



OPERATING AND SERVICE MANUAL

(HP Part No. 02116-9041)

INTERFACE KIT 12535A

CROSSBAR SCANNER

INTERFACE

MANUAL CHANGES

A yellow updating supplement may accompany this manual to correct manual errors (errata) and to describe differences between the kits described herein and the kit furnished. The supplement may also provide additional operating and service information, as required.

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. Interface Kit 12535A for Hewlett-Packard Computer Systems consists of the following:

- a. Crossbar Scanner Interface Card (HP Part No. 02116-6123).
- b. Interconnecting Cables (HP Part No. 02116-6117 and 10503-6001).
- c. BCS 8-4-2-1 Scanner Control Driver Tape (HP Part No. 20010B), or 4-2'-2-1 Scanner Control Driver Tape (HP Part No. 20012B).
- d. Scanner/Digital Voltmeter Test Binary Tape (HP Accessory No. 20349A).

1-3. The crossbar scanner interface card permits computer control of the scanner to provide random scanning of up to 600 separate signal sources. The interface card contains control and output logic for the 2911 Crossbar Scanner; but it does not contain interrupt logic. It plugs into any of the interface card Input/Output slots of the computer and assumes the lower Select Code of the slot it is plugged into.

1-4. The Data Source Interface Card of Interface Kit 12541A or 12604B, the Digital Voltmeter (Programmer) Interface Card of Interface Kits 12533A, 12567A, or 12550A and their interconnecting cables are used in conjunction with the crossbar scanner interface card. (The interface cards of Interface Kits 12533A, 12534A, and 12550A are identical. However, each uses a different interconnecting cable.) The data source interface card receives the measurement data from the voltmeter for transfer to the computer. The digital voltmeter (programmer) interface card provides program control of the voltmeter function, range, and sample period. Refer to the applicable Interface Kit section in Volume Three for detailed information on Interface Kits 12533A, 12541A, 12550A and 12567A.

SECTION II
INSTALLATION AND PROGRAMMING

2-1. INSTALLATION.

2-2. Install the interface card in the computer as follows:

- a. Turn off computer power.
- b. Open the computer for access to the I/O cards.
- c. Plug the Crossbar Scanner Program Card (12535A) into the I/O slot assigned for the particular computer system.
- d. Pass the interconnecting cable through the rear panel of the computer and up to the card. Slide the 48-pin connector onto the card and close the computer.
- e. Interconnect the interface card, the HP 2911A Guarded Crossbar Scanner, and the HP 2911B Crossbar Scanner Control as illustrated in Figure 2-1.

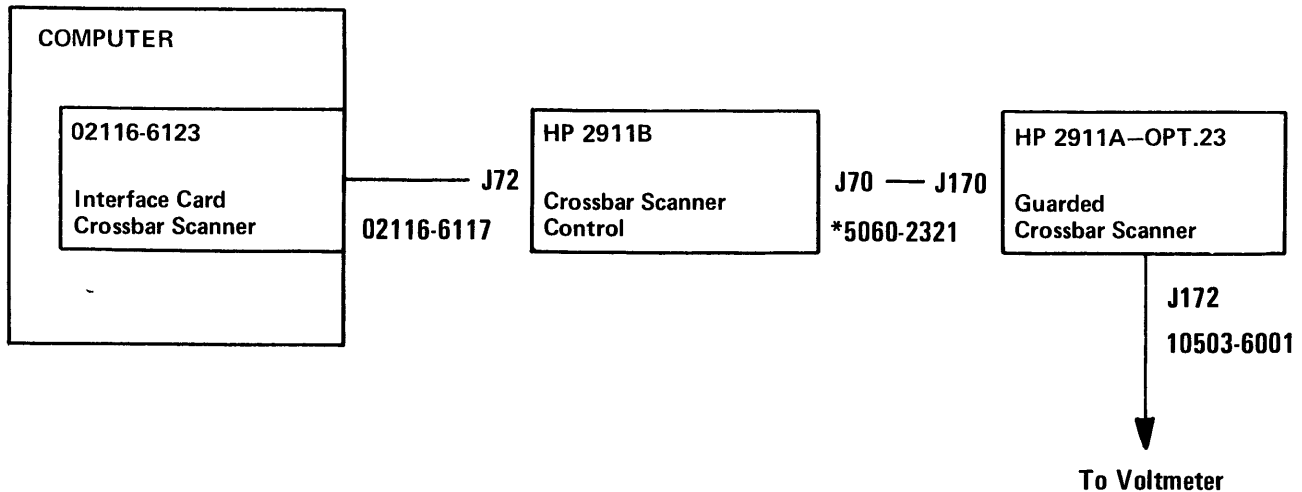
2-3. TURN-ON.

2-4. Turn on the computer and scanner set as follows:

- a. On the computer, press the POWER pushbutton.
- b. On the HP 2911B Crossbar Scanner Control:
 1. Press to latch SINGLE SCAN and LOCAL pushbuttons.
 2. Press and release POWER, then RESET pushbuttons. The amber indicator above STEP pushbutton should now be illuminated.
 3. Set NO OF WIRE SCAN switch (S10) on the rear of the instrument to 3, if the HP 2911A Guarded Crossbar contains Option 23. Otherwise, set it as desired.

2-5. PROGRAMMING.

2-6. The HP standard software facilities may be used to input data using the 2911 Guarded Crossbar Scanner and a Digital Voltmeter. The Basic Control System (BCS) includes an Input/Output control subroutine which requires only



*Cable not supplied with this interface kit.

Figure 2-1. Interconnecting Diagram

a simple calling sequence to transfer data between memory, the Scanner and the Digital Voltmeter. Refer to the Basic Control System Reference manual for complete details.

2-7. SAMPLE PROGRAM.

2-8. The user may also program a subroutine to perform all of the necessary operations to input data using the Scanner and the Digital Voltmeter. The following sample program illustrates the instructions required to operate the devices for dc voltage measurements and to input the voltmeter readings. Refer to Table 2-1, following the sample program, for description of Scanner delay and function. In this example, the following interface card Select Code assignments are assumed: Digital Voltmeter (Programmer) Interface Card (Select Code 17); Crossbar Scanner Interface Card (Select Code 20); and Data Source Interface Card (Select Code 21). Also, the Skip-on-Flag-Set method is used to signal the computer that voltmeter data is available in the Data Source Interface Card. If the interrupt system is to be used to indicate that data is available to the computer, an STF 0 instruction is required in the example after the RDVLT NOP instruction to enable the computer interrupt system. An interrupt subroutine must then be entered when the Flag FF on the Data Source Interface Card is set and the computer receives an interrupt signal. The interrupt subroutine must process and store the voltmeter reading (steps 5 through 11). Upon return to the program, the STC 20B instruction is required to increment the channel identification and initiate another voltmeter reading.

	RDVLT	NOP		
		LDA	RDNG	Load A register with voltmeter Function, Range and Sample Period.
		OTA	17B	Set-up voltmeter to read dc volts and have a 10V range and a 0.1-second sample period via Digital Voltmeter (Programmer) Interface Card.
		LDA	DELAY	Load A register with Scanner ohms/frequency/delay indicator. (Ohms and Frequency not required in this sample program.) Delay = 27 milliseconds.
		LDB	INP	Load B register with Scanner channel identification for the first measurement.
		OTA	20B,C	Reset the Flag FF of the Crossbar Scanner Interface Card. This enables the output of the 27-millisecond delay indicator to the 2911 Crossbar Scanner. (The C (Clear Flag) portion of the instruction initializes the Scanner I/O card to accept delay data.)
		STF	20B	Set the Flag FF of the Crossbar Scanner Interface Card to enable output of the Scanner channel identification.
		OTB	20B	Output the channel identification to the 2911 Crossbar Scanner.
(1)	LOOP	STC	20B	Set the Control FF on the Crossbar Scanner Interface Card to initiate a Reset Command to the 2911 Crossbar Scanner. This sets the scanner to the channel specified by the channel identification and initiates the first reading by the voltmeter after the 27-millisecond delay. (Each successive STC instruction increments the channel identification of the scanner.)
(2)		STC	21B,C	Set the Control FF and reset the Flag FF on the Data Source Interface Card. The set Control FF removes the +HOLD signal to the voltmeter, enabling it to make a measurement. The reset Flag FF can now be set to indicate that a reading has been taken.

(3)	SFS	21B	Has the Flag FF been set, indicating that the voltmeter reading is available on the Data Source Interface Card?
(4)	JMP	*-1	No, keep testing.
(5)	LIA	21B	Yes, load the 1st 16 bits into the A register.
(6)	LIB	21B	Load the 2nd 16 bits into the B register.
(7)	DST	VPLC, I	Store the voltmeter reading in memory.
(8)	ISZ	VPLC	} Modify the address of storage.
(9)	ISZ	VPLC	
(10)	ISZ	CNTR	Have all 100 readings been taken?
(11)	JMP	LOOP	No, return to LOOP and set the Control FF on the Crossbar Scanner Interface Card to initiate another reading.
(12)	CLC	21B	Yes, reset the Control FF on the Data Source Interface Card. This restores the +HOLD signal to the voltmeter, preventing it from taking another reading.
	JMP	RDVLT, I	Exit from routine.
RDNG	OCT	144	DC volts, 10V Range, 0.1-sec Sample Period
DELAY	OCT	3	27 Milliseconds
INP	OCT	0	Channel 0
VPLC	DEF	VSTOR	
	COM	VSTOR (200)	Data Storage Buffer
CNTR	DEC	-99	

- OR -

To change channel identification and make 100 additional readings, program the following instead of the JMP RDVLT, I to exit from the routine.

LDB	INK	Load B register with new Scanner channel identification.
OTB	20B	Output the channel identification to the 2911 Crossbar Scanner.

- repeat instructions (1) through (12) -


```

JMP      RDVLT,I  Exit from routine.
INK      OCT      100
CNTR     DEC      -199
    
```

- OR -

To change the delay to the Scanner and make the same 100 readings again, program the following instead of the JMP RDVLT,I to exit from the routine.

```

LDA      DELAY    Load A register with the new delay
                        indicator. Delay = 62 milliseconds.
OTA      20B,C    Reset the Flag FF of the Crossbar
                        Scanner Interface Card. This enables
                        the output of the 62-millisecond delay
                        indicator to the 2911 Crossbar Scanner.
    
```

- repeat instructions (1) through (12) -

```

JMP      RDVLT,I  Exit from routine.
DELAY    OCT      5
END
    
```

Table 2-1. Scanner Delay

FUNCTION					DELAY(MS)			
BITS	15	thru	5	4	3	2	1	0
		NOT		AC/DC Volts	00	15		000
		USED		Freq.	01	17.5		001
				Resist.	10	22		010
						27		011
						42		100
						62		101
						145		110
						500		111

For example, the scanner program word 25 (octal) would be an OHMS program with a 62 msec. measurement encode delay.

NOTE

There is a fixed Scanner delay of 16 milliseconds which is added to the above.

SECTION III
THEORY OF OPERATION

3-1. GENERAL.

3-2. During the following explanation of operation using the computer, the 2911 Crossbar Scanner and the Digital Voltmeter, refer to Figure 3-1 for a simplified logic diagram of the crossbar scanner interface card. Refer to the Interface Kit 12541A and 12533A/12550A sections in Volume Three for logical diagrams of the data source interface card and the digital voltmeter (programmer) interface card. Table 5-2 lists the leadwire connections between the crossbar scanner interface card and the 2911B Crossbar Scanner Control.

3-3. FUNCTION, RANGE, AND SAMPLE PERIOD.

3-4. The voltmeter function, range, and sample period must be programmed through the digital voltmeter (programmer) interface card. Refer to the Interface Kit 12533A/12550A section in Volume Three for information on coding, etc. for programming the voltmeter. The computer program must not issue a set control (STC) instruction to the digital voltmeter (programmer) interface card. All control of voltmeter measurements when using the 2911 Crossbar Scanner is accomplished through the crossbar scanner interface card.

3-5. CHANNEL IDENTIFICATION.

3-6. An output from A (OTA) or an output from B (OTB) instruction from the computer provides Channel Identification bits 0 through 11 to the crossbar scanner interface card. For these bits to be enabled to the scanner, a Set Flag (STF) instruction must be programmed. The resulting STF signal received by the card sets the Flag FF and its output is "anded" with the IOO signal which resulted from the OTA/B instruction. The "and" gate output causes the Channel Identification bits to set the FF's on the interface card. The bits are then transferred to the scanner and identify the channel (input line or lines) on which the measurement is to be made by the voltmeter. The "and" gate output also sets the Reset/Step FF.

3-7. OHMS/FREQUENCY/DELAY.

3-8. An OTA or OTB instruction must then issue bits 0 through 4 to the scanner interface card, followed by a Clear Flag (CLF) instruction. Bits 0, 1, and 2 of the four bits comprise an octal digit which selects one of eight delay times in the 2911 Scanner as listed in Table 3-1. The delay occurs between the selection

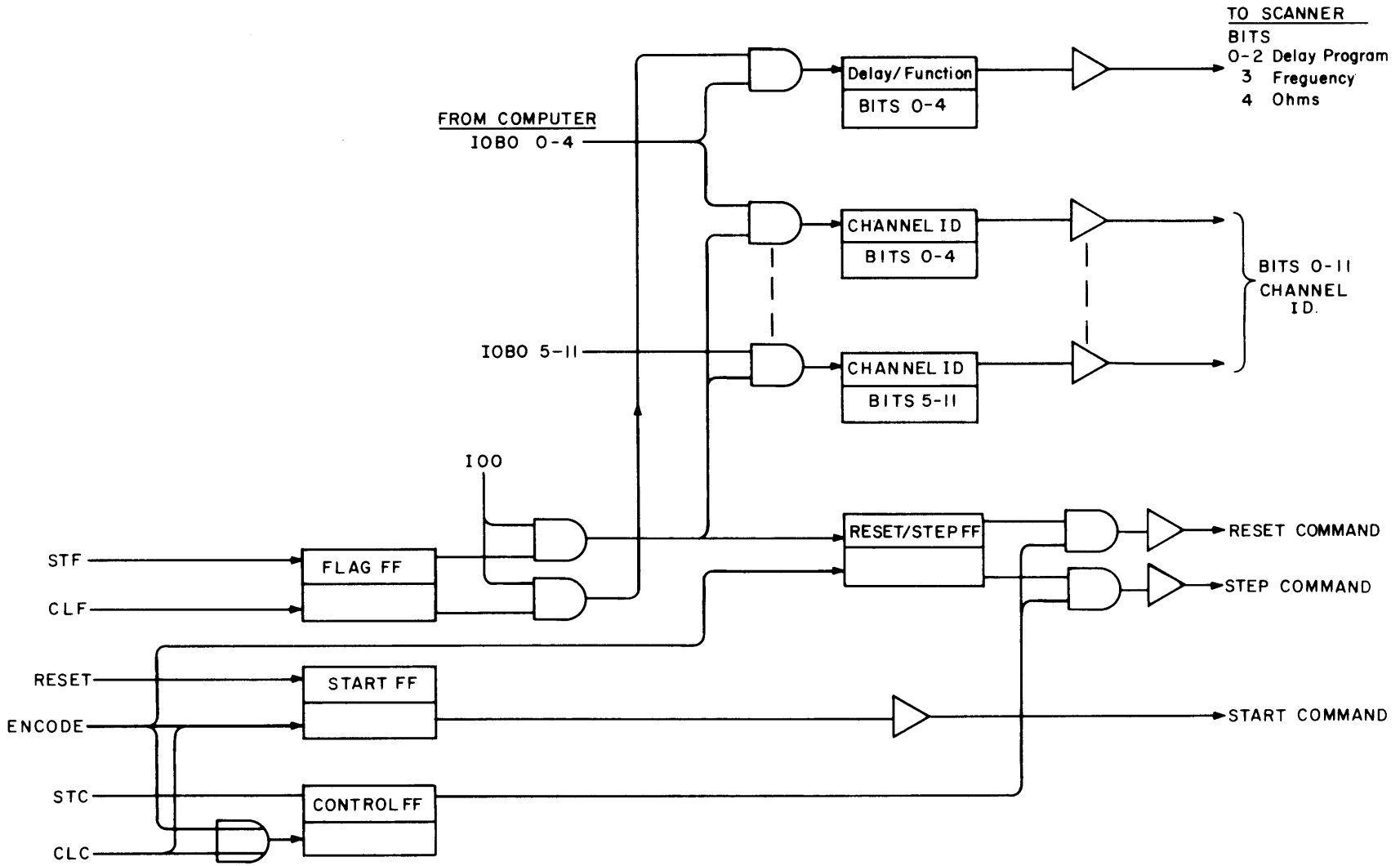


Figure 3-1. Simplified Logic Diagram

of the scanner channel and the initiation of a measurement by the voltmeter. (The delay allows the voltmeter to initiate autoranging and allows for overload recovery of the voltmeter and the HP 2411A Guarded Data Amplifier.) Bits 3 and 4 indicate to the scanner whether frequency or resistance lines are to be scanned, respectively. If bits 3 and 4 are both "zero", the scanner is prepared to scan voltage input lines. The CLF instruction resets the Flag FF on the scanner interface card and its output is "anded" with the IOO signal which resulted from the OTA/B instruction. Logic "ones" in any of the 0 through 4 bit positions are enabled to set the applicable FF's on the interface card. The outputs of the FF's are then transferred to the 2911 Scanner.

Table 3-1. Programmed Delay Times

BITS			DELAY
2	1	0	(MS)
0	0	0	15
0	0	1	17.5
0	1	0	22
0	1	1	27
1	0	0	42
1	0	1	62
1	1	0	145
1	1	1	500

3-9. MEASUREMENT INITIATION.

3-10. A Set Control (STC) instruction must be programmed to the data source interface card to remove the +HOLD signal to the digital voltmeter. This prepares the voltmeter to make a measurement on receipt of an Encode command generated by the scanner. A programmed STC instruction to the scanner interface card provides the STC signal which sets the Control FF. The output of the Control FF enables the output of the Reset/Step FF and a Reset Command signal is applied to the scanner. The reset Command signal positions the scanner to the channel established by the channel identification bits from the computer. The scanner returns a Reset signal to its interface card which sets the Start FF. The reset output of the Start FF is inverted and sent to the scanner as a Start Command signal. The Start Command signal causes the completion of scanner input connections after the Reset Command signal, and is required only to start the first scan. (Subsequent scans are completely initiated by the Step Command signal from the scanner interface card.)

3-11. At the end of the delay programmed to scanner, the scanner issues an Encode signal to its interface card and the Control FF on the digital voltmeter (programmer) interface card. The output of the Control FF is an Encode signal to the digital voltmeter, causing the voltmeter to measure the contents of the channel to which the scanner is positioned. The Encode signal to the scanner interface card resets the Start, Control, and Reset/Step FF's. The Reset/Step FF is now prepared to apply a Step Command signal to the scanner to increment the Channel Identification on receipt of another STC signal from the computer.

3-12. INTERRUPT INITIATION.

3-13. Upon completion of the measurement, the voltmeter places the 32 bits of measurement data in the data source interface card and issues a +Record Command signal to the digital voltmeter (programmer) interface card and the data source interface card. The signal resets the Control FF on the digital voltmeter (programmer) interface card, which removes the Encode signal to the voltmeter. When the data source interface card receives the +Record Command signal, it re-applies the +HOLD signal to the voltmeter, preventing it from making any further measurements. One millisecond after receiving the signal, the Flag Buffer FF on the data source interface card is set and initiates an interrupt signal to the computer. The computer program must then input the data from the data source interface card.

3-14. SECOND MEASUREMENT INITIATION.

3-15. Only an STC instruction to the crossbar scanner interface card is required to initiate another voltmeter measurement if the conditions of the following steps "a" through "c" are met. In this case, the STC signal sets the Control FF on the scanner interface card. The output of the Control FF enables the reset-side output of the Reset/Step FF (reset by the last Encode signal) which applies a Step Command signal to the scanner. This increments the Channel Identification number and initiates a measurement after the programmed delay.

- a. The same type of measurement (voltage, frequency, or resistance) is to be performed.
- b. The same delay is to be used between channel selection and initiation of the voltmeter measurement.
- c. The next higher-numbered channel is to be used for the measurement.

3-16. If any of the conditions in steps "a" through "c" in the previous paragraph change, the changed condition must be programmed according to the instructions of Paragraphs 3-5 through 3-11, as applicable. **EXAMPLE:** If the channel to be used is not the next higher-numbered channel, but the other conditions remain the same, the OTA/B instruction of Paragraph 3-11 must be programmed. This instruction is then followed by an STC instruction to the scanner interface card to initiate the measurement.

SECTION IV
MAINTENANCE

4-1. INTRODUCTION.

4-2. This section contains the verification test procedure, flowchart and table of pin assignments for the interconnecting cable.

4-3. VERIFICATION PROGRAM.

4-4. The Accessory No. 20349A Scanner/Digital Voltmeter Test Program is a software module which verifies proper operation of a Model 2911 Guarded Crossbar Scanner set operating with a digital voltmeter under computer control. The verification test consists of step-by-step preliminary and test procedures.

4-5. EQUIPMENT REQUIRED.

4-6. The following equipment (or equivalent) is required to perform this test.

HP 2114A, 2115A, 2116A/B Computer (4K Memory minimum)
HP 2911A/B Guarded Crossbar Scanner
HP 2752A or 2754A Teleprinter
HP 12531B Buffered Teleprinter Input/Output Kit
HP 175A Oscilloscope with 10X Probe
HP 412A DC Voltmeter - Ohmmeter - Ammeter

4-7. PRELIMINARY PROCEDURE.

4-8. It is assumed that the required equipment is properly installed and power is ON. Proceed as follows:

a. On the teleprinter, set the LINE/OFF/LOCAL switch to LINE (2752A Teleprinter) or the LOCAL/ON LINE switch to ON LINE (2754B Teleprinter). Set the MODE switch on the 2754B to the KT position.

b. Place the test software module in the teleprinter tape reader or photo-reader if available.

c. Set the computer switch register to the starting address of the Basic Binary Loader: 007700 for 4K memory, 017700 for 8K memory, 037700 for 16K memory, 057700 for 24K memory, or 077700 for 32K memory.

NOTE

When using a 2114A Computer, the illuminated switch is equivalent to the up position of a 2115A or 2116B switch.

- d. Press the LOAD ADDRESS pushbutton.
- e. Set the LOADER switch to ENABLED.
- f. Press the PRESET pushbutton, then press the RUN pushbutton.
- g. When the computer halts, set the LOADER switch to PROTECTED. The "T" register should contain 102077.

4-9. TEST PROCEDURE.

4-10. Before proceeding, it is necessary to have certain responses ready for answering computer queries: (1) The model number and coding of the digital voltmeter; (2) The user must check and record by select code the location of interface cards in the I/O slots of the computer.

- a. Set the switch register to octal 2000 (switch 10 up, all others down).
- b. Press the LOAD ADDRESS pushbutton.
- c. Set the teleprinter select code into the switch register.
- d. Press the PRESET pushbutton, then the RUN pushbutton.

NOTE

Press the RETURN key, then the LINE FEED key after each reply on the teleprinter. The switch register settings of switches 0 and 15 for any section of this routine are:

Switch 0 down - do not repeat
 Switch 0 up - repeat this section
 Switch 15 down - teletype printout
 Switch 15 up - suppress printout

- e. The Teleprinter will print:

CODE ?

Type "8421" or "4221", as applicable to the instruments being verified. See Figure 4-1 for a typical sequence.

- f. The Teleprinter will print:

SCANNER ?

Type the Scanner I/O address.

```
CODE? 8421
SCANNER? 12
DSI? 0
SCAN OF CH'S 0 THRU 9
SET SW REG; PRESS RUN
PAUSE
SCAN OF CH'S 0 THRU 9
SET SW REG; PRESS RUN
PAUSE
TEST DELAY
DELAY? 05
DELAY? 00
DELAY? 00
DELAY? 11
DELAY? 23
DELAY? -3
USE OHMMETER
FREQ
PAUSE
OHMS
PAUSE
CH #? 3
HOW MANY? 5
SCAN PROG? 05
SET SW REG; PRESS RUN
PAUSE
SET SW REG; PRESS RUN
PAUSE
CH #? 0
HOW MANY? 10
SCAN PROG? 07
SET SW REG; PRESS RUN
PAUSE
STOP
```

Figure 4-1. Sample Printout

- g. The Teleprinter will print:

DSI?

- h. Type 0.

- i. The Teleprinter will type:

SET SW REG; PRESS RUN

PAUSE

Set the switch register switch 0 up to repeat the automatic scan test and down to proceed with next test. Press RUN.

- j. The Teleprinter will print:

TEST DELAY

DELAY?

- k. The Teleprinter will print:

SCAN OF CH's 0 THRU 9

Watching the Scanner Control display, verify that the Scanner steps through channels 0 through 9.

1. With switch register switch 0 in the down position, type a delay code selected from Table 2-1.

2. The Scanner will be programmed to channel 0 with the above delay, approximately twice a second. To verify delay times, connect an oscilloscope to 1V/cm vertical gain, negative trigger, and negative slope. Adjust the time base to see the positive-going edge of the signal. Verify that the signal is a transition from ground to approximately -24 volts, with a duration $\pm 20\%$ of the delay set in step "a".

3. Set switch register switch 0 to the up position. Teleprinter will print again:

DELAY?

4. Set switch register switch 0 to the down position and enter another delay. Repeat step "b" above.

5. To terminate this test, type a minus number other than 0 the next time the Teleprinter prints:

DELAY?

m. Press RUN.

1. The Teleprinter will print:

OHMS
PAUSE

2. Channel 0 is now programmed for the Resistance function. With an ohmmeter, verify continuity between Channel 0, Terminal 0 and J173-A.

n. To perform the operator-controlled scan test, perform the following:

1. Set switch register switch 15 up. Press RUN.

2. The Teleprinter will print:

CH# ?

Type the first channel of the block to be scanned.

3. The Teleprinter will print:

HOW MANY ?

Type the number of channels to be scanned (10 maximum).

4. The Teleprinter will print:

SCAN PROG

Type two digits (see Table 2-1).

5. The scan will be performed, then the Teleprinter will print:

SET SW REG; PRESS RUN

PAUSE

6. Set the switch register as follows:

Switch	Position	
1	Up	End of test
1	Down	Continue test
0	Up	Enter new scan information (i. e. , restart step b)
0	Down	Repeat previous scan

7. Repeat step 2, or proceed to n, depending on the switch register setting chosen in step 6.

- o. To restart test, proceed as follows:
 - 1. With switch register switch 1 to the up position, press LOAD ADDRESS.
 - 2. Set all switch register switches to the down position, and press RUN. This restarts the test at step "e".

4-11. PRINTED CIRCUIT CARD REMOVAL AND REPLACEMENT.

4-12. Where printed circuit cards are removed from any unit in the system for any reason, care should be taken that they are replaced in their proper position. Malfunction and possible damage may result unless this precaution is observed. Instrument power should be OFF whenever printed circuit cards are removed or replaced.

SECTION V
REPLACEABLE PARTS

5-1. INTRODUCTION.

5-2. Refer to Table 5-1 for a list of replaceable parts in alphanumerical order of their reference designations, with a description, HP part number for each part and manufacturer's code. A list of manufacturers and their code numbers is provided in Table 5-3. Figure 5-1 is included, in this section, as an aid for parts location.

5-3. ORDERING INFORMATION.

5-4. To order a replacement part, address the order or inquiry to your local Hewlett-Packard field office. See the list at the rear of this manual for field office addresses.

5-5. Specify the following information for each part when ordering:

- a. Hewlett-Packard part number.
- b. Circuit reference designation.
- c. Description.

5-6. To order a part not listed in Table 5-1, give a complete description of the part and include its function and location.

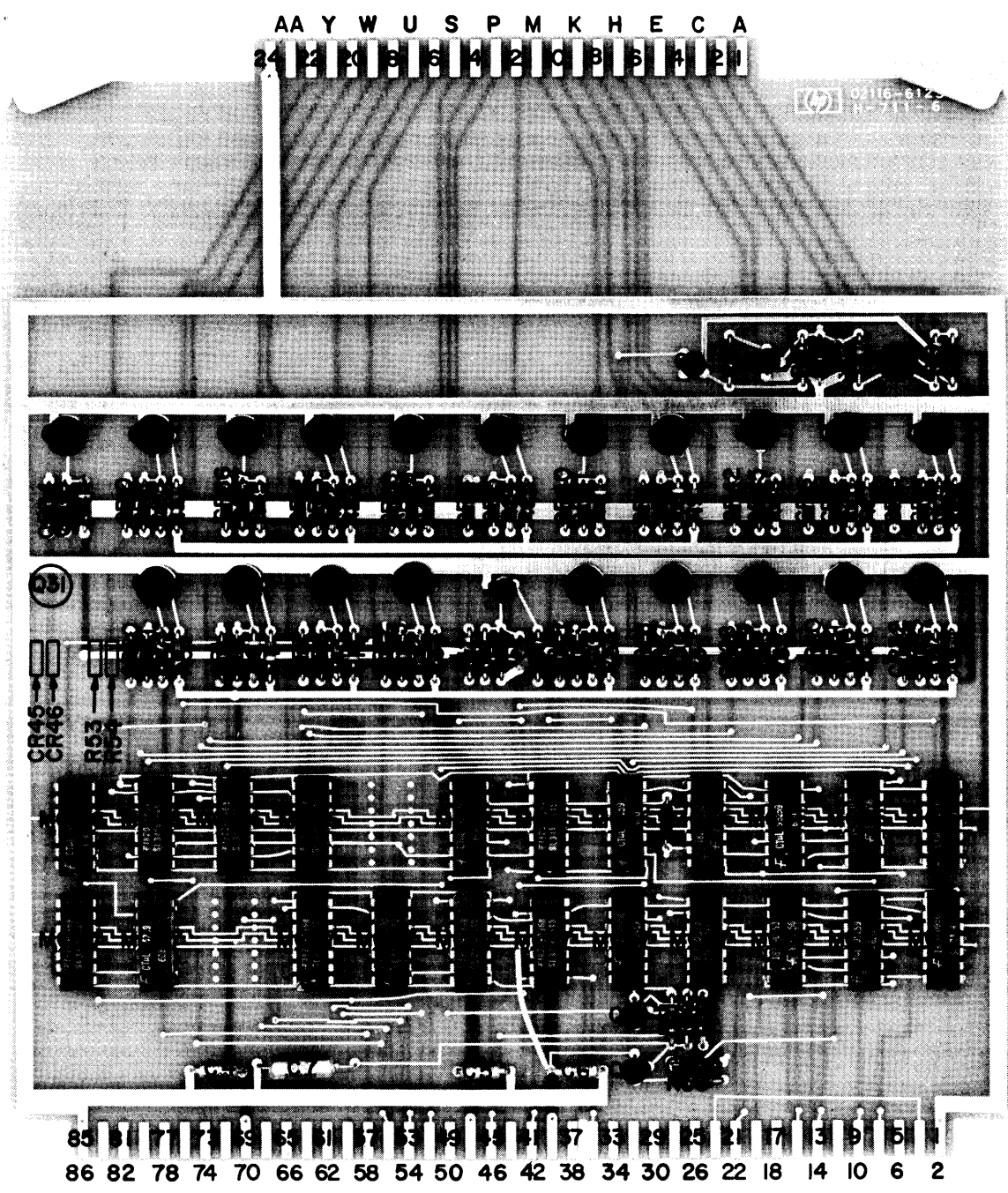


Figure 5-1. Parts Location

REFERENCE DESIGNATION	DESCRIPTION	HP STOCK NO.	MFR. CODE	MFR. PART NO.	QTY.	1-YR. SPA.
	12535A Crossbar Scanner Programmer	02116-6123	04404			
C1,2	C:fxd, cer, 0.001 μ f, 600VDCW	0150-0050	77630	OBD	2	1
C4,5,6	C:fxd, Ta elect, 2.2 μ f, 25VDCW	0180-0155	56289	150D225X0020A2	3	1
C7	C:fxd, elect, 6.8 μ f, 35VDCW	0180-0116	56289	150D685X9035B2	1	1
CR1-46*	Diode:Silicon, 30MA, 30VDCW	1901-0040	07263	FDG 1088	46	3
MC16,27,36, 56,76,117, 126	IC:CTL Dual Input NOR Gate	1820-0952	07263	SL3455	7	1
MC17,57	IC:CTL, Dual 2-Input Buffer	1820-0956	07263	SL3459	2	1
MC26,37,46	IC:CTL 2-2-3-Input AND Gate, or Tie Outputs	1820-0953	07263	SL3456	3	1
MC47	IC: Dual Rank Reset Flip-Flop	1820-0957	07263	SL3460	1	1
MC66,67,77, 87,96,97, 106,116,127	IC:CTL Dual Latch	1820-0968	07263	SL3466	9	2
Q4,5,7,10-22, 24-28,31*	Transistor:Silicon PNP	1853-0058	07263	2N3644	22	2
Q6,8,9,29,30	Transistor:Silicon NPN	1854-0094	07263	2N3646	5	1
R6,8,10,13,20, 22,24,26,28, 30,32,34,36, 38,40,42, 44-48,53*	R:fxd, comp, 470 Ω , 5%, 1/4W	0683-4715	01121	CB 4715	22	4
R7,9,14	R:fxd, comp, 12K, 5%, 1/4W	0683-1235	01121	CB 1235	3	1

*Note: CR45, CR46, Q31, and R53 first used on Revision K-811-6.

Table 5-1. Replaceable Parts List

12535A

Section V

REFERENCE DESIGNATION	DESCRIPTION	HP STOCK NO.	MFR. CODE	MFR. PART NO.	QTY.	1-YR. SPA.
	02116-6123 (Cont'd.)					
R11	R:fxd, comp, 2.2K, 5%, 1/4W	0683-2225	01121	CB 2225	1	1
R12,17,19	R:fxd, comp, 3.3K, 5%, 1/4W	0683-3325	01121	CB 3325	3	1
R15,49,50	R:fxd, comp, 1K, 5%, 1/4W	0683-1025	01121	CB 1025	3	1
R16	R:fxd, comp, 4.7K, 5%, 1/4W	0683-4725	01121	CB 4725	1	1
R18	R:fxd, comp, 22K, 5%, 1/4W	0683-2235	01121	CB 2235	1	1
R21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 54*	R:fxd, comp, 1.8K, 5%, 1/4W	0683-1825	01121	CB 1825	13	3
R51	R:fxd, comp, 12 Ω , 5%, 1/4W	0683-1205	01121	CB 1205	1	1
R52	R:fxd, flm 4.7K, 2%, 1/8W	0757-0940	75042	CEA	1	1

*Note: R54 first used on Revision K-811-6.

Table 5-1. Replaceable Parts List (Cont'd.)

Table 5-2. Interconnecting Cable Leadwire Connections

INTERFACE CARD CONNECTOR PIN	CROSSBAR SCANNER CONTROL CONNECTOR PIN	SIGNAL
A W S M F Z L N R U X Y J H D E B C V K P T 24 BB	S C H \bar{x} t n B F L R V Z d j \bar{p} \bar{u} y CC a \bar{z} A W HH HH h	Encode Command Ohm Switching Frequency Switching Bit 0 Bit 1 Delay Bit 2 (1) (2) 10^0 (2', 4) (4, 8) (1) (2) 10^1 (2', 4) (4, 8) (1) (2) 10^2 (2', 4) (4, 8) Reset Command Step Command +Reset Start Command Gnd Gnd Upper Limit Disable
NOTE: PINS 24 AND BB CONNECTED ON INTERFACE CARD CONNECTOR; PINS HH AND h CONNECTED ON CROSSBAR SCANNER CONTROL CONNECTOR.		

Table 5-3. Manufacturers' Code List

Code No.	Manufacturer	Address
01121	Allen Bradley Co.	Milwaukee, Wis. 53204
04404	Hewlett-Packard Co., Automatic Measurement Div.	Palo Alto, Calif. 94306
07263	Fairchild Camera and Instrument Corp., Semiconductor Div.	Mountain View, Calif. 94040
56289	Sprague Electric Co.	N. Adams, Mass. 01247
75042	International Resistance Co., Inc.	Philadelphia, Pa. 19108
77630	TRW Electronics Components Div.	Camden, New Jersey 08103

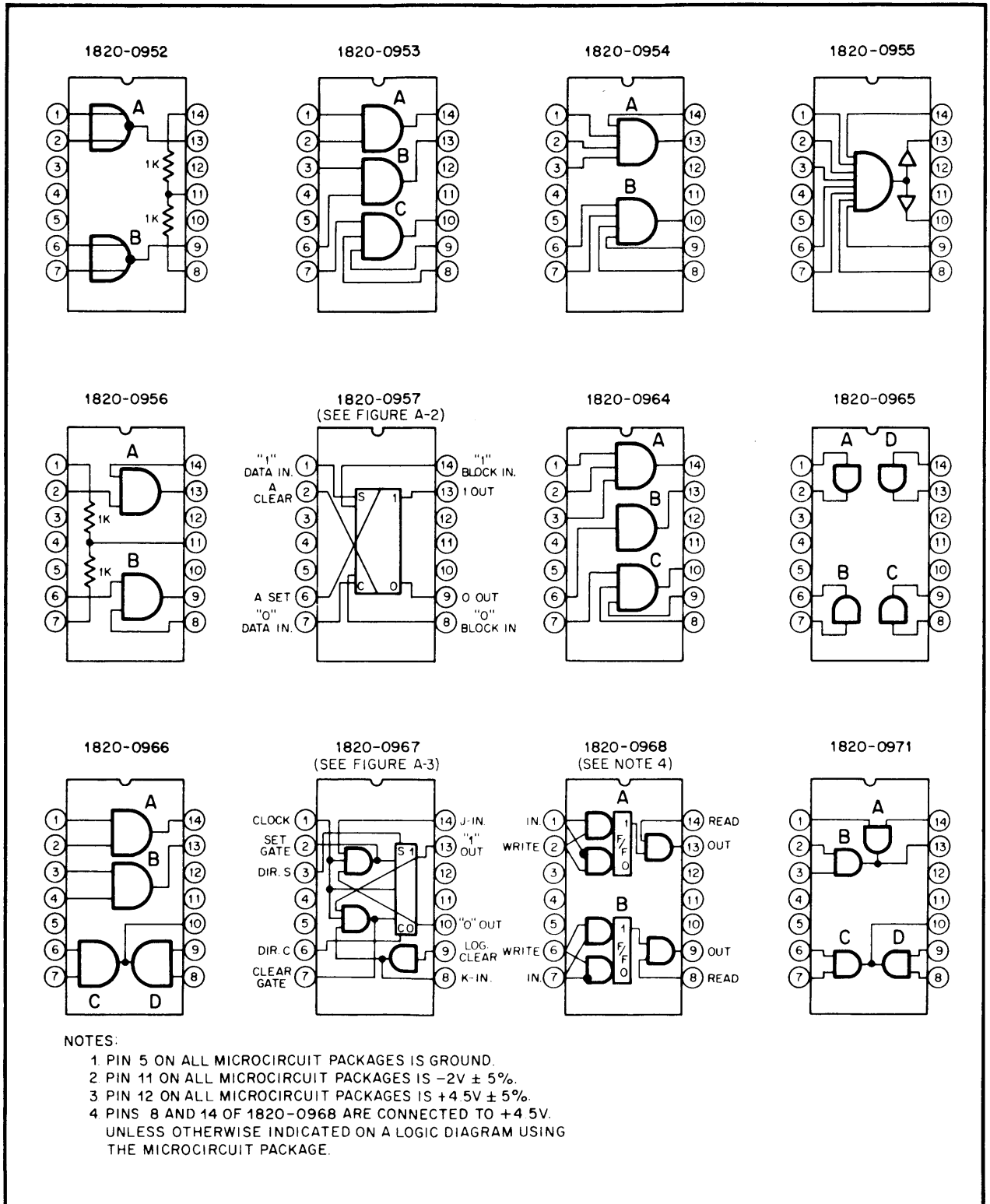


Figure A-1. Logic Diagrams for Microcircuit Packages, Top View

Appendix A
 Figures A-2, A-3

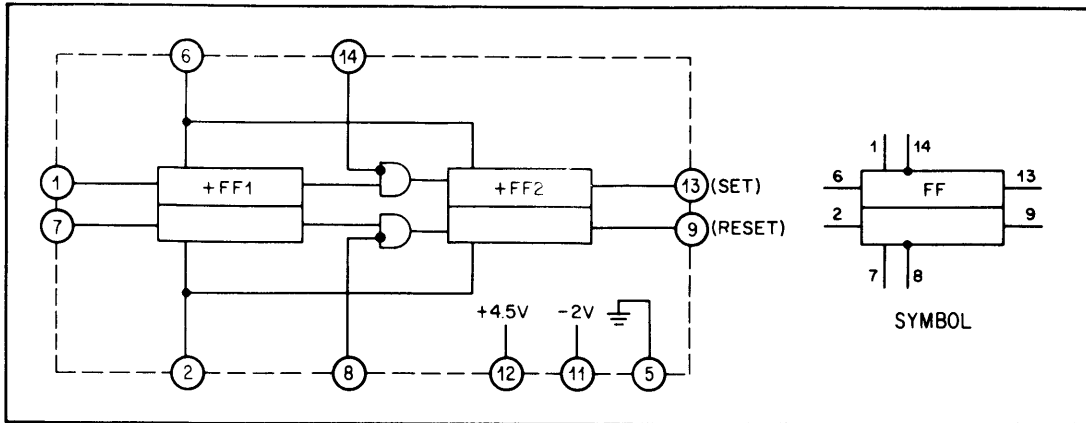


Figure A-2. Simplified Logic Diagram of 1820-0957 Microcircuit Package

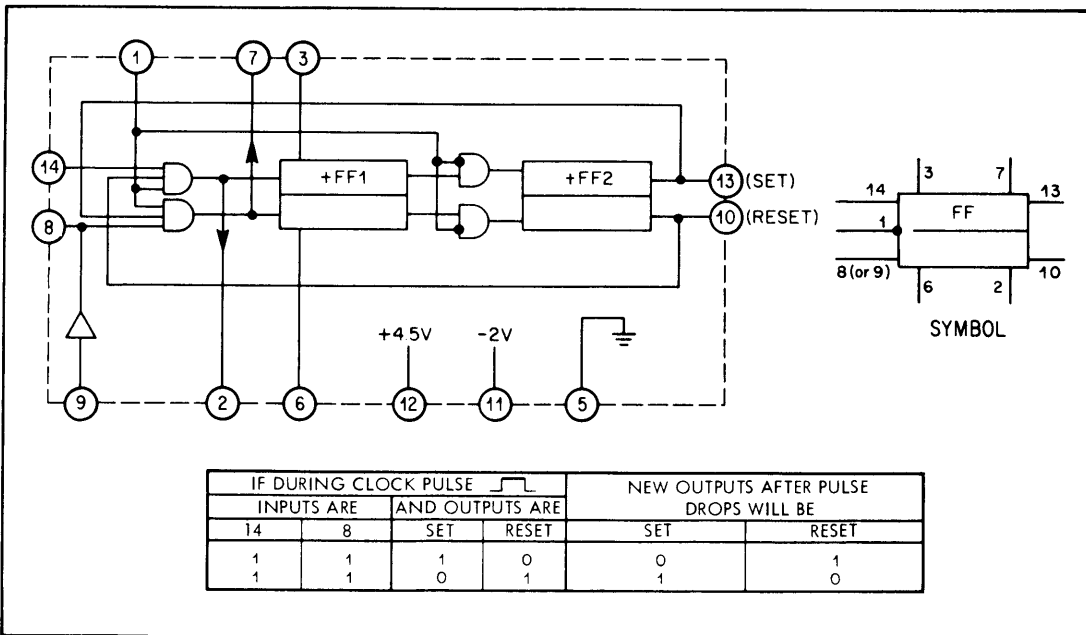


Figure A-3. Simplified Logic Diagram of 1820-0967 Microcircuit Package

Appendix A Figure A-4

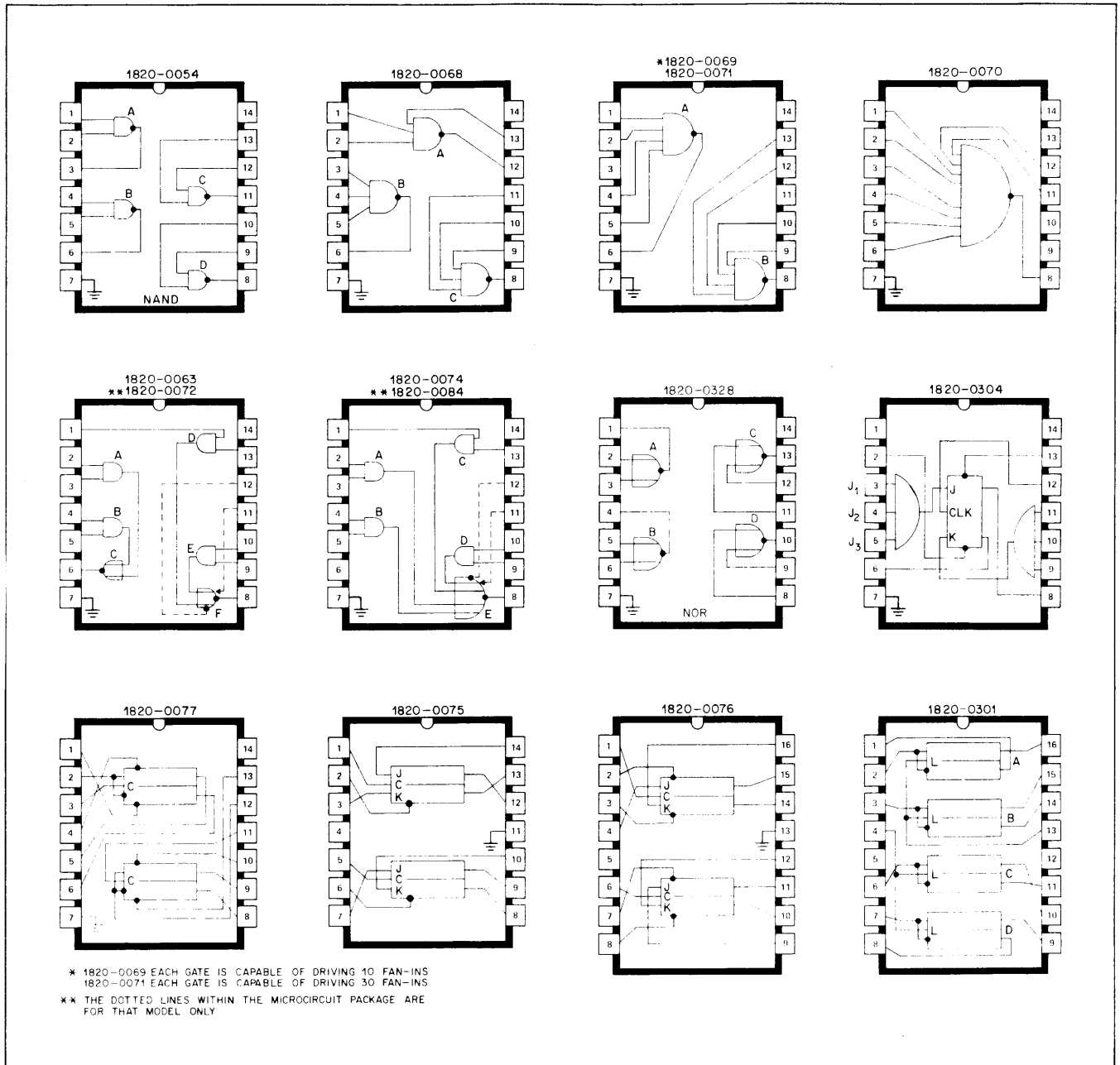
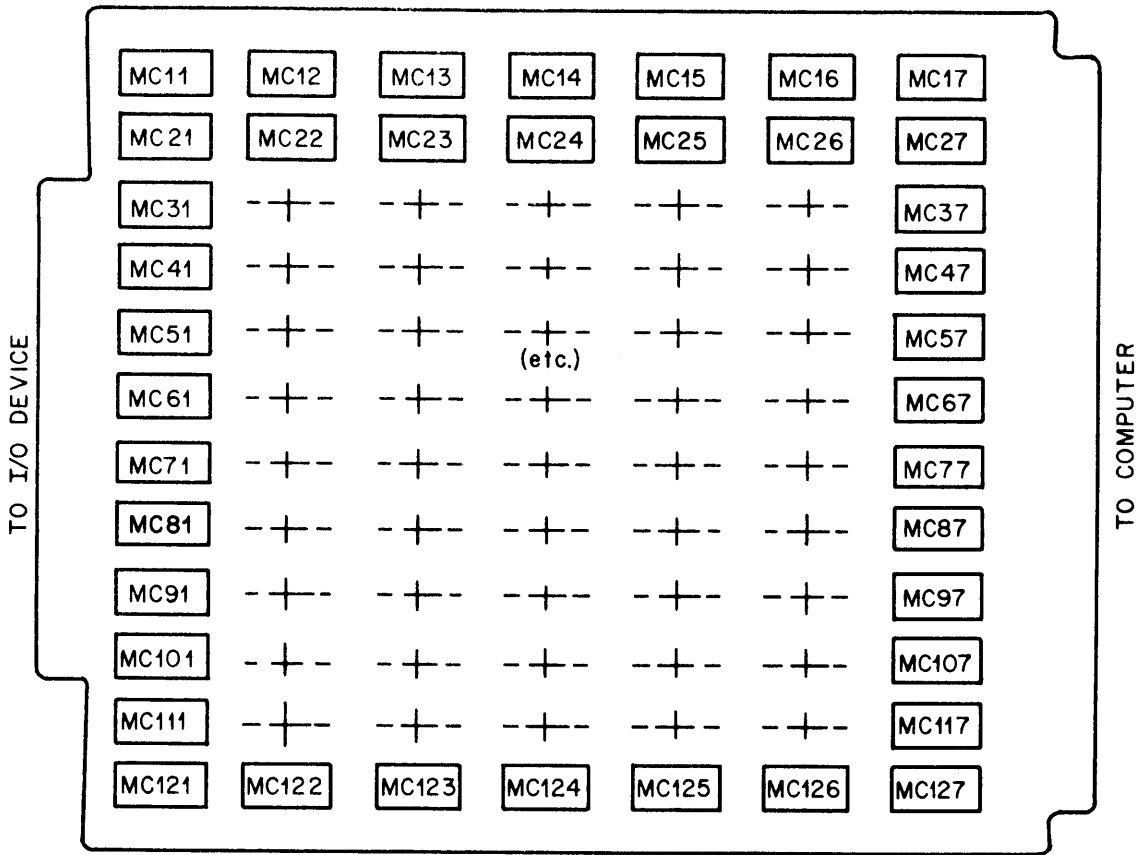


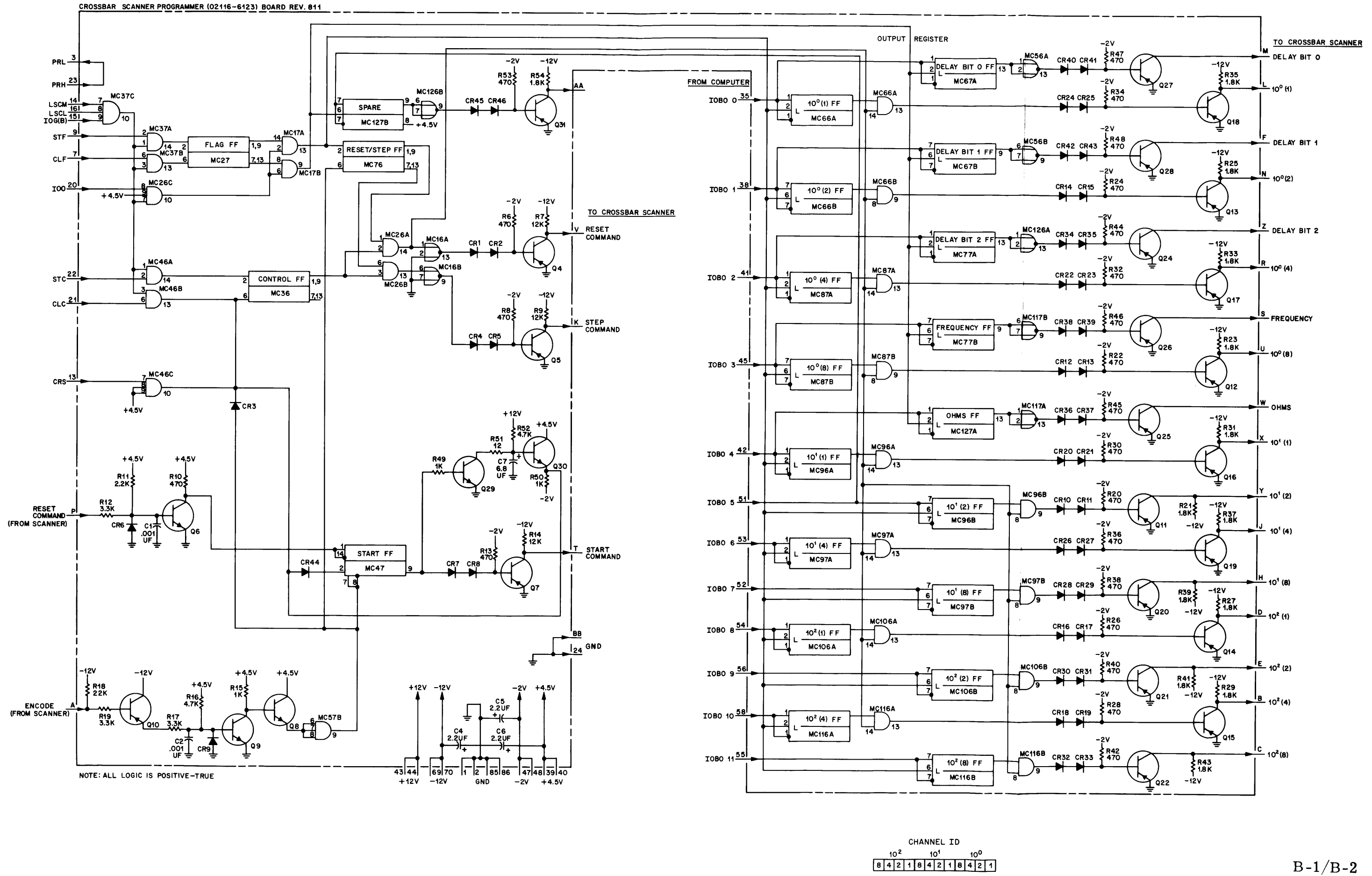
Figure A-4. Logic Diagram for Microcircuit Packages, Top View

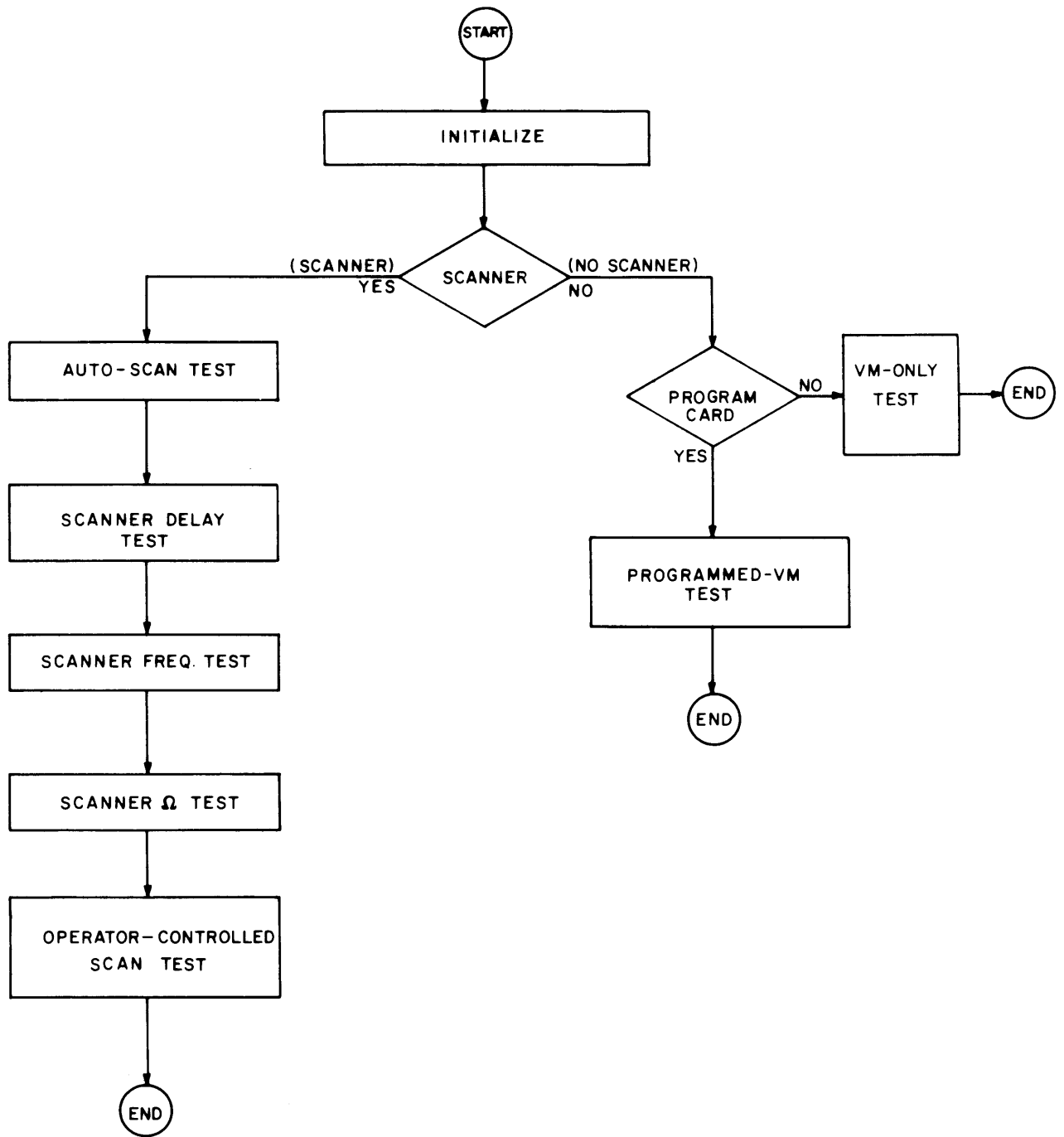
Appendix A
Figure A-5



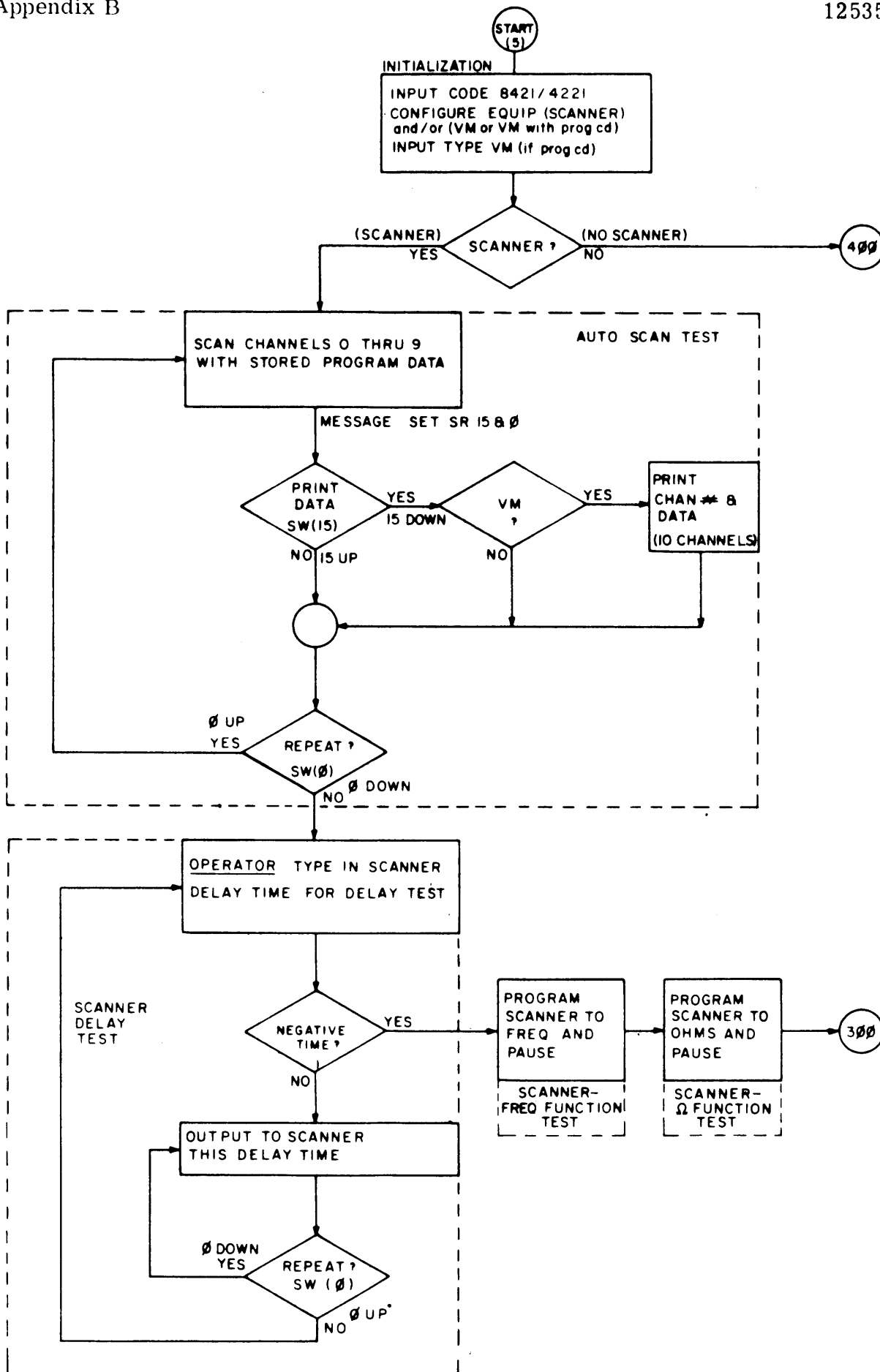
NOTE: A Microcircuit Package always assumes the reference designation assigned to its location on the card as illustrated in this figure.

Figure A-5. Microcircuit Package Locations



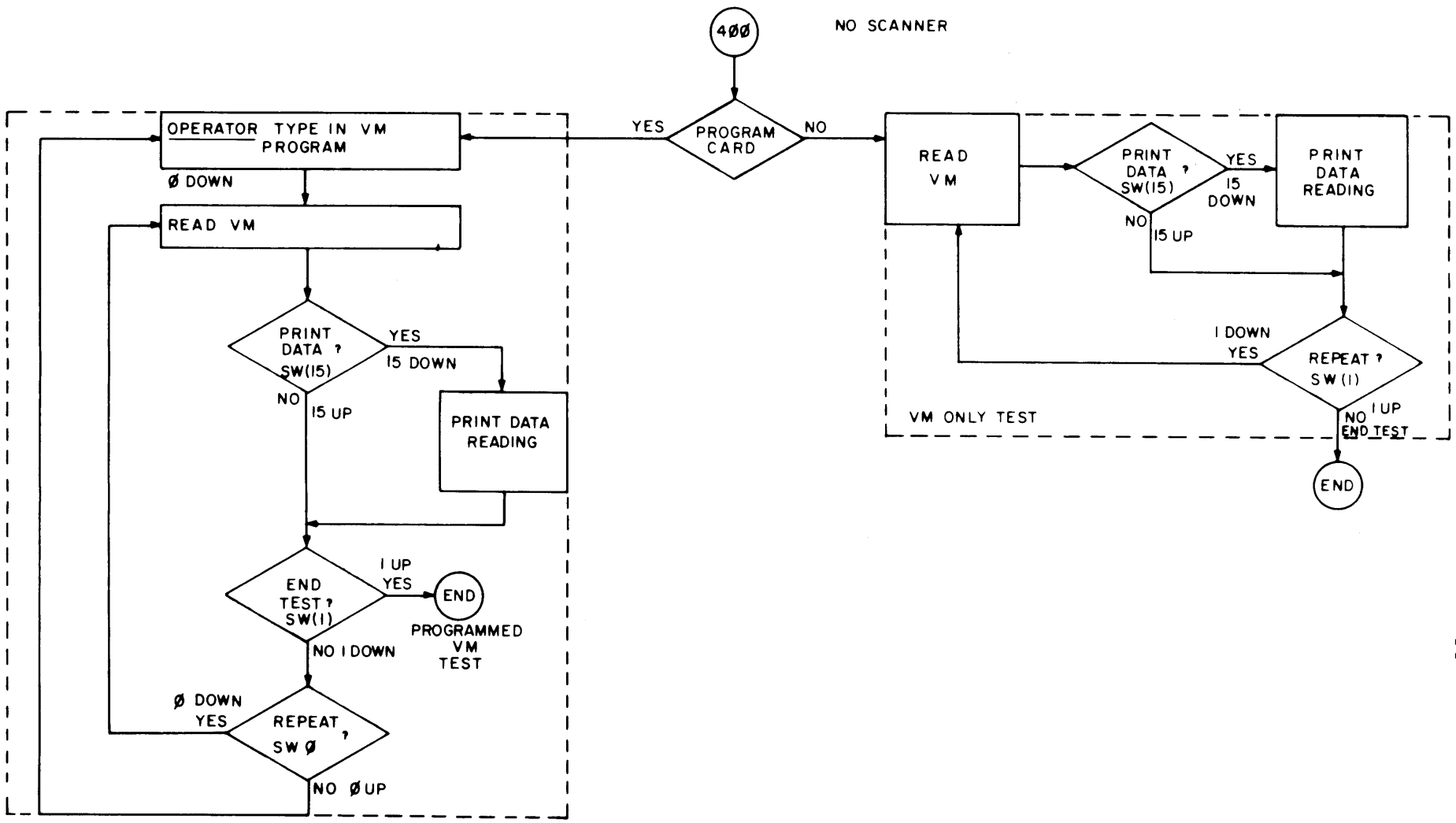


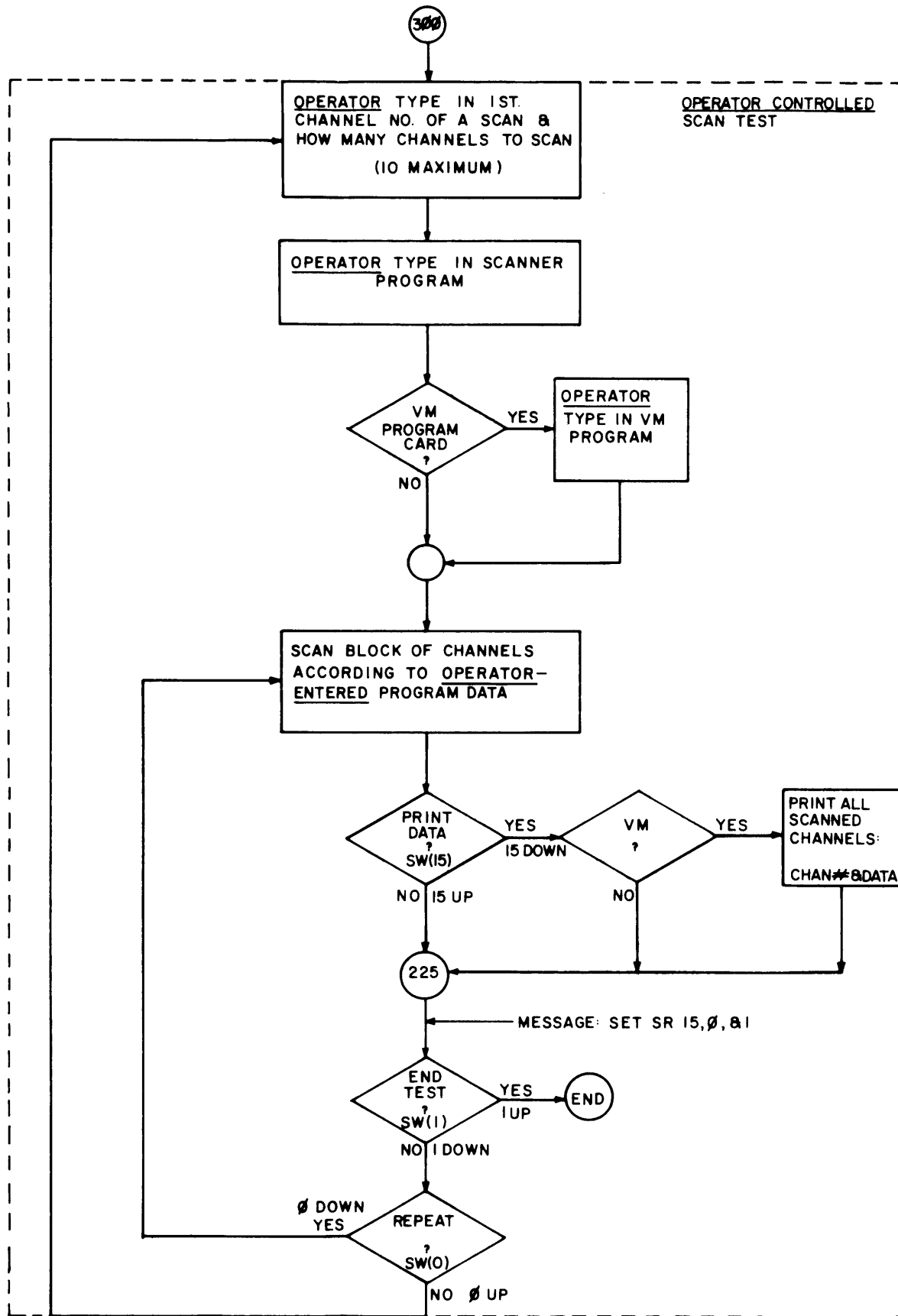
Test Program Flow Chart



Test Program Flow Chart (Cont'd)

Test Program Flow Chart (Cont'd)





Test Program Flow Chart (Cont'd)

VERIFICATION PROGRAM LISTING

FTN,B,L,A

PROGRAM VERIF

```

C
C THIS IS A CUSTOMER VERIFICATION SOFTWARE PROGRAM.
C IT IS TO BE USED WITH ANY OF THESE INSTRUMENT CONFIGURATIONS:
C   A.  SCANNER
C   B.  SCANNER AND VOLTMETER WITH OR WITHOUT A PROGRAM CARD
C   C.  VOLTMETER WITH OR WITHOUT A PROGRAM CARD
C
C THE SCANNER MUST BE A 2911; THE VOLTMETER, A 2401 OR 2402
C THE VOLTMETER AND SCANNER CAN BE 8421 OR 4221
C
C THIS PROGRAM USES THE D.42,D.41,AND D.40 DRIVERS AND THEY ARE
C   EQUIPMENT NUMBERS 7, 10, AND 11 RESPECTIVELY.
C
C AN ARRAY IS INITIALLY SET UP TO SUPPLY DATA FOR THE INITIAL SCANNER
C   TEST - CHANNELS 0 THRU 9 ARE SCANNED.
C
C INPUT PROGRAM-DATA ARRAY:
C   DIMENSION ICHAN(10),ISCPG(10),IVMPG(10)
C OUTPUT DATA ARRAY:
C   DIMENSION IRNG(10),DATA(10),IFUN(10)
C
C INPUT ARRAY EQUIVALENCES:
C   EQUIVALENCE (ICHAN(1),IC1)
C   EQUIVALENCE (ISCPG(1),IS1),(ISCPG(9),IS9),(ISCPG(10),IS10)
C   EQUIVALENCE (IVMPG(1),IV1),(IVMPG(2),IV2),(IVMPG(3),IV3),
C   1(IVMPG(4),IV4),(IVMPG(5),IV5),(IVMPG(6),IV6),(IVMPG(7),IV7),
C   2(IVMPG(8),IV8),(IVMPG(9),IV9),(IVMPG(10),IV10)
C OUTPUT ARRAY EQUIVALENCES:
C   EQUIVALENCE (IRNG(1),IRNG1)
C   EQUIVALENCE (DATA(1),DATA1)
C   EQUIVALENCE (IFUN(1),IFUN1)
C
C INITIALIZE ICHAN ARRAY:
C   DO 5 I=1,10
C     ICHAN(I)=I-1
C INITIALIZE ISCPG ARRAY:
C   DO 7 I=1,8
C     ISCPG(I)=I-1
C     IS9=3
C     IS10=4
C INITIALIZE IVMPG ARRAY:
C   IV1=42B
C   IV2=143B
C   IV3=244B
C   IV4=45B
C   IV5=146B
C   IV6=242B
C   IV7=43B
C   IV8=144B
C   IV9=245B
C   IV10=46B
C
C   IPCAD=0
C
C THIS SECTION CONFIGURES THE SYSTEM TO BE VERIFIED
C
C   WRITE (2,706)
C TYPE IN 8421 OR 4221 DEPENDING ON INSTRUMENTS.

```

```

      READ (1,*)   ICODE
C   SET CODE CONTROL WORD IN DRIVER SECTION
      CALL STCOD(ICODE)
      CALL SETCD(ICODE)
      WRITE (2,710)
C   IF SYSTEM HAS A SCANNER, TYPE I/O ADDRESS: IF NOT, TYPE 0.
      READ (1,700) ISCAD
      IF (ISCAD) 10,20,10
C   CONFIGURE SCANNER
      10 CALL SETAD (7,ISCAD)
      20 WRITE (2,713)
C   IF SYSTEM HAS A VOLTMETER, TYPE I/O ADDRESS; IF NOT, TYPE 0.
      READ (1,700) IVMAD
      IF (IVMAD) 30,70,30
C   CONFIGURE DSI
      30 CALL SETAD (9,IVMAD)
      WRITE (2,717)
C   IF SYSTEM HAS A VM PROGRAM CD, TYPE I/O ADDRESS; IF NOT, TYPE 0.
      READ (1,700) IPCAD
      IF (IPCAD) 40,70,40
C   CONFIGURE PROGRAM CARD
      40 CALL SETAD (8,IPCAD)
      45 WRITE (2,720)
C   TYPE IN 2401 OR 2402 DEPENDING ON VOLTMETER.
      READ (1,*)   ITYPE
      ITYPE=ITYPE-2400
      GO TO      (70,50)   ITYPE
C   RESET INITIAL VOLTMETER PROGRAM ARRAY FOR A 2402
      50 DO 55 I=2,9
      55 IVMPG(I)=IAND(77H, IVMPG(I))
C
C   BEGIN TEST
C
      70 ISW1=1
      IF (ISCAD) 73,400,73
      73 N=10
      ITEST=1
      75 WRITE (2,725)
      CALL ENDIO
      78 I=1
      100 WRITE (7) ICHAN(I),ISCPG(I)
      120 IF (IVMAD) 140,200,140
      140 WRITE (9)
      160 IF (IPCAD) 170,180,170
      170 WRITE (8) IVMPG(I)
      180 READ (9,730) IRNG(I), DATA(I),IFUN(I)
      GO TO 215
C   DELAY LOOP TO SUBSTITUTE IF NO VOLTMETER
      200 DO 202 K=1,300000
      202 CONTINUE
      215 I=I+1
      GO TO (222,275,227,219,227) ITEST
      219 IF (I-N-1) 100,227
      222 IF (I-11) 100,225
      225 WRITE (2,735)
      PAUSE
      GO TO (227,330) ISW1
C   SW REG (15), WHEN UP, WILL SUPPRESS THE PRINTOUT
      227 IF (ISSW(15)) 238,230
      230 IF (IVMAD) 233,238,233

```

```

C PRINT OUT DATA MEASURED BY VOLTMETER
233 IF (ISCAD) 236,235,236
235 WRITE (2,731) DATA1,IRNG1,IFUN1
GO TO 238
236 WRITE (2,732) (ICHAN(I),DATA(I),IRNG(I),IFUN(I),I=1,N)
238 GO TO (240,240,415,225,435) ITEST
240 IF (ISSW(0)) 75,270

C
C NEXT - SCANNER DELAY CHECK
270 WRITE (2,742)
ITEST=2
271 WRITE (2,743)
C TYPE IN SCANNER DELAY
READ (1,*) IS1
C ICHAN(1)=0
IF (IS1) 280,78
275 IF (ISSW(0)) 271,78

C
C FREQUENCY TEST
280 WRITE (2,747)
IS1=148
C ICHAN(1)=0
285 WRITE (7) IC1,IS1
PAUSE
GO TO (290,290,300) ITEST

C
C OHMS TEST
290 WRITE (2,750)
IS1=248
C ICHAN(1)=0
ITEST=3
GO TO 285

C
C CONTROLLED SCAN WITH OR WITHOUT VOLTMETER
300 ISW1=2
ITEST=4
321 WRITE (2,760)
C TYPE IN FIRST CHANNEL OF BLOCK TO BE SCANNED
READ (1,*) IC1
DO 322 I=2,10
322 ICHAN(I)=ICHAN(I-1)+1
WRITE (2,761)
C TYPE IN NUMBER OF CHANNELS TO BE SCANNED
READ (1,*) N
WRITE (2,790)
C TYPE IN SCANNER PROGRAM
READ (1,700) IS1
DO 328 I=1,N
328 ISCPG(I)=IS1
IF (IPCAD) 350,78,350
C REPEAT, OR REPROGRAM SCAN TEST, OR END TEST ?
330 IF (ISSW(1)) 500,333
333 IF (ISSW(0)) 321,78
C VOLTMETER PROGRAM CARD
350 WRITE (2,792)
C TYPE IN VOLTMETER PROGRAM
READ (1,700) IV1
IF (ISCAD) 379,377,379
C IF NO SCANNER, SET BIT 15 OF VM PROGRAM WORD TO 1
377 IV1=IV1+1000000H

```

```
      GO TO 435
379 DO 380 I=1,N
380 IVMPG(I)=IV1
      GO TO 78
C
C NO SCANNER IN SYSTEM
400 IF (IPCAD) 430,410,430
C
C VOLTMETER ONLY - NO SCANNER OR PROGRAM CARD
410 ITEST=3
415 I=1
C REPEAT READING OR END TEST?
420 IF (ISSW(1)) 500,140
C
C VOLTMETER WITH PROGRAM CARD
430 ITEST=5
      GO TO 350
435 I=1
C REPEAT, OR REPROGRAM VOLTMETER, OR END TEST?
      IF (ISSW(1)) 500,440
440 IF (ISSW(0)) 350,140
C
700 FORMAT (K3)
706 FORMAT (/ "CODE? ←")
710 FORMAT (/ "SCANNER? ←")
713 FORMAT (/ "DSI? ←")
717 FORMAT (/ "PROG.CD? ←")
720 FORMAT (/ "2401 OR 2402? ←")
725 FORMAT (/ "SCAN OF CH'S 0 THRU 9")
730 FORMAT (I1,X,E10.4,I4)
731 FORMAT (// "DATA= ",E14.7,3X,"RANGE= ",I1,3X,"FUNCTION= ",I2)
732 FORMAT (// "CHAN ",I3,5X,"DATA= ",E14.7,3X,"RANGE= ",I1,3X,
1"FUNCTION= ",I2)
735 FORMAT (/ "SET SW REG; PRESS RUN")
742 FORMAT (/ "TEST DELAY")
743 FORMAT (/ "DELAY? ←")
747 FORMAT (/ "USE OHMMETER"// "FREQ")
750 FORMAT (// "OHMS")
760 FORMAT (/ "CH #? ←")
761 FORMAT (/ "HOW MANY? ←")
790 FORMAT (/ "SCAN PROG? ←")
792 FORMAT (/ "VM PROG? ←")
C
500 END
      END%
```

MANUAL IDENTIFICATION

SUPPLEMENT DESCRIPTION

Manual Printed: NOV 1969

Manual Part Number: 02116-9041

This supplement is provided to correct manual errors, to describe differences between the kit components furnished and those described in the manual, and to provide additional operating and service instructions, as required.

CHANGE

DESCRIPTION

- 1 Page 1-1, Paragraph 1-2, "c", Change HP part numbers to 20010C for 8-4-2-1 and to 20012C for 4-2'-2-1.
- 2 Page 1-1, Paragraph 1-2, "d" and Page 4-1, Paragraph 4-4. Change HP accessory number 20349A to 20349-90001 Rev. D.

Pages B9 through B12. Delete. Use listing on Pages US-3 through US-7 of this supplement.
- 3 Page 4-1, Paragraph 4-4. Change to read as follows:
"The HP 20349-90001 Scanner/Digital Voltmeter Test Program is a software module which verifies proper operation of a Model 2911 Guarded Crossbar Scanner set operating with or without a digital voltmeter under computer control. The voltmeter may be a Model 2402A or 2401C. The instructions in this section assume that a voltmeter is not used. The verification test consists of step-by-step preliminary and test procedures."
- 4 Page 1-1, Paragraph 1-2. After "d", add the following:
When the HP 12535A Kit is purchased as part of an HP subsystem, the binary test tape furnished is HP Part No. 20530-60001; tape 20349-90001 serves no subsystem purpose and is not included.
- 5 Pages 4-4 and 4-5. Replace steps "g" through "m" of Paragraph 4-10 with the following:
 - g. The teleprinter will print:

DSI?
 - h. Type 0 (followed by LINE FEED and RETURN).
 - i. The teleprinter will print:

SCAN OF CH'S Ø THRU 9

Watching the Scanner Control display, verify that the Scanner steps through channels 0 through 9.
 - j. The teleprinter will print:

SET SW REG; PRESS RUN
PAUSE
 - k. Set Switch Register switch 0 down. (If a repeat of the Automatic Scan Test performed in step "i" is desired set switch 0 up.) Press RUN.
 - l. The teleprinter will print:

TEST DELAY
DELAY?

CHANGEDESCRIPTION

5
(Continued)

- 1) With switch 0 in the down position, type a delay code selected from Table 2-1.
 - 2) The Scanner will be programmed to channel 0 with the delay selected above, approximately two times per second. To verify delay times, connect an oscilloscope to the junction of R18 and R19 (see Figure 5-1). Set the oscilloscope controls for 1V/cm vertical gain, negative trigger, and negative slope; adjust the time base to see the positive-going edge of the signal. Verify that the signal is a transition from ground to approximately -24 volts having a duration within $\pm 20\%$ of the delay selected in step 1.
 - 3) Set switch 0 up; the teleprinter will print:

DELAY
 - 4) Set switch 0 down and type another delay code. Repeat step 2.
 - 5) To terminate this test, set switch 0 up and - after the teleprinter prints DELAY? - set switch 0 down and type a minus number other than -0 (followed by LINE FEED and RETURN).
- m. The teleprinter will print:

USE OHMMETER

FREQ

PAUSE
- n. Check circuit continuity as follows:
- 1) Withdraw the crossbar switch from the main chassis.

CAUTION

Beware of any dangerous potentials which may be present at cable terminations to the input connectors.
 - 2) A microswitch is located behind the lower left-hand corner of the rear panel to disable the crossbar switch when the rear panel is withdrawn; this microswitch must be held closed when making the continuity checks of this procedure. Also, disconnect the cable at connector J173 on the rear panel.
 - 3) Using an ohmmeter, verify continuity between the channel 0 input terminal 0 and the center conductor of BNC connector J172. (A 1/16 ampere fuse, on the rear panel, is in series with the BNC ground conductor and will blow if a test light type of continuity tester is used.)
- o. Press RUN. The teleprinter will print OHMS and PAUSE Using an ohmmeter, verify continuity between terminals of channel 0 and connector J173 as listed below:
- 1) terminal 0 and pin A.
 - 2) terminal 1 and pin B.
 - 3) terminal 2 and the inner shield.
 - 4) terminal 3 and pin C.
 - 5) terminal 4 and pin D.
 - 6) terminal 5 and the outer shield.

Return the crossbar switch to its normal position in the cabinet. Complete the test procedure for the HP 12535A by performing steps "n" and "o" on pages 4-5 and 4-6 of the manual.

- 6 Page 4-1, Paragraph 4-6. Change first listing to read:
 HP 2114, 2115, 2116, 2100 Computer (4K Memory minimum).

VERIF 2911 SCANNER/DVM TEST

FTN,B,L

```

PROGRAM VERIF
C   UPDATED 12 JAN 1970 BY G.A. ANZINGER
C   UPDATE USES NEW D.40A,D.42A AND D.00A DRIVERS
C   MODIFIED FOR COMPATIBILITY WITH HP 2100 AUG. 1971
C   THE PROGRAM LOOKS THE SAME TO THE USER
C
C   THIS IS A CUSTOMER VERIFICATION SOFTWARE PROGRAM.
C   IT IS TO BE USED WITH ANY OF THESE INSTRUMENT CONFIGURATIONS:
C   A.  SCANNER
C   B.  SCANNER AND VOLTMETER WITH OR WITHOUT A PROGRAM CARD
C   C.  VOLTMETER WITH OR WITHOUT A PROGRAM CARD
C
C   THE SCANNER MUST BE A 2911; THE VOLTMETER, A 2401 OR 2402
C   THE VOLTMETER OUTPUT CODE MUST BE 8421 OR 4221 AND THE SAME
C   AS THE SCANNER CODE
C
C   THIS PROGRAM USES THE D.42,D.41,AND D.40 DRIVERS AND THEY ARE
C   EQUIPMENT NUMBERS 7, 10, AND 11 RESPECTIVELY.
C
C   AN ARRAY IS INITIALLY SET UP TO SUPPLY DATA FOR THE INITIAL SCANNER
C   TEST - CHANNELS 0 THRU 9 ARE SCANNED.
C
731 FORMAT (/"DATA= ",E14.7,3X,"RANGE= ",I1,3X,"FUNCTION= ",I2)
732 FORMAT (/"CHAN ",I3,5X,"DATA= ",E14.7,3X,"RANGE= ",I1,3X,
1"FUNCTION= ",I2)
706 FORMAT (/"CODE? +")
710 FORMAT (/"SCANNER? +")
713 FORMAT (/"DSI? +")
717 FORMAT (/"PROG.CD? +")
720 FORMAT (/"2401 OR 2402? +")
725 FORMAT (/"SCAN OF CH'S 0 THRU 9")
730 FORMAT (I1,X,E10.0,I4)
735 FORMAT (/"SET SW KEG; PRESS RUN")
742 FORMAT (/"TEST DELAY")
743 FORMAT (/"DELAY? +")
747 FORMAT (/"USE OHMMETER"//"FREQ")
750 FORMAT (/"OHMS")
760 FORMAT (/"CH #? +")
761 FORMAT (/"HOW MANY? +")
790 FORMAT (/"SCAN PROG? +")
792 FORMAT (/"VM PROG? +")
C
C   INPUT PROGRAM-DATA ARRAY:
C
C   DIMENSION ICHAN(10),ISCPG(10),IVMPG(10)
C   OUTPUT DATA ARRAY:
C   DIMENSION IRNG(10),DATA(10),IFUN(10)
C
C   CONFIGURING ARRAY
C   DIMENSION IAD(3)
C
C   COMMON DECLARATION
C   COMMON ICHAN,ISCPG,IRNG,DATA,IFUN
C
C   CONFIGURING EQUIVALENCES
C   EQUIVALENCE (ISCAD,IAD(3)),(IVMAD,IAD(1)),(IPCAD,IAD(2))
C
C   INPUT ARRAY EQUIVALENCES:
C   EQUIVALENCE (ICHAN(1),IC1)

```

VERIF 2911 SCANNER/DVM TEST

```

EQUIVALENCE (ISCPG(1),IS1),(ISCPG(9),IS9),(ISCPG(10),IS10)
EQUIVALENCE (IVMPG(1),IV1),(IVMPG(2),IV2),(IVMPG(3),IV3),
1(IVMPG(4),IV4),(IVMPG(5),IV5),(IVMPG(6),IV6),(IVMPG(7),IV7),
2(IVMPG(8),IV8),(IVMPG(9),IV9),(IVMPG(10),IV10)
C OUTPUT ARRAY EQUIVALENCES:
EQUIVALENCE (IRNG(1),IRNG1)
EQUIVALENCE (DATA(1),DATA1)
EQUIVALENCE (IFUN(1),IFUN1)
C
C INITIALIZE ICHAN AND ISCPG ARRAYS
CALL INIT
C INITIALIZE IVMPG ARRAY:
IV1=42B
IV2=143B
IV3=244B
IV4=45B
IV5=146B
IV6=242B
IV7=43B
IV8=144B
IV9=245B
IV10=46B
C
C IPCAD=3
C
C THIS SECTION CONFIGURES THE SYSTEM TO BE VERIFIED
C
C CONFIGURE THE TTY
CALL SETAD (0,IAND(77H,ISSW(15)),2)
C
C WRITE (2,706)
C TYPE IN 8421 OR 4221 DEPENDING ON INSTRUMENTS.
READ (1,*) ICODE
WRITE (2,710)
C IF SYSTEM HAS A SCANNER, TYPE I/O ADDRESS; IF NOT, TYPE 0.
READ (1,*) ISCAD
C PRESET PROGRAMMER ADDRESS IN CASE IT IS NOT DEFINED
IPCAD=3
WRITE (2,713)
C IF SYSTEM HAS A VOLTMETER, TYPE I/O ADDRESS; IF NOT, TYPE 0.
READ (1,*) IVMAD
IF (IVMAD) 30,70,30
30 WRITE (2,717)
C IF SYSTEM HAS A VM PROGRAM CD, TYPE I/O ADDRESS; IF NOT, TYPE 0.
READ (1,*) IPCAD
IF (IPCAD) 40,70,40
40 WRITE (2,720)
C TYPE IN 2401 OR 2402 DEPENDING ON VOLTMETER.
READ (1,*) ITYPE
ITYPE=ITYPE-2400
GO TO (70,50) ITYPE
C RESET INITIAL VOLTMETER PROGRAM ARRAY FOR A 2422
50 DO 55 K=2,9
55 IVMPG(K)=IAND(77H, IVMPG(K))
C
C CONFIGURE SYSTEM DRIVERS
70 DO 65 I=1,3
IF (IAD(I))65,65,60
60 CALL SETAD(I+37H,IAD(I)-(IAD(I)/10)*2+(ICODE/8421)*100B,1)
65 CONTINUE

```

VERIF 2911 SCANNER/DVM TEST

```

C
C
C   TURN OFF SETAD
C
C   CALL SETAD (0,0,0)
C BEGIN TEST
C
  ISW1=1
  IF (ISCAD) 73,400,73
73 N=10
  ITEST=1
75 WRITE (2,725)
  CALL ENDIO
78 I=1
100 WRITE (7) ICHAN(I),ISCPG(I)
120 IF (IVMAD) 140,200,140
140 WRITE (9)
160 IF (IPCAD) 170,180,170
170 WRITE (8) IVMPG(I)
180 READ (9,730) IRNG(I), DATA(I),IFUN(I)
  GO TO 215
C DELAY LOOP TO SUBSTITUTE IF NO VOLTMETER
200 DO 202 IRNG1 = 1,2
  DO 202 IFUN1 = 1,50363B
202 CONTINUE
215 I=I+1
  GO TO (222,275,227,219,227) ITEST
219 IF (I-N-1) 100,227
222 IF (I-11) 100,225
225 WRITE (2,735)
  PAUSE
  GO TO (227,330) ISW1
C SW REG (15),WHEN UP,WILL SUPPRESS THE PRINTOUT
227 IF (ISSW(15)) 238,230
230 IF (IVMAD) 233,238,233
C PRINT OUT DATA MEASURED BY VOLTMETER
233 IF (ISCAD) 236,235,236
235 WRITE (2,731) DATA1,IRNG1,IFUN1
  GO TO 238
236 WRITE (2,732) (ICHAN(I),DATA(I),IRNG(I),IFUN(I),I=1,N)
238 GO TO (240,240,415,225,435) ITEST
240 IF (ISSW(0)) 75,270
C
C NEXT - SCANNER DELAY CHECK
270 WRITE (2,742)
  ITEST=2
271 WRITE (2,743)
C TYPE IN SCANNER DELAY
  READ (1,*) IS1
C   ICHAN(1)=
  IF (IS1) 280,78
275 IF (ISSW(0)) 271,78
C
C FREQUENCY TEST
280 WRITE (2,747)
  IS1=14B
C   ICHAN(1)=
285 WRITE (7) IC1,IS1
  PAUSE
  GO TO (290,290,300) ITEST

```

VERIF 2911 SCANNER/DVM TEST

```

C
C OHMS TEST
290 WRITE (2,750)
    IS1=248
C ICHAN(1)=M
    ITEST=3
    GO TO 285
C
C CONTROLLED SCAN WITH OR WITHOUT VOLTMETER
300 ISW1=2
    ITEST=4
    CALL CLRIO
321 WRITE (2,760)
C TYPE IN FIRST CHANNEL OF BLOCK TO BE SCANNED
    READ (1,*) IC1
    DO 322 I=2,10
322 ICHAN(I)=ICHAN(I-1)+1
323 WRITE (2,761)
C TYPE IN NUMBER OF CHANNELS TO BE SCANNED
    READ (1,*) N
    IF (N-11) 324,323
324 WRITE (2,790)
C TYPE IN SCANNER PROGRAM
    READ (1,*) IS1
C CONVERT FROM DECIMAL TO OCTAL
    IS1=IS1-(IS1/10)*2-(IS1/100)*16
    DO 325 I=1,N
328 ISCPG(I)=IS1
    IF (IPCAD) 350,78,350
C REPEAT, OR REPROGRAM SCAN TEST, OR END TEST ?
330 IF (ISSW(1)) 500,333
333 IF (ISSW(4)) 321,78
C VOLTMETER PROGRAM CARD
350 WRITE (2,792)
C TYPE IN VOLTMETER PROGRAM
    READ (1,*) IV1
C CONVERT FROM DECIMAL TO OCTAL
    IV1=IV1-(IV1/10)*2-(IV1/100)*16
    IF (ISCAD) 379,377,379
C IF NO SCANNER, SET HIT 15 OF VM PROGRAM WORD TO 1
377 IV1=IV1+1000000B
    GO TO 435
379 DO 380 I=1,N
380 IVMPG(I)=IV1
    GO TO 78
C
C NO SCANNER IN SYSTEM
400 IF (IPCAD) 430,410,430
C
C VOLTMETER ONLY - NO SCANNER OR PROGRAM CARD
410 ITEST=3
415 I=1
C REPEAT READING OR END TEST?
420 IF (ISSW(1)) 500,140
C
C VOLTMETER WITH PROGRAM CARD
430 ITEST=5
    GO TO 350
435 I=1
C REPEAT, OR REPROGRAM VOLTMETER, OR END TEST?

```

VERIF 2911 SCANNER/DVM TEST

```
      IF (ISSW(1)) 500,440
440  IF (ISSW(N)) 350,140
500  END
      SUBROUTINE INIT
C      INITIALIZE ICHAN AND ISCPG ARRAYS
      COMMON ICHAN(10),ISCPG(10)
      EQUIVALENCE (ISCPG(9),IS9),(ISCPG(10),IS10)
      DO 5 I = 1,10
        IS9 = I-1
        ISCPG(I) = IS9
5      ICHAN(I) = IS9
        IS9 = 3
        IS10 = 4
      RETURN
      END
      END$
```