About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual is the best copy we could find; it may be incomplete or contain dated information. If we find a more recent copy in the future, we will add it to the Agilent website.

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Agilent no longer sells this product. Our service centers may be able to perform calibration and repair if necessary, but no other support from Agilent is available. You will find any other available product information on the Agilent Test & Measurement website, www.tm.agilent.com.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. In other documentation, to reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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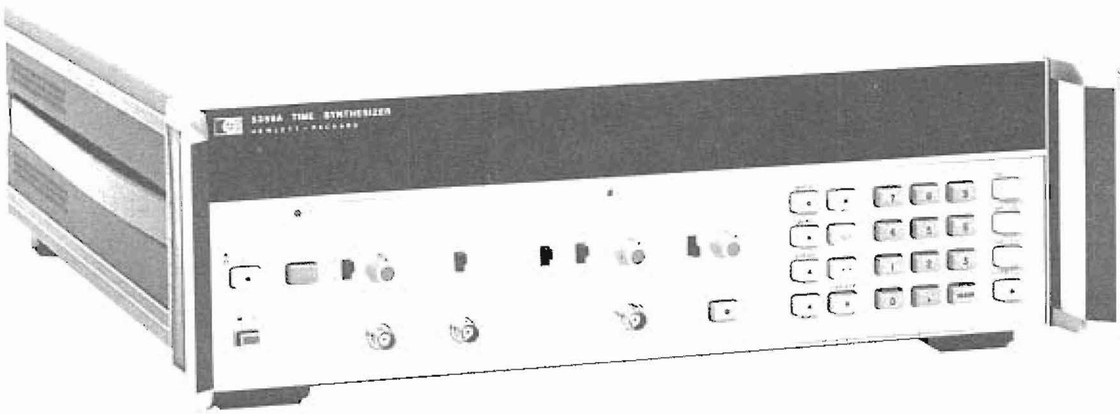
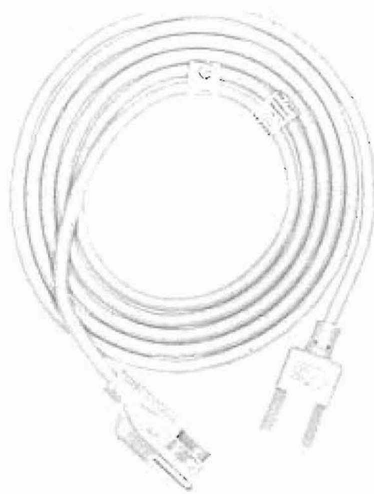


MODEL 5359A



LINE POWER CABLE

Figure 1-1. HP Model 5359A Time Synthesizer and Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual provides information pertaining to the installation, operation, testing, adjustment, and maintenance of the HP Model 5359A Time Synthesizer. *Figure 1-1* shows the 5359A with accessories supplied.

1-3. Packaged with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of this manual. This supplement should be kept with the instrument for use by the operator. Additional copies of the Operating Information Supplement may be ordered through your nearest Hewlett-Packard office. The part numbers are listed on the title page of this manual.

1-4. The full manual is divided into eight sections, each covering a particular topic for the operating and service of the HP Model 5359A. The topics by section number are:

Section	Topic
I	General Information
II	Installation
III	Operating and Programming
IV	Operation Verification
V	Adjustments
VI	Replaceable Parts
VII	Manual Changes
VIII	Service

1-5. SPECIFICATIONS

1-6. Instrument specifications are listed in *Table 1-1*. These specifications are the performance standards or limits against which the instrument may be tested.

1-7. INSTRUMENTS COVERED BY MANUAL

1-8. The 5359A Option 001 is documented in this manual. The differences are noted in the appropriate location such as OPTIONS in Section I, the Replaceable Parts List, and the schematic diagrams.

1-9. This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

1-10. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement which contains change information that documents the differences.

1-11. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement.

The supplement for this manual is keyed to the manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-12. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-13. HP-IB INTERFACING AND PROGRAMMING INFORMATION

1-14. Section II of this manual contains instructions for interfacing the Model 5359A with the HP-IB. A brief description of the sequence of events comprising the transfer of data by the HP-IB is provided in Section III followed by programming information. Information concerning the design criteria of the bus is available in IEEE Standard 488-1975, titled *"IEEE Standard Digital Interface for Programmable Instrumentation"*.

1-15. INSTRUMENT AND MANUAL IDENTIFICATION

1-16. The instrument serial number is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and a five-digit suffix. A letter between the prefix and suffix identifies the country in which the instrument was manufactured (A=USA, G=West Germany, J=Japan, U=United Kingdom). All correspondence with Hewlett-Packard concerning this instrument should include the complete serial number.

1-17. If the serial number of your instrument is lower than the serial number on the title page of this manual, you must modify your manual for agreement with your instrument. Refer to Section VII, MANUAL CHANGES, for the information that will adapt this manual to your instrument.

1-18. DESCRIPTION

1-19. The Hewlett-Packard Model 5359A Time Synthesizer is capable of generating digital delays from Ø to 160 ms in steps of less than 50 ps with <100 ps rms jitter typical. It uses a phase-startable-phase-lockable oscillator which allows the 5359A to commence digital time synthesis in synchronism with a randomly occurring external pulse. In addition, the time synthesizer can generate pulse trains with frequency or periods selectable to 10 MHz and with controllable pulse width.

1-20. OPTIONS

1-21. There are both equipment options and accessory options available for the 5359A. All options are designated by a three-digit number. The first digit of the option number identifies the option as either equipment or accessory. For an equipment option, the first digit is a zero and for an accessory option, the first digit is a nine. The following is a list of equipment and accessory options available with the 5359A:

Option	Description
001	High Stability Crystal Oven (10544A)

1-22. For more information concerning these options, contact your local HP Sales and Service Office. A list of HP Sales and Service offices is provided at the end of this manual.

1-23. ACCESSORIES SUPPLIED

1-24. The only accessory supplied with the HP Model 5359A is a power cord (HP Part Number 8120-1378) as shown in *Figure 1-1*.

1-25. EQUIPMENT AVAILABLE

1-26. A service accessory kit for the HP Model 5359A is available for troubleshooting and repairing the instrument. The service accessory kit contains seven extender boards and a service aid board. The accessory kit may be obtained from Hewlett-Packard by ordering Service Accessory Kit Model Number 10870A.

1-27. RECOMMENDED TEST EQUIPMENT

1-28. Equipment necessary to maintain the HP Model 5359A is listed in *Table 1-2*. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-1. Specifications

MODES:
External Trigger Mode — "Delay" and output pulse width must both be selected. "Delay" is the time from the leading edge of the sync output to the leading edge of the output pulse.
Internal Trigger Mode — Period or frequency is selected and the width of the output pulse. "Delay" is not specified in this mode.

RANGE:

Delay	0 ns to 160 ms
Width	5 ns to 160 ms (width + delay ≤160 ms)
Period	Minimum 100 ns or width + 85 ns. Maximum 160 ms.
Frequency	Same as corresponding period

STEP SIZE:
50 ps minimum, keyboard selectable, for both "width" and "delay".

ABSOLUTE ACCURACY:
±1 ns ± time base error

INSERTION DELAY:
Less than 140 ns in preset. For "delays" greater than 100 ns, reduced to less than 40 ns in the auto position. Fixed in both cases.

JITTER:
Between external trigger or sync out, and the output pulse.
Standard time base
100 ps rms typical 200 ps rms max (delays 0 to 10 ms)
500 ps rms typical 1 ns rms max (delays 10 ms to 160 ms)
High stability time base (Option 001)
100 ps rms typical 200 ps rms max (delay 0—160 ms)

EXTERNAL TRIGGER INPUT:
Trigger level adjustable -2V to +2V. Slope selectable + or -.

MANUAL TRIGGER:
Pushbutton

SYNC OUTPUT:
1 volt positive pulse into 50Ω, from 200Ω source impedance.
Width 35 ns nominal. Rise/Fall times <5 ns.

OUTPUT PULSE:
Amplitude adjustable from 0.5V to 5V into 50Ω from 50Ω output impedance.
Offset adjustable from -1V to +1V, or OFF.
Normal or Complement Mode selectable; Rise/Fall times less than 5 ns; typical 3.5 ns.
Short circuit proof; external voltage must not be applied.
Offset and Amplitude may be displayed.

Table 1-1. Specifications (Cont'd)

REPETITION RATE:
Internal Trigger Mode
Maximum repetition rate 10 MHz
Period ≥ width +75 ns typical
External Trigger Mode
"Preset" Sync Delay
Maximum repetition rate 7.5 MHz typical
Period ≥ delay + width +75 ns typical
"Auto" Sync Delay
Maximum repetition rate 13 MHz typical
Period ≥ delay + width −30 ns typical
The "Auto" mode requires a delay of at least 100 ns. For delays of less than 100 ns, the same specifications as for "Preset" apply.

EDGE 1 OUTPUT: (rear panel)
Occurs with fixed time relationship to the leading edge of the output pulse. Specifications are the same as for SYNC OUT.

EDGE 2 OUTPUT: (rear panel)
Occurs with fixed time relationship to the end of the output pulse. Specifications are the same as for SYNC OUT.

EVENTS MODE:
Substitutes an external input for the internally counted clock. "Delay" and "Width" must both be specified in events.
Trigger Level: Adjustable −2V to +2V
Slope: Selectable + or −
Frequency: Up to 100 MHz
Delay from "Ext Trigger Input" to the first event counted is less than 50 ns
Range: "delay" 2 events to 16777215 events
"width" 1 event to 16777214 events
"width" + "delay" <16777216 events

FREQUENCY STANDARD (rear panel)
Input: 5 or 10 MHz >1.0V p-p into 1 KΩ. Maximum input 10V.
Output: 10 MHz. 1V p-p into 50Ω in sync with time base chosen (INT or EXT).

TIME BASE:
High Stability Time Base
Crystal Frequency 10 MHz
Stability:
Aging Rate: $<5 \times 10^{-10}$ per day
Short Term: $<1 \times 10^{-11}$ for 1 s average
Temperature: $<7 \times 10^{-9}$ 0°C to 55°C
Line Voltage: $<1 \times 10^{-10}$, ±10% from nominal

OPERATING TEMPERATURE: 0° to 50°C
WEIGHT: 14.55 kg (30 lbs).
DIMENSIONS:
Height: 133 mm (5¼")
Width: 426 mm (16¾")
Depth: 521 mm (20½")

10811A

シリアル 2012A 以降は High Stability Time Base は
スタンダードとなった。(それ以前のもので オーブンがついていたらそれは
オプション 001 である) 大寺

1990.3.12 from Pete BUDLONG

Table 1-2. Recommended Test Equipment

Equipment	Required Characteristics	USED FOR Oper. Verif.	Adjust.	Trouble-shooting	Recommended HP Model
Service Kit Consists of:			X	X	10870A
Service Board	No Substitute			X	05370-60014
Extender Board	15 Pin			X	5060-0049
Extender Board	22 Pin			X	5060-0630
Extender Board	For 5370A Use				05370-60074
Extender Board	For A7 Oscillator Power Supply			X	05370-60076
Extender Board	For Digital Section (A9 thru A23, except A16)			X	05370-60075
Extender Board	For A24 200 MHz (Multiplier Assembly)			X	05370-60077
Extender Board	For A16			X	05359-60078
Pulse Generator		X	X		8082A
Oscilloscope		X	X		1720A
Sampling Oscilloscope			X		140A
Sampling Plug-In			X		1410A
Spectrum Analyzer			X		141T/8552A/ 8554L
Active Probe			X	X	1120A
Probe P.S.			X	X	1122A
Signature Analyzer	No Substitute			X	5004A
DMM	3½ Digit with 0.1% Accuracy		X	X	3435A
Controller	HP-IB	X		X	9825A
Logic Probe				X	545A
Pulser				X	546A
Current Tracer				X	547A
9 Cables	4′ BNC 50Ω Cables (2 matched length within ½″)	X	X	X	11170C
Tuning Wand	Ceramic		X		8730-0013
Tuning Wand	Long Plastic		X		8730-0011
Time Interval Probes	No Sutstitute	X			5363A
Universal Time Interval Counter			X		5370A

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides all information necessary to install the HP 5359A. Covered in this section are initial inspection, power requirements, line voltage selection, interconnection, circuit options, mounting, storage, and repackaging for shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the shipment has been checked mechanically and electrically. The contents of the shipment should be as shown in *Figure 1-1*. Procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping material for the carrier's inspection.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. The HP 5359A requires a power source of 100, 120, 220, or 240 Vac, +5%, –10%, 48 to 66 Hz single phase. Power consumption is 220 VA maximum.

WARNING

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTOTRANSFORMER FOR VOLTAGE REDUCTION, MAKE SURE THE COMMON TERMINAL IS CONNECTED TO THE EARTHED POLE OF THE POWER SOURCE.

2-8. Line Voltage Selection

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure the instrument is set to the voltage of the power source.

2-9. *Figure 2-1* provides instructions for line voltage and fuse selection. The line voltage selection card and the proper fuse are factory installed for 120V ac operation.

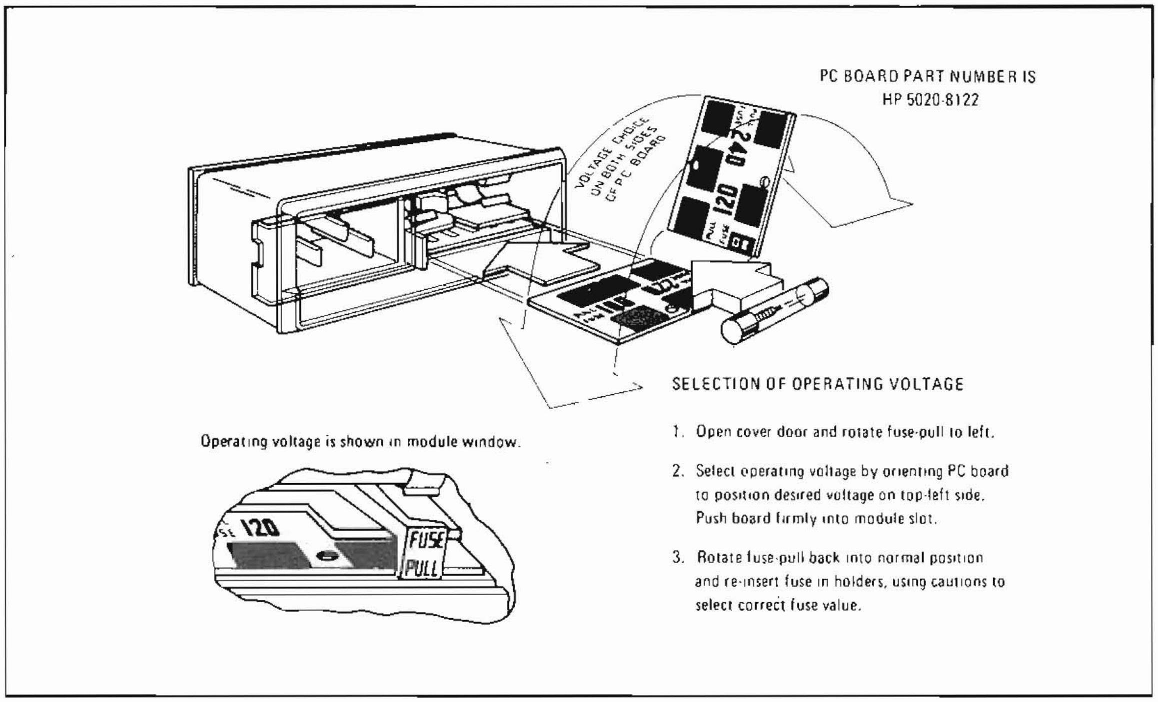


Figure 2-1. Line Voltage Selection

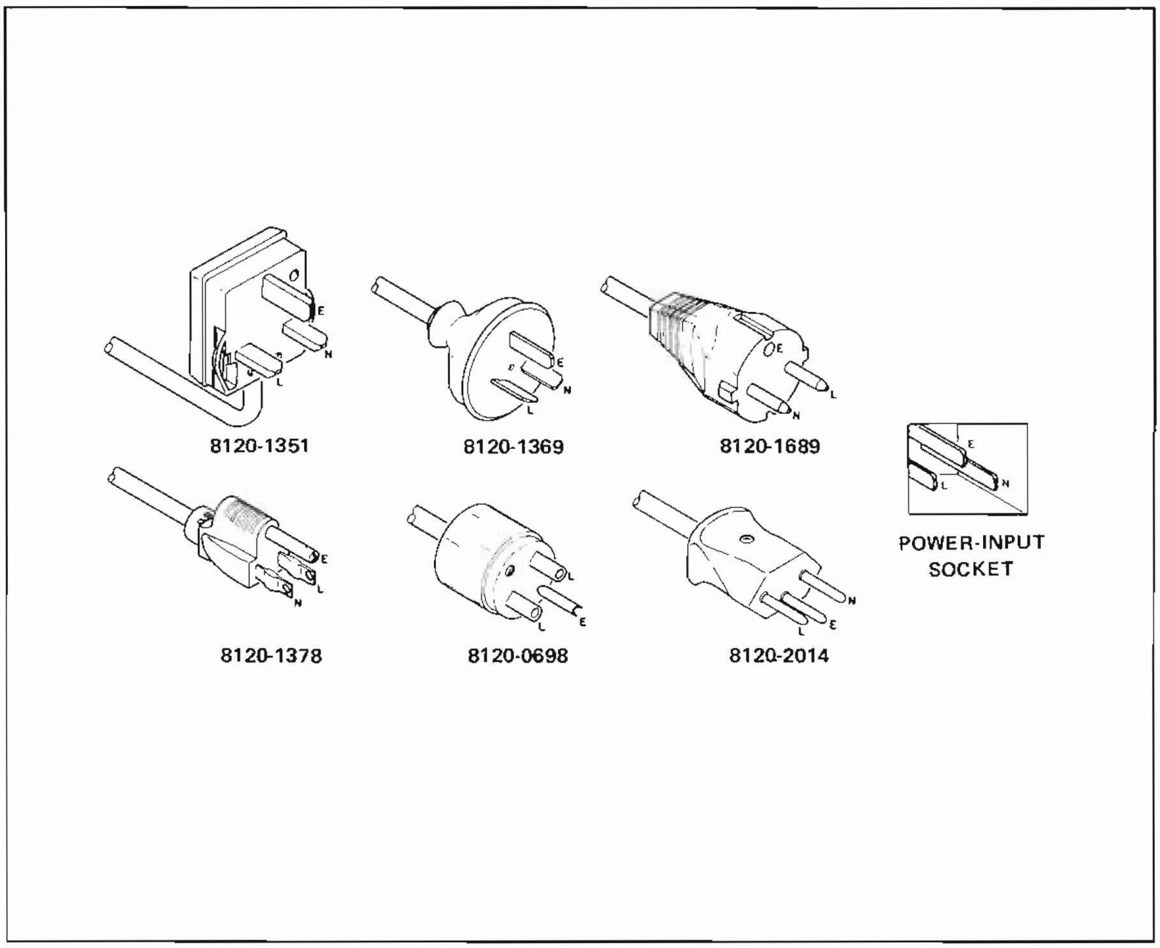


Figure 2-2. Power Cable HP Part Numbers versus Main Plugs Available

2-10. Power Cable

WARNING

BEFORE SWITCHING ON THIS INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THIS INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

2-11. The 5359A is shipped with a three-wire power cable. When the cable is connected to an appropriate ac power source, the cable connects the chassis to earth ground. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to *Figure 2-2* for the part numbers of the power cable and plug configurations available.

2-12. Interconnections

2-13. HEWLET-PACKARD INTERFACE BUS. Interconnection data concerning the rear panel HP-IB connector is provided in *Figure 2-3*. This connector is compatible with the HP 10631A/B/C/D HP-IB Cables. The HP-IB system allows interconnection of up to 15 (including the controller) HP-IB compatible instruments. The HP-IB cables have identical "piggy back" connectors on both ends so that several cables can be connected to a single source without special adapters or switch boxes. System components and devices may be connected in virtually any configuration desired. There must, of course, be a path from the calculator (or other controller) to every device operating on the bus. As a practical matter, avoid stacking more than three or four cables on any one connector. If the stack gets too large, the force on the stack produces great leverage which can damage the connector mounting. Be sure each connector is firmly (finger tight) screwed in place to keep it from working loose during use.

2-14. CABLE LENGTH RESTRICTIONS. To achieve design performance with the HP-IB, proper voltage levels and timing relationship must be maintained. If the system cable is too long, the lines cannot be driven properly and the system will fail to perform properly. Therefore, when interconnecting an HP-IB system, it is important to observe the following rules:

a. The total cable length for the system must be less than or equal to 20 metres (65 feet).

b. The total cable length for the system must be equal to or less than 2 metres (6.6 feet) times the total number of devices connected to the bus.

c. The total number of instruments connected to the bus must not exceed 15.

2-15. 5359A Listen Address

2-16. The 5359A contains a rear panel HP-IB Instrument address selection switch. There are five switches designated (5, 4, 3, 2, 1) which are used to select the address. Instructions for setting and changing the listen address are provided in Section III of this manual along with 5359A programming codes.

2-17. HP-IB Descriptions

2-18. A description of the HP-IB is provided in Section III of this manual. A study of this information is necessary if the user is not familiar with the HP-IB concept. Additional information concerning the design criteria and operation of the bus is available in IEEE Standard 488-1975, titled *"IEEE Standard Digital Interface for Programmable Instrumentation"*.

2-19. OPERATING ENVIRONMENT

2-20. Operating and Storage Temperature

2-21. In order for the 5359A to meet the specifications listed in *Table 1-1*, the operating environment must be within the following limits:

Temperature	0° to +55°C
Humidity	<88% relative
Altitude	<15,000 feet

2-22. Cooling System

2-23. A forced air cooling system is used to maintain the operating temperature required by the instrument. The cooling fan is located on the left-side of the rear panel (while looking at the rear panel). When operating the 5359A, choose a location that provides at least 8 cm (3 in.) of clearance at the rear and at least 2 cm (1 in.) for each side. Failure to provide adequate air clearance will result in execessive temperature reducing instrument reliability. The clearances provided by the plastic feet in bench stacking and the filler strip in rack mounting allow air passage across the top and bottom cabinet surfaces.

CAUTION

The left side-cover (facing front of instrument) is perforated, the right side-cover is not. This provides proper instrument cooling. DO NOT transpose covers or perforate the cover on the right side, or excessive heat, potentially damaging to the instrument, may result.

2-24. Bench Operation

2-25. The instrument has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand raises the front of the instrument for easier viewing of the control panel and the plastic feet are shaped to make full width modular instruments self aligning when stacked.

2-26. STORAGE AND SHIPMENT

2-27. Environment

2-28. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature	-40°C to +75°C
Humidity	<95% relative
Altitude	<50,000 feet

2-29. Packaging

2-30. ORIGINAL PACKAGING. Containers and materials equivalent to that used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, and full serial number. Aslo, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument model number and full serial number.

2-31. OTHER PACKAGING. The following general instructions should be used for repackaging with commercially available materials:

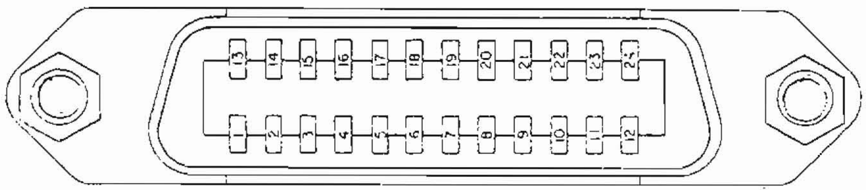
a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A doublewall carton made of 250 pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

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

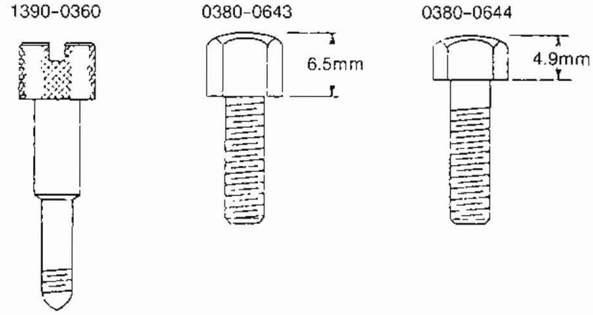


PIN	LINE	
1	DIO1	
2	DIO2	
3	DIO3	
4	DIO4	
13	DIO5	
14	DIO6	
15	DIO7	
16	DIO8	
5	EOI	
17	REN	
6	DAV	
7	NRFD	
8	NDAC	
9	IFC	
10	SRQ	
11	ATN	
12	SHIELD-CHASSIS GROUND	
18	P/O TWISTED PAIR WITH PIN 6	
19	P/O TWISTED PAIR WITH PIN 7	THESE PINS
20	P/O TWISTED PAIR WITH PIN 8	ARE
21	P/O TWISTED PAIR WITH PIN 9	INTERNALLY
22	P/O TWISTED PAIR WITH PIN 10	GROUNDED
23	P/O TWISTED PAIR WITH PIN 11	
24	ISOLATED DIGITAL GROUND	

CAUTION

The 5359A contains metric threaded HP-IB cable mounting studs as opposed to English threads. Metric threaded HP 10631A, B, C, or D HP-IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable hardware illustrations and part numbers follow.

LOCKSCREW 1390-0360   LONG MOUNTING STUD 0380-0643   SHORT MOUNTING STUD 0380-0644



Logic Levels

The Hewlett-Packard Interface Bus logic levels are TTL compatible, i.e., the true (1) state is 0.0V dc to 0.4V dc and the false (0) state is +2.5V dc to +5.0V dc.

Programming and Output Data Format

Refer to Section III, Operation

Mating Connector

HP 1251-0293; Amphenol 57-30240.

Mating Cables Available

HP 10631A, 0.9 metres (3 ft.), HP 10631B, 1.8 metres (6 ft.)
HP 10631C, 3.7 metres (12 ft.)
HP 10631D, 0.5 metres (1.5 ft.)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus System may contain no more than 1.8 metres (6 ft.) of connecting cable per instrument.
2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus System is 20.0 metres (65.6 ft.).

Figure 2-3. Hewlett-Packard Interface Bus Connection

SECTION III
OPERATING AND PROGRAMMING

3-1. INTRODUCTION

3-2. This section provides complete operating and programming information for the HP Model 5359A Time Synthesizer. Included in this section are a description of all front and rear panel controls, connectors and indicators, manual and remote operating instructions, and operator's maintenance.

3-3. OPERATOR'S MAINTENANCE

3-4. The only operator maintenance is replacement of the primary power fuse located within the Line Module Assembly. For instructions on how to change the fuse, refer to Section II, Line Voltage Selection.

CAUTION

MAKE SURE THAT ONLY SLOW-BLOW TYPE FUSES WITH THE REQUIRED RATED CURRENT ARE USED FOR REPLACEMENT. THE USE OF REPAIRED FUSES AND THE SHORT-CIRCUITING OF FUSE-HOLDERS MUST BE AVOIDED.

3-5. POWER/WARM UP

3-6. The HP Model 5359A requires a power source of 100, 120, 220, or 240V ac, +5%, -10%, 48 to 66 Hz single phase. Selection of the line voltage and the input power fuse is described in Section II, Preparation for Use.

3-7. The 5359A has a two-position power switch, STBY and ON. For 5359A Option 001 only, it is important that the instrument remain connected to the power source and be in the STBY mode when not in use. This supplies the necessary power to the crystal oven to maintain a constant oven temperature and eliminates the need for a long warm-up period. When the STBY mode is not used or power has been disconnected from the instrument, allow 30 minutes in the ON mode for the instrument (crystal oven) to warm-up.

WARNING

POWER IS ALWAYS PRESENT AT THE LINE SWITCH AND POWER TRANSFORMER, AND UNREGULATED DC IS PRESENT WHENEVER THE LINE CORD IS ATTACHED. DISCONNECT THE POWER CORD TO REMOVE ALL POWER FROM THE INSTRUMENT.

3-8. PANEL FEATURES

3-9. Front panel controls, front panel indicators and rear panel features of the HP Model 5359A are described in *Figures 3-3, 3-4* and *3-5* respectively. These figures locate and describe all operator controls, connectors, and indicators.

3-10. OPERATOR'S CHECKS

3-11. A procedure for verifying the basic operation of the 5359A Time Synthesizer is provided in *Figure 3-6*. This check utilizes the instrument's self-calibration cycle and verification of front panel indicators. No additional equipment is required.

NOTE

This check is not intended to verify the output, accuracy or performance specifications of the instrument.

3-12. OPERATING INSTRUCTIONS

WARNING

BEFORE THE INSTRUMENT IS SWITCHED ON, ALL PROTECTIVE EARTH TERMINALS, EXTENSION CORDS, AUTO-TRANSFORMERS AND DEVICES CONNECTED TO IT SHOULD BE CONNECTED TO A PROTECTIVE EARTH GROUNDED SOCKET. ANY INTERRUPTION OF THE PROTECTIVE EARTH GROUNDING WILL CAUSE A POTENTIAL SHOCK HAZARD THAT COULD RESULT IN PERSONAL INJURY.

WARNING

ONLY FUSES WITH THE REQUIRED RATED CURRENT AND SPECIFIED TYPE SHOULD BE USED. DO NOT USE REPAIRED FUSES OR SHORT CIRCUITED FUSE-HOLDERS. TO DO SO COULD CAUSE A SHOCK OR FIRE HAZARD.

CAUTION

BEFORE THE INSTRUMENT IS TURNED ON, IT MUST BE SET TO THE VOLTAGE OF THE POWER SOURCE, OR DAMAGE TO THE INSTRUMENT COULD RESULT.

3-13. Operating the 5359A Time Syntheiszer requires adjustment and programming of the front panel keys and controls. These keys and controls are arranged in four major groups. From left to right across the front panel the groups are:

a. EXTERNAL ENABLE

b. SYNC DELAY

c. OUTPUT

d. FUNCTION/DATA/UNITS

3-14. External Enable

3-15. The EXTERNAL ENABLE section contains the External Trigger input and the controls that affect it. The LEVEL control is adjustable from -2V to +2V and determines the trigger level of the external input. The setting of the SLOPE switch selects the enabled slope. The MAN TRIG key initiates one external trigger, independent of any external input, each time the key is pressed.

3-16. SYNC Delay

3-17. The SYNC DELAY section contains the output connector for the SYNC OUTPUT pulse, and the PRESET/AUTO select switch. Sync Delay is the amount of insertion delay between the external trigger and the Sync Output pulse. After an external trigger, the 5359A requires a minimum of about 140 ns to produce an output pulse. The SYNC Delay Preset mode inserts a fixed delay of about 140 ns between the external trigger and sync out. This provides the minimum processing time, while still allowing the 5359A to output with "zero" delay from sync output to output pulse.

3-18. In applications where specified pulse delays will be 100 ns or more, a sync delay mode of less than 40 ns may be selected. The fixed sync delay of about 40 ns combined with a 100 ns (minimum) pulse delay provides the minimum processing time. This combination shortens the total time from external trigger to the sync output pulse by about 100 ns. See *Figure 3-1*.

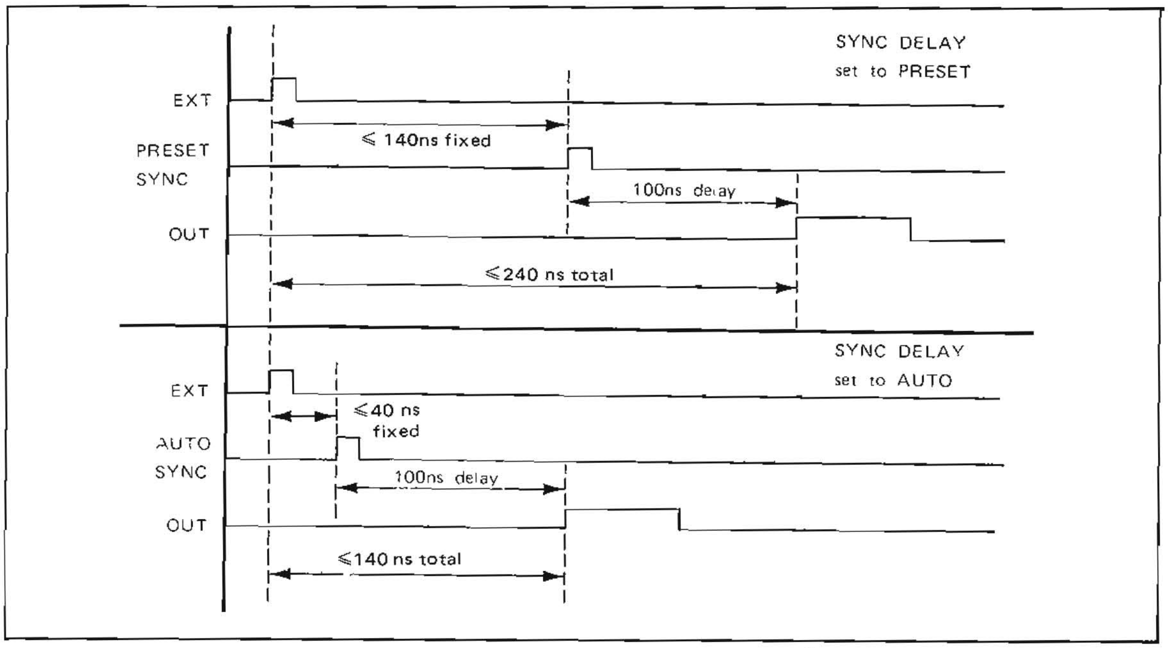


Figure 3-1. PRESET/AUTO Sync Delay

3-19. The PRESET/AUTO switch selects a fixed sync delay of less than 140 ns in PRESET. In AUTO, the sync delay may be either fixed at less than 40 ns or fixed at less than 140 ns, as determined by the programmed pulse delay. If a 100 ns (or greater) pulse delay is specified the sync delay is less than 40 ns. If a pulse delay of less than 100 ns is specified, the sync delay automatically resets to less than 140 ns (typical 135 ns). In the AUTO mode (with delay set to ≥100 ns) the SYNC OUT is simply a buffered version of the EXT TRIGGER. Therefore, if the EXT TRIGGER is at a frequency in excess of the capabilities of the 5359A, extra SYNC OUT pulses may occur.

3-20. Output

3-21. The OUTPUT section contains the output connector and output controls. The output pulse may be normal or complimented, positive polarity or negative polarity, as determined by the settings of the POLARITY switches. The output amplitude is adjustable from 0.5V to 5V with the AMPLITUDE control. The ON/OFF switch activates the OFFSET control. The output DC offset is adjustable from -1V to +1V when activated, and is preset to zero when off. The DISPLAY LEVELS key activates a continuous digital display of both amplitude and offset voltage levels.

3-22. Function/Data/Units

3-23. The FUNCTION keys control which operating parameter is displayed and precede the entry of new data. They also allow the stepped manipulation of entered data and initiation of a self calibration cycle.

3-24. The DATA keys, when preceded by a function key, are used to enter a new operating parameter. The new parameter entry is completed by selection of a UNITS key. The data entry is displayed as it is keyed in, and can be cleared and re-entered anytime prior to pressing a units key. Illegal or out of range entries result in an error message. However, the 5359A does retain the preceding parameters.

3-25. Stepping

3-26. A separate STEP SIZE parameter can be entered and stored for each of the four functions, Width, Delay, Period, and Frequency, by pressing the desired function followed by STEP SIZE 23, DATA 24, and UNITS 25, 26, 27, or 28.

3-27. CALIBRATION

3-28. The CAL 20 key causes calibration of six internal timing parameters. The routine should be performed after any change in the front panel Amplitude of Offset controls, or following a significant change in operating temperature. The calibration is performed to the 50% point of the rise/fall times of the output pulse, as determined by the Amplitude and Offset controls. During Calibration the 5359A Output is open circuited.

3-29. The calibration can be expanded beyond the 5359A signal BNC's with the 5363A Time Interval Probes, through an External Timing Compensation procedure outlined in Section IV.

3-30. TURN-ON CHARACTERISTICS

3-31. When the 5359A is turned on, a power-up reset and self-check/calibration cycle is automatically initiated. The sequence is as follows:

1. Initially, all segments, indicators, and annunciators on the front panel and display are blanked out.
2. Then, all segments, indicators, annunciators, and pushbutton key LEDs in the front panel are lighted, except for CLOCK 29 . A self-calibration is performed at this time. If the calibration cannot be completed, the display returns with error message 8.n or 9.n. Refer to paragraph 3-36.
3. Finally, the display reads 100.00 ns WIDTH. The WIDTH function key LED and OUTPUT indicator LED are lighted.

3-32. Successful completion of the turn-on self-check cycle is indicated by a display of 100.00 ns WIDTH. During power-up, the microprocessor performs a checksum of the program ROM's and a checkerboard bit pattern is written into and read from RAM. Any ROM or RAM failure halts the cycle and displays an error message. Refer to Error Messages, paragraph 3-35.

3-33. After power-up and self-check, the 5359A assumes the following output parameters:

WIDTH	100.00 ns
PERIOD	1.00 μs
FREQUENCY	1.00 MHz
STEP SIZE	1.00 ns/1.000000000 kHz

3-34. Output polarity, amplitude, and offset are set by front panel controls.

NOTE

Perform the CAL whenever Output Amplitude or Level is changed to insure accurate timing.

3-35. Error Messages

3-36. Under certain conditions the 5359A will display an error message (number) or error indication (annunciator lite). There are nine numbered error messages in all. Errors 6.n and 7.n pertain to power-up only. Errors 4 through 7 and 9 generally indicate service related problems. Refer to Section VIII for additional information.

Error	Message
Err 1	Indicates an illegal remote command or an undefined function.
Err 2	Data out of range.
Err 3	Illegal key combination (local of HP-IB)
Err 4	Phase-locked-loop out of lock.
Err 5	Undefined key (hardware problem).
Err 6.n	RAM error
Err 7.n	ROM error
Err 7.9	ROM missing
Probe Err 8.n	Unable to calibrate using external probes.
Err 9.n	Calibrate error.

3-37. The 5359A may also indicate an error condition by flashing on and off the non-numbered error annunciator ERR (36). This display indicates that the last parameter entered is inconsistent with parameters previously entered. For example, the ERR annunciator will flash if an attempt is made to enter a pulse width of 2 ms after a period of 1 ms is specified. The new data is accepted, but the OUTPUT is disabled until the inconsistency is corrected (this permits the operator to enter new data in any order).

3-38. OPERATING CHARACTERISTICS

3-39. The following paragraphs describe the four general modes of operation for the 5359A Time Synthesizer. The modes of pulse generation are:

a. External Trigger/Delay

b. External Trigger/Events

c. Frequency/Period

d. Triggered Frequency

3-40. *Figures 3-7, 3-8, 3-9,* and *3-10* describe general operating instructions for the HP Model 5359A in each of four major modes of operation. The description control numbers correspond to the control locator illustration.

3-41. External Trigger/Delay

3-42. In this mode, the 5359A uses an external trigger input to generate an output pulse whose width and delay are selected by the user. Delay is defined as the time from the leading edge of the Sync Output to the leading edge of the Output pulse. The Sync Output is synchronized to the external trigger input with the amount of insertion delay fixed at either less than 40 ns or less than 140 ns. The output delay and width are selected over the following range:

Delay: 0 ns to 160 ms

Width: 5 ns to 160 ms

(Width + Delay $\leq$ 160 ms)

3-43. *Figure 3-2a* illustrates the timing relationships for the External Trigger/Delay mode of operation.

3-44. External Trigger/Events

3-45. The External Trigger/Events mode is similar to External Trigger/Delay mode previously described. An external trigger input is used to generate an output pulse whose width and delay are specified in terms of Events rather than time. An external Events input, up to 50 MHz, is substituted for the internally counted clock. The output delay and width are selectable over the following range:

Delay: 2 to 16777215 Events

Width: 1 to 16777214 Events

(Width + Delay ≤ 16777216 Events)

3-46. To prevent ambiguity as to the first event counted, the Events input pulses generally should not be present until about 50 ns following the EXT TRIGGER. Given this requirement, the Events signal may occur at up to a 100 MHz rate (50% duty cycle).

3-47. *Figure 3-2b* illustrates the timing relationships for the External Trigger/Events mode of operation.

3-48. Frequency/Period

3-49. The Frequency/Period mode is internally triggered and independent of any external inputs. The 5359A generates an output pulse train whose frequency (or period) and pulse width are selected by the user. Delay is not specified in this mode. The input frequency/period and pulse width are selectable over the following range:

Frequency: 6.25 Hz to 10 MHz.
Period: 100 ns to 160 ms
Width: 5 ns to 160 ms
(Period ≥ Width + 85 ns)

3-50. *Figure 3-2c* illustrates the timing relationships for the Frequency/Period mode of operation.

3-51. Triggered Frequency

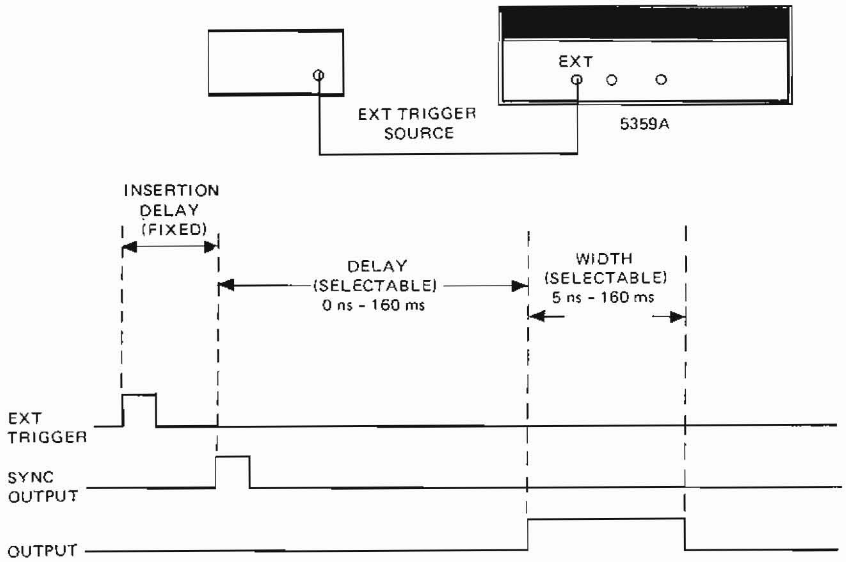
3-52. The Triggered Frequency mode generates a pulse train with frequency and pulse width specified, as in the Frequency/Period mode previously described. The output, however, is "gated" by an external trigger input. The user defines the duration of the gated "burst" of output pulses by selecting the slope and trigger level of the external input. Delay is not specified in this mode. The frequency/period and pulse width ranges are as specified in paragraph 3-49.

3-53. The delay from the EXT TRIGGER to the first pulse of the output burst is fixed for any given set of frequency/period and width parameters (i.e., the burst is synchronized to the EXT TRIGGER input). One sync output occurs for each EXT TRIGGER.

3-54. The Triggered Frequency mode is entered by pressing TRIG FREQ 28 key while in the Frequency/Period mode. Pressing this key again (while in the Triggered Frequency mode) restores operation to normal Frequency/Period mode of operation.

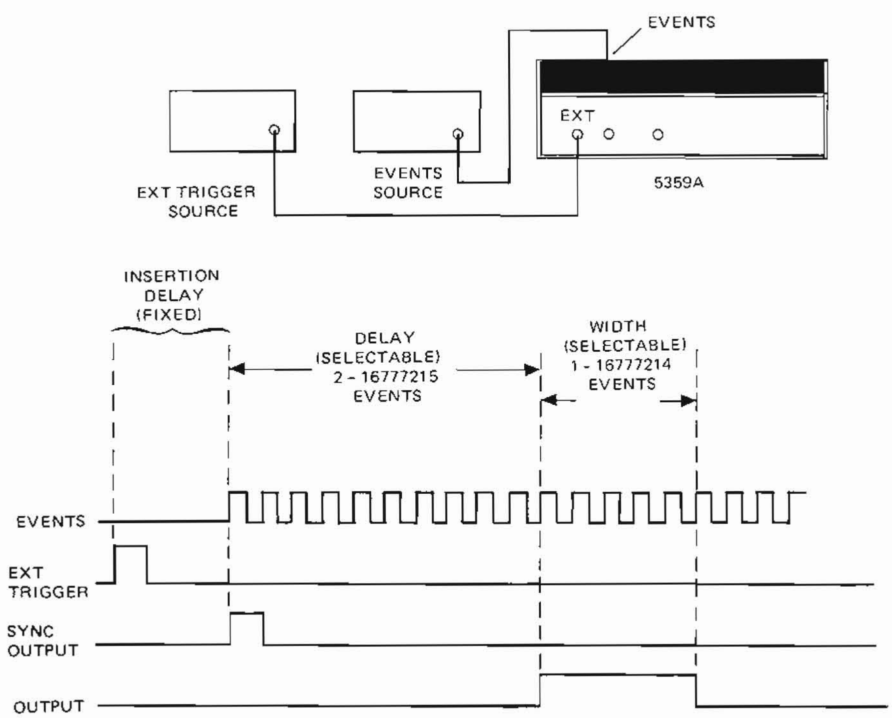
3-55. *Figure 3-2d* illustrates the timing relationships for the Triggered Frequency mode of operation.

5359A EXTERNAL TRIGGER/DELAY MODE



- WIDTH + DELAY ⩽ 160ms
- IF 'PRESET' INSERTION DELAY ⩽ 140ns
- IF 'AUTO' AND DELAY ⩾ 100ns INSERTION DELAY ⩽ 40ns

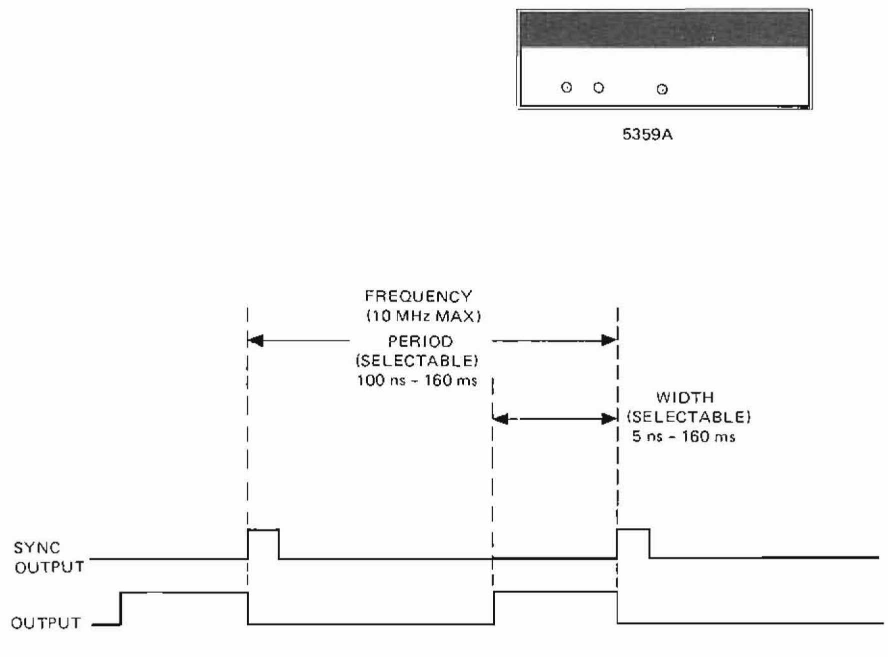
5359A EXTERNAL TRIGGER/EVENTS MODE



- WIDTH + DELAY ⩽ 16777216 EVENTS

Figure 3-2. Modes of Operation

5359A FREQUENCY/PERIOD MODE



● PERIOD ≥ WIDTH + 85ns

5359A TRIGGERED FREQUENCY MODE

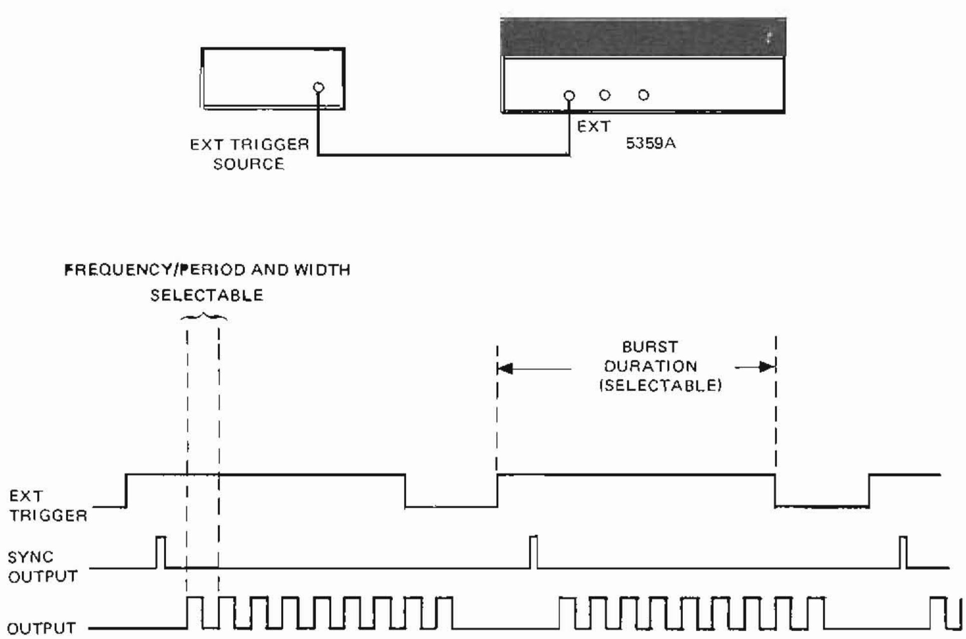
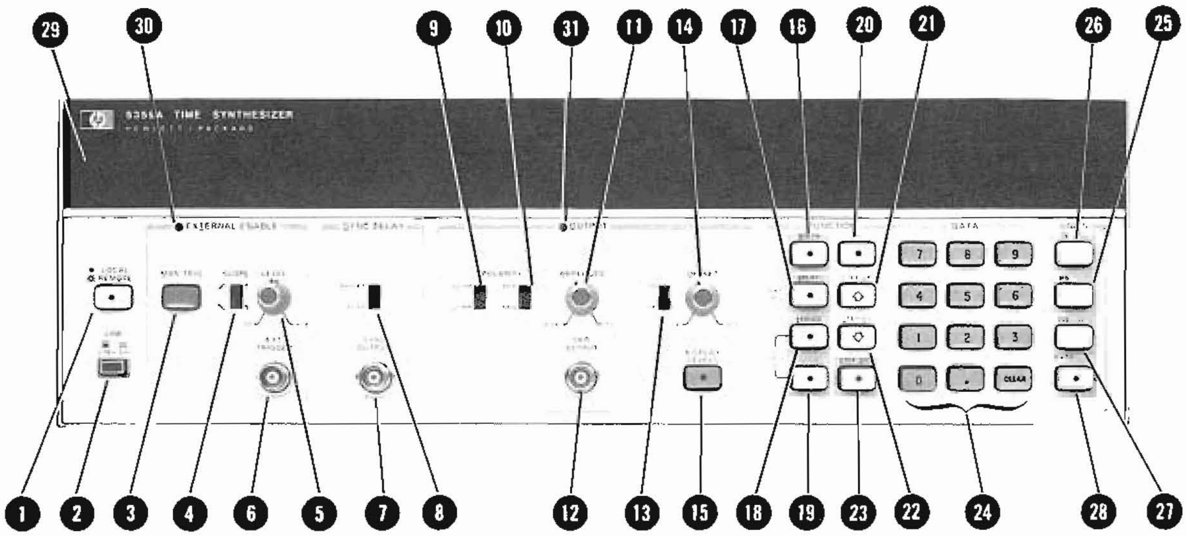


Figure 3-2. Modes of Operation (Cont'd)



1 Returns the instrument to local control when operated remotely and Local Lockout command has not been issued.

2 Supplies power to entire machine in the ON position. Supplies power only to the oscillator oven (Option 001 only) in the STBY (standby) position.

3 Manually triggers a single output pulse when in external enable mode.

4 Switch setting selects the slope of the EXT TRIGGER input that triggers the output.

5 Level control which sets the trigger level of the EXT TRIGGER input.

6 Input BNC connector for EXT TRIGGER input.

7 Output BNC connector for SYNC OUTPUT.

8 Switch setting selects insertion delay for sync output.

9 Switch setting selects either normal or complemented output pulse.

10 Switch setting selects either positive or negative polarity output pulse.

11 Level control which sets the amplitude voltage of the output pulse.

12 Output BNC connector for output pulse (50Ω output impedance).

13 Switch setting which enables adjustable offset voltage for output pulse. Off position selects zero volts offset.

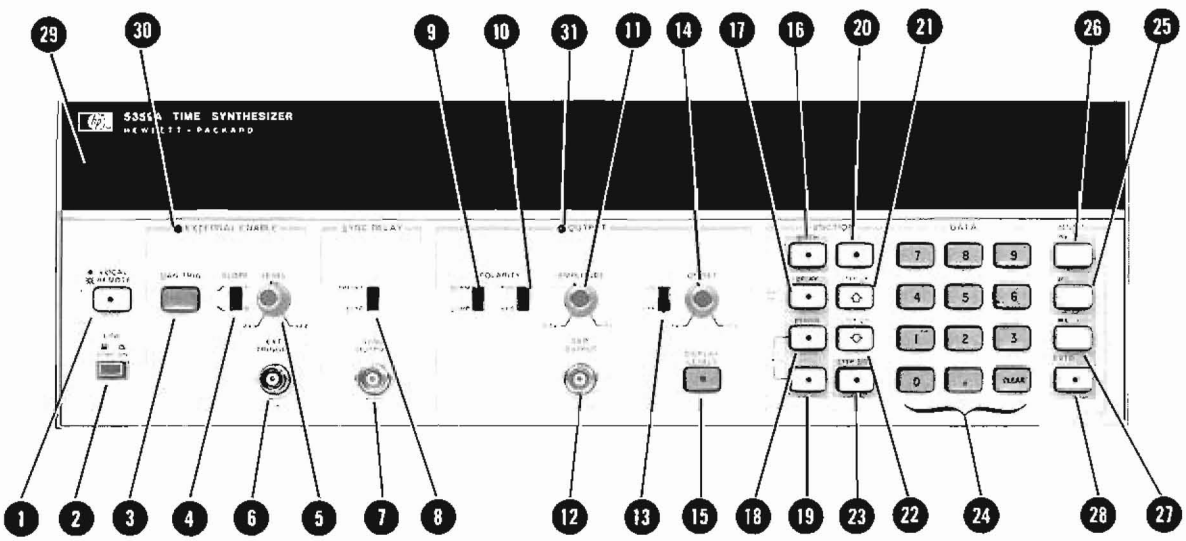
14 Level control which sets the offset voltage of the output pulse.

15 Measures and continuously displays the amplitude and offset voltage of the output pulse.

16 WIDTH function displays current output pulse width while enabling keyboard entry of new width data.

17 DELAY function displays current output pulse delay parameter while enabling keyboard entry of new delay data.

Figure 3-3. Front Panel Controls



18 PERIOD function displays current pulse train period (reciprocal of frequency), while enabling keyboard entry of new frequency data.

19 FREQ function displays current pulse train frequency (reciprocal of period) while enabling keyboard entry of new frequency data.

20 CAL function initiates an automatic self-calibration cycle in which 6 internal timing parameters are calibrated. Should be pressed after changing Amplitude or Offset controls to recalibrate to the 50% point of the output rise/fall times.

21 Single (or continuous if pressed in and held) step up of Width, Delay, Period or Frequency selection in increment of selected step size.

22 Single (or continuous if pressed in and held) step down of Width, Delay, Period or Frequency selection in increments of selected step size.

23 STEP SIZE displays current step size of the enabled function mode and allows keyboard entry of new step size data.

24 Keyboard for the entry of Width, Delay, Period, Frequency, Events or Step Size data. CLEAR key aborts entered data (prior to pressing a UNITS key) and blanks the display.

25 Used in conjunction with DATA keyboard, executes entry of displayed number in units of nanoseconds or hertz as determined by the function mode.

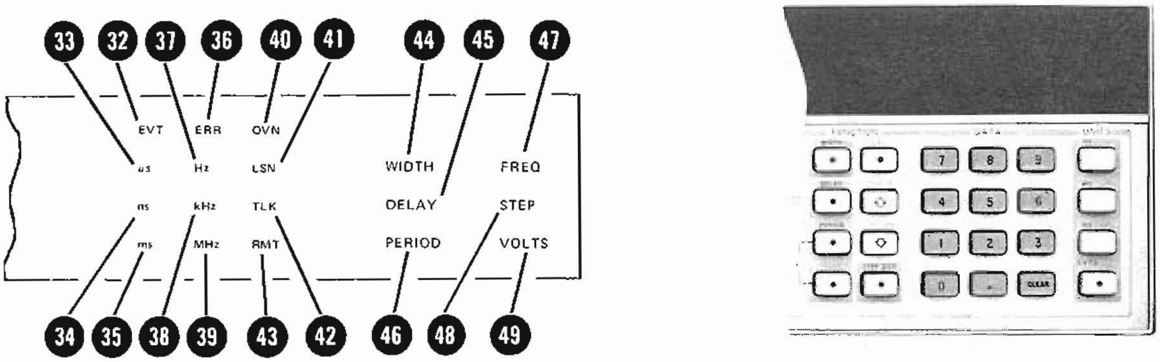
26 Used in conjunction with DATA keyboard, executes entry of displayed number in units of microseconds or kilohertz as determined by the function mode.

27 Used in conjunction with DATA keyboard, executes entry of displayed number in units of milliseconds or megahertz as determined by the function mode.

28 Events mode substitutes external input (EVENTS) for the internally counted clock. Output pulse delay and width specified in terms of external input events. Triggered Frequency mode outputs a keyboard selected frequency (period) burst with duration determined (gated) by the external trigger input.

29 CLOCK LOSS — When lit indicates no clock (internal or external) present.

Figure 3-3. Front Panel Controls (Cont'd)



30 EXTERNAL ENABLE — Indicates External Trigger required to produce output.

31 OUTPUT — Indicates output circuitry is active.

NOTE

This indication does not mean an output pulse is present. It does indicate that the programmed parameters are legal and the processor will allow an output.

32 EVT — output programmed in terms of Events.

33 μs — microseconds (10^{-6} seconds)

34 ns — nanoseconds (10^{-9} seconds)

35 ms — milliseconds (10^{-3} seconds)

36 ERR — Flashes indicate an error: last parameter entered inconsistent with parameters entered previously. Example: attempt to enter width of 2 ms after period is specified as 1 ms.

37 Hz — Hertz

38 kHz — kilohertz (10^3 hertz)

39 MHz — Megahertz (10^6 hertz)

40 OVN — Oven temperature indicator. When lit, crystal oscillator oven (option 001) is operating below required temperature.

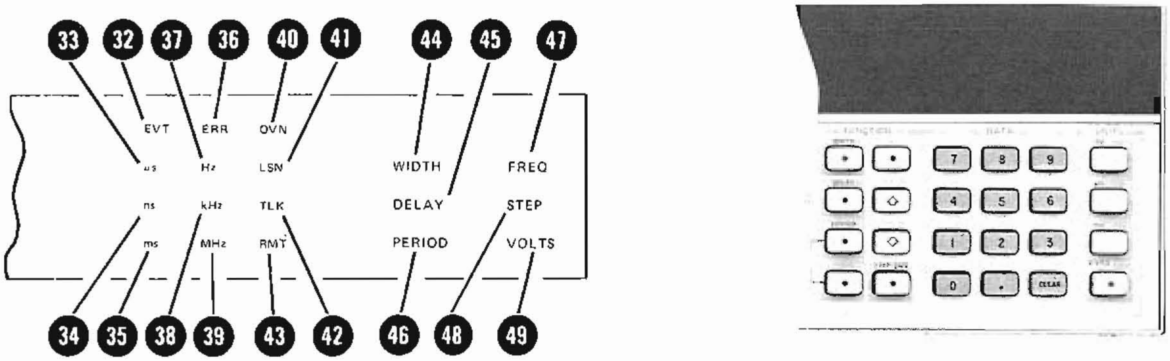
41 LSN — Listen indicates 5359A is remotely programmed to listen via HP-IB.

42 TLK — Talk indicates 5359A is remotely programmed to talk via HP-IB.

43 RMT — Remote indicates the 5359A is under remote control.

44 WIDTH — Indicates that the displayed data describes the output pulse width.

Figure 3-4. Front Panel Indicators



45 DELAY — Indicates that the displayed data describes the amount of delay from sync output to output pulse.

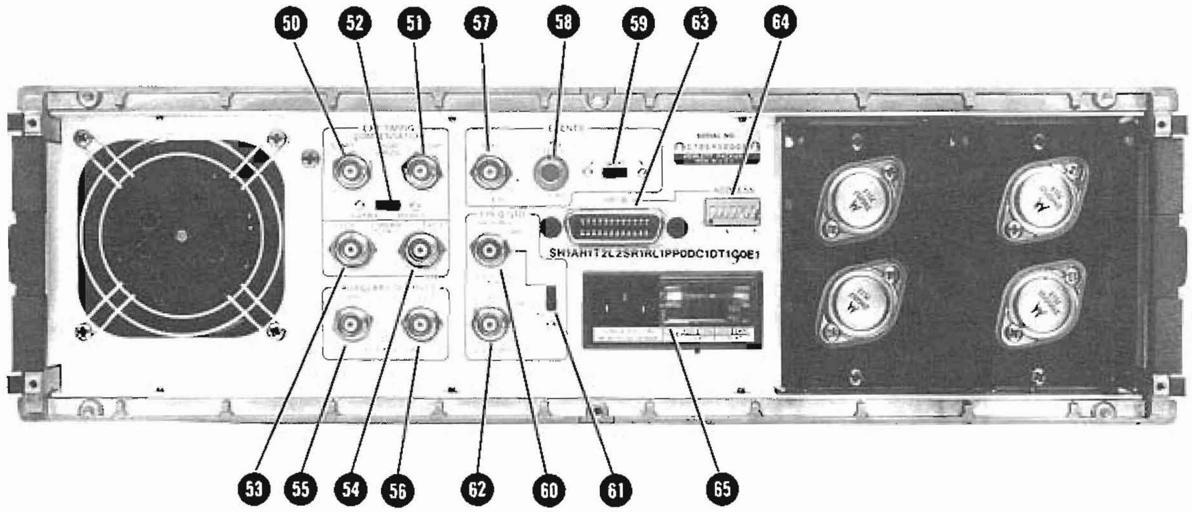
46 PERIOD — Indicates that the displayed data describes the period of the output.

47 FREQ — Indicates that the displayed data describes the frequency of the output.

48 STEP — Indicates that the displayed data describes the step size for the indicated function (the value which is added or subtracted by the STEP UP and STEP DOWN keys, respectively).

49 VOLTS — Indicates that the data displayed is in units of volts (pulse amplitude and offset).

Figure 3-4. Front Panel Indicators (Cont'd)



50 Start channel input BNC connector for HP 5363A Time Interval Probes.

51 Stop channel input BNC connector for HP 5363A Time Interval Probes.

52 Enable/Disable switch for HP 5363A probe inputs.

53 EXT X output BNC connector (to HP 5363A).

54 EXT Y output BNC connector (to HP 5363A).

55 EDGE 1 output BNC connector outputs auxiliary pulse (1 volt RMS into 50Ω) in sync with leading edge of output pulse.

56 EDGE 2 output BNC connector, outputs auxiliary pulse (1 volt RMS into 50Ω) in sync with trailing edge of output pulse.

57 EVENTS input BNC connector accepts asynchronous input up to 100 MHz to substitute for internal clock in Events mode.

58 TRIGGER LEVEL control adjusts ±2 volts to select trigger level of the Events input signal.

59 SLOPE switch selects the positive or negative slope of the Events input signal.

60 FREQ STD INPUT BNC connector allows synchronous operation with an external standard of either 5 or 10 megahertz (1 volt peak-to-peak into 1KΩ required. Maximum input 10V).

61 FREQ STD EXT/INT switch selects either internal (10 MHz) or external time base.

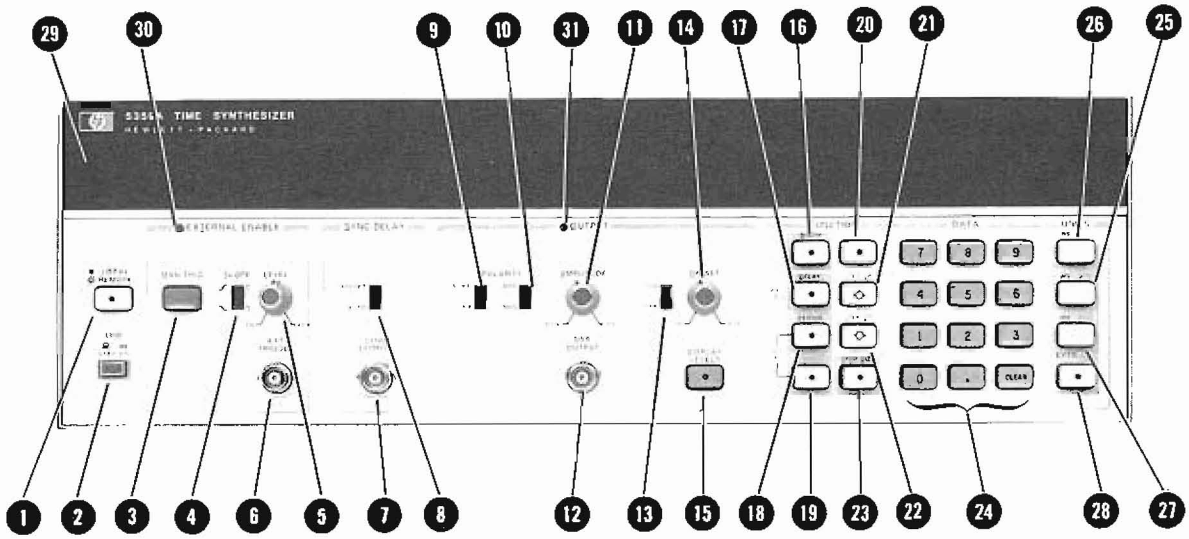
62 FREQ STD OUTPUT BNC connector provides 10 Megahertz in sync with time base chosen (EXT or INT). Amplitude is 1 volt peak-to-peak into 50Ω.

63 HP-IB Interface connector for remote operation via HP-IB.

64 HP-IB ADDRESS switch contains address switches A1 through A5. Switches A6 and A7 are not connected.

65 AC power input module permits 5359A operation from 100, 120, 220 or 240 volts AC. The number visible in the window indicates nominal line voltage to which instrument must be connected (see *Figure 2-1*). Protective grounding conductor connects to the instrument through this module.

Figure 3-5. Rear Panel Features



1. Before switching on the instrument, ensure that the power transformer primary is matched to the available line voltage, the correct fuse is installed, and that all safety precautions have been observed. See Power Requirements, Line Voltage Selection, Power Cables, and associated warnings and cautions in Section II of this manual. Description numbers below matched the numbers in *Figure 3-3.*

2. Preset the 5359A front panel controls as follows:

   EXTERNAL SLOPE
   - SLOPE 4 .... (positive slope)
   - LEVEL 5 .... approximate center

   SYNC DELAY
   - PRESET/AUTO 8 .... PRESET

   OUTPUT
   - POLARITY 9 10 .... NORM, POS
   - AMPLITUDE 11 .... approximate center
   - OFFSET 13 14 .... OFF, approximate center

3. Preset the 5359A rear panel controls as follows:

   EXTERNAL TIMING COMPENSATION
   - ENABLE/DISABLE 52 .... DISABLE

   EVENTS
   - TRIG LEVEL 58 .... approximate center
   - SLOPE 59 .... (positive slope)

   FREQ STD
   - EXT/INT 61 .... INT

4. Press LINE switch 2 to ON position and observe the self-calibration routine (see Paragraph 3-27). After calibration verify that the display indicates 100.00 ns WIDTH, and that the WIDTH FUNCTION key 16 and OUTPUT 30 LED indicators are lit.

NOTE

When the instrument is first turned on, the processor performs a self-check on the ROM's and RAM's and self-calibrates. If, during power-up or normal operation, an Error Messages is displayed, refer to Paragraph 3-35 ERROR MESSAGES in this section.

Figure 3-6. Operator's Checks

5. Press DISPLAY LEVELS 15. Verify that there are two groups of three digits displayed. The left group indicates the output pulse amplitude and the right group indicates the DC offset of the pulse (volts). Change the POLARITY switches 9, 10 to the COMP and NEG positions. Verify that the letter "c" and "–" (negative) sign precede the display groupings. Return the POLARITY switches to the NORM and POS positions. Vary the AMPLITUDE control 11, and verify that the left-most digits vary from approximately 0.50 volts to 5.00 volts. Slide the OFFSET OFF/ON switch 13 to ON, and vary the OFFSET control 14. Verify that the right-most digits vary from approximately -1.00 volts to 1.00 volts. Return the OFFSET ON/OFF switch to OFF. Verify that the displayed Offset voltage returns to 0.00 volts.

6. Press function keys WIDTH 16, DELAY 17, PERIOD 18, and FREQ 19 in succession, and observe the recall of power-up parameters as follows:

   WIDTH .... 100.00 ns
   DELAY .... --- --- --- -- ns
   PERIOD .... 1.00000 μs
   FREQ .... 1.00000 MHz

NOTE

When no parameter is entered, as in DELAY above, a series of eleven dashes (all display center segments) will be lit.

Verify that the displayed annunciator and function key LED correspond to the key pressed.

7. Press, in sequence, function key WIDTH 16 and STEP SIZE 23. Verify that the predefined power-up STEP SIZE of 1.00 ns is displayed. Verify that the STEP SIZE key LED and the STEP and WIDTH annunciators are lit. Verify that the LED indicator on the associated function key (WIDTH) is flashing. Repeat the above procedure for the DELAY 17, PERIOD 18 and FREQ 19 function keys (delay and period step size 1.00 ns and frequency step size 1.000 000 00 kHz).

8. Press function key WIDTH 16. Verify that momentarily pressing the STEP UP key 21 increments the displayed WIDTH by 1.00 ns. Press and hold the STEP UP key 21 and verify that the displayed WIDTH is increasing in steps of 1 ns, at a rate of approximately 7 steps per second. Repeat the above procedure using the STEP DN 22 key.

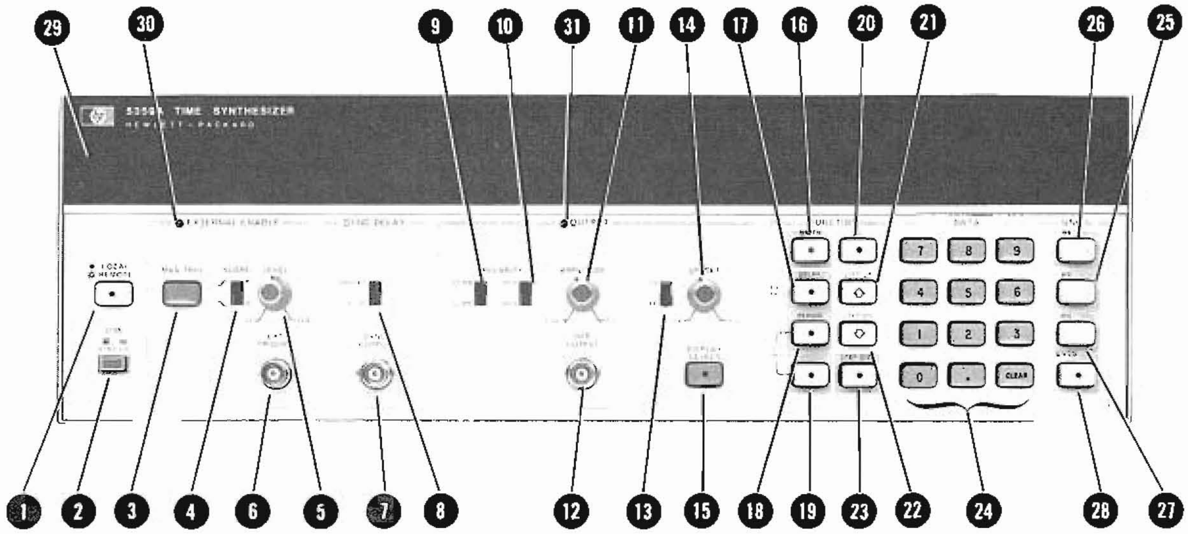
9. Press function key PERIOD 18 and verify a period of 1.000 00 μs. Press function key WIDTH 16 and observe a width of 100.00 ns (reenter these parameters if necessary). Attempt to enter an illegal width parameter (i.e. 2.0 μs) and verify the ERR annunciator 36 is flashing and the associated function key (PERIOD) LED is flashing. This display indicates that a 2.000 00 μs pulse WIDTH is inconsistent with the previously entered 1.000 00 PERIOD. The ERR may be cleared by entering a consistent parameter.

10. Press function key CAL 20, and verify that the OUTPUT LED 31 and selected function key LED momentarily blank, while the CAL (self-calibration) is performed.

NOTE

The CAL routine can be initiated without affecting any currently programmed function mode or parameter.

Figure 3-6. Operator's Checks (Cont'd)



1. Set LINE switch 2 to the ON position. The 5359A will perform self-calibration, and assume power up parameters (Paragraph 3-30).

2. Set SYNC DELAY 8 and OUTPUT controls 9 10 13 14 for desired output pulse. (If short insertion delay is not essential set 8 to PRESET.)

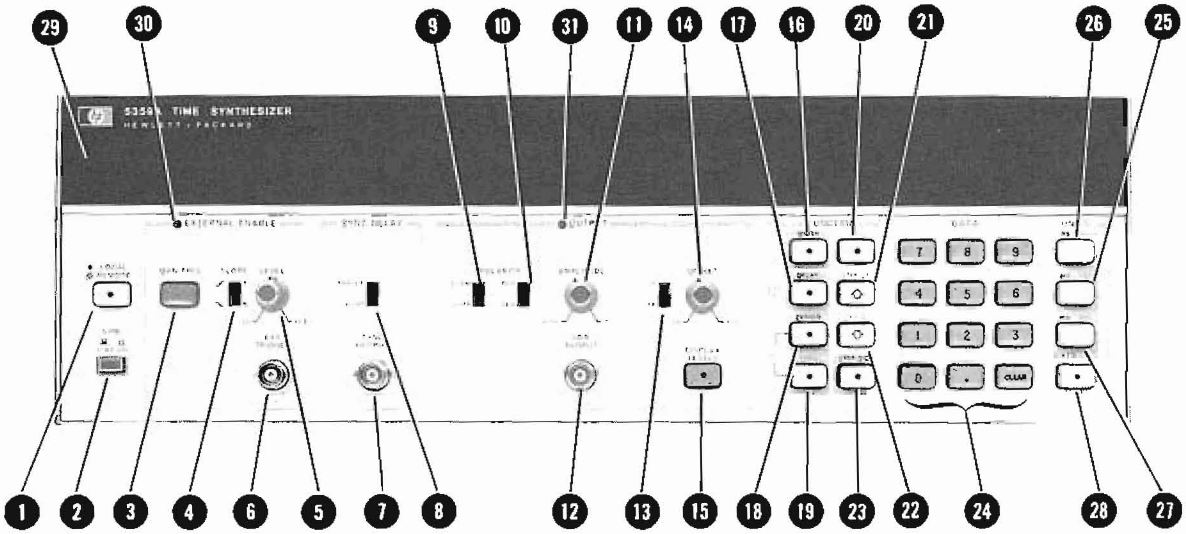
3. Connect external trigger signal to EXT TRIGGER input jack 6 .

4. Set EXTERNAL ENABLE slope 4 and LEVEL 5 controls for desired trigger.

5. Select desired delay by pressing DELAY 17 , DATA 24 and UNITS 25 26 27 in sequence.

6. Select desired width by pressing WIDTH 16 , DATA 24 and UNITS 25 26 27 in sequence.

Figure 3-7. EXT TRIGGER/DELAY



1. Set LINE switch 2 to ON position. The 5359A will perform self-calibration and assume power-up parameters (Paragraph 3-30).

2. Set SYNC DELAY 8 and OUTPUT controls 9 10 11 13 14 for desired output pulse. (If short insertion delay is not essential set 8 to PRESET.)

3. Connect external trigger signal to EXT TRIGGER input jack 6 .

4. Set EXTERNAL ENABLE Slope 4 and Level 5 controls for desired trigger.

5. Connect events signal to EVENTS input jack 57 on rear panel.

6. Set EVENTS Slope 59 and Level 58 controls for desired trigger.

7. Select desired delay by pressing DELAY 17 DATA 24 and EVENTS 28 in sequence. Data entry is referenced to number of Events.

8. Select desired width by pressing WIDTH 16 , DATA 24 , and UNITS 28 in sequence.

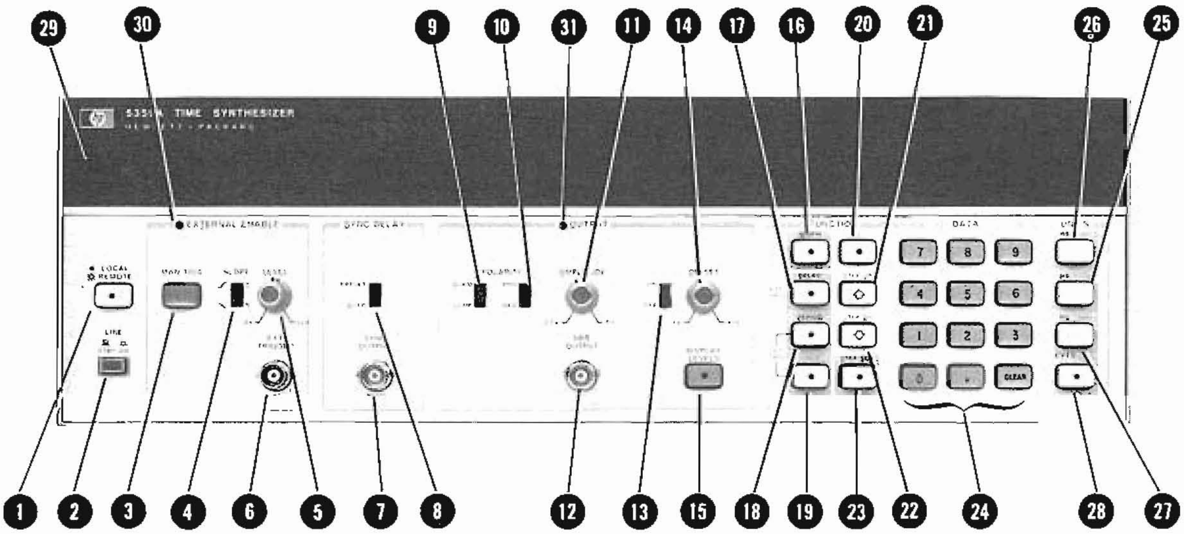
NOTE

Both Delay and Width must be specified as Events. If either value is not specified, a default value of 10 events is entered.

NOTE

The Events Level adjustment 58 (on rear panel) should be set to the approximate correct position prior to entering the Events mode. Failure to due so may result in attempting to count the noise or ripple pulses on the Events signal, causing an apparent "lock-up" in the 5359A (i.e., Output may cease). This condition may be cleared by pressing the EVT 28 key.

Figure 3-8. EXT TRIGGER/EVENTS



1. Set LINE switch 2 to ON position. The 5359A will perform self-calibration and assume power-up parameters (Paragraph 3-30).

2. Set OUTPUT controls 9 10 11 13 14 for desired output pulse.

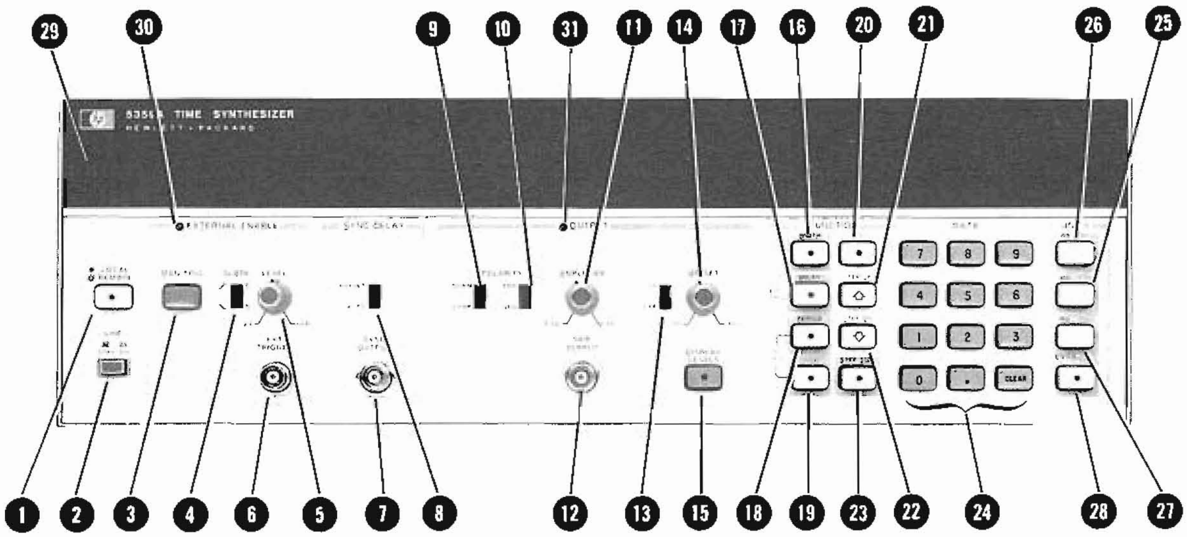
3. Select desired frequency (or period) by pressing FREQ 19 or PERIOD 18 , DATA 24 and UNITS 25 26 27 in sequence.

4. Select desired width by pressing WIDTH 16 , DATA 24 and UNITS 25 26 27 in sequence.

NOTE

The 5359A is a TIME SYNTHESIZER, rather than a Frequency Synthesizer. When data is entered, it is internally converted to the corresponding period, which is then synthesized. Since the accuracy of the instrument is stated in terms of absolute TIME (1 ns), the percentage frequency accuracy improves as frequency is lowered (i.e., 1 ns is 1% of a 10 MHz signal's period, but only 1×10^{-6}% of the 10 Hz signal's period).

Figure 3-9. FREQUENCY/PERIOD



1. Set LINE switch 2 to ON position. The 5359A will perform self-calibration and assume power-up parameters (Paragraph 3-30).

2. Set OUTPUT controls 9 10 11 13 14 for desired output pulse.

3. Connect external trigger signal to EXT TRIGGER input jack 6 .

4. Set EXTERNAL ENABLE Slope 4 and Level 5 controls for desired trigger.

5. Select desired frequency (or period) by pressing FREQ 19 or PERIOD 18 , DATA 24 and UNITS 25 26 27 in sequence.

6. Select desired width by pressing WIDTH 16 , DATA 24 and UNITS 25 26 27 in sequence.

7. Press TRIG FREQ 28 to enable the external trigger.

8. To return to normal Frequency/Period mode, press TRIG FREQ 28 again.

Figure 3-10. TRIGGERED FREQUENCY

3-56. PROGRAMMING

3-57. Introduction

3-58. The 5359A Time Synthesizer is fully compatible with the Hewlett-Packard Interface Bus (HP-IB). The bus capability is installed as standard equipment and allows the 5359A to respond to remote control instructions via the HP-IB.

NOTE

HP-IB is Hewlett-Packard's implementation of IEEE Std. 488-1975, "Standard Digital Interface for Programmable Instrumentation".

3-59. This section describes how to use the 5359A on the HP-IB. Before programming the 5359A, the operator must be familiar with the selected computing controller (e.g., the 9825A or 9830A calculator), the capabilities of the HP-IB, and the manual operation and capabilities of the 5359A. The following HP manuals provide useful background information:

HP-IB User Guide, 9830A, (P/N 59300-90002)
Hewlett-Packard 9825A Calculator General I/O Programming (P/N 09825-90024)
Hewlett-Packard 9825A Calculator Extended I/O Programming (P/N 09825-90025)
Condensed Description of the Hewlett-Packard Interface Bus (P/N 59401-90030)

3-60. Interface Function

3-61. The capability of a device connected to the HP-IB is specified by its interface functions. *Table 3-1* lists the interface functions of the 5359A using the terminology of the IEEE 488-1975 standard (Appendix C). The interface functions are also listed below the rear panel HP-IB connector. Interface functions provide the means for a device to receive, process, and send messages over the HP-IB.

Table 3-1. HP-IB Interface Capability

Interface Function Subset Identifier	Interface Function Description
SH1	Complete source handshake capability.
AH1	Complete acceptor handshake capability.
T2	Talker (basic talker, serial poll, no talk only mode, does not unaddress to talk if addressed to listen).
L2	Listener (basic listener, no listen only mode, does not unaddress to listen if addressed to talk).
SR1	Service request capability.
RL1	Complete remote/local capability.
PPØ	No parallel poll capability.
DC1	Device clear capability.
DT1	Devce trigger capability.
CØ	No controller capability.
E1	One unit load.

3-62. Bus Messages

3-63. Messages are the means by which devices exchange control and measurement information. There are 12 basic messages which can be sent over the interface. *Table 3-2* lists each bus message, a description of the message, how the 5359A uses that message, and examples of 9825A implementation of the messages.

Table 3-2. Bus Message Usage

Message	Description	5359A Use	Sample 9825A Statement
Data	Transfers device-dependent information from one device to one or more devices on the Bus.	Accepts program codes. See Table 3-4 for code set. Sends instrument state in "teach mode".	wrt 704, "F6e6"
Trigger	Causes a group of selected devices to simultaneously initiate a set of device-dependent actions.	Starts counting delay or period (same as pressing MANUAL TRIGGER when in local mode or sending the TM command when in remote).	trg 7 or trg 704
Clear	Causes an instrument to be set to a pre-defined state (a certain range, function, etc.).	Clears bits 5, 6 and 7 of status word. Clears Service Request.	clr 7 or clr 704
Remote	Permits selected devices to be set to remote operation, allowing parameters and device characteristics to be controlled by Bus Messages.	Goes to remote when REN true and listen or talk address sent. Locks out all controls except *.	rem 704
Local	Causes selected devices to return to local (front panel) operation.	Remain as currently configured and enable local control or all switches and controls.	lcl 704
Local Lockout	Disables local control of selected devices.	Disables LOCAL/REMOTE pushbutton.	llo 7
Clear Lockout and Local	Returns all devices to local (front panel) control and simultaneously clears the Local Lockout Message.	Same as Local Message and enable LOCAL/REMOTE pushbutton.	lcl 7
Require Service	Indicates a device's need for interaction with the controller.	Pulls on SRQ to indicate change in status byte or single cycle output completed. See status byte below.	rds (7) →A if bit (7, A) (bit 7 = 1 if SRQ true)
Status Byte	Presents status information of a particular device; one bit indicates whether or not the device currently requires service, the other 7 bits (optional) are used to indicate the type of service required.	See Table 3-5.	rds (704) →S (test bits in S)
Status Bit	A single bit of device-dependent status information which may be logically combined with status bit information from other devices by the controller.	Does Not Use	—
Pass Control	Passes bus controller responsibilities from the current controller to a device which can assume the Bus supervisory role.	Does Not Use	—
Abort	Unconditionally terminates Bus communications and returns control to the system controller.	Clears Talk, Listen, Serial Poll and Enable. Current configuration unchanged.	cli 7

**Trigger level control, amplitude control, offset control, events level control, internal/external time base switch, and local pushbutton (see Local Lockout below).*

3-64. Address Selection

3-65. To use the 5359A in an HP-IB system, set the rear panel address switches as shown in *Table 3-3*. The five right-hand switches, A5 through A1, set the talk and listen addresses of the 5359A. Switches A6 and A7 are not connected. The examples listed in this section assume an address setting of 00100, which is a 5-bit binary equivalent of decimal 04. This number is important when using an HP 9825A calcualtor, since the calculator addresses the 5359A to talk and listen using the address 704 (the "7" being the select code of the 98034A HP-IB Interface and the "04" being the 5359A address). The equivalent ASCII addresses are talk "D" and listen "$". The ASCII addresses are used when the computing controller is an HP 9830A Calculator.

3-66. Device Command Definitions

3-67. A device command is a sequence of one or more ASCII-coded bytes, sent to the 5359A over the HP-IB, that cause the 5359A to perform a specific function. Before discussing individual device commands, it is useful to classify these commands into three types: terse commands, decimal commands, and binary commands. Definitions and examples of each type follow:

Terse command: A specific sequence of one or more ASCII-coded bytes not followed by a decimal or binary number. For example, the character "C" causes the 5359A to execute a calibrate sequence. The characters "OC" cause the 5359A to output pulses in the complement polarity.

Decimal command: A sequence of one or more ASCII-coded bytes followed by a sequence of bytes representing a decimal number and a terminator. Numbers are explained below. A terminator is either a comma, carriage return or linefeed. For example, the sequence "F2.e6," causes the 5359A to output 2 MHz in the frequency mode.

Binary command: A sequence of one or more ASCII-coded bytes followed by a sequence of bytes representing a binary number. For example, the binary command:

LN (byte #1) (byte #2) . . . (byte #66) is the "learn" command.

For decimal commands, the number used must be of the form:

$$[+ \text{ or } -]\ X_0X_1 \ldots X_M\ [.]\ Y_0Y_1 \ldots Y_N\ [e \text{ or } E\ [+ \text{ or } -]\ Z_0 \text{ or } Z_0Z_1]$$

where:

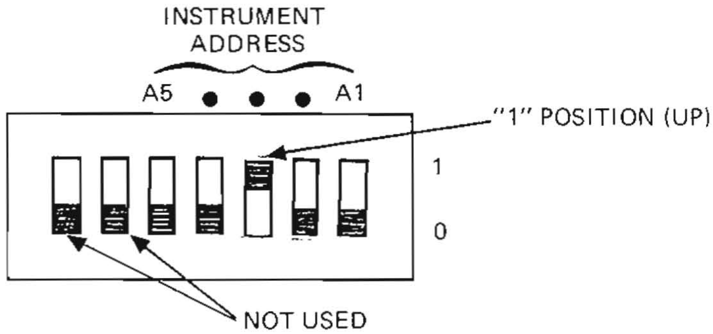
X_i = digit (i = 0 to M; $M \geq 0$)

Y_j = digit (j = 0 to N; $N \geq 0$; $N+M \geq 1$)

Z_k = digit (k = 0 to 1, one or two allowed)

[ ] = optional

Table 3-3. Address Selection



ASCII CODE CHARACTER		ADDRESS SWITCHES					DECIMAL EQUIV-LENT OF BINARY SWITCH SETTING
LISTEN	TALK	A_5	A_4	A_3	A_2	A_1	
SP	@	0	0	0	0	0	00
!	A	0	0	0	0	1	01
"	B	0	0	0	1	0	02
#	C	0	0	0	1	1	03
$	D	0	0	1	0	0	04
%	E	0	0	1	0	1	05
&	F	0	0	1	1	0	06
'	G	0	0	1	1	1	07
(	H	0	1	0	0	0	08
)	I	0	1	0	0	1	09
*	J	0	1	0	1	0	10
+	K	0	1	0	1	1	11
,	L	0	1	1	0	0	12
—	M	0	1	1	0	1	13
.	N	0	1	1	1	0	14
/	O	0	1	1	1	1	15
Ø	P	1	0	0	0	0	16
1	Q	1	0	0	0	1	17
2	R	1	0	0	1	0	18
3	S	1	0	0	1	1	19
4	T	1	0	1	0	0	20
5	U	1	0	1	0	1	21 ◄ Normally Reserved for HP-IB Controller
6	V	1	0	1	1	0	22
7	W	1	0	1	1	1	23
8	X	1	1	0	0	0	24
9	Y	1	1	0	0	1	25
:	Z	1	1	0	1	0	26
;	[	1	1	0	1	1	27
<	\	1	1	1	0	0	28
=	]	1	1	1	0	1	29
>	~	1	1	1	1	0	30

The following are examples of valid numbers:

-123 or 123. or 123e0 or +123

+0.6e6 or .6E6 or 0.6e+6

27E-09 or 27E-9 or 27e-9

Thus, to command the 5359A to output 345 kHz use any of the following decimal commands:

F345000,

or F3.45e+5,

or F+.345E6 CR (CR = carriage return)

3-68. In the discussion that follows, each 5359A device command is classified as to type.

3-69. THE 5359A DEVICE COMMANDS

3-70. *Table 3-4* shows the complete set of 5359A device commands. The codes are organized into functional groups for ease of description and use. Each group of commands is discussed below in detail. The order in which the codes are listed and sent over the HP-IB is arbitrary. Each code is processed on an interrupt basis by the microprocessor and implemented immediately. For example, the decimal command "F9.9e6", is sent to the processor via the HP-IB interface card (05370-60015), character by character, until the "," is received. On receipt of the "," the processor causes the 5359A to immediately output 9 MHz. The 5359A powers up with a width set to 100 ns and a frequency set to 1 MHz. When the 5359A goes into remote, the current switch settings and controls are "memorized" and become the starting point for HP-IB operation. The only conditions not recorded are the current setting of the AMPLITUDE and OFFSET controls. These controls remain locally enabled when the 5359A goes into remote. Lastly, all ASCII letters may be sent over the HP-IB in either upper or lower case.

3-71. FUNCTION MODE. The decimal commands in this group duplicate the operation of the front panel WIDTH, DELAY, PERIOD, FREQ, DATA, and UNITS keys. Each decimal command must include a number and a terminator (comma, carriage return, or line feed). The numbers used for FREQ and PERIOD have units of hertz and seconds, respectively. The units for DELAY and WIDTH are events, if the numbers are equal to or greater than one, or seconds, if less than one.

Example: For delay of 25 ns send

D 25 e - 9, or

D.025 e - 6 LF (LF = Line Feed)

3-72. STEP MODE. The commands in this group duplicate the operation of the STEP SIZE (width, delay, period, or frequency steps), STEP UP, and STEP DOWN keys. To program a step size (a) send a step size prefix (F, P, D, or W for Frequency, Period, Delay, or Width), (b) SS)Step Size), (c) a number and (d) a terminator. The numbers used for FREQ and PERIOD STEP SIZES have units of hertz and seconds, respectively. The units for DELAY and WIDTH are events, if the numbers are equal to or greater than one, or seconds, if less than one.

Table 3-4. 5359A Device Commands

Command Group	Device Command	Description	Equivalent Key/Switch/Control	Command Type
Function Mode	F <num> <term>*	Frequency Mode (Hz)	FREQ /DATA/UNITS	Decimal
	P <num> <term>	Period Mode (seconds)	PERIOD /DATA/UNITS	Decimal
	D <num> <term>	Delay } Seconds, if Delay/Width less than 1. Events otherwise.	DELAY DATA/UNITS	Decimal
	W <num> <term>	Width } Seconds, if Delay/Width less than 1. Events otherwise.	WIDTH /DATA/UNITS	Decimal
Step Mode	<prefix> SS <num> <term>	Step Size (units correspond to the units of the prefix) <prefix> = F, P, D, or W	STEP SIZE /DATA/UNITS	Decimal
	<prefix> SU	Step Up (single step)	STEP UP	Terse
	<prefix> SD	Step Down (single step)	STEP DOWN	Terse
Events Mode	EN	Events Slope Negative	EVENTS SLOPE	Terse
	EP	Events Slope Positive	EVENTS SLOPE	Terse
Trigger Mode	TP	External Trigger-Positive Slope	SLOPE	Terse
	TN	External Trigger-Negative Slope	SLOPE	Terse
	TM	Trigger Manual	MAN TRIG pressed once	Terse
	ID	Trigger Input Disable	Disconnect/connect EXT TRIGGER input	Terse
	IE	Trigger Input Enable	Disconnect/connect EXT TRIGGER input	
	TF NF	Triggered Frequency On Normal Frequency (No trigger needed)	TRIG FREQ	Terse

Table 3-4. 5359A Device Commands (Continued)

Command Group	Device Command	Description	Equivalent Key/Switch/Control	Command Type
Output Mode	ON	Output-Normal	POLARITY NORM COMP	Terse
	OC	Output-Complement	NORM COMP	Terse
			AMPLITUDE	Terse
	OA <num> <term>	Output Amplitude and Display Levels	0.5V 5V and DISPLAY LEVELS	Decimal
			OFFSET	
	OO <num> <term>	Output Offset and Display Levels	-1V +1V and DISPLAY LEVELS	Decimal
	OL	Output Local (Enable front panel OFFSET and AMPLITUDE controls)	DISPLAY LEVELS	Terse
	SC	Single Cycle	No equivalent	Terse
	RA	Rearm (initiate single cycle)	No equivalent	Terse
	NC	Normal Cycle (cancels SC)	No equivalent	Terse
	OD	Output Disable	No equivalent	Terse
	OE	Output Enabled	No equivalent	Terse
Sync Delay Mode	SP	Sync Delay-Preset	PRESET AUTO	Terse
	SA	Sync Delay-Auto	PRESET AUTO	Terse
Calibration Mode	C	Perform Calibration	CAL	Terse
	ECE	External Compensation Enable (Enable 5363A Probes)	EXT TIMING COMPENSATION	Terse
			ENABLE DISABLE	Terse
	ECD	External Compensation Disable (Disable 5363A Probes)	ENABLE DISABLE	
Teach/ Learn	TE	Teach	None	Terse
	LN	Learn	None	Binary

*<num> = *number*
<term> = *terminator (ASCII carriage return, line feed, or comma)*

3-73. After programming the step size, one step up or step down is accomplished by sending F, P, D, or W followed by SU (Step Up) or SD (Step Down).

Example:

(1) For width step size of 10 ns send WSS 10 e–9,

(2) To step up the width 30 ns, send WSUWSUWSU or WSUSUSU

3-74. EVENTS MODE. The terse commands EN and EP select the slope for events detection corresponding to Events Slope Negative or Events Slope Positive.

3-75. TRIGGER MODE. The terse commands in this group program various trigger modes. The external trigger slope is selected by sending either TP (Trigger-Postive Slope) or TN (Trigger-Negative Slope). A single trigger, equivalent to pressing MAN TRIG once, can be programmed by sending the terse command TM. The externally supplied trigger signal (or the internal self-trigger in FREQUENCY or PERIOD MODE) is effectively turned off and on by sending ID (Trigger Input Disabled) or IE (Trigger Input Enabled). ID is intended for temporarily disabling the input. In addition to IE, the input will be re-enabled by NC, C, new data, and certain other commands. The triggered frequency mode may be enabled and disabled by sending TF (Triggered Frequency mode) or NF (Normal Frequency mode).

3-76. OUTPUT MODE. The front panel OUTPUT NORM/COMP functions are programmed by sending the terse commands ON or OC, respectively. The AMPLITUDE and OFFSET controls can be operated locally by sending OL. Whenever the OL command is sent, the 5359A will automatically display the amplitude and offset control settings (equivalent to pressing DISPLAY LEVELS in local operation). Once the AMPLITUDE and OFFSET controls are adjusted as desired, the settings can be "read and saved" by programming the terse commands OA or OO. As an alternative, the decimal command OA and OO may be used to program a desired output amplitude and output offset. The numbers used for these decimal commands have units of volts and a resolution of 20 mV. As always, decimal commands are followed by a terminator: comma, carriage return or line feed. Sending either one of the decimal commands OA or OO results in disabling local operating of both controls.

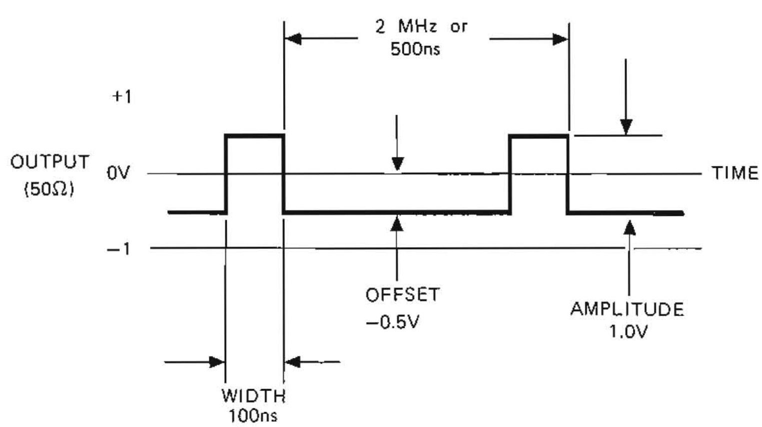
3-77. SYNC DELAY MODE. The codes SP (Sync Delay-Preset) and SA (Sync Delay-Auto) are completely analogous to the front panel SYNC DELAY PRESET/AUTO control setting.

Examples:

(1) f = 2 MHz

width = 100 ns

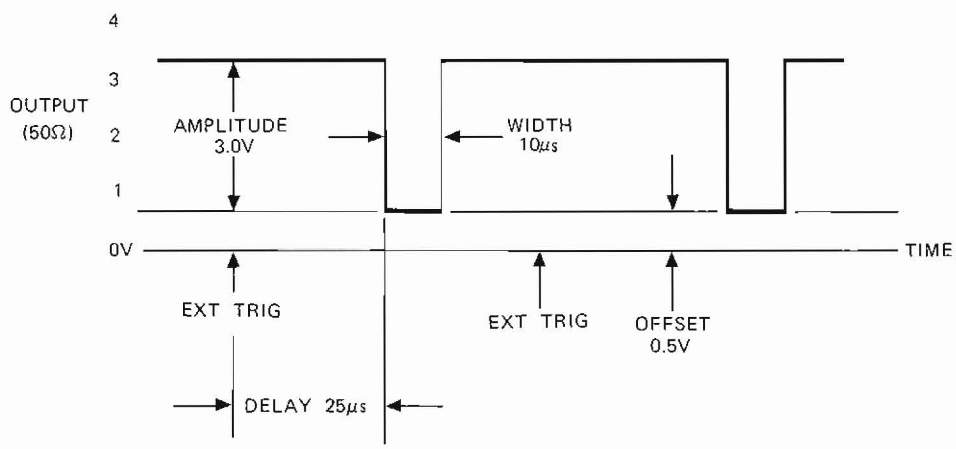
sending f2e6, w100e–9, oa1, OO –.5 LF



(2) delay = 25 μs

width = 10 μs

sending d25e-6, w10e-6, oc, oa3, OO +.5,



3-78. By using the SC (Single Cycle) terse command, one output pulse is produced for the first trigger pulse until an RA (Re-Arm) command is set. Upon receipt of the RA command, the occurrence of a trigger pulse will produce one more output pulse. While the single cycle mode is in effect, changing the pulse parameters also produces one output pulse. In this fashion, a sequence of individually tailored pulses (varying delays and widths) may be synthesized and controlled via the external trigger input. Sending NC (Normal Cycle) or C (Calibrate) cancels the single cycle mode of operation.

3-79. The command OD (output disable) turns off the output pulse and opens a relay that changes the OUTPUT impedance to a high state. This capability is useful when calibrating the 5359A with the 5363A Time Interval Probes. The 5363A should be calibrated with the probes either grounded or inserted into a 50Ω system with no signal applied. The command OE (output enable) reconnects the output pulse to the OUTPUT connector. OD is intended for temporarily disabling the output. In addition to OE, the output is reconnected by C, new data, or certain other commands.

3-80. CALIBRATION MODE. Sending the program code C is equivalent to pressing the front panel CAL button. The codes ECE (External Compensation Enable) and ECD (External Compensation Disable) remotely enable/disable calibration through the 5363A Time Interval Probes (C must be sent to actually perform the calibration after sending ECE or ECD).

3-81. TEACH AND LEARN. At any point in time, the complete state of the 5359A may be "taught" via HP-IB to the controller. Sixty-six 8-bit bytes are required to define the state of the 5359A. At a later time, the 66 bytes may be transferred back to the 5359A and the 5359A will return to the previous operational state. To exercise the teach and learn mode, proceed as follows:

a. With the 5359A in local mode, set the instrument controls, switches and functions as desired.

b. Address the 5359A to listen and send the terse command TE (teach).

c. Address the 5359A to talk. The 5359A then automatically sends 66 bytes to the controller.

d. Modify the state of the 5359A as desired either locally or via the HP-IB.

e. Address the 5359A to listen and send the terse command LN (learn).

f. Send the 66 bytes to the 5359A. When the 5359A receives the 66th byte, it will automatically calibrate and go to the defined state.

NOTE

When using the teach and learn commands, the state of the offset and amplitude controls will be recorded, i.e., if these controls are operable locally before the teach command is used, then they will be operable locally after the learn command has been set. If it is desired to "teach" manually set values for amplitude and offset, send either the OO terse command (output offset) or the OA terse command prior to sending the teach command.

3-82. Refer to Program Example 2 for a specific application of the teach and learn mode using the 9825A computing controller.

3-83. PROGRAMMING HINTS

1. The Terminator (comma, CR, LF) at the end of numerical data is essential. For example:

   wrt 704, "w 100e-9d100e-9" is incorrect

   This should be written as:

   wrt 704, "w 100e-9, d100 e-9"

   A CR LF (carriage return/linefeed) is inserted at the end of the line by the 9825A.

2. Extra Terminators may be used to synchronize the calculator to the 5359A. For example:

   a. wrt 704, "w 100 e-9" (CR LF automatic). The CR causes the 5359A to begin processing the number, however, the LF is accepted into the one byte command buffer and the calculator will proceed with the program while the 5359A is still processing the width data.

   b. wrt 704, "w 100 e-9," (CR LF automatic). In this example, the second comma starts the 5359A processing the number. The CR is accepted into the command buffer, but the linefeed cannot be sent until the CR is processed (and ignored). Therefore, the calculator must wait until the width is set as specified before continuing to the next line. The 5359A always processes commands in the order received.

3-84. SERVICE REQUEST MESSAGE AND STATUS BYTE

8-85. In general, service is requested (bus line SRQ set low) when certain status bits are set or cleared. *Table 3-5* gives the usage for each status bit and the effect of each bit on the service request message.

Table 3-5. Table of Status Bits and Effect on SRQ

Bit	Set to a "One" When	Set to a "Zero" When	Effect on SRQ
8	Entering debug monitor	Leaving debug monitor	None
7	Service Requested	Any legal device command received or change from remote to local or clear bus message received.	Generated when set to one. Cleared when set to zero or when serial polled.
6	Any error message except 8.4, 8.5, or 8.6 is displayed.	Clear bus message received.	Generated when conditions to set this bit occur.
5	Error messages 8.4, 8.5, or 8.6 are displayed.	Calibrate operation is performed (but may be set to one again if error occurs) or clear bus message received.	Generated when conditions to set this bit occur.
4	Time base set to EXT.	Time base set to INT.	Time base should not be changed while instrument is running.
3	Oven time base not up to temperature.	Oven up to temp or no oven installed.	Generated when any change in this bit.
2	Output disabled by a duty cycle* error.	No duty cycle error.	Generated when any change in this bit.
1	Cycle complete in single cycle mode.	Rearm command or new data received or leave single cycle mode.	Generated when this bit set to a one.

*Duty cycle error:
(1) Width too wide for period specified
(2) Delay plus width too large
(3) Delay too negative

3-86. PROGRAMMING EXAMPLES

3-87. The following HP-IB programming examples are provided for information only. The sample program utilizes a 9825A Computing Controller and a 5359A address of decimal 4.

EXAMPLE 1

Goal: Program 5359A for a delay of Ø ns and a pulse width of 300 ns. Then once per second, increase the delay by 20 ns and decrease the width by 20 ns. This action keeps the trailing edge of the pulse fixed relative to the sync pulse (5359A address switches 00100).

9825A Computing
Controller Program

```
0: rem 7
1: wrt 704,"W300
 e-9,D0,WSS20e-
 9,DSS20e-9"
2: beep
3: for I=1 to 10
4: wait 1000
5: wrt 704,"wsd"
6: wrt 704,"dsu"
7: beep
8: next I
9: stp
*17250
```

Line Ø: Insures that the REN bus line is set low (assertive).

Line 1: Program the 5359A for a width of 300 ns, a delay of 0 ns, a width step size of 20 ns and a delay step size of 20 ns.

Line 2: Beep.

Line 3: Set up loop for 10 delay and width changes.

Line 4: Wait 1 second.

Line 5: Step down width once (the 5359A responds identically to upper and lower case letters).

Line 6: Step up delay once.

Line 7: Beep.

Line 8: Increment the loop counter.

Line 9: Stop after 10 passes through the loop.

Procedure:

1. Power-up 5359A.
2. Manually enter a delay of 0 nsec. This step puts the 5359A in an external trigger mode.
3. Apply an appropriate trigger signal to EXT TRIGGER. Use a signal with a period of at least 300 ns (<3.3 MHz).
4. Monitor the 5359A SYNC OUTPUT and OUTPUT pulse with a dual channel oscilloscope. Use either a scope with 50Ω input impedance or 50Ω feed throughs.
5. Adjust the trigger LEVEL control until an output is produced.
6. Enter the above program into a 9825A calculator.
7. Press (RUN) on the 9825A. Verify proper operation by observing the SYNC OUTPUT and the OUTPUT pulse on the oscilloscope.

EXAMPLE 2

Goal: Demonstrate the teach and learn capability of the 5359A.

Procedure:

1. Power-up 5359A.
2. Manually alter the power-up state of the 5359A by entering an appropriate function, step-sizes, etc.
3. Enter the 9825A program shown below.
4. Press (RUN) on the 9825A. When the 9825A display returns with (5359A →→ 9825A), the 5359A has "taught" its operational state to the 9825A.
5. Turn 5359A power off then on (returns 5359A to its power-up state, i.e. width = 100 ns and period = 1 μs).
6. Press (CONTINUE) on the 9825A. When the 9825A display returns with (9825A →→ 5359A), the 5359A has "learned" the previous operational state stored in the 9825A.

```
0: dim A[100]
1: wtb 704,"te";
 red 704
2: for I=1 to 66
3: rdb(731)→A[I]
4: next I
5: beep;dsp "535
 9A →→ 9825A";
 stp
6: wtb 704,"ln"
7: for I=1 to 66
8: wtb 731,A[I]
9: next I
10: beep;dsp
 "9825A →→ 5359A
 "
11: end
*15369
```

Line 0: Dimension variable A.

Line 1: Send teach command to the 5359A and address the 5359A to talk.

Line 2: Set-up loop to read 66 bytes.

Line 3: Read byte from HP-IB interface.

Line 4: Loop until 66 bytes read.

Line 5: Beep, display message, stop.

Line 6: When (CONTINUE), send learn command to 5359A (5359A addressed to listen).

Line 7: Set-up loop to output 66 bytes.

Line 8: Write byte to HP-IB interface.

Line 9: Loop until 66 bytes output.

Line 10: Beep, display message.

Line 11: End.

Note: If the amplitude and offset controls are operable locally before the teach/learn cycle is executed, then they will be locally operable after the cycle is completed. To include the amplitude and offset control settings in the teach/learn cycle, send the terse commands OO or OA before sending the TE (Teach) command.

SECTION IV
OPERATION VERIFICATION AND PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures from page 4-1 through 4-15 verify all major functions, controls, inputs, and outputs of the 5359A, both locally and via the HP-IB. The complete procedure can be performed without access to the interior of the 5359A. This verification procedure can be used as an incoming inspection for comparison in periodic maintenance, troubleshooting, and after repairs, or adjustments. A complete performance test starts on page 4-16.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for the operation verification procedure is listed in *Table 1-2*. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

4-5. CALIBRATION CYCLE

4-6. The 5359A requires periodic verification of operation. Depending on the use and environment conditions, the 5359A should be checked using the operation verification procedure at least every 6 months.

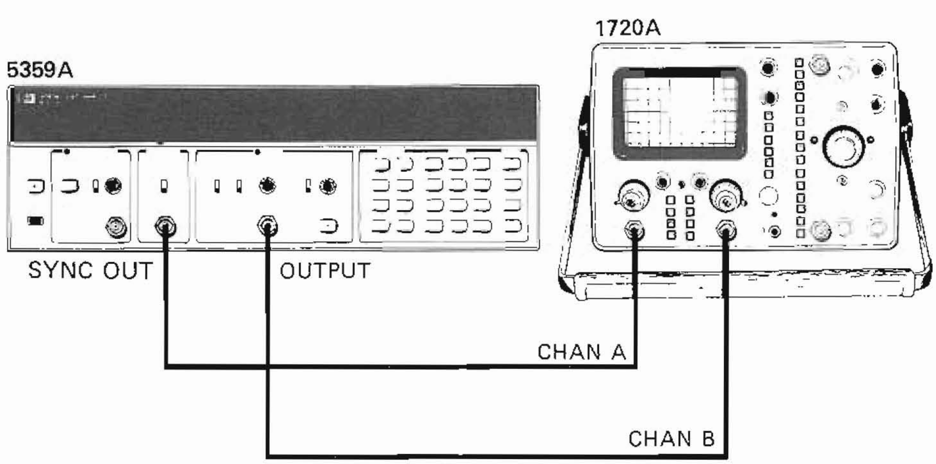
4-7. Successful completion of the Operation Verification procedure verifies the proper operation of the circuits in the HP 5359A Time Synthesizer.

4-8. LOCAL OPERATION VERIFICATION

4-9. Output Pulse, Controls, and Keyboard

1. Before switching on the instrument, ensure that the power transformer primary is matched to the available line voltage, the correct fuse is installed, and that all safety precautions have been observed. See Power Requirements, Line Voltage Selection, Power Cables, and associated warnings and cautions in Section II of this manual.

   Setup:



2. Preset the 5359A front panel controls as follows:

   EXTERNAL SLOPE
   - SLOPE .... _/‾
   - LEVEL .... approximate center

   SYNC DELAY
   - POLARITY .... NORM, POS
   - AMPLITUDE .... approximate center
   - OFFSET .... OFF, approximate center

3. Preset the 5359A rear panel controls as follows:

   EXTERNAL TIMING COMPENSATION
   - ENABLE/DISABLE .... DISABLE

   EVENTS
   - TRIG LEVEL .... approximate center
   - SLOPE .... _/‾

   FREQ STD
   - EXT/INT .... INT

4. Preset the 1720A Oscilloscope control as follows:

   - CHANNEL A .... 1 volt/Div., 50Ω input Z
   - CHANNEL B .... 1 Volt/Div., 50Ω input Z
   - HORZ DISPLAY .... MAIN
   - VERT DISPLAY .... ALT
   - INT TRIG .... A
   - TIME/DIV .... .2 μs

5. Press LINE switch ❷ to ON positon and observe the self-calibration routine (see Paragraph 3-27). After calibration verify that the display indicates 100.00 ns WIDTH, and that the WIDTH FUNCTION key ⓰ and OUTPUT ㉛ LED indicators are lit. Adjust oscilloscope Trigger Level for stable display of SYNC OUT and OUTPUT pulses.

NOTE

> When the instrument is first turned on, the processor performs a self-check on the ROM's and RAM's and self-calibrates. If during power up or normal operation, an Error Message is displayed, refer to Paragraph 3-35 ERROR MESSAGES in Section III.

6. Press DISPLAY LEVELS and observe two groups of three digits displayed. The left group indicates the output pulse amplitude and the right group indicates the DC (volts) offset of the output pulse.

7. Vary the AMPLITUDE control and verify that the output pulse waveform is adjustable from approximately 0.50 volts to 5.00 volts and that the left-most grouping of digits continously corresponds to the output pulse level.

8. Slide the OFFSET OFF/ON switch to ON and vary the OFFSET control. Verify that the output pulse waveform DC offset is adjustable from approximately -1.00 volt to 1.00 volt and that the right-most grouping of digits continously corresponds to the output pulse DC offset. Return the OFFSET OFF/ON to OFF and verify that the waveform and level display return to 0.00 volts.

9. Change the NORM/COMP polarity switch to COMP and verify the output pulses with respect to the SYNC OUT, is now "complemented" and that the letter "c" precedes the display groupings. Return polarity switch to NORM.

10. Change the POS/NEG polarity switch to NEG and verify the output pulse with respect to the SYNC OUT, is now "negative going" and that a "-" (negative) sign precedes the display groupings. Return polarity switch to POS.

11. Press function keys WIDTH, DELAY, PERIOD, and FREQ in succession and verify parameters as follows:

WIDTH	100 ns
DELAY	--- --- --- --ns
PERIOD	1.000 00 μs
FREQ	1.000 00 MHz

NOTE

When no parameter is entered, as in DELAY above, a series of 11 dashes (all display center segments) will be lit.

Verify that the displayed annunciator and function key LED correspond to the key pressed.

12. Press, in sequence, function key WIDTH 16 and STEP SIZE 23 . Verify that the predefined power-up STEP SIZE of 1.00 ns is displayed. Verify that the STEP SIZE key LED and the STEP and WIDTH annunciators are lit. Verify that the LED indicator on the associated function key (WIDTH) is flashing. Repeat the above procedure for the DELAY 17 , PERIOD 18 and FREQ 19 function keys (delay and period step size 1.00 ns and frequency step size 1.000 000 00 kHz).

13. Enter a width step size of 10 ns, by pressing the WIDTH, STEP SIZE, 1, 0, and ns/Hz keys in succession. Refresh width display by pressing WIDTH key. Momentarily press STEP UP and verify that the displayed width increments up by 10 ns. Press and hold the STEP UP key and verify that the waveform and display value are increasing in steps of 10 ns, at a rate of approximately 7 steps per second. Press and hold STEP DN and verify the output pulse width waveform and display value decrement down in steps of 10 ns.

14. Press function key PERIOD 18 and verify a period of 1.000.00 μs. Press function key WIDTH 16 and observe a width of 100.00 ns (re-enter these parameters if necessary). Attempt to enter an illegal width parameter (i.e., 2.0 μs) and verify the ERR annunciator is flashing and the associated function key (PERIOD) LED is flashing. This display indicates that a 2.000 00 μs pulse WIDTH is inconsistent with the previously entered 1.000 00 PERIOD. The illegal parameter has been entered and the previous parameters are still active. The ERR may be cleared by entering a legal parameter.

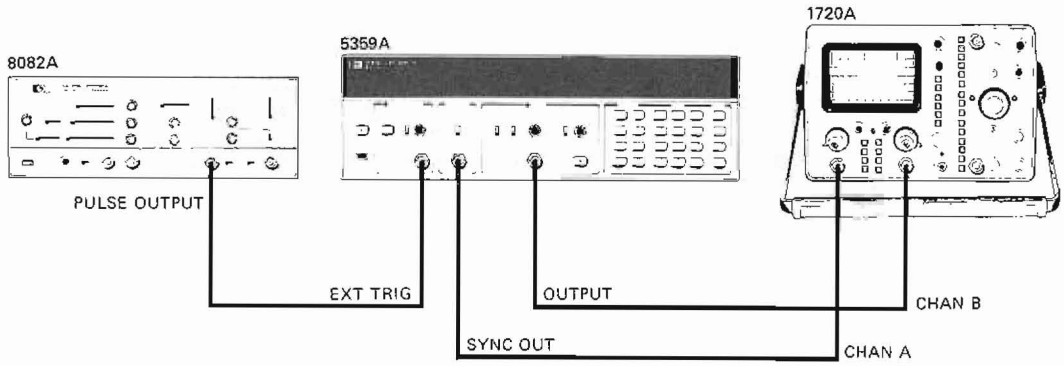
15. Press function key CAL 20 , and verify that the OUTPUT LED, selected function key LED and both SYNC OUT and OUTPUT pulses momentarily blank, while the CAL (self-calibration) is performed.

NOTE

The CAL routine can be initiated without affecting any currently programmed function mode or parameter.

4-10. EXTERNAL TRIGGER

Setup:

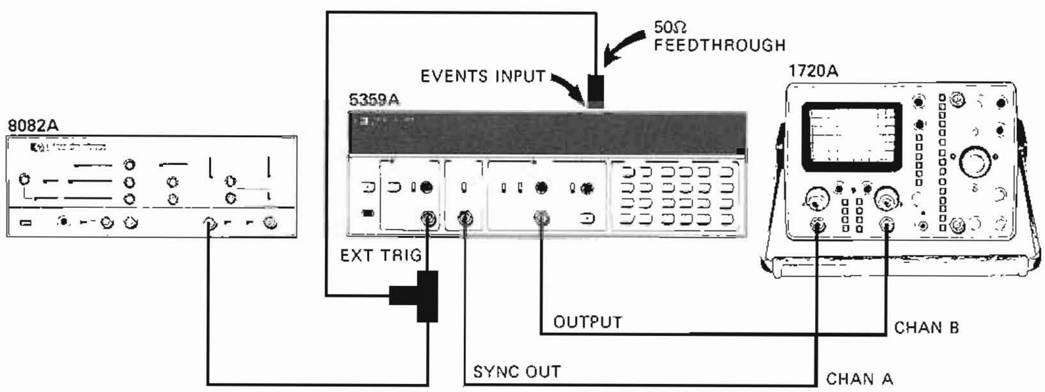


1. Preset the 8082A controls to produce a train of approximately 50 ns pulses, amplitude of 1-volt at a rate of approximately 1 Megahertz.

2. Program the 5359A for a Delay of 200 ns, by pressing the DELAY, 2, 0, 0, ns/Hz keys in succession. Verify that the EXTERNAL ENABLE LED is lighted. Adjust EXTERNAL ENABLE LEVEL control for stable oscilloscope display of Sync Out and Output pulses. Verify a 100 ns Output pulse occurring 200 ns after the Sync Out. Temporarily remove the EXT TRIG input (disconnect BNC cable) and verify that no Sync Out or Output pulses are present.

4-11. EVENTS INPUT

Setup:



1. Enter the Events mode by pressing the WIDTH, 2, EVTS, DELAY, 3, EVTS keys in succession

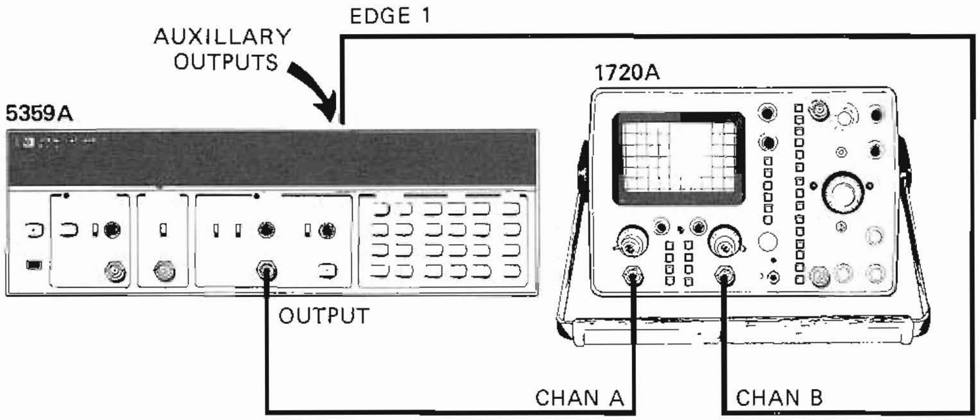
NOTE

In this mode of operation, both WIDTH and DELAY must be specified, in units of EVENTS.

2. Set the oscilloscope TIME/DIV to 1 μs and adjust the EVENTS TRIG LEVEL control on rear panel for stable oscilloscope display of Sync Out and Output pulses. (Readjust EXTERNAL ENABLE LEVEL if necessary.) Verify an approximate 2 μs Output pulse occurring approximately 3 μs after the Sync Out.

4-12. AUXILIARY OUTPUTS

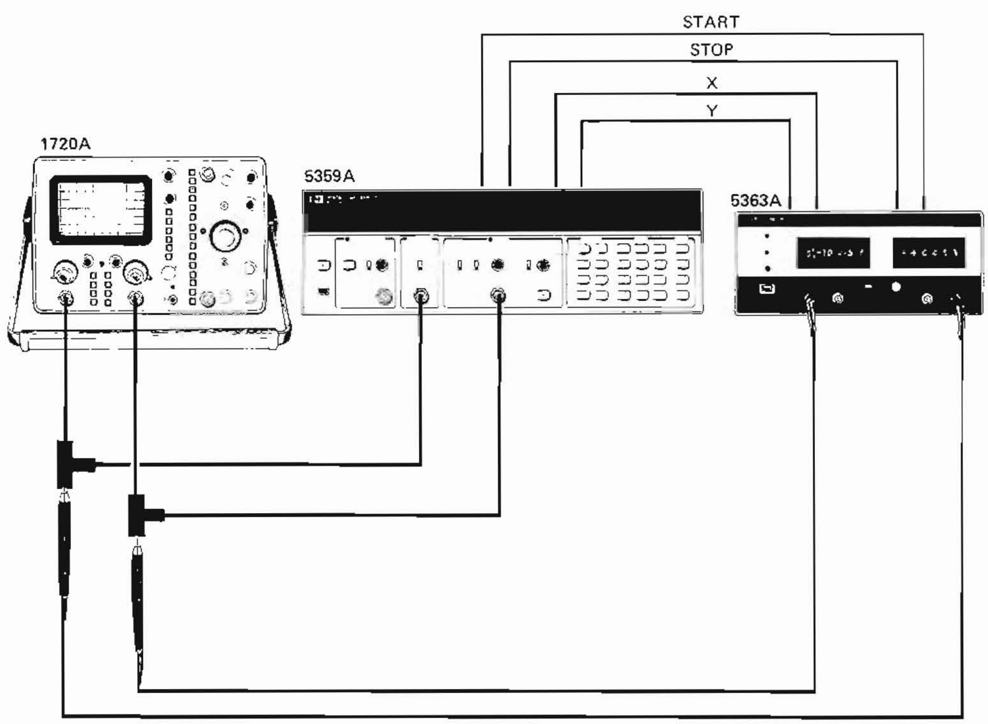
Setup:



1. Program the 5359A for a WIDTH of 100 ns and a FREQ of 1 MHz (through keyboard or power-down and power-up). Set the oscilloscope TIME/DIV to 0.1 μs and verify an EDGE 1 output pulse of approximately 35 ns in sync with the leading edge of the output pulse.
2. Reconnect Channel B oscilloscope input to EDGE 2 Output and verify an output pulse of approximately 35 ns in sync with the trailing edge of the output pulse.

4-13. EXTERNAL ENABLE COMPENSATION

Setup:



1. Preset the 5363A controls as follows:

   START .... A + 0.50 $\nearrow$
   STOP .... B + 0.50 $\nearrow$
   PULL TO ADD
   10.00 nsec .... IN

   NOTE

   Perform the self-calibrate routine on 5363A prior to configuration with 5359A.

2. Preset the 5359A controls as follows:

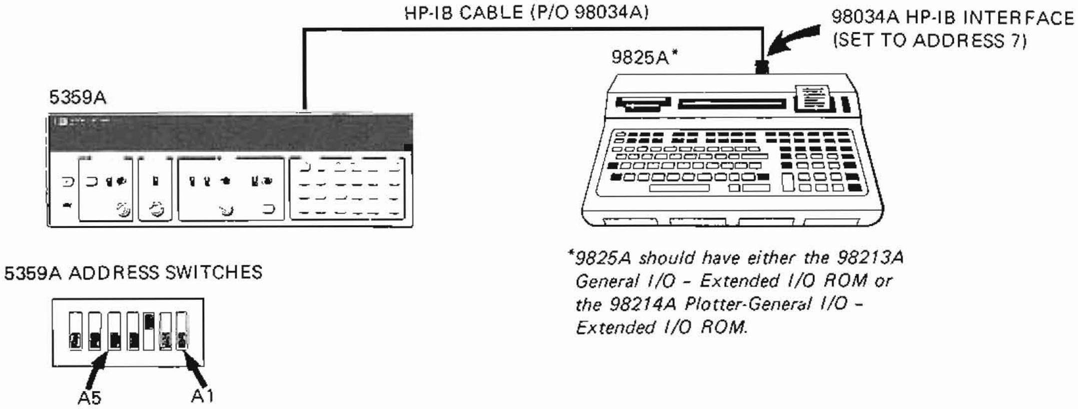
   EXTERNAL ENABLE .... ≈ CENTERED, $\nearrow$
   SYNC DELAY .... PRESET
   POLARITY .... NORM, POS
   AMPLITUDE .... ≈ 1V
   OFFSET .... OFF
   EXT TIMING COMPENSATION
   (REAR PANEL) .... DISABLE

3. Press 5359A LINE switch to ON and observe the self-calibration routine (see paragraph 3-30). After calibration verify that the display indicates 100.00 ns WIDTH, and that the WIDTH FUNCTION key and OUTPUT LED indicators are lit.
4. Connect 5363A probe A to SYNC OUT and probe B to OUTPUT (via 10218A BNC to PROBE ADAPTORS). Place EXT TIMING COMPENSATION switch on rear panel to ENABLE.
5. Press 5359A CAL key, and verify a completed calibration (i.e., momentary blanking of display followed by the return of previous display of 100.00 ns WIDTH).
6. Remove 5363A probe B from OUTPUT BNC and press CAL key. Verify Probe Err 8.1.
7. Return EXT TIMING COMPENSATION switch to DISABLE. Press CAL key and verify a completed calibration (i.e., momentary blanking of display followed by the return of display of 100.00 ns WIDTH.

4-14. 5359A HP-IB VERIFICATION PROGRAM

4-15. The 9825A program listed in *Table 4-2* exercises the 5359A through various operating modes, described below, via its HP-IB Interface. If the 5359A successfully completes all phases of the verification program, then there is a high probability that the instrument is working properly. If the 5359A does not respond as described, refer to the overall troubleshooting in Section VIII.

4-16. To perform the verification, set up the 5359A as shown and set its rear panel address switch to Address Ø4.



Additional equipment required (connect to 5359A as directed by the program).

Dual-Channel Oscilloscope	1720A or equivalent
Pulse or Function Generator	3312A or equivalent
BNC Cables	4

4-17. Set the 5359A controls as follows:

FRONT

EXT TRIG SLOPE	_/¯
LEVEL	≈ØV
SYNC DELAY	PRESET
POLARITY	NORM/POS
AMPLITUDE	midrange
OFFSET	ON/midrange

REAR

FREQ STD EXT/INT	INT
EXT TIMING COMPENSATION	DISABLE

4-18. The program listed in *Table 4-2* may be keyed into the 9825A or may be loaded from an HP-IB Verification Cassette, HP P/N 59300-10001 (Revision E or later), which also contains HP-IB verification program for other instruments. To run the program on the cassette, insert the cassette into the 9825A, load file Ø, and press RUN. Type 5359 CONTINUE when the instrument model number is requested. The 9825A will then load and run the 5359A verification program.

4-19. Apply power to the 5359A and verify that the time synthesizer powers up with a display of 100.00 ns width as per checkpoint 1 listed on the 9825A printer. Any other 5359A display (hieroglyphics, error messages, etc.) constitutes an instrument failure. Refer to Section VIII for troubleshooting.

4-20. The program goes through 21 checkpoints (tests) as described in *Table 4-1*. The information in *Table 4-1* tells what occurs during each test and gives the corresponding portion of the 9825A printer output produced as the program is run. The 9825A printer output tells what the condition of the 5359A should be at the end of the test. Checkpoints 9 through 18 require observation of the SYNC and OUTPUT signals using an oscilloscope. Connect the scope, when instructed to do so by the 9825A printer. Checkpoints 14 through 18 require an external trigger to be supplied to the 5359A. Connect a pulse or function generator when instructed to do so by the 9825A printer. At the conclusion of each test the 9825A stops and displays the current checkpoint. To advance to the next test, simply press CONTINUE. If it is desired to repeat a test, type cont "9" EXECUTE, for example, to repeat checkpoint 9.

Table 4-1. Model 9825A Program Description

Check Point	Test Name	9825A Printer Output/Comments
1	Set-up	CHECK POINT 1 5359A front panel set-up check. Verify: *ONLY KEYS LIT: * WIDTH *5359A DISPLAY: * 100.00 * ns * WIDTH *EXT ENABLE..off *OUTPUT.......on *Means that the operator checks for these conditions. When verified, press CONTINUE. ----------------
2	Listen Address	CHECK POINT 2 Program sends 5359A listen address. Verify: *ONLY KEYS LIT: * LOC/REM * WIDTH *5359A DISPLAY: * 100.00 * ns * WIDTH * LSN * RMT *EXT ENABLE..off *OUTPUT.......on ----------------
3	Talk Address	CHECK POINT 3 Program sends 5359A talk address. Verify: *ONLY KEYS LIT: * LOC/REM * WIDTH 5359A DISPLAY: * 100.00 * ns * WIDTH * TLK * RMT *EXT ENABLE..off *OUTPUT.......on

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments	
4	Remote/Local	CHECK POINT 4 Press LOC/REM on 5359A. Verify: *ONLY KEYS LIT: * WIDTH 5359A DISPLAY: * 100.00 * ns * WIDTH * TLK *EXT ENABLE..off *OUTPUT.......on	Operator must press LOCAL on 5359A, then verify as indicated.
5	Local-Lockout	CHECK POINT 5 Program sends 5359A listen address & sets local-lockout. Press LOC/REM on the 5359A and verify as per CHK POINT 2.	5359A should have same indication as those listed for Checkpoint 2.
6	Calibrate	CHECK POINT 6 Press CONTINUE on the 9825A and observe 5359A CAL KEY LED. It should light as a CAL is done. 5359A front panel remains as per CHK POINT 2 after CAL done.	CAL key LED turns on and OUTPUT LED turns off during calibrate cycle approximately 1 s.

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments	
7	External Timing Compensation	---------------------- CHECK POINT 7 Program sets EXT COMP ENABLE and CAL. Verify: *ONLY KEYS LIT: * LOC/REM * WIDTH *5359A DISPLAY: * ProbE * Err 8.1 * LSN * RMT * ns * WIDTH *EXT ENABLE..off *OUTPUT.......on	Do not connect a 5363A for this test.
8	Display and Adjust Levels	---------------------- CHECK POINT 8 DISPLAY LEVELS Test. Verify: *AMP adjustable *from < 0.5 * to > 5.0 V *OFFSET adjusts *from < -1.0 * to > +1.0 V *ONLY KEYS LIT: * LOC/REM * DISP LVLS *5359A DISPLAY: * LSN * RMT * VOLTS *EXT ENABLE..off *OUTPUT.......on Leave AMP at 4.00 V and OFFSET at -1.00	Adjust AMPLITUDE and OFFSET controls and verify (5359A displays) these ranges. Display also has AMP OFFSET voltage displayed Convenient for the following scope observations.

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments	
9	SNYC and OUTPUT	--------------- CHECK POINT 9 Connect SYNC and OUTPUT to scope (50 ohms): Set SYNC chan: 1 V/DIV Set OUTPUT chan: 2 V/DIV Set TIME/DIV to: 500 ns Trig on SYNC sig	Trigger scope on channel with SYNC signal as input.
		Verify OUTPUT: * 1 MHZ * Amp +4 V * Offset -1 V * Width 100 ns Verify SYNC: * Amp 1 V * Width 40 ns	Approximate value.
10	Normal/ Compliment	--------------- CHECK POINT 10 OUTPUT NORM/COMP Test. Program switches from NORM to COMP 10 times.	See Section III if required, for a description of NORM/COMP
		Press CONTINUE while observing the scope.	Small "c" also present on the 5359A when OUTPUT in COMP mode.
11	Postive/ Negative	--------------- CHECK POINT 11 OUTPUT POS/NEG Test. Program sets OFFSET to 0 and then switches from POS to NEG 5 times.	
		Press CONTINUE while observing the scope.	See Section III, if required, for a description of POS/NEG output. 5359A display will flash as data is input via HP-IB.

Table 4-1. Model 9825A Program Description (Continued)

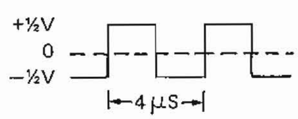
Check Point	Test Name	9825A Printer Output/Comments
12	Output Disable	CHECK POINT 12 OUTPUT Disable Test. Program disables and enables the OUTPUT 5 times. Press CONTINUE while observing the scope. NOTE: OUTPUT LED does not flash.
13	External Trigger Delay Mode	CHECK POINT 13 FREQ/PERIOD Test Program sets: Period......2 us Width.....100 ns Width SS...20 ns Then it steps the width up to 1 us and back down to 100 ns. Press CONTINUE while observing the scope. While stepping, the output turns off so that the scope display will flash. 5359A display indicates current width.
14	Frequency/ Period Mode	CHECK POINT 14 EXT TRIGGER Test. Connect a pulse gen (pg) to EXT TRIGGER IN. Set pg rep rate to 250 KHZ. Set pg amp to 1 V sq wave 0 V offset. Replace SYNC to scope with pg signal Approximately: 

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments	
		Program sets 5359A for: DELAY.....500 ns WIDTH......50 ns Verify: *ONLY KEYS LIT: * LOC/REM * DELAY *5359A DISPLAY: * 500.00 * ns * DELAY * LSN * RMT *EXT ENABLE...on *OUTPUT.......on *SCOPE DISPLAY: *DELAY....640 ns *(EXT TRG - OUT) *WIDTH.....50 ns	Measured from leading edge of the EXT TRIGGER signal to the leading edge of the OUTPUT signal, i.e., 640 ns = 140 ns (insertion delay) + 500 ns (Programmed delay).
15	SYNC Delay	CHECK POINT 15 SYNC DELAY Test. Program sets SYNC DELAY AUTO to PRESET 10 times. Press CONTINUE while observing the scope.	Delay between EXT TRIG and OUTPUT should alternate between 640 and 540 ns (approx.) 5359A OUTPUT LED flashes during SYNC delay switching.
16	External Trigger Disable	CHECK POINT 16 TRIG DISABLE Test. Program disables and enables EXT TRIG 10 times. Press CONTINUE while observing the scope.	Output should alternate between on and off.

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments	
17	External Trigger Slope	------------------ CHECK POINT 17 TRIG SLOPE Test. Program sets +/- slope 10 times. Press CONTINUE while observing the scope.	Output moves depending on which slope selected.
18	Triggered Frequency Mode	------------------ CHECK POINT 18 TRIG FREQ Test. Program sets: WIDTH......10 ns FREQ.......5 MHZ Verify: *ONLY KEYS LIT: * LOC/REM * FREQ * EVTS * (flashing) *5359A DISPLAY: * 5.0000 * MHZ * FREQ * LSN * RMT *EXT ENABLE..... *........flashing *OUTPUT........on *SCOPE DISPLAY * TRIG FREQ	Should be a burst of 11 Output pusles.
19	Teach/Learn	------------------ CHECK POINT 19 TEACH/LEARN Test 5359A teaches current set-up to 9825A. Turn 5359A power off then ON. Press CONTINUE. Verify that the 5359A learns the mode per CHK POINT 18	Before the program stops, the set-up as per check-point 18, is "taught" to the 9825A. When power is turned OFF then ON, the 5359A returns to the normal power-up. 1 MHz/100 ns width. When CONTINUE is pressed, 5359A "learns" the set-up i.e., it should return to triggered frequency mode.

Table 4-1. Model 9825A Program Description (Continued)

Check Point	Test Name	9825A Printer Output/Comments
20	Error 1	CHECK POINT 20 HP-IB Illegal Command Test. Program sends undefined HP-IB command. Verify: *5359A DISPLAY: * Err * 1
21	Service Request Duty Cycle Error	CHECK POINT 21 SERVICE REQUEST Test. Programs delay and width that gives a duty cycle error PERIOD......1 us WIDTH.......3 us Width too large for specified period The program then checks for a service request; conducts a serial poll & prints the status byte in octal. Verify: A Duty cycle error should cause a Service Request. *ONLY KEYS LIT: * LOC/REM * WIDTH * PERIOD * (flashing) Due to duty cycle error. *5359A DISPLAY: * 3.00000 * US * WIDTH * RMT * ERR * (flashing) Due to duty cycle error. *EXT ENABLE..off *OUTPUT......off *STATUS BYTE: * 102 * 106 * if cold oven Status byte should be one of these two values. Measured Status Byte = 102 Actual received status byte is printed here. Should be 102 or 106. END OF TEST

4-21. PERFORMANCE TESTS

4-22. The following procedures can be used as the Performance Tests for the HP 5359A Time Synthesizer. Results of the Performance Tests may be tabulated on the HP5359A Performance Test Record at the end of this section.

4-23. The equipment needed to perform these tests are:

One HP 5370B Universal Time Interval Counter,
One HP 3312A Function Generator (or equivalent)
One HP 1725A 275 MHz Oscilloscope (or equivalent)
One 50Ω Feed-Through (HP part # 10100C)

4-24. *Table 4-2* lists a summary of the eight tests and the specifications tested:

Table 4-2. Summary of the HP 5359A Performance Tests

PARAGRAPH NUMBER	DESCRIPTION	SPECIFICATION
4-25	Delay	0nS to 160mS
4-28	Period	100nS to 160mS
4-31	Width	5nS to 160mS
4-34	Step Size	minimum 50pS
4-37	Jitter	200 pS rms max (Delays 0nS–10mS) 1nS rms max (Delays 10mS–160mS)
4-40	SYNC OUTPUT	1 volt positive pulse width 35nS nominal Rise/Fall time <5nS
4-43	OUTPUT PULSE	Amplitude adjustable 0.5V to 5v Offset adjustable −1V to +1V Rise/Fall times <5nS
4-46	Insertion Delay	<140nS in PRESET <40nS in AUTO

4-25. DELAY

4-26. Specification Tested: 0 nS delay and 160mS delay at various output amplitudes.

4-27. Equipment: HP 5370B, HP 3312A

1. Set the 5359A front panel controls as follows:

EXTERNAL ENABLE
  LEVEL .... midrange
  SLOPE .... +
SYNC DELAY .... PRESET
OUTPUT
  POLARITY .... NORM,POS
FUNCTION
  WIDTH 5nS

4-25. DELAY

4-26. Specification Tested: 0 nS delay and 160mS delay at various output amplitudes.

4-27. Equipment: HP 5370B, HP 3312A

1. Set the 5359A front panel controls as follows:

EXTERNAL ENABLE	
LEVEL	midrange
SLOPE	+
SYNC DELAY	PRESET
OUTPUT	
POLARITY	NORM,POS
FUNCTION	
WIDTH	5nS

2. Set the 5370B front panel controls as follows:

FUNCTION	TI
STATISTICS	MEAN
SAMPLE SIZE	1
ARMING	±TI
PERIOD COMPLMNT	STOP
START	
TRIG LVL	0.50V (mid range of SYNC pulse)
SLOPE	+
STOP	
TRIG LVL	0.50V (mid range of OUTPUT pulse)
SLOPE	+
INPUTS	50Ω, ÷1(both START and STOP)
START COM	SEP
COUPLING	DC

3. Set the HP 3312A for a 1 MHz, approximately 2Vp-p square wave with no offset.

4. Connect the 5359A, 3312A and 5370B as shown in *Figure 4-1*.

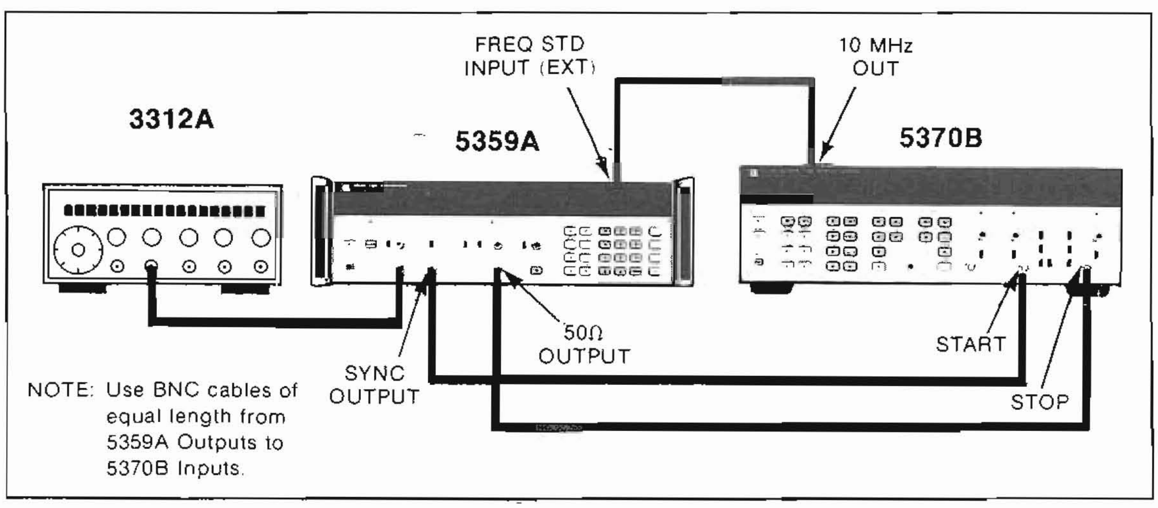


Figure 4-1. Setup for DELAY Performance Test

5. Modify the 5359A front panel (OUTPUT AMPLITUDE, OUTPUT OFFSET and FUNCTION DELAY) and the 5370B front panel (STOP TRIGGER LEVEL) to meet the first parameters shown in *Table 4-3*.

6. Press the CAL key — This sets the Internal delay constants to the midrange of the OUTPUT and SYNC OUT pulses.

7. Verify that the time interval measured on the 5370B meets the MEASURED DELAY specified for the appropriate line in *Table 4-3*.

8. Perform steps 5, 6, and 7 for all the lines in *Table 4-3*.

Table 4-3. Measurement Parameters for Individual RANGE Testing

OUTPUT AMPTD (5359A)	OUTPUT OFFSET (5359A)	FNCTN DELAY (5359A)	STOP TRG LVL (5370B)	MEASURED DELAY (5370B)
+1.00V	Off	0nS	+0.50V	±1nS
+3.00V	Off	0nS	+1.50V	±1nS
+4.00V	Off	0nS	+2.00V	±1nS
+1.00V	ON/+1V	0nS	+1.50V	±1nS
+1.00V	ON/−1V	0nS	-0.50V	±1nS
+1.00V	Off	160mS	+0.50V	160mS±1nS
+3.00V	Off	160mS	+1.50V	160mS±1nS
+4.00V	Off	160mS	+2.00V	160mS±1nS
+1.00V	ON/+1V	160mS	+1.50V	160mS±1nS
+1.00V	ON/−1V	160mS	-0.50V	160mS±1nS

4-28. PERIOD

4-29. Specification Tested: 100nS Period and 160mS period at various output amplitudes.

4-30. Equipment: 5370B

1. Set the 5359A front panel controls as follows:

   OUTPUT
   POLARITY .... NORM,POS
   OFFSET .... OFF
   FUNCTION
   WIDTH 5nS

2. Set the 5370B front panel controls as follows:

   FUNCTION .... PERIOD
   GATE 0.1S

3. Connect the 5359A and 5370B as shown in *Figure 4-2*.

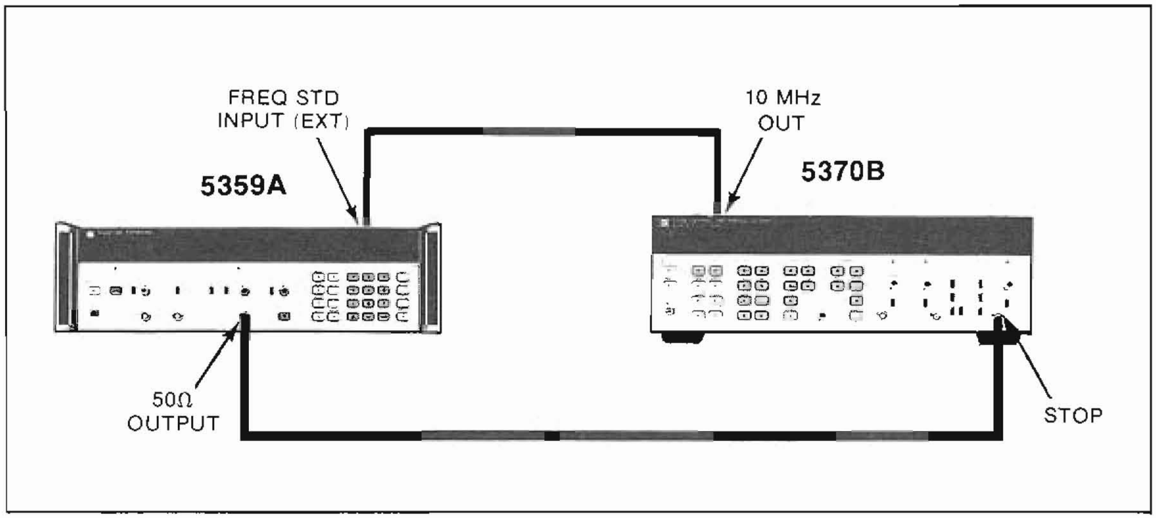


Figure 4-2. Setup for PERIOD Performance Test

4. Modify the 5359A front panel (OUTPUT AMPLITUDE, OUTPUT OFFSET, and FUNCTION PERIOD) and the 5370B front panel (STOP TRIG LVL) to meet the first parameters shown in *Table 4-4.*

5. Press the CAL key.

6. Verify that the PERIOD measured on the 5370B meets or exceeds the MEASURED PERIOD specified for the appropriate line in *Table 4-4.*

7. Perform steps 4, 5, and 6 for all the lines in *Table 4-4.*

Table 4-4. Measurement Parameters for Individual PERIOD Testing

OUTPUT AMPLITUDE (5359A)	**OUTPUT OFFSET (5359A)**	**FUNCTION PERIOD (5359A)**	**STOP TRG LVL (5370B)**	**MEASURED PERIOD (5370B)**
+1.00V	Off	100nS	+0.50V	100nS±1nS
+3.00V	Off	100nS	+1.50V	100nS±1nS
+4.00V	Off	100nS	+2.00V	100nS±1nS
+1.00V	ON/+1.00V	100nS	+1.50V	100nS±1nS
+1.00V	ON/-1.00V	100nS	-0.50V	100nS±1nS
+1.00V	Off	160mS	+0.50V	160mS±1nS
+3.00V	Off	160mS	+1.50V	160mS±1nS
+4.00V	Off	160mS	+2.00V	160mS±1nS
+1.00V	ON/+1.00V	160mS	+1.50V	160mS±1nS
+1.00V	ON/-1.00V	160mS	-0.50V	160mS±1nS

4-31. WIDTH

4-32. Specification Tested: 5nS width and 160mS width at various output amplitudes.

4-33. Equipment: HP 5370B and HP 3312A

1. Set the 5359A front panel controls as follows:

EXTERNAL ENABLE	
LEVEL	midrange
SLOPE	+
SYNC DELAY	PRESET
OUTPUT	
POLARITY	NORM,POS
FUNCTION	
DELAY	0nS

2. Set the 5370B front panel controls as follows:

FUNCTION	TI
STATISTICS	MEAN
SAMPLE SIZE	1
ARMING	±TI
PERIOD COMPLMNT	STOP
INPUT	
START	
SLOPE	+
IMPEDANCE	1MΩ
ATTENUATION	÷1
COUPLING	DC
STOP	
SLOPE	–
IMPEDANCE	1MΩ
ATTENUATION	÷1
COUPLING	DC
START COM	SEP

注意!

3. Set the HP 3312A for a 1 MHz, approximately 2Vp-p square wave with no offset.

4. Connect the 3312A, 5359A and 5370B as shown in *Figure 4-3.*

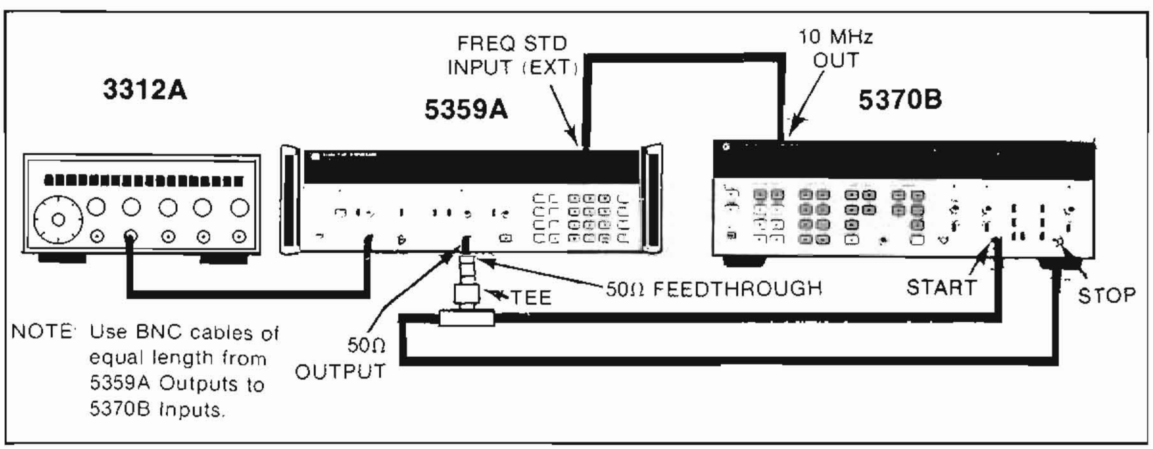


Fig4-3. correct!

Figure 4-3. Setup for WIDTH Performance Test

5. Modify the 5359A front panel (OUTPUT AMPLITUDE, OUTPUT OFFSET and FUNCTION WIDTH) and the 5370B front panel (START/STOP TRIG LVL) to meet the first requirements shown in *Table 4-5.*

6. Press the CAL key.

7. Verify that the time interval measured for the pulse width meets the qualifications specified under MEASURED WIDTH for the appropriate line in *Table 4-5.*

8. Perform steps 5, 6 and 7 for all the lines in *Table 4-5.*

NOTE

If the WIDTH reading is slightly out of tolerance, make sure that the START and STOP Trigger Levels of the 5370B are set to the mid points of the signals.

Table 4-5. Measurement Parameters for Individual WIDTH Testing

OUTPUT AMPTD (5359A)	OUTPUT OFFSET (5359A)	FNCTN WIDTH (5359A)	START + STOP TRG LVL (5370B)	MEASURED WIDTH (5370B)
+1.00V	Off	5nS	+0.50V	5nS±1nS
+3.00V	Off	5nS	+1.50V	5nS±1nS
+4.00V	Off	5nS	+2.00V	5nS±1nS
+1.00V	ON/+1.00V	5nS	+1.50V	5nS±1nS
+1.00V	ON/-1.00V	5nS	-0.50V	5nS±1nS
+1.00V	Off	160mS	+0.50V	160mS±1nS
+3.00V	Off	160mS	+1.50V	160mS±1nS
+4.00V	Off	160mS	+2.00V	160mS±1nS
+1.00V	ON/+1.00V	160mS	+1.50V	160mS±1nS
+1.00V	ON/-1.00V	160mS	-0.50V	160mS±1nS

4-34. STEP SIZE

4-35. Specification Tested: 50pS minimum step size for width and delay functions. Other step sizes are also tested.

4-36. Equipment: HP 5370B and HP 3312A

1. WIDTH STEP SIZE

   a. Set the 5359A front panel controls as follows:

      EXTERNAL ENABLE
        LEVEL .... midrange
        SLOPE .... +
      SYNC DELAY .... PRESET

OUTPUT
- POLARITY .... NORM,POS
- AMPLITUDE .... +1.00V
- OFFSET .... OFF

FUNCTION
- DELAY 0nS
- WIDTH 5nS

b. Set the 5370B front panel controls as follows:

FUNCTION .... TI
STATISTICS .... MEAN
SAMPLE SIZE 1
ARMING .... ±TI
- PERIOD COMPLMNT .... STOP

START
- TRIG LVL .... +0.50V
- SLOPE .... +
- IMPEDANCE 1MΩ
- ATTENUATION .... ÷1
- COUPLING .... DC

STOP
- TRIG LVL .... +0.50V 注意
- SLOPE .... −
- IMPEDANCE 1MΩ
- ATTENUATION .... ÷1
- COUPLING .... DC

START COM .... SEP

c. Set the HP 3312A for a 1MHz, approximately 2.0Vp-p square wave with no offset.

d. Connect the 5359A and 5370B as shown in *Figure 4-3*.

e. Press the CAL key.

f. Verify that the value measured using the 5370B is 5nS ± 1nS.

g. Press the WIDTH key.

h. Enter the STEP SIZE from *Table 4-6*.

i. Press the STEP UP/DOWN key as indicated in *Table 4-6*.

j. Verify that the measured pulse width value from the 5370B meets the tolerance shown in *Table 4-6*.

k. Perform steps h, i, and j for all the lines in *Table 4-6*.

Table 4-6. Measurement Parameters for WIDTH STEP SIZE Testing

STEP SIZE (5359A)	**STEP UP/DOWN (5359A)**	**MEASURED WIDTH (5370B)**
.05nS	STEP UP	5.05nS±1nS
1nS	STEP UP	6.05nS±1nS
10nS	STEP UP	16.05nS±1nS
100nS	STEP UP	116.05nS±1nS
100nS	STEP DOWN	16.05nS±1nS
10nS	STEP DOWN	6.05nS±1nS
1nS	STEP DOWN	5.05nS±1nS
.05nS	STEP DOWN	5.00nS±1nS

☆ Step SIZE入力 → ↑ ↓ KEY 操作 ⇒ Measured width に 変わる!

2. DELAY STEP SIZE

a. Set the 5359A front panel controls as follows:

EXTERNAL ENABLE
  LEVEL .... midrange
  SLOPE .... +
SYNC DELAY .... PRESET
OUTPUT
  POLARITY .... NORM,POS
  AMPLITUDE .... +1.00V
  OFFSET .... OFF
FUNCTION
  WIDTH 5nS
  DELAY 0nS

b. Set the 5370B front panel controls as follows:

FUNCTION .... TI
STATISTICS .... MEAN
SAMPLE SIZE 1
ARMING .... ±TI
  PERIOD COMPLMNT .... STOP
START
  TRIG LVL .... +0.50V
  SLOPE .... +
  IMPEDANCE .... ~~1MΩ~~ 50Ω
  ATTENUATION .... ÷1
  COUPLING .... DC
STOP
  TRIG LVL .... +0.50V 注意
  SLOPE .... +
  IMPEDANCE .... ~~1MΩ~~ 50Ω
  ATTENUATION .... ÷1
  COUPLING .... DC
START COM .... SEP

c. Set the HP 3312A for a 1MHz 2Vp-p square wave with no offset.

d. Connect the 3312A, 5359A and 5370B as shown in *Figure 4-4*.

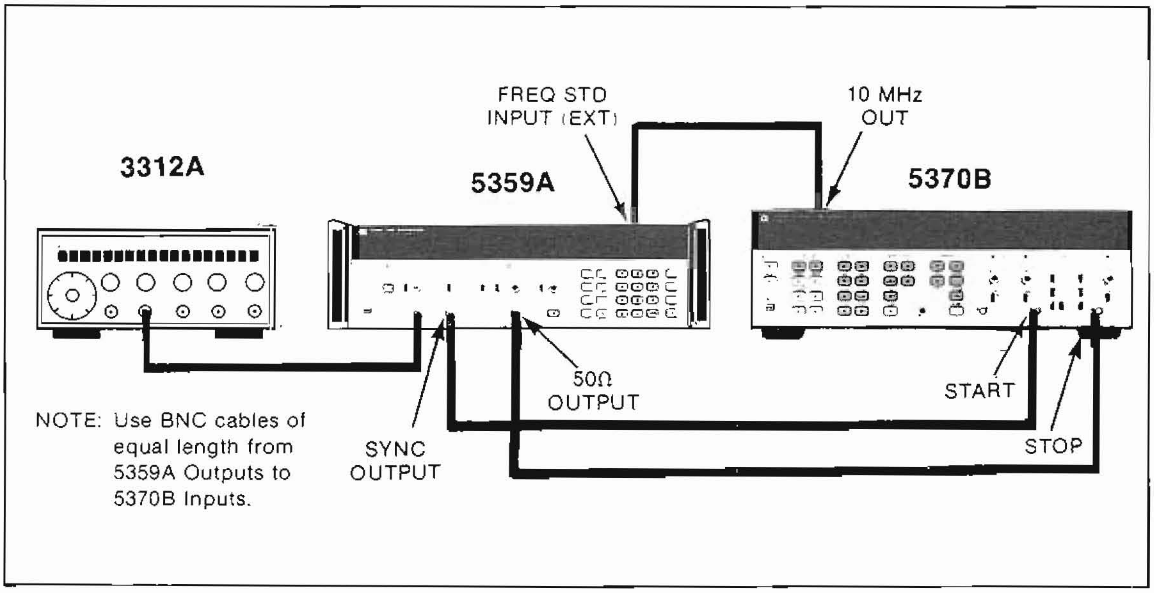


Figure 4-4. Setup for DELAY STEP SIZE Performance Test

e. Press the CAL key.

f. Verify that the DELAY time measured using the 5370B is between ±1nS.

g. Press the DELAY key.

h. Enter the STEP SIZE from *Table 4-7.*

i. Press the STEP UP/DOWN key as indicated in *Table 4-7.*

j. Press the CAL key.

k. Verify that the measured DELAY from the 5370B meets the tolerance shown in *Table 4-7.*

l. Perform steps i, j, and k for each line in *Table 4-7.*

Table 4-7. Measurement Parameters for DELAY STEP SIZE Testing

STEP SIZE (5359A)	STEP UP/DOWN (5359A)	MEASURED DELAY (5370B)
.05nS	STEP UP	.05nS±1nS
1nS	STEP UP	1.05nS±1nS
10nS	STEP UP	11.05nS±1nS
100nS	STEP UP	111.05nS±1nS
100nS	STEP DOWN	11.05nS±1nS
10nS	STEP DOWN	1.05nS±1nS
1nS	STEP DOWN	.05nS.1nS
.05nS	STEP DOWN	±1nS

4-37. JITTER

4-38. Specification Tested: Standard Timebase — 200pS rms max (delays 0nS to 10 mS), 1nS rms max (delays 10mS to 160mS); High Stability Timebase (Option 001) — 200pS rms max (delays 0nS through 160mS)

4-39. Equipment: HP 5370B, HP 3312A

1. Set the HP3312A for a 1MHz 2V p-p square wave with no offset.

2. Set the HP 5359A front panel controls as follows:

   EXTERNAL ENABLE
   SLOPE .... +
   LEVEL .... midrange
   SYNC DELAY .... PRESET
   OUTPUT
   POLARITY .... NORM,POS
   AMPLITUDE .... +1.00V
   OFFSET .... OFF
   FUNCTION
   WIDTH 5nS

3. Set the HP 5370B front panel controls as follows:

   FUNCTION .... TI
   STATISTICS .... STD DEV
   SAMPLE SIZE 100
   ARMING .... ±TI
   PERIOD COMPLMNT .... STOP
   START
   TRIG LVL .... +0.50V
   SLOPE .... +
   IMPEDANCE 50Ω
   ATTENUATION .... ÷1
   COUPLING .... DC
   STOP
   TRIG LVL .... +0.50V
   SLOPE .... +
   IMPEDANCE 50Ω
   ATTENUATION .... ÷1
   COUPLING .... DC
   START COM .... SEP

4. Connect the 5359A, 3312A, and 5370B as shown in *Figure 4-5*.

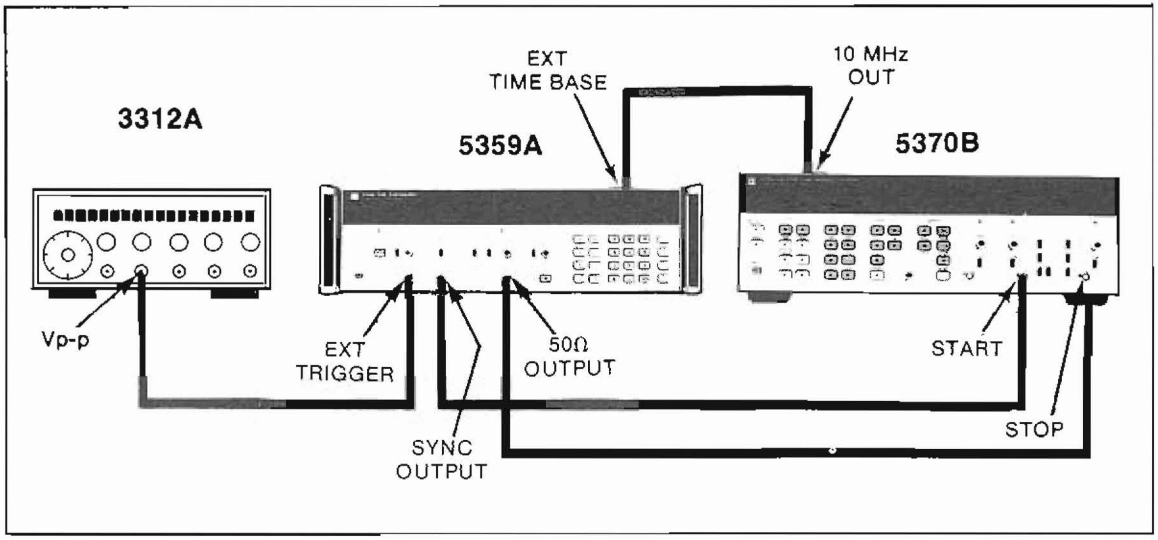


Figure 4-5. Setup For Jitter Performance Test

5. Set the DELAY to the first (or subsequent values) specified value from *Table 4-8.*

6. Verify that the Standard Deviation (Jitter) measured on the 5370B meets the tolerance shown in *Table 4-8.*

7. Perform steps 5 and 6 for each line in *Table 4-8.*

Table 4-8. Measurement Parameters for Individual JITTER Testing

DELAY (5359A)	MEASURED JITTER (Standard Deviation) (5370B)
0nS	<200pS rms
10mS*	<1nS rms (<200pS for Option 001 Instruments)
160mS*	<1nS rms (<200pS for Option 001 Instruments

*Note — For longer delays, the HP 5370B takes a longer time to complete the measurement.

4-40. SYNC OUTPUT

4-41. Specifications tested: SYNC Output Pulse Level: +1.00V ± 0.15V
SYNC Output Pulse Width: 40nS ± 15nS
SYNC Output Pulse Rise Time: < 5nS
SYNC Output Pulse Fall Time: < 5nS

4-42. Equipment: HP1725A (or equivalent)

1. Set the HP 5359A front panel controls as follows:

SYNC DELAY .... PRESET
OUTPUT
  POLARITY .... Norm/Pos
  AMPLITUDE .... +1.00V
  OFFSET .... Off
FUNCTION
  WIDTH 100nS
  Period 1.0μS

2. Set the HP 1725A front panel controls as follows:

Channel A Volts/Div	0.2(50Ω)
Vertical Display	A Channel (IN)
INT TRIG	A Channel (IN)
Main Sweep	0.01μS/Div
Horizontal Display	MAIN (IN)
All Other Buttons	OUT

3. Connect the 5359A, and 1725A as shown in *Figure 4-6*.

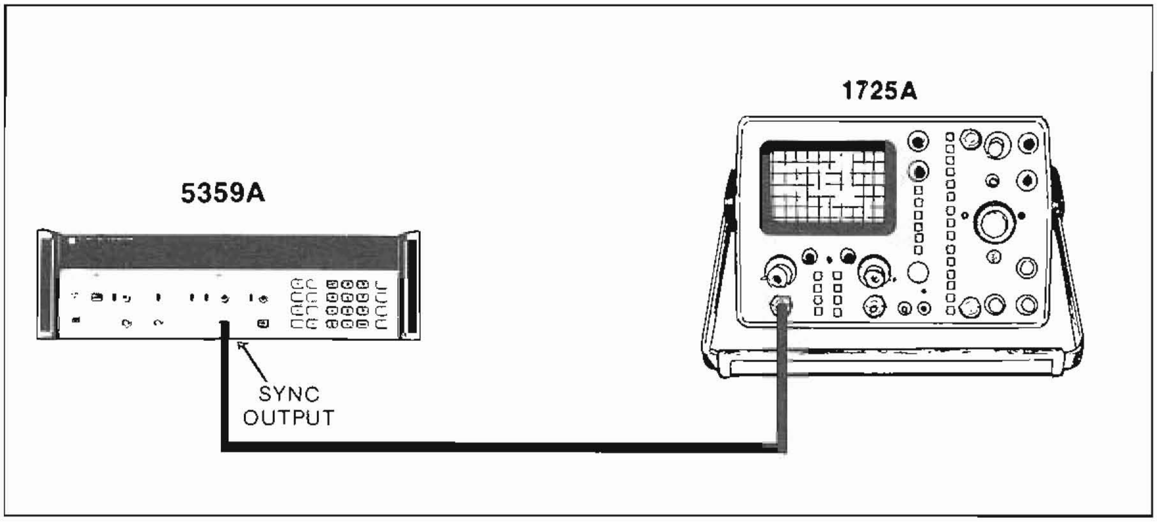


Figure 4-6. Setup for SYNC OUTPUT Performance Test

4. Using the HP1725A, verify that the SYNC Output Pulse Level is +1.00 V ±0.15V.

5. Using the HP 1725A, verify that the SYNC Output Pulse Width is 40nS ±15nS.

6. To measure the Rise/Fall Time of the SYNC Output Pulse perform steps a. through e.

   a. Press the HORIZ DISPLAY MAG X10 button in. (This gives the HP 1725A a horizontal scale of 1nS/Div.)

   b. Set the MAIN TRIGGERING ± button to ± (out).

   c. Using the HP 1725A, verify that the SYNC Output Pulse Rise Time is less than 5nS.

   d. Set the MAIN TRIGGERING ± button to – (in).

   e. Using the HP 1725A, verify that the SYNC Output Pulse Fall time is less than 5nS.

4-43. OUTPUT PULSE

4-44. Specifications Tested: OUTPUT Pulse Amplitude: Adjustable from 0.50V to 5V.
OUTPUT Pulse Offset: adjustable from -1V to +1V.
OUTPUT Pulse Rise Time: < 5nS
OUTPUT Pulse Fall Time: < 5nS

4-45. Equipment: HP 1725A, HP 3312A

1. Set the HP 5359A front panel controls as follows:

EXTERNAL ENABLE
  SLOPE .... +
  LEVEL .... midrange
  SYNC DELAY .... PRESET
OUTPUT
  POLARITY .... NORM,POS
  OFFSET .... OFF
FUNCTION
  DELAY 0nS
  WIDTH 100nS

2. Set the HP 1725A front panel controls as follows:

VERTICAL DISPLAY .... A Channel (IN)
INT TRIG .... A Channel (IN)
MAIN SWEEP 0.01μS/Div
HORIZONTAL DISPLAY .... MAIN (IN)
All other buttons .... OUT

3. Set the HP 3312A for a 1MHz 2Vp-p square wave with no offset.

4. Connect the 5359A, 3312A and 1725A as shown in *Figure 4-7.*

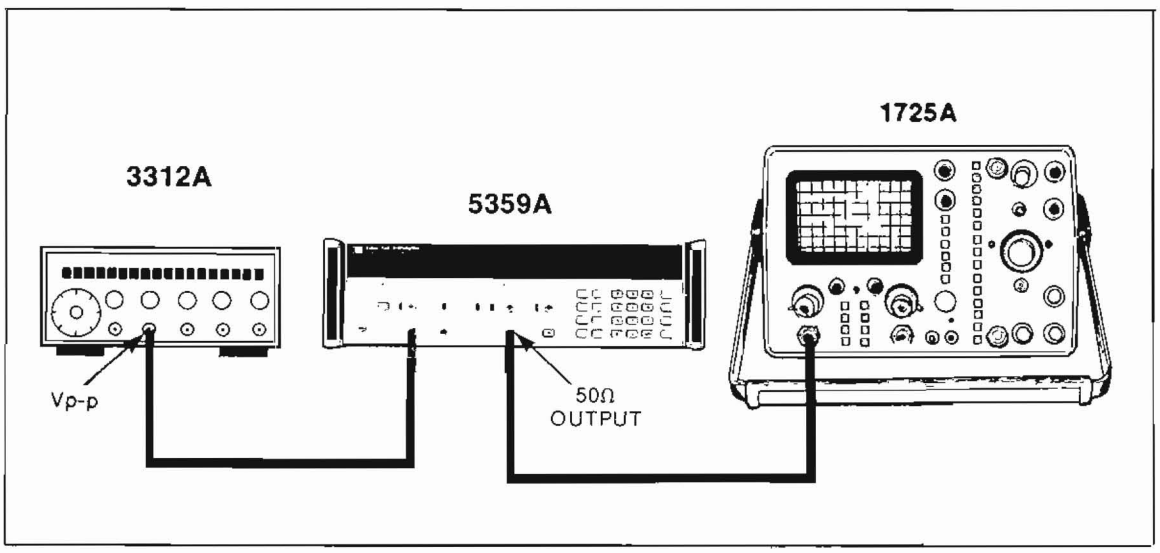


Figure 4-7. Setup for Testing Output Amplitude and Offset

5. **OUTPUT Pulse Amplitude**

   a. Set the 5359A OUTPUT AMPLITUDE to +0.50V.

   b. Using the HP 1725A, verify that the OUTPUT Pulse Amplitude is 0.50V ±0.03V.

   c. Set the HP 5359A OUTPUT AMPLITUDE to +5.00V.

   d. Using the HP 1725A, verify that the OUTPUT Pulse Amplitude is +5.00V ±0.03V.

6. **OUTPUT Pulse Offset**

   a. Make the following changes to the 5359A front panel controls:

   OUTPUT
   Amplitude .... +2.00V
   Offset ON/-1.00V

   b. Using the HP 1725A, verify that the peak amplitude of the OUTPUT pulse is +1.00V ±0.003V. Verify the base amplitude is -1.00V ±0.15V.

   c. Set the OUTPUT OFFSET to +1.00V.

   d. Using the HP 1725A, verify that the peak amplitude of the OUTPUT pulse is +3.00V ±0.03V. Verify the base amplitude is +1.00V ±0.15V.

7. **OUTPUT Pulse Rise and Fall Time**

   a. Make the following changes to the 5359A front panel controls:

   OUTPUT
   Amplitude .... +1.00V
   Offset .... OFF

   b. Make the following changes to the 1725A front panel:

   HORIZONTAL DISPLAY .... MAG X10 (IN)
   MAIN TRIGGERING .... ± (OUT)

   c. Using the HP 1725A, verify that the OUTPUT Pulse Rise Time is less than 5nS.

   d. Set the MAIN TRIGGERING ± button to – (IN).

   e. Using the HP 1725A, verify that the OUTPUT PULSE Fall Time is less than 5nS.

4-46. INSERTION DELAY

4-47. Specifications Tested: <140nS (when in PRESET)
<40nS (when in AUTO)

4-48. Equipment: 5370B, 3312A

1. Set the 3312A for a 1MHz 2V p-p square wave with no offset.

2. Set the 5359A front panel controls as follows:

EXTERNAL ENABLE
  SLOPE .... +
  LEVEL .... midrange
  SYNC DELAY .... PRESET
OUTPUT
  POLARITY .... NORM,POS
  AMPLITUDE .... +1.00V
  OFFSET .... OFF
FUNCTION
  DELAY 200nS

3. Set the 5370B front panel controls as follows:

FUNCTION .... TI
STATISTICS .... MEAN
SAMPLE SIZE 1
ARMING .... ±TI
  PERIOD COMPLMNT .... STOP
START
  TRIG LVL .... Preset
  SLOPE .... +
  IMPEDANCE 50Ω
  ATTENUATION .... ÷1
  COUPLING .... DC
STOP
  TRIG LVL .... +0.50V
  SLOPE .... +
  IMPEDANCE 50Ω
  ATTENUATION .... ÷1
  COUPLING .... DC
START COM .... SEP

4. Press the CAL key.

5. Connect the 5359A, 3312A, and 5370B as shown in *Figure 4-8*.

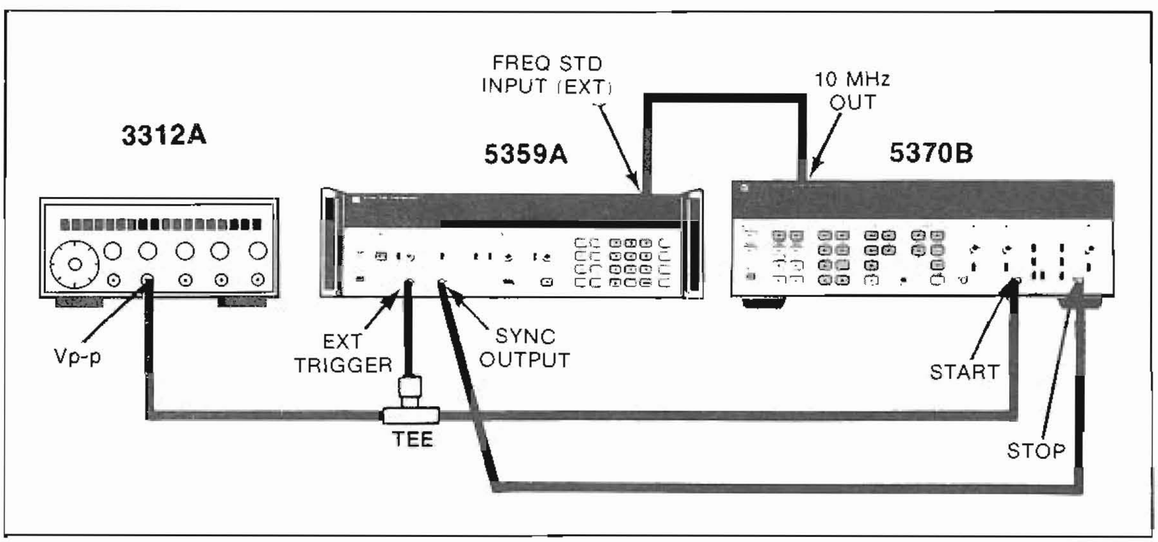


Figure 4-8. Setup For Measuring Insertion Delay

6. Verify that the value measured on the 5370B for insertion delay is less than or equal to 140nS.

7. Change the SYNC DELAY to AUTO.

8. Verify that the value measured on the 5370B for insertion delay is less than or equal to 40nS.

4-49. THE PERFORMANCE TEST FOR THE 5359A IS NOW COMPLETE.

PERFORMANCE TEST RECORD (Page 1 of 2)

HEWLETT-PACKARD MODEL 5359A
TIME SYNTHESIZER

Repair/Work Order No. ______________

Serial Number: ______________

Temperature: ______________

Test Performed By: ______________

Relative Humidity: ______________

Date: ______________

Post Calibration Test: ☐

Notes: ______________

Pre Calibration Test: ☐

PARA. NO.	TEST			RESULTS MINIMUM	RESULTS ACTUAL	RESULTS MAXIMUM
4-25	**DELAY**					
	with Delay = 0 ns					
	Amplitude = +1.00V	Offset =	Off	-1ns	______	+1ns
	+3.00V		Off	-1ns	______	+1ns
	+4.00V		Off	-1ns	______	+1ns
	+1.00V		On/+1.00V	-1ns	______	+1ns
	+1.00V		On/-1.00V	-1ns	______	+1ns
	with Delay = 160 ms					
	Amplitude = +1.00V	Offset =	Off	159.999999ms	______	160.000001ms
	+3.00V		Off	159.999999ms	______	160.000001ms
	+4.00V		Off	159.999999ms	______	160.000001ms
	+1.00V		On/+1.00V	159.999999ms	______	160.000001ms
	+1.00V		On/-1.00V	159.999999ms	______	160.000001ms
4-28	**PERIOD**					
	with Period = 100ns					
	Amplitude = +1.00V	Offset =	Off	99ns	______	101ns
	+3.00V		Off	99ns	______	101ns
	+4.00V		Off	99ns	______	101ns
	+1.00V		On/+1.00V	99ns	______	101ns
	+1.00V		On/-1.00V	99ns	______	101ns
	with Period = 160 ms					
	Amplitude = +1.00V	Offset =	Off	159.999999ms	______	160.000001ms
	+3.00V		Off	159.999999ms	______	160.000001ms
	+4.00V		Off	159.999999ms	______	160.000001ms
	+1.00V		On/+1.00V	159.999999ms	______	160.000001ms
	+1.00V		On/-1.00V	159.999999ms	______	160.000001ms
4-31	**WIDTH**					
	with Width = 5 ns					
	Amplitude = +1.00V	Offset =	Off	4ns	______	6ns
	+3.00V		Off	4ns	______	6ns
	+4.00V		Off	4ns	______	6ns
	+1.00V		On/+1.00V	4ns	______	6ns
	+1.00V		On/-1.00V	4ns	______	6ns
	with Width = 160 ms					
	Amplitude = +1.00V	Offset =	Off	159.999999ms	______	160.000001ms
	+3.00V		Off	159.999999ms	______	160.000001ms
	+4.00V		Off	159.999999ms	______	160.000001ms
	+1.00V		On/+1.00V	159.999999ms	______	160.000001ms
	+1.00V		On/-1.00V	159.999999ms	______	160.000001ms

HP 5359A PERFORMANCE TEST RECORD (Page 2 of 2)

PARA. NO.	TEST	CORRECT DISPLAY	RESULTS MINIMUM	RESULTS ACTUAL	RESULTS MAXIMUM
4-34	**STEP SIZE**				
	Width Step Size (Width = 5ns)				
	Step Size = 0.05ns Up/Down =	Up	4.05ns		6.05ns
	1ns	Up	5.05ns		7.05ns
	10ns	Up	15.05ns		17.05ns
	100ns	Up	115.05ns		117.05ns
	100ns	Down	15.05ns		17.05ns
	10ns	Down	5.05ns		7.05ns
	1ns	Down	4.05ns		6.05ns
	.05ns	Down	4.00ns		6.00ns
	Delay Step Size (~~Width~~ delay = 0ns)				
	Step Size = 0.05ns Up/Down =	Up	-950ps		1.05ns
	1ns	Up	50ps		2.05ns
	10ns	Up	10.05ns		12.05ns
	100ns	Up	110.05ns		112.05ns
	100ns	Down	10.05ns		12.05ns
	10ns	Down	50ps		2.05ns
	1ns	Down	-950ps		1.05ns
	.05ns	Down	-1.00ns		1.00ns
4-37	**JITTER**				
	with Delay = 0 ns		—		200ps
	10ms		—		1ns*
	160ms		—		1ns*
4-40	**SYNC OUTPUT**				
	AMPLITUDE		0.85V		1.15V
	WIDTH		25ns		55ns
	RISE TIME		—		5ns
	FALL TIME		—		5ns
4-43	**50Ω OUTPUT**				
	AMPLITUDE				
	Amplitude = +0.5V Offset =	Off	+0.47V		+0.53V
	+5.00V	Off	+4.97V		+5.03V
	OFFSET				
	Amplitude = +2.00V Offset =	On/-1.00V	+0.97V		+1.03V
	+2.00V	On/+1.00V	+2.97V		+3.03V
	RISE TIME		—		5ns
	FALL TIME		—		5ns
4-46	**INSERTION DELAY**				
	PRESET		—		140ns
	AUTO (DELAY = 200ns)		—		40ns

* 200ps for Option 001 Instruments.

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes the adjustments which will return the 5359A to peak operating condition after repairs are completed or for periodic preventative maintenance. If the adjustments are to be considered valid, the 5359A must have a half-hour warm-up and the line voltage must be within +5 to -10% of nominal.

5-3. ORDER OF ADJUSTMENT

5-4. The following is a list of the adjustment procedures provided in the recommended order of adjustment. With the following exception, the actual order of adjustment is not critical, however, it is recommended that adjustments be performed only when necessary and only to the indicated assembly. The A17 and A16 adjustments are complementary procedures and both should be performed when either is indicated, and A17 must precede A16.

A22	Digital Timing
A24	200 MHz Multiplier
A23	Startable VCO
A19	Auto-Zero
A21	Analog Timing
A17	Output Reference
A16	Processor Interface
A27	10 MHz Crystal Oscillator

5-5. SAFETY CONSIDERATIONS

5-6. Although the HP Model 5359A has been designed in accordance with International Safety Standards, this manual contains information, cautions, and warnings which MUST be followed to ensure safe operation and to retain the 5359A in safe conditon (also see Sections II and III of this manual). Service and adjustments should be performed only by qualified personnel.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDING) CON – DUCTOR (INSIDE OR OUTSIDE THE 5359A) OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE 5359A DANGEROUS. INTENTIONAL INTERRUPTION IS PROHIBITED.

5-7. Any adjustment, maintenance, or repair of the opened 5359A with voltage applied should be avoided as must as possible and, when inevitable, should be carried out by a skilled person who is aware of the hazard involved. Capacitors inside the 5359A may still be charged even if the 5359A has been disconnected from its source of supply.

5-8. Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided. Whenever it is likely that the protection offered by fuses has been impaired, the 5359A must be made in operative and secured against any unintended operator.

WARNING

ADJUSTMENTS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE 5359A WHILE PROTECTIVE COVERS ARE REMOVED. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

5-9. EQUIPMENT REQUIRED

5-10. The test equipment required for all of the adjustment procedures is listed in *Table 1-2*, Recommended Test Equipment. The test equipment required for the adjustment of each particular assembly is listed at the beginning of the adjustment procedure for that assembly. This listing is a duplicate of the listing in *Table 1-2* and is supplied as a quick reference. The critical specifications of the substitute test instruments must meet or exceed the standards listed in *Table 1-2* if the 5359A is to meet the specifications in *Table 1-1*.

5-11. ADJUSTMENT LOCATIONS

5-12. As an adjustment aid, locators are given for each assembly adjustment procedure and appear at the end of each adjustment procedure. These locators are simplified illustrations of the assembly showing variable resistors, variable capacitors, test points, etc., needed for adjustment of the assembly.

5-13. ASSEMBLY REMOVAL AND REPLACEMENT

5-14. All of the assemblies, with the exception of A11 and A16, can be easily removed by lifting up on the board extraction tabs and pulling the assembly straight up out of the motherboard connector. The right-angle ribbon cable connectors on A11 and A16 must be removed prior to extracting these assemblies.

A22 Digital Timing Assembly

Equipment:
HP 3435A DMM

Accessories:
Ceramic Tuning Wand

Setup:

1. Set the 3435A function to dc V and RANGE to AUTO.
2. Turn the power switch of the 5359A to ON and observe auto-calibrate and then display of 100.00 ns Width.
3. Connect the DMM between the "-3V" TP and "⏚" TP on A22.
4. Adjust A22 R61 for -3.00V ±0.02V.
5. This completes adjustment of A22.

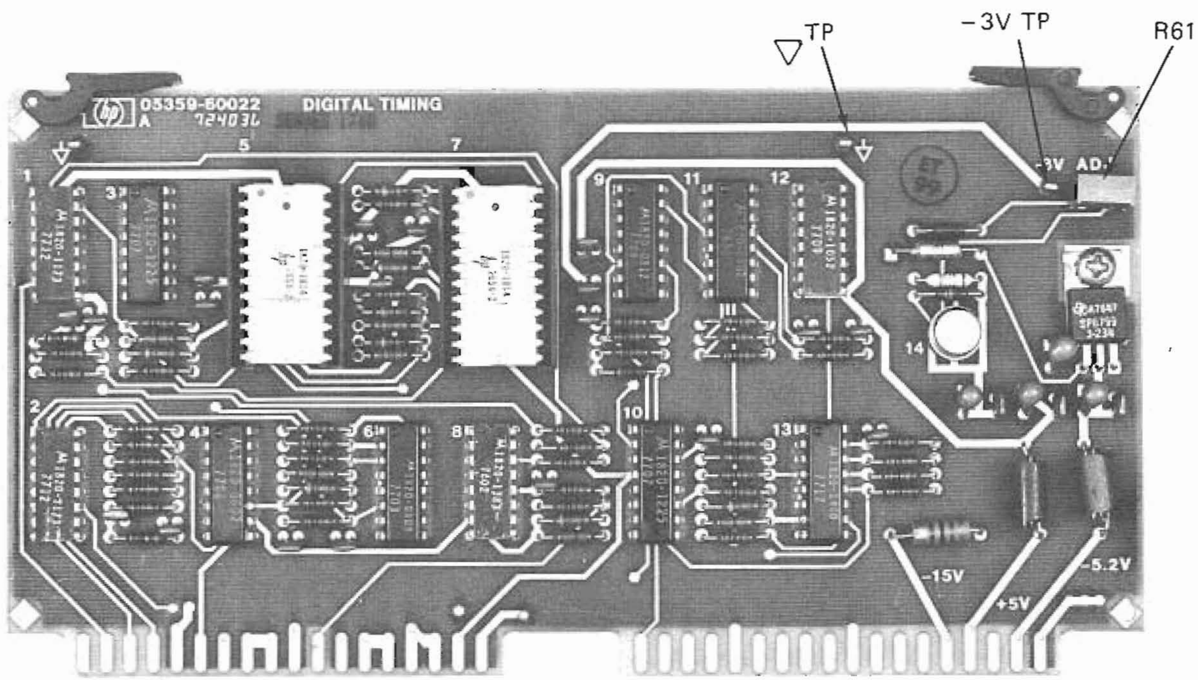


Figure 5-1. A22 Digital Timing Assembly Adjustments

A24 200 MHz Multiplier Assembly

Equipment:
HP 141T/8552A/8554L Spectrum Analyzer
HP 1120A Active Probe
HP 1122A Probe Power Supply

Accessories:
HP 1024A 10:1 Divider Tip
HP 5060-0474 Spanner Tip
HP 8710-0033 Ceramic Tuning Wand
12" Alligator Clip Lead

Setup:

1. Connect 10:1 divider tip and spanner tip to active probe. Connect probe to power supply.

CAUTION

Always set 5359A power to STBY before removing or inserting assembly boards.

2. Set 141T/8552A/8554L Spectrum Analyzer as follows:

STORAGE	STD
PERSISTANCE	MIN
BANDWIDTH	100 kHz
SCAN WIDTH	10 MHz PER DI
INPUT ATTENUATOR	10 dB
CENTER FREQUENCY	50 MHz
SCAN TIME	2 ms
LOG REF LEVEL DIAL	-10 dBm
LOG REF LEVEL VERNIER	Ø
LOG REF LEVEL SWITCH	LOG
VIDEO FILTER SWITCH	OFF
SCAN MODE SWITCH	INT
SCAN TRIGGER SWITCH	AUTO

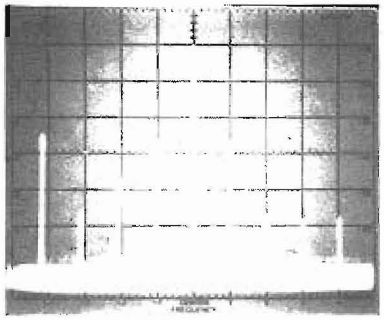
3. Connect 1120A Active Probe to spectrum analyzer RF INPUT.
4. Connect probe tip to A24 TP3.

NOTE

Make ALL the following adjustments with ceramic tuning wand only.

Figure 5-2. A24 200 MHz Multiplier Assembly Adjustments

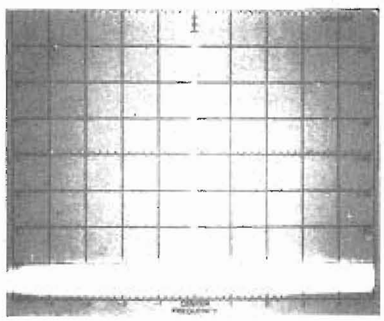
5. Adjust A24C54 for equal amplitude for the 40 MHz and 60 MHz sidebands around the 50 MHz center frequency as shown. Do not readjust C54 during the remaining procedure.



50 MHz Center Frequency Signal

6. Set spectrum analyzer input attenuator to 20 dB and connect probe tip to A21TP2.

7. Adjust A24C52, C51, C46, C33, and C28 to minimize all sidebands around the 50 MHz signal as completely as possible. Repeat adjustment as necessary until sidebands are down 60 dB or more as shown.



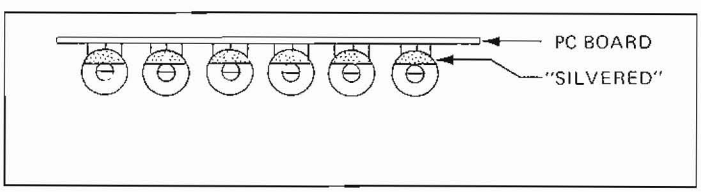
50 MHz Sidebands Adjustment Signal

8. Set spectrum analyzer as follows:

CENTER FREQUENCY	200 MHz
BANDWIDTH	300 kHz
SCAN WIDTH	50 MHz/DIV
LOG REF LEVEL DIAL	+10 dBm

9. Connect probe tip to A24TP1. The probe ground connection is critical. Poor ground will give excessive 10 MHz frequency components.

10. Adjust A24C20, C18, C12, C10, C6, and C2 to the prealignment position ("silvered" half of each capacitor adjacent to board ground plane) as shown.[1]



Capacitor Prealignment Position

Figure 5-2. A24 200 MHz Multiplier Assembly Adjustments (Continued)

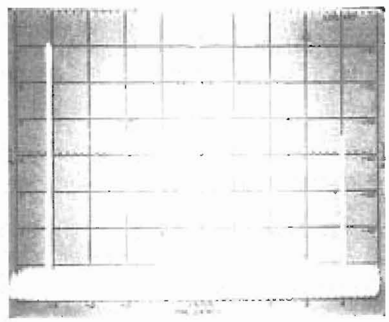
11. Adjust A24C20, C18, C12, C10, C6, and C2 to maximize the amplitude of the 200 MHz center frequency signal.

12. Readjust A24C20, C18, C12, C10, C6, and C2 to minimize all sidebands around the 200 MHz center frequency as completely as possible.

NOTE

Maintaining the maximum amplitude of the 200 MHz center frequency is not critical at this point and the amplitude of the second harmonic (400 MHz) is not critical.

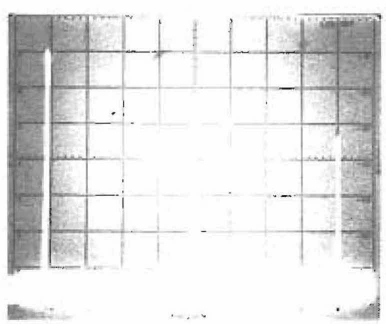
13. Repeat adjustment as necessary until sidebands are down 65 dB or more as shown.



200 MHz Sideband Adjustment Signal

14. Set spectrum analyzer LOG REF LEVEL VERNIER for 200 MHz center frequency at Ø dB log reference level on display screen.

15. Verify the following Test Limits.



200 MHz Test Limit Signal

Figure 5-2. A24 200 MHz Multiplier Assembly Adjustments (Continuted)

TEST LIMIT

a) Connect probe tip to U1 pin 2 and observe 200 MHz signal amplitude down less than 30 dB.

b) Connect probe tip to U1 pin 14 and observe 200 MHz signal amplitude down less than 30 dB.

c) Connect probe tip to U2 pin 3 and observe 200 MHz signal amplitude down less than 30 dB.

d) This completes adjustments of A24.

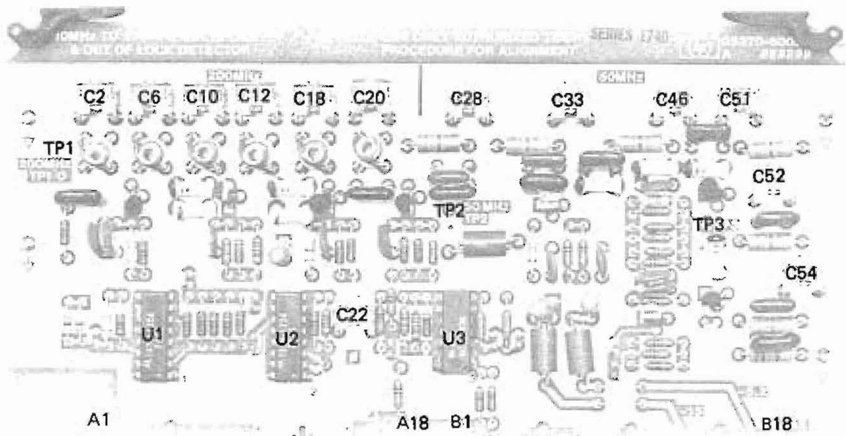


Figure 5-2. A24 200 MHz Multiplier Assembly Adjustments (Continued)

A23 Startable VCO Assembly

Equipment:
HP 1720A Oscilloscope
HP 10014A Scope Probes (2 each)

Setup:

1. Remove and reinstall the A23 assembly on extender board (05370-60075).
2. Connect Channel A and Channel B scope probes as follows:

   CHANNEL A .... A23 MIXER GATED TP (U7 pin 3)
   CHANNEL B .... A23 DIV GATED TP (U4 pin 6)
   SCOPE PROBE GROUND CLIPS .... A23 ⏚ (ground) TP

3. Set 1720A controls as follows:

   CHANNELS A&B .... DC (1 MΩ)
   VOLTS/DIV 0.05
   VERT DISPLAY .... ALT
   INT TRIG .... "A"
   TIME/DIV .... 10 ns/Div
   MAIN TRIGGERING .... "+"

4. Set 5359A controls as follows:

   LINE .... ON
   DELAY .... 5 μs
   EXT TRIGGER .... REMOVE ALL CONNECTIONS

5. Adjust A23R8 BAL such that the leading edges of the scope signals A and B occur at the same time (as close as possible).
6. Remove power (LINE switch to STBY) and replace A23 assembly (without extender) into instrument.
7. Remove scope probe connections and reconnect Channel A scope probe to A23TP2, and probe ground to ⏚ TP.
8. Set 5359A controls as follows:

   LINE .... ON
   DELAY .... 5 μs
   EXT TRIGGER .... REMOVE ALL CONNECTIONS

9. Set oscilloscope for 0.1 μs/Div.
10. Adjust A23 MIXER SYM, R19 for a 50% duty cycle.
11. This completes the A23 adjustments.

Figure 5-3. A23 Startable PLL Oscillator Assembly Adjustments

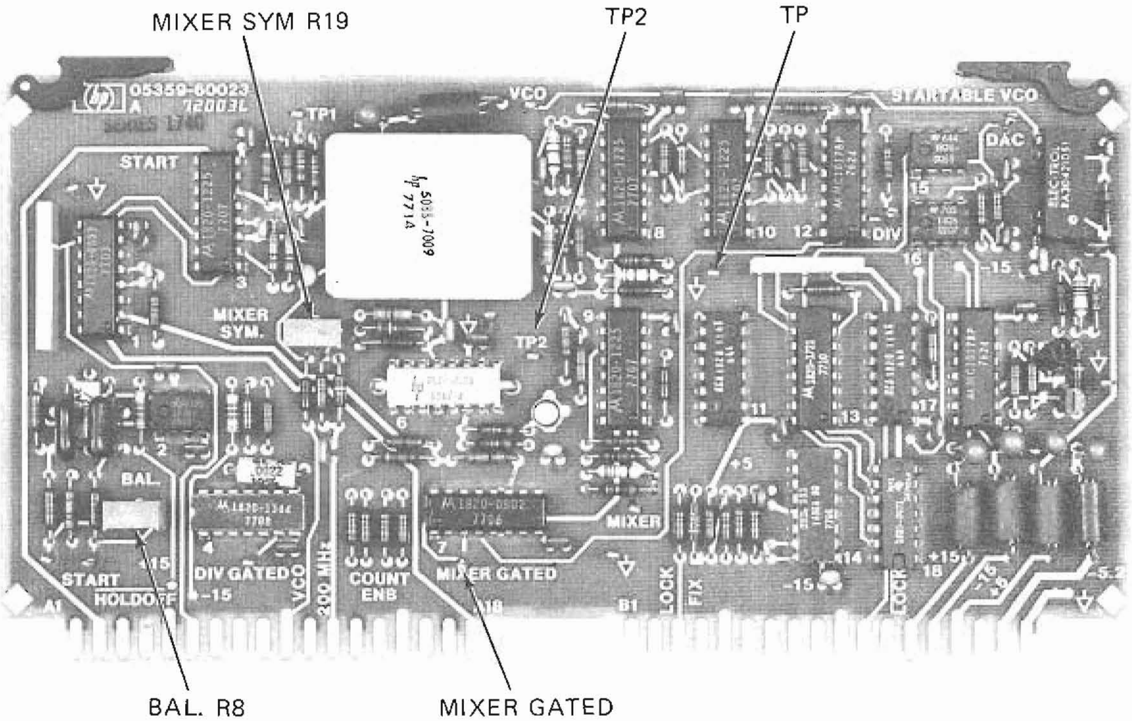


Figure 5-3. A23 Startable PLL Oscillator Assembly Adjustments (Continued)

A19/A21 Auto-Zero/Analog Timing Assemblies

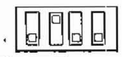
NOTE

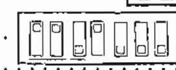
The adjustments on A19 and A21 may interact with each other. Alternate procedures back and forth to verify the specified outputs.

Equipment: None required

Setup:

1. Set 5359A controls as follows:

A16 "Debug" switches to .... 

A9 switches .... 

A18 switches .... CKT

EXT TIMING COMPENSATION .... DISABLE

FREQ STD .... INT

EXT TRIG SLOPE .... P

SYNC DELAY .... PRESET

POLARITY .... NORM/POS

OFFSET .... OFF

EXT TRIG LEVEL .... 2 O'Clock

AMPLITUDE .... 12 O'Clock

LINE .... ON

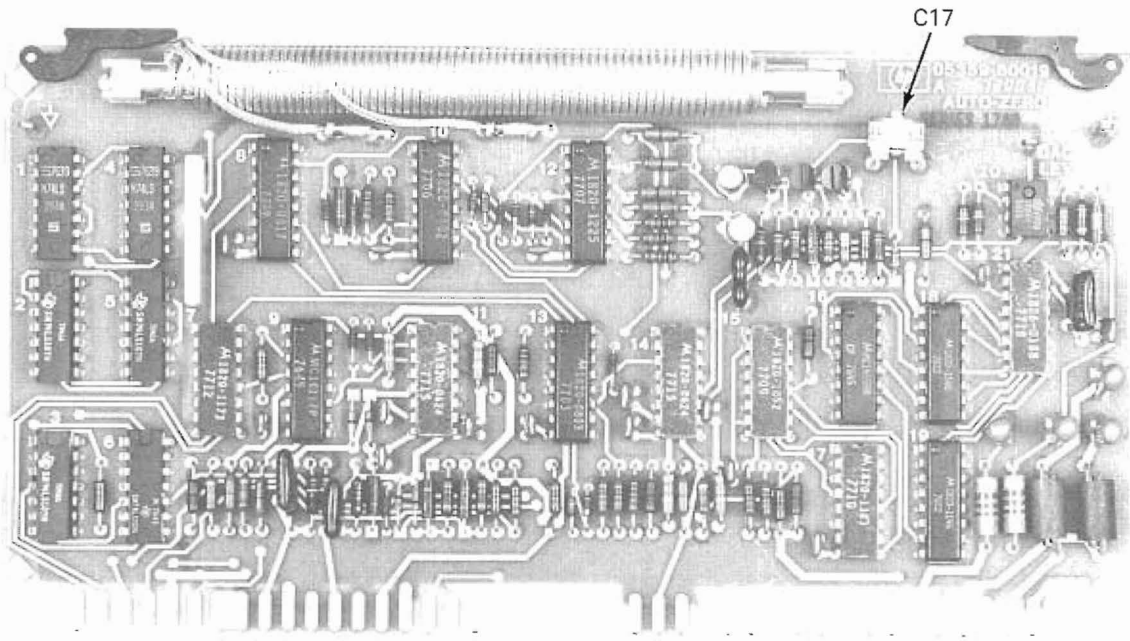
NOTE

The A16 switch setup has placed the microprocessor in a special service mode. The constants associated with analog step sizes (S_D and S_W) and precedence detector range are continuously measured and displayed in loops which are entered through front panel keys CAL, STEP UP and STEP DOWN, and exited by CLEAR.

2. Place LINE to STBY, remove and reinstall the A21 assembly on extender board (05370-60075), and return line switch to ON.
3. Push CAL and observe precedence displayed detector capture range. Adjust C17 on A19 for a display of 12.5 to 12.8 ns. A jitter of 0.2 ns is acceptable.
4. Push CLEAR and hold until display shows 100.00 ns width. This exits the loop.
5. Push STEP UP and observe displayed "S_D" (X1000) analog step size constant. Adjust A21, C24 (rear adjustable capacitor) for a display of 44 to 46 ns. A jitter of 0.6 ns is acceptable.
6. Push CLEAR and hold until display shows 100.00 ns WIDTH. This exits the loop.
7. Push STEP DOWN and observe displayed "S_W" (X1000) analog step size constant. Adjust A21, C20 (front adjustable capacitor) for a display of 44 to 46 ns. A jitter of 0.6 ns is acceptable.
8. Push CLEAR and hold until display shows 100.00 ns WIDTH. This exits the loop.
9. Remove power (LINE switch to STBY) and replace A21 assembly (without extender into instrument.
10. This completes the adjustments for the A19 and A21 assemblies. However, this service mode also allows the recall and display of the following calibration constants.

Figure 5-4. A19/A21 Auto-Zero/Analog Timing Assembly Adjustments

PUSH	CONSTANT DISPLAYED	NORMAL RANGE
WIDTH	C_W	-5 ns to +5 ns
DELAY	C_D	15 ns to 35 ns
PERIOD	C_P	-79 ns to -40 ns
FREQ	C_{DS}	-79 ns to -40 ns



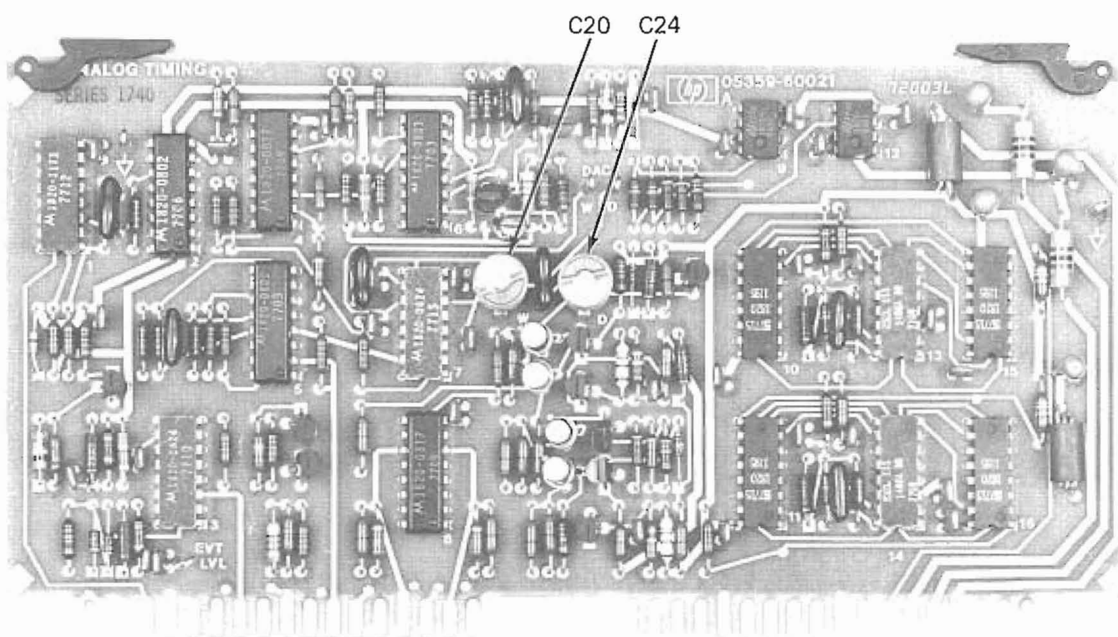


Figure 5-4. A19/21 Auto-Zero/Analog Timing Assembly Adjustments (Continued)

A17 Output Reference

Equipment:
- HP 3435 DMM
- HP 140A/1410A/1424A Sampling Scope

Accessories:
- HP 8491A
- 20 dB Attenuator

Setup:

1. Set the 3435A function to dc V and RANGE to AUTO.
2. Turn the LINE switch on the 5359A to ON and observe auto-calibrate and then display of 100.00 ns width.
3. Connect the 50Ω OUTPUT to 3435A through a 50Ω feedthrough.
4. Remove any connections to the EXT TRIGGER input.
5. Enter DELAY of Ø ns.
6. Adjust A17 as per the following table.

Table 5-1. A17 Adjustments

Step	Polarity	Offset	Amplitude Control	Offset Control	Adjust
*1.	Comp/Neg	Off	ccw	—	Min Ampl (R1) for -0.40V ±0.01V
*2.	Comp/Pos	Off	ccw	—	BAL (R20) or +0.40V ±0.01V
3.	Norm/Pos	Off	cw	—	Verify reading -100 to +200 mV
4.	Norm/Pos	Off	cw	—	If reading not in range of Ø to +100 mV, readjust BAL slightly.
*5.	Comp/Neg	Off	cw	—	Max Ampl (R16) for -5.10V ±0.03V
*6.	Comp/Neg	Off	ccw	—	Min Ampl (R1) for -0.40V ±0.01V
7.	Norm/Neg	On	Midrange	ccw	Neg Offset (R18) for -1.10V ±0.02V
8.	Norm/Neg	On	Midrange	cw	Pos Offset (R9) for +1.10V ±0.02V

**Alternate adjustments until both readings are stable.*

注 A16 ADJ [illegible]

7. Connect 50Ω OUTPUT to sampling scope input through 20 dB attenuator. Connect SYNC OUT to sampling scope trigger input.
8. Set the 5359A as follows:

POLARITY	NORM/POS
OFFSET	OFF
EXTERNAL TRIG	Connect external trigger to "EXT TRIGGER" input
LEVEL	for output pulse
DELAY	10 ns
WIDTH	20 ns

9. Set Amplitude control fully cw and adjust HI DRIVE (R56) for best rise time and fall time consistent with 10% maximum overshoot.

Figure 5-5. A17 Output Reference Assembly Adjustments

10. Set Amplitude control fully ccw and adjust LO DRIVE (R50) for best rise time and fall time consistent with 10% maximum overshoot.

11. Repeat instructions 3, 4, 5, and continue as per the following table.

Table 5-1. A17 Adjustments (Continued)

Step	Polarity	Offset	Amplitude Control	Offset Control	Adjust
9.	Comp/Neg	Off	cw	—	Verify reading of -5.1V ±0.05V. If not, return to step 1 and repeat procedure.
10.	Comp/Neg	Off	ccw	—	Verify reading of -0.37V to -0.45V

12. This completes the adjustments for A17.

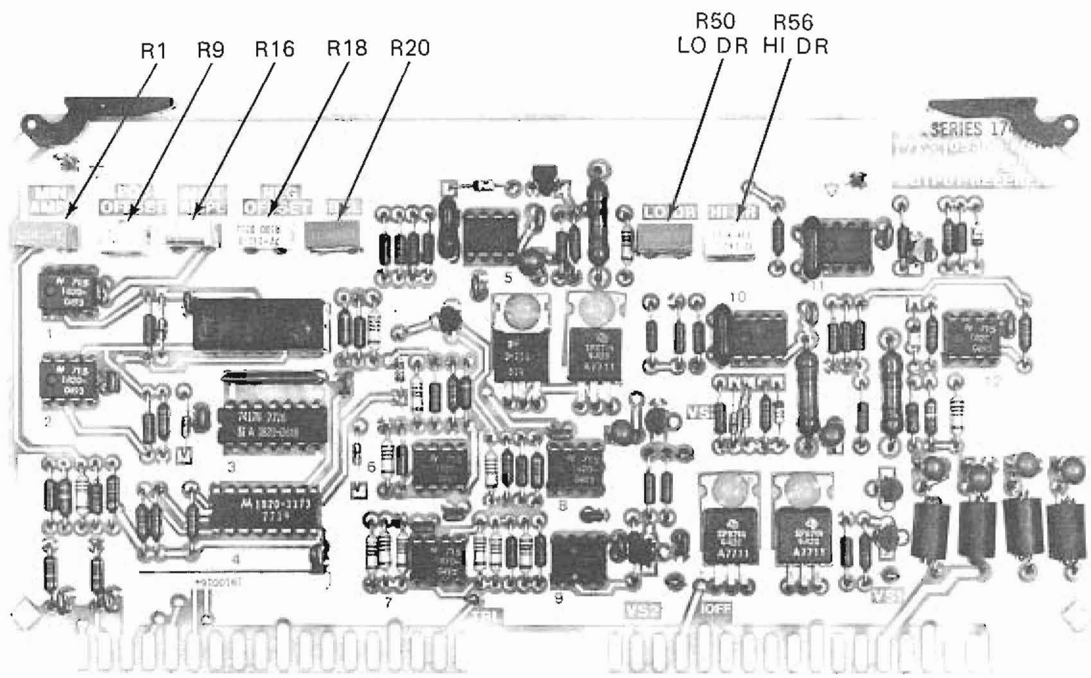


Figure 5-5. A17 Output Reference Assembly Adjustments (Continued)

A16 Processor Interface

NOTE

Complete adjustments on A17 before performing A16 procedure.

Equipment:
- HP 3435 DMM
- HP 9825 Calculator
- HP 98034 Interface

Setup:

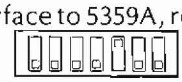
1. Connect 9825A calculator with 98034 Interface to 5359A, rear panel HP-IB connector, J14. Set 5359A HP-IB address switch A5S1 to  Address "4".
2. Set the 3435A function to dc V and RANGE to AUTO.
3. Turn the LINE switch on the 5359A to ON and observe auto-calibrate and then display of 100.00 ns width.
4. Connect the 50Ω OUTPUT to 3435A through a 50Ω feedthrough.
5. Remove any connections to the EXT TRIGGER input.
6. Enter DELAY of Ø ns.
7. Adjust A16 as per the following table:

Table 5-2. A16 Adjustments

Step	9825 Keyboard Command	A16 Adjust
*1	wrt 704, "OCOA 0.5, OOØ" EXECUTE	R11 for +0.50V ±0.01V
*2	wrt 704, "OCOA 5, OOØ" EXECUTE	R17 for +5.00V ±0.03V
*3	wrt 704, "ONOA 2.75, OO-1" EXECUTE	R14 for -1.00V ±0.02V
*4	wrt 704, "ONOA 2.75, OO1" EXECUTE	R21 for +1.00V ±0.02V

**Alternate adjustments until both readings are stable.*

8. This completes the adjustments for A16.

Figure 5-6. A16 Processor Interface Assembly Adjustments

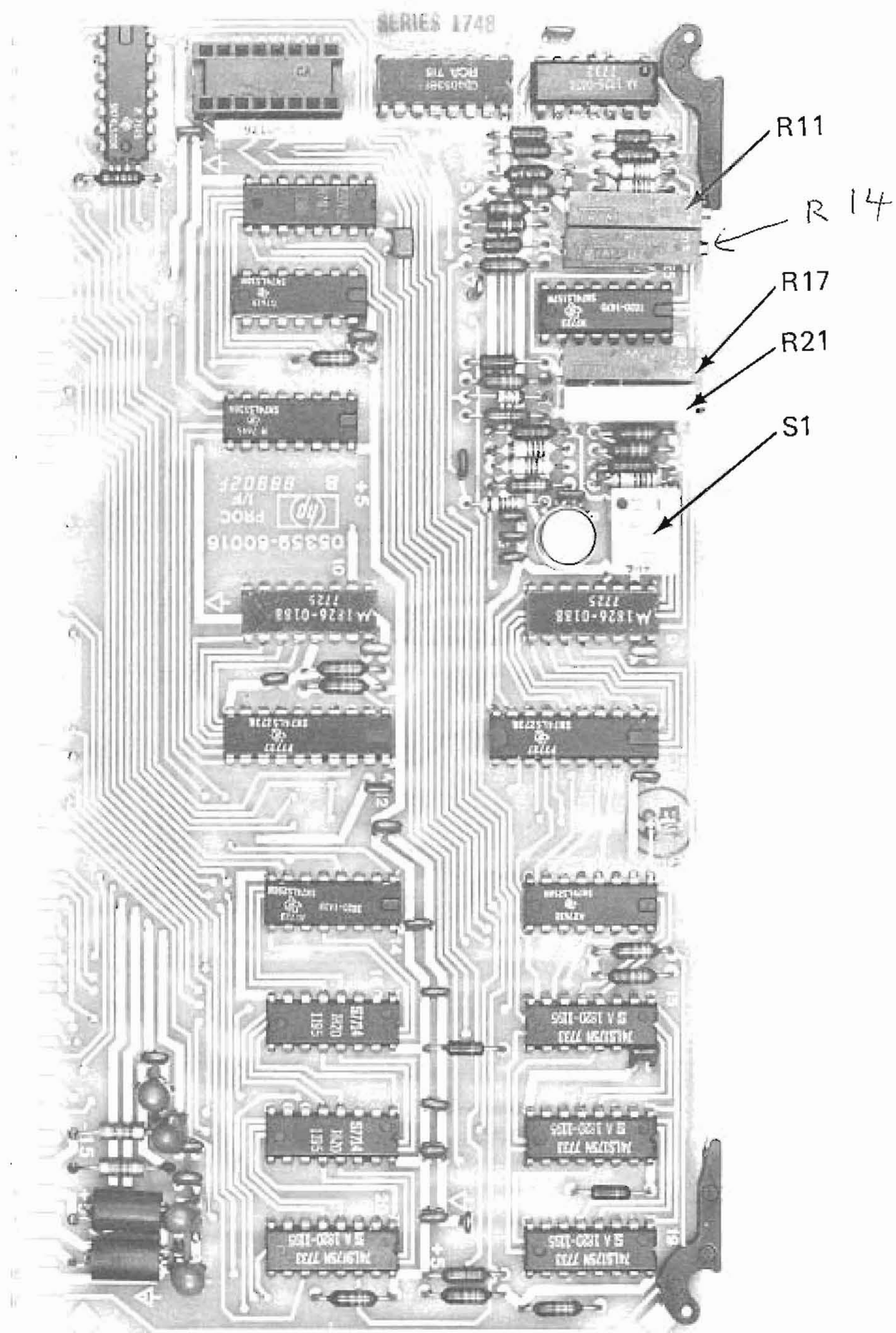


Figure 5-6. A16 Processor Interface Assembly Adjustments (Continued)

A27 Oscillator (Standard or Option 001)

Every few months, the oscillator should be checked to a house standard. When adjustment is required, use the oscilloscope method shown. Using the appropriate sweep speed, adjust the oscillator until the movement of the pattern is stopped.

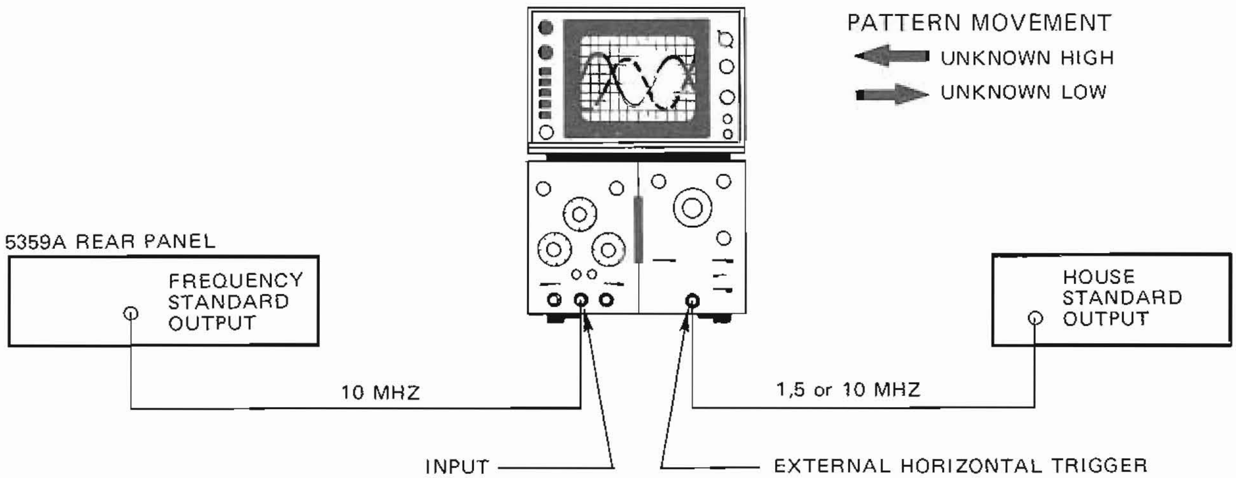


Table 5-3. Sweep Movement versus Calibration Accuracy

MOVEMENT	SWEEP SPEED			NOTES
	1 μsec/cm	0.1μsec/cm	0.01μsec/cm	
1 cm/sec 1 cm/10 sec 1 cm/100 sec	1×10^{-6} 1×10^{-7} 1×10^{-8}	1×10^{-7} 1×10^{-8} 1×10^{-9}	1×10^{-8} 1×10^{-9} 1×10^{-10}	Time scope trace movement with second hand of watch or clock

Adjustments for the A27 Oscillator Assembly are now complete.

Figure 5-7. A27 10 MHz Crystal Oscillator Assembly Adjustments

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. *Table 6-1* lists abbreviations used in the parts list and throughout the manual. *Table 6-2* lists all replaceable parts in reference designation order. *Table 6-3* contains the names and addresses that correspond with the manufacturers' code numbers.

6-3. ABBREVIATIONS

6-4. *Table 6-1* lists abbreviations used in the parts list, schematics, and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. REPLACEABLE PARTS LIST

6-6. *Table 6-2* is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alphanumerical order by reference designation.

c. Miscellaneous parts.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty.) used in the instrument.

c. The description of the part.

d. A typical manufacturer of the part in a five-digit code.

e. The manufacturer's number for the part.

The total quantity for each part is given only once at the first appearance of the part number in the list.

6-7. ORDERING INFORMATION

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-10. PARTS PROVISIONING

6-11. Stocking spare parts for an instrument is often done to ensure quick return to service after a malfunction occurs. Hewlett-Packard has a Spare Parts Kit available for this purpose. The kit consists of selected replaceable assemblies and components for this instrument. The contents of the kit and the Recommended Spares list are based on failure reports and repair data, and parts support for 1 year. A complimentary Recommended Spares list for this instrument may be obtained on request and the Spare Parts Kit may be ordered through your nearest Hewlett-Packard office.

6-12. DIRECT MAIL ORDER SYSTEM

6-13. Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the sysem are:

a. Direct ordering and shipment from the HP Parts Center in Mountain View, California.

b. No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).

c. Prepaid transportation (there is a small handling charge for each order).

d. No invoices — to provide these advantages, a check or money order must accompany each order.

6-14. Mail order forms and specific ordering information is available through your local HP office. Addresses and phone numbers are located at the back of this manual.

Table 6-1. Abbreviations and Reference Designators

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

A	= ampere	BAL	= balance	COEF	= coefficient	°C	= degree Celsius (centrigrade)
ac	= alternating current	BCD	= binary coded decimal	COM	= common	°F	= degree Fahrenheit
ACCESS	= accessory	BD	= board	COMP	= composition	°K	= degree Kelvin
ADJ	= adjustment	BE CU	= beryllium copper	COMPL	= complete	DEPC	= deposited carbon
A/D	= analog-to-digital	BFO	= beat frequency oscillator	CONN	= connector	DET	= detector
AF	= audio frequency	BH	= binder head	CP	= cadmium plate	diam	= diameter
AFC	= automatic frequency control	BKDN	= breakdown	CRT	= cathode-ray tube	DIA	= diameter (used in parts list)
AGC	= automatic gain control	BP	= bandpass	CTL	= complementary transistor logic	DIFF AMPL	= differential amplifier
AL	= aluminum	BPF	= bandpass filter	CW	= continuous wave	div	= division
ALC	= automatic level control	BRS	= brass	cw	= clockwise	DPDT	= double-pole, double-throw
AM	= amplitude modulation	BWO	= backward-wave oscillator	D/A	= digital-to-analog	DR	= drive
AMPL	= amplifier	CAL	= calibrate	dB	= decibel	DSB	= double sideband
APC	= automatic phase control	ccw	= counterclockwise	dBm	= decibel referred to 1 mW	DTL	= diode transistor logic
ASSY	= assembly	CER	= ceramic	dc	= direct current	DVM	= digital voltmeter
AUX	= auxiliary	CHAN	= channel	deg	= degree (temperature interval or difference)	ECL	= emitter coupled logic
avg	= average	cm	= centimeter	°	= degree (plane angle)		
AWG	= american wire gauge	CMO	= coaxial				

Table 6-1. Abbreviations and Reference Designators (Continued)

ABBREVIATIONS (CONTINUED)

EMF	= electromotive force
EDP	= electronic data processing
ELECT	= electrolytic
ENCAP	= encapsulated
EXT	= external
F	= farad
FET	= field-effect transistor
F/F	= flip-flop
FH	= flat head
FIL H	= fillister head
FM	= frequency modulation
FP	= front panel
FREQ	= frequency
FXD	= fixed
g	= gram
GE	= germanium
GHz	= gigahertz
GL	= glass
GND	= ground(ed)
H	= henry
h	= hour
HET	= heterodyne
HEX	= hexagonal
HD	= head
HDW	= hardware
HF	= high frequency
HG	= mercury
HI	= high
HP	= Hewlett-Packard
HPF	= high pass filter
HR	= hour (used in parts list)
HV	= high voltage
Hz	= Hertz
IC	= integrated circuit
ID	= inside diameter
IF	= intermediate frequency
IMPG	= impregnated
in	= inch
INCD	= incandescent
INCL	= include(s)
INP	= input
INS	= insulation
INT	= internal
kg	= kilogram
kHz	= kilohertz
kΩ	= kilohm
kV	= kilovolt
lb	= pound
LC	= inductance-capacitance
LED	= light-emitting diode
LF	= low frequency
LG	= long
LH	= left hand
LIM	= limit
LIN	= linear taper (used in parts list)
lin	= linear
LK WASH	= lockwasher
LO	= low; local oscillator
LOG	= logarithmic taper (used in parts list)
log	= logarithm(ic)
LPF	= low pass filter
LV	= low voltage
m	= meter (distance)
mA	= milliampere
MAX	= maximum
MΩ	= megohm
MEG	= meg (10^6) (used in parts list)
MET FLM	= metal film
MET OX	= metal oxide
MF	= medium frequency; microfarad (used in parts list)
MFR	= manufacturer
mg	= milligram
MHz	= megahertz

mH	= millihenry
mho	= mho
MIN	= minimum
min	= minute (time)
..′	= minute (plane angle)
MINAT	= miniature
mm	= millimeter
MOD	= modulator
MOM	= momentary
MOS	= metal-oxide semiconductor
ms	= millisecond
MTG	= mounting
MTR	= meter (indicating device)
mV	= millivolt
mVac	= millivolt, ac
mVdc	= millivolt, dc
mVpk	= millivolt, peak
mVp-p	= millivolt, peak-to-peak
mVrms	= millivolt, rms
mW	= milliwatt
MUX	= multiplex
MY	= mylar
µA	= microampere
µF	= microfarad
µH	= microhenry
µmho	= micromho
µs	= microsecond
µV	= microvolt
µVac	= microvolt, ac
µVdc	= microvolt, dc
µVpk	= microvolt, peak
µVp-p	= microvolt, peak-to-peak
µVrms	= microvolt, rms
µW	= microwatt
nA	= nanoampere
NC	= no connection
N/C	= normally closed
NE	= neon
NEG	= negative
nF	= nanofarad
NI PL	= nickel plate
N/O	= normally open
NOM	= nominal
NORM	= normal
NPN	= negative-positive-negative
NPO	= negative-positive zero (zero temperature coefficient)
NRFR	= not recommended for field replacement
NSR	= not separately replaceable
ns	= nanosecond
nW	= nanowatt
OBD	= order by description
OD	= outside diameter
OH	= oval head
OP AMPL	= operational amplifier
OPT	= option
OSC	= oscillator
OX	= oxide
oz	= ounce
Ω	= ohm
P	= peak (used in parts list)
PAM	= pulse-amplitude modulation
PC	= printed circuit
PCM	= pulse-code moudulation; pulse-count modulation
PDM	= pulse-duration modulation
pF	= picofarad
PH BRZ	= phosphor bronze
PHL	= Phillips

PIN	= positive-intrinsic-negative
PIV	= peak inverse voltage
pk	= peak
PL	= phase lock
PLO	= phase lock oscillator
PM	= phase modulation
PNP	= positive-negative-positive
P/O	= part of
POLY	= polystyrene
PORC	= porcelain
POS	= positive; position(s) (used in parts list)
POSN	= position
POT	= potentiometer
p-p	= peak-to-peak
PP	= peak-to-peak (used in parts list)
PPM	= pulse-position modulation
PREAMPL	= preamplifier
PRF	= pulse-repetition frequency
PRR	= pulse repetition rate
ps	= picosecond
PT	= point
PTM	= pulse-time modulation
PWM	= pulse-width modulation
PWV	= peak working voltage
RC	= resistance capacitance
RECT	= rectifier
REF	= reference
REG	= regulated
REPL	= replaceable
RF	= radio frequency
RFI	= radio frequency interference
RH	= round head; right hand
RLC	= resistance-inductance-capacitance
RMO	= rack mount only
rms	= root-mean-square
RND	= round
ROM	= read-only memory
R&P	= rack and panel
RWV	= reverse working voltage
S	= scattering parameter
s	= second (time)
..″	= second (plane angle)
S-B	= slow-blow (fuse (used in parts list)
SCR	= silicon controlled rectifier, screw
SE	= selenium
SECT	= sections
SEMICON	= semiconductor
SHF	= superhigh frequency
SI	= silicon
SIL	= silver
SL	= slide
SNR	= signal-to-noise ratio
SPDT	= single-pole, double-throw
SPG	= spring
SR	= split ring
SPST	= single-pole, single-throw
SSB	= single sideband
SST	= stainless steel
STL	= steel
SQ	= square
SWR	= standing-wave ratio
SYNC	= synchronize
T	= timed (slow-blow fuse)
TA	= tantalum
TC	= temperature compensating
TD	= time delay

TERM	= terminal
TFT	= thin-film transistor
TGL	= toggle
THD	= thread
THRU	= through
TI	= titanium
TOL	= tolerance
TRIM	= trimmer
TSTR	= transistor
TTL	= transistor-transistor logic
TV	= television
TVI	= television interference
TWT	= traveling wave tube
U	= micro (10^{-6}) (used in parts list)
UF	= microfarad (used in parts list)
UHF	= ultrahigh frequency
UNREG	= unregulated
V	= volt
VA	= voltampere
Vac	= volts ac
VAR	= variable
VCO	= voltage-controlled oscillator
Vdc	= volts dc
VDCW	= volts dc, working (used in parts list)
V(F)	= volts, filtered
VFO	= variable-frequency oscillator
VHF	= very-high frequency
Vpk	= volts peak
Vp-p	= Volts peak-to-peak
Vrms	= volts rms
VSWR	= voltage standing wave ratio
VTO	= voltage-tuned oscillator
VTVM	= vacuum-tube voltmeter
V(X)	= volts, switched
W	= watt
W/	= with
WIV	= working inverse voltage
WW	= wirewound
W/O	= without
YIG	= yttrium-iron-garnet
Zo	= characteristic impedance

NOTE

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

MULTIPLIERS

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

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	05370-60080	5	1	POWER SUPPLY MOTHERBOARD SERIES 2552	28480	05370-60080
A1H1	1530-1098	4	4	CLEVIS 0.070-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
A1H2	1530-1098	4		CLEVIS 0.070-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
A1J1	1251-0493	9	1	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0493
A1MP1	0380-0336	1	3	SPACER-RVT-ON .312-IN-LG .152-IN-ID	28480	0380-0336
A1MP2	0380-0336	1		SPACER-RVT-ON .312-IN-LG .152-IN-ID	28480	0380-0336
A1MP3	0380-0336	1		SPACER-RVT-ON .312-IN-LG .152-IN-ID	28480	0380-0336
A1R1	0757-0435	0	3	RESISTOR 3.92K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A1R2	0757-0283	6	21	RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1R3	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1R4	0757-0435	0		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A1XA6	1251-1365	6		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
A1XA7	1251-0472	4	1	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0472
A1XA8	1251-2035	9	2	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1XA69	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A2	05359-60002	6	1	MAIN MOTHERBOARD SERIES 1808	28480	05359-60002
A2J1	1200-0519	3	10	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
	1251-1365	6	3	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-1365
	1251-2026	8	26	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28480	1251-2026
A3				NOT ASSIGNED		
A4				NOT ASSIGNED		
A5	05370-60005	4	1	HP-IB CONNECTOR SERIES 1748	28480	05370-60005
A5H1	2190-0017	4	2	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
A5H2	2190-0017	4		WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
A5M3	1530-1098	4		CLEVIS 0.070-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
A5M4	1530-1098	4		CLEVIS 0.070-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
A5MP1	0380-0643	3	2	STANDOFF-HEX .255-IN-LG 6-32-THD	28480	0380-0643
A5MP2	0380-0643	3		STANDOFF-HEX .255-IN-LG 6-32-THD	28480	0380-0643
A5SW	3101-1973	7	1	SWITCH-SL 7-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1973
A5XJ1	1200-0482	9	7	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A5XJ2	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A5XS1	1200-0485	2	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0485
	1251-3283	1	1	CONN-RECT MICRORBN 24-CKT 24-CONT	28480	1251-3283
A6	05370-60081	6	1	POWER SUPPLY CONTROL SERIES 1748	28480	05370-60081
A6C1	0180-0491	5	46	CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A6C2	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A6C3	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A6C4.	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A6C5	0160-2208	4	7	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A6C6	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A6C7	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A6C8	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A6CR1	1901-0522	4	2	DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A6CR2	1901-0522	4		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A6CR3	1902-0632	9	2	DIODE-ZNR 1N5354B 17V 5% PD=5W TC=+75%	04713	1N5354B
A6CR4	1902-0632	9		DIODE-ZNR 1N5354B 17V 5% PD=5W TC=+75%	04713	1N5354B
A6CR5	1902-0074	3	2	DIODE-ZNR 7.15V 5% DO-35 PD=.4W	28480	1902-0074
A6CR6	1902-0074	3		DIODE-ZNR 7.15V 5% DO-35 PD=.4W	28480	1902-0074
A6CR7	1902-0783	1	2	DIODE-ZNR 16V 5% PD=1W IR=5UA	28480	1902-0783
A6CR8	1902-0783	1		DIODE-ZNR 16V 5% PD=1W IR=5UA	28480	1902-0783

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6DS1	1990-0620	0	7	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A6DS4	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A6F1	2110-0423	8	3	FUSE 1.5A 125V NTD .281X.093	28480	2110-0423
A6F2	~~2110-0454~~ 2110-0685	5	2	FUSE 7A 125V .281X.093	28480	2110-0454
A6F3	~~2110-0454~~	5		FUSE 7A 125V .281X.093	28480	2110-0454
A6F4	2110-0423	8		FUSE 1.5A 125V NTD .281X.093	28480	2110-0423
A6Q1	1853-0036	2	11	TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A6Q2	1854-0215	1	23	TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A6Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A6Q4	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A6R1	0811-3499	8	2	RESISTOR .07 3% 5W PW TC=0+-90	28480	0811-3499
A6R2	0811-3499	8		RESISTOR .07 3% 5W PW TC=0+-90	28480	0811-3499
A6R3	0811-3475	0	2	RESISTOR .4 1% 3W PW TC=0+-90	28480	0811-3475
A6R4	0811-3475	0		RESISTOR .4 1% 3W PW TC=0+-90	28480	0811-3475
A6R5	0757-0280	3	112	RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R7	0698-3444	1	5	RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A6R8	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A6R9	0698-3258	5	1	RESISTOR 5.36K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5361-F
A6R10	0757-0442	9	24	RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A6R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R12	0698-3279	0	1	RESISTOR 4.99K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4991-F
A6R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R14	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A6R15	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A6R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A6R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R18	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A6R19	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A6R20	0757-0446	3	3	RESISTOR 15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A6R21	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A6R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A6R23	0811-1037	6	2	RESISTOR 315 1% 3W PW TC=0+-20	28480	0811-1037
A6R24	0811-1037	6		RESISTOR 315 1% 3W PW TC=0+-20	28480	0811-1037
A6TP1	0360-1682	0	31	TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6TP5	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6TP6	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A6U1	1820-0477	6	7	IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A6U2	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A6U3	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A6U4	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A6U5	1826-0316	4	2	V REF TO-5	27014	LH0070-1H
	5000-9043	6	3	PIN EXTRACTOR	28480	5000-9043
	5040-6843	2	3	EXTRACTOR BLK	28480	5040-6843
A7	05370-60007	6	1	OVEN OSCILLATOR POWER SUPPLY SERIES 2648	28480	05370-60007
A7C1	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A7C2	0180-2730	9	1	CAPACITOR-FXD 1700UF+75-10% 30VDC AL	28480	0180-2730
A7C3	0160-0576	5	2	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A7C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A7C5	0180-1746	5	1	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A7CR1	1906-0069	4	1	DIODE-FW BRDG 400V 1A	28480	1906-0069
A7CR2	1901-0028	5	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR3	1902-3172	8	1	DIODE-ZNR 11V 2% DO-35 PD=.4W TC=+.062%	28480	1902-3172
A7F1	2110-0423	8		FUSE 1.5A 125V NTD .281X.093	28480	2110-0423
A7H1	2360-0055	1	1	SCREW-MACH 6-32 .188-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
A7H2	2420-0014	0	5	NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7Q1	1854-0071	7	1	TRANSISTOR NPN SI TO-92 PD=300MW	2M627	CP4071
A7R1	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A7R2	0757-0726	2	1	RESISTOR 511 1% .25W F TC=0+-100	24546	NA5-1/4-T0-511R-F
A7TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A7TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A7TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A7TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A7U1	1826-0147	9	1	IC 7812 V RGLTR TO-220	04713	MC7812CP
	5000-9043	6		PIN EXTRACTOR	28480	5000-9043
	5040-6843	2		EXTRACTOR BLK	28480	5040-6843
A8	05370-60008	7	1	FREQUENCY BUFFER SERIES 2311	28480	05370-60008
A8C1	0160-2055	9	11	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C2	0160-3877	5	5	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A8C3	0160-3879	7	198	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C7	0140-0234	0	2	CAPACITOR-FXD 500PF +-1% 300VDC MICA	72136	DM15F501F0300WV1C
A8C8	0140-0234	0		CAPACITOR-FXD 500PF +-1% 300VDC MICA	72136	DM15F501F0300WV1C
A8C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C11	0160-2236	8	1	CAPACITOR-FXD 1PF +-.25PF 500VDC CER	28480	0160-2236
A8C12	0160-3878	6	22	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A8C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C15	0160-3046	0	4	CAPACITOR-FXD 250PF +-1% 100VDC MICA	28480	0160-3046
A8C16	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A8C17	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A8C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C19	0160-2240	4	1	CAPACITOR-FXD 2PF +-.25PF 500VDC CER	28480	0160-2240
A8C20	0160-2197	0	2	CAPACITOR-FXD 10PF +-5% 300VDC MICA	28480	0160-2197
A8C21	0160-3046	0		CAPACITOR-FXD 250PF +-1% 100VDC MICA	28480	0160-3046
A8C22	0160-3046	0		CAPACITOR-FXD 250PF +-1% 100VDC MICA	28480	0160-3046
A8C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C24	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A8C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8C26	0160-2197	0		CAPACITOR-FXD 10PF +-5% 300VDC MICA	28480	0160-2197
A8C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A8CR1	1901-0535	9	3	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A8CR2	1901-0040	1	21	DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A8DS1	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A8L1	9100-0348	2	5	INDUCTOR RF-CH-MLD 1UH 1%	28480	9100-0348
A8L2	9100-0348	2		INDUCTOR RF-CH-MLD 1UH 1%	28480	9100-0348
A8L3	9100-0348	2		INDUCTOR RF-CH-MLD 1UH 1%	28480	9100-0348
A8L4	9100-0348	2		INDUCTOR RF-CH-MLD 1UH 1%	28480	9100-0348
A8L5	9100-1788	6	34	CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A8L6	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A8Q1	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8Q2	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8Q3	1854-0009	1	2	TRANSISTOR NPN SI PD=300MW FT=600MHZ	04713	2N709
A8Q4	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8Q5	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8Q6	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A8Q7	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A8Q9	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A8R1	1810-0080	6	6	NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A8R2	0757-0413	4	1	RESISTOR 392 1% .125W F TC=0+-100	24546	CT4-1/8-T0-392R-F
A8R3	1810-0080	6		NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A8R4	0757-1093	8	4	RESISTOR 3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3001-F
A8R5	0698-3443	0	1	RESISTOR 287 1% .125W F TC=0+-100	24546	CT4-1/8-T0-287R-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8R6	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R7	1810-0080	6		NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A8R8	0698-3442	9	15	RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A8R9	0757-0394	0	21	RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A8R10	1810-0080	6		NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A8R11	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R14	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R16	0757-0346	2	7	RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A8R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A8R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R21	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A8R22	1810-0080	6		NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A8TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A8TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A8TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A8TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A8U1	1820-0803	2	10	IC GATE ECL OR-NOR TPL	04713	MC10105P
A8U2	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A8U3	1820-0802	1	8	IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A8U4	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A8U5	1820-1224	3	3	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10216P
A8U6	1820-1224	3		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10216P
	5000-9043	6		PIN EXTRACTOR	28480	5000-9043
	5040-6843	2		EXTRACTOR BLK	28480	5040-6843
A9	05359-60027	9	1	PROCESSOR SERIES 2332	28480	05359-60027
A9C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C11	0180-0106	9	4	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A9C12	0160-3651	3	2	CAPACITOR-FXD 68PF +-10% 200VDC CER	28480	0160-3651
A9C13	0180-0106	9		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A9C15	0160-2743	2	2	CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A9C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C17	0160-3651	3		CAPACITOR-FXD 68PF +-10% 200VDC CER	28480	0160-3651
A9C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C19	0160-2743	2		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A9C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A9L1	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A9Q1	1854-0560	9	1	TRANSISTOR NPN SI DARL PD=310MW	04713	MPS A12
A9R1	1810-0279	5	3	NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-
A9R2	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-
A9R3	1810-0279	5		NETWORK-RES 10-SIP 4.7K OHM X 9	91637	CSC10A01-472G/MSP10A01-
A9R4	0698-7205	0	8	RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-T0-51R1-F
A9R5	0698-7252	7	4	RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9R6	1810-0277	3	1	NETWORK-RES 10-SIP 2.2K OHM X 9	91637	CSC10A01-222G/MSP10A01-
A9R7	0698-7246	9	1	RESISTOR 2.61K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2611-F
A9R8	0757-0405	4	4	RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A9R9	0698-7268	5	1	RESISTOR 21.5K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2152-F
A9R10	0698-7236	7	15	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R11	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R12	0698-7248	1	2	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A9R13	0698-7248	1		RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-F
A9R14	0757-0465	6	3	RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A9R15	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A9R16	0698-7260	7	3	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A9R17	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R18	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A9R19	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R20	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A9R21	0698-7188	8	2	RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A9R22	0698-7196	8	2	RESISTOR 21.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-21R5-F
A9R23	0698-7188	8		RESISTOR 10 1% .05W F TC=0+-100	24546	C3-1/8-T0-10R-F
A9R24	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R25	0698-7196	8		RESISTOR 21.5 1% .05W TC=0+-100	24546	C3-1/8-T0-21R5-F
A9R26	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R27	0698-7252	7		RESISTOR 4.64K 1% .05W F TC=0+-100	24546	C3-1/8-T0-4641-F
A9R28	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R29	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A9R30	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A9S1	3101-1989	5	1	SWITCH-SL 10-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1989
A9TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A9TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A9TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A9TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A9U1	1820-1081	0	2	IC DRVR TTL S BUS QUAD	18324	8T26AN
A9U2	1820-1081	0		IC DRVR TTL S BUS QUAD	18324	8T26AN
A9U3	05359-80003	2	1	IC NMOS 65536 (64K) ROM 450-NS 3-S	28480	05359-80003
A9U4	1820-1202	7	3	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A9U5	1818-0135	8	3	IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U6	1820-1199	1	5	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A9U7	1820-1197	9	7	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A9U8	1818-0135	8		IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U9	1820-1204	9	4	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A9U10	1818-0135	8		IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U11	1820-1196	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A9U12	1820-1368	6	5	IC DRVR TTL BUS HEX 1-INP	27014	DM8096N
A9U13*	05370-80003	4	1	ROM-PROGRAMMED	28480	05370-80003
A9U14	1820-1368	6		IC DRVR TTL BUS HEX 1-INP	27014	DM8096N
A9U15	1820-1209	4	1	IC BFR TTL LS NAND QUAD 2-INP	01295	SN74LS38N
A9U16	1820-1368	6		IC DRVR TTL BUS HEX 1-INP	27014	DM8096N
A9U17	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A9U18	1820-2137	9	1	IC MICPROC NMOS 8-BIT	04713	MC68A00P
A9U19	1820-1804	5	1	TRANSISTOR ARRAY 14-PIN PLSTC TO-116	04713	MPQ6842
A9U20	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A9XS1	1200-0639	8	1	SOCKET-IC 20-CONT DIP DIP-SLDR	28480	1200-0639
A9XU3	1200-0565	9	6	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A9XU5	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A9XU8	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A9XU10	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A9XU13	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A9XU18	1200-0552	4	1	SOCKET-IC 40-CONT DIP-SLDR	28480	1200-0552
	1480-0116	8	22	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A10				NOT ASSIGNED		

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11	05370-60011	2	1	DISPLAY INTERFACE SERIES 1808	28480	05370-60011
A11C1	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C3	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C4	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C5	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C6	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C7	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A11C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C16	0180-0230	0	2	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A11C17	0180-0106	9		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A11C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A11C19	0180-0230	0		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A11C20	0180-1714	7	1	CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006S2
A11J1	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A11J2	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A11J3	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A11L1	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A11L2	9100-3060	1	1	INDUCTOR 260UH 15%	28480	9100-3060
A11L3	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A11Q11	1853-0326	3	6	TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11Q12	1853-0326	3		TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11Q13	1853-0326	3		TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11Q14	1853-0326	3		TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11Q15	1853-0326	3		TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11Q16	1853-0326	3		TRANSISTOR PNP SI PD=1W FT=50MHZ	04713	MPS-U51
A11R1	0698-3435	0	13	RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R2	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R3	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R4	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R5	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R6	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R7	1810-0141	0	2	NETWORK-RES 9-SIP 330.0 OHM X 8	91637	CSP09C07-331J
A11R8	0698-7218	5	16	RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R9	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R10	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R11	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R12	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R13	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R14	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R15	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R16	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R17	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R18	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R19	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R20	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R21	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R22	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435
A11R23	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R24	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R25	0698-7205	0		RESISTOR 51.1 1% .05W F TC=0+-100	24546	C3-1/8-TO-51R1-F
A11R26	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R27	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R28	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F
A11R29	1810-0141	0		NETWORK-RES 9-SIP 330.0 OHM X 8	91637	CSP09C07-331J
A11R30	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-TO-178R-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A11R31	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R32	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R33	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R34	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R35	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R36	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R37	0698-7218	5		RESISTOR 178 1% .05W F TC=0+-100	24546	C3-1/8-T0-178R-F
A11R38	1810-0176	1	5	NETWORK-RES 5-SIP 4.7K OHM X 4	28480	1810-0176
A11R39	1810-0176	1		NETWORK-RES 5-SIP 4.7K OHM X 4	28480	1810-0176
A11R40	0757-0416	7	31	RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A11R41	0698-3132	4	4	RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A11R42	0757-0469	0	2	RESISTOR 150K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1503-F
A11R43	0757-0469	0		RESISTOR 150K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1503-F
A11TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11TP5	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11TP6	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A11U1	1820-0799	5	6	IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U2	1816-1089	9	3	IC TTL LS 64-BIT STAT RAM 80-NS 3-S	27014	DM74LS189N
A11U3	1820-0799	5		IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U4	1816-1089	9		IC TTL LS 64-BIT STAT RAM 80-NS 3-S	27014	DM74LS189N
A11U5	1820-0468	5	2	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN7445N
A11U6	1820-0799	5		IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U7	1816-1089	9		IC TTL LS 64-BIT STAT RAM 80-NS 3-S	27014	DM74LS189N
A11U8	1820-0799	5		IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U9	1820-1885	2	3	IC RGTR TTL LS D-TYPE QUAD	27014	DM74LS173N
A11U10	1820-0799	5		IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U11	1820-1428	9	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS158N
A11U12	1820-0799	5		IC DRVR TTL NAND DUAL 2-INP	01295	SN75452BP
A11U13	1820-1885	2		IC RGTR TTL LS D-TYPE QUAD	27014	DM74LS173N
A11U14	1820-0468	5		IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN7445N
A11U15	1820-1204	9		IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A11U16	1820-1207	2	2	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A11U17	1820-1443	8	3	IC CNTR TTL LS BIN ASYNCHRO	01295	SN74LS293N
A11U18	1820-1204	9		IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A11U19	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A11U20	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A11U21	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A11U22	1820-1112	8	9	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A11U23	1820-1989	7	1	IC CNTR TTL LS BIN DUAL 4-BIT	07263	74LS393PC
A11U24	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A11U25	1820-0269	4	1	IC GATE TTL NAND QUAD 2-INP	01295	SN7403N
A11U26	1820-1204	9		IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A11U27	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A12				NOT ASSIGNED		
A13				NOT ASSIGNED		
A14				NOT ASSIGNED		
A15	05370-60015	6	1	HP-IB INTERFACE SERIES 2410	28480	05370-60015
A15C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

See introduction to this section for ordering information
*Indicates factory selected value
+Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A15C12	0180-0106	9		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A15DS1	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS2	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS3	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS4	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15J1	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A15J2	1200-0482	9		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0482
A15L1	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A15MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A15MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A15R1	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A15R2	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A15R3	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A15R4	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A15R5	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A15R6	1810-0164	7	4	NETWORK-RES 9-SIP 4.7K OHM X 8	91637	CSP09C07-472J
A15R7	1810-0164	7		NETWORK-RES 9-SIP 4.7K OHM X 8	91637	CSP09C07-472J
A15R8	1810-0164	7		NETWORK-RES 9-SIP 4.7K OHM X 8	91637	CSP09C07-472J
A15TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A15U1	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U2	1820-1216	3	3	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A15U3	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U4	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86AN
A15U5	1820-3460	3	1	IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A15U6	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U7	1820-0068	1	1	IC GATE TTL NAND TPL 3-INP	01295	SN7410N
A15U8	1820-1885	2		IC RGTR TTL LS D-TYPE QUAD	27014	DM74LS173N
A15U9	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U10	1820-1368	6		IC DRVR TTL BUS HEX 1-INP	27014	DM8096N
A15U11	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A15U12	1820-1198	0	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS03N
A15U13	1820-1368	6		IC DRVR TTL BUS HEX 1-INP	27014	DM8096N
A15U14	1820-1206	1	1	IC GATE TTL LS NOR TPL 3-INP	01295	SN74LS27N
A15U15	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U16	1820-1282	3	2	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN74LS109AN
A15U17	1820-1144	6	4	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A15U18	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U19	1820-1282	3		IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN74LS109AN
A15U20	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A15U21	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A15U22	1820-1997	7	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	34335	AM74LS374AP
A15U23*	05342-80006	3	1	ROM-PROGRAMMED	28480	05342-80006
A15U24	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A15U25	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	34335	AM74LS374AP
A15U26*	05342-80007	4	1	ROM-PROGRAMMED	28480	05342-80007
A15U27	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15U28	1820-1997	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG PRL-IN	34335	AM74LS374AP
A15U29	1820-1689	4	4	IC TRANSCEIVER TTL INSTR-BUS IEEE-488	04713	MC3446AP
A15U30	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A15U31	1820-1689	4		IC TRANSCEIVER TTL INSTR-BUS IEEE-488	04713	MC3446AP
A15U32	1820-1689	4		IC TRANSCEIVER TTL INSTR-BUS IEEE-488	04713	MC3446AP
A15U33	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A15U34	1820-1689	4		IC TRANSCEIVER TTL INSTR-BUS IEEE-488	04713	MC3446AP
A15U35	1820-0904	4	1	IC COMPTR TTL L MAGTD 5-BIT	07263	93L24PC
A15U36	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A15U37	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A15XU23	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A15XU26	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519

See introduction to this section for ordering information
*Indicates factory selected value
+Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0403-0189	2	20	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A16	05359-60016	2	1	PROCESSOR INTERFACE SERIES 1808	28480	05359-60016
A16C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C10	0160-0571	0	2	CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A16C11	0160-0571	0		CAPACITOR-FXD 470PF +-20% 100VDC CER	28480	0160-0571
A16C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C19	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A16C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C22	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A16C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C26	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A16C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A16C28	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A16CR1	1902-0052	7	1	DIODE-ZNR 6.81V 2% DO-35 PD=.4W	28480	1902-0052
A16J1	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A16L1	9100-2277	0	4	INDUCTOR RF-CH-MLD 120UH 10%	28480	9100-2277
A16L2	9100-2277	0		INDUCTOR RF-CH-MLD 120UH 10%	28480	9100-2277
A16L3	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A16L4	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A16R1	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R2	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R3	1810-0176	1		NETWORK-RES 5-SIP 4.7K OHM X 4	28480	1810-0176
A16R5	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R6	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A16R7	0757-0439	4	6	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A16R9	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A16R10	0698-3152	8	2	RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A16R11	2100-3095	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TRN	73138	89PR200
A16R12	0698-3152	8		RESISTOR 3.48K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3481-F
A16R13	0757-0276	7	5	RESISTOR 61.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A16R14	2100-3123	0	1	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	73138	89PR500
A16R15	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R16	0698-4442	1	1	RESISTOR 4.42K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4421-F
A16R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A16R17	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	73138	89PR1K
A16R18	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R19	0698-3155	1	14	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R20	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R21	2100-3109	2	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	73138	89PR2K
A16R22	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A16R23	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R24	0698-5808	5	3	RESISTOR 4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4001-F
A16R25	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R26	0757-0443	0	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1102-F
A16R27	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A16R28	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R29	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A16R30	0698-0082	7	4	RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A16R31	0757-0419	0	3	RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
A16R32	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R33	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R34	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R35	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R36	0698-0085	0	3	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A16R37	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A16R38	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A16R39	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R40	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R41	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A16R48	0699-0072	7	2	RESISTOR 6.81M 1% .125W F TC=0+-150	28480	0699-0072
A16S1	3101-1841	8	1	SWITCH-SL 4-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1841
A16TP1	0360-0535	0	50	TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A16TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A16U1	1826-0424	5	1	IC OP AMP GP DUAL 14-DIP-P PKG	04713	MC3405P
A16U2	1820-1313	1	1	ANALOG MULTIPLEXER 3 CHNL 16 -DIP-P	3L585	CD4053BE
A16U3	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A16U4	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A16U5	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A16U6	1820-1207	2		IC GATE TTL LS NAND 8-INP	01295	SN74LS30N
A16U7	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A16U8	1826-0316	4		V REF TO-5	27014	LH0070-1H
A16U9	1826-0188	8	6	D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
A16U10	1826-0188	8		D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
A16U11	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A16U12	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A16U13	1820-1439	2	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE	01295	SN74LS258BN
A16U14	1820-1439	2		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE	01295	SN74LS258BN
A16U15	1820-1195	7	9	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A16U16	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A16U17	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A16U18	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A16U20	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A17	05359-60017	3	1	OUTPUT REFERENCE SERIES 2624	28480	05359-60017
A17C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C10	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A17C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C14	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C17	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C19	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A17C20	0160-2208	4		CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C22	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C24	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C25	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C26	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C27	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A17C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A17CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A17CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A17CR3	1902-0041	4	4	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A17CR4	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A17CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A17CR6	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A17CR7	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A17CR8	1902-0041	4		DIODE-ZNR 5.11V 5% DO-35 PD=.4W	07263	1N751A
A17CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A17CR10	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A17H1	2360-0286	0	4	SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
A17H2	2360-0286	0		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
A17H3	2360-0286	0		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
A17H4	2360-0286	0		SCREW-MACH 6-32 .25-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
A17H5	2420-0014	0		NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A17H6	2420-0014	0		NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A17H7	2420-0014	0		NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A17H8	2420-0014	0		NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
A17K1	0490-1458	3	2	RELAY 2C 12VDC-COIL 1A 28VDC	11532	732-12
A17K2	0490-1458	3		RELAY 2C 12VDC-COIL 1A 28VDC	11532	732-12
A17L1	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A17L2	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A17L3	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A17L4	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A17MP1	0340-0620	2	4	INSULATOR-XSTR THRM-CNDCT	28480	0340-0620
A17MP2	0340-0620	2		INSULATOR-XSTR THRM-CNDCT	28480	0340-0620
A17MP3	0340-0620	2		INSULATOR-XSTR THRM-CNDCT	28480	0340-0620
A17MP4	0340-0620	2		INSULATOR-XSTR THRM-CNDCT	28480	0340-0620
A17Q1	1853-0233	1	1	TRANSISTOR PNP SI PD=40W FT=3MHZ	28480	1853-0233
A17Q2	1854-0420	0	3	TRANSISTOR NPN SI PD=40W FT=3MHZ	28480	1854-0420
A17Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A17Q4	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A17Q5	1854-0420	0		TRANSISTOR NPN SI PD=40W FT=3MHZ	28480	1854-0420
A17Q6	1854-0420	0		TRANSISTOR NPN SI PD=40W FT=3MHZ	28480	1854-0420
A17Q7	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A17Q8	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A17Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A17Q10	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A17Q11	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A17R1	2100-3349	2	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	28480	2100-3349
A17R2	0698-6360	6	30	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R3	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A17R4*	0757-0438	3	12	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A17R5	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A17R6	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R7	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1003-F
A17R8	0757-0444	1	4	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A17R9	2100-3274	2	1	RESISTOR-TRMR 10K 10% C SIDE-ADJ 1-TRN	28480	2100-3274
A17R10	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R12	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R13	1810-0164	7		NETWORK-RES 9-SIP 4.7K OHM X 8	91637	CSP09C07-472J
A17R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R16	2100-3273	1	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	28480	2100-3273

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R18	2100-3351	6	3	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A17R19	1810-0176	1		NETWORK-RES 5-SIP 4.7K OHM X 4	28480	1810-0176
A17R20	2100-3350	5	2	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A17R21	0757-0421	4	3	RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A17R22	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R23	0757-0278	9	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1781-F
A17R24	0698-5808	5		RESISTOR 4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4001-F
A17R25	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R26	0757-0430	5	4	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2211-F
A17R27	0757-1093	8		RESISTOR 3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3001-F
A17R28	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R29	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R30	0698-4002	9	6	RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A17R31	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R32	0698-5808	5		RESISTOR 4K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4001-F
A17R33	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R34	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R36	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1101-F
A17R37	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A17R38	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A17R39	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A17R40	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R41	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R42	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A17R43	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A17R44	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R45	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R47	0757-0984	4	5	RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A17R48	0757-0401	0	8	RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A17R49	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R50	2100-3350	5		RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A17R51	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R52	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R53	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R54	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R55	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R56	2100-3352	7	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A17R57	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R58	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R59	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R60	0757-0984	4		RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A17R61	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R62	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R63	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R64	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R65	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R66	0757-0984	4		RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A17R67	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R68	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R69	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R70	0698-3226	7	1	RESISTOR 6.49K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6491-F
A17R71	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R72	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A17R73	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A17R74	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R75	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R76	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R77	0757-0430	5		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2211-F
A17R78	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A17R79	0698-3439	4	2	RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F
A17R80	0698-3439	4		RESISTOR 178 1% .125W F TC=0+-100	24546	CT4-1/8-T0-178R-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A17TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17TP4	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17TP5	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17TP6	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A17U1	1826-0519	9	7	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U2	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U3	1820-0618	7	1	IC BFR TTL NON-INV HEX	01295	SN7417N
A17U4	1820-1173	1	7	IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A17U5	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A17U6	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U7	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U8	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U9	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
A17U10	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A17U11	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A17U12	1826-0519	9		IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	01295	TL071CP
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A18	05359-60018	4	1	OUTPUT AMPLIFIER SERIES 1824	28480	05359-60018
A18C1	0160-3875	3	9	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A18C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C8	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A18C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C10	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A18C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C15	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A18C16	0180-0210	6	2	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A18C17	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A18C18	0160-3874	2	2	CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A18C19	0160-3874	2		CAPACITOR-FXD 10PF +-.5PF 200VDC CER	28480	0160-3874
A18C20	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A18C22	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A18C23	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A18C24	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A18C25	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A18C26	0160-2238	0	5	CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A18CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A18CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A18CR3	1902-0522	6	2	DIODE-ZNR 1N5340B 6V 5% PD=5W IR=1UA	04713	1N5340B
A18CR4	1902-0522	6		DIODE-ZNR 1N5340B 6V 5% PD=5W IR=1UA	04713	1N5340B
A18CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A18CR6	1901-0050	3	2	DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A18CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A18CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	9N171	1N4150
A18CR10	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A18K1	0490-0617	4	2	RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A18K2	0490-0508	2	2	RELAY 2C 12VDC-COIL .5A 28VDC	28480	0490-0508
A18K3	0490-0508	2		RELAY 2C 12VDC-COIL .5A 28VDC	28480	0490-0508

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18L1	9140-0256	5	1	INDUCTOR-FIXED RF CHOKE, 3 TURNS PER	28480	9140-0256
A18L2	9100-0346	0	1	INDUCTOR RF-CH-MLD 50NH 20%	28480	9100-0346
A18L3	9140-0118	8	4	INDUCTOR RF-CH-MLD 500UH 5%	28480	9140-0118
A18L4	9140-0118	8		INDUCTOR RF-CH-MLD 500UH 5%	28480	9140-0118
A18L5	9100-2276	9	3	INDUCTOR RF-CH-MLD 100UH 10%	28480	9100-2276
A18L6	9140-0118	8		INDUCTOR RF-CH-MLD 500UH 5%	28480	9140-0118
A18L7	9140-0118	8		INDUCTOR RF-CH-MLD 500UH 5%	28480	9140-0118
A18L8	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A18L9	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A18L10	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A18L11	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A18Q1	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A18Q2	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A18Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A18Q4	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A18Q5	1853-0247	7	2	TRANSISTOR PNP SI PD=200MW FT=1.5GHZ	28480	1853-0247
A18Q6	1853-0247	7		TRANSISTOR PNP SI PD=200MW FT=1.5GHZ	28480	1853-0247
A18R1	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R2	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R3	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R4	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R5	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A18R6	0698-4437	4	1	RESISTOR 2.94K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2941-F
A18R7	0757-0291	6	2	RESISTOR 24.9 1% .125W F TC=0+-100	19701	5033R-1/8-T0-2492-F
A18R8	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A18R9	0757-0291	6		RESISTOR 24.9 1% .125W F TC=0+-100	19701	5033R-1/8-T0-2492-F
A18R10	0757-0984	4		RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A18R11	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R12	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R13	0757-0284	7	3	RESISTOR 150 1% .125W F TC=0+-100	24546	CT4-1/8-T0-151-F
A18R14	0757-0984	4		RESISTOR 10 1% .5W F TC=0+-100	28480	0757-0984
A18R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R17	0757-0284	7		RESISTOR 150 1% .125W F TC=0+-100	24546	CT4-1/8-T0-151-F
A18R18	0698-0085	0		RESISTOR 2.61K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2611-F
A18R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R20	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R21	0757-0407	6	6	RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A18R22	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1781-F
A18R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R24	0757-0284	7		RESISTOR 150 1% .125W F TC=0+-100	24546	CT4-1/8-T0-151-F
A18R25	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A18R26	0698-6433	4	2	RESISTOR 100 1% .25W F TC=0+-100	28480	0698-6433
A18R26	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R27	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A18R28	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R29	0698-6433	4		RESISTOR 100 1% .25W F TC=0+-100	28480	0698-6433
A18R30	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A18R31	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A18R32	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R33	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A18R34	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A18R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A18R37	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R38	0698-7229	8	2	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-F
A18R39	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-F
A18R40	0698-3437	2	38	RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A18R41	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	CT4-1/8-T0-751-F
A18R42	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R43	0757-0399	5	20	RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A18R44	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R45	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A18R46	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R47	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A18R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18R49	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A18S1	3101-1213	8	2	SWITCH-TGL SUBMIN DPST .5A 120VAC PC	28480	3101-1213
A18S2	3101-1213	8		SWITCH-TGL SUBMIN DPST .5A 120VAC PC	28480	3101-1213
A18TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP4	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP5	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP6	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP7	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP8	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP9	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP10	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP11	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18TP12	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A18U1	1820-0624	5	6	IC COMPTR ECL A/D DUAL	04713	MC1651L
A18U2	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A18U3	5088-7013	0	1	OUTPUT AMPLIFIER	28480	5088-7013
A18U4	1820-0805	4	2	IC GATE ECL EXCL-OR/NOR TPL 2-INP	04713	MC10107P
A18U3XA1	1251-1556	7	14	CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA2	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA3	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA4	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA5	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA6	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA7	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA8	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA9	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA10	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA11	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA12	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA13	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
A18U3XA14	1251-1556	7		CONNECTOR-SGL CONT SKT .018-IN-BSC-SZ	28480	1251-1556
	0403-0189	2		EXTR-PC-BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A19	05359-60019	5	1	AUTO-ZERO SERIES 1808	28480	05359-60019
A19C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C3	0160-2204	0	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A19C4	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A19C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C15	0160-0196	5	3	CAPACITOR-FXD 24PF +-5% 300VDC MICA	28480	0160-0196
A19C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C17	0121-0036	0	7	CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A19C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C19	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A19C20	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A19C21	0140-0145	2	10	CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A19C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C23	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A19C24	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19CR1	1902-3002	3	4	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A19CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A19CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A19CR4	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A19CR5	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A19CR6	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A19CR7	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A19CR8	1902-3002	3		DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	28480	1902-3002
A19CR9	1902-3057	8	3	DIODE-ZNR 3.74V 2% DO-35 PD=.4W	28480	1902-3057
A19CR10	1901-1068	5	3	DIODE-SCHOTTKY SM SIG	28480	1901-1068
A19CR11	1902-3003	4	8	DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A19DL1	05359-80001	7	1	DELAY LINE-A Z	28480	05359-80001
A19F1MP1	2110-0269	0	2	FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
A19F1MP2	2110-0269	0		FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
A19L1	9140-0143	9	9	INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A19L2	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A19L3	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A19L4	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A19L5	9100-1637	4	2	INDUCTOR RF-CH-MLD 120UH 5%	28480	9100-1637
A19L6	9100-1637	4		INDUCTOR RF-CH-MLD 120UH 5%	28480	9100-1637
A19L7	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A19L8	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A19Q1	1854-0019	3	6	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A19Q2	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A19Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A19Q4	1853-0015	7	6	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A19Q5	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A19R1	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R2	1810-0020	4	1	NETWORK-RES 8-SIP 1.5K OHM X 7	28480	1810-0020
A19R3	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R4	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A19R5	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R6	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A19R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R8	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R9	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A19R10	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A19R11	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A19R12	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R13	0698-7220	9	2	RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A19R14	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R15	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A19R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R17	0698-7244	7	1	RESISTOR 2.15K 1% .05W F TC=0+-100	24546	C3-1/8-T0-2151-F
A19R18	0698-7220	9		RESISTOR 215 1% .05W F TC=0+-100	24546	C3-1/8-T0-215R-F
A19R19	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R20	0698-3441	8	7	RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A19R21	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R22	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R23	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A19R24	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R25	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R27	0698-7210	7	2	RESISTOR 82.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-82R5-F
A19R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R29	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R30	0698-7215	2	2	RESISTOR 133 1% .05W F TC=0+-100	24546	C3-1/8-T0-133R-F
A19R31	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F
A19R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R33	0698-7215	2		RESISTOR 133 1% .05W F TC=0+-100	24546	C3-1/8-T0-133R-F
A19R34	0698-7210	7		RESISTOR 82.5 1% .05W F TC=0+-100	24546	C3-1/8-T0-82R5-F
A19R35	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-F

See introduction to this section for ordering information
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†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R37	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R38	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R39	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R40	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R41	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R46	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R47	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R48	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A19R49	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R50	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A19R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A19R52	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A19R53	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R54	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A19R55	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R56	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A19R57	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A19R58	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A19R59	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
A19R60	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A19R61	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A19R62	0698-3150	6	7	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A19R63	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A19R64	0757-0274	5	7	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A19R65	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A19R66	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A19TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A19TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A19TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A19U1	1820-1443	8		IC CNTR TTL LS BIN ASYNCHRO	01295	SN74LS293N
A19U2	1820-1469	8	3	IC FF TTL LS J-K NEG-EDGE-TRIG CLEAR	01295	SN74LS107AN
A19U3	1820-1469	8		IC FF TTL LS J-K NEG-EDGE-TRIG CLEAR	01295	SN74LS107AN
A19U4	1820-1443	8		IC CNTR TTL LS BIN ASYNCHRO	01295	SN74LS293N
A19U5	1820-1469	8		IC FF TTL LS J-K NEG-EDGE-TRIG CLEAR	01295	SN74LS107AN
A19U6	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A19U7	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A19U8	1820-0817	8	5	IC FF ECL D-M/S DUAL	04713	MC10131P
A19U9	1820-0811	2	1	IC GATE ECL OR-AND-INV DUAL 2-3-INP	04713	MC10117P
A19U10	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A19U11	1820-0624	5		IC COMPTR ECL A/D DUAL	04713	MC1651L
A19U12	1820-1225	4	7	IC FF ECL D-M/S DUAL	04713	MC10231P
A19U13	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A19U14	1820-0624	5		IC COMPTR ECL A/D DUAL	04713	MC1651L
A19U15	1820-1052	5	2	IC XLTR ECL ECL-TO-TTL QUAD 2-INP	04713	MC10125L
A19U16	1820-1722	6	1	IC RGTR CMOS 8-BIT	04713	MC14559BCP
A19U17	1820-1383	5	2	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A19U18	1820-1146	8	4	IC BFR CMOS NON-INV HEX	3L585	CD4050BE
A19U19	1820-1146	8		IC BFR CMOS NON-INV HEX	3L585	CD4050BE
A19U20	1820-0493	6	4	IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A19U21	1826-0188	8		D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A20	05359-60020	8	1	TRIGGER AMPLIFIER SERIES 1808	28480	05359-60020
A20C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C2	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A20C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C5	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877

See introduction to this section for ordering information
*Indicates factory selected value
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Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A20C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A20C12	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A20C13	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A20C14	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A20C15	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A20C16	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A20CR1	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A20CR2	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A20CR3	1901-0376	6	4	DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A20CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A20L1	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A20L2	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A20L3	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A20L4	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A20L5	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A20L6	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A20MP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A20MP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A20Q1	1855-0334	7	1	TRANSISTOR-DUAL N-CHAN D-MODE SI	17856	DN377
A20R1	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A20R2	0698-7332	4	1	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-7332
A20R3	0757-0123	3	1	RESISTOR 34.8K 1% .125W F TC=0+-100	28480	0757-0123
A20R4	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A20R5	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A20R6	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A20R7	0757-0419	0		RESISTOR 681 1% .125W F TC=0+-100	24546	CT4-1/8-T0-681R-F
A20R8	0757-0464	5	1	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-9092-F
A20R9	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A20R11	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	CT4-1/8-T0-348R-F
A20R12	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A20R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A20R14	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A20R15	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A20R16	1810-0030	6	3	NETWORK-RES 8-SIP 1.0K OHM X 7	28480	1810-0030
A20R17	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A20R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A20R21	1810-0030	6		NETWORK-RES 8-SIP 1.0K OHM X 7	28480	1810-0030
A20R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A20R23	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A20R24	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A20R25	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A20R26	1810-0030	6		NETWORK-RES 8-SIP 1.0K OHM X 7	28480	1810-0030
A20R28	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A20R29	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A20R30	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A20R31	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A20R32	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A20TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A20TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A20U1	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A20U2	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A20U3	1820-0624	5		IC COMPTR ECL A/D DUAL	04713	MC1651L
A20U4	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A20U5	1820-0805	4		IC GATE ECL EXCL-OR/NOR TPL 2-INP	04713	MC10107P
A20U6	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A20U7	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A20U8	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A20U9	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A20U10	1820-0804	3	1	IC GATE ECL NOR TPL	04713	MC10106P

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A21	05359-60021	9	1	ANALOG TIMING SERIES 1808	28480	05359-60021
A21C1	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C5	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A21C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C9	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A21C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C11	0160-0196	5		CAPACITOR-FXD 24PF +-5% 300VDC MICA	28480	0160-0196
A21C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C20	0121-0061	1	2	CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PS18A
A21C21	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A21C23	0160-0196	5		CAPACITOR-FXD 24PF +-5% 300VDC MICA	28480	0160-0196
A21C24	0121-0061	1		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PS18A
A21C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C28	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C35	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A21C36	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A21C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C38	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C40	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C43	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A21C44	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A21C45	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A21C46	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A21C47	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A21CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A21CR2	1902-3094	3	2	DIODE-ZNR 5.11V 2% DO-35 PD=.4W	28480	1902-3094
A21CR3	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A21CR4	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A21CR5	1901-0376	6		DIODE-GEN PRP 35V 50MA DO-35	9N171	1N3595
A21CR6	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A21CR7	1902-3094	3		DIODE-ZNR 5.11V 2% DO-35 PD=.4W	28480	1902-3094
A21CR8	1901-1068	5		DIODE-SCHOTTKY SM SIG	28480	1901-1068
A21CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A21CR10	1902-3057	8		DIODE-ZNR 3.74V 2% DO-35 PD=.4W	28480	1902-3057
A21CR11	1902-3057	8		DIODE-ZNR 3.74V 2% DO-35 PD=.4W	28480	1902-3057
A21CR12	1901-1068	5		DIODE-SCHOTTKY SM SIG	28480	1901-1068
A21CR13	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A21CR14	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A21L1	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A21L2	9100-2277	0		INDUCTOR RF-CH-MLD 120UH 10%	28480	9100-2277
A21L3	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A21L4	9140-0143	9		INDUCTOR RF-CH-MLD 3.3UH 10%	28480	9140-0143
A21L5	9100-2277	0		INDUCTOR RF-CH-MLD 120UH 10%	28480	9100-2277

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21L6	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A21L7	9140-0210	1	3	INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A21L8	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A21L9	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A21Q1	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A21Q2	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21Q4	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21Q5	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21Q6	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q8	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	27014	2N3906
A21Q9	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q10	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A21Q11	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A21Q12	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A21Q13	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A21Q14	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21Q15	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A21Q16	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A21R1	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R2	0698-0084	9	2	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A21R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R5	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A21R6	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A21R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R8	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A21R10	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A21R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R13	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R14	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R15	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A21R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R18	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R19	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R21	0698-3438	3	2	RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A21R22	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R23	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A21R24	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A21R25	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R26	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A21R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R28	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R31	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A21R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R33	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R34	0698-3437	2		RESISTOR 133.1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R36	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R37	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R41	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R42	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R44	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R45	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R46	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R47	0698-3438	3		RESISTOR 147 1% .125W F TC=0+-100	24546	CT4-1/8-T0-147R-F
A21R48	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R49	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R50	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A21R51	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21R52	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R53	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A21R54	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2151-F
A21R55	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A21R56	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A21R57	0757-0290	5	2	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	5033R-1/8-T0-6191-F
A21R58	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A21R59	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A21R60	0757-0418	9	4	RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A21R61	0757-0440	7	4	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A21R62	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A21R63	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A21R64	0757-0290	5		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	5033R-1/8-T0-6191-F
A21R66	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R67	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4640-F
A21R68	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A21R69	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A21R71	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A21R72	0698-3444	1		RESISTOR 316 1% .125W F TC=0+-100	24546	CT4-1/8-T0-316R-F
A21R73	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A21R74	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A21R75	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A21R76	0698-3441	8		RESISTOR 215 1% .125W F TC=0+-100	24546	CT4-1/8-T0-215R-F
A21R77	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A21R78	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A21R79	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A21R80	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A21R81	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A21R82	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A21R83	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-4641-F
A21TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A21TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A21TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A21TP4	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A21TP5	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A21U1	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A21U2	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A21U3	1820-0624	5		IC COMPTR ECL A/D DUAL	04713	MC1651L
A21U4	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A21U5	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A21U6	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A21U7	1820-0624	5		IC COMPTR ECL A/D DUAL	04713	MC1651L
A21U8	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A21U9	1820-0493	6		IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A21U10	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A21U11	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A21U12	1820-0493	6		IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A21U13	1826-0188	8		D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
A21U14	1826-0188	8		D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
A21U15	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A21U16	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A22	05359-60022	0	1	DIGITAL TIMING SERIES 1808	28480	05359-60022
A22C1	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A22C2	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C3	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A22C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C9	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C10	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C20	0180-0291	3	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C21	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A22C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C23	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A22C24	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A22C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22C26	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A22C27	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A22L1	9140-0210	1		INDUCTOR RF-CH-MLD 100UH 5%	28480	9140-0210
A22L2	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A22L3	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A22Q1	1853-0234	2	1	TRANSISTOR PNP SI PD=65W FT=3MHZ	01295	TIP42A
A22R1	0757-0398	4	2	RESISTOR 75 1% .125W F TC=0+-100	24546	CT4-1/8-T0-75R0-F
A22R2	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R3	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R5	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A22R6	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A22R7	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A22R8	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R10	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R11	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R12	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R13	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A22R14	0757-0398	4		RESISTOR 75 1% .125W F TC=0+-100	24546	CT4-1/8-T0-75R0-F
A22R15	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R16	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R18	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A22R19	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A22R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R21	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A22R22	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A22R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R24	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A22R25	0757-0421	4		RESISTOR 825 1% .125W F TC=0+-100	24546	CT4-1/8-T0-825R-F
A22R26	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R27	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A22R28	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A22R29	0698-3132	4		RESISTOR 261 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2610-F
A22R30	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A22R31	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R32	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R33	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R34	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R35	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R36	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A22R37	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A22R38	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R39	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R40	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R41	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A22R42	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R43	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A22R46	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R47	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R48	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A22R49	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A22R50	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A22R58	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1211-F
A22R59	0698-3428	1	1	RESISTOR 14.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-14R7-F
A22R60	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2371-F
A22R61	2100-3351	6		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A22TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A22TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A22TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A22U1	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A22U2	1820-1173	1		IC XLTR ECL TTL-TO-ECL QUAD 2-INP	04713	MC10124L
A22U3	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A22U4	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A22U6	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A22U8	1820-1383	5		IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A22U10	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A22U11	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A22U12	1820-0817	8		IC FF ECL D-M/S DUAL	04713	MC10131P
A22U12	1820-1052	5		IC XLTR ECL ECL-TO-TTL QUAD 2-INP	04713	MC10125L
A22U13	1820-1400	7	1	IC GATE ECL AND QUAD 2-INP	04713	MC10104P
A22U14	1826-0004	7	1	IC 304 V RGLTR TO-100	07263	UA304HC
A22XAU5	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A22XAU7	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	05359-80002	8	1	LBL-5359A3.3VADJ	28480	05359-80002
A23	05359-60023	1	1	STARTABLE PLL OSCILLATOR SERIES 1824	28480	05359-60023
A23C1	0140-0198	5	2	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A23C2	0160-0154	5	2	CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A23C3	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A23C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C5	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23C6	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C7	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C8	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C9	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23C10	0160-0154	5		CAPACITOR-FXD 2200PF +-10% 200VDC POLYE	28480	0160-0154
A23C11	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C12	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C13	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A23C14	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C15	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A23C16	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C18	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C19	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C20	0160-3876	4	1	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A23C21	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C22	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C23	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C24	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C25	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C26	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C27	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23C28	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23C31	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A23C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C35	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A23C36	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A23C37	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A23C38	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A23C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A23C40	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A23CR1	1902-3003	4		DIODE-ZNR 2.37V 2% DO-7 PD=.4W TC=-.074%	28480	1902-3003
A23CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A23CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A23K1	0490-0617	4		RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A23L1	9100-2276	9		INDUCTOR RF-CH-MLD 100UH 10%	28480	9100-2276
A23L2	9100-2276	9		INDUCTOR RF-CH-MLD 100UH 10%	28480	9100-2276
A23L3	9100-2248	5	1	INDUCTOR RF-CH-MLD 120NH 10%	28480	9100-2248
A23L4	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A23L5	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A23L6	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A23L7	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A23L8	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A23L9	9100-2265	6	1	INDUCTOR RF-CH-MLD 10UH 10%	28480	9100-2265
A23Q1	1854-0009	1		TRANSISTOR NPN SI PD=300MW FT=600MHZ	04713	2N709
A23Q2	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A23Q3	1854-0215	1		TRANSISTOR NPN SI TO-92 PD=350MW	04713	2N3904
A23R1	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A23R2	1810-0080	6		NETWORK-RES 8-SIP 500.0 OHM X 7	28480	1810-0080
A23R3	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A23R4	0757-0446	3		RESISTOR 15K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1502-F
A23R5	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A23R6	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A23R7	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5111-F
A23R8	2100-3351	6		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	28480	2100-3351
A23R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R10	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R12	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A23R13	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A23R14	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A23R15	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A23R16	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A23R17	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A23R18	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A23R19	2100-3352	7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A23R20	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R21	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R22	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A23R23	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R24	0757-0276	7		RESISTOR 61.9 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6192-F
A23R26	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A23R26	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A23R27	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R28	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R29	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R30	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A23R31	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A23R32	0698-3442	9		RESISTOR 237 1% .125W F TC=0+-100	24546	CT4-1/8-T0-237R-F
A23R33	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A23R34	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R35	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A23R36	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A23R37	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A23R38	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A23R39	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A23R40	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R41	0698-3435	0		RESISTOR 38.3 1% .125W F TC=0+-100	28480	0698-3435

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23R42	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	CT4-1/8-T0-619R-F
A23R43	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R44	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R45	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R46	0698-3430	5	1	RESISTOR 21.5 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21R5-F
A23R47	0698-3446	3	1	RESISTOR 383 1% .125W F TC=0+-100	24546	CT4-1/8-T0-383R-F
A23R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R49	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R50	0757-0399	5		RESISTOR 82.5 1% .125W F TC=0+-100	24546	CT4-1/8-T0-82R5-F
A23R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R52	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A23R53	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R54	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R55	1810-0176	1		NETWORK-RES 5-SIP 4.7K OHM X 4	28480	1810-0176
A23R56	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R57	0757-0407	6		RESISTOR 200 1% .125W F TC=0+-100	24546	CT4-1/8-T0-201-F
A23R58	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R59	0698-3437	2		RESISTOR 133 1% .125W F TC=0+-100	24546	CT4-1/8-T0-133R-F
A23R60	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R61	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A23R62	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R63	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R64	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A23R65	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1001-F
A23R66	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R67	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	CT4-1/8-T0-511R-F
A23R68	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A23R69	0757-1093	8		RESISTOR 3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3001-F
A23R70	0757-0435	0		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A23TP1	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP2	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP3	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP4	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP5	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP6	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP7	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP8	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP9	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP10	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP11	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP12	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP13	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP14	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23TP15	0360-0535	0		TERMINAL-TEST POINT .330IN ABOVE	28480	0360-0535
A23U1	1820-0803	2		IC GATE ECL OR-NOR TPL	04713	MC10105P
A23U2	1820-0493	6		IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A23U3	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A23U4	1820-1344	8	1	IC PL LOOP 14-DIP-C PKG	04713	MC12040L
A23U5	5088-7009	4	1	VCO STARTABLE	28480	5088-7009
A23U6	1820-2000	5	1	IC FF ECL D-M/S POS-EDGE-TRIG	28480	B196D-0100
A23U7	1820-0802	1		IC GATE ECL NOR QUAD 2-INP	04713	MC10102P
A23U8	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A23U9	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A23U10	1820-1225	4		IC FF ECL D-M/S DUAL	04713	MC10231P
A23U11	1820-1146	8		IC BFR CMOS NON-INV HEX	3L585	CD4050BE
A23U12	1820-1632	7	2	IC CNTR ECL BIN ASYNCHRO POS-EDGE-TRIG	04713	MC10178P
A23U13	1820-1721	5	1	IC RGTR CMOS 8-BIT	04713	MC145498CP
A23U14	1826-0188	8		D/A 8-BIT 16-CERDIP BPLR	04713	MC1408L-8
A23U15	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P PKG	27014	LM311N
A23U16	1826-0207	2	1	IC OP AMP WB 8-DIP-P PKG	01295	LM318P
A23U17	1820-1146	8		IC BFR CMOS NON-INV HEX	3L585	CD4050BE
A23U18	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
A23U19	1820-1632	7		IC CNTR ECL BIN ASYNCHRO POS-EDGE-TRIG	04713	MC10178P

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A23XU5	1200-0475	0	32	CONNECTOR-SGL CONT SKT .017-IN-BSC-SZ	28480	1200-0475
A23XU6	1200-0475	0		CONNECTOR-SGL CONT SKT .017-IN-BSC-SZ	28480	1200-0475
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A24	05370-60124	8	1	200 MHZ MULTIPLIER SERIES 2217	28480	05370-60124
A24C1	0140-0209	9	4	CAPACITOR-FXD 5PF +-10% 500VDC MICA	72136	DM15C050K0500WV1CR
A24C2	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C3	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C6	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C7	0160-2238	0		CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A24C8	0160-2247	1	2	CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	28480	0160-2247
A24C9	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C10	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C11	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C12	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C15	0160-2238	0		CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A24C16	0160-2247	1		CAPACITOR-FXD 3.9PF +-.25PF 500VDC CER	28480	0160-2247
A24C17	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A24C18	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C19	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C20	0121-0036	0		CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A24C21	0140-0209	9		CAPACITOR-FXD 5PF +-10% 500VDC MICA	72136	DM15C050K0500WV1CR
A24C22	0121-0165	6	7	CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C23	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C26	0140-0201	1	2	CAPACITOR-FXD 12PF +-5% 500VDC MICA	72136	DM15C120J0500WV1CR
A24C27	0140-0209	9		CAPACITOR-FXD 5PF +-10% 500VDC MICA	72136	DM15C050K0500WV1CR
A24C28	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C29	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C30	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C31	0140-0201	1		CAPACITOR-FXD 12PF +-5% 500VDC MICA	72136	DM15C120J0500WV1CR
A24C32	0140-0209	9		CAPACITOR-FXD 5PF +-10% 500VDC MICA	72136	DM15C050K0500WV1CR
A24C33	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C34	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C35	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A24C36	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A24C37	0150-0059	8	2	CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0150-0059
A24C38	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C39	0180-0491	5		CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0491
A24C40	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C41	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C42	0150-0059	8		CAPACITOR-FXD 3.3PF +-.25PF 500VDC CER	28480	0150-0059
A24C43	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C43	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A24C44	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C44	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A24C45	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A24C45	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A24C46	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C47	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A24C48	0160-2238	0		CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A24C49	0160-2238	0		CAPACITOR-FXD 1.5PF +-.25PF 500VDC CER	28480	0160-2238
A24C50	0160-3878	6		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A24C51	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C52	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C53	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A24C54	0121-0165	6		CAPACITOR-V TRMR-CER 7-25PF 350V PC-MTG	73899	DV11PR25B
A24C55	0140-0145	2		CAPACITOR-FXD 22PF +-5% 500VDC MICA	72136	DM15C220J0500WV1CR
A24C56	0160-3046	0		CAPACITOR-FXD 250PF +-1% 100VDC MICA	28480	0160-3046

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24CR1	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A24CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	9N171	1N4148
A24L1	05370-60127	1	6	CABLE AY 05370	28480	05370-60127
A24L2	05370-60127	1		CABLE AY 05370	28480	05370-60127
A24L3	05370-60127	1		CABLE AY 05370	28480	05370-60127
A24L4	05370-60127	1		CABLE AY 05370	28480	05370-60127
A24L5	05370-60127	1		CABLE AY 05370	28480	05370-60127
A24L6	05370-60127	1		CABLE AY 05370	28480	05370-60127
A24L7	9140-0095	0	6	INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L8	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A24L9	9140-0095	0		INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L10	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A24L11	9100-1788	6		CORE-FERRITE CHOKE-WIDEBAND;IMP:>680	28480	9100-1788
A24L12	9140-0095	0		INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L13	9140-0095	0		INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L14	9140-0095	0		INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L15	9140-0095	0		INDUCTOR 270NH 10% .155D-INX.375LG-IN	28480	9140-0095
A24L16	9100-0348	2		INDUCTOR RF-CH-MLD 1UH 1%	28480	9100-0348
A24Q1	1854-0092	2	8	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q2	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q3	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q4	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q5	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q6	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q7	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24Q8	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A24R1	0757-0269	8	9	RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R2	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A24R3	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R4	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	CT4-1/8-T0-51R1-F
A24R5	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R6	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R7	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R8	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R9	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	CT4-1/8-T0-162R-F
A24R10	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R11	0757-0433	8	1	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3321-F
A24R12	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R13	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A24R14	0757-0414	5	1	RESISTOR 432 1% .125W F TC=0+-100	24546	CT4-1/8-T0-432R-F
A24R15	0757-0269	8		RESISTOR 270 1% .125W F TC=0+-100	24546	CT4-1/8-T0-271-F
A24R16	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A24R17	0757-0441	8	3	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A24R18	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A24R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R20	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A24R21	0757-0415	6	1	RESISTOR 475 1% .125W F TC=0+-100	24546	CT4-1/8-T0-475R-F
A24R22	0698-4002	9		RESISTOR 5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-5001-F
A24R23	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R24	0757-0439	4		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-6811-F
A24R25	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1212-F
A24R26	0757-1093	8		RESISTOR 3K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3001-F
A24R27	0757-0441	8		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-8251-F
A24R28	0757-0199	3	2	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A24R29	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A24R30	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-7501-F
A24R31	0757-0199	3		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2152-F
A24R32	0757-0430	5		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2211-F
A24R33	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R35	0757-0430	5		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2211-F
A24R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R37	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R38	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R39	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R40	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A24R41	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R42	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R43	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-1002-F
A24R44	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	CT4-1/8-T0-101-F
A24R45	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A24R46	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A24R72	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A24R73	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	28480	0757-0346
A24TP1	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A24TP2	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A24TP3	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A24TP4	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A24TP5	0360-1682	0		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A24U1	1820-0920	4	1	IC RCVR ECL LINE RCVR QUAD 2-INP	04713	MC1692L
A24U2	1820-1224	3		IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10216P
A24U3	1826-0138	8	1	IC COMPARATOR GP QUAD 14-DIP-P PKG	01295	LM339N
A24W1	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A24W2	8159-0005	0		RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A25	05359-60025	3	1	DISPLAY & KEYBOARD SERIES 1848	28480	05359-60025
A25DS1	1990-0540	3	11	DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS2	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS3	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS4	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS5	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS6	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS7	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS8	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS9	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS10	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS11	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS12	1990-0533	4	30	LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS13	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS14	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS15	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS16	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS17	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS18	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS19	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS20	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS21	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS22	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS23	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS24	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS25	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS26	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS27	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS28	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS29	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS30	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS31	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS32	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS33	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS34	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS35	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS36	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS37	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS38	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS39	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS40	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25DS41	1990-0533	4		LED-LAMP LUM-INT=15MCD IF=20MA-MAX	28480	HLMP-3316
A25DS42	1990-0487	7	2	LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A25DS43	1990-0487	7		LED-LAMP LUM-INT=2MCD BVR=5V	28480	HLMP-1401
A25DS44	1990-0670	0	9	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS45	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS46	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS47	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS48	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS49	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS50	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS51	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS52	1990-0670	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	1990-0670
A25DS53	1990-0486	6	1	LED-LAMP LUM-INT=2MCD IF=25MA-MAX BVR=5V	28480	HLMP-1301
A25H1	0624-0270	0	2	SCREW-TPG 2-32 .25-IN-LG PAN-HD-SLT	00000	ORDER BY DESCRIPTION
A25H2	0624-0270	0		SCREW-TPG 2-32 .25-IN-LG PAN-HD-SLT	00000	ORDER BY DESCRIPTION
A25H3	2190-0014	1	2	WASHER-LK INTL T NO. 2 .089-IN-ID	78189	1902-00-00-2580
A25H4	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	78189	1902-00-00-2580
A25H5	3050-0367	2	2	WASHER-FL MTLC NO. 3 .105-IN-ID	28480	3050-0367
A25H6	3050-0367	2		WASHER-FL MTLC NO. 3 .105-IN-ID	28480	3050-0367
A25J1	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J2	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J3	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25MP3	05328-40003	8	2	SPACER-LED LONG	28480	05328-40003
A25MP4	05328-40003	8		SPACER-LED LONG	28480	05328-40003
A25XDS1	1200-0474	9	11	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS2	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS3	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS4	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS5	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS6	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS7	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS8	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS9	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS10	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
A25XDS11	1200-0474	9		SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
	05341-20037	3	1	BLOCK-ANNUN	28480	05341-20037
	05341-40001	3	1	BLOCK-ANNUN	28480	05341-40001
	05370-40001	8	1	BLOCK-ANNUN	28480	05370-40001
A26	05359-60026	4	1	FRONT PANEL CONTROLS SERIES 1808	28480	05359-60026
A26A2	10811-60003	7	1	BD AY-EDGE CONN	28480	10811-60003
A26C1	0121-0511	6	1	CAPACITOR-V TRMR-AIR 1-30PF 250V PNL-MTG	28480	0121-0511
A26F1	2110-0617	2	1	FUSE-THERMAL 108 DEG C	28480	2110-0617
A26J1	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A26J2	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A26MP1	10811-60106	1	1	OVEN-AY	28480	10811-60106
A26MP2	10811-20202	4	1	OVEN COVER-UPPER	28480	10811-20202
A26MP3	10811-20203	5	1	OVEN COVER-LOWER	28480	10811-20203
A26MP4	10811-20206	8	1	HOUSING FOAMED A	28480	10811-20206
A26MP5	10811-20211	5	1	COV-BOT.	28480	10811-20211
A26MP6	10811-40001	3	1	FOAM COOKIE-TOP	28480	10811-40001
A26Q7	1854-0701	0	2	TRANSISTOR NPN SI DARL TO-220AB PD=70W	04713	MJE2100
A26Q8	1854-0701	0		TRANSISTOR NPN SI DARL TO-220AB PD=70W	04713	MJE2100
A26R1	2100-2492	4	1	RESISTOR-VAR CONTROL CCP 5K 20% LIN	28480	2100-2492
A26R2	2100-2661	9	2	RESISTOR-VAR CONTROL CCP 1K 20% LIN	28480	2100-2661
A26R3	2100-2661	9		RESISTOR-VAR CONTROL CCP 1K 20% LIN	28480	2100-2661
A26R20*	0698-7239	0	1	RESISTOR 1.33K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1331-F
A26R20*	8159-0005	0	3	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A26S1	3101-2220	9	5	SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S2	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S3	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S4	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S5	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26Y1	5080-0094	7	1	SC XTAL-TESTED	28480	5080-0094
	0340-0864	6	2	INSULATOR-XSTR THRM-CNDCT	28480	0340-0864
	0520-0164	1	8	SCREW-MACH 2-56 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
	10811-40002	4	1	FOAM COOKIE-IN	28480	10811-40002
	2200-0103	2	2	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2200-0597	8	5	SCREW-MACH 4-40 .188-IN-LG	28480	2200-0597
	2260-0009	3	1	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	3050-0229	5	2	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0229
	3050-1021	7	2	WASHER-SHLDR NO.4 .116-IN-ID .215-IN-OD	28480	3050-1021
	10811-68115	8	1	OSC AY-2PCL60115	28480	10811-68115

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CHASSIS AND MISC PARTS		
A1J1	1251-0493	9	1	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	28480	1251-0493
A1R1	0757-0435	0	2	RESISTOR 3.92K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A1R2	0757-0283	6	2	RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1R3	0757-0283	6		RESISTOR 2K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-2001-F
A1R4	0757-0435	0		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	CT4-1/8-T0-3921-F
A5SW1	3101-1973	7	1	SWITCH-SL 7-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1973
A6MP1	5000-9043	6	3	PIN EXTRACTOR	28480	5000-9043
A6MP2	5000-9043	6		PIN EXTRACTOR	28480	5000-9043
A6MP3	5000-9043	6		PIN EXTRACTOR	28480	5000-9043
A6MP4	5040-6843	2	3	EXTRACTOR BLK	28480	5040-6843
A6MP5	5040-6843	2		EXTRACTOR BLK	28480	5040-6843
A6MP6	5040-6843	2		EXTRACTOR BLK	28480	5040-6843
A9C21	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A9MP1	0403-0189	2	22	EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A9MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A9MP3	1480-0116	8	24	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A9MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A9S1	3101-1989	5	1	SWITCH-SL 10-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1989
A9U3	1818-1785	6	1	IC NMOS 65536 (64K) EPROM 450-NS 3-S	04713	MCM68764C
A9U5	1818-0135	8	3	IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U8	1818-0135	8		IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U10	1818-0135	8		IC NMOS 1024 (1K) STAT RAM 360-NS 3-S	04713	MCM68A10L
A9U18	1820-2137	9	1	IC MICPROC NMOS 8-BIT	04713	MC68A00P
A11MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A11MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A11MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A11MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A11MP5	1400-0249	0	1	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249
A15DS1	1990-0620	0	4	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS2	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS3	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15DS4	1990-0620	0		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584, BENT LEADS
A15MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A15MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A15MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A15MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A16MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A16MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A16MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A16MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A16S1	3101-1841	8	1	SWITCH-SL 4-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1841
A17MP5	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A17MP6	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A17MP7	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A17MP8	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A18MP15	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A18MP16	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A18MP17	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A18MP18	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A18S1	3101-1213	8	2	SWITCH-TGL SUBMIN DPST .5A 120VAC PC	28480	3101-1213
A18S2	3101-1213	8		SWITCH-TGL SUBMIN DPST .5A 120VAC PC	28480	3101-1213
A18U3	5088-7013	0	1	OUTPUT AMPLIFIER	28480	5088-7013

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A19DL1	05359-80001	7	1	DELAY LINE-A Z	28480	05359-80001
A19MP3	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A19MP4	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A19MP5	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A19MP6	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A20MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A20MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A20MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A20MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A21MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A21MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A21MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A21MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A21MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A21MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A22MP1	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A22MP2	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A22MP3	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A22MP4	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A22U5	1820-1814	7	2	IC CNTR 24-BIT	28480	D200-0100
A22U7	1820-1814	7		IC CNTR 24-BIT	28480	D200-0100
A23H1	2190-0124	4	1	WASHER-LK INTL T NO. 10 .195-IN-ID	28480	2190-0124
A23H2	2950-0078	9	1	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	28480	2950-0078
A23MP41	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A23MP42	0403-0189	2		EXTR-PC BD BLK POLYC .062-IN-BD-THKNS	28480	0403-0189
A23MP43	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A23MP44	1480-0116	8		PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
A23U5	5088-7009	4	1	VCO STARTABLE	28480	5088-7009
A23U6	1820-2000	5	1	IC FF ECL D-M/S POS-EDGE-TRIG	28480	B196D-0100
A25DS1	1990-0540	3	11	DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS2	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS3	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS4	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS5	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS6	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS7	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS8	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS9	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS10	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25DS11	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A25H1	2190-0014	1	2	WASHER-LK INTL T NO. 2 .089-IN-ID	78189	1902-00-00-2580
A25H2	2190-0014	1		WASHER-LK INTL T NO. 2 .089-IN-ID	78189	1902-00-00-2580
A25H3	3050-0367	2	2	WASHER-FL MTLC NO. 3 .105-IN-ID	28480	3050-0367
A25H4	3050-0367	2		WASHER-FL MTLC NO. 3 .105-IN-ID	28480	3050-0367
A25J1	1200-0519	3	5	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J2	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J3	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J4	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25J5	1200-0519	3		SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0519
A25MP1	05341-20037	3	1	BLOCK-ANNUN	28480	05341-20037
A25MP2	05341-40001	3	1	BLOCK-ANNUN	28480	05341-40001
A25MP3	05370-40001	8	1	BLOCK-ANNUN	28480	05370-40001
A26BB1	05359-20026	0	1	BD-BLANK	28480	05359-20026
A26R1	2100-2492	4	2	RESISTOR-VAR CONTROL CCP 5K 20% LIN	28480	2100-2492
A26R2	2100-2661	9	2	RESISTOR-VAR CONTROL CCP 1K 20% LIN	28480	2100-2661
A26R3	2100-2661	9		RESISTOR-VAR CONTROL CCP 1K 20% LIN	28480	2100-2661
A26S1	3101-2220	9	5	SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S2	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S3	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S4	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220
A26S5	3101-2220	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-2220

See introduction to this section for ordering information
*Indicates factory selected value
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Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A25SH1	0624-0227	7	2	SCREW-TPG 4-40 .25-IN-LG PAN-HD-POZI STL	00000	ORDER BY DESCRIPTION
A25SH2	0624-0227	7		SCREW-TPG 4-40 .25-IN-LG PAN-HD-POZI STL	00000	ORDER BY DESCRIPTION
B1	3160-0209	4	1	FAN-TBAX 35-CFM 105-125V 50/60-HZ	23936	8500D
C1	0180-2799	0	2	CAPACITOR-FXD .017F+75-10% 20VDC AL	28480	0180-2799
C2	0180-2800	4	2	CAPACITOR-FXD .01F+75-10% 40VDC AL	28480	0180-2800
C3	0180-2799	0		CAPACITOR-FXD .017F+75-10% 20VDC AL	28480	0180-2799
C4	0180-2800	4		CAPACITOR-FXD .01F+75-10% 40VDC AL	28480	0180-2800
CB1	3103-0032	1	1	SWITCH-THRM FXD +194F 3A OPN-ON-RISE	28480	3103-0032
CR1	1906-0216	3	4	DIODE-FW BRDG 400V 15A	1B546	VL447
CR2	1906-0216	3		DIODE-FW BRDG 400V 15A	1B546	VL447
CR3	1906-0216	3		DIODE-FW BRDG 400V 15A	1B546	VL447
CR4	1906-0216	3		DIODE-FW BRDG 400V 15A	1B546	VL447
F1	2110-0083	6	1	FUSE 2.5A 250V NTD 1.25X.25 UL	28480	2110-0083
J4	0960-0443	1	1	LINE MODULE-FILTERED	28480	0960-0443
J9	1250-1253	9	2	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1253
J12	1250-1253	9		CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	28480	1250-1253
Q1	1854-0669	9	2	TRANSISTOR NPN 2N6057 SI TO-3 PD=150W	04713	2N6057
Q2	1854-0669	9		TRANSISTOR NPN 2N6057 SI TO-3 PD=150W	04713	2N6057
Q3	1853-0411	7	2	TRANSISTOR PNP 2N6050 SI DARL TO-3	28480	1853-0411
Q4	1853-0411	7		TRANSISTOR PNP 2N6050 SI DARL TO-3	28480	1853-0411
R1	2100-2492	4		RESISTOR-VAR CONTROL CCP 5K 20% LIN	28480	2100-2492
S1	3101-1720	2	1	SWITCH-PB DPDT ALTNG 4A 250 VAC	28480	3101-1720
S1	5060-9436	7	27	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S15	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S16	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S17	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S18	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S19	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S20	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S21	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S22	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S23	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S24	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S25	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S26	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
S27	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
T1	9100-3056	5	1	TRANSFORMER-POWER 100/120/220/240V	28480	9100-3056
W1	05370-60401	4	1	CBL AY-PS XSTR	28480	05370-60401
W2	05370-60402	5	1	CBL AY-PWR SW	28480	05370-60402
W3	05359-60403	1	1	CBL AY-10 MHZ AZ	28480	05359-60403
W4	05359-60404	2	1	CBL AY-START	28480	05359-60404
W5	05370-60405	8	1	CBL AY-EXT FR IN	28480	05370-60405
W6	05370-60406	9	1	CBL AY-10MHZ OUT	28480	05370-60406
W7	05359-60407	5	1	CBL AY-OUTPUT	28480	05359-60407
W8	05370-60408	1	1	CBL AY-REAR PNL	28480	05370-60408
W9	05359-60409	7	1	CBL AY-EDGE ONE	28480	05359-60409
W10	05359-60410	0	1	CBL AY-EDGE TWO	28480	05359-60410

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W11	05359-60411	1	1	CBL AY-START PRB	28480	05359-60411
W12	05359-60412	2	1	CBL AY-STOP PRBE	28480	05359-60412
W13	05359-60413	3	1	CBL AY-REAR PNL	28480	05359-60413
W14	05359-60414	4	1	CBL AY-10MHZ TB	28480	05359-60414
W15	05359-60415	5	1	CBL AY-PULSE	28480	05359-60415
W16	05359-60416	6	1	CBL AY-EXT. TRIG	28480	05359-60416
W17	05359-60417	7	1	CBL AY-EVENTS IN	28480	05359-60417
W18	05359-60418	8	1	CBL AY-SYNC OUT	28480	05359-60418
	0340-0596	1	4	INSULATOR-XSTR THRM-CNDCT	28480	0340-0596
	0340-0833	9	4	INSULATOR-XSTR POLYE	28480	0340-0833
	0370-0914	0	1	BEZEL-PB KNOB,.490LG,.330W,.165HI,JADE	28480	0370-0914
	0370-0970	8	1	PUSHBUTTON .230 X .390 X .413 IN H; JADE	28480	0370-0970
	0370-1005	2	4	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
	0510-1148	2	18	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
	0515-0896	5	6	SCREW-MACH M4 X 0.7 10MM-LG	28480	0515-0896
	0515-1055	0	8	SCREW-MACH M4 X 0.7 6MM-LG 90-DEG-FLH-HD	28480	0515-1055
	0515-1132	4	4	SCREW-MACH M5 X 0.8 10MM-LG	28480	0515-1132
	0515-1331	5	8	SCREW-METRIC SPECIALTY M4 X 0.7 THD; 6	28480	0515-1331
	05359-00003	1	1	PNL-REAR	28480	05359-00003
	05359-00006	4	1	HOLD DOWN-BOARD	28480	05359-00006
	05359-00007	5	1	SUPPORT-CENTER	28480	05359-00007
	05370-00006	9	1	SHLD-OSC	28480	05370-00006
	05370-00008	1	2	BKT-MB EDGE	28480	05370-00008
	05370-00016	1	2	BRACKET-ANGLE	28480	05370-00016
	1200-0523	9	14	LOCK-DUAL INLINE PKG INLINE PACKAGE	28480	1200-0523
	1205-0335	1	1	HEAT SINK TO-3-CS	28480	1205-0335
	1251-3283	1	1	CONN-RECT MICRORBN 24-CKT 24-CONT	28480	1251-3283
	1460-1345	5	2	TILT STAND SST	28480	1460-1345
	2110-0305	5	1	FUSE 1.25A 250V TD 1.25X.25 UL	75915	3131.25
	2940-0256	4	2	NUT-HEX-DBL-CHAM 1/2-28-THD .095-IN-THK	00000	ORDER BY DESCRIPTION
	2950-0035	8	1	NUT-HEX-DBL-CHAM 15/32-32-THD	00000	ORDER BY DESCRIPTION
	3160-0309	5	1	FINGER GUARD	4N833	12601-43 UL VERSION
	5040-6967	1	8	PLOTHN-COR BLOCK	28480	5040-6967
	5060-9462	9	1	HPIB EXTENDER AY	28480	5060-9462
	8120-1378	1	1	CABLE ASSY 18AWG 3-CNDCT JGK-JKT	28480	8120-1378
	8120-2462	6	7	CABLE ASSY 26AWG 16-CNDCT	28480	8120-2462
	5020-8896	7	2	TRIM-FRONT HDL	28480	5020-8896
	5021-5803	2	1	FRAME-FRONT	28480	5021-5803
	5021-5804	3	1	FRAME-REAR	28480	5021-5804
	5021-5837	2	4	STRUT-CORNER	28480	5021-5837
	5040-0170	6	7	SPT BD	28480	5040-0170
	5040-6928	4	1	STRIP-DIVIDER	28480	5040-6928
	5040-6937	5	3	CLIP WINDOW	28480	5040-6937
	5040-7201	8	2	FOOT	28480	5040-7201
	5040-7202	9	1	TOP TRIM	28480	5040-7202
	5040-7221	2	4	STANDOFF-REAR	28480	5040-7221
	5040-7222	3	2	FOOT-NON SKID	28480	5040-7222
	5041-0244	7	3	KEY CAP-55,M	28480	5041-0244
	5041-0253	8	6	KEY CAP 1/2	28480	5041-0253
	5041-0286	7	1	KEY CAP 1/2	28480	5041-0286
	5041-0310	8	1	KEY CAP-BLANK	28480	5041-0310
	5041-0319	7	1	KEYCAP-LGT PIPE	28480	5041-0319
	5041-0776	0	1	KEY CAP-CLEAR	28480	5041-0776
	5041-0841	0	1	KEY CAP		
	5041-0846	5	1	KEY CAP-0		
	5041-0847	6	1	KEY CAP-1		
	5041-0848	7	1	KEY CAP-2		
	5041-0849	8	1	KEY CAP-3		
	5041-0850	1	1	KEY CAP-4		
	5041-0851	2	1	KEY CAP-5		
	5041-0852	3	2	KEY CAP-6		
	5041-0853	4	1	KEY CAP-7		
	5041-0854	5	1	KEY CAP-8		

See introduction to th
*Indicates factory sel
†Backdating informat

シャーシ外装部品　SYSTEM II - SYSTEM II PLUS　対比リスト

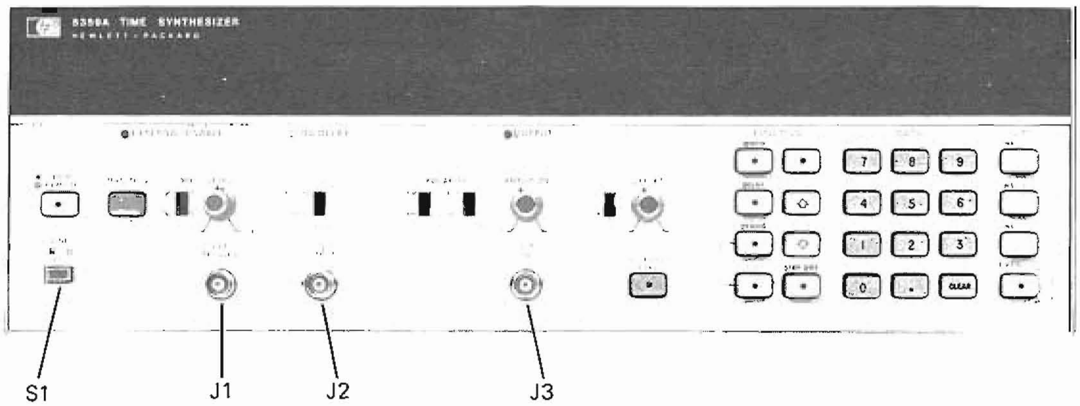
部品名	部品記号	SYSTEM II 部品番号	SYSTEM II PLUS 部品番号
TOP COVER	MP4	5061-9435	5062-3735
BOTTOM COVER	MP3	5061-9447	5062-3747
SIDE COVER	MP2	5060-9880	5062-3780
SIDE COVER(PERFORATED)	MP2	5061-1942	05359-00008
FRONT FRAME	MP21	5021-5803	5021-8403
SIDE HANDLE	MP1	5060-9804	5062-3704
HANDLE STRAPCAP(FRONT)	MP10	5041-6819	5041-8819
HANDLE STRAPCAP(REAR)	MP11	5041-6820	5041-8820
FOOT(FRONT)	MP12	5040-7201	5041-8801
FOOR NON-SKID(REAR)	MP8	5040-7222	5041-8822
TOP TRIM	MP7	5040-7202	5041-8802
FRONT FRAME HANDLE	MP33	5061-9499	5062-3799
FRONT HANDLE TRIM	MP34	5020-8896	5021-8496

SYSTEM II部品とは・・・従来から存在するカラーで統一されたシャーシ外装部品類。
SYSTEM II PLUS部品とは・ここ1～2年で登場した、新しいカラーで、うすい灰色のシャーシ外装部品類。

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	5041-0855	6	2	KEY CAP-UP	28480	5041-0855
	5041-1602	3	1	KEY, HALF	28480	5041-1602
	5041-6819	4	2	STRP-HDLE CAP FR	28480	5041-6819
	5041-6820	7	2	STRP-HDLE CAP R	28480	5041-6820
	5060-9804	3	2	STRAP HANDLE ASY	28480	5060-9804
	5060-9880	5	1	COV-SIDE ASSY	28480	5060-9880
	5061-1942	6	1	COV-SIDE AY-PERF	28480	5061-1942
	5061-9435	8	1	COV AY-TOP	28480	5061-9435
	5061-9447	2	1	COV AY-BOTTOM	28480	5061-9447
	5061-9499	4	2	SYS II HANDLES	28480	5061-9499
	5061-9677	0	1	KIT-RK FLANGE	28480	5061-9677
	5061-9683	8	1	KIT-RK HNDL & FLNG	28480	5061-9683
	5061-9771	5	1	RACK-FLANGE	28480	5061-9771
	05359-00001	9	1	PNL-DRESS FR	28480	05359-00001
	05359-00002	0	1	PNL-SUB FR	28480	05359-00002
	05359-00004	2	2	BULKHEAD-BD GDE	28480	05359-00004
	05359-20201	3	1	WINDOW	28480	05359-20201
	05359-20203	5	1	SUPPORT-MTHR BD	28480	05359-20203
	05359-20204	6	1	SUPPORT-MTHR BD	28480	05359-20204
	05370-00005	8	1	CHAS-PWR SUP	28480	05370-00005
	05370-00014	9	1	DIFFUSER #1	28480	05370-00014
	05370-00015	0	1	DIFFUSER #2	28480	05370-00015

See introduction to this section for ordering information
*Indicates factory selected value
†Backdating information in Section VII



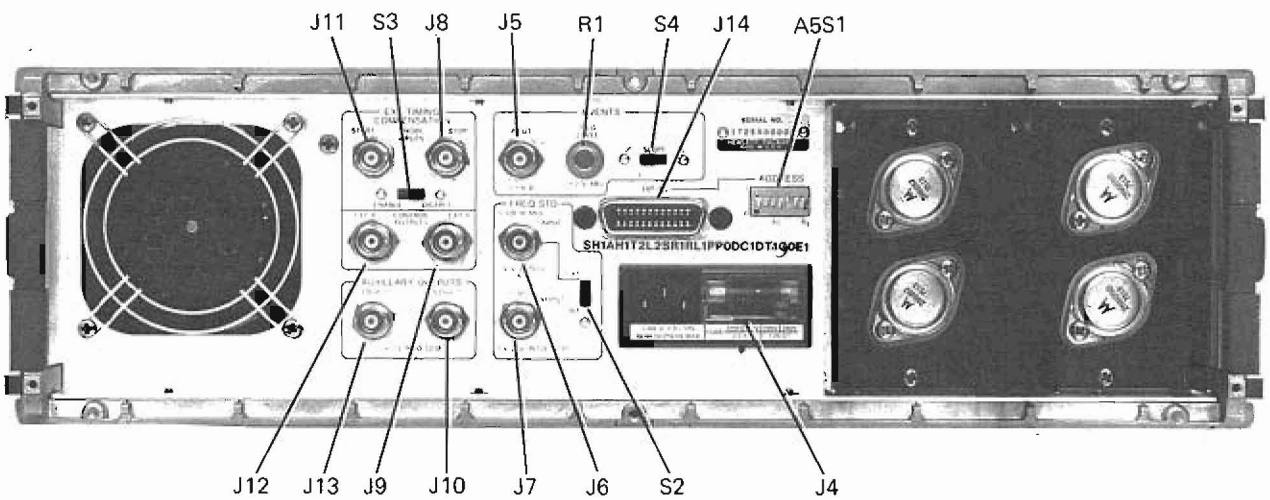


Figure 6-1. Front and Rear View Locations

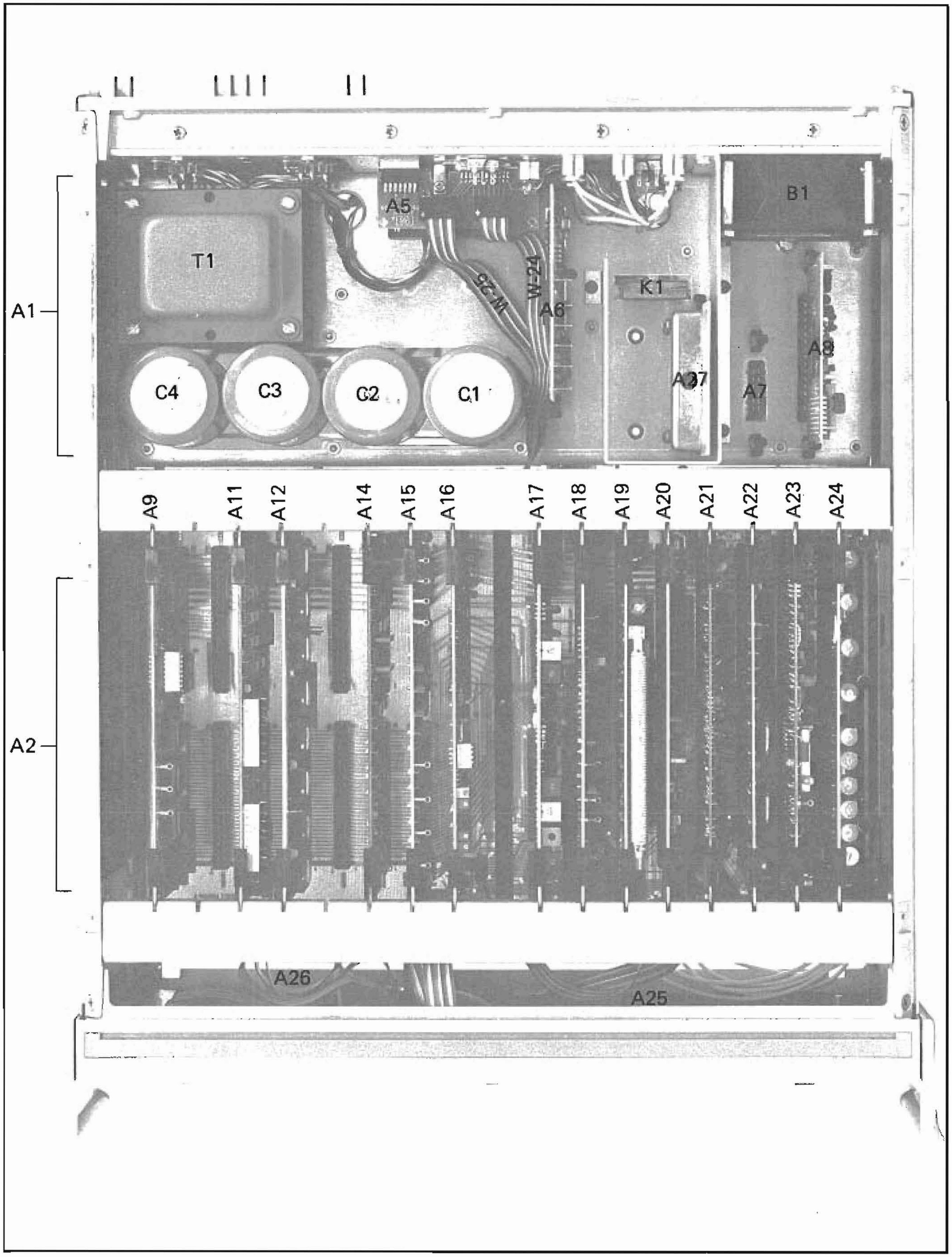


Figure 6-2. Top Internal View

Table 6-3. Code List of Manufacturers

Mfr Code	Manufacturer Name	Address		Zip Code
S0545	NEC ELECTRONICS LTD	MTN VIEW	CA US	94043
00000	ANY SATISFACTORY SUPPLIER			
01295	TEXAS INSTRUMENTS INC	DALLAS	TX US	75265
03888	K D I PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA INC SEMI-COND PROD	PHOENIX	AZ US	85008
07263	FAIRCHILD CORP	MOUNTAIN VIEW	CA US	94042
1B546	VARO SEMICONDUCTOR INC	GARLAND	TX US	75046
11532	TELEDYNE RELAYS	HAWTHORNE	CA US	90250
17856	SILICONIX INC	SANTA CLARA	CA	95054
18324	SIGNETICS CORP	SUNNYVALE	CA US	94086
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH	FL US	33407
2M627	ROHM CORP	IRVINE	CA US	92716
23936	PAMOTOR DIV WILLIAM J PURDY	BURLINGAME	CA	94010
24546	CORNING ELECTRONICS	SANTA CLARA	CA US	95050
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA US	95052
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
3L585	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE	CA US	94086
4N833	ETRI INC	MONROE	NC US	28110
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
72136	ELECTRO MOTIVE CORP	FLORENCE	SC	06226
73138	BECKMAN INDUSTRIAL CORP	FULLERTON	CA US	92632
73899	J F D ELECTRONICS CORP	BROOKLYN	NY	11219
75915	LITTELFUSE INC	DES PLAINES	IL US	60016
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN	IL	60126
9N171	UNITRODE CORP	LEXINGTON	MA US	02173
91637	DALE ELECTRONICS INC	EL PASO	TX US	79936

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments. This manual applies directly to Model 5359A instruments having serial prefix 2648A.

7-3. NEWER INSTRUMENTS

7-4. As changes are made, newer instruments may have a serial prefix not listed in this manual. Manuals for these instruments are supplied with a manual change sheet, containing the required information. Contact the nearest Hewlett-Packard Sales and Service Office for information if this sheet is missing.

7-5. OLDER INSTRUMENTS

7-6. To adapt this manual to instruments having a serial prefix prior to 2648A, perform the backdating that applies to your instrument's serial prefix as listed in *Table 7-1* below:

Table 7-1. Model 5359A Backdating

If Your Instrument has Serial Prefix	Make the following changes to your Manual
2640A	1
2624A	1, 2
2552A	1 through 3
2510A	1 through 4
2426A	1 through 5
2410A	1 through 6
2226A	1 through 7
2126A	1 through 8
2116A	1 through 9
2040A	1 through 10
2036A	1 through 11
2024A	1 through 12
2016A	1 through 13
2012A	1 through 14
2008A	1 through 15
1936A	1 through 16
1848A	1 through 17
1844A	1 through 18
1832A	1 through 19
1824A	1 through 20
1748A	1 through 21

CHANGE 1

Table 6-2. A7 Oscillator Power Supply Replacement Parts:
Change A7CR1 to 1901-0366.

Figure 8-4. A16 Troubleshooting:
Replace Figure 8-4 with Figure 7-7.

CHANGE 2

Table 6-2. A9 Processor Assembly Replaceable Parts:
Change A9 to 05370-60009.
Delete A9C21.
Change A9R1-R3 to 1810-0164 (4.7K).
Change A9R6 to 1810-0164 (4.7K).

CHANGE 2 Con't.

Change A9R14 to 0757-0472 (200K).
Change A9R23 to 0698-7236 (1K).
Change A9R24 to 0698-7196 (21.5).
Change A9R25 to 0698-7236 (1K).
Change A9R26 to 0698-7188 (10 ohms).
Change A9S1 to 3101-1973.
Delete A9U3.
Change A9U13 to 1816-0409.
Change A9U18 to 1820-1480.
Change Terminal test point to 0360-0535.
Delete A9XU13.
Add A12 (05359-60212) ROM Board.

Page 8-5. Table 8-1, Assembly Identification:
Change A9 part number to 05370-60009.
Add A12 (05359-60212) ROM Board.

Page 8-57, Figure 8-4.
Replace with the following A9 Troubleshooting Flowchart Figure 7-4.

Page 8-75. Figure 8-12, A9 Processor Assembly Schematic Diagram:
Change A9 to 0537-60009.
Change A9R14 to 200K ohms.
Change A9R23 to 1K ohm.
Change A9R24 to 21.5 ohms.
Change A9R25 to 1K ohm.
Change A9R26 to 10 ohms.
Delete A9C21 and A9U3.

CHANGE 3

Page 5-12. Adjustments:
Change step 3 to "−100 to +150 mV".

Table 6-2, A17 Replaceable Parts:
Change A17R23 to 0757-0283 (2K).

Page 8-85. Figure 8-17, A17 Output Reference Assembly:
Change A17R23 to 2K ohms.

CHANGE 4

Table 6-2. A1 Power Supply Replaceable Parts:
Change A1 to 05370-60001.
Add A1K1 0~~5~~490-0908, Relay.
Add A1XK1 0490-0907, Relay Socket.

Table 6-2. A6 Power Supply Control Replaceable Parts:
Change A6 to 05370-60006.
Change A6R18 to 0757-0280 (2K).
Change A6R21 to 0757-0283 (2K).
Change A6R23, R24 to 0811-1219 (250 ohms).

Page 8-5, Table 8-1. Assembly Identification:
Change A1 to 05370-60001.
Change A6 to 05370-60006.

Page 8-50. Service:
Replace paragraphs 8-126 and 8-127 with the following:

8-125. A1, A6 Power Supply Motherboard/Power Supply Control Assembly

8-126. The Power Supply Motherboard/Power Supply Control Assembly supplies all DC power for the instrument, except for the Option 001 Oven Oscillator. The AC line voltage enters through the Power Module (correct selection of line voltage determined by Power Module card) to the

Power Transformer primary windings and the instrument fan. The secondaries of the power transformer are rectified, filtered, and sent to the Power Relay. A separate transformer secondary supplies power to the Oven Oscillator Power Supply (A7) used with Option 001.

8-127. When the front panel ON-STANDBY switch is activated, AC power is sent to the fan and unregulated DC is sent to the Power Relay, enabling the four unregulated DC voltages to the Power Supply Control Assembly (A6). The A6 assembly then converts the four unregulated DC voltages, +10V, +20V, -20V, and -10V (fused at the input) to +5V, +15V, -15V and -5.2V for distribution throughout the instrument. These voltages are supplied by four separate linear series-pass regulators which are referenced to a single +10.0V precision reference IC (A6U5).

Page 8-65. Figure 8-8. Overall Block Diagram:
Replace 5359A Power Supply diagram with block diagram (Figure 7-1) below.

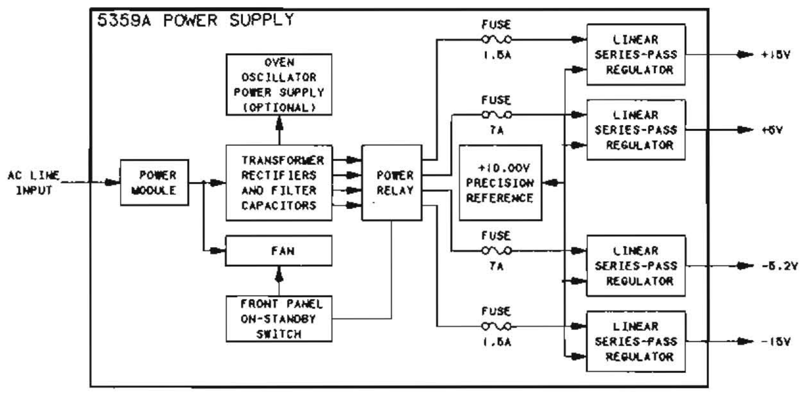


Figure 7-1. Partial 5359A Power Supply Block Diagram

Page 8-69, Figure 8-9. A1/A2/A6 Motherboard/Power Supply Assy Schematic:
Change A1 part number to 05370-60001.
Change A6 part number to 05370-60006.
Change A1/A6 schematic as shown in Figure 7-2 to add A1K1 Relay.
Change R18, R21 to 2K ohms.
Change R23, R24 to 250 ohms.

CHANGE 5

Table 6-2, Replaceable Parts:
Change Rack Flange Kit to 5061-0777 (English).
Change Rack Handle Flange Kit 5061-0083 (English).
Change Rack Flange to 5061-2071 (English).

CHANGE 6

Table 6-2. A17 Output Control Replaceable Parts:
Add K1 0490-0679.
Delete K2 0490-1458.
Delete R78, R79.
Replace A17 schematic and component locator with Figure 7-5

CHANGE 7

Table 6-2. A15 HP-IB Interface Replaceable Parts:
Change U5 to 1820-1207.

Table 6-2. A17 Output Control Replaceable Parts:
Change Insulator - XStr Therm-Cndct to 0340-0864.

CHANGE 8

Table 6-2. A8 Frequency Buffer Replaceable Parts:
Delete C27.
Change R8 to 0698-3437 133 ohms.

Table 6-2. A17 Output Control Replaceable Parts:
Change R4 to 0757-1093 3K ohms.

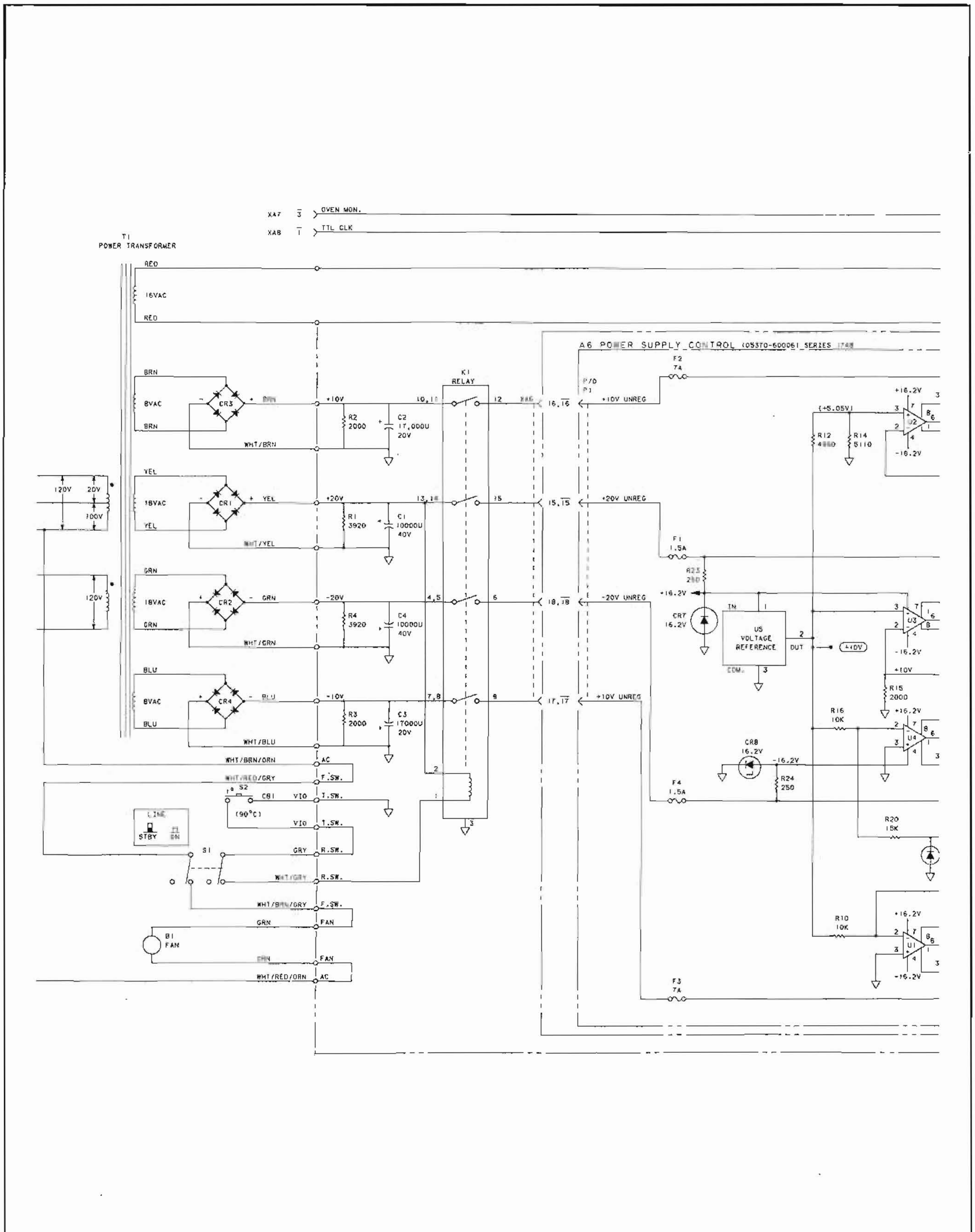


Figure 7-2. Partial Motherboard/Power Supply Assembly Schematic

CHANGE 9

Table 6-2. A24 200 MHz Multiplier Assembly Replaceable Parts:
Change A24L1 thru L6 to 05255-6019.

Table 6-2. Options:
Change Option 913 Rack Flange to 5060-0171.

CHANGE 10

Table 6-2, Chassis Replaceable Parts:
Change A27 to 10811-60101.

CHANGE 11

Table 6-2, Chassis Replaceable Parts:
Change A27 to 10811-60101.

CHANGE 12

Table 6-2, Chassis Replaceable Parts:
Change A27 to 10811-60101.

CHANGE 13

Table 6-2. A9 Processor Assembly Replaceable Parts:
Change R9, R10 to 0698-7252 (4, 64K).

Figure 8-15, Figure 8-12. A9 Processor Assembly Schematic Diagram:
Change R9, R10 to 4.64K.
Change R14 to 200K.

CHANGE 14

Table 6-2. A24 200 MHz Multiplier Assembly Replaceable Parts:
Change A24 to 05370-60024.
Delete R45 and R46.
Change A24U1 to 1820-1224.

Figure 8-24. A24 200 MHz Multiplier Assembly Schematic Diagram:
Change A24 to 05370-60024.
Delete R45 and R46.
Change connections to U1 and U1D as shown below in Figure 7-3.

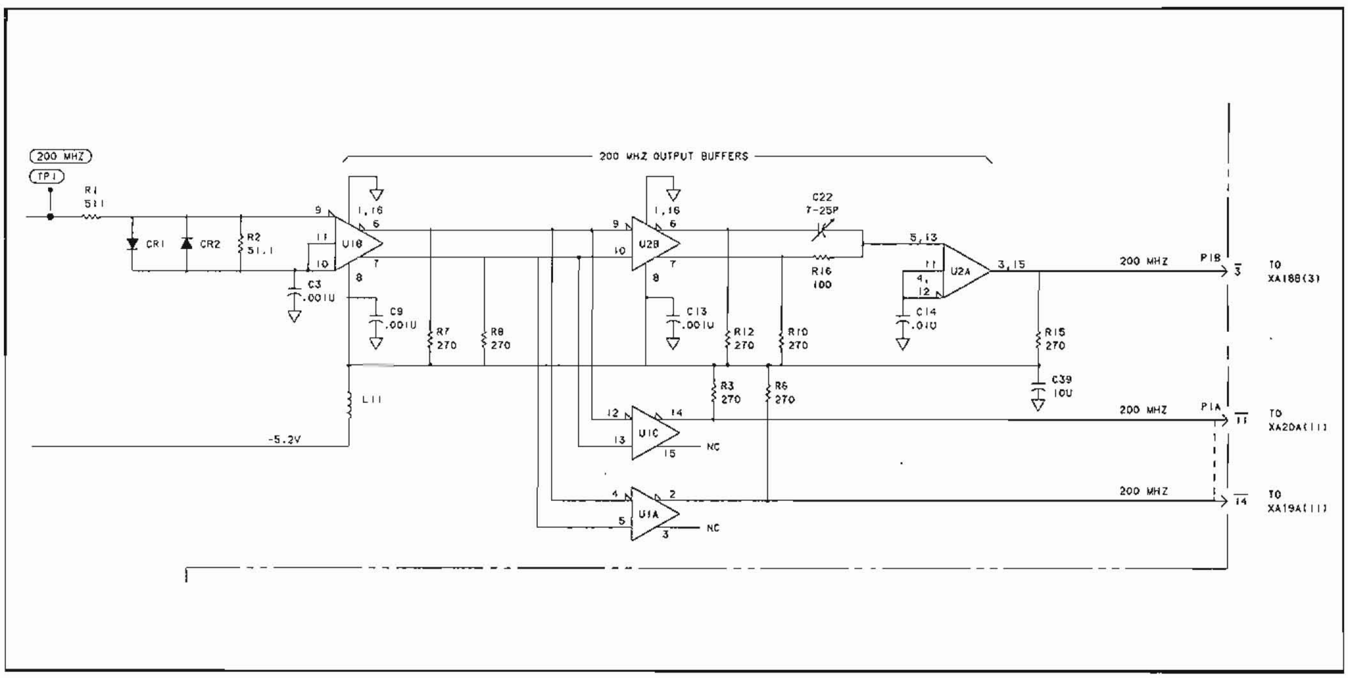


Figure 7-3. Partial A24 200 MHz Multiplier Assembly

CHANGE 15

Paragraph 1-21:

Add Options 907 Front Handle Assy, 908 Rack Mount Flange Kit, 909 Rack Mount Flange Kit/Handle Assy.

Table 6-2. Replaceable Parts:

Standard instruments with serial number prefixes below 2012A had an air temperature oscillator assembly A7 (05370-60069). The parts list and schematic Figure 7-6.

Table 7-2. Replaceable Parts

Reference Designation	HP Part Number	√	Qty	Description	Mfr Code	Mfr Part Number
A7	05370-60007	6	1	OSCILLATOR POWER SUPPLY	28480	05370-60007
A7C1	0160-0128	3	1	CAPACITOR-FXD 2.2UF +-20% 50VDC CER	28480	0160-0128
A7C2	0180-2730	9	1	CAPACITOR-FXD 1700UF+75-10% 30VDC AL	28480	0180-2730
A7C3	0160-0576	5	5	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A7C4	0160-0576	5		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-0576
A7C5	0180-1746	5	6	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X902082
A7CR1	1901-0366	4	1	DIODE-FW BRDG 400V 1A	28480	1901-0366
A7CR2	1901-0028	5	1	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR3	1902-3172	8	1	DIODE-ZNR 11V 2% DO-7 PD=.4W TC=+.062%	28480	1902-3172
A7F1	2110-0423	8		FUSE 1.5A 125V FAST-BLO .281X.093	28480	2110-0423
A7Q1	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A7R1	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A7R2	0757-0726	2	1	RESISTOR 511 1% .25W F TC=0+-100	27167	C5-1/4-T0-511R-F
A7U1	1826-0147	9	2	IC 7812 V RGLTR	04713	MC7812CP
				A7 MISCELLANEOUS		
	0360-0535	0		TERMINAL TEST POINT PCB	00000	ORDER BY DESCRIPTION
	2360-0055	1	5	SCREW-MACH 6-32 .188-IN-LG SDG-HD-SLT	00000	ORDER BY DESCRIPTION
	2420-0014	0	5	NUT-HEX-DBL-CHAM 6-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
	5000-9043	6		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6843	2		EXTRACTOR, P.C. BOARD	28480	5040-6843

CHANGE 16

Instruments with series prefixes 2008A and below had Options 907, 908, and 909 available. Option 907 was for a front handle assembly, Option 908 was for a rack mount flange kit, and Option 909 was for a rack mount flange kit/handle assembly.

CHANGE 17

Table 6-2. Replaceable Parts:

Change F1 to 2110-0301, 3 amp 250V slo-blo.

CHANGE 18

Table 6-2. A25 Front Panel Display/Keyboard Assy Replaceable Parts:

Change A25DS42, 43 to A25DS42-DS52 1990-0487.

CHANGE 19

Table 6-2. Replaceable Parts:

Change CR1 thru CR4 to 1906-0032.

CHANGE 20

Table 6-2. A17 Output Control Replaceable Parts:

Delete 0360-0535 Terminal test point.

CHANGE 21

Table 6-2. A17 Output Control Replaceable Parts:

Change A17U1, U2, U6, U7 thru U9 and U12 to 1820-0493 (LM307N).

Table 6-2. A23 Startable VCO Assembly Replaceable Parts:

Change A23L9 to 9100-2248 (0.120 μH).

Figure 8-23. A23 Startable VCO Schematic Diagram:

Change A23L9 to 0.120 μH.

1 CLOCK/ROM Signatures

U11(2)	00UP (H level)
(3)	00UP (H level)
(4)	0007
(5)	0086
(6)	0022
(7)	0033
(9)	00UP
(10)	001P
(11)	001F
(12)	0000 (L level)
(13)	0000 (L level)
(14)	00UP (H level)
(15)	00UP
U13(5)	0030
(6)	008P
(7)	0038
(9)	0080
U17(2)	00FP
U20(2)	0038
(3)	00F6
(5)	0038
(6)	00FP
(9)	00F6
(11)	0038

2 ADDRESS BUS

P1A3	UUUF
4	FFFU
5	8487
6	P760
7	1U5H
8	0355
9	U75A
10	6F99
11	7792
12	6322
13	37C6
14	6U2C
15	4FC9
16	486C
17	9UP2
18	0001

3 PROCESSOR FREE-RUN

U18(9)	UUUU
10)	FFFF
(11)	8484
(12)	P763
(13)	1U5P
(14)	0356
(15)	U759
(16)	6F9A
(17)	7791
(18)	6321
(19)	37C5
(20)	6U28
(22)	4FCA
(23)	4868
(24)	9UP1
(25)	0002

4 RAM/ROM Select Logic

U7(6)	328F
U9(6)	PACH
U9(8)	C72P
U6(2)	9UP1
U6(4)	0002

F Partial Data Bus Driver/Receiver Check

U4(1)	0000 (toggling)
(2)	PACH
(3)	PACH
(4)	0003 (H level)
(5)	0003 (H level)
(6)	PACP
(8)	0003 (toggling)
(9)	PACP
(10)	0000 (toggling)
(11)	0003 (H level)
(12)	0003 (toggling)
(13)	0003 (H level)

6 Data Bus Driver Logic

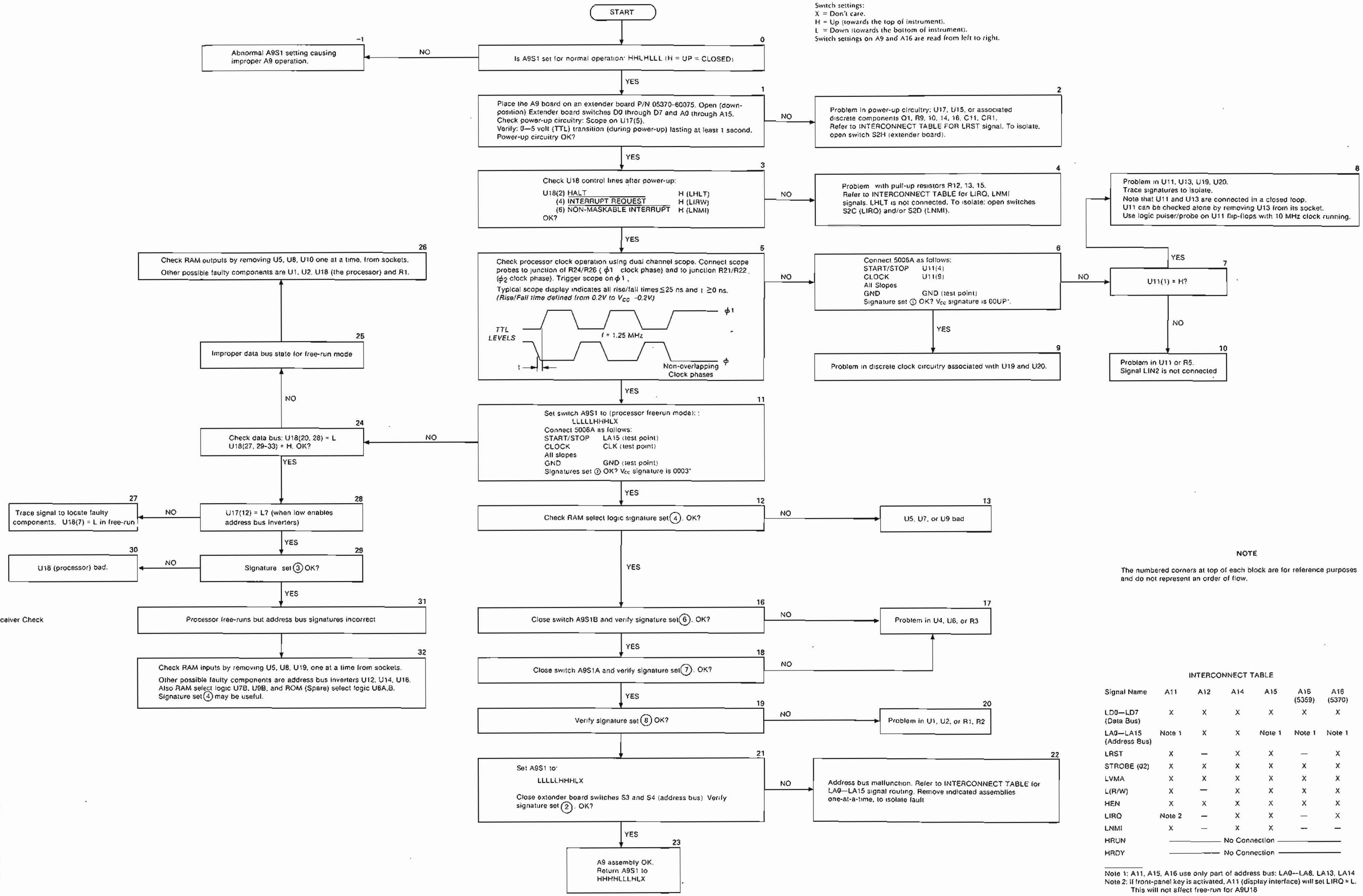
U6(8)	0000
U6(9)	0003

7 Data Bus Receiver Logic

U4(12)	0003 (toggling)

8 Data Bus Receiver/Drivers

U1(4)	5FC5
(7)	0P30
(9)	764P
(12)	CUHP
U2(4)	0000 (toggling)
(7)	594A
(9)	0000 (toggling)
(12)	1HHA



NOTE
Switch settings:
X = Don't care.
H = Up (towards the top of instrument).
L = Down (towards the bottom of instrument).
Switch settings on A9 and A16 are read from left to right.

NOTE

The numbered corners at top of each block are for reference purposes and do not represent an order of flow.

INTERCONNECT TABLE

Signal Name	A11	A12	A14	A15	A16 (5359)	A16 (5370)
LD0—LD7 (Data Bus)	X	X	X	X	X	X
LA0—LA15 (Address Bus)	Note 1	X	X	Note 1	Note 1	Note 1
LRST	X	—	X	X	—	X
STROBE (02)	X	X	X	X	X	X
LVMA	X	X	X	X	X	X
L(R/W)	X	—	X	X	X	X
HEN	X	X	X	X	X	X
LIRQ	Note 2	—	X	X	—	X
LNMI	X	—	X	X	—	—
HRUN	No Connection					
HRDY	No Connection					

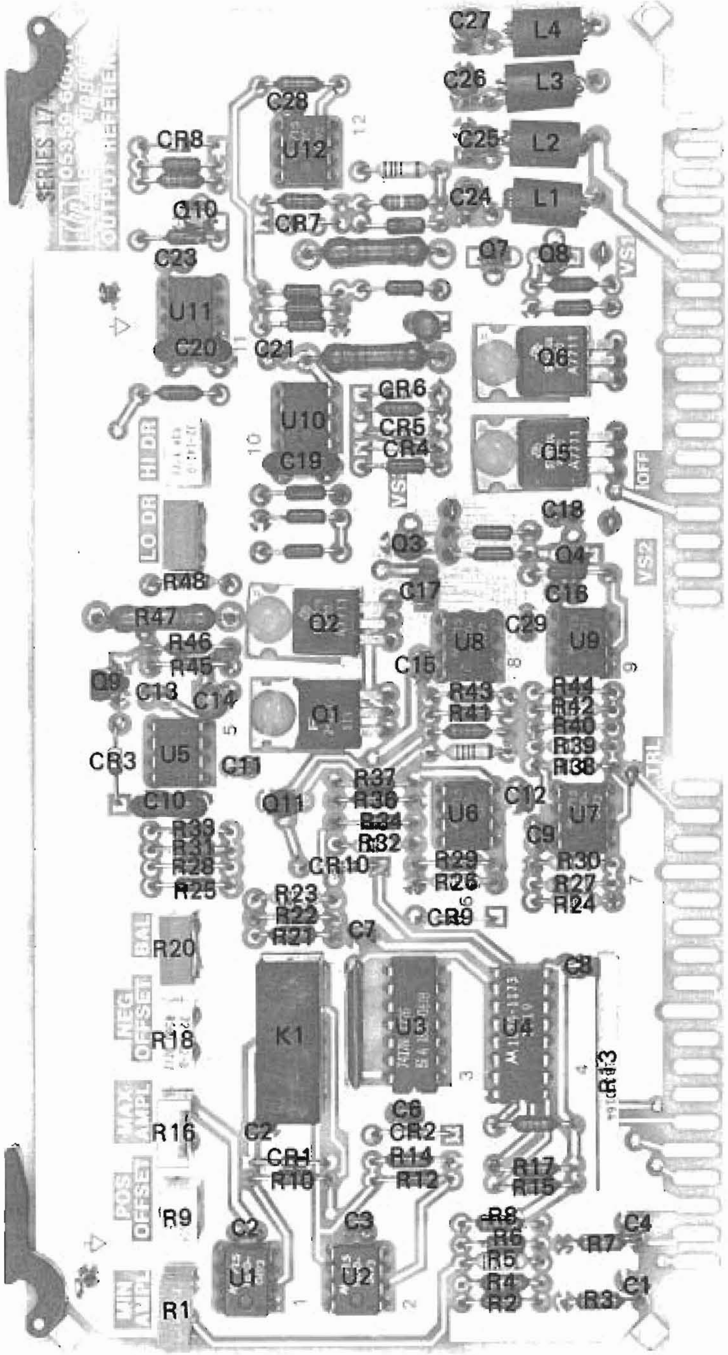
Note 1: A11, A15, A16 use only part of address bus: LA0—LA8, LA13, LA14
Note 2: If front-panel key is activated, A11 (display interface) will set LIRQ = L. This will not affect free-run for A9U18

*If V_{cc} signature is different then shown, do not proceed any further. Check your SA set-up

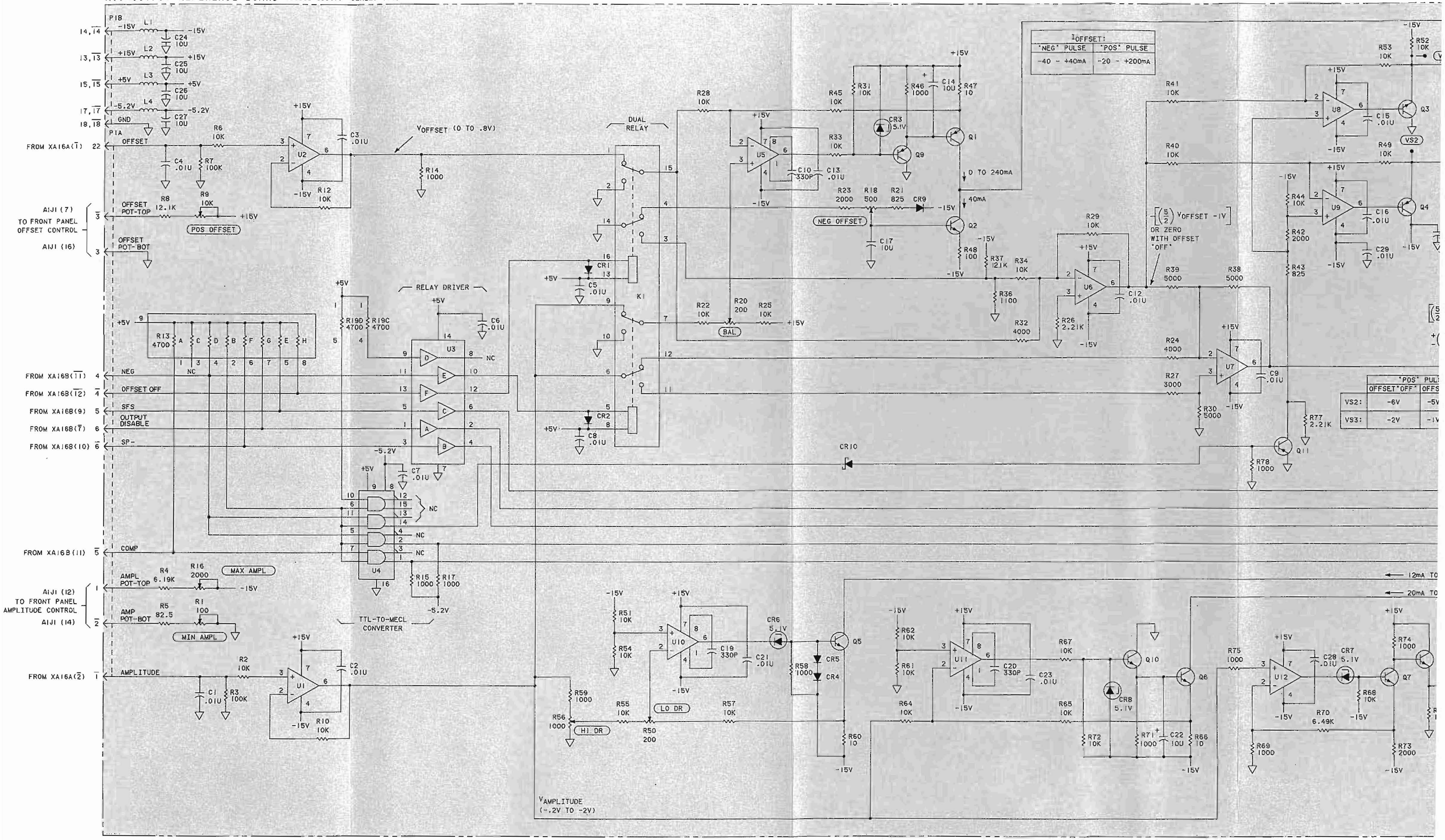
Figure 7-4. A9 Processor Troubleshooting Flowchart

Figure 7-4
A9 PROCESSOR TROUBLESHOOTING FLOWCHART

(See Page 7-7)


C27
L4
C26
L3
C28
CR8
U12
C25
L2
C24
L1
Q10
CR7
C23
Q7
Q8
VS1
U11
C20
C21
Q6
CR6
U10
CR5
CR4
Q5
HI DR
C19
OFF
LO DR
C18
Q3
Q4
VS2
R48
C17
C16
R47
Q2
C29
R46
U8
U9
R45
C15
Q9
C13
C14
R44
R43
R42
R41
R40
Q1
R39
U5
CR3
C11
R38
R37
C10
Q11
R36
U6
C12
U7
R34
R33
R32
C9
R31
R29
R30
R28
CR10
R25
R26
R27
R23
R24
R22
CR9
BAL
R21
C7
R20
C8
NEG OFFSET
K1
U3
U4
R18
R13
MAX AMPL
C6
R16
C2
CR2
CR1
R14
POS OFFSET
R10
R12
R17
R15
R9
C2
C3
R8
C4
R6
R7
R5
U1
U2
R4
C1
MIN AMPL
R1
R2
R3

A17 OUTPUT REFERENCE BOARD (05359-60017) SERIES 1748



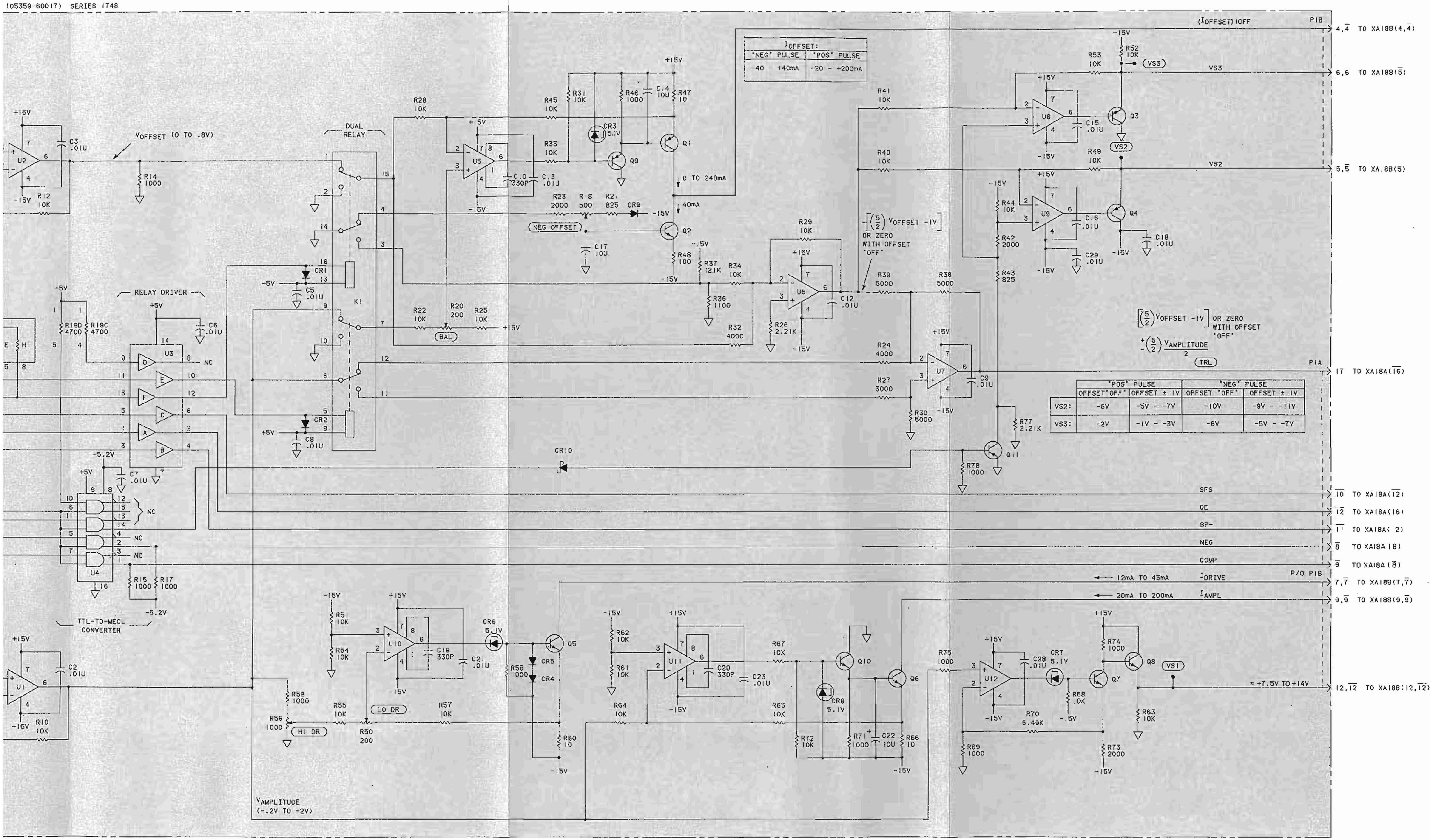
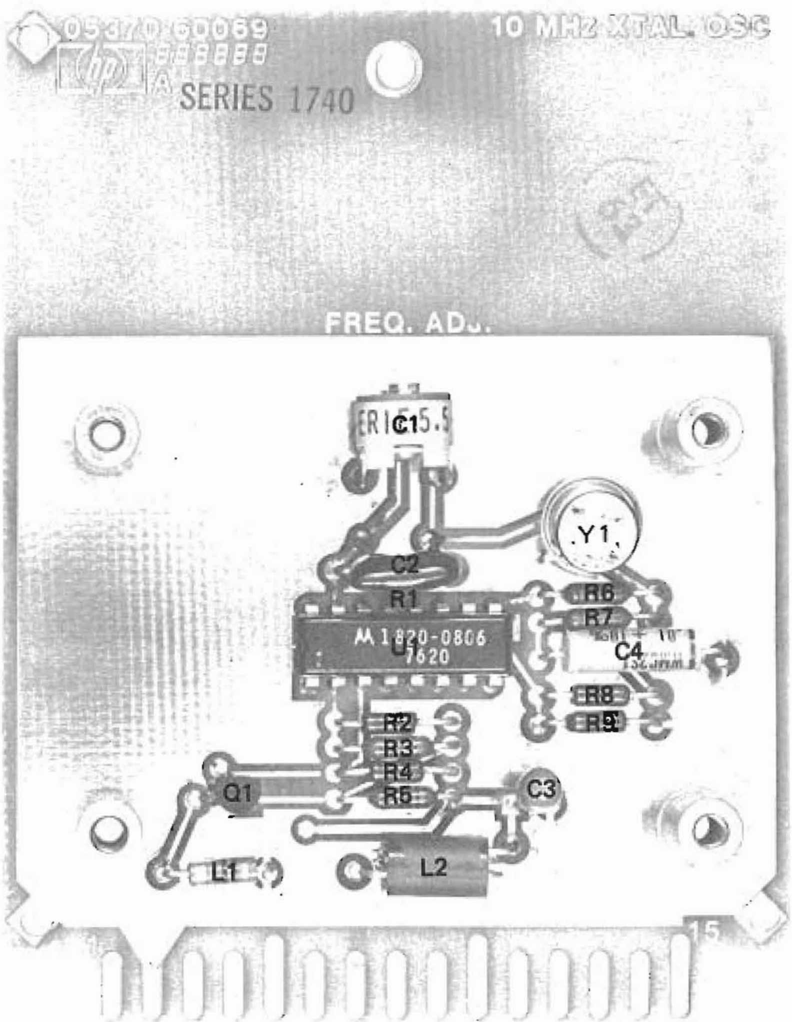


Figure 7-5. A17 Output Reference Assembly

Figure 7-5
A17 OUTPUT REFERENCE ASSEMBLY

(See Page 7-9)



0537D-60069
10 MHz XTAL. OSC
SERIES 1740
FREQ. ADJ.
C1
Y1
C2
R1
R6
R7
1820-0806
7620
U1
C4
R8
R9
R2
R3
R4
R5
Q1
C3
L1
L2
15

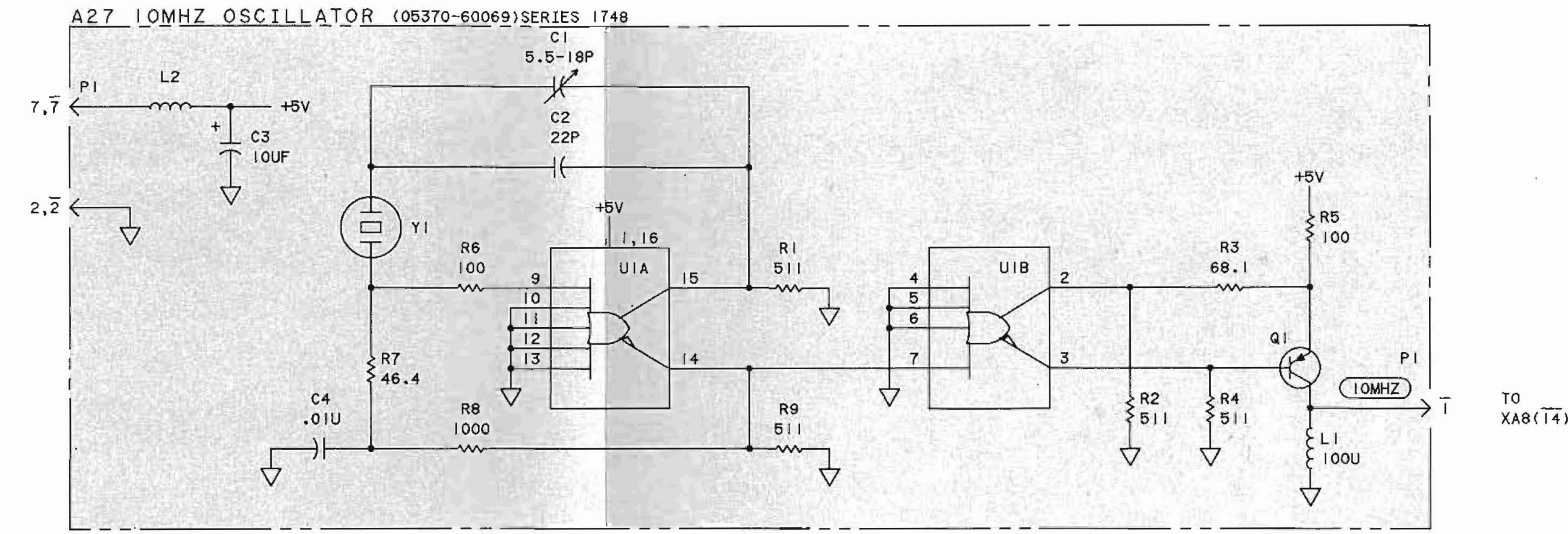


Figure 7-6. A27 10 MHz Crystal Oscillator Assembly

Figure 7-6
A27 10 MHz CRYSTAL OSCILLATOR ASSEMBLY

(See Page 7-11)

A16 TROUBLESHOOTING SIGNATURE SETS
BELOW SERIAL PREFIX 2640A

SIG. SET 1

P1A — $\overline{6}$	UUHA
P1A — 14	CF61
P1A — 4	86H0
P1A — $\overline{10}$	1C9F
P1A — $\overline{9}$	8343
P1A — $\overline{8}$	P76A
P1A — $\overline{7}$	9A6F
P1A — $\overline{11}$	0F46
P1A — 19	86H0
P1A — 5	2661
P1A — $\overline{12}$	91HH
P1A — $\overline{13}$	HPUH
P1A — $\overline{14}$	AF15
P1A — $\overline{19}$	FPPU
P1A — $\overline{20}$	FPPU

SIG. SET 2

P1A — 6	55U4
P1A — 7	3UA5
P1A — 8	5862
P1A — 9	7C12
P1A — 10	6HHP
P1A — 11	AU06
P1A — 12	260C
P1A — 13	43U9

SIG. SET 3

U4 — 7	960F
U4 — 9	17AU
U4 — 10	APC0
U4 — 11	7A36
U4 — 12	3U9F
U4 — 13	1295
U4 — 14	P6C3
U4 — 15	388A

SIG. SET 4

U7 — 7	9290
U7 — 9	1HH3
U7 — 10	8F4P
U7 — 11	88PA
U7 — 12	F947
U7 — 14	4AAA
U7 — 15	64P4

SIG. SET 5

U20 — 2	86H0
U20 — 6	0000
U20 — 11	800A
U20 — 14	1A78

SIG. SET 6

U19 — 10	86H0
U19 — 15	86H0

SIG. SET 7

U16 — 3	0000
U16 — 6	0000
U16 — 11	C605
U16 — 14	PC5C

SIG. SET 8

U15 — 2	86H0
U15 — 6	164F
U15 — 11	0000
U15 — 14	0000

SIG. SET 9

U18 — 3	0000
U18 — 7	86H0
U18 — 11	P0U9
U18 — 14	H9HC

SIG. SET 10

U17 — 3	0000
U17 — 6	70CU
U17 — 11	0000
U17 — 14	0000

SIG. SET 11

U13 — 4	3A4H
U13 — 7	5877
U13 — 9	30F0
U13 — 12	6580

SIG. SET 12

U14 — 4	P0FP
U14 — 7	C9AH
U14 — 9	P894
U14 — 12	7H43

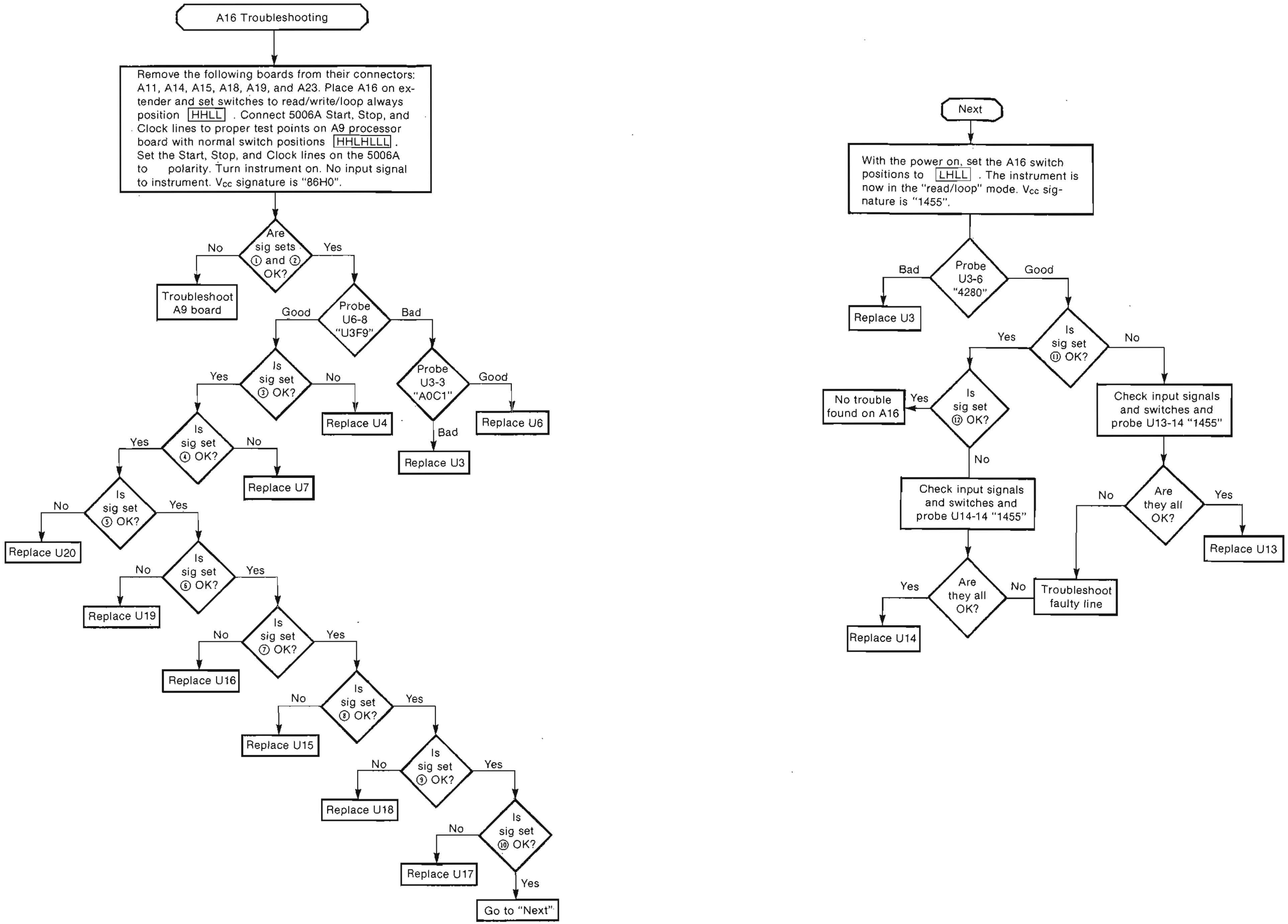


Figure 7-7. A16 Troubleshooting Flowchart

Figure 7-7
A16 TROUBLESHOOTING FLOWCHART

(See Page 7-13)

SECTION VIII
SERVICE

WARNING

LINE VOLTAGE IS EXPOSED WITHIN THE 5359A EVEN WHEN THE POWER SWITCH IS IN THE STBY POSITION. REMOVAL OF THE POWER CORD IS REQUIRED TO FULLY UNPOWER THE 5359A.

8-1. INTRODUCTION

8-2. This section contains the information needed to service the HP Model 5359A. The information includes theory of operation, recommended test equipment, schematic diagram notes, safety considerations, troubleshooting information, service aids, block diagrams, and schematic diagrams. This section includes a cross-reference table, *Table 8-1,* to aid the correlation of assembly reference designations with their HP part numbers.

8-3. THEORY OF OPERATION

8-4. The theory of operation is divided into two parts. First, an overview of the instrument is presented using a simplified block diagram. This discussion introduces the main functional sections and describes particular techniques utilized within the 5359A. Secondly, each individual assembly is discussed in detail using the Overall Block Diagram. The assemblies are discussed in a sequence which complements the basic signal path and functional relationships.

8-5. TROUBLESHOOTING

8-6. Troubleshooting for the 5359A is presented through a series of troubleshooting flowcharts. The flowcharts are self-explanatory, designed to isolate instrument malfunctions to the assembly, and in some cases, the component level. The flowcharts consist of *Figures 8-3* through *8-8,* and are located just prior to the individual assembly schematics.

8-7. The schematic diagrams for all of the assemblies (with the exception of the A2 Motherboard assembly) are located at the end of this section. They are arranged in numerical order according to the assembly number (i.e., A9, A10, A11, etc.) in *Figures 8-9* through *8-28.*

8-8. RECOMMENDED TEST EQUIPMENT

8-9. Test equipment and test equipment accessories required to maintain the 5359A are listed in *Table 1-2.* Equipment other than that listed may be used if it meets the listed critical specifications.

8-10. SCHEMATIC DIAGRAM NOTES

8-11. *Figure 8-1* shows the symbols used on the schematic diagrams. *Figure 8-1* also shows the method for assigning reference designators, assembly numbers, and subassembly numbers.

8-12. Reference Designations

8-13. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc., as shown in *Table 8-1.* As shown in *Figure 8-1,* subassemblies within an assembly are given a subordinate A number. For example, rectifier subassembly A1, has the complete designator A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number, if any. For example, CR1 on the rectifier assembly is designated A25A1CR1.

8-14. Identification Markings on Printed Circuit Boards

8-15. HP printed circuit boards (see *Figure 8-1*) have four identification numbers; an assembly part number, a series number, a revision letter, and a production code. The assembly part number has 10 digits (such as 05359-60021) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1748) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed circuit board is lower than that on the schematic, refer to Section VII for backdating information. If it is higher, refer to the yellow looseleaf manual sheets for this manual. If the manual change sheets are missing, contact your local HP Sales and Service Office. See the listing on the back cover of this manual.

8-16. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four-digit, seven-segment number used for production purposes.

8-17. SAFETY CONSIDERATIONS

8-18. Although the 5359A has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the 5359A in safe operating condition (also see Sections II, III, V). Service and adjustments should be performed only by qualified service personnel.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDING) CONDUCTOR (INSIDE OR OUTSIDE THE 5359A) OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE 5359A DANGEROUS.

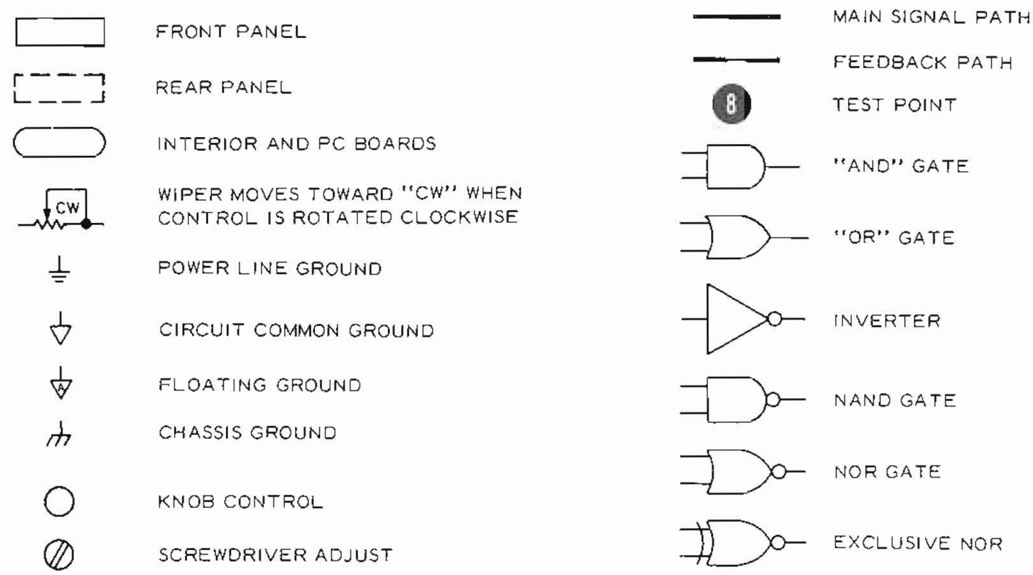
8-19. Any adjustment, maintenance, and repair of the opened 5359A under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved. Capacitors inside the 5359A may still be charged even if the 5359A has been disconnected from its source of power.

WARNING

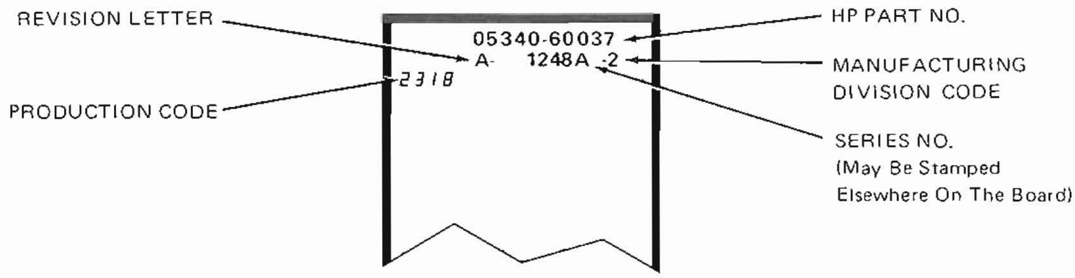
LINE VOLTAGE IS EXPOSED WITHIN THE 5359A EVEN WHEN THE POWER SWITCH IS IN STBY. REMOVAL OF THE POWER CORD IS NECESSARY TO FULLY UNPOWER THE 5359A.

8-20. Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the shortcircuiting of fuseholders must be avoided. Whenever it is likely that this protection has been impaired, the 5359A must be made inoperative and be secured against any unintended operation.

SYMBOLS



PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

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

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

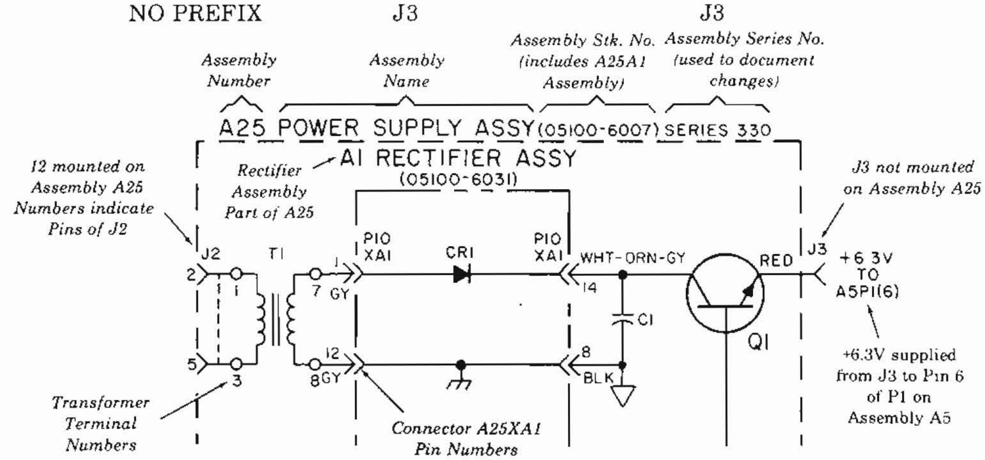


Figure 8-1. Schematic Diagram Notes

WARNING

THE SERVICE INFORMATION IS OFTEN USED WITH POWER SUPPLIED AND PROTECTIVE COVERS REMOVED FROM THE 5359A. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

CAUTION

Series pass transistor cases on rear panel have voltage on them and require insultors between them and the heatsink. Power supply damage is inevitable if transistor cases are shorted to the chassis.

8-21. SERVICE AIDS

8-22. Service Accessory Kit

8-23. A service accessory kit for the 5359A is available for the convenience of troubleshooting and repairing the 5359A. The service accessory kit contains extender boards and a service board (05370-60014). The accessory kit may be obtained from Hewlett-Packard by ordering Service Accessory Kit, Part Number 10870A.

8-24. Pozidriv Screwdrivers

8-25. Many screws in the 5359A appear to be Phillips, but are not. To avoid damage to the screw slots, Pozidriv screwdrivers should be used.

8-26. Service Aids on Printed Circuit Boards

8-27. The servicing aids include test points, transistor and integrated circuit designations, adjustment callouts, and assembly stock numbers.

8-27. Assembly Identification

8-29. The assembly number, name, and Hewlett-Packard part number of 5359A assemblies are listed in *Table 8-1*.

8-30. Signal Distribution

8-31. *Tables 8-2* and *8-3* list the signals used in the 5359A. *Table 8-2* is a list of all signals in alphabetical order, and includes the origin and destinations of each. *Table 8-3* is arranged in numerical order, by assembly number, and lists the signals which enter and exit that individual assembly. Throughout both tables; a dash (—) preceding a mnemonic indicates the signal name is overlined or "notted", and an asterisk (*) following a mnemonic indicates the "origin" of the signal. For all digital signals the move positive of the two voltage states represents the "true" state of the signal name (e.g., the more positive state of the "EVENT ENB" line represents the "event enabled" condition, and the more positive state of "— OUT OF LOCK" represents the "*not* out of lock" condition.

Table 8-1. Assembly Identification

Assembly	Name	Part Number
A1	Power Supply Motherboard	05370-60080
A2	Main Motherboard	05359-60002
A3	NOT ASSIGNED	—
A4	NOT ASSIGNED	—
A5	HP-IB Connector	05370-60005
A6	Power Supply Control	05370-60081
A7	Oven Oscillator Power Supply (Option 001)	05370-60007
A8	Frequency Buffer	05370-60008
A9	Processor	05370-60109
A10	Spare — NOT ASSIGNED	—
A11	Display Interface	05370-60011
A12	NOT ASSIGNED	—
A13	NOT ASSIGNED	—
A14	Service Aid (Part of 10870A Service Accessory Kit)	05370-60014
A15	HP-IB Interface	05370-60015
A16	Processor Interface	05359-60016
A17	Output Reference	05359-60017
A18	Output Amplifier	05359-60018
A19	Auto-Zero	05359-60019
A20	Trigger Amplifier	05359-60020
A21	Analog Timing	05359-60021
A22	Digital Timing	05359-60022
A23	Startable PLL Osc	05359-60023
A24	200 MHz Multiplier	05370-60124
A25	Display and Keyboard	05359-60025
A26	Front Panel Controls	05359-60026
A27	10 MHz Crystal Osc	10811-60111

Table 8-2. Instrument Signal Distribution

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	-(R/W')	A16A 14	
	-(R/W')	BUSA 11	(L(R/W'))
	+15 V	A01 6 *	
	+15 V	A01 - 6 *	
	+15 V	A16B 16	
	+15 V	A16B -16	
	+15 V	A17B 13	
	+15 V	A17B -13	
	+15 V	A18B 13	
	+15 V	A18B -13	
	+15 V	A19B 13	
	+15 V	A19B -13	
	+15 V	A20B 13	
	+15 V	A20B -13	
	+15 V	A21B 13	
	+15 V	A21B -13	
	+15 V	A22B 13 X	(FEED-THROUGH)
	+15 V	A22B -13 X	(FEED-THROUGH)
	+15 V	A23B 13	
	+15 V	A23B -13	
	+15 V	A24B 11	
	+15 V	A24B -11	
	+15 V	BUSB 11	
	+15 V	BUSB -11	
	+5 V	A01 5 *	
	+5 V	A01 - 5 *	
	+5 V	A16B 18	
	+5 V	A16B -18	
	+5 V	A17B 15	
	+5 V	A17B -15	
	+5 V	A18B 15	
	+5 V	A18B -15	
	+5 V	A19B 15	
	+5 V	A19B -15	
	+5 V	A20B 15	
	+5 V	A20B -15	
	+5 V	A21B 15	
	+5 V	A21B -15	
	+5 V	A22B 15	
	+5 V	A22B -15	
	+5 V	A23B 15	
	+5 V	A23B -15	
	+5 V	A24B 15	
	+5 V	A24B -15	
	+5 V	BUSB 15	
	+5 V	BUSB -15	
	-15 V	A01 2 *	
	-15 V	A01 - 2 *	
	-15 V	A16B 17	
	-15 V	A16B -17	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	-15 V	A17B 14	
	-15 V	A17B -14	
	-15 V	A18B 14	
	-15 V	A18B -14	
	-15 V	A19B 14	
	-15 V	A19B -14	
	-15 V	A20B 14	
	-15 V	A20B -14	
	-15 V	A21B 14	
	-15 V	A21B -14	
	-15 V	A22B 14	
	-15 V	A22B -14	
	-15 V	A23B 14	
	-15 V	A23B -14	
	-15 V	A24B 13	
	-15 V	A24B -13	
	-15 V	BUSB 13	
	-15 V	BUSB -13	
	-5.2 V	A01 3 *	
	-5.2 V	A01 - 3 *	
	-5.2 V	A16B 20	
	-5.2 V	A16B -20	
	-5.2 V	A17B 17	
	-5.2 V	A17B -17	
	-5.2 V	A18B 17	
	-5.2 V	A18B -17	
	-5.2 V	A19B 17	
	-5.2 V	A19B -17	
	-5.2 V	A20B 17	
	-5.2 V	A20B -17	
	-5.2 V	A21B 17	
	-5.2 V	A21B -17	
	-5.2 V	A22B 17	
	-5.2 V	A22B -17	
	-5.2 V	A23B 17	
	-5.2 V	A23B -17	
	-5.2 V	A24B 17	
	-5.2 V	A24B -17	
	-5.2 V	BUSB 17	
	-5.2 V	BUSB -17	
	10 MHZ - AZ	A01 *	COAX
	10 MHZ - AZ	A19B 2	COAX
	10 MHZ - CLK	A01 1 *	
	10 MHZ - CLK	BUSB 8	TO A9 AND A10 ONLY
	10 MHZ - CLK	BUSB - 8	TO A9 AND A10 ONLY
	10 MHZ - TB	A01 *	COAX
	10 MHZ - TB	A24B - 8	COAX

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	100 MHZ CLOCK	A22A 6	MICROSTRIP
	100 MHZ CLOCK	A23A - 4 *	MICROSTRIP
	200 MHZ REF	A23A 12	MICROSTRIP
	200 MHZ REF	A24A -11 *	MICROSTRIP
	-A0	A16A - 6	
	-A0	BUSA - 3	(LA0)
	-A1	A16A - 7	
	-A1	BUSA - 4	(LA1)
	-A10	A16A -16 X	(FEED-THROUGH)
	-A10	BUSA -13	(LA10)
	-A11	A16A -17 X	(FEED-THROUGH)
	-A11	BUSA -14	(LA11)
	-A12	A16A -18 X	(FEED-THROUGH)
	-A12	BUSA -15	(LA12)
	-A13	A16A -19	
	-A13	BUSA -16	(LA13)
	-A14	A16A -20	
	-A14	BUSA -17	(LA14)
	-A15	A16A -21 X	(FEED-THROUGH)
	-A15	BUSA -18	(LA15)
	-A2	A16A - 8	
	-A2	BUSA - 5	(LA2)
	-A3	A16A - 9	
	-A3	BUSA - 6	(LA3)
	-A4	A16A -10	
	-A4	BUSA - 7	(LA4)
	-A5	A16A -11	
	-A5	BUSA - 8	(LA5)
	-A6	A16A -12	
	-A6	BUSA - 9	(LA6)
	-A7	A16A -13	
	-A7	BUSA -10	(LA7)
	-A8	A16A -14	
	-A8	BUSA -11	(LA8)

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD	-A9	A16A -15 X	(FEED-THROUGH)
	-A9	BUSA -12	(LA9)
	A<B	A16B - 9	
	A<B	A19A - 3 *	
	AMPL POT - BOT	A17A - 2 *	
	AMPL POT - BOT	J1 14	
	AMPL POT - TOP	A17A 1 *	
	AMPL POT - TOP	J1 12	
	AMPLITUDE	A16A - 2 *	
	AMPLITUDE	A17A - 1	
	-ANALOG DELAY	A16B 13 *	
	-ANALOG DELAY	A20B 12 X	(FEED-THROUGH)
	-ANALOG DELAY	A20B -12 X	(FEED-THROUGH)
	-ANALOG DELAY	A21B -12	
	-ANALOG WIDTH	A16B -13 *	
	-ANALOG WIDTH	A21B 12	
	AUTO ZERO	A16A 3 *	
	AUTO ZERO	A19A -17	
	AUTO ZERO	A22A - 1	
	-BALANCE PREC	A16B 8 *	
	-BALANCE PREC	A19A - 2	
	-BALANCED	A16B 6	
	-BALANCED	A19A 3 *	
	CAL TRIG	A19A 14 *	MICROSTRIP
	CAL TRIG	A20A -14	MICROSTRIP
	CAL TRIG DISABLE	A19A 16 *	
	CAL TRIG DISABLE	A20A -16	
	COMP	A16B 11 *	
	COMP	A17A - 5	
	COUNT ENB	A22A 17	MICROSTRIP
	COUNT ENB	A23A 18 *	MICROSTRIP
	CYCLE COMPLETE	A16A 2	
	CYCLE COMPLETE	A22B - 1 *	
	-D0	A16A 6	(LSB)
	-D0	A21B 4	(LSB)

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	-D0	A21B - 4	(LSB)
	-D0	A22A - 2	(SR DATA)
	-D0	A22B 4 X	(FEED-THROUGH)
	-D0	A22B - 4 X	(FEED-THROUGH)
	-D0	A23B - 4 X	(FEED-THROUGH)
	-D0	BUSA 3	(LD0)
	-D1	A16A 7	
	-D1	A21B 5	
	-D1	A21B - 5	
	-D1	BUSA 4	(LD1)
	-D2	A16A 8	
	-D2	A21B 6	
	-D2	A21B - 6	
	-D2	BUSA 5	(LD2)
	-D3	A16A 9	
	-D3	A21B 7	
	-D3	A21B - 7	
	-D3	BUSA 6	(LD3)
	-D4	A16A 10	
	-D4	A21B 8	
	-D4	A21B - 8	
	-D4	BUSA 7	(LD4)
	-D5	A16A 11	
	-D5	A21B 9	
	-D5	A21B - 9	
	-D5	BUSA 8	(LD5)
	-D6	A16A 12	
	-D6	A21B 10	
	-D6	A21B -10	
	-D6	BUSA 9	(LD6)
	-D7	A16A 13	(MSB)
	-D7	A21B 11	(MSB)
	-D7	A21B -11	(MSB)
	-D7	BUSA 10	(LD7)
	-DELAY CLOCK	A16B 2 *	
	-DELAY CLOCK	A22A - 3	
	DELAYED SYNC	A20A 17	MICROSTRIP
	DELAYED SYNC	A22A -18 *	MICROSTRIP
	EDGE 1 OUT	A21A -16 *	COAX
	EDGE 1 OUT	RP B	COAX
	EDGE 2 OUT	A21A -10 *	COAX
	EDGE 2 OUT	RP C	COAX

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	ENB CAL REF	A16B 7 *	
	ENB CAL REF	A19A 1	
	ENB PROBES SW	A16B -15	
	ENB PROBES SW	RPW F *	BRN/GRN
	ENB DIGITAL DELAY	A21A 17	MICROSTRIP
	ENB DIGITAL DELAY	A22A -16 *	MICROSTRIP
	ENB DIGITAL WIDTH	A21A 15	
	ENB DIGITAL WIDTH	A22A -14 *	MICROSTRIP
	EVENT ENB	A16B - 1 *	
	EVENT ENB	A22A 3	MICROSTRIP
	EVENTS CLOCK	A21A 8 *	MICROSTRIP
	EVENTS CLOCK	A22A - 8	MICROSTRIP
	EVENTS IN	A21A - 1	COAX
	EVENTS IN	RP A *	COAX
	EVENTS POT - BOT	A21A - 3 *	
	EVENTS POT - BOT	RPW B	BLK/ORN
	EVENTS POT - TAP	A21A - 4	
	EVENTS POT - TAP	RPW A *	BLK/RED
	EVENTS POT - TOP	A21A - 2 *	
	EVENTS POT - TOP	RPW C	BLK/BRN
	EVT NEG EDGE ENB	A16A 22 *	
	EVT NEG EDGE ENB	A22A 4	
	EVTS SLOPE NEG SW	A16B 15	
	EVTS SLOPE NEG SW	RPW E *	BRN/YEL
	EXT ENB	A16B - 4 *	
	EXT ENB	A2ØA 5	
	EXT STD SW	AØ1 *	JUMPER WIRE
	EXT STD SW	A16B 22	
	EXT TRIG INPUT	A2ØA 1	COAX
	EXT TRIG INPUT	FP *	COAX
	EXT X	A16B 14 *	
	EXT X	RPW D	BLK/VIO
	EXT Y	A16B -14 *	
	EXT Y	RPW G	BLK/GRY
	GND	AØ1 4 *	
	GND	AØ1 - 4 *	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	GND	A16B 19	+5 V RETURN (FEED-THROUGH)
	GND	A16B -19	+5 V RETURN (FEED-THROUGH)
	GND	A16B 21	
	GND	A16B -21	
	GND	A17B 16 X	+5 V RETURN
	GND	A17B -16 X	+5 V RETURN
	GND	A17B 18	
	GND	A17B -18	
	GND	A18A 1	
	GND	A18A - 1	
	GND	A18A - 2	
	GND	A18A 3	
	GND	A18A - 3	
	GND	A18A 4	
	GND	A18A - 4	
	GND	A18A 5	
	GND	A18A - 5	
	GND	A18A - 6	
	GND	A18A 7	
	GND	A18A - 7	
	GND	A18A 9	
	GND	A18A - 9	
	GND	A18A -10	
	GND	A18A 11	
	GND	A18A -11	
	GND	A18A 13	
	GND	A18A -13	
	GND	A18A -14	
	GND	A18A 15	
	GND	A18A -15	
	GND	A18A 17	
	GND	A18A -17	
	GND	A18A -18	
	GND	A18B 1	
	GND	A18B - 1	
	GND	A18B 2	
	GND	A18B 3	
	GND	A18B - 3	
	GND	A18B 16 X	+5 V RETURN (FEED-THROUGH)
	GND	A18B -16 X	+5 V RETURN (FEED-THROUGH)
	GND	A18B 18	
	GND	A18B -18	
	GND	A19A - 4	
	GND	A19A 5	
	GND	A19A - 6	
	GND	A19A 7	
	GND	A19A 8	
	GND	A19A - 8	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2) *****CONTINUED*****	GND	A19A - 9	
	GND	A19A 10	
	GND	A19A -10	
	GND	A19A 11	
	GND	A19A -11	
	GND	A19A -12	
	GND	A19A 13	
	GND	A19A -13	
	GND	A19A -14	
	GND	A19A 15	
	GND	A19A -15	
	GND	A19A 18 X	(FEED-THROUGH)
	GND	A19A -18 X	(FEED-THROUGH)
	GND	A19B 1	
	GND	A19B - 1	
	GND	A19B - 2	
	GND	A19B 3	
	GND	A19B - 3	
	GND	A19B 16	+5 V RETURN
	GND	A19B -16	+5 V RETURN
	GND	A19B 18	
	GND	A19B -18	
	GND	A20A 2	
	GND	A20A 12	
	GND	A20A -12	
	GND	A20A -13 X	(FEED-THROUGH)
	GND	A20A 14 X	(FEED-THROUGH)
	GND	A20A 15	
	GND	A20A -15	
	GND	A20A 16 X	(FEED-THROUGH)
	GND	A20A -17 X	(FEED-THROUGH)
	GND	A20A 18 X	(FEED-THROUGH)
	GND	A20B 1	
	GND	A20B - 1	
	GND	A20B 2 X	(FEED-THROUGH)
	GND	A20B 3	
	GND	A20B - 3	
	GND	A20B 16 X	+5 V RETURN (FEED-THROUGH)
	GND	A20B -16 X	+5 V RETURN (FEED-THROUGH)
	GND	A20B 18	
	GND	A20B -18	
	GND	A21A 1	
	GND	A21A 7	
	GND	A21A - 7	
	GND	A21A - 8	
	GND	A21A 9	
	GND	A21A - 9	
	GND	A21A 10	
	GND	A21A 11	
	GND	A21A -11	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2) *****CONTINUED*****	GND	A21A -12	
	GND	A21A 13	
	GND	A21A 14	
	GND	A21A -14	
	GND	A21A -15	
	GND	A21A 16	
	GND	A21A -17	
	GND	A21A 18	
	GND	A21A -18	
	GND	A21B 16 X	+5 V RETURN (FEED-THROUGH)
	GND	A21B -16 X	+5 V RETURN (FEED-THROUGH)
	GND	A21B 18	
	GND	A21B -18	
	GND	A22A 5	
	GND	A22A - 6	
	GND	A22A 7	
	GND	A22A - 7	
	GND	A22A 8	
	GND	A22A 9	
	GND	A22A - 9	
	GND	A22A 10	
	GND	A22A -10	
	GND	A22A 12	
	GND	A22A -12	
	GND	A22A 13	
	GND	A22A -13	
	GND	A22A 14	
	GND	A22A 15	
	GND	A22A -15	
	GND	A22A 16	
	GND	A22A -17	
	GND	A22A 18	
	GND	A22B 16 X	+5 V RETURN (FEED-THROUGH)
	GND	A22B -16 X	+5 V RETURN (FEED-THROUGH)
	GND	A22B 18	
	GND	A22B -18	
	GND	A23A 1	
	GND	A23A - 1	
	GND	A23A - 2 X	(FEED-THROUGH)
	GND	A23A 3	
	GND	A23A - 3	
	GND	A23A 4 X	(FEED-THROUGH)
	GND	A23A 5	
	GND	A23A - 5	
	GND	A23A 11	
	GND	A23A -11	
	GND	A23A -12 X	(FEED-THROUGH)
	GND	A23A 13	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	GND	A23A -13	
	GND	A23A 17	
*****CONTINUED*****	GND	A23A -17	
	GND	A23A -18 X	(FEED-THROUGH)
	GND	A23B 16 X	+5 V RETURN (FEED-THROUGH)
	GND	A23B -16 X	+5 V RETURN (FEED-THROUGH)
	GND	A23B 18	
	GND	A23B -18	
	GND	A24A 10	
	GND	A24A -10	
	GND	A24A 11	
	GND	A24A 12	
	GND	A24A -12	
	GND	A24A 13	
	GND	A24A -13	
	GND	A24A 14	
	GND	A24A 15	
	GND	A24A -15	
	GND	A24B 2	
	GND	A24B - 2	
	GND	A24B 3	
	GND	A24B 4	
	GND	A24B - 4	
	GND	A24B 7	
	GND	A24B - 7	
	GND	A24B 8	
	GND	A24B 9	
	GND	A24B - 9	
	GND	A24B 16	+5 V RETURN
	GND	A24B -16	+5 V RETURN
	GND	A24B 18	
	GND	A24B -18	
	GND	BUSB 7	TO A9 AND A10 ONLY
	GND	BUSB - 7	TO A9 AND A10 ONLY
	GND	BUSB 12	+15 V RETURN
	GND	BUSB -12	+15 V RETURN
	GND	BUSB 14	-15 V RETURN
	GND	BUSB -14	-15 V RETURN
	GND	BUSB 16	+5 V RETURN
	GND	BUSB -16	+5 V RETURN
	GND	BUSB 18	
	GND	BUSB -18	
	GND	J1 1	
	GND (UNUSED)	A21A 2	NO CONNECTION
	H02	A16A 4	
	H02	BUSA 1	
	HEN	A16A 19	
	HEN	BUSA 16	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2) *****CONTINUED*****	HRUN	A16A 18 X	(FEED-THROUGH)
	HRUN	BUSA 15	
	IAMPL	A17B 9 *	
	IAMPL	A17B - 9 *	
	IAMPL	A18B 9	
	IAMPL	A18B - 9	
	IDRIVE	A17B 7 *	
	IDRIVE	A17B - 7 *	
	IDRIVE	A18B 7	
	IDRIVE	A18B - 7	
	INT ENB	A16B 4 *	
	INT ENB	A20A 4	
	-INT ENB -- ECL	A19A 6	
	-INT ENB -- ECL	A20A - 7 *	
	-INT TRIG	A20A 13	MICROSTRIP
	-INT TRIG	A21A -13 *	MICROSTRIP
	INT TRIG DISABLE	A19A 4 *	
	INT TRIG DISABLE	A20A - 4	
	IOFF	A17B 4 *	
	IOFF	A17B - 4 *	
	IOFF	A18B 4	
	IOFF	A18B - 4	
	-IRQ	A16A 16 X	(FEED-THROUGH)
	-IRQ	BUSA 13	(LIRQ)
	-LOCK	A16A -22 *	
	-LOCK	A23B 11	
	LOCK FIX	A16B -10 *	
	LOCK FIX	A23B 3	
	LOGIC RETURN	A16A - 4	
	LOGIC RETURN	BUSA - 1	
	-MANUAL TRIG	A16B - 5 *	
	-MANUAL TRIG	A20A 3	
	NEG	A16B -11 *	
	NEG	A17A 4	
	NEG - ECL	A17A 8 X	(FEED-THROUGH)
	NEG - ECL	A17A - 8 *	
	NEG - ECL	A18A 8	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	-NMI	A16A 17 X	(FEED-THROUGH)
	-NMI	BUSA 14	(LNMI)
	NURM - ECL	A17A 9 X	(FEED-THROUGH)
	NURM - ECL	A17A - 9 *	
	NURM - ECL	A18A - 8	
	OFFSET	A16A - 1 *	
	OFFSET	A17A 2	
	OFFSET OFF	A16B -12 *	
	OFFSET OFF	A17A - 4	
	OFFSET POT - BOT	A17A 3 *	
	OFFSET POT - BOT	J1 16	
	OFFSET POT - TOP	A17A - 3 *	
	OFFSET POT - TOP	J1 7	
	-OUT OF LOCK	A16B 12	
	-OUT OF LOCK	A24A -18 *	
	OUTPUT DISABLE	A16B - 7 *	
	OUTPUT DISABLE	A17A 6	
	OUTPUT DISABLE	A19A 2	
	OUTPUT ENB (RLY)	A17A 12 X	(FEED-THROUGH)
	OUTPUT ENB (RLY)	A17A -12 *	
	OUTPUT ENB (RLY)	A18A 16	
	OVEN TEMP OK	A01 - 1 *	
	OVEN TEMP OK	A16B -22	
	PERIOD DISABLE	A16B - 6 *	
	PERIOD DISABLE	A20A - 6	
	-PULSE	A18B - 2	COAX
	-PULSE	A21A 12 *	COAX
	PULSE OUTPUT	A18A 14 *	COAX
	PULSE OUTPUT	FP	COAX
	-RELOAD	A16B 1 *	
	-RELOAD	A22A 2	
	-RST	A16A 21 X	(FEED-THROUGH)
	-RST	BUSA 18	(LRST)
	SFS	A16B 9 *	
	SFS	A17A 5	
	SFS (RELAY)	A17A 10 X	(FEED-THROUGH)
	SFS (RELAY)	A17A -10 *	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	SFS (RELAY)	A18A -12	
	SINGLE CYCLE ENB	A16A 1 *	
	SINGLE CYCLE ENB	A22B 1	
	SP-	A16B 10 *	
	SP-	A17A - 6	
	SP- (RELAY)	A17A 11 X	(FEED-THROUGH)
	SP- (RELAY)	A17A -11 *	
	SP- (RELAY)	A18A 12	
	SPARE 1	A16A 15	UNUSED
	SPARE 1	BUSA 12	UNUSED
	SPARE 2	A16A 20	UNUSED
	SPARE 2	BUSA 17	UNUSED
	SPARE 3	A16A - 5	UNUSED
	SPARE 3	BUSA - 2	UNUSED
	SPARE 4	BUSB - 9	TO A9 AND A10 ONLY
	SPARE 5	BUSB 9	TO A9 AND A10 ONLY
	SPARE 6	BUSB -10	TO A9 AND A10 ONLY
	SPARE 7	BUSB 10	TO A9 AND A10 ONLY
	START	A20B - 2 *	COAX
	START	A23A 2	COAX
	-START PREC	A16B - 8 *	
	-START PREC	A19A - 1	
	START PROBE	A19A 12	COAX
	START PROBE	RP D *	COAX
	-START TRIG	A16B - 2 *	
	-START TRIG	A21A 4	
	-START TRIG	A22A 1 X	(FEED-THROUGH)
	STOP PROBE	A19A 9	COAX
	STOP PROBE	RP E *	COAX
	SYNC	A18A 18	MICROSTRIP
	SYNC	A20A -18 *	MICROSTRIP
	SYNC DELAY ENB	A16B 3 *	
	SYNC DELAY ENB	A20A 6	
	SYNC DELAY ENB	A22A - 5	

Table 8-2. Instrument Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
MAIN MOTHER BOARD (A2)	SYNC OUTPUT	A18A 2 *	COAX
	SYNC OUTPUT	FP	COAX
	TRIG A	A18A 6 *	MICROSTRIP
	TRIG A	A19A - 5	MICROSTRIP
	TRIG B	A18A 10 *	MICROSTRIP
	TRIG B	A19A - 7	MICROSTRIP
	-TRIG HOLDOFF	A22A 11 *	
	-TRIG HOLDOFF	A23A 6	
	TRIG LEVEL - BOT	A20A - 1 *	
	TRIG LEVEL - BOT	J1 6	
	TRIG LEVEL - TAP	A20A - 3	
	TRIG LEVEL - TAP	J1 5 *	
	TRIG LEVEL - TOP	A20A - 2 *	
	TRIG LEVEL - TOP	J1 4	
	TRIG SLOPE +	A16B 5 *	
	TRIG SLOPE +	A20A - 5	
	TRL	A17A 17 *	
	TRL	A17A -17 X	(FEED-THROUGH)
	TRL	A18A -16	
	VCO	A23A 10 *	
	VCO	A24B 1	
	VCO (UNUSED)	A24B - 1	NO CONNECTION
	-VMA	A16A 5	
	-VMA	BUSA 2	(LVMA)
	VS1	A17B 12 *	
	VS1	A17B -12 *	
	VS1	A18B 12	
	VS1	A18B -12	
	VS2	A17B 5 *	
	VS2	A17B - 5 *	
	VS2	A18B 5	
	VS3	A17B 6 *	
	VS3	A17B - 6 *	
	VS3	A18B - 5	
	-WIDTH CLOCK	A16B - 3 *	
	-WIDTH CLOCK	A22A - 4	
	END OF LIST		

Figure 8-3. Assembly Signal Distribution

Descriptions	Signals	Assembly Destinations	Comments
PWR SUP MOTHER BD	10 MHZ - AZ	A01	* COAX
	10 MHZ - TB	A01	* COAX
	EXT STD SW	A01	* JUMPER WIRE
	10 MHZ - CLK	A01 1	*
	OVEN TEMP OK	A01 - 1	*
	-15 V	A01 2	*
	-15 V	A01 - 2	*
	-5.2 V	A01 3	*
	-5.2 V	A01 - 3	*
	GND	A01 4	*
	GND	A01 - 4	*
	+5 V	A01 5	*
	+5 V	A01 - 5	*
	+15 V	A01 6	*
	+15 V	A01 - 6	*
PROCESSOR I/F	SINGLE CYCLE ENB	A16A 1	*
	OFFSET	A16A - 1	*
	CYCLE COMPLETE	A16A 2	
	AMPLITUDE	A16A - 2	*
	AUTO ZERO	A16A 3	*
	H02	A16A 4	
	LOGIC RETURN	A16A - 4	
	-VMA	A16A 5	
	SPARE 3	A16A - 5	UNUSED
	-D0	A16A 6	(LSB)
	-A0	A16A - 6	
	-D1	A16A 7	
	-A1	A16A - 7	
	-D2	A16A 8	
	-A2	A16A - 8	
	-D3	A16A 9	
	-A3	A16A - 9	
	-D4	A16A 10	
	-A4	A16A -10	
	-D5	A16A 11	
	-A5	A16A -11	
	-D6	A16A 12	
	-A6	A16A -12	
	-D7	A16A 13	(MSB)
	-A7	A16A -13	
	-(R/W')	A16A 14	
	-A8	A16A -14	
	SPARE 1	A16A 15	UNUSED
	-A9	A16A -15	X (FEED-THROUGH)
	-IRQ	A16A 16	X (FEED-THROUGH)
	-A10	A16A -16	X (FEED-THROUGH)
	-NMI	A16A 17	X (FEED-THROUGH)
	-A11	A16A -17	X (FEED-THROUGH)
	HRUN	A16A 18	X (FEED-THROUGH)
		A16A -18	X (FEED-THROUGH)

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
****CONTINUED****	HLN	A16A 19	UNUSED
	-A13	A16A -19	
	SPARE 2	A16A 20	X (FEED-THROUGH)
	-A14	A16A -20	X (FEED-THROUGH)
	-RST	A16A 21	*
	-A15	A16A -21	*
	EVT NEG EDGE ENB	A16A 22	
	-LOCK	A16A -22	*
			*
	-RELOAD	A16B 1	*
	EVENT ENB	A16B - 1	*
	-DELAY CLOCK	A16B 2	*
	-START TRIG	A16B - 2	*
	SYNC DELAY ENB	A16B 3	*
	-WIDTH CLOCK	A16B - 3	*
	INT ENB	A16B 4	**********
	EXT ENB	A16B - 4	
	TRIG SLOPE +	A16B 5	*
	-MANUAL TRIG	A16B - 5	*
	-BALANCED	A16B 6	
	PERIOD DISABLE	A16B - 6	*
	ENB CAL REF	A16B 7	*
	OUTPUT DISABLE	A16B - 7	*
	-BALANCE PREC	A16B 8	*
	-START PREC	A16B - 8	*
	SFS	A16B 9	*
	A<B	A16B - 9	
	SP-	A16B 10	*
	LOCK FIX	A16B -10	*
	COMP	A16B 11	*
	HLC	A16B -11	*
	-OUT OF LOCK	A16B 12	
	OFFSET OFF	A16B -12	*
	-ANALOG DELAY	A16B 13	*
	-ANALOG WIDTH	A16B -13	*
	EXT X	A16B 14	*
	EXT Y	A16B -14	*
	EVTS SLOPE NEG SW	A16B 15	
	ENB PROBES SW	A16B -15	
	+15 V	A16B 16	
	+15 V	A16B -16	
	-15 V	A16B 17	
	-15 V	A16B -17	
	+5 V	A16B 18	
	+5 V	A16B -18	
	GND	A16B 19	+5 V RETURN
	GND	A16B -19	+5 V RETURN
	-5.2 V	A16B 20	
	-5.2 V	A16B -20	

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
OUTPUT	GND	A18A 1	
	GND	A18A - 1	
	SYNC OUTPUT	A18A 2	* COAX
	GND	A18A - 2	
	GND	A18A 3	
	GND	A18A - 3	
	GND	A18A 4	
	GND	A18A - 4	
	GND	A18A 5	
	GND	A18A - 5	
	TRIG A	A18A 6	* MICROSTRIP
	GND	A18A - 6	
	GND	A18A 7	
	GND	A18A - 7	
	NEG - ECL	A18A 8	
	NORM - ECL	A18A - 8	
	GND	A18A 9	
	GND	A18A - 9	
	TRIG B	A18A 10	* MICROSTRIP
	GND	A18A -10	
	GND	A18A 11	
	GND	A18A -11	
	SP- (RELAY)	A18A 12	
	SPS (RELAY)	A18A -12	
	GND	A18A 13	
	GND	A18A -13	
	PULSE OUTPUT	A18A 14	* COAX
	GND	A18A -14	
	GND	A18A 15	
	GND	A18A -15	
	OUTPUTENB(RLY)	A18A 16	
	TRL	A18A -16	
	GND	A18A 17	
	GND	A18A -17	
	SYNC	A18A 18	MICROSTRIP
	GND	A18A -18	
	GND	A18B 1	
	GND	A18B - 1	
	GND	A18B 2	
	-PULSE	A18B - 2	COAX
	GND	A18B 3	
	GND	A18B - 3	
	IOFF	A18B 4	
	IOFF	A18B - 4	
	VS2	A18B 5	
	VS3	A18B - 5	
	IDRIVE	A18B 7	
	IDRIVE	A18B - 7	
	IAMPL	A18B 9	
	IAMPL	A18B - 9	
	VS1	A18B 12	

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	GND	A16B 21	
	GND	A16B -21	
	EXT STD SW	A16B 22	
******************	OVEN TEMP OK	A16B -22	
OUTPUT CONTROL	AMPL POT - TOP	A17A 1	*
	AMPLITUDE	A17A - 1	
	OFFSET	A17A 2	
	AMPL POT - BOT	A17A - 2	*
	OFFSET POT-BOT	A17A 3	*
	OFFSET POT-TOP	A17A - 3	*
	NEG	A17A 4	
	OFFSET OFF	A17A - 4	
	SFS	A17A 5	
	COMP	A17A - 5	
	OUTPUT DISABLE	A17A 6	
	SP-	A17A - 6	
	NEG - ECL	A17A 8	X (FEED-THROUGH)
	NEG - ECL	A17A - 8	*
	NORM - ECL	A17A 9	X (FEED-THROUGH)
	NORM - ECL	A17A - 9	*
	SFS (RELAY)	A17A 10	X (FEED-THROUGH)
	SFS (RELAY)	A17A -10	*
	SP- (RELAY)	A17A 11	X (FEED-THROUGH)
	SP- (RELAY)	A17A -11	*
	OUTPUT ENB(RLY)	A17A 12	X (FEED-THROUGH)
	OUTPUT ENB(RLY)	A17A -12	*
	TRL	A17A 17	*
	TRL	A17A -17	X (FEED-THROUGH)
	IOFF	A17B 4	*
	IOFF	A17B - 4	*
	VS2	A17B 5	*
	VS2	A17B - 5	*
	VS3	A17B 6	*
	VS3	A17B - 6	*
	IDRIVE	A17B 7	*
	IDRIVE	A17B - 7	*
	IAMPL	A17B 9	*
	IAMPL	A17B - 9	*
	VS1	A17B 12	*
	VS1	A17B -12	*
	+15 V	A17B 13	
	+15 V	A17B -13	
	-15 V	A17B 14	
	-15 V	A17B -14	
	+5 V	A17B 15	
	+5 V	A17B -15	
	GND	A17B 16	X+5V RTN(FEED-THROUGH)
	GND	A17B -16	X+5V RTN(FEED-THROUGH)
	-5.2 V	A17B 17	
	-5.2 V	A17B -17	
	GND	A17B 18	
	GND	A17B -18	

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
*****CONTINUED*****	VS1	A18B -12	
	+15 V	A18B 13	
	+15 V	A18B -13	
	-15 V	A18B 14	
	-15 V	A18B -14	
	+5 V	A18B 15	
	+5 V	A18B -15	
	GND	A18B 16	X+5V RTN(FEED-THROUGH)
	GND	A18B -16	X+5V RTN(FEED-THROUGH)
	-5.2 V	A18B 17	
	-5.2 V	A18B -17	
	GND	A18B 18	
	GND	A18B -18	
AUTO ZERO	ENB CAL REF	A19A 1	
	-START PREC	A19A - 1	
	OUTPUT DISABLE	A19A 2	
	-BALANCE PREC	A19A - 2	
	-BALANCED	A19A 3	*
	A<B	A19A - 3	*
	INT TRIG DISABLE	A19A 4	*
	GND	A19A - 4	
	GND	A19A 5	
	TRIG A	A19A - 5	MICROSTRIP
	-INT ENB --ECL	A19A 6	
	GND	A19A - 6	
	GND	A19A 7	
	TRIG B	A19A - 7	MICROSTRIP
	GND	A19A 8	
	GND	A19A - 8	
	STOP PROBE	A19A 9	COAX
	GND	A19A - 9	
	GND	A19A 10	
	GND	A19A -10	
	GND	A19A 11	
	GND	A19A -11	
	START PROBE	A19A 12	COAX
	GND	A19A -12	
	GND	A19A 13	
	GND	A19A -13	
	CAL TRIG	A19A 14	* MICROSTRIP
	GND	A19A -14	
	GND	A19A 15	
	GND	A19A -15	
	CAL TRIG DISABLE	A19A 16	*
	AUTO ZERO	A19A -17	
	GND	A19A 18	X (FEED-THROUGH)
	GND	A19A -18	X (FEED-THROUGH)

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	GND	A19B 1	
	GND	A19B - 1	
	10 MHZ - AZ	A19B 2	COAX
	GND	A19B - 2	
	GND	A19B 3	
	GND	A19B - 3	
	+15 V	A19B 13	
	+15 V	A19B -13	
	-15 V	A19B 14	
	-15 V	A19B -14	
	+5 V	A19B 15	
	+5 V	A19B -15	
	GND	A19B 16	+5 V RETURN
	GND	A19B -16	+5 V RETURN
	-5.2 V	A19B 17	
	-5.2 V	A19B -17	
	GND	A19B 18	
	GND	A19B -18	
TRIGGER AMP	EXT TRIG INPUT	A20A 1	COAX
	TRIG LEVEL -BOT	A20A - 1	*
	GND	A20A 2	
	TRIG LEVEL -TOP	A20A - 2	*
	-MANUAL TRIG	A20A 3	
	TRIG LEVEL -TAP	A20A - 3	
	INT ENB	A20A 4	
	INT TRIG DISABLE	A20A - 4	
	EXT ENB	A20A 5	
	TRIG SLOPE +	A20A - 5	
	SYNC DELAY ENB	A20A 6	
	PERIOD DISABLE	A20A - 6	
	-INT ENB -- ECL	A20A - 7	*
	GND	A20A 12	
	GND	A20A -12	
	-INT TRIG	A20A 13	MICROSTRIP
	GND	A20A -13	X (FEED-THROUGH)
	GND	A20A 14	X (FEED-THROUGH)
	CAL TRIG	A20A -14	MICROSTRIP
	GND	A20A 15	
	GND	A20A -15	
	GND	A20A 16	X (FEED-THROUGH)
	CAL TRIG DISABLE	A20A -16	
	DELAYED SYNC	A20A 17	MICROSTRIP
	GND	A20A -17	X (FEED-THROUGH)
	GND	A20A 18	X (FEED-THROUGH)
	SYNC	A20A -18	* MICROSTRIP

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	GND	A20B 1	
	GND	A20B - 1	
	GND	A20B 2	X (FEED-THROUGH)
	START	A20B - 2	* COAX
	GND	A20B 3	
	GND	A20B - 3	
	-ANALOG DELAY	A20B 12	X (FEED-THROUGH)
	-ANALOG DELAY	A20B -12	X (FEED-THROUGH)
	+15 V	A20B 13	
	+15 V	A20B -13	
	-15 V	A20B 14	
	-15 V	A20B -14	
	+5 V	A20B 15	
	+5 V	A20B -15	
	GND	A20B 16	X +5 V RTN(FEED-THROUGH)
	GND	A20B -16	X +5 V RTN(FEED-THROUGH)
	-5.2 V	A20B 17	
	-5.2 V	A20B -17	
	GND	A20B 18	
	GND	A20B -18	
ANALOG TIMING	GND	A21A 1	
	EVENTS IN	A21A - 1	COAX
	GND (UNUSED)	A21A 2	NO CONNECTION
	EVENTS POT - TOP	A21A - 2	*
	EVENTS POT - BOT	A21A - 3	*
	-START TRIG	A21A 4	
	EVENTS POT - TAP	A21A - 4	
	GND	A21A 7	
	GND	A21A - 7	
	EVENTS CLOCK	A21A 8	* MICROSTRIP
	GND	A21A - 8	
	GND	A21A 9	
	GND	A21A - 9	
	GND	A21A 10	
	EDGE 2 OUT	A21A -10	* COAX
	GND	A21A 11	
	GND	A21A -11	
	-PULSE	A21A 12	* COAX
	GND	A21A -12	
	GND	A21A 13	
	-INT TRIG	A21A -13	* MICROSTRIP
	GND	A21A 14	
	GND	A21A -14	
	END DIGITAL WIDTH	A21A 15	MICROSTRIP
	GND	A21A -15	
	GND	A21A 16	
	EDGE 1 OUT	A21A -16	* COAX
	END DIGITAL DELAY	A21A 17	MICROSTRIP
	GND	A21A -17	
	GND	A21A 18	
	GND	A21A -18	

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
****CONTINUED****	-D0	A21B 4	(LSB)
	-D0	A21B - 4	(LSB)
	-D1	A21B 5	
	-D1	A21B - 5	
	-D2	A21B 6	
	-D2	A21B - 6	
	-D3	A21B 7	
	-D3	A21B - 7	
	-D4	A21B 8	
	-D4	A21B - 8	
	-D5	A21B 9	
	-D5	A21B - 9	
	-D6	A21B 10	
	-D6	A21B -10	
	-D7	A21B 11	(MSB)
	-D7	A21B -11	(MSB)
	-ANALOG WIDTH	A21B 12	
	-ANALOG DELAY	A21B -12	
	+15 V	A21B 13	
	+15 V	A21B -13	
	-15 V	A21B 14	
	-15 V	A21B -14	
	+5 V	A21B 15	
	+5 V	A21B -15	
	GND	A21B 16	X +5V RTN(FEED-THROUGH)
	GND	A21B -16	X +5V RTN(FEED-THROUGH)
	-5.2 V	A21B 17	
	-5.2 V	A21B -17	
	GND	A21B 18	
	GND	A21B -18	
STARTABLE PLL OSC	GND	A23A 1	
	GND	A23A - 1	
	START	A23A 2	COAX
	GND	A23A - 2	X (FEED-THROUGH)
	GND	A23A 3	
	GND	A23A - 3	
	GND	A23A 4	X (FEED-THROUGH)
	100 MHZ CLOCK	A23A - 4	* MICROSTRIP
	GND	A23A 5	
	GND	A23A - 5	
	-TRIG HOLDOFF	A23A 6	
	VCO	A23A 10	*
	GND	A23A 11	
	GND	A23A -11	
	200 MHZ REF	A23A 12	MICROSTRIP
	GND	A23A -12	X (FEED-THROUGH)
	GND	A23A 13	
	GND	A23A -13	
	GND	A23A 17	
	GND	A23A -17	
	COUNT ENB	A23A 18	* MICROSTRIP
	GND	A23A -18	X (FEED-THROUGH)

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	LOCK FIX	A23B 3	
	-D0	A23B - 4	X (FEED-THROUGH)
	-LOCK	A23B 11	
	+15 V	A23B 13	
	+15 V	A23B -13	
	-15 V	A23B 14	
	-15 V	A23B -14	
	+5 V	A23B 15	
	+5 V	A23B -15	
	GND	A23B 16	X+5V RTN(FEED-THROUGH)
	GND	A23B -16	X+5V RTN(FEED-THROUGH)
	-5.2 V	A23B 17	
	-5.2 V	A23B -17	
	GND	A23B 18	
	GND	A23B -18	
DIGITAL TIMING	-START TRIG	A22A 1	X (FEED-THROUGH)
	AUTO ZERO	A22A - 1	
	-RELOAD	A22A 2	
	-D0	A22A - 2	(SR DATA)
	EVENT ENB	A22A 3	
	-DELAY CLOCK	A22A - 3	
	EVT NEG EDGE ENB	A22A 4	
	-WIDTH CLOCK	A22A - 4	
	GND	A22A 5	
	SYNC DELAY ENB	A22A - 5	
	100 MHZ CLOCK	A22A 6	MICROSTRIP
	GND	A22A - 6	
	GND	A22A 7	
	GND	A22A - 7	
	GND	A22A 8	
	EVENTS CLOCK	A22A - 8	MICROSTRIP
	GND	A22A 9	
	GND	A22A - 9	
	GND	A22A 10	
	GND	A22A -10	
	-TRIG HOLDOFF	A22A 11	*
	GND	A22A 12	
	GND	A22A -12	
	GND	A22A 13	
	GND	A22A -13	
	GND	A22A 14	
	END DIGITAL WIDTH	A22A -14	* MICROSTRIP
	GND	A22A 15	
	GND	A22A -15	
	GND	A22A 16	
	END DIGITAL DELAY	A22A -16	* MICROSTRIP
	COUNT ENB	A22A 17	MICROSTRIP
	GND	A22A -17	
	GND	A22A 18	
	DELAYED SYNC	A22A -18	* MICROSTRIP

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	SINGLE CYCLE ENB	A22B 1	
	CYCLE COMPLETE	A22B -1	*
	-D0	A22B 4	X (FEED-THROUGH)
	-D0	A22B -4	X (FEED-THROUGH)
	+15 V	A22B 13	X (FEED-THROUGH)
	+15 V	A22B -13	X (FEED-THROUGH)
	-15 V	A22B 14	
	-15 V	A22B -14	
	+5 V	A22B 15	
	+5 V	A22B -15	
	GND	A22B 16	X+5V RTN(FEED-THROUGH)
	GND	A22B -16	X+5V RTN(FEED-THROUGH)
	-5.2 V	A22B 17	
	-5.2 V	A22B -17	
	GND	A22B 18	
	GND	A22B -18	

Table 8-3. *Assembly Signal Distribution (Continued)*

Descriptions	Signals	Assembly Destinations	Comments
200 MHZ MULTIPLIER	GND	A24A 10	
	GND	A24A -10	
	GND	A24A 11	
	200 MHZ REF	A24A -11	* MICROSTRIP
	GND	A24A 12	
	GND	A24A -12	
	GND	A24A 13	
	GND	A24A -13	
	GND	A24A 14	
	GND	A24A 15	
	GND	A24A -15	
	-OUT OF LOCK	A24A -18	*
	VCO	A24B 1	
	VCO (UNUSED)	A24B - 1	NO CONNECTION
	GND	A24B 2	
	GND	A24B - 2	
	GND	A24B 3	
	GND	A24B 4	
	GND	A24B - 4	
	GND	A24B 7	
	GND	A24B - 7	
	GND	A24B 8	
	10 MHZ - TB	A24B - 8	COAX
	GND	A24B 9	
	GND	A24B - 9	
	+15 V	A24B 11	
	+15 V	A24B -11	
	-15 V	A24B 13	
	-15 V	A24B -13	
	+5 V	A24B 15	
	+5 V	A24B -15	
	GND	A24B 16	+5 V RETURN
	GND	A24B -16	+5 V RETURN
	-5.2 V	A24B 17	
	-5.2 V	A24B -17	
	GND	A24B 18	
	GND	A24B -18	

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
A9 THROUGH A15	HØ2	BUSA 1	
	LOGIC RETURN	BUSA - 1	
	-VMA	BUSA 2	(LVMA)
	SPARE 3	BUSA - 2	UNUSED
	-DØ	BUSA 3	(LDØ)
	-AØ	BUSA - 3	(LAØ)
	-D1	BUSA 4	(LD1)
	-A1	BUSA - 4	(LA1)
	-D2	BUSA 5	(LD2)
	-A2	BUSA - 5	(LA2)
	-D3	BUSA 6	(LD3)
	-A3	BUSA - 6	(LA3)
	-D4	BUSA 7	(LD4)
	-A4	BUSA - 7	(LA4)
	-D5	BUSA 8	(LD5)
	-A5	BUSA - 8	(LA5)
	-D6	BUSA 9	(LD6)
	-A6	BUSA - 9	(LA6)
	-D7	BUSA 1Ø	(LD7)
	-A7	BUSA -1Ø	(LA7)
	-(R/W')	BUSA 11	(L(R/W'))
	-A8	BUSA -11	(LA8)
	SPARE 1	BUSA 12	UNUSED
	-A9	BUSA -12	(LA9)
	-IRQ	BUSA 13	(LIRQ)
	-A1Ø	BUSA -13	(LA1Ø)
	-NMI	BUSA 14	(LNMI)
	-A11	BUSA -14	(LA11)
	HRUN	BUSA 15	
	-A12	BUSA -15	(LA12)
	HLN	BUSA 16	
	-A13	BUSA -16	(LA13)
	SPARE 2	BUSA 17	UNUSED
	-A14	BUSA -17	(LA14)
	-RST	BUSA 18	(LRST)
	-A15	BUSA -18	(LA15)
	GND	BUSB 7	TO A9 AND A1Ø ONLY
	GND	BUSB - 7	TO A9 AND A1Ø ONLY
	1Ø MHZ - CLK	BUSB 8	TO A9 AND A1Ø ONLY
	1Ø MHZ - CLK	BUSB - 8	TO A9 AND A1Ø ONLY
	SPARE 5	BUSB 9	TO A9 AND A1Ø ONLY
	SPARE 4	BUSB - 9	TO A9 AND A1Ø ONLY
	SPARE 7	BUSB 1Ø	TO A9 AND A1Ø ONLY
	SPARE 6	BUSB -1Ø	TO A9 AND A1Ø ONLY
	+15 V	BUSB 11	
	+15 V	BUSB -11	
	GND	BUSB 12	+15 V RETURN
	GND	BUSB -12	+15 V RETURN
	-15 V	BUSB 13	
	-15 V	BUSB -13	
	GND	BUSB 14	-15 V RETURN

Table 8-3. Assembly Signal Distribution (Continued)

Descriptions	Signals	Assembly Destinations	Comments
	GND	BUSB -14	-15 V RETURN
	+5 V	BUSB 15	
	+5 V	BUSB -15	
	GND	BUSB 16	+5 V RETURN
	GND	BUSB -16	+5 V RETURN
	-5.2 V	BUSB 17	
	-5.2 V	BUSB -17	
	GND	BUSB 18	
	GND	BUSB -18	
FRONT PANEL	PULSE OUTPUT	FP	COAX
	SYNC OUTPUT	FP	COAX
	EXT TRIG INPUT	FP	* COAX
FRONT PANEL CABLE	GND	J1 1	
	TRIG LEVEL-TOP	J1 4	
	TRIG LEVEL-TAP	J1 5	
	TRIG LEVEL-BOT	J1 6	
	OFFSET POT-TOP	J1 7	
	AMPL POT - TOP	J1 12	
	AMPL POT - BOT	J1 14	
	OFFSET POT-BOT	J1 16	
REAR PANEL	EVENTS IN	RP A	* COAX
	EDGE 1 OUT	RP B	COAX
	EDGE 2 OUT	RP C	COAX
	START PROBE	RP D	* COAX
	STOP PROBE	RP E	* COAX
REAR PANEL WIRES	EVENTS POT-TAP	RPW A	* BLK/RED
	EVENTS POT-BOT	RPW B	BLK/ORN
	EVENTS POT-TOP	RPW C	BLK/BRN
	EXT X	RPW D	BLK/VIO
	EVTS SLOPE NEG SW	RPW E	* BRN/YEL
			* BRN/GRN
	ENB PROBES SW	RPW F	BLK/GRY
	EXT Y	RPW G	

8-32. LOGIC SYMBOLS

8-33. Logic symbols used in this manual conform to the American National Standard ANSI Y32.14-1973 (IEEE Std. 91-1973). This standard supersedes MIL-STD-806B. In the following paragraphs logic symbols are described.

8-34. Logic Concepts

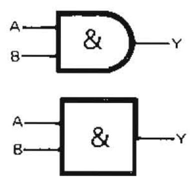
8-35. The binary numbers 1 and Ø are used in pure logic where 1 represents true, yes, or active and Ø represents false, no or inactive. These terms should not be confused with the physical quantity (e.g., voltage) that may be used to implement the logic, nor should the term "active" be confused with a level that turns a device on or off. A truth table for a relationship in logic shows (implicitly or explicitly) all the combinations of true and false input conditions and the result (output). There are only two basic logic relationships, AND and OR. The following illustrations assume two inputs (A and B), but these can be generalized to apply to more than two inputs.

AND Y is true if and only if A is true and B is true (or more generally, if all inputs are true).
Y=1 if and only if A=1 **and** B=1
Y=A•B

TRUTH TABLE

A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

EQUIVALENT SYMBOLS

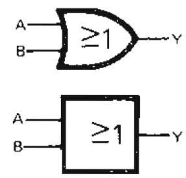


OR Y is true if and only if A is true or B is true (or more generally, if one or more inputs(s) is (are) true).
Y=1 if and only if A=1 **or** B=1
Y=A+B

TRUTH TABLE

A	B	Y
1	1	1
1	0	1
0	1	1
0	0	0

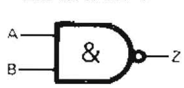
EQUIVALENT SYMBOLS



8-36. Negation

8-37. In logic symbology, the presence of the negation indication symbol o provides for the representation of logic function inputs and outputs in terms *independent* of their physical values, the Ø-state of the input or output being the 1-state of the symbol referred to by the symbol description.

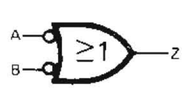
EXAMPLE 1



TRUTH TABLE

A	B	Z
1	1	0
1	0	1
0	1	1
0	0	1

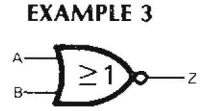
EXAMPLE 2



TRUTH TABLE

A	B	Z
1	1	0
1	0	1
0	1	1
0	0	1

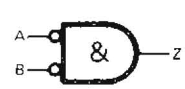
EXAMPLE 3



TRUTH TABLE

A	B	Z
1	1	0
1	0	0
0	1	0
0	0	1

EXAMPLE 4



TRUTH TABLE

A	B	Z
1	1	0
1	0	0
0	1	0
0	0	1

EXAMPLE 1 says that Z is *not* true if A is true *and* B is true or that Z is true if A *and* B are *not* both true. $\bar{Z}$=AB or Z=$\overline{AB}$. This is frequently referred to an NAND (for NOT AND).

EXAMPLE 2 says that Z is true if A is *not* true *or* if B is *not* true. $Z = \bar{A} + \bar{B}$. Note that this truth table is identical to that of Example 1. The logic equation is merely a De Morgan's transformation of the equations in Example 1. The symbols are equivalent.

EXAMPLE 3 $\bar{Z} = A + B$ or $Z = \overline{A + B}$ and,

EXAMPLE 4 $Z = \bar{A} \bullet \bar{B}$, also share common truth table and are equivalent transformations of each other. The NOT OR form (Example 3) is frequently referred to as NOR.

NOTE

In this manual the logic negation symbol is NOT used.

8-38. Logic Implementation and Polarity Indication

8-39. Devices that can perform the basic logic functions, AND and OR, are called gates. Any device that can perform one of these functions can also be used to perform the other if the relationship of the input and output voltage levels to the logic variables 1 and Ø is redefined suitably.

8-40. In describing the operation of electronic logic devices, the symbol H is used to represent a "high level", which is a voltage within the more-positive (less-negative) of the two ranges of voltages used to represent the binary variables. L is used to represent a "low-level", which is a voltage within the less-positive (more-negative) range.

8-41. A function table for a device shows (implicitly or explicitly) all the combinations of input conditions and the resulting output conditions.

8-42. In graphic symbols, inputs or outputs that are active when at the high level are shown without polarity indication. The polarity indicator symbol ⊵ denotes that the active (one) state of an input or output *with respect to which it is attached* is the low level.

NOTE

The polarity indicator symbol "⊵" is used in this manual.

EXAMPLE 5

Assume two devices having the following function tables.

DEVICE #1
FUNCTION TABLE

A	B	Y
H	H	H
H	L	L
L	H	L
L	L	L

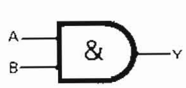
DEVICE #2
FUNCTION TABLE

A	B	Y
H	H	H
H	L	H
L	H	H
L	L	L

POSITIVE LOGIC

By assigning the relationship H=1, L=0 at both input and output, Device #1 can perform the AND function and Device #2 can perform the OR function. Such a consistent assignment is referred to as positive logic. The corresponding logic symbols would be:

DEVICE #1

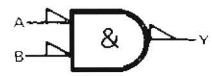


DEVICE #2

NEGATIVE LOGIC
Alternatively, by assigning the relationship H=0, L=1 at both input and output, Device #1 can perform the OR function and Device #2 can perform the AND function. Such a consistent assignment is referred to as negative logic. The corresponding logic symbols would be:

DEVICE #1

DEVICE #2

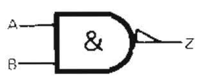


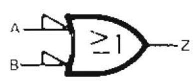
8-43. MIXED LOGIC. The use of the polarity indicator symbol ( ) automatically invokes a mixed-logic convention. That is, positive logic is used at the inputs and outputs that do not have polarity indicators, negative logic is used at the inputs and outputs that have polarity indicators.

EXAMPLE 6
FUNCTION TABLE

A	B	Z
H	H	L
H	L	H
L	H	H
L	L	H

This may be shown either of two ways:



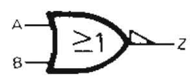


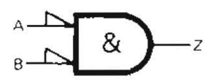
Note the equivalence of these symbols to examples 1 and 2 and the fact that the function table is a positive-logic translation (H=1, L=0) of the NAND truth table, and also note that the function table is the negative-logic translation (H=0, L=1) of the NOR truth table, given in Example 3.

EXAMPLE 7
FUNCTION TABLE

A	B	Z
H	H	L
H	L	L
L	H	L
L	L	H

This may be shown either of two ways:





Note the equivalence of these symbols to examples 3 and 4 and the fact that the function table is a positive-logic translation (H=1, L=0) of the NOR truth table, and also note that the function table is the negative-logic translation (H=0, L=1) of the NAND truth table, given in Example 1.

8-44. It should be noted that one can easily convert from the symbology of positive-logic merely by substituting a polarity indicator ( ) for each negative indicator (o) while leaving the distinctive shapes alone. To convert from the symbology of negative logic, a polarity indication ( ) is substituted for each negation indicator (o) and the OR shape is substituted for the AND shape or vice versa.

8-45. It was shown that any device that can perform OR logic can also perform AND logic and vice versa. DeMorgan's transformation is illustrated in Example 1 through 7. The rules of the transformation are:

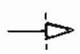
1. At each input or output having a negation (o) or polarity ( ) indicator, delete the indicator.
2. At each input or output not having an indicator, add a negation (o) or polarity ( ) indicator.
3. Substitute the AND symbol for the OR symbol or vice versa.

   These steps do not alter the assumed convention; positive-logic stays positive, negative-logic stays negative, and mixed-logic stays mixed.

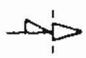
8-46. The choice of symbol may be influenced by these considerations: (1) The operation being performed may best be understood as AND or OR. (2) In a function more complex than a basic gate, the inputs will usually be considered as inherently active high or active low (e.g., the J and K inputs of a J-K flip-flop are active high and active low, respectively. (3) In a chain of logic, understanding and the writing of logic equations are often facilitated if active-low or negated outputs feed into active-low or negated inputs.

8-47. Other Symbols

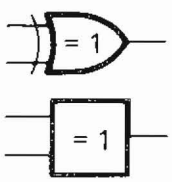
8-48. Additional symbols are required to depict complex logic diagrams, as follows:



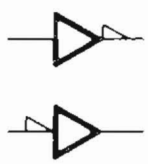
Dynamic input activated by transition from a low level to a high level. The opposite transition has no effect at the output.



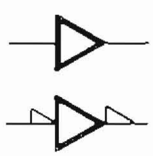
Dynamic input activated by transition from a high level to a low level. The opposite transition has no effect at the output.



Exclusive OR function. The output will assume its indicated active level if and only if one and only one of the two inputs assumes its indicated active level.

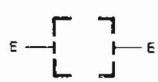


Inverting function. The output is low if the input is high and it is high if the input is low. The two symbols shown are equivalent.

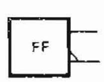


Noninverting function. The output is high if the input is high and it is low if the input is low. The two symbols shown are equivalent.

OUTPUT DELAY. The output signal is effective when the input signal returns to its opposite state.

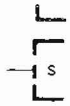


EXTENDER. Indicates when a logic function increases (extends) the number of inputs to another logic function.



FLIP-FLOP. A binary sequential element with two stable states: a set (1) state and a reset (0) state. Outputs are shown in the 1 state when the flip-flop is set. In the reset state the outputs will be opposite to the set state.

RESET. A 1 input will reset the flip-flop. A return to 0 will cause no further effect.

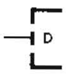


SET. A 1 input will set the flip-flop. A return to 0 will cause no further action.

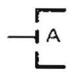
TOGGLE. A 1 input will cause the flip-flop to change state. A return to 0 will cause no further action.

J INPUT. Similar to the S input except if both J and K (see below) are at 1, the flip-flop changes state.

K INPUT. Similar to the R input (see above).



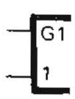
D INPUT (Data). Always dependent on another input (usually C). When the C and D inputs are at 1, the flip-flop will be set. When the C is 1 and the D is 0, the flip-flop will reset.



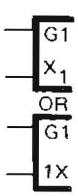
Address symbol has multiplexing relationship at inputs and demultiplexing relationship at outputs.

8-49. Dependency Notation "C" "G" "V" "F"

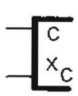
8-50. Dependency notation is a way to simplify symbols for complex IC elements by defining the existence of an AND relationship between inputs, or by the AND conditioning of an output by an input without actually showing all the elements and interconnections involved. The following examples use the letter "C" for control and "G" for gate. The dependent input is labeled with a number that is either prefixed (e.g., 1X) or subscripted (e.g., X_1). They both mean the same thing. The letter V is used to indicate an OR relationship between inputs or between inputs and outputs with this letter (V). The letter F indicates a connect-disconnect relationship. If the F (free dependency) inputs or outputs are active (1) the other usual normal conditions apply. If one or more of the F inputs are inactive (Ø), the related F output is disconnected from its normal output condition (it floats).



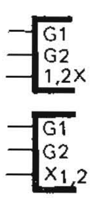
The input that controls or gates other inputs is labeled with a "C" or a "G", followed by an identifying number. The controlled or gated input or output is labeled with the same number. In this example, "1" is controlled by "G1."



When the controlled or gated input or output already has a functional lable (X is used here), that label will be prefixed or subscripted by the identifying number.



If a particular device has only one gating or control input then the identifying number may be eliminated and the relationship shown with a subscript.

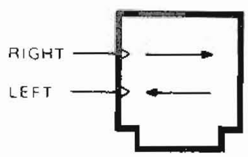


If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix or subscript, separated by commas. In this example "X" is controlled by "G1" and "G2."

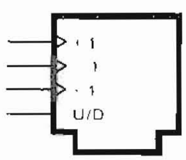
8-51. Control Blocks

8-52. A class of symbols for complex logic are called control blocks. Control blocks are used to show where common control signals are applied to a group of functionally separate units. Examples of types of control blocks follow:

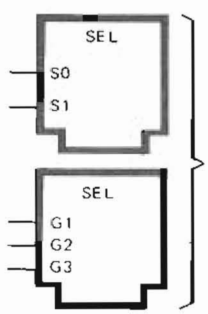
Register control block. This symbol is used with an associated array of flip-flop symbols to provide a point of placement for common function lines, such as a common clear.



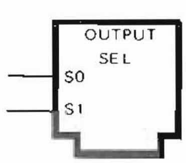
Shift register control block. These symbols are used with any array of flip-flop symbols to form a shift register. An active transition at the inputs causes left or right shifting as indicated.



Counter control block. The symbol is used with an array of flip-flops or other circuits serving as a binary or decade counter. An active transition at the +1 or −1 input causes the counter to increment one count upward or downward, respectively. An active transition at the ±1 input causes the counter to increment one count upward or downward depending on the input at an up/down control.



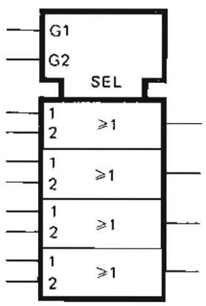
Selector control block. These symbols are used with an array of OR symbols to provide a point of placement for selection (S) or gating (G) lines. The selection lines enable the input designated 0, 1, ...n of each OR function by means of a binary code where S0 is the least-significant digit. If the 1 level of these lines is low, polarity indicators (◺) will be used. The gating lines have an AND relation with the respective input of each OR function: G1 with the inputs numbered 1, G2 with the input numbered 2, and so forth. If the enabling levels of these lines is low, polarity indicators (◺) will be used.



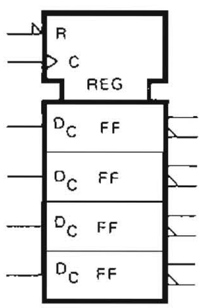
Output selector control block. This symbol is used with a block symbol having multiple outputs to form a decoder. The selection lines enable the output designated 0, 1, ...n of each block by means of a binary code where S0 is the least-significant digit. If the 1 level of these lines is low, polarity indicators (◺) will be used.

8-53. Complex Logic Devices

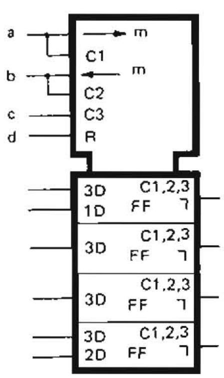
8-54. Logic elements can be combined to produce very complex devices that can perform more difficult functions. A control block symbol can be used to simplify understanding of many complex devices. Several examples of complex devices are given here.



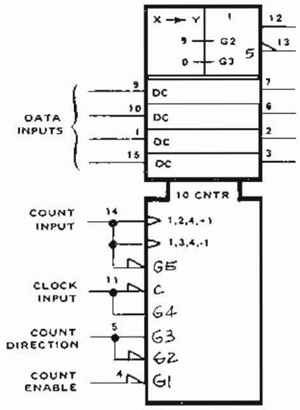
Selector control block used to simplify AND portion of a quad AND-OR select gate. When G1 is high, the data presented at the "1" inputs will be gated through. When G2 is high, the data presented at the "2" inputs will be gated through.



Register control block used to illustrate a quad D-type latch. There is a common active-low reset (R), and a common edge-triggered control input (C). Since there is only one dependency relationship, the controlling input is not numbered and the controlled functions (D) are subscripted with a C.



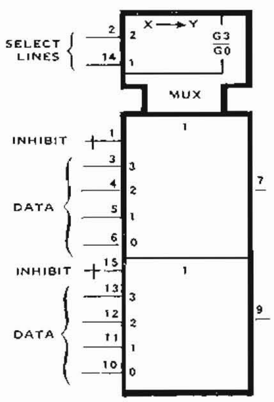
Shift register control block used to show common inputs to a bidirectional shift register. Notice that "→m" means shift the contents of the right or down by "m" units. And "←m" means shift the contents to the left or up by "m" units. Note: If m=1, it may be omitted. Inputs "a" and "b" are each single IC pins that have two functions. Input "a" enables one of the inputs to the top D-type flip-flop (1D), and also shifts the register contents down one unit. Input "b" enables one of the inputs to the bottom flip-flop (2D), and also shifts the register contents up on unit. Input "c" loads all four flip-flops in parallel (3D). Input "d" is a common reset. The output delay indicator is used because these are master-slave flip-flops.



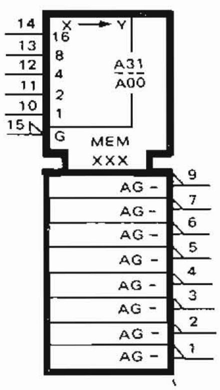
Bidirectional Modulus 10 Counter control block used to show parallel data inputs and borrow/carry outputs. Data is entered at pins 9, 10, 1, and 15 when the C input is active (pin 11 LOW). IFF G1 and G4 are active (pin 11 HIGH and pin 4 LOW), then counting action is enabled. G3 (pin 5 HIGH) enables the decrementing count action and borrow output. The counting action (incrementing or decrementng by one) when enabled by the applicable gating inputs, takes place on the LOW to HIGH transition of the input to pin 14. In addition, G5 (pin 14 LOW) enables the associated carry or borrow output on pin 13. The common output block at the top of the symbol indicates that the BCD outputs are decoded (X→Y) into 0 and 9. These are further ORed together and two outputs made available. The output on pin 12 is HIGH when either a borrow or carry is present and enabled. Similarly, the output on pin 13 is LOW IFF it is enabled by G5 (pin 14 LOW). At minimum count, all flip-flop outputs will be LOW. With the BCD code, only pin 7 (bit weighting of 8) and pin 3 (bit weighting of 1) will be HIGH for the maximum count condition. The action of the counter is not defined for conditions in which data entered has a value in excess of the BCD maximum of 9.

NOTE

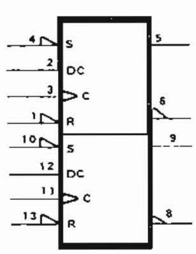
The counter common control block is placed at the bottom, just below the bit with the lowest arithmetic power.



Multiplexer control block used to show dual 4 input multiplexer with common select lines. Input stages on pins 2 and 14 are decoded (X→Y) according to their weighting modifiers to form AND gates (G0 through G3) in the common control block. The data inputs have numeric modifiers to indicate the specific gate which must be active for that input to be selected. The output on pin 7 will be HIGH IFF the selected input is HI and the inhibit input on pin 1 is LOW. Similarly, the output on pin 9 will be HIGH IFF the selected input is HIGH and and the inhibit input on pin 15 is LOW. If an inhibit input (pin 1 or 15) is HIGH, the corresponding output (pin 7 or 9) will be LOW regardless of the state of the selected input. The X→Y symbol is the coder (converter, translator) general symbol.



Read Only Memory (ROM) with 32 addresses. Address selection is determined by the five upper inputs which are decoded into 32 possible addresses (A00 through A31) corresponding to the weighting modifiers at the inputs. Input modifier G (pin 15) gates the outputs. Stored data will be read from the selected memory address if G is active (LOW). The output data pins (1-7 and 9) are active LOW. The "—" indicator shows the 8 outputs are capable of supplying LOW outputs only. A HIGH output is usually supplied by a resistor to a "HIGH" voltage.



Dual D-Type Flip-Flop. The dual D-type Flip-Flop consists of two independent D-type flip-flops. The information present at the data (D_C) input is transferred to the active-high and active-low outputs on a low-to-high transition of the clock (C) input. The data input is then locked out and the outputs do not change again until the next low-to-high transition of the clock input. The set (S) and reset (R) inputs override all other input conditions: when (S) is low, the active-high output is forced high; when reset (R) is low, the active-high output is forced low. Although normally the active-low output is the complement of the active-high output, simultaneous low inputs at the set and reset will force both the active-low and active-high outputs to go high at the same time on some D-type flip-flops. This condition will exist only for the length of time that both set and reset inputs are held low. The flip-flop will return to some indeterminate state when both the set and reset inputs are returned to the high state.

8-55. BLOCK DIAGRAM THEORY

8-56. Introduction

8-57. Digital Time Synthesis refers to the ability to select and manipulate the time difference between a trigger pulse and an output pulse. The 5359A Time Synthesizer generates pulses with precisely set delays and widths after the arrival of an external trigger pulse. Additionally, output pulse trains or bursts may be triggered internally. To insure and maintain maximum accuracy, an auto-calibration routine is provided. This routine automatically measures and compensates for differences in internal delays, temperature or aging effects in components or, with 5363A Time Interval Probes, cable lengths in a particular application.

8-58. A phase-locked startable oscillator allows the 5359A to commence digital time synthesis in synchronism with a randomly occurring external pulse. The output pulse delay and width are referenced to the sync out pulse. The time relationship between the external trigger pulse and the sync out pulse is always fixed. This technique allows extremely stable, low jitter time delays from 160 ms down to Ø ns.

8-59. A microprocessor based controller monitors and directs the overall instrument operation. The following paragraphs reference the simplified block diagram *Figure 8-2*, and describe the basic technique of digital time synthesis.

8-60. Simplified Block Description

8-61. The 5359A Time Synthesizer develops an output pulse by presetting two identical parallel delay channels with delay and width parameters. A common clock drives both delay channels, whose outputs then set and reset a flip-flop generating the output pulse. The simplified block diagram in *Figure 8-2* illustrates the functional relationship of the following sections:

a. Startable PLL Oscillator
b. Digital Delays
c. Analog Delays
d. Output Flip-Flop
e. Digital Sync Delay
f. Auto Calibrate

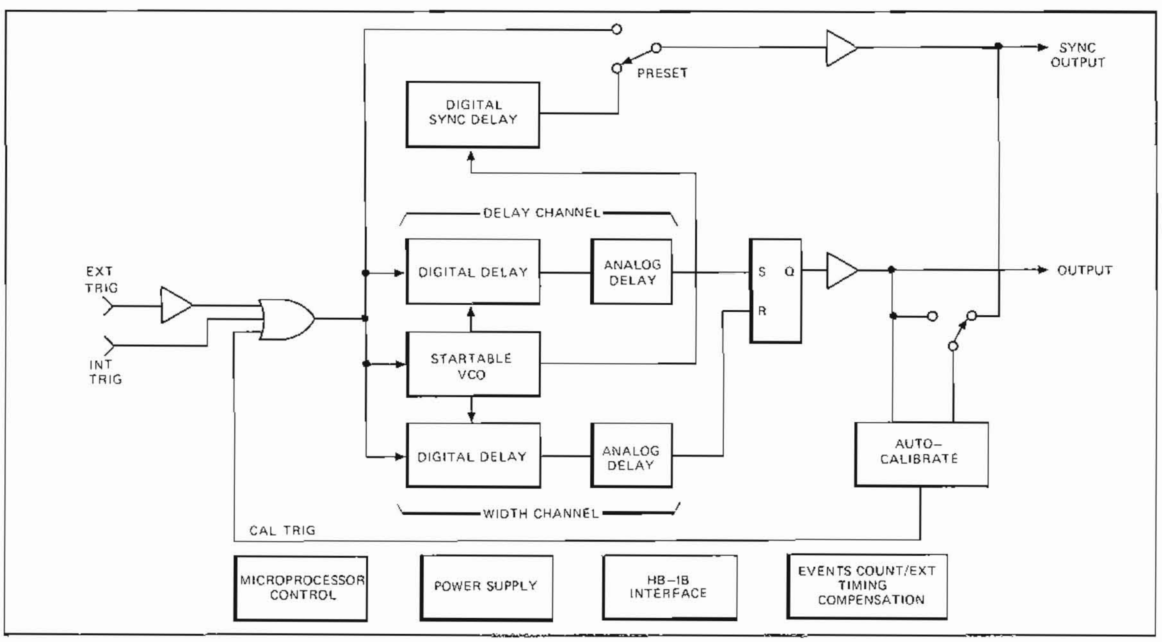


Figure 8-2. Simplified Block Diagram

8-62. The startable oscillator is a phase-locked triggered oscillator, producing bursts of ≈ 100 MHz clock pulses which start in-phase with the sync out. The frequency is locked to the internal crystal, while maintaining the phase relationship with the external trigger. This clock drives both delay channels and the digital sync delay.

8-63. There are two identical delay channels, one for pulse delay and one for pulse width. Each delay channel consists of a digital delay assembly and an analog delay assembly. Digital delay is accomplished by clocking a down-counter, preset to some number of clock periods equal to the desired delay (less a correction factor to be discussed later). The down-counters are presettable from 1 to 16777215 counts. Counting the 100 MHz clock, the down-counters can be preset to provide any desired delay from 10 ns to >160 ms in steps of ≈10 ns.

8-64. Analog Delay assemblies are added to extend the selectable delay resolution beyond the 10 ns limitation imposed by the 100 MHz clock. Analog delay is accomplished by comparing a generated ramp voltage to a selectable DC level. The DC level is derived from DAC's which are controlled by the microprocessor. The point in time where the ramp crosses the level represents the end of the delay. Varying the DC level in calibrated steps produces predictable incremental changes in the amount of delay. This analog delay interpolation scheme provides a selectable delay from Ø to 10 ns, in ≈50 ps steps. Each delay channel, combining digital and analog delays, produces an overall delay, selectable from Ø ns to >160 ms in ≈50 ps steps.

8-65. The delay channels drive the output flip-flop, which generates the output pulse. The end of the programmed delay in the pulse delay channel sets the output flip-flop, producing the leading edge of the output pulse. The pulse width channel is preset with the sum of the selected pulse delay and pulse width (less a correction factor to be discussed later). This insures that the reset of the output flip-flop, which produces the trailing edge of the output pulse, always occurs second.

8-66. The digital sync delay produces the fixed insertion delay between the external trigger and the sync out pulse when in the Preset (normal) position. The Auto position provides a method of selecting either a long (digital delay) or short insertion delay (when the specified pulse delay is greater than 100 ns).

8-67. The Auto-Calibrate assembly provides a method of measuring and compensating for the fixed propagation delays and offsets present within the various amplifiers and timing circuits. This insures instrument accuracy that is independent of temperature, aging, or amplitude ofthe output signal. The auto-calibrate cycle is performed during power-up, and can be repeated at any time via a front panel key (CAL) or via the HP-IB. The calibration routine, although independent of programmed parameters of delay and width, does reference the mid-point of the output pulse. To maintain maximum instrument accuracy, the auto-calibrate cycle should be initiated whenever the output pulse amplitude or offset is changed.

8-68. Typical Instrument Operation

8-69. On power-up, the microprocessor checks the ROM's, RAM's, lights the front panel indicators and all segments of all readouts. It then performs the auto-calibrate cycle, and presets the following operating conditions:

MODE	Frequency/Period
WIDTH	100.00 ns
PERIOD	1.00 μs
FREQUENCY	1.00 MHz
STEPS SIZES	1.00 ns/1.00000000 kHz

8-70. The settings of the front panel controls determine the polarity, amplitude, and offset of the output pulse. The generation of an output pulse begins with the arrival of an internal trigger. The internal trigger starts the 100 MHz triggered phase-locked oscillator and enables both delay channels. The digital delay assemblies for both delay and pulse width channels, and the digital sync delay now begin counting down the 10 ns periods of the clock. The auto-calibrate routine has previously measured and stored the various internal delay constants, including the sync out insertion delay. Compensation for all the stored constants is calculated in the microprocessor and reflected in the final number that is preset into the delay channels. (A detailed discussion of these routines follows.) When the digital delay count in the pulse delay channel reaches zero, the analog delay is triggered. The digital delay counter is also automatically reset with the preset number. When the analog delay times out, a comparator sets the output flip-flop and produces the leading edge of the output pulse. The pulse width channel, in the same manner, counts down a delay equal to the sum of the pulse delay and width. The pulse width channel output resets the flip-flop, producing the trailing edge of the output pulse. The microprocessor performs all calculations, enters, stores, and transfers data and in general, monitors the instrument operation. Once parameters are determined and preset, the microprocessor then assumes a passive role, basically idling while monitoring for error conditions or new keyboard selections.

8-71. Determination of Digital Delays

8-72. The output pulse is created by the two delay channels which are preset with the following four variables:

$$\text{Pulse Delay Channel}\begin{cases} D_D = \text{number preset in digital delay} \\ A_D = \text{number preset in analog delay} \end{cases}$$

$$\text{Pulse Width Channel}\begin{cases} D_W = \text{number preset in digital delay} \\ A_W = \text{number preset in analog delay} \end{cases}$$

The following factors are used in the determination of the four delay variables:

$$\text{User Selections}\begin{cases} \text{<Delay>} = \text{delay as specified on front panel or via the HP-IB} \\ \text{<Width>} = \text{width as specified on front panel or via the HP-IB} \\ \text{<Period>} = \text{period as specified on front panel or via the HP-IB} \end{cases}$$

$$\begin{array}{c}\text{Measured by the Cali-}\\ \text{bration routine}\end{array}\begin{cases} C_D = \text{delay constant for normal (PRESET) insertion delay} \\ C_{DS} = \text{delay constant for short (AUTO) insertion delay} \\ C_W = \text{width constant} \\ C_P = \text{period constant} \\ S_D = \text{measured analog step-size for delay channel} \\ S_W = \text{measured analog step-size for width channel} \end{cases}$$

$$P = \text{period of the} \simeq 100 \text{ MHz clock} = 10.078125 \text{ ns}$$

8-73. The actual numbers preset into the four delay assemblies are derived using the following equations:

For externally triggered modes, where Delay and Width are specified:

$$D_D = \text{Integer of} \left[\frac{\text{<Delay>} + C_D}{P} \right]$$

$$A_D = \frac{\left[\frac{<\text{Delay}> + C_D}{P}\right] - (D_D)\ (P)}{S_D}$$

$$D_W = \text{Integer of } \frac{<\text{Delay}> + C_D + <\text{Width}> + C_W}{P}$$

$$A_W = \frac{\left[\frac{<\text{Delay}> + C_D + <\text{Width}> + C_W}{P}\right] - (D_W)\ (P)}{S_W}$$

NOTE

Replace C_D with C_{DS} in above equations when a short insertion delay (AUTO with delay >100 ns) is specified.

For internally triggered modes, where Period (Frequency) and Width are specified:

$$D_W = \text{Integer of } \frac{<\text{Period}> + C_P}{P}$$

$$A_W = \left[\frac{<\text{Period}> + C_P}{P}\right] - (D_W\ (P)$$

$$D_D = \text{Integer of } \frac{<\text{Period}> + C_P - (<\text{Width}> + C_W)}{P}$$

$$A_D = \frac{\left[\frac{<\text{Period}> + C_P - (<\text{Width}> + C_W)}{P}\right]}{S_D}$$

8-74. These equations are an integral part of the instrument's firmware, permanently stored in ROM. The various applicable factors are selected or measured and stored in RAM. It is possible to recall and display the Delay, Width, and Period factors via the front panel keys. In addition, the six factors determined by calibrate routine may also be recalled and displayed through a procedure described in Section V, A19/A21 Adjustments, Step 10. All four delay variables (D_D, A_D, D_W, and A_W) are recalculated each time any new entry is keyed in. The six factors measured by the calibrate routine, however, (C_D, C_{DS}, C_W, C_P, S_D, and S_W) remain constant until the calibration cycle is repeated. The four delay variables, once preset into the delay channels, remain unchanged, automatically resetting themselves after each output, until new parameters are entered.

8-75. Auto-Calibrate Routine

8-76. To insure the most accurate delays possible, a calibration routine is provided which "remeasures" the actual values of the six internal constants C_D, C_{DS}, C_W, C_P, S_D, and S_W used in the delay equations. The calibration routine starts by determining the step size of the analog delay circuits (S_W and S_D) and measuring the fixed delays associated with the overall delay channels (C_D and C_W). In addition, the insertion delay from the external trigger to sync out can assume either of two values (in AUTO) requiring an additional constant (C_{DS}) relating to the alternate arrangement. Finally, during internally triggered modes, the end of the second delay channel (width) automatically retriggers the instrument. This configuration allows the first delay channel (delay) to control the width, and the second delay channel (width) to set the period of the output signal. An additional constant (C_P) must be determined, representing the fixed delays within the configured period loop.

8-77. Part of the calibration routine also includes a "balance" operation, in which the precedence/coincidence detector that measures the various constants is calibrated. Although the calibration routine is primarily intended to compensate for very slight variations in the instrument's internal delays, an additional benefit is the ability to extend the points of calibration outside the instrument. External Timing compensation can be included in the calibration by using the HP 5363 Time Interval Probes. The probes detect the sync output and main output to actual points of interest and extend the calibration beyond the front panel BNC's.

8-78. The auto-calibration circuit measures the required constants by injecting signals into the timing path which follow precisely the same path followed by signals generated during actual operation, and by providing a coincidence detector to compare the timing relationships of the output signals and internal references. The calibration "sequence of events" is independent of any programmed parameters; however, the measurements are referenced to the nominal 50% point of the output signal, as set by the front panel amplitude and offset controls, or from the HP-IB.

8-79. Assembly Block Theory

8-80. The following paragraphs reference the Overall Block Diagram, *Figure 8-8*, and provide the theory of operation on a block level for each individual assembly. The sequence is intended to follow the basic signal path as well as group interacting functional assemblies together.

8-81. A20 Trigger Amplifier Assembly

8-82. The trigger amplifier assembly performs the gating required to route either the EXT TRIG, the INT TRIG, or the CAL TRIG signals as START, to the (A23) Startable PLL Oscillator Assembly, as determined by the instrument mode of operation. Front panel controls or the HP-IB direct the assemblies selection of Slope and Trigger Level for the EXT TRIGGER signal, as well and MANUAL TRIGGER. The selection of either short or long insertion delay ffor the Sync Output pulse is accomplished by gating either the DELAYED SYNC or EXT TRIG out of the assemby as SYNC.

8-83. A23 Startable PLL Oscillator

8-84. The A23 assembly generates three basic signals: COUNT ENABLE, which enables both Digital Delay on A22; a "burst" or ≈100 MHz CLOCK pulses, which drive the delay channels; and VCO, which is used on A23 and routed to A24 for the Out-of-Lock detector.

8-85. The Startable Oscillator is the heart of the assembly operation. It oscillates at a frequency of 198.44961 MHz, as controlled by the VCO tuning voltage, and phase-locked to the 200 MHz reference by a ratio of 129 : 128. Its oscillations can be stopped, and then restarted in sync with the start pulse, with the phase-locked-loop "resetting" to the new phase relationship.

8-86. The START signal enters the board triggering two one-shot delay generators. The oscillations of the Startable Oscillator are momentarily inhibited for approximately 10 ns (as determined by the fixed delay of the one shots), after which, oscillations are "restarted" in-phase with the trailing edge of the one-shot output. The output of a second one-shot, with a longer delay (approximately 35 ns), sets the Holdoff flip-flop, disables the Phase Detector, resets the ÷128 SCALER and outputs a COUNT ENABLE signal to the digital delays on A22. The Phase Detector remains disabled until the signal from the startable oscillator and the 200 MHz reference are coincident. At this time, the mixer will clock the coincidence flip-flop, enabling the Phase Detector, allowing the ÷128 SCALER to start counting. Since the SCALER has been adjusted in phase to match the new MIXER output phase, phase locking will continue at the new phase relationship. As the Startable Oscillator restarts, CLOCK pulses at 99.22481 MHz are output through the enabled ÷2 flip-flop, to the Digital Delays, which were enabled by COUNT ENABLE. The A22 Digital Timing Assembly responded to COUNT ENABLE by setting $\overline{\text{TRIG HOLD OFF}}$ low, which locks out any further start pulses. When the preset Delay Channels have counted down to zero, $\overline{\text{TRIG HOLDOFF}}$ goes high, indicating the end of the cycle. This transition unlocks the one-shot, arming the assembly for another start pulse and clocks the Holdoff Flip-Flop, which locks up the ÷2 flip-flop, inhibiting any additional CLOCK pulses.

8-87. The phase detector in the Phase Locked Loop samples at a rate of approximately 1.6 MHz. If the Startable VCO is being restarted at a rate in excess of this sampling rate, it is possible that no sample will be taken and the loop will go out of lock, letting the VCO control voltage drift (to the end of its range) resulting in an error in the VCO frequency. When the input data is such that this condition may occur (i.e., input trigger >1 MHz) the processor sets the $\overline{\text{LOCK}}$ line high. A digital sample-and-hold (on A23) responds by measuring the present VCO control voltage, duplicating it through a DAC and then substituting this DAC voltage for the normal voltage from the phase detector. Although the loop is now "open", the VCO will be held at a frequency close to its normal frequency. The open loop condition will remain until new data is presented, permitting successful locking (during Calibrate, the loop will lock, allowing an updating of the digital sample-and-hold signal).

8-88. The processor sets this open loop condition whenever D_W (the digital delay number for the width channel) is less than 100. This corresponds to a period, or a delay + width, of slightly more than 1 μs. In the external trigger mode, the processor does not know the actual repetition rate of the external trigger, but does know that the minimum time between "starts" (of the VCO) is at least as long as the digital count down.

8-89. Although the open loop frequency is not as accurate as in the locked stated, at most, 100 periods will be counted. The affect of VCO frequency accuracy on absolute timing accuracy is directly proportional to the number of cycles counted. This technique allows the 5359A to meet and maintain its accuracy specifications throughout short durations (>1 μs) with the phase locked loop "open".

8-90. In the open loop condition, the digital sample-and-hold voltage is supplied to the "Out-of-Lock" detector on A24. Since this voltage is close to that occurring during locked operation, the Out-of-Lock detector does not give an out-of-lock indication.

8-91. A24 200 MHz Multiplier Assembly

8-92. The 200 MHz Multiplier Assembly takes one 10 MHz reference from the A8 reference Oscillator Buffer board and increases it to 200 MHz. This is accomplished by two cascaded multipliers (X5 and X4) providing a combined frequency multiplication factor of X20. The 200 MHz signal is then filtered and buffered and output as a reference to the A23 Startable PLL Oscillator. In addition, a separate voltage comparator circuit monitors the VCO Tuning Voltage from A23. If the VCO tuning voltage exceeds designed limits, an Out-of-Lock signal will be generated and sent to the A16 Processor Interface Board, generating an Err 4 message and setting a status bit.

NOTE

The 5359A will operate and output without the A24 assembly installed, however, this is not an accurate output. As the 200 MHz will not be generated, the Startable VCO on A23 will run, but not locked to any reference frequency. This condition normally results in an out-of-lock indication which disables the output. However, the Out-of-Lock detector is also located on A24, therefore, no out-of-lock signal will be generated and the (unreferenced) output will be allowed. To insure an accurate output, the A24 assembly must be installed.

8-93. A22 Digital Timing Assemby

8-94. The Digital Timing Assembly contains the two "Johnson" presettable down-counters, which provide the digital delay for the Delay and Width channels, and the digital Sync Delay circuits. $\overline{\text{DELAY CLOCK}}$ and $\overline{\text{WIDTH CLOCK}}$ serially load data from DØ to preset the down-counters. COUNT ENABLE, generated on A23, enables these counters and the SYNC DELAY counter. Clock select circuits determine whether the ≈100 MHz CLOCK or the Events input drive the down-counters. After an enable and clock are received, $\overline{\text{TRIG HOLDOFF}}$ is set low, disabling further start pulses on A23. This condition remains until both down-counters finish counting, at which time, $\overline{\text{TRIG HOLDOFF}}$ is released. The preset delay data is automatically reloaded into the down-counters from storage registers within the chip at the end of each cycle. The END DIGITAL DELAY and END DIGITAL WIDTH signals, generated as each counter reaches zero, are routed to A21 Analog Timing to being the analog delays.

8-95. The Sync Delay circuit is active only when SYNC DELAY ENB (generated on A16) is present. The COUNT ENABLE pulse initiates a fixed digital delay of approximately 80 ns, to generate DELAYED SYNC. This signal is fed back to the A20 Trigger Amplifier board, where it is selected as SYNC OUT. This circuit provides the (longer) fixed insertion delay used for the normal sync delay configurations.

8-96. During single cycle operation (available only under HP-IB control) the Single Cycle Enb line is high. In this mode, the $\overline{\text{TRIG HOLDOFF}}$ line remains low at the completion of a cycle, but the CYCLE COMPLETE line is set high, signaling the processor that a pulse has been output. CYCLE COMPLETE goes low, and $\overline{\text{TRIG HOLDOFF}}$ high, upon receipt of a Reload and strobe from the processor — this occurs following receipt of an "RA" (rearm) HP-IB command or the loading of new data into the Johnson counters following receipt of new timing parameters.

8-97. A21 Analog Timing Assembly

8-98. The Analog Timing Assembly contains the two identical analog delay generators which provide the last 10 ns of selectable delay for the Delay and Width Channels. The outputs of the Delay Analog and Width Analog circuits combine to drive a flip-flop which generates the output pulse. As the operation of the two analog generators is identical, only the Delay Channel Analog Generator will be described.

8-99. The ANALOG DELAY signal clocks eight bits of parallel data from the processor bus lines (DØ through D7), into buffer storage registers. The eight bits of data stored represent, in binary format, the programmed delay for the analog circuitry. The eight-bit byte is fed from the registers to a digital-to-analog converter, where it is converted to a proportional DC reference voltage.

8-100. The END DIGITAL DELAY signal from A22 triggers a ramp generator. The ramp voltage and dc reference level feed a comparator, which switches at the point in time where the ramp crosses the reference level. The output of the comparator resets the ramp generator and clocks the flip-flop, producing the rising edge of the output pulse. In a similar fashion, the Width Analog Delay generator times out and resets the flip-flop producing the trailing edge. The comparators also trigger the one-shots which generate the EDGE 1 and EDGE 2 pules. These signals, available on the rear panel, are auxiliary marker pulses synchronous with the rising and falling edges of the output pulse.

8-101. An additional circuit on this board is the Events-In Trigger Amplifier. This circuit conditions the Events-In signal with the selected Events Trigger Level, as determined on a rear panel control, to produce the EVENTS CLOCK. This signal is output to the A22 assembly where it is synchronized, and then made available to the Digital Delays.

8-102. A17 Output Reference Assembly

8-103. The Output Reference Assembly accepts front panel control settings and levels and various processor command lines, and generates the control signals for the A18 Output board. The Amplitude and Offset level settings drive the current and voltage sources which control the A18 pulse amplifier. The Processor commands feed relay drivers, which reroute the OUTPUT and SYNC signals during calibration. The status of the polarity switch settings is translated and sent to the exclusive-OR gates feeding the pulse amplifier.

8-104. A18 Output Assembly

8-105. The Output assembly contains the output amplifiers for the OUTPUT pulse and SYNC OUT pulse, and the signal switching relays and high-speed voltage comparators used during calibration. The pulse amplifier conditions the Pulse signal from A21 with amplitude, offset, and polarity data from the A17 Output Reference. The sync amplifier squares and buffers the SYNC signal from A20. During normal instrument operation, these signals are routed through relays, and output to front panel BNC's as PULSE and SYNC OUTPUT. During calibration, the pulse and sync signals are redirected to the A19 Auto-Zero Assembly as TRIG A and TRIG B.

8-106. A19 Auto-Zero Assembly

8-107. The Auto-Zero assembly contains the various circuits used to perform calibration. Calibration consists of determining the fixed delays associated with the overall delay channels and actual step size values of the analog delay circuits. The processor performs the necessary calculations and maintans general control of the routine. The Auto-Zero circuitry performs two functions: it generates and injects signals into the signal path to serve as reference marks, and it provides a means of detecting coincidence between the reference marks and the signal of interest. The determination of delays is accomplished by injecting signals and varying the Digital and Analog Channel delays until the point of coincidence is found. The values of the constants are determined by reconfiguring the signal path and repeating the routine.

8-108. Select circuits determine whether the signals TRIG A and TRIG B or, during EXT TIMING COMPENSATION, START PROBE, and STOP PROBE, are input to the Precedence Detector. The Precedence Detector, Offset Register, and Processor form the "coincidence detector" which measures the delays. The Calibration Timing Generator produces the control signals and reference marker signals which are used during the calibration routine.

8-109. A9 Processor Assembly

8-110. The Processor Assembly contains the microprocessor, clock logic, and driver circuits, RAM and ROM Address Decode logic, and Address and Data Buffers. The A9 assembly uses the Motorola 6800 Microprocessor for control and computational purposes. The Address Bus contains 16 lines which can address up to 65K locations. The address bus data travels in one direction (out only). The Data Bus contains 8 lines. These lines are bidirectional (Input and Output) to the A9 assembly. The third bus is the Control Bus. These lines are primarily microprocessor inputs, with the following exceptions: the R/W (Read/Write) line is an output to the RAM's. The VMA (Valid Memory Address) line is used for decoding. The BA (Bus Available) line is used to tell assemblies on the Address Bus that the bus is not being used by the microprocessor. The remaining control lines enable the microprocessor to monitor the status of the rest of the instrument. The RAM's are used to store current data. 10 MHz is present from the A8 Reference Oscillator Buffer board to drive the Microprocessor Clock State Machine, which creates all necessary processor clocks.

8-111. A12 ROM Assembly

8-112. The ROM Assembly contains all the program routines (firmware) for the Microprocessor. These programs are permanently stored and provide the instructions that direct the overall operation of the microprocessor, enabling it to respond to user control.

8-113. A11 Display Interface Assembly

8-114. The Display Interface Assembly contains the circuits which allow the microprocessor to communicate with the display and keyboard. This assembly is connected directly to the instrument's internal processor bus. All the logic for decoding and driving, and the latch and RAM used for the key data and display data are located on the A11 assembly. The RAMs store the current program parameters, which can be recalled and displayed by front panel keys.

8-115. A25 Display and Keyboard Assembly

8-116. The Display and Keyboard assembly contains the 11 (seven-segment) LED displays, the LED annunciators and indicators, and the control keyboard.

8-117. A26 Front Panel Control Assembly

8-118. The Front Panel Control board contains the External Trigger Slope switch and Level control, the Sync Delay Preset/Auto switch, Output Amplitude and Offset controls, and Polarity and Offset switches.

8-119. A27 10 MHz Oscillator Assembly

8-120. The A27 assembly is the standard room temperature 10 MHz crystal oscillator. It consists of a crystal controlled oscillator stage and an output buffer stage. The 10 MHz output is sent to the A8 Reference Oscillator Buffer assembly. An optional (Option 001) 10 MHz oscillator may replace this assembly. This is an oven temperature controlled crystal oscillator with much higher stability. Included with this option is the Oven Oscillator Power Supply (A7) which provides an unregulated +25 volts to power the oven and unregulated +11 volts and +12 volts to power the oven controller circuitry and oscillator amplifier, respectively.

8-121. A8 Reference Oscillator Buffer Assembly

8-122. The Reference Oscillator Buffer Assembly receives 10 MHz from either of two sources. The first source is the internal crystal time base. The second source is the EXTernal frequency input (5 or 10 MHz) from the rear panel connector. The selected 10 MHz signal is shaped and sent to four buffers and a signal monitor. The monitor is an LED and a one-shot multivibrator triggered by the 10 MHz signal. When the LED indicator is on, 10 MHz is present.

8-123. A16 Processor Interface Assembly

8-124. The responsibility of the Processor Interface Assembly is to regulate, via the Address, Data and Control Line buses, the interaction between the A9 Processor and the rest of the instrument. The assembly performs the following three separate function operations:

1. STROBE GENERATION, which monitors and decodes the Address bus into a number of "strobe pulses" which are used throughout the instrument (and on the A16 board).

2. WORD GENERATION, which provides bidirectional communication between the processor data bus and the instrument through several 8-bit bytes or words. There are three buffer storage registers, A, B, and C, monitoring the Data bus, generating three 8-bit words (or 24 output control lines), which are output to the instrument. In addition, two groups of eight bits from the instrument are input, via an eight-bit switch and gate, to the data bus. The Strobe Generator, via the Address bus, controls the operation of the Word Generator.

3. AMPLITUDE/OFFSET GENERATION, which selects the Amplitude and Offset Control levels which are sent to the A17 Output Control board from either of two sources: local front panel control settings or remote HP-IB. The levels for remote are derived from the bus data, stored by buffer registers and converted by DAC's to the desired Amplitude and Offset.

8-125. A1, A6 Power Supply Motherboard/Power Supply Control Assembly

8-126. The Power Supply Motherboard/Power Supply Control Assembly (A1,A6) supplies all dc power for the instrument, except for the Quartz Crystal Oven Oscillator. The ac line voltage enters through the Power Module (correct selection of line voltage determined by Power Module card) to the power transformer primary windings and to the instrument fan. The voltages from the secondaries of the power transformer are rectified, filtered, and sent directly to the Power Supply Control Assembly (A6). The four unregulated voltages of +10V, +20V, -20V, and -10V are fused at the A6 board inputs. A separate transformer secondary winding supplies power to the Quartz Crystal Oven Oscillator Power Supply (A7).

8-127. When the front panel STBY-ON switch is set to ON, ac power is sent to the fan, and voltage is applied to the Voltage Reference IC, enabling conversion of the four unregulated votages to regulated voltages of +5V, +15V, -15V, and -5.2V for distribution throughout the instrument. These voltages are supplied by four separate linear series-pass regulators which are referenced to a single +10.0V precision reference IC (A6U5).

8-128. A15 HP-IB Interface Logic Assembly

8-129. The HP-IB Interface Logic Assembly serves as an interface between the 5359A and an external controller, via the HP Interface Bus. The A15 assembly consists of seven interface registers (which are used by the microprocessor for interpreting commands and data, sending status and data, interpreting interrupts, etc.), two command decoding ROM's, and source and acceptor handshake circuitry.

8-130. A5 HP-IB Connector Assembly

8-131. The A5 assembly provides the interconnection between the A15 HP-IB Interface Logic Assembly and the interface bus. Switch S1 is used to select the address code for the instrument.

8-132. DETAILED THEORY OF OPERATION

8-133. A20 TRIGGER AMPLIFIER BOARD

8-134. There are two signals that come from the A20 Trigger Amplifier, START, which goes to the A23 Startable VCO, and SYNC, which goes to the A18 output amplifier.

8-135. Start Signal

8-136. The START signal is generated by the INTERNAL TRIGGER or the EXTERNAL TRIGGER or the CALIBRATE TRIGGER. The following paragraphs examine the signal paths from their introduction onto the A20 Trigger Amplifier to their departure from the A20 Assembly.

8-137. The internal trigger signal comes from A21 as an inverted signal (NOT) INT TRIG into the inverted input of the AND gate U10B (11).

8-138. Also U10B receives two other signals, from A16 and A19, which select the (NOT) INT TRIG as the START signal (U10B(2)). In order for the (NOT) INT TRIG to be selected as the START signal, INT ENB must be High, EXT ENB must be Low, and INT TRIG DISABLE must be Low. The signal paths are to:

1. U10B (10) from U7D(9), which has inputs stemming from U2C(12), which is INT ENB and INT TRIG DISABLE, and

2. U10B(9) from U2B(3), which receives its input from the output of U1B(6) which is the NAND product of EXT ENB and INT ENB.

8-139. The external trigger signal comes from the TRIG INPUT BNC on the front panel EXT TRIG INPUT. This signal is processed to decide where on this signal a trigger condition occurs (the signal condition for triggering is set up from the front panel controls which enter A20 as TRIG LEVEL-BOT, TRIG LEVEL-TAP and TRIG LEVEL-TOP). The actual external trigger signal enters U5C(15). (The external trigger processing circuitry is in the lower]left-hand corner of the A20 schematic).

8-140. The external trigger signal is exclusively ORed at U5C with a signal from U5A(2). The signal from U5A(2) is the product of the EXCLUSIVE OR of the (NOT) MANUAL TRIG and the TRIG SLOPE +. This circuitry prevents the occurrence of both a MANUAL and an EXTERNAL trigger at the same time. The output of U5C(13) goes to the clock input of U9A(6) and clocks in the inverted EXT ENB signal (which sets itself and waits for the next clock). The output of U5C(13) also goes to flip-flop U9B(12,10) which is clocked by the internal trigger signal into U9B(11).

8-141. The inverted output of the flip flop U9B(14) goes into the inverted input U10A(4). The other inputs into U10A are:

1. U10A(5), (NOT) INT TRIG

2. U10A(6), the NAND product of INT TRIG DISABLE and (NOT) INT ENB and

3. U10A(7), the NAND product of EXT ENB and INT ENB.

8-142. In summary, the external trigger or manual trigger (as long as they don't arrive at the same time) is selected when EXT TRIG INPUT or (NOT) MANUAL TRIG is High, the INT TRIG DISABLE is Low, the INT ENB is High, the (NOT) INT TRIG is Low and the EXT ENB is High. Notice that if the above conditions are true, the (NOT) INT TRIG signal does not get through U10B and, therefore, cannot affect the START signal. The calibrate trigger enters A20 from A19 as CAL TRIG. CAL TRIG enters U6B(10) where it is ORed with two other signals, one of which comes from the EXT TRIG circuitry U9A(3).

8-143. The other input enters U6B(11) and comes from the AND product of (NOT) PERIOD DISABLE (from A16) and the inverted output of U7B(3). The output of U7B(3) is Low when the START signal is High and is High when the START signal is Low. The CAL TRIG output leaves the inverted output of U6B(6) and goes to U10C(13) where it is ANDed with two other signals into U10C(14) and U10C(12). U10C(14) is the CAL TRIG DISABLE signal and U10C(12) is (NOT) PERIOD DISABLE. In short, when CAL TRIG is High, PERIOD DISABLE is High and CAL TRIG DISABLE is Low; the CAL TRIG signal controls the START signal.

8-144. Sync

8-145. The SYNC signal is basically determined by the START, DELAYED SYNC, CAL TRIG and SYNC DELAY ENB signals. The inputs arrive at NOR gate U8A(5) and U8A(4), the output of U8A(2) is the SYNC signal. U6B(7) is the CAL TRIGGER output (an inverted version of this signal goes to the CAL TRIGGER/START signal select gate U10C). It goes to the inverted input of U8C(10) which ANDs this signal with SYNC DELAY ENB. The ANDed product of these two signals goes to U8A(5).

8-146. The SYNC DELAY ENB signal goes to the inverted input of U8B(7) and the DELAYED SYNC signal goes to the inverted input U8B(6) where they get ANDed. The ANDed output of these signals U8B(3) goes to U8A(4).

8-147. A23 STARTABLE PLL OSCILLATOR ASSEMBLY

8-148. The A23 assembly generates three signals:

1. COUNT ENABLE, which enables Digital Delay on A22

2. "burst" of ~100 MHz CLOCK pulses which drive the delay channels

3. VCO, which is used on A23 and routed to A24 for the out-of-lock detector

8-149. The START signal from A20 enters the A23 board triggering two one-shot delay generators. The oscillations of the Startable Oscillator are inhibited for approximately 10ns (as determined by the fixed delay of U3A one-shot), after which oscillations are "restarted" in phase with the trailing edge of the one-shot output. The output of a second one-shot U3B with a longer delay of approximately 53 ns sets the Holdoff flip-flop, disables the Phase Detector, resets the DIVIDE-BY-128 SCALER and outputs a COUNT ENABLE signal to the A22 board. The Phase Detector remains disabled until the signal from the startable oscillator and the 200 MHz reference are coincident.

8-150. At this time the mixer will clock the coincidence flip-flop, enabling the Phase Detector, allowing the DIVIDE-BY-128 SCALER to start counting. Because the SCALER has been adjusted in phase to match the new MIXER output phase, phase locking will continue at the new phase relationship. As the Startable Oscillator restarts, CLOCK pulses at 199.22481 Mhz are output through the enabled divide-by-2 flip-flop U8 to the Digital Delay which was enabled by COUNT ENABLE.

8-151. The A22 Digital Timing Assembly responded to COUNT ENABLE by setting (NOT) TRIG HOLDOFF Low, locking out any further start pulses. When the preset Delay Channels have counted down to zero, (NOT) TRIG HOLDOFF goes High, indicating the end of a cycle. This transition unlocks the one-shot, arming the assembly for another START pulse and clocks the HOLD OFF flip-flop which locks up the divide-by-2 flip-flop, inhibiting any additional CLOCK pulses.

8-152. Digital Sample and Hold

8-153. The phase detector in the Phase Locked Loop samples at a rate of approximately 1.6 MHz. If the Startable VCO is being restarted at a rate in excess of this sampling rate, it is possible that no sample will be taken and the loop will go out of lock, letting the VCO control voltage drift to the end of its range, resulting in an error in the VCO frequency. When the input data is such that this condition may occur (i.e., input trigger > 1MHz), the processor sets the (NOT) LOCK line High which enables the Successive Approximation Register U13 to START conversion.

8-154. At this point, U13 converts the voltage out of comparator U15(7) into discrete levels Q0-Q7. The outputs of U13 Q0-Q7 are then buffered by U17 and U11 and converted to a current in U14. The output of U14(4) goes to U16(2) where it is converted to a voltage and compared to the Loop VCO voltage in U15. This process of matching the Sample & Hold VCO voltage to the Loop VCO continues until they are equal, at which time the EOC output of U13(11) goes High, switching K1 and creating a new loop which includes the Digital Sample and Hold circuitry.

Although the original loop is now "open", the VCO will be held at a frequency close to its normal frequency. This "Open loop" condition will remain until new data is presented, permitting successful locking. (During the Calibrate cycle the loop will relock, allowing an update of the Digital Sample & Hold signal).

8-155. The processor sets this open loop condition whenever Dw (the digital delay number for the width channel) is less than 100. This corresponds to a period (a delay + width) of slightly less than 1 μs. (In the external trigger mode the processor does not know the actual repetition rate of the external trigger, but does know that the minimum time between "starts" of the VCO is at least as long as the digital count-down.) The effect of VCO frequency accuracy on absolute timing is directly proportional to the number of cycles counted. (In the "open loop" condition, the Digital Sample and Hold voltage is supplied to the Out-of-Lock detector on A24. Because this voltage is close to that occurring during locked operation, the Out-of-Lock detector does not give an Out-of-Lock indication.)

8-156. A22 DIGITAL TIMING ASSEMBLY

8-157. The Digital Timing Assembly contains the two presettable down-counters which provide the digital delay for the Delay and Width channels and the digital Sync Delay circuits. DELAY CLOCK and WIDTH CLOCK serially load data from D0 to preset the down-counters. COUNT ENABLE, generated on A23, enables these counters and the SYNC DELAY counter. Clock select circuits determine whether the ~100 MHz CLOCK or the Events input drives the down-counters.

8-158. When EVENT ENB goes High, U2B(1) goes High and U2B(3) goes Low. This disables the 100 MHz clock through U4C. The EVENTS CLOCK then clocks the (NOT) EVT NEG EDGE ENB into U3A(7); and the (NOT) EVENTS CLOCK clocks the EVT NEG EDGE ENB into U3B(10). The inverted outputs of U3A(3) and U3B(14) are then fed into U4B(6) and U4A(5) respectively. This logic decides whether EVENT CLOCKS or (NOT) EVENTS CLOCK (depending on edge selection) are used.

8-159. If EVT NEG EDGE ENB is Low, then EVENTS CLOCK is the chosen clock. (U3A and U3B reset whenever either DISP OUT of U5 or U7 or U13D(9) goes High). U1D takes the (NOT) D0 signal and inverts it so D0 is loaded into U5 and U7 instead of (NOT) D0. The (NOT) WIDTH CLOCK and the (NOT) DELAY CLOCK lines determine which down counter is to be loaded with the serial D0 information. (NOT) TRIG HOLDOFF is the NORed product of:

1. The ORed product of U5(11), U7L(11) and U13D(9), and
2. The clock in P1B SINGLE CYCLE ENB allows only one pulse out (HP-IB operation only).

8-160. During single cycle operation (available only under HP-IB control) the Single Cycle Enb line is High. In this mode, the (NOT) TRIG HOLDOFF line remains Low at the completion of a cycle, but the CYCLE COMPLETE line is set High, signaling the processor that a pulse has been output.

8-161. CYCLE COMPLETE goes Low, and (NOT) TRIG HOLDOFF goes High upon receipt of a RELOAD strobe from the processor — this occurs following receipt of an "RA" (rearm) HP-IB command or the loading of new data into the counters following receipt of new timing parameters. After an enable and clock are received, (NOT) TRIG HOLDOFF is set Low, disabling further start pulses on A23. This condition remains until both down-counters finish counting, at which time, (NOT) TRIG HOLDOFF is released.

8-162. The preset delay data is automatically reloaded into the down-counters from storage registers within the chip at the end of each cycle via the (NOT) RELOAD from A16. The END DIGITAL DELAY and END DIGITAL WIDTH signals, generated as each counter reaches zero, are routed to the A21 Analog Timing Assembly to begin the analog delays.

8-163. The Sync Delay circuit is active only when SYNC DELAY ENB from A16 is present. When SYNC DELAY ENB goes High, the set input into U10(5) goes Low, which allows the outputs of U10A to toggle with a clock from U8(14) and reset U8(9). The output of U8(15) ANDed with the output of U10(3) create the DELAYED SYNC pulse from A22 (which is fed back into A20). The COUNT ENABLE pulse initiates fixed digital delay of approximately 80 ns, to generate DELAYED SYNC. This signal is fed back to the A20 Trigger Amplifier board, where it is selected as SYNC OUT. This circuit provides the (longer) fixed insertion delay used for the normal sync delay configuration.

8-164. A21 ANALOG TIMING ASSEMBLY

8-165. The Analog Timing Assembly contains the two identical analog delay generators which provide the last 10 ns of selectable delay for the Delay and Width Channels. The outputs of the Delay Analog and Width Analog circuits combine to drive a flip-flop which generates the output pulse. As the operation of the two analog generators is identical, only the Delay Channel Analog Generator will be described.

8-166. The (NOT) ANALOG DELAY signal from A16 clocks the eight bits of parallel data from the processor bus lines with U16 and U11. (The (NOT) ANALOG WIDTH signal from A16 clocks the eight bits of parallel data into U15 and U10.) (All registers U10, U11, U15, and U16 have their reset lines tied High to avoid reset). The non-inverted outputs of U16 and U11 go into the D-to-A converter U14(5-12).

8-167. The DAC output U14(4) goes to U12(2) to be amplified and exits U12(6) going into U7A(6), a comparator. Meanwhile, the END DIGITAL DELAY signal has entered onto A21 from A22 to clock flip-flop U8A, the output of which excites a ramp generator (Q9,Q10,Q13-Q15), which is fed into comparator U7A(5). When the voltage on U7A(5) crosses over the voltage level on U7A(6), the output U7A(2) becomes High. This output U7A(2) gets fed into U4(6) and into the set input of U8A(5), which sets U8A(2) to High, and reinitializes the ramp.

8-168. The output from the comparator into U4(6) causes the output of that flip-flop U4(2) to go High and U4(3) to go Low, thereby creating the (NOT) PULSE and the EDGE 1 OUT signal from A21. (The ANALOG WIDTH works in the same manner).

8-169. An additional circuit on this board is the Events-In Trigger Amplifier. This circuit conditions the Events-In signal with the selected Events Trigger Level, as determined on a rear panel control, to produce the EVENTS CLOCK. This signal is output to the A22 assembly where it is synchronized and made available to the Digital Delays.

8-170. A17 OUTPUT REFERENCE ASSEMBLY

8-171. The Offset On/Off switch on the front panel controls relay A17K1. When the offset switch is ON, the OFFSET voltage is routed through U2 and relay A17K1. From A17K1, the OFFSET voltage is routed through Op amps U5, U6, U7, U8 and U9 in order to produce offset parameters IOFF, VS2 and VS3.

8-172. The AMPLITUDE signal comes from the front panel Amplitude pot, and is routed through U1, U10, U11 and U12 to produce amplitude parameters VS1, I Drive and I Amp. These parameters are proportional to the selected voltage on the front panel display.

8-173. U7 produces the TRL (Trigger Reference Level) signal used during the Calibration cycle so that the calibration cycle references the midpoint of the selected output voltage.

8-174. Control signals SFS, OE, SP-, NEG, and COMP are routed through the A17 assembly from the A16 Processor I/F.

8-175. A18 OUTPUT ASSEMBLY

8-176. The Output Assembly consists of the Trig A and B Comparator, the Sync Amplifier, and the Output Amplifier Circuits.

8-177. The Output Amplifier Circuit contains U3 Output Hybrid Amplifier, U4A, U4B and U2A to condition the PULSE signal from A21 to create the desired output. IOFF, IDRIVE, IAMPI, VSI, VS2 and VS3 are input parameters to U3 that control the output amplitude and offset.

8-178. The Sync Amplifier U2B, U2C and Q2-Q4 amplify the SYNC signal to create the SYNC OUTPUT pulse.

8-179. In the TRIG A and TRIG B Comparator, relays K1-K3 route SYNC OUT and PULSE OUT signals through this circuit during the Auto-Calibrate cycle. ECL Comparator U1 creates the TRIG A and TRIG B signals from SYNC OUT and PULSE OUT signals.

8-180. A19 AUTO-ZERO ASSEMBLY

8-181. When the AUTO-ZERO Signal goes High, the calibration process is enabled. Upon completion of the cycle, AUTO-ZERO goes Low so that the 5359A reverts back to normal operation. During this internal calibration process, the A19 assembly performs two tasks:

1. First it calibrates the Precedence Detector,
2. Then it calibrates the rest of the instrument.

8-182. PRECEDENCE DETECTOR CALIBRATION. The CAL TRIG signal is routed through A20 to the A23 assembly and serves as a START pulse to trigger the delay generation process. Finally, the PULSE signal at the output of A18U3 is routed through relays A18K2 and A18K3 as TRIG A and TRIG B. Since TRIG A and TRIG B are equivalent, ideally, the A19 Precedence Detector would detect their arrival as being coincident, but it does not due to inherent delays in the Precedence Detector Circuitry.

8-183. Calibration of the Precedence Detector is an iterative process, and the A19 assembly repeats the above steps, each time changing the value of a number stored in an offset register. The value stored in the offset register is proportional to the delays inherent in the Precedence Detector, which uses this value in its sampling process as a compensation factor. When the Precedence Detector has detected TRIG A's and TRIG B's arrival at the same time, the Precedence Detector is considered to be calibrated. The final value in the offset register is stored for use during calibration of the rest of the instrument.

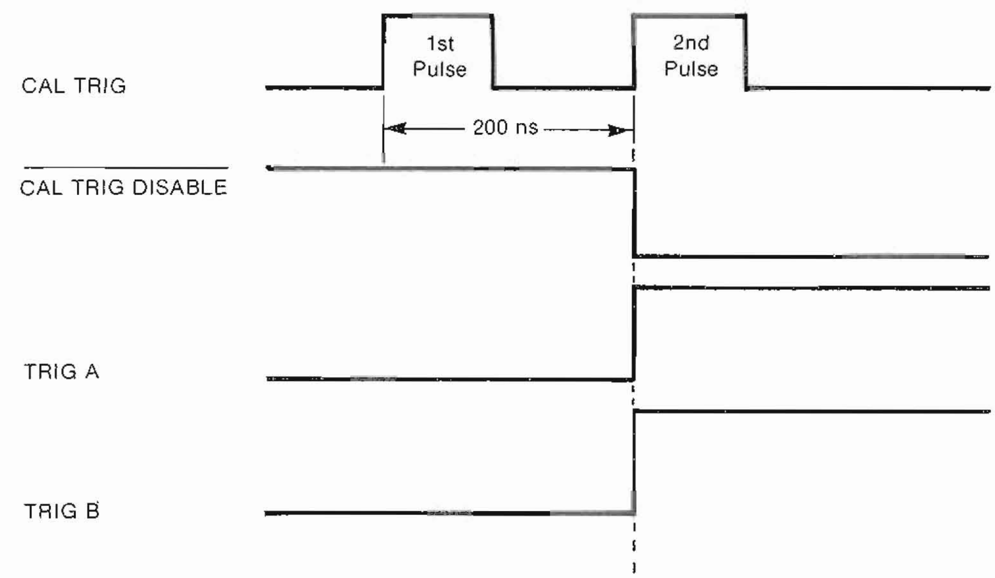
8-184. TRIG A AND B COMPENSATION CALIBRATION. This process is also an iterative one, where the time of arrival of TRIG A and TRIG B are detected and compensated. Refer to the following figure for the following discussion.

8-185. CAL TRIG is a string of two pulses exactly 200 ns apart.

1. The first CAL TRIG pulse is routed through A20 to the A23 assembly as a START pulse triggering delay generation. The microprocessor has placed values into the A22 Johnson counters and the A21 DACs to generate a PULSE signal at A18U3 200 ns later. The PULSE signal feeds back to the A19 Precedence Detector as TRIG B.
2. 200 ns after the first CAL TRIG pulse, the second CAL TRIG pulse and the CAL TRIG DISABLE signal arrive at A20, but the latter signal went Low thus disabling a START pulse. The second CAL TRIG pulse is gated out of A20 as a SYNC pulse to the A18 assembly. The SYNC pulse is routed through the A18 relays as TRIG A and returns to the A19 Precedence Detector.

3. The objective is to achieve coincidence by varying TRIG B such that TRIG A and TRIG B are detected by the Precedence Detector as having arrived at the same time. (The microprocessor increments or decrements the value in the A22 Johnson counters and in the A21 DACs in order to vary the timing of TRIG B.)

4. This entire process is completed when the TRIG A and TRIG B pulses arrive together in time at the A19 Precedence Detector. When this is achieved, the BALANCED signal goes Low signaling the microprocessor, and normal operation is resumed.



A19 AUTO-ZERO TIMING RELATIONSHIPS

8-186. A9 PROCESSOR ASSEMBLY

8-187. Microprocessor U18 has an 8 bit bidirectional Data Bus and a 16 bit unidirectional Address Bus. The Clock Logic circuits consists of U11 and U13 to provide the clocks for the microprocessor, RAMs and Decode Logic. U19 and U20 condition the clock signals to clock 1 and clock 2 inputs of the microprocessor. U1 and U2 are the Driver Circuits and U4, U6, U7 and U9 comprise the Decode Logic.

8-188. A11 DISPLAY INTERFACE ASSEMBLY

8-189. Anode Dividers Q1-Q16 turn on the anodes of the 7-segment displays, status LEDs, and Keyboard LEDs. U5 and U4 are decoders to turn on the anode dividers and Keyboard LEDs. U1, U3, and U6 are segment drivers for the 7-segment LEDs. U10 and U12 are status LED drivers. U2, U4 and U7 are the RAMs that store words to select the output drivers. U15B, U18A, U18B, U19, U21B and U24C comprise the Address Decode Logic enabling and disabling RAMs and Key Latch. U8 is the Scan counter. U13, U22A and U22B comprise the Key Down and Interrupt Logic circuitry. U23A, U23B, U27A and U27B comprise the Clock Logic and Divider.

8-190. A16 PROCESSOR INTERFACE ASSEMBLY

8-191. A16 contains Strobe Generation Circuits, Word Generation Circuits, and Amplitude/Offset Generation Circuits.

8-192. The Strobe Generation Circuit consists of U4 and U7 to decode the address bus to produce strobe pulses. The Word Generation Circuit is made up of U17 and U18, 8-bit buffer A; U15 and U16, 8-bit buffer B; U19 and U20, 8-bit buffer C; and U13 and U14 comprising the 8-bit switch and 8-bit gate to send the status signals back to the Microprocessor.

8-193. Amplitude/Offset Generation circuits. The Data bus and Strobe Generator feed Registers U11 and U12 with offset and amplitude data during remote control. In the local mode, the front panel Amplitude and Offset pots have control. Analog Multiplexer U2 selects remote or local Amplitude and Offset information. Voltage regulators U8 and CR1 supply stability to the Amplitude and Offset generation.

8-194. REPLACING FRONT PANEL LIGHTS

8-195. For the purpose of replacement, the front panel lights can be divided into three catagories: 1) seven-segment display and annunciator LED's; 2) pushbutton switch and clock loss LED's; and 3) external enable and output LED's. Replacement procedures are given under separate headings for each type.

8-196. Seven-Segment Display and Annunciator LED's

8-197. To replace an LED of this type, first remove the red display window by sliding the three plastic slide clamps to the left. The window is now free of remove. To replace any of the seven-segment displays, insert an IC puller over the top and bottom of the LED display and pull out.

8-198. To replace an annunciator LED, first remove the top cover and the red display window. Remove the frosted plastic sheet that covers the annunciator block. Gently place the tips of a pair of needle-nose pliers over the LED while applying a soldering iron to the solder connections of the rear of the A25 Display and Keyboard assembly. Remove the LED. When replacing the new LED, be sure to insert the cathode (the shorter lead) into the pc hole with the square pad.

8-199. Pushbutton Switch and Clock Loss LED's

8-200. There are two methods of replacing these LED's. The first method involves removing the front panel and using heat-shrink tubing to extract the LED. The second method requires the A25 Display and Keyboard assembly be removed from the instrument. Neither of these procedures is overly difficult or time consuming; however, Method 1 is preferred if the heat-shrink tubing is available. See last paragraph under Method 1 for clock loss LED replacement.

8-201. METHOD 1. To replace a pushbutton switch LED, first remove the front panel by removing the hardware associated with the three BNC's, the three LEVEL controls. Also remove nut from backside of A25 Display and Keyboard assembly near right side of instrument. The pushbutton can now be removed using an IC puller.

NOTE

The pushbuttons can be removed with the front panel on if the IC puller is modified by breaking it in half and filing down both sides of the blade's wide portion just before it tapers down to the narrow tip area. Insert the tip between pushbutton and front panel and place tip of puller under back side of pushbutton. Hold opposite side of pushbutton with finger and pull forward.

8-202. Once the pushbutton is removed, place heat-shrink tubing that is about ⅛" ID (HP P/N 0890-0983) over the replacement (new) LED and use a heat gun to shrink tubing around LED. Pull tubing off of LED and insert through the middle of the front panel switch and securely over the faulty LED. Heat the LED solder connection on rear side of the A25 board and remove LED. Use toothpick to clear solder holes. Place tubing over new LED and insert into place. Short lead of LED (cathode) goes into hold with square pad. Solder in place.

8-203. The Clock Loss LED can also be replaced using the heat-shrink tubing method as outlined above. The front panel need not be removed. If tubing is not available, use Method 2. Be sure to retain the spacing insulator when installing the new LED.

8-204. METHOD 2. This method requires removing the A25 Display and Keyboard assembly. The procedure is outlined under *Pushbutton Switch Removal*. Once the board is removed and disassembled, remove the specific switch for access to the LED and remove the LED in the normal manner.

8-205. External Enable and Output LED's

8-206. Remove the front panel by removing the hardware associated with the three BNC jacks, the three LEVEL pots. Also, remove nut from back side of A25 Display and Keyboard assembly, near right side of the instrument. Gently hold the LED with a pair of needle-nose pliers while heating the solder connections on the rear side of A25. Remove the LED. At this point, the large plastic spacer will come free. Tilt the instrument and shake until space falls out. This part was used when the board was loaded prior to wave soldering and is no longer required. The new LED can be properly positioned by hand during replacement.

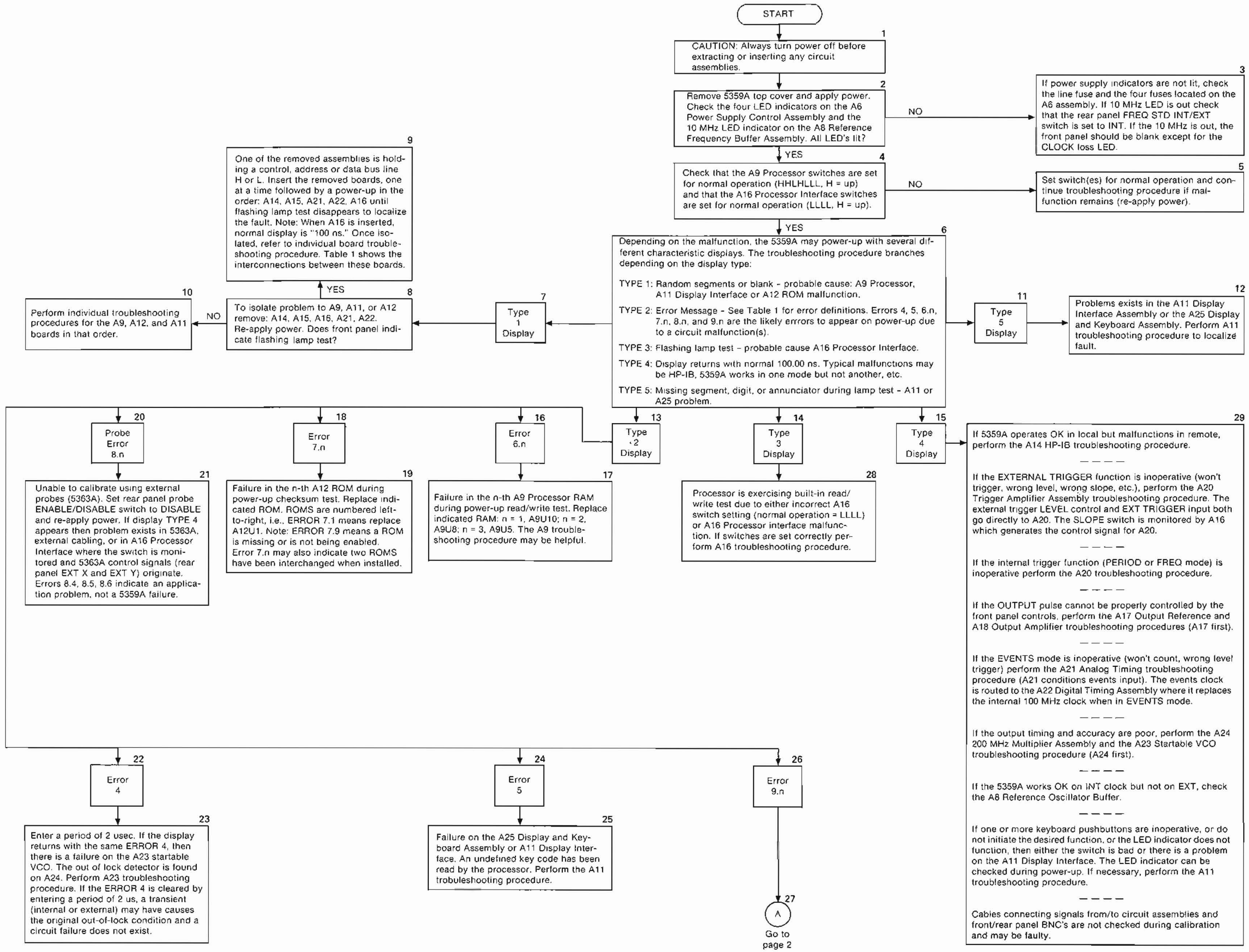
8-207. PUSHBUTTON SWITCH REMOVAL

8-208. The following procedure outlines the steps necessary to disassemble the instrument for the removal of the pushbutton switches.

1. Remove the top and bottom covers.
2. Remove trim strip along top of front panel frame.
3. Remove four screws each from top and bottom of front panel frame.
4. Disconnect the three ribbon cables from the A25 board and the two from A26.
5. Remove the three (two blue, one white) power switch harness cable guides from the bottom side of A1 assembly. This will allow some slack in the cable harness.
6. Slide the front panel assembly forward and free of the instrument. (The power switch remains in place.)
7. Place the assembly face down on the table; and using a pair of long-nose pliers, remove all retainer clips holding the A25 board in place.
8. Remove the nut on the right side of the A25 board.
9. Leave the assembly face down and lift the A25 board straight up. The front panel has spacers on the studs, and they will fall out if this is turned upside down.
10. Cut away that part of the red switch stud that has been heat staked to the back side of the board.
11. Remove faulty switch and insert new switch into place.
12. Using soldering iron with special tip (HP P/N T-142886), heat-stake new switch to back side of board.
13. Replacement is the reversal of this procedure.

Table 1. Processor Bus Connections

Signal Name	Function	A11	A12	A14	A15	A16	A21	A22
LA0	Address Bus	X	X	X	X	X		
LA1	Address Bus	X	X	X	X	X		
LA2	Address Bus	X	X	X	X	X		
LA3	Address Bus	X	X	X	X	X		
LA4	Address Bus	X	X	X	X	X		
LA5	Address Bus	X	X	X	X	X		
LA6	Address Bus	X	X	X	X	X		
LA7	Address Bus	X	X	X	X	X		
LA8	Address Bus	X	X	X	X	X		
LA9	Address Bus		X	X				
LA10	Address Bus		X	X				
LA11	Address Bus		X	X				
LA12	Address Bus		X	X				
LA13	Address Bus	X	X	X	X	X		
LA14	Address Bus	X	X	X	X	X		
LA15	Address Bus		X	X				
LD0	Data Bus	X	X	X	X	X	X	X
LD1	Data Bus	X	X	X	X	X	X	
LD2	Data Bus	X	X	X	X	X	X	
LD3	Data Bus	X	X	X	X	X	X	
LD4	Data Bus	X	X	X	X	X	X	
LD5	Data Bus	X	X	X	X	X	X	
LD6	Data Bus	X	X	X	X	X	X	
LD7	Data Bus	X	X	X	X	X	X	
LRST	Control	X		X	X			
STROBE ($\emptyset_2$)	Control	X	X	X	X	X		
LVMA	Control	X	X	X	X	X		
L(R/W)	Control	X		X	X	X		
HEN	Control	X	X	X	X	X		
LIRQ	Control	X		X	X			
LNMI	Control	X			X			



NOTE

The numbered corners at top of each block are for reference purposes only and do not represent an order of flow.

Figure 8-3. Overall Assembly Troubleshooting Flowchart (Sheet 1 of 2)

Figure 8-3
OVERALL ASSEMBLY TROUBLESHOOTING FLOWCHART
(Sheet 1 of 2)

(See Page 8-59)

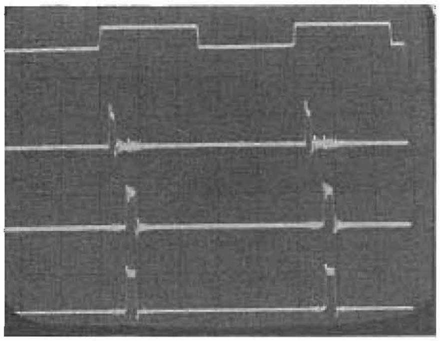


Figure A: External Trigger Input (1V/cm)
Start (1V/cm)
Sync (1V/cm)
Delayed Sync (1V/cm)

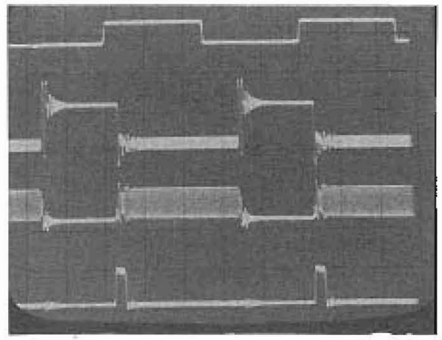


Figure B: External Trigger Input (1V/cm)
Trigger Holdoff (1V/cm)
100 MHz Clock (1V/cm)
Count Enable (1V/cm)

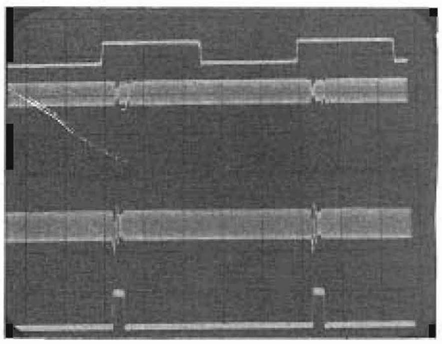


Figure C: External Trigger Input (1V/cm)
Trigger Holdoff "Grounded" (1V/cm)
100 MHz Clock (1V/cm)
Count Enable (1V/cm)

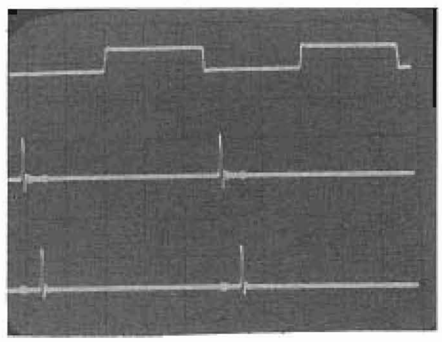


Figure D: External Trigger Input (1V/cm)
End Digital Delay (1V/cm)
End Digital Width (1V/cm)

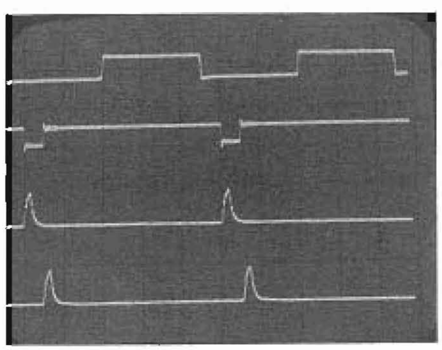
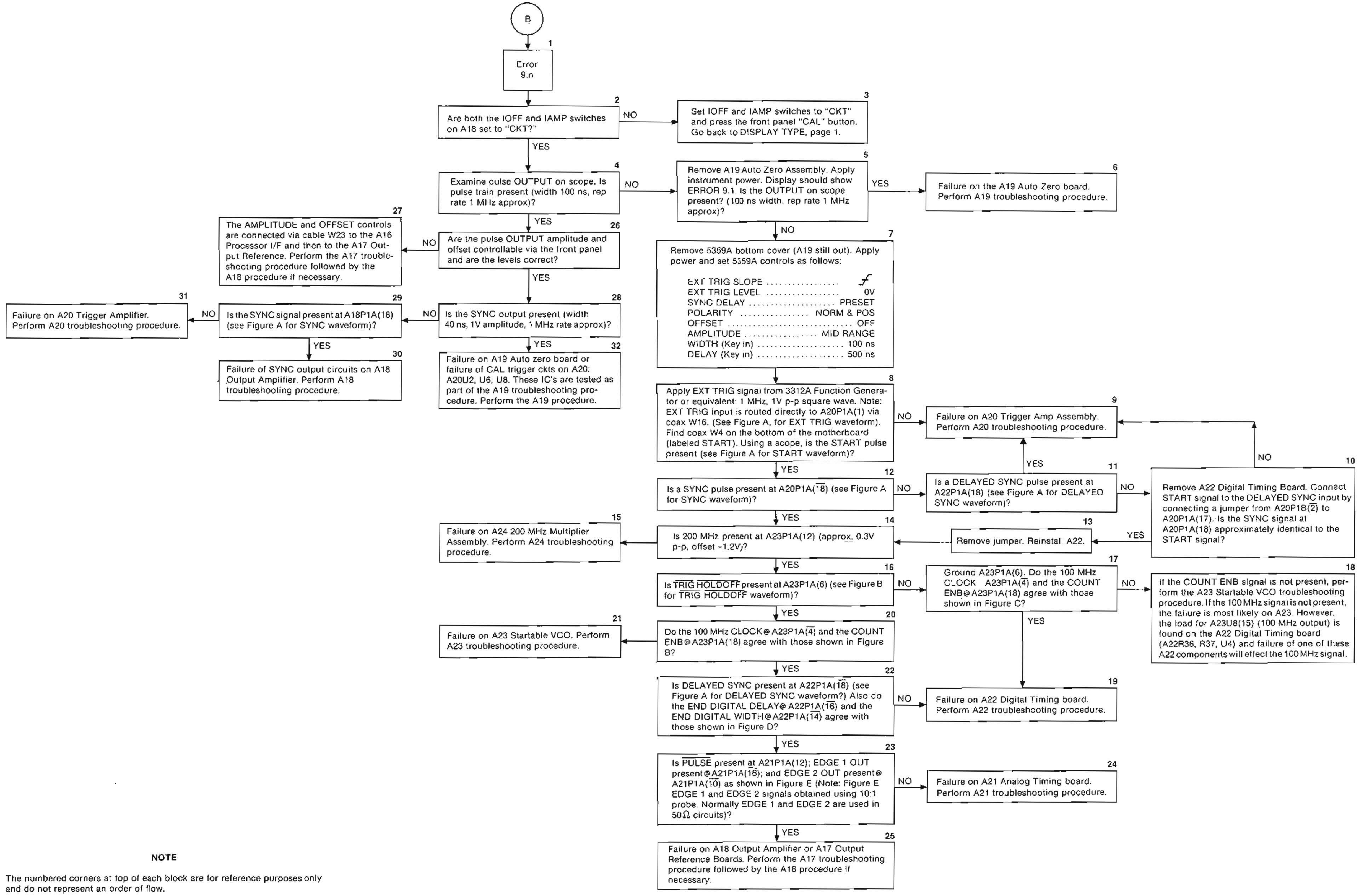


Figure E: External Trigger Input (1V/cm)
Pulse (1V/cm)
Edge 1 (5V/cm)
Edge 2 (5V/cm)



NOTE

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Figure 8-3. Overall Assembly Troubleshooting Flowchart (Sheet 2 of 2)

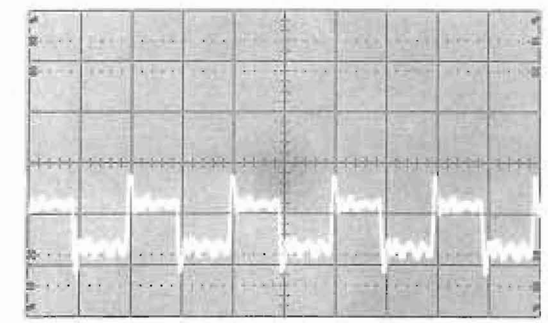
8-209. A8 REFERENCE FREQUENCY BUFFER ASSEMBLY TROUBLESHOOTING

8-210. Begin troubleshooting the A8 Assembly by first placing the assembly on an extender board (i.e., 5060-90049 extender board found in the 10870A service accessory kit). The following seven photos show waveforms which appear at designated points throughout the circuit. The first five are those waveforms of the internal 10MHz clock with the rear panel FREQ STD switch in INT. The last two show waveforms found in the circuitry used to shape and develop the external time base input. For the last two photos, an external 10 MHz is applied to the rear panel jack J6 with the FREQ STD switch in EXT position. All waveforms were taken using an HP 1725A oscilloscope with an HP 10017A probe. No special 5359A front panel setup is necessary.

REAR PANEL FREQ STD SWITCH **INT**
USE 10 DIVIDER PROBE HP 10017A

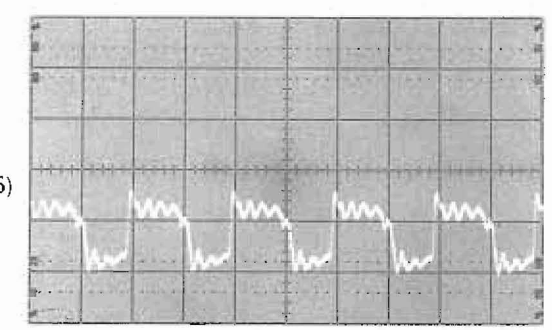
0.1V/div., 50 ns/div.

TP INT
U2C(13)



0.1V/div., 50 ns/div.

U1(6)



0.1V/div., 50 ns/div.

U4(14)
U3(2, 3)

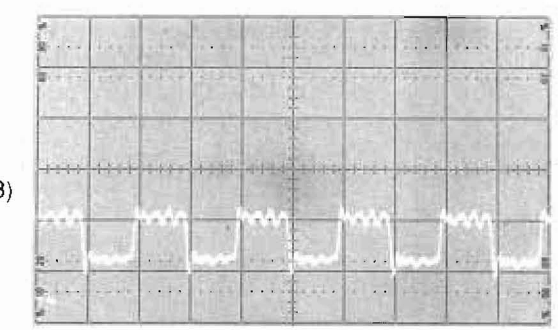
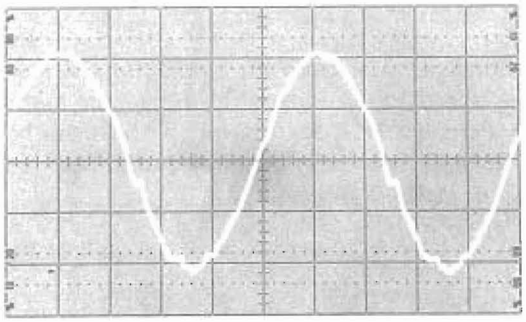


Figure 8-3
OVERALL ASSEMBLY TROUBLESHOOTING FLOWCHART
(Sheet 2 of 2)

(See Page 8-61)

0.1V/div., 20 ns/div.

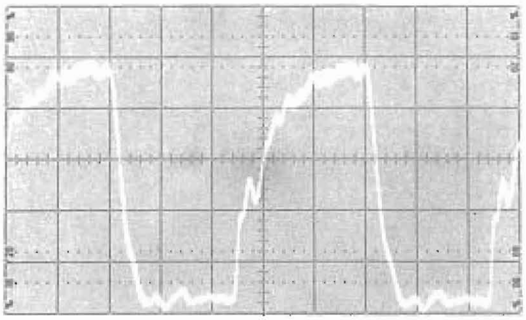
10 MHz EXT OUTPUT (Junction of C7 and C8)



0V

0.1V/div., 20 ns/div.

10 MHz CLK (Collector of Q3)

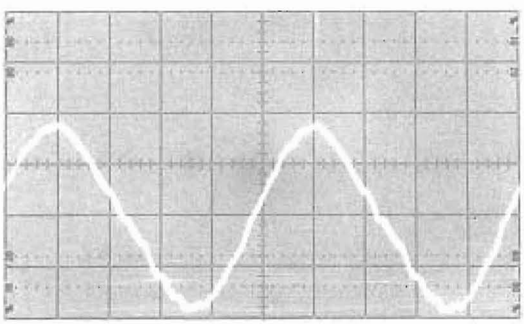


0V

REAR PANEL FREQ STD SWITCH **EXT** WITH 10 MHz INPUT AT REAR PANEL J6

0.2V/div., 20 ns/div.

A8P1A($\overline{8}$)



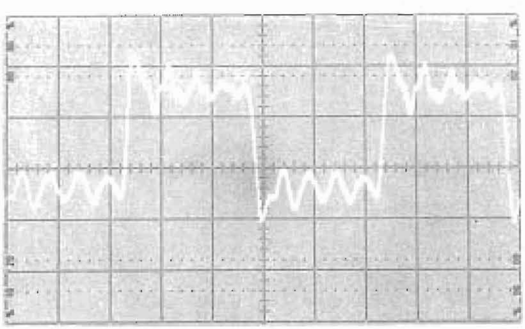
0V

The last signal has a dc offset such that it can only be seen if it is inverted by the oscilloscope. To do this, move the probe to Channel B and press B Invert.

.05V/div., 20 ns/div.

TP EXT

U2B(9)



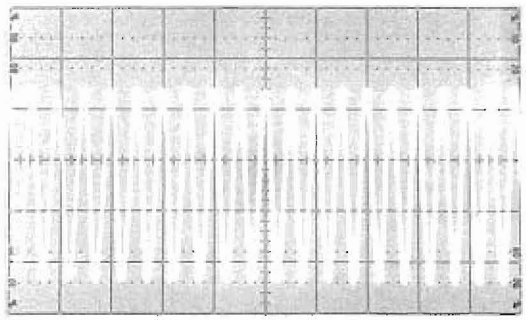
0V

8-211. A24 200 MHz MULTIPLIER ASSEMBLY TROUBLESHOOTING

8-212. Begin troubleshooting the A24 assembly by placing the assembly on an extender board (i.e., 05370-60077 extender board found in the 10870A service accessory kit). The following five photos show waveforms which appear at designated points throughout the circuit. All waveforms were taken using an HP 1725A (275 MHz) oscilloscope and 10020A resistive dividers with a 20:1 tip. No special 5359A front panel setup is necessary.

0.1V/div., 10 ns/div., 50Ω

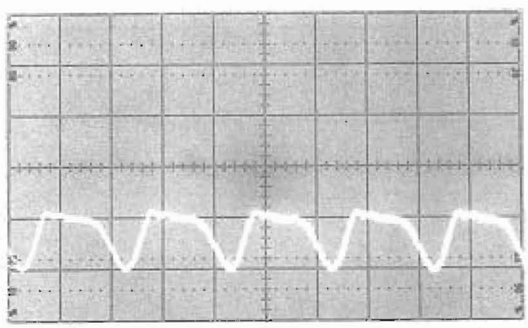
TP1
(200 MHz)



— 0V

0.1V/div., 10 ns/div., 50Ω

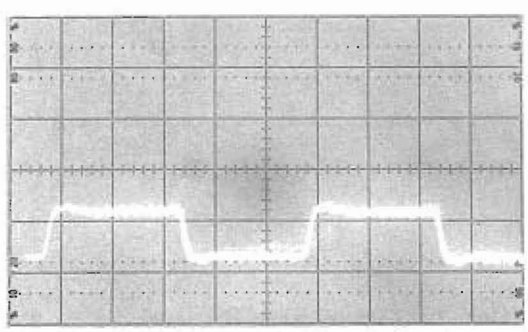
TP2
(50 MHz)



— 0V

0.05V/div., 20 ns/div.

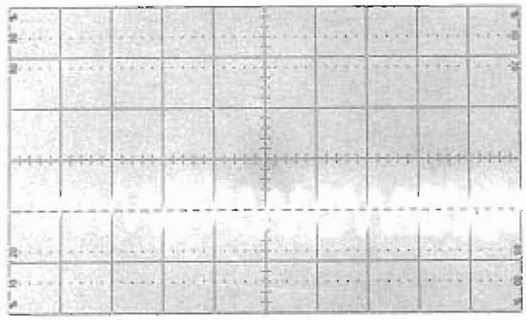
10 MHz INPUT
P1B$\overline{(8)}$



— 0V

0.02V/div., 10 ns/div.

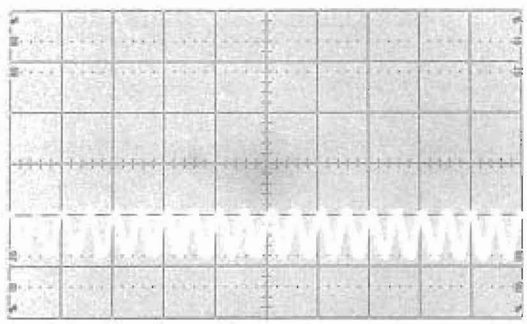
U2A(3, 15)



0V

0.02V/div., 10 ns/div.

200 MHz
U1(14)
U1(2)



0V

The following dc bias voltages for transistors Q1 through Q8 were measured with an HP 3465A Digital Multimeter. They were measured with the 5359A A8 assembly removed.

NOTE

All of the collectors are at ground (0V).

	Base	Emitter
Q1	-14.9V	-15.0V
Q2	-12.0V	-12.7V
Q3	- 7.9V	- 8.5V
Q4	- 8.5V	- 9.1V
Q5	- 7.6V	- 8.2V
Q6	- 7.5V	- 8.1V
Q7	- 7.6V	- 8.2V
Q8	- 7.5V	- 8.1V

8-213. A20 TRIGGER AMPLIFIER ASSEMBLY TROUBLESHOOTING

8-214. A20 consists of three circuits:

1. External Trigger Input Circuit
2. START circuit (produces START signal)
3. SYNC circuit (produces SYNC signal)

8-215. To perform the troubleshooting, proceed as follows:

1. Apply power to 5359A and set controls as follows:

   a. EXT TRIG SLOPE .... POSITIVE
      SYNC DELAY .... AUTO
      POLARITY .... NORM/POS
      OFFSET .... OFF
      AMPLITUDE .... 12 O'CLOCK POSITION
      WIDTH .... 100 ns
      DELAY .... 500 ns

   b. Apply EXT TRIG signal from 3312A Function Generator or equivalent: 1MHz, 1 V p-p square wave.

   c. Placé A20 assembly on extender board 05370-60075 with switches in closed position (up).

2. Verify EXT TRIG INPUT at TP1. If not present, then troubleshoot back to BNC input.

3. Verify EXT TRIG INPUT at TP2. If not present, then troubleshoot back to BNC input. EXT TRIG INPUT at TP2 is a 1 Vp-p square wave with a -1.5 volt offset and frequency equal to frequency of EXT TRIG signal form 3312A Function Generator.

4. Verify presence of START signal at P1B(2) or U10A(3). START signal has frequency equal to 1 MHz, 1 Vp-p square wave with -2 volt offset and pulse width is 20ns. If not there, then troubleshoot back to TP2. (If signals in steps 2-4 are present, then START circuitry in external trigger mode is good).

5. Verify SYNC signal at P1A(18) or U8A(2). Signal same as in step 4. If O.K., then SYNC circuit in AUTO mode is good, and External Trigger Input circuit is good. Go to STEP 10. If not there, then continue to STEP 6.

6. Verify EXT TRIG INPUT signal is gated through at U9(3). Signal same as in STEP 4. If not there, then replace U9 or surrounding components (C16, R31, R32 or R15).

7. Verify EXT TRIG INPUT signal is gated through at U6B(7). Signal same as in STEP 4. If not there, then replace U6.

8. Verify EXT TRIG INPUT signal gated through at U8C(14). Signal same as in STEP 4. If not there, then replace U8.

9. Verify EXT TRIG INPUT signal gated through at U8A(2). If not there, then replace U8.

10. Change front panel SYNC DELAY switch from AUTO to PRESET.

11. Verify SYNC signal at P1A(18) or U8A(2). Signal same as in STEP 4. If there, then SYNC circuit in PRESET mode is good.

12. Verify DELAYED SYNC signal at P1A(17) or U8B(6). Signal same as in STEP 4. If not there, then troubleshoot Digital Sync Delay circuit A22 Assembly.

13. Verify that DELAYED SYNC signal is gated through at at U8B(3). Signal same as in STEP 4, but inverted. If not there, then replace U8.

14. Verify that DELAYED SYNC is gated through at U8A(2). Signal same as in STEP 4. If not there, then replace U8.

15. Reapply power to 5359A by turning it OFF, then ON again. Leave it in power-up condition. (Remove any external trigger input).

16. Verify that START signal is present at P1B(2) or U10B(2). Signal same as in STEP 4. If there, then START circuitry is good. If not there, then troubleshoot back to (NOT) INT TRIG signal to isolate failure.

17. Verify SYNC signal at P1A(18) or U8A(2). Signal same as in STEP 4. If there, then SYNC circuitry is good. If not there, then troubleshoot back to (NOT) INT TRIG signal to isolate failure.

8-216. A23 STARTABLE PLL OSCILLATOR ASSEMBLY TROUBLESHOOTING

1. Place A23 on Extender Board 05370-60075 with switches closed (up position).

2. Turn power to 5359A on. Leave 5359A in default power-up condition.

3. Verify that VCO voltage is between -3.3V and -10V. If it is, and ERR 4 is displayed, then problem lies in the A24 Out-Of-Lock-Detector Circuit.

4. If VCO voltage is -12 V, then PLL circuit is out of lock. Problem either lies in A23 PLL circuit or A23 Digital Sample and Hold circuit.

5. If problem is in A23 Digital Sample and Hold circuit, then ERR 4 message will disappear when an output frequency of 0.5 MHz is entered on the 5359A Front Panel. If ERR 4 message does not disappear, then problem lies in A23 PLL circuit.

6. As a last suggestion, the most common failure on the A23 Assembly is the Startable VCO Hybrid, A23U5, P/N 5088-7009.

8-217. A21 DELAY AND WIDTH DACs TROUBLESHOOTING

1. Enter Width - 100ns
   Period - 300ns
   Step Size - .04ns for both period and width

2. To verify Delay DAC:

   Put the 5359A in the Width function and connect a 10:1 oscilloscope probe to the "D" test point on the A21 board. The Oscilloscope will display a DC level between +2V and -2V. This is approximately equal to 11 ns in time.

   Check the range of the DAC by increasing and decreasing width using the step size (arrow up or arrow down) key.

3. Input data to U14 for:

	MSB							LSB
+2.00V -----	1	1	1	1	1	1	1	1
-2.00V -----	0	0	0	1	1	1	1	x

4. Each time the width is changed, "ANALOG DELAY" should go Low. It can be seen by probing U11, pin 9.

5. To verify Width DAC:

   Put the 5359A in period function and a connect 10:1 oscilloscope probe to the "W" test point on the A21 board. The Oscilloscope will display a DC level between +2V and -2V. This is approximately equal to 11 ns in time.

   Check the range of the "DAC" by increasing and decreasing the period using step size (arrow up or arrow down) key.

6. Input data to U13 for:

	MSB							LSB
+2.00V -----	1	1	1	1	1	1	1	1
-2.00V -----	0	0	0	1	1	1	1	x

7. Least significant bit (LSB) at U14 should change its state every +50 ps change in the width/period.

8. Change in the LSB reflects approximate change of 15 mV at the "D" test point.

8-218. A22 DIGITAL TIMING ASSEMBLY TROUBLESHOOTING

1. Enter a period of approximately 500 ns.

2. The Signal COUNT ENB has the same period as specified through the front panel.

3. END DIGITAL DELAY and END DIGITAL WIDTH have the same period as specified on the front panel. The difference between the rising edges of the two signal is the width specified on the front panel. Use the step size to decrease or increase the period and width on the front while monitoring the change in both signals at U6-15 and U6-2 on the scope.

4. The control signals to the DELAY counter and the WIDTH counter show activity only when the specified parameters are changed, the CAL button is pushed, or during power up. Use a logic probe to observe activity on:

   a. width clock

   b. delay clock

   c. reload

5. If the control signals are not showing any activity as mentioned in step 4, the problem lies on the A16 Processor Interface Assembly.

6. If the END DIGITAL DELAY and END DIGITAL WIDTH are not behaving as mentioned in step 3, then most probably the Johnson counters are erratic.

A16 TROUBLESHOOTING SIGNATURE SETS
SERIAL PREFIX 2640A AND ABOVE

SIG. SET 1	
P1A — $\overline{6}$	F4FF
P1A — 14	0000
P1A — 4	7554
P1A — $\overline{10}$	HU57
P1A — $\overline{9}$	F1PF
P1A — $\overline{8}$	722H
P1A — $\overline{7}$	050U
P1A — $\overline{11}$	074P
P1A — 19	755U
P1A — 5	0000
P1A — $\overline{12}$	H6PP
P1A — $\overline{13}$	0258
P1A — $\overline{14}$	2225
P1A — $\overline{19}$	1180
P1A — $\overline{20}$	1180

SIG. SET 2	
P1A — 6	4PU3
P1A — 7	755U
P1A — 8	A043
P1A — 9	A043
P1A — 10	9CPU
P1A — 11	755U
P1A — 12	9CPU
P1A — 13	4PU3

SIG. SET 3	
U4 — 7	755U
U4 — 9	755U
U4 — 10	755U
U4 — 11	755U
U4 — 12	755U
U4 — 13	755U
U4 — 14	755U
U4 — 15	755U

SIG. SET 4	
U7 — 7	755U
U7 — 9	755U
U7 — 10	755U
U7 — 11	755U
U7 — 12	755U
U7 — 14	755U
U7 — 15	755U

SIG. SET 5	
U20 — 2	755U
U20 — 6	0000
U20 — 11	0000
U20 — 14	0000

SIG. SET 6	
U19 — 10	755U
U19 — 15	755U

SIG. SET 7	
U16 — 3	0000
U16 — 6	0000
U16 — 11	0000
U16 — 14	0000

SIG. SET 8	
U15 — 2	755U
U15 — 6	0000
U15 — 11	0000
U15 — 14	0000

SIG. SET 9	
U18 — 3	0000
U18 — 7	755U
U18 — 11	0000
U18 — 14	0000

SIG. SET 10	
U17 — 3	0000
U17 — 6	0000
U17 — 11	0000
U17 — 14	0000

SIG. SET 11	
U13 — 4	4PU3
U13 — 7	755U
U13 — 9	A043
U13 — 12	A043

SIG. SET 12	
U14 — 4	9CPU
U14 — 7	4PU3
U14 — 9	9CPU
U14 — 12	4PU3

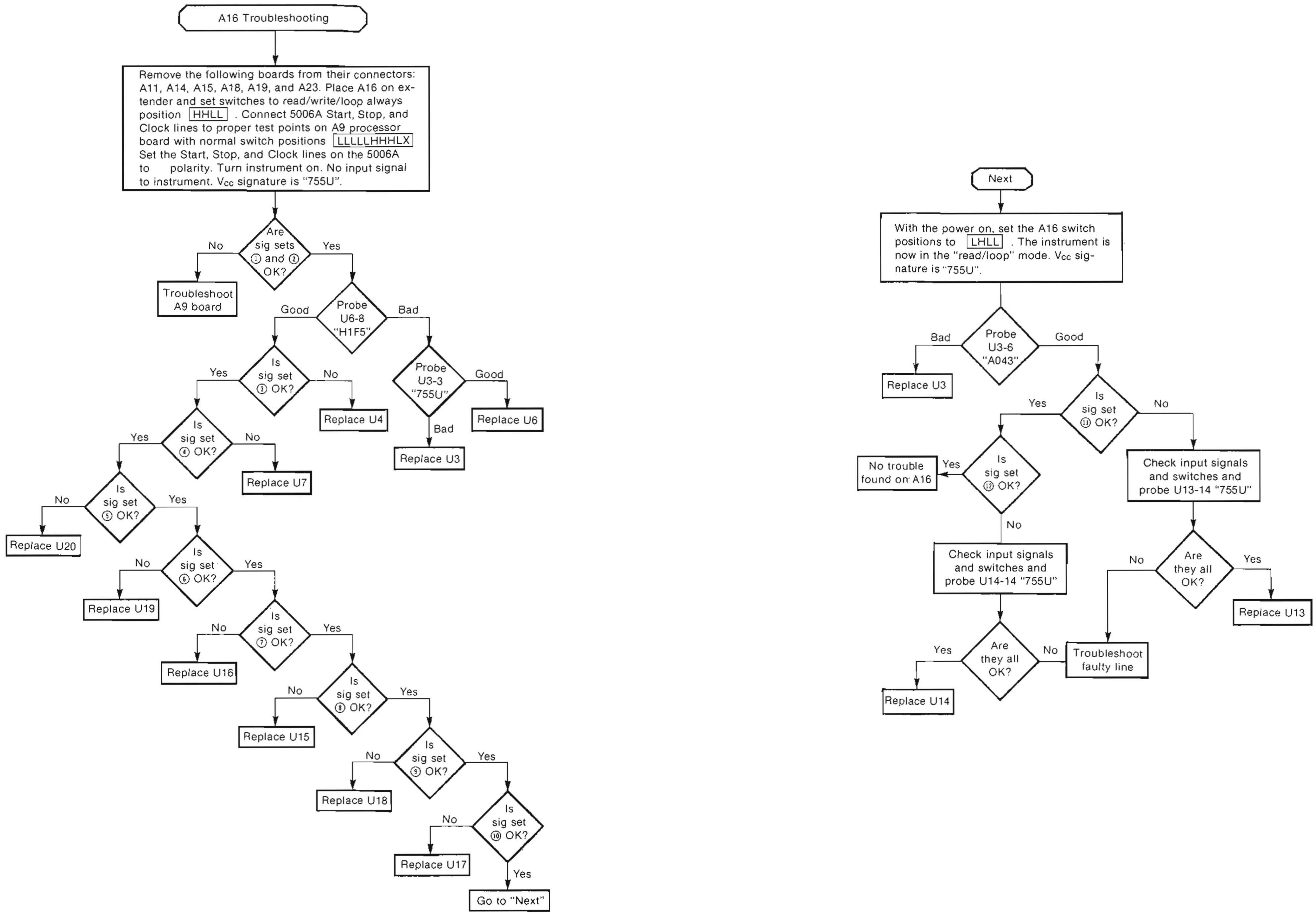


Figure 8-4. A16 Troubleshooting Flowchart

Figure 8-4
A16 TROUBLESHOOTING FLOWCHART

(See Page 8-69)

① CLOCK/ROM Signatures

U11	(2)	00UP (H level)
	(3)	00UP (H level)
	(4)	0007
	(5)	0086
	(6)	0022
	(7)	0033
	(9)	00UP
	(10)	001P
	(11)	001F
	(12)	0000 (L level)
	(13)	0000 (L level)
	(14)	00UP (H level)
	(15)	00UP
U13	(5)	0030
	(6)	008P
	(7)	0038
	(9)	0080
U17	(2)	00FP
U20	(2)	0038
	(3)	00F6
	(5)	0038
	(6)	00FP
	(9)	00F6
	(11)	0038

② ADDRESS BUS

P1A	$\overline{3}$	UUUF
	$\overline{4}$	FFFU
	$\overline{5}$	8487
	$\overline{6}$	P760
	$\overline{7}$	1U5H
	$\overline{8}$	0355
	$\overline{9}$	U75A
	$\overline{10}$	6F99
	$\overline{11}$	7792
	$\overline{12}$	6322
	$\overline{13}$	37C6
	$\overline{14}$	6U2C
	$\overline{15}$	4FC9
	$\overline{16}$	486C
	$\overline{17}$	9UP2
	$\overline{18}$	0001

③ PROCESSOR FREE-RUN

U18	(9)	UUUU
	(10)	FFFF
	(11)	8484
	(12)	P763
	(13)	1U5P
	(14)	0356
	(15)	U759
	(16)	6F9A
	(17)	7791
	(18)	6321
	(19)	37C5
	(20)	6U28
	(22)	4FCA
	(23)	4868
	(24)	9UP1
	(25)	0002

④ RAM/ROM Select Logic

U7(6)	328F
U9(6)	PACH
U9(8)	C72P
U6(2)	9UP1
U6(4)	0002

⑤ Partial Data Bus Driver/Receiver Check

U4	(1)	0000 (toggling)
	(2)	PACH
	(3)	PACH
	(4)	0003 (H level)
	(5)	0003 (H level)
	(6)	PACP
	(8)	0003 (toggling)
	(9)	PACP
	(10)	0000 (toggling)
	(11)	0003 (H level)
	(12)	0003 (toggling)
	(13)	0003 (H level)

⑥ Data Bus Driver Logic

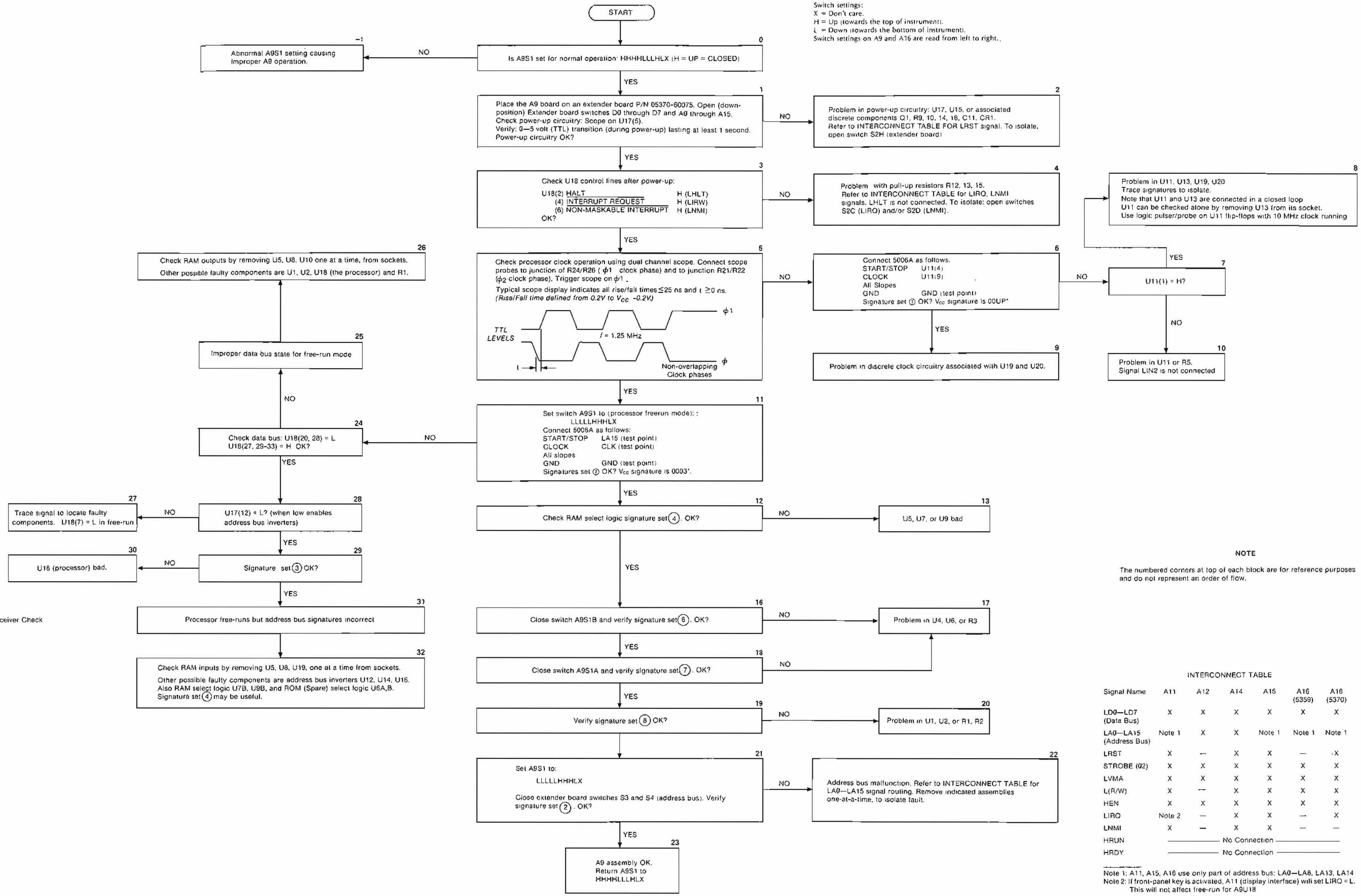
U6(8)	0000
U6(9)	0003

⑦ Data Bus Receiver Logic

U4(12) 0003 (toggling)

⑧ Data Bus Receiver/Drivers

U1	(4)	5FC5
	(7)	0P30
	(9)	764P
	(12)	CUHP
U2	(4)	0000 (toggling)
	(7)	594A
	(9)	0000 (toggling)
	(12)	1HHA



NOTE
Switch settings:
X = Don't care.
H = Up (towards the top of instrument).
L = Down (towards the bottom of instrument).
Switch settings on A9 and A16 are read from left to right.

NOTE

The numbered corners at top of each block are for reference purposes and do not represent an order of flow.

INTERCONNECT TABLE

Signal Name	A11	A12	A14	A15	A16 (5359)	A16 (5370)
LD0—LD7 (Data Bus)	X	X	X	X	X	X
LA0—LA15 (Address Bus)	Note 1	X	X	Note 1	Note 1	Note 1
LRST	X	—	X	X	—	X
STROBE (ϕ2)	X	X	X	X	X	X
LVMA	X	X	X	X	X	X
L(R/W)	X	—	X	X	X	X
HEN	X	X	X	X	X	X
LIRQ	Note 2	—	X	X	—	X
LNMI	X	—	X	X	—	—
HRUN	No Connection					
HRDY	No Connection					

Note 1: A11, A15, A16 use only part of address bus: LA0—LA8, LA13, LA14
Note 2: If front-panel key is activated, A11 (display interface) will set LIRQ = L.
This will not affect free-run for A9U18

*If V_{cc} signature is different then shown, do not proceed any further. Check your SA set-up.

Figure 8-5. A9 Assembly Troubleshooting Flowchart

Figure 8-5
A9 ASSEMBLY TROUBLESHOOTING FLOWCHART

(See Page 8-71)

①

Data Lines	SIG
P1A(3)	29C0
P1A(4)	206H
P1A(5)	3P66
P1A(6)	02F8
P1A(7)	99PU
P1A(8)	62CC
P1A(9)	2F7H
P1A(10)	CA46

②

U13 Inputs	SIG
Pin 10	486C
Pin 12	9UP2
Pin 13	HIGH (0003)
Pin 15	HIGH (0003)
Pin 9	LOW (0000)
Pin 11	LOW (0000)
Pin 14	HIGH (0003)
Pin 1	HIGH (0003)

With all ROMs installed

③

ROM OUTPUTS	SIG
U1(9)	38F2
U1(10)	PF33
U1(11)	HU9H
U1(13)	4413
U1(14)	C7AF
U1(15)	1631
U1(16)	UUUH
U1(17)	8597

④

TP1	U219 (U12 pin 15)
TP2	7CA1 (U12 pin 14)
TP3	P254 (U12 pin 13)
TP4	2756 (U12 pin 12)
TP5	CU29 (U12 pin 11)
TP6	59C9 (U12 pin 10)
TP7	98H1 (U12 pin 9)
TP8	32U8 (U12 pin 7)

⑤

U1(9)	H40H
U1(10)	UPUH
U1(11)	9849
U1(13)	3A8A
U1(14)	3F54
U1(15)	38CP
U1(16)	HU61
U1(17)	F49U

⑥

U2(9)	8448
U2(10)	P5C5
U2(11)	3802
U2(13)	F843
U2(14)	UA65
U2(15)	2059
U2(16)	A43C
U2(17)	33HF

⑦

U3(9)	UU29
U3(10)	H048
U3(11)	625F
U3(13)	005A
U3(14)	8599
U3(15)	ICA9
U3(16)	28AO
U3(17)	8PF5

⑧

U4(9)	4956
U4(10)	0A71
U4(11)	C9H3
U4(13)	A331
U4(14)	PA86
U4(15)	U13A
U4(16)	C628
U4(17)	5607

⑨

U5(9)	6C72
U5(10)	4U7H
U5(11)	39U3
U5(13)	5950
U5(14)	58C8
U5(15)	00C5
U5(16)	C0H3
U5(17)	33U5

⑩

U6(9)	812P
U6(10)	86CF
U6(11)	P4OP
U6(13)	8725
U6(14)	7448
U6(15)	1P66
U6(16)	2P77
U6(17)	2686

⑪

U7(9)	F97P
U7(10)	8AAF
U7(11)	00UF
U7(13)	5240
U7(14)	53AP
U7(15)	929F
U7(16)	7U5U
U7(17)	8H8A

⑫

U8(9)	00AU
U8(10)	1A24
U8(11)	FFAU
U8(13)	H222
U8(14)	ACA5
U8(15)	P5C3
U8(16)	9A99
U8(17)	7334

NOTE
The numbered corners at top of each block are for reference purposes only and do not represent an order of flow.

A12 is deleted for series 2648A and above.

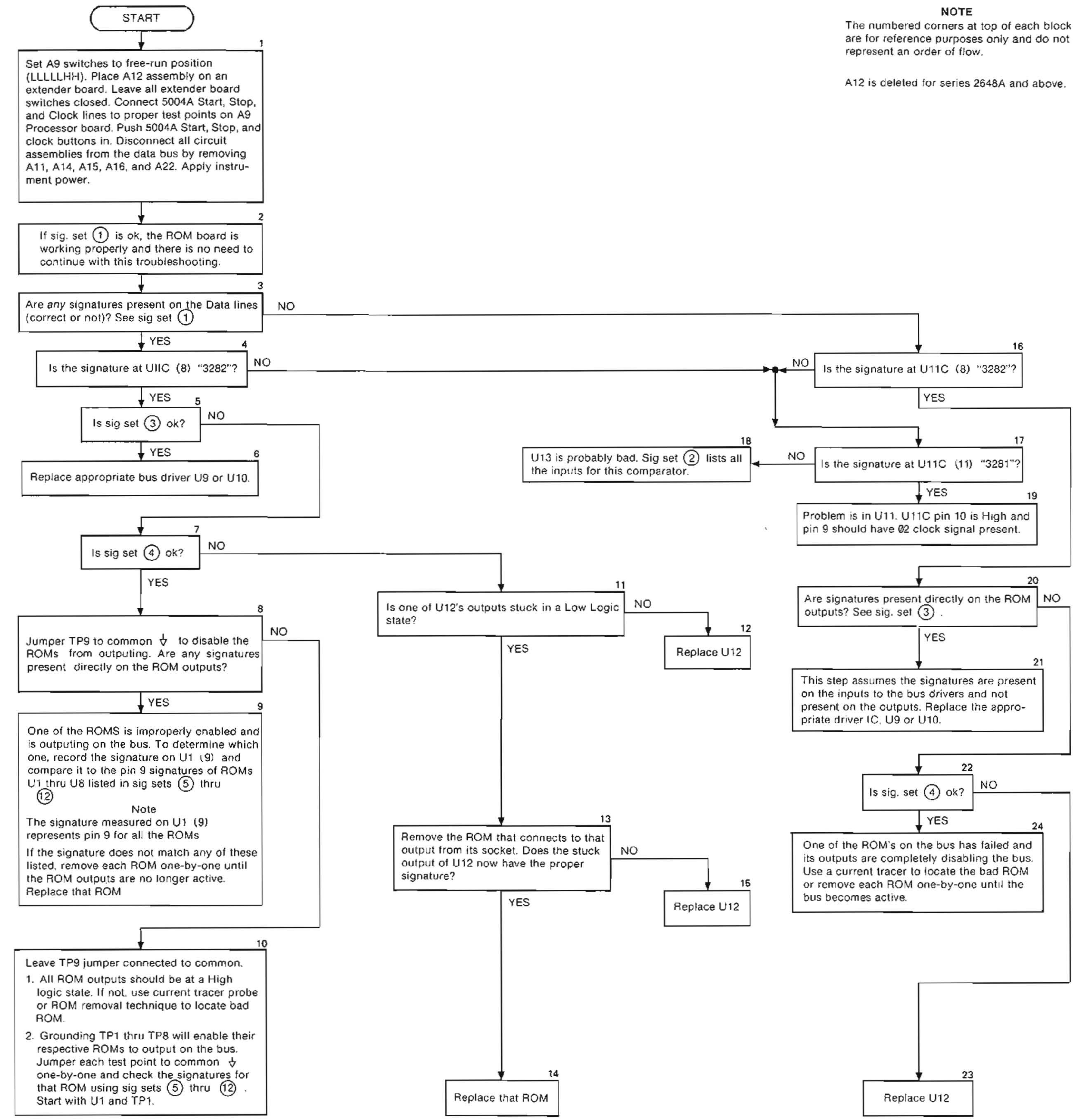
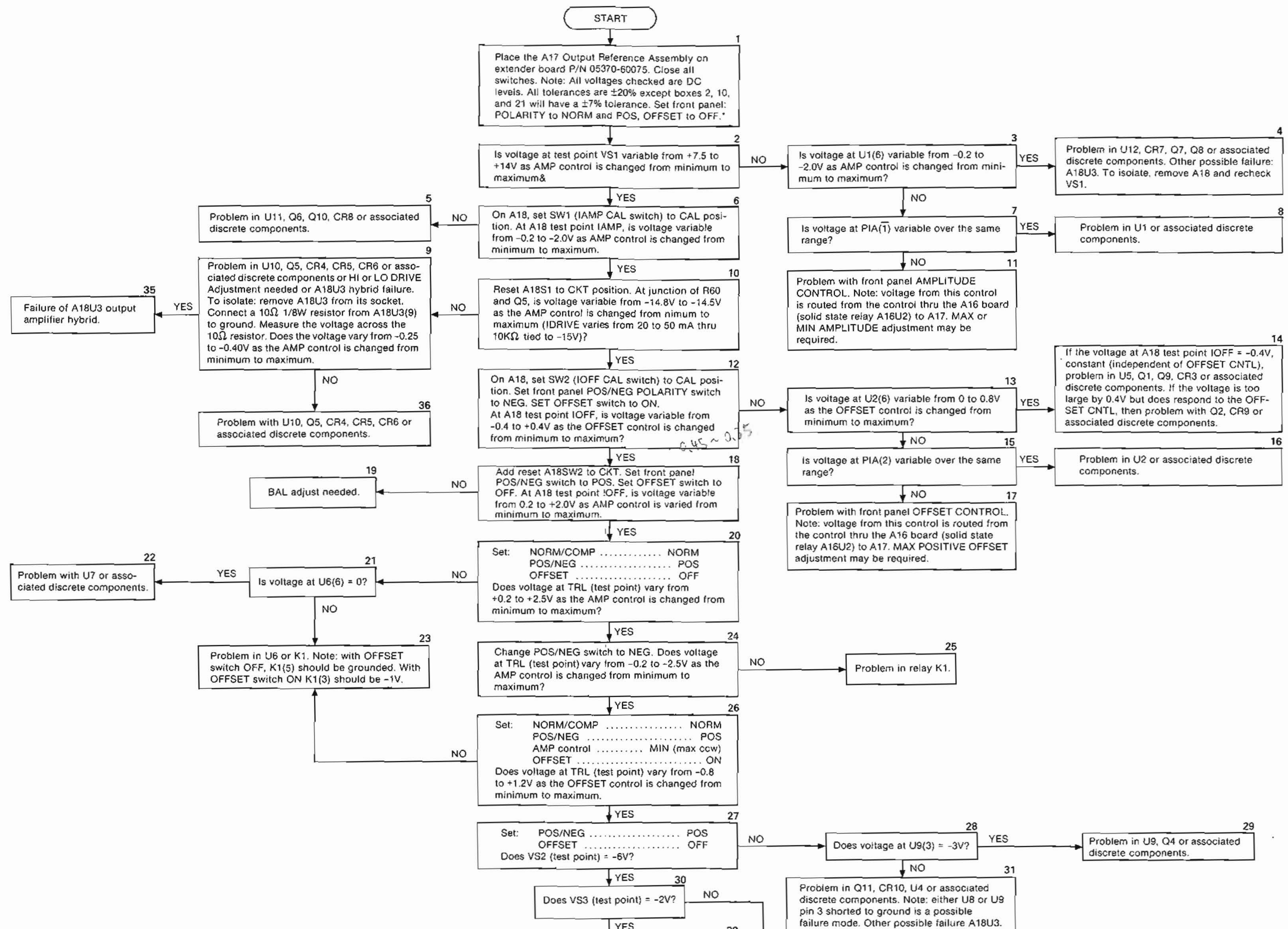


Figure 8-6. A12 ROM Troubleshooting Flowchart (Deleted for series 2648 and above)

Figure 8-6
A12 ROM TROUBLESHOOTING FLOWCHART
(Deleted for series 2648 and above)

(See Page 8-73)



POS/NEG	POS	POS	NEG	NEG
OFFSET	OFF	-1 to 1	OFF	-1 to 1
VS2	-6	-5 to -7	-10	-9 to -11
VS3	-2	-1 to -3	-6	-5 to -7

*Note: When the remainder of the instrument is functioning properly (display/keyboard active) then relay "clicks" can be heard when either the POLARITY POS/NEG or the OFFSET switches are activated. A17 components: relay driver U3 and relay K1.

The numbers at the top of each box are for reference purposes only and do not represent an order of flow.

Figure 8-7. A17 Output Reference Troubleshooting Flowchart

Figure 8-7
A17 OUTPUT REFERENCE TROUBLESHOOTING FLOWCHART

(See Page 8-75)

Note: The numbers at the top of each box are for reference purposes only and do not represent an order of flow.

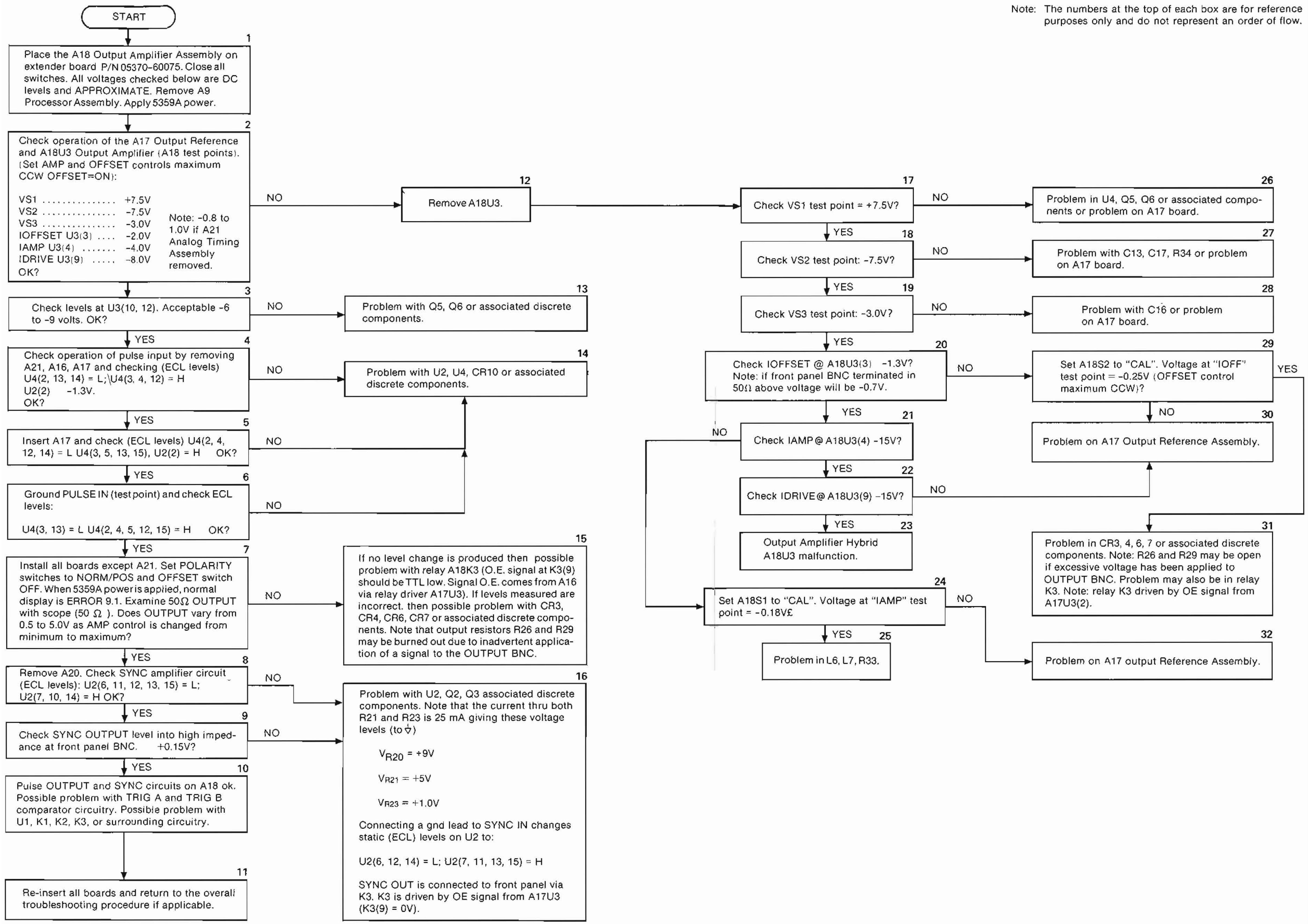
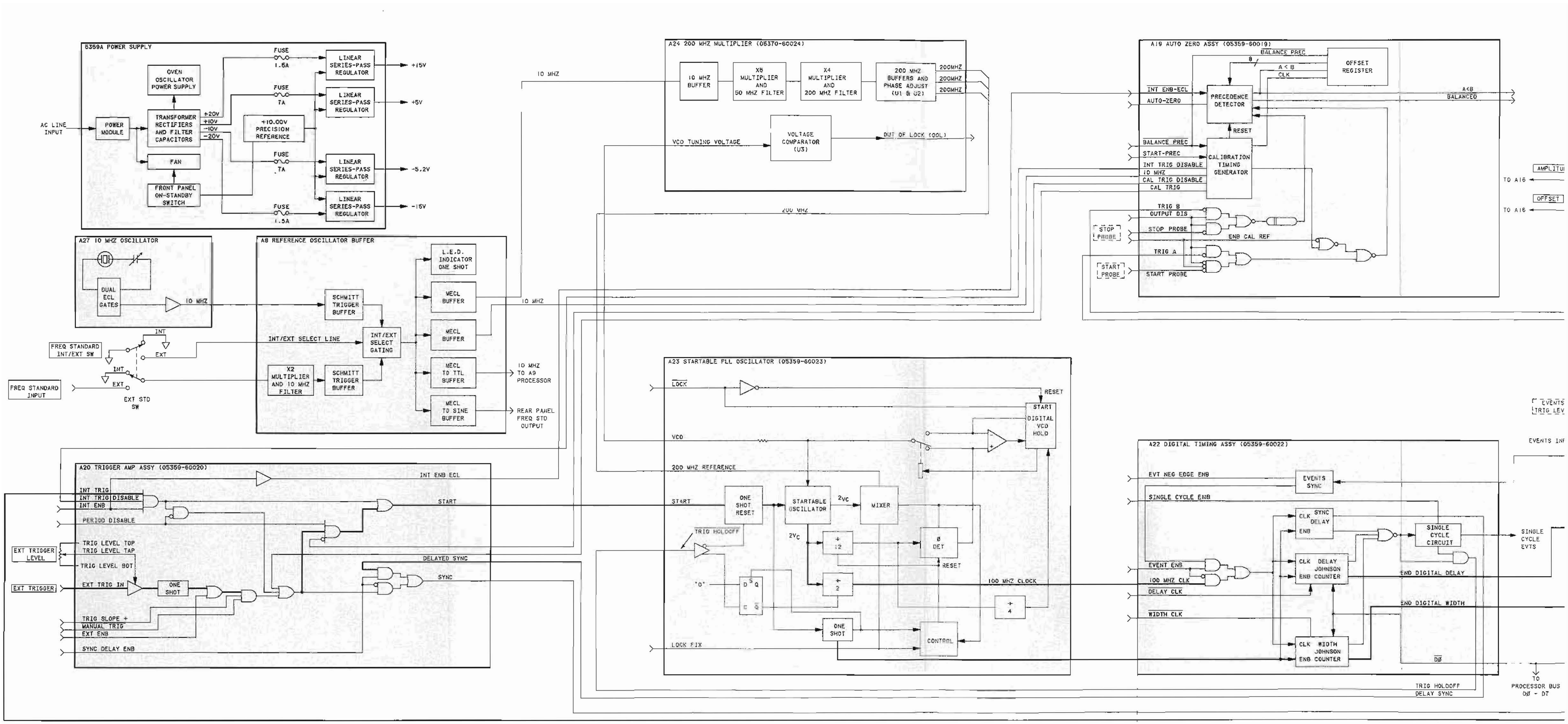


Figure 8-8. A18 Output Troubleshooting Flowchart

Figure 8-8
A18 OUTPUT TROUBLESHOOTING FLOWCHART

(See Page 8-77)



5359A POWER SUPPLY
AC LINE INPUT
POWER MODULE
OVEN OSCILLATOR POWER SUPPLY
TRANSFORMER RECTIFIERS AND FILTER CAPACITORS
+20V
+10V
-10V
-20V
FAN
FRONT PANEL ON-STANDBY SWITCH
+10.00V PRECISION REFERENCE
FUSE 1.5A
FUSE TA
LINEAR SERIES-PASS REGULATOR
+15V
+5V
-5.2V
-15V
A27 10 MHZ OSCILLATOR
DUAL ECL GATES
10 MHZ
A8 REFERENCE OSCILLATOR BUFFER
SCHMITT TRIGGER BUFFER
INT/EXT SELECT LINE
INT/EXT SELECT GATING
X2 MULTIPLIER AND 10 MHZ FILTER
L.E.D. INDICATOR ONE SHOT
MECL BUFFER
MECL TO TTL BUFFER
MECL TO SINE BUFFER
10 MHZ TO A9 PROCESSOR
REAR PANEL FREQ STD OUTPUT
FREQ STANDARD INT/EXT SW
INT
EXT
FREQ STANDARD INPUT
EXT STD SW
A24 200 MHZ MULTIPLIER (05370-60024)
10 MHZ BUFFER
X5 MULTIPLIER AND 50 MHZ FILTER
X4 MULTIPLIER AND 200 MHZ FILTER
200 MHZ BUFFERS AND PHASE ADJUST (U1 & U2)
200MHZ
VCO TUNING VOLTAGE
VOLTAGE COMPARATOR (U3)
OUT OF LOCK (OOL)
200 MHZ
A19 AUTO ZERO ASSY (05359-60019)
BALANCE PREC
OFFSET REGISTER
A < B
CLK
INT ENB-ECL
AUTO-ZERO
PRECEDENCE DETECTOR
RESET
A<B
BALANCED
START-PREC
INT TRIG DISABLE
CAL TRIG DISABLE
CAL TRIG
CALIBRATION TIMING GENERATOR
TRIG B
OUTPUT DIS
STOP PROBE
ENB CAL REF
TRIG A
START PROBE
AMPLITU
TO A16
OFFSET
A20 TRIGGER AMP ASSY (05359-60020)
INT TRIG
INT TRIG DISABLE
INT ENB
PERIOD DISABLE
INT ENB ECL
START
TRIG LEVEL TOP
TRIG LEVEL TAP
TRIG LEVEL BOT
EXT TRIGGER LEVEL
EXT TRIGGER
EXT TRIG IN
ONE SHOT
DELAYED SYNC
SYNC
TRIG SLOPE +
MANUAL TRIG
EXT ENB
SYNC DELAY ENB
A23 STARTABLE PLL OSCILLATOR (05359-60023)
LOCK
RESET
START DIGITAL VCO HOLD
VCO
200 MHZ REFERENCE
ONE SHOT RESET
STARTABLE OSCILLATOR
2Vc
MIXER
TRIG HOLDOFF
÷12
Ø DET
"0"
÷2
100 MHZ CLOCK
÷4
LOCK FIX
CONTROL
A22 DIGITAL TIMING ASSY (05359-60022)
EVT NEG EDGE ENB
EVENTS SYNC
SINGLE CYCLE ENB
CLK SYNC DELAY ENB
SINGLE CYCLE CIRCUIT
SINGLE CYCLE EVTS
EVENT ENB
100 MHZ CLK
DELAY CLK
CLK DELAY JOHNSON ENB COUNTER
END DIGITAL DELAY
END DIGITAL WIDTH
WIDTH CLK
CLK WIDTH JOHNSON ENB COUNTER
DØ
TO PROCESSOR BUS DØ - D7
TRIG HOLDOFF
DELAY SYNC
EVENTS
TRIG LEV
EVENTS INF

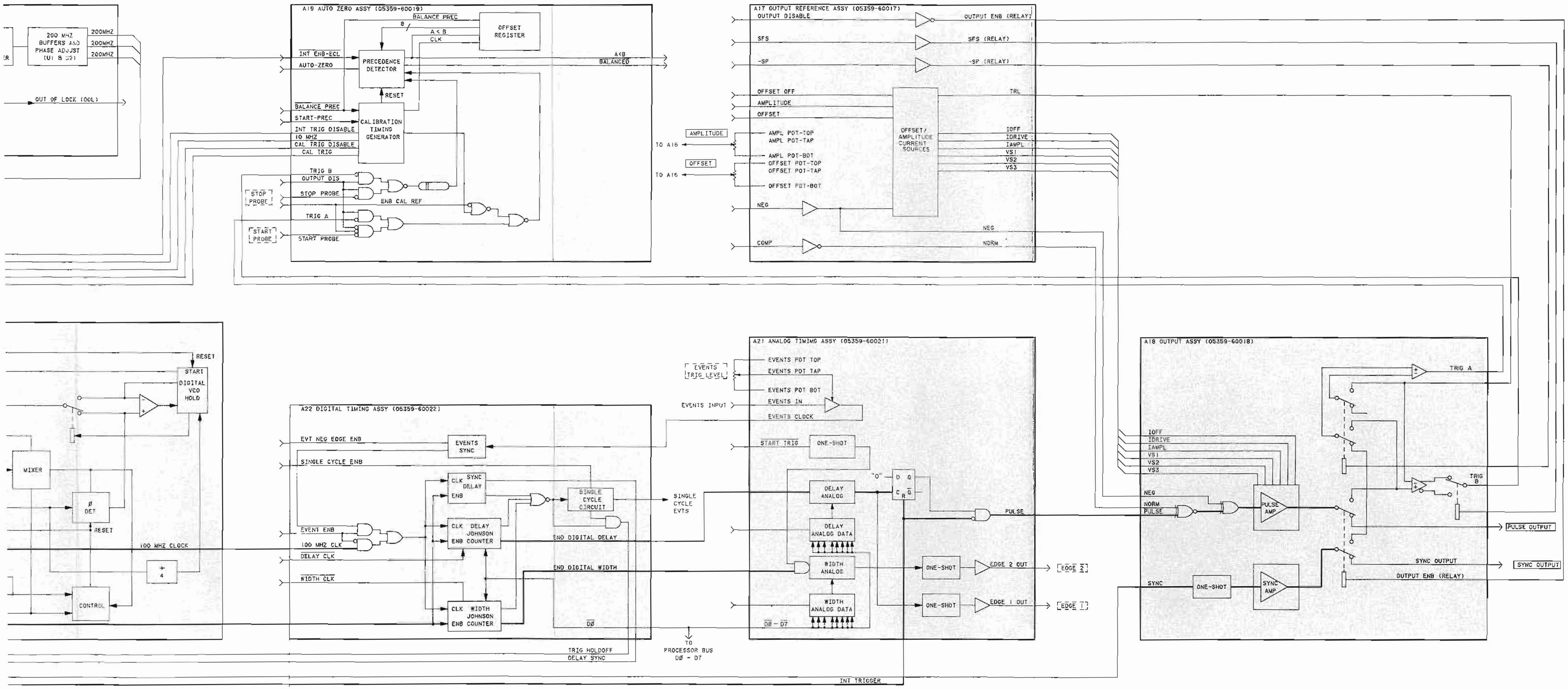
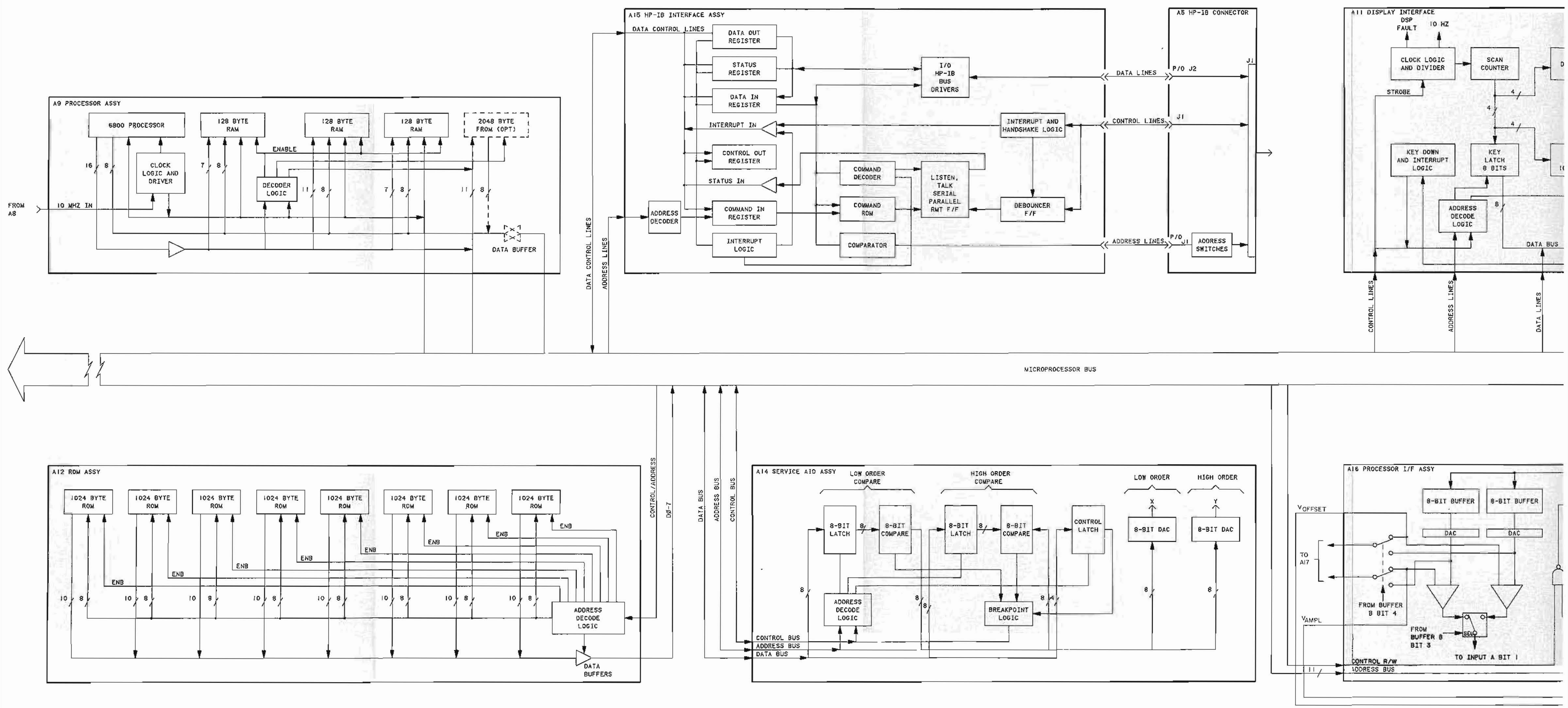


Figure 8-9. Overall Block Diagram
(Sheet 1 of 2)

Figure 8-9
OVERALL BLOCK DIAGRAM
(Sheet 1 of 2)

(See Page 8-79)



A9 PROCESSOR ASSY
6800 PROCESSOR
128 BYTE RAM
128 BYTE RAM
128 BYTE RAM
2048 BYTE FROM (OPT)
CLOCK LOGIC AND DRIVER
DECODER LOGIC
ENABLE
FROM A8
10 MHZ IN
DATA BUFFER
A15 HP-IB INTERFACE ASSY
DATA CONTROL LINES
DATA OUT REGISTER
STATUS REGISTER
DATA IN REGISTER
INTERRUPT IN
CONTROL OUT REGISTER
STATUS IN
COMMAND IN REGISTER
INTERRUPT LOGIC
ADDRESS DECODER
I/O HP-IB BUS DRIVERS
INTERRUPT AND HANDSHAKE LOGIC
COMMAND DECODER
COMMAND ROM
COMPARATOR
LISTEN, TALK SERIAL PARALLEL RMT F/F
DEBOUNCER F/F
A5 HP-IB CONNECTOR
DATA LINES
CONTROL LINES
ADDRESS LINES
ADDRESS SWITCHES
A11 DISPLAY INTERFACE
DSP FAULT
10 HZ
CLOCK LOGIC AND DIVIDER
SCAN COUNTER
STROBE
KEY DOWN AND INTERRUPT LOGIC
KEY LATCH 8 BITS
ADDRESS DECODE LOGIC
DATA BUS
DATA CONTROL LINES
ADDRESS LINES
CONTROL LINES
ADDRESS LINES
DATA LINES
MICROPROCESSOR BUS
A12 ROM ASSY
1024 BYTE ROM
ENB
ADDRESS DECODE LOGIC
DATA BUFFERS
CONTROL/ADDRESS
D0-7
DATA BUS
ADDRESS BUS
CONTROL BUS
A14 SERVICE AID ASSY
LOW ORDER COMPARE
HIGH ORDER COMPARE
8-BIT LATCH
8-BIT COMPARE
CONTROL LATCH
LOW ORDER
HIGH ORDER
8-BIT DAC
ADDRESS DECODE LOGIC
BREAKPOINT LOGIC
CONTROL BUS
ADDRESS BUS
DATA BUS
A16 PROCESSOR I/F ASSY
8-BIT BUFFER
8-BIT BUFFER
DAC
DAC
VOFFSET
TO A17
FROM BUFFER B BIT 4
VAMPL
FROM BUFFER B BIT 3
TO INPUT A BIT 1
CONTROL R/W
ADDRESS BUS

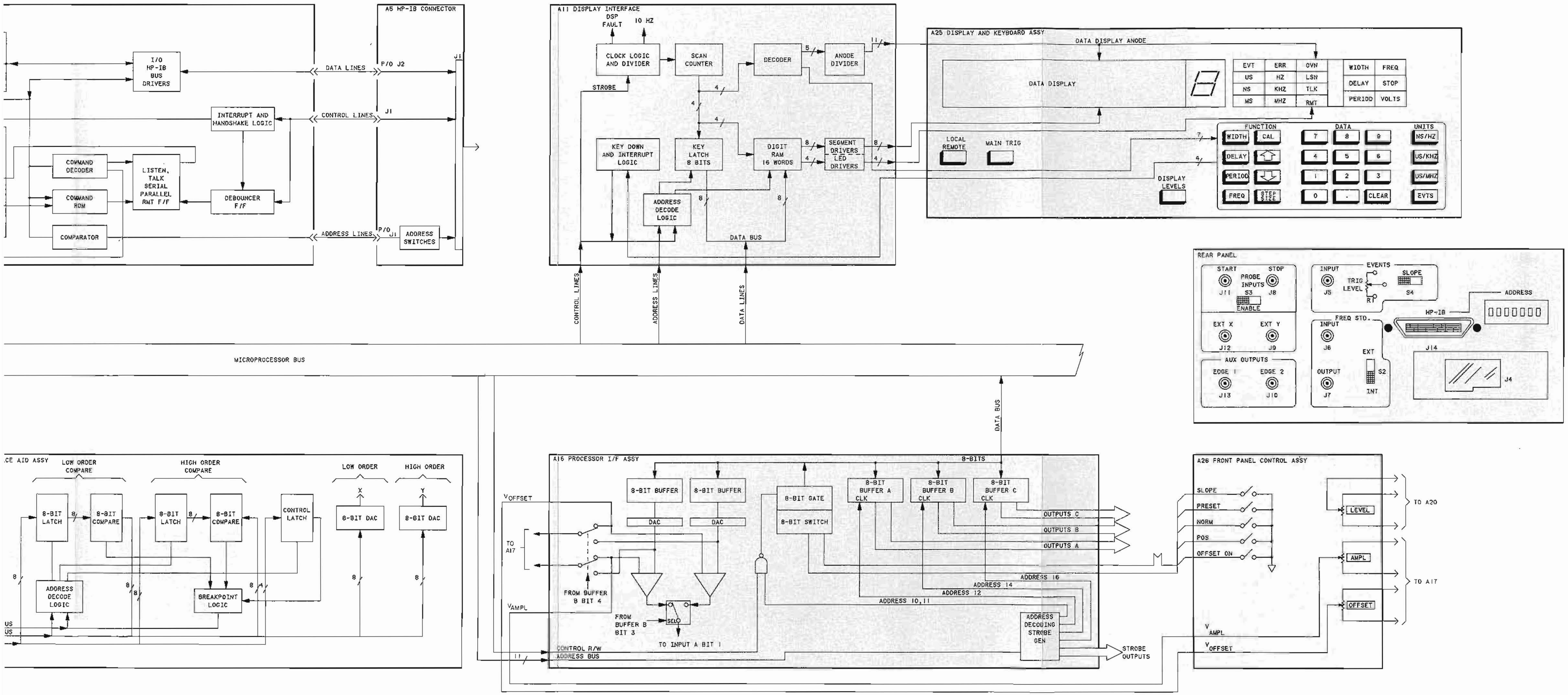
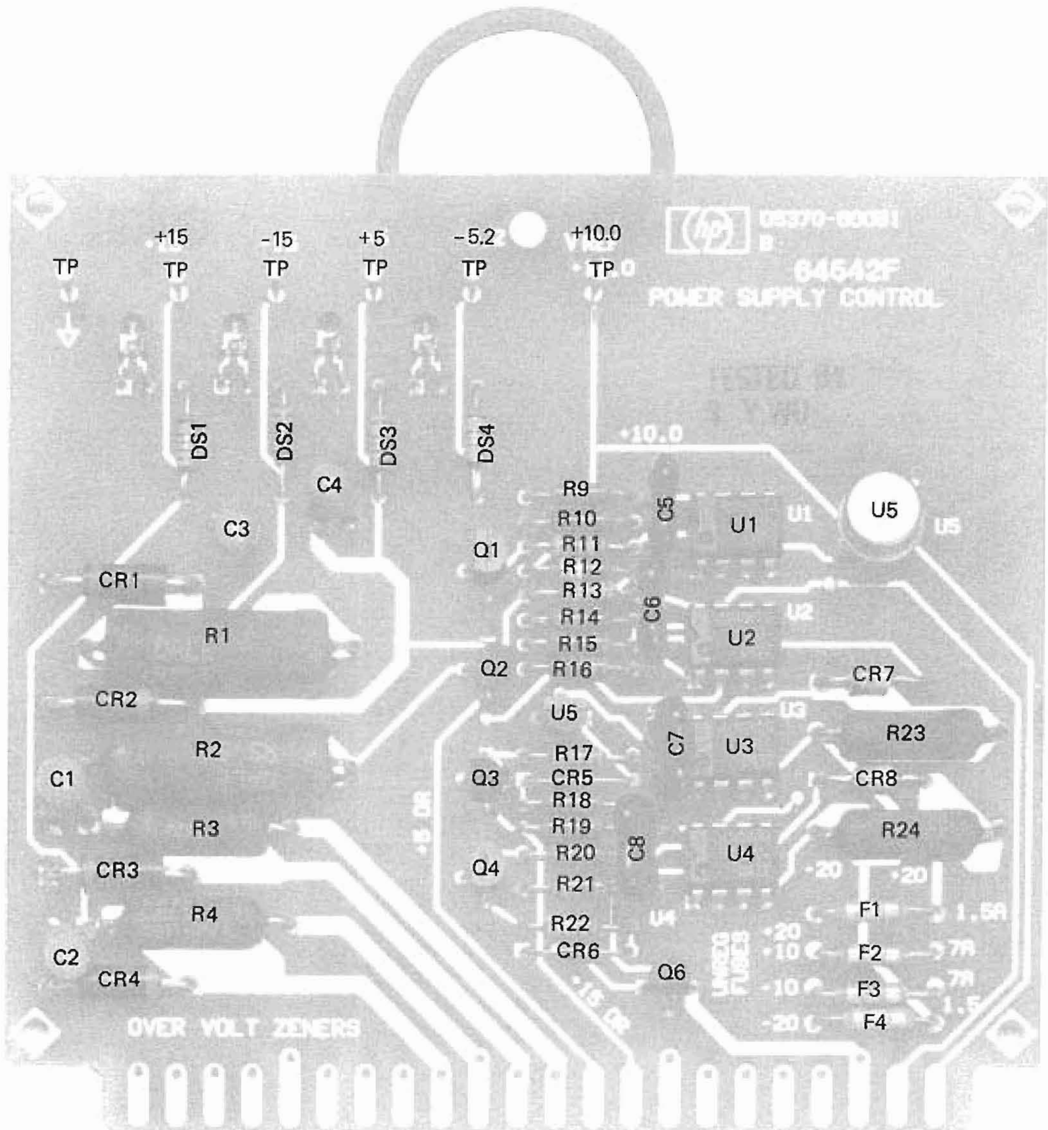
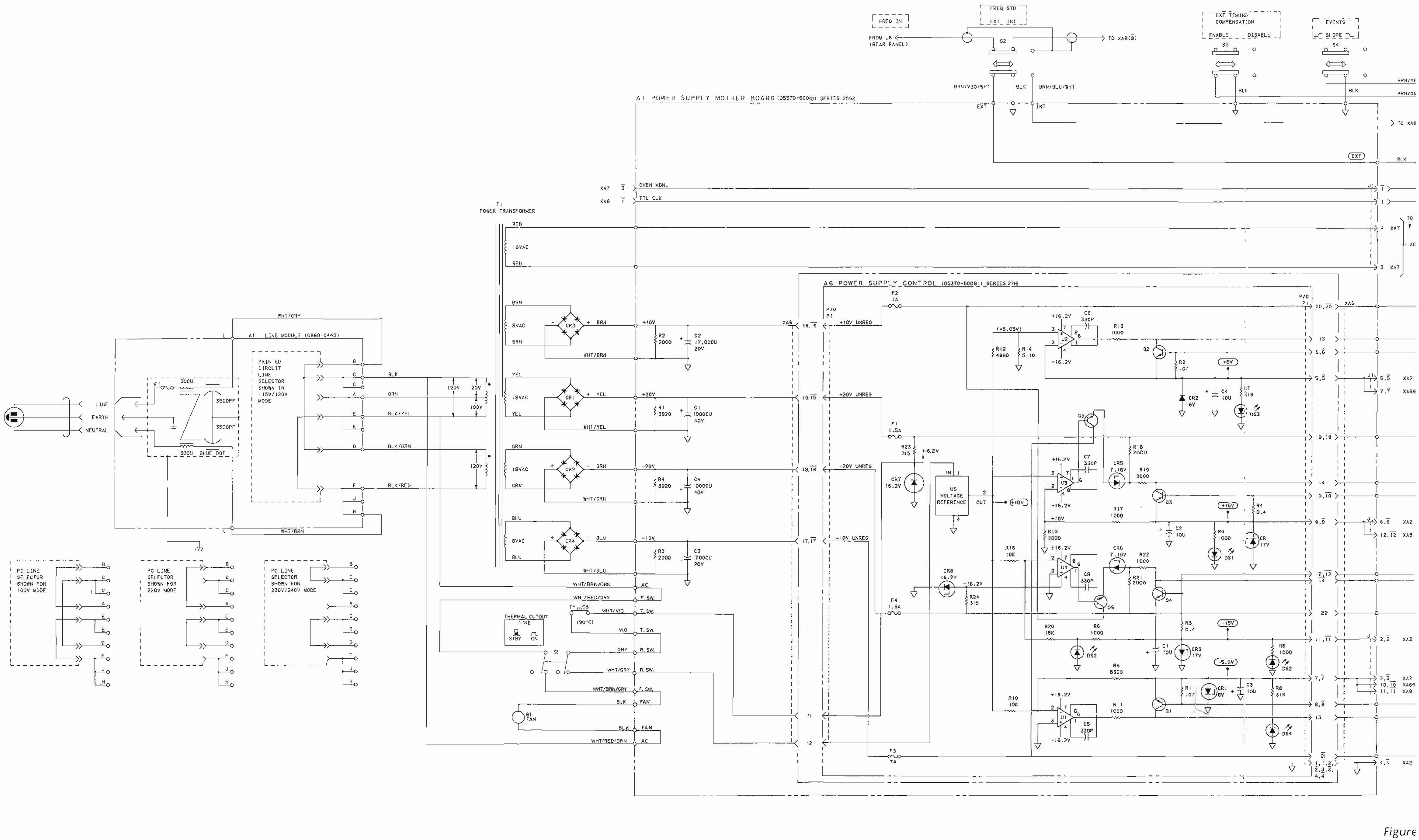


Figure 8-9. Overall Block Diagram (Sheet 2 of 2)

Figure 8-9
OVERALL BLOCK DIAGRAM
(Sheet 2 of 2)

(See Page 8-81)


64642F
POWER SUPPLY CONTROL
TP
+15
TP
-15
TP
+5
TP
-5.2
TP
+10.0
TP
DS1
DS2
DS3
DS4
+10.0
C3
C4
R9
R10
R11
R12
R13
R14
R15
R16
Q1
Q2
C5
C6
C7
C8
U1
U2
U3
U4
U5
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
R1
R2
R3
R4
R17
R18
R19
R20
R21
R22
R23
R24
C1
C2
Q3
Q4
Q6
F1
F2
F3
F4
OVER VOLT ZENERS



FREQ IN
FROM J6 (REAR PANEL)
FREQ STD
EXT INT
S2
TO XA8
EXT TIMING COMPENSATION
ENABLE DISABLE
S3
EVENTS
SLOPE
S4
A1 POWER SUPPLY MOTHER BOARD (05370-60010) SERIES 2552
OVEN MON.
TTL CLK
T1 POWER TRANSFORMER
16VAC
8VAC
18VAC
CR1
CR2
CR3
CR4
A6 POWER SUPPLY CONTROL (05370-60081) SERIES 2716
+10V UNREG
+20V UNREG
-20V UNREG
-10V UNREG
U5 VOLTAGE REFERENCE
A1 LINE MODULE (0960-0443)
PRINTED CIRCUIT LINE SELECTOR SHOWN IN 115V/120V MODE
LINE
EARTH
NEUTRAL
BLUE DOT
PC LINE SELECTOR SHOWN FOR 100V MODE
PC LINE SELECTOR SHOWN FOR 220V MODE
PC LINE SELECTOR SHOWN FOR 230V/240V MODE
THERMAL CUTOUT
LINE
STBY ON
B1 FAN

Figure

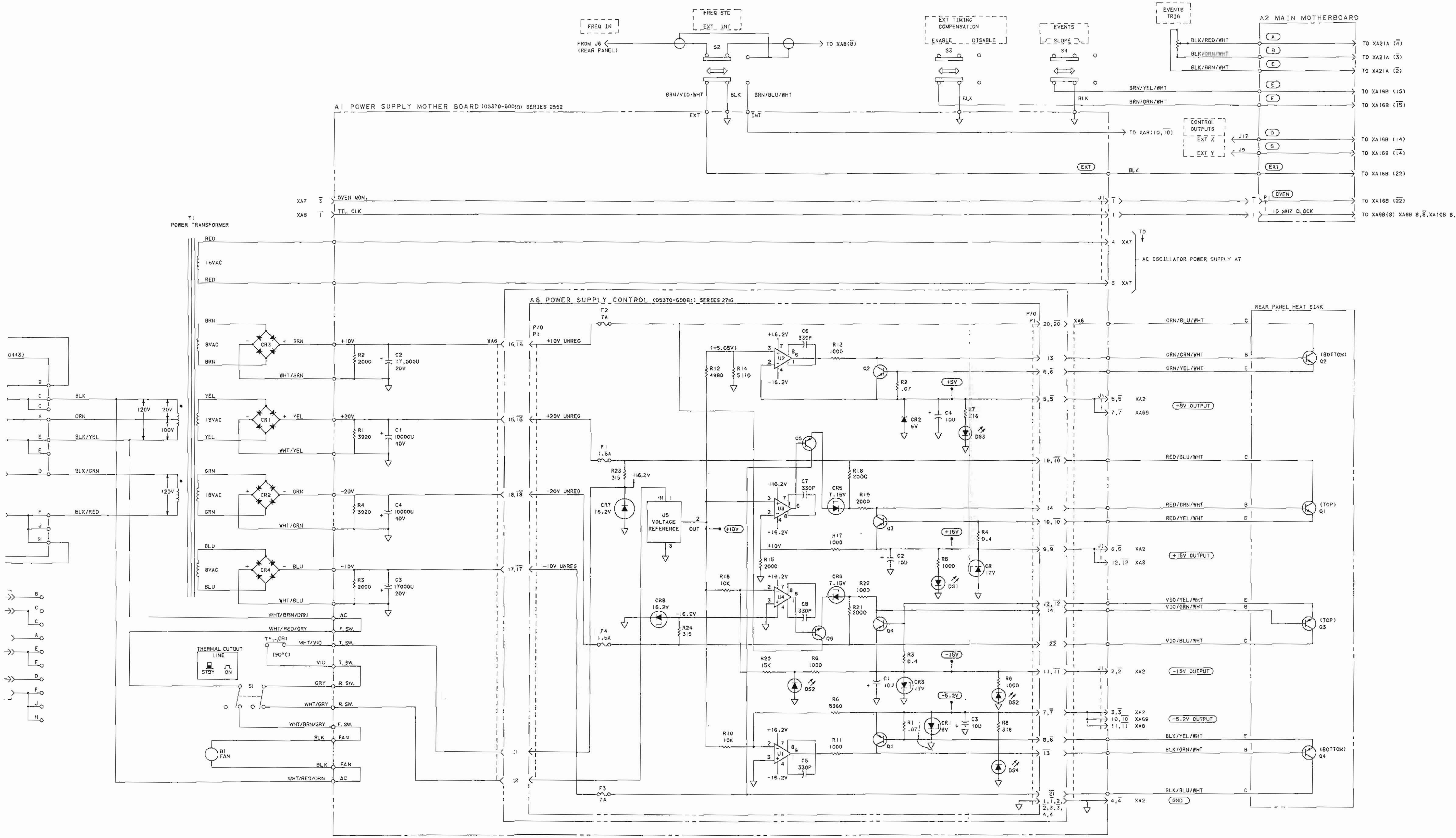
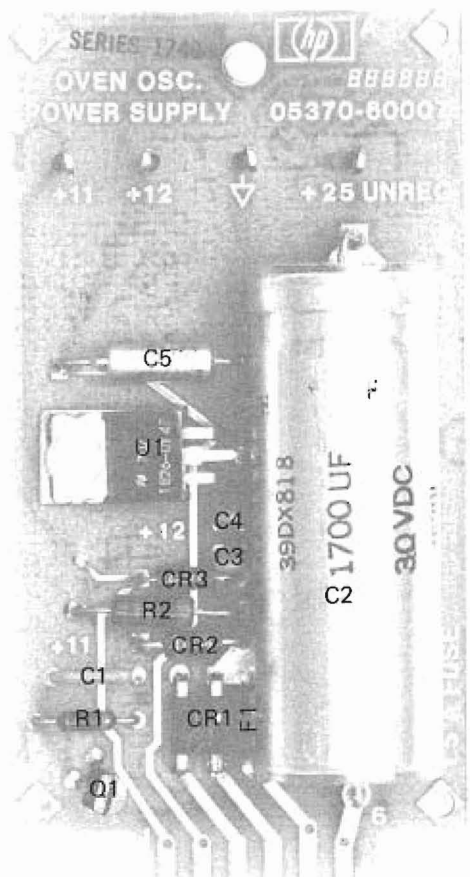


Figure 8-10. A1/A2/A6 Motherboard/Power Supply Assembly

Figure 8-10
A1/A2/A6 MOTHERBOARD/POWER SUPPLY ASSEMBLY

(See Page 8-83)


SERIES 1740
OVEN OSC.
POWER SUPPLY
05370-60007
+11
+12
+25 UNREG
C5
U1
+12
C4
C3
CR3
R2
+11
CR2
C1
R1
CR1
F1
Q1
39DX818
1700 UF
30 VDC
C2

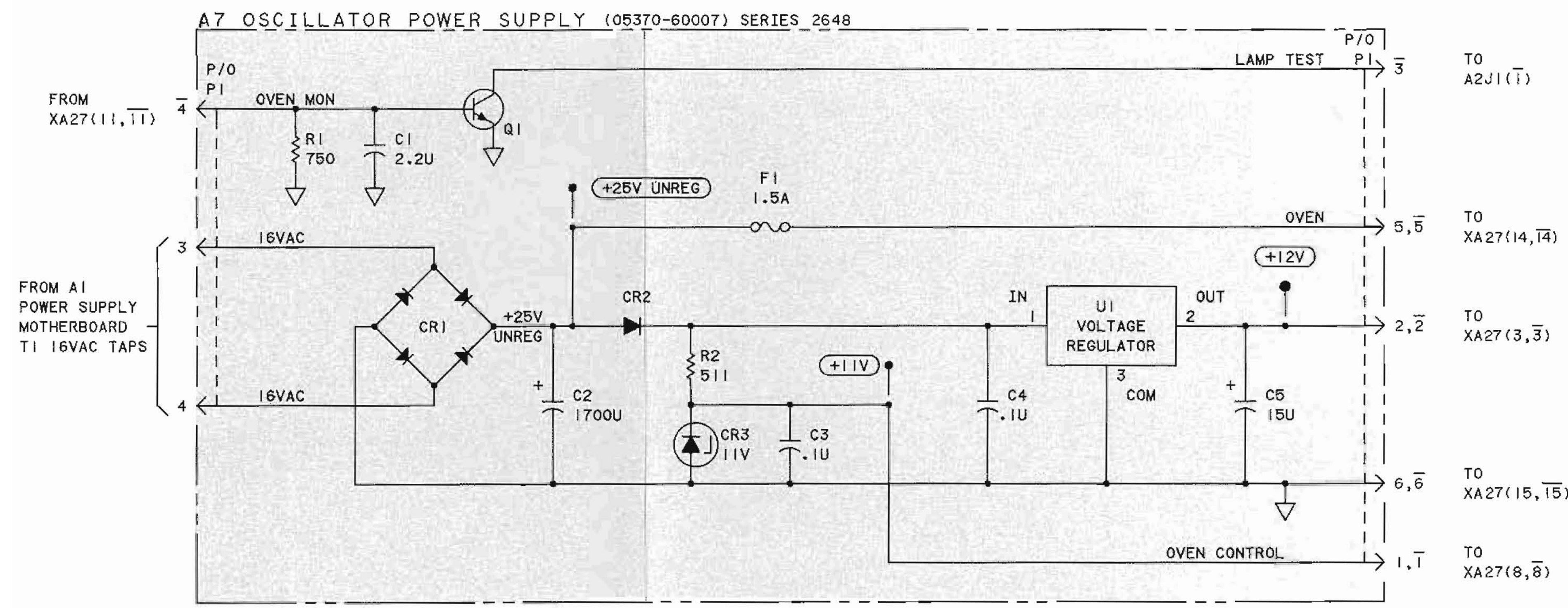
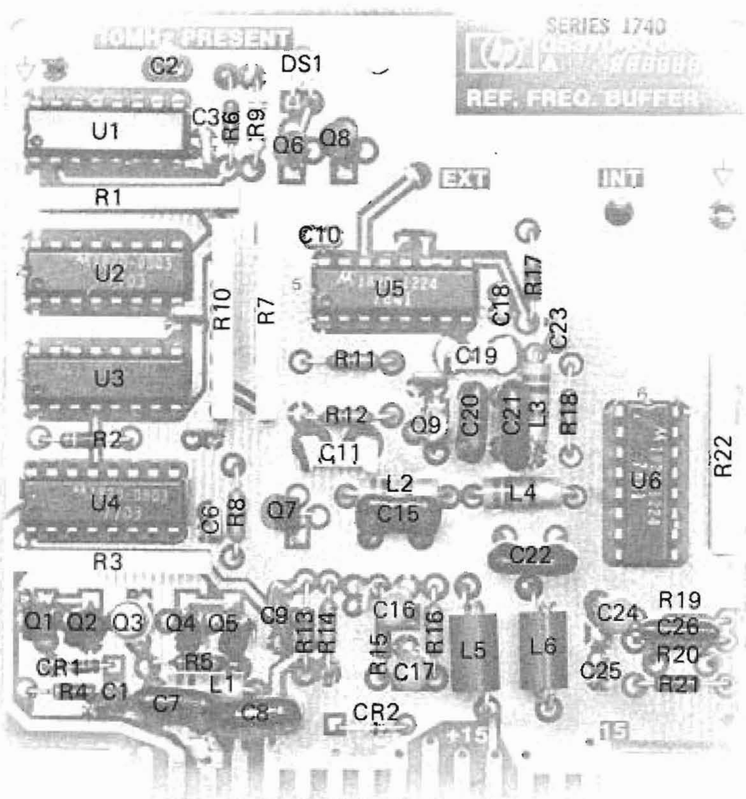


Figure 8-11. A7 Oven Oscillator Power Supply Assembly

Figure 8-11
A7 OVEN OSCILLATOR POWER SUPPLY ASSEMBLY

(See Page 8-85)


10MHZ PRESENT
SERIES 1740
REF. FREQ. BUFFER
DS1
C2
U1
C3
R6
R9
Q6
Q8
R1
EXT
INT
C10
U2
U3
U5
R10
R7
R17
C18
C23
R11
C19
R12
Q9
C20
C21
L3
R18
R2
C11
U6
R22
U4
C6
R8
Q7
L2
C15
L4
C22
R3
Q1
Q2
Q3
Q4
Q5
C9
R13
R14
C16
R15
R16
C17
L5
L6
C24
R19
C26
R20
C25
R21
CR1
R5
L1
R4
C1
C7
C8
CR2
+15
15

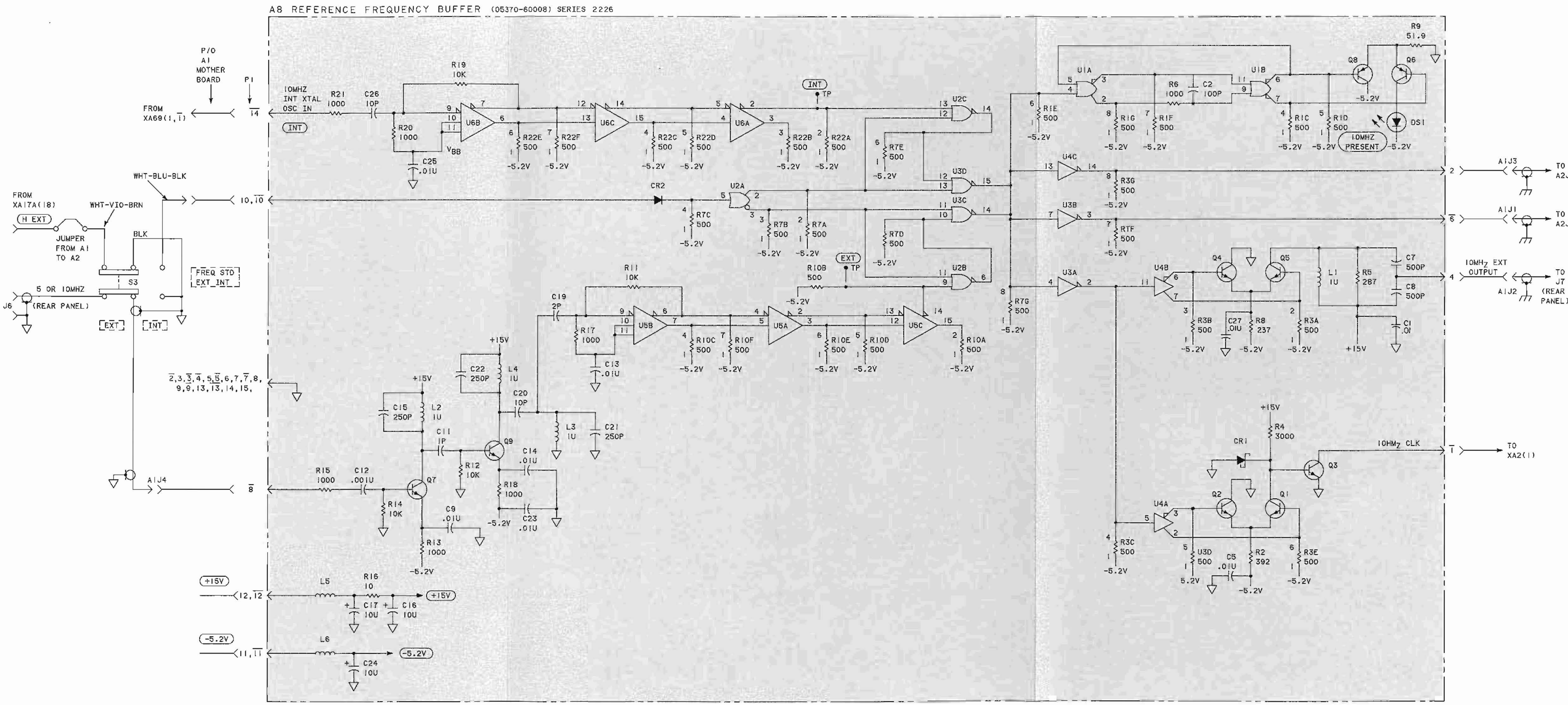
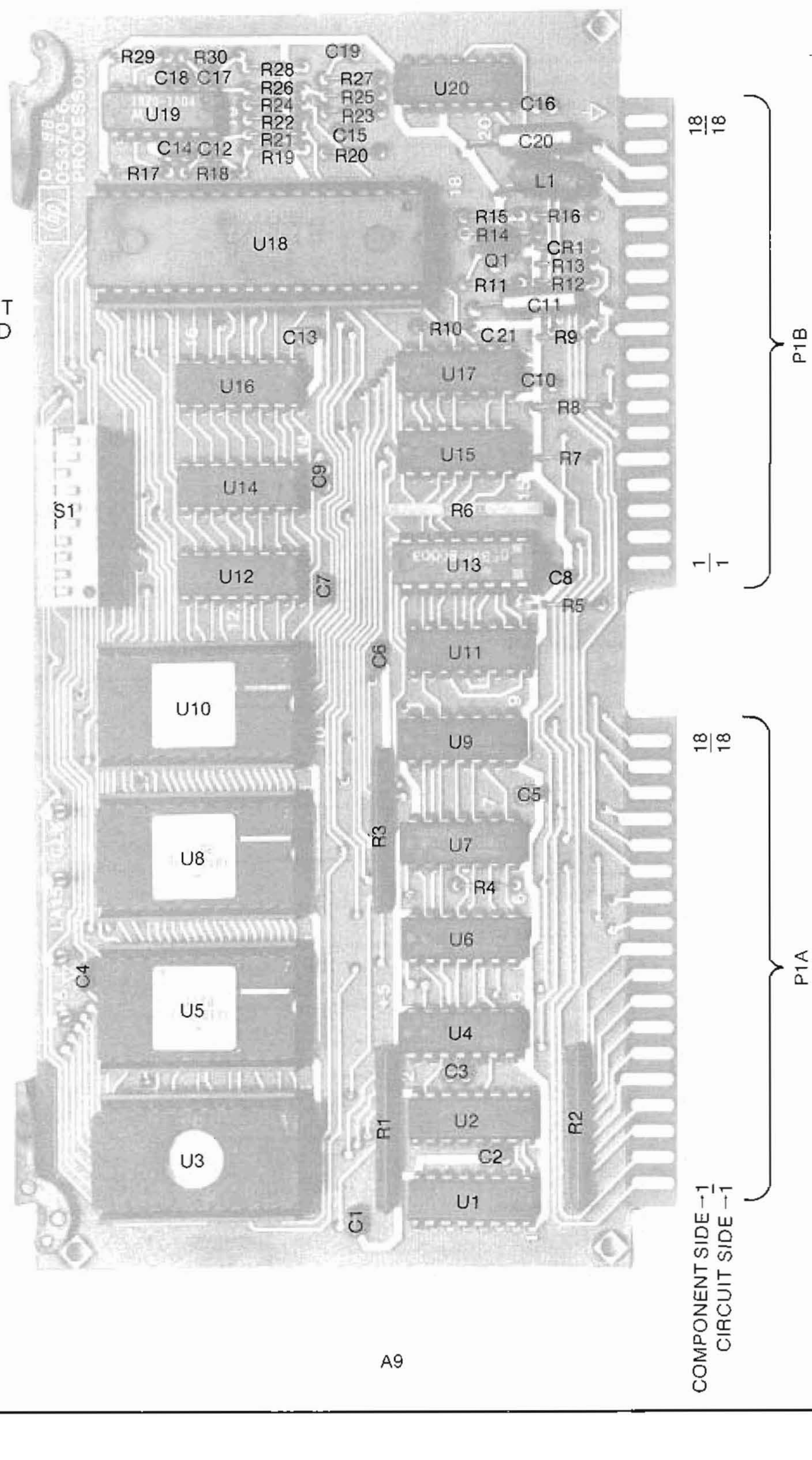


Figure 8-12. A8 Frequency Buffer Assembly

Figure 8-12
A8 FREQUENCY BUFFER ASSEMBLY

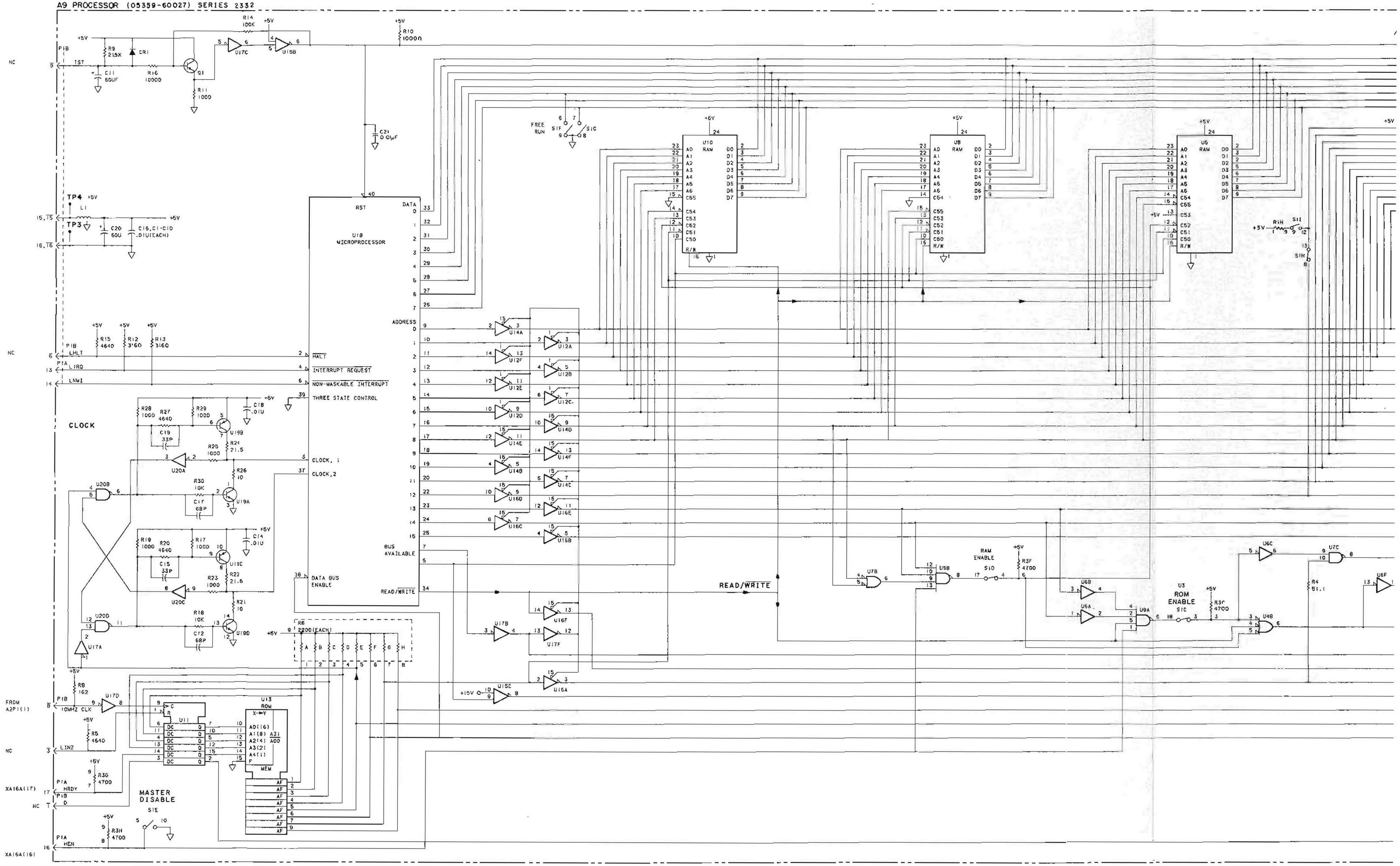
(See Page 8-87)

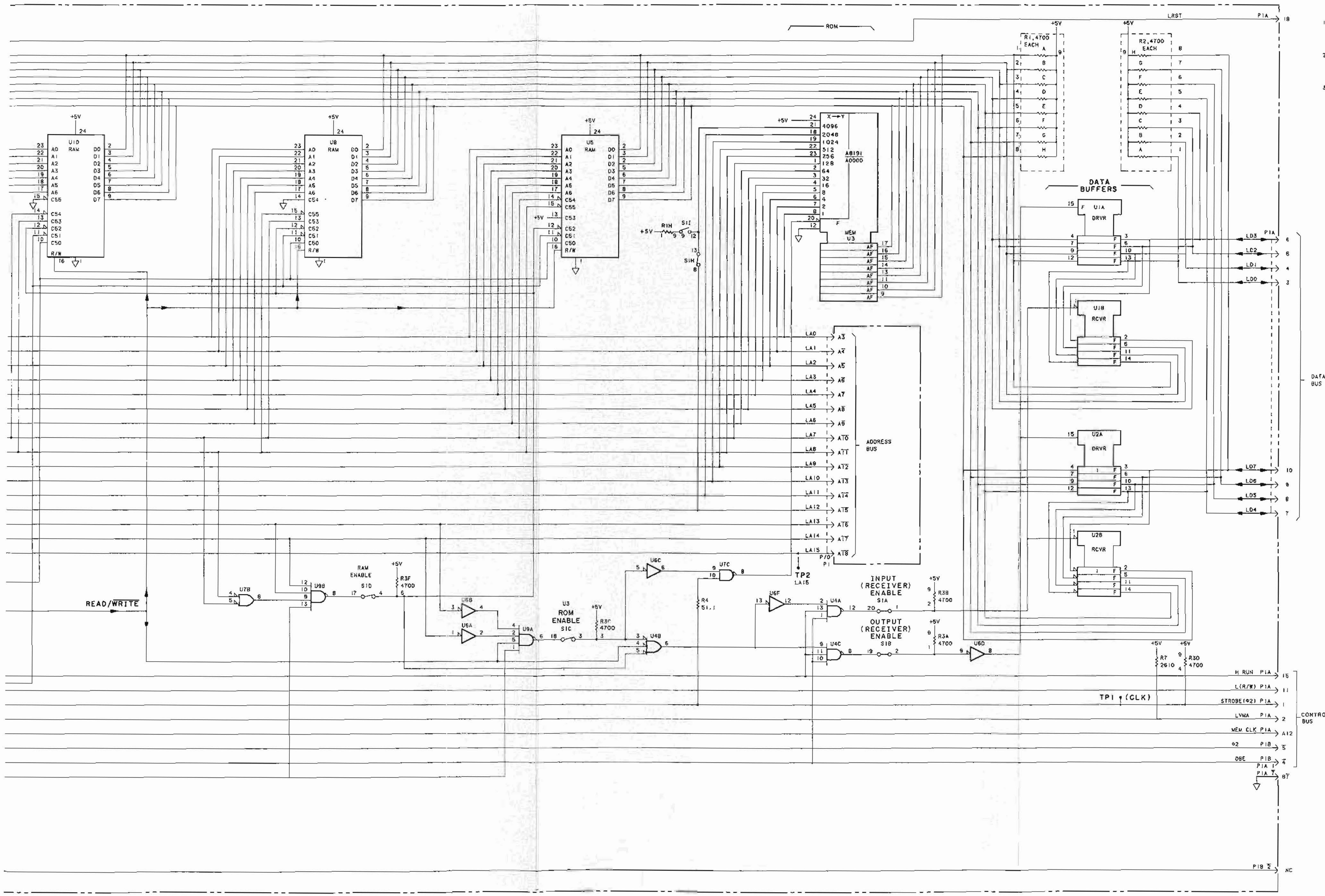
C21 ON CIRCUIT
SIDE OF BOARD



A9

A9 PROCESSOR (05359-60027) SERIES 2332





NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN FARADS
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT AVERAGE VALUES SHOWN

A9 REFERENCE DESIGNATIONS

C1-21
CR1
L1
Q1
R1-30
S1
U1-20

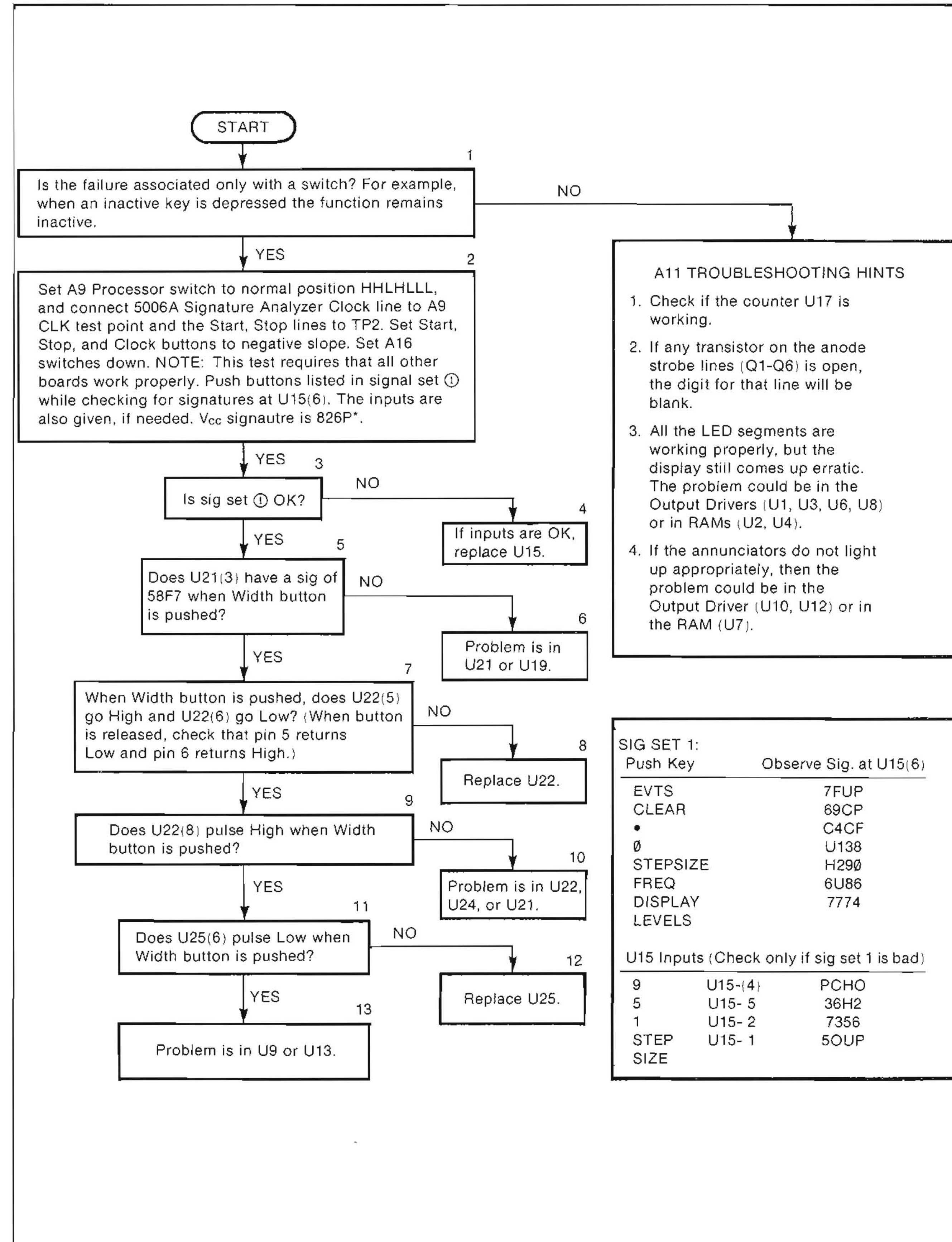
A9 TABLE OF ACTIVE ELEMENTS

REFERENCE DESIGNATIONS	HP PART NUMBER	MFR. PART NUMBER
CR1	1901-0040	1901-0040
Q1	1854-0560	MPSA12
U1, U2	1820-1081	MC8T26AP
U3	05359-A0003	053 9-80003
U4	1820-1202	SN74LS10N
U5, U8, U10	1818-0135	MCM68A10L
U6, U17	1820-1199	SN74LS04N
U7, U20	1820-1197	SN74LS00N
U9	1820-1204	SN74LS20N
U11	1820-1196	SN74LS174N
U12, U14, U16	1820-1368	SN74366N
U13	05370-80003	05370-80003
U15	1820-1209	SN74LS38N
U18	1820-2137	MC68A00P
U19	1820-1804	MPQ6842

Figure 8-13. A9 Processor Assembly

Figure 8-13
A9 PROCESSOR ASSEMBLY

(See page 8-89)



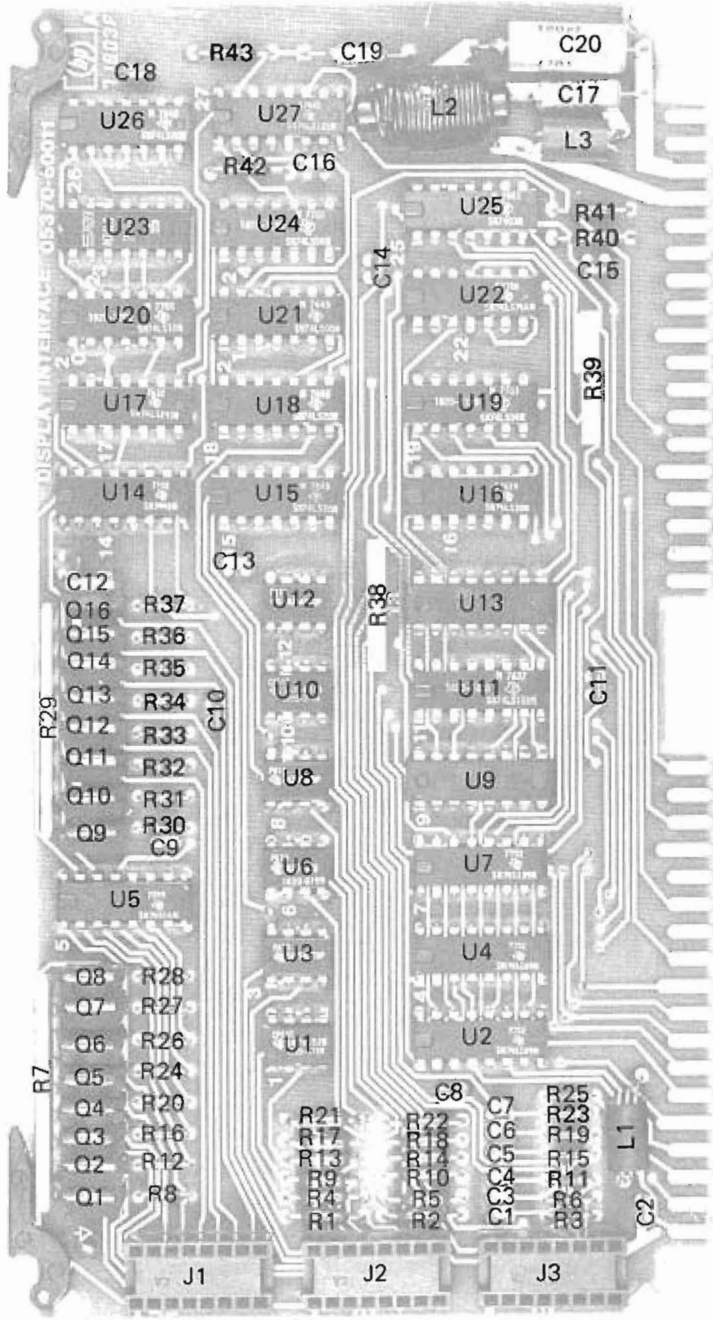
Push Key	Observe Sig. at U15(6)
EVTS	7FUP
CLEAR	69CP
•	C4CF
Ø	U138
STEPSIZE	H29Ø
FREQ	6U86
DISPLAY	7774
LEVELS	

U15 Inputs (Check only if sig set 1 is bad)

9	U15-(4)	PCHO
5	U15- 5	36H2
1	U15- 2	7356
STEP SIZE	U15- 1	5OUP

Figure 8-13
A9 PROCESSOR ASSEMBLY

(See page 8-89)



R43
C19
C20
C18
C17
U26
U27
L2
L3
R42
C16
DISPLAY INTERFACE 05370-60011
U25
R41
U23
U24
R40
C14
C15
U22
U20
U21
R39
U17
U18
U19
U14
U15
U16
C13
C12
Q16
R37
U12
R38
U13
Q15
R36
Q14
R35
Q13
R34
C10
U10
U11
C11
R29
Q12
R33
Q11
R32
U8
U9
Q10
R31
Q9
R30
C9
U6
U7
U5
U3
U4
Q8
R28
Q7
R27
Q6
R26
U1
U2
Q5
R24
R7
Q4
R20
C8
C7
R25
R21
R22
R23
Q3
R16
R17
R18
C6
R19
L1
Q2
R12
R13
R14
C5
R15
Q1
R8
R9
R10
C4
R11
R4
R5
C3
R6
R1
R2
C1
R3
C2
J1
J2
J3

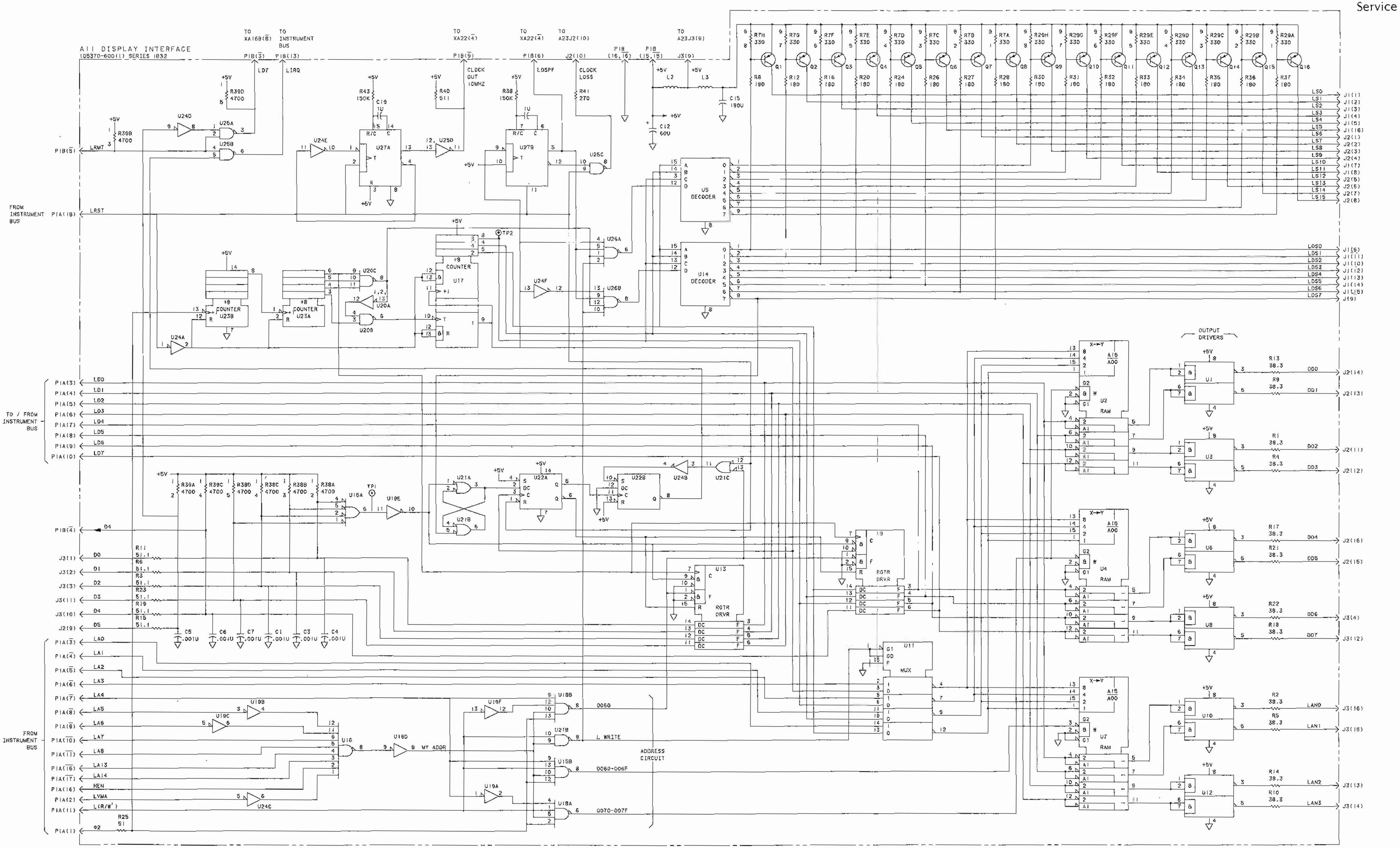
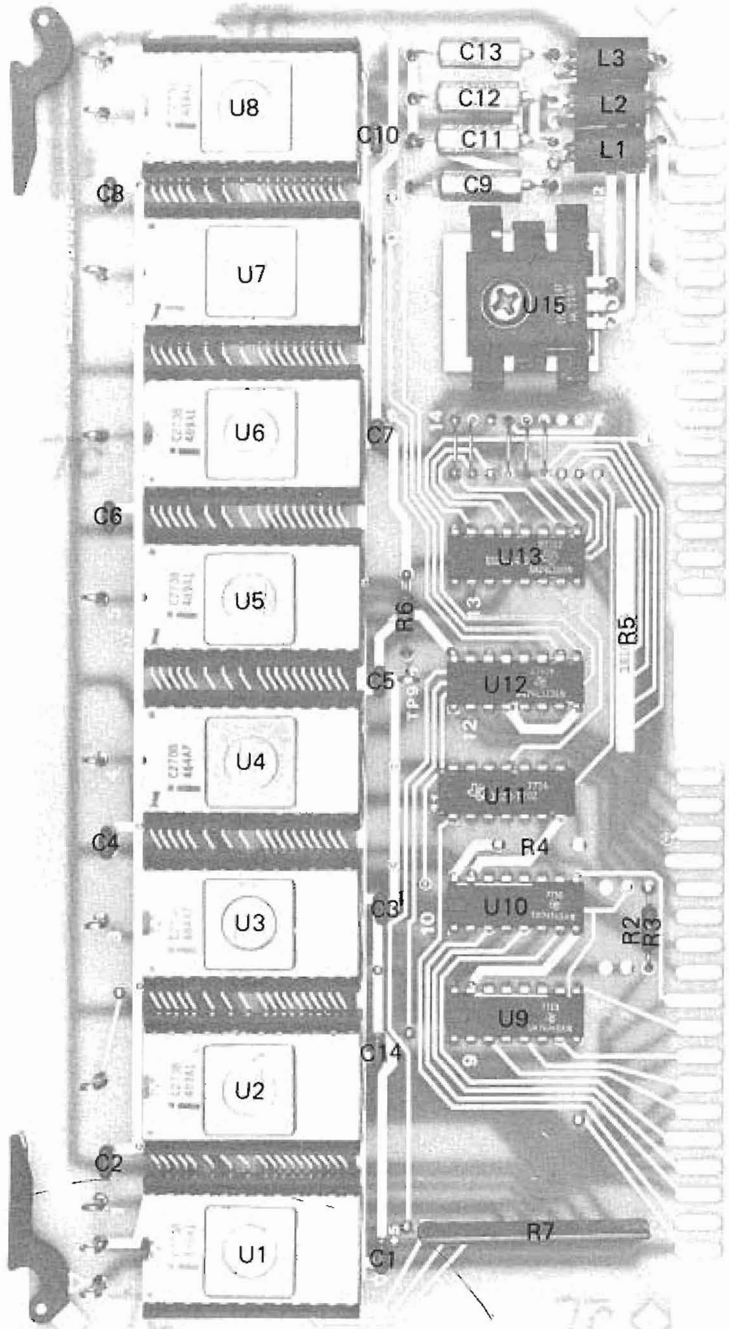
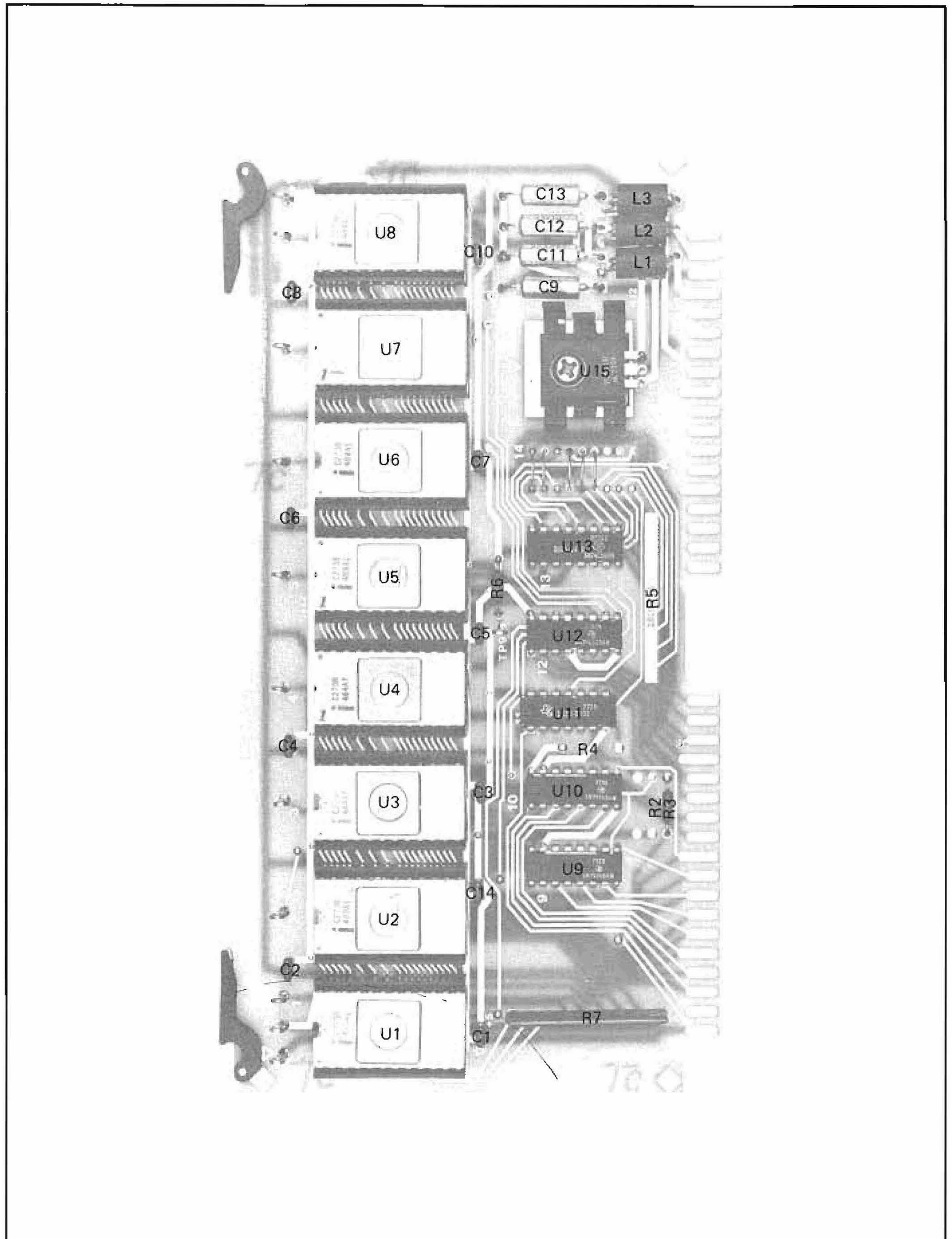


Figure 8-14. A11 Display Interface Assembly and Troubleshooting Flowchart

Figure 8-14
A11 DISPLAY INTERFACE ASSEMBLY
AND TROUBLESHOOTING FLOWCHART

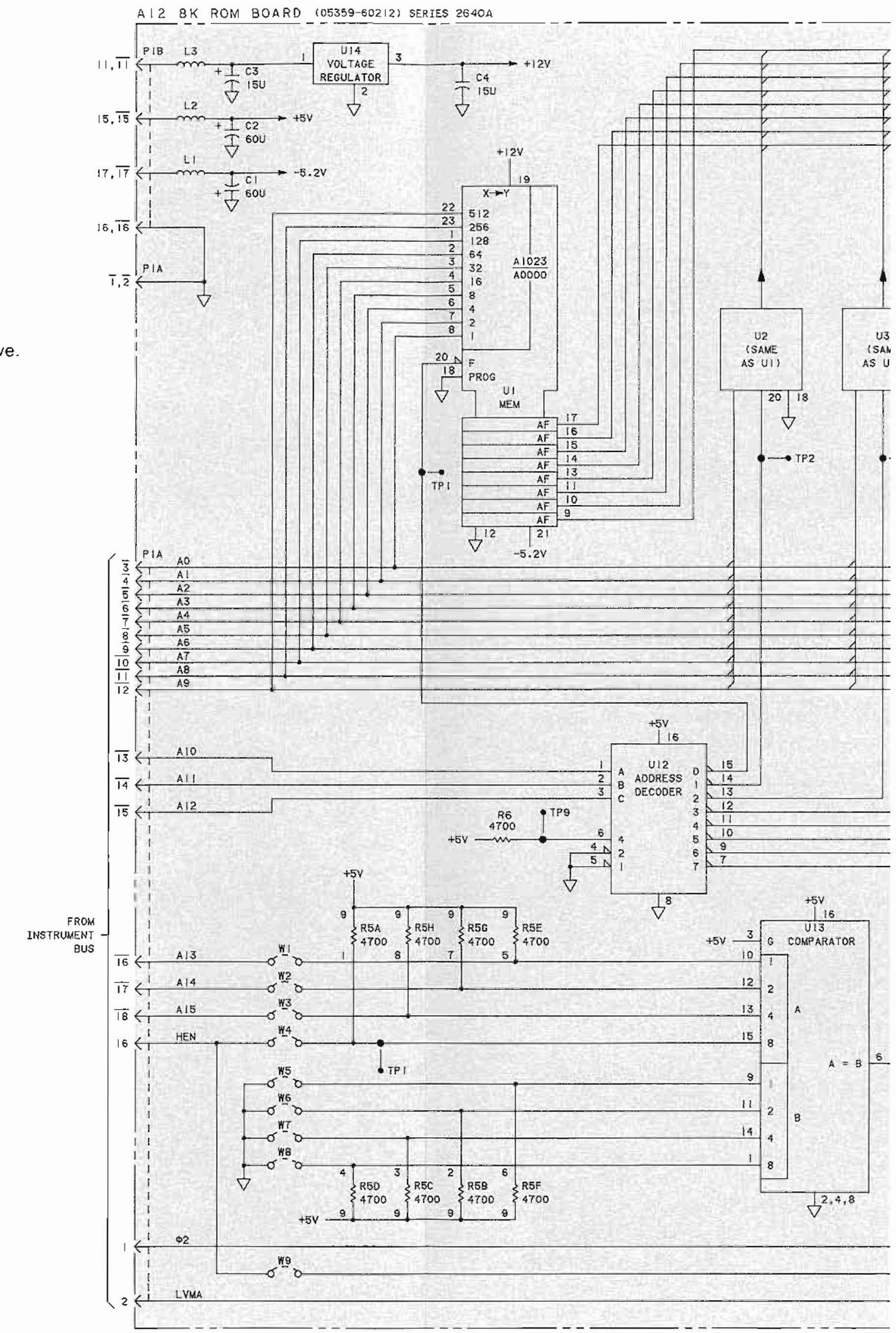
(See Page 8-91)


C13
L3
C12
L2
C10
C11
L1
C9
U8
C8
U7
U15
U6
C7
C6
U13
U5
R6
R5
C5
U12
TP9
U4
U11
C4
R4
U3
C3
U10
R2
R3
U9
C14
U2
C2
R7
U1
C1



NOTE

A12 is deleted for series 2648A and above.



NOTE

ted for series 2648A and above.

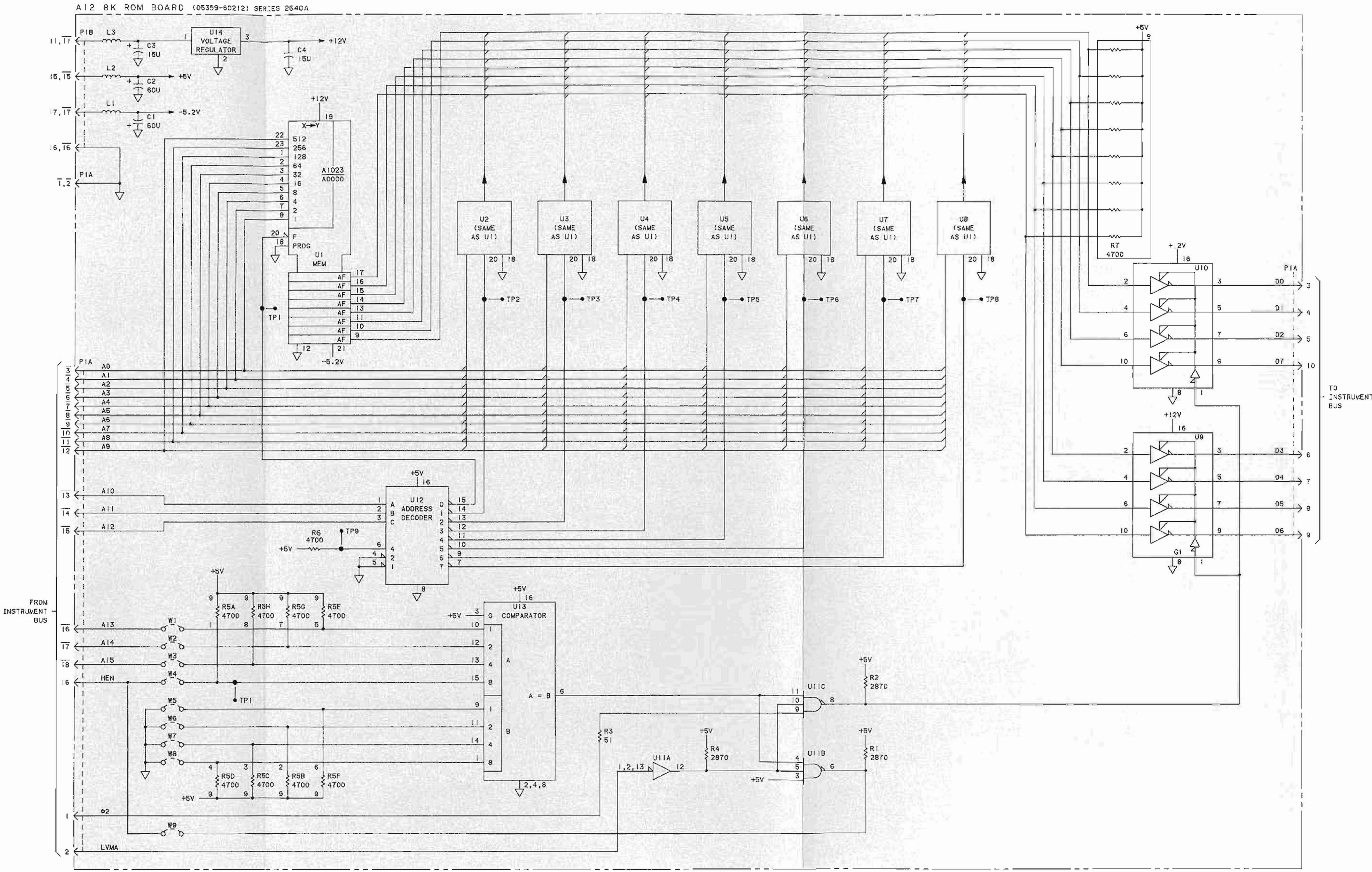
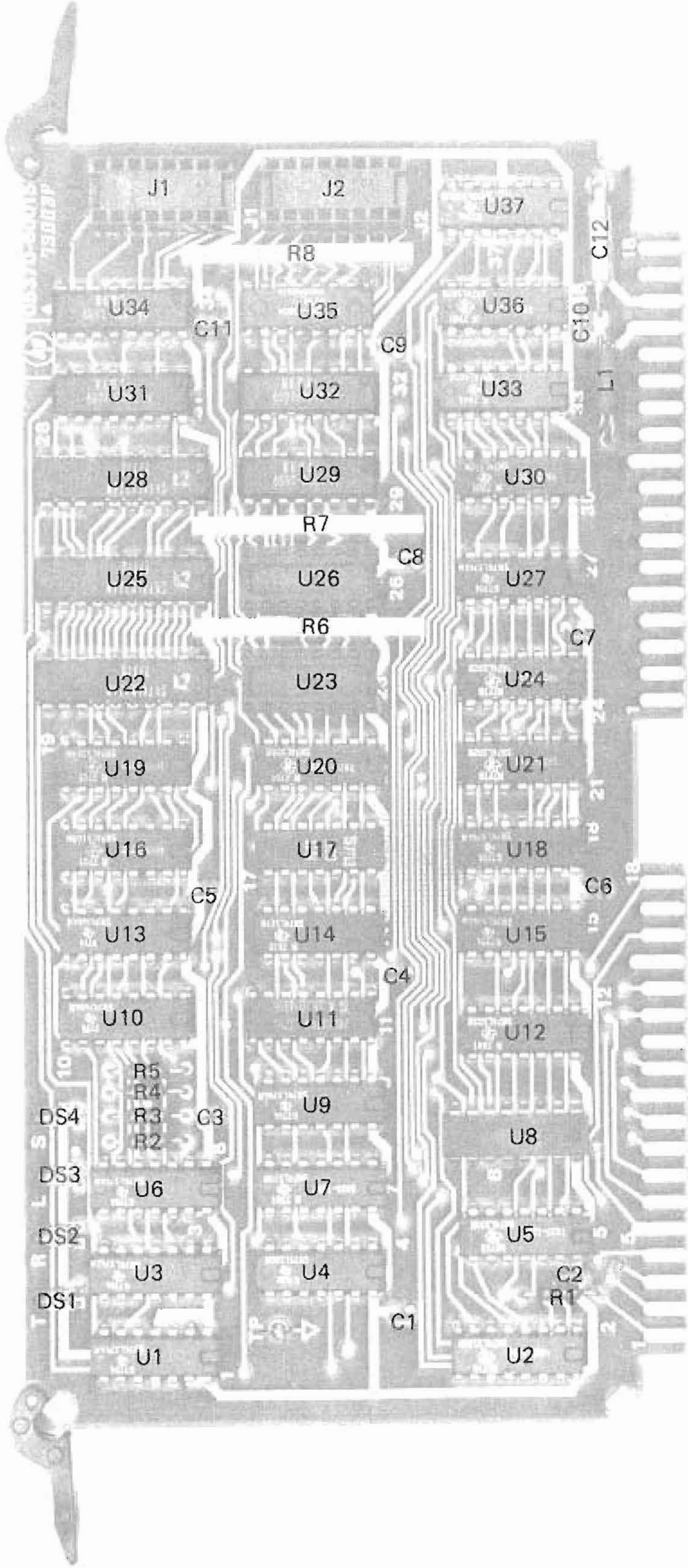
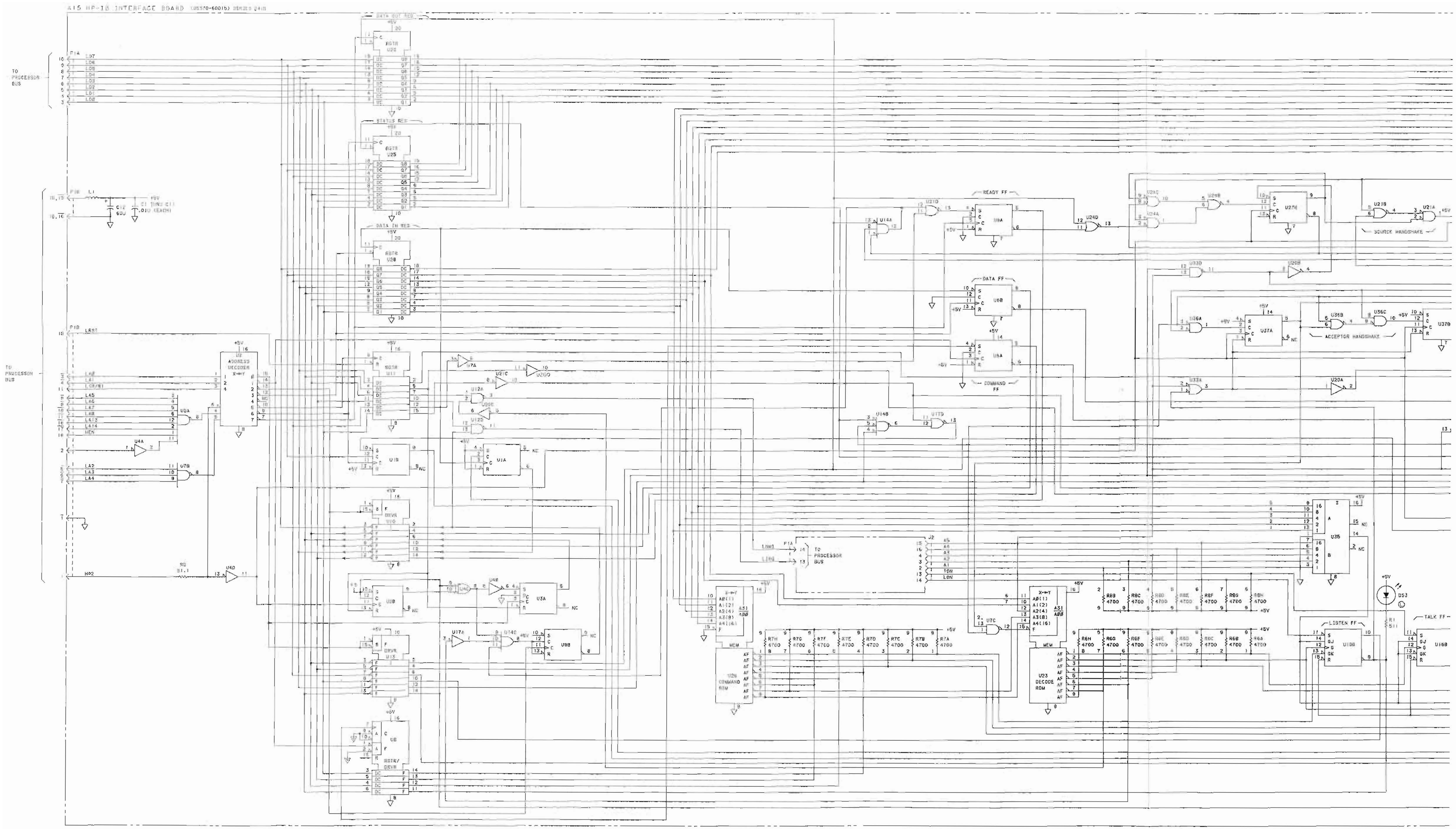


Figure 8-15. A12 ROM Assembly
(A12 is deleted for series 2648A and above)

Figure 8-15
A12 ROM ASSEMBLY
(A12 is deleted for series 2648A and above)

(See Page 8-93)


J1
J2
U37
C12
R8
U34
C11
U35
U36
C10
C9
U31
U32
U33
L1
U28
U29
U30
R7
C8
U25
U26
U27
R6
C7
U22
U23
U24
U19
U20
U21
U16
U17
U18
C5
C6
U13
U14
U15
C4
U10
U11
U12
R5
R4
DS4
R3
C3
R2
U9
U8
DS3
U6
U7
DS2
U5
U3
U4
C2
R1
DS1
C1
U1
U2


A15 HP-IB INTERFACE BOARD (05370-60015) SERIES 2410
TO PROCESSOR BUS
DATA OUT REG
STATUS REG
DATA IN REG
ADDRESS DECODER
READY FF
DATA FF
COMMAND FF
SOURCE HANDSHAKE
ACCEPTOR HANDSHAKE
TO PROCESSOR BUS
COMMAND ROM
DECODE ROM
LISTEN FF
TALK FF

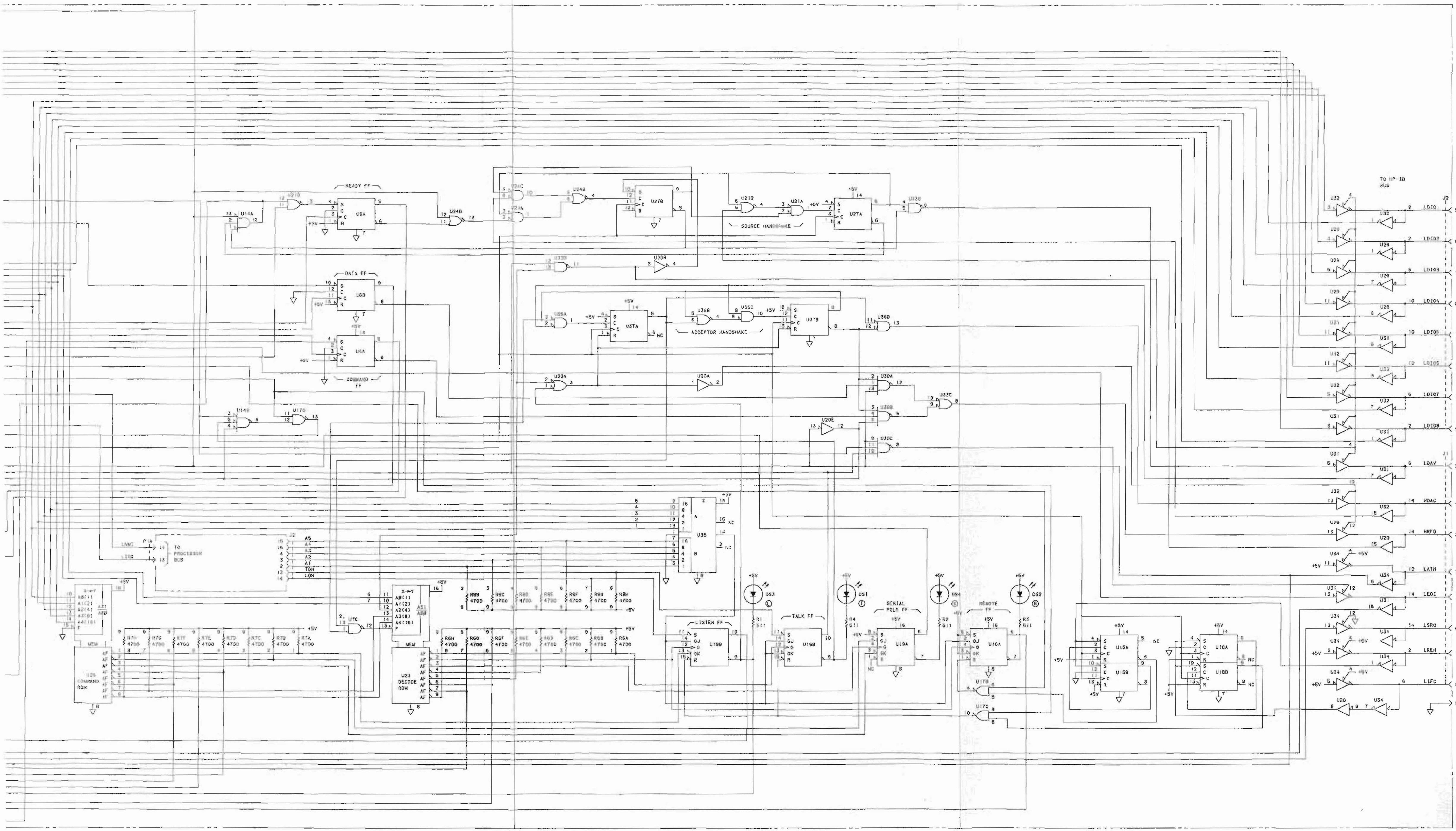
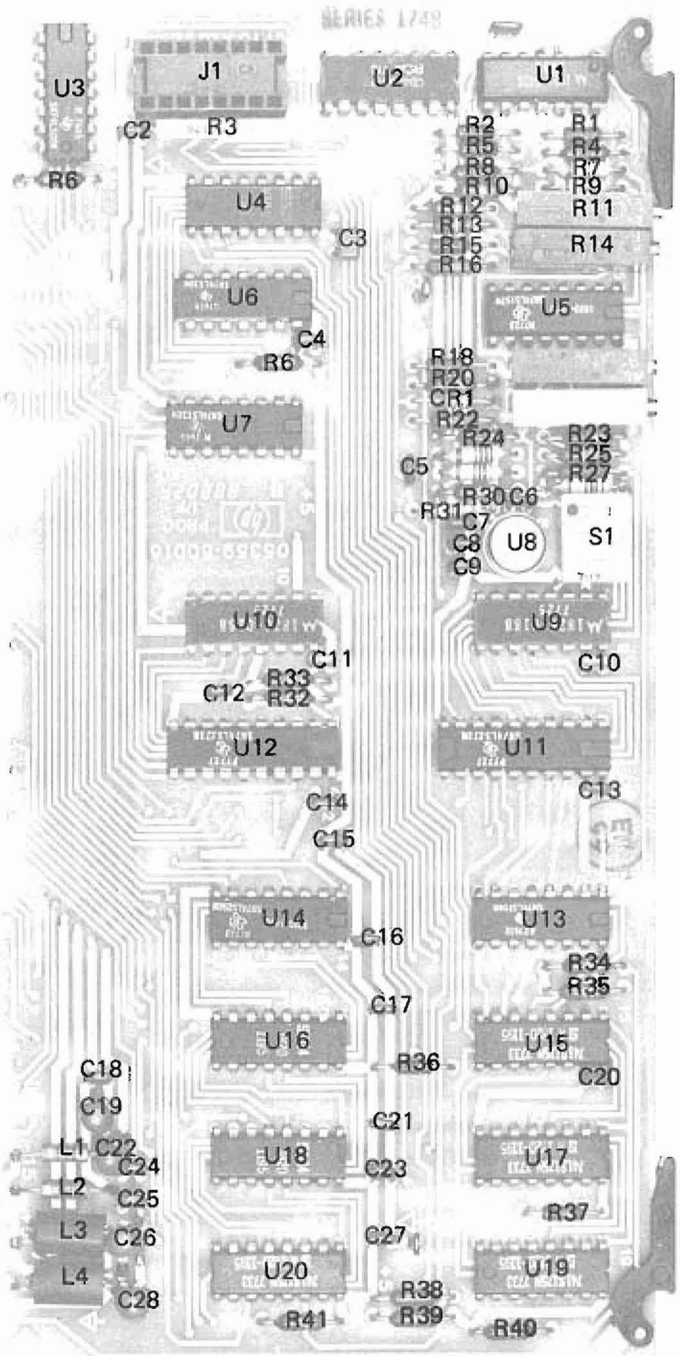


Figure 8-16. A15 HP-IB Interface Assembly

Figure 8-16
A15 HP-IB INTERFACE ASSEMBLY

(See Page 8-95)


U3
J1
U2
U1
C2
R3
R2
R1
R5
R4
R8
R7
R10
R9
R6
U4
R12
R11
R13
C3
R15
R14
R16
U6
U5
C4
R6
R18
R20
CR1
U7
R22
R23
R24
R25
C5
R27
R30
C6
R31
C7
U8
S1
C8
C9
U10
U9
C11
C10
R33
C12
R32
U12
U11
C14
C13
C15
U14
U13
C16
R34
R35
C17
U16
U15
R36
C18
C20
C19
C21
L1
C22
U18
U17
C24
C23
L2
C25
R37
L3
C26
C27
U20
U19
L4
R38
C28
R39
R41
R40

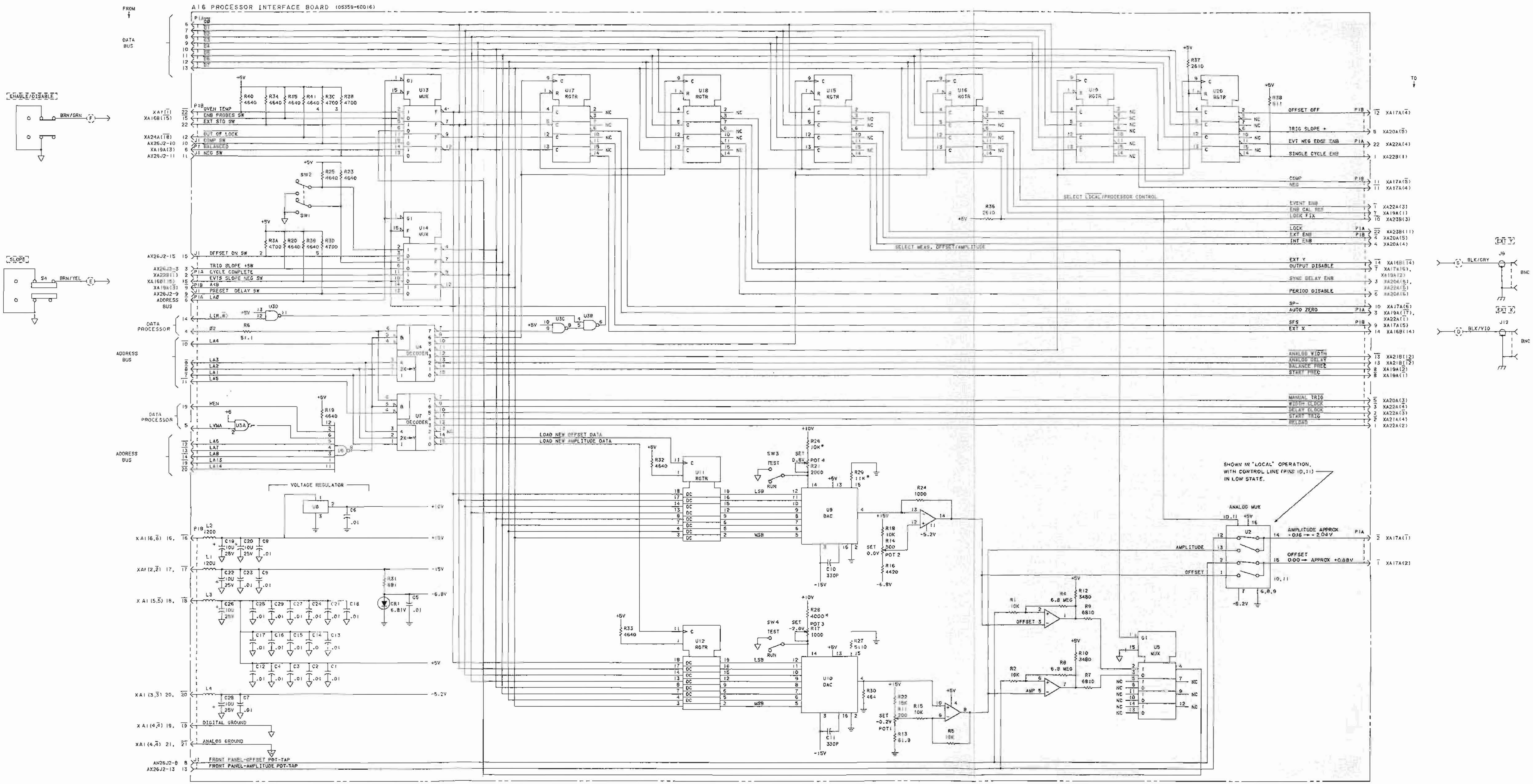
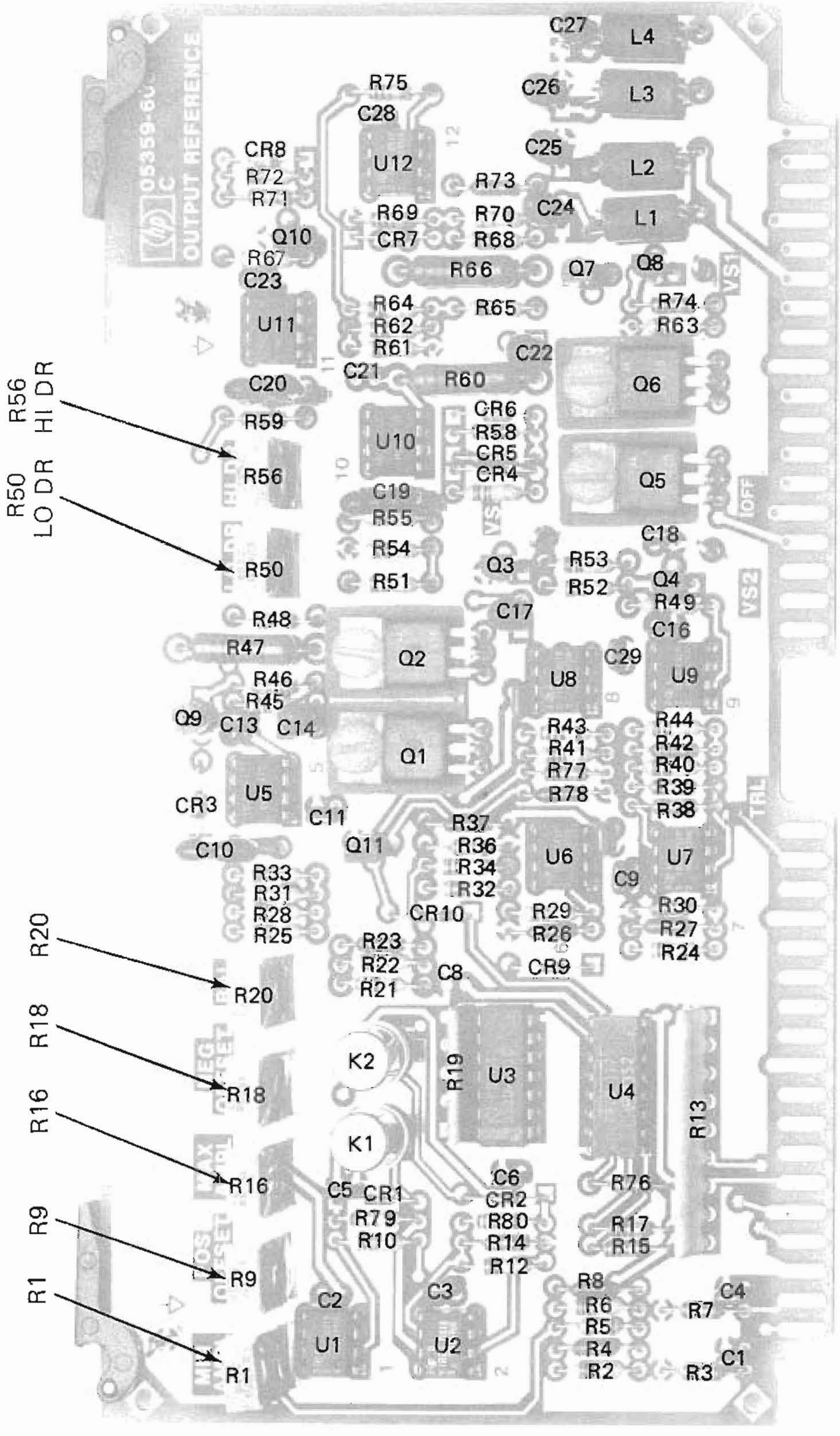


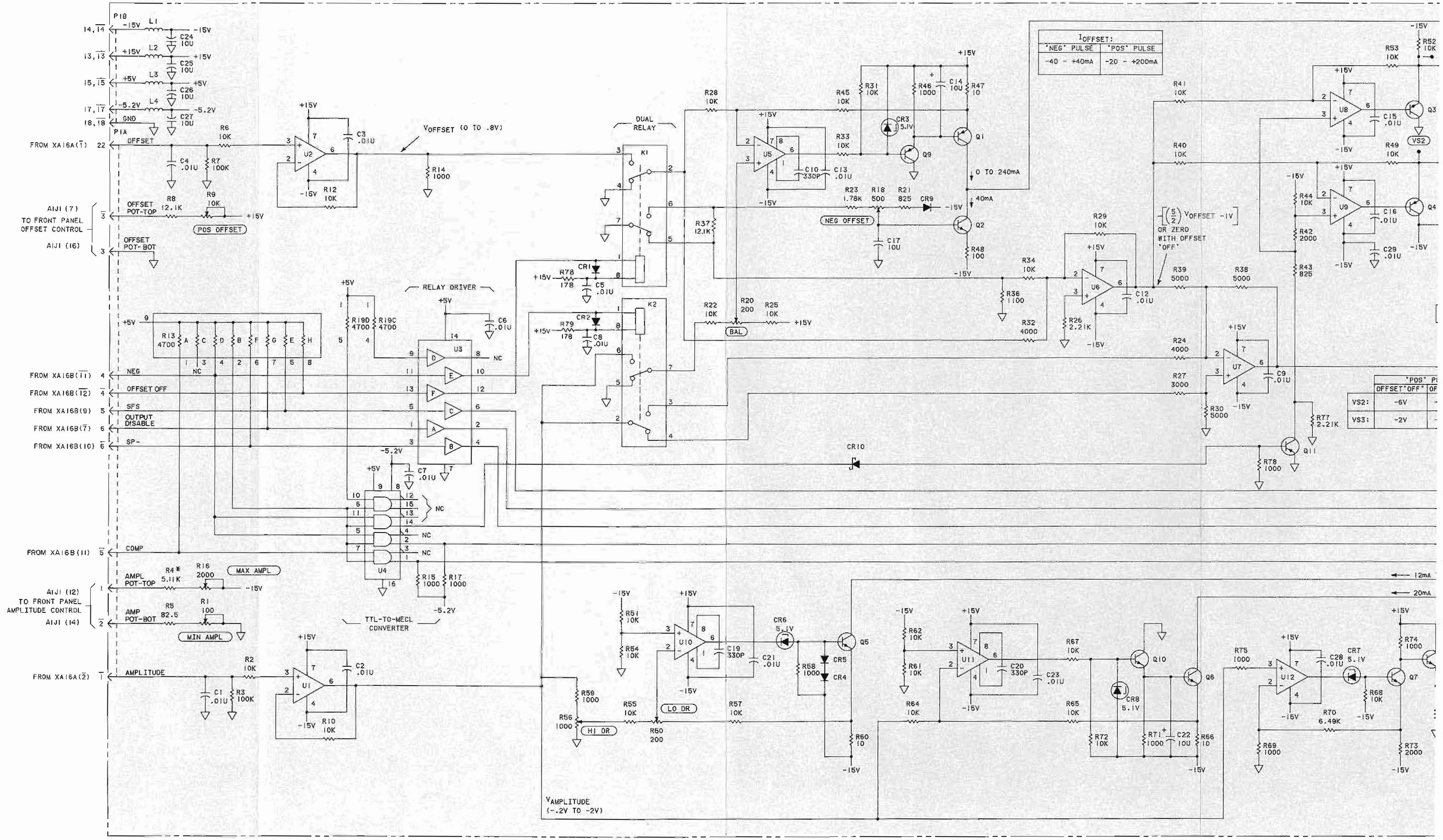
Figure 8-17. A16 Processor Interface Assembly

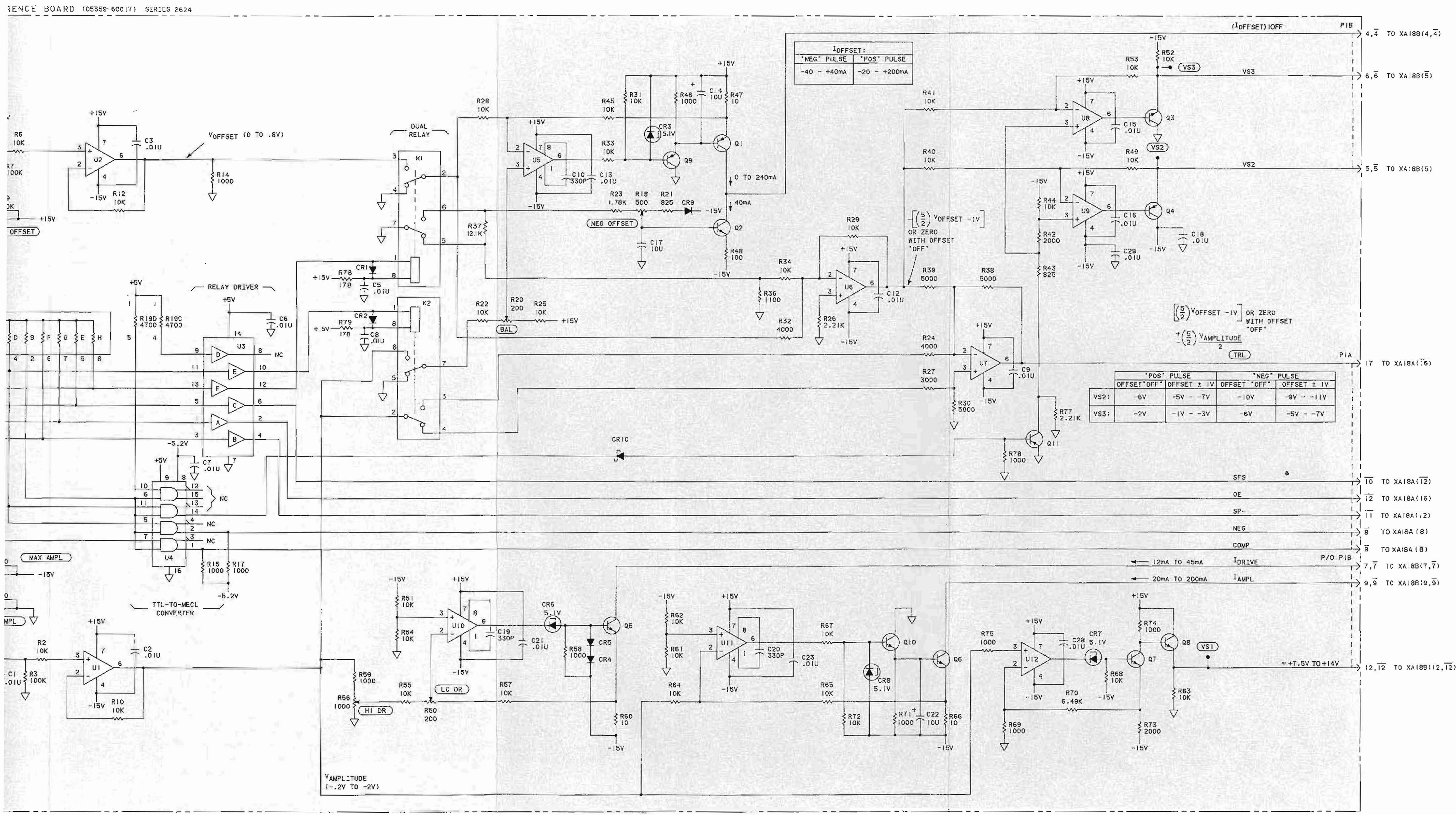
Figure 8-17
A16 PROCESSOR INTERFACE ASSEMBLY

(See Page 8-97)


R56 HI DR
R50 LO DR
R20
R18
R16
R9
R1

A17 OUTPUT REFERENCE BOARD (05359-60017) SERIES 2624





IOFFSET:

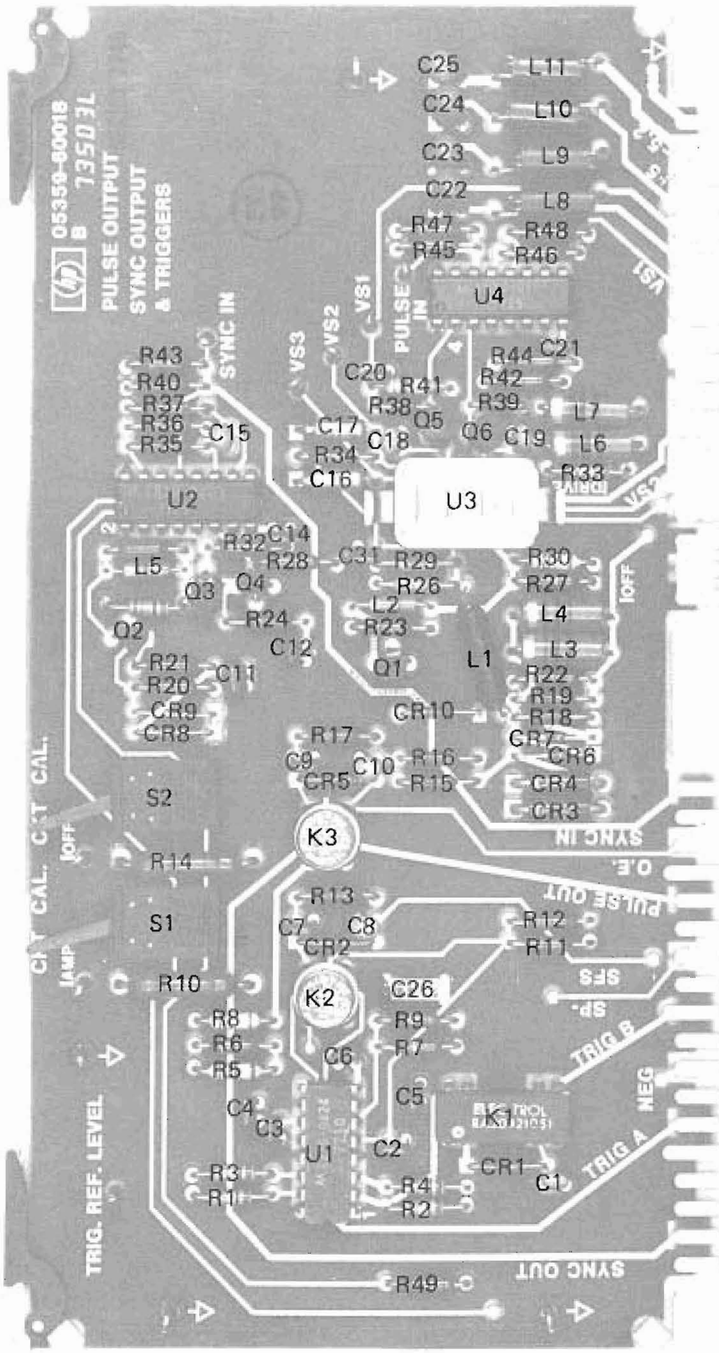
"NEG" PULSE	"POS" PULSE
-40 - +40mA	-20 - +200mA

	"POS" PULSE		"NEG" PULSE	
	OFFSET "OFF"	OFFSET ± 1V	OFFSET "OFF"	OFFSET ± 1V
VS2:	-6V	-5V - -7V	-10V	-9V - -11V
VS3:	-2V	-1V - -3V	-6V	-5V - -7V

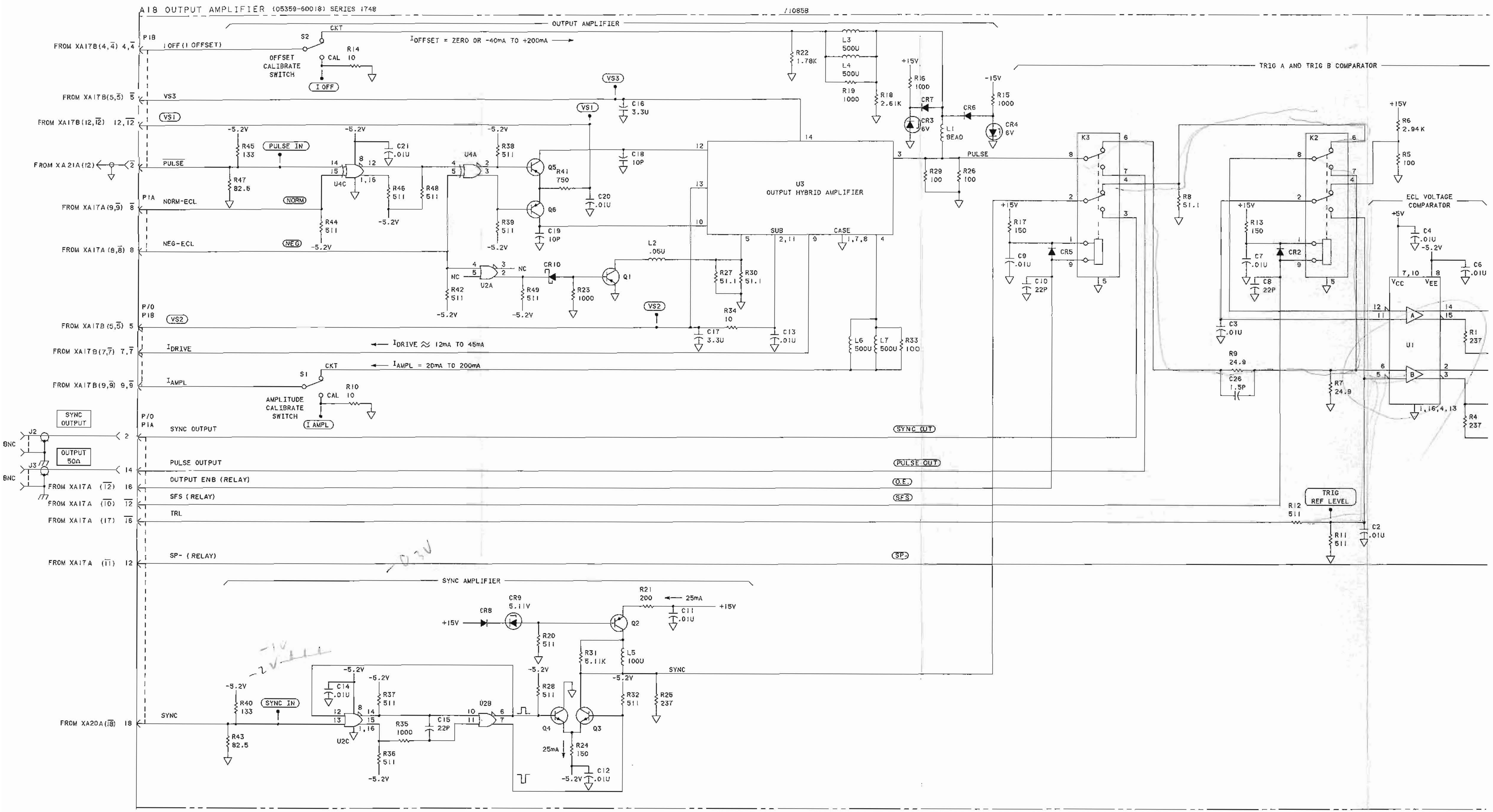
Figure 8-18. A17 Output Reference Assembly

Figure 8-18
A17 OUTPUT REFERENCE ASSEMBLY

(See Page 8-99)



05359-60018
B
PULSE OUTPUT
SYNC OUTPUT
& TRIGGERS
SYNC IN
VS3
VS2
VS1
PULSE IN
C25
L11
C24
L10
C23
L9
C22
L8
R47
R48
R45
R46
U4
R43
R40
R37
R36
R35
C15
C20
R44
C21
R42
R41
R38
R39
Q5
Q6
L7
C17
C18
C19
L6
R34
R33
C16
U3
U2
R32
C14
C31
R28
R29
R30
L5
R26
R27
Q3
Q4
L2
L4
Q2
R24
R23
L3
R21
C12
Q1
L1
R20
C11
R22
CR9
R19
CR10
R18
CR8
R17
CR7
C9
C10
R16
CR6
CR5
R15
CR4
S2
CR3
SYNC IN
K3
R14
O.E.
PULSE OUT
R13
S1
C7
C8
R12
CR2
R11
SFS
R10
K2
C26
SP.
R8
R9
R6
R7
TRIG B
R5
C6
C5
NEG
K1
C4
C3
U1
C2
TRIG A
CR1
R3
C1
R4
R1
R2
TRIG. REF. LEVEL
SYNC OUT
R49


A18 OUTPUT AMPLIFIER (05359-60018) SERIES 1748
OUTPUT AMPLIFIER
TRIG A AND TRIG B COMPARATOR
ECL VOLTAGE COMPARATOR
OFFSET CALIBRATE SWITCH
AMPLITUDE CALIBRATE SWITCH
U3 OUTPUT HYBRID AMPLIFIER
SYNC AMPLIFIER
FROM XA17B(4,4) 4,4
FROM XA17B(5,5) 5
FROM XA17B(12,12) 12,12
FROM XA21A(12)
FROM XA17A(9,9) 8
FROM XA17A(8,8) 8
FROM XA17B(5,5) 5
FROM XA17B(7,7) 7,7
FROM XA17B(9,9) 9,9
FROM XA17A (12) 16
FROM XA17A (10) 12
FROM XA17A (17) 16
FROM XA17A (11) 12
FROM XA20A(18) 18
SYNC OUTPUT
OUTPUT 50Ω
PULSE OUTPUT
OUTPUT ENB (RELAY)
SFS (RELAY)
TRL
SP- (RELAY)
TRIG REF LEVEL
IOFFSET = ZERO OR -40mA TO +200mA
IDRIVE ≈ 12mA TO 45mA
IAMPL = 20mA TO 200mA

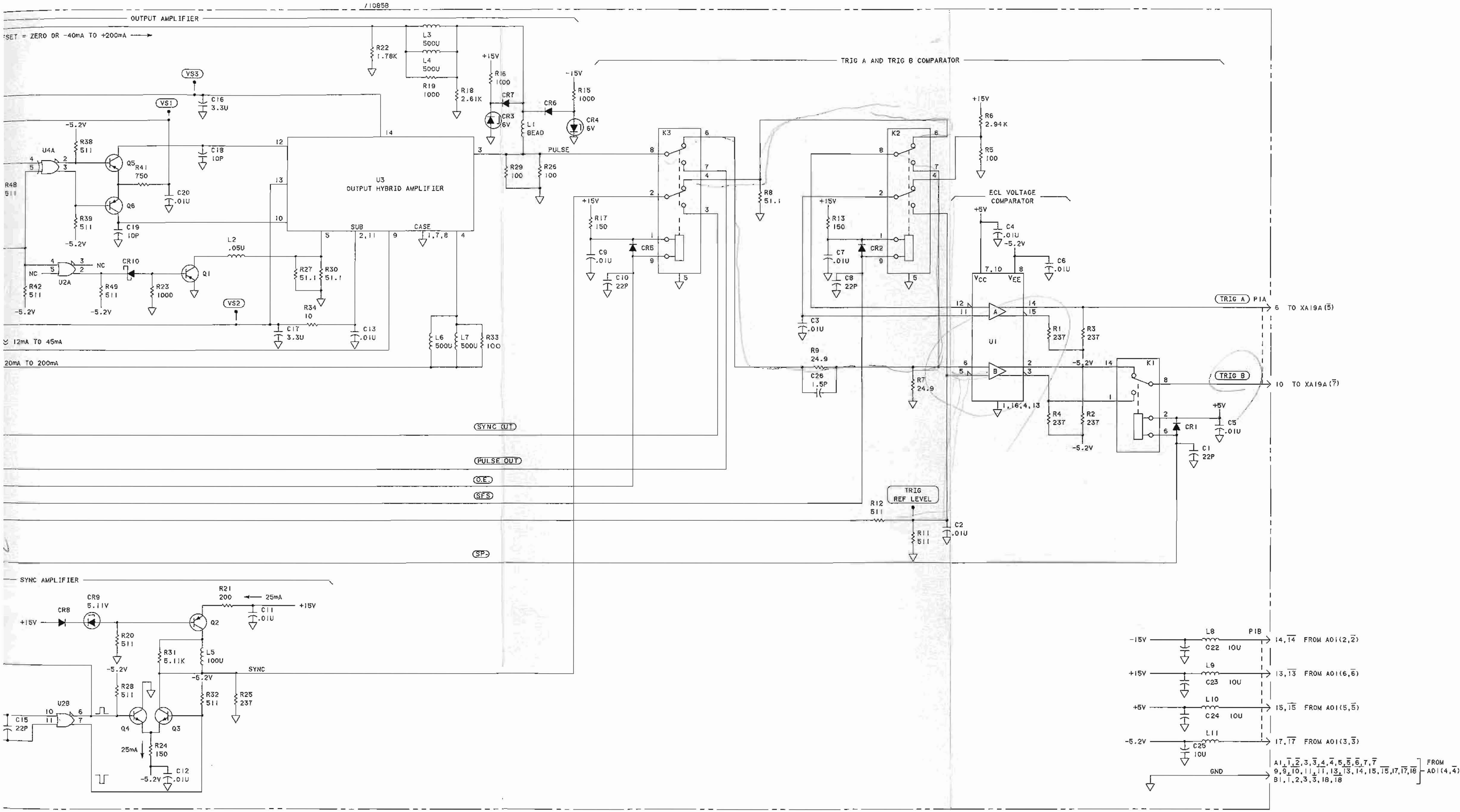
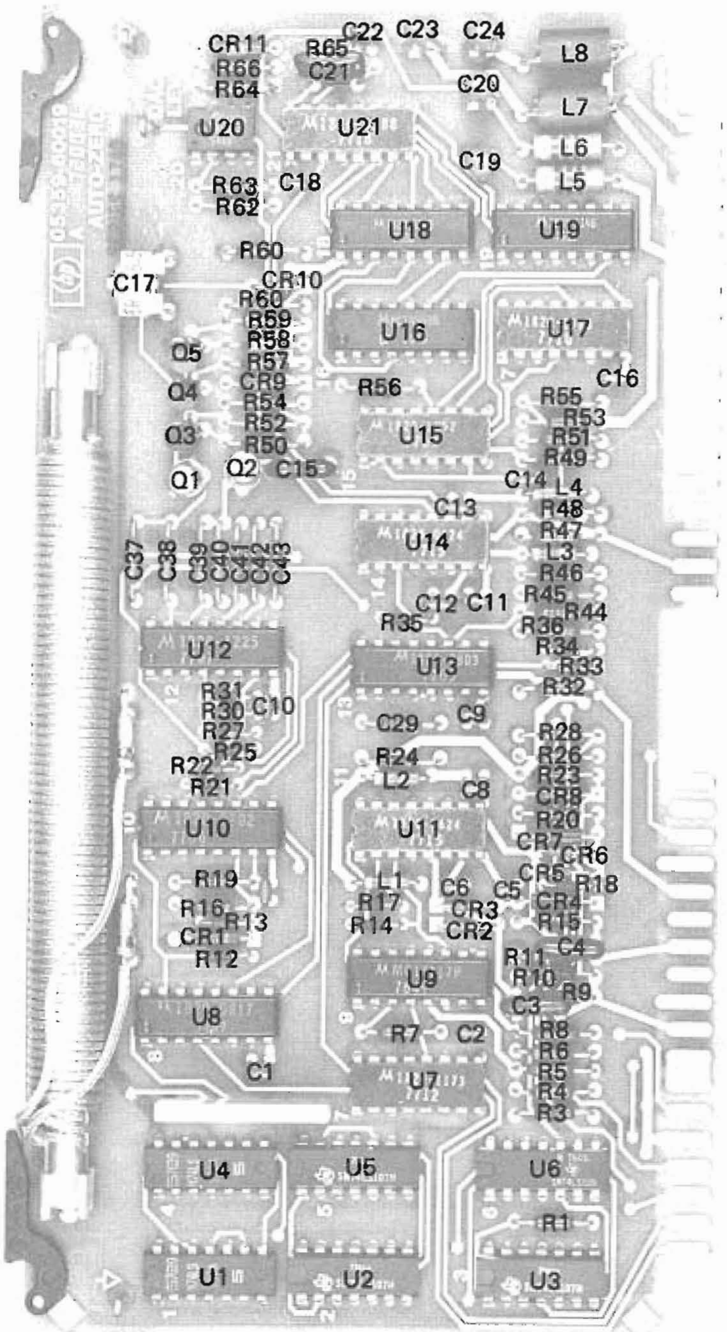


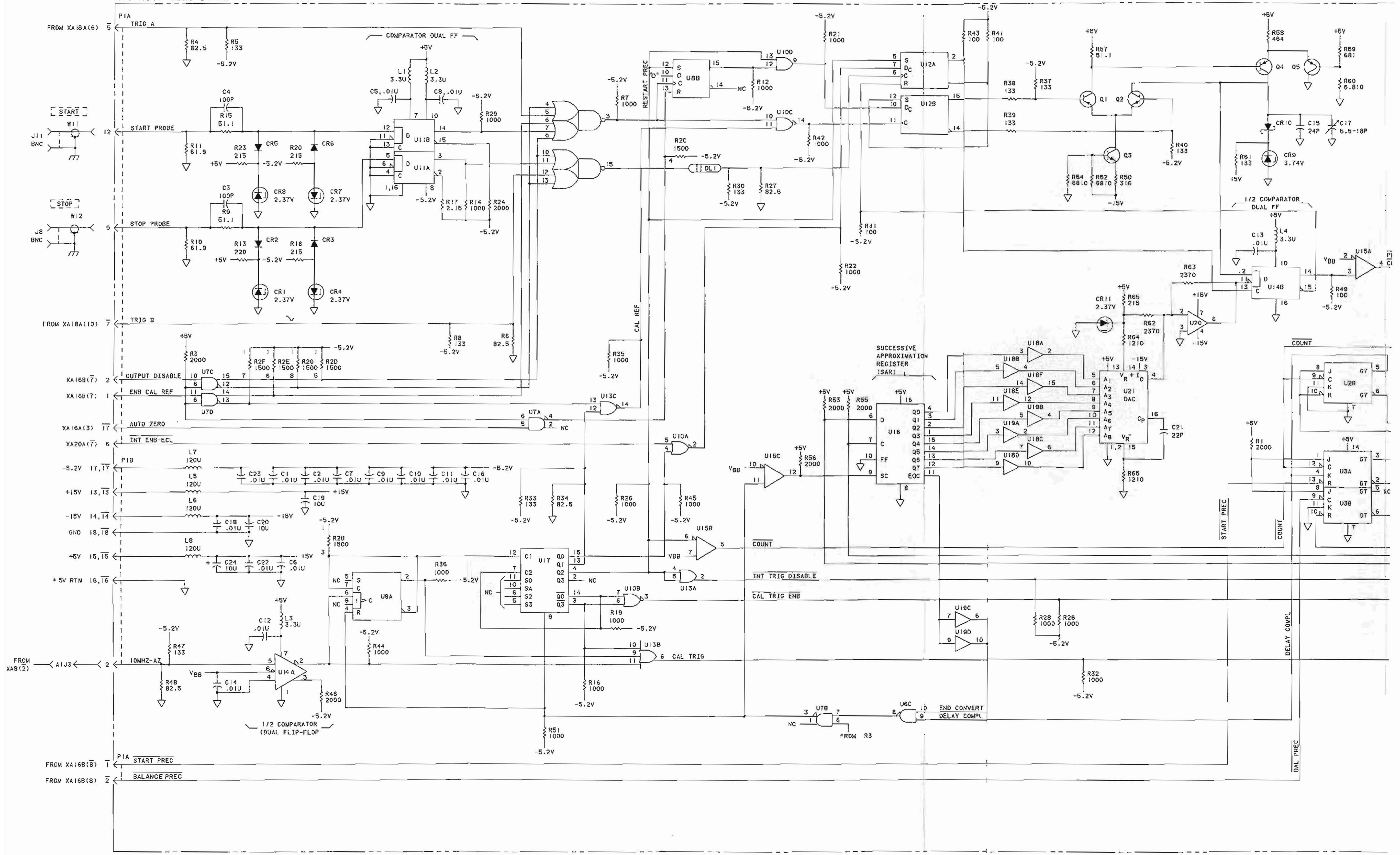
Figure 8-19. A18 Output Assembly

Figure 8-19
A18 OUTPUT ASSEMBLY

(See Page 8-101)


CR11
R65
C22
C23
C24
L8
R66
C21
R64
C20
L7
U20
U21
L6
C19
R63
C18
L5
R62
U18
U19
R60
C17
CR10
R60
R59
U16
U17
R58
Q5
R57
CR9
Q4
R56
C16
R55
R54
R53
R52
U15
Q3
R51
R50
R49
Q2
C15
C14
Q1
L4
C13
R48
R47
C37
C38
C39
C40
C41
C42
C43
U14
L3
R46
R45
C12
C11
R44
R35
R36
R34
U12
U13
R33
R32
R31
C10
R30
C29
C9
R28
R27
R25
R26
R24
R22
R23
L2
C8
R21
CR8
U10
U11
R20
CR7
CR6
R19
L1
C6
CR5
R18
C5
R17
CR3
CR4
R16
R13
R14
CR2
R15
CR1
C4
R12
R11
R10
U9
R9
C3
U8
R8
R7
C2
R6
C1
U7
R5
R4
R3
U4
U5
U6
R1
U1
U2
U3

A19 AUTO ZERO BOARD (05359-60019) SERIES 1748



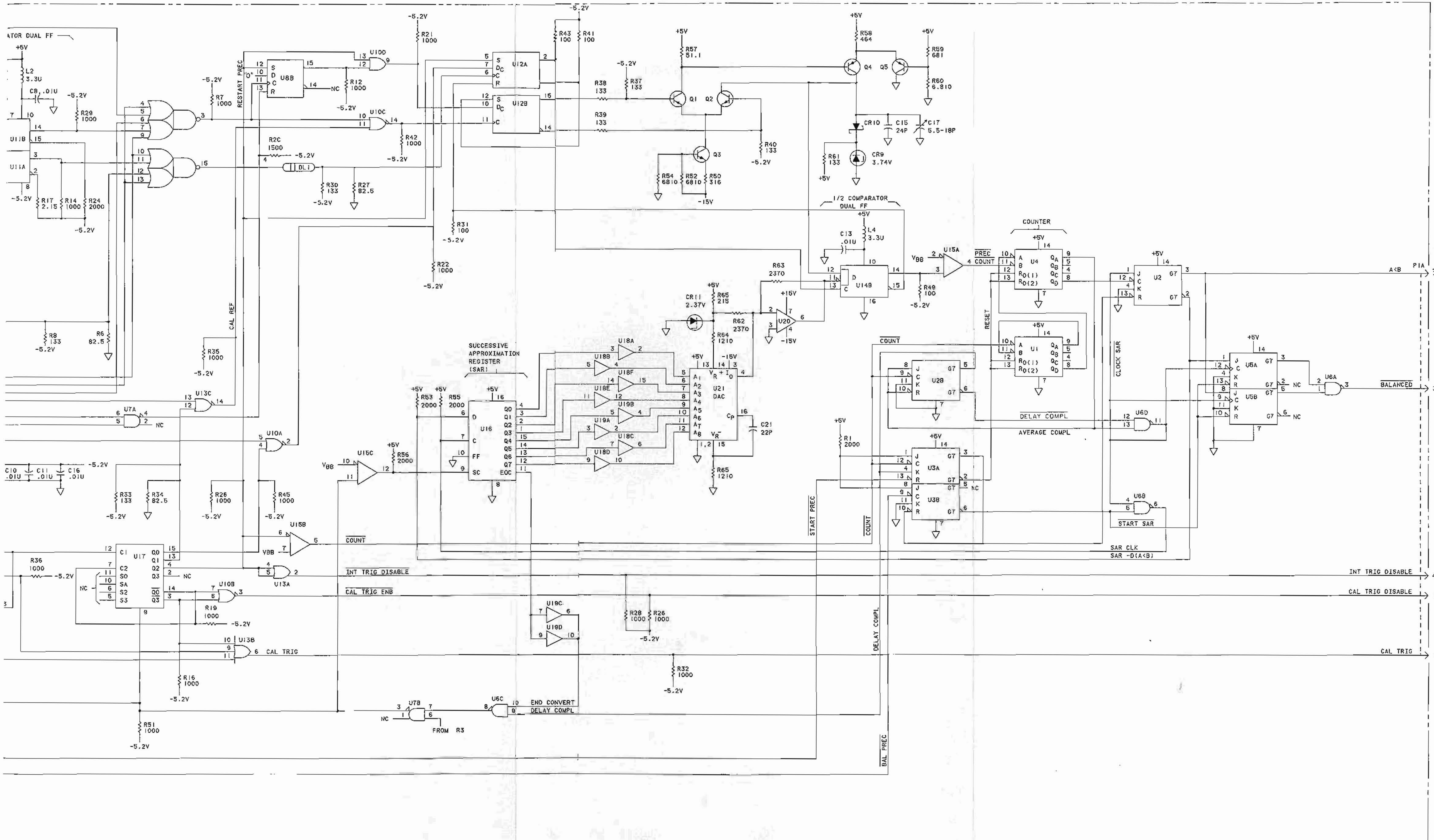
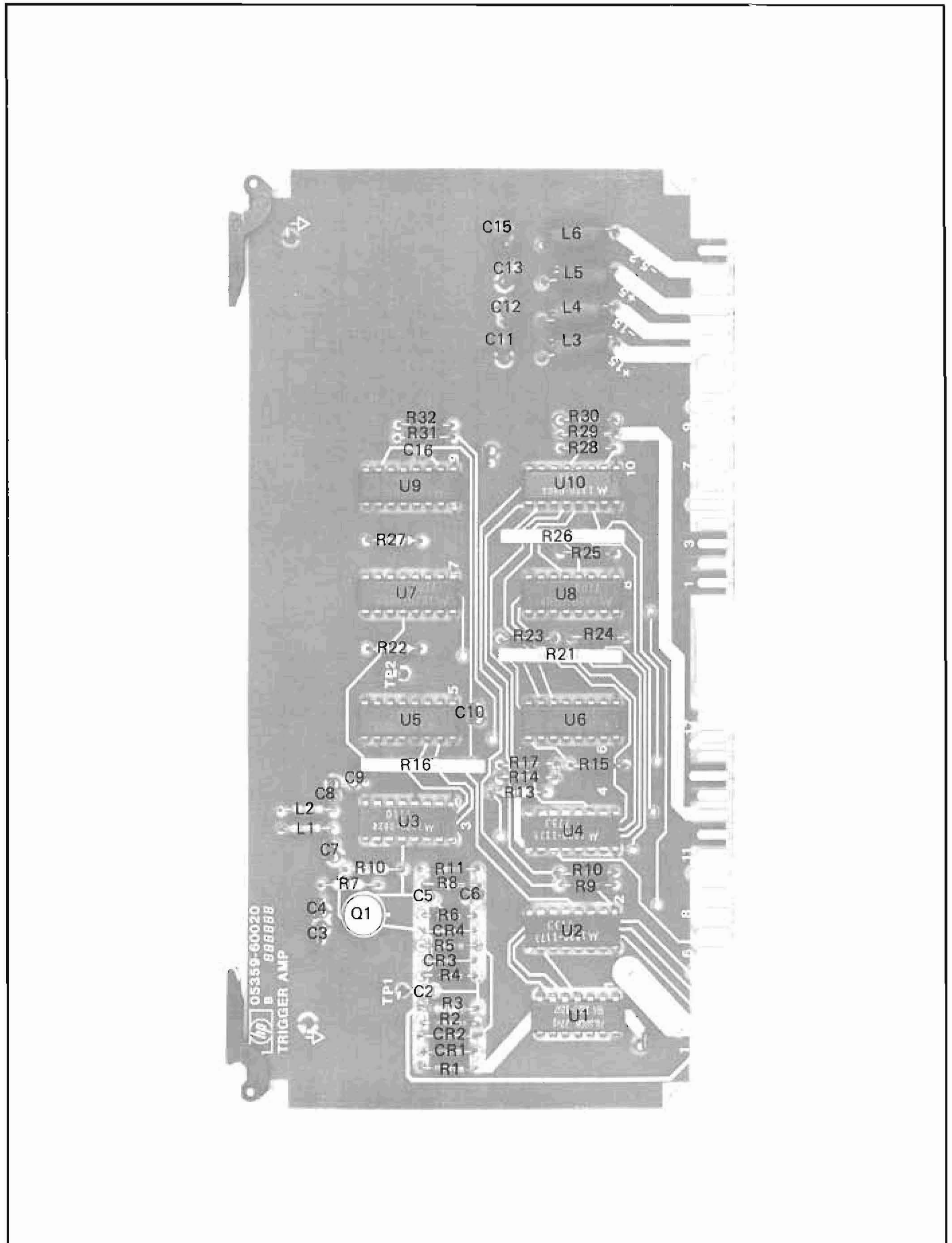
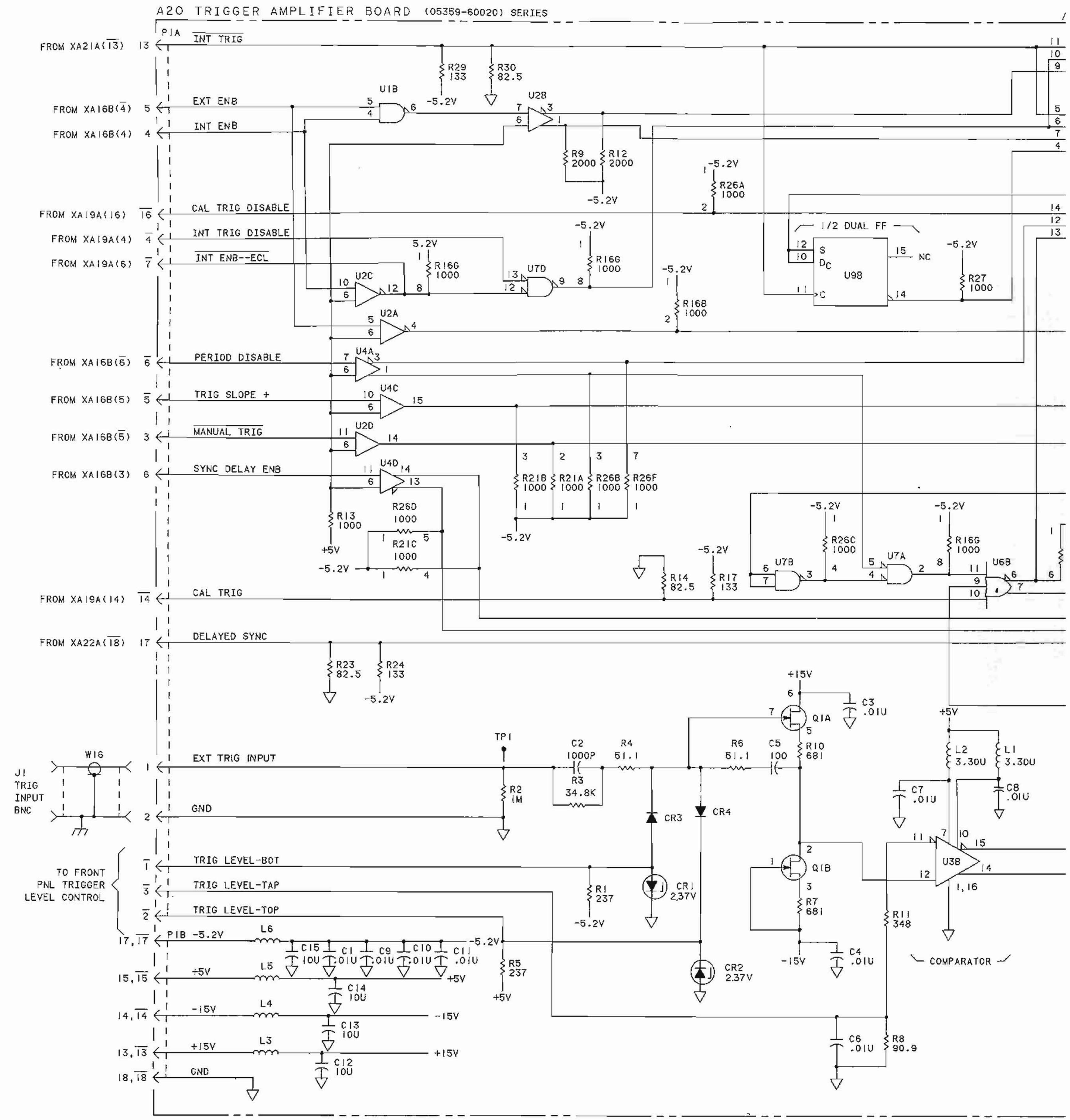


Figure 8-20. A19 Auto-Zero Assembly

Figure 8-20
A19 AUTO-ZERO ASSEMBLY

(See Page 8-103)


C15
L6
C13
L5
C12
L4
C11
L3
R32
R31
C16
R30
R29
R28
U9
U10
R26
R27
R25
U7
U8
R23
R24
R22
R21
U5
C10
U6
R16
R17
R14
R13
R15
C9
C8
L2
L1
U3
U4
C7
R10
R11
R8
R7
C6
C5
R10
R9
C4
Q1
R6
CR4
R5
C3
CR3
R4
U2
TP1
C2
R3
R2
CR2
CR1
R1
U1
05359-60020
TRIGGER AMP


A20 TRIGGER AMPLIFIER BOARD (05359-60020) SERIES
P1A
FROM XA21A(13)
INT TRIG
FROM XA16B(4)
EXT ENB
FROM XA16B(4)
INT ENB
FROM XA19A(16)
CAL TRIG DISABLE
FROM XA19A(4)
INT TRIG DISABLE
FROM XA19A(6)
INT ENB--ECL
FROM XA16B(6)
PERIOD DISABLE
FROM XA16B(5)
TRIG SLOPE +
FROM XA16B(5)
MANUAL TRIG
FROM XA16B(3)
SYNC DELAY ENB
FROM XA19A(14)
CAL TRIG
FROM XA22A(18)
DELAYED SYNC
J1 TRIG INPUT BNC
W16
EXT TRIG INPUT
GND
TO FRONT PNL TRIGGER LEVEL CONTROL
TRIG LEVEL-BOT
TRIG LEVEL-TAP
TRIG LEVEL-TOP
P1B -5.2V
+5V
-15V
+15V
GND
1/2 DUAL FF
U9B
COMPARATOR
U3B
Q1A
Q1B
TP1
R29 133
R30 82.5
R9 2000
R12 2000
R26A 1000
R16G 1000
R16B 1000
R27 1000
R21B 1000
R21A 1000
R26B 1000
R26F 1000
R26D 1000
R21C 1000
R13 1000
R14 82.5
R17 133
R26C 1000
R16G 1000
R23 82.5
R24 133
C2 1000P
R4 51.1
R3 34.8K
R2 1M
R6 51.1
C5 100
R10 681
C3 .01U
L2 3.30U
L1 3.30U
C7 .01U
C8 .01U
CR3
CR4
R1 237
CR1 2.37V
R7 681
C4 .01U
R11 348
R5 237
CR2 2.37V
C6 .01U
R8 90.9
C15 10U
C1 .01U
C9 .01U
C10 .01U
C11 .01U
C14 10U
C13 10U
C12 10U

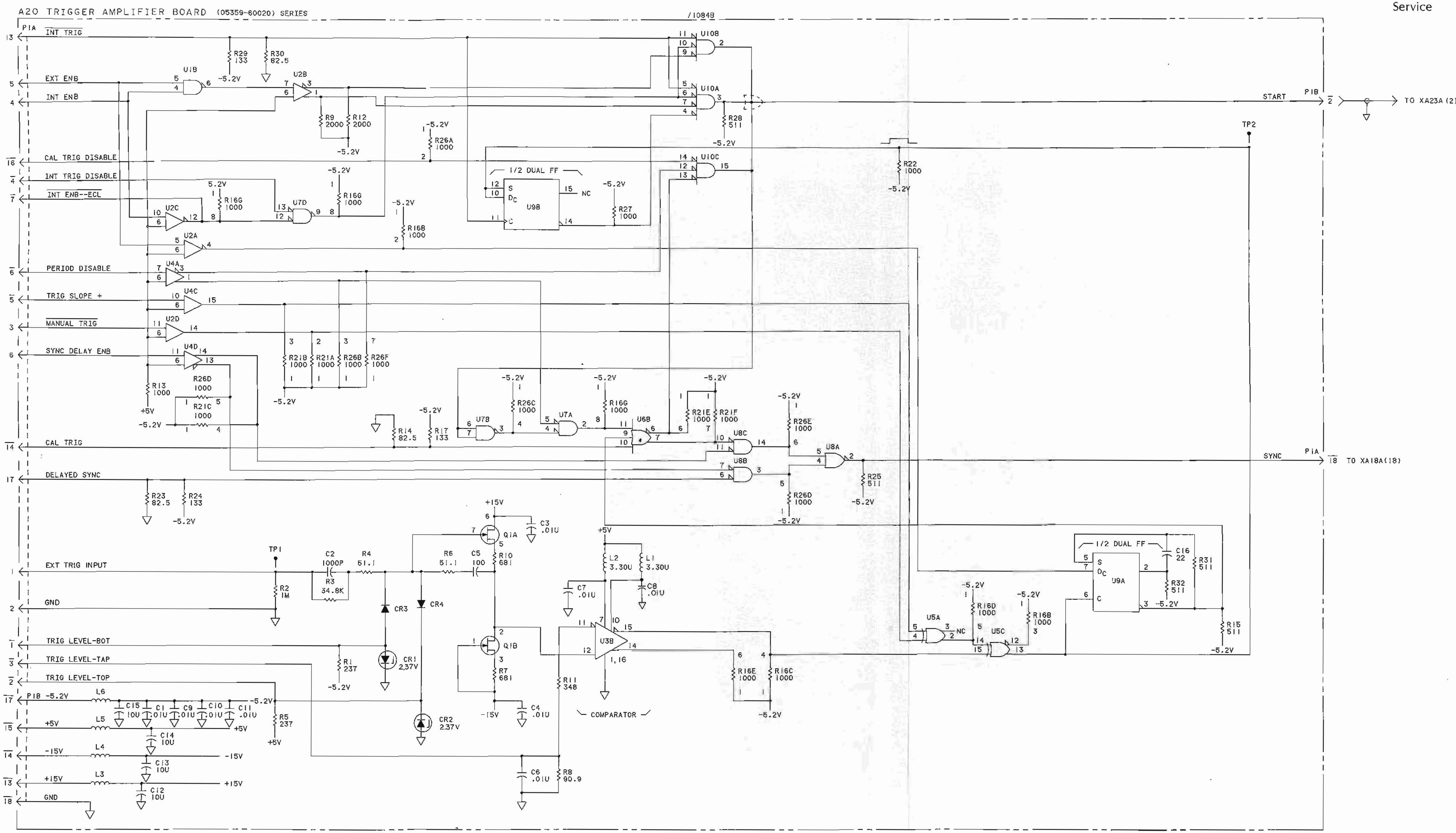
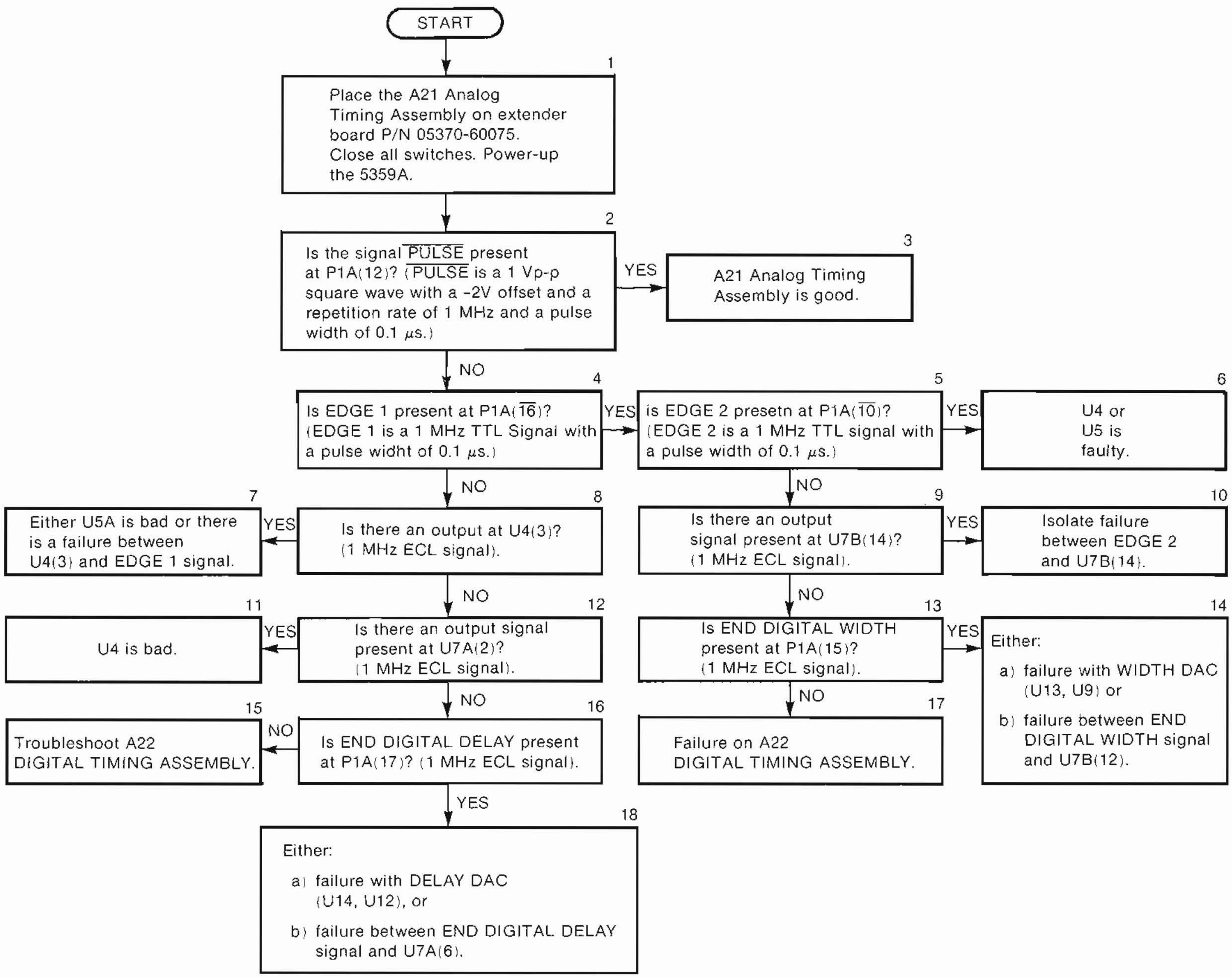


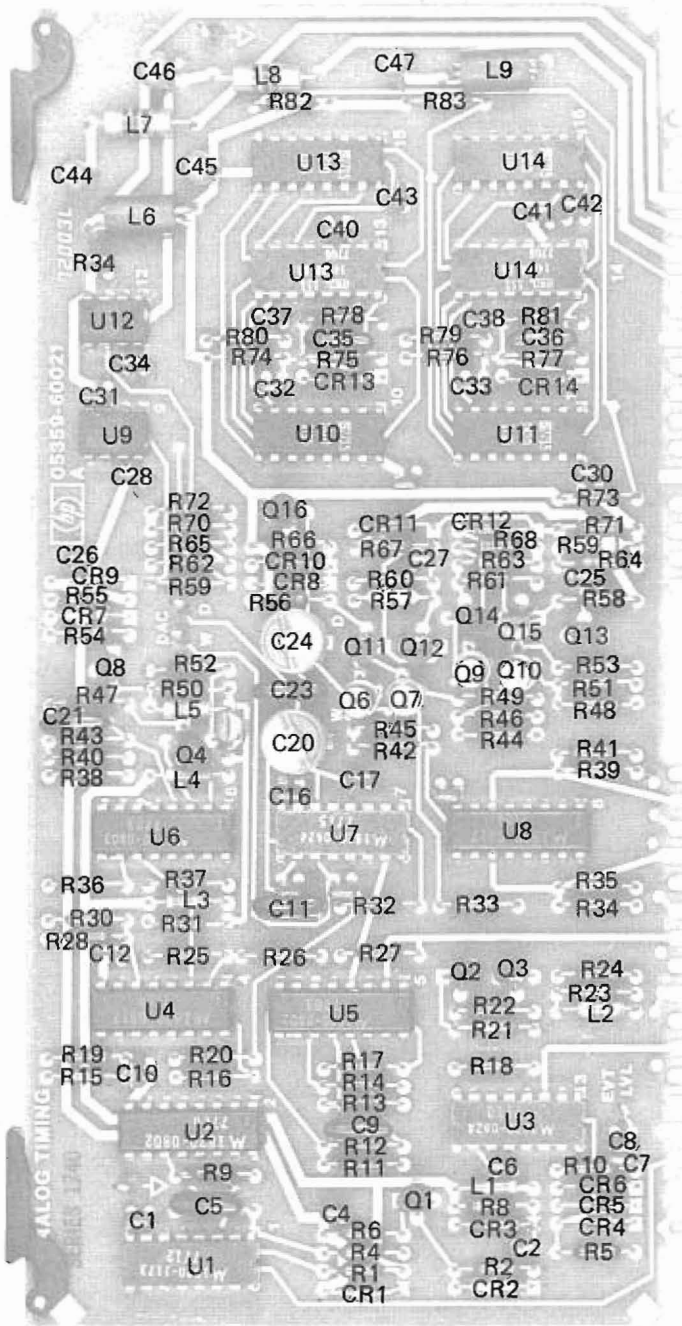
Figure 8-21. A20 Trigger Amplifier Assembly and Troubleshooting Flowchart

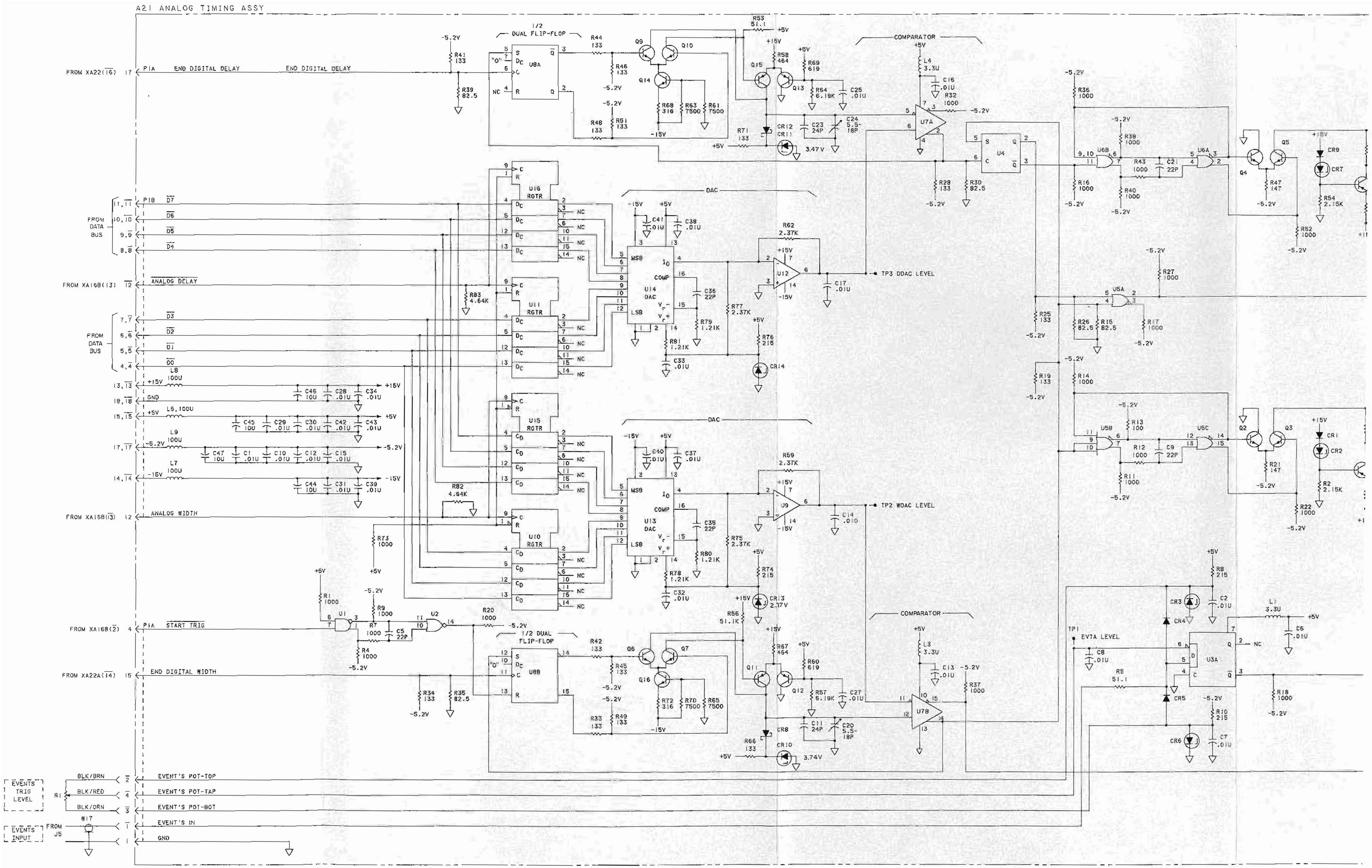
Figure 8-21
A20 TRIGGER AMPLIFIER ASSEMBLY

(See Page 8-105)

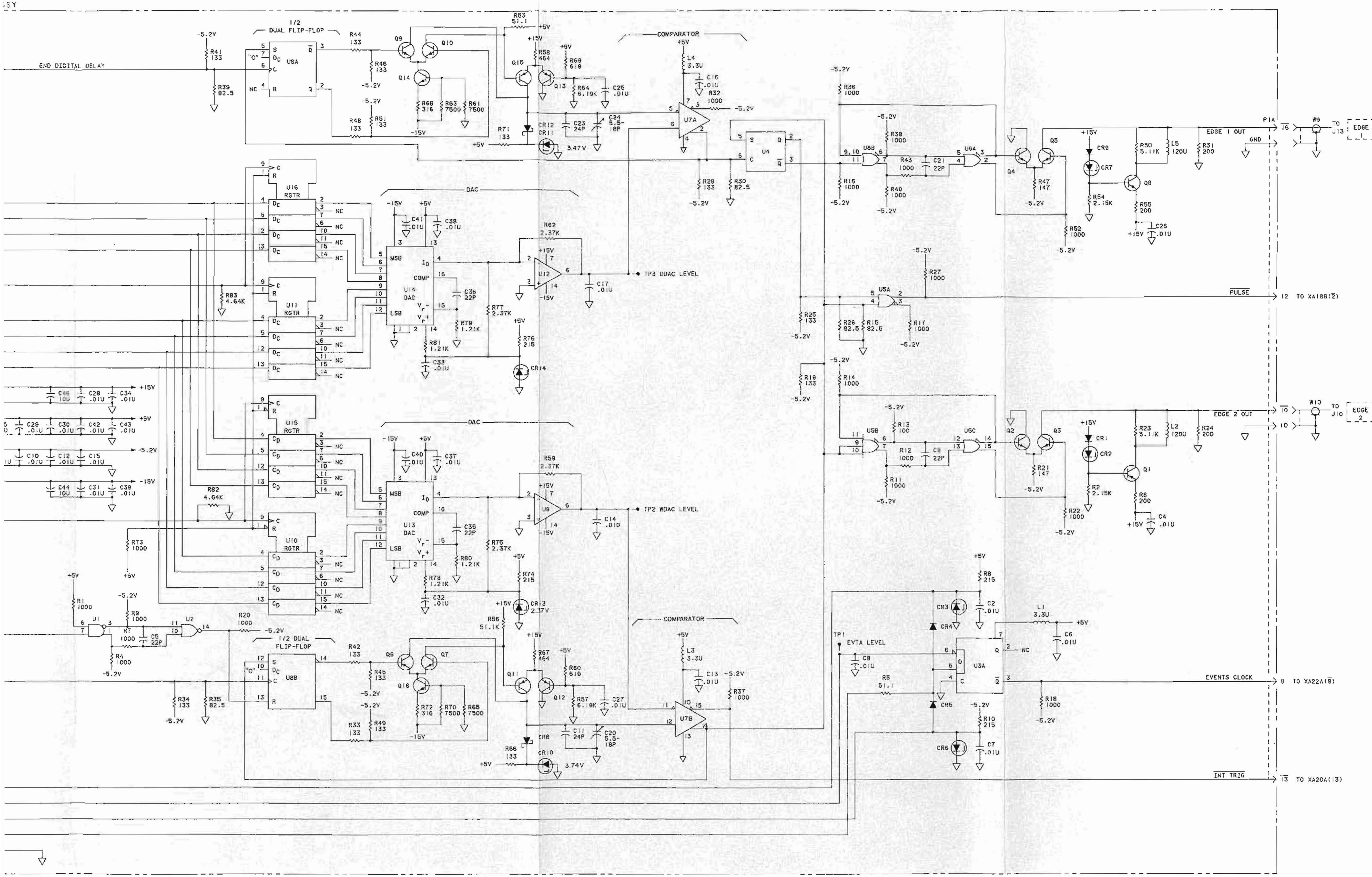
A21 TROUBLESHOOTING
(Assuming Power-Up Default Conditions)




C46 L8 C47 L9
R82 R83
L7
C44 C45 U13 U14
C43 C41 C42
L6
C40
R34 U13 U14
U12
C37 R78 C38 R81
R80 C35 R79 C36
R74 R75 R76 R77
C34
C32 CR13 C33 CR14
C31
U9 U10 U11
05359-60021
C28 C30
R72 R73
Q16
R70 CR11 CR12 R71
R65 R66 R68
C26 R67 R59 R64
R62 CR10 R63
CR9 C27
R55 R59 CR8 R60 R61 C25
CR7 R56 R57 R58
R54 Q14 Q15 Q13
C24 Q11 Q12
Q8 R52 R53
Q9 Q10
R47 R50 C23 R51
L5 Q6 Q7 R49 R48
C21 R46
R43 R45 R44
C20 R42 R41
R40 Q4
R38 L4 C17 R39
C16
U6 U7 U8
R36 R37 R35
L3
C11 R32 R33 R34
R30 R31
R28 C12 R25 R26 R27 R24
Q2 Q3
R23
U4 U5 R22 L2
R21
R19 R20 R17 R18
R15 C10 R16 R14
R13
U2 C9 U3 C8
R12 C6 R10 C7
R9 R11
L1 CR6
C5 Q1 R8 CR5
C1 C4 CR3 CR4
R6
R4 C2 R5
U1 R1 R2
CR1 CR2
ANALOG TIMING



A21 ANALOG TIMING ASSY
FROM XA22(16) 17
P1A
END DIGITAL DELAY
1/2 DUAL FLIP-FLOP
U8A
COMPARATOR
U7A
U4
FROM DATA BUS
P1B
D7
D6
D5
D4
U16 RGTR
DAC
U14 DAC
MSB
LSB
COMP
U12
TP3 DDAC LEVEL
FROM XA16B(13) 12
ANALOG DELAY
U11 RGTR
D3
D2
D1
D0
U5A
U15 RGTR
U13 DAC
U9
TP2 WDAC LEVEL
FROM XA15B(13) 12
ANALOG WIDTH
U10 RGTR
U5B
U5C
FROM XA16B(2) 4
START TRIG
U1
U2
1/2 DUAL FLIP-FLOP
U8B
FROM XA22A(14) 15
END DIGITAL WIDTH
U7B
TP1
EVTA LEVEL
U3A
EVENTS TRIG LEVEL
BLK/BRN
BLK/RED
BLK/ORN
EVENT'S POT-TOP
EVENT'S POT-TAP
EVENT'S POT-BOT
EVENTS INPUT
FROM J5
W17
EVENT'S IN
GND



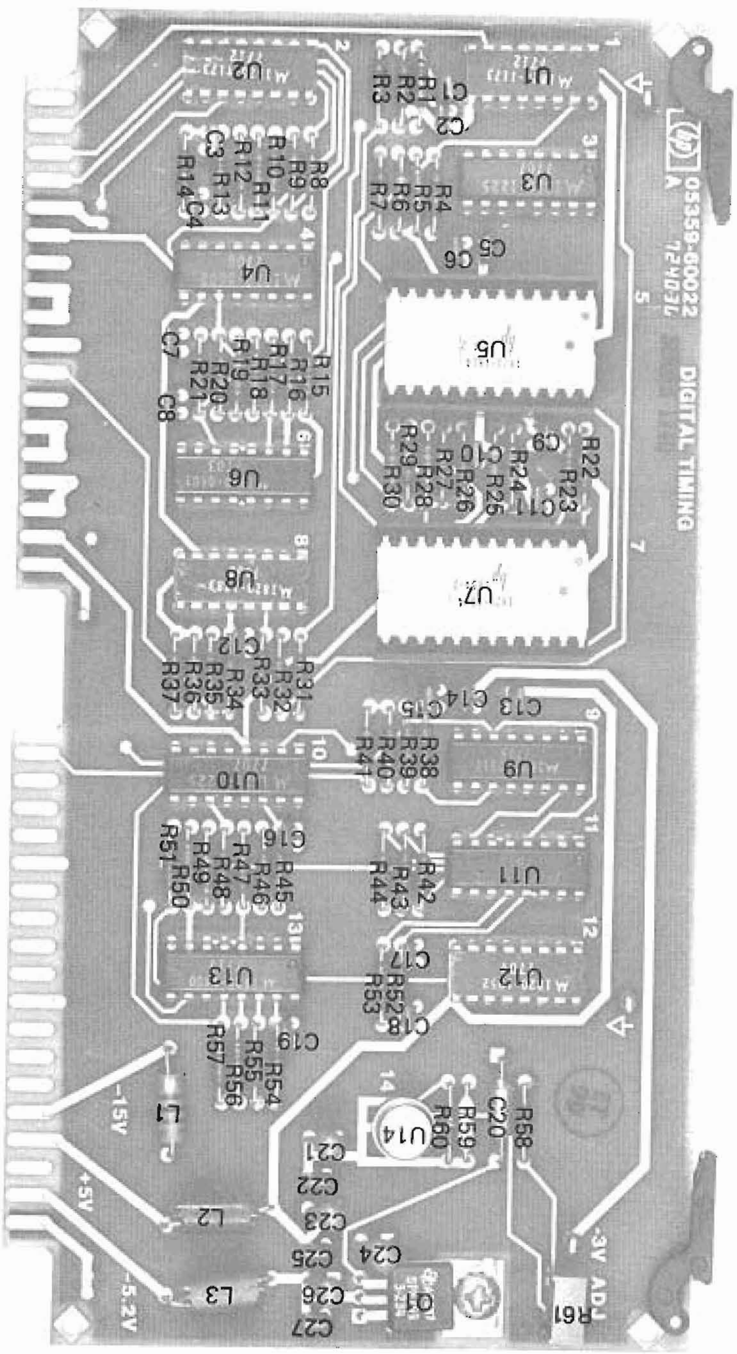
NOTES:

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

Figure 8-22. A21 Analog Timing Assembly and Troubleshooting Flowchart

Figure 8-22
A21 ANALOG TIMING ASSEMBLY
AND TROUBLESHOOTING FLOWCHART

(See Page 8-107)



05359-60022
A
DIGITAL TIMING
-15V
+5V
-5.2V
-3V ADJ

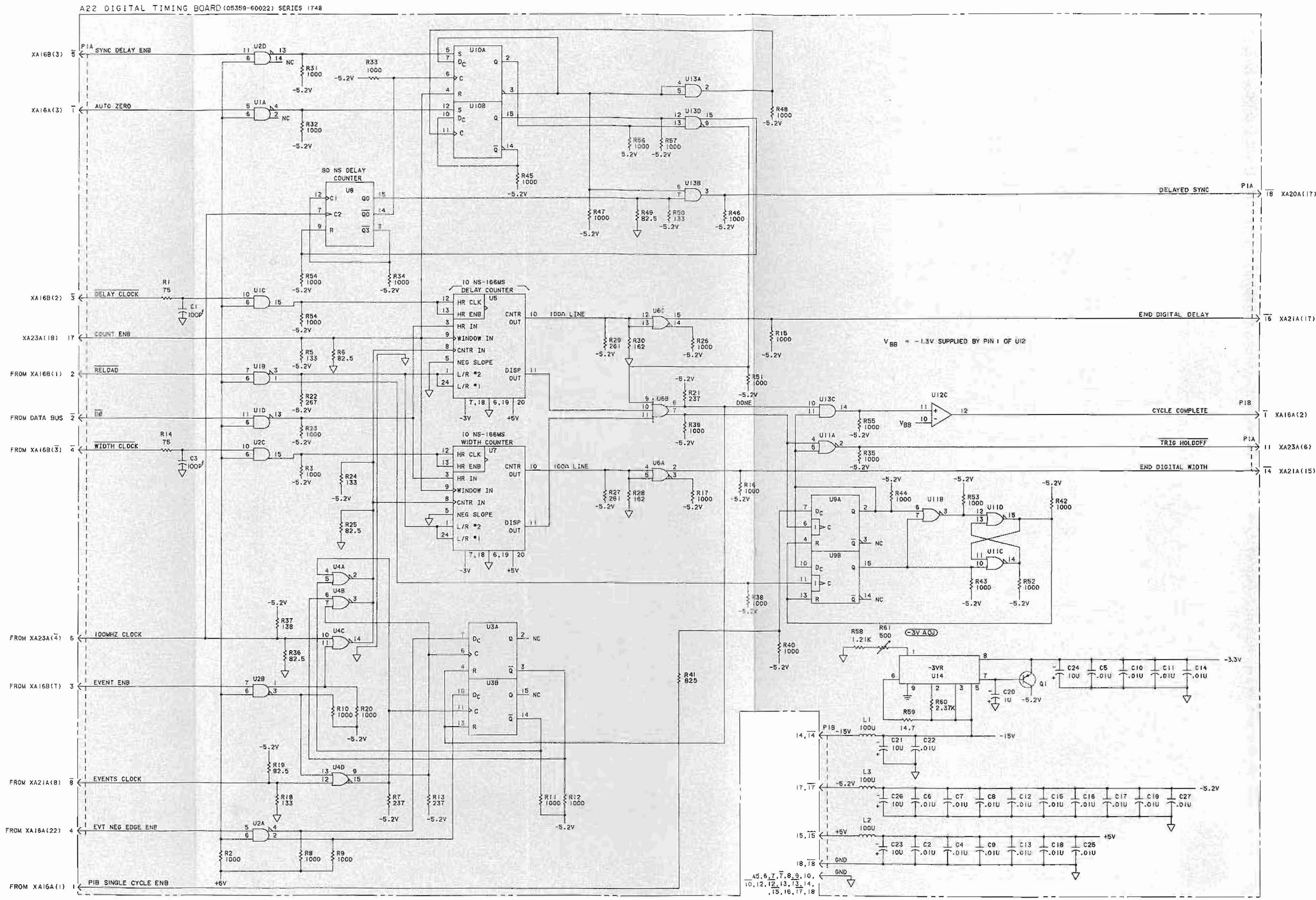
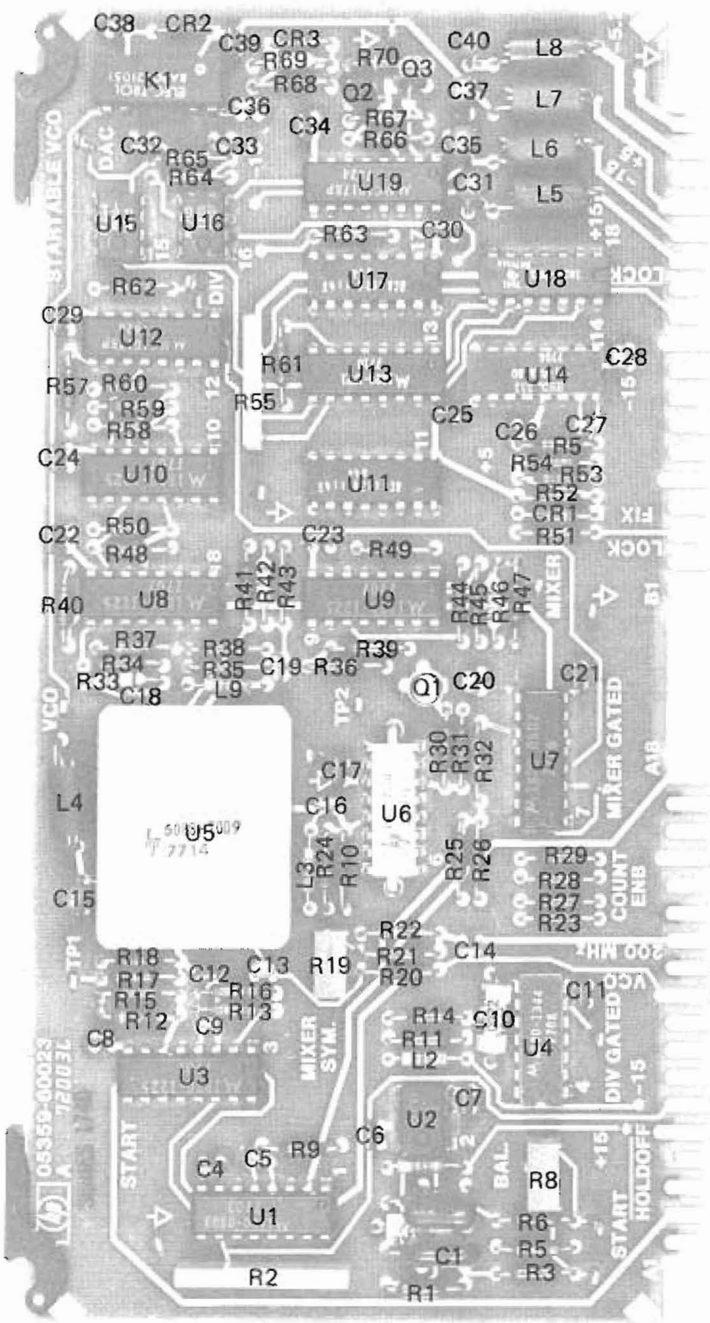
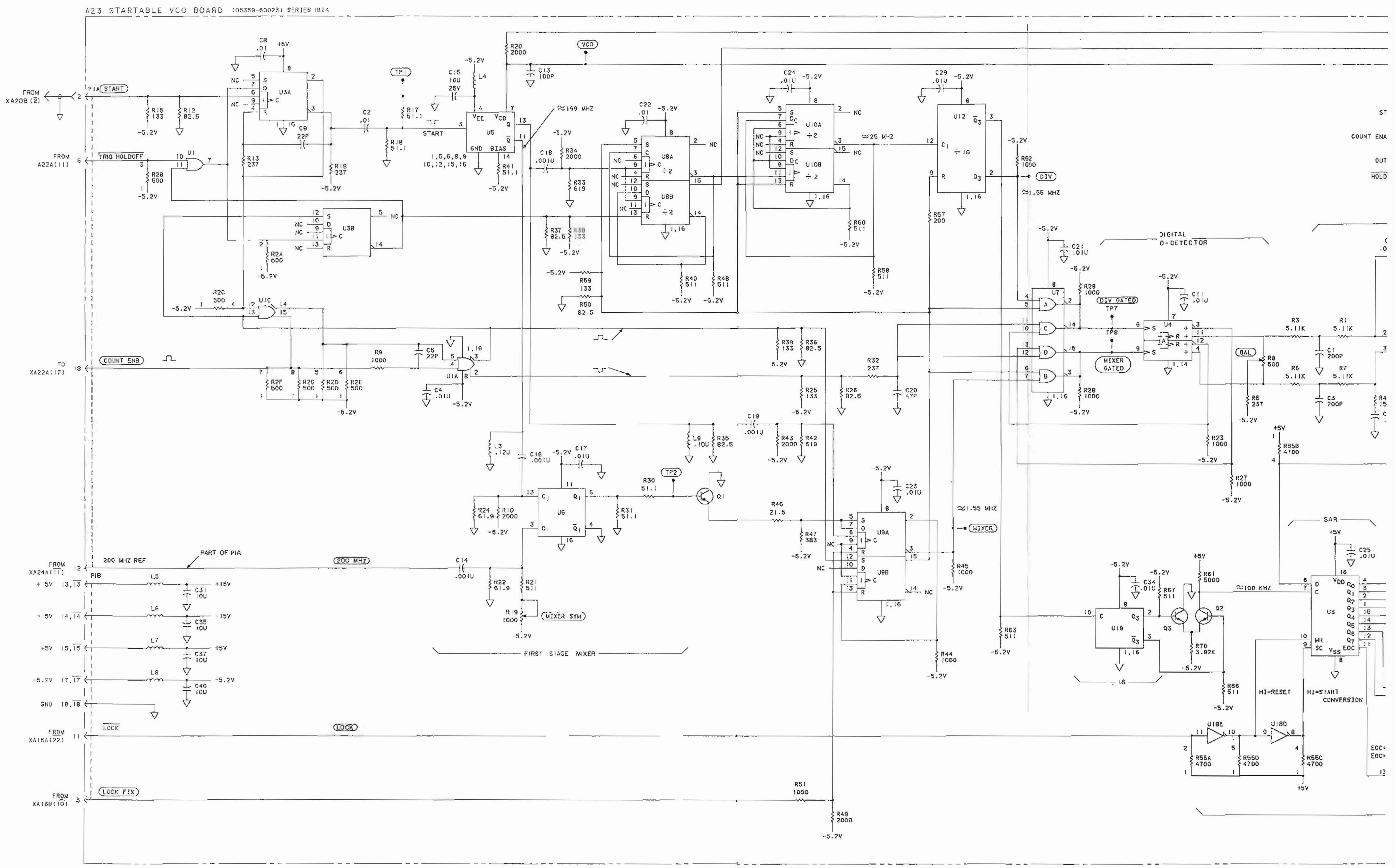


Figure 8-23. A22 Digital Timing Assembly

Figure 8-23
A22 DIGITAL TIMING ASSEMBLY

(See Page 8-109)


C38
CR2
C39
CR3
R69
R70
C40
L8
K1
R68
Q2
Q3
C37
L7
STARTABLE VCO
C36
C34
R67
R66
C35
L6
C32
R65
C33
DAC
R64
U19
C31
L5
U15
U16
R63
C30
R62
U17
U18
DIV
LOCK
C29
U12
R61
U13
U14
C28
R57
R60
R59
R55
C25
C26
C27
R58
R5
R54
R53
C24
U10
U11
R52
CR1
FIX
C22
R50
C23
R48
R49
R51
LOCK
MIXER
R40
U8
R41
R42
R43
U9
R44
R45
R46
R47
R37
R38
R39
R34
R35
C19
R36
R33
C18
L9
Q1
C20
C21
VCO
TP2
MIXER GATED
C17
R30
R31
R32
U7
A18
L4
C16
U6
U5
L3
R24
R10
R25
R26
R29
R28
R27
R23
COUNT ENB
C15
R22
TP1
R18
C13
R19
R21
C14
200 MHz
R17
C12
R16
R20
VCO
C11
R15
R13
R14
C10
R12
C9
R11
U4
DIV GATED
C8
MIXER SYM.
L2
-15
U3
C7
U2
START
C6
C4
C5
R9
+15
HOLDOFF
BAL
R8
05359-60023
U1
R6
R5
START
C1
R2
R3
R1


A23 STARTABLE VCO BOARD (05359-60023) SERIES 1824
FROM XA20B(2)
START
FROM A22A(11)
TRIG HOLDOFF
TO XA22A(17)
COUNT ENB
FROM XA24A(11)
200 MHZ REF
PART OF P1A
200 MHz
FIRST STAGE MIXER
FROM XA16A(22)
LOCK
FROM XA16B(10)
LOCK FIX
VCO
TP1
TP2
DIV
DIV GATED
MIXER GATED
MIXER
MIXER SYM
BAL
DIGITAL Φ-DETECTOR
SAR
HI=RESET
HI=START CONVERSION
≈199 MHZ
≈25 MHZ
≈1.55 MHZ
≈100 KHZ

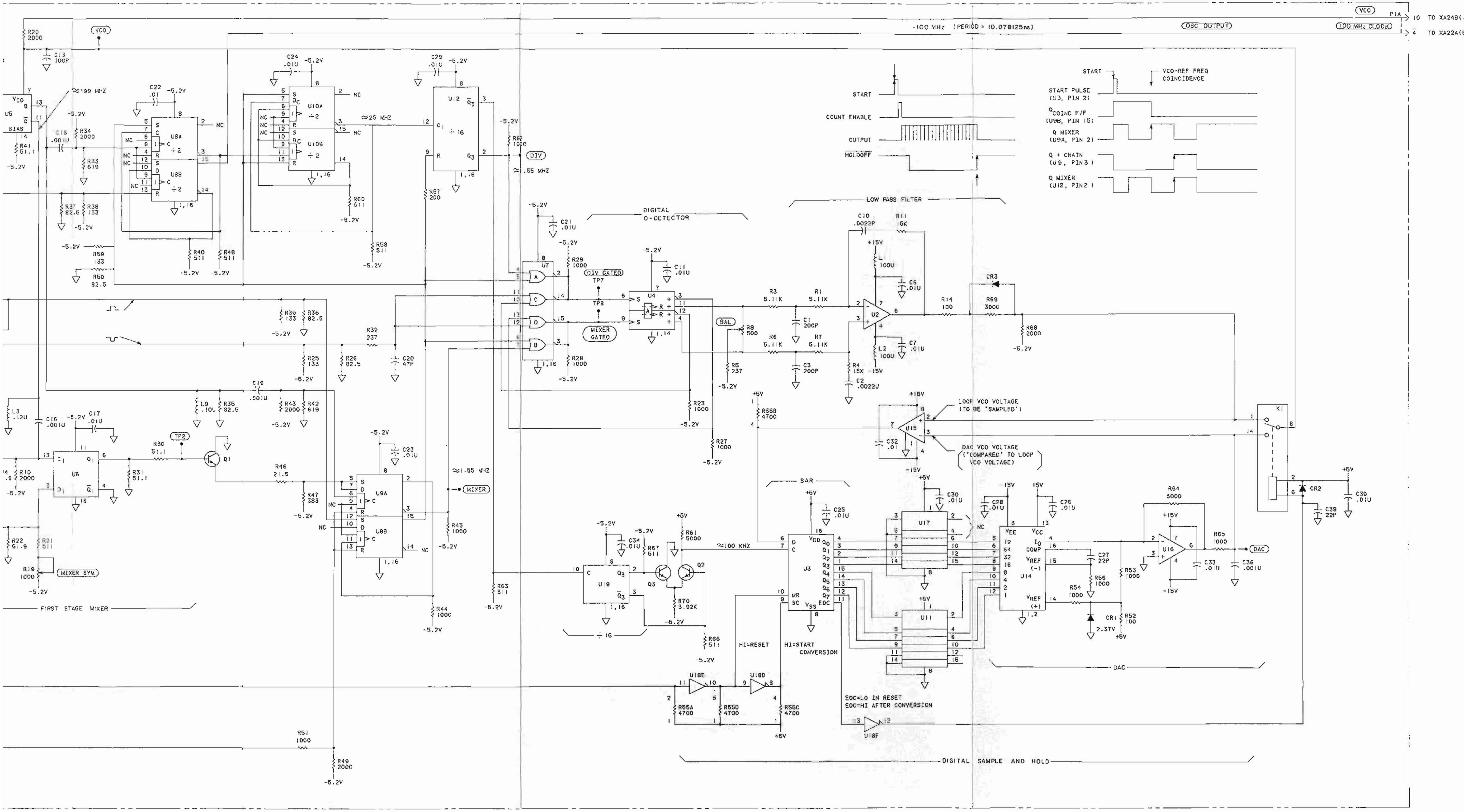
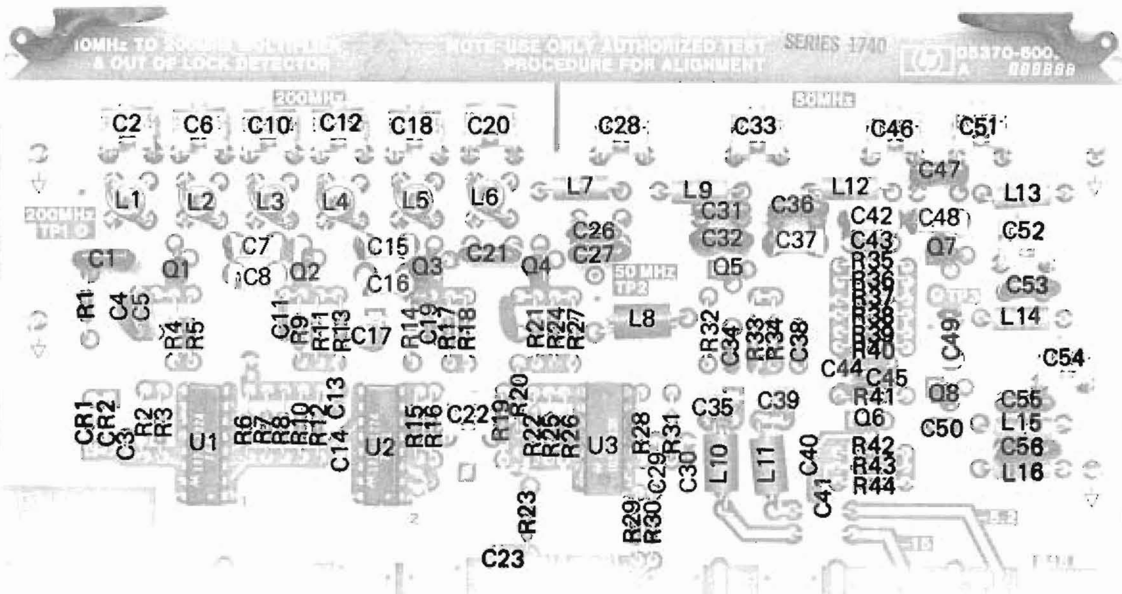
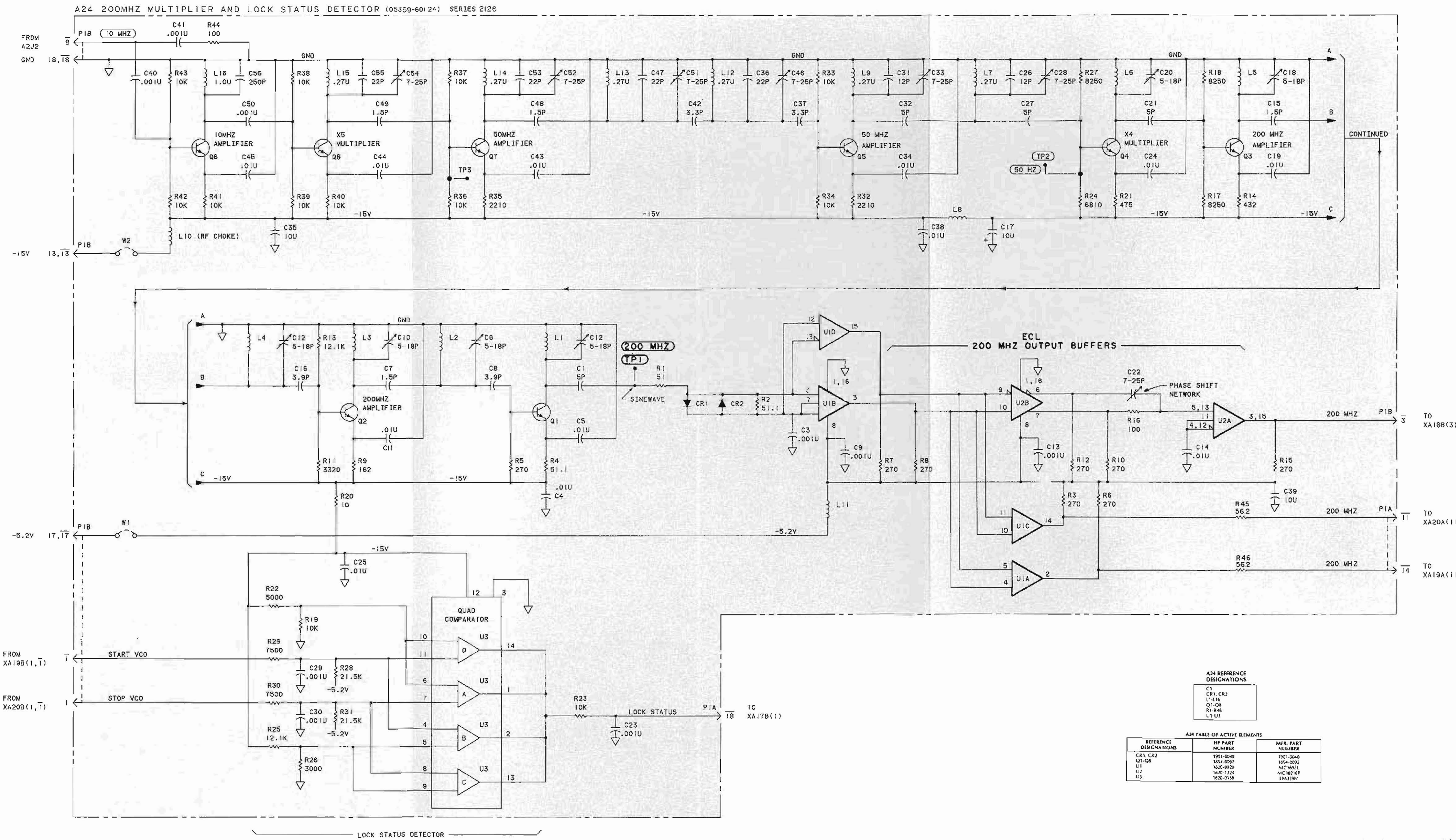


Figure 8-24. A23 Startable PLL Oscillator Assembly

Figure 8-24
A23 STARTABLE PLL OSCILLATOR ASSEMBLY

(See Page 8-111)


NOTE: USE ONLY AUTHORIZED TEST
PROCEDURE FOR ALIGNMENT
SERIES 1740
200MHz
50MHz
200MHz TP1
50 MHz TP2
C2 C6 C10 C12 C18 C20 C28 C33 C46 C51
L1 L2 L3 L4 L5 L6 L7 L9 L12 C47 L13
C31 C36 C42 C48 C52
C7 C15 C21 C26 C32 C37 C43 Q7
C1 Q1 C8 Q2 Q3 Q4 C27 Q5 R35 R36 R39 R37 R38 R38 R40
C16 C53
R1 C4 C5 C11 R9 R11 R13 C17 R14 C19 R17 R18 R21 R24 R27 L8 R32 C34 R33 R34 C38 C49 L14
R4 R5 C44 C45 C54
CR1 CR2 R2 R3 U1 R6 R7 R8 R10 R12 C14 C13 U2 R15 R16 C22 R19 R20 R22 R25 R26 U3 R28 R31 C35 C39 R41 Q8 C55
C3 C29 C30 L10 L11 C40 Q6 C50 L15
R42 R43 R44 C56 L16
C41
R23 R29 R30
C23



A24 REFERENCE DESIGNATIONS

C1
CR1, CR2
L1-L16
Q1-Q8
R1-R46
U1-U3

A24 TABLE OF ACTIVE ELEMENTS

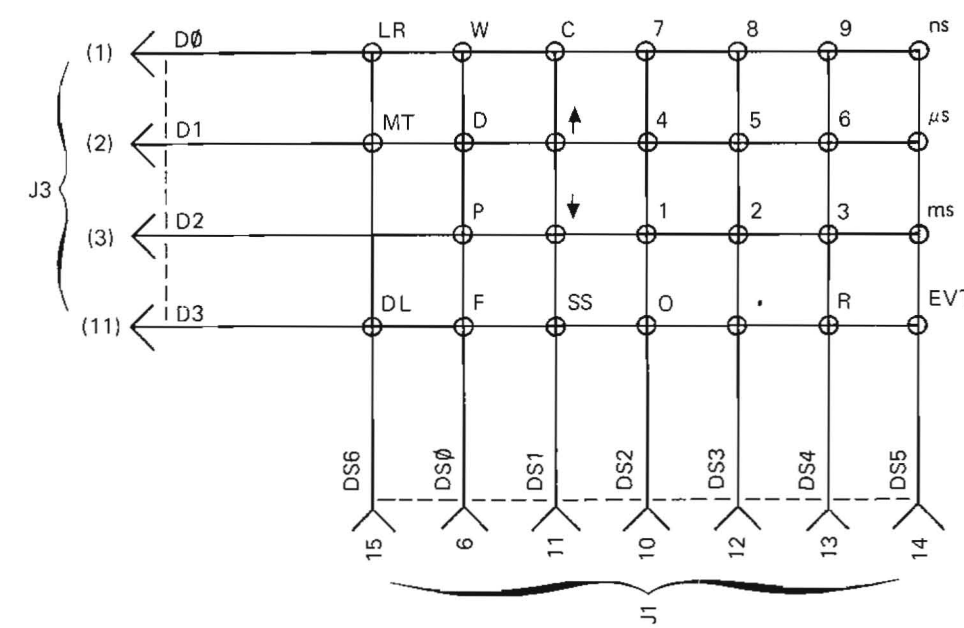
REFERENCE DESIGNATIONS	HP PART NUMBER	MFR. PART NUMBER
CR1, CR2	1901-0040	1901-0040
Q1-Q8	1854-0092	1854-0092
U1	1820-0920	MC1692L
U2	1820-1224	MC10216P
U3.	1820-0138	LM339N

Figure 8-25. A24 200 MHz Multiplier Assembly

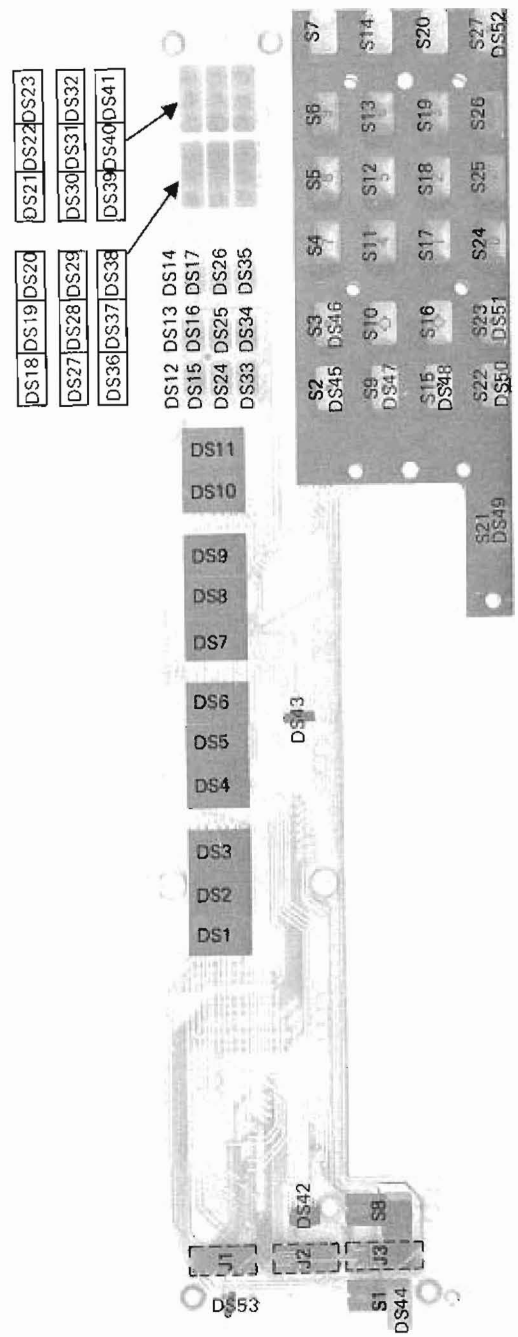
Figure 8-25
A24 200 MHz MULTIPLIER ASSEMBLY

(See Page 8-113)

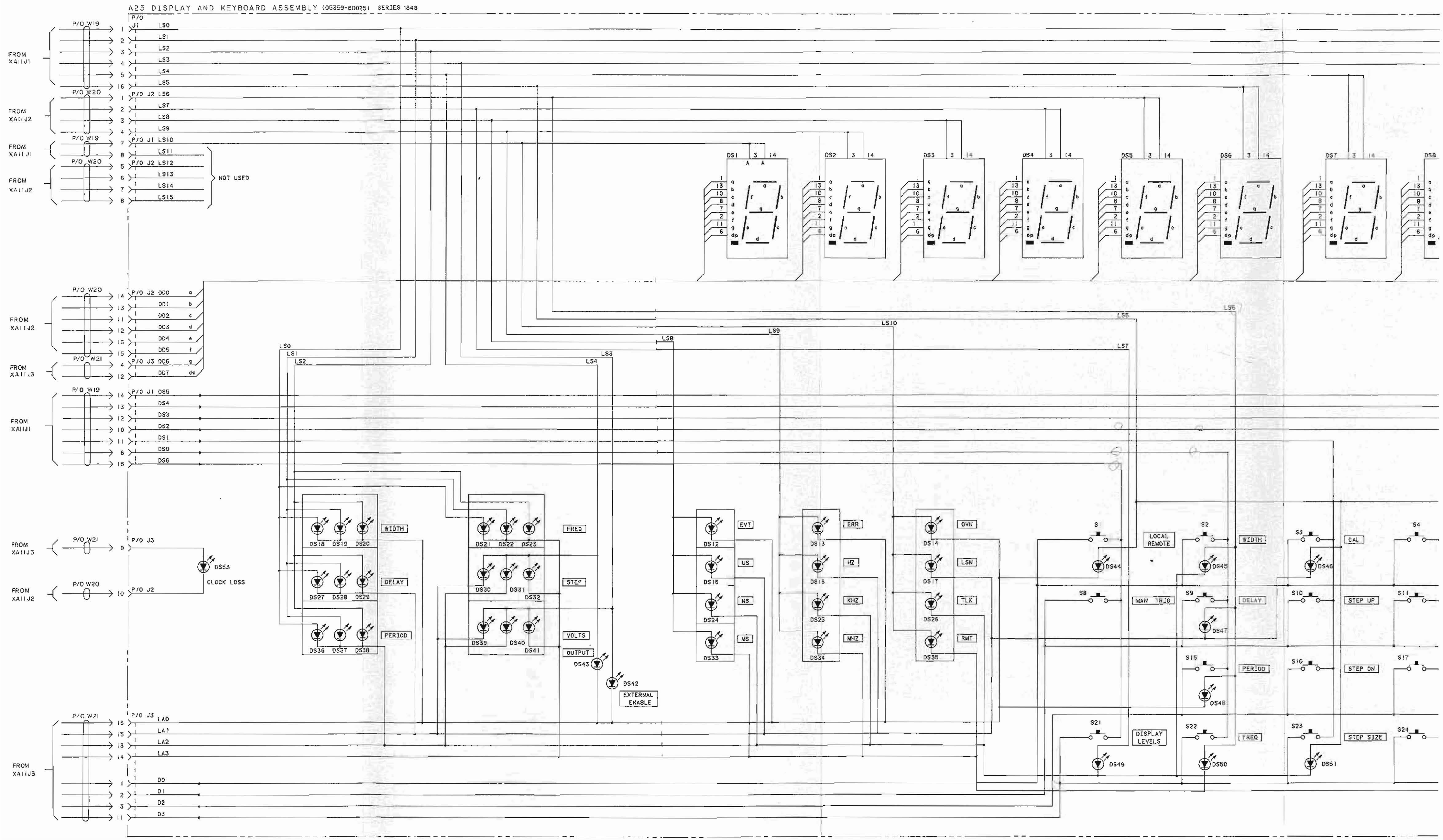
SWITCH FUNCTION LOGIC



LR = LOCAL/REMOTE
MT = MAN TRIG
DL = DISPLAY LEVELS
W = WIDTH
D = DELAY
P = PERIOD
F = FREQ
SS = STEP SIZE
R = CLEAR
C = CAL



DS18 DS19 DS20
DS27 DS28 DS29
DS36 DS37 DS38
DS21 DS22 DS23
DS30 DS31 DS32
DS39 DS40 DS41
DS12 DS13 DS14
DS15 DS16 DS17
DS24 DS25 DS26
DS33 DS34 DS35
S7 S14 S20 S27 DS52
S6 S13 S19 S26
S5 S12 S18 S25
S4 S11 S17 S24
S3 DS46 S10 S16 S23 DS51
S2 DS45 S9 DS47 S15 DS48 S22 DS50
S21 DS49
DS11
DS10
DS9
DS8
DS7
DS6
DS5
DS4
DS43
DS3
DS2
DS1
DS42
S8
J1 J2 J3
DS53
S1
DS44


A25 DISPLAY AND KEYBOARD ASSEMBLY (05359-60025) SERIES 1848
FROM XA11J1
FROM XA11J2
FROM XA11J3
P/O W19
P/O W20
P/O W21
P/O J1
P/O J2
P/O J3
LS0
LS1
LS2
LS3
LS4
LS5
LS6
LS7
LS8
LS9
LS10
LS11
LS12
LS13
LS14
LS15
NOT USED
DD0
DD1
DD2
DD3
DD4
DD5
DD6
DD7
DS0
DS1
DS2
DS3
DS4
DS5
DS6
DS7
DS8
DS53
CLOCK LOSS
WIDTH
DELAY
PERIOD
FREQ
STEP
VOLTS
OUTPUT
EXTERNAL ENABLE
EVT
US
NS
MS
ERR
HZ
KHZ
MHZ
OVN
LSN
TLK
RMT
LOCAL REMOTE
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DISPLAY LEVELS
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STEP UP
STEP ON
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LA1
LA2
LA3
D0
D1
D2
D3

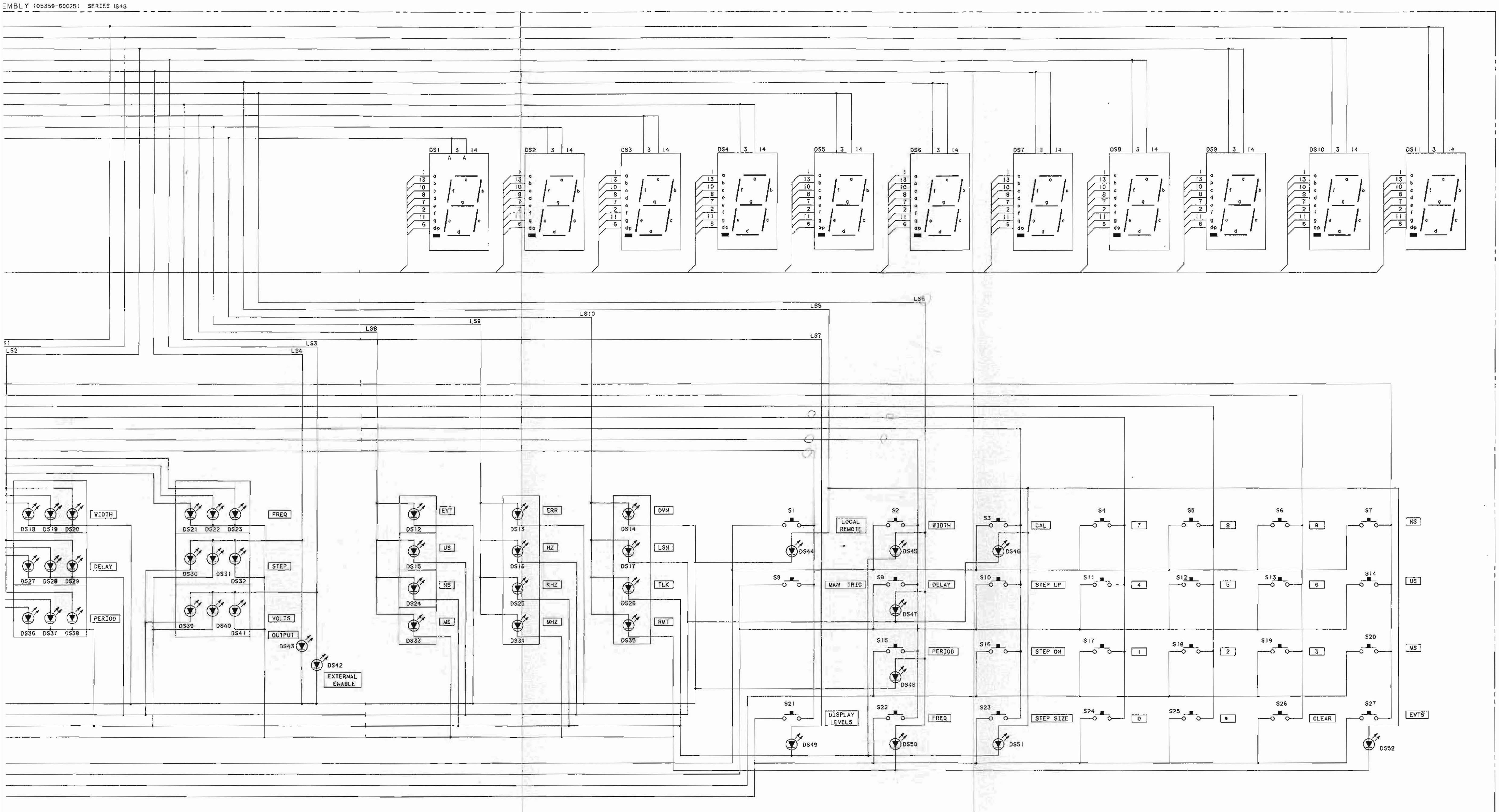
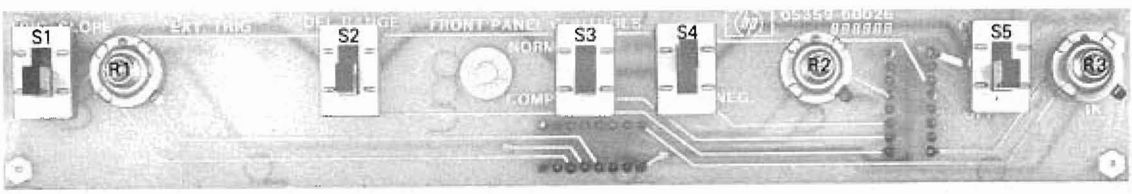


Figure 8-26. A25 Display and Keyboard Assembly

Figure 8-26
A25 DISPLAY AND KEYBOARD ASSEMBLY

(See Page 8-115)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R1
EXT TRIG
S2
NORM
S3
COMP
S4
NEG
R2
S5
R3

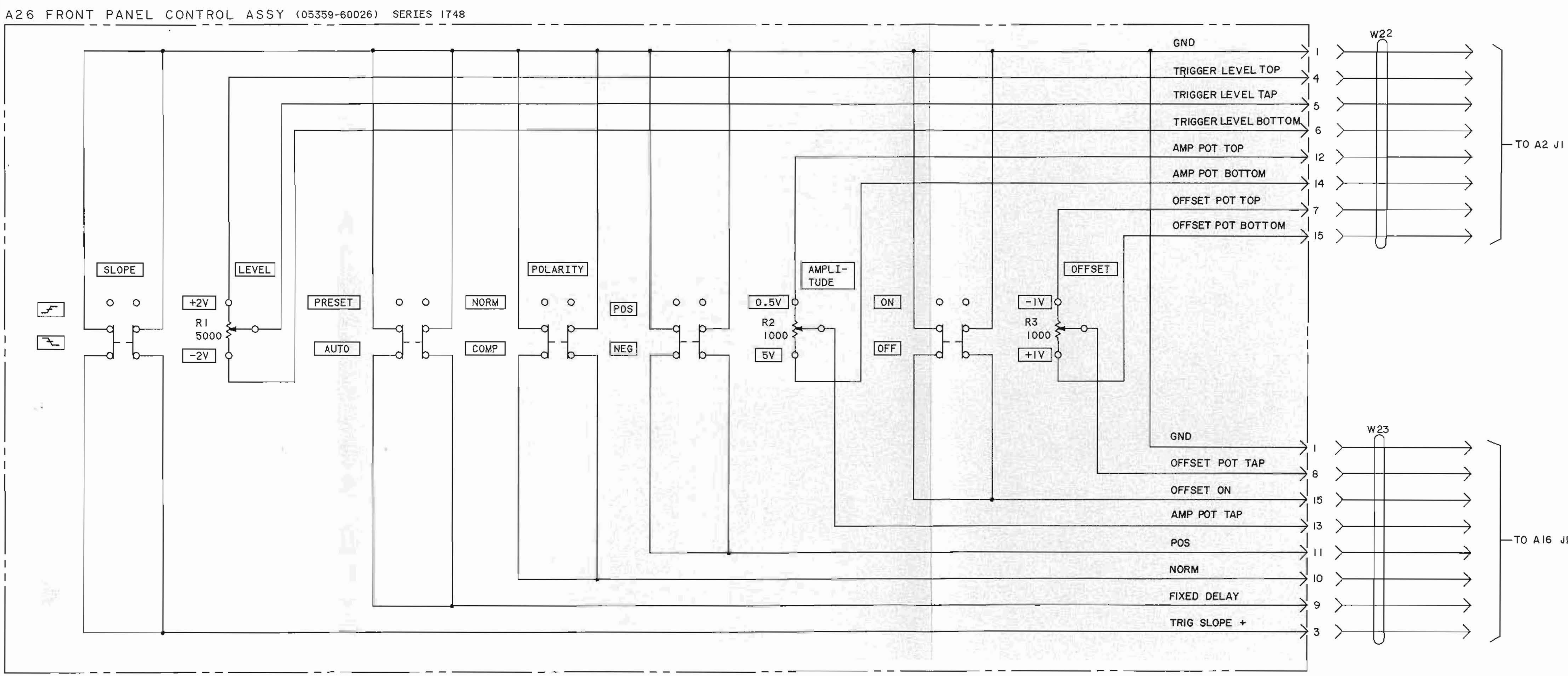

Figure 8-27. A26 Front Panel Control Assembly

Figure 8-27
A26 FRONT PANEL CONTROL ASSEMBLY

(See Page 8-117)


10544A
HEWLETT · PACKARD
CRYSTAL OSCILLATOR
HEWLETT PACKARD
+
FREQ. ADJ.

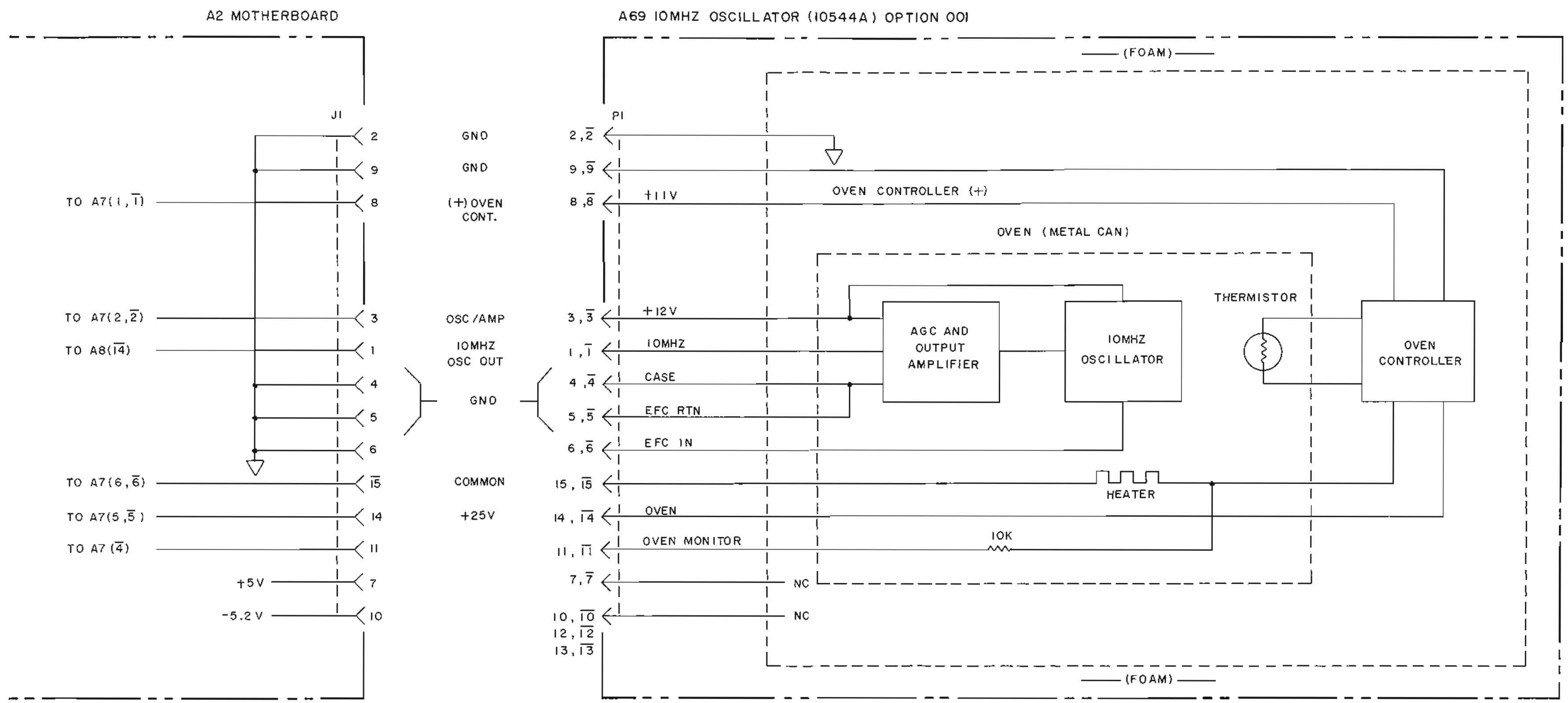

Figure 8-28. A27 10 MHz Crystal Oscillator Assembly (Serial Prefix 2012A)

Figure 8-28
A27 10 MHz CRYSTAL OSCILLATOR ASSEMBLY
(SERIAL PREFIX 2012A)

(See Page 8-119)

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(over)

Service needed

☐ CALIBRATION ONLY ☐ REPAIR

OTHER ______________________

Observed symptoms/problems

FAILURE MODE IS:

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SENSITIVE TO:

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FAILURE SYMPTOMS ______________________

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OTHER ______________________

Observed symptoms/problems

FAILURE MODE IS:

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FAILURE SYMPTOMS ______________________

If unit is part of automatic system list model numbers of controller and other related components. ______________________

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Service needed

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Observed symptoms/problems

FAILURE MODE IS:

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SENSITIVE TO:

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FAILURE SYMPTOMS ______________________

If unit is part of automatic system list model numbers of controller and other related components. ______________________

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FAILURE SYMPTOMS ______________________

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SENSITIVE TO:

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