MULTIPROGRAMMER INTERFACE

MODEL 59500A

OPERATING AND SERVICE MANUAL

FOR SERIALS 1544A-00123 AND ABOVE *

* For Serials Above 1544A-00123
a change page may be included.

* For Serials Below 1544A-00123
Refer to Appendix A.

HP Part No. 59500-90001
Microfiche Part No. 59500-90002

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MANUAL CHANGES
Model 59500A Multiprogrammer Interface
Manual HP Part No. 59500-90001

Make all corrections in the manual according to errata below, then check the following table for your multiprogrammer interface serial number and enter any listed change(s) in the manual.

SERIAL		MAKE CHANGES
Prefix	Number	
All	- - -	Errata
1617A	00214-00303	1
1640A	00304-00723 00728, 00730-00753 00763, 00765, 00768, 00771-00783	1, 2
1640A	00724-00727 00729, 00754-00762 00766, 00769 00770	1, 2, 3
1809A	00784-up	1, 2, 3

ERRATA:

On the title page, change serial number appearing in the title and associated notes to "1536A-00123".

In Appendix A, on Page 7-1, change Paragraph A-1 to read: "For serial numbers below 1536A-00123, contact NJD Service for backdating information".

In Replaceable Parts Table, under A1 Power Supply Board, delete CR1, SCR 25A, HP Part No. 1884-0223. This part (CR1) is located on the chassis. Add CR1 (1884-0223) to the components listed under Chassis Electrical on page 6-7.

On Figure 7-1 (Sheet 1) indicate with a single asterisk that SCR CR1, shown functionally in the crowbar circuit, is physically located on the chassis.

On Figure 7-1 (Sheet 2), in the Signal Mnemonics Table, make the following changes:

1. Delete the asterisk next to the ADRT mnemonic.
2. Change the EOI mnemonic to read: "END OR IDENTIFY".
3. Add *IFC, "INTERFACE CLEAR" to the list.

In Replaceable Parts Table, under Miscellaneous (page 6-8), change HP Part No. of Chaining Cable Assy. (59500A-6940B) to 14541-60001.

CHANGE 1:

In Replaceable Parts Table, change HP Part No. of the Power Module from "5060-9421" to "0960-0443". The old and new modules are directly interchangeable.

ERRATA:

Add the following sentence at the end of paragraph 2-16: "An instruction card attached to the 59500A rack mounting kit illustrates and describes the procedures for preparing the 59500A for rack mounting. Rack mounting kit, HP Part No. 5060-8739, can be obtained by specifying Option 908 when ordering your 59500A unit."

In the replaceable parts table, under Miscellaneous, add the following:

Metric Conversion kit HP Part No. 5060-0138.
Metric Warning label HP Part No. 5951-7587.

Add the following notice to paragraph 1-18: "Effective December 1, 1975, extra manuals may be obtained by ordering Option 910 when ordering your instrument. The number of extra manuals depends on the number of Option 910s ordered.

CHANGE 2:

To conform with IEEE Standard 488-1975, the HP-IB connector mounting studs on the A2 Main Board Assembly have been changed from English to metric threads making the metric conversion kit unnecessary. An HP-IB cable assembly is no longer supplied with the Model 59500A. Delete metric conversion kit 5060-0138 and HP-IB cable assembly 8120-1834 (or 10631B) from the parts list.

▶ CHANGE 3:

On page 6-5 (A2 Assembly) and Figure 7-1, Sheet 2, encoder sequencer circuit, delete the following components:

Resistor R17, 5.1k, 5%, HP Part No. 0683-5125.
Resistor R18, 5.1k, 5%, HP Part No. 0683-5125.
Capacitor C11, 0.001μF, HP Part No. 0150-0050.

Replace C11 with jumper wire no. 22, HP Part No. 8151-0013.

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between your instrument and the instrument described by this manual.

1-17 ORDERING ADDITIONAL MANUALS

1-18 One manual is shipped with each instrument. Additional manuals may be purchased from your local Hewlett-Packard field office (see list at rear of this manual for addresses). Specify the model number, serial number prefix, and HP part number shown on the title page.

Table 1-1. General Information

ELECTRICAL CHARACTERISTICS

Logic Levels: Ground true, TTL compatible.
Input Levels (From HP-IB):
1 = true ≤ 0.8V
Ø = false ≥ 2.0V
Output Levels (To HP-IB):
1 = true = 0Vdc to 0.4Vdc
Ø = false = +2.5Vdc to +5Vdc

Input Loading (From HP-IB): Each of the 16 bus lines is terminated with 3kΩ to +5V and 6.2kΩ to ground. Each input is equivalent to one TTL load (or less).

Output Circuits (To HP-IB): Each of 11 open collector output circuits (DIO1-DIO7, SRQ, DAV, NRFD, NDAC) can drive 14 bus loads.

Input Loading (From 6940B): Each of 16 inputs ($\overline{B15}$, $\overline{B11}$-$\overline{BØØ}$, $\overline{FLAG}$, TME, $\overline{IEN}$) is terminated with 330Ω to +5V and 750Ω to ground.

Output Circuits (To 6940B): 17 open collector drivers for data bits $\overline{DØØ}$-$\overline{D15}$ and $\overline{GATE}$ signal.

FUNCTION

Interfaces the 6940B Multiprogrammer to the controller and up to 13 additional bus devices via the HP-IB. Provides the following HP-IB capabilities: talker (T6), listener (L4), source handshake (SH1), acceptor handshake (AH1), and service request (SR1).

Interconnecting Cables:
(1) Controller-to-59500A: Standard 72-inch (1.8 meters) HP-IB cable No. 10631B, supplied with 59500A.

(2) 59500A-to-6940B: Standard 18-inch (0.46 meters) chaining cable No. 14541A, supplied with 59500A.

Operating Modes:
(1) Listen mode: 59500A can input data from the HP-IB when addressed.

(2) Talk mode: 59500A can output data to the HP-IB when addressed.

(3) Service request: 59500A can notify the controller that the 6940B requires service. The service request (SRQ) line allows a single bus instrument to request service while the calculator is doing another operation.

Talk/Listen Addresses:
The 59500A/6940B Multiprogrammer has a suggested talk address of "W" and listen address of "7" which are factory set (address switches on rear of 59500A). However, any of 31 pairs of talk/listen address combinations can be selected using the address switches on rear of 59500A.

Connectors:
(1) The HP-IB connector (24-pins) is located on the rear of the 59500A and is designated J1.
(2) The MULTIPROGRAMMER connector (50-pins) is located on the rear of the 59500A and is designated J2.

INPUT POWER REQUIREMENTS

100/120/220/240Vac (selectable), 48-440Hz, 15W.

TEMPERATURE RANGE:

Operating: 0° to 55°C.
Storage: –40° to +75°C

59500A DIMENSIONS:

3 1/4 inches (82.6mm) high x 16 3/4 inches (425.5mm) wide x 18 3/4 inches (463.6mm) deep.

59500A WEIGHT:

12 lbs. (5.4kg)

COOLING:

Natural Convection.

SECTION II
INSTALLATION

2-1 INITIAL INSPECTION

2-2 Before shipment, this instrument was inspected and found to be free of mechanical and electrical defects. As soon as the instrument is received, proceed as instructed in the following paragraphs.

2-3 Mechanical Check

2-4 If external damage to the shipping carton is evident, ask the carrier's agent to be present when the instrument is unpacked. Check the instrument for external damage such as broken controls or connectors, and dents or scratches on the panel surfaces. If the instrument is damaged, file a claim with the carrier's agent and notify your local Hewlett-Packard Sales and Service Office as soon as possible (see list at rear of this manual for addresses).

2-5 Electrical Check

2-6 Check the electrical performance of the instrument as soon as possible after receipt. Section V of this manual contains procedures which will verify instrument operation on the HP-IB. These procedures are also suitable for incoming quality control inspection. Refer to the inside front cover of the manual for the Certification and Warranty statements.

2-7 REPACKAGING FOR SHIPMENT

2-8 To insure safe shipment of the instrument, it is recommended that the package designed for the instrument be used. The original packaging material is reusable. If it is not available, contact your local Hewlett-Packard field office to obtain the materials. This office will also furnish the address of the nearest service office to which the instrument can be shipped. Be sure to attach a tag to the instrument specifying the owner, model number, full serial number, and service required, or a brief description of the trouble.

2-9 INSTALLATION DATA

2-10 HP-IB Connector

2-11 The HP-IB connector (J1) on the rear of the 59500A interfaces directly to the HP-IB. Figure 2-1 illustrates the pin configuration of J1 which is a 24-pin, type 57, microribbon connector. The HP-IB cable, supplied with the 59500A, is 6 feet in length. HP-IB cables are also available in 3 feet and 12 feet lengths. All cables are identical except for length. The HP model number for each cable is as follows:

HP Model No.	Cable Length
10631A	3 feet
10631B	6 feet
10631C	12 feet

2-12 The HP-IB cables use the same piggyback connector on both ends. The connectors may be stacked one on another. As many as 15 instruments (including the controller) can be connected in parallel to the same HP-IB, however, the following two restrictions must be observed when piggybacking the HP-IB cables. (1) The total cable length of interconnecting cables for the HP-IB system must be less than or equal to 20 meters (65.6 feet), (2) The total cable length for the system must be less than or equal to 2 meters (6.56 feet) times the total number of devices (e.g., up to 6 meters of cable may be used to connect 3 devices to the HP-IB).

2-13 Multiprogrammer Connector

2-14 All data and control information exchanged between the 59500A and the 6940B passes through MULTIPROGRAMMER connector (J2) on the rear of the 59500A. Figure 2-2 illustrates the pin configuration of J2 which is a 50 pin microribbon connector. An 18-inch chaining cable (14541A) is supplied with the 59500A to connect the 59500A to the 6940B. A connection is made between pins 18 and 19 of connector J2 through the 59500A unit. This is the system enable (SYE) interlock. Thus, if the cable is removed from J2, all output cards in the system (6940B and any 6941B's) are disabled (refer to Paragraph 3-26 in 6940B manual).

2-15 System Installation

2-16 Procedures for interconnecting a calculator (9830A or 9820A/21A) and a multiprogrammer system (59500A, 6940B, and any 6941B's) to the HP-IB are provided in Chapter IV of the 6940B Multiprogrammer User's Guide. The procedures include connecting the cables, setting addresses, and turning on the equipment in the proper sequence.

2-17 INPUT POWER REQUIREMENTS

2-18 The 59500A may be operated continuously from a nominal 100V, 120V, 220V, or 240V (48-440Hz) power source. A printed circuit board located within the ac power module on the rear panel selects the power source. Voltage choices are available on both sides of the PC board. Before connecting the instrument to the power source, check that the PC board selection matches the nominal line voltage of the source. The operating voltage is shown in the window of the ac power module. If required, select the proper voltage as follows (refer to Figure 2-3):

a. Remove power cable from instrument.
b. Move plastic door on power module aside.
c. Rotate FUSE PULL to the left and remove line fuse F1.
d. Remove PC board from slot. Select operating voltage by orienting PC board to position the desired voltage on top-left side of PC board. Push board firmly into slot.
e. Rotate FUSE PULL back into normal position and re-insert fuse F1 in holder using caution to select the correct value for F1 (0.5A slo-blo for 100V or 120V and 0.25A slo-blo for 220V or 240V).
f. Close plastic door and connect power cable.

2-19 When the instrument leaves the factory, a 0.5A fuse is installed for 120V operation. An envelope containing a 0.25A fuse for 220V/240V operation is attached to the instrument. Make sure that the correct fuse value for F1 is installed if the position of the PC board is changed.

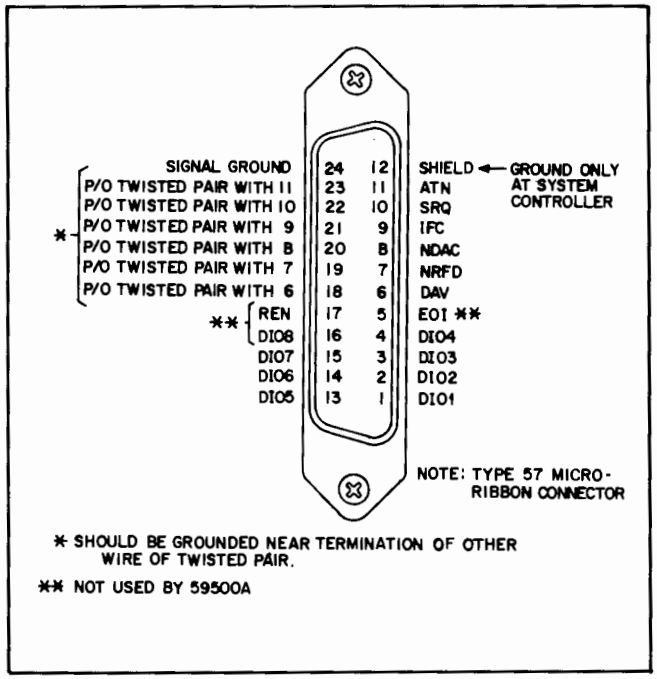


Figure 2-1. HP-IB Connector J1

NOTE

The 6940B and 6941B units also have ac power modules on their rear panel. Before connecting these instruments to a power source, ensure that the proper line voltage has been selected and the correct fuse is installed (refer to Section II in the 6940B and 6941B manuals).

2-20 Power Cable

2-21 To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a three conductor power cable. The third conductor is the ground conductor and when the cable is plugged into an appropriate receptacle, the instrument is grounded. The offset pin on the power cable's three prong connector is the ground connection.

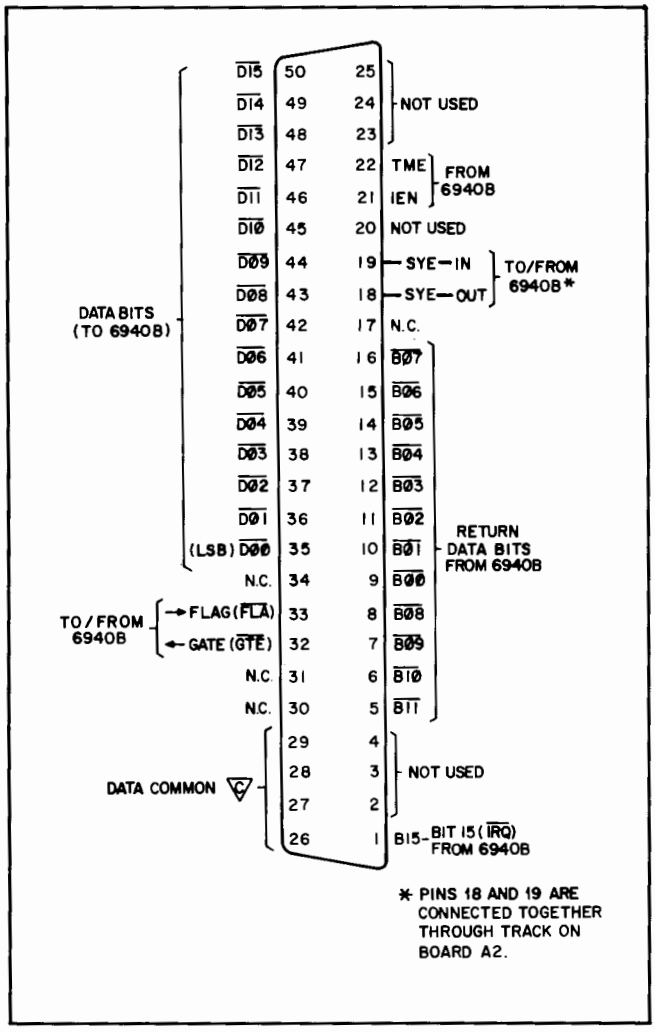


Figure 2-2. Multiprogrammer Connector J2

2-22 To preserve the protection feature when operating the instrument from a two-connect outlet, use a three-prong to two-prong adapter and connect the green lead on the adapter to ground.

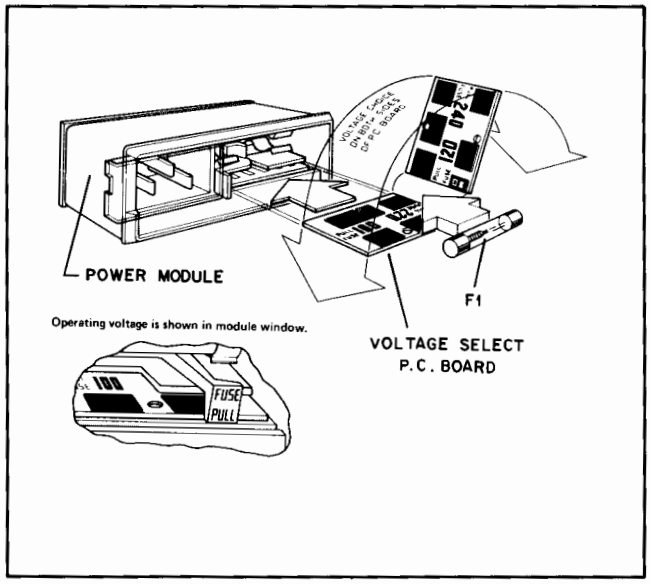


Figure 2-3. Line Voltage Selection

SECTION III
OPERATING INSTRUCTIONS

3-1 PRE-OPERATIONAL CONSIDERATIONS

3-2 Before applying power to the 59500A, ensure that the proper operating voltage (100V, 120V, 220V, or 240V) has been selected and the correct fuse is installed (see Paragraph 2-17). Also, ensure that all HP-IB system connections (between calculator and 59500A, between 59500A and 6940B, and between 6940B and any 6941B's that may be used) have been completed. System cable connections and the power turn-on sequence are described in Chapter IV of the 6940B's User's Guide.

3-3 Controls and Indicators

3-4 Front Panel. The 59500A front panel contains an ON-OFF LINE switch (and associated pilot lamp) and six status indicators. The front panel LINE indicator should light and the +5V supply voltage should be present when the LINE switch is turned on. The +5V power supply contains a built-in crowbar to protect the 59500A's circuits (see Figure 7-1, Sheet 1).

3-5 The six status indicators are used in the verification programs and are also useful when troubleshooting the 59500A/6940B multiprogrammer. Four status indicators are associated with the HP-IB-to-59500A interface and two are associated with the 59500A-to-6940B multiprogrammer interface. The function of each indicator is described in Table 3-1.

3-6 Address Switches. The talk and listen addresses for the 59500A/6940B are selected by address switches located on the rear of the 59500A Interface Unit. The switches are factory set to correspond with the suggested talk address of "W" and listen address of "7". As shown in Figure 3-1 there are 7 address switches. The last two switches, 6 and 7, have no affect in making the selection and are ignored. The remaining switches, 1 through 5 (corresponding to data lines DIO1 through DIO5) are factory set as follows:

Address Switch	Setting
1	"1"
2	"1"
3	"1"
4	"Ø"
5	"1"

3-7 Bits DIO1-DIO5 specify a portion of the address. The complete address is specified by 7 bits (DIO1 through DIO7). The logic states of the two most significant bits DIO7, DIO6) specify a listen or a talk address as follows.

3-8 The listen address "7" is specified by the following logic levels on the HP-IB data lines.

DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
Ø	1	1	Ø	1	1	1

LISTEN

3-9 The talk address "W" is specified by the following logic levels on the HP-IB data lines.

DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1
1	Ø	1	Ø	1	1	1

TALK

3-10 Pre-Operational Checkout

3-11 The verification programs given in Section V of this manual check that the major functions of the 59500A/6940B multiprogrammer are operational. The verification tests are essentially "GO/NO-GO" checks. If a function is found to be inoperable, troubleshooting procedures are provided to isolate the problem to the 59500A or 6940B. Complete troubleshooting procedures for the 59500A are provided in Section V of this manual while troubleshooting procedures for the 6940B are provided in the 6940B Operating and Service Manual. It is recommended that the verification programs be run when the 59500A/6940B system is first placed in operation.

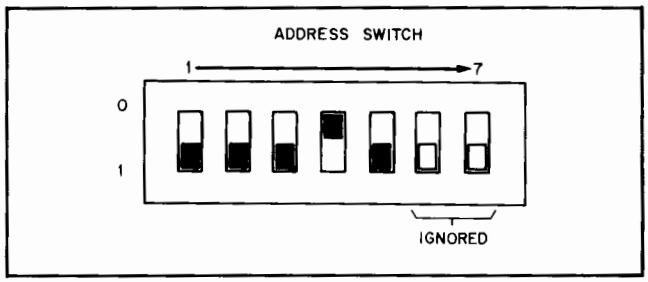


Figure 3-1. Address Switches on Rear of 59500A

Table 3-1. 59500A Indicators

INDICATOR	FUNCTION
LISTEN ADDRESS (HP-IB)	Lights when multiprogrammer is addressed to listen and remains lighted until: 1. Unlisten command is received, or 2. Multiprogrammer talk address is received, or 3. Interface clear signal is received.
TALK ADDRESS (HP-IB)	Lights when multiprogrammer is addressed to talk and remains lighted until: 1. Multiprogrammer listen address is received, or 2. Another bus device is addressed to talk, or 3. Untalk command is received, or 4. Interface clear signal is received.
SERVICE REQUEST (HP-IB)	Lights when: 1. Multiprogrammer completes operation(s) in the timing mode, or 2. Multiprogrammer requests an interruption of the current programming sequence. Remains lighted until the serial poll enable command has been received and the multiprogrammer is addressed to talk. The service request is not reset (SERVICE REQUEST INDICATOR off) in response to the interface clear signal.
SERIAL POLL (HP-IB)	Lights when serial poll enable command (SPE) has been received and multiprogrammer is addressed to talk. Remains lighted until: 1. Serial poll disable (SPD) command is received, or 2. Another bus device is addressed to talk, or 3. Untalk command is received, or 4. Interface clear signal is received.
GATE (Multiprogrammer)	Lights when multiprogrammer gate signal is generated and remains lighted until gate signal is terminated. The gate signal can only be generated when a "T" gate code is received. The gate signal is terminated when the leading edge of the multiprogrammer flag is received. Note that the "X" code can be used to terminate the gate signal for certain "hangup" conditions (see Paragraphs 6-37 and 6-57 in 6940B User's Guide).
FLAG (Multiprogrammer)	Lights when multiprogrammer is busy and extinguishes when multiprogrammer is ready to accept new data. During the timing mode there is a wait-for-flag interval that starts (flag busy) when a multiprogrammer input/output card is addressed with a gate ("T") and ends (flag ready) when the card returns the trailing edge of the flag. When the flag goes ready, (in the timing mode), indicating the operation is completed, the SERVICE REQUEST indicator lights.

3-12 OPERATING 59500A/6940B ON THE HP-IB

3-13 The 59500A/6940B is capable of performing the following HP-IB functions: Listener (L4), talker (T6), service request (SR1), acceptor handshake (AH1), and source handshake (SH1). The 59500A/6940B does not have the following HP-IB capabilities: extended listener (LEØ), extended talker (TEØ), controller (CØ), remote-local (RLØ), parallel poll (PPØ), device clear (DCØ), or device trigger (DTØ). These capabilities (HP-IB compatibility mnemonics L4, T6, LEØ, TEØ, etc.) are defined in IEEE Std. 488-1975 (IEEE Standard Interface for Programmable Instrumentation). The 59500A/6940B HP-IB functions are briefly described in the following paragraphs.

3-14 Listener Function (L4)

3-15 Conditions for Addressing and Unaddressing. See LISTEN ADDRESS indicator in Table 3-1.

3-16 Data Input Format. The 59500A converts serial ASCII characters from the HP-IB into the 16-bit format required by the 6940B. Control, data, and address words are received. These formats are described in Paragraphs 5-6 through 5-22 of the 6940B Multiprogrammer User's Guide.

3-17 Talker Function (T6)

3-18 Conditions for Addressing and Unaddressing. See TALK ADDRESS indicator in Table 3-1.

3-19 Data Output Format. The 59500A/6940B sends two types of words to the HP-IB: return data words and status bytes. A return data word contains an input request character, four octal data characters, and carriage return/line feed characters. An 8-bit status byte is sent to the HP-IB in response to a serial poll routine. The formats for return data words and status bytes are descirbed in Paragraph 5-23 through 5-31 of the 6940B Multiprogrammer User's Guide.

3-20 Serial Poll Responses. See SERIAL POLL indicator in Table 3-1.

3-21 Service Request Function (SR1)

3-22 The service request function is used by the 59500A to notify the controller that the multiprogrammer requires service. The reasons for a multiprogrammer service request are listed in Table 3-1 (SERVICE REQUEST indicator). Refer to Paragraph 3-28 in Chapter III of the 6940B Multiprogrammer User's Guide for a detailed description

3-23 Acceptor Handshake Function (AH1)

3-24 A three-wire handshake cycle occurs with each character transferred from the HP-IB (source) to the 59500A (acceptor). The acceptor handshake cycle is described in detail in Paragraph 4-3 of this manual.

3-25 Source Handshake Function (SH1)

3-26 A three-wire handshake cycle occurs with each character transferred from the 59500A (source) to the HP-IB (acceptor). The source handshake cycle is described in detail in Paragraph 4-13 of this manual.

3-27 PROGRAMMING

3-28 Complete programming instructions are provided in Chapters V and VI of the 6940B User's Guide. Chapter V contains programming fundamentals and Chapter VI contains sample programs for each type of plug-in card that can be used in the multiprogrammer mainframe.

SECTION IV
PRINCIPLES OF OPERATION

4-1 INTRODUCTION

4-2 This section describes the 59500A's 3-wire handshake timing circuits that control the transfer of each character between the HP-IB and the 59500A. Descriptions and timing diagrams are provided for the acceptor handshake circuits (HP-IB-to-59500A transfers) and for the source handshake circuits (59500A-to-HP-IB transfers). The descriptions and diagrams support the troubleshooting procedures provided in Section V. The remaining circuits (decoders, latches, etc.) within the 59500A are described in sufficient detail in Chapter III of the 6940B Multiprogrammer User's Guide to support the troubleshooting procedures given in this manual.

4-3 ACCEPTOR HANDSHAKE

4-4 The acceptor handshake circuits consist of the 3-wire handshake logic, clock generator and the acceptor handshake logic (see Figure 7-1, Sheet 2). When the HP-IB is in the command mode ($\overline{ATN}$ true) or when the 59500A is in the listen mode (addressed to listen and $\overline{ATN}$ goes false), the 3-wire handshake logic is enabled through NOR gate Z53. As each character is transferred to the 59500A (acceptor) from the controller (source), a 3-wire handshake cycle occurs. Unrecognized characters will be ignored (not decoded) but the handshake cycle will occur anyway. The timing sequence for the handshake cycle depends upon a number of conditions which are described in the following paragraphs. Timing diagrams are included with each description. Note that the encircled numbers on the timing diagrams designate test points which coincide with the test points shown on the schematic and component location diagrams provided in Section VII.

4-5 All Characters Except "T", "X", And "Z"

4-6 Figure 4-1 illustrates the timing sequence when any character except a "T", "X", or "Z" gate code is received by the 59500A.

T_0: Initially, the $\overline{NRFD}$ signal (J1-7) is HI (false-ready for data) and the $\overline{NDAC}$ signal (J1-8) is LO (true-data not accepted). Also $\overline{DAV}$ (J1-6) is HI (false-data not valid) at this time.

T_1: The source (assume controller) puts a character on the HP-IB and indicates that the character is valid by setting $\overline{DAV}$ LO (true).

T_2: After a delay of approximately 0.3μsec, the CLKL (Z62-13) and $\overline{CLKL}$ (Z62-4) signals are generated.

a. If the HP-IB is in the command mode ($\overline{ATN}$ LO), the CLKL signal gates a recognized command character which sets or resets the applicable latch (listen, talk or serial poll).

b. If the 59500A has been previously commanded to listen and $\overline{ATN}$ goes HI (false), the CLKI signal (Z54-11) is generated and gates a recognized number into the output data shift register (Z18-Z20) or a recognized letter (other than "T", "X", "Z") into the address register (Z17).

T_3: After approximately 0.5μsec, the trailing edge of $\overline{CLKL}$ signal (Z62-4) sets NDACL flip-flop (Z49). With Z49 set, the $\overline{Q}$ output (Z49-8) goes LO causing NRFD (J1-7) to go LO (not ready for data) and $\overline{NDAC}$ (J1-8) to go HI (data accepted).

T_4: The controller, sensing $\overline{NDAC}$ HI, sets $\overline{DAV}$ HI (data not valid). With $\overline{DAV}$ HI, DACL flip-flop Z49 is cleared causing $\overline{NDAC}$ (J1-8) to go LO (data not accepted). Also with DACL F/F cleared (Z49-8 HI), input pin 1 to NAND gate Z63 is HI. Input pins Z63-2 and 13 are also HI in this case (any character except "T", "X", or "Z") causing $\overline{NRFD}$ to go HI (ready for data). At this point, the handshake cycle is completed allowing the controller to initiate another transfer.

4-7 "T", "X", Or "Z" Characters

4-8 Figure 4-2 illustrates the timing sequence when an "X" or "Z" gate code, or a "T" gate code (with TME off) is received. The timing sequence is the same as described in Paragraph 4-6 except that at T_4, the $\overline{NRFD}$ signal is held LO (not ready for data) preventing the controller from inputting another character for approximately 30μsec. The delay allows the 6940B sufficient time to store and process the data that preceded the gate code character. The 30μsec delay is provided by gate code detector Z64 which holds Z63-2 LO for approximately 30μsec. After 30μsec, (see T_5, Figure 4-2), $\overline{NRFD}$ goes HI (ready for data).

4-9 As shown in Figure 4-2, the "T" code generates the multiprogrammer gate which strobes bits $\overline{D\emptyset\emptyset}$ through $\overline{D15}$ into the 6940B and also results in an automatic flag (J2-33) from the 6940B when the timing mode is off (TME at J2-22 is LO). The trailing edge of the flag generates a 2μsec positive pulse (Z62-5) which stores return data bits ($\overline{B11}$-B$\emptyset\emptyset$) in the input latch (Z14-Z16). The trailing edge of the flag also generates a 2μsec negative pulse (Z62-12)

which is used to set $\overline{SRQ}$ (J1-10) LO (true) when the 6940B is in the timing mode (see Paragraph 4-11).

4-10 "T" Character With TME On

4-11 When a "T" is received and the 6940B is operating in the timing mode (TME at J2-22 is HI), the timing sequence is the same as shown in Figure 4-2 except that the $\overline{NRDF}$ signal can be held LO (not ready for data) for more than 30μsec. In the timing mode, Z63-13 is held LO by the flag signal. If the 6940B does not complete operations within 30μsec, the flag signal will override the gate code delay (see Figure 4-2, T_5). In many cases the flag will be held LO for a number of seconds until the 6940B completes operations. When operations are completed, the trailing edge of the flag will cause $\overline{NRFD}$ to go HI (ready for data). With TME on, the trailing edge of flag also sets the service request ($\overline{SRQ}$) LO indicating that operations are completed.

4-12 Note that the 6940B flag signal will not affect the $\overline{NRFD}$ handshake signal when the 6940B is in the interrupt mode ($\overline{IEN}$ and TME both on). For this condition, the inputs at pins 12 and 13 of NAND gate Z56 are both HI. Consequently, the output (pin 6) of NAND gate Z63 is HI overriding the flag input at pin 3 of Z63. Thus, when multiprogrammer input card(s) time out (interrupt), the resulting flag(s) will not affect the $\overline{NRFD}$ line, however, the trailing edge of the flag from the first interrupting card sets the $\overline{SRQ}$ line true (LO).

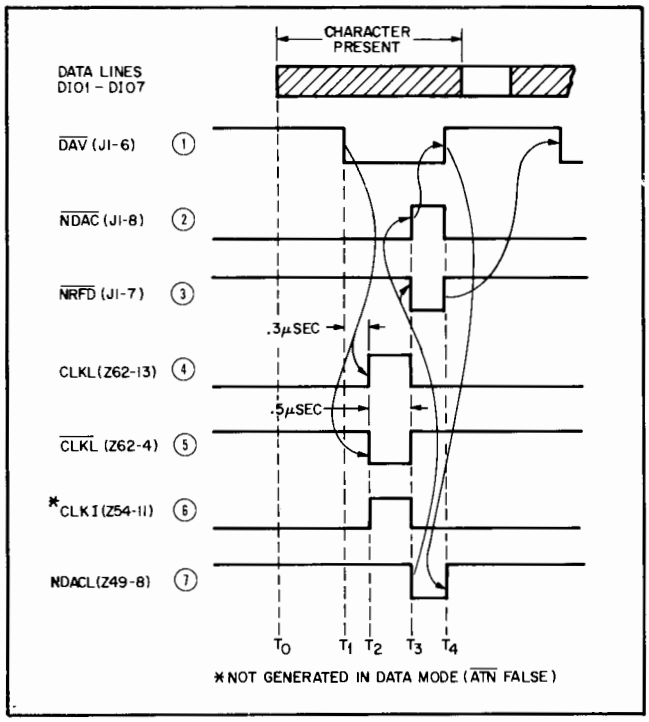


Figure 4-1. Acceptor Handshake Signals (All Characters Except "T", "X", and "Z") Timing Diagram

4-13 SOURCE HANDSHAKE

4-14 A 3-wire handshake cycle occurs with each character transferred from the 59500A (source) to the controller (acceptor). The source handshake logic implements the handshake cycle and also advances the encoder sequencer as each character is transferred (see Figure 7-1, Sheet 2).

4-15 When the 59500A talk address is received and $\overline{ATN}$ goes false (HI), the encoder will translate bit $\overline{MB15}$ into one octal digit and bits $\overline{MB11}$-$\overline{MB\emptyset\emptyset}$ into four octal digits. The octal digits (characters) are transmitted from the encoder onto the HP-IB starting with the octal digit representing $\overline{MB15}$, followed by four octal digits representing $\overline{MB11}$-$\overline{MB\emptyset9}$, $\overline{MB\emptyset8}$-$\overline{MB\emptyset6}$, $\overline{MB\emptyset5}$-$\overline{MB\emptyset3}$, and $\overline{MB\emptyset2}$-$\overline{MB\emptyset\emptyset}$, respectively. Carriage return (CR) and line feed (LF) characters are added after the last octal digit ($\overline{MB\emptyset2}$-$\overline{MB\emptyset\emptyset}$) as an "end of record" indication to the controller.

4-16 The first character (representing $\overline{MB15}$) is enabled and transferred onto the bus as soon as the 59500A's talk address is received and $\overline{ATN}$ goes false. The remaining characters are enabled and transferred with each subsequent

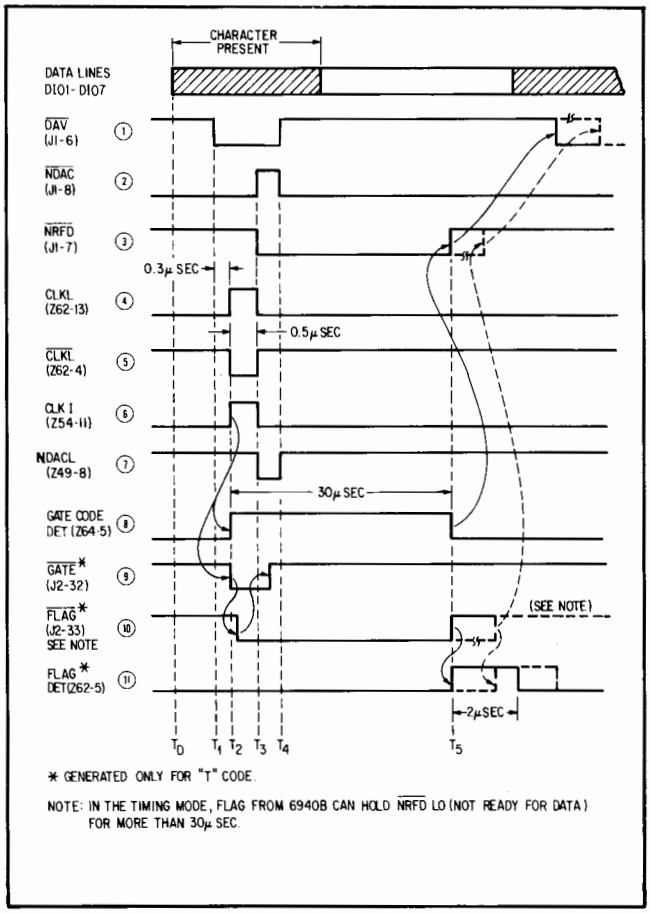


Figure 4-2. Acceptor Handshake Signals ("T", "X", or "Z" Characters) Timing Diagram

handshake cycle. Since the controller (in this case calculator) ends the input cycle after the CR/LF characters are received, the transfer is terminated and the encoder sequencer is cleared after the seven characters have been transferred. Note that if the cycle is not terminated, these seven characters plus nine "7's" would be transferred. Thus, if the bus handshake is continued, the 59500A will repeatedly send a string of 16 characters.

4-17 The timing sequence that occurs with each character transferred is shown in Figure 4-3.

T_0: Initially, the 59500A is addressed to talk, $\overline{ATN}$ is false (HI), and the listener (controller in this case) is ready for data: $\overline{NRFD}$ goes HI and $\overline{NDAC}$ is LO.

T_1: After a delay of approximately 4μsec, Z57-5 goes HI causing a negative pulse (approx. 2μsec wide) to be generated at Z64-4. See source handshake circuits on Sheet 2 of Figure 7-1.

T_2: The trailing edge of the 2μsec negative pulse from Z64-4 causes Z57-9 (DAVT) to go HI and Z57-8 ($\overline{DAVT}$) to go LO. With DAVT HI, $\overline{DAV}$ goes LO indicating that the character is valid.

T_3: With $\overline{DAV}$ LO, the controller (acceptor) sets $\overline{NDAC}$ HI (data accepted) and $\overline{NRFD}$ LO (not ready for data). With $\overline{NDAC}$ HI, Z57-5 goes LO, Z57-9 goes LO, and Z57-8 goes HI. With Z57-9 LO, $\overline{DAV}$ goes HI indicating the character is not valid. The LO to HI transition at Z57-8 advances the encoder sequencer enabling the next character to be transferred (see Paragraph 4-18).

T_4, T_5: The listener sets $\overline{NDAC}$ LO and NRFD HI and the cycle is repeated (see T_1).

4-18 The encoder sequencer consists of the following: 4-bit up counter (Z47), 4-to-10 line decoder (Z48), and inverters (Z41, Z45, and Z54). These circuits provide the enable signals that transfer the seven characters in the proper order. The up counter (Z47) is cleared when the 59500A is not enabled to talk or when $\overline{ATN}$ is true. For this condition, EN1 is HI, enabling encoder bit $\overline{MB15}$. When the 59500A is addressed to talk and $\overline{ATN}$ goes false, the first character (representing bit MB15) is transferred. Each character is then transferred in succession under control of the handshake cycle. As each character is accepted, the up-counter is advanced by one and the 4-to-10 line decoder (Z48) produces the next enable signal (EN2, EN3, EN4, etc.). The combination of enable signals and encoder gates and inverters produces the proper ASCII code on data lines DIO1-DIO7 for each character transferred.

4-19 Note that when the serial poll enable latch (Z40) is set, the 59500A is addressed to talk, and $\overline{ATN}$ goes false, a low level pulse ($\overline{LD}$) is generated and loads a count of 4 into the 4-bit up-counter (Z47). For this condition, enable service byte (ENSB) is HI since both EN5 and serial poll active state (SPAS) are both high. The ENSB signal is NANDed (Z39) with the service request active state (RQSA) signal, encoded as bit DIO7, and transferred along with DIO1-DIO6 as the status byte.

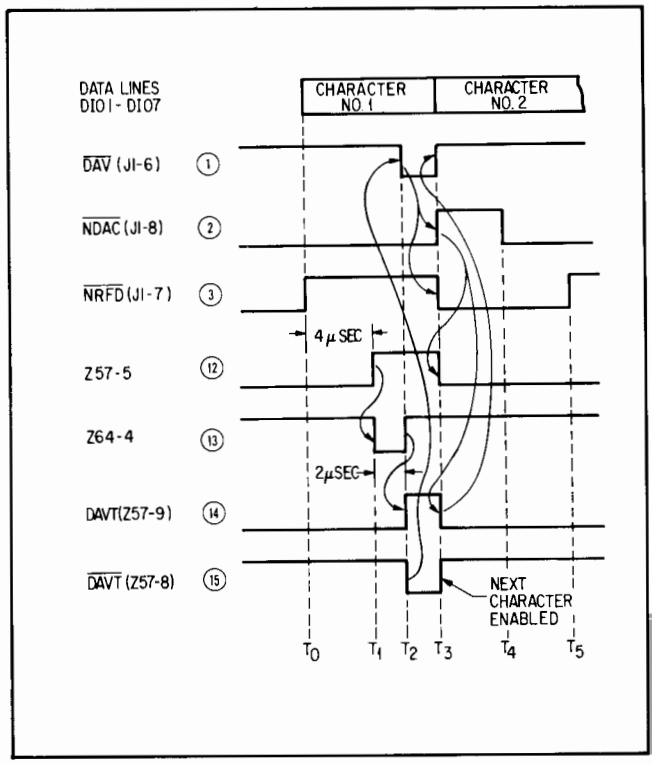


Figure 4-3. Source Handshake Signals, Timing Diagram

SECTION V
MAINTENANCE

5-1 INTRODUCTION

5-2 This section contains verification programs and troubleshooting procedures for the Multiprogrammer Interface, Model 59500A. The verification programs check that the 59500A is operating properly by verifying that the major functions of the 59500A/6940B system can be programmed from an HP9830 or 9820/21 calculator. The troubleshooting procedures are directly related to the verification programs and are performed when the verification program provides an incorrect indication (display or printout). The troubleshooting procedures isolate a malfunction to the 59500A at the component level or to the 6940B at the unit level. Troubleshooting procedures for the 6940B are provided in Operating and Service Manual, HP Part No. 06940-90005. Note that both the Verification Programs and the troubleshooting procedures provided in this section assume that the appropriate calculator (9830 or 9820/21) and HP-IB Interface Card are operating properly.

5-3 TEST EQUIPMENT

5-4 The 9830 or 9820/21 calculator (equipped with the bus interface card and required options) provides all signal inputs necessary for checking and troubleshooting the 59500A/6940B. The additional test instruments required for troubleshooting are listed in Table 5-1.

5-5 If available, Bus System Analyzer HP Model 59401A can be used in place of the calculator and/or HP-IB test Card (see Table 5-1) when troubleshooting the 59500A/6940B. The 59401A provides talker, listener, and controller modes of operation. The operating speed of the 59401A varies from one character at a time in the halt mode, to two characters per second in the slow mode, and full HP-IB speed in the fast mode. Thus, the 59401A can be used to exercise the 59500A/6940B as a talker and as a listener as well as allowing one character at a time to be transferred and checked.

5-6 VERIFICATION PROGRAMS

5-7 The verification programs check that the major functions of the 59500A/6940B system can be programmed from the calculator. The programs provided in this section are similar to those presented in Chapter V of the 6940B Multiprogrammer User's Guide for the HP-IB, except that the sequence in which they are executed is different and some programs have minor modifications. The revised sequence aids in isolating a hardware malfunction if an incorrect indication is obtained from a particular program. The troubleshooting procedures, provided in subsequent paragraphs, are performed when an incorrect indication is obtained. Since there are significant differences in programming a 9830 calculator versus the 9820/21 calculators, detailed program listings are provided for each of these calculator types. However, since the same verification checks are made regardless of calculator type, the descriptions and operating procedures for the verification tests apply to any of the three calculator types.

5-8 System Connections

5-9 The calculator – 59500/6940 system is connected as shown in Figure 5-1. The calculator options and additional installation data (cable length limitations, system turn-on sequence, etc.) are described in Chapter IV of the 6940B Multiprogrammer User's Guide. The verification programs all assume that the 59500/6940 has been assigned a listen address of "7" and talk address of "W". Note, similarly, that the verification programs also assume that the calculator has been assigned its standard listen address of "5" and talk address of "U". Finally, these verification programs are designed to exercise the functions of the 59500/6940 only; do not install any multiprogrammer input/output cards in the 6940 mainframe. Further, do not connect any 6941 extenders to the 6940 during the system verification.

5-10 The 9830 – 59500/6940 verification programs assume that you have a printer in your calculator installation; if you don't have a printer, you can modify the programs by changing all PRINT statements to DISP. (See Paragraph 5-23.)

5-11 Program Descriptions

5-12 The verification programs establish that the major functions of the 59500/6940 multiprogrammer HP-IB system are operational. The tests are essentially "GO/NO-GO" checks with hardware diagnoses of inoperable functions left to the troubleshooting procedures (see Paragraph 5-29). The programs should be executed in the order presented in the following paragraphs the first time the 59500/6940 system is placed in operation. Later, after the system has been operational, the user can select any of the test(s) to verify function(s) that are suspected of being faulty.

Table 5-1. Test Equipment Required

TYPE	CHARACTERISTICS	USE	RECOMMENDED MODEL
Logic Probe	Impedance: 25kΩ. Trigger threshholds: 2.0V and 0.8V, nominal. Min. pulse width: 10 nsec	Logic Circuit Trouble-shooting.	HP 10525T
HP-IB Test Card	Connects to 59500A connector J1 and provides a separate pin for each of 16 bus lines plus a pin for common ground.	Check logic levels on bus lines and control handshake cycle by using appropriate jumpers.	HP 59405-66503 (Part of HP Model 59405A HP-IB Calculator Interface Kit).
Multimeter	10Ω to 1mΩ, ±5% 0.1V to 100V, ±2%	General Troubleshooting	HP 427
Oscilloscope	Bandwidth: dc to 50MHz Sensitivity: 2mV/div.	Check handshake cycle timing.	HP Model 180A with 1804A and 1821A plug-ins.

5-13 59500 LISTEN Mode Verification. This program verifies the following listen mode capabilities of the 59500:

1. The 59500 responds to its listen address (assumed to be "7").
2. The 59500 unlistens when appropriately programmed and does not respond to any other listen addresses.
3. The 59500 does not unlisten when any other listen address is programmed.
4. The 59500 unlistens in response to interface clear.
5. The 59500 unlistens when made a talker.

5-14 59500 TALK Mode Verification. This program verifies the following talk mode capabilities of the 59500:

1. The 59500 responds to its talk address (assumed to be "W").
2. The 59500 untalks when programmed to untalk.
3. The 59500 untalks when any other talk address programmed.
4. The 59500 untalks when made a listener.
5. The 59500 untalks in response to interface clear.

5-15 Data Output – Calculator to 59500/6940 – Verification. This program verifies the following data output capabilities of the 59500/6940:

1. When programmed to listen, the 59500 correctly outputs valid address/data to the 6940. Valid 59500/6940 address/data patterns are manipulated to verify that the 16 data bits output from the 59500 to the 6940 can be correctly programmed.
2. The program verifies that when the 59500 is not a listener, it does not process valid address/data for output to the 6940.
3. The program also verifies that when it is a listener, the 59500 correctly handshakes but does not process

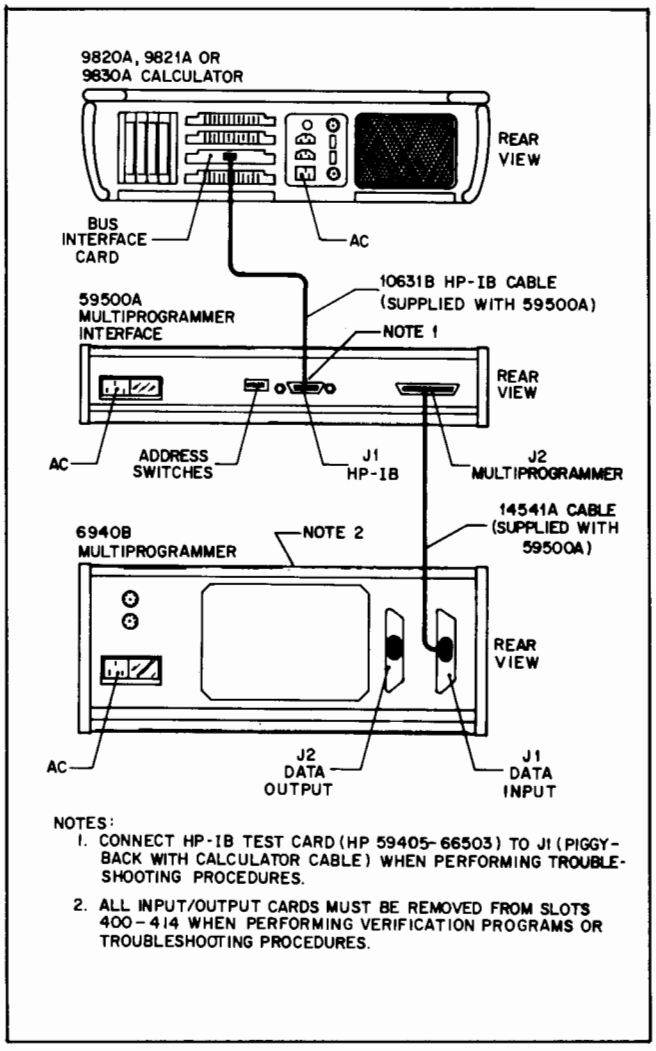


Figure 5-1. System Connections

output bus data that is not valid for the 59500/6940. That is, the 59500 does not process or output to the 6940 bus data that is not: (1) a valid 6940 address byte; (2) an octal data byte; or (3) an X, T, or Z data transfer code.

5-16 **59500/6940 Gate/Flag Verification.** This program verifies the following Gate/Flag features of the 59500/6940:

1. The 59500 correctly sets its Gate output to the 6940 and the 6940 correctly receives the Gate when a "T" is programmed.
2. The 59500 resets the Gate to the 6940 when an "X" is programmed.
3. The 6940 Flag to the 59500 is correctly received in the 59500.

5-17 **Data Input – 59500/6940 to Calculator – Verification.** This program verifies the following data input capabilities of the 59500/6940:

1. The program instructs the user on how to input data to the calculator from the 6940 via the 59500, sets the 59500/6940 to talk, and then verifies that the input is correct. The user can input as many data patterns as desired.
2. The program also verifies that the 59500 does not accept data from the 6940 when the 6940 Flag input is not received with the input data.

5-18 **59500/6940 Serial Poll Mode Verification.** This program verifies the following serial poll mode capabilities of the 59500/6940:

1. The 6940/59500 correctly set the service request line.
2. The 59500 executes a serial poll correctly, resetting its service request appropriately.
3. The 59500 disables the serial poll mode when appropriately programmed.
4. The 59500 returns the correct status byte when serial polled. Checks are made that status bit 7 of the status byte is on if service request is set, and off if service request is cleared prior to the serial poll.
5. The 59500 does not reset its service request in response to interface clear.

5-19 Operational Check List

5-20 All of the verification programs are user-interactive, functional tests of the major functions of the 59500/6940. The programs continually suspend operation (stop) and request (either via the 9830 display or the 9820/21 printer) that the user examine specific test status (usually indicators on the 59500/6940) and continue the verification program if they are normal. If test results are not as requested by the program, the user should refer to checklist below and re-run the test before troubleshooting or continuing with subsequent verification programs. While the failure of a test most often indicates that a hardware problem exists, certain operational or equipment configuration mistakes can be made and result in erroneous indications. If you get an indication of a failure, run through the following checklist before initiating the applicable hardware troubleshooting procedures given in Paragraph 5-29.

1. Check that the required calculator options have been installed as described in Chapter IV of the 6940B Multiprogrammer User's Guide.
2. Check that the interconnecting cables between the calculator, 59500, and 6940 are not defective and are installed correctly.
3. Check that all units are turned on and that the 6940 is set to REMOTE operation unless otherwise instructed in a verification program (all programs except the Data Input and Gate/Flag verification programs require that the 6940 be set to REMOTE operation only).
4. Check that all multiprogrammer input/output cards have been removed from the 6940 and that there is no 6941 connected to the 6940.

CAUTION

Turn power off at the 6940 before removing I/O cards. Failure to do so may result in equipment malfunctions.

5. Check that there are no other devices connected on the HP-IB.
6. Check that the 59500 address switches have been set for listen address "7" and that the calculator bus interface has been set for listen address "5". If either or both of these address assignments must be changed, then you must modify the verification programs accordingly.
7. Check that the program was typed into the calculator correctly. For instance, on the 9830 if you type "U" with the SHIFT key depressed, you will enter a lower case "u" instead of the talk address of the calculator. The calculator display (and printer, if you have one) does not print lowercase letters, however, so that you cannot detect this error through inspection. If in doubt, re-enter the program(s).
8. Check that the 59500 and 6940 were turned on in the sequence given in the verification program. The turn on sequence is especially important for the Serial Poll Mode, Data Output, and Data Input tests.
9. If in doubt, check that the calculator and HP-IB Interface Card are operating properly.

5-21 Operating Procedures – 9830 Calculator – 59500/6940 Verification Programs

5-22 The verification program listings for a 9830 calculator-based HP-IB system employing the 59500/6940 are

provided in Figure 5-2. To execute the programs, simply type them in as listed and depress the RUN, EXECUTE calculator keys. Note that the programs do not overlay themselves so that it is possible to load all of them together.

5-23 Once the verification programs are loaded into the calculator, they are essentially "stand alone" in that all instructions needed to execute the program are given on the calculator Printer and Display. As previously mentioned, if you don't have a printer, you must modify the 9830 verification programs. One alternative is to change all PRINT statements to DISP in order to view the messages on the calculator display (putting in appropriate STOPs, of course, for multi-line messages). The other alternative is to simply delete all PRINT statements and refer to the program listings for program instructions. As part of program execution, the user notifies the program that correct test results have been achieved by pressing calculator keys, CONT, EXECUTE and continuing the program. Thus, there are two types of messages, described below, displayed for the user by the program.

5-24 Program Instruction Messages. These messages are used by the program to describe the test results the user should observe or how to implement a test procedure. All of these messages are defined by the addition of a "(C)" at the end of the line. The "(C)" indicates that the user should continue the program by depressing calculator keys CONT, EXECUTE.

5-25 Test Inquiry Messages. These messages are all single-line display messages that ask the user to observe specific test results as indicated by the 59500/6940 indicators. These messages are all yes/no questions that the user must respond to in either of two ways:

1. Yes. If the test results are as indicated in the message, the user can press CONT, EXECUTE to so notify the program and continue the test. Note that only the indicators specifically mentioned in the message are significant so that the state of any other 59500/6940 indicators should be ignored.

2. No. If the expected test results are not obtained, the user should not continue but should refer to the operational check list (Paragraph 5-19) and rerun the program that failed from the beginning. If the expected test results are not obtained, refer to applicable troubleshooting procedure (see Paragraph 5-29).

Listen Mode Verification

```
1 PRINT "59500 LISTEN MODE VERIFICATION. FOLLOW DISPLAY INSTRUCTIONS."
3 PRINT
5 DISP "TURN 59500 OFF,THEN BACK ON.(C)"
7 STOP
9 CMD "?U7"
11 DISP "59500 LISTEN LITE ON?"
13 STOP
15 CMD "?!#$%&'()*+,./0123456789:;=<>"
17 OUTPUT (13,19)256,34,512;
19 FORMAT 3B
21 DISP " LISTEN LITE OFF?"
23 STOP
25 CMD "7!#$%&'()*+,./12345689:;<=>"
27 OUTPUT (13,19)256,34,512;
29 DISP "LISTEN LITE ON?"
31 STOP
33 DISP "DEPRESS 'STOP,CONT,EXECUTE'"
35 STOP
37 DISP "LISTEN LITE OFF?"
39 STOP
41 CMD "7W"
43 DISP "LISTEN LITE OFF,TALK LITE ON?"
45 STOP
47 CMD "7"
49 DISP "LISTEN LITE ON,TALK LITE OFF?"
51 STOP
53 PRINT "LISTEN MODE O.K.-CHECK TALK MODE"
54 PRINT
55 END
```

Figure 5-2. 9830A Verification Programs

Talk Mode Verification

```
100 PRINT "TALK MODE VERIFICATION. FOLLOW DISPLAY INSTRUCTIONS."
102 PRINT
104 DISP "TURN 59500 OFF,THEN BACK ON.(C)"
106 STOP
108 OUTPUT (13,110)256,95,512;
110 FORMAT 3B
112 CMD "W"
114 DISP "59500 TALK LITE ON?"
116 STOP
118 OUTPUT (13,110)256,95,512;
120 DISP "TALK OFF?"
122 STOP
124 DISP "TALK LITE SHOULD BLINK ONCE(C)"
126 STOP
128 Q=64
130 FOR N=1 TO 30
132 IF Q=87 THEN 142
134 CMD "W"
136 OUTPUT (13,110)256,Q,512;
138 DISP "TALK BLINK ON/OFF ONCE?"
140 STOP
142 Q=Q+1
144 NEXT N
146 CMD "W7"
148 DISP "TALK LITE OFF,LISTEN LITE ON?"
150 STOP
152 CMD "W"
154 DISP "DEPRESS 'STOP,CONT,EXECUTE'"
156 STOP
158 DISP "TALK LITE OFF?"
160 STOP
162 PRINT "TALK MODE O.K.-CHECK DATA OUTPUT MODE."
163 PRINT
164 END
```

Data Output Verification

```
300 PRINT "DATA OUTPUT-9830 TO 6940-VERIFICATION.FOLLOW DISPLAY INSTRUCTIONS."
304 PRINT
306 PRINT "TURN 6940 OFF.TURN 59500 OFF,THEN BACK ON.TURN 6940 ON.(C)"
307 PRINT
308 STOP
310 CMD "?U7","07777"
312 DISP "ALL 6940 DATA LITES ON?"
314 STOP
316 CMD "?U7","@"
318 DISP "ALL 6940 DATA LITES OFF?"
320 STOP
322 REM MARCH A '1' DOWN EACH 6940 BIT POSITION.
324 N=0
326 FOR A=0 TO 3
328 FOR B=0 TO 2
330 FORMAT F1005.0
332 Q=(2↑B)*(10↑A)
334 OUTPUT (13,330)"@"Q
336 DISP "ONLY 6940 DATA LITE"N"ON?"
338 STOP
340 N=N+1
342 NEXT B
344 NEXT A
346 CMD "?U7","A"
348 DISP "ONLY 6940 DATA LITE 12 ON?"
```

Figure 5-2. (continued) 9830A Verification Programs

Data Output Verification (continued)

```
350 STOP
352 OUTPUT (13,*)"B"
354 DISP "ONLY 6940 DATA LITE 13 ON?"
356 STOP
358 OUTPUT (13,*)"D"
360 DISP "ONLY 6940 DATA LITE 14 ON?"
362 STOP
364 OUTPUT (13,*)"H"
366 DISP "ONLY 6940 DATA LITE 15 ON?"
368 STOP
370 REM MARCH A '0' DOWN BITS 15-00
372 X=(7777)-(2↑B*10↑A)
374 CMD "?U7","G7777"
376 DISP "ONLY 6940 DATA LITE 15 OFF?"
378 STOP
380 OUTPUT (13,*)"K7777"
382 DISP "ONLY 6940 DATA LITE 14 OFF?"
384 STOP
386 OUTPUT (13,*)"M7777"
388 DISP "ONLY 6940 DATA LITE 13 OFF?"
390 STOP
392 OUTPUT (13,*)"N7777"
394 DISP "ONLY 6940 DATA LITE 12 OFF?"
396 STOP
398 N=11
400 FOR A=3 TO 0 STEP -1
402 FOR B=2 TO 0 STEP -1
406 X=(7777)-(2↑B*10↑A)
408 OUTPUT (13,330)"O"X
410 DISP "ONLY 6940 DATA LITE"N"OFF?"
412 STOP
414 N=N-1
416 NEXT B
418 NEXT A
420 CMD "?U7","E2525"
422 DISP "ONLY EVEN(0,2,...)LITES ON?"
424 STOP
426 CMD "?U7","J5252"
428 DISP "ONLY ODD DATA LITES ON?"
430 STOP
432 REM VERIFY THAT 59500 DOES NOT SEND DATA
434 REM TO 6940 WHEN NOT A LISTENER.
436 CMD "?U7","@0000"
438 CMD "?U","O7777"
440 DISP "ALL 6940 DATA LITES OFF?"
442 STOP
444 REM VERIFY THAT WHEN A LISTENER,59500 H/S BUT DOES NOT PROCESS
446 REM NON-ADDRESS OR DATA CHARACTERS.
448 CMD "?U7","O7777"
450 FOR I=1 TO 98
452 FORMAT 1B
454 READ B
456 OUTPUT (13,452)B;
458 DATA 0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
460 DATA 21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42
462 DATA 43,44,45,46,47,56,57,58,59,60,61,62,80,81,82,83,85,86
464 DATA 89,91,92,93,94,96,97,98,99,100,101,102,103,104,105,106,107
466 DATA 108,109,110,111,112,113,114,115,116,117,118,119,120,121,122,123
468 DATA 124,125,126,127
470 NEXT I
472 DISP "ALL 6940 DATA LITES ON?"
474 STOP
475 REM REPEAT ABOVE WITH 6940 DATA LITES OFF
476 OUTPUT (13,*)"@"
```

Figure 5-2. (continued) 9830A Verification Programs

```
478 RESTORE
480 FOR I=1 TO 98
482 READ B
484 OUTPUT (13,452)B
486 NEXT I
488 DISP "ALL 6940 DATA LITES OFF?"
490 STOP
492 PRINT "DATA OUTPUT O.K.-CHECK GATE/FLAG"
493 PRINT
494 END
```

Gate/Flag Verification

```
700 PRINT "59500/6940 GATE/FLAG VERIFICATION.FOLLOW DISPLAY INSTRUCTIONS."
702 PRINT
704 CMD "?U7","00020T@T"
706 DISP "59500 GATE LITE ON,FLAG OFF?"
708 STOP
710 DISP "6940 LOAD OUTPUT LITE ON?"
712 STOP
714 OUTPUT (13,*)"X"
716 DISP "GATE AND LOAD OUTPUT LITES OFF?"
718 STOP
720 DISP "PUT 6940 IN LOCAL MODE (C)"
722 STOP
724 CMD "?U7","@T"
726 DISP "59500 GATE LITE ON?"
728 STOP
730 DISP "PUSH AND HOLD 6940 'RET DATA'(C)"
732 STOP
734 DISP "59500 GATE OFF,FLAG ON?"
736 STOP
738 DISP "RELEASE 6940 'RET DATA'(C)"
740 STOP
742 DISP "FLAG OFF?"
744 STOP
746 PRINT "GATE/FLAG O.K.CHECK DATA INPUT"
747 PRINT
748 END
```

Data Input Verificaton

```
500 PRINT "DATA INPUT-6940 TO 9830-VERIFICTION.FOLLOW PRINTER INSTRUCTIONS."
503 PRINT
504 PRINT "TURN 6940 OFF.TURN 59500 OFF,THEN BACK ON.TURN 6940 ON.(C)"
506 PRINT
508 STOP
510 OUTPUT (13,*)"OT@"
512 PRINT "SET 6940 TO LOCAL MODE. WHEN 'ENTER DATA' APPEARS,"
514 PRINT "INPUT DATA FROM 6940: 1.SET BITS 15,11-0 AS DESIRED,"
516 PRINT "2.PUSH 6940 'RETURN DATA'"
518 PRINT "3.DEPRESS 'CONT,EXECUTE' AND CHECK PRINTER.IF:"
520 PRINT "A.INPUT O.K. GO TO STEP 4. B.INPUT N.G. FIX PROBLEM."
522 PRINT "4(A)T0 INPUT DATA AGAIN,PRESS'CONT,EXECUTE' TO REPEAT FROM STEP 1."
524 PRINT " (B)T0 CONTINUE INPUT TEST, PRESS 'STOP, RUN 584, EXECUTE'.(C)"
525 PRINT
526 WAIT 3000
568 PRINT "ENTER DATA!"
569 PRINT
570 STOP
572 CMD "?W5"
576 ENTER (13,*)A
578 PRINT "OCTAL DATA="A
579 PRINT
580 STOP
```

Figure 5-2. (continued) 9830A Verification Programs

Data Input Verification (continued)

```
582 GOTO 568
584 PRINT "SET 6940 DATA TO 7777 AND PUSH 'RETURN DATA,CONT,EXECUTE'"
585 PRINT
586 STOP
592 CMD "?W5"
594 ENTER (13,*)A
596 PRINT "WHEN'CHANGE DATA!' APPEARS:"
600 PRINT "1.SET BITS 11-0 AS DESIRED"
604 PRINT "2.DON'T PUSH 'RET DATA'"
608 PRINT "3.DEPRESS 'CONT,EXECUTE' AND CHECK PRINTER.IF:"
612 PRINT "A.INPUT DID NOT CHANGE,'CHANGE DATA!' APPEARS AGAIN"
616 PRINT "TO CHANGE DATA AGAIN, REPEAT FROM 1. ABOVE."
620 PRINT "TO END TEST, DEPRESS 'STOP,RUN 658, EXECUTE'."
624 PRINT "B.IF INPUT CHANGED,TEST IS ABORTED"
630 PRINT
631 WAIT 3000
632 PRINT "CHANGE DATA!"
633 PRINT
634 STOP
636 CMD "?W5"
638 ENTER (13,*)B
640 IF A#B THEN 644
642 GOTO 632
644 PRINT "TEST ABORTED!INPUT CHANGED TO:"B
648 PRINT "INPUT DATA CHANGED TO"B"(C)"
652 PRINT "DID YOU PUSH 'RET DATA' OR CHANGE 6940 BIT 15?"
656 GOTO 660
658 PRINT "RETURN 6940 REMOTE/LOCAL SWITCH TO REMOTE"
659 PRINT "DATA INPUT O.K.-CHECK SERIAL POLL"
660 PRINT
662 END
```

Serial Poll Verification

```
200 PRINT "SERIAL POLL MODE VERIFICATION. FOLLOW DISPLAY INSTRUCTIONS."
202 PRINT
204 DISP "TURN 59500 OFF,THEN BACK ON.(C)"
206 STOP
208 CMD "?U7","00020T"
210 DISP "59500 SERV REQ & LIST. ON?"
212 STOP
214 IF STAT13 <= 1 THEN 224
216 DISP "59500 SRQ MALFUNCTION"
218 GOTO 270
220 FORMAT 5B
222 FORMAT 3B
224 OUTPUT (13,220)256,95,53,24,512;
226 CMD "W"
228 DISP "TLK & SER POLL ON,SERV.REQ. OFF?"
230 STOP
232 A=RBYTE13
234 IF A=64 THEN 240
236 DISP "STATUS BYTE ERROR-BIT 7 OFF"
238 GOTO 270
240 OUTPUT (13,222)256,25,512;
242 DISP "SERIAL POLL LITE OFF?"
244 STOP
```

Figure 5-2. (continued) 9830A Verification Programs

Serial Poll Verification (continued)

```
246 OUTPUT (13,220)256,95,53,24,512;
248 CMD "W"
250 A=RBYTE13
252 IF A#64 THEN 258
254 DISP "STATUS BYTE ERROR-BIT 7 ON"
256 GOTO 270
258 CMD "?U7","00020T"
260 DISP "DEPRESS 'STOP,CONT,EXECUTE'"
262 STOP
264 DISP "SERVICE REQUEST LITE ON?"
266 STOP
268 PRINT "SERIAL POLL MODE O.K.-TEST COMPLETE."
269 PRINT
270 END
```

Figure 5-2. (continued) 9830A Verification Programs

5-26 Operating Procedures — 9820/9821 Calculator — 59500/6940 Verification Programs

5-27 The verification program listings for a 9820/9821 calculator-based HP-IB system employing the 59500/6940 are provided in Figure 5-3. To execute the programs type them in as listed in the manual, depress calculator keys END, EXECUTE, and RUN PROGRAM.

5-28 The verification programs are "stand alone" with all instructions required to operate the tests printed on the calculator printer. The programs output two types of messages, program instructions and test inquiry, that are similar to the messages output by the 9830 calculator programs are described in Paragraphs 5-24 and 5-25. Note that the 9820/9821 calculator requires a different operator response than that required by the 9830. That is, instead of depressing "CONT, EXECUTE" in response to an instruction that ends in "(C)", or a test inquiry message, the 9820/9821 user should depress "RUN PROGRAM". Thus, the 9820/9821 instruction messages requiring this response all end in "(R)" instead of "(C)". Of course, like the 9830 programs, the test inquiry messages all end in a "?" and require the appropriate yes or no response as discussed in Paragraph 5-25 for the 9830.

Listen Mode Verification

```
0:
PRT "59500 LISTE
N","MODE","VERIF
ICATION."⊢
1:
PRT "FOLLOW PRIN
TER","INSTRUCTIO
NS"⊢
2:
SPC 2⊢
3:
PRT "TURN 59500
OFF","THEN BACK
ON(R)"⊢
4:
SPC 2⊢
5:
STP ⊢
6:
CMD "?U7"⊢
7:
PRT "LISTEN LITE
 ON?"⊢
8:
SPC 2⊢
9:
STP ⊢
10:
CMD "?  !≠$%&'()
*+-,./0123456789:
;<=>"⊢
11:
FMT Y1,Z;WRT 13⊢
12:
WTB 13,34⊢
13:
FMT Y2,Z;WRT 13⊢
14:
PRT "LISTEN LITE
 OFF?"⊢
15:
SPC 2⊢
16:
STP ⊢
17:
CMD "7 :! ≠$%&'(
)*+-,./012345689
;<=>"⊢
18:
FMT Y1,Z;WRT 13⊢
19:
WTB 13,34⊢
20:
FMT Y2,Z;WRT 13⊢
21:
PRT "LISTEN LITE
 ON?"⊢
22:
SPC 2⊢
23:
STP ⊢
24:
PRT "DEPRESS STO
P","RUN PROGRAM
"⊢
25:
SPC 2⊢
26:
STP ⊢
27:
PRT "LISTEN LITE
 OFF?"⊢
28:
SPC 2⊢
29:
STP ⊢
30:
CMD "?W"⊢
```

Figure 5-3. 9820/21A Verification Programs

Listen Mode (continued)

```
31:
PRT "LISTEN LITE
 OFF,","TALK LIT
E ON?"⊢
32:
SPC 2⊢
33:
STP ⊢
34:
CMD "7"⊢
35:
PRT "LISTEN LITE
 ON","TALK LITE
OFF?"⊢
36:
SPC 2⊢
37:
STP ⊢
38:
PRT "LISTEN MODE
 O.K.","CHECK TA
LK MODE."⊢
39:
SPC 8⊢
40:
END ⊢
R335
```

Talk Mode Verification

```
0:
PRT "TALK MODE",
"VERIFICATION"⊢
1:
PRT "FOLLOW PRIN
TER","INSTRUCTIO
NS"⊢
2:
SPC 3⊢
3:
PRT "TURN 59500"
,"OFF THEN ON(R)
"⊢
4:
SPC 2⊢
5:
STP ⊢
6:
CMD "→"⊢
7:
CMD "W"⊢
8:
PRT "59500 TALK"
,"LITE ON?"⊢
9:
SPC 2⊢
10:
STP ⊢
11:
CMD "→"⊢
12:
PRT "TALK LITE O
FF?"⊢
13:
SPC 2⊢
14:
STP ⊢
15:
PRT "TALK LITE S
HOULD","BLINK ON
CE(R)"⊢
16:
SPC 2⊢
17:
STP ⊢
18:
64→A⊢
19:
"Q";IF A=94;GTO
"A"⊢
20:
IF A=87;GTO "B"⊢
21:
CMD "W"⊢
22:
FMT Y1,Z;WRT 13⊢
23:
WTB 13,A⊢
24:
FMT Y2,Z;WRT 13⊢
25:
PRT "TALK LITE",
"BLINK ONCE?"⊢
26:
SPC 2⊢
27:
STP ⊢
28:
"B";A+1→A⊢
29:
GTO "Q"⊢
30:
"A";CMD "W7"⊢
31:
PRT "TALK LITE O
FF","LISTEN LITE
 ON?"⊢
32:
SPC 2⊢
33:
STP ⊢
34:
CMD "W"⊢
35:
PRT "DEPRESS STO
P,","RUN PROGRAM
"⊢
36:
SPC 2⊢
37:
STP ⊢
38:
PRT "TALK LITE O
FF?"⊢
39:
SPC 2⊢
40:
STP ⊢
41:
PRT "TALK MODE O
.K.","CHECK DATA
 OUTPUT."⊢
42:
SPC 8⊢
43:
END ⊢
R340
```

Data Output Verification

```
0:
PRT "DATA OUTPUT
","VERIFICATION.
","FOLLOW PRINTE
R","INSTRUCTIONS
."⊢
1:
PRT "TURN 6940 O
FF.","TURN 59500
","OFF THEN ON."
,"TURN 6940 ON.(
R)"⊢
2:
SPC 2;STP ⊢
3:
CMD "?U7","07777
"⊢
4:
PRT "ALL 6940 DA
TA","LITES ON?";
SPC 2;STP ⊢
5:
CMD "?U7","@"⊢
6:
PRT "ALL 6940 DA
TA","LITES OFF?"
⊢
7:
SPC 2⊢
8:
STP ⊢
9:
0→C→A→B⊢
10:
"X";2↑B*10↑A→X⊢
```

Figure 5-3. (continued) 9820/21A Verification Programs

```
11:
FMT "@",FXD *.0;
WRT 13,X⊢
12:
PRT "ONLY 6940 B
IT"⊢
13:
PRT C,"ON?"⊢
14:
SPC 2⊢
15:
STP ⊢
16:
B+1→B;IF 3=B;
GTO "Y"⊢
17:
C+1→C⊢
18:
GTO "X"⊢
19:
"Y";A+1→A;0→B⊢
20:
IF 4=A;GTO "P"⊢
21:
C+1→C⊢
22:
GTO "X"⊢
23:
"P";CMD "?U7","A
"⊢
24:
PRT "ONLY 6940 B
IT"⊢
25:
PRT "12 ON?"⊢
26:
SPC 2⊢
27:
STP ⊢
28:
CMD "?U7","B"⊢
29:
PRT "ONLY 6940 B
IT"⊢
30:
PRT "13 ON?"⊢
31:
SPC 2⊢
32:
STP ⊢
33:
CMD "?U7","D"⊢
34:
PRT "ONLY 6940 B
IT"⊢
35:
PRT "14 ON?"⊢
36:
SPC 2⊢
37:
STP ⊢
38:
CMD "?U7","H"⊢
39:
PRT "ONLY 6940 B
IT"⊢
40:
PRT "15 ON?"⊢
41:
SPC 2⊢
42:
STP ⊢
43:
CMD "?U7","G7777
"⊢
44:
PRT "ONLY 6940 B
IT"⊢
45:
PRT "15 OFF?"⊢
46:
SPC 2⊢
47:
STP ⊢
48:
CMD "?U7","K7777
"⊢
49:
PRT "ONLY 6940 B
IT"⊢
50:
PRT "14 OFF?"⊢
51:
SPC ⊢
52:
STP ⊢
53:
CMD "?U7","M7777
"⊢
54:
PRT "ONLY 6940 B
IT"⊢
55:
PRT "13 OFF?"⊢
56:
SPC 2⊢
57:
STP ⊢
58:
CMD "?U7","N7777
"⊢
59:
PRT "ONLY 6940 B
IT"⊢
60:
PRT "12 OFF?"⊢
61:
SPC 2⊢
62:
STP ⊢
63:
11→C;3→A;2→B⊢
64:
"A";7777-2↑B*10↑
A→X⊢
65:
FMT "0",FXD *.0;
WRT 13,X⊢
66:
PRT "ONLY 6940 B
IT"⊢
67:
PRT C,"OFF?"⊢
68:
SPC 2⊢
69:
STP ⊢
70:
B-1→B;IF 0>B;
GTO "B"⊢
71:
C-1→C⊢
72:
GTO "A"⊢
73:
"B";A-1→A;2→B;
IF 0>A;GTO "C"⊢
74:
C-1→C⊢
75:
GTO "A"⊢
76:
"C";CMD "?U7","E
2525"⊢
77:
PRT "ONLY 6940 E
VEN"⊢
78:
PRT "(0,2...)BIT
S ON?"⊢
79:
SPC 2⊢
80:
STP ⊢
81:
CMD "?U7","J5252
"⊢
82:
PRT "ONLY 6940 O
DD"⊢
83:
PRT "BITS ON?"⊢
```


Figure 5-3. (continued) 9820/21A Verification Programs

Data Output (continued)

```
84:
SPC 2↵
85:
STP ↵
86:
CMD "?U7","@0"↵
87:
CMD "?U","07777"
↵
88:
PRT "ALL 6940 DA
TA"↵
89:
PRT "BITS OFF?"↵
90:
SPC 2↵
91:
STP ↵
92:
PRT "WAIT"↵
93:
SPC 3↵
94:
CMD "?U7","07777
"↵
95:
CFG 1↵
96:
"E";0→A↵
97:
"F";WTB 13,A↵
98:
IF A=47;GTO "G"↵
99:
A+1→A↵
100:
GTO "F"↵
101:
"G";56→A↵
102:
"H";WTB 13,A↵
103:
IF A=62;GTO "I"↵
104:
A+1→A↵
105:
GTO "H"↵
106:
"I";80→A↵
107:
"J";WTB 13,A↵
108:
IF A=83;GTO "L"↵
109:
IF A=86;A+1→A;
GTO "L"↵
110:
IF A=89;GTO "L"↵
111:
IF A=94;GTO "L"↵
112:
IF A>127;GTO "M"
↵
113:
A+1→A↵
114:
GTO "J"↵
115:
"L";A+2→A↵
116:
GTO "J"↵
117:
"M";IF FLG 1=1;
GTO "N"↵
118:
PRT "ALL 6940 DA
TA"↵
119:
PRT "BITS ON?"↵
120:
SPC 2↵
121:
STP ↵
122:
PRT "WAIT"↵
123:
SPC 3↵
124:
SFG 1↵
125:
CMD "?U7","@"↵
126:
GTO "E"↵
127:
"N";PRT "ALL 694
0 DATA"↵
128:
PRT "BITS OFF?"↵
129:
SPC 2↵
130:
STP ↵
131:
PRT "DATA OUTPUT
 O.K"↵
132:
PRT "CHECK GATE/
"↵
133:
PRT "FLAG";SPC 8
↵
134:
END ↵
R199
```

Gate/Flag Verification

```
0:
PRT "GATE/FLAG"↵
1:
PRT "VERIFICATIO
N"↵
2:
PRT "FOLLOW PRIN
TER"↵
3:
PRT "INSTRUCTION
S."↵
4:
SPC 2↵
5:
PRT "TURN 6940 O
FF.";PRT "TURN 5
9500"↵
6:
PRT "OFF THEN ON
.";PRT "TURN 694
0 ON.(R)"↵
7:
SPC 2↵
8:
STP ↵
9:
CMD "?U7","00020
T@T"↵
10:
PRT "59500 GATE
ON;";PRT "FLAG O
FF?"↵
11:
STP ;SPC 2↵
12:
PRT "6940 LOAD O
UTPUT";PRT "LITE
 ON?";STP ;SPC 2
↵
13:
FMT Z,"X";WRT 13
↵
14:
PRT "59500 GATE
OFF?";PRT "6940
LOAD";PRT "OUTPU
T OFF?";SPC 2;
STP ↵
15:
PRT "PUT 6940 IN
";PRT "LOCAL MOD
E(R)";SPC 2;STP
↵
16:
CMD "?U7","@T"↵
17:
PRT "59500 GATE
ON?";SPC 2;STP ↵
```

Figure 5-3. (continued) 9820/21A Verification Programs

```
18:
PRT "PUSH AND HO
LD";PRT "6940'RE
T DATA'(R)";SPC
2;STP ⊢
19:
PRT "59500 GATE
OFF,";PRT "FLAG
ON?";SPC 2;STP ⊢
20:
PRT "RELEASE";
PRT "'RET DATA'(
R)";SPC 2;STP ⊢
21:
PRT "59500 FLAG
OFF?";SPC 2;STP
⊢
22:
PRT "GATE/FLAG O
.K."⊢
23:
PRT "CHECK DATA
INPUT";SPC 8⊢
24:
END ⊢
R335
```

Data Input Verification

```
0:
PRT "DATA INPUT"
⊢
1:
PRT "VERIFICATIO
N"⊢
2:
PRT "FOLLOW PRIN
TER"⊢
3:
PRT "INSTRUCTION
S."⊢
4:
SPC 2⊢
5:
PRT "TURN 6940 O
FF."⊢
6:
PRT "TURN 59500"
⊢
7:
PRT "OFF THEN ON
."⊢
8:
PRT "TURN 6940 O
N.(R)"⊢
9:
SPC 2⊢
10:
STP ⊢
11:
CMD "?U7","OT@"⊢
12:
PRT "PUT 6940 IN
 LOC."⊢
13:
PRT "WHEN ENTER"
⊢
14:
PRT "DATA! APPEA
RS"⊢
15:
PRT "INPUT DATA"
⊢
16:
PRT "FROM 6940-"
⊢
17:
PRT "1.SET BITS"
⊢
18:
PRT " 15,11-0,"⊢
19:
PRT "2.PUSH 6940
"⊢
20:
PRT " 'RETURN DA
TA',"⊢
21:
PRT "3.DEPRESS C
ALC."⊢
22:
PRT " 'RUN PROGR
AM',"⊢
23:
PRT "4.CHECK PRI
NTER"⊢
24:
PRT "A.IF INPUT
O.K."⊢
25:
PRT " GO TO STEP
 5"⊢
26:
PRT "B.IF INPUT
N.G."⊢
27:
PRT "FIX PROBLEM
"⊢
28:
PRT "5.A.TO INPU
T"⊢
29:
PRT " MORE DATA,
"⊢
30:
PRT "PRESS'RUN P
RGRM'"⊢
31:
PRT "B.TO CONTIN
UE"⊢
32:
PRT "INPUT TEST"
⊢
33:
PRT "PRESS 'GO T
O 45'"⊢
34:
PRT "THEN'RUN PR
GRM'"⊢
35:
SPC 8⊢
36:
"B";PRT "ENTER D
ATA!"⊢
37:
SPC 2⊢
38:
STP ⊢
39:
CMD "?W5"⊢
40:
FMT FXD 5.0;RED
13,A⊢
41:
PRT A⊢
42:
SPC 2⊢
43:
STP ⊢
44:
GTO "B"⊢
45:
"A";PRT "SET 694
0 DATA"⊢
46:
PRT "TO 7777,"⊢
47:
PRT "PUSH'RET DA
TA',"⊢
48:
PRT "THEN'RUN PR
GRM'"⊢
49:
SPC 2⊢
50:
STP ⊢
51:
CMD "?W5"⊢
52:
FMT FXD 5.0;RED
13,A⊢
53:
PRT "WHEN CHANGE
"⊢
```

Figure 5-3. (continued) 9820/21A Verification Programs

Data Input (continued)

```
54:
PRT "DATA! APPEA
RS-"⊢
55:
PRT "1.SET 6940
BITS"⊢
56:
PRT "11-0,"⊢
57:
PRT "2.DON'T PRE
SS"⊢
58:
PRT "'RET DATA'"
⊢
59:
PRT "3.PRESS'RUN
 PRG'"⊢
60:
PRT "4.CHANGE DA
TA"⊢
61:
PRT "AS DESIRED"
⊢
62:
PRT "TO END TEST
-"⊢
63:
PRT "PRESS'GOTO
78'"⊢
64:
PRT "THEN'RUN PR
GRM'"⊢
65:
SPC 8⊢
66:
"C";PRT "CHANGE
DATA!"⊢
67:
SPC 2⊢
68:
STP ⊢
69:
CMD "?W5"⊢
70:
FMT FXD 5.0;RED
13,B⊢
71:
IF A≠B;GTO "F"⊢
72:
GTO "C"⊢
73:
"F";PRT "TEST AB
ORTED!";PRT "INP
UT CHANGED TO";
PRT B⊢
74:
PRT "DID YOU PUS
H"⊢
75:
PRT "'RET DATA'?
"⊢
76:
PRT "OR.CHANGE B
IT 15?"⊢
77:
SPC 2;GTO "E"⊢
78:
"D";PRT "DATA IN
PUT O.K."⊢
79:
PRT "CHECK SERIA
L POLL";SPC 8⊢
80:
"E";END ⊢
R257
```

Serial Poll Mode Verification

```
0:
PRT "SERIAL POLL
","VERIFICATION"
⊢
1:
PRT "FOLLOW PRIN
TER","INSTRUCTIO
NS."⊢
2:
SPC 3⊢
3:
PRT "TURN 59500"
,"OFF THEN ON(R)
"⊢
4:
SPC 2⊢
5:
STP ⊢
6:
CMD "?U7","00020
T"⊢
7:
PRT "59500 SERVI
CE","REQUEST ON?
";SPC 2;STP ⊢
8:
IF (RDS 13=0)+(
RDS 13=1);GTO "X
"⊢
9:
PRT "59500 SRQ",
"MALFUNCTION"⊢
10:
"A";GTO "FIN"⊢
11:
"X";CMD "?→5%"⊢
12:
CMD "W";RDB 13→R
2⊢
13:
IF R2=64;GTO "GO
OD"⊢
14:
PRT "STATUS BYTE
","ERRROR","BIT
7 OFF."⊢
15:
SPC 2;GTO "FIN"⊢
16:
"GOOD";PRT "TALK
 AND","SERIAL PO
LL ON,","SERVICE
 REQ.OFF?";SPC 2
;STP ⊢
17:
CMD "?→%"⊢
18:
PRT "SERIAL POLL
 OFF?";SPC 2;
STP ⊢
19:
CMD "?→5%";CMD "
W";RDB 13→R2⊢
20:
IF R2≠64;GTO "K"
⊢
21:
PRT "STATUS BYTE
","ERRROR","BIT
7 ON";SPC 2;GTO
"FIN"⊢
22:
"K";CMD "?U7","0
0020T"⊢
23:
PRT "DEPRESS 'ST
OP'","'RUN PROGR
AM'";SPC 2;STP ⊢
24:
PRT "SERVICE REQ
. ON?";SPC 2;
STP ⊢
25:
PRT "SERIAL POLL
 O.K.","TEST COM
PLETE.";SPC 8⊢
26:
"FIN";END ⊢
R324
```

Figure 5-3. (continued) 9820/21A Verification Programs

5-29 TROUBLESHOOTING

5-30 The troubleshooting procedures are directly related to the verification programs provided in Figures 5-2 and 5-3. Troubleshooting flow charts for the listen, talk, data output, gate/flag, data input, and serial poll verification programs are given in Figures 5-4 through 5-9 respectively. Each flow chart repeats the test inquiry messages of the corresponding verification program. If the expected test results are not obtained as indicated by the 59500A/6940B indicators, the flow chart directs the user to a troubleshooting procedure which will isolate a hardware malfunction. The listen and talk mode troubleshooting procedures isolate a malfunction to components within the 59500A unit. Since the 6940B is involved in the data output, gate/flag, data input, and serial poll verification programs, the corresponding flow chart will isolate a malfunction to the 59500A at the component level or to the 6940B at the unit level. Troubleshooting procedures for the 6940B unit are provided in Operating and Service Manual HP Part No. 06940-90005.

5-31 Additional troubleshooting procedures are provided for the 59500A's power supply (Table 5-2) and for the acceptor and source 3-wire handshake circuits (Figures 5-10 and 5-11, respectively). These troubleshooting procedures supplement the troubleshooting flow charts given in Figures 5-4 through 5-9.

NOTE

Before connecting the test setup, inspect the HP-IB and MULTIPROGRAMMER connectors and cables for damage (broken or bent pins, etc.)

5-32 Test Setup

5-33 The test setup shown in Figure 5-1 is also used for troubleshooting with the following changes:

a. Remove top cover from 59500A to gain access to boards A1 and A2.

b. Open hinged front panel of 6940B and connect logic probe to connector located on card cage.

c. Apply power to the system in the following sequence:

1. Turn on calculator (and printer if applicable).
2. Set 6940B to LOCAL then turn power on.
3. Turn on 59500A.
4. Switch 6940B to REMOTE.

d. Perform applicable troubleshooting procedure:
Figure 5-4: Listen Mode Troubleshooting
Figure 5-5: Talk Mode Troubleshooting
Figure 5-6: Data Output Troubleshooting
Figure 5-7: Gate/Flag Troubleshooting
Figure 5-8: Data Input Troubleshooting
Figure 5-9: Serial Poll Troubleshooting

e. If specified by the particular troubleshooting procedure, connect the HP-IB test card (see Paragraph 5-34) to J1 on rear of 59500A as shown in Figure 5-1. The test card is connected to J1 in piggyback fashion with calculator connector.

5-34 HP-IB Test Card

5-35 The HP-IB test card (HP 59405-66503) is included with the HP 59405 HP-IB calculator interface kit and is useful in troubleshooting the 59500A because it allows manual control of the 3-wire handshake cycle. The test card is used when performing the data input, serial poll, acceptor handshake, and source handshake troubleshooting procedures (Figures 5-8 through 5-11, respectively). Use of the card is described in the applicable procedure. The card is especially useful when performing the data input (59500/6940-to-calculator) troubleshooting procedures because it allows one character at a time to be enabled and checked.

5-36 Handshake Circuit Timing

5-37 Figures 5-10 and 5-11 provide static checks of the acceptor and source handshake circuits. However, it is possible to have a condition where a faulty circuit would not be detected by performing these checks. If a timing problem is suspected, the handshake circuits must be checked dynamically. A dynamic test can be made by looping the appropriate program to continually repeat the cycle while observing the handshake signals on a multi-channel oscilloscope. The handshake cycle timing relationships are described and shown (Figures 4-1 through 4-3) in Section IV. Programs which can be used to continually recycle the handshake circuits are similar to those provided with the troubleshooting procedures.

5-38 REMOVAL AND REPLACEMENT

5-39 Main Board Assembly A2

5-40 When replacing components on board A2, perform the following steps to gain access to bottom side of board.

a. Remove 6 screws securing top cover. Slide top cover to the rear and remove.

b. Remove 12 screws securing A2 board to chassis.

c. Remove 3 screws on rear of unit securing connector bracket to chassis.

d. Move board A2 (with connector bracket attached) forward and turn over to gain access to bottom side of board.

e. To completely free the A2 board from the front panel, remove the wires from terminal block A2TB1. Refer to wire list below when replacing wires. Note that terminals are numbered 1 through 9 (right to left from front of unit).

Terminal No.	Wire Color	Function
A2TB1 –1	BLK	+5V COMMON
–2	RED	+5V
–3	BLK/RED/WHT	+5V (DS1-DS6 Indicators)
–4	BRN/BLK/WHT	TALK (DS2)
–5	GRN/BLK/WHT	LISTEN (DS1)
–6	YEL/BRN/WHT	SERVICE REQUEST (DS3)
–7	RED/BRN/WHT	SERIAL POLL (DS4)
–8	YEL/BLU/WHT	FLAG (DS6)
–9	YEL/ORN/WHT	GATE (DS5)

5-41 Power Supply Board A1

5-42 Components on board A1 are accessible for replacement when the bottom cover is removed. Note that SCR A1CR1 and voltage regulator A1U2 are mounted on the chassis assembly (above board A1). The remaining power supply components, transformer T1 and rectifier U1, are accessible when the top cover is removed.

Table 5-2. Power Supply Troubleshooting

Step No.	Trouble	Probable Cause	Isolation Procedure	Normal Indication	If Indication Is Abnormal
1	LINE indicator fails to light when LINE switch is on.	a. Primary ac power not connected.	a. Check that power cord is connected to ac source, fuse F1 is installed, and the voltage select PC card matches the ac source (See Paragraph 2-17).	– –	– –
		b. Defective LINE indicator (DS7).	b. Replace DS7.	– –	– –
		c. Fuse F1 open.	c. Set LINE switch to OFF, replace fuse F1 and set LINE switch to ON again.	c. LINE indicator lights.	c. Check if F1 has blown. If it has, set LINE switch to OFF and check that proper fuse is installed (.5A for 100/120Vac, or .25A for 220/240Vac). If proper selection was made, check for short circuit: power module, power transformer T1, rectifier U1, or A1 board (A1U2, C1, or C2).
2	LINE indicator ON, but +5V regulated output is at OV.	a. Defective power transformer or power module.	a. Measure voltage across ac input to full-wave bridge rectifier U1.	a. Approx. 10Vac.	a. Transformer T1 or power module defective.
		b. Full-wave bridge rectifier U1 defective.	b. Measure voltage across + and – output terminals of U1.	b. Approx. 11Vdc.	b. Full-wave bridge rectifier U1 defective.

Table 5-2. Power Supply Troubleshooting (continued)

Step No.	Trouble	Probable Cause	Isolation Procedure	Normal Indication	If Indication Is Abnormal
2 (cont.)		c. Shorted component on power supply board A1 or main board assembly A2.	c. Set LINE switch OFF. Remove red wire (+5V) connecting power supply output to A2TB1-2. Set LINE switch ON and measure voltage between red wire (+5V) and common black wire (A2TB1-1).	c. +5V	c. If +5V is measured, check for a shorted component or track on the A2 board. If OV is measured, see probable cause 2d.
		d. Crowbar SCR (A1CR1) shorted.	d. Set LINE switch OFF. Measure the resistance between red and black wires. Connect positive meter lead to red wire and meter common to black wire.	d. High impedance > 10K.	d. Open connection at anode of A1CR1 and measure resistance between red and black wires. If short circuit is cleared, replace A1CR1. If short circuit still exists, check A1C3 and A1U2, (pin 2) for short to ground.
		e. Crowbar or linear voltage regulator circuit defective.	e. Set LINE switch OFF. Restore the A1CR1 anode connection. Open A1CR1 gate connections. Set LINE switch ON and measure +5V output.	e. +5V	e. If +5V measured, check crowbar circuit (A1CR1, Q1, VR1). If +5V is not measured, replace A1U2.

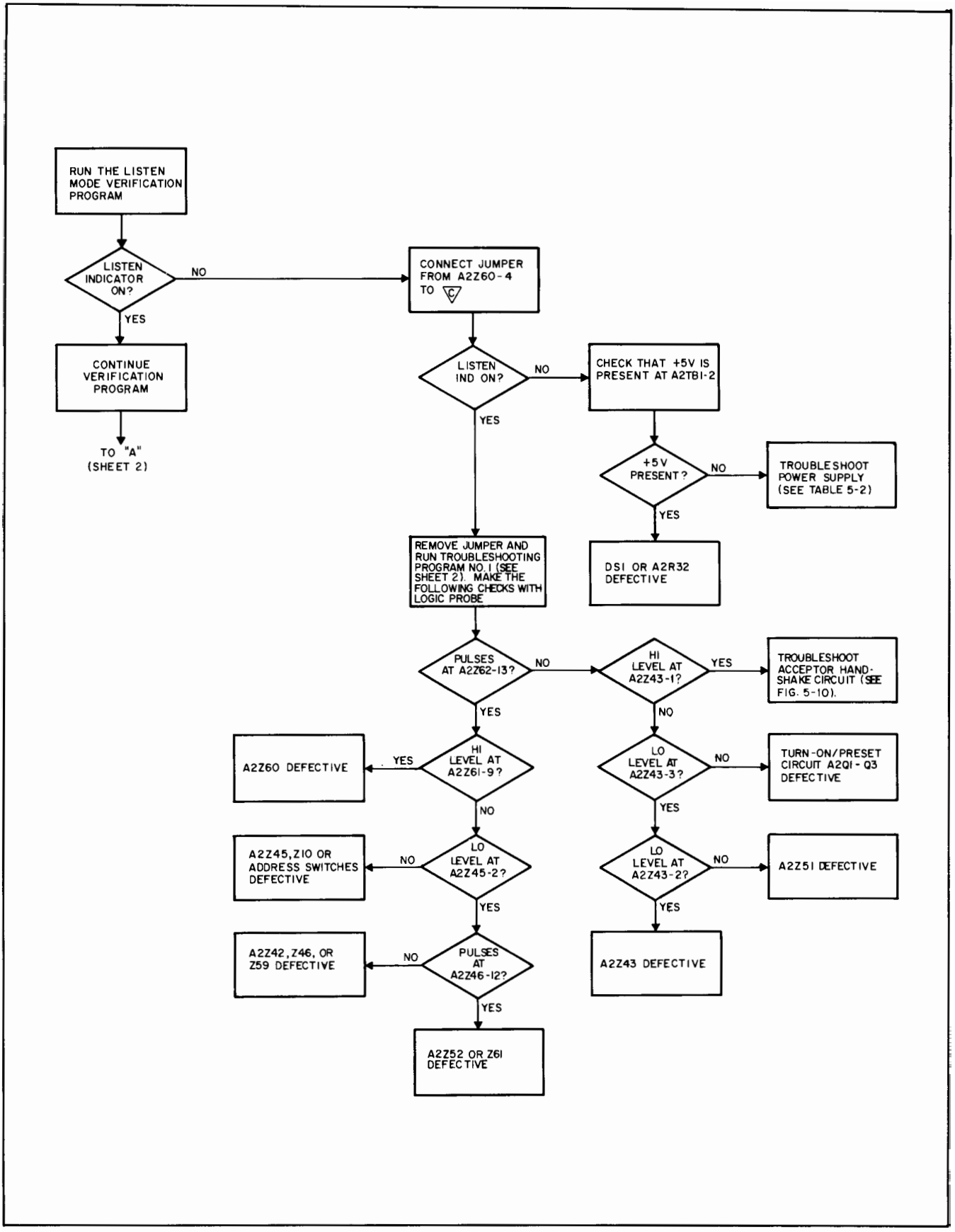
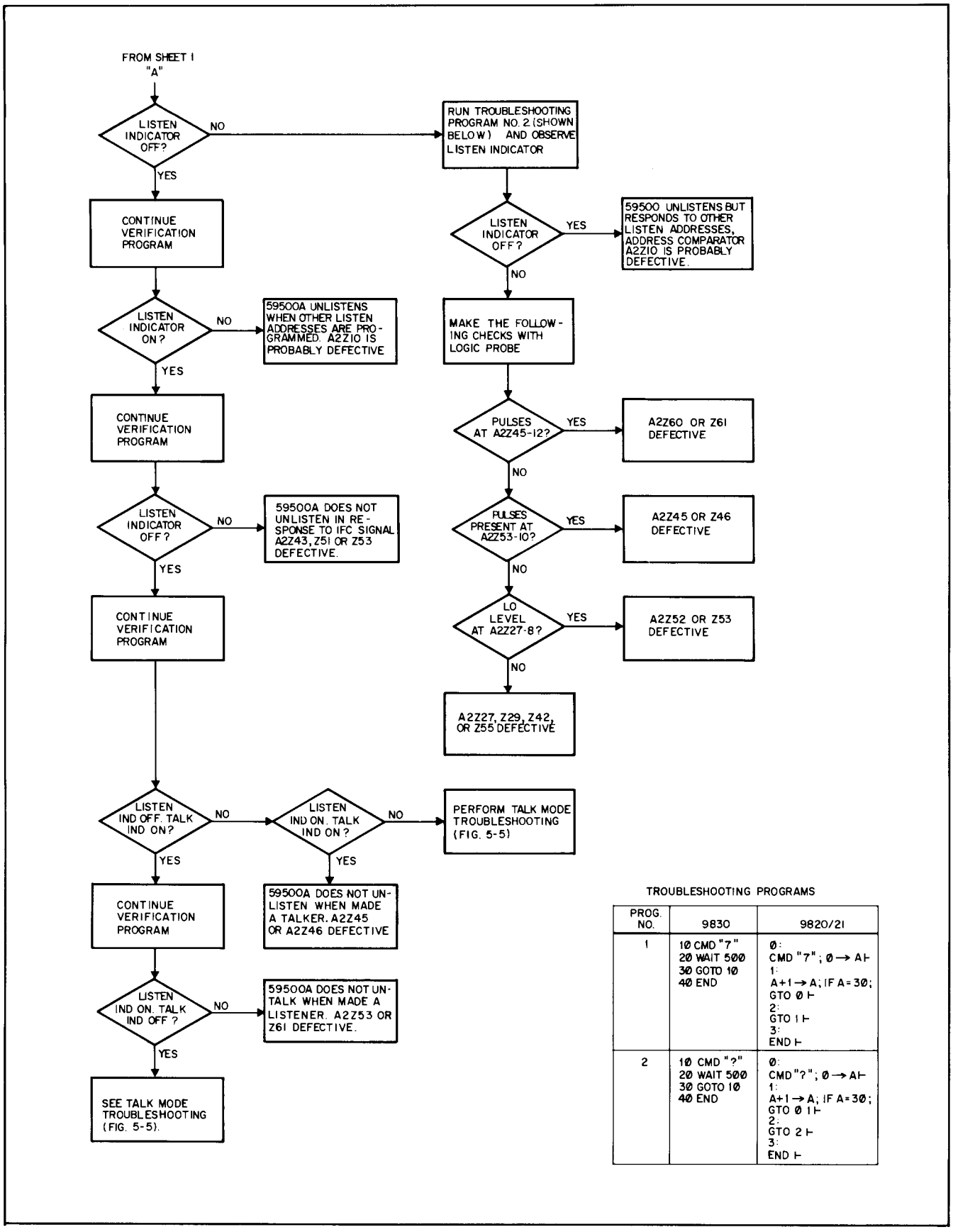


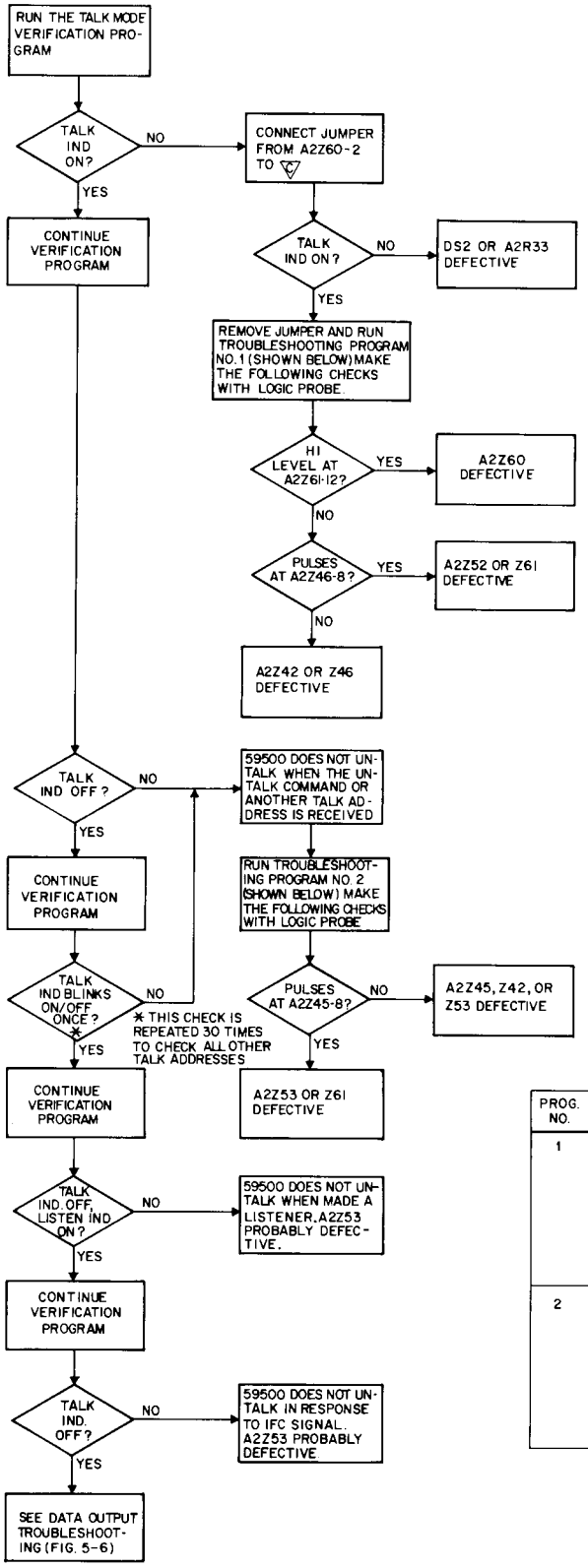
Figure 5-4 (Sheet 1). Listen Mode Troubleshooting



TROUBLESHOOTING PROGRAMS

PROG. NO.	9830	9820/21
1	10 CMD "7" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "7"; 0 → A⊢ 1: A+1 → A; IF A=30; GTO 0 ⊢ 2: GTO 1 ⊢ 3: END ⊢
2	10 CMD "?" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "?"; 0 → A⊢ 1: A+1 → A; IF A=30; GTO 0 1⊢ 2: GTO 2 ⊢ 3: END ⊢

Figure 5-4 (Sheet 2). Listen Mode Troubleshooting



TROUBLESHOOTING PROGRAMS

PROG. NO.	9830	9820/9821
1	10 CMD "W" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "W";0 → A⊢ 1: A+1 → A; IF A=30; GTO 0⊢ 2: GTO 1⊢ 3: END ⊢
2	10 CMD"-" 20 WAIT 500 30 GOTO 10 40 END	0 CMD "→"; 0 → A⊢ 1: A+1 → A; IF A=30; GTO 0⊢ 2: GTO 1⊢ 3: END ⊢

Figure 5-5. Talk Mode Troubleshooting

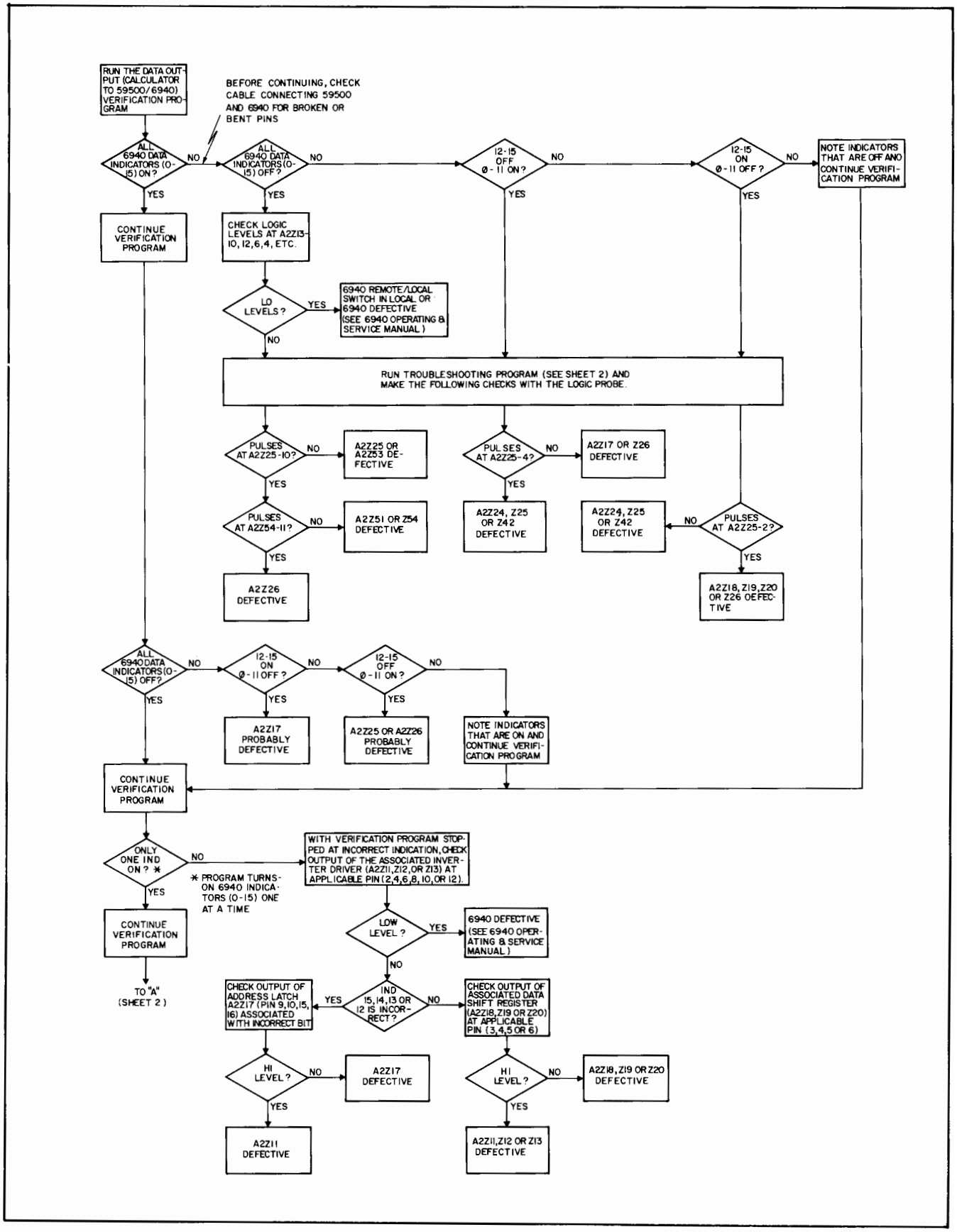
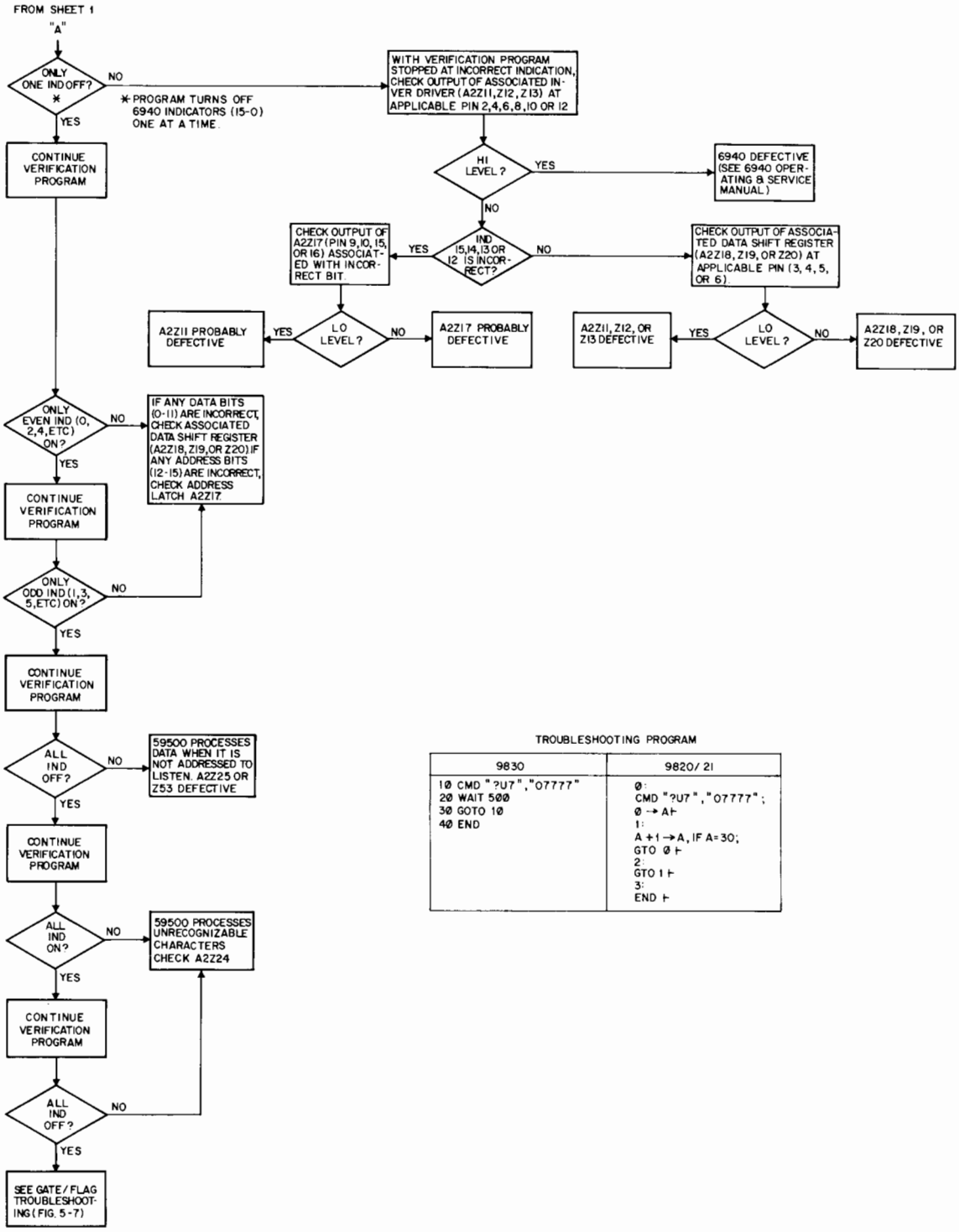


Figure 5-6 (Sheet 1). Data Output (Calculator-to-59500A/6940B) Troubleshooting



TROUBLESHOOTING PROGRAM

9830	9820/21
10 CMD "?U7","07777" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "?U7","07777"; 0 → A⊢ 1: A+1 → A, IF A=30; GTO 0⊢ 2: GTO 1⊢ 3: END⊢

Figure 5-6 (Sheet 2). Data Output (Calculator-to-59500A/6940B) Troubleshooting

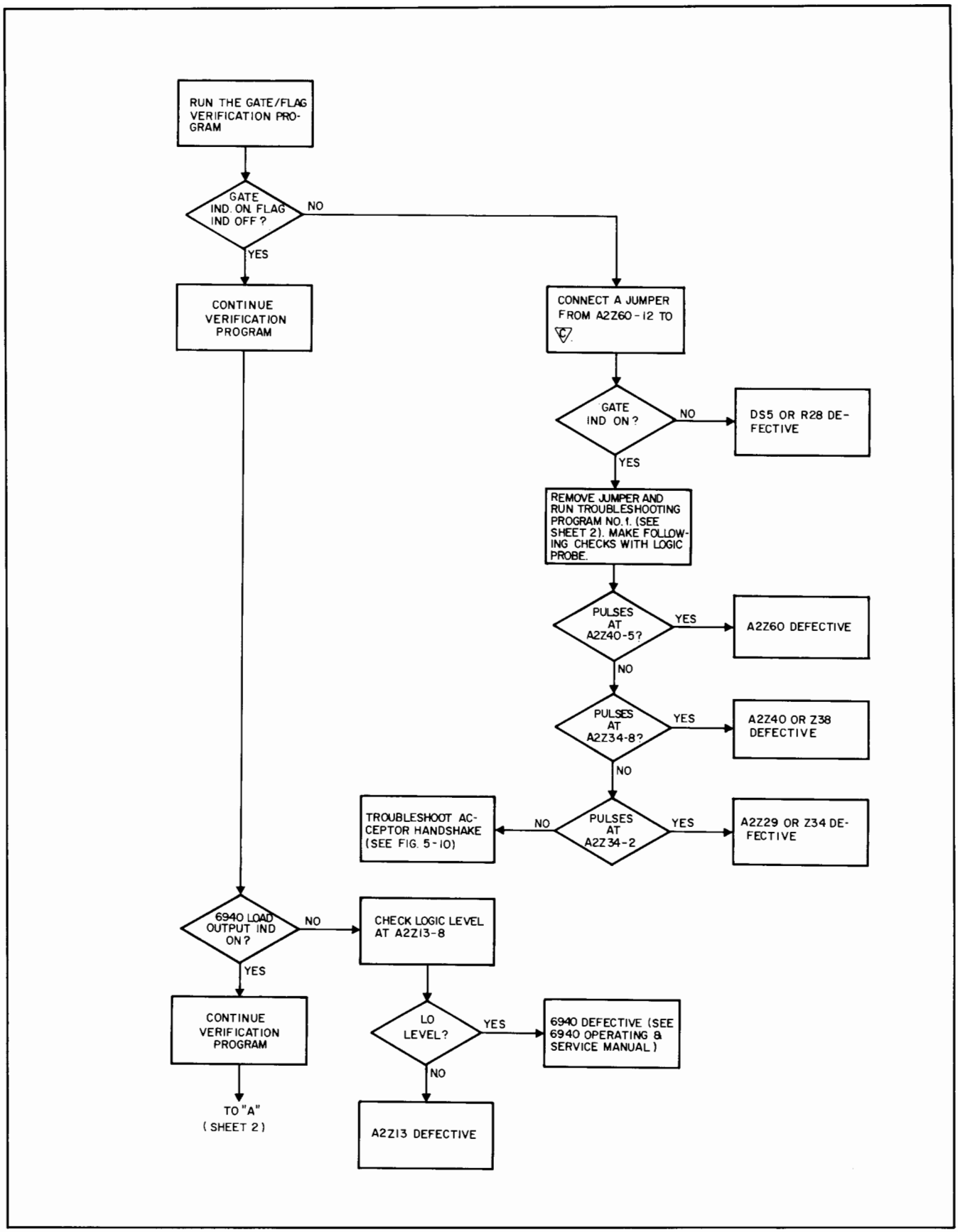
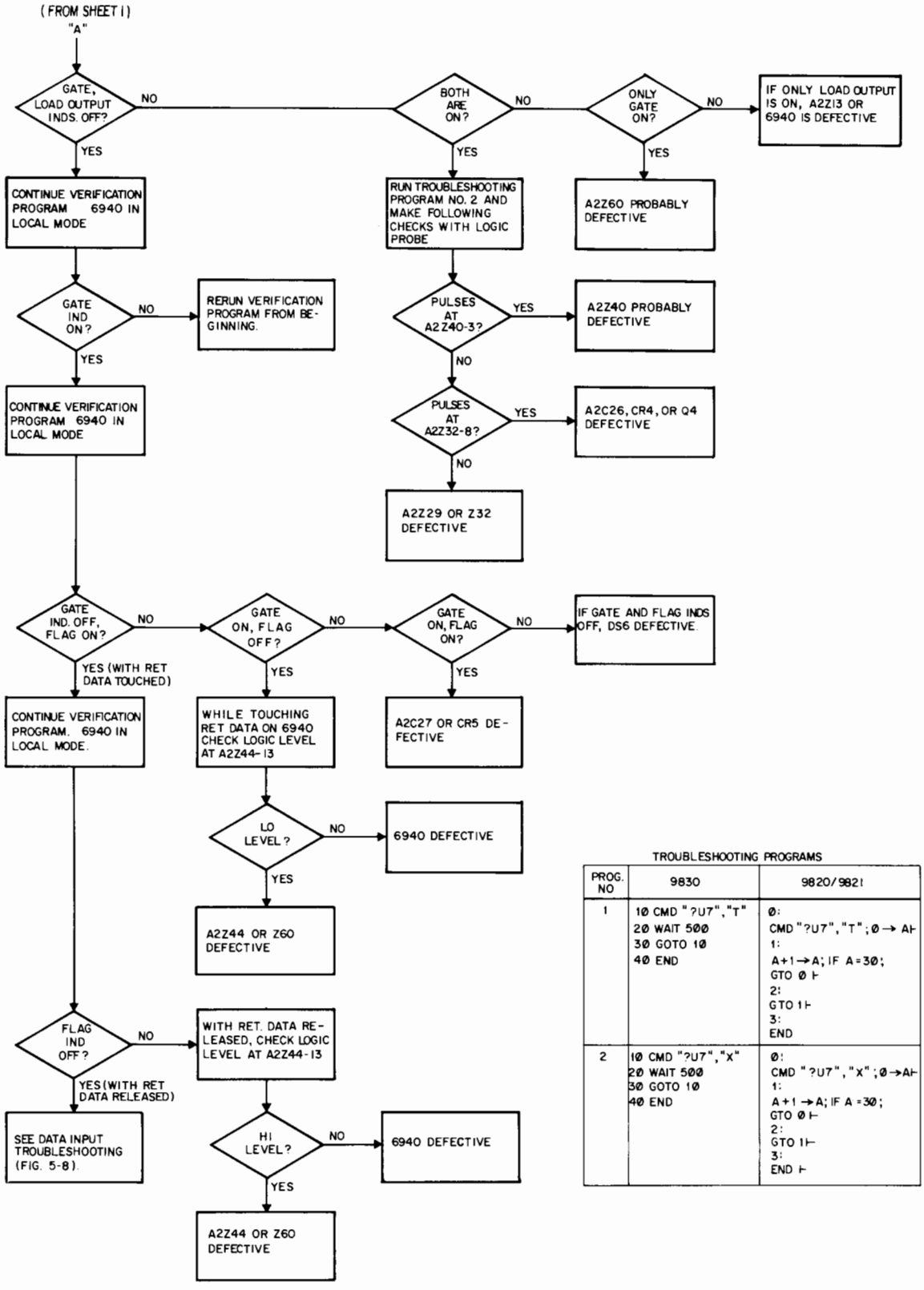


Figure 5-7 (Sheet 1). Gate/Flag Troubleshooting



TROUBLESHOOTING PROGRAMS

PROG. NO	9830	9820/9821
1	10 CMD "?U7","T" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "?U7","T";0→A 1: A+1→A; IF A=30; GTO 0 2: GTO 1 3: END
2	10 CMD "?U7","X" 20 WAIT 500 30 GOTO 10 40 END	0: CMD "?U7","X";0→A 1: A+1→A; IF A=30; GTO 0 2: GTO 1 3: END

Figure 5-7. (Sheet 2). Gate/Flag Troubleshooting

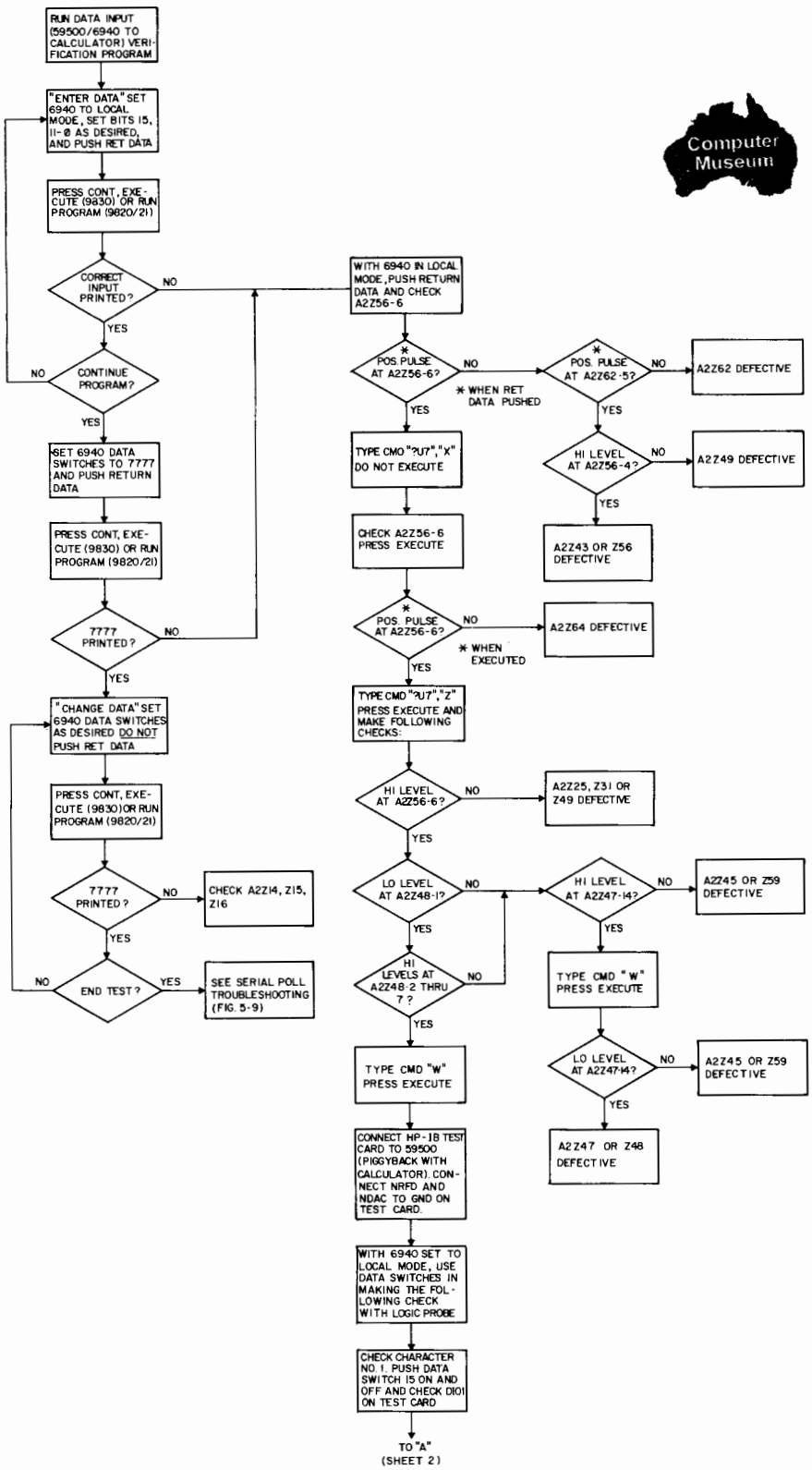


Figure 5-8 (Sheet 1). Data Input (59500A/6940B-to-Calculator) Troubleshooting

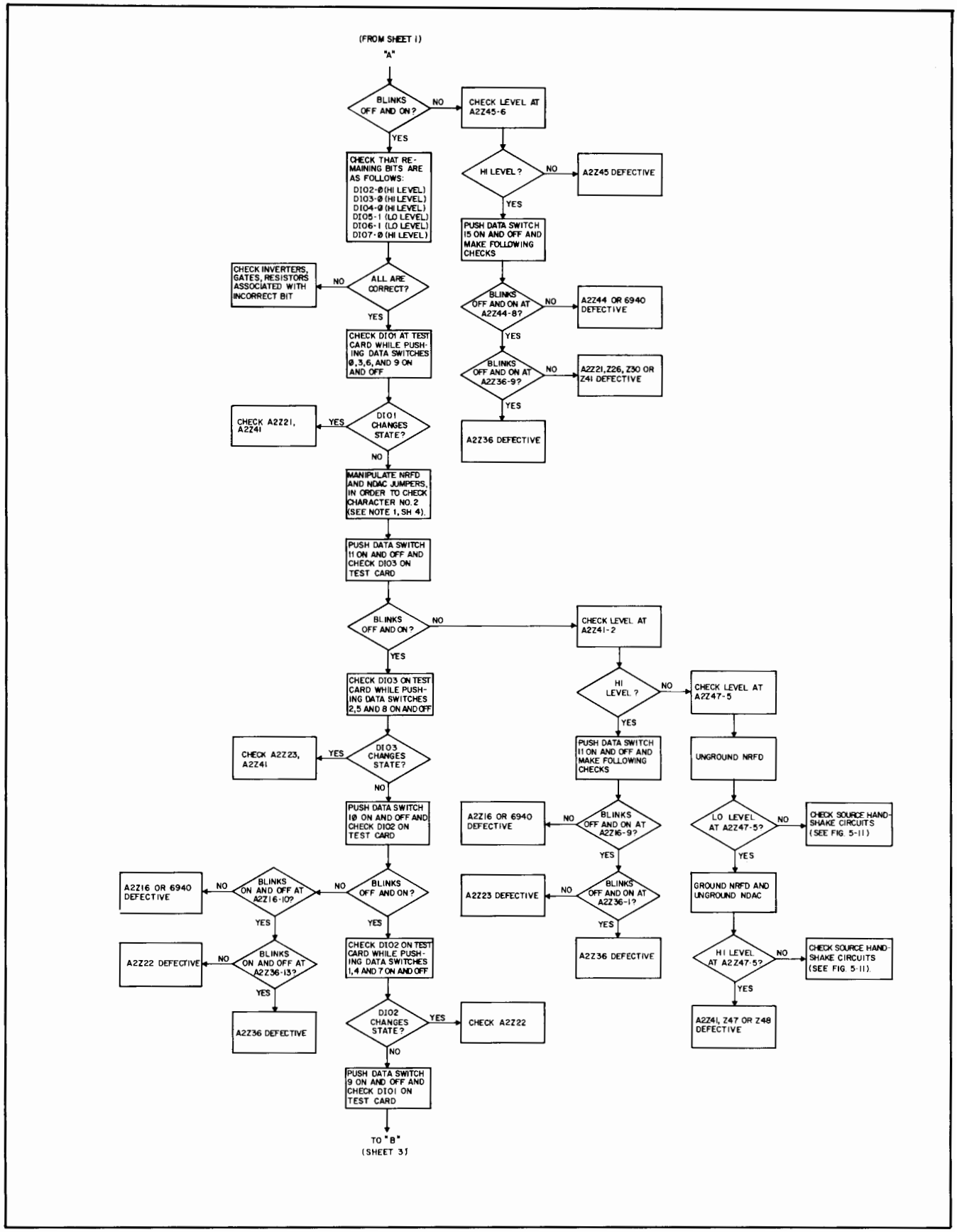


Figure 5-8 (Sheet 2). Data Input (59500A/6940B-to-Calculator) Troubleshooting

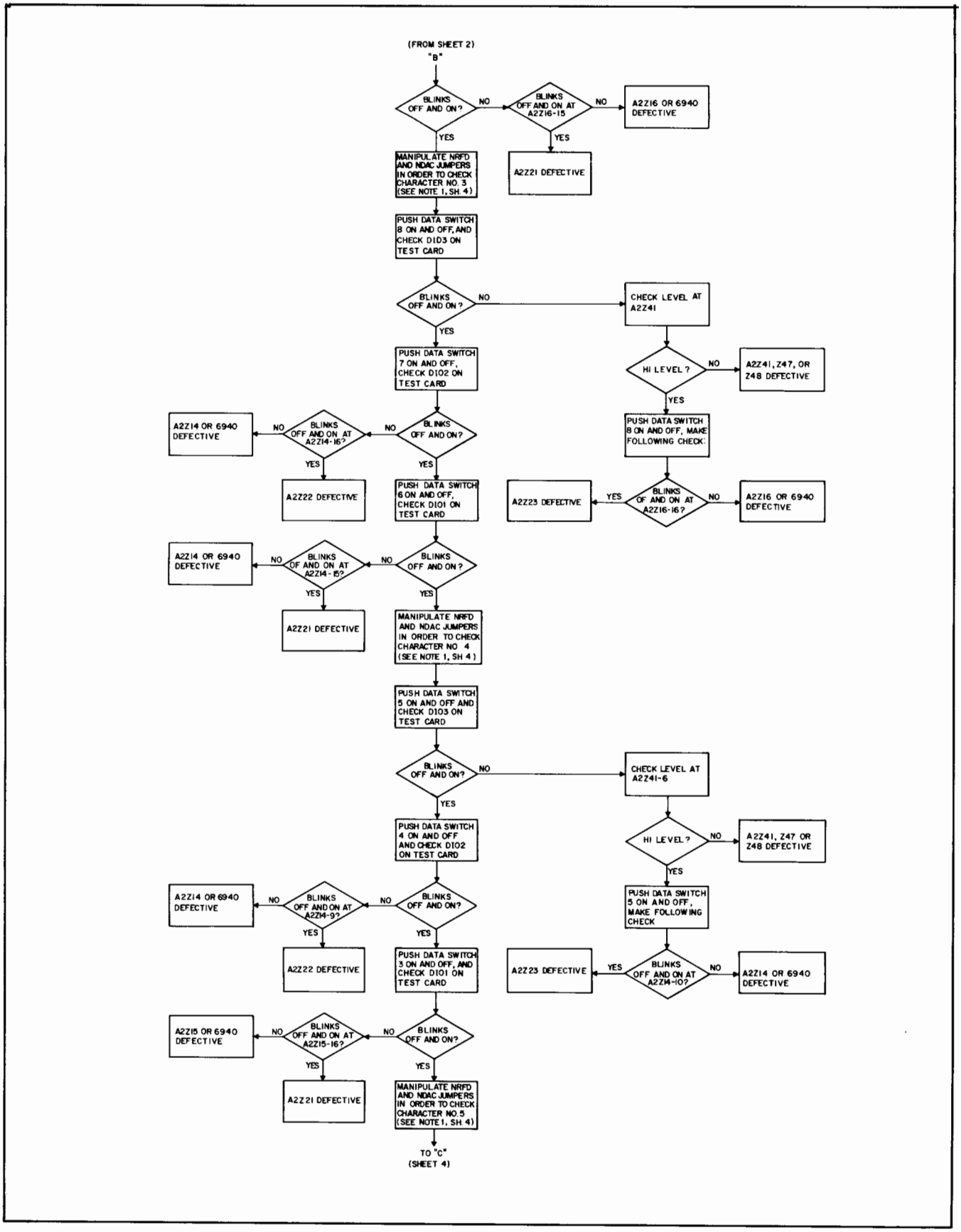


Figure 5-8 (Sheet 3). Data Input (59500A/6940B-to-Calculator) Troubleshooting

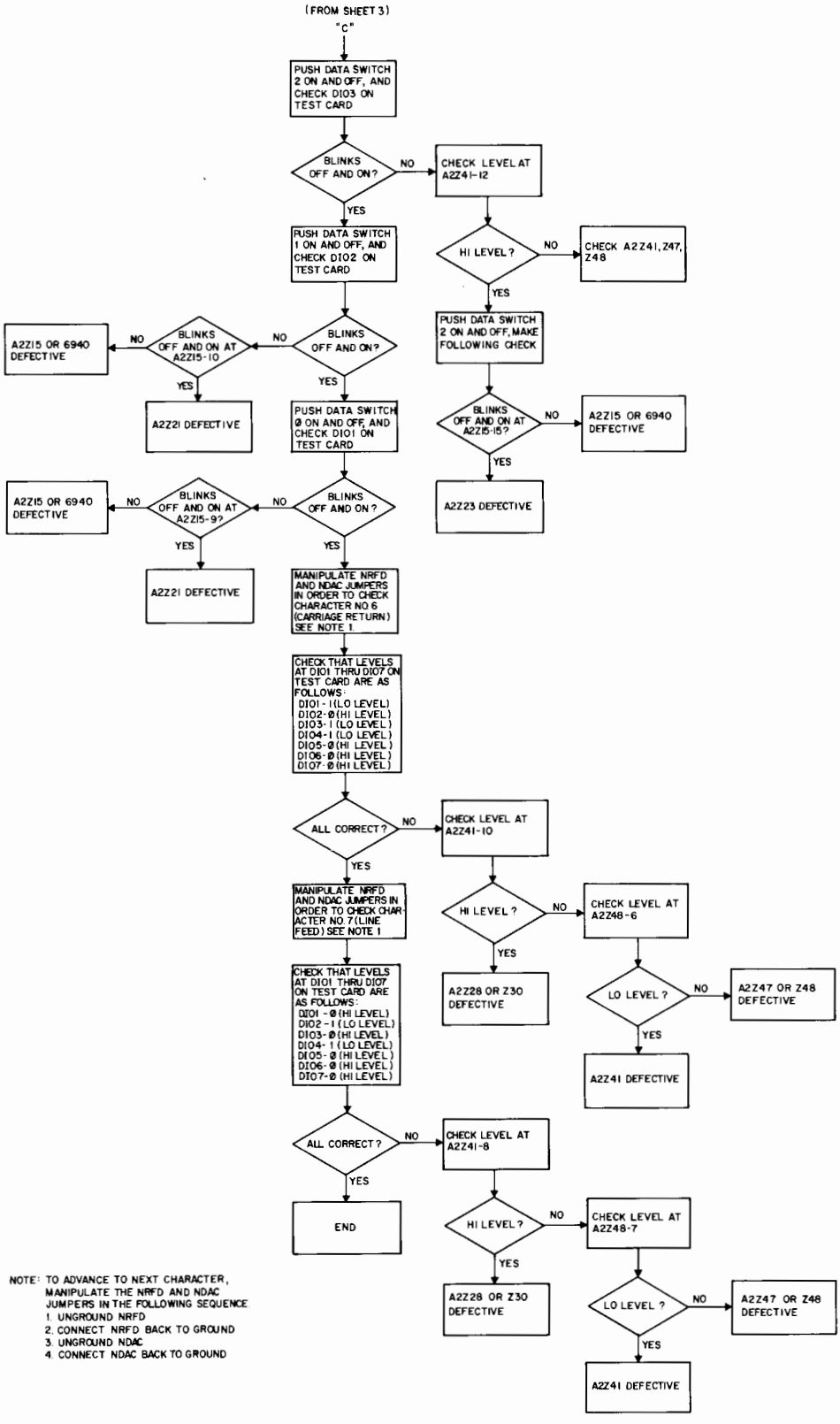


Figure 5-8 (Sheet 4). Data Input (59500A/6940B-to-Calculator) Troubleshooting

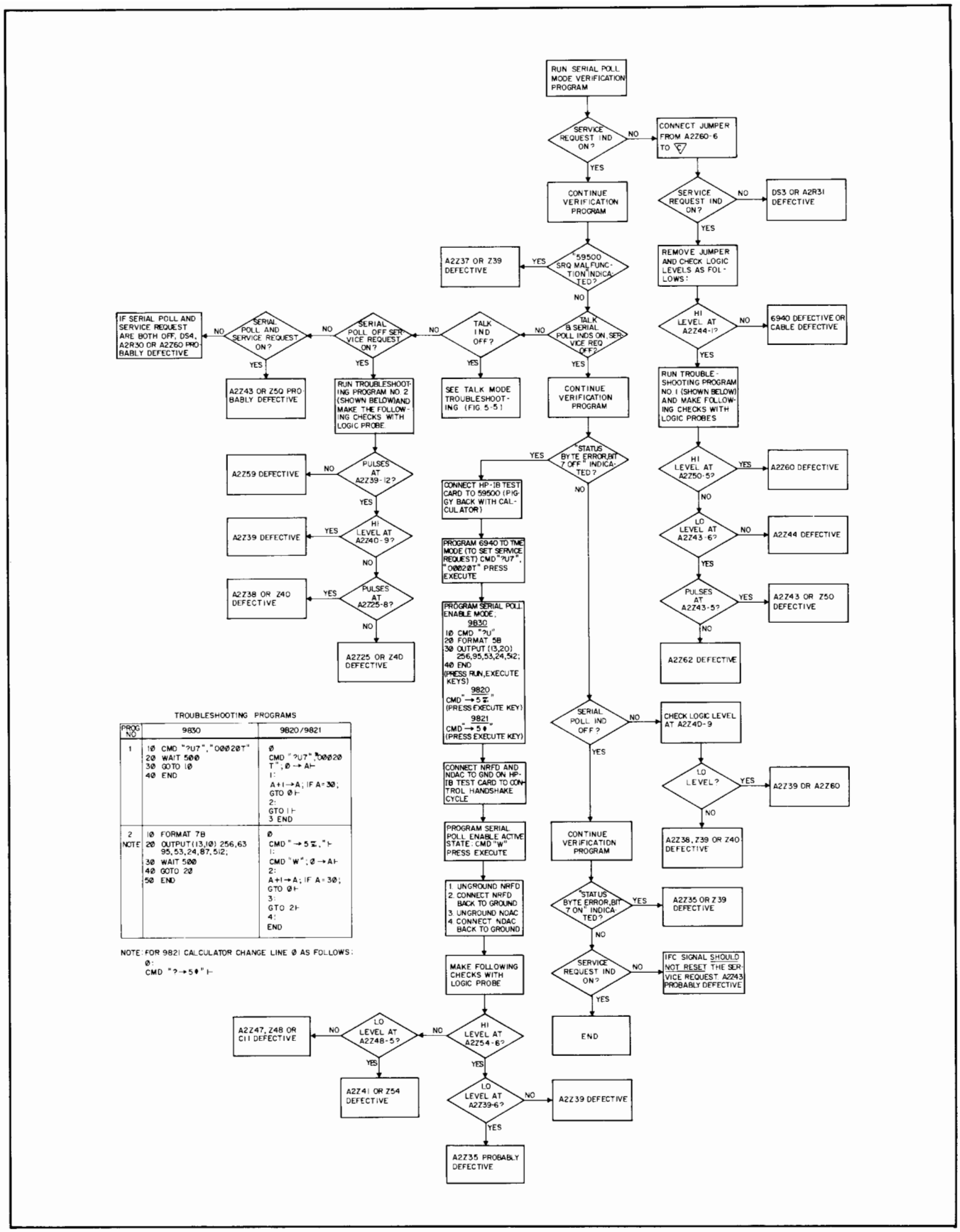


Figure 5-9. Serial Poll Troubleshooting

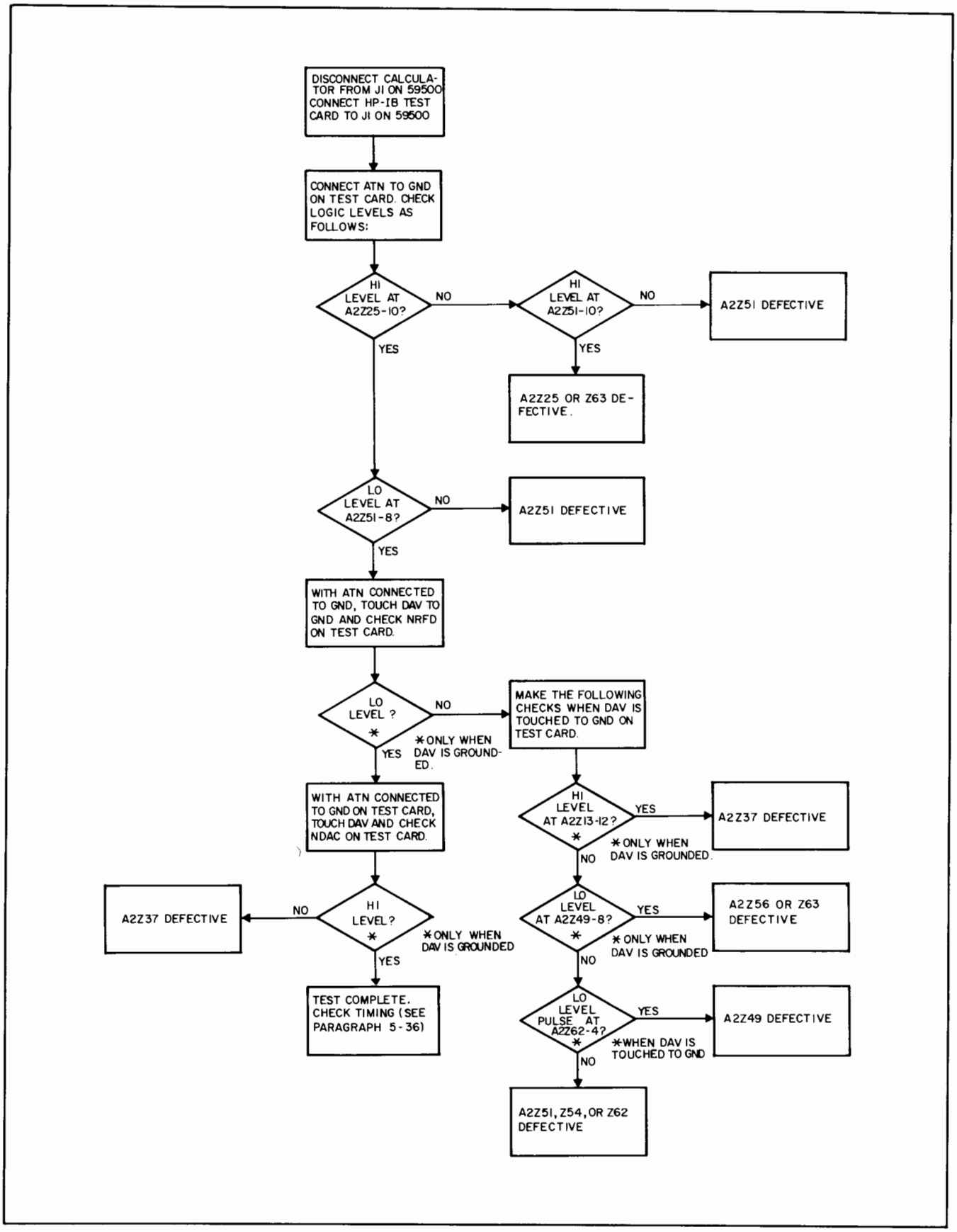


Figure 5-10. Acceptor Handshake Troubleshooting

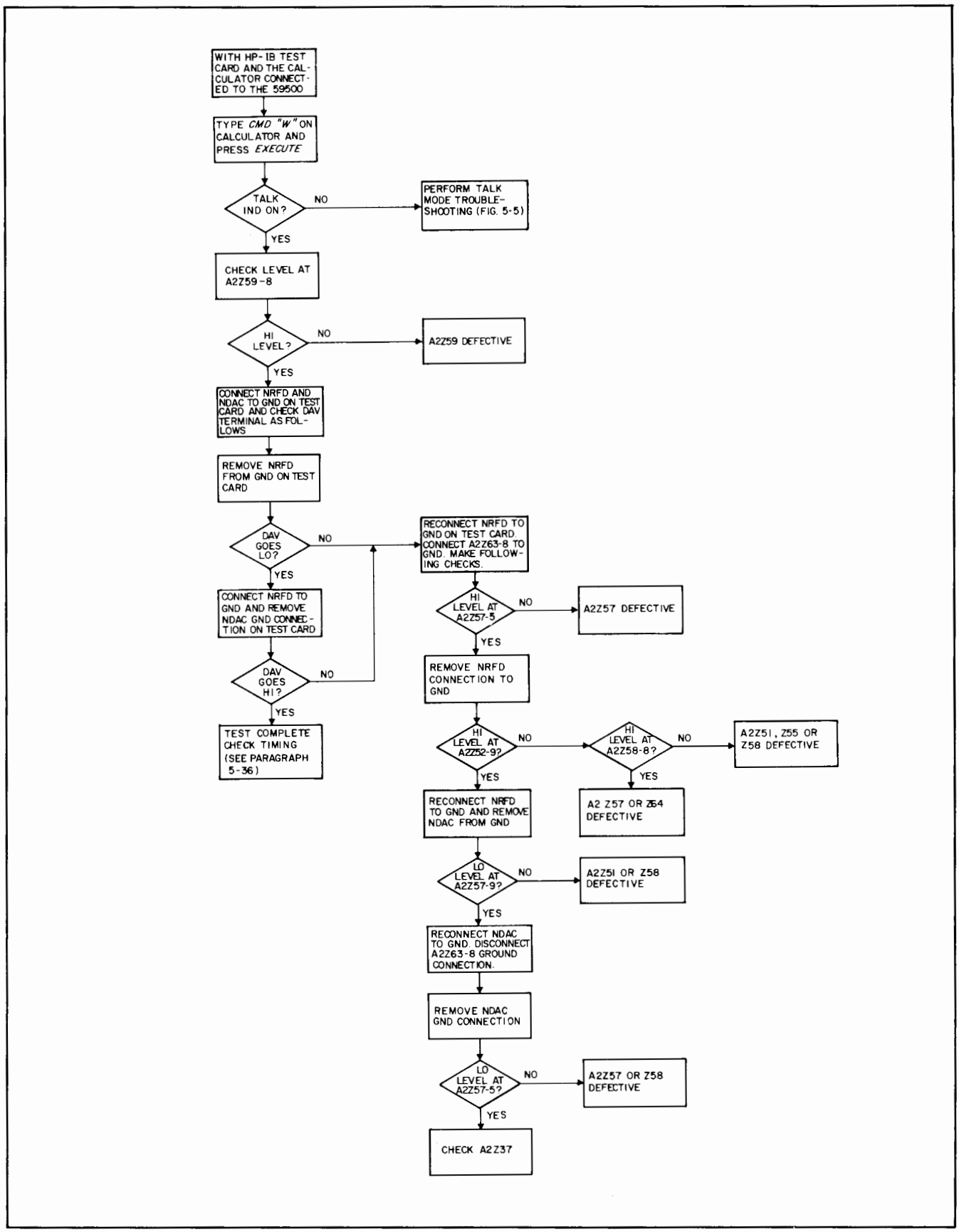


Figure 5-11. Source Handshake Troubleshooting

SECTION VI
REPLACEABLE PARTS

6-1 INTRODUCTION

6-2 This section contains information for ordering replacement parts. Table 6-4 lists parts in alpha-numeric order by reference designators and provides the following information:

a. Reference Designators. Refer to Table 6-1.

b. Description. Refer to Table 6-2 for abreviations.

c. Total Quantity (TQ). Given only the first time the part number is listed except in instruments containing many sub-modular assemblies, in which case the TQ appears the first time the part number is listed in each assembly.

d. Manufacturer's Part Number or Type.

e. Manufacturer's Federal Supply Code Number. Refer to Table 6-3 for manufacturer's name and address.

f. Hewlett-Packard Part Number.

g. Recommended Spare Parts Quantity (RS) for complete maintenance of one instrument during one year of isolated service.

h. Parts not identified by a reference designator are listed at the end of Table 6-4 under Mechanical and/or Miscellaneous. The former consists of parts belonging to and grouped by individual assemblies; the latter consists of all parts not immediately associated with an assembly.

6-3 ORDERING INFORMATION

6-4 To order a replacement part, address order or inquiry to your local Hewlett-Packard sales office (see lists at rear of this manual for addresses). Specify the following information for each part: Model, complete serial number, and any Option or special modification (J) numbers of the instrument; Hewlett-Packard part number; circuit reference designator; and description. To order a part not listed in Table 6-4, give a complete description of the part, its function, and its location.

Table 6-1. Reference Designators

A	= assembly	E	= miscellaneous electronic part
B	= blower (fan)	F	= fuse
C	= capacitor	J	= jack, jumper
CB	= circuit breaker	K	= relay
CR	= diode	L	= inductor
DS	= device, signaling (lamp)	M	= meter

Table 6-1. Reference Designators (Continued)

P	= plug	V	= vacuum tube, neon bulb, photocell, etc.
Q	= transistor	VR	= zener diode
R	= resistor	X	= socket
S	= switch	Z	= integrated circuit or network
T	= transformer		
TB	= terminal block		
TS	= thermal switch		

Table 6-2. Description Abbreviations

A	= ampere	mod.	= modular or modified
ac	= alternating current	mtg	= mounting
assy.	= assembly	n	= nano = 10^{-9}
bd	= board	NC	= normally closed
bkt	= bracket	NO	= normally open
°C	= degree Centigrade	NP	= nickel-plated
cd	= card	Ω	= ohm
coef	= coefficient	obd	= order by description
comp	= composition	OD	= outside diameter
CRT	= cathode-ray tube	p	= pico = 10^{-12}
CT	= center-tapped	P.C.	= printed circuit
dc	= direct current	pot.	= potentiometer
DPDT	= double pole, double throw	p-p	= peak-to-peak
DPST	= double pole, single throw	ppm	= parts per million
elect	= electrolytic	pvr	= peak reverse voltage
encap	= encapsulated	rect	= rectifier
F	= farad	rms	= root mean square
°F	= degree Farenheit	Si	= silicon
fxd	= fixed	SPDT	= single pole, double throw
Ge	= germanium	SPST	= single pole, single throw
H	= Henry	SS	= small signal
Hz	= Hertz	T	= slow-blow
IC	= integrated circuit	tan.	= tantulum
ID	= inside diameter	Ti	= titanium
incnd	= incandescent	V	= volt
k	= kilo = 10^{3}	var	= variable
m	= milli = 10^{-3}	ww	= wirewound
M	= mega = 10^{6}	W	= Watt
μ	= micro = 10^{-6}		
met.	= metal		
mfr	= manufacturer		

Table 6-3. Code List of Manufacturers

CODE	MANUFACTURER	ADDRESS
00629	EBY Sales Co., Inc.	Jamaica, N.Y.
00656	Aerovox Corp.	New Bedford, Mass.
00853	Sangamo Electric Co. S. Carolina Div.	Pickens, S.C.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Ind.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc.	Dallas, Texas
01686	RCL Electronics, Inc.	Manchester, N.H.
01930	Amerock Corp.	Rockford, Ill.
02107	Sparta Mfg. Co.	Dover, Ohio
02114	Ferroxcube Corp.	Saugerties, N.Y.
02606	Fenwal Laboratories	Morton Grove, Ill.
02660	Amphenol Corp.	Broadview, Ill.
02735	Radio Corp. of America, Solid State and Receiving Tube Div.	Somerville, N.J.
03508	G.E. Semiconductor Products Dept.	Syracuse, N.Y.
03797	Eldema Corp.	Compton, Calif.
03877	Transitron Electronic Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
04009	Arrow, Hart and Hegeman Electric Co.	Hartford, Conn.
04072	ADC Electronics, Inc.	Harbor City, Calif.
04213	Caddell & Burns Mfg. Co. Inc.	Mineola, N.Y.
04404	*Hewlett-Packard Co. Palo Alto Div.	Palo Alto, Calif.
04713	Motorola Semiconductor Prod. Inc.	Phoenix, Arizona
05277	Westinghouse Electric Corp. Semiconductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	Grand Junction, Colo.
05820	Wakefield Engr. Inc.	Wakefield, Mass.
06001	General Elect. Co. Electronic Capacitor & Battery Dept.	Irmo, S.C.
06004	Bassik Div. Stewart-Warner Corp.	Bridgeport, Conn.
06486	IRC Div. of TRW Inc. Semiconductor Plant	Lynn, Mass.
06540	Amatom Electronic Hardware Co. Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co.	Penacook, N.H.
06666	General Devices Co.	Indianapolis, Ind.
06751	Semoor Div. Components, Inc.	Phoenix, Arizona
06776	Robinson Nugent, Inc.	New Albany, N.Y.
06812	Torrington Mfg. Co.	Van Nuys, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp.	Elmira, N.Y.
07263	Fairchild Camera and Instrument	Mountain View, Calif.
07387	Birtcher Corp., The	Los Angeles, Calif.
07397	Sylvania Electric Prod. Inc.	Mountainview, Calif.
07716	IRC Div. of TRW Inc.	Burlington, Iowa
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Co. Components Div.	Mountain View, Calif.
08484	Breeze Corporations, Inc.	Union, N.J.
08530	Reliance Mica Corp.	Brooklyn, N.Y.
08717	Sloan Company, The	Sun Valley, Calif.
08730	Vemaline Products Co. Inc.	Wyckoff, N.J.
08806	General Elect. Co. Minature Lamp Dept.	Cleveland, Ohio
08863	Nylomatic Corp.	Norrisville, Pa.
08919	RCH Supply Co.	Vernon, Calif.
09021	Airco Speer Electronic Components	Bradford, Pa.
09182	*Hewlett-Packard Co. New Jersey Div.	Rockaway, N.J.
09213	General Elect. Co. Semiconductor Prod. Dept.	Buffalo, N.Y.
09214	General Elect. Co. Semiconductor Prod. Dept.	Auburn, N.Y.
09353	C & K Components Inc.	Newton, Mass.
09922	Burndy Corp.	Norwalk, Conn.
11115	Wagner Electric Corp. Tung-Sol Div.	Bloomfield, N.J.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of Cal. Inc.	So. Pasadena, Calif.
11502	IRC Div. of TRW Inc.	Boone, N.C.
11711	General Instrument Corp.	Newark, N.J.
12136	Philadelphia Handle Co.	Camden, N.J.
12615	U.S. Terminals, Inc.	Cincinnati, Ohio
12617	Hamlin Inc.	Lake Mills, Wisconsin
12697	Clarostat Mfg. Co. Inc.	Dover, N.H.
13103	Thermalloy Co.	Dallas, Texas
14493	*Hewlett-Packard Co.	Loveland, Colo.
14655	Cornell-Dubilier Electronics Div. Federal Pacific Electric Co.	Newark, N.J.
14936	General Instrument Corp. Semiconductor Prod. Group	Hicksville, N.Y.
15801	Fenwal Elect.	Framingham, Mass.
16299	Corning Glass Works	Raleigh, N.C.

*Use Code 28480 assigned to Hewlett-Packard Co., Palo Alto, California

Table 6-3. Code List of Manufacturers

CODE	MANUFACTURER ADDRESS
16758	Delco Radio Div. of General Motors Corp. Kokomo, Ind.
17545	Atlantic Semiconductors, Inc. Asbury Park, N.J.
17803	Fairchild Camera and Instrument Corp. Mountain View, Calif.
17870	Daven Div. Thomas A. Edison Industries McGraw-Edison Co. Orange, N.J.
18324	Signetics Corp. Sunnyvale, Calif.
19315	Bendix Corp. The Navigation and Control Div. Teterboro, N.J.
19701	Electra/Midland Corp. Mineral Wells, Texas
21520	Fansteel Metallurgical Corp. No. Chicago, Ill.
22229	Union Carbide Corp. Electronics Div. Mountain View, Calif.
22753	UID Electronics Corp. Hollywood, Fla.
23936	Pamotor, Inc. Pampa, Texas
24446	General Electric Co. Schenectady, N.Y.
24455	General Electric Co. Nela Park, Cleveland, Ohio
24655	General Radio Co. West Concord, Mass.
24681	LTV Electrosystems Inc. Memcor/Components Operations Huntington, Ind.
26982	Dynacool Mfg. Co. Inc. Saugerties, N.Y.
27014	National Semiconductor Corp. Santa Clara, Calif.
28480	Hewlett-Packard Co. Palo Alto, Calif.
28520	Heyman Mfg. Co. Kenilworth, N.J.
28875	IMC Magnetics Corp. Rochester, N.H.
31514	SAE Advance Packaging, Inc. Santa Ana, Calif.
31827	Budwig Mfg. Co. Ramona, Calif.
33173	G.E. Co. Tube Dept. Owensboro, Ky.
35434	Lectrohm, Inc. Chicago, Ill.
37942	P.R. Mallory & Co. Indianapolis, Ind.
42190	Muter Co. Chicago, Ill.
43334	New Departure-Hyatt Bearings Div. General Motors Corp. Sandusky, Ohio
44655	Ohmite Manufacturing Co. Skokie, Ill.
46384	Penn Engr. and Mfg. Corp. Doylestown, Pa.
47904	Polaroid Corp. Cambridge, Mass.
49956	Raytheon Co. Lexington, Mass.
55026	Simpson Electric Co. Div. of American Gage and Machine Co. Chicago, Ill.
56289	Sprague Electric Co. North Adams, Mass.
58474	Superior Electric Co. Bristol, Conn.
58849	Syntron Div. of FMC Corp. Homer City, Pa.

CODE	MANUFACTURER ADDRESS
59730	Thomas and Betts Co. Philadelphia, Pa.
61637	Union Carbide Corp. New York, N.Y.
63743	Ward Leonard Electric Co. Mt. Vernon, N.Y.
70563	Amperite Co. Inc. Union City, N.J.
70901	Beemer Engrg Co. Fort Washington, Pa.
70903	Belden Corp. Chicago, Ill.
71218	Bud Radio, Inc. Willoughby, Ohio
71279	Cambridge Thermionic Corp. Cambridge, Mass.
71400	Bussmann Mfg. Div.of McGraw & Edison Co. St. Louis, Mo.
71450	CTS Corp. Elkhart, Ind.
71468	I.T.T. Cannon Electric Inc. Los Angeles, Calif.
71590	Globe-Union Inc. Milwaukee, Wis.
71700	General Cable Corp. Cornish Wire Co. Div. Williamstown, Mass.
71707	Coto Coil Co. Inc. Providence, R.I.
71744	Chicago Miniature Lamp Works Chicago, Ill.
71785	Cinch Mfg. Co. and 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.
72699	General Instrument Corp. Newark, N.J.
72765	Drake Mfg. Co. Harwood Heights, Ill.
72962	Elastic Stop Nut Div. of Amerace Esna Corp. Union, N.J.
72982	Erie Technological Products Erie, Pa.
73096	Hart Mfg. Co. Hartford, Conn.
73138	Beckman Instruments Fullerton, Calif.
73168	Fenwal, Inc. Ashland, Mass.
73293	Hughes Aircraft Co. Electron Dynamics Div. Torrance, Calif.
73445	Amperex Electronic Hicksville, N.Y.
73506	Bradley Semiconductor Corp. New Haven, Conn.
73559	Carling Electric, Inc. Hartford, Conn.
73734	Federal Screw Products, Inc. Chicago, Ill.
74193	Heinemann Electric Co. Trenton, N.J.
74545	Hubbell Harvey Inc. Bridgeport, Conn.
74868	Amphenol Corp. Amphenol RF Div. Danbury, Conn.
74970	E.F. Johnson Co. Waseca, Minn.

Table 6-3. Code List of Manufacturers

CODE	MANUFACTURER	ADDRESS
75042	IRC Div. of TRW, Inc.	Philadelphia, Pa.
75183	*Howard B. Jones Div. of Cinch Mfg. Corp.	New York, N.Y.
75376	Kurz and Kasch, Inc.	Dayton, Ohio
75382	Kilka Electric Corp.	Mt. Vernon, N.Y.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76381	Minnesota Mining and Mfg. Co.	St. Paul, Minn.
76385	Minor Rubber Co. Inc.	Bloomfield, N.J.
76487	James Millen Mfg. Co. Inc.	Malden, Mass.
76493	J.W. Miller Co.	Compton, Calif.
76530	Cinch	City of Industry, Calif.
76854	Oak Mfg. Co. Div. of Oak Electro/ Netics Corp.	Crystal Lake, Ill.
77068	Bendix Corp., Electrodynamics Div.	No. Hollywood, Calif.
77122	Palnut Co.	Mountainside, N.J.
77147	Patton-MacGuyer Co.	Providence, R.I.
77221	Phaostron Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine and Foundry Co.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77764	Resistance Products Co.	Harrisburg, Pa.
78189	Illinois Tool Works Inc.	Elgin, Ill.
78452	Everlook Chicago, Inc.	Chicago, Ill.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78526	Stanwyck Winding Div. San Fernando Electric Mfg. Co. Inc.	Newburgh, N.Y.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78584	Stewart Stamping Corp.	Yonkers, N.Y.
79136	Waldes Kohinoor, Inc.	L.I.C., N.Y.
79307	Whitehead Metals Inc.	New York, N.Y.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Co.	Mt. Kisco, N.Y.
80031	Mepco	Morristown, N.J.
80294	Bourns, Inc.	Riverside, Calif.
81042	Howard Industries	Racine, Wisc.
81073	Grayhill, Inc.	La Grange, Ill.
81483	International Rectifier	El Segundo, Calif.
81751	Columbus Electronics	Yonkers, N.Y.
82099	Goodyear Sundries & Mechanical Co. Inc.	New York, N.Y.
82142	Airco Speer Electronic Components	Du Bois, Pa.
82219	Sylvania Electric Products Inc.	Emporium, Pa.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals and Controls Inc.	Attleboro, Mass.
82866	Research Products Corp.	Madison, Wisc.
82877	Rotron Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83186	Victory Engineering	Springfield, N.J.
83298	Bendix Corp.	Eatontown, N.J.
83330	Herman H. Smith, Inc.	Brooklyn, N.Y.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable	Brookfield, Mass.
83508	Grant Pulley and Hardware Co.	West Nyack, N.Y.
83594	Burroughs Corp.	Plainfield, N.J.
83835	U.S. Radium Corp.	Morristown, N.J.
83877	Yardeny Laboratories	New York, N.Y.
84171	Arco Electronics, Inc.	Great Neck, N.Y.
84411	TRW Capacitor Div.	Ogallala, Neb.
86684	RCA Corp.	Harrison, N.J.
86838	Rummel Fibre Co.	Newark, N.J.
87034	Marco & Oak Industries	Anaheim, Calif.
87216	Philco Corp.	Lansdale, Pa.
87585	Stockwell Rubber Co.	Philadelphia, Pa.
87929	Tower-Olschan Corp.	Bridgeport, Conn.
88140	Cutler-Hammer Inc.	Lincoln, Ill.
88245	Litton Precision Products Inc, USECO	Van Nuys, Calif.
90634	Gulton Industries Inc.	Metuchen, N.J.
90763	United-Car Inc.	Chicago, Ill.
91345	Miller Dial and Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat, Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Neb.
91662	Elco Corp.	Willow Grove, Pa.
91929	Honeywell Inc.	Freeport, Ill.
92825	Whitso, Inc.	Schiller Pk., Ill.
93332	Sylvania Electric Prod.	Woburn, Mass.
93410	Essex Wire Corp.	Mansfield, Ohio
94144	Raytheon Co.	Quincy, Mass.
94154	Wagner Electric Corp.	Livingston, N.J.
94222	Southco Inc.	Lester, Pa.
95263	Leecraft Mfg. Co. Inc.	L.I.C., N.Y.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95712	Bendix Corp.	Franklin, Ind.
95987	Weckesser Co. Inc.	Chicago, Ill.
96791	Amphenol Corp.	Janesville, Wis.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97702	IMC Magnetics Corp.	Westbury, N.Y.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98410	ETC Inc.	Cleveland, Ohio
98978	International Electronic Research Corp.	Burbank, Calif.
99934	Renbrandt, Inc.	Boston, Mass.

*Use Code 71785 assigned to Cinch Mfg. Co., Chicago, Ill.

Table 6-4. Replaceable Parts

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	HP PART NO.	RS
A1	**5V Power Supply Board**					
C1	fxd, elect. 6000μF 25V	1	32D602G025AD2A	56289	0180-2520	1
C2	fxd, cer. 0.1μF 50V	1	5C5081-CML	56289	0150-0121	1
C3	fxd, elect. 4.7μF 35V	1	150D475X9035B2	56289	0180-0100	1
C4	fxd, elect. 0.22μF 35V	1	150D224X9035A2	56289	0180-1735	1
CR1	SCR, 25A	1		28480	1884-0223	1
Q1	SS PNP Si	1		28480	1853-0099	1
R1, 2	fxd, ww, 50Ω 5% 5W	2	243E50R5	56289	0811-1854	1
R3	fxd, comp 10K 5% 1/2W	1	EB-1035	01121	0686-1035	1
R4	fxd, comp 150Ω 5% 1/2W	1	EB-1515	01121	0686-1515	1
R5	fxd, comp 33Ω 5% 1/2W	1	EB-3305	01121	0686-3305	1
R6	fxd, comp 510Ω 5% 1/2W	1	EB-5115	01121	0686-5115	1
U2	Linear voltage reg. (5V) IC	1	LM309K	27014	1820-0430	1
VR1	Diode, zener 5.62V	1		28480	1902-3104	1
A2	**Main Board Assembly**					
C1-10	fxd, cer. 1μF 25V	18	5C13C-CML	56289	0160-0127	3
C11	fxd, cer. 0.001μF 1kV	6	C067B102E102ZS26	56289	0150-0050	2
C12-14	fxd, cer. 1μF 25V		5C13C-CML	56289	0160-0127	
C15	Not assigned					
C16	fxd, cer. 1μF 25V		5C13C-CML	56289	0160-0127	
C17	fxd, cer. 0.001μF 1kV		C067B102E102ZS26	56289	0150-0050	
C18, 19	fxd, cer. 1μF 25V		5C13C-CML	56289	0160-0127	
C20, 30	fxd, cer. .005μF 100V		C023B101E502MS27	56289	0160-2639	1
C21	fxd, elect. 4.7μF	1	150D475X5006A2	56289	0180-1954	1
C22	fxd, cer. 1μF 25V		5C13C-CML	56289	0160-0127	
C23	fxd, mica 20pF 500V	1		28480	0160-0370	1
C24	fxd, cer. 1μF 25V		5C13C-CML	56289	0160-0127	
C25-27	fxd, cer. 0.001μF 1kV		C067B102E102ZS26	56289	0150-0050	
C28	fxd, cer. 0.0022μF 200V	1	VK33BW222M	95275	0160-2289	1
C29	fxd, cer. 0.001μF 1kV		C067B102E102ZS26	56289	0150-0050	
CR1, 2, 4, 5, 6	Diode, Si 200mA 75V	5	1N4148	28480	1901-0050	5
CR3	Stabistor, Si 10prv 400mW	1	1N4157	28480	1901-0460	1
J1	HP-IB Connector (24-Contacts)	1	57-20240-2	71785	1251-3283	
J2	MP Connector (50-Contacts)	1	57-40500-375	71785	1251-0087	
Q1-4	SS NPN Si	4	2N4141	28480	1854-0071	4
R1-6	fxd, comp 1k 5% 1/4W	6	CB-1025	01121	0683-1025	1
R7-22	fxd, comp 5.1k 5% 1/4W	31	CB-5125	01121	0683-5125	4
R23	Not assigned					
R24-27	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R28-33	fxd, comp 120Ω 5% 1/4W	6	CB-1215	01121	0683-1215	1
R34-36	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R37	fxd, metal film 10k 2% 1/8W	1	C4-1/8-TO-1002-G	24546	0757-0948	1
R38	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R39	fxd, film 39k 1% 1/8W	1	C4-1/8-TO-3902-F	24546	0698-6076	
R40	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R41	fxd, film 3.83k 1% 1/8W	1	C4-1/8-TO-3831-F	24546	0698-3153	
R42, 43	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R44	fxd, comp 51k 5% 1/4W	1	CB-5135	01121	0683-5135	1

Table 6-4. Replaceable Parts

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	HP PART NO.	RS
A2R45	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R46	fxd, comp 2k 5% 1/4W	1	CB-2025	01121	0683-2025	1
R47, 48	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R49-51	fxd, comp 10k 5% 1/4W	4	CB-1035	01121	0683-1035	1
R52	fxd, comp 360Ω 5% 1/4W	1	CB-3615	01121	0683-3615	1
R53	fxd, film 2.87k 1% 1/8W	1	C4-1/8-TO-2871-F	24546	0698-3151	
R54	fxd, comp 10k 5% 1/4W		CB-1035	01121	0683-1035	
R55	fxd, comp 5.1k 5% 1/4W		CB-5125	01121	0683-5125	
R56	fxd, comp 470 5% 1/4W		CB-4715	01121	0683-4715	
S1	Address switch, 7PST	1		28480	3101-1973	
TB1	Barrier Block (9 terminals)	1		28480	0360-1237	
Z1, 2	Resistor Network, 3k/6.2k , 5% .02W	2	216C	56289	1810-0136	1
Z3, 4	Resistor Network, 1k , 5% 1/8W	2	200C-1855-CRR	56289	1810-0121	1
Z5-7	Resistor Network, 750Ω 5% .15W	3	200C-1902-CRR	56289	1810-0075	1
Z8, 9	Resistor Network, 330Ω 5% 1/8W	2	200C-1873-CRR	56289	1810-0141	1
Z10	Digital Comparator, IC	1	93L24DC	07263	1820-0904	1
Z11, 12, 13	Hex Inverters Buffers/Drivers, IC	4	SN7416N	01295	1820-0577	4
Z14-17	4-Bit Bistable Latch, IC	4	SN74LS75N	01295	1820-1411	4
Z18-20	8-Bit Parallel-Out Serial Shift Reg. IC	3	SN74LS164N	01295	1820-1433	3
Z21-23	Quad 2-Input NAND Gate, IC	3	SN74LS03N	01295	1820-1198	3
Z24	Dual 4-Input NAND Gate, IC	1	SN74LS20N	01295	1820-1204	1
Z25	Hex Inverter, IC	3	SN74LS04N	01295	1820-1199	3
Z26	Quad 2-Input Positive-AND Gate, IC	5	SN74LS08N	01295	1820-1201	5
Z27	8-Input Positive-NAND Gate, IC	5	SN74LS30N	01295	1820-1207	5
Z28	Hex Inverter, IC	2	SN74LS05N	01295	1820-1200	2
Z29	Hex Schmitt-Trigger Inverter, IC	5	SN74LS14N	01295	1820-1416	5
Z30	Hex Inverter, IC		SN74LS05N	01295	1820-1200	
Z31-34	8-Input Positive-NAND Gate, IC		SN74LS30N	01295	1820-1207	
Z35-37	Quad 2-Input Positive-NAND Buffer, Open Coll., IC	3	SN7438N	01295	1820-0621	3
Z38	Quad 2-Input Positive-AND Gate, IC		SN74LS08N	01295	1820-1201	
Z39	Quad 2-Input Positive-NAND Gate, IC	2	SN74LS00N	01295	1820-1197	2
Z40	Dual D-Type Positive-Edge-Triggered Flip-Flop, IC	4	SN74LS74N	01295	1820-1112	4
Z41	Hex Inverter, IC		SN74LS04N	01295	1820-1199	
Z42	Hex Schmitt Trigger Inverter, IC		SN74LS14N	01295	1820-1416	
Z43	Quad 2-Input Positive-NOR Gates	3	SN74LS02N	01295	1820-1144	3
Z44	Hex Schmitt Trigger Inverter, IC		SN74LS14N	01295	1820-1416	
Z45	Hex Inverter IC		SN74LS04N	01295	1820-1199	
Z46	Triple 3-Input Positive-NAND Gate	2	SN74LS10N	01295	1820-1202	2
Z47	4-Bit UP/Down Counter, IC	1	SN74LS193N	01295	1820-1194	1
Z48	4-Line-to-10-Line Decoder, IC	1	SN74LS42N	01295	1820-1418	1
Z49, 50	Dual D-Type Positive-Edge-Triggered Flip-Flop, IC		SN74LS74N	01295	1820-1112	
Z51	Hex Schmitt Trigger Inverter, IC		SN74LS14N	01295	1820-1416	
Z52, 53	Quad 2-Input Positive NOR Gate		SN74LS02N	01295	1820-1144	
Z54	Quad 2-Input Positive-AND Gate, IC		SN74LS08N	01295	1820-1201	
Z55	Hex Schmitt Trigger Inverter, IC		SN74LS14N	01295	1820-1416	
Z56	Quad 2-Input Positive-NAND Gate, IC		SN74LS00N	01295	1820-1197	
Z57	Dual D-Type Positive-Edge-Triggered Flip-Flop, IC		SN74LS74N	01295	1820-1112	

Table 6-4. Replaceable Parts

REF. DESIG.	DESCRIPTION	TQ	MFR. PART NO.	MFR. CODE	HP PART NO.	RS
Z58, 59	Quad 2-Input Positive-AND Gate, IC		SN74LS08N	01295	1820-1201	
A2Z60	Hex Inverters Buffers/Drivers, IC		SN7416N	01295	1820-0577	
Z61	Dual J-K Flip-Flop, IC	1	SN74LS73N	01295	1820-1574	1
Z62	Dual Monostable Multivibrator with Schmitt Trigger Inputs, IC	2	SN74LS221N	01295	1820-1437	2
Z63	Triple 3-Input Positive NAND Gate, IC		SN74LS10N	01295	1820-1202	
Z64	Dual Monostable Multivibrator with Schmitt Trigger Inputs, IC		SN74LS221N	01295	1820-1437	
	Front Panel - Electrical					
DS1-6	Indicator, Light Emitting Diode, Green	6			1990-0521	6
	HP-IB: LISTEN ADDRESS (DS1); TALK ADDRESS (DS2); SERVICE REQUEST (DS3); SERIAL POLL (DS4)					
	MULTI-PROGRAMMER: GATE (DS5); FLAG (DS6)					
DS7	Indicator Lamp (LINE)	1		28480	2140-0015	1
R1	fxd, comp 33k 5% 1/2W	1	EB-3335	01121	0686-3335	1
S1	LINE switch, toggle DPST, 3A, 250V	1	81024-GB	04009	3101-0003	1
	Power Module (includes fuse, voltage selection PC card, and filter)			28480	5060-9421	
F1	Line Fuse F1, 500mAT slo-blo (100/120Vac operation)	1	MDL-1/2	71400	2110-0202	2
	Chassis - Electrical					
T1	Power Transformer	1		28480	59500-80091	1
U1	Diode, Full wave bridge, Rect.	1	SA3337	14099	1901-0526	1
	Mechanical					
	Chassis Assembly	1				
	Frame Assembly	1		28480	5060-0730	
	Side Cover	2		28480	5000-8595	
	Top Cover, perforated	1		28480	5060-8707	
	Bottom Cover, perforated	1		28480	5060-8731	
	Cable clamp	4			1400-0093	
	Foot Assembly	5			5060-0767	
	Front Panel Assembly	1		28480	59500-60005	
	Clip, LED mount (DS1-6)	6		28480	1400-0547	
	Retainer Ring	6		28480	1400-0540	
	Lamp, clear (DS7)	1		28480	5040-0234	
	Lamp, base (DS7)	1		28480	5040-0305	
	A1 Power Supply Board Assy.					
	Insulator mica	2			0340-0181	
	Insulator transistor	2			0340-0503	
	PC board	1			59500-20021	
	A2 Main Board Assy.					
	IC Socket, 14-pin (Address Switch)	1			1200-0485	

Table 6-4. Replaceable Parts

REF. DESIG.	DESCRIPTION	TQ.	MFR. PART NO.	MFR. CODE	HP PART NO.	RS
	Miscellaneous					
	Stand, Tilt	1		28480	1490-0030	
	Fuse, 250mAT slo-blo (220/240Vac operation)	1	MDL-1/4	71400	2110-0201	
	Chaining Cable Assy. (59500A-6940B)	1		28480	14541-90001	
	HP-IB Cable Assy. (59500A-Calculator)	1		28480	10631B	

SECTION VII
CIRCUIT DIAGRAMS

7-1 INTRODUCTION

7-2 This section contains the circuit diagrams necessary for the operation and maintenance of Multiprogrammer Interface, Model 59500A.

7-3 COMPONENT LOCATION ILLUSTRATIONS

7-4 The component location illustrations show the physical location and reference designation of each part on the chassis and printed circuit boards A1 and A2. The illustrations include the location of all test points.

7-5 SCHEMATIC DIAGRAMS

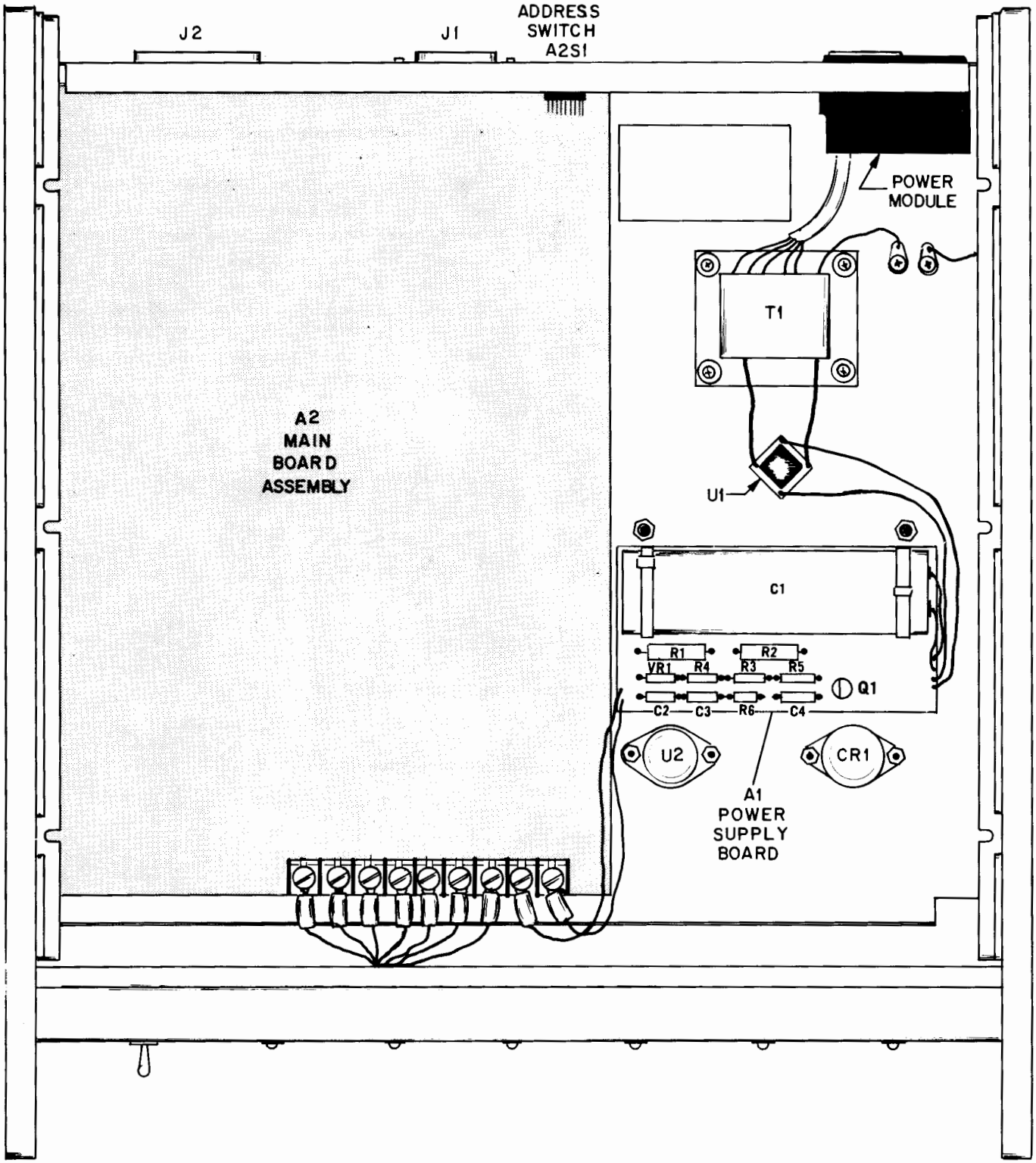
7-6 The schematic diagram for Model 59500A, Figure 7-1, consists of two sheets. Sheet 1 illustrates the power supply circuits and includes the schematic notes. Sheet 2 illustrates the circuits on main board assembly A2 and includes a list of signal mnemonics. Test points (encircled numbers) appear on the schematic and coincide with the test points on the component location diagrams. The test points on schematic Sheet 2 also coincide with the test points on the timing diagrams shown in Section IV.

APPENDIX A

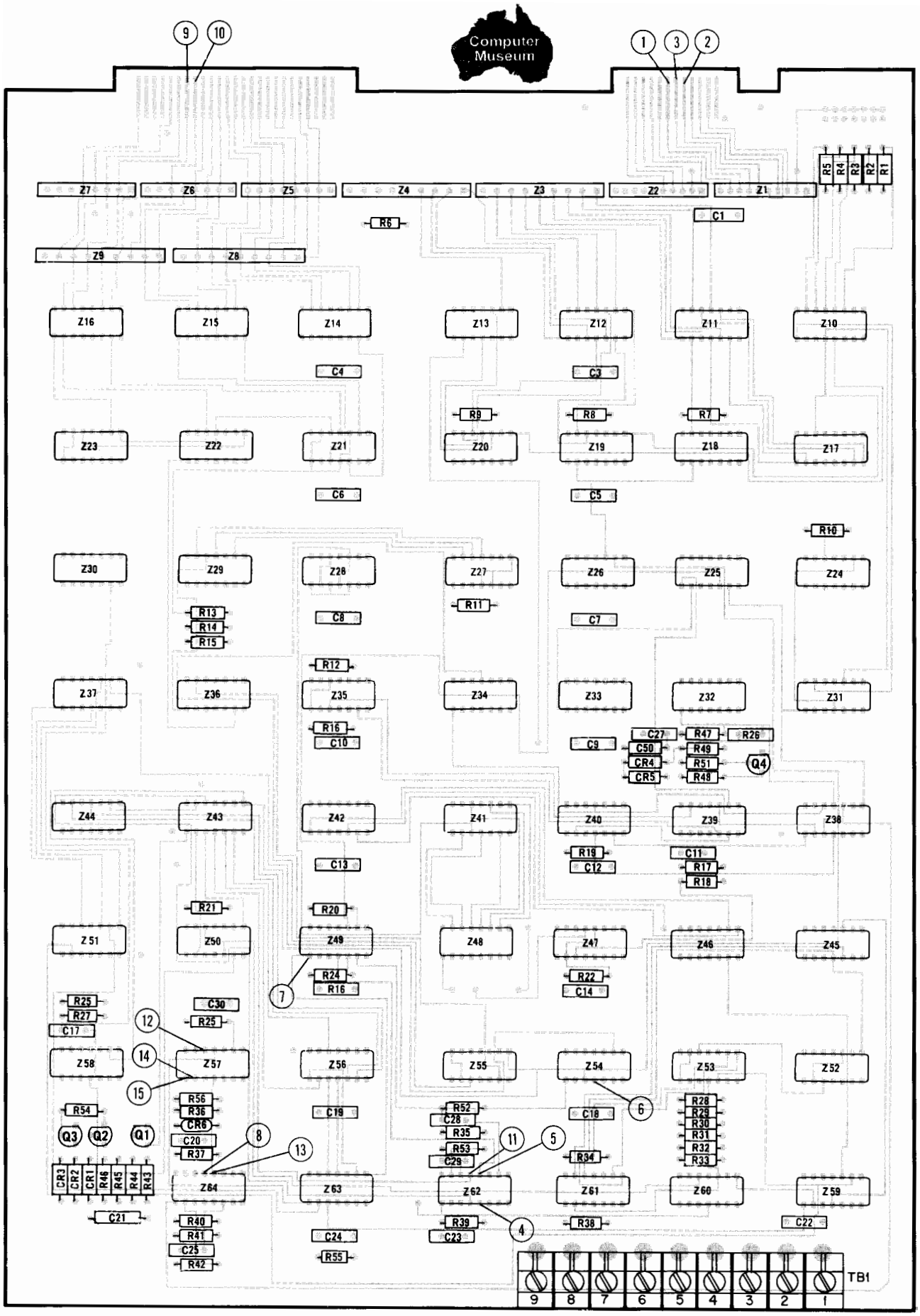
MANUAL BACKDATING CHANGES

A-1 For serial numbers below 1544A-00123, contact NJD Service for backdating information.

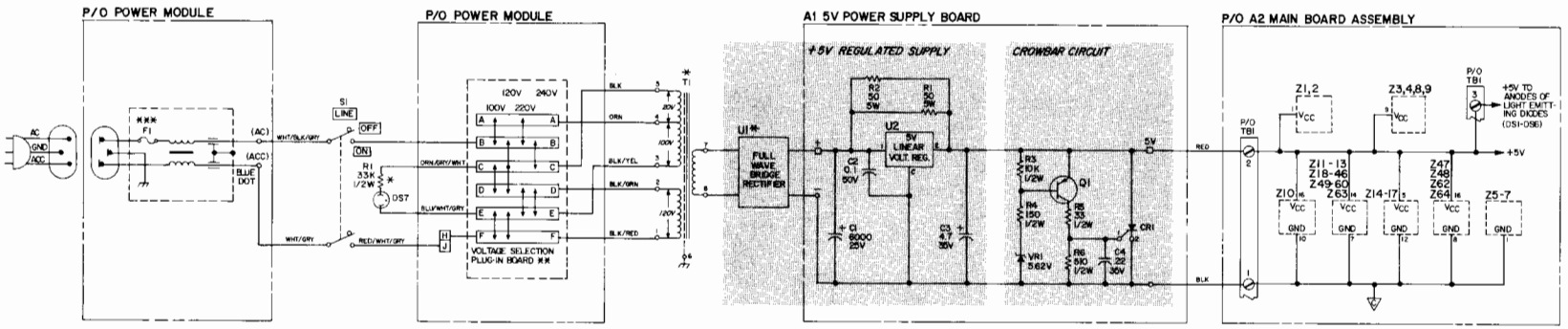
Hewlett-Packard
New Jersey Division
Green Pond Rd.
Rockaway, N. J. 07866
Telephone: 201-627-6400
Twx: 710-987-8461



Chassis Top View, Component Locations



A2 Main Board Assembly, Component Locations



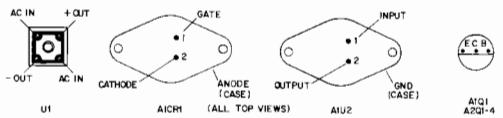
* COMPONENTS LOCATED ON CHASSIS.

** VOLTAGE CHOICE IS ON BOTH SIDES OF P.C. PLUG-IN BOARD. SELECT OPERATING VOLTAGE (100, 120, 220, OR 240VAC) BY ORIENTING P.C. BOARD TO POSITION THE DESIRED VOLTAGE ON TOP LEFT SIDE OF P.C. BOARD AND PUSHING BOARD FIRMLY INTO POWER MODULE SLOT.

*** INSTALL 0.5A FUSE FOR 100/120VAC INPUT POWER OR 0.25A FOR 220/240 VAC INPUT POWER.

SCHEMATIC NOTES:

1. ALL RESISTORS IN OHMS, ±5% 1/4W, UNLESS OTHERWISE INDICATED.
2. ALL 1/2W RESISTORS ARE ±5%, ALL 1/8W RESISTORS ARE 1% UNLESS OTHERWISE INDICATED.
3. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE INDICATED.
4. [ ] DENOTES FRONT PANEL MARKING.
5. PIN LOCATIONS FOR BRIDGE RECTIFIER (U1), VOLTAGE REGULATORS (A1U2), SCR (A1CR1), AND TRANSISTORS ON THE A1 AND A2 BOARDS ARE AS FOLLOWS:



6. PIN LOCATIONS FOR INTEGRATED CIRCUITS ARE AS FOLLOWS.

A2Z10, A2Z14-17, A2Z47, A2Z48, A2Z62, A2Z64

A2Z11-13, A2Z18-46, A2Z49-60, A2Z63

(ALL TOP VIEWS)

7. THE SQUARE PLATED PADS ON THE P.C. BOARD INDICATE ONE OF THE FOLLOWING:
   A. PIN 1 OF ANY I.C. OR TRANSFORMER.
   B. POSITIVE END OF POLARIZED CAPACITOR.
   C. CATHODE OF A DIODE OR EMITTER OF A TRANSISTOR.
8. ADDRESS SWITCHES 1 THRU 5 ARE SHOWN SET FOR A TALK ADDRESS OF "W" AND A LISTEN ADDRESS OF "+".

Figure 7-1 (Sheet 1). Model 59500A, Power Supply Circuits, Schematic Diagram

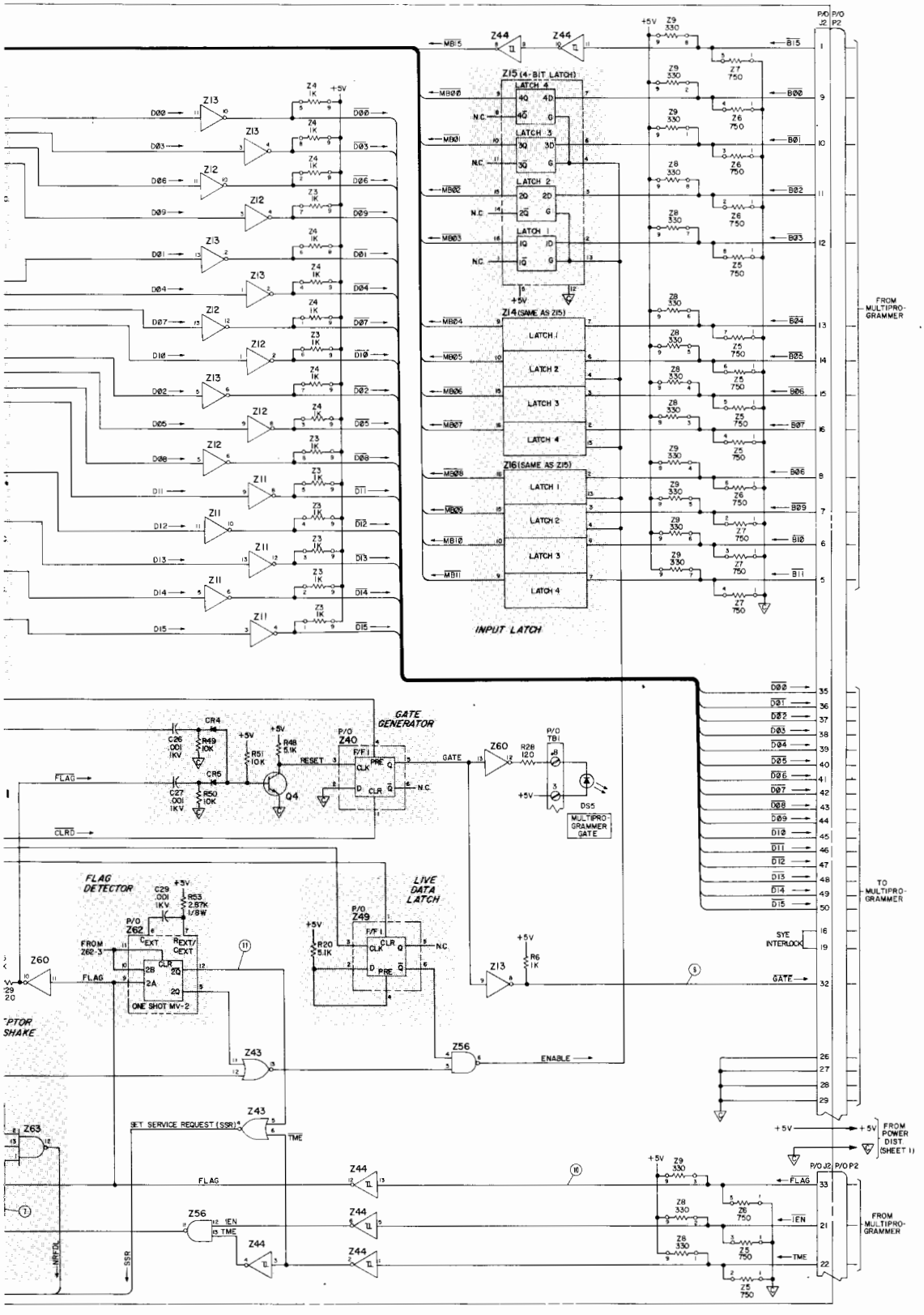
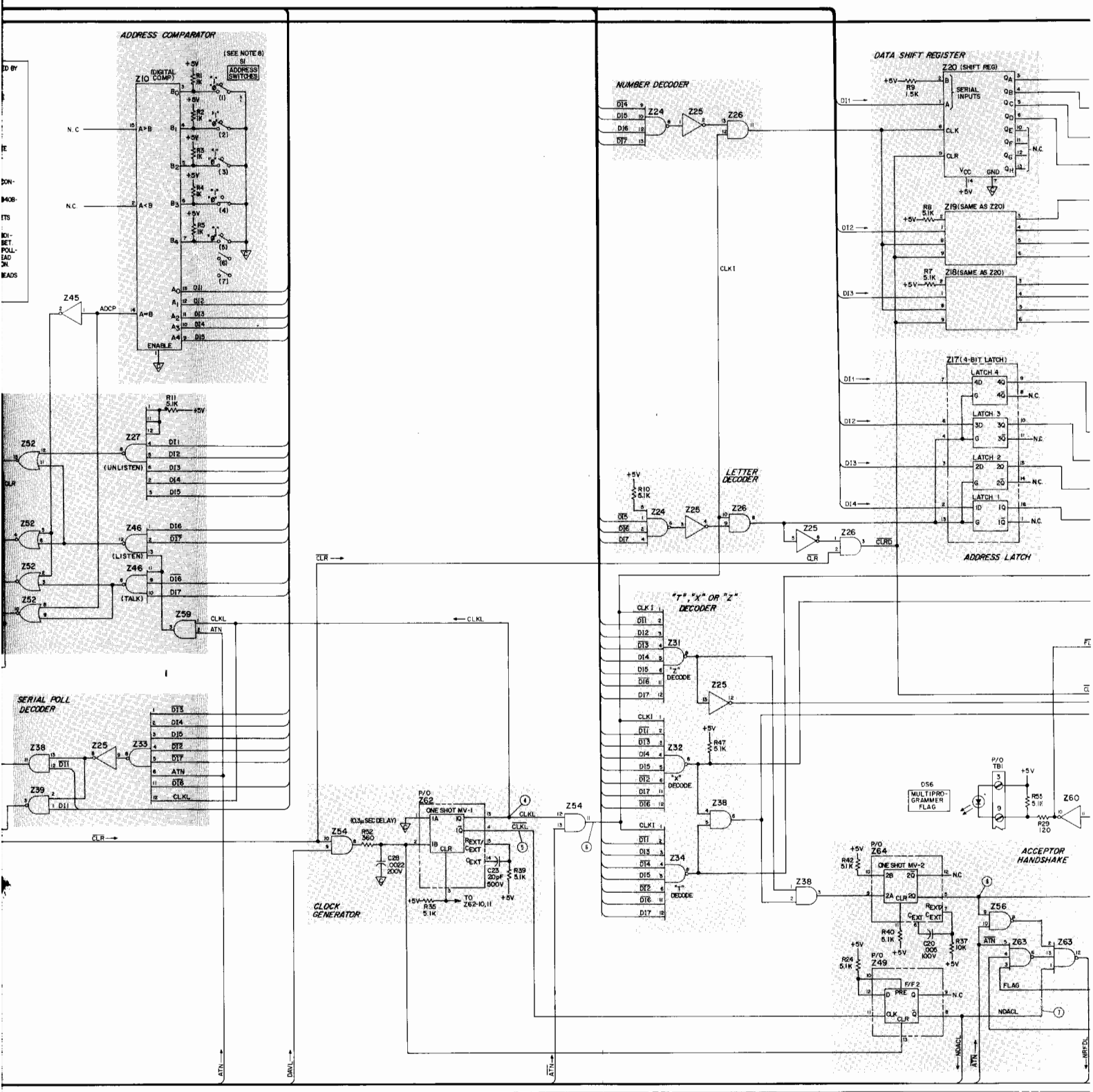
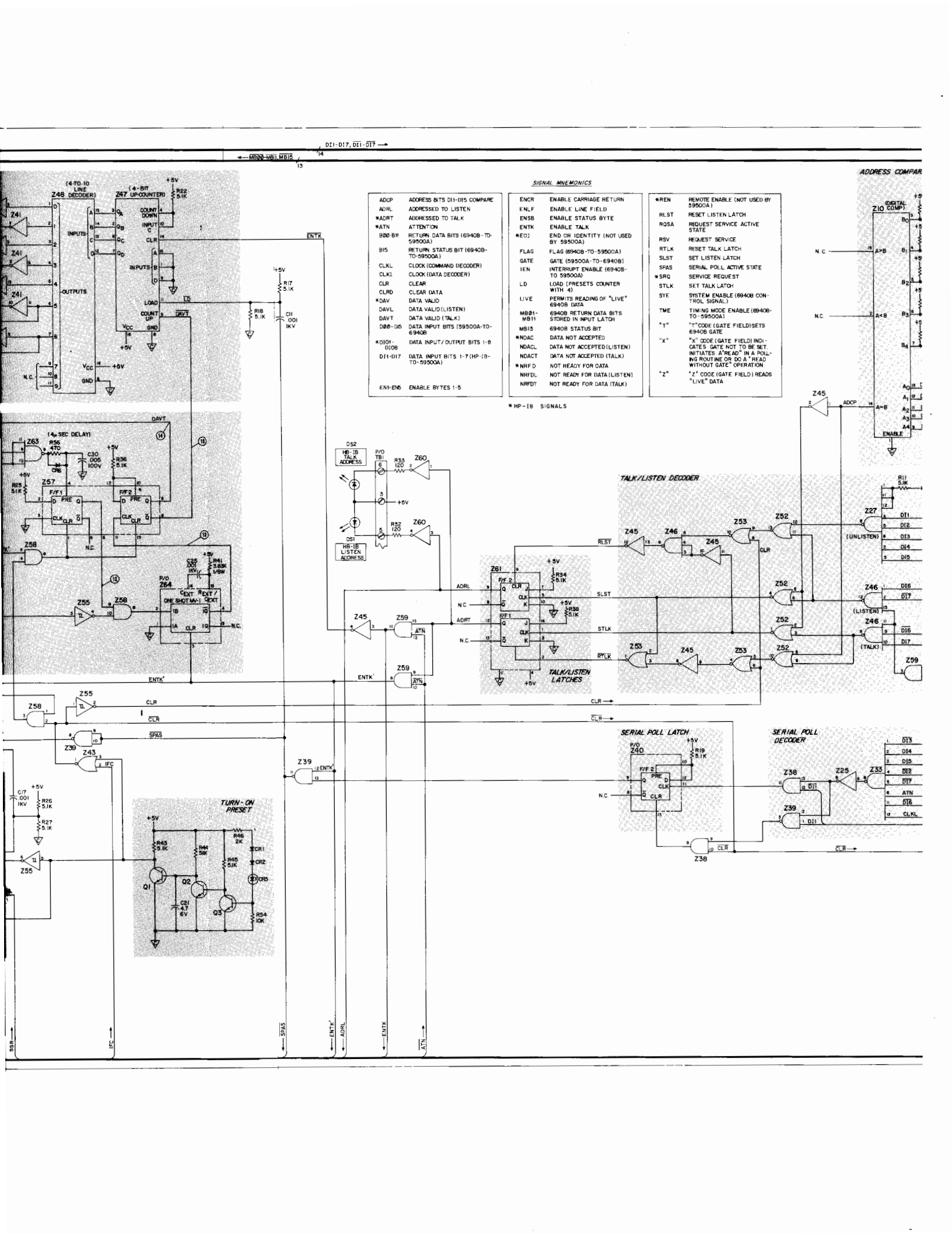
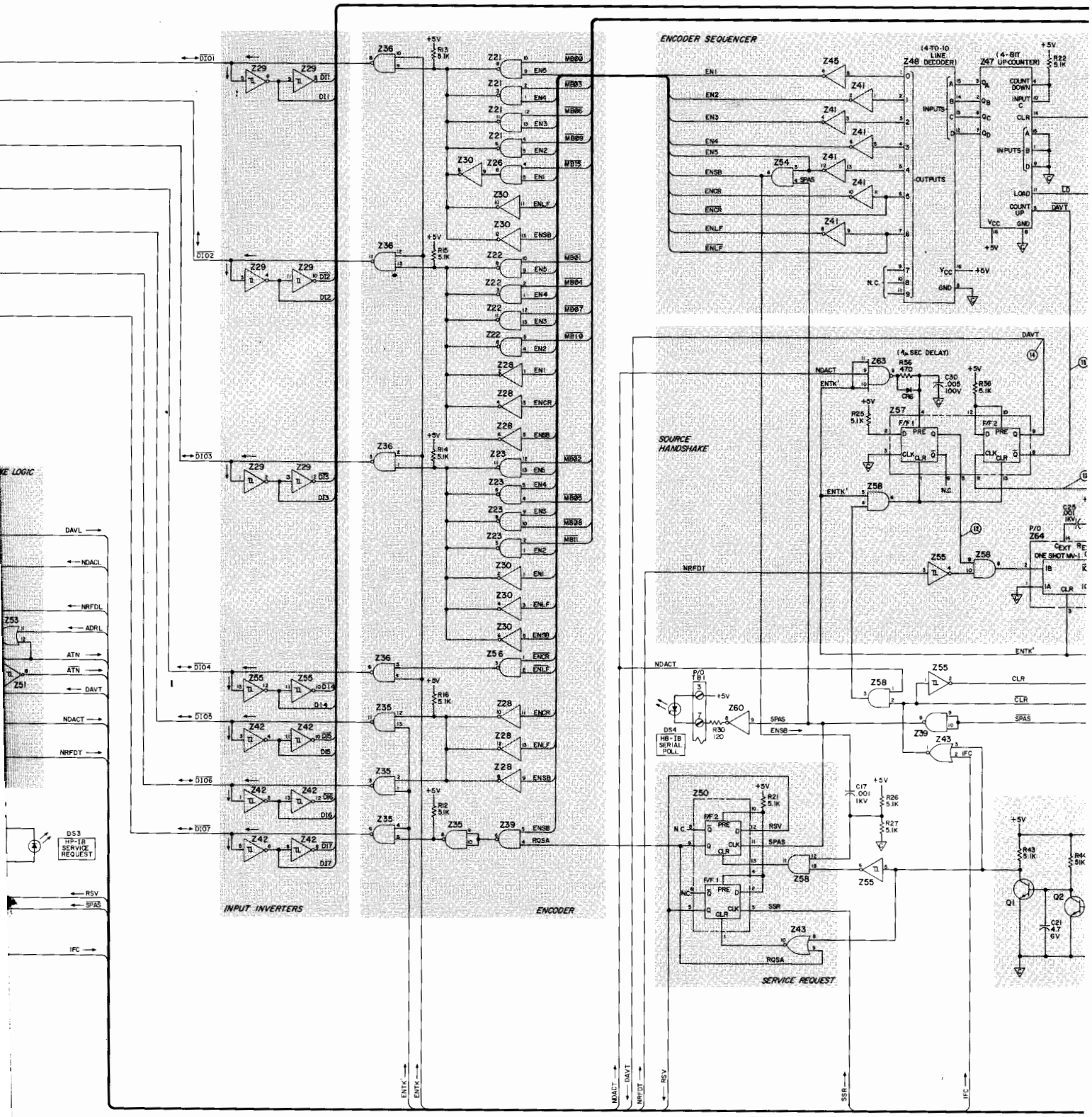
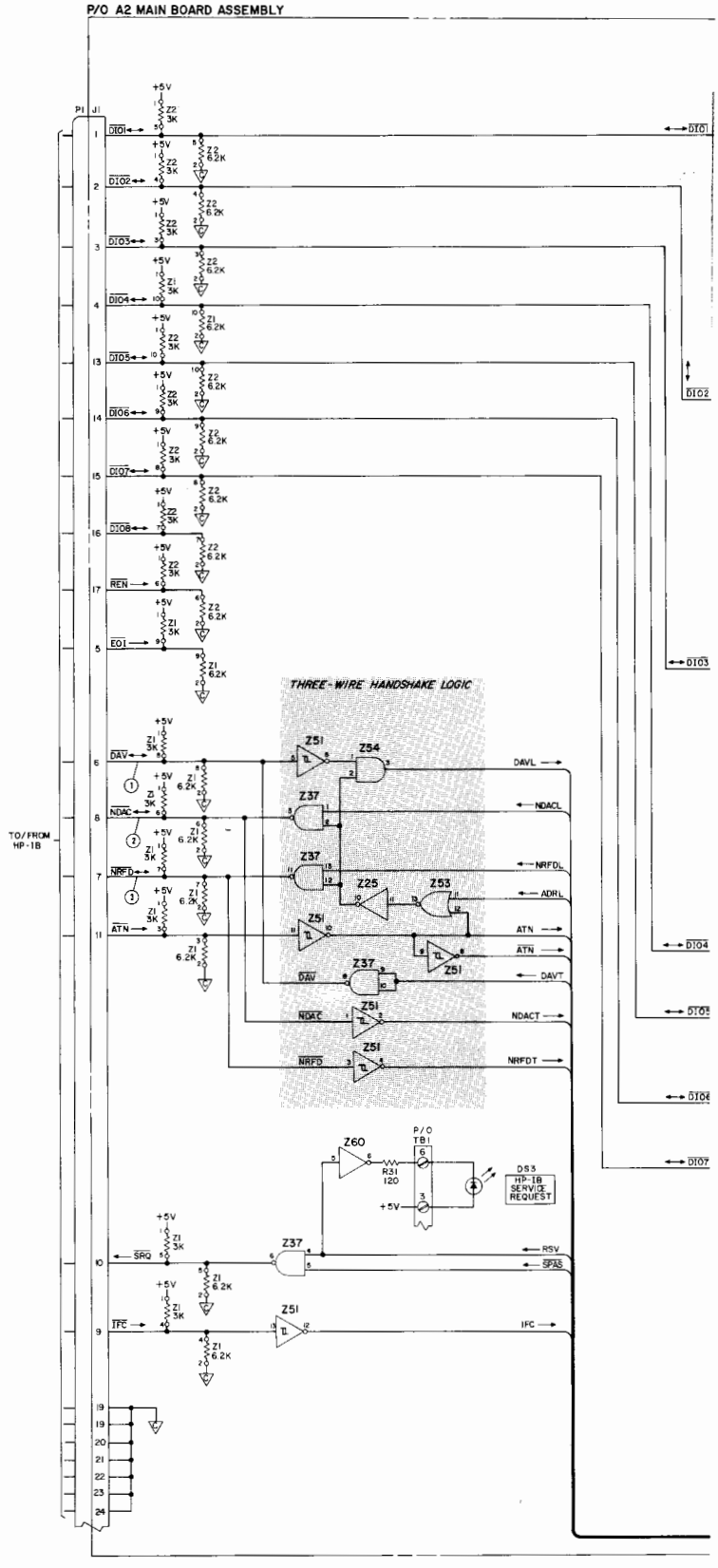


Figure 7-1 (Sheet 2). Model 59500A, Main Board Assembly A2, Schematic Diagram


ADDRESS COMPARATOR
(SEE NOTE 8)
S1
ADDRESS SWITCHES
Z10 (DIGITAL COMP)
N.C
N.C
Z45
ADCP
ENABLE
R11 5.1K
Z27
(UNLISTEN)
Z46
(LISTEN)
Z46
(TALK)
Z52
Z59
CLKL
ATN
SERIAL POLL DECODER
Z38
Z25
Z33
Z39
CLR
P/O Z62
ONE SHOT MV-1
(0.3μ SEC DELAY)
Z54
R52 360
C28 .0022 200V
C23 20pF 500V
R39 5.1K
R36 5.1K
TO Z62-10,11
CLOCK GENERATOR
NUMBER DECODER
Z24
Z25
Z26
LETTER DECODER
R10 5.1K
"T","X" OR "Z" DECODER
Z31
"Z" DECODE
Z32
"X" DECODE
Z34
"T" DECODE
Z38
DATA SHIFT REGISTER
Z20 (SHIFT REG)
SERIAL INPUTS
R9 1.5K
R8 5.1K
Z19(SAME AS Z20)
R7 5.1K
Z18(SAME AS Z20)
Z17(4-BIT LATCH)
LATCH 4
LATCH 3
LATCH 2
LATCH 1
ADDRESS LATCH
DS6
MULTIPRO-GRAMMER FLAG
P/O TB1
R55 5.1K
R29 120
Z60
ACCEPTOR HANDSHAKE
P/O Z64
ONE SHOT MV-2
R42 5.1K
R40 5.1K
C20 .005 100V
R37 10K
P/O Z49
F/F 2
R24 5.1K
Z56
Z63
FLAG
NDACL
NRFDL


DI1-DI7, DI1-DI7
MB00-MB11, MB15
14
13
SIGNAL MNEMONICS
ADCP ADDRESS BITS DI1-DI5 COMPARE
ADRL ADDRESSED TO LISTEN
*ADRT ADDRESSED TO TALK
*ATN ATTENTION
DB0-DB1 RETURN DATA BITS (6940B-TO-59500A)
BI5 RETURN STATUS BIT (6940B-TO-59500A)
CLKL CLOCK (COMMAND DECODER)
CLK1 CLOCK (DATA DECODER)
CLR CLEAR
CLRD CLEAR DATA
*DAV DATA VALID
DAVL DATA VALID (LISTEN)
DAVT DATA VALID (TALK)
DB0-DB5 DATA INPUT BITS (59500A-TO-6940B
*DI01-DI08 DATA INPUT/OUTPUT BITS 1-8
DI1-DI7 DATA INPUT BITS 1-7 (HP-IB-TO-59500A)
EN1-EN5 ENABLE BYTES 1-5
ENCR ENABLE CARRIAGE RETURN
ENLF ENABLE LINE FIELD
ENSB ENABLE STATUS BYTE
ENTK ENABLE TALK
*EOI END OR IDENTITY (NOT USED BY 59500A)
FLAG FLAG (6940B-TO-59500A)
GATE GATE (59500A-TO-6940B)
IEN INTERRUPT ENABLE (6940B-TO 59500A)
LD LOAD (PRESETS COUNTER WITH 4)
LIVE PERMITS READING OF "LIVE" 6940B DATA
MB01-MB11 6940B RETURN DATA BITS STORED IN INPUT LATCH
MBI5 6940B STATUS BIT
*NDAC DATA NOT ACCEPTED
NDACL DATA NOT ACCEPTED (LISTEN)
NDACT DATA NOT ACCEPTED (TALK)
*NRFD NOT READY FOR DATA
NRFDL NOT READY FOR DATA (LISTEN)
NRFDT NOT READY FOR DATA (TALK)
*REN REMOTE ENABLE (NOT USED BY 59500A)
RLST RESET LISTEN LATCH
RQSA REQUEST SERVICE ACTIVE STATE
RSV REQUEST SERVICE
RTLK RESET TALK LATCH
SLST SET LISTEN LATCH
SPAS SERIAL POLL ACTIVE STATE
*SRQ SERVICE REQUEST
STLK SET TALK LATCH
SYE SYSTEM ENABLE (6940B CONTROL SIGNAL)
TME TIMING MODE ENABLE (6940B-TO-59500A)
"T" "T" CODE (GATE FIELD) SETS 6940B GATE
"X" "X" CODE (GATE FIELD) INDICATES GATE NOT TO BE SET. INITIATES A "READ" IN A POLLING ROUTINE OR DO A "READ WITHOUT GATE" OPERATION
"Z" "Z" CODE (GATE FIELD) READS "LIVE" DATA
* HP-IB SIGNALS
ADDRESS COMPAR
(4-TO-10 LINE DECODER)
Z48
Z47 (4-BIT UP-COUNTER)
Z41
INPUTS
OUTPUTS
COUNT DOWN
INPUT C
CLR
LOAD
COUNT UP
ENTK
DAVT
+5V
R22 5.1K
R17 5.1K
R18 5.1K
C11 .001 1KV
N.C.
GND
(4μ SEC DELAY)
Z63
R56 470
C30 .005 100V
R36 5.1K
R25 5.1K
Z57
F/F1
F/F2
PRE
CLK
CLR
Z58
Z55
C25 .001 1KV
R41 3.83K 1/8W
P/O Z64
ONE SHOT MV-1
CEXT
REXT/CEXT
DS2
HP-IB TALK ADDRESS
DS1
HP-IB LISTEN ADDRESS
P/O TB1
R33 120
R52 120
Z60
Z61
F/F 2
F/F 1
R34 5.1K
R38 5.1K
ADRL
ADRT
N.C.
Z45
Z46
Z53
Z52
Z59
ATN
TALK/LISTEN DECODER
TALK/LISTEN LATCHES
RLST
SLST
STLK
RTLK
Z10 (DIGITAL COMP)
A>B
A<B
A=B
ADCP
ENABLE
R11 5.1K
Z27
(UNLISTEN)
(LISTEN)
(TALK)
DI1
DI2
DI3
DI4
DI5
DI6
DI7
CLR
SPAS
IFC
Z39
Z43
C17 .001 1KV
R26 5.1K
R27 5.1K
TURN-ON PRESET
R43 5.1K
R44 5K
R45 5.1K
R46 2K
CR1
CR2
CR3
Q1
Q2
Q3
C21 4.7 6V
R54 10K
SERIAL POLL LATCH
P/O Z40
R19 5.1K
SERIAL POLL DECODER
Z38
Z25
Z33
DI1
ATN
CLKL
SSR
IFC
SPAS
ENTK'
ADRL
ENTK
ATN


ENCODER SEQUENCER
SOURCE HANDSHAKE
INPUT INVERTERS
ENCODER
SERVICE REQUEST
DAVL
NDACL
NRFDL
ADRL
ATN
DAVT
NDACT
NRFDT
RSV
SPAS
IFC
SRQ
ENTK'
SSR
DS3 HP-IB SERVICE REQUEST
DS4 HP-IB SERIAL POLL
(4-TO-10 LINE DECODER)
(4-BIT UP-COUNTER)
(4μ SEC DELAY)
ONE SHOT MV-1
F/F 1
F/F 2
INPUTS
OUTPUTS
COUNT DOWN
COUNT UP
INPUT C
LOAD
CLR
PRE
CLK
GND
Vcc
+5V
N.C.
RQSA
SPAS
ENSB
ENCR
ENLF
EN1
EN2
EN3
EN4
EN5


P/O A2 MAIN BOARD ASSEMBLY
P1
J1
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
REN
EOI
DAV
NDAC
NRFD
ATN
SRQ
IFC
THREE-WIRE HANDSHAKE LOGIC
DAVL
NDACL
NRFDL
ADRL
ATN
DAVT
NDACT
NRFDT
TO/FROM HP-IB
P/O TB1
DS3 HP-IB SERVICE REQUEST
R31 120
+5V
RSV
SPAS
IFC