4	W24		8	W45		8	W25								1	W38	2	1	W18		2	W39		2	W19		4	W40		4	W20		8	W41		8	W21								1	W34	1	1	W14		2	W35		2	W15		4	W36		4	W16		8	W37		8	W17								1	W30	Least Significant Digit (Loaded last)	1	W10		2	W31		2	W11		4	W32		4	W12		8	W33		8	W13	W5	<p>Selects operating mode of card.</p> <p>W5 PGM = Program mode of operation chosen when card is used for instrument programming or similar functions. (HP 12798B ignores any space, minus, or decimal point within the data word.)</p> <p>W5 RCD = Record mode of operation used when card is employed to interface a parallel input recorder. (HP 12798B accepts space, minus, and decimal point and outputs a modified 4-bit code for each character.)</p>	W50	<p>Selects bit voltage level for all BCD output lines.</p> <p>W50 5V = +12V ±1V through 10K ohms</p> <p>W50 12V = +5V ±0.5V through 10K ohms</p> <p>Note: Jumper W50 is hard-wired as follows: 12798-60010 card: 5V 12798-60011 card: 5V 12798-60012 card: 12V Jumper may be set as desired.</p>	W6	<p>Selects Trigger sense of Busy signal applied at card terminal 21.</p> <p>W6 A = Typical Busy Inputs</p> <p>W6 B = Trigger</p> <p>Negative-going trigger resets Store Data signal and allows card to accept new data.</p>	W9, W51	<p>Control action of the Wait-Busy (NWI/B) circuitry on the card, allowing selection of the start and end of the NWI/B signal within the Store Data/Busy cycle. The four settings of W9, W51 and corresponding Wait-Busy signals selected are detailed below:</p> <p>W9 H, W51 H = Store Data</p> <p>W9 H, W51 S = Busy</p> <p>W9 O, W51 H = Wait-Busy (NWI/B)</p> <p>W9 O, W51 S = Wait-Busy (NWI/B)</p> <p>Note: W51 "H" position can only be used with ground-true Busy signals.</p>	W7	<p>Selects sense of Store Data signal output at card terminal 22.</p> <p>W7 H = Store Data</p> <p>W7 L = Store Data</p> <p>Note: Amplitude of Store Data signal is programmed by jumper W8.</p>	W8	<p>Selects amplitude of Store Data signal programmed by jumper W7.</p> <p>W8 5V 12V = +12V ±1V through 330 ohms</p> <p>W8 5V 12V = +5V ±0.5V through 330 ohms</p> <p>R</p> <p>Terminals permit a pull-up resistor to be connected for use by an external Busy line.</p> <p> 0 16V = Resistor connected to +16V supply. Minimum value 3.9K ohms.</p> <p> 0 5V = Resistor connected to +5V supply. Minimum value 100 ohms.</p>
HP 12798-60010 (Positive-true Output card)	HP 12798-60011 (Ground-true output card)	HP 12798-60012 (+12V-true output card)																																																																																																																																																																													
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Figure 2-4. HP 12798B Application No. 3

DATA WORD

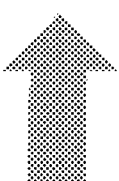
Pin	HP 5050A/B Printout Columns ①	BCD Weight	Pin	HP 5050A/B Printout Columns ①	BCD Weight
19	Most Significant Digit 10	1	9	Least Significant Digit 1	1
20		2	10		2
W		4	K		4
X	(Loaded First)	8	L	(Loaded Last)	8
17	9	1	7	4	1
18		2	8		2
U		4	H		4
V		8	J		8
15	8	1	5	3	1
16		2	6		2
S		4	E		4
T		8	F		8
13	7	1	3	2	1
14		2	4		2
P		4	C		4
R		8	D		8
11	6	1	1	1	1
12		2	2		2
M		4	A		4
N		8	B		8

CONTROL SIGNALS

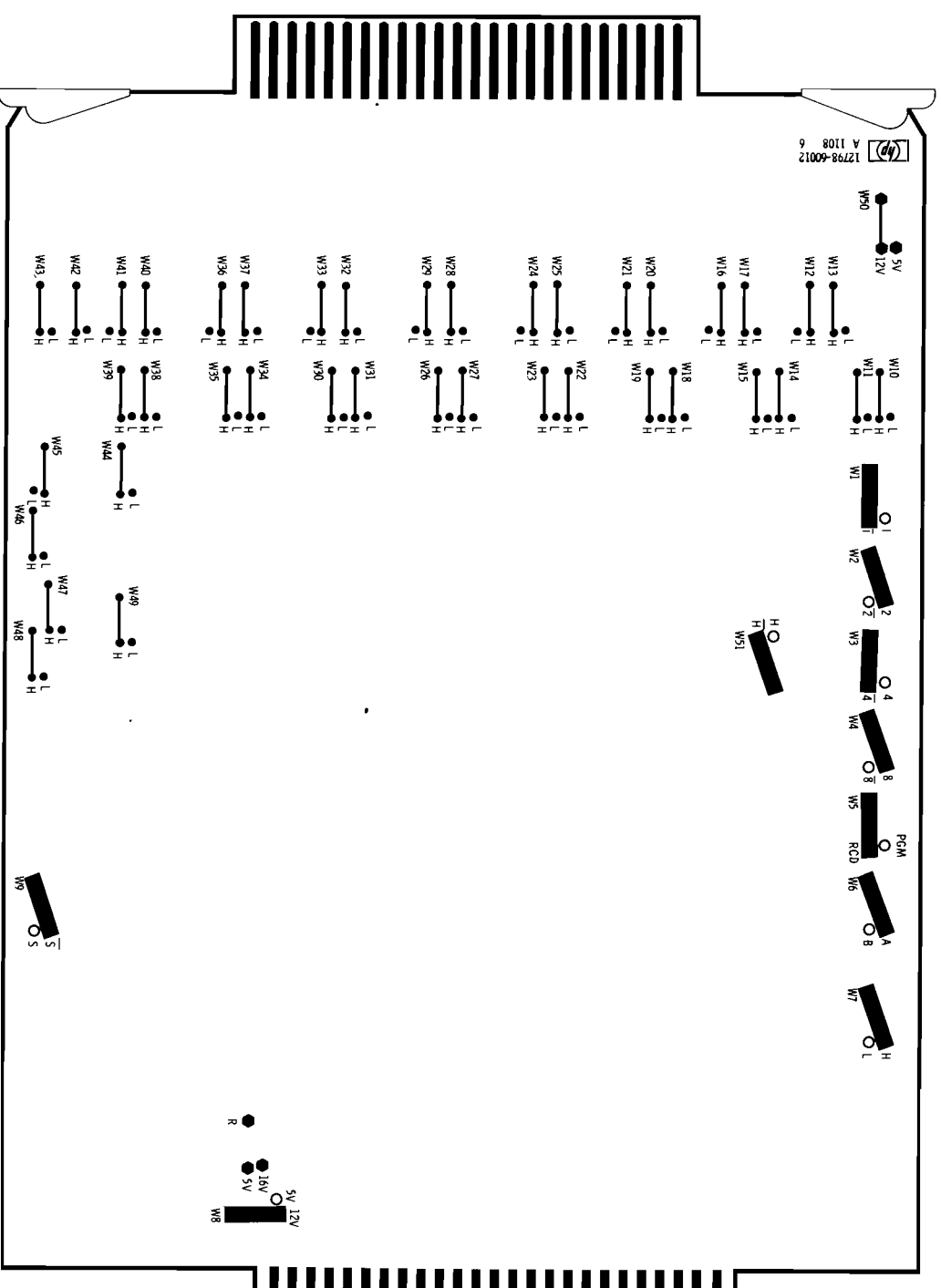
Pin	Signal
AA	Reference Voltage, High Level
23	Reference Voltage, Low Level
22	Store Data
BB	Ground
21	Busy

① Order of column printout may be changed internally in the HP 5050A/B and HP 562A.

NOTE



HP 12798-60012 JUMPER SETTINGS



HP 5050A/B DIGITAL RECORDER

EQUIPMENT REQUIRED

- a. HP 12798-60012 BCD Output Card (+12V-true output).
 - b. HP 02547-6040 Cable to interconnect with HP 5050A/B Digital Recorder.
- Note: The above items comprise HP 12798B Option 001. If either item is required separately, order by HP part number.
- c. HP 5050A Digital Recorder Serial Prefix 720, 740, 744, 752, 828; or HP 5050B Digital Recorder Serial Prefix 836, 908.

INSTRUMENT OPTIONS REQUIRED

Any one of the following is required:

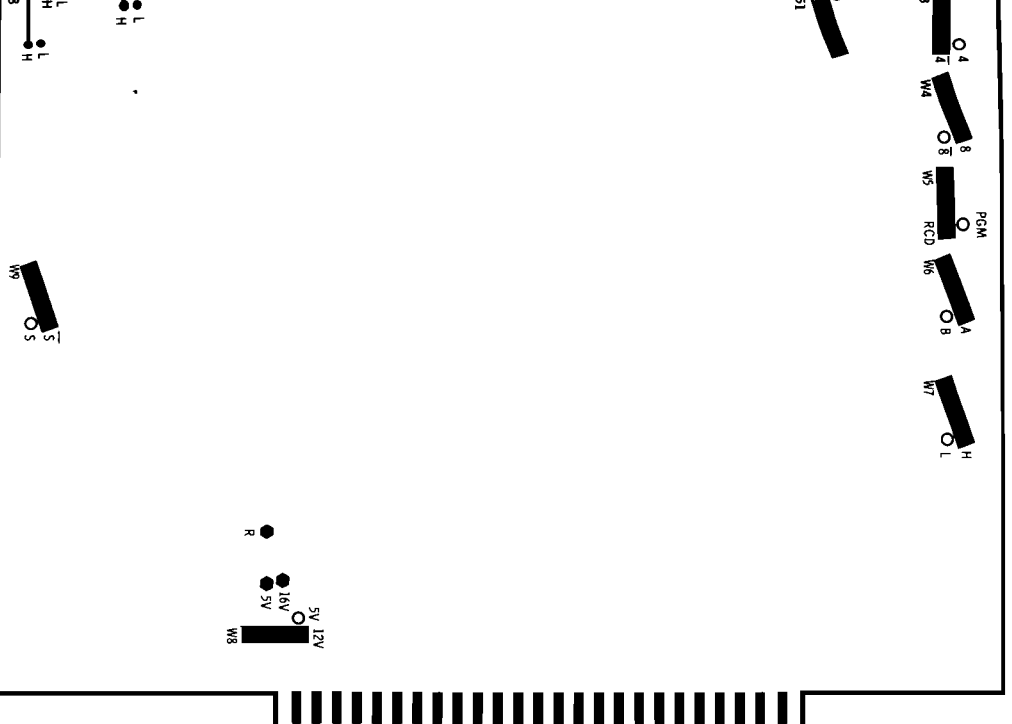
- a. Option H06: 11 column systems version.
- b. Option H66: 11 column systems version with data storage.
- c. Option H106: 11 column systems version with digital clock (clock uses 6 columns, but not any of the 11 data columns).
- d. Option H166: 11 column systems version with digital clock and data storage (clock uses 6 columns, but not any of the 11 data columns).
- e. Option J11: 12 column systems version.

OTHER

- a. The f
- b.

INST

- a.

2 JUMPER SETTINGS

- INSTRUMENT OPTIONS REQUIRED**
- Any one of the following is required:
- Option H06: 11 column systems version.
 - Option H66: 11 column systems version with data storage.
 - Option H106: 11 column systems version with digital clock (clock uses 6 columns, but not any of the 11 data columns).
 - Option H166: 11 column systems version with digital clock and data storage (clock uses 6 columns, but not any of the 11 data columns).
 - Option J11: 12 column systems version.

- Option J22: 12 column systems version with data storage.
- Option J33: 12 column systems version with digital clock (clock uses 6 columns, but not any of the 12 data columns).
- Option J44: 12 column systems version with digital clock and data storage (clock uses 6 columns, but not any of the 12 data columns).

Note: Only 10 data columns can be driven from each HP 12798A or B. The column boards must all be in the slots connected to either A1J1 (slots A10 through A14) or A1J2 (slots A5 through A9). The above options are shipped with some boards connected to connector A1J1 and some connected to A1J2. The boards should be rearranged for use with the HP 12798A or B.

- Option M07: Systems version without column boards (one Option 020 column board required for each two data columns printed. Only 10 columns can be used to print data from each HP 12798A or HP 12798B).

OTHER INSTRUMENT OPTIONS ALLOWED

The following options are for use with Option M07:

- Option 015: Motor Control.
- Option 020: Column Board (one board for each two data columns; maximum of 10 columns can be used with an HP 12798B).
- Option 050: Data Storage for 20 columns.
- Option 051: Data Storage for 10 columns.
- Option 055: Digital Clock (does not require column boards; uses up to 7 print columns).

INSTRUMENT CONTROL SETTINGS

- REAR PANEL
When interfacing the HP 5050A/B to an HP 12798A/B, connect the data cable to either A1J1 or A1J2, depending on which slots the column boards are in. (Slots A10 through A14 connect to A1J1. Slots A5 through A9 connect to A1J2.) If the HP 5050A/B does not have storage, set the Print Command switch for the connector used to the upper position.

Set the other Print Command switch to the lower position.

If the HP 5050A/B has storage, set the Print Command switch (instrument will have only one Print Command switch) to the lower position (marked with a "1" on the panel).

- FRONT PANEL
Press ON-OFF switch
Press OPERATE switch.

OUTPUT FORMAT

The number of words accepted and their position in the output is determined by the input. A total of up to 10 characters may be output by the BCD output card. The printed output is left-hand justified and presents the following characters (standard character set on digital recorder):

ASCII Input to Card	BCD Output on Recorder
Digits 0 through 9	Digits 0 through 9
E (See Note)	*
, (Comma) (See Note)	Blank
Blank	Blank
- (Minus)	- (Minus)

Note: BCD character equivalent applies to HP 5050A/B Digital Recorder only. Character print on HP 562A depends on specific unit.

HP 562A DIGITAL RECORDER**EQUIPMENT REQUIRED**

- HP 12798-60012 BCD Output Card (+12V-true output).
- HP 02547-6040 Cable to interconnect with HP 562A Digital Recorder.
Note: The above items comprise HP 12798B Option 001. If either item is required separately, order by HP part number.
- HP 562A Digital Recorder, Serial Prefix 134, 147, 214, 246, 247, 312, 334, 812.

INSTRUMENT OPTIONS REQUIRED

- Option 022: +1248 Column Board. One board is required for each print column.
- Option 030: BCD Connector Assembly for up to 9 columns.
- Option 031: BCD Connector Assembly for up to 6 columns.
- Option 034: BCD Connector Assembly for up to 10 columns.

① Only one of these options is required. If Option 030 or 031 is used, consult HP 562A Operating and Service Manual Connector Assembly diagram to determine input location of data digits.

Figure 2-5. HP 5050A/B and HP 562A Digital Recorder Interface



DATA WORD

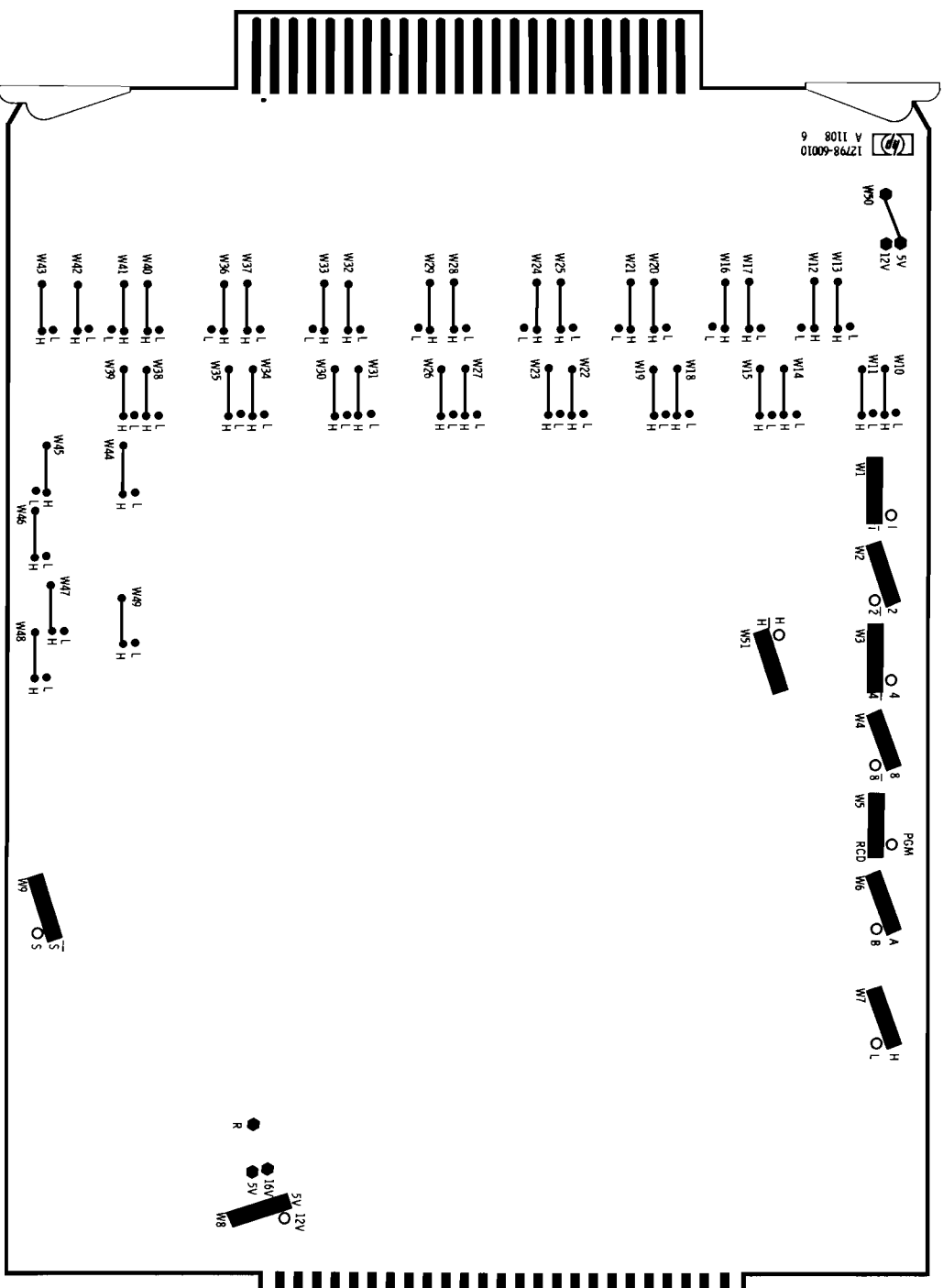
Pin	HP 5055A Printout Columns	BCD Weight	Pin	HP 5055A Printout Columns	BCD Weight
19	Most Significant Digit 10	1	9	Least Significant Digit 1	1
20		2	10		2
W		4	K		4
X		8	L		8
17	9	1	7	4	1
18		2	8		2
U		4	H		4
V		8	J		8
15	8	1	5	3	1
16		2	6		2
S		4	E		4
T		8	F		8
13	7	1	3	2	1
14		2	4		2
P		4	C		4
R		8	D		8
11	6	1	1	1	1
12		2	2		2
M		4	A		4
N		8	B		8



CONTROL SIGNALS

Pin	Signal
AA	Reference Voltage, High Level
23	Reference Voltage, Low Level
22	Store Data
BB	Ground
21	Busy

HP 12798-60010 JUMPER SETTINGS



EQUIPMENT REQUIRED

- a. HP 12798-60010 BCD Output Card (positive-true output).
- b. HP 02547-6040 Cable to interconnect with HP 5055A Digital Recorder.

CONTROL SETTINGS

- c. The above items comprise HP 12798B Option 010. If either part is required separately, order by HP part number.
- c. HP 5055A Digital Recorder, Serial Prefix 0960, 0972, or 1108A.

INSTRUMENT OPTION REQUIRED

- a. Option H15: Systems version.

OTHER INSTRUMENT OPTIONS ALLOWED

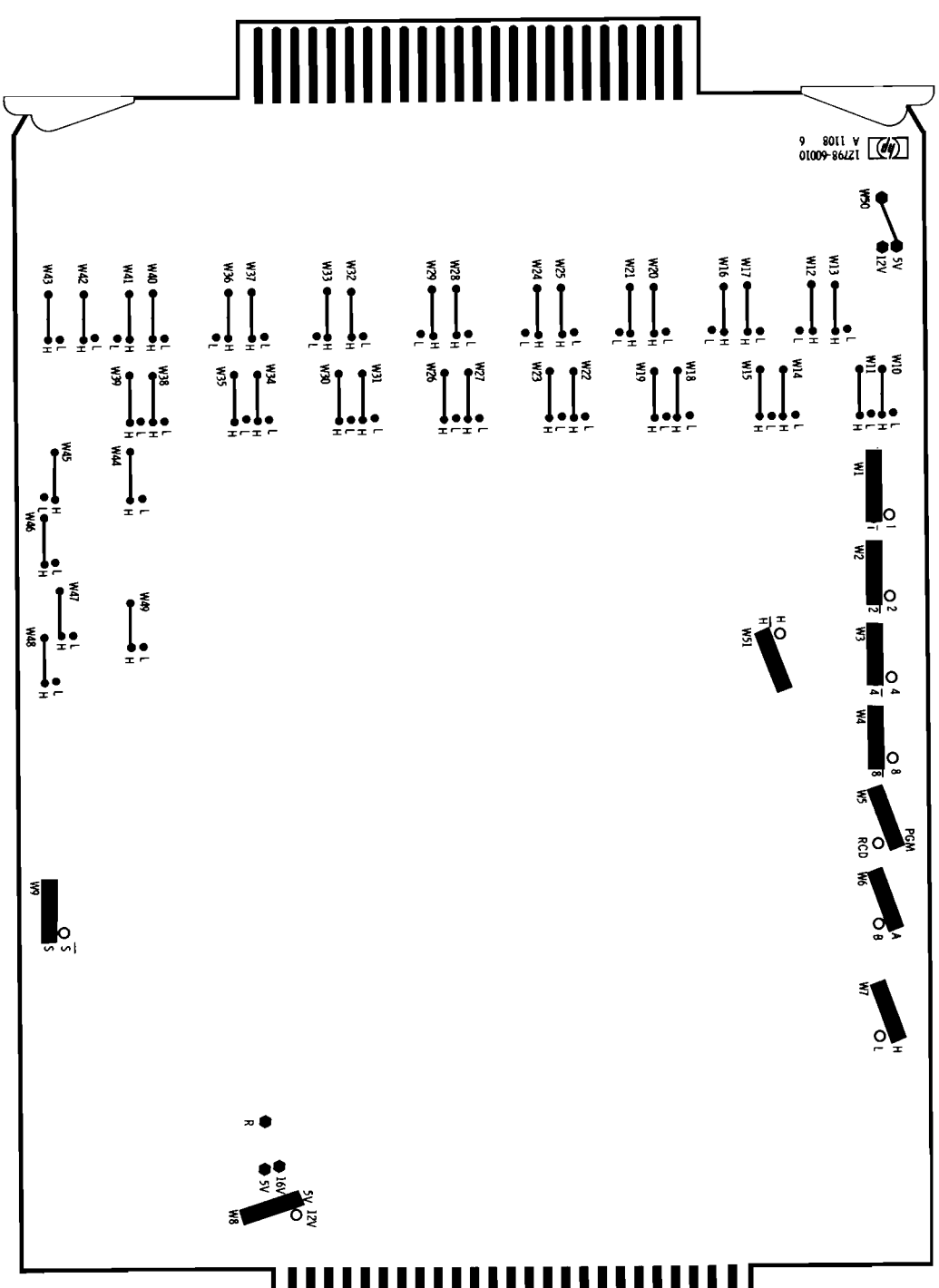
- a. Option 001: 50 Hz Power.
- b. Option 005: Cabinet color.

- a. FRONT PANEL
OPERATE-STANDBY: OPERATE
Power: ON
- b. REAR PANEL
-8421/+8421: +8421
BLANKING ON/OFF: As desired.

UNFOLD FOR
Figure 2-5. HP 5050A/B and HP 562A
Digital Recorder Interface

Figure 2-6. HP 5055A Digital Recorder Interface

HP 12798-60010 JUMPER SETTINGS



PROGRAM WORD FORMAT

Pin	HP 2759B Programming Digit Position	BCD Weight	Pin	HP 2759B Programming Digit Position	BCD Weight
19	Most Significant Digit 10 ⁶ (Loaded First)	1	9	Least Significant Digit 1 (Loaded Last)	1
20		2	10		2
W		4	K		4
X		8	L		8
17	9	1	7	4	1
18		2	8		2
U		4	H		4
V		8	J		8
15	8	1	5	3	1
16		2	6		2
S		4	E		4
T		8	F		8
13	7	1	3	2	1
14		2	4		2
P		4	C		4
R		8	D		8
11	6	1	1	1	1
12		2	2		2
M		4	A		4
N		8	B		8

CONTROL SIGNALS

Pin	Signal
AA	Not Used
23	Not Used
22	Store Data (Frequency Change Command)
BB	Ground
21	Busy (Flag)

EQUIPMENT REQUIRED

- HP 12798-60010 BCD Output Card (positive-true output).
 - HP 02547-6055 Cable to interface with HP 2759B Synthesizer Programmer.
- Note: Cable HP 02547-6055 is supplied with the HP 2759B.
- HP 2759B Synthesizer Programmer, Serial Prefix 903.

INSTRUMENT OPTIONS REQUIRED

No instrument options are required.

OTHER INSTRUMENT OPTIONS ALLOWED

- Option 100: 7 Digits, High True
- Note: Use only the 7 most significant digits of the data register on the HP 12798B BCD Output Card.

CONTROL SETTINGS

Set jumper W2 on the HP 2759B Control Card (A1) to the +6V position.

Figure 2-7. HP 2759B Synthesizer Programmer Interface

PROGRAM WORD FORMAT

NOTES

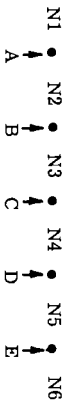
- ① If Local Control (front panel) is desired, make HP 12798B programming digit number 9 a 5 for Local, 1/10s gate, or a 6 for Local, 1/60s gate. Also be sure to program digits 8, 7 and 6 as desired. Digit 5 must be 1 to enable Local control. After digits 9, 8, 7, 6, 5 have been programmed, the remaining 5 digits may be programmed or not. Then press LOCAL on the front panel. If digits 4 through 0 were not programmed before LOCAL was pressed, the appropriate items should be selected with the front panel switches. The decimal point position is not selectable in the LOCAL mode, but is always automatically selected by the HP 3450A. Local Control may also be obtained by disconnecting the HP 3450A from the HP 12798B and pressing LOCAL on the HP 3450A front panel.
- ② The >10G ohm Input Impedance is effective only on the 0.1V, 1V and 10V DC ranges.
- ③ Integration Delay inserts a 100 ms delay interval into the Sample Period prior to the integration of each Input Voltage (once per Sample Period on Non-Ratio and three times on Ratio). It is required that Integration Delay be programmed when 1/60s Gate is programmed on the 10M ohm range. AC function automatically adds an Integration Delay of 2.4s ($3 \times 2.4s = 7.2s$ total delay per Sample Period on AC Ratio).
- ④ Internal Trigger should be inhibited if the HP 12797A BCD Input Interface Card is used to interface the HP 3450A digital output to the coupler/controller. If the HP 12797A is not used, the Internal Trigger should be enabled unless the front panel MAN/EXT switch is to be used to manually trigger the HP 3450A. The HP 12798B BCD Output card has no provision for externally triggering the HP 3450A.
- ⑤ Manual Trigger should be inhibited to prevent triggering of the HP 3450A from the front panel MAN/EXT switch. Manual Trigger Inhibit also prevents operation of all front panel controls including the LOCAL switch. See Note 1 for instructions to return the HP 3450A to LOCAL mode.
- ⑥ If decimal Point Position is programmed to AUTO, the decimal point will be displayed in its correct position as determined by the range and function of the HP 3450A. If the Decimal Point Position is programmed to something other than Auto, the decimal point will be displayed in that position regardless of the range and function of the HP 3450A. The programmable positions are:

DC	E	D	C	B	A
1000V	1000V	100 mV	10V	1000 mV	
100V	100V	100V	10V	1000 mV	
1000K Ω	1000K Ω	100K Ω	10K Ω	1K Ω	
10000	X1000	X100	X10	X1	

The Auto positions are:

In Local Mode, the Decimal Point Position is always automatic.

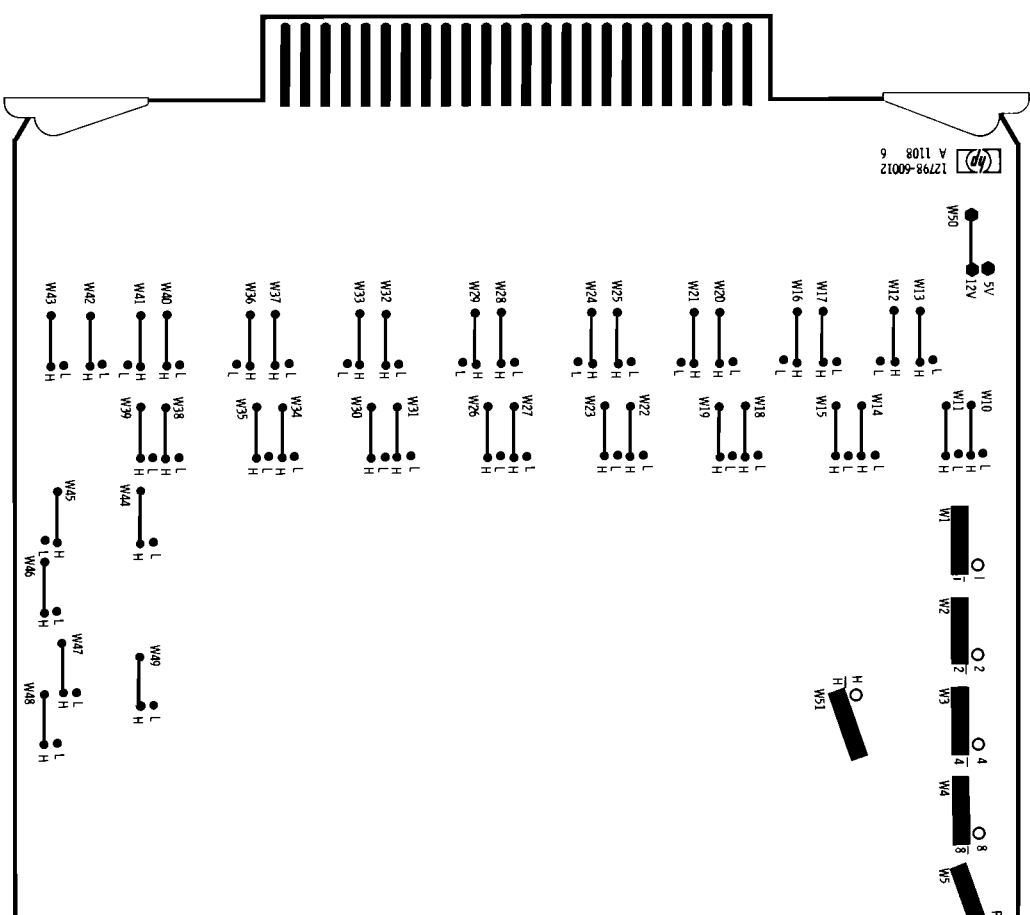
- ⑦ All of the DC functions have two possible codes either of which may be used. All function codes are operative only if the appropriate option is present in the HP 3450A (e.g., Option 001 for ACV, 002 for Ohms). If the function selected is not present, the data display will blank and an overload indication will be given. Note that the Limit Test Limits are not programmed with the Interface used for Remote Control.
- ⑧ If Ratio function is programmed, a β or an 8 is normally used for the non-ratio range digit. The HP 3450A will automatically autorange when measuring the Y (denominator) input for a ratio measurement.
- ⑨ The Ratio Range should normally be programmed to Auto or to X1. In general, the first Y reading made in Ratio, after the HP 12798B program word is changed, will result in the primary range of the HP 3450A recycling to the 1000V or 10M ohm range. Since only the X1 ratio range is compatible with this primary range, the ratio range will recycle to the X1 range. Even if the Y input is small enough to allow the primary range to auto range downward, the ratio range cannot change during the current measurement period because the range circuitry is in a Hold state. The resulting reading will probably be an overload reading. When the next reading is taken, the ratio range will change to the programmed range provided the Y input primary range is compatible with the programmed ratio range. To avoid this problem, the ratio range should be programmed to Auto. If a ratio range other than Auto is programmed in spite of these problems, the second and subsequent readings following a program change or a Y input range change will usually be correct. Use zero (0) for Non-Ratio function.



Function	Remarks	HP 12798B Programming Digits
		9 8 7 6 5 4 3 2 1 0
1/10s Gate	Choose one Gate Length ①	1 2
1/60s Gate	Choose one Input Impedance ②	β 1
10M ohm Input Impedance	Choose one Integration Delay ③	β 1
100 ms Integration Delay	Choose one Internal Trigger Function ④	1 β
No Integration Delay	Choose one Manual Trigger Function ⑤	1 β
Internal Trigger Inhibit		
Internal Trigger Enable		
Manual Trigger Inhibit		
Manual Trigger Enable		
Decimal Point Display Position:	Choose one Decimal Point Display Position ⑥	1 2 3 4 5 6 7 8
Function:		
DC		β 1
AC		β 2
Ohms		β 3
DC		β 4
DC-Ratio		β 5
AC-Ratio		β 6
Ohms-Ratio	Choose one Function ⑦	β 7
DC Limit Test		1 1
AC Limit Test		1 1
Ohms Limit Test		1 2
DC Limit Test		1 3
DC Ratio Limit Test		1 4
AC Ratio Limit Test		1 5
Ohms Ratio Limit Test		1 6
DC Ratio Limit Test		1 7
Non-Ratio Range: (Ratio)		β
10M ohms	Choose one Non-Ratio Range ⑧	1
1 kV/1M ohms		2
100V/100K ohms		3
10V/10K ohms		4
1V/1K ohms		5
100 mV/100 ohms		6
AUTO		8
Ratio Range:		β
X1	Choose one Ratio Range ⑨	1
X10		2
X1000		3
AUTO		4

PROGRAM WORD EXAMPLES

Function	Digit 9	Digit 8	Digit 7	Digit 6	Digit 5	Digit 4	Digit 3	Digit 2	Digit 1	Digit 0
1/10s Gate, 10G ohm Input Impedance, No Integration Delay, Internal Trigger Inhibit, Manual Trigger Inhibit, Auto Decimal Point, Ohms Ratio, (Ratio), Auto Ratio Range	1	1	0	0	8	0	6	0	4	
1/60s Gate, 10G ohm Input Impedance, 100 ms Integration Delay, Internal Trigger Inhibit, Manual Trigger Inhibit, Auto Decimal Point, AC, 10V, Not Ratio	2	1	0	0	0	8	0	1	4	0



EQUIPMENT REQUIRED

- a. HP 12798-60012 BCD Output Card (+12V-tru output).
- b. HP 12798-60002 Cable to interconnect with HP 3450A Multi-Function Meter.

INSTRUMENTS

- a. HP 3450A Multi-Function Meter, Serial Prefix 916, 931, 935, 941, 946, 950, 953, 956, or 959.
- b. HP 12798-60002 Cable to interconnect with HP 3450A Multi-Function Meter.
- c. HP 3450A Multi-Function Meter, Serial Prefix 916, 931, 935, 941, 946, 950, 953, 956, or 959.

Note: The above items comprise HP 12798B Option 003. If either part is comprised separately, order by HP part number.

Figure 2-7. HP 2759B Programmer Interface

PROGRAM WORD FORMAT

HP 3482A/84A Control Signals		HP 12798B Programming Digits										
Function	Remarks	MSD	9	8	7	6	5	4	3	2	1	LSD
Enable Program ①	Enter Enable Digit	1	0	0	0	0	0	0	0	0	0	0
Range: 1000V/10M ohm		0	1	0	0	0	0	0	0	0	0	0
1000K ohm		0	0	1	0	0	0	0	0	0	0	0
100V/100K ohm		0	0	0	1	0	0	0	0	0	0	0
10V/10K ohm	Choose one Range	0	0	0	0	1	0	0	0	0	0	0
1000 mV/1000 ohm		0	0	0	0	0	1	0	0	0	0	0
100 mV/100 ohm		0	0	0	0	0	0	1	0	0	0	0
Function: VDC	Choose one Function	0	0	0	0	0	0	0	1	0	0	0
VAC (AC)		0	0	0	0	0	0	0	0	1	0	0
VAC (DC) ②		0	0	0	0	0	0	0	0	0	1	0
Ohms	Choose one Not Ratio	0	0	0	0	0	0	0	0	0	0	0
Ratio ③		0	0	0	0	0	0	0	0	0	0	0
Filter: Out	Choose one Filter Position	0	0	0	0	0	0	0	0	0	0	0
A		0	0	0	0	0	0	0	0	0	0	0
B		0	0	0	0	0	0	0	0	0	0	0
Last four digits are not used ④		0	0	0	0	0	0	0	0	0	0	0

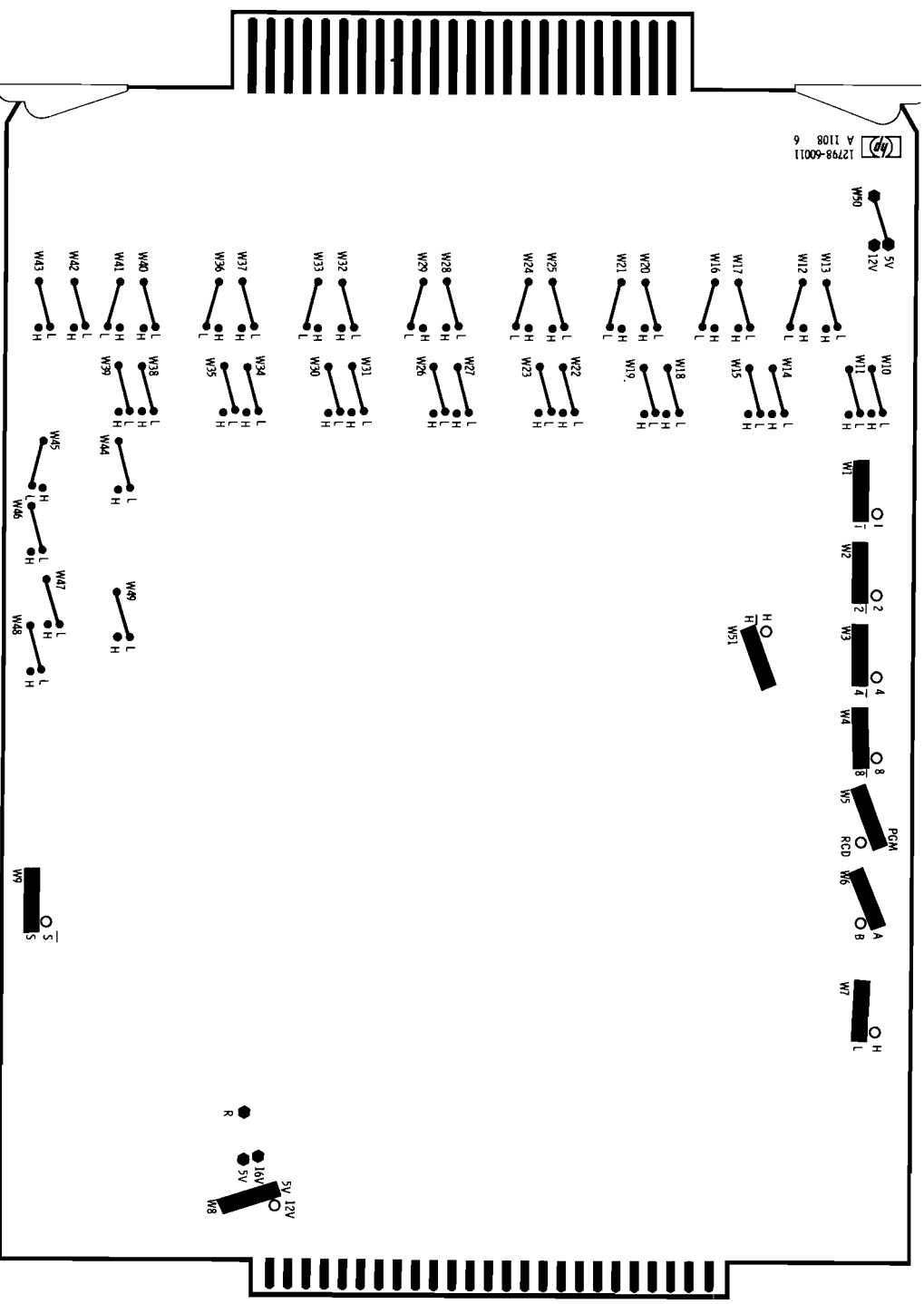
PROGRAM WORD EXAMPLES

Enable, 10V, VAC (AC), Not Ratio Filter Out	1	2	0	1	0	0	0	0	0	0	0	0
Enable, 1000V, VDC, Not Ratio, Filter Out	1	0	0	0	0	0	0	0	0	0	0	0

NOTES

- ① Enable digit may be any non-zero digit if the HP 2570A system includes an HP 9100A/B Calculator. This digit may be any digit including zero if the system does not include a calculator.
- ② HP 3484A only.
- ③ HP 3480A/B Option 002 only.
- ④ Last four digits may be any digit or may be omitted.
- ⑤ Trailing zeroes may be omitted from the HP 12798B programming word.

HP 12798-60011 JUMPER SETTINGS



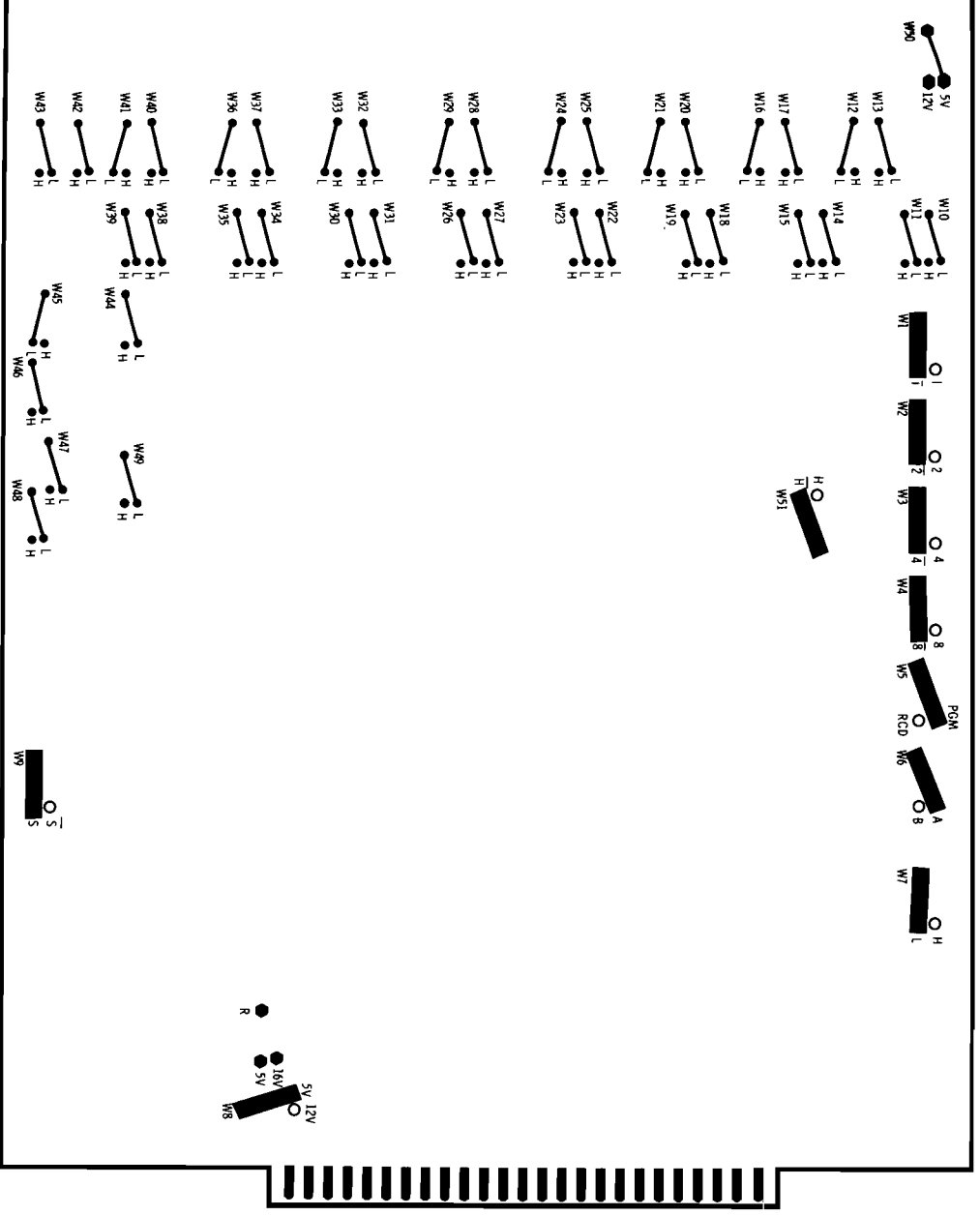
EQUIPMENT REQUIRED

- a. HP 12798-60011 BCD Output Card (ground-true output).
 - b. HP 12798-60003 Cable to interconnect with HP 3482A/84A Plug-In in an HP 3480A/B Voltmeter.
- Note: The above items comprise HP 12798B Option 004. If either part is required separately, order by HP part number.
- c. HP 3480A Digital Voltmeter, Serial Prefix 928 or HP 3480B Digital Voltmeter, Serial Prefix 960.
 - d. HP 3482A DC Range Unit or HP 3484A Multi-Function Unit.

INSTRUMENT OPTIONS REQUIRED

- a. For HP 3480A:
 - Option 003: BCD Output, any Serial Suffix, or
 - Option 004: Isolated BCD Output, only Serial Suffix 00325 and up.
- b. For HP 3480B: As for HP 3480A.

HP 12798-60011 JUMPER SETTINGS



INSTRUMENT OPTIONS REQUIRED

- a. For HP 3480A:
 - Option 003: BCD Output, any Serial Suffix, or
 - Option 004: Isolated BCD Output, only Serial Suffix 00325 and up.
- b. For HP 3480B:
 - As for HP 3480A.

Note: The above items comprise HP 12798B Option 004. If either part is required separately, order by HP part number.

HP 3480A Digital Voltmeter, Serial Prefix 928 or HP 3480B Digital Voltmeter, Serial Prefix 960.
 HP 3482A DC Range Unit or HP 3484A Multi-Function Unit.

OTHER INSTRUMENT OPTIONS ALLOWED

- a. For HP 3480A/B:
 - Option 002: Ratio.
 - Option 003: BCD Output. Not recommended for systems applications.
 - Option 004: Isolated BCD Output (only for Serial Suffix 00325 and above). Recommended for systems applications.
- b. For HP 3482A:
 - Standard
 - Option 021: Isolated Remote Control (only for Serial Suffix 00351 and above). Requires HP 3480A/B Option 004. Recommended for systems applications.

- c. For HP 3484A:
 - Standard
 - Option 041: Isolated Remote Control (only for Serial Suffix 00325 and above). Requires HP 3480A/B Option 004. Recommended for systems applications.
 - Option 042: Ohms Converter.
 - Option 043: True RMS AC Converter.

CONTROL SETTINGS

The controls listed below are not programmable and should be set as follows:

- SAMPLE RATE:**
 - Set to HOLD if the HP 12797A BCD Input Interface Card is used to interface the digital output of the HP 3480A/B mainframe to the HP 2570A Coupler/Controller. Do not set to HOLD if the BCD input card is not used.
 - FRONT/REAR Terminal Selector: As desired.

NOT REMOTELY PROGRAMMABLE

The HP 3481A Buffer Amplifier has no selectable ranges or functions to be remotely controlled.

TRIGGER DELAY

Some delay for instrument response time must occur between a program change or a change in input signal and the beginning of the measurement. This de-

lay may be incorporated in the HP 2570A program or it may be generated internally by the HP 3480A/B plug-in when a jumper is properly set.

If the plug-in generated delay is desired, set the jumper on the A3 board to IN. Note that this internally generated delay is not always equal to the response time, but ranges from 10% to 400% of the response time. In particular, note that the maximum measuring rate of the meter is reduced to 200 readings per second when the External Trigger Delay jumper is IN.

Instrument response times and internally generated delay times are shown in the following table. These delay times are generated only if the External Trigger Delay jumper is set to IN and they apply only to the external triggers. (The front panel Trigger switch action is not delayed by this jumper.)

Function	Delay Time	Response Time
VDC Filter Out	4 ms	1 ms
VDC Filter A	250 ms	200 ms
VDC Filter B	1 s	1 s
VAC (AC)	1 s	1 s
VAC (DC)	3 s	15 s
OHMS, 100 ohm Range through 100K ohm Range, Filter Out	4 ms	1 ms
1000K ohms Range Filter A	200 ms	200 ms
10M ohms Range, Filter A	200 ms	2 ms

If the HP 12797A BCD Input Interface Card is used to interface the digital output of the HP 3480A/B to the HP 2570A Coupler/Controller, the position of the jumper can be determined by operating the HP 3480A/B from an HP 2570A. Observe the delay between the issuance of an E command to the HP 12797A and the flashing of the SAMPLE RATE indicator. On VDC, Filter B, or VAC (AC), the delay should be ~1s if the jumper is IN. The delay can be checked either while single stepping through an HP 2570A program or while running a program at high speed with no other delays (e.g., @1E@1O pinned on the control card, with the HP 12797A in I/O Slot 1).

The external Trigger Delay jumper on PC card A3 may be exposed by removing the bottom cover from the HP 3482A or HP 3484A plug-in. If the HP 3484A has the Option 043, True RMS AC Converter, the converter board must be moved to expose the jumper. Remove the two screws marked by arrows on the bottom, left-hand side (with respect to the front panel of the plug-in) of the AC Converter card A7. This card is hinge-mounted at the opposite edge and may be tilted up to expose card A3 and the Delay jumper. Refer to the appropriate plug-in Operating and Service Manual for further information.

Figure 2-9. HP 3482A/84A Programming Interface

PROGRAM WORD FORMAT

HP 6130B/6131B Control Signals		HP 12798B Programming Digits										
Function	Remarks	MSSD	9	8	7	6	5	4	3	2	1	LSD
Enable Program ①	Enter Enable Digit	1	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Current Latch: 20 mA		∅	1	1	1	1	1	1	1	1	1	∅
50 mA		∅	1	1	1	1	1	1	1	1	1	∅
70 mA		∅	1	1	1	1	1	1	1	1	1	∅
100 mA		∅	1	1	1	1	1	1	1	1	1	∅
200 mA		∅	1	1	1	1	1	1	1	1	1	∅
500 mA		∅	1	1	1	1	1	1	1	1	1	∅
700 mA	HP 6130B only	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
1000 mA		∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Voltage Range: X10	Choose one Range	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
X1		∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Voltage Polarity: Plus (+)	Choose one Polarity	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Minus (-)		∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Voltage Magnitude	Enter Magnitude ②	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Last two digits are not used ③		∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅

PROGRAM WORD EXAMPLES

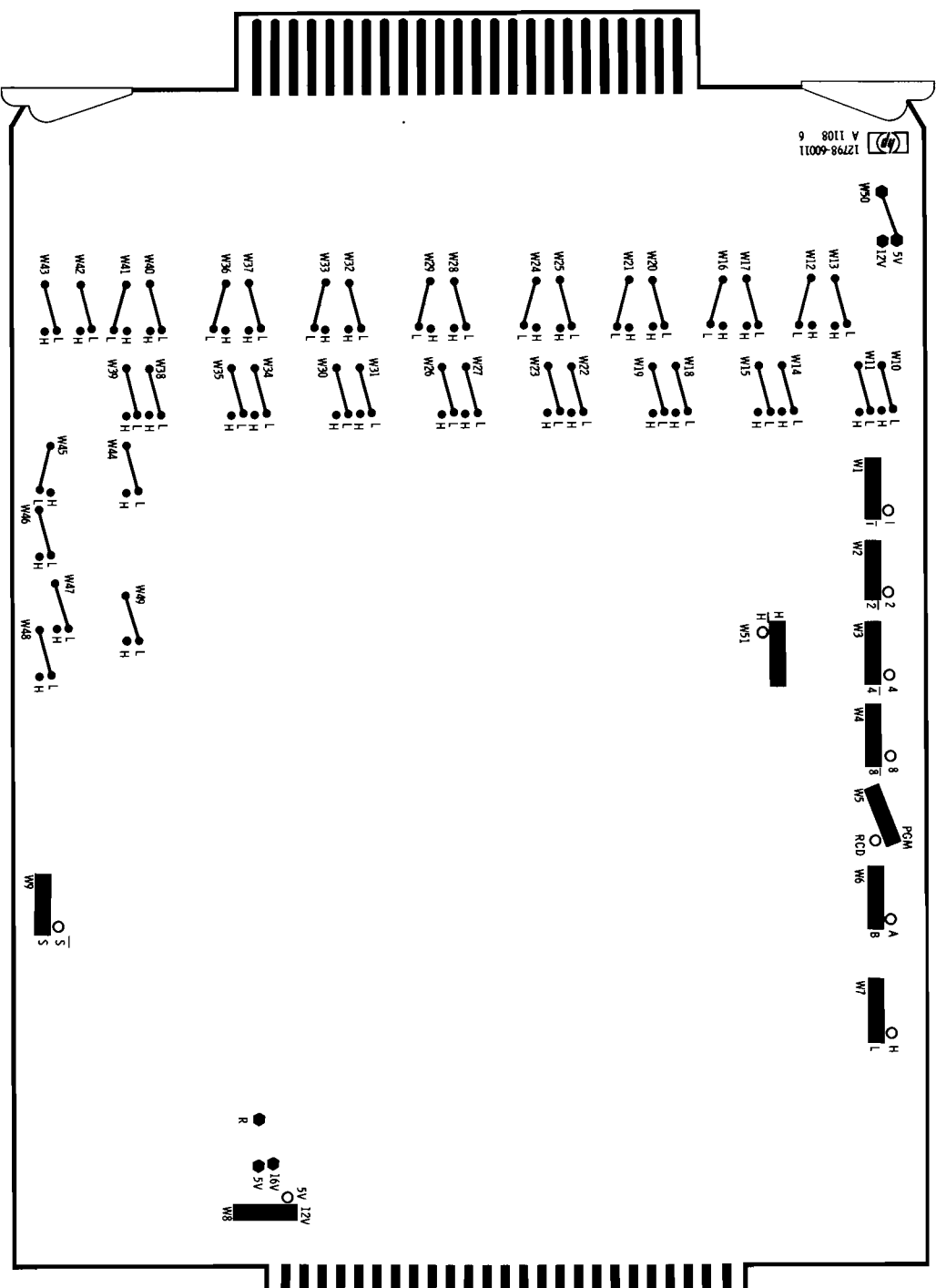
Enable, 200 mA Latch, X10 Range,	1	4	∅	1	3	8	2	5	∅	∅	∅	∅
Minus, 38.25 volts	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅	∅
Enable, 1000 mA Latch, X1 Range, plus, 5 volts	1	7	1	∅	5	∅	∅	∅	∅	∅	∅	∅

NOTES

- ① Enable digit may be any non-zero digit if the HP 2570A system includes an HP 9100A/B Calculator. This digit may be any digit including zero if the system does not include a calculator.
- ② Voltage magnitude is in millivolts if X1 range is selected, tens of millivolts if X10 range is selected. D3 is most significant digit.
- ③ The ninth and tenth digits in the programmed word do not have to be given to the HP 12798B. If they are given, they may be any number.
- ④ Trailing zeros may be omitted from the magnitude, only if the jumpers W1 through W4 on the HP 12798B card are positioned for an HP 12798B output of zero (1 2 4 8) during preset state.



HP 12798-60011 JUMPER SETTINGS



EQUIPMENT REQUIRED

- a. HP 12798-60011 Output Card (ground-true output).
- b. HP 12798-60009 Cable to interconnect with HP 6130B/6131B Digital Voltage Source.

Note: The above items comprise HP 12798B Option 005. If either part is required separately, order by HP part number.

- c. HP 6130B BCD Digital Voltage Source, Serial Prefix 8J, 9E, 9G, 9L, ∅D, or HP 6131B BCD Digital Voltage Source, Serial Prefix 1018A.

INSTRUMENT OPTIONS REQUIRED

- a. For HP 6130B: J80
- b. For HP 6131B: J80

CONTROL SETTINGS

The HP 6130B/6131B controls listed below are not remotely programmable and should be set as follows:

- | | |
|-----------------------|---|
| STORAGE switch: | STORE (On PC Board A2, behind front panel). |
| METER RANGE, VOLTAGE: | As desired. |
| METER RANGE, CURRENT: | As desired. |
| CURRENT LATCH DELAY: | Determined by capacitor C _T attached to terminals on rear panel. |

UNFOLD FOR
Figure 2-9. HP 3482A/84A Programming Interface

Figure 2-10. HP 6130B/6131B Programming Interface

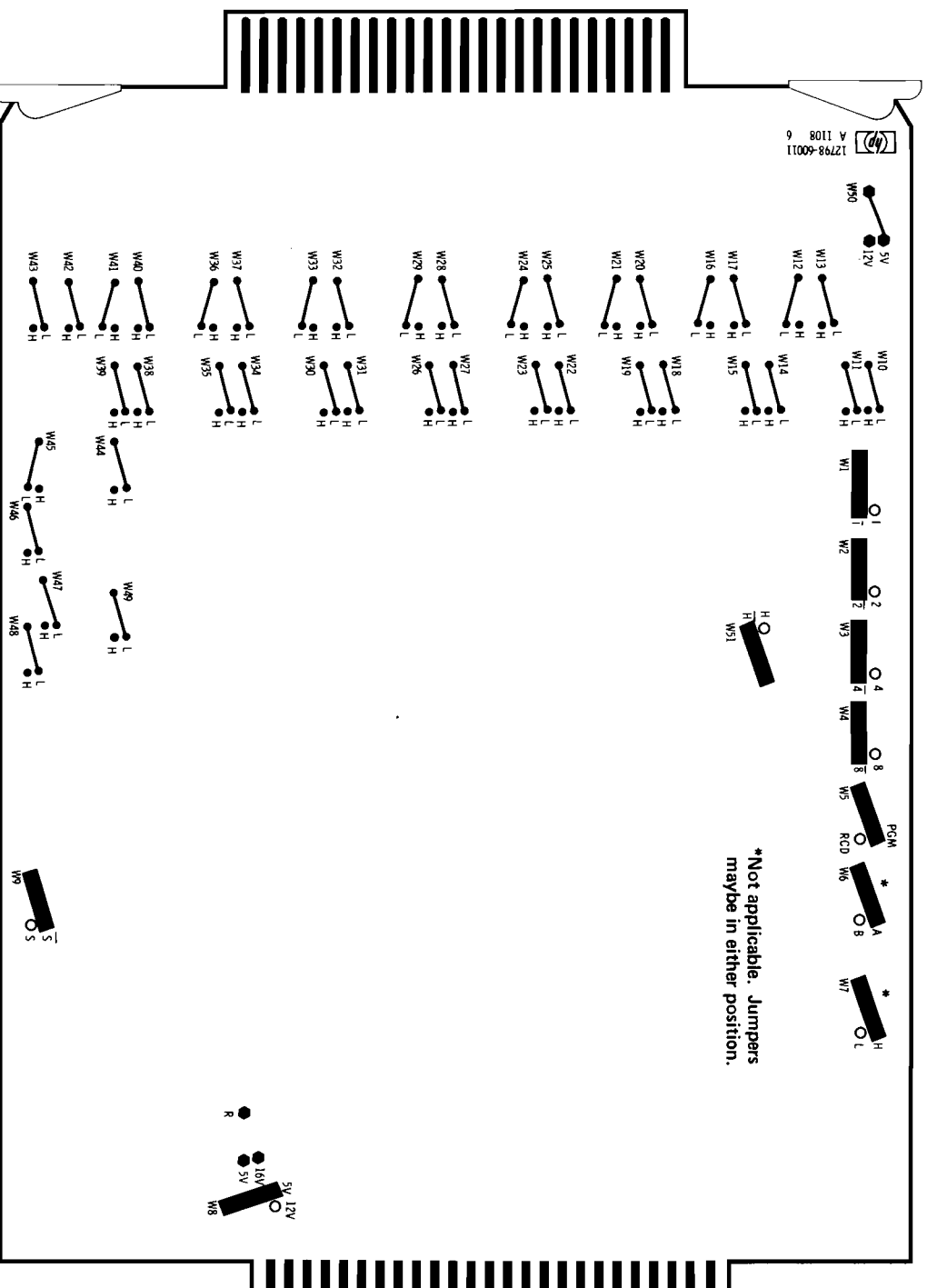
WORD FORMAT

HP 12798B Programming Digits										
MSD	9	8	7	6	5	4	3	2	1	LSD
one	1	0	0	0	0	0	0	0	0	0
one	2	0	0	0	0	0	0	0	0	0
one	3	0	0	0	0	0	0	0	0	0
one	4	0	0	0	0	0	0	0	0	0
one	1	0	0	0	0	0	0	0	0	0
one	2	0	0	0	0	0	0	0	0	0
one	3	0	0	0	0	0	0	0	0	0
one	4	0	0	0	0	0	0	0	0	0
one	1	0	0	0	0	0	0	0	0	0
one	2	0	0	0	0	0	0	0	0	0
one	3	0	0	0	0	0	0	0	0	0
one	4	0	0	0	0	0	0	0	0	0
one	1	0	0	0	0	0	0	0	0	0
one	2	0	0	0	0	0	0	0	0	0
one	3	0	0	0	0	0	0	0	0	0
one	4	0	0	0	0	0	0	0	0	0
one	1	0	0	0	0	0	0	0	0	0
one	2	0	0	0	0	0	0	0	0	0
one	3	0	0	0	0	0	0	0	0	0
one	4	0	0	0	0	0	0	0	0	0

WORD EXAMPLES

B,	3	1	0	0	2	0	0	0	0	0
1	0	0	0	2	0	4	0	0	1	1

HP 12798-60011 JUMPER SETTINGS



EQUIPMENT REQUIRED

- a. HP 12798-60011 BCD Output Card (ground-true output).
- b. HP 12798-60006 Cable to interconnect with HP 5326A/B Universal Counter.

Note: The above items comprise HP 12798B Option 008. If either part is required separately, order by respective HP part number.

- c. HP 5326A or HP 5326B Universal Counter, Serial Prefix 945 (both instruments).

INSTRUMENT OPTIONS REQUIRED

- a. Option H18: Includes 002 Remote Programming, 003 +8421 Digital Output, Zero Suppress Defeated, External Reset at Digital Recorder Output, and BNC Input Connector for DVM (HP 5326B only).

OTHER INSTRUMENT OPTIONS ALLOWED

- a. Option 001: 8-Digit Display.

INSTRUMENT OPTIONS NOT ALLOWED

- a. Option 002: Remote Programming } Not allowed apart from Option H18.
- b. Option 003: +8421 Output }

INSTRUMENT CONTROL SETTINGS

The HP 5326A/B controls listed below are not programmable and should be set as follows:

- FAST/NORM/HOLD:** Set to HOLD if an HP 12797A BCD Input Card is used to interface the digital output of the HP 5326A/B to the HP 2570A Coupler/Controller.
- SEP/COM:** As desired.
- AC/DC Input Signal Coupling:** As desired.
- Input Attenuators:** As desired.
- LEVER controls:** As desired.
- STORAGE:** As desired.
- OSC INT/EXT:** As desired.
- STOP/START Function:** Not programmable.

PROGRAM RESPONSE TIME

The response time of the Function, Time Base, and Slope Select lines is less than 5 μ s and no extra delay is required in the coupler/controller program between programming these lines and encoding the HP 5326A/B using the HP 12797A BCD Input Interface. The speed of the HP 2570A forces a delay of at least 5 μ s between these two operations. However, if the DVM is programmed in the HP 5326B (DVM, READ A or READ B), a 5 ms delay must be inserted between the programming of the range line and the encoding of the counter. The delay must be included every time an HP 12798B programming word includes a DVM programming function, even if the range and function have not been changed since the last program word. This delay may be incorporated in the program source (e.g., ≥ 6 ms to input the three ASCII characters of an HP 2570A I/O instruction from the HP 2748A Tape Reader or 300 ms to input the instruction from a teleprinter). The delay may also be incorporated by setting HP 12798B jumper W9 to S to generate a nominal 300 ms delay.

Figure 2-11. HP 5326A/B Programming Interface

PROGRAM WORD FORMAT

HP 5326A/B Control Signals		HP 12798B Programming Digits									
Function	Remarks	MSD	8	7	6	5	4	3	2	1	LSD
Not Check	Choose one	9	8	7	6	5	4	3	2	1	∅
Check		1	∅	∅	∅	∅	∅	∅	∅	∅	∅
Function: Frequency A		3	1	∅	∅	∅	∅	∅	∅	∅	∅
Frequency C			2	∅	∅	∅	∅	∅	∅	∅	∅
Period			4	∅	∅	∅	∅	∅	∅	∅	∅
Period Average A			∅	1	∅	∅	∅	∅	∅	∅	∅
Time Interval A to B	Choose one Function		∅	2	∅	∅	∅	∅	∅	∅	∅
Time Interval Average			∅	4	∅	∅	∅	∅	∅	∅	∅
Read A (Trig. level)			∅	∅	1	∅	∅	∅	∅	∅	∅
Read B (Trig. level)			∅	∅	∅	2	∅	∅	∅	∅	∅
DVM			∅	∅	∅	∅	4	∅	∅	∅	∅
Time Base: 0.1 μs/1						1	∅	∅	∅	∅	∅
1 μs/10 ¹						2	∅	∅	∅	∅	∅
10 μs/10 ²						4	∅	∅	∅	∅	∅
0.1 ms/10 ³						∅	1	∅	∅	∅	∅
1 ms/10 ⁴	Choose one Time Base					∅	2	∅	∅	∅	∅
10 ms/10 ⁵						∅	4	∅	∅	∅	∅
0.1s/10 ⁶						∅	∅	1	∅	∅	∅
1s/10 ⁷						∅	∅	∅	2	∅	∅
10s/10 ⁸						∅	∅	∅	∅	4	∅
+Slope A	Choose one Slope A								∅	∅	∅
-Slope A									1	∅	∅
+Slope B	Choose one Slope B									∅	1
-Slope B											∅
Not DVM											∅
10V	Choose one ①										1
100V											2
1000V											4

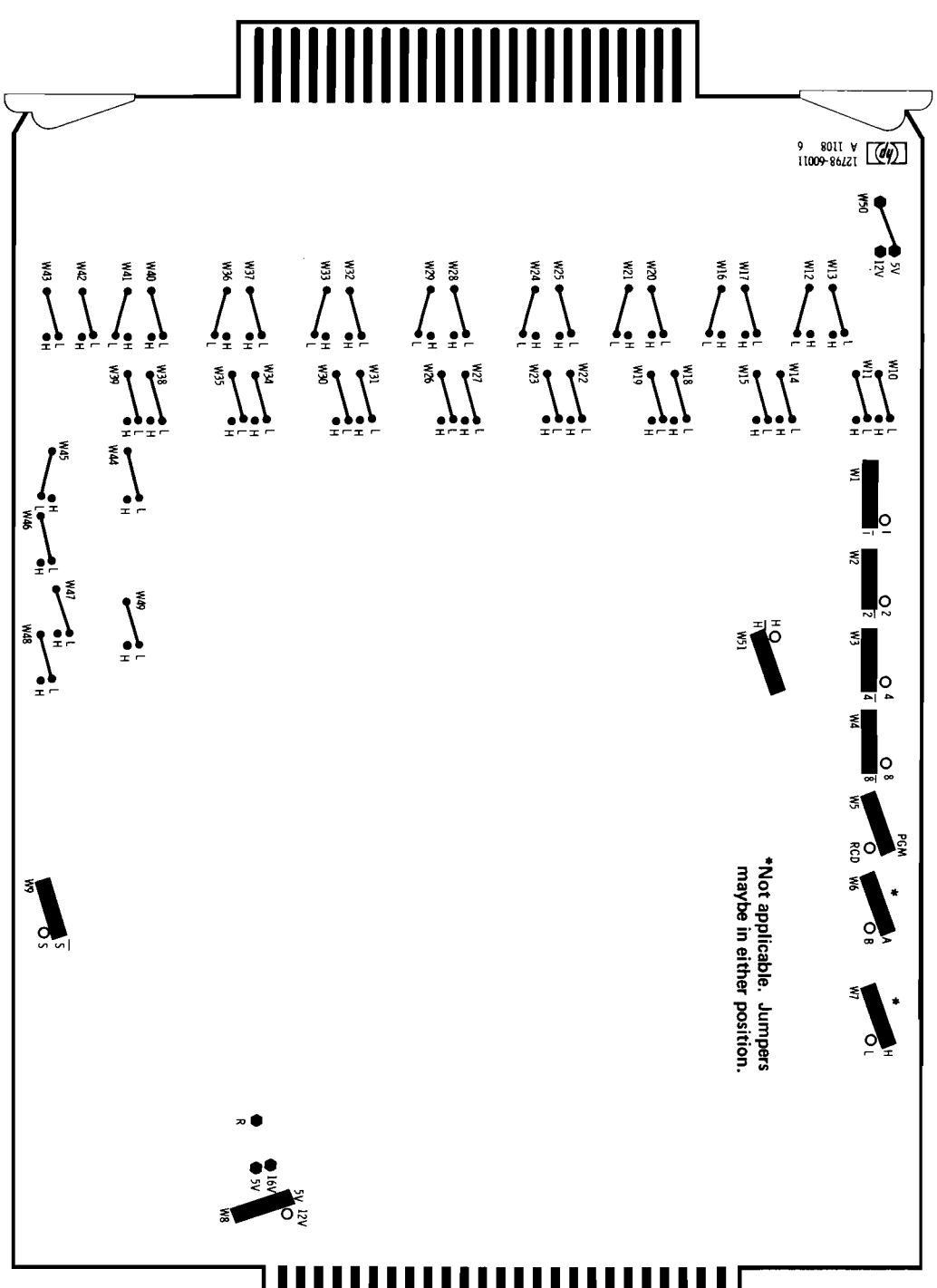
PROGRAM WORD EXAMPLES

Check, Frequency A, 1 μs, +Slope A, +Slope B, Not DVM	3	1	∅	∅	2	∅	∅	∅	∅	∅	∅
Not Check, Read B, 10 ms, +Slope A, -Slope B, 10V	1	∅	∅	2	∅	4	∅	∅	∅	1	1

NOTES

- ① For HP 5326B only.
- ② One of these required for DVM reading.
- ③ Trailing zeroes may be omitted from the HP 12798B programming word.

HP 12798-60011 JUMPER SETTINGS



EQUIPMENT REQUIRED

- a. HP 12798-60011 BCD Output Card (ground-true output).
 - b. HP 12798-60006 Cable to interconnect with HP 5326A/B Universal Counter.
- Note: The above items comprise HP 12798B Option 008. If either part is required separately, order by respective HP part number.
- c. HP 5326A or HP 5326B Universal Counter, Serial Prefix 945 (both instruments).

INSTRUMENT OPTIONS REQUIRED

- a. Option H18: Includes 002 Remote Programming, 003 +8421 Digital Output, Zero Suppress Defeated, External Reset at Digital Recorder Output, and BNC Input Connector for DVM (HP 5326B only).
- OTHER INSTRUMENT OPTIONS ALLOWED**
- a. Option 001: 8-Digit Display.

PROGRAM WORD FORMAT

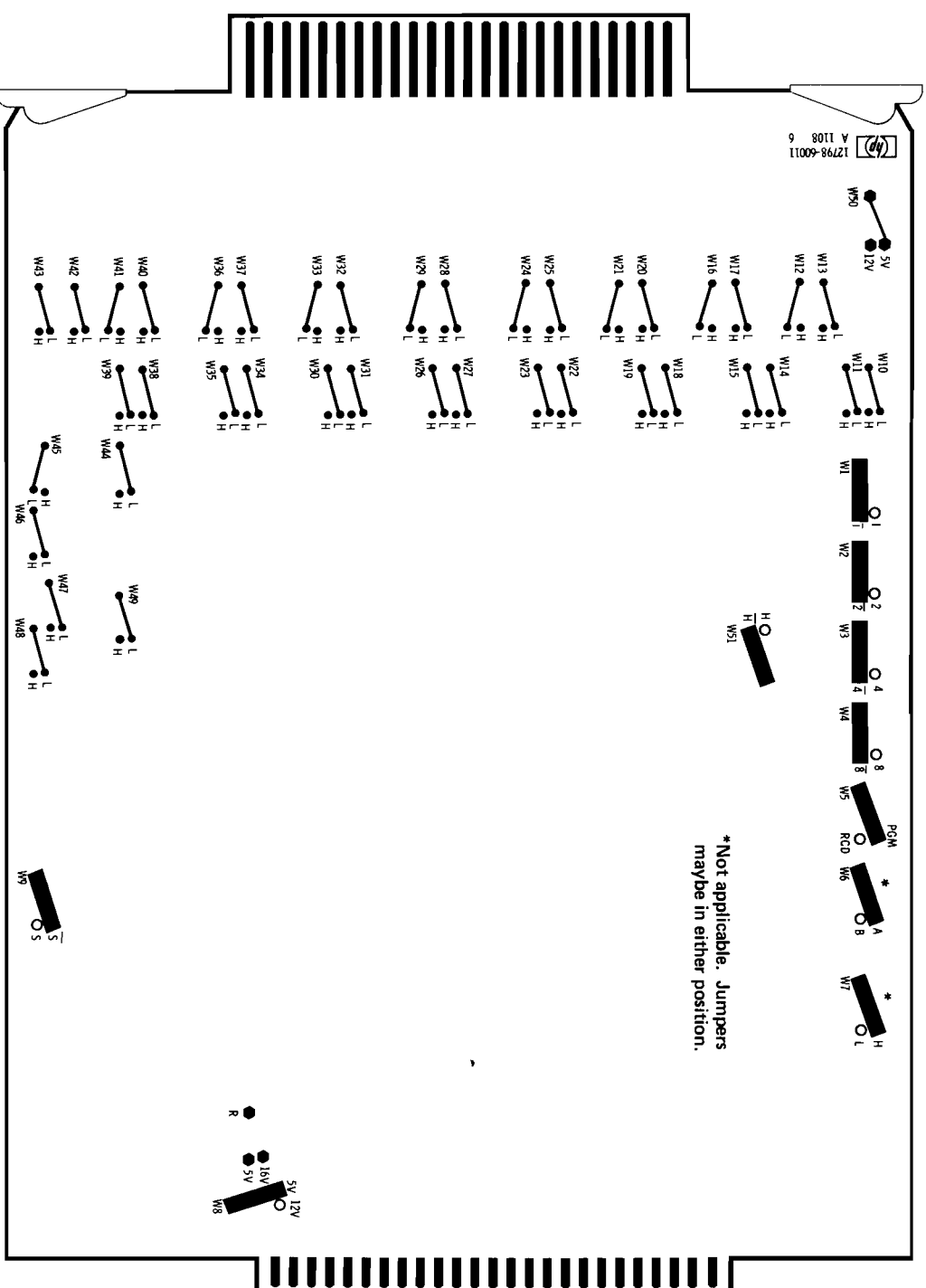
HP 5325B Control Signals		HP 12798B Programming Digits										
Function	Remarks	MSD	9	8	7	6	5	4	3	2	1	LSD
+Slope A	Choose one Slope A	1										
-Slope A		2										
+Slope B	Choose one Slope B	1										
-Slope B		2										
Function: Frequency A	Choose one Function	1										
Period A		2										
Check		4										
Period Average A		1										
Ratio A/B		2										
Time Interval A to B		4										
Time Base: 0.1 μ s/1	Choose one Time Base	1										
1 μ s/10		2										
10 μ s/10 ²		4										
0.1 ms/10 ³		1										
1 ms/10 ⁴		2										
10 ms/10 ⁵		4										
0.1s/10 ⁶		1										
1s/10 ⁷		2										
10s/10 ⁸		4										
Attenuator: Channel A, AC, X1	Choose one Attenuator A Setting ①	1										
AC, X10		2										
AC, X100		4										
DC, X1		1										
DC, X10		3										
DC, X100		5										
Attenuator: Channel B, AC, X1	Choose one Attenuator B Setting ①	1										
AC, X10		2										
AC, X100		4										
DC, X1		1										
DC, X10		3										
DC, X100		5										
Least significant digit may be any character		②										

PROGRAM WORD EXAMPLES

+Slope A, +Slope B, Check, 1 ms, (A) AC X1, (B) AC X1	1	1	4	0	0	2	0	0	0	0	0	0
-Slope A, +Slope B, Time Interval A to B, 1s, (A) AC X10, (B) DC X100	2	1	0	4	0	0	2	2	5	0	0	0

Notes: ① HP 5325B - Option 001 only. ② Last digit and trailing zeros may be omitted.

HP 12798-60011 JUMPER SETTINGS



EQUIPMENT REQUIRED

- HP 12798-60011 BCD Output Card (ground-true output).
- HP 12798-60005 Cable to interconnect with HP 5325B Universal Counter.

Note: The above two items comprise HP 12798B Option 007. If either part is required separately, order by HP part number.

- HP 5325B Universal Counter, Serial Prefix 820, 844, 846, 904, 930, 932, 936, or 944.

INSTRUMENT OPTIONS REQUIRED

- For HP 5325B, Serial Prefix 820, 844, 846, 904, 930, 932 or 936: } Option H39 or H62 or H70.
- For HP 5325B, Serial Prefix 944: No Options required.

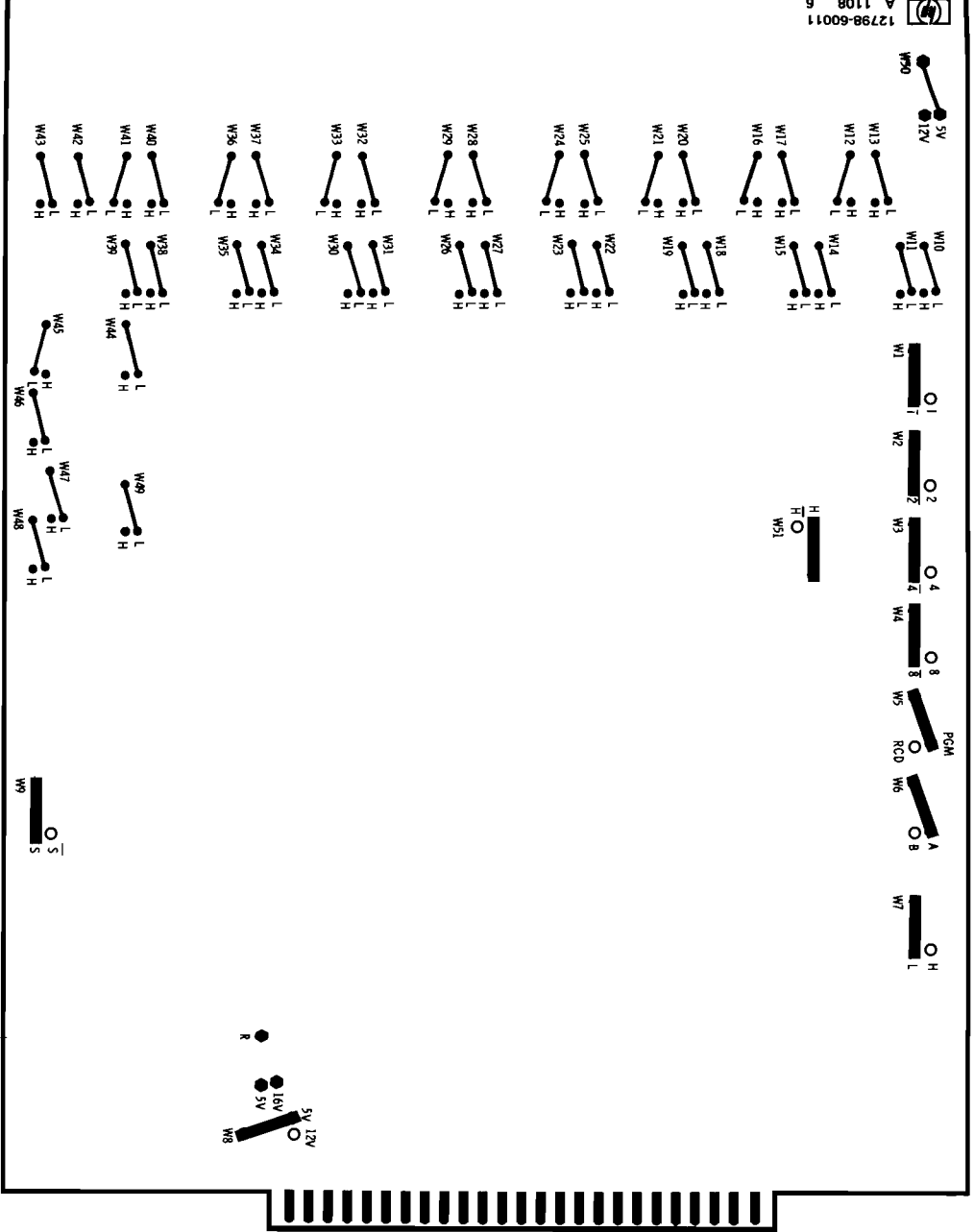
Note: If the instrument is used with an HP 12797A BCD Input Card, the customer must move an internal jumper. See remarks below:

- OTHER INSTRUMENT OPTIONS ALLOWED**
- Option 001: Remotely programmable attenuator switch and AC/DC switch.
 - Options H62 Allowable for instrument Serial and H70: Prefixes not requiring them.

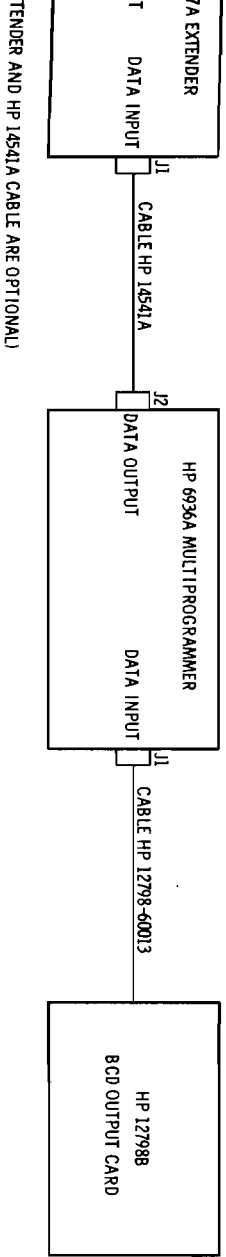
Figure 2-11. HP 5326A/B Programming Interface

Figure 2-12. HP

HP 12798-60011 JUMPER SETTINGS



INTERCONNECTIONS



EQUIPMENT REQUIRED

- a. HP 12798-60011 BCD Output Card (Ground-true output)
- b. HP 12798-60013 Cable to interconnect the HP 6936A Multiprogrammer to the BCD Output Card.
- c. HP 6936A Multiprogrammer, Serial Prefix 1033A (-00101 and up).

HP 6936A INSTRUMENT OPTIONS REQUIRED

No option required.

ALLOWABLE HP 6936A OPTIONS AND ACCESSORIES

- a. No options available at the time of this printing.
- b. Any HP 6936A accessory which does not alter the means or method of communication between the HP 6936A Multiprogrammer and the HP 12798B BCD Output Card may be used. The following list includes the currently available programmable accessories. (See also "OPERATING NOTES, Accessories.")

ACCESSORY EXTENDERS AND PROGRAMMABLE OUTPUT CARDS

- a. HP 6937A Extender, Serial Prefix 1033A (-00101 and up).
- b. HP 69300A through HP 69304A Resistance Output Cards, Run 1.
- c. HP 69310A through HP 69313A Resistance Output Cards, Run 1.
- d. HP 69320A Low-Speed D/A Converter Card, Run 1. (See HP 69351A Voltage Regulator Card.)
- e. HP 69321A High-Speed D/A Converter Card, Run 1. (See HP 69351A Voltage Regulator Card.)
- f. HP 69330A Relay Register Card, Run 1.
- g. HP 69331A TTL Output Card, Run 1. Standard - Ground True Option 073 - Positive True
- h. HP 69351A Voltage Regulator Card, Run 1. (One each required for one or more HP 69320A or HP 69321A D/A Converter Cards used in HP 6936A or HP 6937A mainframe.

HP 6936A CONTROL SETTINGS

Data Source: REMOTE (See OPERATING NOTES)

HP 12798B JUMPER SETTINGS

W1 = I	W5 = PGM	W9 = S
W2 = $\bar{2}$	W6 = A	W50 = +5
W3 = $\bar{4}$	W7 = L	W51 = H
W4 = $\bar{8}$	W8 = +5	R = Empty

OPERATING NOTES

DATA SOURCE

The DATA SOURCE may be changed from LOCAL to REMOTE, or vice versa, without affecting the data already given to the I/O cards in the multiprogrammer, provided that no STORE DATA (GATE) signal is currently being issued by the HP 12798B and no BUSY (FLAG) signal is being received by the HP 12798B.

This feature allows the user to issue infrequently used data or control words (e.g., initialization data) outside of the coupler/controller program.

INITIALIZATION OF HP 6936A

The HP 6936A requires initialization data at time of power turn-on. If this data is to be given outside the coupler/controller program, the DATA SOURCE switch on the front panel may be set to LOCAL and the data entered manually by means of the front panel switch register. When the user is ready to begin programming the multiprogrammer with the coupler/controller, he need only switch the DATA SOURCE to REMOTE and proceed with the coupler/controller operation.

If means are available for entering non-repeating instructions into the coupler/controller (e.g., calculator, TTY, or photoreader), the initialization program may be entered into the HP 6936A from the coupler/controller.

ACCESSORIES

The number and variety of HP 6936A accessories available and yet to be introduced preclude a complete listing of them and of their operating procedures. The following general rules apply to all existing accessory extenders and programmable output cards for the HP 6936A Multiprogrammer. These existing accessories are listed under "Allowable Options and Accessories."

- 1. The method of entering control words and data words into the multiprogrammer from the HP 12798B is independent of the accessories used with the multiprogrammer.
- 2. The content of the control words and the data words does depend on the accessories used. The individual accessory manual, as well as the HP 6936A Operating and Service Manual, should be consulted to determine the content of these programming words.

Figure 2-12A. HP 6936A Programming Interface

PROGRAM WORD FORMAT

HP 3485A Control Signals	Remarks	HP 12798B Programming Digits										
Function		MSD	9	8	7	6	5	4	3	2	1	LSD
Enable Program ①	Enter Enable Digit	1										
Scan Mode: Step	Choose one Scan Mode	1	0									
Single Scan		2	0									
Continuous Scan		4	0									
Home	Choose one Filter Position	8	0									
Random		0	1									
Random/Last Channel:	Choose Random or Last Channel	0	1									
0		2										
0		3										
0		4	8									
0		5	0									
Range: 100 mV	Choose one Range											
1000 mV												
10 V												
Filter: Out	Choose one Filter Position											
In												
Last three digits not used ②												

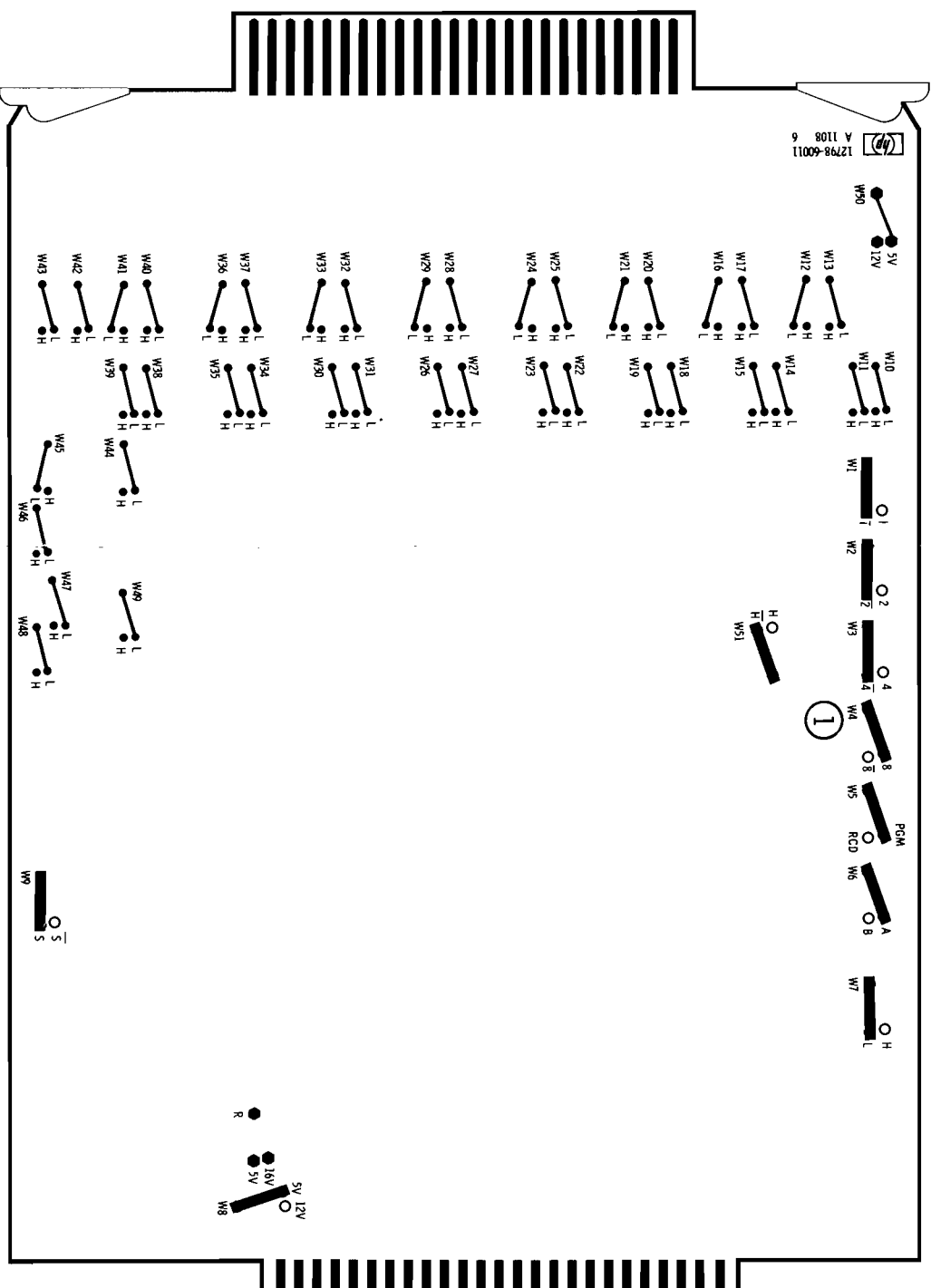
PROGRAM WORD EXAMPLES

Enable, Random, Channel 23, 1000 mV, Filter In	1	0	1	2	3	1	1	0	0	0
Enable, Continuous Scan, Last Channel 40, 100 mV Filter Out	1	4	0	4	0	0	0	0	0	0
Enable, Home ③	1	8	0							

NOTES

- Enable digit may be any non-zero digit if the coupler/controller system includes an HP 9100A/B Calculator. This digit may be any digit including zero if the system does not include a calculator.
- Last three digits may be any digit or may be omitted.
- Only programming digits 9 and 8 need be given for the Home Scan Mode. If programming digit 7 is given it should be zero.
- Trailing zeros following the Random/Last Channel digits may be omitted. A zero in the Random/Last Channel digits must not be omitted unless the Home Scan Mode is selected.

HP 12798-60011 JUMPER SETTINGS



EQUIPMENT REQUIRED

- Interface Card: HP 12798-60011 (ground/tru output) HP 12798-012
- Interface Cable: HP 12798-60014
- HP 3480A-004 Digital Voltmeter, Serial Prefix 928 or HP 3480B-004 Digital Voltmeter, Serial Prefix 960.
- HP 3485A-057 Scanning Unit, Serial Prefix 1107.

HP 3480A/B AND HP 3485A OPTIONS REQUIRED

- For HP 3480A/B
Option 004: Isolated BCD Output, Serial Suffix 00325 and up.
- For HP 3485A:
 - Option 057: Remote Control
 - Any one of the following options:
 - Option 051: 10 Channels
 - Option 052: 20 Channels
 - Option 053: 30 Channels
 - Option 054: 40 Channels
 - Option 055: 50 Channels

OTHER HP 3480A/B AND OPTIONS ALLOWED

- For HP 3480A/B:
Option 002: Ratio. Instrument with the
- For HP 3485A:
No other options are (July, 1971).

HP 3480A/B CONTROL

RATIO MODE (Rear panel, HP 3480A/B, Option 002 only):
RATIO REFERENCE RANGE panel, HP 3480A/B, Option (only):

HP 3485A CONTROL

FILTER: REM
RANGE: REM
RANDOM/ LAST CHANNEL: REM
CHANNEL DELAY: As desired program
MODE: REM

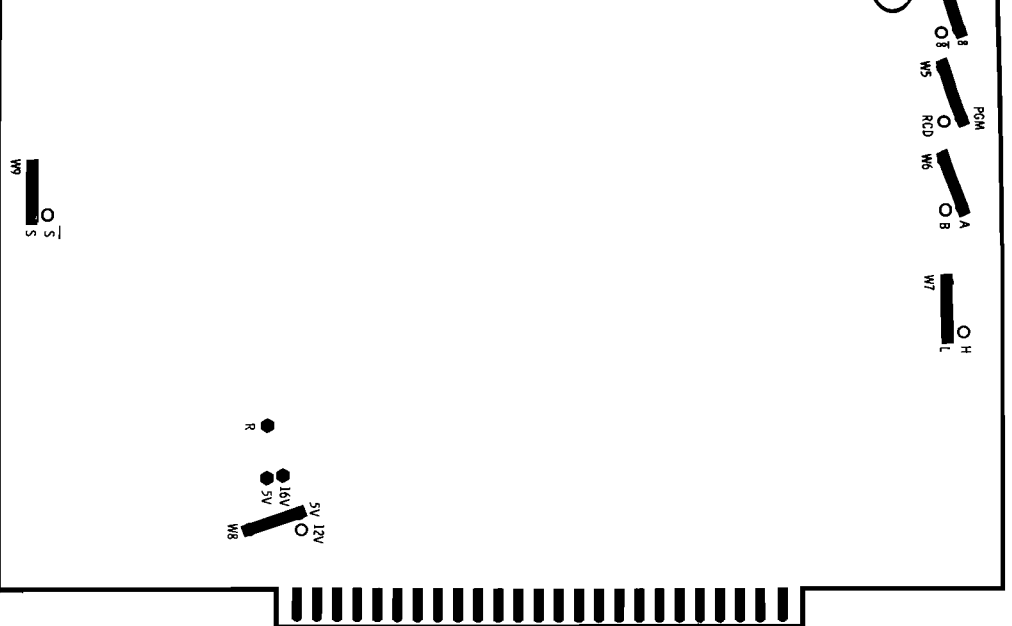
HP 12798-60011 JUMPER

W1 = 1 W5 = PGM
W2 = 2 W6 = A
W3 = 4 W7 = L
W4 = 8 W8 = 5V

- The position of W4 depends on the information used. See OPERATING information.



PER SETTINGS



OTHER HP 3480A/B AND HP 3485A OPTIONS ALLOWED

- a. For HP 3480A/B:
Option 002: Ratio. This option may be in the instrument but may not be used with the HP 3485A.
- b. For HP 3485A:
No other options are available at this time (July, 1971).

HP 3480A/B CONTROL SETTINGS

RATIO MODE (Rear panel, HP 3480A/B, Option 002 only): OFF
 RATIO REFERENCE RANGE (Rear panel, HP 3480A/B, Option 002 only): Either position

HP 3485A CONTROL SETTINGS

FILTER: REM
 RANGE: REM
 RANDOM/ LAST CHANNEL: REM
 CHANNEL DELAY: As desired (This control is not programmable.)
 MODE: REM

HP 12798-60011 JUMPER SETTINGS

W1 = $\bar{1}$ W5 = PGM W9 = S
 W2 = $\bar{2}$ W6 = A W50 = 5V
 W3 = $\bar{4}$ W7 = L W51 = \bar{H}
 W4 = 8 W8 = 5V R = Empty

① The position of W4 depends upon the scan mode used. See OPERATING NOTES for further information.

- For HP 3480A/B
- Option 004: Isolated BCD Output, Serial Suffix 00325 and up.
- For HP 3485A:
 - 1. Option 057: Remote Control
 - 2. Any one of the following options:
 - a) Option 051: 10 Channels
 - b) Option 052: 20 Channels
 - c) Option 053: 30 Channels
 - d) Option 054: 40 Channels
 - e) Option 055: 50 Channels

SUMMARY OF COMMAND SEQUENCE FOR REMOTE OPERATION OF HP 3485A SCANNING UNIT

Step Mode (W4 = 8)	Random Mode (W4 = 8 or $\bar{8}$)	Single Scan Mode (W4 = 8)	Continuous Scan Mode (W4 = 8)
E } Channel 1 I } Channel 1	E } Selected Channel I } Selected Channel	I } Channel 1 E } Channel 1	I } Channel 1 E } Channel 1
E } Channel 2 I } Channel 2	E } Selected Channel I } Selected Channel	E } Channel 2 O } Channel 2	E } Channel 2 O } Channel 2
E } Channel 3 I } Channel 3	E } Selected Channel I } Selected Channel	E } Channel 3 O } Channel 3	E } Channel 3 O } Channel 3
E } Last Channel I } Last Channel	E } Selected Channel I } Selected Channel	E } Last Channel O } Last Channel	E } Last Channel O } Last Channel
E } Channel 1 I } Channel 1	E } Selected Channel I } Selected Channel	I } Reprogram scanner to resume scan E } Channel 1 O } Channel 1	E } Channel 1 O } Channel 1
E } Channel 2 I } Channel 2	E } Selected Channel I } Selected Channel	E } Channel 2 O } Channel 2	E } Channel 2 O } Channel 2
E } Last Channel I } Last Channel	E } Selected Channel I } Selected Channel	E } Last Channel O } Last Channel	E } Last Channel O } Last Channel

NOTES:

- 1. All "I" commands are addressed to the HP 12798B BCD Output Card.
- 2. All "E" and all "O" commands are addressed to the HP 12797A BCD Input Card.
- 3. Home Mode: If W4 = 8, @aI sends the scanner Home. If W4 = $\bar{8}$, @aI180, sends the scanner Home.



UNFOLD FOR
 Figure 2-12A. HP 6936A Programming Interface
 US-5

UNFOLD FOR
 Figure 2-12B. HP 3480/85 Scanning Unit Interface
 (Sheet 1 of 2)
 US-6

OPERATING NOTES

In the example I/O instructions in the following notes, the HP 12798B is assumed to be in I/O slot 4. The programming digits are assumed to come from a device which generates a Done signal (pulls NDNE low) when it transmits a comma (,) to indicate the end of a transmission. The control card and some I/O cards must transmit some other character (e.g., reverse slash (\) or space () in order to activate the Done signal. Consult the appropriate coupler/controller or I/O card manual to determine when the Done signal is activated (NDNE pulled low). In the Scan Mode example below, the reference to the comma following the "I" command actually refers to the appropriate end of the transmission character of the I/O card transmitting the programming digits to the HP 12798B.

Typical instruction used in OPERATING NOTES

"I" instruction to card in _____
I/O slot 4
Enable digit _____
Continuous scan mode _____
Last Channel = 37 _____
Range = 1000 mV _____
Filter not enabled _____
End of transmission character _____

STEP MODE

An "I" command to the HP 12798B is given between an "E" and an "O" command to the HP 12797A for each scan advance step. LAST CHANNEL is followed by Channel 1. Jumper W4 on the HP 12798B must be in position 8. (Continuous Scan Mode is similar in operation except that the "I" command need be given only once--when the mode is begun or when some parameter such as range or last channel is changed.)

- If the scanner is not Home, issue an "@4118," command to the HP 12798B card in I/O slot 4 to send the scanner Home, or press the HOME button on the front panel of the scanner. If the scanner is Home (no CID illuminated) and is in Ready condition (R is illuminated), proceed to Step "c".
- If the scanner is Home and is not in Ready condition, proceed to Step "b" and then to Step "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "b" may be included in the first scan advance operation.)

- Issue an "E" command to the HP 12797A BCD Input Card. The Ready Light (R) will come on immediately.

- Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411403720, for Step mode, Last Channel = 27, Range = 10V, Filter not enabled). The Ready light will go off and the next Channel ID light will come on. After the expiration of the CHANNEL DELAY (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.]

- Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- Repeat Steps "b" through "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured, the next scan advance operation will advance the scanner to Channel 1.

SINGLE SCAN MODE

One "I" command allows one complete scan from Channel 1 to the selected LAST CHANNEL, with only an "E" and an "O" command required for each step in the scan cycle. LAST CHANNEL is not followed by Channel 1 unless another "I" command is given. Jumper W4 on the HP 12798B should be in position 8.

- If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to Step "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

- Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411403720, for the Single Scan mode, with Last Channel = 23, Range = 10V and Filter not enabled). If the scanner was in Ready condition (R illuminated) during Step "a", R will go off and Channel ID = 1 will come on. After the expiration of the Channel Delay (set on the front

panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d". If the scanner was not in Ready condition during Step "a", no lights come on at this time; proceed to Step "c".

- Issue an "E" command to HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.

- Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- Repeat Steps "c" and "d" for each reading desired. Do not perform Steps "c" and "d" after the LAST CHANNEL measurement is complete without first performing Step "b" to begin a new scan cycle. Then proceed to Steps "c" and "d" as usual. If this restriction is violated, the coupler/controller system will halt until either the RESET or the START button on the coupler/controller is pressed.

NOTE

Once the regular cycle is started in Single Scan mode ("I" command, "E", "O", "E", "O" . . .) another "I" command at any point before an "E" command will send scanner to Home and the following "E" command will advance the scanner to Channel 1.

- CONTINUOUS SCAN MODE
- One "I" command allows continuous cycling of the scanner with only an "E" and an "O" command to the HP 12797A required for each step in the scan cycle. LAST CHANNEL is followed by Channel 1. Jumper W4 on the HP 12798B should be in position 8.

- If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

- Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411403720, for the Continuous mode, with Last Channel = 37, Range = 10V and Filter not enabled). If scanner was in Ready condition (R illuminated) during Step "a", R goes off and Channel ID = 1 comes on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d".

If the scanner was not in Ready condition during Step "a", no lights come on at this time; proceed to Step "c".

- Issue an "E" command to HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.

- Issue "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- Repeat Steps "c" and "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured and transferred to the ASCII bus, the next "E" command will advance the scanner to Channel 1.

- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

NOTE

Once the regular cycle is started in Continuous mode ("I" command, "E", "O", "E", "O" . . .) another "I" command at any point before an "E" command will send the scanner to Home and the following "E" command will advance the scanner to Channel 1.

NOTE

An "I" command to the HP 12797A BCD Input Card, and an "O" command to the HP 12797A for each reading on the selected Random Channel. The desired channel is set by the program. Jumper W4 on the HP 12798B should be in position 8.

RANDOM MODE

- b. Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411401520, for the Continuous mode, with Last Channel = 37, Range = 10V and Filter not enabled). If scanner was in Ready condition (R illuminated) during Step "a", R goes off and Channel ID = 1 comes on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d".
- c. Issue an "E" command to the HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.
- d. Issue "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.
- e. Repeat Steps "c" and "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured and transferred to the ASCII bus, the next "E" command will advance the scanner to Channel 1.

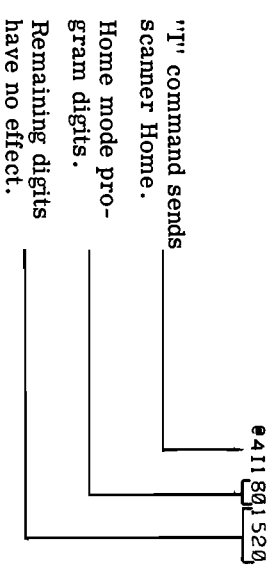
- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "c". If scanner is not in Ready condition, proceed to Step "b". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "b" may be included in the first Random Scan operation.)
- b. Issue an "E" command to the HP 12797A BCD Input Card. The Ready Light (R) will come on immediately.
- c. Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411011520, for the Random mode with the Random Channel = 15, Range = 10V and Filter not enabled). The Ready light will go off and the selected Channel ID light will come on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel indicated by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.]
- d. Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the HP coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.
- e. Repeat Steps "b" through "d" for each desired channel or for each reading on the same selected channel.

If it is desired to use the Random Mode in conjunction with the Step Mode, jumper W4 should be in position 8 instead of 8. Operation is identical in both cases except that with W4 = 8, the scanner automatically goes Home as soon as the HP 12798B receives an "I" command (even before any programming digits are transmitted to the card). When W4 = 8, the scanner does not automatically go Home upon receipt by the HP 12798B of an "I" command. However, whenever the scan mode is changed to a different mode the scanner should be sent Home between scan modes. If W4 = 8, the scanner will go Home only when the HP 12798B is given the "I" command followed by the appropriate programming digits for Home mode (e.g., @4118.).

HOME MODE

- a. An "I" command to the HP 12798B is given to send the scanner Home, i.e., scan counter set to zero, all channels open.
- b. W4 = 8. When W4 is set to position 8 the issuance of an "I" command to the HP 12798B causes the scanner to go Home immediately, even before any programming digits are issued. Therefore, it is not necessary to issue the Enable Program (1) and the Home mode (80) programming digits to the HP 12798B to send the scanner to Home. If another set of program digits is to be given, they may be issued immediately after the "I" command. For example, suppose the scanner is at channel 23 and it is desired to initiate a new scan of 15 channels in continuous scan mode. The I/O card instruction and associated program word would be:
 - "I" command sends scanner Home.
 - Programming digits establish conditions for new scan.
 - End of transmission character terminates output from programming digit source and initiates scan operation.

If program considerations make it desirable to issue the same number of programming digits with every "I" command, and it is desired to send the scanner Home without initiating a new scan operation, the Home mode programming digits may be issued with an "I" command. The programming digits following the Enable Program (1) and Home mode digits (80) will not affect the Home mode and may be any desired digits.



- b. W4 = 8. When W4 is set to 8 the issuance of an "I" command to the HP 12798B does not automatically send the scanner Home. Therefore, it is necessary to issue the Enable Program (1) and the Home mode (80) programming digits with an "I" command to the HP 12798B. The scanner will go Home as soon as the 8 is issued. The digit following the 8 may be zero or may be omitted. Remaining digits may be omitted or issued if desired, but they will have no effect on the scanner. The comma (or other end of transmission character) should be issued to terminate the output from the programming digit source and to terminate the input to the HP 12798B.
- A typical Home command would be:

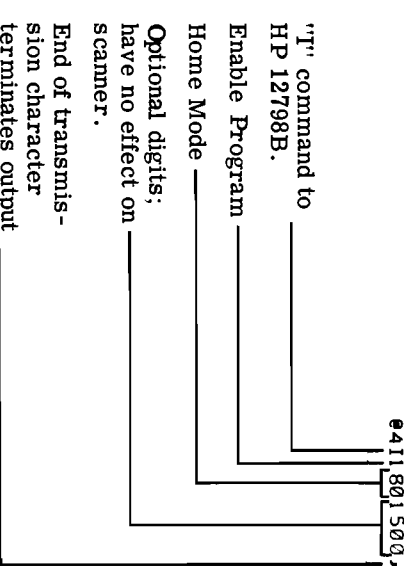
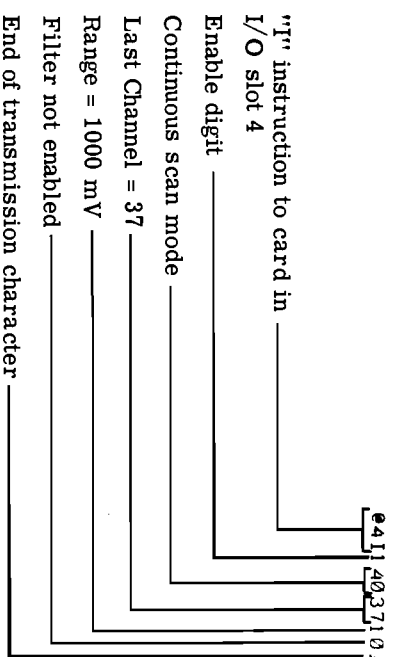


Figure 2-12B. HP 3480/85 Scanning Unit Interface

OPERATING NOTES

In the example I/O instructions in the following notes, the HP 12798B is assumed to be in I/O slot 4. The programming digits are assumed to come from a device which generates a Done signal (puls DNDNE low) when it transmits a comma (,) to indicate the end of a transmission. The control card and some I/O cards must transmit some other character (e.g., reverse slash (\) or space ()) in order to activate the Done signal. Consult the appropriate coupler/controller or I/O card manual to determine when the Done signal is activated (NDNE pulled low). In the Scan Mode example below, the reference to the comma following the "r" command actually refers to the appropriate end of the transmission character of the I/O card transmitting the programming digits to the HP 12798B.

Typical instruction used in OPERATING NOTES



An "r" command to the HP 12798B is given between an "E" and an "O" command to the HP 12797A for each scan advance step. LAST CHANNEL is followed by Channel 1. Jumper W4 on the HP 12798B must be in position 8. (Continuous Scan Mode is similar in operation except that the "r" command need be given only once--when the mode is begun or when some parameter such as range or last channel is changed.)

- a. If the scanner is not Home, issue an "@4118," command to the HP 12798B card in I/O slot 4 to send the scanner Home, or press the HOME button on the front panel of the scanner. If the scanner is Home (no CID illuminated) and is in Ready condition (R is illuminated), proceed to Step "c".
- If the scanner is Home and is not in Ready condition, proceed to Step "b" and then to Step "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "b" may be included in the first scan advance operation.)

- b. Issue an "E" command to the HP 12797A BCD Input Card. The Ready Light (R) will come on immediately.

- c. Issue the appropriate "r" command to the HP 12798B BCD Output Card (e.g., @411102720, for Step mode, Last Channel = 27, Range = 10V, Filter not enabled). The Ready light will go off and the next Channel ID light will come on. After the expiration of the CHANNEL DELAY (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "r" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.]

- d. Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- e. Repeat Steps "b" through "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured, the next scan advance operation will advance the scanner to Channel 1.

SINGLE SCAN MODE

One "r" command allows one complete scan from Channel 1 to the selected LAST CHANNEL, with only an "E" and an "O" command required for each step in the scan cycle. LAST CHANNEL is not followed by Channel 1 unless another "r" command is given. Jumper W4 on the HP 12798B should be in position 8.

- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to Step "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

- b. Issue the appropriate "r" command to the HP 12798B BCD Output Card (e.g., @411202320, for the Single Scan mode, with Last Channel = 23, Range = 10V and Filter not enabled). If the scanner was in Ready condition (R illuminated) during Step "a", R will go off and Channel ID = 1 will come on. After the expiration of the Channel Delay (set on the front

panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "r" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d". If the scanner was not in Ready condition during Step "a", no lights come on at this time; proceed to Step "c".

- c. Issue an "E" command to HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.

- d. Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- e. Repeat Steps "c" and "d" for each reading desired. Do not perform Steps "c" and "d" after the LAST CHANNEL measurement is complete without first performing Step "b" to begin a new scan cycle. Then proceed to Steps "c" and "d" as usual. If this restriction is violated, the coupler/controller system will halt until either the RESET or the START button on the coupler/controller is pressed.

NOTE

Once the regular cycle is started in Single Scan mode ("r" command, "E", "O", "E", "O" . . .) another "r" command at any point before an "E" command will send scanner to Home and the following "E" command will advance the scanner to Channel 1.

CONTINUOUS SCAN MODE

One "r" command allows continuous cycling of the scanner with only an "E" and an "O" command to the HP 12797A required for each step in the scan cycle. LAST CHANNEL is followed by Channel 1. Jumper W4 on the HP 12798B should be in position 8.

- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

- b. Issue the appropriate "r" command to the HP 12798B BCD Output Card (e.g., @411403720, for the Continuous mode, with Last Channel = 37, Range = 10V and Filter not enabled). If scanner was in Ready condition (R illuminated) during Step "a", R goes off and Channel ID = 1 comes on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "r" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d".

If the scanner was not in Ready condition during Step "a", no lights come on at this time; proceed to Step "c".

- c. Issue an "E" command to HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.

- d. Issue "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- e. Repeat Steps "c" and "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured and transferred to the ASCII bus, the next "E" command will advance the scanner to Channel 1.

- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "b" and then directly to Step "d", skipping Step "c". If the scanner is not in Ready condition, proceed to Step "b" and then to "c". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "c" may be included in the first Continuous Scan operation.)

- b. Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411401520, for the Continuous mode, with Last Channel = 37, Range = 10V and Filter not enabled). If scanner was in Ready condition (R illuminated) during Step "a", R goes off and Channel ID = 1 comes on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel shown by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.] Proceed to Step "d".
If the scanner was not in Ready condition during Step "a", no lights come on at this time; proceed to Step "c".

- c. Issue an "E" command to HP 12797A. The previous Channel ID light will go off (if any was lit) and the next Channel ID light will come on. After the expiration of the Channel Delay, begun by the "E" command, the HP 3480A/B will measure the voltage on the scanner channel shown by the illuminated Channel ID.

- d. Issue "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- e. Repeat Steps "c" and "d" for each reading desired. When the voltage on the selected LAST CHANNEL has been measured and transferred to the ASCII bus, the next "E" command will advance the scanner to Channel 1.

NOTE

Once the regular cycle is started in Continuous mode ("I" command, "E", "O", "E", "O" . . .) another "I" command at any point before an "E" command will send the scanner to Home and the following "E" command will advance the scanner to Channel 1.

- a. If the scanner is in Ready condition (R is illuminated), proceed to Step "c". If scanner is not in Ready condition, proceed to Step "b". (Press RESET on the coupler/controller if it is desired to remove the scanner from the Ready condition so that Step "b" may be included in the first Random Scan operation.)

- b. Issue an "E" command to the HP 12797A BCD Input Card. The Ready Light (R) will come on immediately.

- c. Issue the appropriate "I" command to the HP 12798B BCD Output Card (e.g., @411011520, for the Random mode with the Random Channel = 15, Range = 10V and Filter not enabled). The Ready light will go off and the selected Channel ID light will come on. After the expiration of the Channel Delay (set on the front panel of the scanner), the HP 3480A/B will measure the voltage on the HP 3485A channel indicated by the illuminated Channel ID. [In this case, the CHANNEL DELAY begins when the comma (or other end of transmission character) following the "I" command causes the HP 12798B to issue a Store Data signal to the HP 3485A.]

- d. Issue an "O" command to the HP 12797A BCD Input Card. The data stored on the card by the HP 3480A/B will be transferred to the ASCII bus in the HP coupler/controller. If the HP 3480A/B has not yet transferred the data to the HP 12797A, the HP 12797A will halt the coupler/controller until the data has been transferred and output to the ASCII bus.

- e. Repeat Steps "b" through "d" for each desired channel or for each reading on the same selected channel.

NOTE

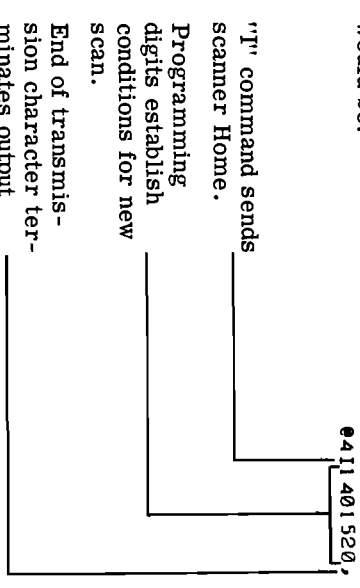
If it is desired to use the Random Mode in conjunction with the Step Mode, jumper W4 should be in position 8 instead of 8. Operation is identical in both cases except that with W4 = 8, the scanner automatically goes Home as soon as the HP 12798B receives an "I" command (even before any programming digits are transmitted to the card). When W4 = 8, the scanner does not automatically go Home upon receipt by the HP 12798B of an "I" command. However, whenever the scan mode is changed to a different mode the scanner should be sent Home between scan modes. If W4 = 8, the scanner will go Home only when the HP 12798B is given the "I" command followed by the appropriate programming digits for Home mode (e.g., @4118.).

HOME MODE

An "I" command to the HP 12798B is given to send the scanner Home, i.e., scan counter set to zero, all channels open.

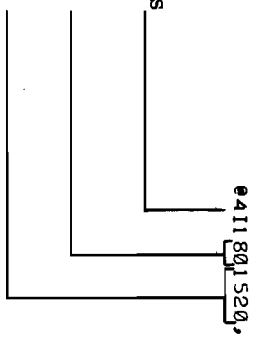
- 2. W4 = 8.

When W4 is set to position 8 the issuance of an "I" command to the HP 12798B causes the scanner to go Home immediately, even before any programming digits are issued. Therefore, it is not necessary to issue the Enable Program (1) and the Home mode (80) programming digits to the HP 12798B to send the scanner to Home. If another set of program digits is to be given, they may be issued immediately after the "I" command. For example, suppose the scanner is at channel 23 and it is desired to initiate a new scan of 15 channels in continuous scan mode. The I/O card instruction and associated program word would be:



If program considerations make it desirable to issue the same number of programming digits with every "I" command, and it is desired to send the scanner Home without initiating a new scan operation, the Home mode programming digits may be issued with an "I" command. The programming digits following the Enable Program (1) and Home mode digits (80) will not affect the Home mode and may be any desired digits.

"I" command sends scanner Home.
Home mode program digits.
Remaining digits have no effect.



- b. W4 = 8.

When W4 is set to 8 the issuance of an "I" command to the HP 12798B does not automatically send the scanner Home. Therefore, it is necessary to issue the Enable Program (1) and the Home mode (80) programming digits with an "I" command to the HP 12798B. The scanner will go Home as soon as the 8 is issued. The digit following the 8 may be zero or may be omitted. Remaining digits may be omitted or issued if desired, but they will have no effect on the scanner. The comma (or other end of transmission character) should be issued to terminate the output from the programming digit source and to terminate the input to the HP 12798B.

A typical Home command would be:

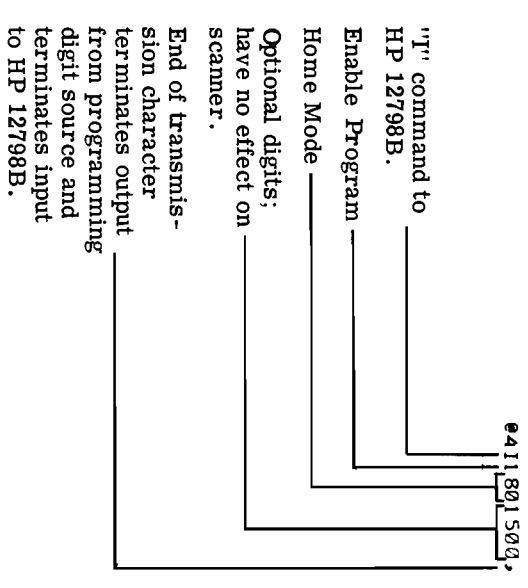


Figure 2-12B. HP 3480/85 Scanning Unit Interface (Sheet 2 of 2) US-7/US-8

2-36. HP 2575A COUPLER/CONTROLLER

2-37. To connect a peripheral device to a BCD output card installed in the HP 2575A, proceed as follows:

- a. Set the HP 2575A LINE ON/OFF switch to OFF.
- b. Locate the rear cover on the back of the instrument. See Figure 2-3 in HP 2575A Operating and Service Manual. Release the rear cover latches and remove the cover.
- c. Hold the connector which mates with the BCD output card with the cable pointing towards the right (away from the fan and power module).
- d. Carefully slide the cable connector onto the pin connections of the BCD output card.
- e. Check that the card is firmly seated in place.
- f. Engage the two tabs on the rear cover into the slots on the rear panel and lock the rear cover in position.
- g. Connect the other end of the cable to the peripheral device.

2-38. OPERATIONAL CHECK**2-39. GENERAL**

2-40. Since the BCD output card will not perform any useful function by itself, an operational check of the card requires the use of the HP 2570A (or HP 2575A) Coupler/Controller and certain external equipment. Also, since the user's system components are not known, separate performance checks, specifying a variety of input/output equipment, are provided for the record and program functions of the card. The user should carry out the check applicable to his equipment.

2-41. In the event that the card does not operate as described, consult the troubleshooting information contained in Section IV of the manual or consult the nearest Hewlett-Packard Sales and Service Office.

2-42. RECORD MODE CHECK

2-43. Equipment Required. The following equipment is required to check operation of the BCD output card when used to interface a digital recorder with the HP 2570A or HP 2575A:

- a. HP 5050A/B, HP 5055A, or HP 562A Digital Recorder.
- b. HP 12798B BCD Output Card, HP Part No. 12798-60010 (for HP 5055A); or HP 12798-60012 (for HP 5050A/B or HP 562A).
- c. HP 02547-6040 cable (for digital recorder).
- d. HP 12797A BCD Input Card (for data source).

- e. A digital data source such as a DVM, counter, etc.
- f. Cable for digital data source interface.
- g. HP 2570A (or HP 2575A) Coupler/Controller.

2-44. System Set-Up. The test set-up is illustrated in Figure 2-13. To assemble, proceed as follows:

NOTE

The test system described is for use with an HP 2570A. If an HP 2575A is employed, the same I/O slot numbers, coupler/controller test program, etc., may be used.

- a. Set HP 2570A LINE ON/OFF switch to OFF.
 - b. Check that the BCD input card is correctly programmed for the data source for not more than 10 characters.
 - c. Insert the BCD input card into I/O slot 2 in the HP 2570A Coupler/Controller.
 - d. Connect the appropriate interface cable between the data source and the BCD input card.
 - e. Program the BCD output card to operate in the record mode with the HP digital recorder in use. See Figure 2-5 or 2-6.
 - f. Place the BCD output card in I/O slot \emptyset . Connect the recorder to the card with cable HP 02547-6040.
 - g. Remove the control panel and control card from the HP 2570A.
 - h. Program instructions @ \emptyset K @2E @2O @2E @2O @2N @2E @2O @ \emptyset I @2E @2O @2E @2O on the control card as shown in Figure 2-13. Set SINGLE/CONT jumper W1 to SINGLE and START jumper W2 to MAN.
 - i. Replace the control card in the HP 2570A and fit the control panel on the front of the control card.
- 2-45. Checkout Procedure. After the system has been assembled, check the record mode of operation as follows:
- a. Switch the digital data source to ON and connect a suitable signal source to its input. Adjust the instrument for a readout.
 - b. Connect the HP 2570A to an ac power source and set LINE ON/OFF switch to ON.
 - c. Energize the digital recorder.
 - d. Set the RUN/STOP switch on the HP 2570A control panel to RUN, and press the START button. Check that the following action now occurs: Digital source takes a reading and the readout is printed in the format programmed on the BCD input card. This

procedure should be repeated 3 times with the recorder presenting 3 lines of readout data. If the digital recorder presents 1, 2, 4, or 5 lines of data, a possible malfunction exists in the card as detailed in the following table. However, before assuming that a malfunction exists, carefully check the test program on the diode pinboard for correct programming and the other parts of the test set-up for correct operation. If the card still fails to operate correctly, consult the troubleshooting information contained in Section IV of this manual or contact your nearest Hewlett-Packard Sales and Service Office.

<u>Readout Lines</u>	<u>Possible Malfunction</u>
1	K command not set
2	I command not set
4	I command not reset
5	K command not reset by N command

2-46. PROGRAM MODE CHECK

2-47. Equipment Required. The following equipment is required to check operation of the BCD output card when used to program an instrument:

- a. HP 2570A (or HP 2575A) Coupler/Controller.
- b. HP 12798-60010 (positive-true output) or HP 12798-60011 (ground-true output) or HP 12798-60012 (+12V-true output) BCD Output Card.
- c. HP 412A VTVM or equivalent.

2-48. System Set-Up. To prepare the system for test, proceed as follows:

- a. Set the HP 2570A LINE ON/OFF switch to OFF.

NOTE

The test system described is for use with an HP 2570A. If an HP 2575A is employed, the same I/O slot number, test program, etc., may be used.

- b. Set the BCD output card jumpers as detailed below:

<u>Jumper</u>	<u>Position</u>	<u>Jumper</u>	<u>Position</u>
W1	$\bar{1}$	W6	B
W2	$\bar{2}$	W7	L
W3	$\bar{4}$	W8	5V
W4	$\bar{8}$	W9	\bar{S}
W5	PGM	W51	\bar{H}

- c. Insert the BCD output card into I/O slot 0 in the HP 2570A.

- d. Remove the control panel and control card from the HP 2570A.

- e. Program @0I, ASCII Sp (space), ASCII-(minus), ASCII 4, ASCII G, and ASCII \ (reverse slash) on the control card as shown in Figure 2-14.

- f. Replace the control card in the HP 2570A and fit the control panel on the front of the control card.

2-49. Check-out Procedure. After the system has been assembled, check the program mode of operation as follows:

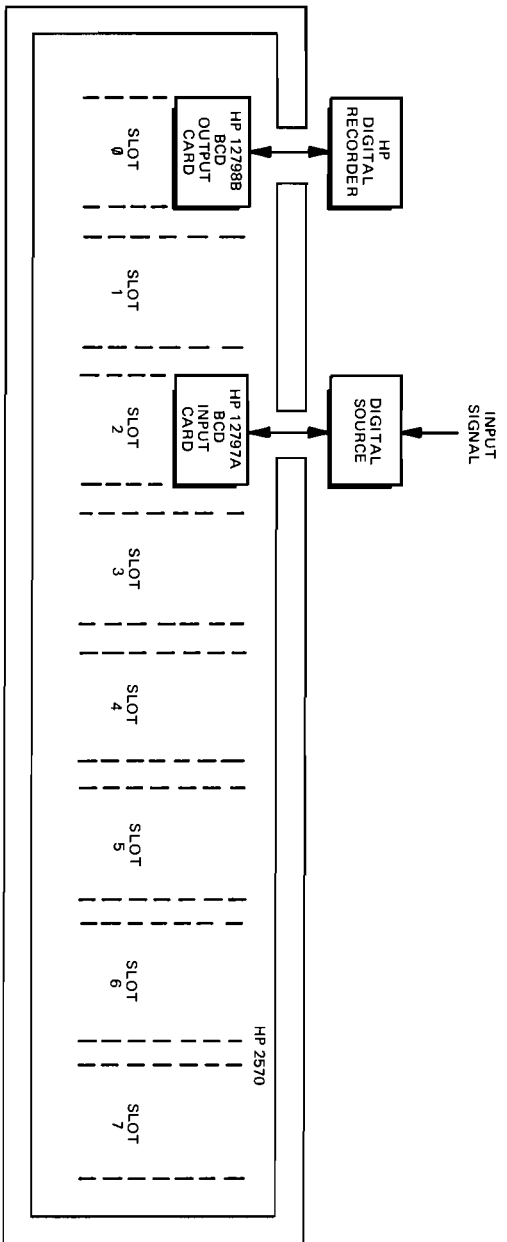
- a. Connect the HP 2570A to an ac power source and set LINE ON/OFF switch to ON.
- b. Set the RUN/STOP switch on the HP 2570A to RUN.
- c. Operate the HP 2570A START switch and check the output lines on the BCD output card as are detailed in Table 2-11.
- d. If the card fails to operate as described above, above, refer to Section IV of this manual for troubleshooting information or contact your nearest Hewlett-Packard Sales and Service Representative.

Table 2-11. Program Mode Check Readout

Output Pin	BCD Weight	Output ^①
19	1	0
20	2	0
W	4	1
X	8	0
17	1	1
18	2	1
U	4	1
V	8	1
15	1	0
16	2	0
S	4	0
T	8	0
13	1	0
14	2	0
P	4	0
R	8	0
11	1	0
12	2	0
M	4	0
N	8	0

① Output Levels:

<u>HP 12798-60010</u>	<u>HP 12798-60011</u>
"1" = + 5V ± 0.5V	"1" = + 0.4V ± 0.4V
"0" = + 0.4V ± 0.4V	"0" = + 5V ± 0.5V
<u>HP 12798-60012</u>	
"1" = + 12V ± 1V	
"0" = + 0.4V ± 0.4V	



COUPLER/CONTROLLER PROGRAM

HP 2570A Pinboard Matrix		HP 2570A Pinboard Matrix	
Step	Instruction	Step	Instruction
0	@0K	7	@20
1	@2E	8	@0I
2	@20	9	@2E
3	@2E	10	@20
4	@20	11	@2E
5	@2N	12	@20
6	@2E		

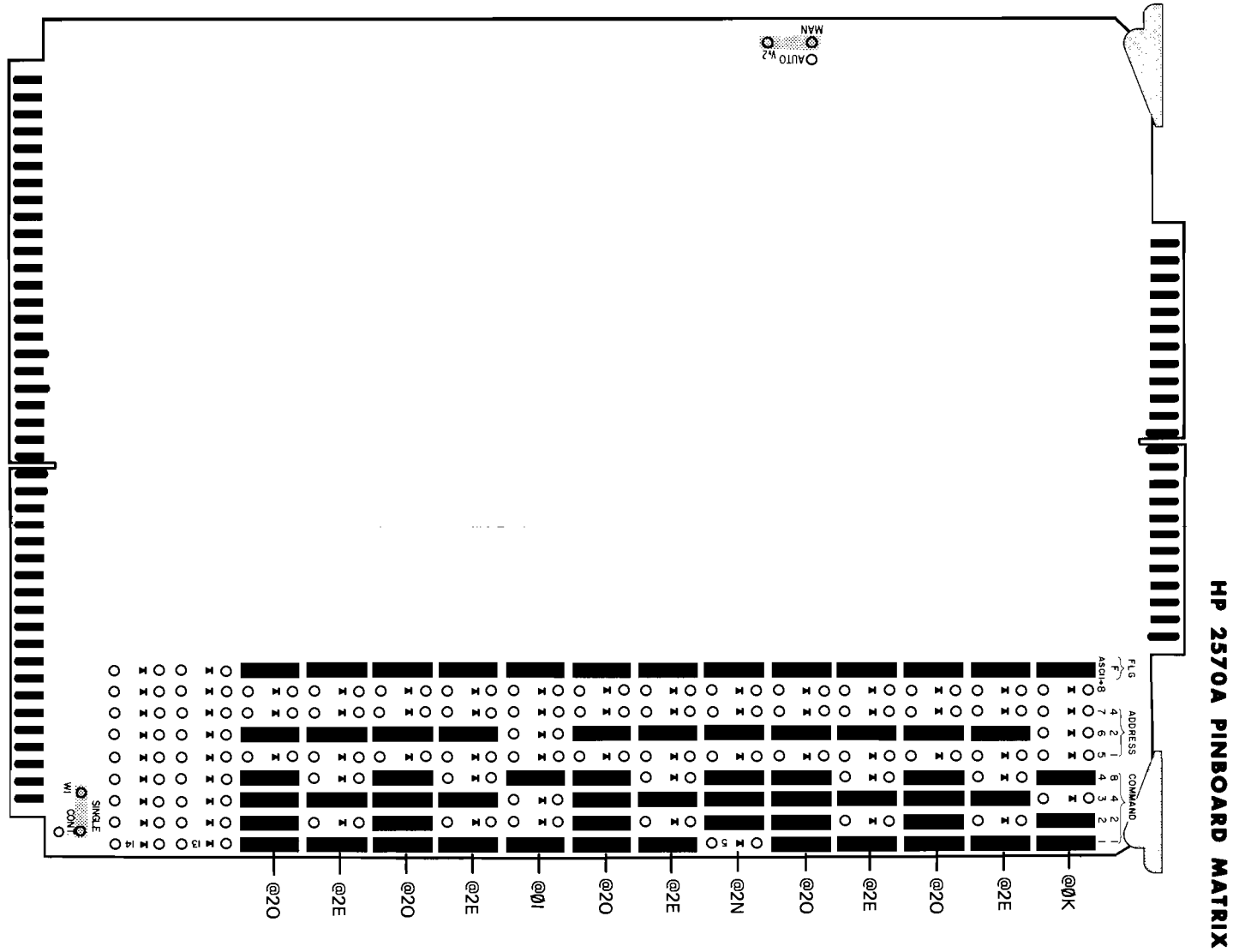


Figure 2-13. Record Mode Check

HP 2570A PINBOARD MATRIX

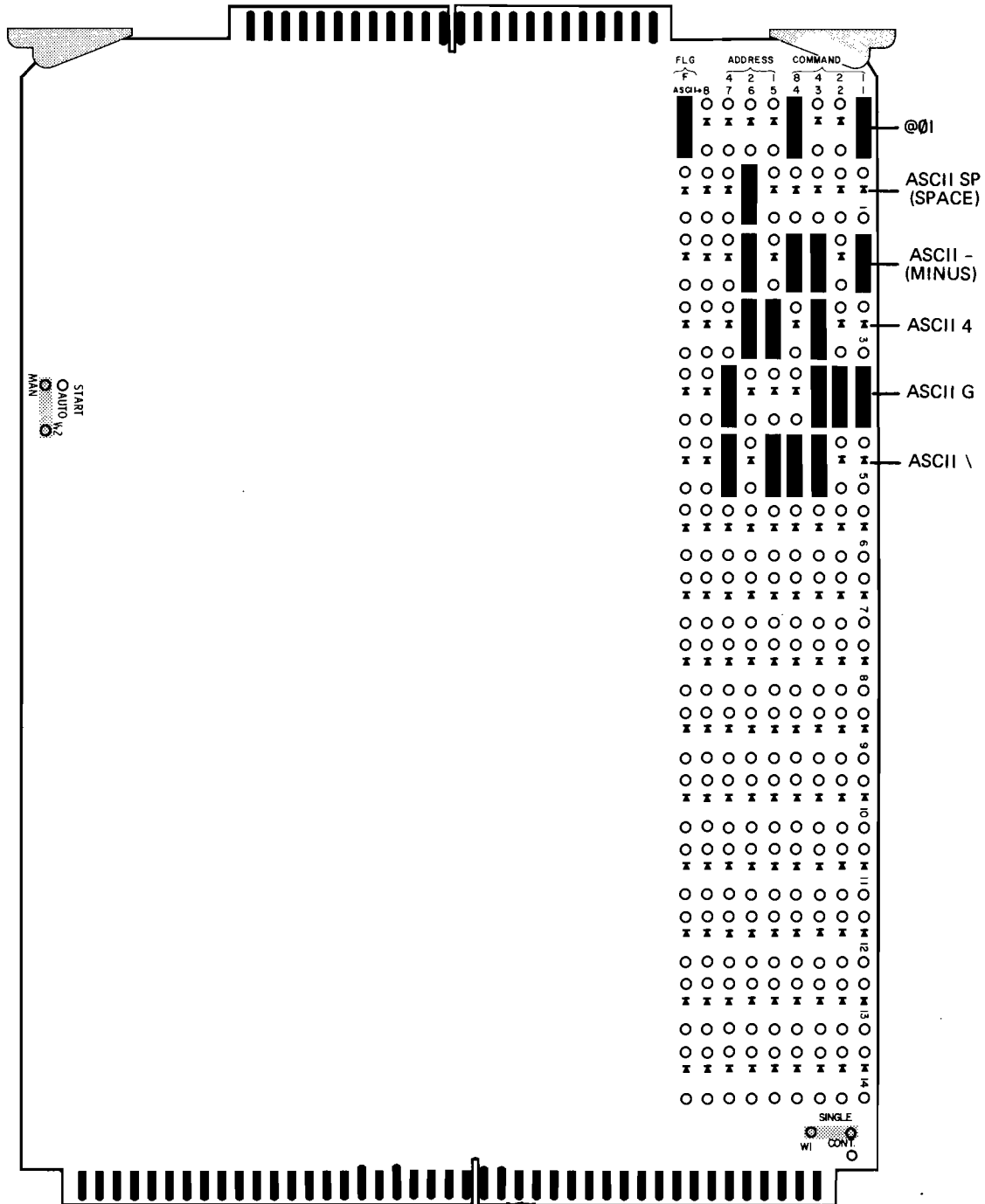


Figure 2-14. Program Mode Check

SECTION III

PRINCIPLES OF OPERATION

3-1. GENERAL INFORMATION

3-2. Figure 4-3 is a schematic of the BCD output card and Figure 3-1 shows circuit timing. Table 2-1 lists the pin connections between the card and the I/O equipment. Refer also to Figure 4-4 for a brief description, including block diagrams, of the integrated circuit elements used in the BCD output card. Table 3-1 defines the signal mnemonics internal to the BCD output card and Table 4-1 in the HP 2570A and HP 2575A Manuals defines the coupler/controller mnemonics.

3-3. BASIC CIRCUIT DESCRIPTION

3-4. The card accepts HP 2570A backplane bit-parallel, character-serial ASCII data which has been output from the coupler/controller pinboard matrix or from a source such as the HP 12797A BCD Input Card. This character information is translated into 8421 BCD by the data input logic on the BCD output card and clocked sequentially by a decade counter into a storage register on the card. Ten 4-bit data latches in the register permit up to 10 characters of information to be stored.

3-5. The card is jumper programmable by W5 to operate in either a Record (RCD) or Program (PGM) mode. When the Record (RCD) position is selected, the card converts, on receiving an I or K command from the HP 2570A, the ASCII signals on the backplane to 8421 BCD. This information is clocked digit-by-digit into the storage/output register. The last character is accompanied with or followed by a Done (NDNE) signal that initiates a Store Data pulse. This signal causes the recorder to print the bit-parallel, character-parallel data appearing on the output lines of the register. The decade counter is returned to zero when the Store Data command is issued. Upon receipt of the Store Data command, the recorder returns a Busy signal to the card and if an attempt is made to enter data before the Busy signal ends, the Wait-Busy (NWIB) line is activated. This suspends the HP 2570A instruction program until the recorder has completed the printout operation. When the recorder has no further need for the data on the output lines, the Busy signal is removed, and the storage register is cleared to a BCD preset pattern programmed with jumpers W1, W2, W3, and W4 if the data was input to the card with the K command. If the data was input with an I command, the storage register will not be preset until another I command is received. Therefore, if a K command follows an I command, those latches which are specifically changed will still contain the digit from the previous data word. Wait-Busy is also deactivated when Busy is removed and the HP 2570A instruction program is allowed to continue to the next instruction. The I command is reset after one word is output; the K command allows the card to continue to output words until the card is addressed with an N command.

3-6. With jumper W5 set to the PGM (program) position, operation of the card is basically similar to the record mode previously discussed. The card converts, upon receipt of an I command from the HP 2570A, the ASCII signals on the backplane to 8421 BCD and these are sequentially clocked into the register. The last digit in the word is either accompanied by or followed with a Done (NDNE) signal that initiates a Store Data pulse. The Store Data signal informs the programmed device that it may execute the programming information contained on the BCD output lines. When the device receives the Store Data signal, it returns a Busy pulse to the card and depending on the positions of jumpers W9 and W51, the card may be programmed to halt the main instruction program of the HP 2570A until the instrument is programmed. If the HP 2570A is allowed to operate and an attempt is made to alter the output register code before the Busy pulse is released, the HP 2570A is halted. If the programmed device is incapable of generating a Busy signal, the BCD output card will allow programming to continue approximately 300 ms after the Store Data pulse. The K command is not programmable in the PGM mode of operation.

3-7. DETAILED CIRCUIT DESCRIPTION

3-8. CONTROL CIRCUITRY

3-9. In order to describe operation of the control logic on the card, assume that Jumper W5 is set to the RCD (Record) position and the circuitry on the card is in a system normalize (Reset) state. This occurs when ac power is first applied to the HP 2570A, or when the RESET momentary switch on the HP 2570A is pressed. Either of these actions causes System Normalize signal NSYN applied at pin AA of the card to go low. This establishes initial conditions for operation which are summarized as follows:

Input Command FF U46D, U46C	Reset
Continuous Command FF U56D, U56C	Reset
End of Data FF U36A, U36B	Reset
End of Word FF U37C, U37D	Reset
Decade Counter U86	Reset to 0000
Data Storage Limit FF U26A	Set
Data Storage elements U84, U83, U82, U72, U62, U52, U42, U32, U22, U12	Preset to bit pattern programmed by jumpers W1, W2, W3, and W4

3-10. The \bar{I} (input one word) and \bar{K} (input words until N command) signals from the Command Decode logic on the BCD output card alert it to input data from the HP 2570A. Assume that the I command is addressed to the I/O slot occupied by the card being described. This causes the \bar{I} output (pin 6) of Command Decode NAND gate U43A to go low. This signal, inverted by U57C, is applied to input pin 13 of NAND gate U14A, and at Strobe (STB) the gate is enabled causing its output (pin 12) to go low and set Input Command flip-flop U46D, U46C. The reset-side output (U46C-11) of the flip-flop holds pin 5 of NOR gate U46B low, and the resulting high output at pin 6 of U46B, designated DTA, sets the logic on the card to accept data. (Input pin 4 of gate U46B remains high since the Continuous Command flip-flop stays in the reset state.)

3-11. The next command given by the HP 2570A that instructs a data source to output data causes the source interface card to activate the Interrupt Program Control (NIPC) line when data is available. When this occurs, information appears in ASCII on the HP 2570A backplane.

3-12. Operation of the BCD output card is now controlled by the HP 2570A character cycle Strobe (NSTB) and End of Character (NEOC) signals. At STB, NAND gate U25B and driver/inverter U37A generate the Data Strobe (DSTB) signal which strobes (clocks) the first 8421 BCD character from the Data Input Logic into storage. Gate U25B has a number of other inputs which also control production of the Data Strobe signal. The function of these signals are as follows:

<u>U25B Input</u>	<u>Signal</u>	<u>Function</u>
12	DTA	Enable signal from Input Command FF.
10	ADINH	Signal derived from Data Storage Limit FF U26A. The flip-flop is reset when the 10th character is entered into the data register and prevents additional characters from being stored.
13	FPST	Reset-side output of End of Word FF stops Data Strobe after last character.
CR24		Prevents non-valid characters from being entered into the data register.

3-13. At End of Character (EOC) gate U76A generates Advance signal FADV, a signal that clocks (advances) decade counter U86. Gate U76A also has a number of additional inputs which perform the following functions:

<u>U76A Input</u>	<u>Signal</u>	<u>Function</u>
1	NCOM	Prevents advancing of counter when system is in compacting mode.
4	DTA	Enable signal from Data Input FF.
2	NTNS	Prevents advancing of counter when system is in transfer mode.
5	ADINH	Output of Data Storage Limit FF. Prevents advancing the counter beyond the 10th digit.
CR47	IPC	Prevents advancing counter when Interrupt Program control is not activated.
CR49		Prevents advancing counter when non-valid character is input to card.

3-14. Successive character cycles clock information into the register in a similar manner until the last character in the word is placed on the backplane. When the data source activates the Done (NDNE) line this signal is employed by the BCD output card to initiate the Store Data command. First NDNE is inverted and NOR "tied" at pin 1 of U46A with STB to produce DNE which is "ANDed" with DTA at gate U46A. The resulting low output at pin 3 of U46A sets End of Data flip-flop U36A, U36B. The high set-side output at pin 3 is connected to input pin 10 of NAND gate U36D and at EOC, the gate is enabled and sets End of Word flip-flop U37C, U37D. The set-side output (pin 11) of the flip-flop, designated PST, is coupled to inverter U15B in the Store Data Interface and causes a dc level change at Store Data output pin 22 on the card. The direction of the level change and the amplitude are programmed with jumpers W7 and W8, respectively.

3-15. End of Word flip-flop output PST also fires 2 μ sec Counter Reset one-shot U36C, U16C whose output (U16C-11) generates signal FPRT. This pulse:

- Resets decade counter U86 to zero and
- Produces signal FRST via NOR U66A and inverter U67B which resets the Input Command and End of Data flip-flops.

3-16. The End of Word flip-flop controls the production of the Wait-Busy signal via Wait-Busy generator U76B and associated circuitry.

3-17. The Wait-Busy signal is generated by the combined action of NAND gate U76B and NOR gate U14C. All inputs to U76B are high when the card is addressed to input data and U14C is activated if an attempt is

Table 3-1. HP 12798B Logic Signals

Mnemonic	Signal	Schematic Grid Reference	Test Point	Description
ADINH	Advance Inhibit	E-8	TP7	Signal inhibits advance of decimal decoder U86 when too much data is input.
$\overline{AS1}$ to $\overline{AS4}$		A-6		8421 BCD data output by Data Input Logic for entry into Data Storage register.
DSTB	Data Strobe	E-9	TP5	Strobes data from Data Input Logic into Data Storage register.
DTA	Data	A-3	TP6	Enables data to be input to card from coupler/controller backplane.
FADV	False Advance	D-6	TP2	Advance (clock) signal for data storage Decade Counter U86.
FAS1 to FAS7	ASCII	A-1, B-1		ASCII bits 1 through 7, internal to BCD output card.
FCLR	Clear	E-4	TP3	Resets selected flip-flops on card as well as causing a PCDE pulse. Occurs on leading or trailing edge of Busy signal as desired via setting of jumper W6.
FE	Letter E	A-4		Decode for ASCII E. Part of Data Input Logic.
FPRT	False Print	C-5		Designates when Store Data command has been issued. Also initiates reset pulse (PRT) for counter U86.
FPST	Preset	C-4		Reset-side output of End of Word FF.
FN	Minus	A-4		Decode for ASCII - (minus) character. Part of Input Data Logic.
FRST	False Reset	C-2		Resets selected logic on card at end of character entry. Signal originates in card.
FSP	Space	B-4		Decode for ASCII space. Part of Data Input Logic.
FSYN	System Normalize	C-1		Initializes card logic at power turn-on or at a later time.
IDSTB	Inhibit Data Strobe	B-5	TP8	Inhibits storage of data when non-valid data is input to card.
\overline{LTR}	Letter	B-4		Part of Data Input Logic circuitry.
\overline{PCDE}	Precode	D-5		Enables preset bit pattern programmed by jumpers W1, W2, W3, and W4. Precode occurs at EOC of I command or with FCLR when K command is activated.
\overline{PGM}	Program	B-3		Enables card program mode of operation.
PRT	Print	C-5	TP4	Resets data storage Decade Counter U86.

Table 3-1. HP 12798B Logic Signals (Continued)

Mnemonic	Signal	Schematic Grid Reference	Test Point	Description
PST	Preset	C-4		Set-side output of End of Word FF. Preset generates Store Data signal.
$\overline{\text{RCD}}$	Record	C-4		Enables card record mode of operation.
C1, C2, C4, C8 $\overline{\text{C1}}, \overline{\text{C2}}, \overline{\text{C4}}, \overline{\text{C8}}$	--	C-6		8421 BCD output of Data Storage Decade Counter U86.
$\overline{0}$ to $\overline{9}$	--	D-12, C-12, B-12, A-12, D-8, C-8, B-8, A-8		10 mutually exclusive outputs of decimal decoder that clock data digit by digit into Data Storage register.
	Logic Ground	E-14	TP1	Logic ground common to system.

made to input data before the peripheral equipment is ready to accept it. The output at pin 8 of U14C is connected via inverter/driver U16D to pin U of the card.

3-18. DATA STORAGE

3-19. The data storage section of the card includes compiling logic and character encoding circuitry that translates ASCII data from the coupler/controller to 8421 BCD; a decade counter and decoder that clocks the BCD data, digit-by-digit into 10 storage/output latches; and line drivers that interface the output of the storage latches to the BCD output terminals on the card.

3-20. The compiling and character encoding logic is designated Data Input Logic in the card schematic. The circuitry consists of a number of NAND gates which translate the coupler/controller ASCII backplane data to 8421 BCD. The circuit has two modes of operation, programmed by the PGM/RCD jumper W5. When the PGM (program) position is selected, the card accepts a) ASCII characters 0 through 9 and converts them to equivalent 8421 BCD and b) characters B through G for conversion to equivalent 10 through 15 BCD code respectively; when the RCD position is selected, the card, in addition to accepting characters 0 through 9, also accepts the following ASCII characters and converts them to the 8421 BCD listed below:

ASCII Character	BCD 8421
Space	1010
E	1111
- (minus)	1011

3-21. The decade counter consists of U86, an HP 1820-0055 integrated circuit element that is externally

connected at pins 1 and 12 to form a standard decade counter. The 8421 BCD output from U86 is coupled to a decimal decoder comprised of 10 NAND gates (U75B, U75A, U74B, U74A, U65B, U65A, U64B, U64A, U55B and U55A), strobed by Data Strobe signal DSTB. The 10 mutually exclusive outputs of the decoder, designated $\overline{0}$ through $\overline{9}$, are coupled via NOR gates (U73C, U73D, U73A, U73B, U63D, U63C, U63B, U63A, U53D, and U53B) to the clock inputs of storage elements U84, U83, U82, U72, U62, U52, U42, U32, U22, and U12. The decoder outputs sequentially clock the decoded ASCII signals $\overline{\text{AS1}}, \overline{\text{AS2}}, \overline{\text{AS3}}, \overline{\text{AS4}}$ from the Data Input Logic into the latches contained in the storage elements. An alternative input to the NOR gates, Precode signal PCDE clocks the preset pattern, programmed by jumpers W1 through W4 in the Data Input Logic, into the storage element latches.

3-22. Decade counter U86 is reset to zero by signal PRT applied to pins 2 and 3 and clocked (advanced) by signal FADV connected to pin 14.

3-23. In the reset state, counter U86 output pins 12, 9, 8, and 11, corresponding to BCD bits 1, 2, 4, and 8 are low; bits $\overline{1}, \overline{2}, \overline{4},$ and $\overline{8}$ output by inverters U85C, U85A, U85D, and U85B are high. The signals are identified as U86 outputs by the prefix C. The appropriate barred and unbarred signals applied to the decimal decoder NAND gates provide a $\overline{0}$ to 9 count. For example, at reset, bits C1, C2, C4 and C8 applied to pins 9, 13, 12 and 10 respectively of NAND gate U75B are all high and produce a zero decode ($\overline{0}$ low) when Data Strobe pulse DSTB goes high. The resulting low output pulse at pin 8 of U75B, coupled to pin 12 of NOR gate U73C, produces a high clock input to data storage element U84. A low Pre-set (PCDE) pulse at pin 13 of NOR gate U73C will produce a similar clock pulse.

3-24. The four bistable latches that comprise the storage element have complementary Q and $\overline{\text{Q}}$ outputs. Information present at the data (D) input is transferred

to the Q output when the clock is high and the Q output follows the data as long as the clock remains high. When the clock goes low, the information present at the data input at the time that the transition occurs is retained at the output until the clock goes high again.

3-25. The Q and \bar{Q} outputs of the data storage latches are connected to terminals 'H' and 'L' respectively of jumpers W49 through W10 on the card. These jumpers permit the card to be hardwired for a positive-true or ground-true BCD output. The output lines selected by W49 through W10 are connected to inverting interface gates contained in integrated circuit elements U71, U61, U51, U41, U21, and U11.

Resistors R40 through R1 comprise pullup resistors for the interface gates. Jumper W50 allows the true state of the data output bit voltage to be programmed for + 5V \pm 0.5V or + 12V. \pm 1.0V.

3-26. Since the operation of all 10 storage latches is similar, only the latch for the most significant digit (MSD) will be described in detail. The data storage latches for the MSD BCD bits 8, 4, 2, and 1 are U84D, U84C, U84B, and U84A respectively. The output jumpers consist of W49 through W46. The interface gates are U71F, U71C, U71B, and U71A; pull-up resistors for the gates are R40 through R37. The BCD 8421 data is output at pins X, W, 20 and 19 on the card's 48-pin PC connector.

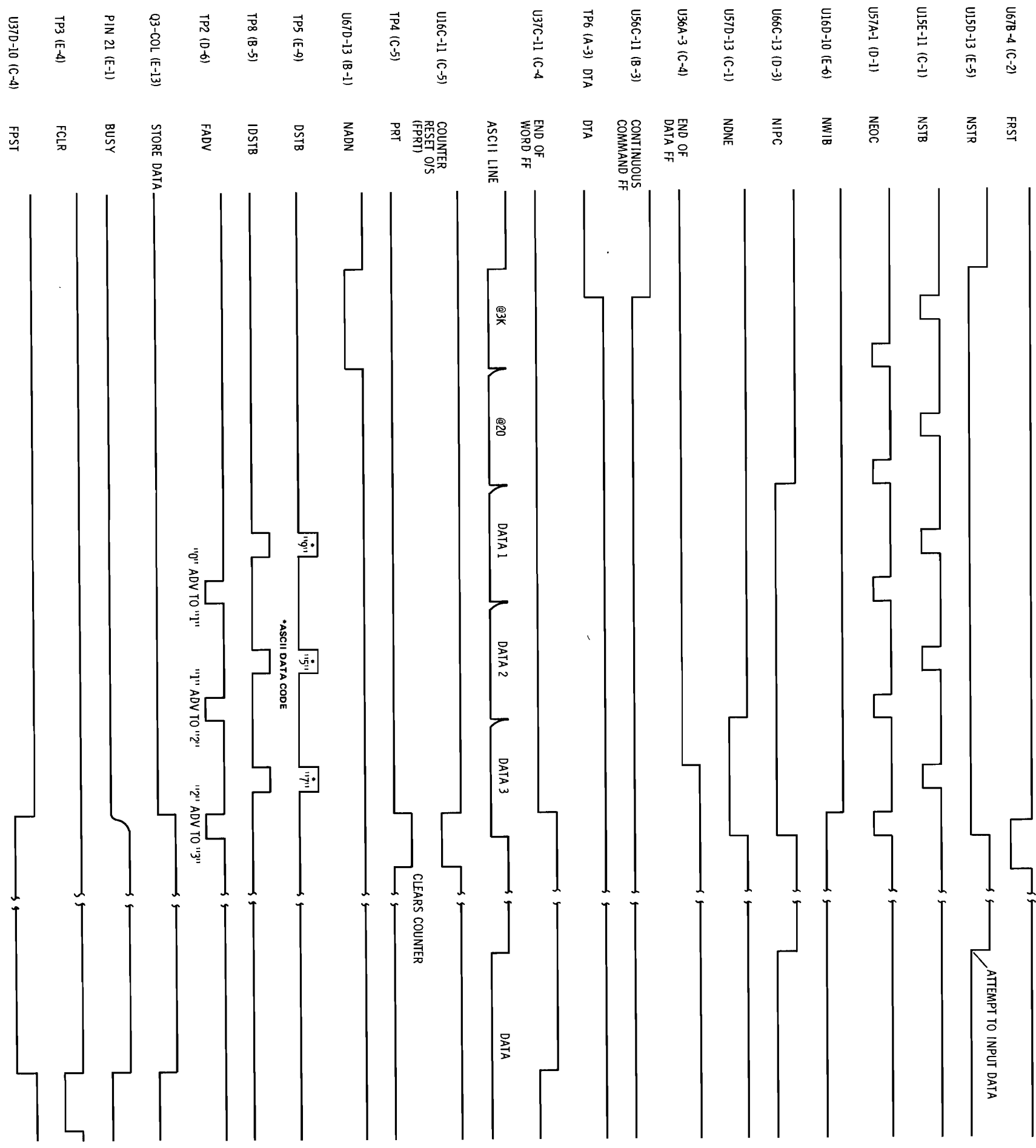


Figure 3-1. Timing Diagram

SECTION IV

SERVICING INFORMATION

4-1. INTRODUCTION

4-2. This section contains maintenance and servicing information for the HP 12798B BCD Output Card. This includes a checkout procedure for the card, troubleshooting information, and a schematic diagram.

4-3. PLUG-IN CARD

4-4. The HP 12798-60010 (positive-true output), HP 12798-60012 (+12V-true output), and HP 12798-60011 (ground-true output) BCD Output Cards are identified by the HP part number etched or stamped on the face of the card. See Figure 4-2.

4-5. LOCATION

4-6. The BCD output card can plug into any of the eight I/O slots in the HP 2570A Coupler/Controller or four I/O slots in the HP 2575A Coupler/Controller. The pin assignment for the I/O slot connections is given in Table 4-2 in the HP 2570A and HP 2575A Operating and Service Manuals.

4-7. PARTS LIST

4-8. A parts list for the BCD output card is included in Section V, and a components location drawing is included in this section. See Figure 4-2.

4-9. SCHEMATIC DIAGRAM

4-10. Figure 4-3 is a schematic of the BCD output card and Figure 4-4 contains a brief description of the integrated circuit elements used on the card.

4-11. TEST EQUIPMENT

4-12. The test equipment required for performance checking is listed in Table 5-2 in the HP 2570A and HP 2575A Operating and Service Manuals.

4-13. REPAIRS AND REPLACEMENT

4-14. REPAIRING CARD

4-15. Card should be taken when repairing or replacing printed circuit components. Refer to Section V in the HP 2570A and HP 2575A Operating and Service Manuals for general information regarding repair and replacement of PC components.

4-16. ADJUSTMENTS

4-17. There are no adjustments on the BCD output card.

4-18. CARD CHECKOUT PROCEDURE

4-19. Since the BCD output card will not perform any useful function by itself, an operational check of the card requires the use of a coupler/controller and a data source for input data to the card. As the user's system components are not known, the following equipment is suggested as a basis for a checkout of the BCD output card:

- a. HP 2570A (or HP 2575A) Coupler/Controller.
- b. BCD Input card, HP 12797A.
- c. A data source such as a DVM, counter, etc., with associated data cable.
- d. HP digital recorder, and HP 02547-6040 cable. Note: Use of the recorder is optional.
- e. HP 412A Voltmeter, or equivalent instrument.

4-21. The procedure employs the HP 12804A Diagnostic Control Panel described in Section IV of the HP 2570A and HP 2575A Coupler/Controller Operating and Service Manuals. In the event that the diagnostic control panel is not available, the coupler/controller backplane signals may be monitored at the HP 2570A/2575A control card signal points shown in Figure 4-1.

4-22. CHECKOUT PROCEDURE

4-23. To verify operation of the BCD output card, carry out the following steps:

- a. Set the HP 2570A LINE ON/OFF switch to OFF.
- b. Set the jumpers on the BCD output card as follows:

<u>Jumper</u>	<u>Position</u>	<u>Jumper</u>	<u>Position</u>
W1	$\bar{1}$	W6	A
W2	$\bar{2}$	W7	H
W3	4	W8	12V
W4	8	W9	S
W5	RCD if card is to be used as data logger; PGM if it is to be used as device control	W51	\bar{H}

c. Insert the BCD output card into I/O slot 0 and the BCD input card (suitably programmed for the data source) into I/O slot 3 in the HP 2570A.

d. Set the HP 2570A LINE ON/OFF switch to ON.

e. Measure the voltage between ground (pin BB) and pins 1 through 20, A through X, and 22 on the front of the BCD output card. (Table 2-1 lists the pin assignment and pin numbering system on the card.) Check that:

- 1) All 8 and 4 BCD weights are $+5V \pm 0.5V$ on card 12798-60010, $+12V \pm 1V$ on card 12798-60012, and $0.4 \pm 0.4V$ on card 12798-60011.
- 2) All 2 and 1 BCD weights are $+0.4V \pm 0.4V$ on cards 12798-60010 and 12798-60012, $+5V \pm 0.5V$ on card 12798-60011.
- 3) The voltage at pin 22 is $+0.4V \pm 0.4V$.

f. Measure the voltage between 1) pins AA and BB, and 2) pins 23 and BB. Check that the voltage in 1) is $+7.2V \pm 1.0V$ and in 2) $+0.7V \pm 0.3V$.

g. Set the HP 2570A LINE ON/OFF switch to OFF. Remove the control panel and control card from the coupler/controller.

h. Program the following instruction program on the HP 2570A control card pinboard matrix:

Program Step	Instruction
Ø	@3E
1	@ØI
2	@3O
3	@3E
4	@ØK
5	@3O
6	@3E
7	@ØN
8	@3O

i. Set SINGLE/CONT jumper W1 to CONT and MAN/AUTO jumper W2 to MAN.

j. Replace the control card in the HP 2570A and fit the diagnostic control panel in place.

k. Set the diagnostic control panel switches as follows:

RUN/STOP	STOP
1 MHz/MAN	1 MHz

l. Set HP 2570A LINE ON/OFF switch to ON and press the START switch. If the HP digital recorder is connected to the BCD output card, carry out all succeeding steps; if not, proceed to step r.

m. Turn the recorder ON/OFF switch to ON and press the STEP button on the control panel a number

of times. Note each data character as it appears on the ASCII code indicators until the recorder prints.

n. Check the printout against the input data. Refer to Table 4-1. Note that the first character input to the recorder appears in the extreme left-hand column and the characters that follow read from left to right.

o. Press the MANUAL PRINT button on the recorder. Note that the corresponding printout is all V's (assuming no special character wheels on the recorder).

p. Set the RUN/STOP switch to RUN. The recorder should now run continuously.

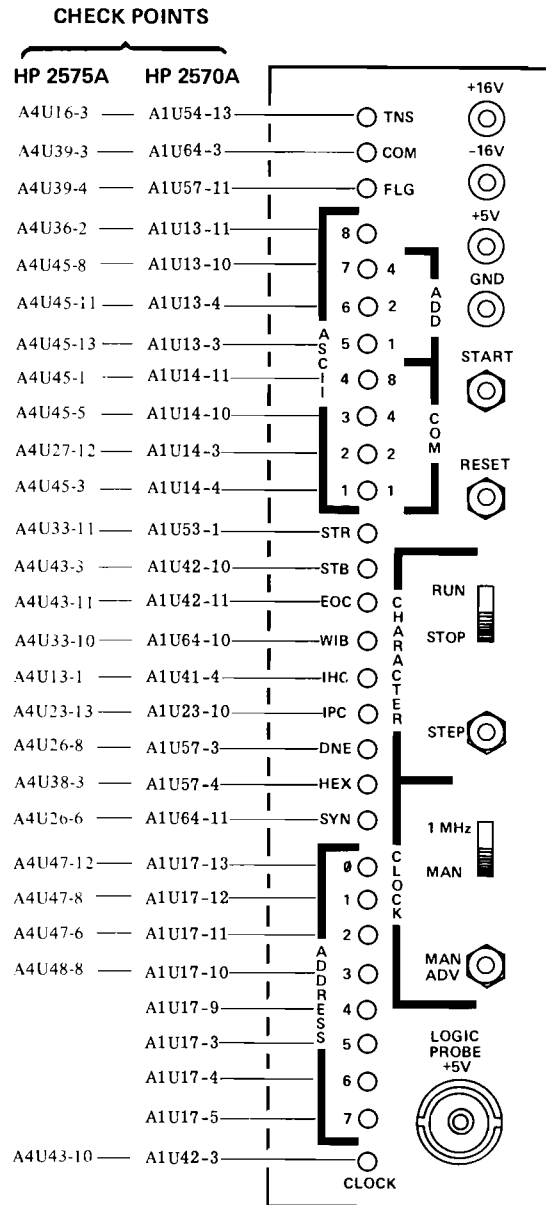


Figure 4-1. Control Card Check Points For Diagnostic Control Panel

q. Set the RUN/STOP switch to STOP and disconnect the recorder from the BCD output card. Proceed to step u.

r. Repeatedly press the STEP button until a data character (FLG character is not lit) appears on the ASCII code indicators.

s. Measure the output voltages at pins X, W, 19, and 20 with respect to ground (BB) on the BCD output card. The output code should correspond to the PGM MODE 8421 bits shown in Table 4-1.

t. Repeat steps r and s, measuring the appropriate output pins until the last (10th) character code appears on the diagnostic control panel ASCII code indicators. Note that the Done (DNE) indicator is lit.

u. Connect an oscilloscope to pins 22 and BB (ground). Set the RUN/STOP switch to RUN.

v. Adjust the oscilloscope to display a positive pulse train. Check that the waveform specifications are as follows:

- Pulse Width: 150 ms to 400 ms
- Pulse Amplitude: 12V ±2V
- Rise Time: < 1V/μs

w. Any deviation in card performance from that detailed in the preceding steps indicates a circuit malfunction. Refer to Table 4-2 for assistance in locating the defective component.

NOTE

Before troubleshooting the card, ensure that the correct supply voltages are available to the card from the coupler/controller backplane. At pins 12, 13, N and P check for +5V ±250 mV; at pins 18 and V check for +16V ±800 mV.

Table 4-1. Input/Output Codes

ASCII Character		ASCII Code Bits	Output Character		BCD Output Code Weight	
RCD Mode	PGM Mode	7 6 5 4 3 2 1	RCD ^① Mode	PGM ^② Mode	RCD Mode 8421	PGM Mode 8421
0	0	0 1 1 0 0 0 0	0	0	0000	0000
1	1	0 1 1 0 0 0 1	1	1	0001	0001
2	2	0 1 1 0 0 1 0	2	2	0010	0010
3	3	0 1 1 0 0 1 1	3	3	0011	0011
4	4	0 1 1 0 1 0 0	4	4	0100	0100
5	5	0 1 1 0 1 0 1	5	5	0101	0101
6	6	0 1 1 0 1 1 0	6	6	0110	0110
7	7	0 1 1 0 1 1 1	7	7	0111	0111
8	8	0 1 1 1 0 0 0	8	8	1000	1000
9	9	0 1 1 1 0 0 1	9	9	1001	1001
E		1 0 0 0 1 0 1	*		1111	
+		0 1 0 1 0 1 1			1100 ^③	
-		0 1 0 1 1 0 1	-		1011	
Space		0 1 0 0 0 0 0	Space		1010	
	B	1 0 0 0 0 1 0		10		1010
	C	1 0 0 0 0 1 1		11		1011
	D	1 0 0 0 1 0 0		12		1100
	E	1 0 0 0 1 0 1		13		1101
	F	1 0 0 0 1 1 0		14		1110
	G	1 0 0 0 1 1 1		15		1111

- ① Character on HP 5050A/B or HP 5055A standard print wheel.
- ② BCD equivalent code.
- ③ Preset value determined by jumpers W1, W2, W3, and W4.

Table 4-2. HP 12798B BCD Output Card Troubleshooting Table

Problem	Possible Cause	Remarks
A. Improper data code at output	Line drivers U11 (A-9, B-9) U21 (B-9, C-9) U31 (C-9, D-9) U41 (D-9, A-13) U51 (B-13) U61 (C-13) U71 (D-13) Data Storage Register elements U12 (A-8) U22 (B-8) U32 (B-8, C-8) U42 (C-8) U52 (D-8) U62 (A-12) U72 (B-12) U82 (B-12, C-12) U83 (C-12) U84 (D-12) Strobe	Verify proper input drivers. Verify proper input voltage to Data Storage register.
B. Improper strobing of data.	NSTB (C-1) NAND Gate U35A (B-5) and inverter U15E (C-1) Data Strobe generator U25B (E-8) and driver/inverter U37A (E-9) NAND gates U55 (A-7, B-7) U64 (C-7) U65 (D-7, A-11) U74 (B-11, C-11) U75 (C-11, D-11) NOR gates U53 (A-8, B-8) U63 (C-8, D-8, A-12) U73 (B-12, C-12, D-12)	Verify Strobe (NSTB) signal is applied at pin Y. Verify proper operation of gate, ie, $\geq +2.5V$ on pin 6 of U35A and pin 10 of U15E for proper data code on backplane. Verify proper signal is obtained at pin 8 of U25B and pin 3 of U37A. Note: Monitor pin 3 at TP5 (DSTB). Verify proper operation of decode strobe gates. Verify proper operation of NOR gates.
C. Decimal Decoder malfunction	Backplane NAND gate U76A (D-6) Decade Counter U86 (C-6)	Verify Compact (NCOM), Flag (NFLG), Transfer (NTNS) are $\geq +2.5V$ and Interrupt Program Control (NIPC) is $\leq +0.6V$ simultaneously and pin 4 of NAND gate U76A (D-6) is $\geq +2.5V$. Verify desired signal on output pin 6 of U76A; a $1 \mu s$ $\leq +0.6V$ pulse coincident with End of Character EOC. Note: Monitor U76A pin 6 at TP2 (FADV). Verify output code cycles from 0000 to 1001. Also verify reset to 0000 with PRT.

Problem	Possible Cause	Remarks
C. (Continued)	Inverters U85C (C-6) U85A (C-6) U85D (C-6) U85B (C-6)	Verify proper operation at output pins 6 (I bit), 2 (Z bit), 12 (4 bit) and 4 (8 bit) respectively.
D. Card fails to accept data	Backplane Command Decode NAND gates U43A (A-2) and U44A (B-2) Inverter U57C (A-2) NAND gate U14A (A-3) Input Command flip-flop U46D, U46C (A-3) NOR gate U46B (A-3)	Verify ASCII inputs NAS1, NAS2, NAS3, and NAS4; Address NADN; Strobe NSTB and Transfer NTNS are of proper value simultaneously. Check NTNS $\geq +2.5V$, NADN and NSTB ($1 \mu s$) $\leq 0.6V$. Check for $\leq +0.6V$ at output pin 6 of U43A for an I command ($1 \mu s$) $\leq +0.6V$ at output pin 6 of U44A for a K command (usually $\approx 5 \mu s$). Check for $\geq +2.5V$ at output pin 6 for an I command ($1 \mu s$). Check $\leq +0.6V$ at output pin 12 at Strobe (STB). Verify operation of flip-flop at reset-side output pin 11 $\leq +0.6V$ for I command.
E. Failure of Store Data Signal to occur.	NDNE input (C-1) Inverter U57D (C-1) NAND gate U46A (C-3) End of Data flip-flop U36A, U36B (C-4) NAND gate U36D (C-4) End of Word flip-flop U37C, U37D (C-4) Inverter U15B (E-11) Inverter U71E (E-11)	Verify Done (NDNE) signal input at pin 17 is $\leq +0.6V$ when desired. Verify Done (DNE) signal at output pin 12 is $\geq +2.5V$ when desired. Only during the $1 \mu s$ that NSTB is low.) Verify output pin 3 of U46A is $\leq +0.6V$ when DNE occurs. Verify operation of flip-flop at set-side output pin 3 for $\geq +2.5V$. Verify output pin 8 for $\leq +0.6V$ at End of character (EOC). Verify flip-flop is set by output of gate U36D. Check set-side output at pin 11 for $\geq +2.5V$, reset side output at pin 10 for $\leq +0.6V$. Verify input pin 3 of U15B for $\geq +2.5V$, output pin 4 for $\leq +0.6V$. Verify input pin 11 of U71E for $\leq +0.6V$, output pin 10 for $\geq +12V$.

Table 4-2. HP 12798B BCD Output Card Troubleshooting Table (Continued)

Problem	Possible Cause	Remarks
E. (Continued)	Transistor Q4 (E-12)	Verify transistor Q4 is operating correctly.
	Transistor Q3 (E-13)	Verify operation of transistor Q3 in accordance with settings of jumpers W7 and W8.
F. Failure of Busy signal to inhibit data.	Transistor Q2 (E-1)	Verify proper operation of Q2 when Busy applied at pin 21 of card.
	Inverter U15C (E-2)	Verify $\leq + 0.6V$ signal at input pin U15C-5 when Busy released; $\geq + 2.5V$ signal at output pin U15C-6 when Busy released.
	Jumper W51 (E-5)	Check that jumper W51 is in H position.
	Gate U14C (E-6)	Verify $\geq + 2.5V$ signal at input pin 10 when Busy released; $\leq + 0.6V$ signal at input pin 8 when Busy released.
	Inverter/Driver U16D (E-6)	Verify $\leq + 0.6V$ signal at input pins 8 and 9 when Busy released; $\geq + 2.5V$ at output pin 10 when Busy released.
G. Reference voltage values incorrect.	Diode CR5 Zener	Check for $+ 7.2V \pm 1.0V$ across diode.
	Diode CR6	Check for $+ 0.7V \pm 0.3V$ across diode.



SERIAL NUMBER
 REVISION CODE
 NUMBER
 HP STOCK NUMBER
 FOR HP 12798B BCD
 OUTPUT CARD
 (+12V:TRUE OUTPUT)
 (POSITIVE:TRUE
 OUTPUT)
 NOTE: HP 12798-60011
 (GROUND:TRUE OUTPUT)
 AND HP 12798-60012
 (+12V:TRUE OUTPUT)
 HAVE SAME COMPONENT
 LAYOUT AS HP 12798-60010.

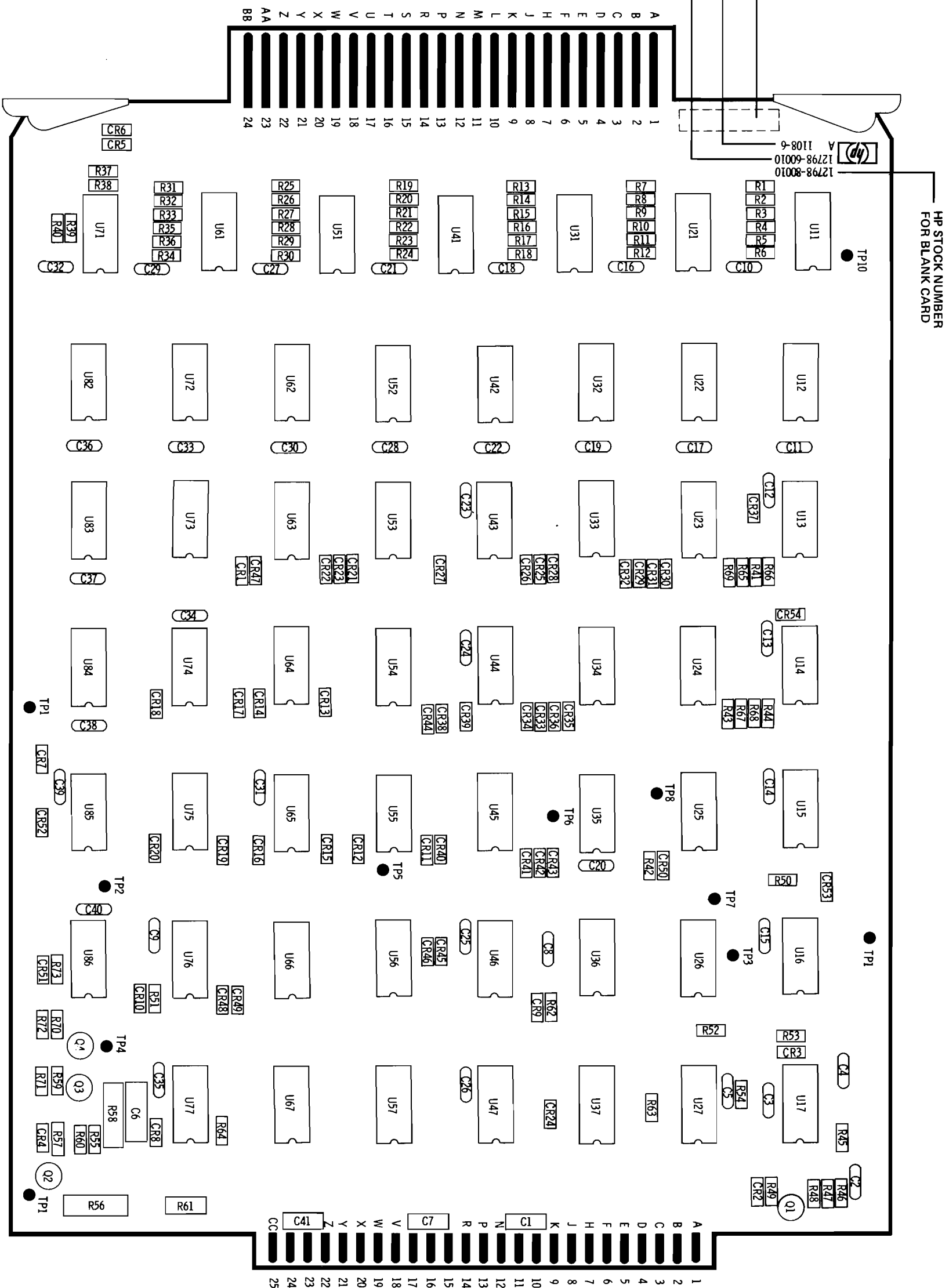


Figure 4-2. HP 12798B BCD Output Card Component Location

INTEGRATED CIRCUIT INDEX

TEST POINT INDEX

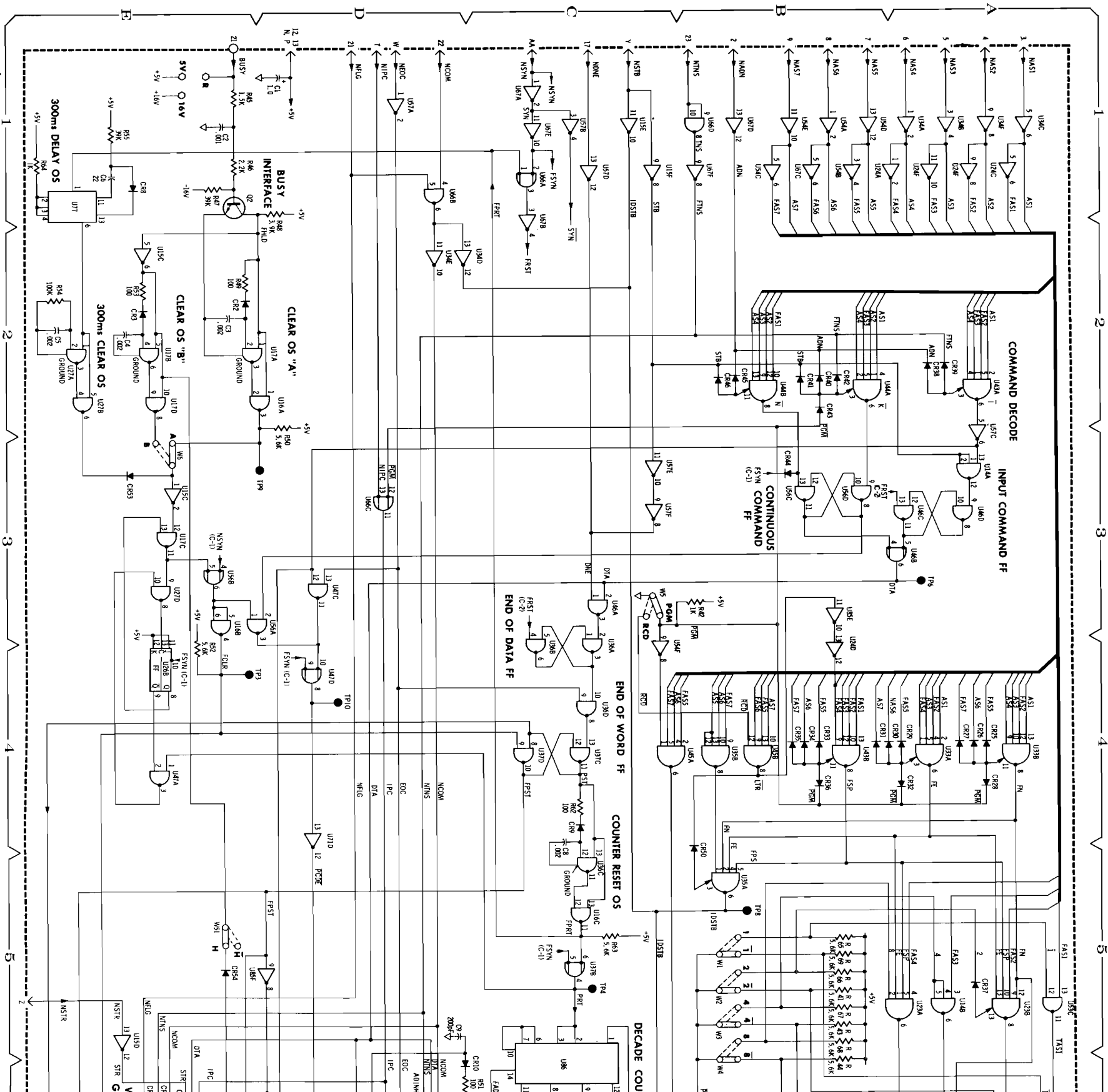
U11A	A-9	U27B	E-2	U47B	D-6	U66B	D-1	TP1	E-14
U11B	A-9	U27C	E-8	U47C	D-3	U66C	D-3	TP2	D-6
U11C	A-9	U27D	E-3	U47D	D-4	U66D	B-1	TP3	E-4
U11D	B-9	U31A	C-8	U51A	B-13	U67A	C-1	TP4	C-5
U11E	B-9	U31B	C-8	U51B	B-13	U67B	C-1	TP5	E-9
U11F	A-9	U31C	D-8	U51C	B-13	U67C	B-1	TP6	A-3
U12A	A-8	U31D	D-8	U51D	B-13	U67D	B-1	TP7	E-8
U12B	A-8	U31E	D-8	U51E	B-13	U67E	C-1	TP8	B-5
U12C	A-8	U31F	C-8	U51F	B-13	U67F	B-1	TP9	E-3
U12D	A-8	U32A	B-8	U52A	D-8	U71A	D-13	TP10	D-4
U13A	A-6	U32B	B-8	U52B	D-8	U71B	D-13		
U13B	A-6	U32C	C-8	U52C	D-8	U71C	D-13		
U13C	A-6	U32D	B-8	U52D	D-8	U71D	D-4		
U13D	A-6	U33A	B-8	U53A	A-6	U71E	E-11		
U14A	A-3	U33B	A-4	U53B	A-8	U71F	D-13		
U14B	A-5	U33C	A-1	U53C	A-5	U72A	B-12		
U14C	E-6	U33D	A-1	U53D	B-8	U72B	B-12		
U15A	E-11	U34C	A-1	U54A	B-1	U72C	B-12		
U15B	E-3	U34D	C-2	U54B	B-1	U72D	B-12		
U15C	E-3	U34E	D-2	U54C	B-1	U73A	C-12		
U15D	E-5	U34F	A-1	U54D	B-1	U73B	B-12		
U15E	C-1	U35A	B-5	U54E	B-1	U73C	D-12		
U15F	C-1	U35B	B-4	U54F	B-1	U73D	C-12		
U16A	D-2	U36A	C-4	U55A	A-7	U74A	B-11		
U16B	E-3	U36B	C-4	U55B	B-7	U74B	C-11		
U16C	C-5	U36C	C-5	U56A	D-3	U75A	C-11		
U16D	E-6	U36D	C-5	U56B	E-3	U75B	D-11		
U17A	D-2	U36E	C-4	U56C	B-3	U76A	D-6		
U17B	E-2	U37A	E-9	U57A	B-3	U76B	E-1		
U17C	E-3	U37B	E-9	U57B	D-1	U77	E-1		
U17D	E-2	U37C	C-5	U57C	C-1	U82A	B-12		
U21A	B-9	U37D	C-4	U57D	A-3	U82B	B-12		
U21B	B-9	U41A	C-4	U57E	C-1	U82C	C-12		
U21C	B-9	U41B	D-9	U57F	C-3	U82D	B-12		
U21D	C-9	U41C	D-9	U61A	C-3	U83A	C-12		
U21E	C-9	U41D	A-13	U61B	C-13	U83B	C-12		
U21F	B-9	U41E	A-13	U61C	C-13	U83C	C-12		
U22A	B-8	U41F	A-13	U61D	C-13	U84A	D-12		
U22B	B-8	U42A	C-8	U61E	C-13	U84B	D-12		
U22C	B-8	U42B	C-8	U61F	C-13	U84C	D-12		
U22D	B-8	U42C	C-8	U62A	A-12	U84D	D-12		
U23A	A-5	U42D	C-8	U62B	A-12	U85A	C-6		
U23B	A-5	U42E	C-8	U62C	A-12	U85B	C-6		
U24A	B-1	U43A	B-4	U62D	A-12	U85C	C-6		
U24C	A-1	U43B	B-2	U63A	C-8	U85D	C-6		
U24D	B-4	U43C	B-2	U63B	C-8	U85E	B-3		
U24E	A-1	U43D	B-4	U63C	D-8	U85F	E-5		
U24F	A-1	U43E	B-4	U63D	A-12	U86A	C-6		
U25A	E-8	U43F	C-3	U64A	C-7	U86B	C-6		
U25B	E-8	U43G	A-3	U64B	C-7	U86C	C-6		
U26A	E-4	U46C	A-3	U65A	D-7	U86D	C-6		
U26B	E-4	U46D	A-3	U65B	D-7				
U27A	E-2	U47A	E-4	U66A	C-1				

NOTES:

1. Unless otherwise specified, resistance in ohms and capacitance in microfarads.
2. denotes 50-pin backplane connector.
3. All logic is positive-true.
4. Information in parentheses refers to grid location on schematic.
5. Resistors R1 through R40 are 10K ohm, ±5%, 1/4W.

6. Hard-wired jumpers W10 through W50 determine card designation and output as follows:

Card	Output	Jumper Settings
HP 12798-60010	Positive-true (BCD OUT POS = 1)	W10 through W49: "H" W50: "5V"
HP 12798-60011	Ground-true (BCD OUT GND = 1)	W10 through W49: "L" W50: "5V"
HP 12798-60012	+12V-true (BCD OUT +12 = 1)	W10 through W49: "H" W50: "12V"



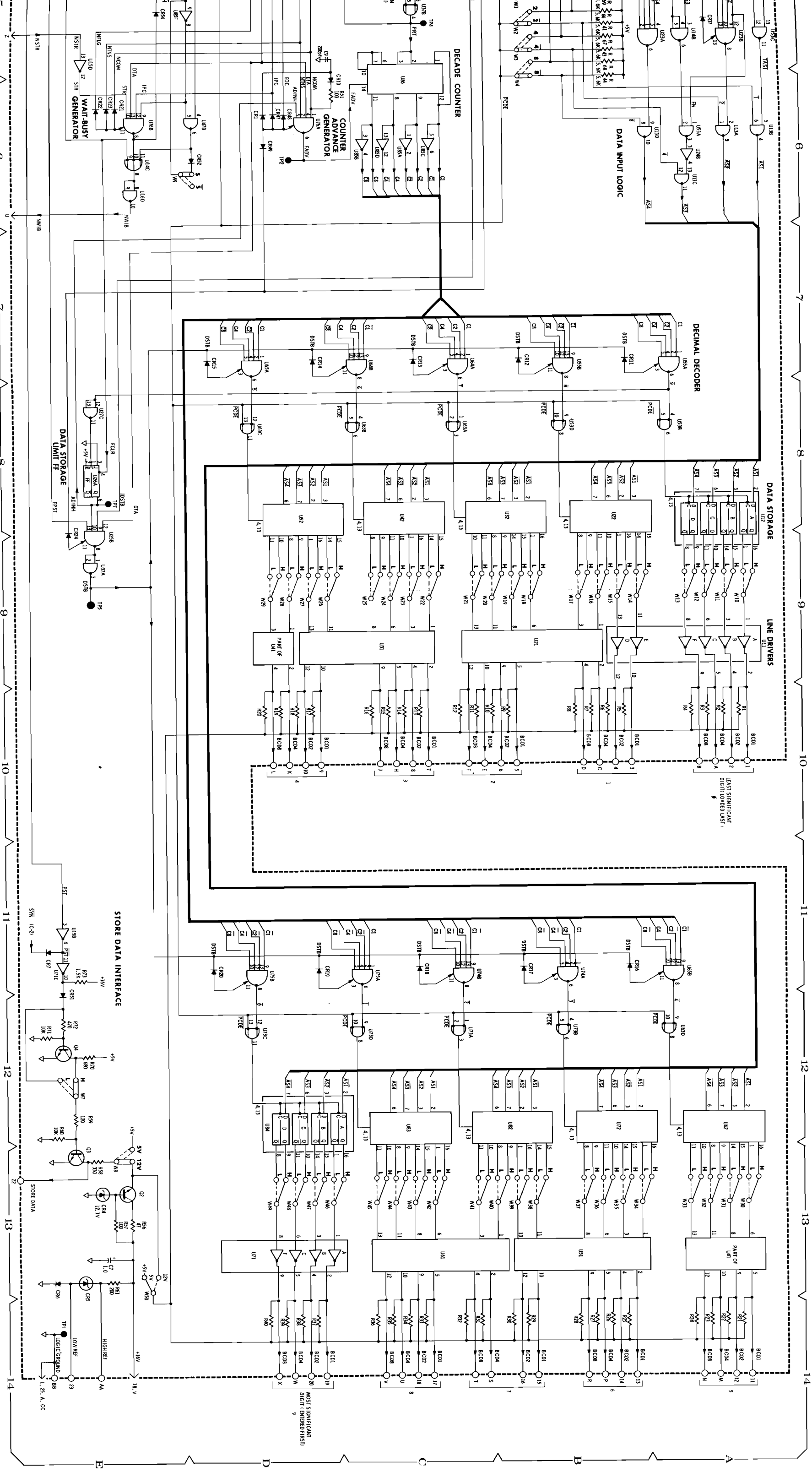


Figure 4-3. HP 12798B BCD Output Card Schematic Diagram

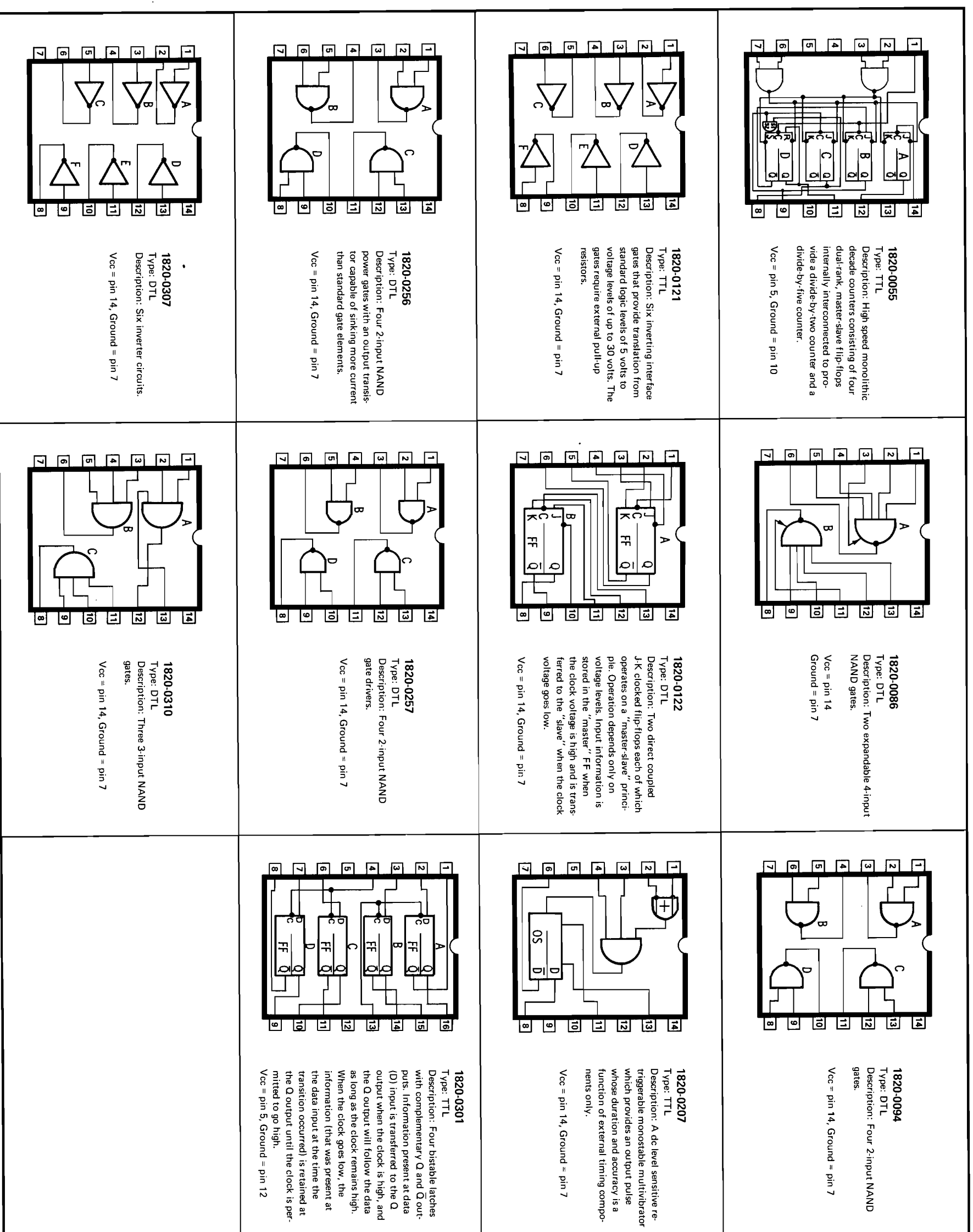


Figure 4-4. Integrated Circuit Elements

SECTION V REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains a list of information for ordering replacement parts. Table 5-1 lists parts alpha-numerically by reference designation. It also provides:

- a. HP stock numbers
- b. A general description of the parts
- c. Typical manufacturer of the part expressed as a five-digit code (a list of manufacturers and their code numbers appears in Table 5-2).
- d. Manufacturer's part, stock, or drawing number
- e. Total quantities used.

5-3. ORDERING INFORMATION

5-4. When ordering replacement parts, each part must be identified by the Hewlett-Packard stock number. To order a part that is not listed in the tables, include the following information:

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

5-5. Address your order or inquiry to your local Hewlett-Packard Sales and Service Office (listed at the rear of this manual).

5-6. If parts are ordered from the original manufacturer, a complete description should be included with each manufacturer's part number. Many numbers listed are type numbers only, and descriptions are needed to facilitate selection.

REFERENCE DESIGNATIONS							
A	= assembly	F	= fuse	MP	= mechanical part	TP	= test point
B	= motor	FL	= filter	P	= plug	U	= integrated circuit
BT	= battery	J	= jack	Q	= transistor	V	= vacuum tube, neon bulb, photocell, etc.
C	= capacitor	K	= relay	R	= resistor	VR	= voltage regulator
CP	= coupler	L	= inductor	RT	= thermistor	W	= cable; jumper
CR	= diode	LS	= loudspeaker	S	= switch	X	= socket
DL	= delay line	M	= meter	T	= transformer	Y	= crystal
DS	= device signaling (lamp)	MK	= microphone	TB	= terminal board	Z	= tuned cavity; network
E	= misc electronic part						
ABBREVIATIONS							
A	= amperes	GL	= glass	N/C	= normally closed	RH	= right hand
AFC	= automatic frequency control	GND	= ground(ed)	NE	= neon	RMO	= rack mount only
AL	= aluminum	H	= henries	NI PL	= nickel plate	RMS	= root-mean-square
AMPL	= amplifier	HDW	= hardware	N/O	= normally open	RWV	= reverse working voltage
BFO	= beat frequency oscillator	HEX	= hexagonal	NOM	= nominal	S-B	= slow-blow
BE CU	= beryllium copper	HR	= hour(s)	NPO	= negative positive zero (zero temperature coefficient)	SCR	= silicon-controlled rectifier
BP	= bandpass	HZ	= hertz	NPN	= negative-positive-negative	SE	= selenium
BRS	= brass	IC	= integrated circuit	NRRFR	= not recommended for field replacement	SECT	= section(s)
BWO	= backward wave oscillator	IMPG	= impregnated	NSR	= not separately replaceable	SEMICOND	= semiconductor
CCW	= counterclockwise	INCAND	= incandescent	OBD	= order by description	SI	= silicon
CD PL	= cadmium plate	INCL	= include(s)	OH	= oval head	SIL	= silver
CER	= ceramic	INS	= insulation(ed)	OX	= oxide	SL	= slide
CL	= capacitive logic	INT	= internal	P	= pico (10 ⁻¹²)	SPG	= spring
CMO	= cabinet mount only	INTCON	= interconnecting	PC	= printed circuit	SPL	= special
COM	= common	K	= kilo (10 ³)	PHL	= Phillips	SST	= stainless steel
COMP	= composition	LH	= left hand	PK	= peak	STA	= steel
COMPL	= complete	LIN	= linear	P-P	= peak-to-peak	TA	= tantalum
CONN	= connector	LK WASH	= lock wash	PIV	= peak inverse voltage	TD	= time delay
CRT	= cathode-ray tube	LPF	= low pass filter	PNP	= positive-negative-positive	TGL	= toggle
CTL	= complementary transistor logic	M	= milli (10 ⁻³)	P/O	= part of	THD	= thread
CU	= copper	MEG	= meg (10 ⁶)	POLY	= polystyrene	TI	= titanium
CW	= clockwise	MET FLM	= metal film	PORC	= porcelain	TOL	= tolerance
DEPC	= deposited carbon	MET OX	= metallic oxide	POS	= position(s)	TSTR	= transistor
DTL	= diode-transistor logic	MFR	= manufacturer	POT	= potentiometer	TTL	= transistor-transistor logic
ELECT	= electrolytic	MHZ	= megahertz	PNT	= point	TWT	= traveling wave tube
ENCAP	= encapsulated	MINTR	= miniature	PWV	= peak working voltage		
EXT	= external	MOM	= momentary	RECT	= rectifier	U	= micro (10 ⁻⁶)
F	= farads	MOS	= metal oxide semiconductor	RF	= radio frequency	V	= volts
FH	= flat head	MTG	= mounting			VAR	= variable
FIL H	= fillister head	MY	= mylar			VDCW	= dc working volts
FXD	= fixed	N	= nano (10 ⁻⁹)			W/	= with
G	= giga (10 ⁹)					W	= watts
GE	= germanium					WIV	= working inverse voltage
						WW	= wirewound
						W/O	= without

Table 5-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	12798-60010	1	BCD OUTPUT CARD WITH POSITIVE TRUE LOGIC	04404	12798-60010
C1	0180-0291	3	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
C2	0160-0938	1	C:FXD MICA 1000 PF 5%	72136	RDH15E102J1C
C3-					
C5	0160-2225	4	C:FXD MICA 2000 PF 5% 300VDCW	72136	RDH19F202J3C
C6	0180-0228	1	C:FXD ELECT 22 UF 10% 15VDCW	56289	1500226X901582-DYS
C7	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
C8	0160-2225		C:FXD MICA 2000 PF 5% 300VDCW	72136	RDH19F202J3C
C9	0140-0198	1	C:FXD MICA 200 PF 5%	72136	RDH15F201J3C
C10-					
C40	0160-2055	31	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-COH
C41	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	1500105X9035A2-DYS
CR1	1901-0081	42	DIODE:SILICON 50 VOLTS WORKING	07263	FD1415
CR2	1910-0016	10	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
CR3	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
CR4	1902-0031	1	DIODE BREAKDOWN:12.7V 5%	28480	1902-0031
CR5	1902-3119	1	DIODE:BREAKDOWN 6.49V 2%	04713	SZ10939-129
CR6	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	FD1415
CR7-					
CR10	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
CR11-					
CR43	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	FD1415
CR44	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
CR45-					
CR51	1901-0081		DIODE:SILICON 50 VOLTS WORKING	07263	FD1415
CR52-	0				
CR54	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
Q1-					
Q4	1854-0215	4	TSTR:SI NPN	80131	2N3904
R1 -					
R40	0683-1035	42	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
R41	0683-5625	11	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R42	0683-1025	2	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
R43	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R44	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R45	0683-1525	1	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525
R46	0683-2225	1	R:FXD COMP 2.2K OHM 5% 1/4W	01121	CB 2225
R47	0683-3935	2	R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935
R48	0683-3925	1	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925
R49	0683-1015	4	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
R50	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R51	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
R52	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R53	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
R54	0683-1045	1	R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
R55	0683-3935		R:FXD COMP 39K OHM 5% 1/4W	01121	CB 3935
R56	0683-4705	1	R:FXD COMP 47 OHM 5% 1/4W	01121	CB 4705
R57	0683-4715	2	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
R58	0761-0054	1	R:FXD MET OX 330 OHM 5% 1W	28480	0761-0054
R59	0683-1215	1	R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215
R60	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
R61	0686-2015	1	R:FXD COMP 200 OHM 5% 1/2W	01121	CB 2015
R62	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
R63	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R64	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
R65 -					
R69	0683-5625		R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625
R70	0683-6815	1	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815
R71	0683-1035		R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
R72	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
R73	0683-5125	1	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
U11	1820-0121	7	IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U12	1820-0301	10	IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U13	1820-0257	2	IC:DTL QUAD 2-INPUT BUFFER	04713	SC8162PK
U14	1820-0310	1	IC:DTL TRIPLE 3-INPUT NAND GATE	07263	U6A996259X
U15	1820-0307	7	IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U16	1820-0256	1	IC:DTL QUAD 2-INPUT POWER GATE	04713	MC858P
U17	1820-0094	10	IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U21	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U22	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U23	1820-0086	13	IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U24	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U25	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U26	1820-0122	1	IC:DTL DUAL JK FF	07263	U6A909359X

Table 5-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
U27	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U31	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U32	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U33	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U34	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U35	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U36	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U37	1820-0257		IC:DTL QUAD 2-INPUT BUFFER	04713	SC8162PK
U41	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U42	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U43-					
U45	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U46	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U47	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U51	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U52	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U53	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U54	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U55	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U56	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U57	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U61	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U62	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U63	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U64	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U65	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U66	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U67	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U71	1820-0121		IC:TTL HEX INTERFACE LAMP DRIVER	18324	N8T90A
U72	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U73	1820-0094		IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
U74-					
U76	1820-0086		IC:DTL DUAL 4-INPUT NAND NOR GATE	04713	MC830P
U77	1820-0207	1	IC:TTL MONOSTABLE MULTIVIBRATOR	07263	SL12395
U82-					
U84	1820-0301		IC:TTL QUAD LATCH BUFF STORAGE	01295	SN4463
U85	1820-0307		IC:DTL HEX INVERTER RL:6K	07263	U6A993659X
U86	1820-0055	1	IC:TTL DECADE COUNTER	01295	SN4356
W1-					
W9	5040-1485	9	CONDUCTOR ASSEMBLY:PLUG-IN JUMPER	28480	5040-1485
W10-					
W50	8159-0005	41	JUMPER WIRE	28480	8159-0005
W51	5040-1485		CONDUCTOR ASSEMBLY:PLUG-IN JUMPER	28480	5040-1485
	12798-60011	1	BCD OUTPUT CARD WITH GROUND TRUE LOGIC (OPTION 020) FOR LIST OF REPLACEABLE PARTS, SEE PARTS LIST FOR 12798-60010.	04404	12798-60011
	12798-60012	1	BCD OUTPUT CARD WITH +12V-TRUE LOGIC (PART OF OPTION 001). FOR LIST OF REPLACEMENT PARTS SEE LIST FOR 12798-60010.	04404	12798-60012

Table 5-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	02547-6040	1	CABLE (PART OF OPTION 001)	04404	02547-6040
	1251-0086	1	CONNECTOR:50 CONTACT R & P	28480	1251-0086
	1251-0171	1	BUSHING:FOR AN TYPE CONNECTOR	28480	1251-0171
	1251-0335	1	CONNECTOR:PC 48 CONTACT (2X24)	95238	K 600-13-PCGD 24
	8120-0081	8	CABLE:SPEC PURP	28480	8120-0081
	02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
	02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003
	12798-60002	1	CABLE (PART OF OPTION 003)	04404	12798-60002
			LIST NOT YET AVAILABLE		
	12798-60003	1	CABLE (PART OF OPTION 004)	04404	12798-60003
	1251-0218	2	CONNECTOR:LOCK POST SUBMINAT TYPE D	71468	DAM-155
	1251-0352	1	BUSHING:CIRCULAR CONNECTOR (SIZE 14S)	91737	18220-6
	1251-1042	1	RETAINER:CONNECTOR	71468	D B 51221-1
	1251-2384	14	CONTACT:R & P CONNECTOR	28480	1251-2384
	1251-2417	1	BODY:R & P CONNECTOR	28480	1251-2417
	1251-2518	1	CONNECTOR:PC 48 (2X24) CONTACT	71785	251-24-30-216
	8120-1281	8	CABLE	28480	8120-1281
	02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
	02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003
	12798-60005	1	CABLE (PART OF OPTION 007)	04404	12798-60005
	1251-0086	1	CONNECTOR:50 CONTACT R & P	28480	1251-0086
	1251-0171	1	BUSHING:FOR AN TYPE CONNECTOR	28480	1251-0171
	1251-2518	1	CONNECTOR:PC 48 (2X24) CONTACT	71785	251-24-30-261
	8120-0204	8	CABLE	28480	8120-0204
	02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
	02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003
	12798-60006	1	CABLE (PART OF OPTION 008)	04404	12798-60006
	1251-0084	1	CONNECTOR MALE:RACK & PANEL	28480	1251-0084
	1251-0171	1	BUSHING:FOR AN TYPE CONNECTOR	28480	1251-0171
	1251-2518	1	CONNECTOR:PC 48 (2X24) CONTACT	71785	251-24-30-216
	02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
	02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003
	12798-60009	1	CABLE (PART OF OPTION 005)	04404	12798-60009
	1251-0086	1	CONNECTOR:50 CONTACT R & P	28480	1251-0086
	1251-0171	1	BUSHING:FOR AN TYPE CONNECTOR	28480	1251-0171
	1251-2518	1	CONNECTOR:PC 48 (2X24) CONTACT	71785	251-24-30-261
	8120-0204	1	CABLE	28480	8120-0204
	02116-4001	1	HOLDER:CONNECTOR	28480	02116-4001
	02116-4003	1	CLAMP CABLE:LARGE	28480	02116-4003

Table 5-2. Code List of Manufacturers

MFR. NO.	MANUFACTURER NAME	ADDRESS
01121	Allen Bradley Co.	Milwaukee, Wis. 53204
01295	Texas Instruments Inc. Semiconductor Components Div.	Dallas, Tex. 75231
04404	Hewlett-Packard Co., Automatic Measurement Div.	Palo Alto, Calif. 94306
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Ariz. 85008
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif. 94040
18324	Signetics Corp.	Sunnyvale, Calif. 94086
28480	Hewlett-Packard Company	Palo Alto, Calif. 94304
56289	Sprague Electric Co.	N. Adams, Mass. 01247
71468	ITT Cannon Electric Inc.	Los Angeles, Calif. 90031
71785	Cinch Mfg. Co. Div. United Carr Fastener Corp.	Chicago, Ill. 60624
72136	Electro Motive Mfg. Co. Inc.	Willimantic, Conn. 06226
80131	Electronic Industries Association. Standard tube or semi-conductor device, any manufacture	Washington, D.C. 20006
91737	ITT Gremar Inc.	Woburn, Mass. 01801
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass. 01801
95238	Continental Connector Corp.	Woodside, N.Y. 11377