HEWLETT hp PACKARD

OPERATING AND SERVICE MANUAL

12597A-003

TAPE PUNCH INTERFACE KIT

(FOR 2114, 2115, AND 2116 COMPUTERS)

Card Assembly
12597-6001, Rev 832

Note

This manual should be retained with Volume Three of the Hewlett-Packard computer system documentation.

12597-90023

HEWLETT-PACKARD COMPANY
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TAPE PUNCH INTERFACE KIT

(FOR 2114, 2115, AND 2116 COMPUTERS)

UPDATING SUPPLEMENT FOR OPERATING AND SERVICE MANUAL

10 FEB 1971

MANUAL IDENTIFICATION

Manual Serial No. Prefix: N/A

Manual Printed: OCT 1970

Manual Part Number: 12597-90023

SUPPLEMENT DESCRIPTION

The purpose of this supplement is to adapt the manual to instruments containing production improvements made subsequent to the printing of the manual and to correct manual errors. Enter the new information (or the Change Number, if more convenient) into the appropriate places in the manual, identified at left.

INSTRUMENT CHANGES

Serial No. Prefix	Change

ASSEMBLY CHANGES

Ref Des	Description	HP Part No.	Rev	Changes

Changes 1, 2, 3, and 4 dated 10 February 1971.

11000 Wolfe Road, Cupertino, California 95014, Tel. (408) 257-7000, TWX 910-338-0221

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CHANGE	DESCRIPTION
1	Page 2-1/2-2, Paragraph 2-11. Change last sentence to read, "See table 1-1 for the current requirements of the tape punch interface card".
2	Page 4-1, Paragraph 4-2. Change to read, "This section provides the theory of operation for the 12597-6001 Tape Punch Interface Card".
3	Page 4-5, Figure 4-4. Extend the second positive level of the *FLG & *IRQ signal one additional time period (i.e., to the beginning of time period T2).
4	Page 5-3/5-4, Figure 5-2. Make the following changes to the logic diagram: a. Delete the connection between R109D pin 6 and the cathode of CR9 (lower-center of the diagram). b. Add an asterisk to input signals labeled: NC, at pin 2 NC, at pin 3 NC, at pin 4 NC, at pin 5 LOW TAPE, at pin 6 c. Change drawing revision letter (lower left corner of diagram) to DWG REV. C. d. Change note 2 to read, "SCHEMATIC DIAGRAM FOR RESISTOR NETWORKS R119 THRU R122". e. Delete note 5.

HEWLETT hp PACKARD

2600A
KEYBOARD-DISPLAY TERMINAL

UPDATING SUPPLEMENT FOR OPERATOR'S MANUAL

15 SEPT 1971

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INSTRUMENT CHANGES

Serial No. Prefix	Change
1123	1
1135	2

ASSEMBLY CHANGES

Ref Des	Description	HP Part No.	Rev	Changes

Change 1 dated 10 June 1971.
Change 2 dated 15 September 1971.

CHANGE	DESCRIPTION
1	The information that is added to reflect serial number prefix 1123 is contained in the maintenance manual. Changes to the operator's manual are not required.
2	The information that is added to reflect serial number prefix 1135 is contained in the maintenance manual. Changes to the operator's manual are not required.

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides general information, installation instructions, programming instructions, theory of operation, maintenance information, and replaceable parts information for the Hewlett-Packard (HP) 12597A-003 Tape Punch Interface Kit (see figure 1-1).

1-3. DESCRIPTION.

1-4. GENERAL.

1-5. The HP 12597A-003 Tape Punch Interface Kit is an option to the standard HP 12597A 8-Bit Duplex Register Interface Kit. This kit supplies the interfacing requirements for the addition of an HP 2753A Tape Punch to the user's computer system.

1-6. INTERFACE KIT CONTENTS.

1-7. The HP 12597A-003 Tape Punch Interface Kit consists of the following:

a. Tape Punch Interface card (part no. 12597-6001).
b. Interface cable (part no. 12597-6005).
c. Test connector, 24-pin (part no. 1251-0332).
d. Operating and service manual (part no. 12597-90023).

1-8. IDENTIFICATION.

1-9. This operating and serivce manual is identified on the title page by interface kit designation and nomenclature, card assembly part number and revision code, manual part number, and publication date. Refer to the information presented in the following paragraphs and ensure that this manual applies to the equipment being serviced.

1-10. Hewlett-Packard uses five digits and a letter (00000A) for standard interface kit designations and a 3-digit suffix (-000) for options to standard interface kits. If the designation of your kit does not agree with that on the title page of this manual, there are differences between your kit and the kit described in this manual. The appropriate manual or manual supplement is available at the nearest HP Sales and Service Office listed at the back of this manual.

1-11. Printed-circuit cards used as plug-in card assemblies or fixed wired assemblies are identified by a letter, a revision code, and a division code stamped on the card (e.g., A-832-6). The letter identifies the version of the etched trace pattern on the unloaded card. The revision code (three middle digits) refers to the electrical characteristics of the loaded card. The division code (last digit) identifies the Hewlett-Packard division which manufactured the card. If the revision code on the printed-circuit card does not agree with the revision code shown on the title page of this

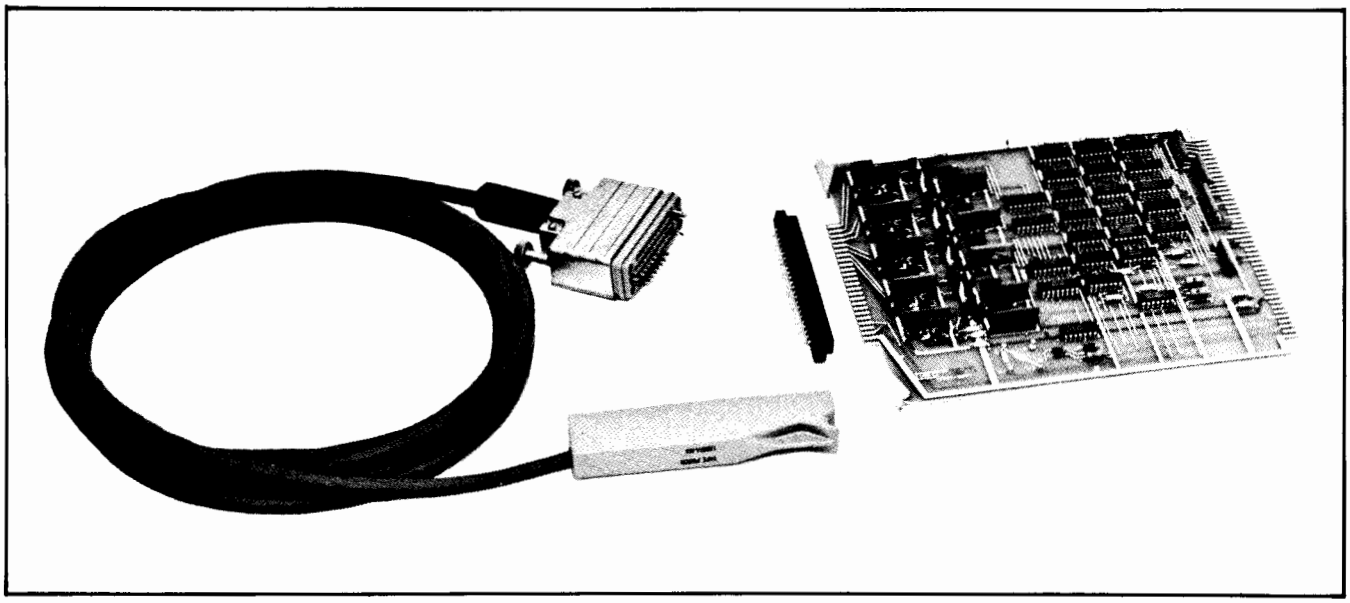


Figure 1-1. HP 12597A-003 Tape Punch Interface Kit

manual, there are differences between your card and the card described in this manual. These differences are described in manual supplements available at the nearest HP Sales and Service Office.

1-12. SPECIFICATIONS.

1-13. Table 1-1 lists the specifications for the HP 12597A-003 Tape Punch Interface Kit.

Table 1-1. Tape Punch Interface Kit Specifications

CHARACTERISTICS	SPECIFICATIONS
Output Levels:	
"1" state	0 to +0.5V, 12 mA sink maximum
"0" state	+12V, 10K source
Input Levels:	
"1" state	0 to +0.5V, 12 mA sink maximum
"0" state	+8V
Computer Power Supply Current Requirements:	
+12V	0.05A
12V	0.02A
-2V	0.05A
+4.5V	0.75A
Interface Card Dimensions:	
Width	7 3/4 inches (196,8 mm)
Height	8 11/16 inches (220,7 mm)
Interface Kit Weight:	
Net Weight	18 oz (675 gm)
Shipping Weight	4 lb (1,8 kg)

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section provides information on unpacking and inspection, reshipment, preparation for installation, and installation of the tape punch interface kit.

2-3. UNPACKING AND INSPECTION.

2-4. If the shipping carton is damaged upon receipt, request that the carrier's agent be present when the kit contents are unpacked. Inspect the card for damage (cracks, broken parts, etc.). If the card is damaged and fails to meet specifications, notify the carrier and the nearest HP Sales and Service Office immediately. (Sales and Service Offices are listed at the back of this manual.) Retain the shipping container and packing material for the carrier's inspection. The HP Sales and Service Office will arrange for repair or replacement of the damaged card without waiting for any claims against the carrier to be settled.

2-5. RESHIPMENT.

2-6. If an item of the kit is to be shipped to Hewlett-Packard for service or repair, attach a tag to the item identifying the owner and indicating the service or repair to be accomplished. Include the model number of the kit.

2-7. Pack the item in the original factory packing material if available. If the original material is not available, standard factory packing material can be obtained from the nearest Hewlett-Packard Sales and Service Office.

2-8. If standard factory packing material is not used, wrap the item in Air Cap TH-240 cushioning (manufactured by Sealed Air Corporation, Hawthorne, New Jersey), or equivalent, and place in a corrugated carton (200 pound test material). Seal the shipping carton securely and mark it "FRAGILE" to ensure careful handling.

2-9. PREPARATION FOR INSTALLATION.

2-10. CURRENT REQUIREMENTS.

2-11. The interface card in this kit obtains its operating current from the computer power supply. Before installing this interface card, determine the current requirements of this card in combination with all other interface or accessory cards already installed in the computer. Volume Three of the computer system documentation describes the procedure for calculating the total current requirements and lists the currents available from the computer. If the total current requirements exceed the limitations of the computer power supply, a Hewlett-Packard power supply extender unit or I/O extender unit must be used. See table 1-1 for the current requirements of the tape reader interface card.

2-12. INTERFACE CARD JUMPERS.

2-13. There are several jumper wires on the tape punch interface card. These jumpers are used to adapt the card for use with I/O devices other than the tape punch. Before installing the interface card, ensure that the jumpers are positioned as described in table 2-1 (see figure 5-2 for physical location of the jumpers).

Table 2-1. Interface Card Jumper Positions

JUMPER	POSITION
W1	A
W2	A
W3	Connected
W4	Connected
W5	Connected
W6	Connected
W7	Connected
W8	Disconnected
W9	Disconnected

2-14. INSTALLATION.

2-15. To install the tape punch interface kit, proceed as follows:

a. Turn off power at the computer and tape punch power switches.

b. Insert the interface card in the computer I/O card slot corresponding to the desired select code (address).

c. Turn on power to the computer and perform the diagnostic program procedure, part number 12554-90023, located in the Manual of Diagnostics.

d. Turn off power at the computer and connect the interconnecting cable between the interface card and the tape punch.

e. Perform the diagnostic program procedure, part number 02753-90092, located in the Manual of Diagnostics to verify proper operation of the interface card in conjunction with the tape punch.

SECTION III

PROGRAMMING

3-1. INTRODUCTION.

3-2. This section provides programming information for the HP 12597A-003 Tape Punch Interface Kit.

3-3. GENERAL INFORMATION.

3-4. The tape punch interface card provides command logic to start the tape punch and flag logic to signal the computer when the tape punch has completed a punch operation. An output storage register provides buffer storage for transfer of eight bits of data from the computer to the tape punch, and an input storage register provides buffer storage for transfer of status information from the tape punch to the computer. The following paragraphs provide information required to program the operation of the command, flag, input register, and output register logic on the tape punch interface card.

3-5. I/O ADDRESSING.

3-6. Through the use of the I/O extender options, some HP computers are capable of operating up to 56 I/O devices. To provide orderly I/O operations, each I/O card slot is assigned a 2-digit octal address called a select code. All program instructions calling for action by the tape punch interface card must include the select code of the interface card.

3-7. SAMPLE PROGRAM.

3-8. Table 3-1 provides a sample program showing the use of the tape punch interface card to operate an HP 2753A Tape Punch. The sample is an actual program listing prepared on an HP computer system using the HP Assembler software package.

3-9. Under control of the sample program, the tape punch will punch 100 8-bit data words as read from 100 consecutive memory locations. Prior to each data word transfer, the tape punch status will be checked for a possible low-tape condition. Low-tape is indicated by a logic 1 in bit 5 of the tape punch status word. To supply the I/O addressing requirements, the tape punch has been arbitrarily assigned a select code of 16 octal.

3-10. The sample program does not use the computer interrupt system. If the interrupt system has been previously enabled, a CLF 00 instruction must be included at the start of the program to turn off the interrupt system.

Table 3-1. Sample Program

```
0001                ASMB,A,B,L,T
0002*
0003*   THIS IS A SAMPLE PROGRAM DEMONSTRATING THE OPERATION OF THE
0004*   HP 12597A-003 TAPE PUNCH INTERFACE. UNDER CONTROL OF THIS
0005*   PROGRAM, THE TAPE PUNCH WILL PUNCH 100, 8-BIT CHARACTERS AS READ
0006*   FROM 100 CONSECUTIVE MEMORY LOCATIONS. THE TAPE PUNCH STATUS
0007*   WILL BE CHECKED PRIOR TO EACH OUTPUT OPERATION AND AN HLT 66B
0008*   DISPLAYED IF THE STATUS WORD INDICATES TAPE SUPPLY IS LOW.
0009*
0010  00400                 ORG 400B    ASSIGN PROGRAM STARTING LOCATION
0011*                                      OF 400 OCTAL.
0012  00400 060432  START LDA CNT       INITIALIZE COUNT-TO-100 COUNTER
0013  00401 070430        STA CNTR      AND STORE IN LOCATION CNTR.
0014  00402 060433        LDA ITBL      GET STARTING ADDRESS OF DATA TO BE
0015  00403 070431        STA PNTR      PUNCHED AND STORE IN PNTR.
0016*
0017  00404 014417  CHECK JSB STAT      JUMP TO SUBROUTINE THAT WILL GET
0018*                                      STATUS WORD.
0019  00405 010434        AND MASK      REMOVE INSIGNIFICANT STATUS BITS.
0020  00406 050435        CPA LOW       IS TAPE SUPPLY LOW?
0021  00407 102066        HLT 66B       YES. HALT COMPUTER.
0022  00410 160431        LDA PNTR,I    NO. GET CHARACTER TO BE PUNCHED.
0023*
0024  00411 014422        JSB PUNCH     JUMP TO SUBROUTINE THAT WILL PUNCH
0025*                                      A CHARACTER.
0026  00412 034431        ISZ PNTR      MOVE POINTER TO NEXT CHARACTER.
0027  00413 034430        ISZ CNTR      INCREMENT COUNTER. 100 OPERATIONS?
0028  00414 024404        JMP CHECK     NO. CHECK STATUS AND PUNCH AGAIN.
0029  00415 102077        HLT 77B       YES. NORMAL END OF PROGRAM.
0030  00416 024400        JMP START     TO RERUN PROGRAM PUSH "RUN".
0031*
0032* ** SUBROUTINE ** THIS ROUTINE GETS STATUS WORD FROM PUNCH.
0033*
0034  00417 000000  STAT  NOP
0035  00420 102516        LIA TPIF      PUT STATUS WORD IN A-REGISTER.
0036  00421 124417        JMP STAT,I    RETURN TO PROGRAM WITH STATUS WORD.
0037*
0038* ** SUBROUTINE ** THIS ROUTINE PUNCHES CHARACTER.
0039*
0040  00422 000000  PUNCH NOP
0041  00423 102316        SFS TPIF      IS TAPE PUNCH READY?
0042  00424 024423        JMP *-1       NO. WAIT.
0043  00425 102616        OTA TPIF      YES. PUT CHARACTER IN INTERFACE
0044*                                      REGISTER.
0045  00426 103716        STC TPIF,C    START TAPE PUNCH.
0046  00427 124422        JMP PUNCH,I   RETURN TO PROGRAM.
0047*
0048*   CONSTANT AND STORAGE INFORMATION.
0049*
0050  00430 000000  CNTR BSS 1     RESERVE ONE LOCATION FOR COUNTER.
0051  00431 000000  PNTR BSS 1     RESERVE ONE LOCATION FOR POINTER.
0052  00432 177634  CNT  DEC -100 INITIAL COUNT FOR COUNTER.
0053  00433 000122  ITBL OCT 122  STARTING LOCATION OF DATA BLOCK.
0054  00016        TPIF EQU 16B   TAPE PUNCH INTERFACE HAS S.C. 16B.
0055  00434 000040  MASK OCT 40
0056  00435 000040  LOW  OCT 40   SAMPLE "LOW TAPE" STATUS WORD.
0057*
0058                      END START
**  NO ERRORS*
```

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides the theory of operation for the 12597-6001 Tape Reader Interface Card.

4-3. FUNCTIONAL THEORY OF OPERATION.

4-4. Figure 4-1 is a flow chart showing the functional theory of operation for the tape punch interface card. The programmed instructions shown in the shaded area of the flow chart are the same as those used in the subroutine portions of the sample program (table 3-1) in Section III of this manual.

4-5. The first programmed instruction (LIA) transfers the tape punch status word from the input storage register to the computer A-register. The status word consists of a single bit (bit 5) that becomes a logic 1 when the tape punch paper tape supply is low. The status word is then checked by software. The computer will normally be programmed to halt if a low-tape condition exists.

4-6. Assuming that the status word does not indicate low tape (bit 5 is logic 0), the next step is to test the state (set or clear) of the Flag FF. If the Flag FF is in the clear state, the punch is busy from some previously programmed punch operation. If the Flag FF is set, the punch is ready to accept data for a new punch operation. An SFS instruction tests the Flag FF. If the Flag FF is clear, the next instruction (JMP *-1) causes the computer to again execute the SFS instruction. This loop continues until the Flag FF is set. An SFS instruction when the Flag FF is set causes the computer to skip the JMP *-1 instruction and continue with the program.

4-7. The computer can also be signaled when the Flag FF is set via interrupt signals (FLG and IRQ) or a Service Request signal. These signals are discussed in detail in paragraphs 4-30 through 4-35.

4-8. The next programmed instruction (OTA) transfers the data word that is to be punched from the computer A-register to the output storage register on the interface card. The tape punch now has data available and requires only that it be commanded to punch the data on paper tape.

4-9. A combined Set Control and Clear Flag (STC xx,C) instruction sets the Control and Command FFs, and clears the Flag Buffer and Flag FFs. The Command FF provides a Punch signal which starts the operation of the tape punch. This completes the programmed instructions required for a punch operation. The computer is now free to perform other operations while the tape punch is completing its operation.

4-10. The tape punch provides a Flag signal when it completes the punch operation. As shown by figure 4-1, the Flag signal sets the Flag Buffer FF and clears the Command FF. At the next computer time T2, an ENF signal sets the Flag FF to indicate that the tape punch is again ready for a new punch operation.

4-11. DETAILED THEORY OF OPERATION.

4-12. GENERAL.

4-13. Diagrams that support the detailed theory of operation for the tape punch interface card include the timing diagram in this section (figure 4-4) and the interface card logic diagram (figure 5-2) in Section V of this manual.

4-14. For an index of signals at the 86-pin edge of the interface card, see Volume Two of the computer system documentation. For an index of signals at the 48-pin edge of the interface card, see table 5-2 in Section V of this manual.

4-15. Logic levels between the computer and the interface card, and logic levels internal to the card are positive-true. The term "true" refers to a signal level of about +3.5 volts and "false" refers to a level of about ground. These signal levels vary somewhat depending on the integrated circuit package involved. Detailed signal level information for the various integrated circuit packages is provided in figure 5-1 in Section V of this manual.

4-16. Signal levels to and from the tape punch are ground-true and are detailed in table 1-1 in Section I of this manual.

4-17. POWER-ON LOGIC.

4-18. When power is initially applied to the computer or the computer PRESET switch is pressed, the computer supplies a POPIO and a CRS signal to the interface card. The POPIO signal sets the Flag Buffer FF and the CRS signal clears the Control and Command FFs. The Control FF, in the clear state, disables the interrupt circuitry on the interface card. A cleared Command FF ensures that the tape punch will be receiving a false Punch signal. At time T2, the computer generates an ENF signal which is gated with the set-side of the Flag Buffer FF to set the Flag FF. The ENF signal also ensures that the IRQ FF is in the clear state.

4-19. The initial operating conditions of the tape punch interface card after power-on are: Flag Buffer and Flag FFs set; Control, Command, and IRQ FFs cleared.

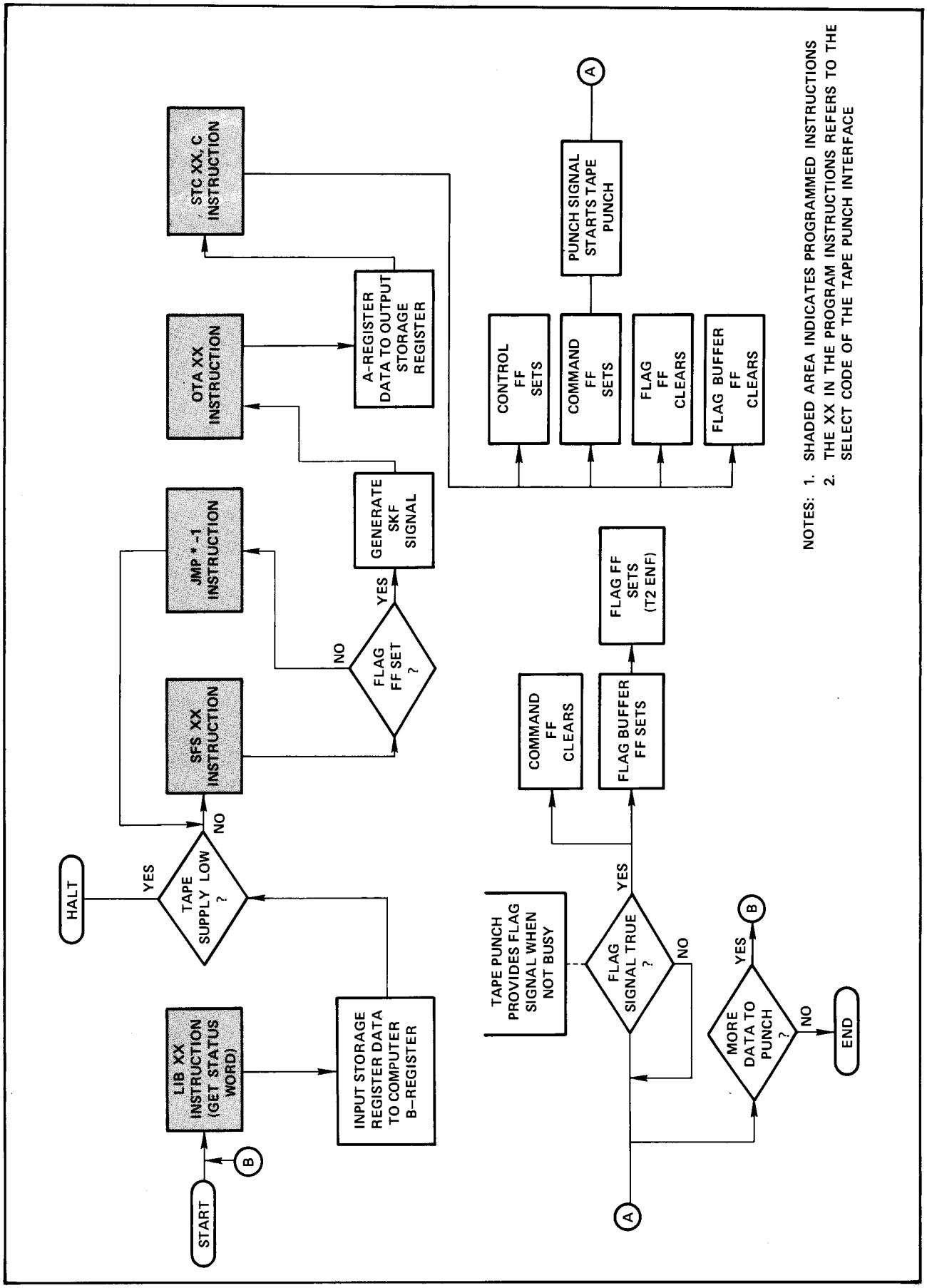


Figure 4-1. Tape Punch Interface Card Functional Operation Flow Chart

4-20. INPUT REGISTER LOGIC.

4-21. The input storage register on the tape punch interface card stores the tape punch status word. Although a full eight bits are transferred to the computer, the status word consists of a single significant bit (bit 5) and, as a logic 1, indicates that the paper tape supply is low. When the interface cable is connected, a ground is applied to pin 21 of the 48-pin edge of the card. This provides a continuous enable to the input storage register so that any change in the status bit is immediately loaded into the bit 5 flip-flop of the register.

4-22. A programmed LIA or LIB instruction addressed to the tape punch interface card provides true SCM, SCL, IOG, and IOI signals. The IOI signal storbes the status word onto the IOBI lines to the computer A- or B-register.

4-23. FLAG LOGIC.

4-24. Before transferring a data word from the computer to the tape punch, the computer must be assured that the punch is not busy operating from some previous data transfer. The state of the Flag FF (set or clear) provides this information to the computer. If the tape punch has not been previously operated, and the state of the Flag FF has not been altered by some programmed instruction, the Flag FF will be in the set state due to the action described in paragraph 4-18. If the tape punch is busy, the Flag FF will be in the clear state due to a programmed Clear Flag instruction described in paragraph 4-39.

4-25. At this point, the discussion of the flag logic assumes that the tape punch is busy and the Flag FF is in the clear state.

4-26. When the tape punch completes an operation, it provides a Flag signal to the interface card. The interface card converts the Flag signal to a 300 nanosecond pulse which clears the Command FF and sets the Flag Buffer FF.

4-27. The timing of the Flag logic at this point is dependent upon the timing of the tape punch and is not related to computer timing. An ENF signal, supplied by the computer every machine cycle at time T2, is gated with the output of the Flag Buffer FF (now in the set state) to set the Flag FF. This action synchronizes the effect of the Flag signal with the computer timing by allowing the Flag FF to be set only at computer time T2.

4-28. When the Flag FF is in the set state, the interface card flag logic responds by generating SKF, FLG and IRQ, or SRQ signals to indicate to the computer that the tape punch is ready to accept a data transfer. The following paragraphs describe how these signals are generated and how they affect computer operation.

4-29. SKIP-ON-FLAG SIGNAL. If the computer is programmed to wait for the Flag FF to be set (for example, an SFS instruction followed by a JMP *-1 instruction as shown in Figure 4-1), the resulting SFS signal gated with a true signal from the set side of the Flag FF generates an SKF signal. This causes the computer to skip the next instruction (in this case JMP *-1) and proceed with the program. Figure 4-2 illustrates the generation of an SKF signal by the interface card. Notice that an SKF signal can also be generated when the Flag FF is in the clear state by programming an SFC instruction. Either way, the state of the Flag FF is being tested and the computer must be programmed to respond accordingly.

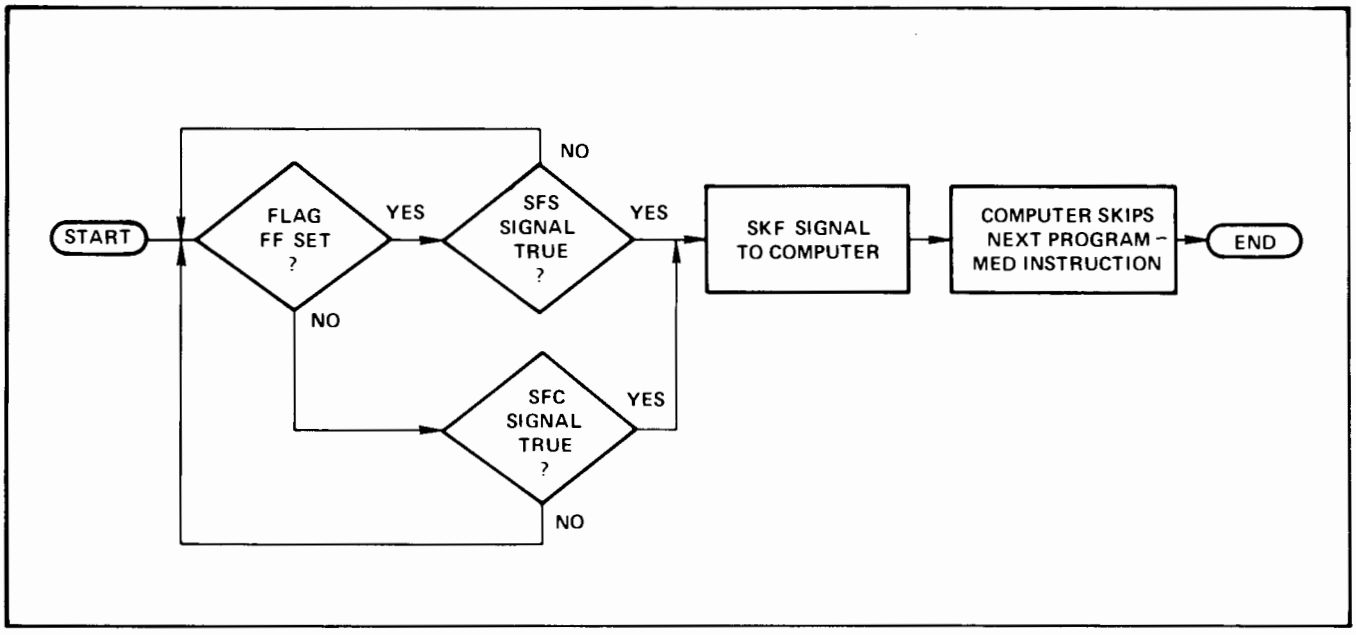


Figure 4-2. Skip-On-Flag Signal Generation Flow Chart

4-30. INTERRUPT SIGNALS. If the computer interrupt system has been enabled by an STF 00 instruction, the computer can be doing work in the main program rather than waiting for the Flag FF to be set. Figure 4-3 illustrates the functions involved in an interrupt operation. To interrupt the main program when the tape punch is ready, the following conditions must be met:

a. Control FF set (paragraph 4-39).
b. Flag Buffer FF set (paragraph 4-26).
c. Flag FF set (paragraph 4-27).
d. IEN signal true (interrupt system enabled).
e. PRH signal true (no higher priority interrupts).

4-31. When all of these conditions are established, an SIR signal from the computer at time T5 sets the IRQ FF which generates true FLG and IRQ signals. These signals are used by the computer I/O control and addressing circuits to generate an interrupt signal. The next machine cycle will then be an interrupt phase (phase 4).

4-32. At time T2 during the interrupt phase, an ENF signal clears the IRQ FF. An SIR signal again sets the IRQ FF at time T5 if the PRH signal is still true. The FLG and IRQ signals this time are used by the computer I/O control and addressing circuits to encode the interrupt address.

4-33. The next machine cycle is controlled by the instruction located at the interrupt address in memory. During this machine cycle, an IAK signal at time T1 clears the Flag Buffer FF and an ENF signal at time T2 clears the IRQ FF. The Flag FF remains set to inhibit lower priority interrupts by providing a false PRL signal. A CLF instruction must be programmed to clear the Flag FF and enable lower priority interrupts just before returning to the main program.

4-34. SERVICE REQUEST SIGNAL. If the computer is equipped with the Direct Memory Access (DMA) option, and if the DMA circuits have been initialized, an 8-bit word can be transferred directly from memory to the tape punch

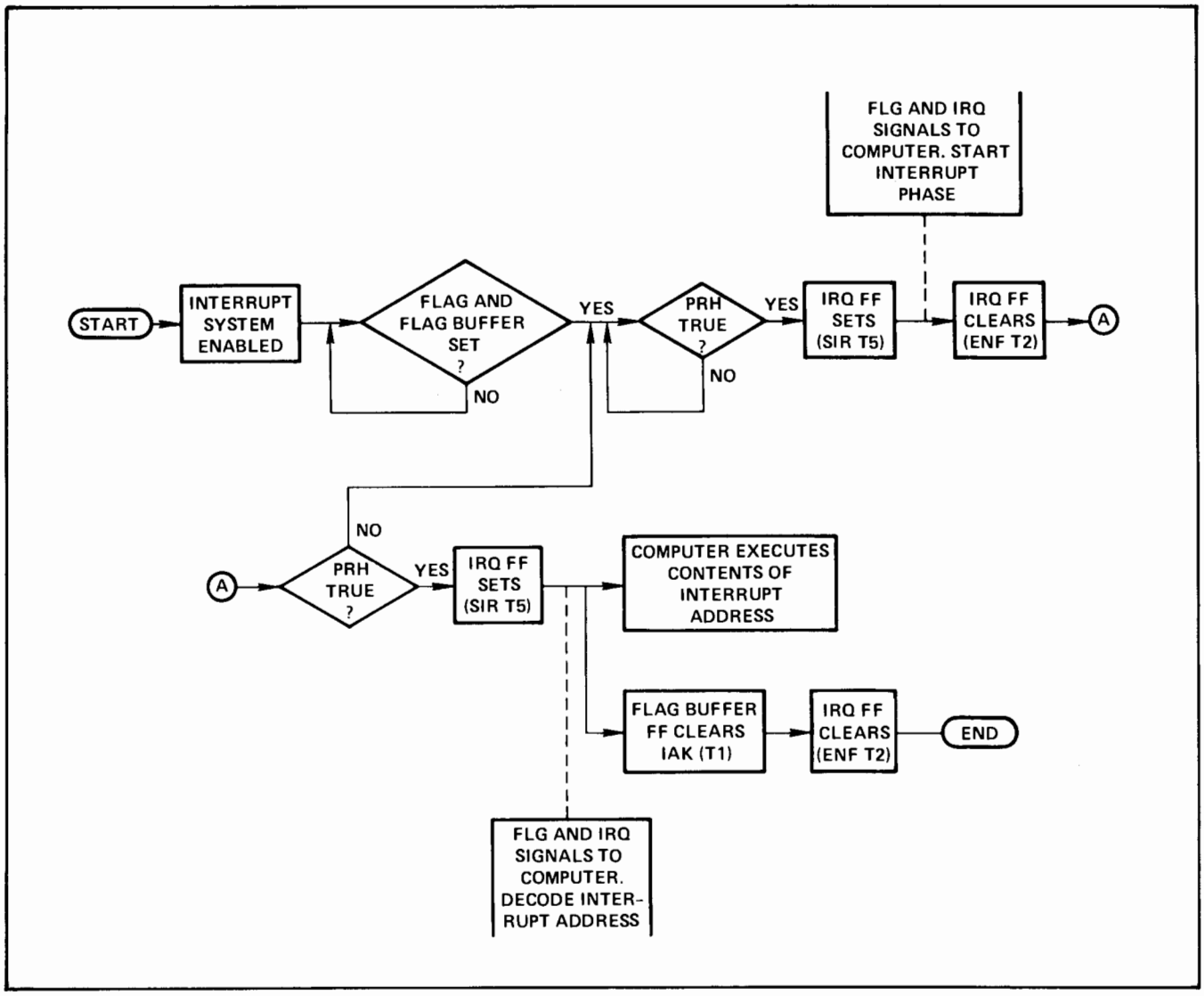


Figure 4-3. Interrupt Operation Flow Chart

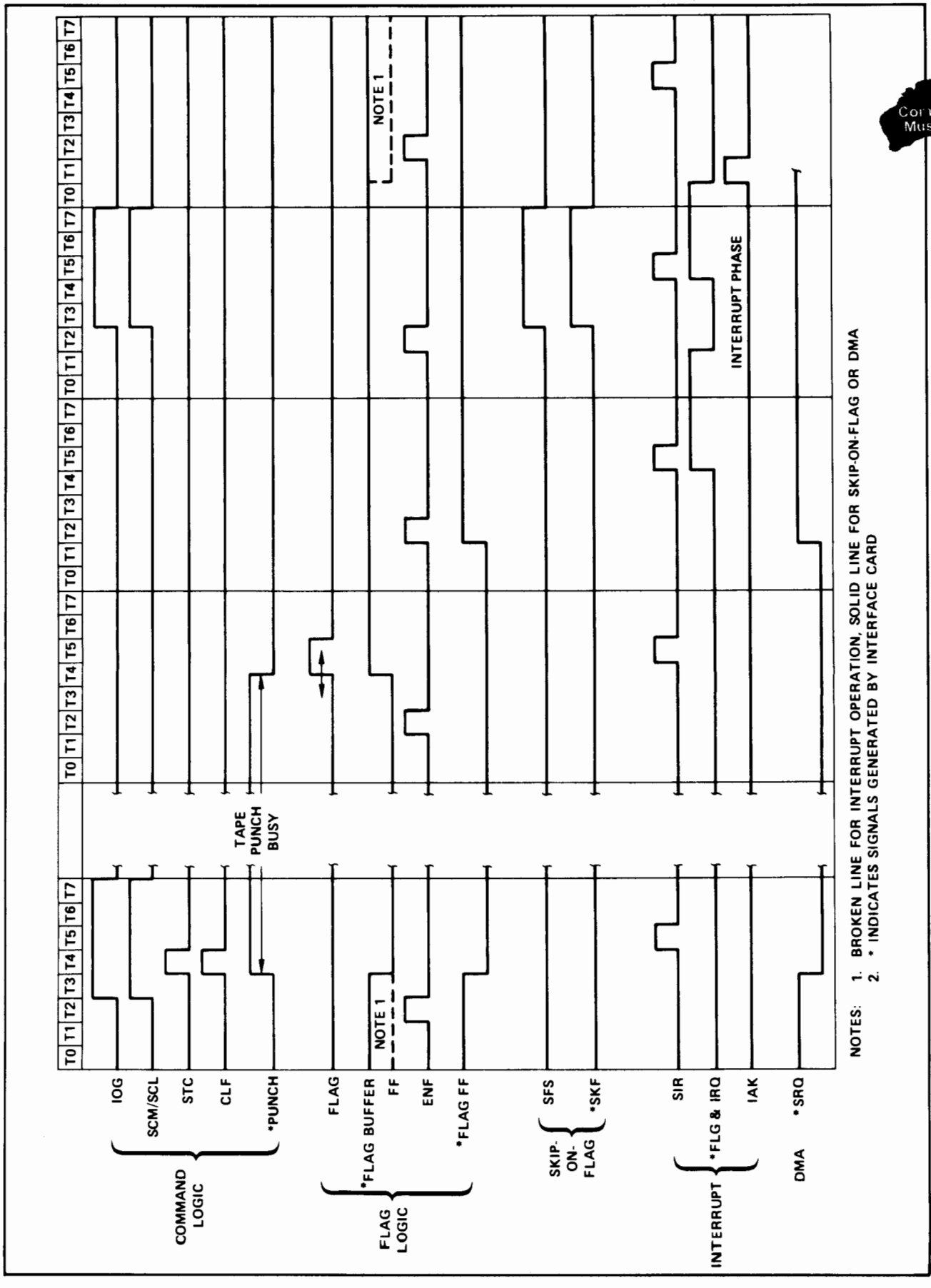


Figure 4-4. Overall Timing Diagram

in one machine cycle. When the Flag FF on the interface card is set, the interface card supplies a true SRQ signal which enables the DMA circuits. The DMA circuits suspend the computer program for one machine cycle and provide the necessary signals to transfer the 8-bit word and start the tape punch.

4-35. Refer to the applicable DMA option operating and service manual for detailed information on DMA controlled I/O operations.

4-36. OUTPUT REGISTER LOGIC.

4-37. After the computer has been signaled that the tape punch is not busy, the output data word can be transferred to the interface card output storage register. This is accomplished with an OTA or OTB instruction (addressed to the tape punch interface card) in the main program or in an interrupt subroutine. Signals to the interface card resulting from an OTA or OTB instruction are SCM, SCL, IOG, and IOO. The IOO signal latches the 8-bit data word into the output storage register.

4-38. COMMAND LOGIC.

4-39. With data in the interface card output storage register, the tape punch need only be commanded to punch the data on paper tape. An STC xx,C (combined Set Control and Clear Flag) instruction with the select code (xx) of the tape punch interface sets the Control and Command FFs and clears the Flag and Flag Buffer FFs. The set side of the Command FF is level-amplified and sent to the tape punch as a Punch signal.

4-40. The set side of the Control FF provides one of the enabling signals for the interrupt logic (see paragraph 4-30). Flag and Flag Buffer FFs in the clear state enable the interface card flag logic. The tape punch will not punch the 8-bit data word and return a Flag signal when it is ready for another punch operation.

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance information for the tape punch interface kit. Included are preventive maintenance instructions, troubleshooting instructions, and maintenance data consisting of a signal index for the interface cable (table 5-2), information pertaining to the integrated circuit characteristics and pin connections (figure 5-1), replaceable parts list for the interface card (table 5-1), and an interface card parts location and logic diagram (figure 5-2).

5-3. PREVENTIVE MAINTENANCE.

5-4. Preventive maintenance for the tape punch interface kit should be performed along with the preventive maintenance routines for the computer system.

5-5. Preventive maintenance consists of running the combined tape punch and tape punch interface diagnostic program procedure, part number 02753-90092, as described in the Manual of Diagnostics. Also, visually inspect the interface card, cable, and connectors for burned or broken components, connections, and insulation.

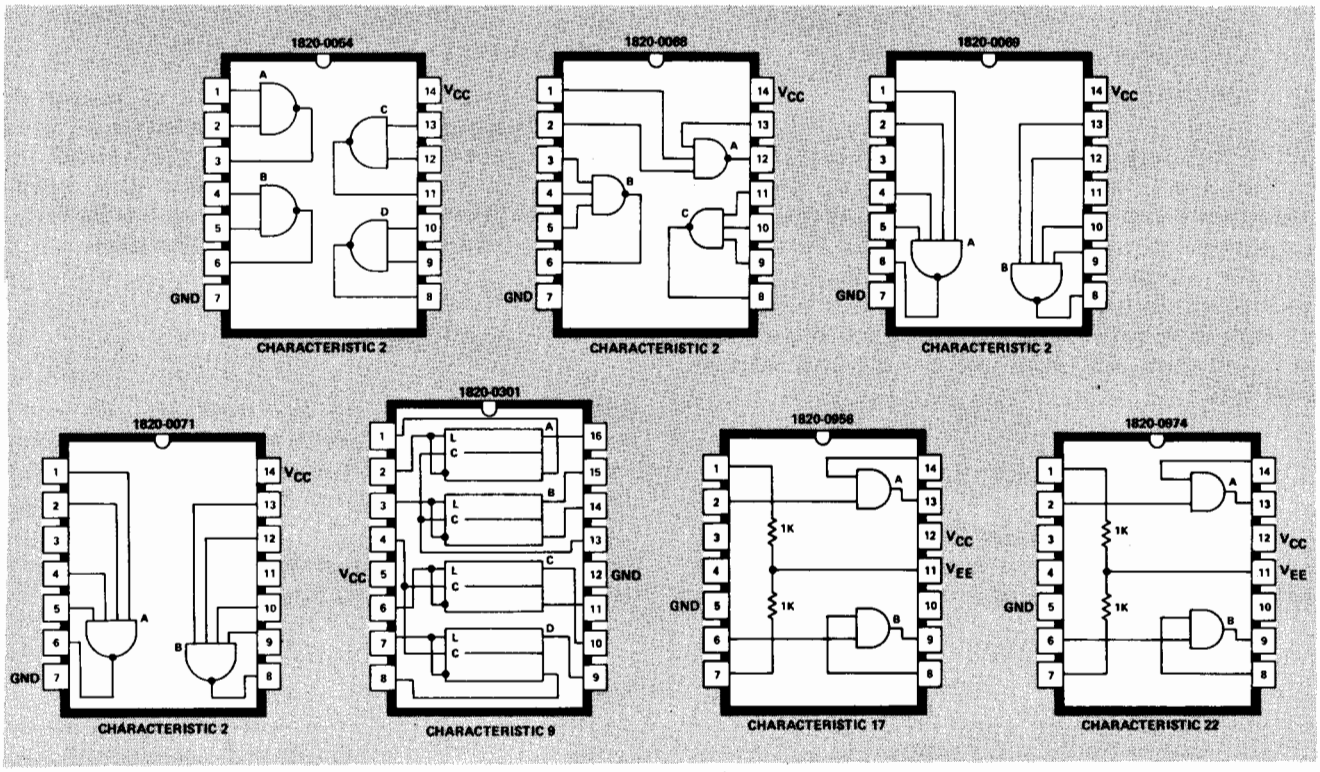
5-6. TROUBLESHOOTING.

5-7. Troubleshooting the tape punch interface card is accomplished by running the diagnostic program procedure, part number 12554-90023, as described in the Manual of Diagnostics and analyzing error halts as they occur.

5-8. Use the maintenance data contained in this section to further isolate faulty components.

Table 5-1. Tape Punch Interface Card Replaceable Parts List

REFERENCE DESIGNATION	HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.
C1 thru C8,18	0140-0198	Capacitor, Fxd, Mica, 200 pF, 5%	28480	0140-0198
C9 thru C16	0140-0191	Capacitor, Fxd, Mica, 56 pF, 5%	28480	0140-0191
C17	0140-0192	Capacitor, Fxd, Mica, 68 pF, 5%	28480	0140-0192
C19,22	0160-0153	Capacitor, Fxd, My, 1000 pF, 10%, 200 VDCW	28480	0160-0153
C20,21	0160-0154	Capacitor, Fxd, My, 2200 pF, 10%	28480	0160-0154
C23 thru C32	0180-0197	Capacitor, Fxd, Elect, 2.2 uF, 10%, 20 VDCW	56289	150D225X9020A2
CR9 thru CR17	1901-0040	Diode, Si, 30 mA, 30 WV	07263	FDG 1088
MC15,36	1820-0068	Integrated Circuit, TTL	56289	USN7410A
MC16,26,47	1820-0956	Integrated Circuit, CTL	07263	SL3459
MC17,25,27,37,46,57,86,94	1820-0054	Integrated Circuit, TTL	56289	USN7400A
MC34,44,64,74	1820-0301	Integrated Circuit, TTL	01295	SN7475N
MC35	1820-0069	Integrated Circuit, TTL	56289	USN7420A
MC45,55,65,75	1820-0974	Integrated Circuit, CTL	07263	SL4817
MC56,66	1820-0071	Integrated Circuit, TTL	56289	USN7440A
Q1 thru Q18	1854-0215	Transistor, Si, NPN	04713	SPS3611
R1 thru R8,18	0757-0417	Resistor, Fxd, Flm, 562 ohms, 1%, 1/8W	28480	0757-0417
R9 thru R17	0757-0442	Resistor, Fxd, Flm, 10.0k, 1%, 1/8W	28480	0757-0442
R19,22,23	0698-3445	Resistor, fxd, Flm, 348 ohms, 1%, 1/8W	28480	0698-3445
R20,30,31	0698-3440	Resistor, Fxd, Flm, 196 ohms, 1%, 1/8W	28480	0698-3440
R21	0698-0082	Resistor, Fxd, Flm, 464 ohms, 1%, 1/8W	28480	0698-0082
R24,25,28,32	0757-0280	Resistor, Fxd, Flm, 1k, 1%, 1/8W	28480	0757-0280
R26,27	0757-0401	Resistor, Fxd, Flm, 100 ohms, 1%, 1/8W	28480	0757-0401
R29	0757-1094	Resistor, Fxd, Flm, 1.47k, 1%, 1/8W	28480	0757-1094
R101,103,105,107,109,111,113, 115,117,118	1810-0008	Resistor Network (6 fxd flm resistor)	28480	1810-0008
R119 thru R122	1810-0020	Resistor Network (7 fxd flm resistor)	28480	1810-0020
W1 thru W7	8159-0005	Jumper Wire	28480	8159-0005



(TOP VIEW)

CHARACTERISTIC	INPUT LEVEL		OUTPUT LEVEL		OPEN INPUT ACTS AS:	MAXIMUM PROPAGATION DELAY	
	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)	LOGIC 1 (VOLTS, MIN)	LOGIC 0 (VOLTS, MAX)		TO LOGIC 1 (NANOSECONDS)	TO LOGIC 0 (NANOSECONDS)
2	+2.0	+0.8	+2.4	+0.4	1	29	15*
9	+2.0*	+0.8	+2.4	+0.4	1	40	25
17	+1.25	+0.5	+2.25	-0.36	0	18	18
22	+1.5	+0.4	+2.2	-0.3	0	24	24

NOTE:
*Required pulse widths; clock 30 ns min., data 75 ns min.

Figure 5-1. Integrated Circuit Pin Connections and Characteristics

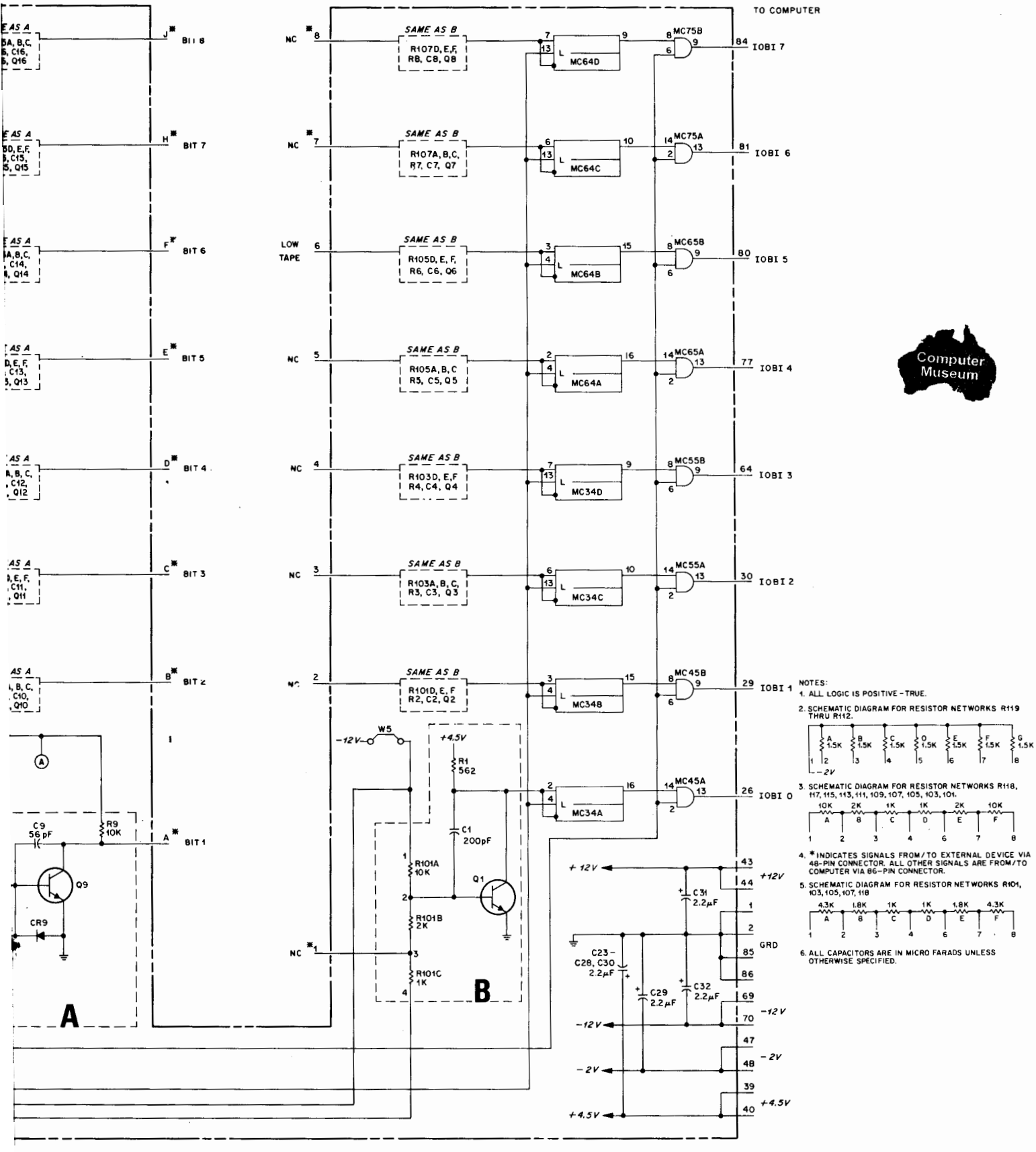
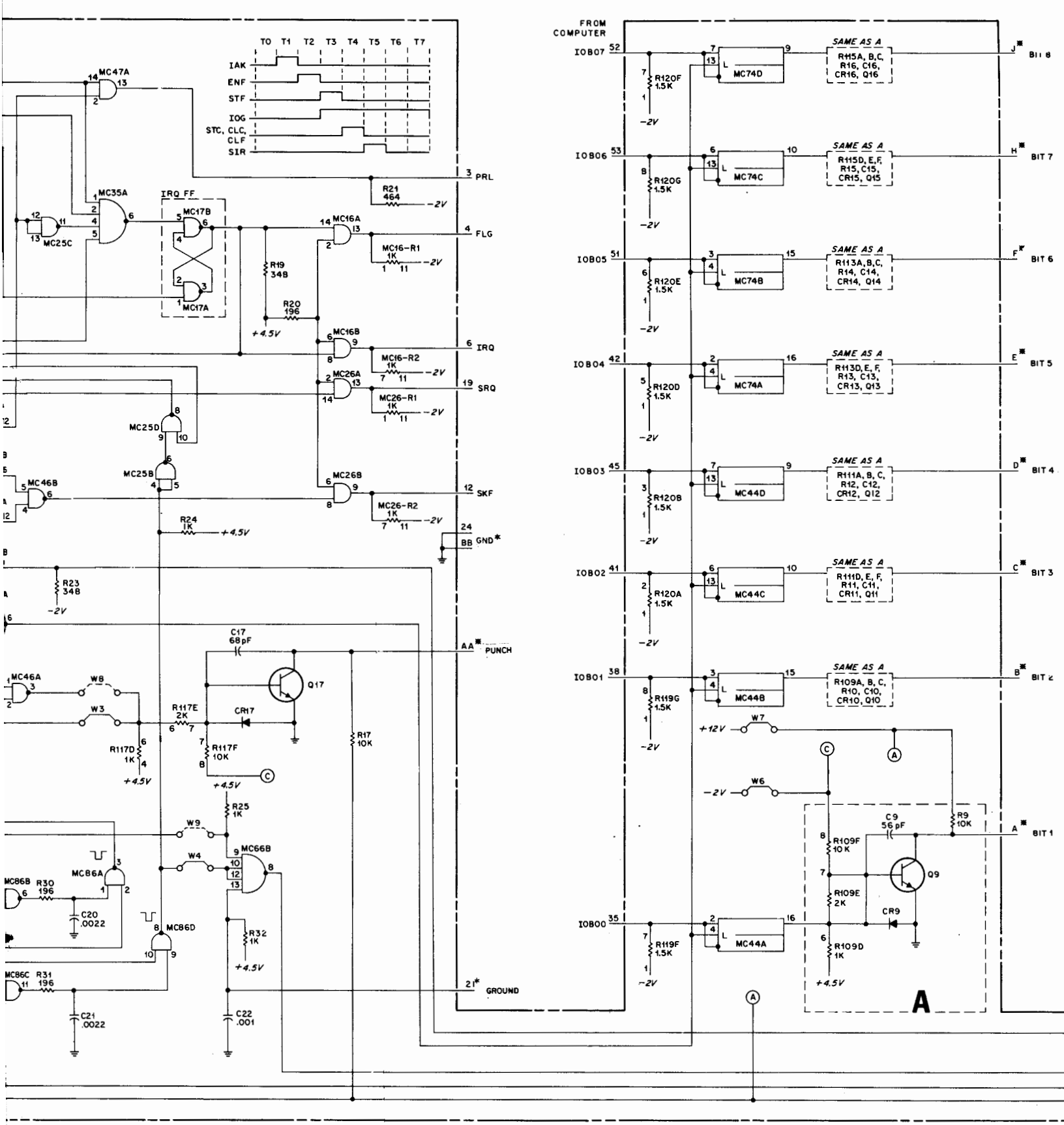


Figure 5-2. Tape Punch Interface Card Parts Location Diagram and Logic Diagram


T0 T1 T2 T3 T4 T5 T6 T7
IAK
ENF
STF
IOG
STC, CLC, CLF
SIR
MC47A
MC35A
MC25C
IRQ FF
MC17B
MC17A
MC16A
MC16B
MC26A
MC26B
MC25D
MC25B
MC46B
MC46A
MC86B
MC86A
MC86C
MC86D
MC66B
R21 464
R19 348
R20 196
MC16-R1 1K
MC16-R2 1K
MC26-R1 1K
MC26-R2 1K
R24 1K
R23 348
R30 196
R31 196
C20 .0022
C21 .0022
C22 .001
R25 1K
R32 1K
C17 68pF
Q17
CR17
R117E 2K
R117D 1K
R117F 10K
R17 10K
W8
W3
W9
W4
+4.5V
-2V
3 PRL
4 FLG
6 IRQ
19 SRQ
12 SKF
24 BB GND*
AA* PUNCH
21* GROUND
FROM COMPUTER
IOB07
IOB06
IOB05
IOB04
IOB03
IOB02
IOB01
IOB00
MC74D
MC74C
MC74B
MC74A
MC44D
MC44C
MC44B
MC44A
R120F 1.5K
R120G 1.5K
R120E 1.5K
R120D 1.5K
R120B 1.5K
R120A 1.5K
R119G 1.5K
R119F 1.5K
SAME AS A
R115A, B, C, R16, C16, CR16, Q16
R115D, E, F, R15, C15, CR15, Q15
R113A, B, C, R14, C14, CR14, Q14
R113D, E, F, R13, C13, CR13, Q13
R111A, B, C, R12, C12, CR12, Q12
R111D, E, F, R11, C11, CR11, Q11
R109A, B, C, R10, C10, CR10, Q10
J* BIT 8
H* BIT 7
F* BIT 6
E* BIT 5
D* BIT 4
C* BIT 3
B* BIT 2
A* BIT 1
+12V
W7
W6
C9 56 pF
R9 10K
R109F 10K
R109E 2K
R109D 1K
CR9
Q9
A

TAPE PUNCH INTERFACE CARD (12597-6001, REV 832)

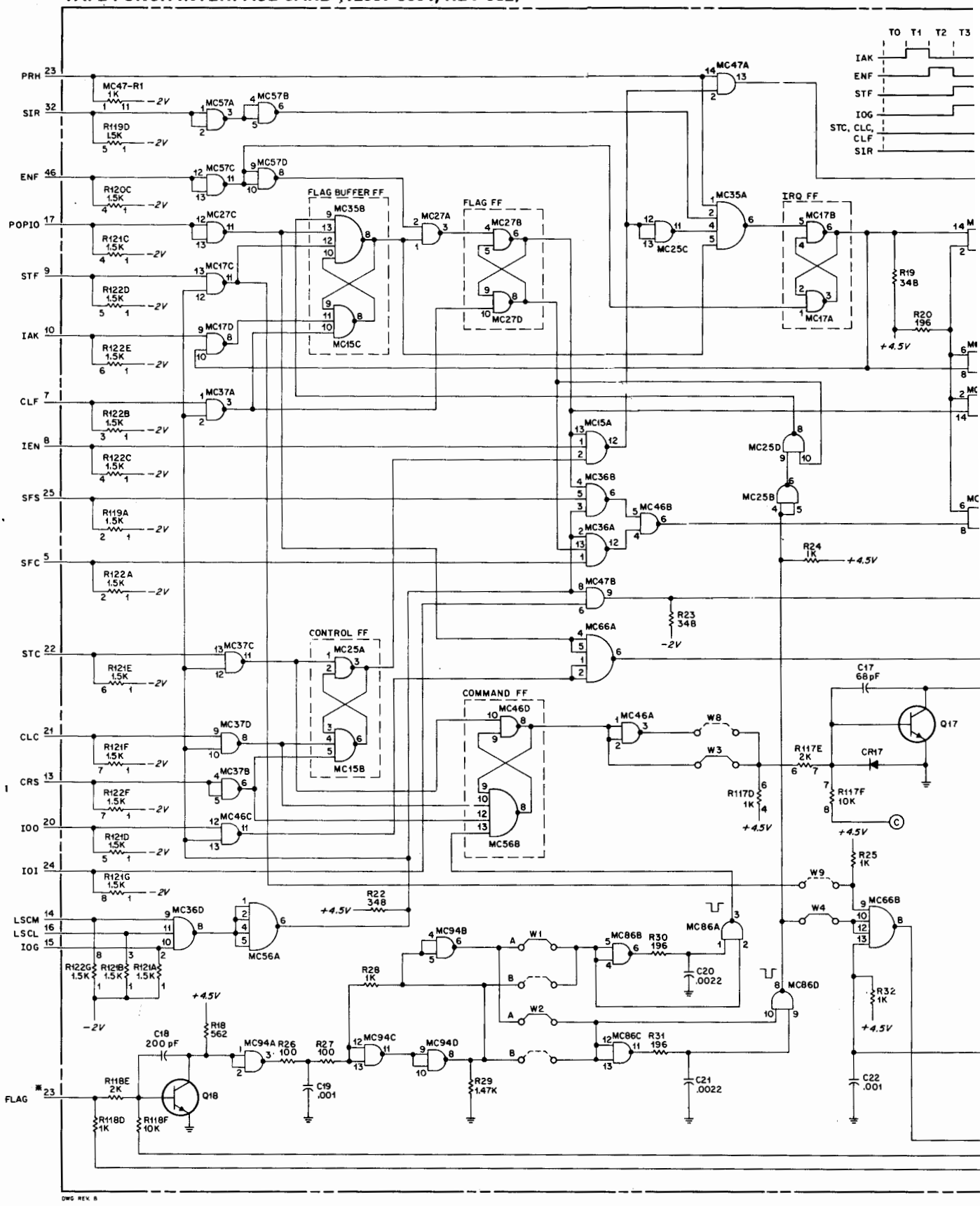
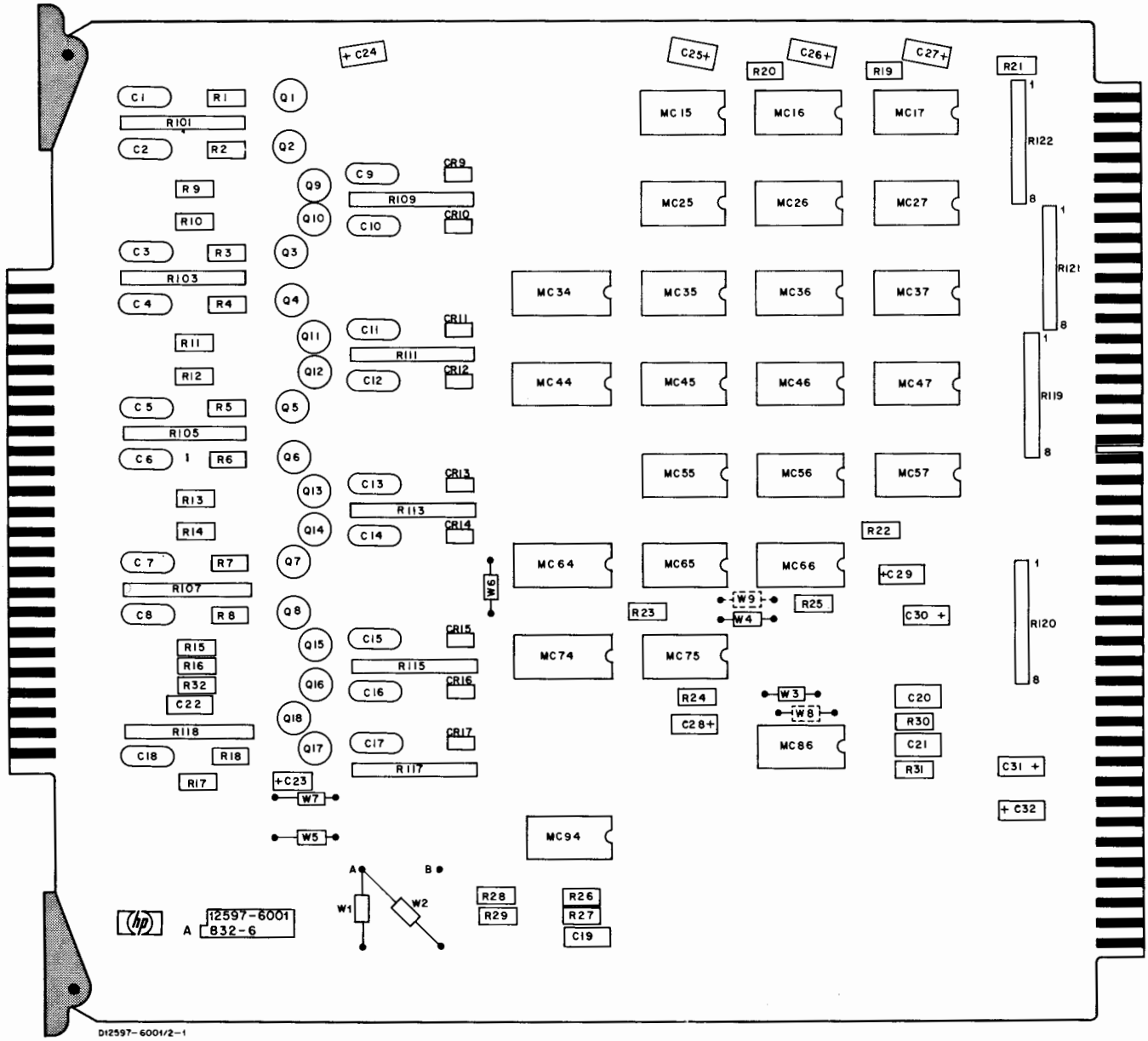


Table 5-2. Interface Cable Signal Index

48-PIN CONNECTOR, PIN NO.	TAPE PUNCH CONNECTOR, PIN NO.	SIGNAL
A	B	Bit 1
B	F	Bit 2
C	L	Bit 3
D	R	Bit 4
E	V	Bit 5
F	Z	Bit 6
H	d	Bit 7
J	j	Bit 8
AA	DD	Punch
6	AA	Low Tape
23	FF	Flag
24,BB,21	HH	Ground



SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section provides information for ordering replacement parts for the 12597A-003 Tape Punch Interface Kit. Table 6-1 is a numerical listing of all replaceable parts in the interface kit.

6-3. An interface card replaceable parts list (table 5-1) and parts location diagram (figure 5-2) are provided in Section V of this manual.

6-4. Tables 5-2 and 6-1 list the following information for each replaceable part:

a. Reference designation of the part (table 5-1 only). (Refer to table 6-2 for an explanation of the abbreviations used in the REFERENCE DESIGNATION column.)

b. Hewlett-Packard part number.

c. Description of the part. (Refer to table 6-2 for an explanation of the abbreviations used in the DESCRIPTION column.)

d. A five digit code that corresponds to the manufacturer of the part. (Refer to table 6-3 for a code list of manufacturers.)

e. Manufacturers part number.

f. Total quantity (TQ) of each part used in the kit or assembly (table 6-1 only).

6-5. ORDERING INFORMATION.

6-6. To order replacement parts, address the order or inquiry to the nearest Hewlett-Packard Sales and Service Office. Refer to the list at the back of this manual for addresses. Specify the following information for each part ordered:

a. Identification of the instrument, kit or assembly containing the part (refer to paragraph 1-6).

b. Hewlett-Packard part number for each part.

c. Description of each part.

d. Circuit reference designation for each part (if applicable).

Table 6-1. Numerical Listing of Replaceable Parts

HP PART NO.	DESCRIPTION	MFR CODE	MFR PART NO.	TQ
0140-0191	Capacitor, Fxd, Mica, 56 pF, 5%	28480	0140-0191	8
0140-0192	Capacitor, Fxd, Mica, 68 pF, 5%	28480	0140-0192	1
0140-0198	Capacitor, Fxd, Mica, 200 pF, 5%	28480	0140-0198	9
0160-0153	Capacitor, Fxd, My, 1000 pF, 10%, 200 VDCW	28480	0160-0153	2
0160-0154	Capacitor, Fxd, My, 2200 pF, 10%	28480	0160-0154	2
0180-0197	Capacitor, Fxd, Elect, 2.2 uF, 10%, 20 VDCW	56289	150D225X9020A2	10
0698-0082	Resistor, Fxd, Flm, 464 ohms, 1%, 1/8W	28480	0698-0082	1
0698-3440	Resistor, Fxd, Flm, 196 ohms, 1%, 1/8W	28480	0698-3440	3
0698-3445	Resistor, Fxd, Flm, 348 ohms, 1%, 1/8W	28480	0698-3445	3
0757-0280	Resistor, Fxd, Flm, 1k, 1%, 1/8W	28480	0757-0280	4
0757-0401	Resistor, Fxd, Flm, 100 ohms, 1/8W	28480	0757-0401	2
0757-0417	Resistor, Fxd, Flm, 562 ohms, 1%, 1/8W	28480	0757-0417	9
0757-0442	Resistor, Fxd, Flm, 10.0 ohms, 1%, 1/8W	28480	0757-0442	9
0757-1094	Resistor, Fxd, Flm, 1.47k, 1%, 1/8W	28480	0757-1094	1
1251-0332	Connector, Pc	13511	143-024-08 (1158)	1
1810-0008	Resistor Network (6 fxd flm resistors)	28480	1810-0008	10
1810-0020	Resistor Network (7 fxd flm resistors)	28480	1810-0020	4
1820-0054	Integrated Circuit, TTL	56289	USN7400A	8
1820-0068	Integrated Circuit, TTL	56289	USN7410A	2
1820-0069	Integrated Circuit, TTL	56289	USN7420A	1
1820-0071	Integrated Circuit, TTL	56289	USN7440A	2
1820-0301	Integrated Circuit, TTL	01295	SN7475N	4
1820-0956	Integrated Circuit, CTL	07263	SL3459	3
1820-0974	Integrated Circuit, CTL	07263	SL4817	4
1854-0215	Transistor, Si, NPN	04713	SPS3611	18
1901-0040	Diode, Si, 30 mA, 30 WV	07263	FDG 1088	9
8159-0005	Jumper Wire	28480	8159-0005	7
12597-6001	Tape Punch Interface Card	28480	12597-6001	1
12597-6005	Cable	28480	12597-6005	1
12597-90023	Operating and Service Manual	28480	12597-90023	1

Table 6-2. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

A	= assembly	K	= relay	TB	= terminal board
B	= motor	L	= inductor	TP	= test point
BT	= battery	M	= meter	U	= integrated circuit
C	= capacitor	MC	= microcircuit	V	= vacuum tube, neon bulb, photocell, etc.
CR	= diode	P	= plug connector		
DL	= delay line	Q	= transistor	VR	= voltage regulator
DS	= indicator (lamp)	R	= resistor	W	= cable, jumper
E	= misc hardware	RT	= thermistor	X	= socket
F	= fuse	S	= switch	Y	= crystal
FL	= filter	T	= transformer	Z	= tuned cavity, network
J	= receptacle connector				

ABBREVIATIONS

A	= amperes	gnd	= ground(ed)	ph	= Phillips head
ac	= alternating current	gra	= gray	pk	= peak
ad	= anode	grn	= green	p-p	= peak-to-peak
Al	= aluminum			pt	= point
AR	= as required	H	= henries	PIV	= peak inverse voltage
adj	= adjust	Hg	= mercury	PNP	= positive-negative-positive
Assy	= assembly	hr	= hour(s)	PWV	= peak working voltage
		Hz	= hertz	porc	= porcelain
B	= base	hdw	= hardware	posn	= position(s)
bp	= bandpass	hex	= hexagon, hexagonal	pozi	= pozidrive
bfo	= beat frequency oscillator			ph brz	= phosphor bronze
blk	= black	ID	= inside diameter		
blu	= blue	IF	= intermediate frequency	rf	= radio frequency
brn	= brown	in.	= inch, inches	rdh	= round head
brs	= brass	I/O	= input/output	rmo	= rack mount only
Btu	= British thermal unit	int	= internal	rms	= root-mean-square
bwc	= backward wave oscillator	incl	= include(s)	RWV	= reverse working voltage
Be Cu	= beryllium copper	insul	= insulation, insulated	rect	= rectifier
		impgrg	= impregnated	r/min	= revolutions per minute
C	= collector	incand	= incandescent		
cw	= clockwise			s	= second
ccw	= counterclockwise	k	= kilo (10^3), kilohm	SB	= slow-blow
cer	= ceramic			Se	= selenium
cmo	= cabinet mount only	lp	= low pass	Si	= silicon
com	= common			scr	= silicon-controlled rectifier
crt	= cathode-ray tube	m	= milli (10^{-3})	sil	= silver
CTL	= capacitor-transistor logic	M	= mega (10^6), megohm	sst	= stainless steel
cath	= cathode	My	= Mylar	stl	= steel
cd pl	= cadmium plate	mfr	= manufacturer	spcl	= special
Comp	= composition	mom	= momentary	spdt	= single-pole, double-throw
conn	= connector	mtg	= mounting	spst	= single-pole, single-throw
compl	= complete	misc	= miscellaneous	semicond	= semiconductor
		met ox	= metal oxide		
dc	= direct current	mintr	= miniature	Ta	= tantalum
dr	= drive			td	= time delay
DTL	= diode-transistor logic	n	= nano (10^{-9})	Ti	= titanium
depc	= deposited carbon	nc	= normally closed or no connection	tgl	= toggle
dpdt	= double-pole, double-throw			thd	= thread
dpst	= double-pole, single-throw	Ne	= neon	tol	= tolerance
		no.	= number or normally open	TTL	= transistor-transistor logic
E	= emitter	np	= nickel plated	term	= terminal
ext	= external	NPN	= negative-positive-negative		
encap	= encapsulated	NPO	= negative positive zero (zero temperature coefficient)	U (μ)	= micro (10^{-6})
elctlt	= electrolytic			V	= volt(s)
		NSR	= not separately replaceable	var	= variable
F	= farads	NRFR	= not recommended for field replacement	vio	= violet
FF	= flip-flop			VDCW	= direct current working volts
flh	= flat head	OD	= outside diameter		
flm	= film	OBD	= order by description	W	= watts
fxd	= fixed	orn	= orange	ww	= wirewound
filh	= fillister head	ovh	= oval head	wht	= white
		oxd	= oxide	WIV	= working inverse voltage
G	= giga (10^9)				
Ge	= germanium	p	= pico (10^{-12})	yel	= yellow
gl	= glass	PC	= printed circuit		

Table 6-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U.S.A Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco, Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Mictron, Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp, Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00809	Croven, Ltd.	Whitby, Ontario, Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Cal.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Cal.
01281	TRW Semiconductors, Inc.	Lawndale, Cal.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co	Alliance, Ohio
01538	Small Parts Inc.	Los Angeles, Cal.
01589	Pacific Relays, Inc.	Van Nuys, Cal.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill.
01960	Pulse Engineering Co	Santa Clara, Cal.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc	Sunnyvale, Cal.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Division	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Cal.
02875	Hudson Tool & Die	Newark, N.J.
03296	Nylon Molding Corp.	Springfield, N.J.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Cal.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div., Finderne Plant	Sumerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taruus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Cal.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Palo Alto Division of Hewlett-Packard Co.	Palo Alto, Cal.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Cal.
04673	Dakota Engr. Inc.	Culver City, Cal.
04713	Motorola Inc. Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Cal.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Cal.
04811	Precision Coil Spring Co.	El Monte, Cal.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Cal.
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Cal.
05397	Union Carbine Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Cal.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Cal.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Cal
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Cal.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Arizona
06812	Torrington Mfg. Co., West Div.	Van Nuys, Cal.
06980	Varian Assoc. Etmac Div.	San Carlos, Cal.
07088	Kelvin Electric Co.	Van Nuys, Cal.
07126	Digitran Co.	Pasadena, Cal.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp., Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Cal.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Cal.
07263	Fairchild Camera & Inst. Corp., Semiconductor Div.	Mountain View, Cal.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp, The	Monterey Park, Cal.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Cal.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Cal.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Cal.
07980	Hewlett-Packard Co., New Jersey Division	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Cal.
08289	Blinn, Delbert Co.	Pomona, Cal.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Cal.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Cal.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div. of CBS Inc	Lowell, Mass.
08806	General Electric Co., Miniature Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Cal.
09097	Electronic Enclosures Inc.	Los Angeles, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Cal.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09795	Pennsylvania Florocarbon	Clifton Heights, Penn.
09922	Burndy Corp	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Cal.
10411	Ti-Tal, Inc.	Berkeley, Cal.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Cal.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Cal.
11314	National Seal	Downey, Cal.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Cal.
11711	General Instrument Corp., Semiconductor Division Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Cal.
11870	Melabs, Inc.	Palo Alto, Cal.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc., Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Cal.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Airco Supply Co., Inc.	Witchita, Kansas
13061	Wilco Products	Detroit, Mich.
13103	Thermolloy	Dallas, Texas
13327	Solitron Devices Inc.	Tappan, N.Y.
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Cal.
14193	Calif. Resistor Corp	Santa Monica, Cal.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, a Div. of Int. Telephone and Telegraph Corporation	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dublier Electric Corp	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Cal.
14960	Williams Mfg. Co.	San Jose, Cal.
15106	The Sphere Co., Inc.	Little Falls, N.J.
15203	Webster Electronics Co.	New York, N.Y.
15287	Sciomics Corp.	Northridge, Cal.
15291	Adjustable Bushing Co.	N. Hollywood, Cal.
15558	Micron Electronics, Garden City, Long Island, N.Y.	
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Cal.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Cal.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mountain View, Cal.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni Spectra Inc.	Detroit, Ill.
16352	Computer Diode Corp.	Lodi, N.J.
16554	Electroid Co.	Union, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Cal.
16688	Ideal Prec. Meter Co., Inc., De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Cal.
17474	Tranex Company	Mountain View, Cal.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Cal.
17856	Siliconix Inc.	Sunnyvale, Cal.
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Cal.
18083	Clevite Corp. Semiconductor Div.	Palo Alto, Cal.
18324	Signetics Corp.	Sunnyvale, Cal.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18565	Chomerics	Plainville, Mass.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison	West Orange, N.J.
19589	Concoa	Baldwin Park, Cal.

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Table 6-3. Code List of Manufacturers (Continued)

Code No.	Manufacturer	Address
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21355	Fafnir Bearing Co., The	New Britian, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23020	General Reed Co.	Metuchen, N.J.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division, Nela Park,	Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobert File Co. of America, Inc.	Carlstadt, N.J.
26851	Compac Hollister Co.	Hollister, Cal.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Cal.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products, Istd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto, Ontario, Canada
37942	P.R. Mallory & Co., Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
40931	Honeywell Inc.	Minneapolis, Minn.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	HP Co., Med. Elec. Div.	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & System Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
58474	Superior Elect. Co.	Bristol, Conn.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electric Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincey, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst, L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Cal.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Cal.
71471	Cinema Div. Aerovox Corp.	Burbank, Cal.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap Division	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Cal.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Cal.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Cal.
73445	Amperex Elect. Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries, Inc.	Philadelphia, Pa.
73734	Federal Screw Products, Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Cal.
73957	Groove-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronic Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights, Inc.	Sandwich, Ill.
75382	Kulka Electric Corp.	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Cal.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Cal.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Cal.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Cal.
77075	Pacific Metals Co.	San Francisco, Cal.
77221	Phaostron Instrument and Electronic Co.	So. Pasadena, Cal.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Division	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Cal.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Cal.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Cal.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80033	Prestole Corp.	Toledo, Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Standard tube or semi-conductor device, any manufacturer.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Cal.
80411	Arco Div. of Robertshaw Controls Co.	Columbus, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Cal.
80583	Hammarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Inst. Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Cal.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Cal.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp., Space & Defense Systems Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod., Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc., Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rolton Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Cal.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Cal.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rosan Inc.	Newport Beach, Cal.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisades Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co., Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp., Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp., Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Cal.
84411	TRW Capacitor Div.	Ogallala, Neb.

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Table 6-3. Code List of Manufacturers (Continued)

Code No.	Manufacturer	Address
94870	Sarkes Tarzian, Inc.	Bloomington, Ind
85454	Boonton Molding Company	Boonton, N.J.
85471	A. B. Boyd Co.	San Francisco, Cal.
85474	R. M. Bracamonte & Co.	San Francisco, Cal.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Division	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Cal.
87034	Marco Industries	Anaheim, Cal.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Cal.
87664	Van Waters & Rogers Inc.	San Francisco, Cal.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Cal.
89473	G. E. Distributing Corp.	Schenectady, N.Y.
89479	Security Co.	Detroit, Mich.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	U. S. Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90365	Belleville Speciality Tool Mfg., Inc.	Belleville, Ill.
90763	United Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Cal.
91146	ITT Cannon Elect. Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Cal.
91345	Miller Dial & Nameplate Co.	El Monte, Cal.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91673	Epiphone Inc.	New York, N.Y.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Cal.
91886	Malco Mfg., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Division	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Cal.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co., Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury, L.I., N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc., Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Pallisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Cal.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp., Electronics Div.	East Patterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95146	Alco Elect. Mfg. Co.	Lawrence, Mass.
95236	Allies Products Corp.	Diania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West, Inc.	Sunnyvale, Cal.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Mfg. Co.	Los Angeles, Cal.
96396	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Cal.
96508	Xcelite, Inc.	Orchard Park, N.Y.
96733	San Fernando Elec. Mfg. Co.	San Fernando, Cal.
96881	Thomson Ind. Inc.	Long Island, N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Tronics, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Cal.
98220	Hewlett-Packard Co., Medical Elec. Div.	Pasadena, Cal.
98278	Microdot, Inc.	So. Pasadena, Cal.
98291	Sealectro Corp.	Mamaronech, N.Y.
98376	Zero Mfg. Co.	Burbank, Cal.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Division of Hewlett-Packard Co.	Palo Alto, Cal.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Cal.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Cal.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Cal.
99707	Control Switch Division, Controls Co. of America	El Segundo, Cal.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Rembrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp., Semiconductor Division	El Monte, Cal.
99957	Technology-Instrument Corp. of California	Newbury Park, Cal.

The following HP Vendors have no number assigned in the latest supplement to the Federal Supply Code for Manufacturers Handbook.

0000F	Malco Tool and Die, Los Angeles, Calif	000CS	Hewlett-Packard Co., Colorado Springs Div., Colorado Springs, Colorado	000QQ	Cooltron, Oakland, Cal.
0000Z	Willow Leather Products Corp., Newark, N.J.	000MM	Rubber Eng. & Development, Hayward, Cal.	000WW	California Eastern Lab, Burlington, Cal.
000AB	ETA, England	000NN	A "N" D Mfg. Co., San Jose, Cal.	000YY	S.K. Smith Co., Los Angeles, Cal.
000BB	Precision Instrument Comp. Co. Van Nuys, Cal.				

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