Errata

Title & Document Type: **5363B Time Interval Probes Operating and Service Manual**

Manual Part Number: **05363-90020**

Revision Date: **December 1982**

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

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, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

www.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

OPERATING AND SERVICE MANUAL

5363B
TIME INTERVAL PROBES

SERIAL PREFIX: 2208A

This manual applies to Serial Prefix 2208A, unless accompanied by a Manual Change Sheet indicating otherwise.

First Edition — December 1982

©Copyright 1982
by
HEWLETT-PACKARD COMPANY
5301 Stevens Creek Boulevard
Santa Clara, California 95050

All Rights Reserved

MANUAL PART NUMBER 05363-90020
Microfiche Part Number 05363-90021

HEWLETT PACKARD

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

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.

WARNING

BEFORE SWITCHING ON THE INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THE 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 PROTECTED EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

WARNING

THE SERVICE INFORMATION FOUND IN THIS MANUAL IS OFTEN USED WITH POWER SUPPLIED AND PROTECTIVE COVERS REMOVED FROM THE INSTRUMENT. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSON INJURY.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT:

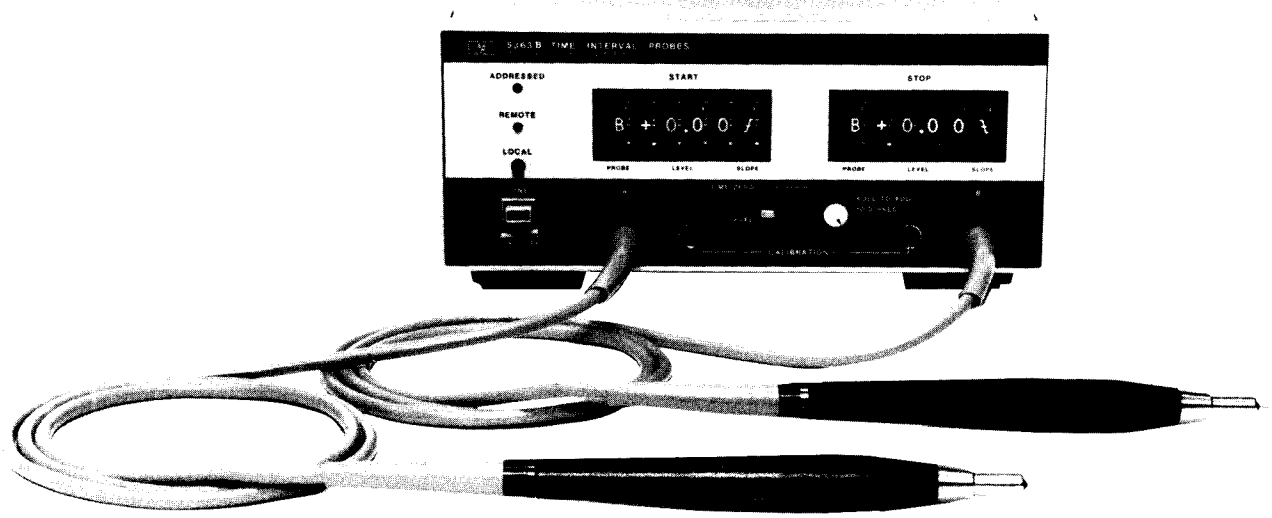
1. **MAKE SURE THE INSTRUMENT IS SET TO THE VOLTAGE OF THE POWER SOURCE.**

2. **ENSURE THAT ALL DEVICES CONNECTED TO THIS INSTRUMENT ARE CONNECTED TO THE PROTECTIVE (EARTH) GROUND.**

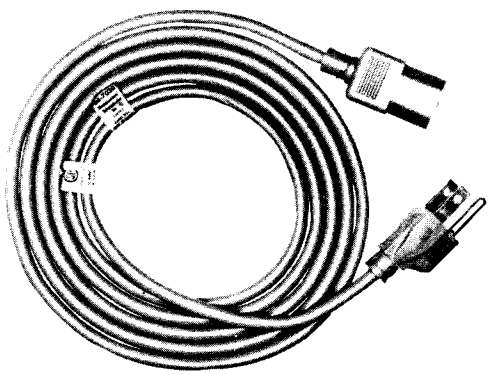
3. **ENSURE THAT THE LINE POWER (MAINS) PLUG IS CONNECTED TO A THREE-CONDUCTOR LINE POWER OUTLET THAT HAS A PROTECTIVE (EARTH) GROUND. (GROUNDING ONE CONDUCTOR OF A TWO-CONDUCTOR OUTLET IS NOT SUFFICIENT.)**

4. **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 SHORT-CIRCUITING OF FUSE HOLDERS MUST BE AVOIDED.**

5. **AVOID STATIC DISCHARGE TO THE PROBE TIPS. DAMAGE TO THE PROBES MAY RESULT. FOLLOW CAUTIONS IN** *FIGURE 1-2.*



MODEL HP 5363B



CORD SET 8120-1378

Figure 1-1. Model HP 5363B and Equipment Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This operating and service manual contains information needed to operate, test, and service the Hewlett-Packard Model 5363B Time Interval Probes. *Figure 1-1* shows the instrument identification, description, and accessories.

1-3. SPECIFICATIONS

1-4. Overall specifications for the HP 5363B are given in *Table 1-1*.

1-5. SAFETY CONSIDERATIONS

1-6. The 5363B Time Interval Probes is a Safety Class I instrument. This instrument has been designed according to international safety standards.

1-7. This operating and service manual contains information, cautions, and warnings which must be followed by the user to ensure safe operation and keep the instrument in safe condition.

1-8. INSTRUMENTS COVERED BY MANUAL

1-9. Attached to the instrument is a serial number plate. The serial number is in the form: 0000A00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL PREFIX on the title page.

1-10. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the newer instrument.

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 identified with the manual print date and part number, both of which appear on the manual title page. Complementary copies of the supplement are available from Hewlett-Packard.

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

Table 1-1. Model 5363B Specifications

INPUT REQUIREMENTS:

Operating Range: ±10V.
Damage Level: ±30V.
Minimum Input Voltage: 100 mV above and below the trigger point.
Minimum Pulse Width: Input signal must remain 100 mV below and above trigger point for at least 5 ns.

ABSOLUTE ACCURACY:

$$\pm 1 \text{ ns}^{*} \pm \frac{\text{START TLA + START NTE}}{\text{START slew rate}} \pm \frac{\text{STOP TLA + STOP NTE}}{\text{STOP slew rate}}$$

where TLA denotes trigger level accuracy and NTE denotes noise trigger error, defined below.

TRIGGER LEVEL ACCURACY:

Trigger Level	-5V to +9V	-5V to -10V	+9V to +10V
1 Trigger Level Accuracy	±8 mV ±0.4 mV/°C ±0.15% trigger voltage	±1% trigger voltage	50 mV
1 Differential Trigger Level Accuracy	±3 mV ±0.3% trigger voltage	±1% trigger voltage	100 mV

Differential trigger level accuracy applies when both START and STOP trigger level voltages are set equal and identical waveforms applied.

1 After calibration and within the range of 100 mV or 8% of signal peak (whichever is greater).

NOISE TRIGGER ERROR: $\sqrt{e_i^2 + e_n^2}$ volts

where e_n = effective rms noise of the 5363B input (typically 125 μV)

e_i = rms input signal noise for a 350 MHz bandwidth

ENVIRONMENTAL: Operating temperature 0°C to 55°C.

SUPPLEMENTARY PERFORMANCE CHARACTERISTICS:
(Describing nonwarranted typical performance parameters.)

Effective Bandwidth: 350 MHz or 1 ns rise time.
Impedance: 1M ohms shunted by <20 pF.
Voltage Resolution: 10 mV.
Delay Compensation Range: 2 ns adjustable about 0.0 or 10.0 ns.
Outputs to Counter: Separate START and STOP outputs; -0.5V to +0.5V into 50 ohms, slew rate through zero volts exceeds 0.50V/ns.
Trigger Level Outputs: Trigger point setting ±75 mV.

GENERAL

Power: 100, 120, 220, 240V ac (+5%, -10%), 48-440 Hz; 40 VA max.
Weight: Net 3.0 kg (6.5 lbs). Shipping: 5.5 kg (12 lbs).
Dimensions: 88.1 mm H × 212 mm W × 295 mm D (3.5" × 8.4" × 11.6");
Probe length 122 cm (4 feet)

*Systematic error that can be eliminated with proper calibration and measurement techniques.

1-13. DESCRIPTION

1-14. The 5363B provides two high impedance, low capacitance time domain probes for the digital measurement of rise times and propagation delays with accuracies calibrated to <1 ns. These probes, used directly with an electronic counter's start and stop channels, provide a digital measurement.

1-15. Each probe contains two high-input impedance to low-output impedance converters. This allows the signal to be measured without loading it down. Because each probe contains two converters, each probe contains a potential start and stop channel. Therefore one probe can provide both a start and stop signal to a counter, or one probe can provide a start signal and the other can provide a stop signal for a rise time or time delay measurement, respectively.

1-16. The probes have an input impedance of 1 Meg ohm and an input capacitance of <15 pF. For use with either Hewlett-Packard or Tektronix® RF hardware, the tip of the probe unscrews to allow the tip to be changed to mate with the specific manufacturer's equipment, see *Figure 1-2.*

®*Registered Trademark*

CAUTION

Avoid static discharge to the probe tips and shields. Damage to probes may result.
Use the following precautions:
Ground yourself before touching probe by touching metal on 5363B cabinet while instrument is plugged into grounded socket. AVOID touching probe tip. Handle by the plastic body of probe.

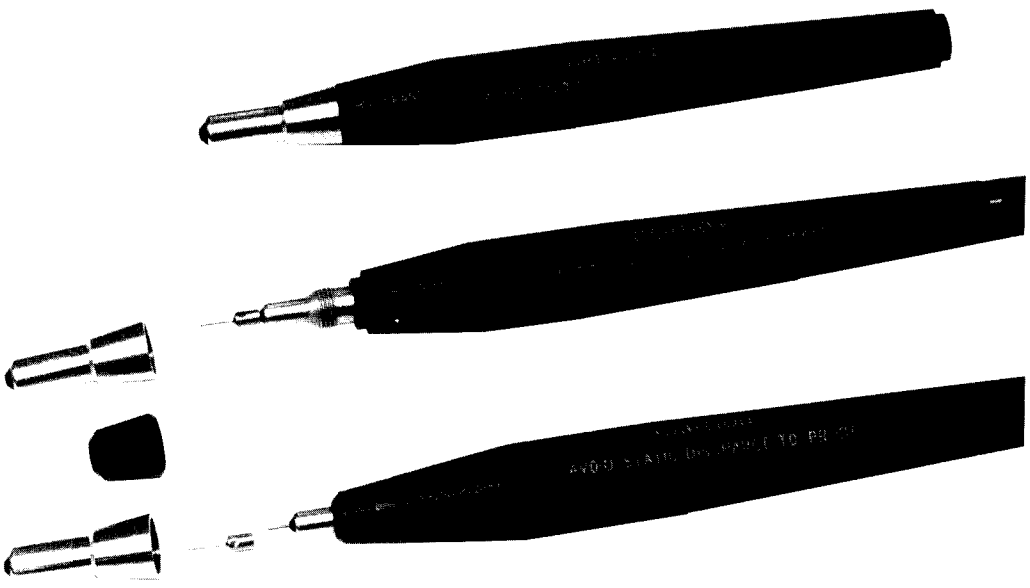


Figure 1-2. Changeable Probe Tips and Probe Cautions

1-17. APPLICATION

1-18. The HP 5363B is designed for use directly with an electronic counter's start and stop channels, in time interval mode to measure the time intervals. The instrument contains four channels, two in each probe, capable of rise time or time delay measurements. Trigger levels may be set in 10 mV steps from -9.99V to +9.99V. The probes can be set to trigger from either positive or negative edges. Outputs are available, on the rear panel, for the start and stop channels in a 50 ohm system. All functions and levels, except delay adjust are programmable via the HP-IB. Provisions for calibration are available on the front panel.

1-19. EQUIPMENT SUPPLIED AND ACCESSORIES AVAILABLE

1-20. *Table 1-2* lists the equipment supplied with the 5363B and *Table 1-3* lists accessories available. An accessory kit for the HP 5363B is available (see *Figure 1-3*) and may be obtained from Hewlett-Packard by ordering Accessory Kit Part No. 10821A.

Table 1-2. Equipment Supplied

DESCRIPTION	HP PART NUMBER
Detachable Power Cord 7½-feet (229 cm) long	8120-1378
Tilt Stand	1460-1345
Ground Clip (2 required)	01123-61302
Ring Tip Adapter (2 required)	05363-20201
Probe Tip Shield (2 required)	05363-20204

1-21. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-22. The 5363B is designed for use with an electronic counter with time interval mode. Operation is described in Section III for use with HP 5335A, HP 5370A, or HP 5345A.

Table 1-3. Accessories Available

DESCRIPTION	HP PART NUMBER
BNC Tee to Probe Adapter	1250-0655
BNC to Probe Adapter	10218A
Hook Tip	10229A
50 Ohm Feedthrough Termination	10100C
HP-IB Cable	10631A
HP Probe Tip	8710-0661
Accessory Kit for 5363B	10821A

1-23. RECOMMENDED TEST EQUIPMENT

1-24. *Table 1-4* lists test equipment recommended for maintaining and checking the performance of the 5363B. Test equipment having equivalent characteristics may be substituted for the equipment listed. One of each unit is required unless otherwise noted.

Table 1-4. Recommended Test Equipment

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED
Precision Power Supply	0–50V ±3.5 mV	HP 6115A
Pulse Generator	Transition Time >500V/μs Maximum Output 10V across 50 ohms	HP 8013A/B
Counter	Time Interval ≥10 ns	HP 5370A
Oscilloscope	50 MHz	HP 180A/1805A
Feedthrough Termination (2)	50 Ohms	HP 10100C
Digital Voltmeter	0 to 100V 0.01% accuracy	HP 3490A
Signature Analyzer		HP 5004A/5005A
Logic State Analyzer		HP 1600A
Logic Pulser		HP 10526T

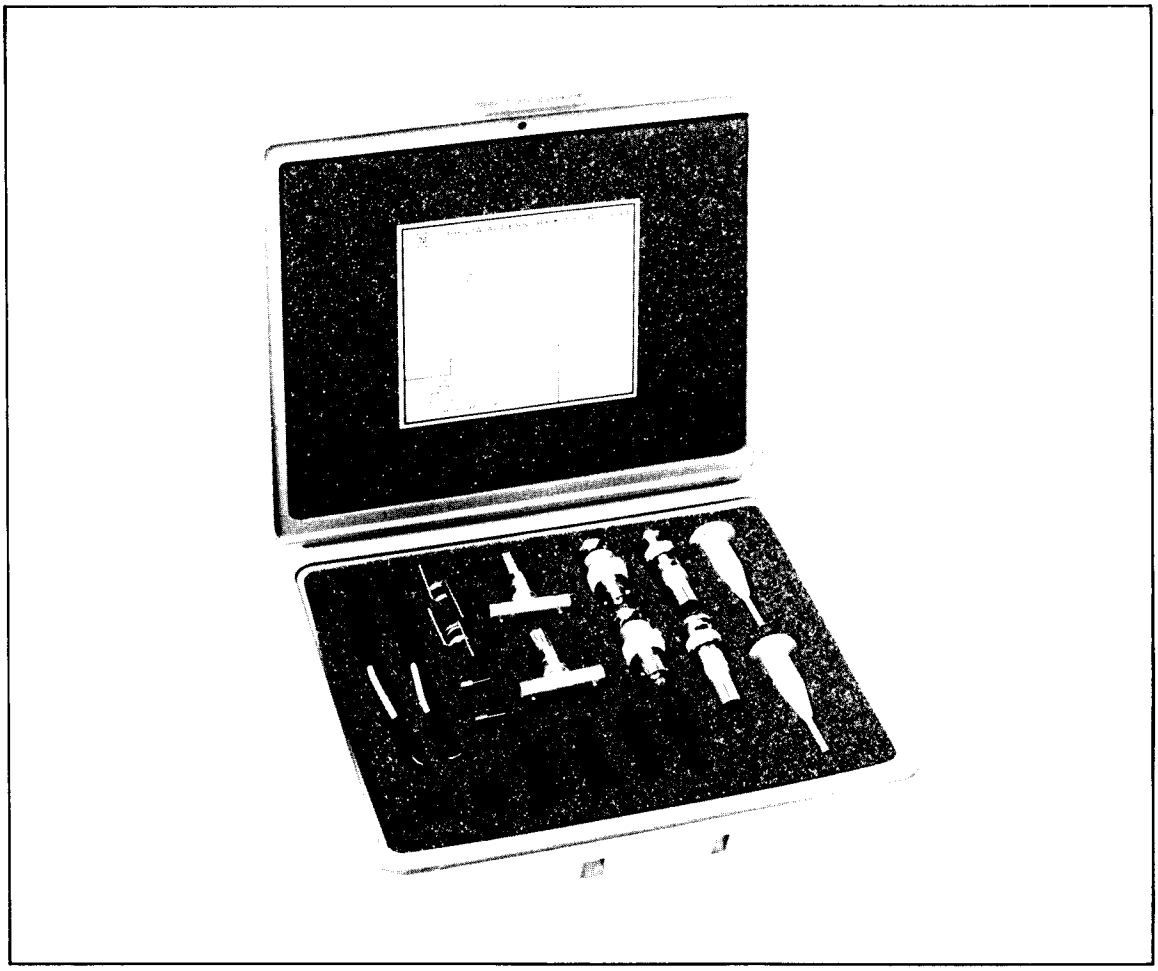


Figure 1-3. Accessory Kit

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides information for unpacking, inspection, preparation for use, storage, and shipment of the 5363B.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, inspect the 5363B for visible damage (scratches, dents, etc.). If the instrument is damaged, notify the carrier and the nearest Hewlett-Packard Sales and Support Office immediately (offices are listed at the back of this manual). Keep the shipping carton and packing material for the carrier's inspection. The HP Sales and Support Office will arrange for repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

CAUTION

The probes can be damaged by an electrostatic discharge through the probe tip. Keep the probe tip shield attached over the probe tips when they are not in use.

2-5. PREPARATION FOR USE

CAUTION

Before connecting this instrument to an ac power line, be sure that the line voltage selector switch on the rear panel is set to proper position as shown in *Figure 3-2*.

2-6. Power Requirements and Line Voltage

2-7. This instrument operates on single phase 100V, 120V, 220V, or 240V ac +5% -10% volts at 48-440 Hz. Maximum power requirement is 30 VA. *Figure 3-2* shows the line selectors and fuse holder. To avoid instrument damage, the line selectors must be set to the correct positions and the correct fuse (as labeled on the rear panel) must be installed. When shipped, the selectors are set for 120-volt operation.

2-8. Power Cables

WARNING

TO PROTECT OPERATING AND SERVICING PERSONNEL, THIS INSTRUMENT IS EQUIPPED WITH A THREE-PIN POWER RECEPTACLE. THE CENTER PIN OF THE RECEPTACLE CONNECTS THE INSTRUMENT CHASSIS AND PANELS TO EARTH GROUND WHEN USED WITH A PROPERLY WIRED THREE-CONDUCTOR OUTLET AND POWER CABLE. IMPROPERLY GROUNDED EQUIPMENT CAN RESULT IN HAZARDOUS POTENTIALS BETWEEN EQUIPMENT.

2-9. To accommodate the different power receptacles used throughout the world, this HP instrument is supplied with one of the power cables shown in *Figure 2-1*. The cable supplied for use in the United States meets the specifications established by the International Electrotechnical Commission (IEC). The male connector of this cable is a NEMA type and the female connector is C.E.E. type.

2-10. Connect the power cable to a power source that has a grounded third conductor. If the line power receptacle is a two-pin type instead of a three-pin receptacle, use a two- to three-pin type adaptor (HP Part No. 1251-0048 for USA applications) and connect the green lead on the adaptor to earth ground. See warning (Paragraph 2-8).

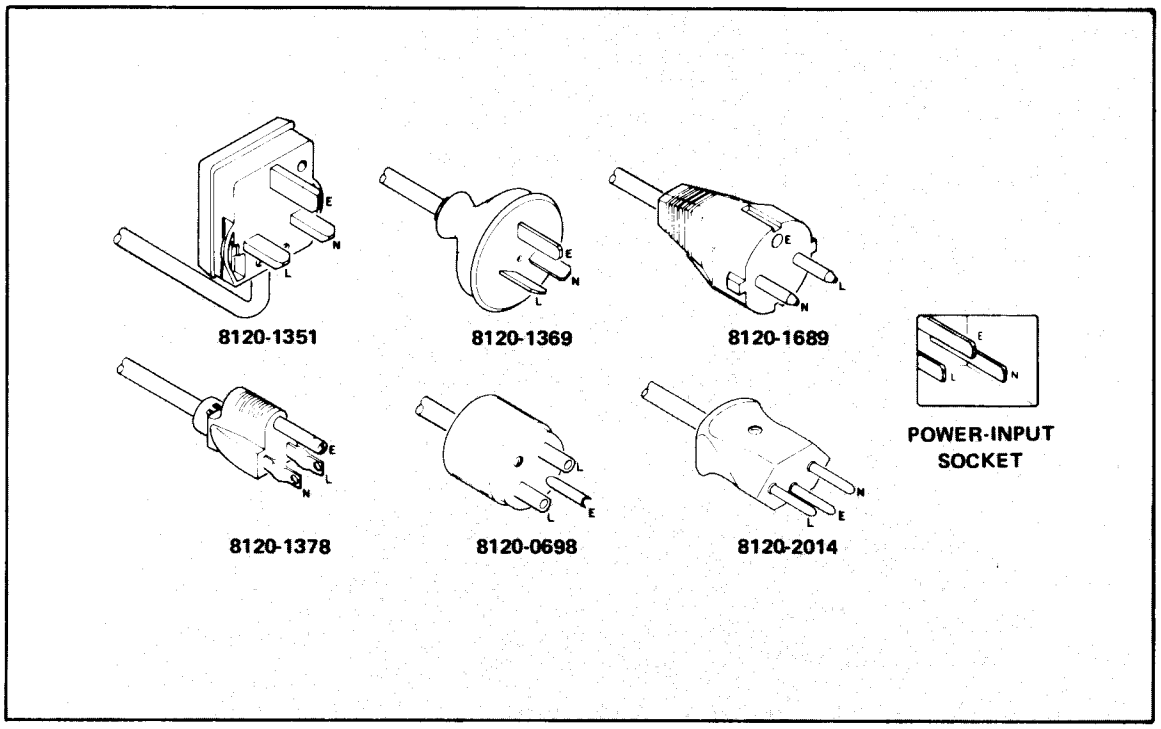


Figure 2-1. Power Cable HP Part Numbers versus Mains Plugs Available

2-11. Operating Environment

2-12. Maximum and minimum allowable operating temperatures are listed in *Table 1-1*. If these limits are exceeded at the installation site, auxiliary heating or cooling should be used to keep the environment within limits.

2-13. Operational Check

2-14. Refer to paragraph 3-10, Calibration Procedures.

2-15. Bench Operation

2-16. The instrument has plastic feet and a fold-away tilt stand for convenience in bench operation. The tilt stand permits inclining the instrument for ease in using front-panel controls and indicators. The plastic feet are shaped to provide clearance for air circulation and to make modular cabinet width instruments self-aligning when stacked.

2-17. PACKAGING FOR RESHIPMENT

2-18. Original Packaging

2-19. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Sales and Support Offices listed at the rear of this manual.

2-20. If the instrument is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, your return address, HP model number and full serial number. Mark the container FRAGILE to assure careful handling.

2-21. In any correspondence refer to the instrument by HP model number and full serial number.

2-22. Other Packaging Methods

2-23. If it becomes necessary to reship an instrument, good commercial packing should be used. Contract packaging companies in many cities can provide dependable custom packaging on short notice. The following general instructions should be followed when repackaging with commercially available materials.

a. If shipping to a Hewlett-Packard Service Office or Center, attach a tag indicating the type of service required, your return address, HP model number, and full serial number.

b. Wrap the instrument in heavy paper or plastic.

c. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

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

e. Seal the shipping container securely.

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

2-24. STORAGE

2-25. If the instrument is to be stored for an extended period of time, it should be enclosed in a clear, sealed container.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This operating section explains the functions of the controls and indicators of the 5363B. It describes typical operating modes in a measurement system, self-calibration procedures and programming information for remote operation via the HP-IB.

3-3. CONTROLS, INDICATORS, AND CONNECTORS

3-4. *Figure 3-1* describes and illustrates the front panel controls, indicators, and connectors. *Figure 3-2* delineates the rear panel controls and connectors.

3-5. TYPES OF OPERATION

3-6. The 5363B may be operated under local (front panel) control or under remote (controller) programming control. All front panel functions can be programmed via the HP-IB, except the setting of the TIME ZERO delay adjustment control.

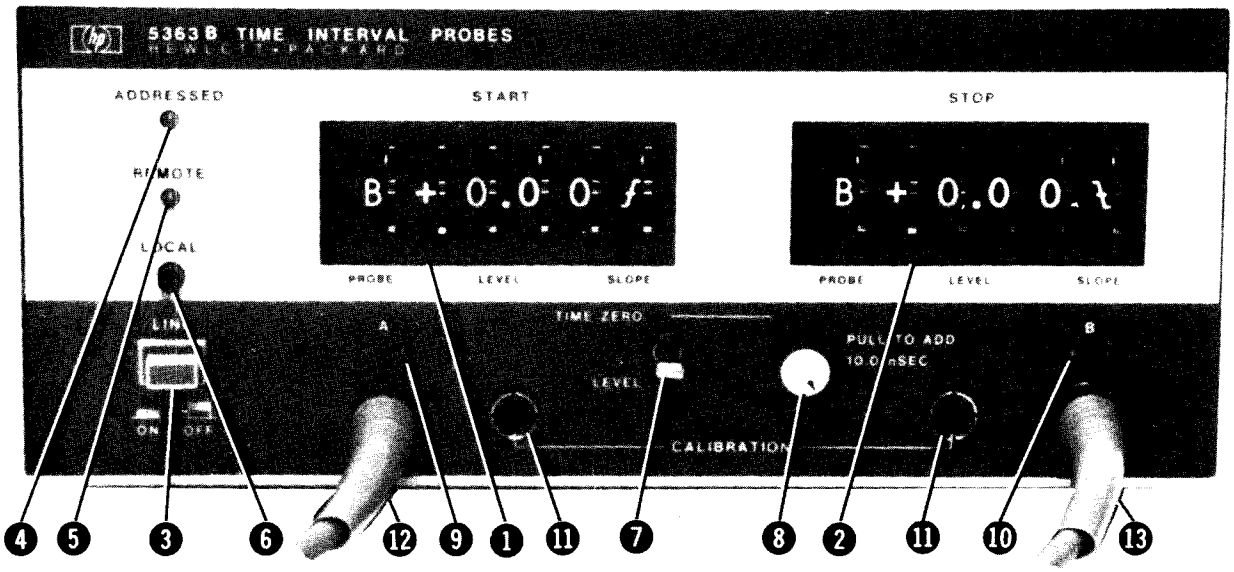
3-7. OPERATION UNDER LOCAL CONTROL

3-8. The following paragraphs describe preliminary set-up procedures for operation under local control.

3-9. Perform the following procedures (refer to *Figure 3-1* for a description of front panel controls and *Figure 3-2* for a description of rear panel controls):

a. Press LINE PUSH ON/OFF pushbutton. When pushbutton is in, power is ON. Power ON status is also indicated by the probes selection indicators.

b. Press LOCAL pushbutton. This will return the 5363B to manual control of the front panel.



❶ START Probe-Level-Slope Switches. There are six thumbwheel switches with functions as follows viewed left to right:

a. Selects probe A or B.
b. Selects level sign + or −.
c,d,e. Selects level voltage.
f. Selects slope — rising or falling edge.

❷ STOP Probe-Level-Slope Switches. Same as START switches.

❸ LINE PUSH ON/OFF Switch. Button in — power ON. Button out — power OFF. Power ON is indicated by trigger lights ON.

❹ ADDRESSED Light. Addressed light ON indicates that the instrument is remotely addressed to listen or talk by HP-IB.

❺ REMOTE Light. Remote light ON indicates that the instrument is under complete remote control and that all front panel controls except the LOCAL pushbutton are locked out.

❻ LOCAL Pushbutton. When LOCAL pushbutton is depressed, the instrument is returned to the control of the front panel controls. This button is inoperative if LOCAL LOCKOUT has been programmed via HP-IB.

❼ TIME ZERO/LEVEL Switch. For trigger level calibration this switch is pressed down until all trigger indicators are lighted. When the switch is lifted up with probes inserted in calibration jacks a fast rise time signal is sent to perform the time zero calibration.

❽ TIME ZERO/PULL TO ADD 10.0 ns knob. When this knob is pulled out, a fixed 10 ns delay is added to the STOP channel. Rotation of the knob gives more precise delay adjustment, compensating for probe and system time delay differences.

❾ A Probe START and STOP channel selection indicators. Above each probe input, there are two indicators, one red and one green. A lighted red indicator above the probe indicates where the stop signal is coming from and a lighted green indicator shows where the start signal comes from. Only one red and one green light will be on at any time except during calibration or unless calibration error occurs.

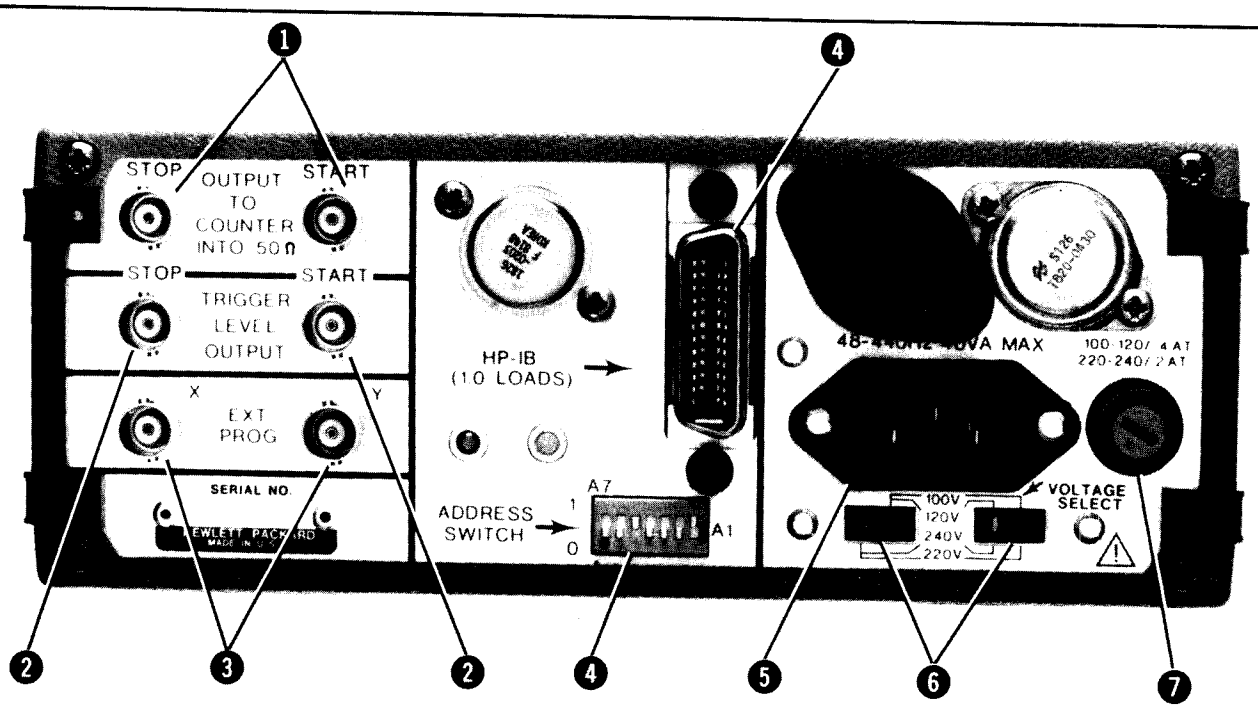
❿ B Probe channel selection indicators. Same as A probe channel selection indicators.

⓫ CALIBRATION Jacks. These jacks provide necessary calibration signals for the probes during the local calibration procedure.

⓬ A Probe. One of the two time interval probes. Probes, polarity, voltage level, and slope are all selectable at the thumbwheel switches in local control, or may be remotely programmed.

⓭ B Probe. Same as A probe, except has blue coding ring.

Figure 3-1. Front Panel Connectors, Controls, and Indicators



❶ START & STOP OUTPUT TO COUNTER. These outputs drive, in a 50 ohms environment, the inputs to the counter required to measure the time intervals. These outputs range nominally from -0.5 volts to +0.5 volts so that the preset level of the counter can be used. The slew rate through zero is greater than 0.25V/ns.

❷ START & STOP TRIGGER LEVEL OUTPUT. Both START and STOP output levels are available. These output levels may be offset from the actual trigger points by up to ±75 mV. These output levels will drive 10 K ohms loads and will be unstable during calibration.

❸ X-Y EXT PROG. These input connectors are for remote programming by other HP products and respond according to the following table:

INPUT X	INPUT Y	PROBE	START ACCORDING TO SWITCH SLOPE	START ACCORDING TO SWITCH LEVEL	USE	PROBE	STOP ACCORDING TO SWITCH SLOPE	STOP ACCORDING TO SWITCH LEVEL
High	Low	A	L	L	Delay	B	R	R
Low	Low	B	R	R	Width	B	R	R
Low	Low	B	R	R	Correction Factor	B	R	R
High	High	As set by Front Panel or Remote						

L = Left (START) Thumbwheel Switch
R = Right (STOP) Thumbwheel Switch

❹ HP-IB connector/ADDRESS SWITCH. Remote programming is accomplished via the HP-IB through this connector. The Listen address is set by selecting the ASCII address on five of the rocker switches (A1 through A5) within the ADDRESS SWITCH. More complete description and instructions are provided starting in Paragraph 3-24.

❺ Input AC Power Connector. Line voltages of 100V, 120V, 220V, and 240V at frequencies from 48 to 440 Hz may be used; 30 VA max.

❻ VOLTAGE SELECT Switches. Two slide switches permit line voltage settings to accommodate 100V, 120V, 220V, or 240V inputs.

❼ FUSE. A 0.4A SLO-BLO fuse is required for 100V or 120V inputs; a 0.20A SLO-BLO fuse is required for 220V or 240V.

Figure 3-2. Rear Panel Controls and Connectors

3-10. CALIBRATION PROCEDURES

NOTE

HP Model 5363B ac ground must be at the same potential as instrument under test. Inaccuracies in trigger level calibration and test measurements will occur if this precaution is not observed.

3-11. Trigger Level Calibration

NOTE 1

Trigger level calibration is necessary when a trigger level error of less than 150 mV is required. IT SHOULD BE PERFORMED WHEN THE SLOPES OR PROBES ARE CHANGED.

NOTE 2

The sequence of calibration procedure is important.

a. Select desired probe and slope configuration.

b. Insert probe or probes to be calibrated into CALIBRATION jacks or connect to ground through ≤50 ohms.

c. Press TIME ZERO/LEVEL switch down until all red and green trigger indicators are lighted.

d. Release TIME ZERO/LEVEL switch.

e. Check that probe channel selection indicators of selected probes are lighted. This is the indication that the Trigger Level Calibration is completed.

NOTE

If all four probe select indicators are flashing, the calibration has NOT been accomplished.

3-12. Sources of calibration errors are:

a. Probes not inserted in CALIBRATION jacks or otherwise grounded.

b. TIME ZERO/LEVEL switch not depressed long enough.

c. Circuit malfunction.

Items a and b can be corrected and, when the TIME ZERO/LEVEL switch is pressed again, a proper calibration will occur. For item c, refer to Section VIII.

3-13. Time Zero Calibration Procedure

a. Connect the 5363B START/STOP outputs to the 5370A START and STOP channels. Refer to *Figure 3-3*.

NOTE

The two cables used to connect the 5363B START/STOP outputs to the 5370A must be of equal length.

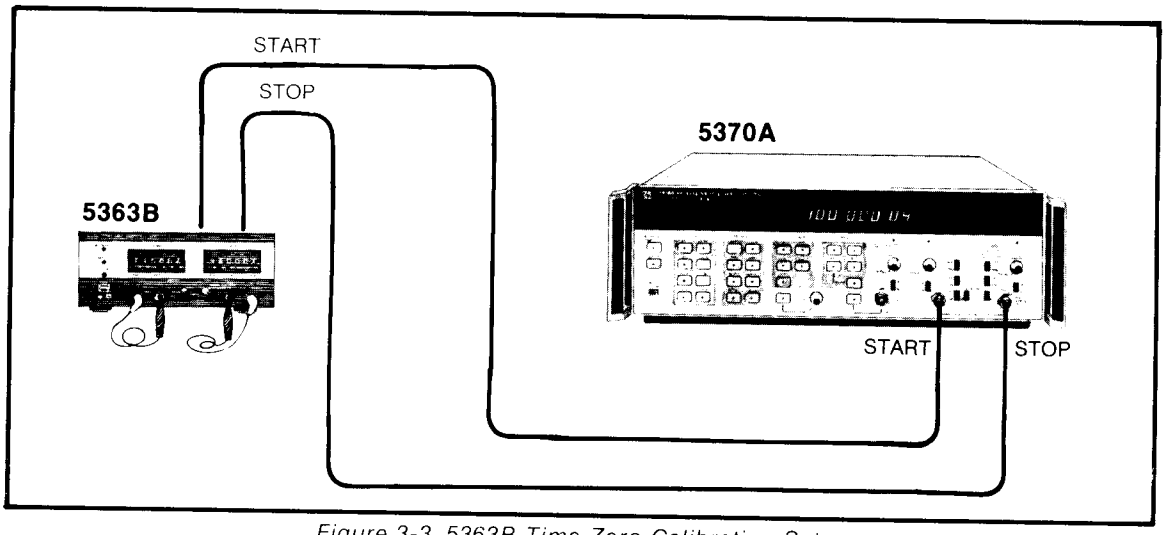


Figure 3-3. 5363B Time Zero Calibration Setup

b. Insert the 5363B probes, A and B, into their adjacent calibration jacks.

c. Set the 5363B A channel thumbwheel switches to read A; 0.00; ⨍ .

d. Set the 5363B B channel thumbwheel switches to read B; 0.00; ⨍ .

NOTE

SLOPE sections of START and STOP thumbwheel switches must be alike; i.e., both set at ⨍ .

e. Set the 5370A Counter controls as follows:

FUNCTION	TI
STATISTICS	MEAN
SAMPLE SIZE	100
DISPLAY RATE	12 O'clock position
ARMING	±TI
INPUTS START/STOP:	
LEVEL	PRESET
INPUT IMPEDANCE	50 ohm
÷1/÷10	÷1
AC/DC	DC
START COM/SEP	SEP
SLOPE	⨍

f. Lift and hold TIME ZERO/LEVEL switch.

g. Adjust PULL TO ADD 10.0 ns knob until 5370A Counter display reads approximately 0.00 ns.

NOTE

If the delay cannot be zeroed out because of the nature of the test setup (different cable lengths, etc.), store the delay by pressing the SET REF key of the 5370A Counter. In the SEF REF mode the delay is subtracted or added automatically from the next subsequent readings.

Probe select indicators for selected START and STOP probes will NOT flash during calibration.

3-14. MINIMUM REQUIREMENTS FOR SIGNAL MEASUREMENTS

3-15. *Figure 3-4* illustrates a waveform showing minimum input signal requirements for conducting measurements with HP 5363B Time Interval Probes.

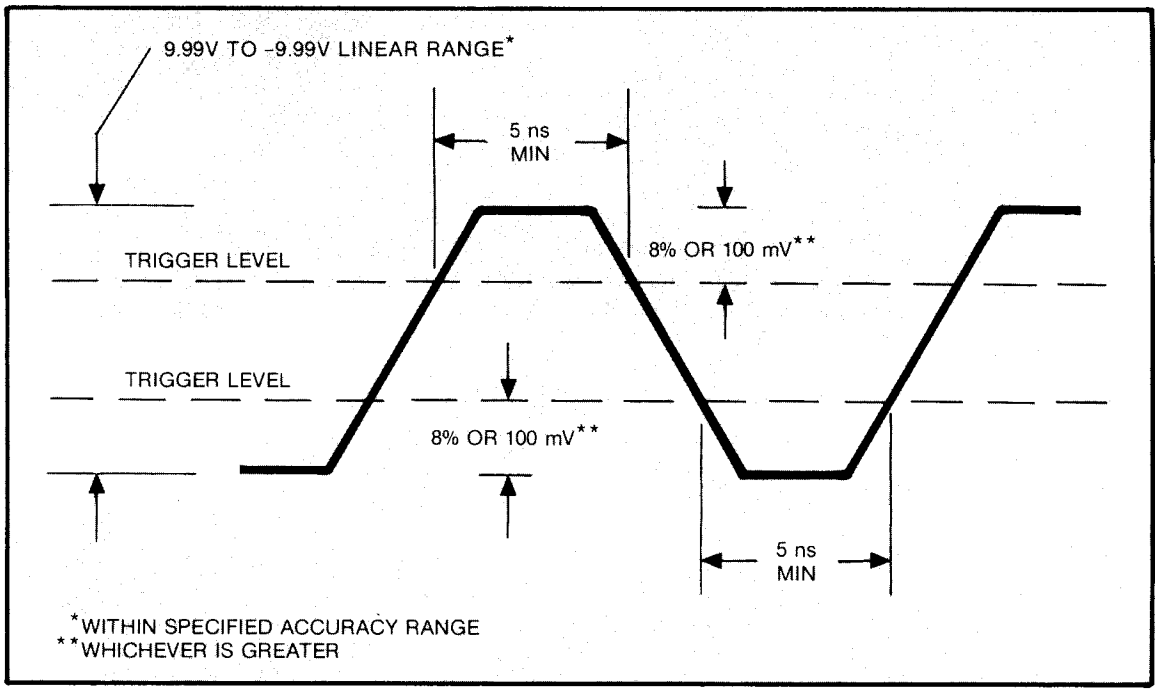


Figure 3-4. Minimum Input Signal Requirements

3-16. PROCEDURES FOR OPERATION UNDER LOCAL CONTROL

3-17. The following paragraphs describe measurement procedures for rise time, fall time, and pulse delay using HP 5345A, HP 5370A, and HP 5335A counters.

3-18. Rise Time (20/80%) Measurement Procedure

3-19. Instrument Setup: HP 5363B Time Interval Probes, HP 182C Oscilloscope, HP 8013B Pulse Generator, and HP 5345A Counter (or HP 5370A Counter, or HP 5335A Counter) are connected as shown in *Figure 3-5*. Except for HP 5363B, all instrument controls are set as shown in *Table 3-1*. HP 5363B controls are set as follows:

START/STOP switches	1	2	3	4	5	6
START	A	+	0	.1	0	⨍
STOP	A	+	0	.4	0	⨍

TIME ZERO/PULL TO ADD 10.00 ns: OUT (for HP 5345A)
TIME ZERO/PULL TO ADD 10.00 ns: IN (for HP 5370A or HP 5335A)

a. Perform Trigger Level Calibration procedure. (See paragraph 3-11.)

b. Connect HP 5363B A probe to special T fitting (HP 1250-0655) BNC and adapter HP 1250-0216 at HP 8013A OUTPUT (+) connector.

c. Measurement displayed on counter (HP 5345A) is rise time plus 10 ns. Measurement displayed on HP 5370A or HP 5335A is actual rise time.

3-20. Fall Time (20/80%) Measurement Procedure

3-21. Instrument Setup: HP 5363B Time Interval Probes, HP 182C Oscilloscope, HP 8013B Pulse Generator, and HP 5345A Counter (or HP 5370A Counter, or HP 5335A) are connected as shown in *Figure 3-5*. Except for HP 5363B instrument controls are set as shown in *Table 3-1*. HP 5363B controls are set as follows:

START/STOP switches	1	2	3	4	5	6
START	A	+	0	.4	0	⊣
STOP	A	+	0	.1	0	⊣

TIME ZERO/PULL TO ADD 10.00 ns: OUT (for HP 5345A)
TIME ZERO/PULL TO ADD 10.00 ns: IN (for HP 5370A or HP 5335A)

a. Perform Trigger Level Calibration procedure. (See paragraph 3-11.)

b. Connect HP 5363B A probe to special T fitting (HP 1250-0655) BNC and adapter HP 1250-0216 at HP 8013A OUTPUT (+) connector.

c. Measurement displayed on HP 5345A Counter is fall time plus 10 ns. Measurement displayed on HP 5370,or HP 5335A is actual fall time.

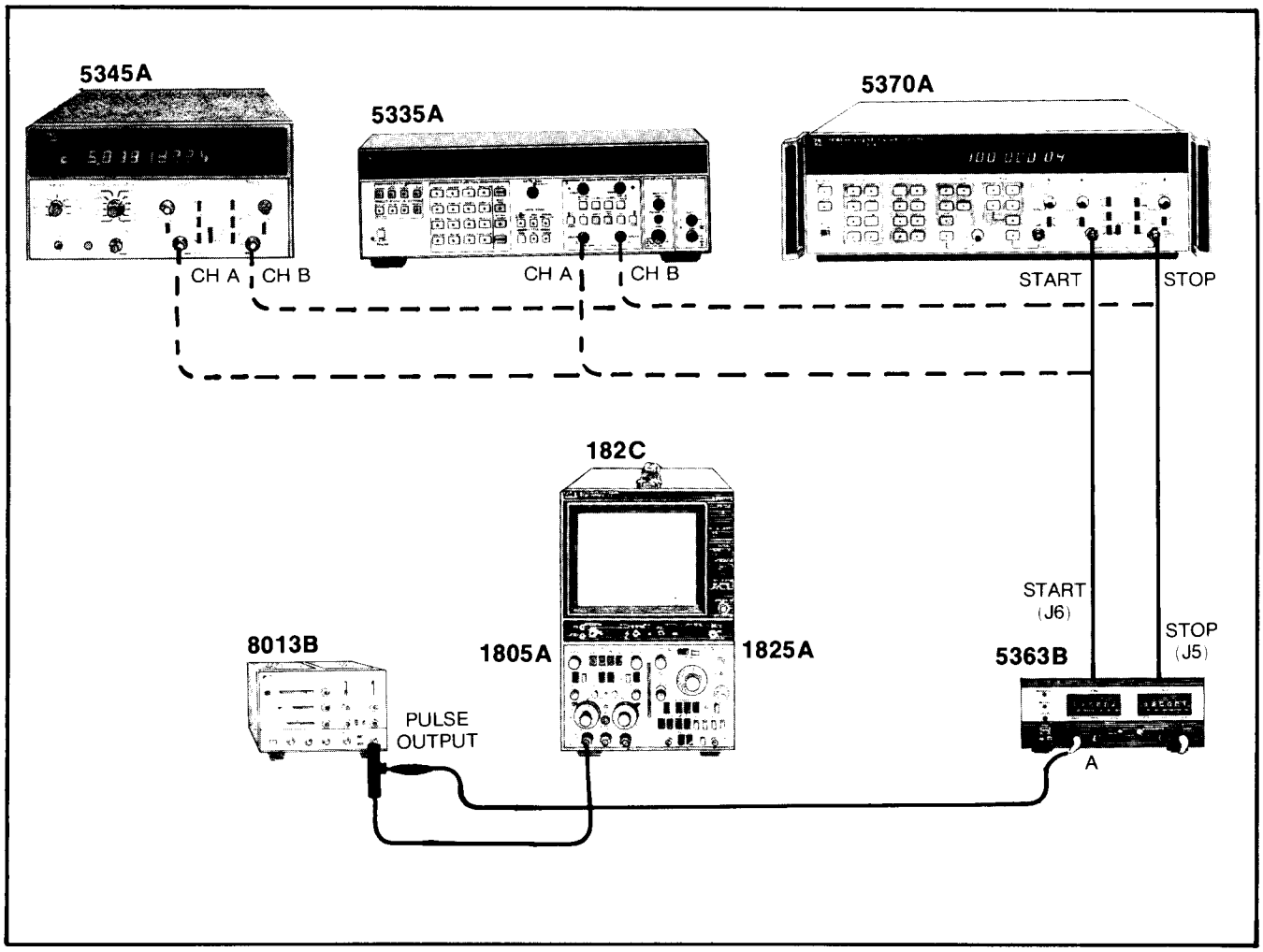


Figure 3-5. Rise Time and Fall Time Measurement Instrument Connections

3-22. Measurement of Pulse Delay Between TRIGGER OUTPUT (+) and OUTPUT on HP 8013B Pulse Generator

3-23. Instrument Setup: HP 5363B Time Interval Probes, HP 182C Oscilloscope, HP 8013B Pulse Generator, and HP 5345A Counter (or HP 5370A Counter, or HP 5335A Counter) are connected as shown in *Figure 3-6*. Except for HP 5363B and HP 8013B control settings specified below, all instrument controls are set as shown in *Table 3-1*. HP 5363B controls are set as follows:

START/STOP switches	1	2	3	4	5	6
START	A	+	0	.1	0	⌐
STOP	B	+	0	.1	0	⌐

HP 8013B PULSE DELAY switch is set as follows: 35 n-1.

a. Perform Trigger Level Calibration procedure (See paragraph 3-11). START and STOP slope settings must be set as they will be used.

b. Connect HP 5363B A probe to HP 8013B TRIGGER OUTPUT (+).

c. Connect HP 5363B B probe to HP 8013B OUTPUT (+).

d. Measurement displayed on HP 5345A Counter is actual pulse delay time plus 10 ns. Model 5370A or 5335A display is actual pulse delay time.

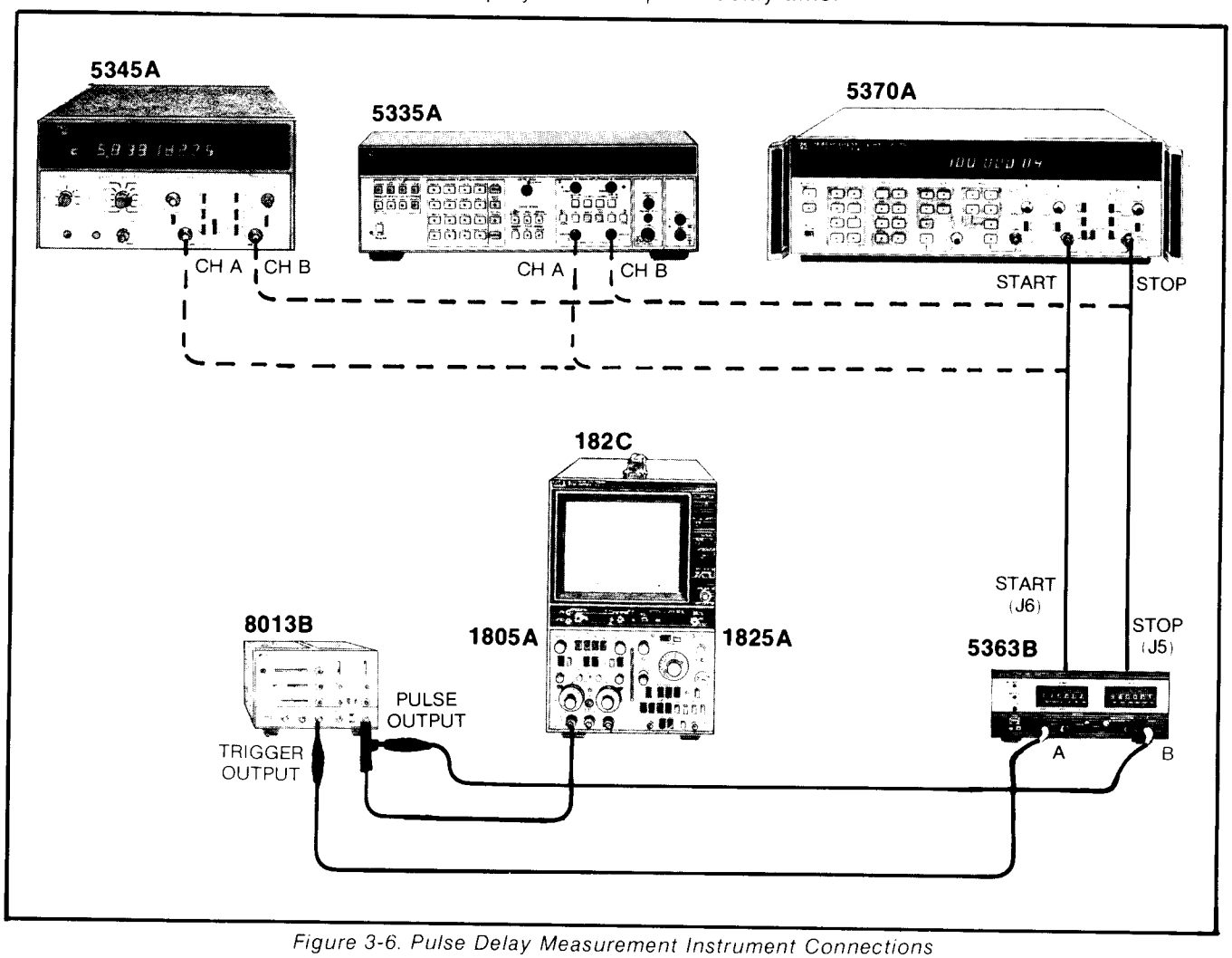


Figure 3-6. Pulse Delay Measurement Instrument Connections

Table 3-1. Instrument Settings for Measurement Examples

MODEL 5345A	FUNCTION	TIME INT A TO B
	GATE TIME	100 μs
	DISPLAY POSITION	AUTO
	SAMPLE RATE	Set as desired
	CHANNEL A & CHANNEL B	
	LEVEL	PRESET
	50 OHMS/1M OHM	50 OHM
	AC/DC	DC
	CHECK/COM A/SEP	SEP
	ATTEN	X1 or X10*
	SLOPE	+
MODEL 5370A	FUNCTION	TI
	STATISTICS	MEAN
	SAMPLE SIZE	1K
	ARMING	±TI
	DISPLAY RATE	Set as desired
	START & STOP CHANNELS	
	LEVEL	PRESET
	50 OHMS/1M OHM	50 OHM
	÷1/÷10	÷1
	START COM/SEP	SEP
	AC/DC	DC
	SLOPE	+
MODEL 8013B	PULSE PERIODS	1μ-0.1m
	VERNIER	MIDRANGE
	PULSE DOUBLE/NORM	NORM
	PULSE DELAY & VERNIER	N/A
	PULSE WIDTH	1-0.1m
	VERNIER	CCW
	OFFSET	OFF
	OUTPUT	(+)
	AMPLITUDE (V)	0.5-1.0
	VERNIER	Set for +0.5 pulse on scope
	NORM/COMPL	NORM
	INT LOAD	IN
MODEL 5335A	FUNCTION	TIME A→B
	GATE MODE	MIN (NO DELAY)
	MATH FUNCTIONS	All off
	STATISTICS FUNCTIONS	MEAN
	CHANNEL A & B INPUTS	
	LEVEL	PRESET
	1 M OHM/50 OHMS	50 OHMS
	SLOPE	+
	X10 ATTN, AC, COM A, and AUTO TRIG	Disabled
MODEL 182C	1805A VERTICAL AMPLIFIER (PLUG-IN)	
	DISPLAY	A
	+UP/-UP	+UP
	DC OFFSET	OFF
	VERNIER TO CAL	CAL
	VOLTS/DIV	0.1 (50 OHMS)
	1825A TIME BASE (PLUG-IN)	
	TIME/DIV	0.05
	POS/NEG	POS
	AUTO/NORM	NORM
	INT/EXT	INT
	REJECT	LF
	AC/DC	DC
	DELAYED TRIGGER	OFF

*X10 for 5345A Prefix 1644A and above.

3-24. PROGRAMMING CAPABILITIES

3-25. The following paragraphs contain programming information for remote operation via the HP-IB. All operating and calibration functions of the HP 5363B are remotely programmable, except the setting of the TIME ZERO delay adjustment control. Programmable functions are:

PROBES	LEVEL CALIBRATE
VOLTAGE SIGN	TRIGGER LEVELS
SLOPE	ZERO DELAY/10 ns DELAY

3-26. Preliminary Procedures

3-27. Setup the 5363B for operation on the HP-IB:

a. Remote programming is accomplished on the HP-IB through the 24-pin HP-IB connector on the rear panel. A controller (such as a HP 9825A) is required to perform the addressing operation, so that the 5363B can be addressed to listen and receive programming codes. The listen address of the HP 5363B is selected by setting the ADDRESS switch on the rear panel.

b. Address Assignment. The 5363B Bus Address must be established by selecting the address codes and setting the rear panel ADDRESS SWITCH (A5/A4/A3/A2/A1). The ADDRESS SWITCH may be set to any value shown in *Table 3-2*, (except 11111). The choice is arbitrary except for considerations or compatibility with application software, and conflict with other devices. If an application software package is being used, choose the address used by the program.

c. Interconnecting Cables. Connect the 5363B to the other devices using the following Bus cables:

LENGTH	ACCESSORY NUMBER
1 m (3 ft.)	10833A
2 m (6 ft.)	10833B
4 m (12 ft.)	10833C
1/2 m (1.5 ft.)	10833D

The cable has a "piggy-back" connector on each end so that cables can be added to a device which already has a cable connected to it. The connectors are provided with lockscrews to secure them to the instrument and to each other.

In order to ensure proper operation of the Bus, two restrictions regarding the total length of Bus cables connected together must be observed. These are:

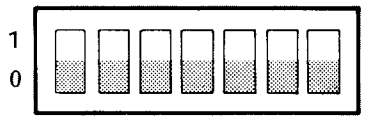
1. The total length of cable permitted to be used in conjunction with one Bus System must be less than or equal to 2 m (6 ft.), times the number of devices connected together (maximum number of devices must be less than or equal to 15).

2. The total maximum length of cable must not exceed 20 m (65 ft.).

There are no restrictions as to the ways various cables may be connected together. It is recommended, however, that no more than three or four piggyback connectors be stacked together on one device, as the resulting cantilevered structure can exert great force on the panels of the device where the connector is mounted, and could cause physical damage. The configuration may be linear (all cables connected end-to-end), or in a star (all cables branching out from a central point), or any combination of the above.

Table 3-2. ASCII Address Codes

ADDRESS SWITCH



A_5 A_4 A_3 A_2 A_1

ADDRESS SWITCHES

ASCII ADDRESS CODES

A_5	A_4	A_3	A_2	A_1	ASCII LISTEN ADDRESS	ASCII TALK ADDRESS	5 BIT DECIMAL EQUIVALENT
0	0	0	0	0	SP	@	0
0	0	0	0	1	!	A	2
0	0	0	1	0	"	B	2
0	0	0	1	1	#	C	3
0	0	1	0	0	$	D	4
0	0	1	0	1	%	E	5
0	0	1	1	0	&	F	6
0	0	1	1	1	'	G	7
0	1	0	0	0	(	H	8
0	1	0	0	1	)	I	9
0	1	0	1	0	*	J	10
0	1	0	1	1	+	K	11
0	1	1	0	0	,	L	12
0	1	1	0	1	-	M	13
0	1	1	1	0	.	N	14
0	1	1	1	1	/	O	15
1	0	0	0	0	Ø	P	16
1	0	0	0	1	1	Q	17
1	0	0	1	0	2	R	18
1	0	0	1	1	3	S	19
1	0	1	0	0	4	T	20
1	0	1	0	1	5	U	21
1	0	1	1	0	6	V	22
1	0	1	1	1	7	W	23
1	1	0	0	0	8	X	24
1	1	0	0	1	9	Y	25
1	1	0	1	0	:	Z	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

3-28. HP-IB Programming

3-29. DESCRIPTION. Programming of the 5363B is accomplished by sending a sequence of program codes via the HP-IB. Because of the Bus structure, the HP 5363B must be designated as the device to receive the program codes. This is done by addressing it to Listen. To complete the remote programming process, the 5363B must be told to respond to the programming codes instead of its local control, by switching it to remote control. This is done by the combination of a Bus Remote Enable and addressing the 5363B to listen. Generally, the remote operation is similar to operating the 5363B from its front panel controls, with a few exceptions as noted in the following description of remote programming.

3-30. PROGRAMMING PROCEDURE. The following steps are necessary to completely determine the 5363B operating modes, using the remote programming codes:

a. Put the Bus into the Remote Enable state by sending the Remote Enable Command (set REN low).

NOTE

The techniques for sending the Remote Enable Command is a function of the particular controller devices (i.e., calculator, computer, etc.).

b. Address the 5363B to Listen by sending the Listen Address assigned to it during setup. The Listen Address switches the 5363B to REMOTE and the REMOTE indicator will be lighted.

c. TRIGGER. Select the desired trigger by sending one of the following codes:

PROGRAMMING CODES

TRIGGER	ASCII	OCTAL	DECIMAL
START	G	107	71
STOP	R	122	82

d. Probe Selection. Select the desired probe by sending one of the following codes:

PROGRAMMING CODES

PROBES	ASCII	OCTAL	DECIMAL
A	A	101	65
B	B	102	66

e. Voltage Sign. Select the desired polarity by sending one of the following codes:

PROGRAMMING CODES

SIGN	ASCII	OCTAL	DECIMAL
+	+	53	43
-	-	55	45

f. Trigger Level. Select the trigger level voltage in the following format: 000. Three characters must be sent. The most significant digit is at the left. Voltage digit codes are as follows:

PROGRAMMING CODES

VOLTAGE DIGIT	ASCII	OCTAL	DECIMAL
0	0	060	48
1	1	061	49
2	2	062	50
3	3	063	51
4	4	064	52
5	5	065	53
6	6	066	54
7	7	067	55
8	8	070	56
9	9	071	57

g. Slope. Select the desired slope by sending one of the following codes:

PROGRAMMING CODES

SLOPE	ASCII	OCTAL	DECIMAL
⨍	U	125	85
⨏	D	104	68

h. Zero Delay. When the additional 10 ns delay is required for the 5345A counter the following program code is sent:

PROGRAMMING CODES

ZERO DELAY	ASCII	OCTAL	DECIMAL
ADD 10 ns DELAY	L	114	76

When zero delay is programmed with the 5370A counter, the following program code is sent:

PROGRAMMING CODES

ZERO DELAY	ASCII	OCTAL	DECIMAL
ZERO DELAY	S	123	83

i. Calibrate. HP 5363B must be in REMOTE. Prior to sending the calibrate commands the probe tips must be grounded. The following program codes are required:

PROGRAMMING CODES

CALIBRATE	ASCII	OCTAL	DECIMAL
LEVEL	@	100	64

3-31. Refer to *Table 3-3* for a complete list of 5363B Programming Codes.

Table 3-3. 5363B Programming Codes

FUNCTION	ASCII	BINARY DIO LINES 7	6	5	4	3	2	1	OCTAL	DECIMAL
TRIGGER*										
START	G	1	0	0	0	1	1	1	107	71
STOP	R	1	0	1	0	0	1	0	122	82
PROBES										
A	A	1	0	0	0	0	0	1	101	65
B	B	1	0	0	0	0	1	0	102	66
VOLTAGE SIGN										
+	+	0	1	0	1	0	1	1	053	43
OR +	SP	0	1	0	0	0	0	0	040	32
-	-	0	1	0	1	1	0	1	055	45
TRIGGER LEVEL LEVEL IN VOLTS D.DD	SEE VOLTAGE DIGIT CODES									
VOLTAGE DIGIT CODES										
0	0	0	1	1	0	0	0	0	060	48
1	1	0	1	1	0	0	0	1	061	9
2	2	0	1	1	0	0	1	0	062	50
3	3	0	1	1	0	0	1	1	063	51
4	4	0	1	1	0	1	0	0	064	52
5	5	0	1	1	0	1	0	1	065	53
6	6	0	1	1	0	1	1	0	066	54
7	7	0	1	1	0	1	1	1	067	55
8	8	0	1	1	1	0	0	0	070	56
9	9	0	1	1	1	0	0	1	071	57
SLOPE										
⨍	U	1	0	1	0	1	0	1	125	85
⨎	D	1	0	0	0	1	0	0	104	68
TIME ZERO DELAY										
ADD 10.00 NS DELAY	L	1	0	0	1	1	0	0	114	76
ZERO DELAY	S	1	0	1	0	0	1	1	123	83
CALIBRATE										
LEVEL	@	1	0	0	0	0	0	0	100	64
CLEAR CODES										
UNLISTEN	?	0	1	1	1	1	1	1	077	63
UNTALK	_ (underscore)	1	0	1	1	1	1	1	137	95
INITIALIZE**	P	1	0	1	0	0	0	0	120	80

*Trigger selection must precede all other program codes for selected channel.

**When 5363B is sent the INITIALIZE code, the following program is selected. B probes START and STOP, 0.00V, -SLOPE.

3-32. UNIVERSAL COMMANDS

3-33. The 5363B obeys the following Universal Commands:

BUS COMMAND	ASCII	OCTAL	DECIMAL
LOCAL LOCKOUT (LLO)	DC1	021	17
GO TO LOCAL (GTL)	SOH	001	1
SERIAL POLL ENABLE (SPE)	CAN	030	24
SERIAL POLL DISABLE (SPD)	EM	031	25

a. Local Lockout (LLO). Local Lockout is a universal command. All responding devices in a bus system will obey a universal command whether they are addressed to listen or not. Thus, the controller does not need to address devices on the bus before sending a universal command.

   Local Lockout (LLO) disables the front panel LOCAL switch so that the unit will remain under remote control even if the switch is pressed. LLO protects the instrument from accidental return to local control during system operation.

   Once the 5363B has been given the LLO command, it can return to local control if any of the following occur:

   1. REN high
   2. Go To Local (GTL) command
   3. Power Up

b. Go To Local (GTL). The addressed Command GTL provides a convenient way to return control of selected devices to the system operator. GTL allows the operator to perform tasks that cannot be done solely under remote control.

c. Serial Poll Enable (SPE). The 5363B responds to the universal command SERIAL POLL ENABLE. The command is required when it is desired to output a Status byte, to determine the status of the 5363B level calibration. See REMOTE CALIBRATION.

d. Serial Poll Disable (SPD). Disables any status byte output from any device on the bus. This command should be issued after a status byte has been output onto the bus.

3-34. Refer to *Table 3-4* for a list of Universal Programming Codes.

3-35. REMOTE CALIBRATION

3-36. Level calibration is necessary when a trigger level error of less than 150mV is required. IT SHOULD BE PERFORMED WHEN THE SLOPES OR PROBES ARE CHANGED. Calibration is accomplished by grounding the probes through 50 ohms or less and sending the level calibration programming code (ASCII @). After sending calibration command, the 5363B causes the Service Request (SRQ) bus control line to become active.

NOTE

For convenience, the probes may be inserted into the front panel CALIBRATION jacks; however, the TIME ZERO/LEVEL switch must be depressed before and during the time the level calibration code is placed onto the bus.

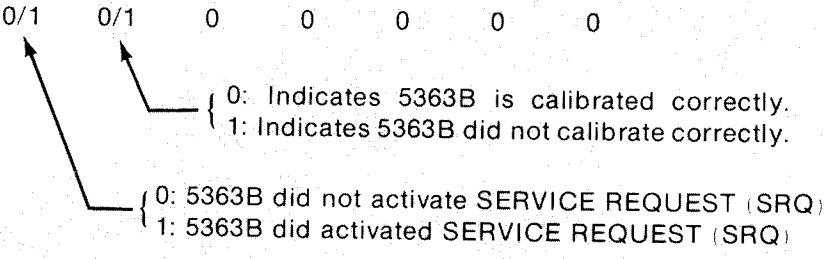
Table 3-4. Universal Programming Codes

FUNCTION	ASCII	BINARY DIO LINES 7	6	5	4	3	2	1	OCTAL	DECIMAL
UNIVERSAL CODES (ATN MUST BE LOW)										
LOCAL LOCKOUT (LLO)	DC1	0	0	1	0	0	0	1	021	17
GO TO LOCAL (GTL)	SOH	0	0	0	0	0	0	1	001	1
SERIAL POLL ENABLE (SPE)	CAN	0	0	1	1	0	0	0	030	24
SERIAL POLL DISABLE (SPD)	EM	0	0	1	1	0	0	1	031	25

3-37. CALIBRATION VERIFICATION. Upon completion of a remote level calibration it may be desired to verify that the 5363B did accomplish calibration. This may be done by sending the SERIAL POLL ENABLE command (ASCII CAN), and then addressing the 5363B to its talk address. When this is complete and the controller is switched back to its data mode (ATN = H) a status byte is output onto the bus. The status byte indicates the following:

STATUS BYTE

BIT	8	7	6	5	4	3	2	1
	0	0/1	0/1	0	0	0	0	0



NOTE

The SERVICE REQUEST control line is cleared upon outputting the status byte.

3-38. TIME ZERO DELAY. When programming Time Zero Delay (add 10.00 ns "L", or zero delay "S", a fast edge (slew rate through 0.0V ≥250V/μs, pulse width ≥5 ns) must be supplied to the probes. The 5363B trigger threshold should then be set to midpoint of the leading edge. The TIME ZERO pot cannot be remotely programmed; it must be considered in the controller software. An example of how the program can do this is shown in Example 1. As a convenience, it is possible to check and set the TIME ZERO pot after it has been remotely programmed, by locally holding the TIME ZERO/LEVEL switch in the raised position with probes inserted in the front panel CALIBRATE jacks. The TIME ZERO pot may also be set to adjust out any delay.

3-39. PROGRAMMING NOTES

a. All remote programming codes and commands are only effective if the 5363B is in REMOTE.

b. The REMOTE indicator lighted indicates that the instrument is under complete remote control and that the front panel controls (except the LOCAL pushbutton) are locked out.

c. When the ADDRESSED indicator is lighted, it indicates that the 5363B is addressed to listen or talk.

d. The order of steps a through g in paragraph 3-30 is arbitrary. A new programming sequence may omit any one or more, steps a through g. The previous value will remain in effect. If a previous value has not been sent, the 5363B will assume its respective INITIALIZE program.

e. Universal Bus commands (LLO, GTL, SPE, SPD) can only be given when the bus is in the address mode (ATN LOW).

f. When the LOCAL pushbutton is depressed, the 5363B is returned to the front panel control. This pushbutton is inoperative if LOCAL LOCKOUT is in effect.

g. The pot on the PULL TO ADD 10.00 ns control is not programmable. The calibration of this pot can be considered in a software program.

3-40. LISTEN FUNCTION. The programmable functions of the 5363B can be controlled via the HP-IB when the HP 5363B is addressed to listen. An address is set on the rear panel ADDRESS switch as shown in *Table 3-2*. When the ASCII listen address on the bus corresponds to the switch setting, as shown in *Table 3-2*, the ADDRESSED indicator lights. The 5363B will then respond to the programming codes listed in *Table 3-3*.

3-41. HP MODEL 9825A CALCULATOR PROGRAMMING EXAMPLES

3-42. TIME ZERO DELAY Programs

3-43. The following example employs the 5345A Electronic Counter and the 9825A Calculator programmed to instruct the 5363B Time Interval Probes via HP-IB to remotely determine the TIME ZERO DELAY. The measured delay is input to the calculator which computes and prints the time zero offset. This offset can then be added to or subtracted from the 5363B measurement, thereby assuring maximum accuracy. Connect equipment as in *Figure 3-7*.

Equipment required:

HP 5345A Electronic Counter (with Options 011 and 012
HP 9825A Calculator (with HP 98034A HP-IB Interface)
HP 5363B Time Interval Probes

NOTE

Set HP-IB address switches on 5345A counter to 10010 (decimal 18) and on 5363B to 10000 (decimal 16). The 5345A TALK ONLY/ADDRESSABLE switch should also be set to the ADDRESSABLE position. Set the 5345A front panel CHANNEL A and B controls to PRESET, 50 ohms, dc, SEP, X1, + (both A and B channels).

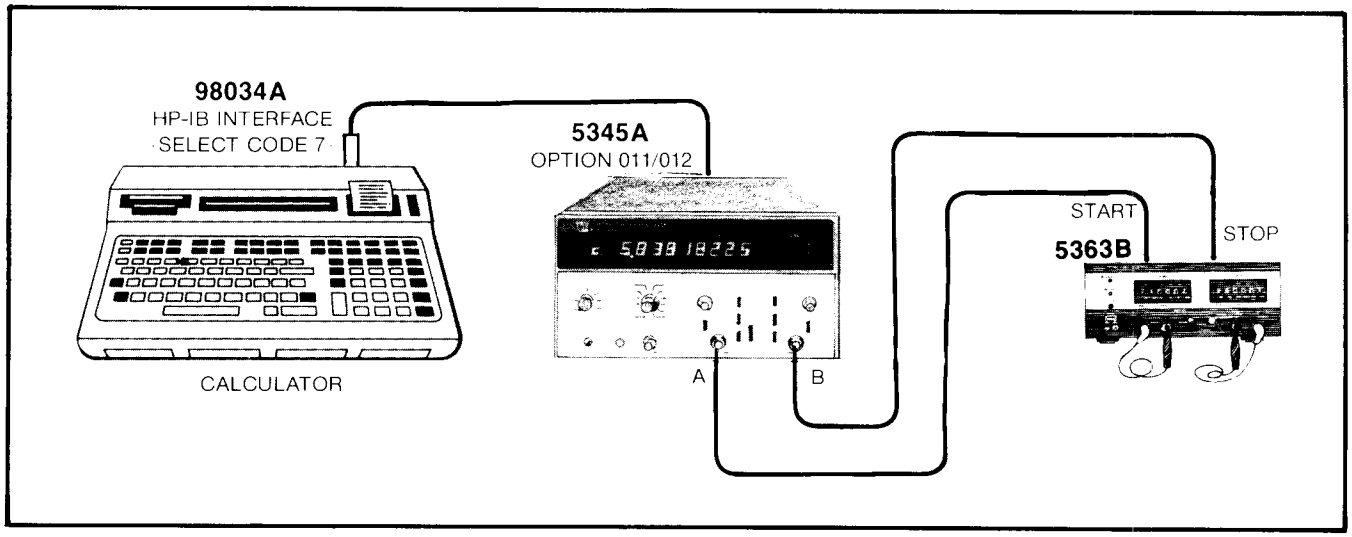
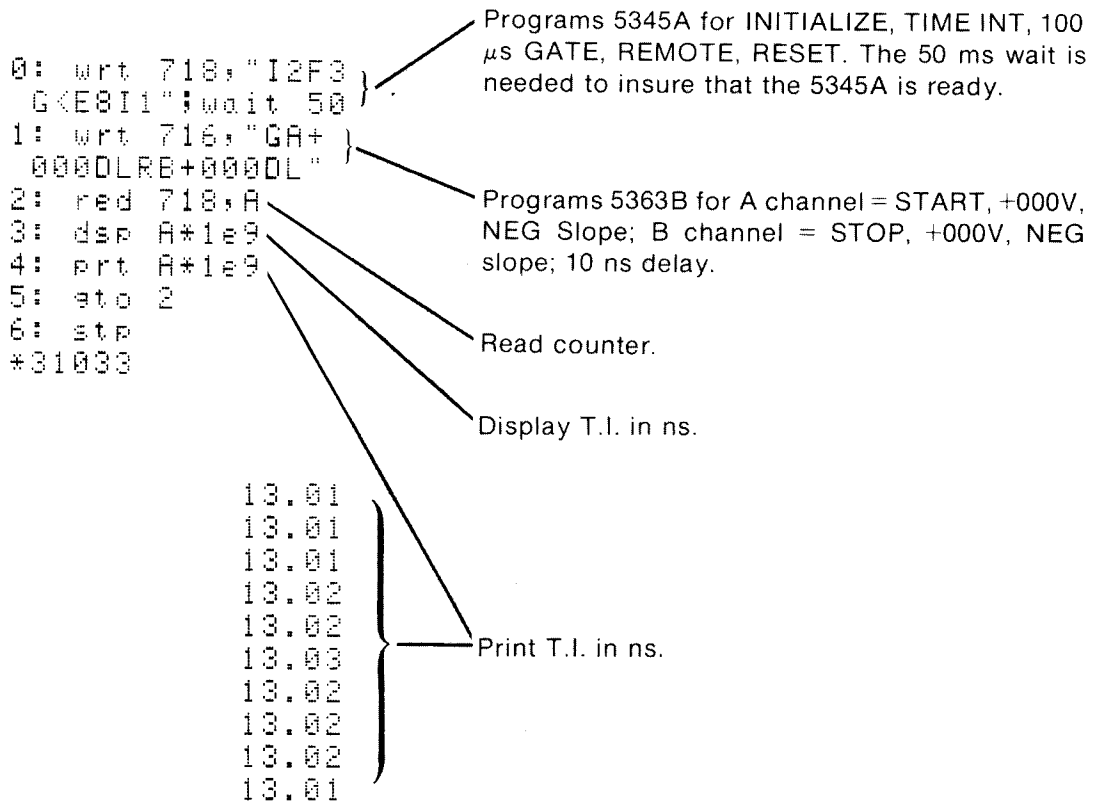


Figure 3-7. Time Zero Measurement Instrument Connections

3-44. LOADING THE PROGRAM. Load the program as listed in Example 1.

3-45. VERIFYING THE PROGRAM. Run a program list after loading the program and check the list with the example program list.

3-46. RUNNING THE PROGRAM. Hold the TIME ZERO/LEVEL switch up (applies pulses to the probes) and press RUN on the 9825A. The calculator should display and print time intervals of approximately 10 ns, depending on the rotation of the PULL TO ADD 10.00 ns potentiometer. To stop the program press RESET.



Program Example 1

3-47. REMOTE CALIBRATION PROGRAM: The following example shows a remote calibration of the 5363B. The 5363B goes into calibrate routine and then requests service (sets SRQ low). The program serial polls the 5363B which outputs a status byte. This status byte is tested to determine if the calibration was correct, incorrect, or incomplete. Service Request is cleared when the status byte is input to the calculator. The calculator displays the result of the calibration and beeps.

Equipment required:

HP 9825A Calculator with HP 98034A HP-IB Interface Assembly HP 5363B Time Interval Probes

NOTE

Set Address switch on 5363B to 10000 (decimal 16).

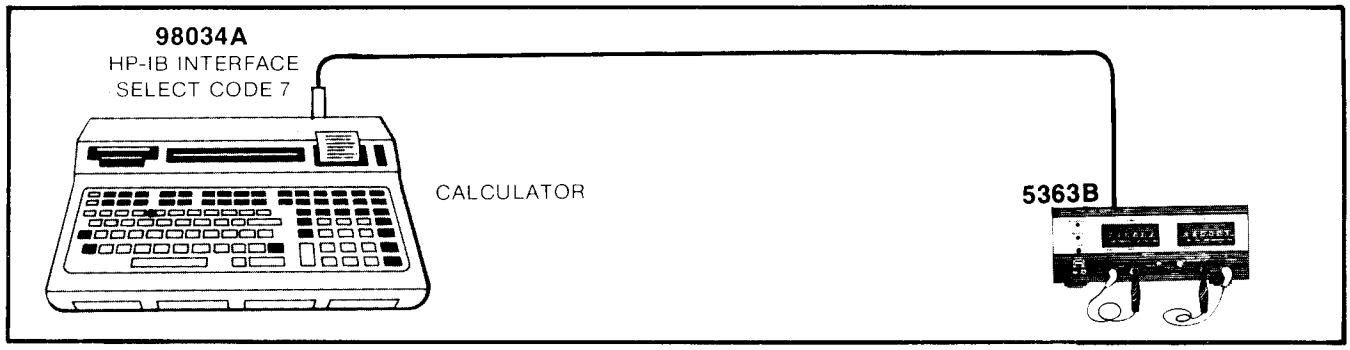


Figure 3-8. Remote Calibration Measurement Instrument Connections

3-48. LOADING THE PROGRAM: Load the program as listed in Example 2.

3-49. VERIFYING THE PROGRAM: Run a program list after loading the appropriate program and check the list with the example program list.

3-50. RUNNING THE PROGRAM: Press RUN on the 9825A. The Calculator will display "CAL BAD" and the value of the status byte in octal 140 . The Calculator continuously loops through the program and beeps each time the status byte is read. Press and hold TIME ZERO/LEVEL switch down, to ground the probe tips*. The calculator will display "CAL OK" and the value of the status byte in octal 100 .

```
0: fxd 0
1: dim A$[5],
 B$[5]
2: for I=1 to 2
3: if I=1;"GA"→A
 $;"RB"→B$
4: if I=2;"GB"→A
 $;"RA"→B$
5: wrt 716,A$&"+
 000UL"&B$&"+
 000UL@"
6: rds(7)→A
7: if bit(7,A)=1
 ;gto 9
8: gto 6
9: rds(716)→S;
 beep
10: if S=96;dsp
 "CAL BAD",dtoS;
 gto 14
11: next I
12: if S=64;dsp
 "CAL OK",dtoS;
 gto 14
13: dsp "STATUS
 BYTE INVALID",
 dtoS
14: stp
*23207
```

Programs 5363B for A channel START, +000V, POS slope; B channel for STOP, +000V, POS slope; 10 ns delay, CALIBRATE, on first pass through Program (I=1). Then reprograms 5363B for A channel STOP; B channel START (other parameters the same), and CALIBRATE, on the second pass (I=2).

Checks SRQ.

Reads status byte after SRQ set LOW.

Prints calibration message depending on value of the status byte.

Program Example 2

*If probe tips are externally grounded, the TIME ZERO/LEVEL switch need not be activated.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The Performance Tests in this section verify specifications in *Table 1-1*. The checks given in the Local Operational Verification and the 5363B HP-IB Operation Verfication Program can be performed to give a high degree of confidence that the 5363B is operating properly. All tests can be accomplished without access to the inside of the instrument. The Operational Verification should be useful for incoming QA, for routine maintenance, and after instrument repair.

4-3. EQUIPMENT REQUIRED

4-4. *Table 4-1* lists the equipment required for the Performance Tests and Operational Verification procedures. Any equipment which satisfies the critical specifications given in the table may be substituted for the recommended equipment.

Table 4-1. Recommended Test Equipment

Instrument	Required Specifications	Recommended HP Model
Digital Multimeter	±15V	3465A
Function Generator	10 MHz	3312A
Oscilloscope	275 MHz Bandwidth	1725A
Controller with HP-IB Interface	IEEE 488	9825A/B with 98034A
Pulse Generator	Output 10V p-p, <3 ns Rise Time	8013B
Cables	4-Foot BNC 50 ohms	11170C
Tee	BNC type	1250-0781
BNC to Probe Adapter Feedthrough	BNC type	10218A
Precision Power Supply	0-10V, ±3.5 mV	6115A
Counter	Time Interval ≥10 ns	5370A
Digital Voltmeter	0-100V, 0.01% accuracy	3490A
Power Splitter	50 ohm	11667A

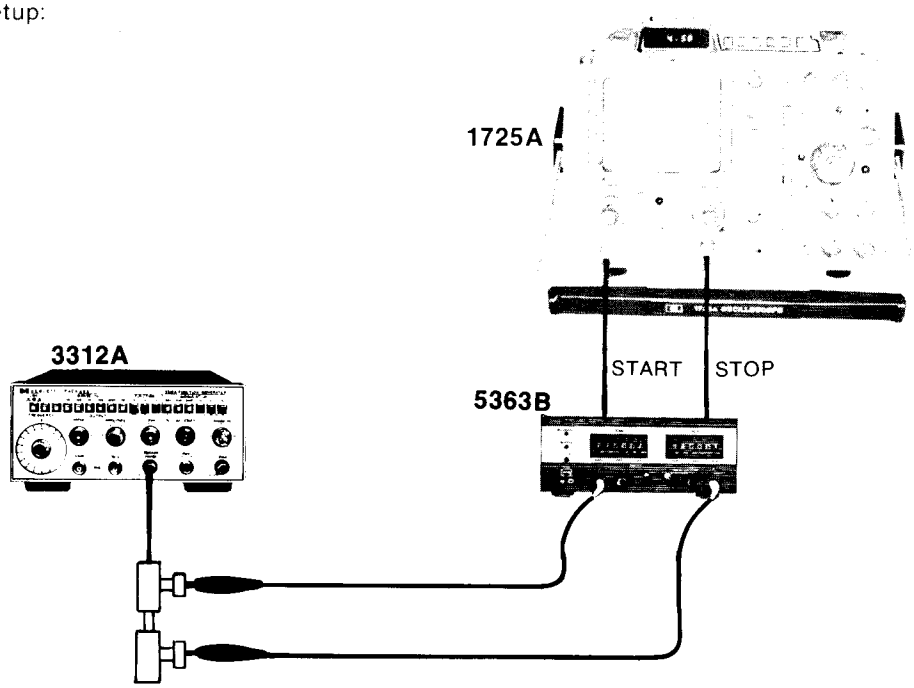
4-5. *Figure 4-1* delineates the equipment required and the procedures necessary to accomplish the Local Verification Check.

OUTPUT TO COUNTER

Equipment required:
5363B Time Interval Probes
3312A Function Generator
1725A Oscilloscope
Four (4) BNC Cables
BNC Type Tee
Probe to BNC Adapter

Description : This procedure verifies the amplitude of the START and STOP output pulses.

Setup:



1. Connect equipment as in diagram above.
2. Set 3312A as follows:

RANGE	1M
FUNCTION	⎍
OFFSET	CAL
AMPLITUDE	10V
SYM	CAL
FREQUENCY	1

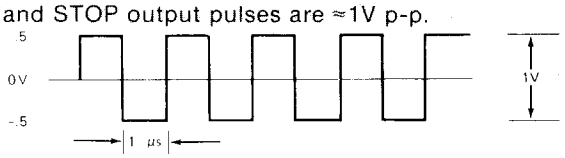
3. Set 5363B as follows:

START	A; +5.00; ⨍
STOP	A; +5.00; ⨍

4. Set 1725A as follows:

CHANNELS A and B Volts/Div.	0.5V/Div
CHANNELS A and B Volts/Div.	Input Impedance 50Ω
TRIGGER	A
CHANNEL A, B	ON
HORIZONTAL DISPLAY	MAIN
TIME/DIV	0.5 μs
SWEEP MODE	AUTO

5. Verify that START and STOP output pulses are ≈1V p-p.



6. Repeat step 5 for START A/STOP B; START B/STOP A; START B/STOP B.

Figure 4-1. Local Operational Verification Check

4-6. 5363B HP-IB VERIFICATION PROGRAM

4-7. The 5363B HP-IB Verification Program exercises the instrument through various operating modes, via its HP-IB Interface. If the 5363B successfully completes all phases of the verification program, then there is a high probability that the instrument is working properly.

4-8. The verification program is divided into three functional sections:

TEST SECTION I, tests the A/B probe selectability, the Calibrate and Initialization functions, and the Local/Remote functions.

TEST SECTION II, tests the DAC Trigger Level programmability.

TEST SECTION III, tests the Trigger Level selection for both slopes and polarities.

4-9. The program is listed in *Table 4-2*, and may be keyed into the 9825A/B or may be loaded from the HP-IB Verification Cassette, HP P/N 59300-10001 (Revision I or later). This tape also contains HP-IB Verification programs for other instruments.

4-10. The program goes through 9 check points (tests) as described in *Figure 4-2*. The information in this table tells what occurs during each test and gives the corresponding portion of the 9825A/B printer output produced as the program runs.

4-11. The test equipment setup required for each of the three TEST SECTIONS is illustrated in *Figure 4-2*.

4-12. To perform the verification:

a. Set the ADDRESS switches on the 5363B to position (except decimal equivalent 21 which is the calculator address) in the range of 00–30.

NOTE

If the verification program is KEYED in, press 9825A/B RUN key and then proceed to step f (below).

b. Insert cassette into the 9825A/B.

c. Load and run file 0 (type: !dp0; press [EXECUTE]).

d. Type in model number to be tested (example: 5363).

e. User is asked; "A=0 B=1". (Type: 1 (for 5363B); press [CONTINUE]).

f. Verification program is automatically loaded and begins executing.

g. At the beginning of the program, the user is asked "select code?", a prompt that should be followed by entering the correct three digit select code (followed by pressing [CONTINUE]). The user should type in the decimal equivalent to the binary address switch setting (preceded by an "7") and press [CONTINUE]; e.g.,for ADDRESS switches set to 10001, the decimal equivalent of 17. In this case the select code is 717.

Error messages are displayed if an error has been made in either selecting or entering a select code. This error message is immediately followed by the prompt, "select code?".

h. As performance is tested, a printout is produced that describes each step of the test.

i. To rerun the program, press [RUN].

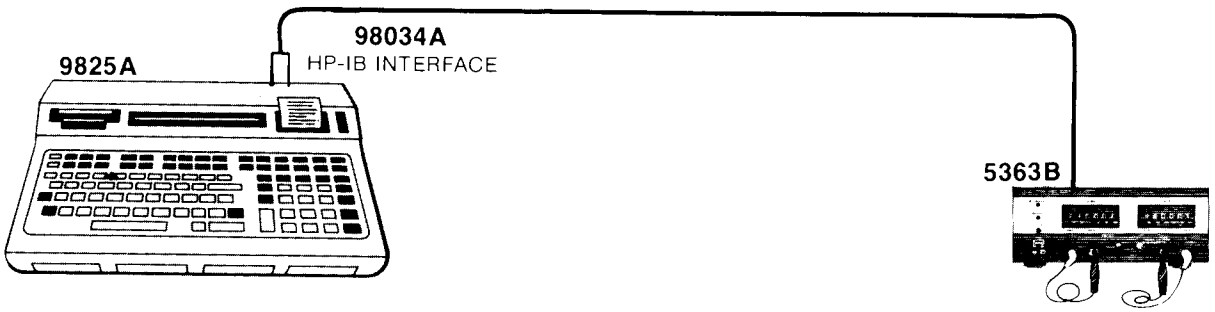
Table 4-2. 5363B HP-IB Verification Program Listing

```
 0: dsp "5363B"
 1: dim Z$[15],B$[5];"**************"→Z$
 2:
 3: if S=0;prt Z$,"To suppress all printing at any time set S=1 (e.g.1→S)."
 4: if S=0;prt "To resume","printing, set   S=0",Z$
 5: if S=0;prt "To loop on any","test section,   set T=1;to end  looping set"
 6: if S=0;prt "T=0",Z$,"To loop on any","check point"
 7: if S=0;prt "set C=1; to end","looping set C=0",Z$
 8: "code":ent "Select Code?",Q;dev "tip",Q
 9: if Q=721;dsp "error: calculator address";wait 1500;gto "code"
10: if Q>730;dsp "error: out of address range→high";wait 1500;gto "code"
11: if Q<700;dsp "error: out of address range→low";wait 1500;gto "code"
12: "I":if S=0;spc 3;prt "TEST SECTION I","This section","tests A/B probe"
13: lcl 7;rem "tip"
14: if S=0;prt "selectability,","the calibrate","and initalize","functions,"
15: if S=0;prt "local and remote","functions and","the switch";spc 3
16: "1":dsp "CHECKPOINT 1";if S=0;prt Z$,"CHECKPOINT 1",Z$,"A/B Probe"
17: if S=0;prt "select"
18: wait 2000;dsp "#1 - Start/A & Stop/B";wrt "tip","GARB";wait 5000
19: dsp "#2 - Start/A & Stop/A";wrt "tip","GARA";wait 5000
20: dsp "#3 - Start/B & Stop/A";wrt "tip","GBRA";wait 5000
21: dsp "#4 - Start/B & Stop /B";wrt "tip","GBRB";wait 5000;rem "tip"
22: if C=1;gto "1"
23: "2":dsp "CHECKPOINT 2";if S=0;spc 3;prt Z$,"CHECKPOINT 2",Z$
24: lcl 7;rem "tip"
25: if S=0;prt "LOCAL/REMOTE"
26: dsp "Press LOCAL";wait 4000;dsp "REMOTE light should go off";wait 5000
27: rem "tip";llo 7;dsp "LOCAL LOCKOUT has been sent";wait 4000
28: dsp "Press LOCAL";wait 2000;dsp "REMOTE light should remain on";wait 3500
29: if C=1;gto "2"
30: "3":dsp "CHECKPOINT 3";if S=0;spc 3;prt Z$,"CHECKPOINT 3",Z$,"CALIBRATE"
31: wait 3500;dsp "Probes must be grounded!";wait 4000;0→A
32: dsp "TIME ZERO/LEVEL must be held!";wait 3000;wrt "tip","@"
33: wait 2000;rds(7)→B;if bit(7,B)=1;prt "SRQ:  OK"
34: rds("tip")→D;if D=64;prt "CALIBRATE: OK"
35: if D#64;prt "CALIBRATE:","  ERROR"
36: if C=1;gto "3"
37: "4":dsp "CHECKPOINT 4";if S=0;spc 3;prt Z$,"CHECKPOINT 4",Z$
38: wait 3000;if S=0;prt "INITIALIZE"
39: wait 3500;dsp "Start/A & Stop/A  -  new set-up";wrt "tip","GARA"
40: wait 4000;dsp "Lights should switch from A to B";wrt "tip","P"
41: wait 4000;if C=1;gto "4"
42: "5":dsp "CHECKPOINT 5";if S=0;spc 3;prt Z$,"CHECKPOINT 5",Z$
43: wait 4000;700→W;if S=0;prt "SWITCH test"
44: wrt W,"GARA";dsp "Address",W,"A probe on?(y=1→r1)";wait 5000
45: if r1=1;prt "Address","responded to:",W;0→r1
46: wrt "tip","GBRB"
47: if W=720;W+2→W;jmp -3
48: if W<730;W+1→W;jmp -4
49: if C=1;gto "5"
50: dsp "End of TEST SECTION I";wait 3000;if T=1;gto "I"
51: "II":dsp "TEST SECTION II";wait 2500;if S=0;spc 3
52: if S=0;prt Z$;spc 3;prt "TEST SECTION II","This section","tests the DAC"
53: if S=0;prt "TRIGGER LEVEL","OUTPUTS out of","5363B. The A"
54: if S=0;prt "probe is used as","START and the B","probe is STOP."
55: if S=0;prt "The calculator","will display the","approximate"
56: if S=0;prt "reading of the","DVM.","Equipment","needed:","  (1) DVM"
57: dsp "Press CONTINUE to continue";stp
58: "6":dsp "CHECKPOINT 6";wait 2500;if S=0;spc 3;prt Z$,"CHECKPOINT 6",Z$
59: 999→A;"START"→B$
60: if S=0;prt "START TRIGGER","LEVEL"
61: gsb "start"
62: if C=1;gto "6"
63: dsp "Press CONTINUE to continue";stp
```

Table 4-2. 5363B HP-IB Verification Program Listing (Continued)

```
64: "7":dsp "CHECKPOINT 7";wait 3000
65: if S=0;spc 3;prt Z$,"CHECKPOINT 7",Z$,"STOP TRIGGER","LEVEL"
66: 999→A;"STOP"→B$
67: gsb "stop"
68: if C=1;gto "7"
69: dsp "End of TEST SECTION II";wait 2500;if T=1;gto "II"
70: if S=0;spc 3;prt Z$
71: "III":dsp "TEST SECTION III";wait 3000
72: if S=0;spc 3;prt "TEST SECTION III","This section"
73: if S=0;prt "tests the remote","trigger setting,","slope and sign"
74: if S=0;prt "programmablity","Equipment"
75: if S=0;prt "needed:"," (1) scope"," (2) function","    generator";spc 3
76: "8":dsp "CHECKPOINT 8";wait 2000;if S=0;prt Z$,"CHECKPOINT 8",Z$
77: if S=0;prt "A probe","START and","STOP"
78: dsp "A probe START";wait 5000
79: wrt "tip","GA+000UL";dsp "1";wait 3500;wrt "tip","GA+000DL";dsp "2"
80: wait 3500;wrt "tip","GA+400UL";dsp "3";wait 3500;wrt "tip","GA+400DL"
81: dsp "4";wait 3500;wrt "tip","GA-400UL";dsp "5";wait 3500
82: wrt "tip","GA-400DL";dsp "6";wait 3500
83: dsp "Press CONTINUE to continue STOP";stp
84: dsp "A probe STOP";wait 5000
85: wrt "tip","RA+000UL";dsp "1";wait 3500;wrt "tip","RA+000DL";dsp "2"
86: wait 3500;wrt "tip","RA+400UL";dsp "3";wait 3500;wrt "tip","RA+400DL"
87: dsp "4";wait 3500;wrt "tip","RA-400UL";dsp "5";wait 3500
88: wrt "tip","RA-400DL";dsp "6";wait 3500
89: if C=1;gto "8"
90: dsp "Press CONTINUE";stp
91: "9":dsp "CHECKPOINT 9";wait 2500;if S=0;spc 3
92: if S=0;prt Z$,"CHECKPOINT 9",Z$,"B probe","START and","STOP"
93: dsp "B probe START";wait 5000
94: wrt "tip","GB+000UL";dsp "1";wait 3500;wrt "tip","GB+000DL";dsp "2"
95: wait 3500;wrt "tip","GB+400UL";dsp "3";wait 3500;wrt "tip","GB+400DL"
96: dsp "4";wait 3500;wrt "tip","GB-400UL";dsp "5";wait 3500
97: wrt "tip","GB-400DL";dsp "6";wait 3500
98: dsp "Press CONTINUE to continue STOP";stp
99: dsp "B probe STOP";wait 5000
100: wrt "tip","RB+000UL";dsp "1";wait 3500;wrt "tip","RB+000DL";dsp "2"
101: wait 3500;wrt "tip","RB+400UL";dsp "3";wait 3500;wrt "tip","RB+400DL"
102: dsp "4";wait 3500;wrt "tip","RB-400UL";dsp "5";wait 3500
103: wrt "tip","RB-400DL";dsp "6";wait 3500
104: if C=1;gto "9"
105: dsp "End of TEST SECTION III";wait 4000;if T=1;gto "III"
106: dsp "End of 5363B program!"
107: end
108: "start":if A>100 or A<-100;wrt "tip","GA",A,"UL"
109: if A=99;wrt "tip","GA+099UL"
110: if A=49;wrt "tip","GA+049UL"
111: if A=-1;wrt "tip","GA-001UL"
112: if A=-51;wrt "tip","GA-051UL"
113: fxd 2;dsp B$,"     ",A/100,"+/-75mV";wait 4000
114: fxd 0;A-50→A;if A>-1000;gto "start"
115: ret
116: "stop":if A>100 or A<-100;wrt "tip","RB",A,"UL"
117: if A=99;wrt "tip","RB+099UL"
118: if A=49;wrt "tip","RB+049UL"
119: if A=-1;wrt "tip","RB-001UL"
120: if A=-51;wrt "tip","RB-051UL"
121: fxd 2;dsp B$,"     ",A/100,"+/-75mV";wait 4000
122: fxd 0;A-50→A;if A>-1000;gto "stop"
123: ret
*20856
```

SECTION I EQUIPMENT SETUP:




```
To suppress all
printing at any
time set S=1 (e.
g. 1+S).
To resume
printing, set
S=0

To loop on any
test section,
set T=1 to end
looping set
T=0

To loop on any
check point
set C=1 to end
looping set C=0
```

General program instructions.

User enters "select code" here (i.e., 701 ... 730 CONTINUE).

```
TEST SECTION 1
This section
tests A/B probe
selectability,
the calibrate
and initialize
functions,
local and remote
functions and
the switch
```

Use Test Section I equipment setup for Check Points 1 through 5.

Figure 4-2. HP-IB Program Description

```
CHECKPOINT 1

A/B Probe
select
```

CHECK POINT 1 verifies that the 5363B responds to remote probe selection by observing the front panel status lights for four probe selections.

```
CHECKPOINT 2

LOCAL/REMOTE
```

CHECK POINT 2 verifies the Local and Remote status by observing front panel lights and pressing LOCAL button as instructed.

```
CHECKPOINT 3

CALIBRATE
SRQ:  OK
CALIBRATE: OK
```

CHECK POINT 3 performs a remote calibration. Both probes must be inserted into the 5363B front panel jacks and, when prompted, the operator must press down and "HOLD" the TIME ZERO/LEVEL switch, until the 9825A prints out the calibration results (i.e., "OK" or "ERROR").

```
CHECKPOINT 4

INITIALIZE
```

CHECK POINT 4 verifies that the 5363B does "Initialize" by observing the probe status lights. When the lights switch from "B" to "A", the instrument has initialized.

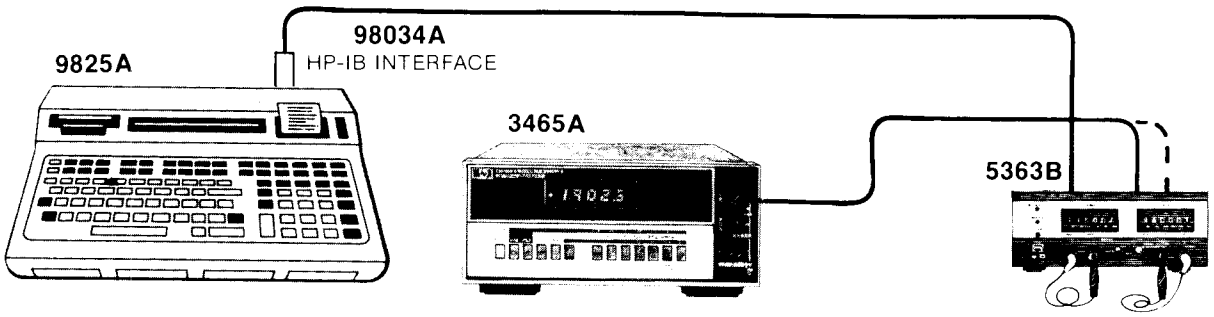
```
CHECKPOINT 5

SWITCH test
Address
responded to:
          701
```

CHECK POINT 5 verifies that the 5363B responds to one and only one HP-IB "address". The address select codes 700 through 730 are sequentially sent out on the bus. The operator monitors the instruments response by observing the probe status lights. The "B" probe status lights will remain on whenever the 5363B is not addressed. The "A" probe status lights indicate the instrument is addressed.

Entering "1→r1" on the 9825A whenever the "A" status lights are on will produce a printout of the active address (i.e., "Address responded to 701").

Figure 4-2. HP-IB Program Description (Continued)

SECTION II EQUIPMENT SETUP:




```
TEST SECTION II
This section
tests the DVM
TRIGGER level
OUTPUTS out of
5363B. The A
probe is used as
START and the B
probe is STOP.
The calculator
will display the
approximate
reading of the
DVM.
Equipment
needed:
   1  DVM
```

General program information. Reconfigure test equipment as in setup above for TEST SECTION II, CHECK POINTS 6 and 7.

```
CHECKPOINT 6
START TRIGGER
LEVEL
```

CHECK POINT 6 remotely programs the START channel TRIGGER LEVEL DAC to "step" from +9.99 to -9.51 in 0.5-volt steps. The operator monitors the measured voltages on the DVM and verifies they are ±75 mV.

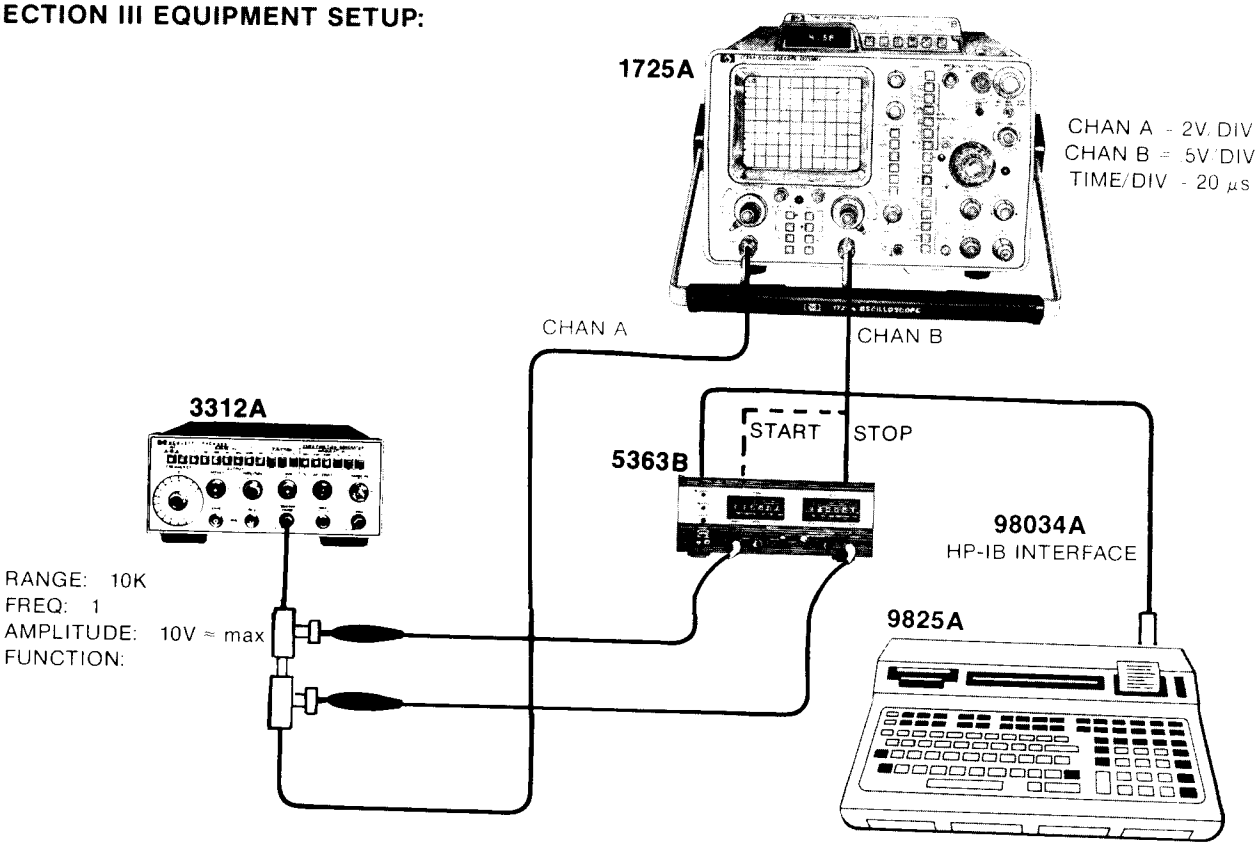
Move the DVM input from START TRIGGER LEVEL to STOP TRIGGER LEVEL.

```
CHECKPOINT 7
STOP TRIGGER
LEVEL
```

CHECK POINT 7 repeats Test 6 above for the STOP channel DAC.

Figure 4-2. HP-IB Program Description (Continued)

SECTION III EQUIPMENT SETUP:




```
TEST SECTION III
This section
tests the remote
trigger setting:
slope and sign
programmability
Equipment
needed:
  (1) scope
  (2) function
      generator
```

General program information. Reconfigure test equipment as in setup above for TEST SECTION III, Check Points 7 and 8.

```
CHECKPOINT 8
************
A probe
START and
STOP
```

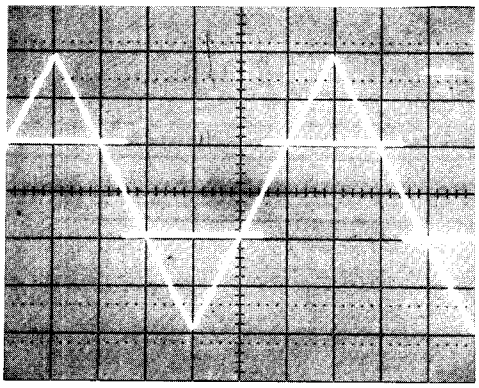
CHECK POINT 8 programs six different "A" probe configurations. As each configuration comes up, the operator compares the actual 1720A display to waveforms 1 through 6 which follow.

```
CHECKPOINT 9
************
B probe
START and
STOP
```

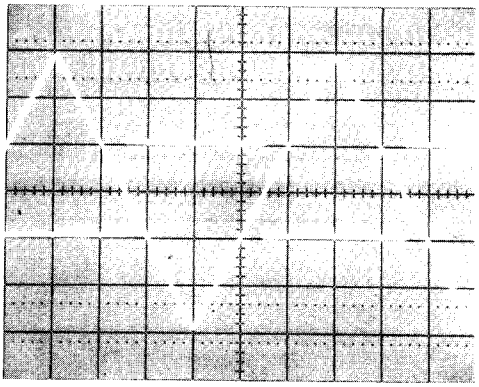
CHECK POINT 9 performs the same test as Check Point 8 on the B probe. Again compare 1720A display to waveforms 1 through 6.

Figure 4-2. HP-IB Program Description (Continued)

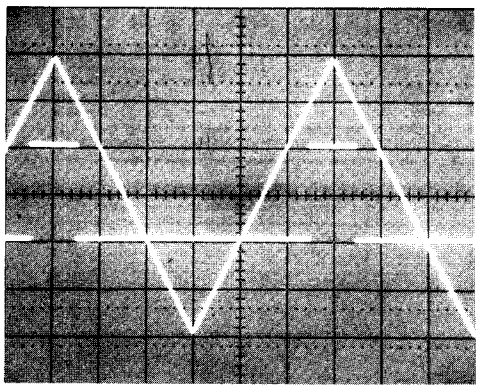
WAVEFORMS FOR TEST SECTION III



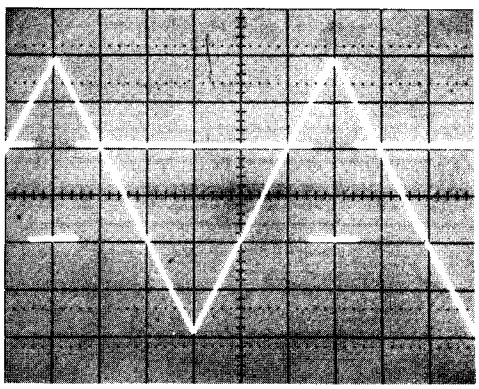
1



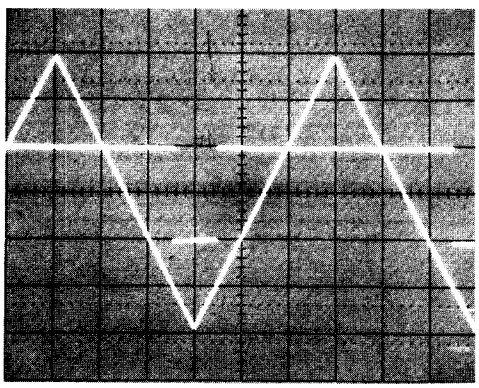
2



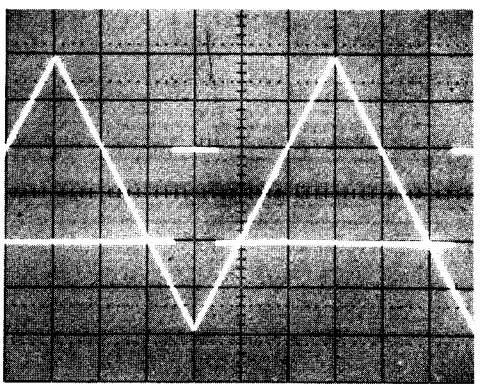
3



4



5



6

Figure 4-2. HP-IB Program Description (Continued)

4-13. Error messages were designed to be as noncryptic as possible. The actual error messages and descriptions follow:

1. "Error: calculator address".

   This message indicates the select code 721, the calculator address, has been entered. Change the ADDRESS switch setting to another position within the range 00–30 and reenter the select code.

2. "Out of Address Range – High". The select code entered was >730. Enter a select code ≤730.

3. "Out of Address Range – Low". The select code entered was <700. Enter a select code ≥700.

4-14. PERFORMANCE TESTS

4-15. Test Equipment

4-16. *Table 4-3*, in addition to the other equipment specified in *Table 4-1*, describes test equipment recommended to accomplish the performance test of the 5363B. Test equipment having equivalent characteristics may be substituted for the equipment listed. Unless otherwise noted one of each unit is required.

Table 4-3. Performance Test Equipment

INSTRUMENT	TYPE REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
Precision Power Supply	+0 - 10V +3.5mV	HP 6115A
Pulse Generator	Transistion Rate 500V/μs Max. Output 10V across 50 ohms	HP 8013B
Counter	Single Shot Resolution better than equal to 2 ns	HP 5370A
Oscilloscope	275 MHz	HP 1725A
Digital Voltmeter	0 to 100V 0.01% accuracy	HP 3490A

4-17. Test Record

4-18. Results of the Performance Test procedures may be tabulated on the Performance Test Record located at the end of Section IV.

4-19. Performance Test

4-20. The performance test given in *Figure 4-3*, may be used to verify proper operation of the HP 5363B.

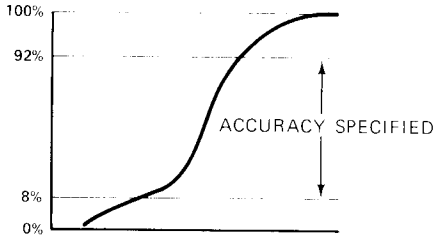
4-21. The performance test given in *Figure 4-4* may be used to verify the delay compensation range of the HP 5363B.

1. ACCURACY TEST

Specifications:

$$\pm 1 \text{ ns}^{*} \pm \frac{\text{START TLA} + \text{START NTE}}{\text{START slew rate}} \pm \frac{\text{STOP TLE} + \text{STOP NTE}}{\text{STOP slew rate}}$$

where TLA denotes trigger level accuracy and NTE denotes noise trigger error.



a. Set counter controls as follows:

FUNCTION	TI
STATISTICS	MEAN
SAMPLE SIZE	1
DISPLAY RATE	12 O'clock position
ARMING	±TI
INPUTS START/STOP:	
LEVEL	Preset
INPUT IMPEDANCE	50 ohm
÷1/÷10	÷1
AC/DC	DC
START COM/SEP	SEP
SLOPE	⨍

b. **Set pulse generator controls as follows:

PULSE PERIOD	.1m-10m
VERNIER	CCW
PULSE DELAY	1μ-0.1m
VERNIER	CCW
PULSE WIDTH	1μ-0.1m
VERNIER	CCW
OUTPUT (+) AMPLITUDE	5.0
VERNIER (S)	full CW
OFFSET	OFF

NOTE

Perform the Trigger Level Calibration procedure (Paragraph 3-11), whenever the 5363B slopes or probes are changed. Do this for all three test setups.

c. Connect HP 5363B A probe to OUTPUT (+) terminal of HP 8013B.

d. Set HP 5363B as follows:

START to A; +5.00; ⨍

STOP to A; +5.00; ⨍

Adjust 5363B TIME/ZERO PULL TO ADD 10.00 ns knob to obtain a reading of 0.000 ns (±20 ps) on the 5370A display.

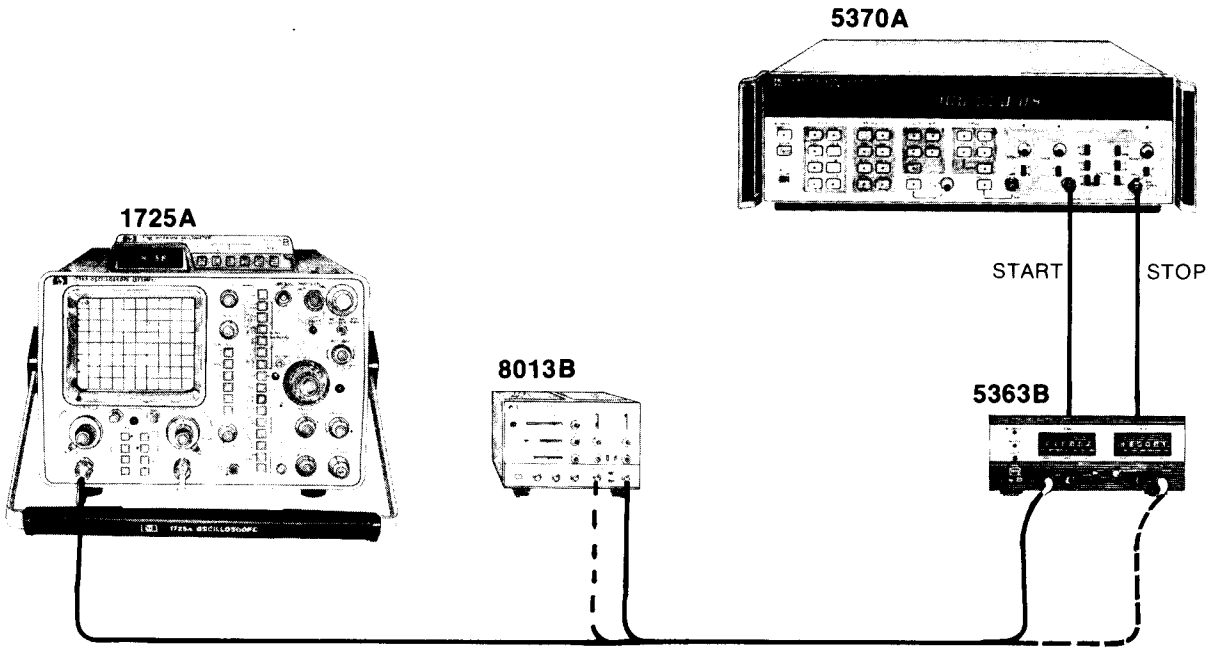
NOTE

The two least significant digits will be difficult to set due to resolution of the control. Set as accurately as possible.

*After calibration and within the range of 100 mV or 8% of signal peak (whichever is greater).

**Pulse width into oscilloscope is ≈0.7 μs and the amplitude is ≈10.0V (into 50 ohms). Internal switch enables HP 8013B to output up to 10V into 50 ohms.

Figure 4-3. Performance Test



e. Set HP 5363B as follows:

START to A; +9.20; ⨍
STOP to A; +9.20; ⨍

The HP 5370A display should now read 0.000 ns ±1 ns. Record on test card.

f. Set HP 5363B as follows:

START to A; +0.80; ⨍
STOP to A; +0.80; ⨍

The HP 5370A display should now read 0.000 ns ±1 ns. Record on test card.

g. Subtract result of step e from step f. Record result on test card.

h. Connect 5363B B probe to OUTPUT (+) terminal of HP 8013B.

i. Repeat steps d through g, selecting B START and STOP. Record results from HP 5370A display on test card.

j. Connect HP 5363B A probe to OUTPUT (−) terminal of HP 8013B.

k. Repeat steps d through g, selecting polarity for START and STOP. Record results from HP 5370A display on test card.

l. Connect HP 5363B B probe to OUTPUT (−) terminal of HP 8013B.

m. Repeat steps d through g, selecting polarity for START and STOP. Record results from HP 5370A display on test card.

2. TRIGGER/DIFFERENTIAL TRIGGER LEVEL ACCURACY TEST

Specifications:

Trigger Level	-5V to +9V	-5V to -10V	+9V to +10V
*Trigger Level Accuracy	±8 mV ±0.4 mV/°C ±0.15% trigger voltage	±1% trigger voltage	50 mV
*Differential Trigger Level Accuracy	±3 mV ±0.3% trigger voltage	±1% trigger voltage	100 mV

NOTE

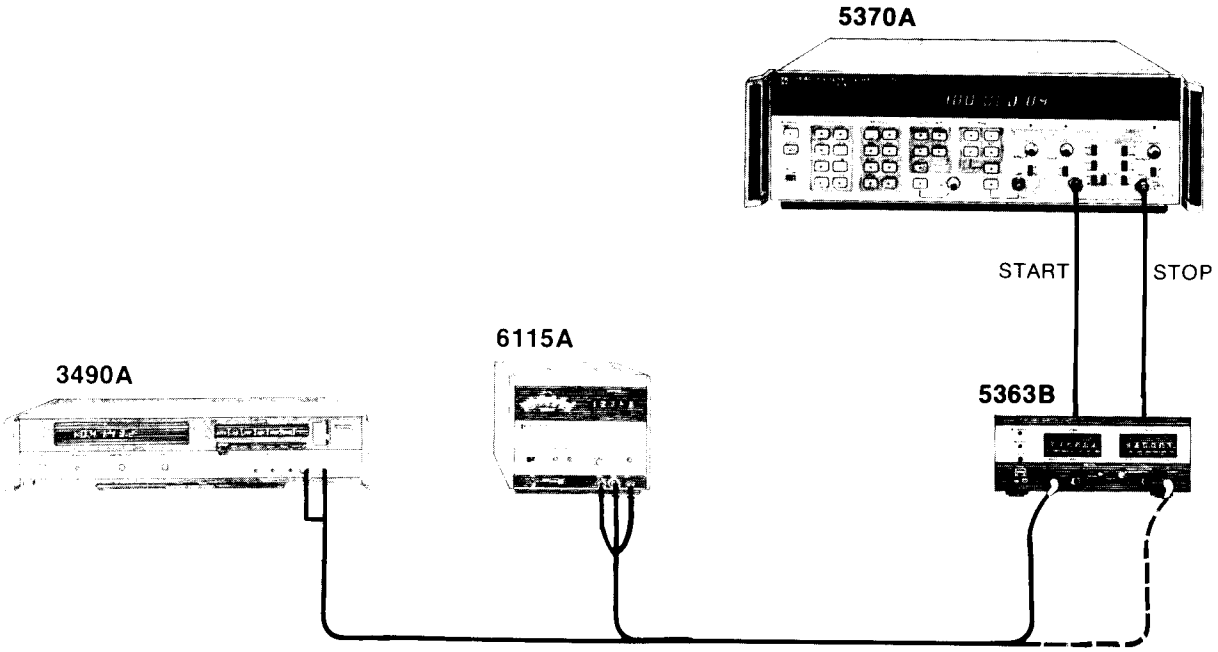
Differential trigger level accuracy applies when both START and STOP trigger level voltages are set equal and identical waveforms applied.

*after calibration.

Figure 4-3. Performance Test (Continued)

Equipment:
Voltmeter: HP 3490A
Precision Power Supply: HP 6115A
Counter: HP 5370A

SETUP FOR TEST 2



a. Set HP 5363B as follows:

START to A; -8.50; ⨍
STOP to A; -8.50; ⨍

b. Set HP 5370A as shown in test setup 1a.

c. Set HP 6115A Power Supply as follows:

METER ..... VOLTS
VOLTAGE ..... -8.55V (initial setting)

d. Perform Trigger Level Calibration as described in paragraph 3-11.

e. Connect (-) OUTPUT of HP 6115A power supply to probe A and to the voltmeter.

f. Connect (+) OUTPUT of HP 6115A power supply to its own ▽ terminal.

g. Slowly increase power supply voltage until the START channel trigger light flashes on the 5370A Counter. Record Voltage (from HP 3490A digital display) on test card.

h. Reset power supply to initial setting of step c, then increase power supply voltage until the STOP channel trigger light flashes on the 5370A Counter. Record voltage (from HP 3490A digital display) on test card.

i. Set HP 5363B as follows:

START to A; +5.05; ⨍
STOP to A; +5.05; ⨍

j. Set HP 6115A Power Supply as follows:

METER ..... VOLTS
VOLTAGE ..... 5.00V (initial setting)

k. Perform Trigger Level Calibration as described in paragraph 3-11.

l. Connect (+) OUTPUT of HP 6115A power supply to probe A and to the voltmeter.

m. Connect (-) OUTPUT of HP 6115A power supply to its own ▽ terminal.

Figure 4-3. Performance Test (Continued)

n. Repeat steps (g) and (h).

o. Set HP 5363B as follows:

START to A; +9.95; ⨍

STOP to A; +9.95; ⨍

p. Set HP 6115A Power Supply as follows:

METER ..... VOLTS
VOLTAGE ..... 9.90V (initial setting)

q. Repeat steps (g) and (h).

r. Repeat steps (a) through (r) using probe B.

s. Repeat steps (a) through (s) using negative slope settings on the HP 5363B.

3. DAC ACCURACY (A2 DAC ASSEMBLY)

Specifications:

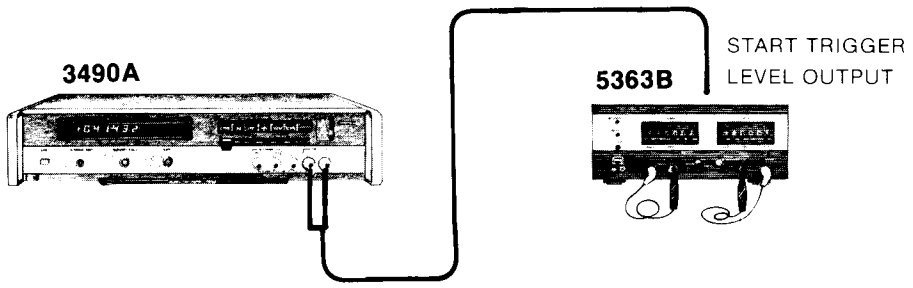
Trigger Point setting ±75 mV.

Equipment required:

HP 5363B Time interval Probes
HP 3490A Digital Multimeter
BNC cable (1)

Description: This procedure verifies the accuracy of DAC dc voltages at selected thumbwheel settings.

SETUP FOR TEST 3



a. Connect equipment as shown in diagram for TEST 3.

b. Set 5363B START thumbwheel switches to: A; +0.00; ⨍ .

c. Set HP 3490A to ... (dc volts), 20 volt range.

d. Dial sequentially each of the following settings on the START thumbwheel switches and note the corresponding measurements on the HP 3490A display. Verify each displayed measurement is within ±75 mV of the thumbwheel setting.

-9.00
-4.50
-0.55
+0.00
+0.55
+4.50
+9.00

e. Revise the setup, connecting the STOP TRIGGER LEVEL output to the HP 3490A. Repeat the above using the STOP thumbwheel switches.

f. Set 5363B STOP thumbwheel switches to A; +0.00; ↵ ; then, repeat c and d.

g. Repeat steps a through f for B channel.

Figure 4-3. Performance Test (Continued)

5363B Delay Compensation Range Test Setup.

a. Connect either the START or STOP outputs of the 5363B to the input of the 50 ohm power splitter (11667A).

NOTE

Use a short 50 ohm BNC-to-BNC coaxial cable for the above connection.

b. Connect the two ouputs of the 11667A power splitter to the 5370A Counter START and STOP channels.

NOTE

The two cables use to connect from the power splitter to the 5370A Counter START and STOP channels must be of equal length.

c. Insert the 5363B probes, A and B, into their adjacent calibration jacks.

d. Set the 5363B A channel thumbwheel switches to read A; 0.00; $\mathcal{F}$.

e. Set the 5363B B channel thumbwheel switches to read B; 0.00. $\mathcal{F}$.

NOTE

Slope sections of START and STOP thumbwheel switches must be alike; i.e., both set at $\mathcal{F}$ before test is started.

f. Set the 5370A Counter controls as follows:

FUNCTION ..... TI
STATISTICS ..... MEAN
SAMPLE SIZE 100
DISPLAY RATE ..... 12 0'clock position
ARMING ..... ±TI
INPUTS START/STOP:
  LEVEL ..... PRESET
  INPUT IMPEDANCE ..... 50 ohm
  ÷1/÷10 ..... ÷1
  AC/DC ..... DC
  START COM/SEP ..... SEP
  SLOPE ..... $\mathcal{F}$

g. Lift and hold TIME ZERO/LEVEL switch.

h. The 5370A counter display now shows a differential channel delay (typically ±60 ps) introduced by the input channels of the counter.

i. Press 5370A SET REF key to take out the ±60 ps delay.

j. Remove the 50 ohm power splitter (11667A) and the cable that connects it to the 5363B.

k. Connect the two BNC-to-BNC cables of the 5370A START and STOP channels directly to the 5363B START and STOP outputs, respectively.

l. Turn the 5363B TIME/ZERO PULL TO ADD 10.0 ns knob fully CCW and CW; the 5370A display should show a range of approximately -1 to +1 ns.

m. Pull out the TIME/ZERO PULL TO ADD 10.0 ns knob.

n. Turn the TIME/ZERO PULL TO ADD 10.0 ns knob fully CCW and CW ;the 5370A display should show a range of approximately 9 to 11 ns.

o. Completion of this test concludes the Performance Test.

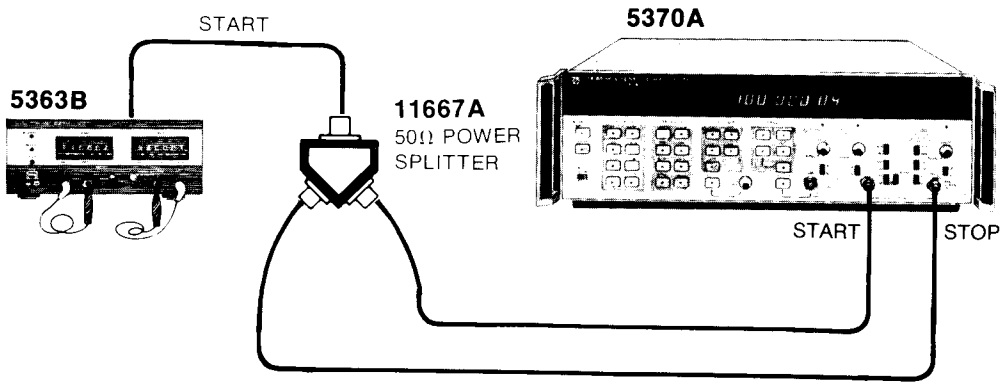


Figure 4-4. Performance Test for 5363B Delay Compensation Range

PERFORMANCE TEST RECORD

HEWLETT-PACKARD MODEL 5363B
TIME INTERVAL PROBE

Test Performed By _____

Serial No. _____

Date _____

DESCRIPTION	TEST LIMIT	CHECK
1. Accuracy Test		
A probe		
+9.20V	0.000 ns ±1 ns	_____
+0.80V	0.000 ns ±1 ns	_____
Test step e minus f	±1 ns	_____
B probe		
+9.20V	0.000 ns ±1 ns	_____
+0.80V	0.000 ns ±1 ns	_____
Test step e minus f	±1 ns	_____
A probe		
-9.20V	0.000 ns ±1 ns	_____
-0.80V	0.000 ns ±1 ns	_____
Test step e minus f	±1 ns	_____
B probe		
-9.20V	0.000 ns ±1 ns	_____
-0.80V	0.000 ns ±1 ns	_____
Test step e minus f	±1 ns	_____

2. Trigger Level Accuracy/Differential Trigger Accuracy		Trigger Slope Setting POS ⨍	NEG ⨍
A probe START at -8.50V	±85.0 mV	_____	_____
A probe STOP at -8.50V	±85.0 mV	_____	_____
A PROBE START — A PROBE STOP	±85.0 mV	_____	_____
A probe START at 5.05V	±16.0 mV	_____	_____
A probe STOP at 5.05V	±16.0 mV	_____	_____
A PROBE START — A PROBE STOP	±18.0 mV	_____	_____
A probe START at 9.95V	50.0 mV	_____	_____
A probe STOP at 9.95V	50.0 mV	_____	_____
A PROBE START — A PROBE STOP	100.0 mV	_____	_____
B probe START at -8.50V	±85.0 mV	_____	_____
B probe STOP at -8.50V	±85.0 mV	_____	_____
B PROBE START — B PROBE STOP	±85.0 mV	_____	_____
B probe START at 5.05V	±16.0 mV	_____	_____
B probe STOP at 5.05V	±16.0 mV	_____	_____
B PROBE START — B PROBE STOP	±18.0 mV	_____	_____
B probe START at 9.95V	50.0 mV	_____	_____
B probe STOP at 9.95V	50.0 mV	_____	_____
B PROBE START — B PROBE STOP	100.0 mV	_____	_____

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments that may be made to the HP 5363B. These ajustments should be made when the 5363B does not meet specifications, or if the performance test has been performed and the results indicate adjustments are necessary. The only equipment required for these adjustments is a HP 3490A Digital Voltmeter.

5-3. SAFETY CONSIDERATIONS

5-4. Although the 5363B 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 5363B in safe condition also see Section VIII of this manual. Service adjustments should be performed only by qualified personnel.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE (GROUNDING) CONDUCTOR OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL IS LIKELY TO MAKE THE 5363B DANGEROUS.

5-5. FACTORY SELECT COMPONENTS

5-6. Some component values of certain circuits are selected at the factory. These are identifiable by an asterisk immediately following the reference designator on the schematic and replaceable parts list. The nominal value of the component is listed. *Table 5-1* lists the parts by reference designator. The Manual Changes supplement will update any changes to factory selected component information.

Table 5-1. 5363B List of Factory Select Components

Reference Designator	Component Values	HP Part No.
A1R111, 121	270 ohms	0683-2715
	287 ohms Nominal	0698-3443
	300 ohms	0757-0911
	390 ohms	0698-4449
A1R110, 120	51.1 ohms Nominal	0757-0394
	(Change in pairs using 1% resistors)	
A2R54	9.5K ohms	0811-0655
	10K ohms Nominal	0811-0641
	10.5K ohms	0811-0656

5-7. DAC ADJUSTMENT PROCEDURE

a. Remove top cover of 5363B and connect DVM to pin 7 of A1U9 (05363-60011) and ▽ (common).

b. Jumper together the ▽ (common) and DAC OFFSET test points on the motherboard (05363-60011).

c. Apply power to the 5363B.

d. Set START switches to -0.00V and adjust resistor A2R40 (-zero) for a reading of +0.075 ±0.001V on the DVM.

e. Set START switches to +0.00V and adjust resistor A2R42 (+zero) for a reading of +0.075 ±0.001V on the DVM.

f. Repeat steps d and e until + and - zero readings are the same.

g. Set START switches to +9.99V and adjust resistor A2R46 (+gain) for a reading of +10.065 ±0.001V on the DVM.

h. Set START switches to -9.99V and adjust resistor A2R45 (-gain) for a reading of -9.915 ±0.001V on the DVM.

i. Repeat steps g and h (if necessary) until + and - gain readings are within tolerances.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. *Table 6-2* lists parts in alphanumerical order of their reference designators and indicates the description and HP part number for each part, together with any applicable notes. The tables also include the following information.

a. Description of part (see list of abbreviations in *Table 6-1*).

b. Typical manufacturer of the part in a five-digit code (see list of manufacturers in *Table 6-3*).

c. Manufacturer's part number.

d. Total quantity used in the instrument.

6-3. Miscellaneous parts are listed in *Table 6-2* following their respective assemblies. General miscellaneous parts are listed at the end of *Table 6-2*.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order of inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers, and reference designation (including instrument model number).

6-6. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

Table 6-1. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS

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

ABBREVIATIONS

A	= ampere	HD	= head	NE	= neon	SPST	= single-pole, single-throw
ac	= alternating current	HDW	= hardware	NEG	= negative	SSB	= single sideband
ACCESS	= accessory	HF	= high frequency	nF	= nanofarad	SST	= stainless steel
ADJ	= adjustment	HG	= mercury	NI PL	= nickel plate	STL	= steel
A/D	= analog-to-digital	HI	= high	N/O	= normally open	SQ	= square
AF	= audio frequency	HP	= Hewlett-Packard	NOM	= nominal	SWR	= standing-wave ratio
AFC	= automatic frequency control	HPF	= high pass filter	NORM	= normal	SYNC	= synchronize
AGC	= automatic gain control	HR	= hour (used in parts list)	NPN	= negative-positive-negative	T	= timed (slow-blow fuse)
AL	= aluminum	HV	= high voltage	NPO	= negative-positive zero (zero temperature coefficient	TA	= tantalum
ALC	= automatic level control	Hz	= hertz	NRFR	= not recommended for field replacement	TC	= temperature compensating
AM	= amplitude modulation	IC	= integrated circuit	ns	= nanosecond	TD	= time delay
AMPL	= amplifier	ID	= inside diameter	NSR	= not separately replaceable	TERM	= terminal
APC	= automatic phase control	IF	= intermediate frequency	nW	= nanowatt	TFT	= thin-film transistor
ASSY	= assembly	IMPG	= impregnated	OBD	= order by description	TGL	= toggle
AUX	= auxiliary	in	= inch	OD	= outside diameter	THD	= thread
AVG	= average	INCD	= incandescent	OH	= oval head	THRU	= through
AWG	= american wire gauge	INCL	= include(s)	OP AMPL	= operational amplifier	TI	= titanium
BAL	= balance	INP	= input	OPT	= option	TOL	= tolerance
BCD	= binary coded decimal	INS	= insulation	OSC	= oscillator	TRIM	= trimmer
BD	= board	INT	= internal	OX	= oxide	TSTR	= transistor
BE CU	= beryllium copper	kg	= kilogram	oz	= ounce	TTL	= transistor-transistor logic
BFO	= beat frequency oscillator	kHz	= kilohertz	Ω	= ohm	TV	= television
BH	= binder head	kΩ	= kilohm	P	= peak (used in parts list)	TVI	= television interference
BKDN	= breakdown	kV	= kilovolt	PAM	= pulse-amplitude modulation	TWT	= traveling wave tube
BP	= bandpass	lb	= pound	PC	= printed circuit	U	= micro (10^{-6}) (used in parts list)
BPF	= bandpass filter	LC	= inductance-capacitance	PCM	= pulse-code modulation; pulse-count modulation	UF	= microfarad (used in parts list)
BRS	= brass	LED	= light-emitting diode	PDM	= pulse-duration modulation	UHF	= ultrahigh frequency
BWO	= backward-wave oscillator	LF	= low frequency	pF	= picofarad	UNREG	= unregulated
CAL	= calibrate	LG	= long	PH BRZ	= phosphor bronze	V	= volt
ccw	= counterclockwise	LH	= left hand	PHL	= phillips	VA	= voltampere
CER	= ceramic	LIM	= limit	PIN	= positive-intrinsic-negative	Vac	= volts ac
CHAN	= channel	LIN	= linear taper (used in parts list)	PIV	= peak inverse voltage	VAR	= variable
cm	= centimeter	lin	= linear	pk	= peak	VCO	= voltage-controlled oscillator
CMO	= coaxial	LK WASH	= lockwasher	PL	= phase lock	Vdc	= volts dc
COEF	= coefficient	LO	= low; local oscillator	PLO	= phase lock oscillator	VDCW	= volts, dc, working (used in parts list)
COM	= common	LOG	= logarithmic taper (used in parts list)	PM	= phase modulation	V-F	= volts, filtered
COMP	= composition	log	= logarithmic	PNP	= positive-negative-positive	VFO	= variable-frequency oscillator
COMPL	= complete	LPF	= low pass filter	P/O	= part of	VHF	= very-high frequency
CONN	= connector	LV	= low voltage	POLY	= polystyrene	Vpk	= volts peak
CP	= cadmium plate	m	= metre (distance)	PORC	= porcelain	Vp-p	= volts peak-to-peak
CRT	= cathode-ray tube	mA	= milliampere	POS	= positive, position(s) (used in parts list)	Vrms	= volts rms
CTL	= complementary transistor logic	MAX	= maximum	POSN	= position	VSWR	= voltage standing wave ratio
CW	= continuous wave	MΩ	= megohm	POT	= potentiometer	VTO	= voltage-tuned oscillator
cw	= clockwise	MEG	= meg (10^6) (used in parts list)	p-p	= peak-to-peak	VTVM	= vacuum-tube voltmeter
D/A	= digital-to-analog	MET FLM	= metal film	PP	= peak-to-peak (used in parts list)	V/X	= volts, switched
dB	= decibel	MET OX	= metal oxide	PPM	= pulse-position modulation	W	= watt
dBm	= decibel referred to 1 mW	MF	= medium frequency; microfarad (used in parts list)	PREAMPL	= preamplifier	W/	= with
dc	= direct current	MFR	= manufacturer	PRF	= pulse-repetition frequency	WIV	= working inverse voltage
deg	= degree (temperature interval or difference)	mg	= milligram	PRR	= pulse repetition rate	WW	= wirewound
... °	= degree (plane angle)	MHz	= megahertz	ps	= picosecond	W/O	= without
°C	= degree Celsius (centrigrade)	mH	= millihenry	PT	= point	YIG	= yttrium-iron-garnet
°F	= degree Fahrenheit	mho	= conductance	PTM	= pulse-time modulation	Zo	= characteristic impedance
°K	= degree Kelvin	MIN	= minimum	PWM	= pulse-width modulation		
DEPC	= deposited carbon	min	= minute (time)	PWV	= peak working voltage		
DET	= detector	... '	= minute (plane angle)	RC	= resistance capacitance		
diam	= diameter	MINAT	= miniature	RECT	= rectifier		
DIA	= diameter (used in parts list)	mm	= millimetre	REF	= reference		
DIFF AMPL	= differential amplifier	MOD	= modulator	REG	= regulated		
div	= division	MOM	= momentary	REPL	= replaceable		
DPDT	= double-pole, double-throw	MOS	= metal-oxide semiconductor	RF	= radio frequency		
DR	= drive	ms	= millisecond	RFI	= radio frequency interference		
DSB	= double sideband	MTG	= mounting	RH	= round head; right hand		
DTL	= diode transistor logic	MTR	= meter (indicating device)	RLC	= resistance-inductance-capacitance		
DVM	= digital voltmeter	mV	= millivolt	RMO	= rack mount only		
ECL	= emitter coupled logic	mVac	= millivolt, ac	rms	= root-mean-square		
EMF	= electromotive force	mVdc	= millivolt, dc	RND	= round		
EDP	= electronic data processing	mVpk	= millivolt, peak	ROM	= read-only memory		
ELECT	= electrolytic	mVp-p	= millivolt, peak-to-peak	R&P	= rack and panel		
ENCAP	= encapsulated	mVrms	= millivolt, rms	RWV	= reverse working voltage		
EXT	= external	mW	= milliwatt	S	= scattering parameter		
F	= farad	MUX	= multiplex	s	= second (time)		
FET	= field-effect transistor	MY	= mylar	... "	= second (plane angle)		
F/F	= flip-flop	μA	= microampere	S-B	= slow-blow fuse (used in parts list)		
FH	= flat head	μF	= microfarad	SCR	= silicon controlled rectifier; screw		
FOL H	= fillister head	μH	= microhenry	SE	= selenium		
FM	= frequency modulation	μmho	= micromho	SECT	= sections		
FP	= front panel	μs	= microsecond	SEMICON	= semiconductor		
FREQ	= frequency	μV	= microvolt	SHF	= superhigh frequency		
FXD	= fixed	μVac	= microvolt, ac	SI	= silicon		
g	= gram	μVdc	= microvolt, dc	SIL	= silver		
GE	= germanium	μVpk	= microvolt, peak	SL	= slide		
GHz	= gigahertz	μVp-p	= microvolt, peak-to-peak	SNR	= signal-to-noise ratio		
GL	= glass	μVrms	= microvolt, rms	SPDT	= single-pole, double-throw		
GND	= ground ed	μW	= microwatt	SPG	= spring		
H	= henry	nA	= nanoampere	SR	= split ring		
h	= hour	NC	= no connection				
HET	= heterodyne	N/C	= normally closed				
HEX	= hexagonal						

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}

6-7. HP PART NUMBER ORGANIZATION

6-8. Following is a general description of the HP part number system.

6-9. Component Parts and Materials

6-10. Generally, the prefix of HP part numbers identifies the type of device. Eight digit part numbers are used, where the four-digit prefix identifies the type of component, part, or material and the four-digit suffix indicates the specific type. Following is a list of some of the more commonly used prefixes for component parts. The list includes HP manufactured parts and purchased parts.

Prefix	Component/Part/Material
0121-	Capacitors, Variable (mechanical)
0122-	Capacitors, Voltage Variable (semiconductor)
0140-	Capacitors, Fixed } Non-Electrolytic
0150-	Capacitors, Fixed } Non-Electrolytic
0160-	Capacitors, Fixed } Non-Electrolytic
0180-	Capacitors, Fixed Electrolytic
0330-	Insulting Materials
0340-	Insultors, Formed
0370-	Knobs, Control
0380-	Spacers and Standoffs
0410-	Crystals
0470-	Adhesives
0490-	Relays
0510-	Fasteners
0674- thru 0778-	Resistors, Fixed (non wire wound)
0811- thru 0831-	Resistors (wire wound)
1200-	Sockets for components
1205-	Heat Sinks
1250-	Connectors (RF and related parts)
1251-	Connectors (non-RF and related parts)
1410-	Bearings and Bushings
1420-	Batteries
1820-	Monolithic Digital Integrated Circuits
1826-	Monolithic Linear Integrated Circuits
1850-	Transistors, Germanium PNP
1851-	Transistors, Germanium NPN
1853-	Transistors, Silicon PNP
1854-	Transistors, Silicon NPN
1855-	Field-Effect-Transistors
1900- thru 1912-	Diodes
1920- thru 1952-	Vacuum Tubes
1990-	Semiconductor Photosensitive and Light-Emitting Diodes
3100- thru 3106-	Switches
8120-	Cables
9100-	Transformers, Coils, Chokes, Inductors, and Filters

6-11. For example, 1854-0037, 1854-0221, and 1851-0192 are all NPN transistors. The first two are silicon and the last is germanium.

6-12. The following list gives the prefixes for HP manufactured parts used in several instruments, e.g., side frames, feet, top and bottom covers, etc. These are eight digit part numbers with the four-digit prefix identifying the type of parts as shown below:

Type of Part	Prefix
Sheet Metal	5000- to 5019-
Machined	5020- to 5039-
Molded	5040- to 5059-
Assemblies	5060- to 5079-
Components	5080- to 5099-

6-13. Specific Instrument Parts

6-14. These are HP manufactured parts for use in individual instruments or series of instruments. For these parts, the prefix indicates the instrument and the suffix indicates the type of part. For example, 05345-60001 is an assembly used in the 5345A. Following is a list of suffixes commonly used.

Type of Part	P/N Suffix
Sheet Metal	-00000 to -00499
Machined	-20000 to -20499
Molded	-40000 to -40499
Assemblies	-60000 to -60499
Components	-80000 to -80299
Documentation	-90000 to -90249

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	05363-60011	3	1	MOTHERBOARD ASSEMBLY (SERIES 2116)	28480	05363-60011
A1C1	0180-2154	1	1	CAPACITOR-FXD 1900UF+75-10% 15VDC AL	28480	0180-2154
A1C2	0180-2382	7	2	CAPACITOR-FXD 1500UF+75-10% 30VDC AL	28480	0180-2382
A1C3	0180-2382	7		CAPACITOR-FXD 1500UF+75-10% 30VDC AL	28480	0180-2382
A1C4	0180-0210	6	2	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A1C5	0160-0127	2	2	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A1C6	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A1C7	0160-3879	7	25	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C8	0180-1735	2	1	CAPACITOR-FXD .22UF+-10% 35VDC TA	56289	150D224X9035A2
A1C9	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A1C10	0180-0210	6		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A1C11	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A1C12	0180-0116	1	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A1C13	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C14	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C15	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C16	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C17	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C18	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C19	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C20	0160-3876	4	8	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C21	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C22	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C23	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C24	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C25	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C26	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C27	0160-3876	4		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1C28	0180-1746	5	2	CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1C29	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C31	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C33	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C35	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C37	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C38	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C39	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C40	0160-2306	3	1	CAPACITOR-FXD 27PF +-5% 300VDC MICA	28480	0160-2306
A1C41	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C42	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C43	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C44	0180-1746	5		CAPACITOR-FXD 15UF+-10% 20VDC TA	56289	150D156X9020B2
A1C45	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C46	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1C47	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1CR1	1906-0096	7	1	DIODE-FW BRDG 200V 2A	04713	MDA202
A1CR2	1901-0028	5	8	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR3	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR4	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR5	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR6	1902-3224	1	1	DIODE-ZNR 17.8V 5% DO-35 PD=.4W	28480	1902-3224
A1CR7	1902-0551	1	2	DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A1CR8	1902-0551	1		DIODE-ZNR 6.2V 5% PD=1W IR=10UA	28480	1902-0551
A1CR9	1901-0040	1	11	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR10	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR11	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR12	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR13	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR14	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR15	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR16	0122-0065	7	1	DIODE-VVC 29PF 3%	28480	0122-0065
A1CR17	1901-0535	9	4	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A1CR18	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A1CR19	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR20	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR21	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR22	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR23	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A1CR24	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A1CR25	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1CR26	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR27	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1CR28	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A1J1	1251-3768	7	1	CONTACT-CONN U/W-POST-TYPE MALE DPSLDR	28480	1251-3768
A1J2	1200-0473	8	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0473
A1J3	1251-2035	9	2	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1J4	1251-2035	9		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1K1	0490-0596	8	1	RELAY 2C 6VDC-COIL .5A 120VAC	28480	0490-0596
A1L1	9100-1788	6	6	CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1L3	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1L4	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1L5	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1L6	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHM@ 100 MHZ	02114	VK200 20/4B
A1Q1	1854-0071	7	10	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q3	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q4	1853-0020	4	4	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q6	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q7				NOT ASSIGNED		
A1Q8	1853-0379	6	4	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0379
A1Q9	1853-0379	6		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0379
A1Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q11	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q12	1853-0379	6		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0379
A1Q13	1853-0379	6		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0379
A1Q14				NOT ASSIGNED		
A1Q15	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q16	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q17	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q18	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q19	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q20	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1R1	0757-0449	6	18	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R2	0683-4725	2	10	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R3	0757-0442	9	21	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R4	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R5	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R7	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R8	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R9	0757-0469	9	1	RESISTOR 150K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1503-F
A1R10	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R11	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R12	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R13	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R14	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R15	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R16	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R17	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R18	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R19	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R20	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R21	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R22	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R23	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R24	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R25	0698-3442	9	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A1R26	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R27	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R28	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R29	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R30	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R31	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R32	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R33	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R34	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R35	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R36	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R37	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R38	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R39	0757-0449	6		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A1R40	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R41	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R42	0683-2025	1	2	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A1R43	0683-2025	1		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A1R44	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R45	0683-2215	1	1	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A1R46	0683-1825	7	1	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A1R47	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+960	01121	CB1055
A1R48	0683-1035	1	6	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R49	0683-3025	3	1	RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A1R50	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R51	0683-1235	3	1	RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A1R52	0683-6225	1	1	RESISTOR 6.2K 5% .25W FC TC=-400/+700	01121	CB6225
A1R53	0683-1025	9	4	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R54	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R55	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R56	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R57	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R58	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R59	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R60	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R61	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R62				NOT ASSIGNED		
A1R63				NOT ASSIGNED		
A1R64	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R65	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1R66	0683-1015	7	2	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R67	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R68	0683-5115	6	12	RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R69	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R70	0683-1525	4	2	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A1R71	0698-0082	7	8	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R72	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R73	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R74	0757-0405	4	6	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R75	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R76	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R77	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R78	0757-0279	0	2	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R79	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R80	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R81	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R82	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R83	0757-0279	0		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R84	0757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A1R85	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R86	0698-0082	7		RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R87	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A1R88	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R89	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R90	0757-0387	1	8	RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R91	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R92	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R93	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R94	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R95	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R96	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R97	0757-0387	1		RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A1R98	0683-3625	9	1	RESISTOR 3.6K 5% .25W FC TC=-400/+700	01121	CB3625
A1R99	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1R100	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R101	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A1R102	0683-4305	4	2	RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A1R103	0683-2015	9	4	RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A1R104	0757-0401	0	4	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R105	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R106	0683-7515	4	1	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A1R107	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R108	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R109	0757-0736	4	2	RESISTOR 1.5K 1% .25W F TC=0+-100	24546	C5-1/4-T0-1501-F
A1R110	0757-0394	0	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1R111*	0698-3443	0	2	RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A1R112	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R113	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R114	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A1R115	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A1R116	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R117	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R118	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R119	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R120	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1R121*	0698-3443	0		RESISTOR 287 1% .125W F TC=0+-100	24546	C4-1/8-T0-287R-F
A1R122	0757-0736	4		RESISTOR 1.5K 1% .25W F TC=0+-100	24546	C5-1/4-T0-1501-F
A1R123	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R124	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R125	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A1R126	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R127	0683-5115	6		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A1R128	0683-4305	4		RESISTOR 43 5% .25W FC TC=-400/+500	01121	CB4305
A1R129				NOT ASSIGNED		
A1R130	1810-0164	7	2	NETWORK-RES 9-SIP4.7K OHM X 8	91637	CSP09C07-472J
A1R131	1810-0055	5	1	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0055
A1R132	1810-0164	7		NETWORK-RES 9-SIP4.7K OHM X 8	91637	CSP09C07-472J
A1R133	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1SW1	3101-0680	1	1	SWITCH-PB DPDT ALTNG 4A 250VAC	28480	3101-0680
A1TP1	0360-0124	3	4	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1U1	1820-1114	0	4	IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	04713	MC14516BCP
A1U2	1820-1371	1	1	IC SWITCH ANLG DUAL 14-DIP-C PKG	27014	AH0152CD
A1U3	1820-1114	0		IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	04713	MC14516BCP
A1U4	1820-1114	0		IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	04713	MC14516BCP
A1U5	1820-0493	6	1	IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A1U6	1820-1114	0		IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	04713	MC14516BCP
A1U7	1826-0208	3	2	IC OP AMP GP 8-DIP-P PKG	27014	LM310N
A1U8	1826-0208	3		IC OP AMP GP 8-DIP-P PKG	27014	LM310N
A1U9	1820-1370	0	1	IC SWITCH ANLG DUAL 14-DIP-C PKG	27014	AH0134CD
A1U10	1820-2053	8	2	IC DCDR TTL LS BCD 4-TO-16-LINE	18324	74LS154N
A1U11	1820-2053	8		IC DCDR TTL LS BCD 4-TO-16-LINE	18324	74LS154N
A1U13	1858-0041	9	4	TRANSISTOR-DUAL H.F. (PAIR)	28480	1858-0041
A1U14	1826-0205	0	1	IC TIMER TTL	18324	NE556A
A1U15	1820-0615	4	2	IC MUXR/DATA-SEL TTL 8-TO-1-LINE 8-INP	04713	MC8312P
A1U16	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A1U17	1858-0041	9		TRANSISTOR-DUAL H.F. (PAIR)	28480	1858-0041
A1U18	1820-1565	5	1	IC COMPARATOR HS DUAL 16-DIP-C PKG	28480	1820-1565
A1U19	1820-1224	3	1	IC RCVR ECL LINE RCVR TPL 2-INP	04713	MC10216P
A1U20	1820-1885	2	1	IC RGTR TTL LS D-TYPE QUAD	04713	SN74LS173N
A1U21	1820-0615	4		IC MUXR/DATA-SEL TTL 8-TO-1-LINE 8-INP	04713	MC8312P
A1U22	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A1U23	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A1U24	1858-0041	9		TRANSISTOR-DUAL H.F. (PAIR)	28480	1858-0041
A1U25	1820-1391	5	2	IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	27014	MM74C161N
A1U26	1820-0833	8	1	IC LCH TTL COM CLEAR 8-BIT	07263	9334PC
A1U27	1858-0041	9		TRANSISTOR-DUAL H.F. (PAIR)	28480	1858-0041
A1U28	1820-1391	5		IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	27014	MM74C161N
A1U29	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A1U30	1818-2294	4	1	IC-MOS ROM 256 X 16	28480	1818-2294
A1XU10	1200-0565	9	2	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A1XU11	1200-0565	9		SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
				A1 MISCELLANEOUS PARTS		
	0380-0111	0	6	STANDOFF-RVT-ON .25-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	1200-0469	2	1	SOCKET-IC 28-CONT DIP-SLDR	28480	1200-0469
	1200-0474	9	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
	1200-0475	0	64	CONNECTOR-SGL CONT SKT .017-IN-BSC-SZ	28480	1200-0475
	1400-0776	8	1	CABLE TIE .01-4-DIA .19-WD NYL	28480	1400-0776

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	05363-60012	4	1	DAC ASSEMBLY (SERIES 2116)	28480	05363-60012
A2C1	0180-0291	3	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C2	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C3	0160-3879	7	3	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C4	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C5	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C6	0160-2199	2	2	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A2C7	0160-2199	2		CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A2CR1	1901-0040	1	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR4	1901-0535	9	1	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A2CR5	1902-0071	0	1	DIODE-ZNR 9V 5% DO-14 PD=.4W TC=+.001%	28480	1902-0071
A2CR6	1901-0028	5	2	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A2CR7	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A2Q1				NOT ASSIGNED		
A2Q2				NOT ASSIGNED		
A2Q3	1853-0036	2	1	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A2Q4	1854-0215	1	2	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q6	1855-0403	1	2	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0403
A2Q7	1855-0403	1		TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0403
A2R1	1810-0176	1	1	NETWORK-RES 5-SIP4.7K OHM X 4	28480	1810-0176
A2R2	1810-0055	5	1	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0055
A2R3	0811-0640	5	8	RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R4	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R5	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R6	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R7	0811-0618	7	5	RESISTOR 100K .1% .125W PWW TC=0+-10	28480	0811-0618
A2R8	0811-0618	7		RESISTOR 100K .1% .125W PWW TC=0+-10	28480	0811-0618
A2R9	0811-0618	7		RESISTOR 100K .1% .125W PWW TC=0+-10	28480	0811-0618
A2R10	0811-0618	7		RESISTOR 100K .1% .125W PWW TC=0+-10	28480	0811-0618
A2R11	0757-0465	6	5	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R12	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R13	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R14	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R15	0811-0648	3	3	RESISTOR 50K .01% .125W PWW TC=0+-10	28480	0811-0648
A2R16	0811-0648	3		RESISTOR 50K .01% .125W PWW TC=0+-10	28480	0811-0648
A2R17	0811-0648	3		RESISTOR 50K .01% .125W PWW TC=0+-10	28480	0811-0648
A2R18	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R19	0811-0647	2	3	RESISTOR 50K .1% .125W PWW TC=0+-10	28480	0811-0647
A2R20	0811-0647	2		RESISTOR 50K .1% .125W PWW TC=0+-10	28480	0811-0647
A2R21	0811-0647	2		RESISTOR 50K .1% .125W PWW TC=0+-10	28480	0811-0647
A2R22	0811-0618	7		RESISTOR 100K .1% .125W PWW TC=0+-10	28480	0811-0618
A2R23	0698-4009	6	4	RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A2R24	0698-4009	6		RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A2R25	0698-4009	6		RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A2R26	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A2R27	0811-0645	0	1	RESISTOR 409.09K .01% .125W PWW TC=0+-10	28480	0811-0645
A2R28	0811-0644	9	1	RESISTOR 453K .01% .125W PWW TC=0+-10	28480	0811-0644
A2R29	0811-0646	1	1	RESISTOR 50K 1% .125W PWW TC=0+-5	28480	0811-0646
A2R30	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R31	0683-1035	1	4	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R32	0683-4725	2	1	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R33	0698-4009	6		RESISTOR 50K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5002-F
A2R34	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A2R35	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R36	0683-1065	7	2	RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
A2R37	0811-0640	5		RESISTOR 100K .01% .125W PWW TC=0+-10	28480	0811-0640
A2R38	0683-1065	7		RESISTOR 10M 5% .25W CC TC=-900/+1100	01121	CB1065
A2R39	0683-1855	3	1	RESISTOR 1.8M 5% .25W FC TC=-900/+1100	01121	CB1855
A2R40	2100-2533	8	2	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3009P-1-203
A2R41	0683-2755	4	1	RESISTOR 2.7M 5% .25W FC TC=-900/+1100	01121	CB2755
A2R42	2100-2533	8		RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TRN	32997	3009P-1-203
A2R43	0683-8225	5	2	RESISTOR 8.2K 5% .25W FC TC=-400/+700	01121	CB8225
A2R44	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R45	2100-2715	4	2	RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3009P-1-202
A2R46	2100-2715	4		RESISTOR-TRMR 2K 10% C SIDE-ADJ 17-TRN	32997	3009P-1-202
A2R47	0683-8225	5		RESISTOR 8.2K 5% .25W FC TC=-400/+700	01121	CB8225
A2R48	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R49	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A2R50	3698-3161	9	1	RESISTOR 38.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3832-F

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R51	0811-0643	8	1	RESISTOR 100K 1% .125W PWW TC=0+-5	28480	0811-0643
A2R52	0811-0642	7	1	RESISTOR 61K 1% .125W PWW TC=0+-5	28480	0811-0642
A2R53	0698-3441	8	1	RESISTOR 215 1% .125W F TC=0+-100	24546	C4-1/8-T0-215R-F
A2R54*	0811-0656	3	1	RESISTOR 10.5K 1% .125W PWW TC=0+-5	28480	0811-0656
A2R56	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A2TP1	0360-0124	3	4	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A2U1	1820-0477	6	2	IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A2U2	1820-0958	8	3	IC LCH CMOS D-TYPE QUAD	3L585	CD4042AF
A2U3	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	S0545	UPC301AC
A2U4	1820-0958	8		IC LCH CMOS D-TYPE QUAD	3L585	CD4042AF
A2U5	1820-0958	8		IC LCH CMOS D-TYPE QUAD	3L585	CD4042AF
A2U6	1858-0035	1	2	TRANSISTOR ARRAY 14-PIN PLSTC DIP	28480	1858-0035
A2U7	1820-0928	2	1	IC BFR CMOS QUAD	3L585	CD4041AE
A2U8	1820-0493	6	2	IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A2U9	1820-0493	6		IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A2U10	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2U11	1858-0035	1		TRANSISTOR ARRAY 14-PIN PLSTC DIP	28480	1858-0035
				A2 MISCELLANEOUS PARTS		
	0360-0065	1		TERMINAL-STUD PKD-TUR SWGFRM-MTG	28480	0360-0065
	0159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	0159-0005

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	05363-60003	3	1	CALIBRATE ASSEMBLY (SERIES 1504)	28480	05363-60003
A3C1	0160-4084	8	4	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C2	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C3	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3C4	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A3C5	0160-3847	9	2	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A3C6	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A3C7	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A3CR5	1901-0535	9	2	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A3CR6	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A3CR7	1901-0029	6	1	DIODE-PWR RECT 600V 750MA DO-29	28480	1901-0029
A3DS1	1990-0486	6	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A3DS2	1990-0486	6		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4684
A3DS3	1990-0485	5	2	LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A3DS4	1990-0485	5		LED-LAMP LUM-INT=800UCD IF=30MA-MAX	28480	5082-4984
A3DS5	1990-0487	7	2	LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A3DS6	1990-0487	7		LED-LAMP LUM-INT=1MCD IF=20MA-MAX BVR=5V	28480	5082-4584
A3J1	1251-3762	1	2	CONNECTOR 5-PIN F POST TYPE	28480	1251-3762
A3J2	1251-3923	6	1	CONNECTOR 6-PIN F POST TYPE	28480	1251-3923
A3J3	1251-3762	1		CONNECTOR 5-PIN F POST TYPE	28480	1251-3762
A3J5	1251-3939	4	2	ADAPTOR-PROBE TO PC BD BE CU: BRIGHT NI	28480	1251-3939
A3J6	1251-3939	4		ADAPTOR-PROBE TO PC BD BE CU: BRIGHT NI	28480	1251-3939
A3L1	9100-2276	9	1	INDUCTOR RF-CH-MLD 100UH 10% .105DX.26LG	28480	9100-2276
A3L2	8159-0005	0	1	RESISTOR-ZERO OHMS 22 AWG LEAD DIA	28480	8159-0005
A3Q1	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q2	1853-0015	7	3	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q3	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q4	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3R1	0683-2015	9	6	RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R2	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R3	0683-2715	6	1	RESISTOR 270 5% .25W FC TC=-400/+630	01121	CB2715
A3R4	0683-1215	9	1	RESISTOR 120 5% .25W FC TC=-400/+600	01121	CB1215
A3R5	0683-4715	0	1	RESISTOR 470 5% .25W FC TC=-400/+630	01121	CB4715
A3R6	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R7	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R8	0698-5174	8	2	RESISTOR 200 5% .125W CC TC=-330/+800	01121	BB2015
A3R9	0683-1025	9	1	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A3R10	0698-3114	2	3	RESISTOR 300 5% .125W CC TC=-330/+800	01121	BB3015
A3R11	0698-3114	2		RESISTOR 300 5% .125W CC TC=-330/+800	01121	BB3015
A3R12	0698-3114	2		RESISTOR 300 5% .125W CC TC=-330/+800	01121	BB3015
A3R13	0760-0008	0	1	RESISTOR 470 5% 1W MO TC=0+-200	28480	0760-0008
A3R14	0683-5105	4	1	RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A3R15	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R16	0683-2015	9		RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A3R17	0698-5174	8		RESISTOR 200 5% .125W CC TC=-330/+800	01121	BB2015
A3R18/S3	2100-3450	6	1	RESISTOR-VAR W/SW 50K 10% 1 TN 4PST-NC-NO	28480	2100-3450
A3S1	3101-1921	5	1	SWITCH-PB SPST MOM .1A	28480	3101-1921
A3S2	3101-1948	6	1	SWITCH-TGL SUBMIN DPDT .02A 20VAC/DC	28480	3101-1948
	05000-20017	7	6	SPACER-L.E.D. (SINGLE)	28480	05000-20017
	1530-1759	4	2	PIN-.24 X .12 DIA	28480	1530-1759
	3050-0376	3	1	WASHER-FL NM NO. 12 .25-IN-ID .5-IN-OD	28480	3050-0376
	3050-0381	0	1	WASHER-FL NM 1/4 IN .266-IN-ID	28480	3050-0381

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	05363-60004	4	1	THUMBWHEEL ASSEMBLY (SERIES 1504)	28480	05363-60004
A4CR1	1901-0535	9	30	DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR2	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR3	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR4	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR5	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR6	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR7	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR8	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR9	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR10	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR11	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR12	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR13	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR14	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR15	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR16	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR17	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR18	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR19	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR20	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR21	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR22	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR23	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR24	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR25	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR26	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR27	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR28	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR29	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4CR30	1901-0535	9		DIODE-SM SIG SCHOTTKY	28480	1901-0535
A4P1	8120-2092	8	1	CABLE ASSY 26AWG 16-CNDCT	28480	8120-2092
A4S1	3100-3327	7	2	SWITCH-THUMBWHEEL 6 MOD; AND END CAPS	28480	3100-3327
A4S2	3100-3327	7		SWITCH-THUMBWHEEL 6 MOD; AND END CAPS	28480	3100-3327

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	05363-60006	6	1	HP-IB BOARD ASSEMBLY (SERIES 2116)	28480	05363-60006
A5C1	0160-0945	2	1	CAPACITOR-FXD 910PF +-5% 100VDC MICA	28480	0160-0945
A5C2	0160-0163	6	1	CAPACITOR-FXD .033UF +-10% 200VDC POLYE	28480	0160-0163
A5C3	0180-0106	9	1	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A5C4	0180-2698	8	1	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	28480	0180-2698
A5CR1	1901-0040	1	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5Q1	1854-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q2	1853-0016	8	1	TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A5R1	0683-6225	1	1	RESISTOR 6.2K 5% .25W FC TC=-400/+700	01121	CB6225
A5R2	0683-1025	9	3	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R3	0683-1035	1	6	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R4	0683-2015	9	1	RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A5R5	0683-1825	7	1	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A5R6	0683-1235	3	1	RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A5R7	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R8	0683-3025	3	1	RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A5R9	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R10	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R11	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R12	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R13	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R14	0683-4725	2	3	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A5R15	1810-0055	5	1	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0055
A5R16	1810-0136	3	2	NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0136
A5R17	1810-0136	3		NETWORK-RES 10-SIP MULTI-VALUE	28480	1810-0136
A5R18	1810-0041	9	1	NETWORK-RES 9-SIP2.7K OHM X 8	28480	1810-0041
A5R19	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R20	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A5R21	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A5S1	3101-1973	7	1	SWITCH-SL 7-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1973
A5TP1	0360-0124	3	2	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A5TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A5U1	1816-2259	7	1	IC-4K ROM 256 X 16	28480	1816-2259
A5U2	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A5U3	1820-0833	8	2	IC LCH TTL COM CLEAR 8-BIT	07263	9334PC
A5U4	1820-0833	8		IC LCH TTL COM CLEAR 8-BIT	07263	9334PC
A5U5	1820-0621	2	2	IC BFR TTL NAND QUAD 2-INP	01295	SN7438N
A5U6	1820-0621	2		IC BFR TTL NAND QUAD 2-INP	01295	SN7438N
A5U7	1820-0615	4	3	IC MUXR/DATA-SEL TTL 8-TO-1-LINE 8-INP	04713	MC8312P
A5U8	1820-1391	5	2	IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	27014	MM74C161N
A5U9	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A5U10	1820-1418	7	1	IC DCDR TTL LS BCD-TO-DEC 4-TO-10-LINE	01295	SN74LS42N
A5U11	1820-1479	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A5U12	1820-0615	4		IC MUXR/DATA-SEL TTL 8-TO-1-LINE 8-INP	04713	MC8312P
A5U13	1820-0615	4		IC MUXR/DATA-SEL TTL 8-TO-1-LINE 8-INP	04713	MC8312P
A5U14	1826-0355	1	1	IC TIMER TTL MONO/ASTBL	28480	1826-0355
A5U15	1820-1391	5		IC CNTR CMOS BIN SYNCHRO POS-EDGE-TRIG	27014	MM74C161N
A5U16	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A5U17	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A5U18	1820-1254	9	1	IC BFR TTL NON-INV HEX 1-INP	27014	DM8095N
A5U19	1816-1089	9	1	IC-TTL 74LS189	27014	DM74LS189N
A5U20	1820-0706	4	1	IC COMPTR TTL MAGTD 5-BIT	07263	9324PC
				A5 MISCELLANEOUS		
	1200-0469	2	1	SOCKET-IC 28-CONT DIP-SLDR	28480	1200-0469
	1200-0556	8	1	SOCKET-DSPL 14-CONT DIP-SLDR	28480	1200-0556
	1251-3283	1	1	CONNECTOR 24-PIN F MICRORIBBON	28480	1251-3283
	1530-1398	4	2	CLEVIS 0.970-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
	3050-0454	8	2	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0454

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	05363-60107	8	1	PROBE ASSEMBLY,CHANNEL "A" (SERIES 2020)	28480	05363-60107
A6C1	0160-4277	1	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	16546	W100BC102M(PD-AG)
A6C2	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C4	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6CR1	1902-0126	6	2	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A6CR2	1902-0126	6		DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A6Q1	1854-0210	6	2	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A6Q2	1854-0210	6		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A6R1	0698-8563	5	1	RESISTOR 1M 1% .15W C TC=0+-200	26654	3C105F
A6R2	0698-8554	4	1	RESISTOR 10K 2% .15W C TC=0+-200	26654	3C103G
A6R3	0698-7260	7	2	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R4	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A6R5	0675-1021	8	2	RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A6R6	0675-1021	8		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A6R7	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R11	0698-8882	1	1	RESISTOR 68 5% .15W C TC=0+-200	28480	0698-8882
A6U1	1855-0219	7	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE TO-78	28480	1855-0219
A6U2	1855-0219	7		TRANSISTOR-JFET DUAL N-CHAN D-MODE TO-78	28480	1855-0219
	0340-0410	8	2	INSULATOR-XSTR NYLON	28480	0340-0410
A6A1	05363-60013	5	1	PROBE-TIP ASSEMBLY	28480	05363-60013
				A6A1 MISCELLANEOUS PARTS		
A6A1MP1	05363-60009	9	1	TIP-BODY ASSEMBLY	28480	05363-60009
A6A1MP2	8710-0661	4	1	TIP-PROBE, HP	28480	8710-0661
A6A1MP3	05363-20204	2	1	PROBE PROTECTOR CAP	28480	05363-20204
A6A1MP4	05363-40001	9	1	PROBE BODY (PAIR)	28480	05363-40001
A6A1MP5	1530-1757	3	1	RING,CODING (BLK)	28480	1530-1757
A6A1W1	05363-60104	5	1	CABLE ASSEMBLY-30V MAX.	28480	05363-60104

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	05363-60108	9	1	PROBE ASSEMBLY-CHANNEL "B" (SERIES 2020)	28480	05363-60108
A7C1	0160-4277	1	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	16546	W100BC102M(PD-AG)
A7C2	0160-3879	7	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C3	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A7C4	0160-3878	6	1	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A7CR1	1902-0126	6	2	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A7CR2	1902-0126	6		DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.072%	28480	1902-0126
A7Q1	1854-0210	6	2	TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A7Q2	1854-0210	6		TRANSISTOR NPN 2N2222 SI TO-18 PD=500MW	04713	2N2222
A7R1	0698-8563	5	1	RESISTOR 1M 1% .15W C TC=0+-200	28654	3C105F
A7R2	0698-8554	4	1	RESISTOR 10K 2% .15W C TC=0+-200	28654	3C103G
A7R3	0698-7260	7	2	RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A7R4	0698-7260	7		RESISTOR 10K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1002-F
A7R5	0675-1021	8	2	RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A7R6	0675-1021	8		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A7R7	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R8	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A7R11	0698-8882	1	1	RESISTOR 68 5% .15W C TC=0+-200	28480	0698-8882
A7U1	1855-0219	7	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE TO-78	28480	1855-0219
A7U2	1855-0219	7		TRANSISTOR-JFET DUAL N-CHAN D-MODE TO-78	28480	1855-0219
	0340-0410	8	2	INSULATOR-XSTR NYLON	28480	0340-0410
A7A1	05363-60013	5	1	PROBE-TIP ASSEMBLY	28480	05363-60013
				(A7A1 MISCELLANEOUS PARTS)		
A7A1MP1	05363-60009	9	1	TIP BODY ASSEMBLY	28480	05363-60009
A7A1MP2	8710-0661	4	1	TIP-PROBE, HP	28480	8710-0661
A7A1MP3	05363-20204	2	1	PROBE PROTECTOR CAP	28480	05363-20204
A7A1MP4	05363-40001	9	1	PROBE BODY (PAIR)	28480	05363-40001
A7A1MP6	1530-1758	3	1	RING-CODING (BLUE)	28480	1530-1758
A7A1W1	05363-60104	5	1	CABLE ASSEMBLY- 30V MAX.	28480	05363-60104

See introduction to this section for ordering information
*Indicates factory selected value

Table 6-2. Replaceable Parts (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
C1				NOT ASSIGNED		
C2	0180-1735	2	2	CAPACITOR-FXD .22UF+-10% 35VDC TA	56289	150D224X9035A2
C3	0180-0230	0	1	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
C4	0180-1735	2		CAPACITOR-FXD .22UF+-10% 35VDC TA	56289	150D224X9035A2
C5	0170-0085	2	2	CAPACITOR-FXD .1UF +-20% 50VDC POLYE	84411	601PE1040R5W3
C6	0170-0085	2		CAPACITOR-FXD .1UF +-20% 50VDC POLYE	84411	601PE1040R5W3
DL1	05363-80001	3	1	DELAY LINE ASSEMBLY	28480	05363-80001
F1	2110-0235	0	1	FUSE .2A 250V TD 1.25X.25 UL	75915	313.200
F1	2110-0340	8	1	FUSE .4A 250V TD 1.25X.25 UL	75915	313.400
J1	1200-0456	7	3	SOCKET-XSTR 2-CONT TO-3	28480	1200-0456
J2	1200-0456	7		SOCKET-XSTR 2-CONT TO-3	28480	1200-0456
J3	1200-0456	7		SOCKET-XSTR 2-CONT TO-3	28480	1200-0456
J4	1251-2357	8	1	CONNECTOR-AC PWR (HP-9 MALE FLG-MTG)	28480	1251-2357
J5	1250-0118	3	6	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J6	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J7	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J8	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J9	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
J10	1250-0118	3		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0118
MP7	05363-20201	9	2	RING (FRONT)	28480	05363-20201
MP8	5040-7208	5	1	COVER (TOP)	28480	5040-7208
MP9	5040-7209	6	1	COVER (BOTTOM)	28480	5040-7209
MP10	5040-7201	8	4	FOOT	28480	5040-7201
MP11	1460-1345	5	2	TILT STAND SST	28480	1460-1345
MP12	5040-7212	1	2	COVER (SIDES)	28480	5040-7212
MP13	05363-00004	8	1	PANEL-REAR	28480	05363-00004
MP14	05363-00008	2	1	BRACKET (LEFT)	28480	05363-00008
MP15	05363-00003	7	1	BRACKET-TRANSFORMER	28480	05363-00003
MP16	59303-00004	9	1	BRACKET-BOARD	28480	59303-00004
MP17	5040-7203	0	1	TRIM-1/2 (TOP)	28480	5040-7203
MP18	5001-0438	7	2	TRIM-SIDE	28480	5001-0438
MP19	5020-8813	8	1	FRAME (FRONT)	28480	5020-8813
MP20	05363-00002	6	1	PANEL-SUB	28480	05363-00002
MP21	59308-60007	3	1	STRAP-GROUND 2 IN.	28480	59308-60007
S1	3101-1609	6	1	SWITCH-SLIDE	28480	3101-1609
T1	9100-3047	4	1	TRANSFORMER	28480	9100-3047
U1	1826-0169	5	1	IC V RGLTR TO-3	27014	LM320K-15
U2	1820-0430	1	1	IC 309 V RGLTR TO-3	07263	LM309K
U3	1826-0203	8	1	IC 7815 V RGLTR TO-3	07263	7815KC
U4	1826-0122	0	1	IC 7805 V RGLTR TO-220	07263	7805UC
U5	1826-0215	2	1	IC V RGLTR TO-220	04713	MC7905.2CT
W1	8120-1378	1		CABLE ASSY-18 AWG, 3-CNDUCT JGK-JKT	28480	8120-1378
W2	05363-60103	4	1	CABLE ASSY-OUTPUT	28480	05363-60103
W3	8120-0117	4	1	CABLE-COAX 50-OHM BRN 28.5PF/FT	28480	8120-0117
XF1	1400-0090	9	1	FUSEHOLDER COMPONENT FOR USE ON	28480	1400-0090
XF1	2110-0564	8	1	FUSEHOLDER BODY 12A MAX FOR UL	H9027	031.1657
XF1	2110-0565	9	1	FUSEHOLDER CAP 12A MAX FOR UL	28480	2110-0565
XF1	2110-0569	3	1	FUSEHOLDER COMPONENT NUT; THREAD M12.7	28480	2110-0569
XF1	2190-0037	8	1	WASHER-LK INTL T 1/2 IN .512-IN-ID	28480	2190-0037
				MISCELLANEOUS PARTS		
	01123-61302	9	2	GROUND-LEAD	28480	01123-61302
	0340-0525	6	1	INSULATOR-XSTR ALUMINUM HD-ANDZ	28480	0340-0525
	0340-0833	9	1	INSULATOR-XSTR POLYE	28480	0340-0833
	0370-0489	4	1	KNOB-CONCENTRIC .418 IN OD; .125 IN DIA	28480	0370-0489
	0370-0914	0	1	BEZEL-PB KNOB,.490LG,.330W,.165HI,JADE	28480	0370-0914
	0370-0970	8	1	PUSHBUTTON .230X.390X.413 IN H; JADE	28480	0370-0970
	0380-0644	4	2	STANDOFF-HEX .327-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	05363-00005	9	1	SPACER	28480	05363-00005
	05363-00007	1	1	SHIELD-R.F.I.	28480	05363-00007
	0570-0130	6	1	SCREW-MACH 6-32 .375-IN-LG BDG-HD-SLT	00000	ORDER BY DESCRIPTION
	0590-0579	9	1	NUT-KNRLD-R 1/4-40-THD .155-IN-THK .3-OD	28480	0590-0579
	1200-0043	8	1	INSULATOR-XSTR ALUMINUM	28480	1200-0043
	1410-0564	3	2	BUSHING-PNL .281-ID .46-LG 3/8-32-THD	28480	1410-0564
	2190-0016	3	6	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2200-0109	8	2	SCREW-MACH 4-40 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2420-0022	0	8	NUT-SPCLY 6-32-THD .23-IN-THK .354-OD	28480	2420-0022
	2510-0205	2	4	SCREW-MACH 8-32 .25-IN-LG PAN-HD-POZI	28480	2510-0205
	2950-0001	8	6	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2950-0038	1	1	NUT-SPCLY 1/2-24-THD .125-IN-THK	28480	2950-0038
	8120-1378	1	2	CABLE ASSY 18AWG 3-CNDCT JGK-JKT	28480	8120-1378

See introduction to this section for ordering information
*Indicates factory selected value

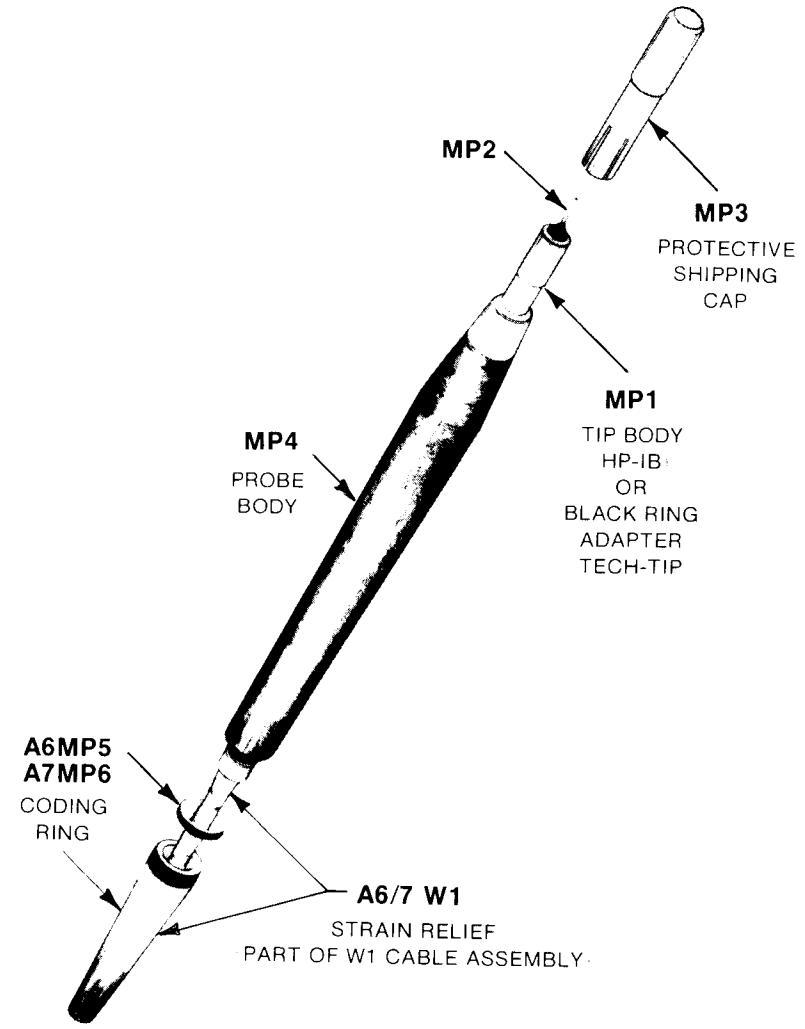


Figure 6-1. Probe Mechanical Parts

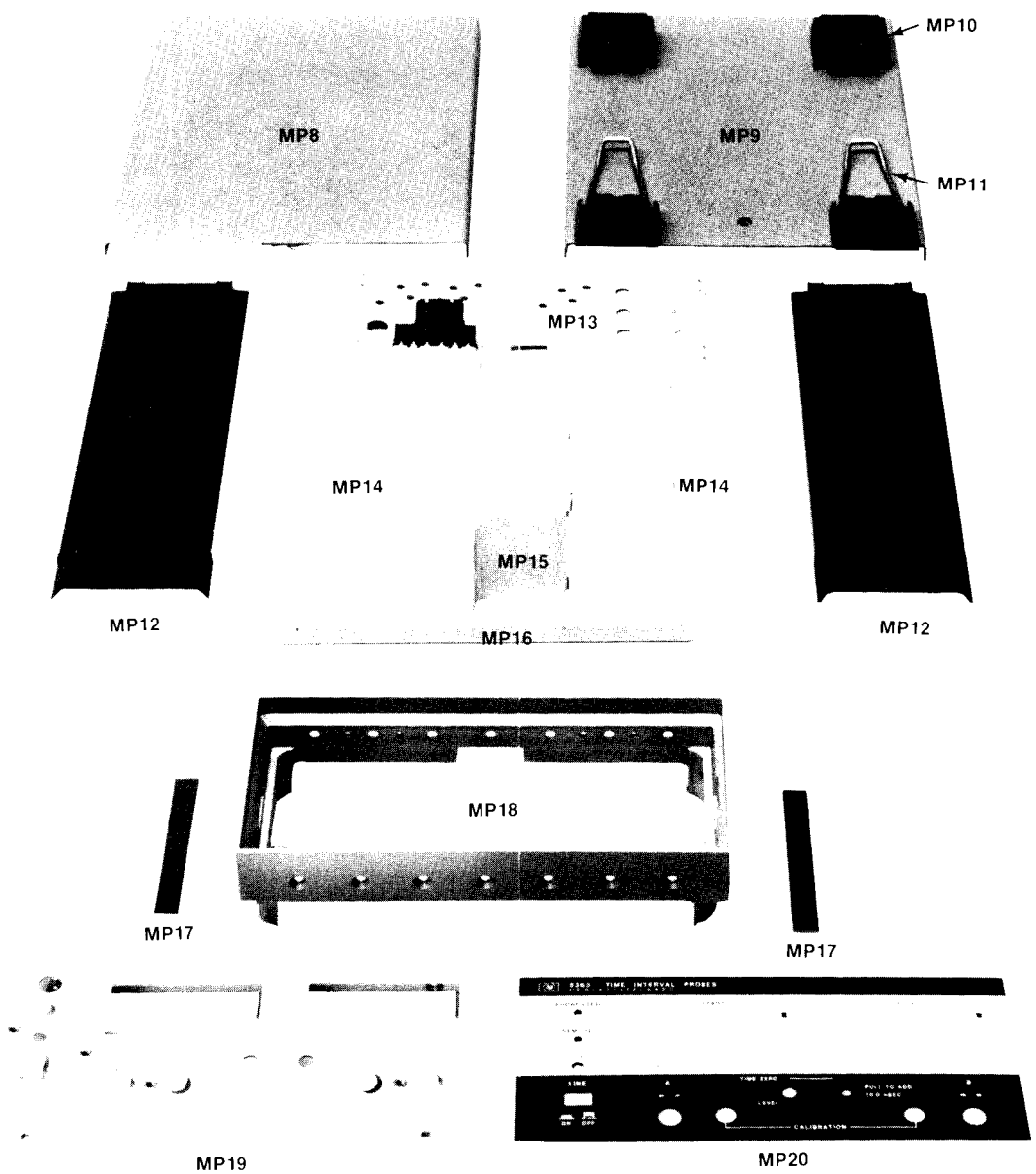


Figure 6-2. Cabinet Mechanical Parts

Table 6-3. Manufacturers Code List

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
H9027	Schurter A G H, Luzern		
S0545	Nippon Electric Co., Tokyo, Japan		
00000	Any Satisfactory Supplier		
01121	Allen-Bradley Co., Milwaukee, WI		53204
01295	Texas Instrument Inc., Semiconductor Component Division, Dallas, TX		75222
02114	Ferroxcube Corporation, Saugerties, NY		12477
04713	Motorola Semiconductor Products, Phoenix, AZ		85008
07263	Fairchild Semiconductor Division, Mountain View, CA		94042
16546	U.S. Capacitor Corporation, Burbank, CA		91504
18324	Signetics Corporation, Sunnyvale, CA		94086
19701	Mepco/Electra Corporation, Mineral Wells, TX		76067
24546	Corning Glass Works (Bradford), Bradford, PA		16701
26654	Varadyne Incorporated, Santa Monica, CA		90404
27014	National Semiconductor Corporation, Santa Clara, CA		95051
28480	Hewlett-Packard Company Corporate Headquarters, Palo Alto, CA		94304
3L585	RCA Corporation Solid State Division, Somerville, NJ		
32997	Bourns Incorporated, Trimpot Products Division, Riverside, CA		92507
56289	Sprague Electric Company, North Adams, MA		01247
75915	Littelfuse Incorporated, Des Plaines, IL		60016
84411	TRW Capacitor Division, Ogallala, NE		69153
91637	Dale Electronics Incorporated, Columbus, NE		68601

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Model 5363B having serial prefix 2208A.

7-5. NEWER INSTRUMENTS

7-6. As changes are made, newer instruments may have 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.

7-7. OLDER INSTRUMENTS

7-8. To adapt this manual to instruments having a serial prefix prior to 2208A, perform the back-dating that applies to your instruments serial prefix as listed in *Table 7-1* below.

Table 7-1. Manual Backdating

If Your Instrument has Serial Prefix	Make the Following Changes to Your Manual
2116A	1
2104A	1,2
2028A	1,2,3
2020A	1,2,3,4
1952A	1 thru 5
1932A	1 thru 6
1920A	1 thru 7
1832A	1 thru 8

CHANGE 1 (Serial Prefix 2116A)

Page 21, Table 8. A5 05363-60006 Replaceable Parts, 5363B ADDENDUM:
Change A5 SERIES from 2208 to 2116.
Change U9 from 1820-1211 to 1820-0598; IC GATE TTL L EXCL-OR QUAD 2-INP; 74L86N.

Page 29, Figure 2. A5 HP-IB Schematic Diagram, 5363B ADDENDUM:
Change A5 SERIES, at top of diagram, from 2208 to 2116.
Change U9B pin 6 to 4; and pin 4 to 6.
Change U9C pin 10 to 8; and pin 8 to 10.

CHANGE 2 (Serial Prefix 2104A)

Pages 17 and 20 , Table 8. A1 05363-60011 Replaceable Parts, 5363B ADDENDUM:
Change A1 SERIES from 2116 to 1832.
Change A1U10 and A1U11 from 1820-2053 to 1820-0702; IC DCDR TTL L BCD 4-TO-16-LINE 4-INP; 93L11PC.
Change A1U20 from 1820-1885 to 1820-1166; IC FF TTL L D-TYPE QUAD; DM85L51N.

Page 21. Table 8. A5 05363-60006 Replaceable Parts, 5363B ADDENDUM:
Change A5 SERIES from 2116 to 1832.
Change A5U2 from 1820-1199 to 1820-0586; IC INV TTL L HEX 1-INP; SN74L04N.
Change A5U10 from 1820-1418 to 1820-1047; IC DCDR TTL L BCD-TO-DEC 4-TO-10-LINE.
Change A5U11 from 1820-1470 to 1820-0710; IC MUXR/DATA-SEL TTL L 2-TO-1-LINE QUAD.
Change A5U16 from 1820-1197 to 1820-0583; IC GATE TTL L NAND QUAD 2-INP; SN74L00N.
Change A5U17 from 1820-1112 to 1820-0596; IC FF TTL L D-TYPE POS-EDGE-TRIG; SN74L74N.

Page 25 and 27. Figure 1. A1 Motherboard Schematic Diagram, ADDENDUM:
Change A1 SERIES, at top of diagram, from 2116 to 1832.

Page 29. Figure 2. A5 HP-IB Schematic Diagram, 5363B ADDENDUM:
Change A5 SERIES, at top of diagram, from 2116 to 1832.

NOTE — The following changes should be made to the 5363A Operating and Service Manual supplied with the 5363B ADDENDUM.

Pages 6-8 and 6-10. Table 6-2. A2 05363-60012 Replaceable Parts:
Change A2 SERIES from 2116 to 2104.
Change A2U10 from 1820-1144 to 1820-0584; IC GATE TTL L NOR QUAD 2-INP; DM74L02.

Page 8-65. Figure 8-11. A2 Digital-to-Analog Converter Board Schematic Diagram:
Change A2 SERIES, at top of diagram, from 2116 to 2104.

CHANGE 3 (Serial Prefix 2028A)

The following changes must be made in the 5363A Operating and Service Manual supplied with the 5363B ADDENDUM.

Page 6-8 and 6-9, Table 6-2. A2 05363-60012 Replaceable Parts:
Change A2 SERIES, at top of diagram , from 2104 to 1952.
Change R53 from 0698-3441 to 0698-3437; RESISTOR 133 1% .125W F TC=0±100.

Page 8-65. Figure 8-11. A2 Digital-to-Analog Converter Board Schematic Diagram:
Change A2 SERIES, at top of diagram, from 2104 to 1952.
Change R53 value from 215 ohms to 133 ohms.

CHANGE 4 (Serial Prefix 2020A)

The following changes must be made in the 5363A Operating and Service Manual supplied with the 5363B ADDENDUM.

Page 3-3, Figure 3-2. Rear Panel Controls and Connectors:
Change fuse ratings shown in photo from "100-120/.4A and 220-240/.2A" to show "100-120/.5A and 220-240/.25A."

Page 3-4, Figure 3-2. Rear Panel Controls and Connectors Continued :
Change Item 7. from reading "0.4A SLO-BLO Fuse is required for 100V or 120V INPUT"; and "a 0.20A fuse is required for 220V or 240V" to read "FUSE. A 0.5A fuse is required for 100V or 120V inputs; a 0.25A fuse is required for 220V or 240V."

Page 6-12, Table 6-2. Replaceable Parts:
Change F1 from 2110-0235 to 2110-0004 .25A 250V SLO BLO.
Change F1 from 2110-0340 to 2110-0012 .50A 250V SLO BLO.

Page 8-63, Figure 8-10. Rear Panel Section of Schematic Diagram:
Change F1 fuse values of 100V-120V from 0.4A to .5A and 220V-240V from 0.20A to .25A.

Page 22. Table 8. Replaceable Parts, 5363B ADDENDUM:
Change F1 from 2110-0235 to 2100-0004 .25A 250V SLO BLO.
Change F1 from 2100-0340 to 2100-0012 .50A 250V SLO BLO.

Page 27, Figure 1. A1 Motherboard Schematic Diagram, 5363B ADDENDUM:
Change F1 ampacity value of the 100V-120V from .4A to .5A.
Change F1 ampacity value of the 220V-240V from .2A to .25A.

CHANGE 5 (Serial Prefix 1952A)

Page 21, Table 8. A6 Replaceable Parts, 5363B ADDENDUM:
Change A7 SERIES from 2020 to 1920.
Replace series resistor A6A1R11 68 ohms with A6A1R9; 0698-8381; RESISTOR 50 5% .1W C TC=0±200 and A6A1R10; 0698-8382; RESISTOR 25 5% .25W C TC=0±150.

Page 22, Table 8. A7 Replaceable Parts, 5363B ADDENDUM:
Replace series resistor A7A1R11 68 ohms with A7A1R9; 0698-8381; RESISTOR 50 5% .1W C TC=0±200 and A7A1R10; 0698-8382; RESISTOR 25 5% .25W C TC=0±150.

CHANGE 6 (Serial Prefix 1932A)

The following changes must be made in the 5363A Operating and Service Manual supplied with the 5363B ADDENDUM.

Page 6-8, Table 6-2, A2 (05363-60012) Replaceable Parts:
Change A2 SERIES from 1952 to 1832.
Change A3R55 from 0757-0463; CD=4; RESISTOR 82.5K 1% .125W F TC=0±100 to 0811-0696; RESISTOR 91K 1% .125W PWW TC=0±5.

Page 8-65, A2 (05363-60012) Schematic Diagram:
Change A2 SERIES at top of diagram from 1952 to 1832.
Change A2R55 value from 82.5K to 91K.

CHANGE 7 (Serial Prefix 1920A)

Page 17, Table 8. A1 Replaceable Parts, 5363B ADDENDUM:
Change A1 SERIES from 1932 to 1832.
Change A1CR1 from 1906-0096; CD=7; DIODE-FW BRDG 200V 2A IN-LINE to 1906-0028; CD=5; DIODE-FW BRDG 100V 1.8A.

Page 18, Table 8. A1 Replaceable Parts, 5363B ADDENDUM:
Add A1CR29; 1902-3191; DIODE-ZNR 13V 2% DO-7 PD=.4W TC=+.06%; 28480.

Page 20, Table 8. A1 Replaceable Parts, 5363B ADDENDUM:
Delete A1R133.
Delete A1XU10 and A1XU11.
Add A1R129; 0698-4446; CD=5; RESISTOR 267 1% .125W F TC=0±100; 24546.

Page 25, Figure 1. A1 Motherboard Schematic Diagram, 5363B ADDENDUM:
Change A1 SERIES at top of diagram from 1932 to 1832.

Page 27, Figure 1. A1 Motherboard Schematic Diagram, 5363B ADDENDUM:
Change A1 SERIES at top of diagram from 1932 to 1832.
Delete R133.
Delete line that connects U5 pins 5 and 9 together.
Add lines connecting U15 pins 9 and 5 to +5V.
Delete line that connects U15 pins 4 and 1 together.
Add line connecting U15 pin 4 to U21B pin 9.
Add A1CR29 and A1R129 A1 schematic diagram as shown in Figure 1. below:

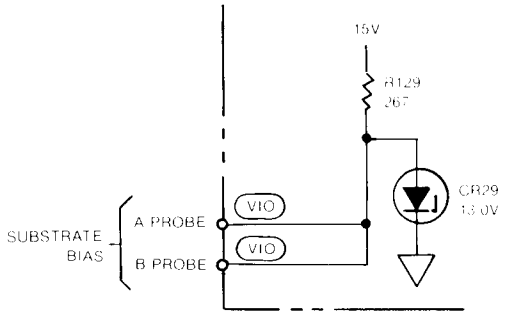


Figure 1.

CHANGE 8 (Serial Prefix 1832A)

Page 21, Table 8. A6 Replaceable Parts, 5363B ADDENDUM:
Change A6 SERIES from 1920 to 1832.
Delete A6A1R9 and A6A1R10.

Page 22, Table 8. A7 Replaceable Parts, 5363B ADDENDUM:
Change A7 SERIES from 1920 to 1832.
Delete A7A1R9 and A7A1R10.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section contains the 5363B theory of operation, troubleshooting information, schematic diagrams, Signature Analysis tables, flowcharts, and repair procedures.

8-3. SAFETY CONSIDERATIONS

8-4. Although this instrument 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 instrument in safe condition (see Sections II, III, and V). Service and adjustments should be performed only by qualified service personnel.

WARNING

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

8-5. Any adjustment, maintenance, and repair of the opened instrument 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 hazard involved.

8-6. Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

8-7. 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 short-circuiting of fuseholders must be avoided.

8-8. Whenever it is likely that this protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

WARNING

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

8-9. THEORY OF OPERATION

8-10. The theory of operation is provided on three levels. The first level is a block diagram description which covers the overall operation. The second level is a detailed description of both the Calibration functions and Algorithmic State Machine. The third level consists of detailed circuit theory, which is located opposite each respective assembly schematic foldout.

8-11. TROUBLESHOOTING

8-12. Troubleshooting information is provided for two general areas. First, troubles associated with the RF section (probes, channel switches, comparators, and drivers), power supply, and DAC assembly which are relatively straightforward. A troubleshooting chart which helps isolate failures in these areas is provided. Second, troubles which appear to be generated by the state machine, HP-IB interface assembly or main motherboard, or associated logic, which are more complex. The troubleshooting section contains flowcharts, Signature Analysis tables, test point locations, and equipment setup diagrams necessary to help locate troubles in these areas.

8-13. SCHEMATIC DIAGRAM FOLDOUTS

8-14. Foldout service sheets are provided at the end of this section. These contain the circuit theory, component locator, and board schematic for the designated assembly.

8-15. RECOMMENDED TEST EQUIPMENT

8-16. Test equipment and accessories required to test and maintain the 5363B Time Interval Probes are listed in Table 1-4. Equipment other than that listed may be used if it meets the listed specifications.

8-17. SERVICE AIDS

8-18. Pozidriv® Screwdrivers

8-19. Many of the screws in the instrument may appear to be Phillips, but are not. To avoid damage to the screw slots, Pozidriv screwdrivers should be used.

8-20. Part Location Aids

8-21. The locations of the individual components mounted on printed circuit boards or other assemblies are shown on the page opposite the appropiate schematic diagram. The part reference designator is the assembly designator plus the part designator (for example, A2R9 is R9 on the A2 assembly). For specific component description and ordering information refer to the parts list in Section VI.

8-22. Servicing Aids on Printed Circuit Boards

8-23. The servicing aids include test points, transistor and integrated circuit designations, assembly names, assembly stock numbers, and digital bus connector pin designations. Refer to *Figures 8-1* and *8-2*.

® *Registered Trademark.*

SYMBOLS

DANGEROUS VOLTAGE, EXCEEDS 1000 VOLTS

FRONT PANEL LABEL

REAR PANEL LABEL

INTERIOR AND PC BOARDS LABEL

WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE

PROTECTIVE CONDUCTOR TERMINAL

CIRCUIT COMMON

IDENTIFIED COMMON

CHASSIS TERMINAL

□ SQUARE ON BOARD IDENTIFIES:
Pin 1 of dip and flat-pack IC's.
Table of TO cases.
+ side of electrolytic capacitors.
Pin 1 of resistor packs.
Cathode of diodes.
Section 1 of dip switches.

KNOB CONTROL

SCREWDRIVER ADJUST

MAIN SIGNAL PATH

FEEDBACK PATH

TEST POINT

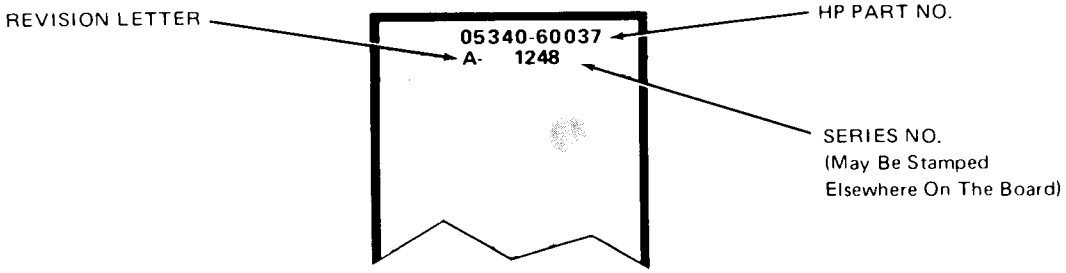
INSTRUCTION MANUAL REFERENCE

ALTERNATING CURRENT

DIRECT CURRENT

ALTERNATING OR DIRECT CURRENT

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

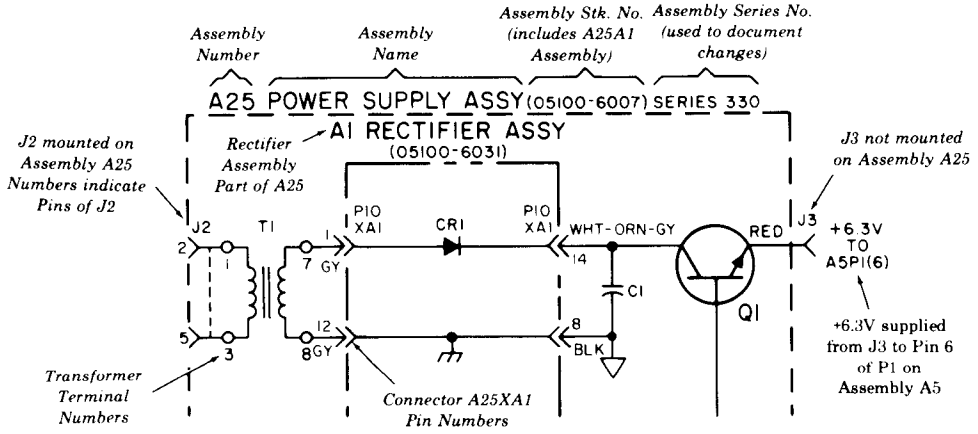
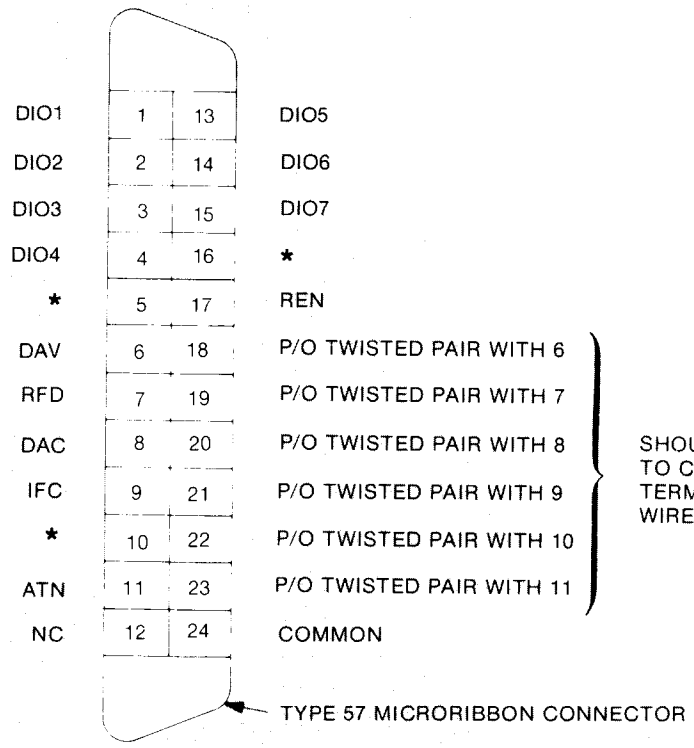


Figure 8-1. Schematic Diagram Notes



*THESE PINS ARE TERMINATED WITH RESISTIVE NETWORKS (SEE SCHEMATIC AND NORMALLY FLOAT AT APPROXIMATELY 3V.)

NOTE 1: PINS 18 THROUGH 23 SHOULD BE CONNECTED TO COMMON NEAR THE TERMINATION OF THE OTHER WIRE OF ITS TWISTED PAIR. PIN 12 IS CONNECTED TO COMMON ONLY AT THE CONTROLLER.

DIGITAL BUS PIN SUMMARY

Digital Bus Connector Pin Number	Line Name	Use
1-4, 13-15	DIO1-7	Carries characters to 5363B for conversion or for processing as Bus commands.
16	DIO8	Not monitored or driven, terminated by resistive network.
6 7 8	DAV RFD DAC	These three lines make up the "handshake" system on the HP Interface Bus. DAV is monitored and RFD and DAC are driven by 5363B control rate of data transferred on DIO lines.
9	IFC	Unconditionally clears Listen F/F, halting remote operation.
11	ATN	Indicates to 5363B whether character on DIO lines is Bus common or data.
17	REN	When low it is one of the conditions necessary to put the 5363B in remote operation. When high it puts the 5363B in local control.
5	EOI	Not monitored or driven, terminated by resistive network.
10	SRQ	Not monitored or driven, terminated by resistive network.
12	Shield	Not connected.
18-24	Grounds	Connected to chassis ground.

Figure 8-2. Digital Bus Connector Pin Designations

8-24. REPAIR

8-25. Disassembly and Reassembly Procedures

WARNING

WHEN THE COVERS ARE REMOVED FROM THE 5363B, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DO NOT REMOVE THE COVERS UNLESS IT IS NECESSARY.

8-26. Top Cover Removal

8-27. To remove the 5363B top cover:

1. Disconnect the power cable from the rear panel of the 5363B.
2. Remove two Posidriv screws from the rear edge of the top cover.
3. Lift the top cover from the rear edge, pulling up and back until free from the front frame. Reverse this procedure to replace the top cover.

8-28. Bottom Cover Removal

8-29. To remove the 5363B bottom cover follow the following procedure:

1. Disconnect the power cable from the rear panel of the 5363B.
2. Place 5363B with bottom cover facing up.
3. Remove four plastic feet from bottom cover. Lift up on the back edge of the plastic foot and slide back.
4. Remove two Pozidriv screws from the rear edge of the bottom cover.
5. Lift the bottom cover from the rear edge, pulling up and back until free from the front frame. Reverse procedure to replace bottom cover.

8-30. Front Panel Removal

8-31. To remove the 5363B front panel:

1. Disconnect the power cable from the rear panel of the 5363B.
2. Remove the top cover.
3. Remove A2 DAC Assembly Board and A5 HP-IB Interface Assembly Board.
4. Remove the trim strip from the top of the front frame.
5. Disconnect the ribbon connector from J2 on the motherboard assembly.
6. Remove the four Pozidriv screws from front frame.

7. Carefully push front panel from behind to free it from the front frame. Allow probe cables to feed through the cable strain reliefs mounted on the front panel. Reverse procedure to replace front panel.

NOTE

Extreme care must be exercised when replacing the front panel assembly to insure proper alignment of the 16 connector pins on the motherboard to the matching sockets on the front panel calibrate assembly. Also, make sure the line off/on switch protrudes through the front panel and does not bind. DO NOT FORCE THIS ASSEMBLY.

8-32. A3 Calibrate Assembly Removal

8-33. To remove the A3 Calibrate Assembly:

1. Disconnect the power cable from the rear panel of the 5363B.
2. Remove the front panel assembly.
3. Remove the knurled nut from the TIME ZERO/LEVEL switch and the plastic knob from the PULL TO ADD 10.00 ns control.
4. Remove the four Pozidriv screws holding the A3 Calibrate Assembly board to the front panel, and pull assembly free. Reverse this procedure to replace A3 Calibrate Assembly.

8-34. LOGIC SYMBOLS

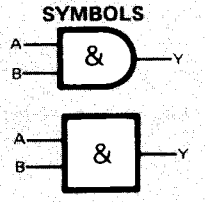
8-35. Logic symbols used in this manual conform to the American National Standard ANSI Y32.14-1973 (IEEE Std. 91-1973). This standard supersedes MIL-STD-8068. In the following paragraphs logic symbols are described.

8-36. Logic Concepts

8-37. The binary numbers 1 and 0 are used in pure logic where 1 represents true, yes, or active and 0 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 confuse 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

EQUIVALENT SYMBOLS



TRUTH TABLE

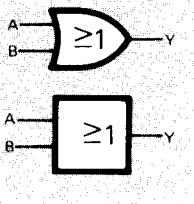
A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

Y is true if and only if A is true and B is true (or more gnerally, if all inputs are true).

Y = 1 if and only if A = 1 and B = 1.
Y = A · B

OR

EQUIVALENT SYMBOLS



TRUTH TABLE

A	B	Y
1	1	1
1	0	1
0	1	1
0	0	0

Y is true if and only if A is true or B is true (or more generally, if one or more input(s) is (are) true).

Y = 1 if and only if A = 1 or B = 1.
Y = A + B

8-38. Negation

8-39. In logic symbology, the presence of the negation indication symbol O provides for the representation of the logic function inputs and outputs in terms independent of their physical values; the 0-state of the input and output being the 1-state of the symbol referred to by the symbol description.

NOTE

In this manual the logic negation symbol is NOT used.

EXAMPLE 1

TRUTH TABLE

A	B	Z
1	1	0
1	0	1
0	1	1
0	0	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. $\overline{Z} = AB$ or $Z = \overline{A} + \overline{B}$. This is frequently referred to as NAND (for NOT AND).

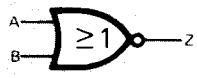
EXAMPLE 2

TRUTH TABLE

A	B	Z
1	1	0
1	0	1
0	1	1
0	0	1

Says that Z is true if A is not true or if B is not true. $Z = \overline{A} + \overline{B}$. Note that this truth table is identical to that of Example 1. This logic equation is merely a DeMorgan's transformation of the equations in Example 1. The symbols are equivalent.

EXAMPLE 3



TRUTH TABLE

A	B	Z
1	1	0
1	0	0
0	1	0
0	0	1

$\overline{Z} = A + B$ or $Z = \overline{AB}$.

EXAMPLE 4

TRUTH TABLE

A	B	Z
1	1	0
1	0	0
0	1	0
0	0	1

$Z = \overline{A} \cdot \overline{B}$, also share common truth table and and are equivalent transformations of each other. The NOT OR form (Example 3) is frequently referred to as NOR.

8-40. Logic Implementation and Polarity Indication

8-41. 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 0 is redefined suitably.

8-42. In decribing 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 variable. L is used to represent a "low level", which is a voltage within the less-positive (more-negative) range.

8-43. A function table for a device shows (implicitly or explicitly) all the combinations of input conditions and the resulting output conditions.

8-44. 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 the symbol to which it is attached is low level.

NOTE

The polarity indicator symbol ◺ is used in this manual.

EXAMPLE 5

DEVICE #1 FUNCTION TABLE

A	B	Y
H	H	H
H	L	L
L	H	L
L	L	L

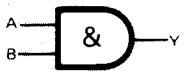
DEVICE #2 FUNCTION TABLE

A	B	Y
H	H	H
H	L	H
L	H	H
L	L	L

Assume two devices having the following function tables.

POSITIVE LOGIC.

DEVICE #1

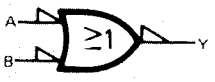


DEVICE #2

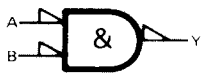
By assigning the relationships H = 1, L = 0 at both input and output, Device #1 can perform the AND function and Device #2 can perform the OR function. Such a consistent assignment is referred to as positive logic.

NEGATIVE LOGIC.

DEVICE #1



DEVICE #2



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.

8-45. MIXED LOGIC. The use of the polarity indicator symbol on some inputs automatically invokes a mixed-logic convention. This is, positive 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.

8-46. 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 (○) while leaving the distinctive shapes alone. To convert from the symbology of negative-logic, a polarity indicator (◺) is substituted for each negation indicator (○) and the OR shape is substituted for the AND shape or vice versa.

8-47. 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 Examples 1 through 7. The rules of the transformation are:

1. At each input or output having a negation (○) or polarity (◺) indicator, delete the indicator.
2. At each input and output not having an indicator, add a negation (○) 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.

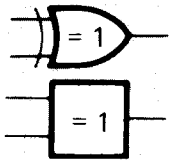
8-48. The choice of symbol may be influenced by these considerations: (1) The operation being performed may best be understood as AND or OR. (2) In a function more complex than a basic gate, the inputs will ususally be considered as inherently active high or active low (e.g.,the J and K inputs of a J-K 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.

8-49. Other Symbols

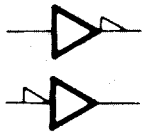
8-50. More symbols are required to depict complex logic diagrams. Some of the other symbols are as follows:

Dynamic input activated by transition from a low level to a high level. The opposite transition has no effect at the output.

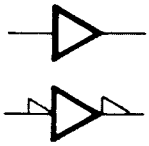
Dynamic input activated by transition from a high level to a low level. The opposite transition has no efect at the output.



Exclusive OR function. The output will assume its indicated active level if and only if one and only one of the inputs assumes its indicated active level.

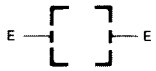


Inverting function. The output is low if the input is high and it is high if the input is low. The two symbols shown are equivalent.

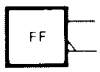


Noninverting function. The output is high if the input is high and it is low if the input is low. The two symbols shown are equivalent.

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 effect.

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.

K INPUT. Similar to the R input (see Reset).

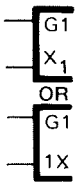
D INPUT (Data). Always dependent on another input (usually C). When the C and D inputs are at 1, the flip-flop will be set. When the C is 1 and the D is 0, the flip-flop will reset.

ADDRESS. Address symbol has multiplexing relationship at inputs and demultiplexing relationship at outputs.

8-51. Dependency Notation "C" "G" "V" "F"

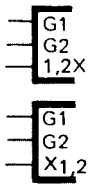
8-52. Dependency Notation is a way to simplify symbols for complex IC elements by defining the existence of an AND relationship between inputs, or by the AND conditioning of an output by an input without actually showing all the elements and interconnections involved. The following examples use the letter "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 . The both mean the same thing. The letter "V" is used to indicate an OR relationship between inputs and outputs with this letter V . The letter "F" indicates a connect-disconnect relationship. If the "F" free dependency inputs and outputs are active 1 the other usual normal conditions apply. If one or more of the "F" inputs are active 0 , 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 label (X is used here), that label will be prefixed or subscripted by the identifying number.

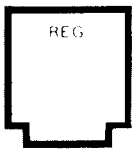
If a particular device has only one gating or control input then the identifying number may be eliminated and the relationship shown with a subscript.



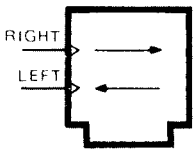
If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix or subscript, separated by commas. In this example "X" is controlled by "G1" and "G2".

8-53. Control Blocks

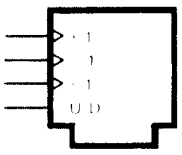
8-54. A class of symbols for complex logic are called control blocks. Control blocks are used to show where common control signals are applied to a group of functionally separate units. Examples of types of control blocks follow:



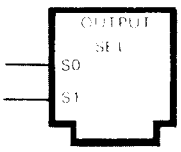
Register control block. This symbol is used with an associated array of flip-flop symbols to provide a point of placement for common function lines, such as a common clear.



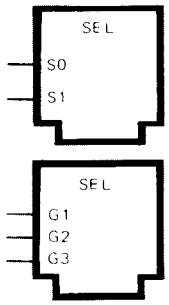
Shift register control block. These symbols are used with any array of flip-flop symbols to form a shift register. An active transition at the inputs causes left or right shifting as indicated.



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 transistion at the ± input causes the counter to increment one count upward or downward depending on the input at as up/down control.



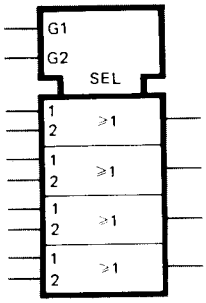
Output selector control block. This symbol is used with a block symbol having multiple outputs to form a decoder. The selection lines enable the output designated 0, 1, ...n each block by means of a binary code where S0 is the least significant digit. If the 1 level of these lines is low polarity indicators (◺) will be used.



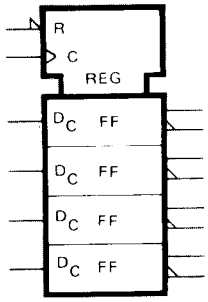
Selector control block. These symbols are used with as array of OR symbols to provide a point of placement for selection (S) or gating (G) lines. The selection lines enable the input designated 0, 1, ...n each OR function by means of a binary code where S0 is the least significant digit. If the 1 level 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 inputs numbered 2, and so forth. If the enabling levels of these lines is low, polarity indicators (◺) will be used.

8-55. Complex Logic Devices

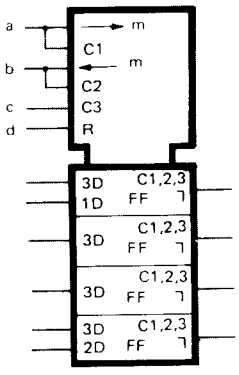
8-56. Logic elements can be combined to produce very complex devices that can perform more difficult functions. A control block symbol can be used to simplify understanding of many complex devices. Several examples of complex devices are given here.



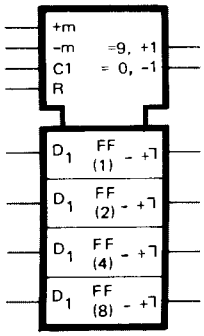
Selector control block used to simplify AND portion of a quad AND-OR select gate. When G1 is high, the data presented at the "1" inputs will be gated through. When G2 is high, the data presented at the "2" inputs will be gated through.



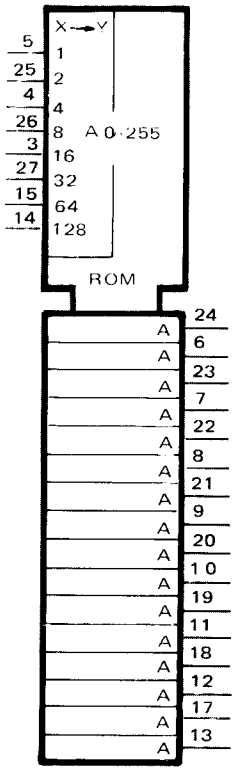
Register control block used to illustrate a quad D-type latch. There is a common active low reset (R), and a common edge triggered control input (C). Since there is only one dependency relationship, the controlling input is not numbered and the controlled functions (D) are subscripted with a C.



Shift register control block used to show common inputs to a bidirectional shift register. Notice that "→m" means shift the contents 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 one 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.



Counter control block used to show common inputs to a Presettable Decade Up/Down Counter. Notice that "+m" means count-up (increment the count) by "m"; "-m" means count down by "m". Note: if m=1, it may be omitted. Since the D-type flip-flops are master-slave, the output delay indicator is used. The "=9", +1, and "=0, -1" notation defines when the carry and borrow outputs are generated. They also define it as a decade counter; a binary counter would have carry indicated with "=15, +1". Flip-flop weighting is indicated in parenthesis.



Read Only Memory with 256 addresses. Address selection is determined by the eight upper inputs which are decoded into 256 possible addresses (A0-A255) corresponding to the weighting modifiers at the inputs. ROMs are initially programmed with a 16-bit word at each address. Storage capacity for the ROM is 256 16-bit words (4096 bits).

8-57. BLOCK DIAGRAM DESCRIPTION

8-58. The following three paragraphs contain a general description which references the block diagram in *Figure 8-3*.

8-59. The HP 5363B accepts signal inputs through the A and B probes. An input signal is applied to one side of a differential JFET pair, while a preselected dc reference voltage is applied to the other. If the signal input crosses the reference level, the differential JFET switch states applying either a START or STOP transition to the motherboard assembly. This transition is routed to the probe select circuit, where channel and slope selections are made. The signal is then directed to a high-speed ECL comparator network, where it is shaped, level shifted, and applied through a 50 ohm driver to a rear panel BNC. The STOP channel contains an adjustable delay circuit and a fixed delay line to compensate for probe and system time delay differences.

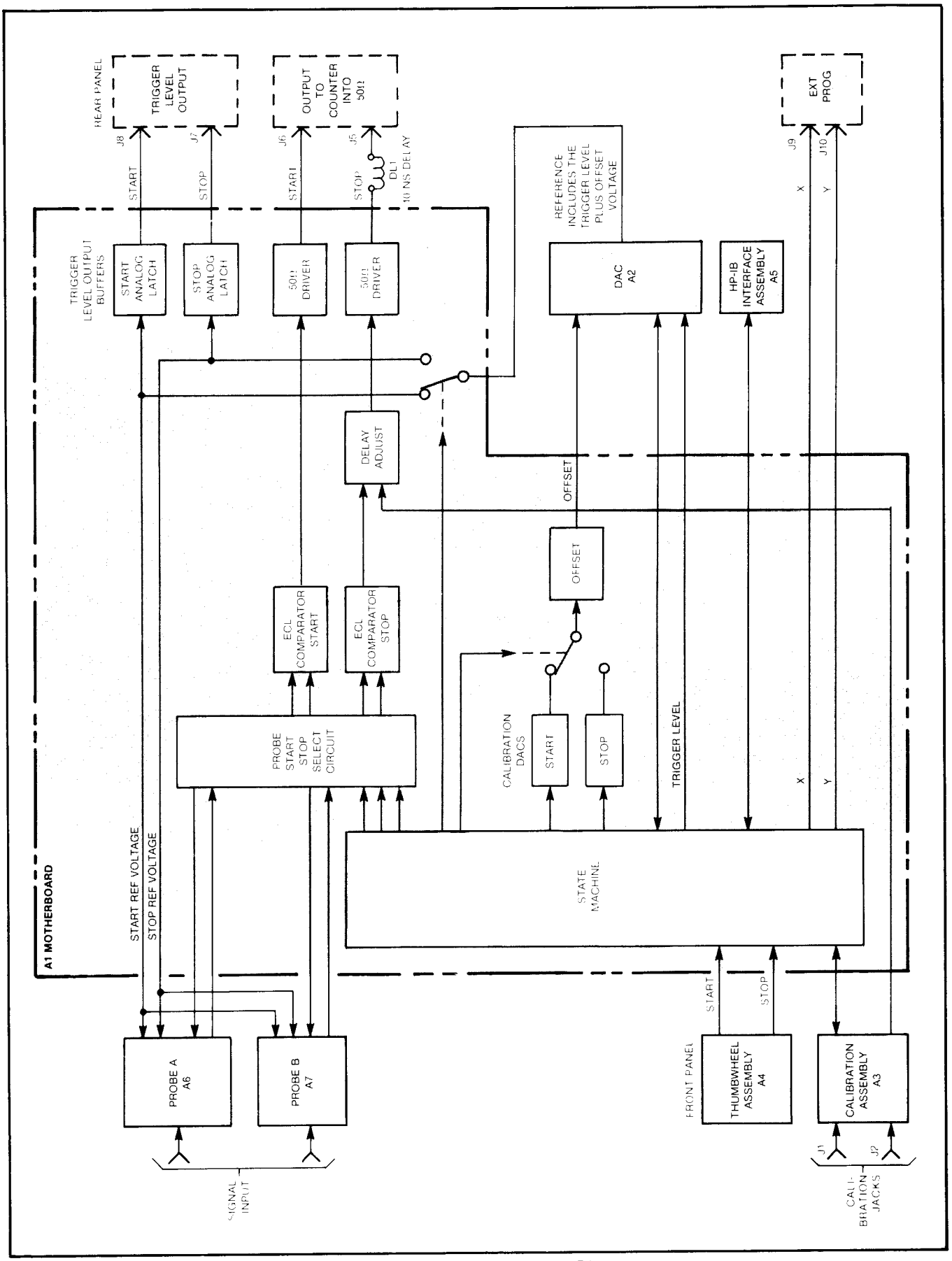


Figure 8-3. 5363B Overall Block Diagram

8-60. The A and B probes are identical in circuitry. The assignment of START and STOP channels to the probes is determined by the user via the thumbwheel switches or HP-IB. A Single probe can be assigned as START channel, STOP channel, or both. The precise trigger points for both STOP and START can be defined by dialing the desired probe, polarity, trigger level, and slope selections into the thumbwheel assembly. This data is continually scanned and updated by the State Machine. The State Machine controls the inputs to the comparators, sets the DAC to furnish reference voltages for the probes, and operate the trigger lights.

8-61. The START and STOP channel reference voltages are produced on the D-to-A converter assembly A2 . A digital BCD signal from the thumbwheel switches or the HP-IB Interface is converted to an analog reference voltage by the reference DAC A2 . This is algebrically summed with a small offset correction voltage from the motherboard calibration DAC and stored by its respective Analog Latch. This routine is continuously repeated, with the State Machine alternately selecting START channel or STOP channel input data. The alternating routine requires only one reference DAC to provide two discrete dc voltage references, whose levels are continuously updated, sampled, and stored. These levels are routed as reference voltages to the probes, and on rear panel BNCs.

8-62. DETAILED THEORY OF CALIBRATION FUNCTIONS

8-63. The 5363B performs two self-correcting functions. These two functions are LEVEL Calibration and TIME ZERO Calibration. Both are controlled by the front panel TIME ZERO/LEVEL toggle switch.

8-64. Level Calibration

8-65. Refer to schematics in back section of manual, *Figures 8-11* through *8-16*. When the TIME ZERO/LEVEL switch is pushed to LEVEL, the machine exits from the Idle Loop Routine (paragraph 8-121) and goes to the Calibration Routine (paragraph 8-123). In this routine the state machine causes the START channel Calibration DAC (A1U3,U4) to output a voltage of -75 mV to the START channels of both probes. This voltage can be traced from the node of A1R24 and A1R8 to A1U2 (in pin 8, out pin 7) to A1U5 (in pin 3, out pin 6) or TP5 ("DAC OFFSET") to pin 2 of A2U9 (on the Reference DAC, A2) where it's summed with the level value* selected on the front panel level switches or via HP-IB. This voltage goes back to A1U9 (in pin 8, out pin 7) and on to the gate (pin 2) of the noninvert of the noninverting JFET of each START channel (A6/A7U1) of the probes.

8-66. This -75 mV offset voltage, applied to the gate of the noninverting JFET, is increased one step (approximately +.6 mV) at a time until the input, or inverting, JFET turns on, sending a START TRIGGER out the white lead to pin 2 of A1U24, or pin 6 of A1U27 (depending on which probe, A or B, is selected as the START probe). This trigger signal is actually a current sink of approximately 20 mA, supplied by the -15V START line, and is not made available (asserted) until the input JFET 'closes'.The trigger signal passes on from A1U24 or U27 to A1U18B and A1U19B pin 13, to A1Q13, which puts a logic "1" on the START TRIG.LIGHT line. This line runs back to the Qualifier Selector MUX A1U21 which is strobed, periodically, by the state machine looking for a START TRIGGER.

8-67. Since a common DAC is used to calibrate the START channel JFETs of both of the A and B probes, the state machine must somehow 'turn on' the appropriate probe and then start the calibration process. This is done by asserting (logic 1) the START CHAN line on the motherboard (A1) using the Command Latch A1U26 pin 5 to turn on the -15V source to the A probe (select the A probe) and turn off that of the B probe. A logic 0 on the START CHAN line does just the opposite. Thus,without the -15V source the undesired probe cannot trigger and consequently the trigger received by the state machine has to come from the selected probe.

8-68. In short, a simplified way of thinking of the calibration process is that the state machine (A1U11, 25, 28, 30) turns on the approperiate probe, resets the Reference DAC A2 so that it's output level is 0.00V, outputs -75 mV via the START Calibration DAC (A1U3, U4) to the probe, checks for a START TRIGGER, increments the DAC output by +0.6 mV, checks for a trigger, etc. This process is repeated until a START TRIGGER is received, or a timer (A1U14A) on the motherboard (which was triggered early in the Calibration Routine, state 170) signals that the calibration process has taken too long. The timers output is >220 ms long, and is used to tell the state machine that something is not allowing the probe(s) to calibrate.

8-69. Once the process has been completed for the START channel probe, the state machine locates and enables the STOP probe and calibrates it in the same way. The STOP channel Calibration DAC consists of A1U1/U6 while the associated components are JFETs A6/A7U2, and transistor arrays A1U13/17. The calibration routine is exactly the same using the STOP channel components.

8-70. If the calibration process is not completed because of the state machine not receiving a trigger for some reason, in either the START or STOP channels, the state machine will exit the Calibration Routine and go to the Error Routine. This causes the state machine to loop and blink the LEDs on and off.

8-71. The JFET pairs of U1 and U2 in the probe assemblies are matched or sorted at the manufacturer per HP specifications. This assures a closeness in specifications between all of the START and STOP input (inverting) JFETs.

8-72. However, there is still a difference in the V$_{gs}$ ratings of the two JFETs within a single A6/A7U1 or U2 package. This means that the trigger voltage of the inverting JFET and that of the noninverting JFET will be off by whatever the difference is between their respective V$_{gs}$ ratings. Also, a small offset exits between the plus and minus terminals of the comparators which sense a trigger situation. And finally, the common-base load of the current source of Q1/CR1 or Q2/CR2 adds to this voltage discrepency.

8-73. The sum of all of these voltage differences is termed the total offset voltage. If all other errors in the triggering system were zero, this voltage would be exactly the difference between the voltage reading from the thumbwheel switches and voltage at which the instrument probe triggers. Since this total offset voltage (hereafter referred to as simply the offset voltage) can be relatively high when compared to the input voltage, it must somehow be calibrated out of the circuit.

8-74. The following, *Figure 8-4*, is a simplified diagram of the input circuit of the 5363B. It is basically a differential amplifier of low common-mode gain, which permits operation over a ±10V range.

8-75. To zero out the effect of the offset voltage, two Calibration DACs are used which find and store the offset value selected START and STOP probes (one DAC for each). This process gets the trigger error due to offset voltage down from as much as 75 mV to .6 mV.

8-76. The importance of the calibration circuit can now be seen. It effectively reduces the trigger error due to offset voltage to a negligible level, producing a more accurate measurement.

*The Reference DAC (A2) is temporarily reset during the Calibration Routine State 166, which puts its output voltage at 0.00V. Therefore the output of the Reference DAC at pin 6 of A2U9 is the output of the Calibration DAC during the calibration cycle.

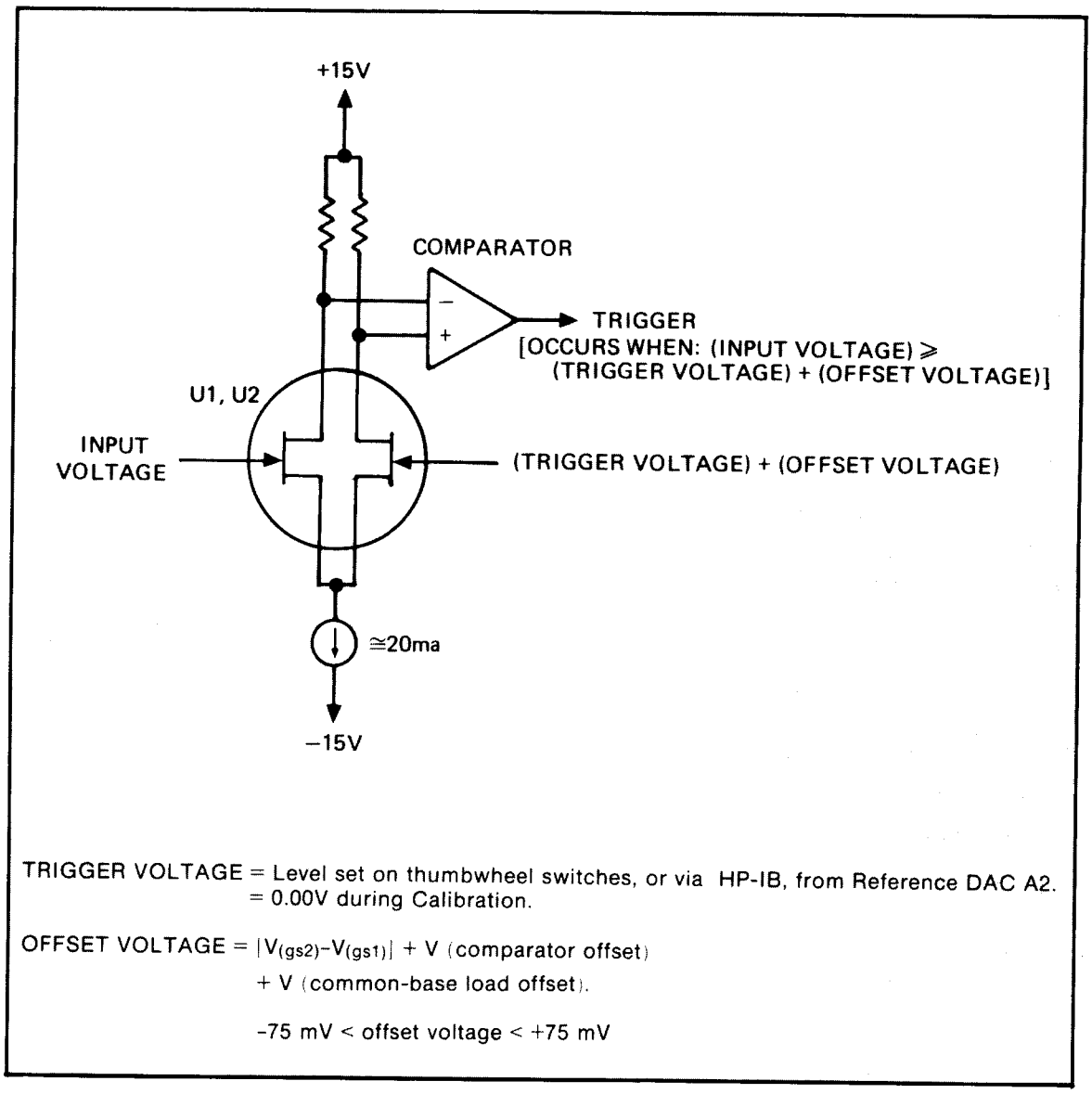


Figure 8-4. Simplified 5363B Input Circuit

8-77. Time Zero Calibration

8-78. There is present in any application configuration, a small time delay caused by the Time Interval Probes, the electronic counter and the connecting cables. The Time Zero Calibration routine provides a method of balancing out this delay. Inserting the probes in the calibration jacks and pressing the front panel TIME ZERO switch injects a stream of high-speed pulses into both START and STOP channels simultaneously. A control pot on the front panel controls the adjustable delay in the STOP channel. By injecting pulses and adjusting the STOP channel delay, the system generated time delay can be matched and effectively reduced to zero. A fixed delay line is switched into the STOP channel to allow operation with counters whose minimum time interval resolution exceeds 1-nanosecond. This fixed delay, however, must be subtracted from the counter display by the operator.

8-79. MULTIPLE LEVEL CALIBRATION TEST PROCEDURE

8-80. Since the Level Calibration Routine checks only one of four possible probe configurations at a time, all four must be tried to localized a problem. This process will, however, still leave some experimentation up to the service technician as each channel uses several components which are not common to more than one channel; i.e., the probe JFETs, the transistor arrays A1U13,17,24,27 , etc. The following is an example of how the Multiple Calibration Test may be used.

8-81. Multiple Level Calibration Test Example

8-82. Multiple level calibration test is the testing of all four possible START and STOP combination of probes A and B e.g., START A/STOP A; START A/STOP B; START B/STOP A; and START B/STOP B.

8-83. A 5363B is received with the complaint that the unit will not calibrate. The unit is powered on, and the front panel controls are set as follows: These settings are examples only; anything may be used.

polarity: +
voltage level: 0.00
slope: positive

8-84. Upon attempting to calibrate in all four combinations several times, the 5363B failed to calibrate in START A/STOP A GARA and START B/STOP A GBRA modes.

8-85. Looking at *Table 8-1*, the Troubleshooting Chart, the failures point to fault 5 on the chart. The suspected active components are A6U2, A1U13, or A6Q1. Since A1U13 is in a socket on the A1 motherboard, it would be wisest to start by swapping A1U13 with A1U17, 24, or 27, and rerunning the test procedure. If a new fault shows up the chances are that the A1U13 which was swapped is bad. If the same fault number arises, then the probe is the next suspect.

8-86. *Table 8-1* shows the fault numbers which correspond to the failed tests. The names of these tests are given in standard nomenclature i.e., START A/STOP A with their respective HP-IB codes below them i.e., GARA . A quick way of referencing these settings without looking at the thumbwheel settings is to remember that the green G LED is START, and the red R LED is STOP. The LEDs can be most efficiently used this way.

8-87. Use *Table 8-1*, Troubleshooting Chart to help localize probable failures. Keep in mind that these are THE MOST PROBABLE FAILURES from a service history standpoint, but NOT THE ONLY POSSIBLE ONES. Also, the technician should write failures in as they occur.

8-88. Program Listings

8-89. The following programs have been written to expedite execution of the Multiple Calibration Test troubleshooting procedure. They have been created for use on the HP 9825A/B and HP 9835A/9845B calculators. The first program requires a 9825A calculator with General I/O ROM, the 98034A HP-IB Interface, and the 5363B Time Interval Probes. The second program is in Basic and designed to be used with a 9835A or 9845A/B calculator, the appropriate I/O ROMs, the 98034A HP-IB Interface, and the HP 5363B.

8-90. The Select Code Address of the 5363B is, in either program, 715. The probes must be put into the calibration socket on the front panel and the TIME ZERO/LEVEL switch must be pushed to LEVEL when prompted by the program. The following steps should be done to run any of the programs:

1. Setup the 5363B, and the other equipment.
2. Power-on the calculator and enter the program.
3. Power-on the 5363B.
4. RUN the Program.
5. Run several tests to insure a good failure number.

```
0: dim C$[5]
1: fxd 0
2: rem 715
3: prt "CALIBRATION","PROGRAM";spc 2;prt "TIME ZERO/LEVEL","switch must be"
4: prt "DOWN - PROBES","must be in the","CAL. SOCKETS";spc 2
5: dsp "Press CONTINUE when ready.";stp
6: wrt 715,"P";dsp "Calibration check: SYSTEM BUSY"
7: 0→A→C→S
8: for I=0 to 3
9: "GARA"→C$
10: if I=1;"GARB"→C$
11: if I=2;"GBRA"→C$
12: if I=3;"GBRB"→C$
13: wrt 715,C$,"3";wait 1000
14: rds(7)→S;if bit(7,S)=0;gsb "SR0"
15: rds(715)→A;if A=64;gto 17
16: C+2^I→C;rds(7)→S;if bit(7,S)=1;gsb "SR1"
17: next I
18: if C=0;dsp "Calibration complete.";gto "END"
19: prt "CHECK FAULT LIST","Number",C;spc 2
20: beep;dsp "CALIBRATION ERROR: ",C
21: stp ;gto 5
22: "END":beep;prt "Calibration OK";prt "----------------";spc 2;wait 3000
23: dsp "END OF TEST";stp
24: "SR0":prt "SRQ ERROR:",C$,"SRQ not rec'd";spc 2;ret
25: "SR1":prt "SRQ ERROR:",C$,"SRQ locked HI";spc 2;ret
*22121
```

Program Listing #1, for 9825A Calculator

```
10   REM : THIS PROGRAM CHECKS THE 5363B FOR CALIBRATION AND SRQ ERRORS.
20   REM : EQUIPMENT NEEDED: 9835A OR 9845A/B CALCULATORS, I/O ROMS,
30   REM :                   98034A HPIB CARD/CABLE AND 5363B TI PROBES.
40   DIM A$[5],C$[5]
50   FIXED 0
60   PRINTER IS 16
70   PRINT PAGE
80   PRINT LIN(3);SPA(17);"HP5363B MULTIPLE CALIBRATION TEST PROGRAM"
90   PRINT LIN(5);SPA(19);"5363B SHOULD BE ON SELECT CODE  715 "
100  PRINT LIN(2);SPA(19);"THE TIME ZERO/LEVEL SWITCH MUST BE PUSHED AND"
110  PRINT SPA(19);"HELD DOWN TO LEVEL DURING THE ENTIRE TEST,"
120  PRINT SPA(19);"AND THE PROBES MUST BE IN THE CALIBRATION"
130  PRINT SPA(19);"SOCKETS."
140  A$=""
150  REMOTE 715
160  INPUT "PUSH TIME ZERO/LEVEL SWITCH DOWN AND PRESS CONTINUE WHEN READY",A$
170  PRINTER IS 0
180  A=C=S=0
190  DISP "CALIBRATION CHECK: SYSTEM  BUSY "
200  OUTPUT 715;"P"                        ! INITIALIZE 5363B
210  FOR I=0 TO 3
220  C$="GARA"                             ! START A / STOP A
230  IF I=1 THEN C$="GARB"                 ! START A / STOP B
240  IF I=2 THEN C$="GBRA"                 ! START B / STOP A
250  IF I=3 THEN C$="GBRB"                 ! START B / STOP B
260  OUTPUT 715;C$,"@"
270  WAIT 1000
280  STATUS 7;S
290  IF BIT(S,7)=0 THEN GOSUB 490    ! SRQ SHOULD BE HI
300  STATUS 715;A
310  IF A=64 THEN 350
320  C=C+2^I
330  STATUS 7;S
340  IF BIT(S,7)=1 THEN GOSUB 510    ! SRQ SHOULD BE LOW
350  NEXT I
360  IF C=0 THEN 430
370  BEEP
380  DISP "CALIBRATION ERROR ";CHR$(129);" ";C;" ";CHR$(128)
390  PRINT "CHECK FAULT LIST";"NUMBER ";C;LIN(2)
400  PAUSE
410  GOTO 140
420  BEEP
430  DISP "CALIBRATION   COMPLETE "
440  PRINT "CALIBRATION OK  ";"------------------";LIN(2)
450  WAIT 3000
460  BEEP
470  DISP " END OF TEST "
480  END                                   ! END OF PROGRAM
490  PRINT "SRQ ERROR: ";C$;SPA(5);"SRQ NOT RECEIVED";LIN(2)
500  RETURN
510  PRINT "SRQ ERROR: ";C$;SPA(5);"SRQ LOCKED HI";LIN(2)
520  RETURN
```

Program Listing #2, for 9835A or 9845A B Calculator

Table 8-1. Troubleshooting Chart - Multiple Calibration Test

NOTE

The TIME ZERO/LEVEL switch must be pushed and held down in the LEVEL position during either a manually or automatically (HP-IB) run calibration test, and the probes must be ground. See note below.

FAULT LIST NO.	TEST(S) FAILED				PROBABLE FAILURES
	START A STOP A (GARA)	START A STOP B (GARB)	START B STOP A (GBRA)	START B STOP B (GBRB)	
1	X				*; Logic failure, check signatures.
2		X			*; Logic failure, check signatures.
3	X	X			A6U1, A1U24, A6Q2, broken black or white wires going to A probe.
4			X		*; Logic failure, check signatures.
5	X		X		A6U2; A1U13, A6Q1; broken orange or yellow wires going to A probe.
6		X	X		*; Start and Stop wires shorted somewhere; Logic failure.
7	X	X	X		Open or intermitten connection to A probe tip or chip resistors; probe not grounded; broken power wires to probe.
8				X	*; Logic failure, check signatures.
9	X			X	*; Logic failure, check signatures.
10		X		X	A7U2; A1U17; A7Q1; broken orange or yellow wires going to B probe.
11	X	X		X	Combination of both test 3 and test 10.
12			X	X	A7U1; A1U27; A1Q2; broken black or white wires going to B probe.
13	X		X	X	Combination of both test 5 and test 12.
14		X	X	X	Open or intermitten connection to the B probe tip or chip resistors; probe not grounded.
					*; Calibration DACs (A1U1, U3, U4, U5, U6); A1Q1 open; A1U2, U9; A1U2, U9; A1U18; A3 Calibration Assembly; A1U14A or B; A2 output.

NOTE

An intermitten calibration switch or improperly run test procedure could cause any of the above errors.

Ground the probes by inserting them into the CALIBRATION sockets on the front panel. Keep them there during the entire test.

*Indicates a fault very likely due to the calibration switch not being held down long enough in the LEVEL position, or being intermitten. Check by grounding the probes and rerunning the test

8-91. THE HP-IB INTERFACE ASSEMBLY

8-92. The Hewlett-Packard Interface Bus HP-IB allows the functions of the 5363B to be controlled remotely. In remote operation, it receives and stores bus data, which is arranged and output to the motherboard in a format which simulates the front panel switches. All control functions and level settings, except delay adjust, are programmable via the HP-IB.

8-93. POWER SUPPLY

8-94. The alternating current line supply is converted to the six fixed and regulated dc voltages required by the 5363B.

8-95. STATE MACHINE DESCRIPTION

8-96. The 5363B contains two state machines, one state machine is located on the A1 Main Motherboard Assembly and another on the A5 HP-IB Interface Assembly. The two circuits are very similar in appearance and operation. References in this section will be directed to the state machine on the A1 Main Motherboard (*Figure 8-11*), but the overall theory applies to both.

8-97. State Machine Circuits

8-98. The state machine consists of clock U14A and U14B, state counters U25 and U28, ROM U30, programmable inverter U22A, qualifier selectors U15 and U21, qualifier flip-flop U23, command decoder U11, and command latch U26.

8-99. U14 contains two separate clock circuits. U14B is the main CLOCK which drives the various latches, decoders, and selectors as well as the ROMs state counters. U14A is the TIMER circuit. A low on U14 pin 6 produces a one-shot logic high timing cycle which is fed as a qualifier input to qualifier selector U21.

8-100. The state counters U25 and U28 are arranged to count from 0 to 255 using U25 to count the lower order bits and U28 for the higher order bits. The LOAD inputs (pin 9) determine whether the counters increment their count by 1 or accept parallel inputs O_0 through O_7. The latter is used to perform jump routines. During the count mode, after U25 receives 10 counts, carry out (pin 15) goes momentarily high allowing a clock and count in U28. For jump routines LOAD (pin 9) goes low, and the next clock pulse causes the O_0 through O_7 parallel inputs to transfer across to their outputs. The outputs of the state counters determine the address for ROM U30.

8-101. The ROM is permanently programmed with a 16-bit word at each of 256 addresses.

8-102. U30 O_{15} (pin 13) is the enable line for command decoder U11. When the ROM output is to be used as a command, U30 pin 13 will be low enabling U11. Command decoder U11 accepts the address generated by ROM outputs O_{10} through O_{13} and directs the next inverted clock pulse to the corresponding output, providing a momentary low command pulse. The low enable for U11 is also applied as a preset for qualifier flip-flop U23A, setting the output (pin 5) high.

8-103. The qualifier selectors U21 and U15 select a qualifier line to examine. ROM outputs O_8 and O_{13} determine which qualifier is enabled and outputs O_{10}, O_{11}, and O_{12} address the specific input line. The status of that line is then fed through exclusive-OR U22D and applied as input data to qualifier flip-flop U23A. Providing U23A has not been preset by the command enable line, the next clock pulse will store the qualifier bit, allowing the qualifier decoder inputs and addresses to change.

8-104. U22A is an exclusive-OR gate which is used as a programmable inverter. Pin 3 is the LOAD input to the state counters, which directs the counters to increment one address or parallel load a jump address. The status of pin 1 will determine if the qualifier bit at pin 2 is inverted or not inverted at pin 3. This allows the use of both high qualifiers and low qualifiers to perform a jump.

8-105. State Machine Functions

8-106. Overall, the state machine can perform four basic operations. The status of ROM outputs O_{14} and O_{15} determine the operation mode as follows:

	ROM A1U30		ROM A5U1	
	O_{15}	O_{14}	O_{15}	O_{14}
1. Execute Command and Count	0	0	1	0
2. Execute Command and Jump (GO TO)	0	1	1	1
3. Examine Qualifier/Jump if High (1)	1	1	0	1
4. Examine Qualifier/Jump if Low (0)	1	0	0	0

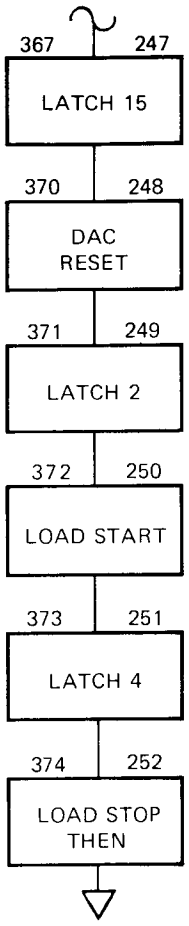
8-107. The following paragraphs describe how the state machine performs these functions:

a. Execute Command and Count
b. Execute Command to GO TO
c. Examine qualifier/Jump if Q=1

8-108. Examine qualifier/jump if Q=0 is similar to example c above and therefore is not necessary to include. Portions of the flowchart in *Figure 8-10* will be used to illustrate these functions.

8-109. EXECUTE COMMAND AND COUNT. An example of execute command and count can be seen in *Figure 8-5*. At address 247 (oct 367) ROM outputs O_{15} and O_{14} are both 0 setting the command and count mode. Outputs O_{10} through O_{13} apply a binary address selection of 0110 (6 decimal) to command decoder U11. The 0 on U11 pin 18 enables the decoder, allowing the next clock pulse on pin 19 to be routed to the selected command line, which is output 6 or CLK LATCH.

8-110. With ROM O_{15} low, U23A is preset so that pin 5 is high. This high to U22A pin 2, along with a low from ROM O_{14} pin 1, drives U22A output pin 3 high. The high disables the LOAD inputs to U25 and U28, thus the state counters will increment one count on the next clock pulse. This readdresses the ROM from 247 (oct 367) to 248 (oct 370). The flowchart in *Figure 8-5.* shows a series of command and count states.



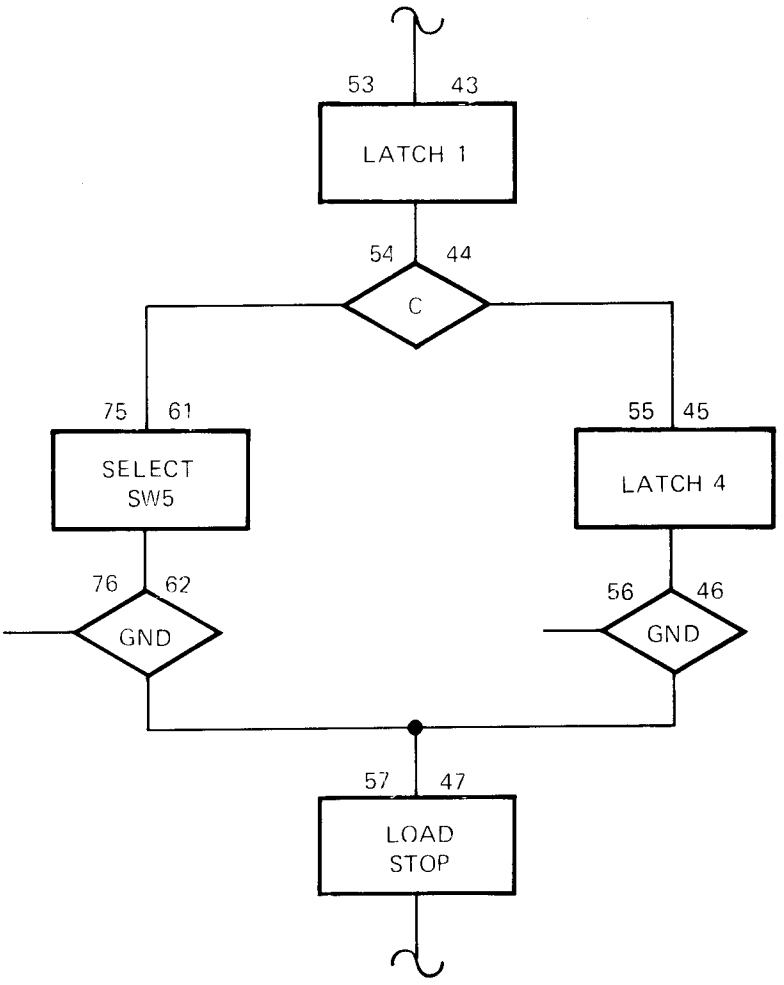
ROM ADDRESS		ROM OUTPUTS	MEANING
OCTAL	DECIMAL	O_{15} ..... O_0	
364	244	10 1110 00 11101111	IF 00= %10 THEN 239
365	245	00 1010 00 00000000	
366	246	01 1011 00 00000001	S 1
367	247	00 0110 00 00000111	
370	248	00 0001 00 00000001	
371	249	00 0110 00 00000010	
372	250	00 1000 00 00000000	
373	251	00 0110 00 00000100	
374	252	01 1001 00 00011101	THEN 29
375	253	10 1000 00 00000001	THEN 1
376	254	11 1111 00 11101101	THEN 237
377	255	10 1110 00 11100000	IF 00= %10 THEN 224

Figure 8-5. Flowchart Examples — Command

8-111. EXECUTE COMMAND AND GO TO. *Figure 8-5* also shows an execute command and GO TO routine at address 252 (oct 374). ROM O_{15} is a 0 and O_{14} is a 1 setting the command mode. The low from O_{15} enables command decoder U11. ROM outputs O_{10} through O_{13} apply a binary address 1001 (9 decimal) to U11 pins 20 through 23. This selects U11 output 9 or command LD STOP. The low from O_{15} also presets U23A, applying a high to U22A pin 2. Another high is applied to U22A pin 1 from ROM O_{14}. This drives U22A output pin 3 low, enabling the LOAD inputs to state counters U25 and U28. The next clock pulse will initate command LD STOP and clock in parallel data on U25 and U28 pins 3 through 6. Thus the state counters will jump from address 252 (oct 374) to 29 (oct 35), binary 00011101.

8-112. EXAMINE QUALIFIER/JUMP IF 1. An example of examine qualifier/jump if 1 is shown in *Figure 8-6*. The diamond shaped box at address 44 (oct 54) is a qualifier decision box. The dependent qualifier line to be examined is indicated by the C within the box. At ROM address 44 (oct 54) ROM output O_{15} and O_{14} are both 1, setting the examine qualifier and jump if Q=1 mode. In this condition, neither the command decoder or latch are enabled, and qualifier flip-flop U23A is not preset, and therefore free to store a qualifier. The low on ROM output O_8 enables qualifier decoder U21, while outputs O_{10} through O_{12} select address 001 (qualifier input I_1) which is the C data line. The state of the C data line will be fed through U21 and U22D, then latched and store in U23A on the next clock pulse. The high on ROM output O_{14} programs U22A for a high qualifier jump. That is, the high from O_{14} combined with a high qualifier bit from U23A will drive U22A pin 3 low, enabling the LOAD inputs to jump state counters U25 and U28. Conversely, a low qualifier bit from U23A would force U22A pin 3 high, allowing the state counters to increment one address. If data line C is high, the state counters will jump to the address on their inputs, pins 3 through 6 (001 11 101, decimal 61, oct 75). If data line C is low, the state counters will increment from address 44 (oct 54) to address 45 (oct 55). Thus the state machine will select a qualifier bit, determine if it is a High, and if it is, jump to an indicated address.

8-113. Addresses 62 (oct 76) and 46 (oct 56) are also examine qualifier states, and operate as described previously. However, the qualifier line indicated is GND, referring to either U15 I_0 or U21 I_6. Since these lines are permanently grounded, the path chosen will be fixed. These qualifiers are used frequently throughout the flowcharts for a forced jump, as in state 62 (oct 76) or dummy state as in state 46 (oct 56).



ROM ADDRESS		RUN OUTPUTS 0_{15} ..... 0_0	MEANING
OCTAL	DECIMAL		
050	40	00 0100 00 00000000	
051	41	00 0110 00 00000001	
052	42	00 0011 00 00000000	
053	43	00 0110 00 00000001	
054	44	11 1001 00 00111101	
055	45	00 0110 00 00000000	
056	46	10 1110 00 00101111	
057	47	00 1001 00 00000000	
060	48	00 1001 00 00000000	
061	49	00 1001 00 00000000	
062	50	01 1001 00 00000001	

Figure 8-6. Flowchart Examples — Qualifier

8-114. Flowchart Operation

8-115. The following paragraphs describe how the flowchart can be used to determine a basic idle loop operation. Refer to the detailed flowchart diagrams provided in the back of this section.

8-116. The Main Program Idle Loop Routine Flowchart, *Figure 8-9*, begins with command CLR RMT CAL (state 0), which clears and presets the A5 HP-IB Interface Assembly. States 1 an 2 check the status of the rear panel BNC jacks X and Y. If either of these lines is pulled low, (ground), the program will exit to the X-Y subroutine. Command LATCH 8 (state 3) addresses output 8 of thumbwheel selector. If probe A is selected, the thumbwheel output data line A is pulled high by resistor pack A1R130, and fed as a qualifier bit to A1U21. Qualifier (state 4) examines this bit and seeing high, jumps to state 51. Command SET START CHAN HI (state 51) sets command latch U26 pin 5 high, enabling the start differential FET pair in Probe A. State 52 is a forced jump to state 6 where, in turn, STOP Channel Probe, START SLOPE, and STOP SLOPE are detected and enabled in the same manner.

8-117. States 15 through 20 serially accept and load the START Channel voltage into voltage drivers U5, U2, and U4, respectively, on A2 DAC Assembly. States 21 through 25 determine and set the polarity for the start voltage. Command LOAD START voltage to the START channel Sample and Hold Reference Amplifier A1U8. This command is repeated four times in order to allow sufficient time for sampling capacitor A1C5 to completely charge to the level of the applied DAC voltage.

8-118. State 29 examines A1U21 pin 6 to determine if A5 HP-IB Interface Assembly has requested RMTCAL (remote calibration). State 30 checks the REMOTE qualifier line (A1U21 pin 3). If REMOTE is high the state machine will jump to state 33. If REMOTE is low, indicating local operation, the state machine continues to state 31. States 31 and 32 examine the front panel level switch, to determine if a level calibration has been requested locally. A level calibrate request either remotely (state 129) or locally (state 32) will exit to the calibration subroutine (state 161). Otherwise, the flowchart continues to state 33 and examines the TIMER qualifier (A1U21 pin 9). The status of the TIMER determines whether the Trigger Light subroutine is entered or bypassed. If the TIMER qualifier is high, the Trigger Light subroutine is bypassed and the program continues to state 34, REMOTE.

8-119. State 34 examines the REMOTE qualifier line, and if true, bypasses the front panel switch qualifier routine (states 35 and 36). States 35 and 36 select and examine the A data line qualifier which looks at the position of the TIME ZERO front panel toggle switch. States 37 through 50 serially select and load the STOP channel voltages and polarity in exactly the same manner as the START channel. This completes a basic idle loop and the program now returns to state 1 to begin again. A simplified diagram of the 5363B main program idle loop and subroutines is given in *Figure 8-7*.

8-120. Flowchart Subroutines

8-121. The main program idle loop continually inputs data and examines qualifiers. Based on the qualifier inputs, the loop can continue through the program or branch to any of the following major subroutines:

1. X-Y External Program
2. Calibration
3. Calibration Error
4. Trigger Light
5. Time Zero

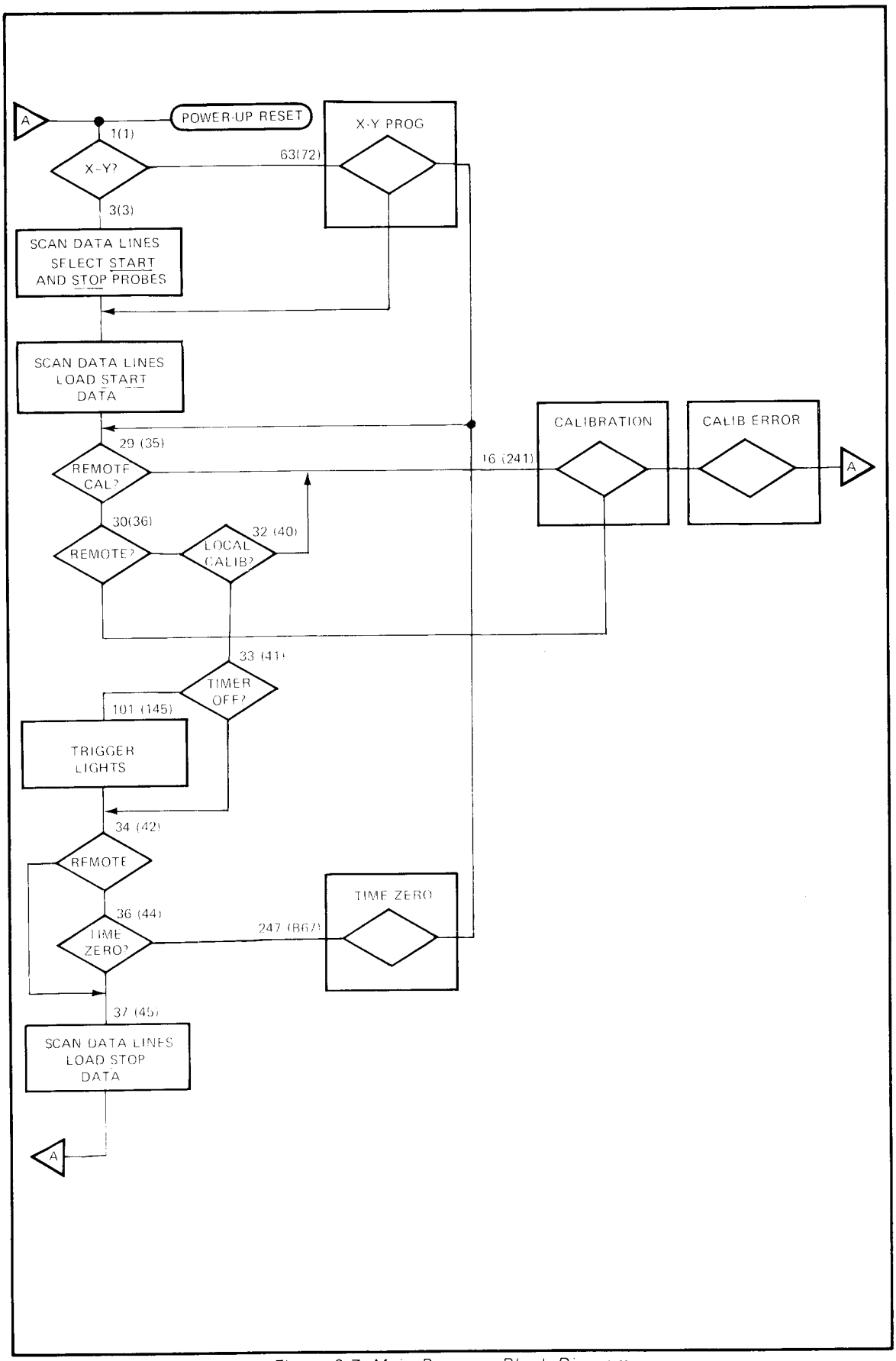


Figure 8-7. Main Program Block Diagram

8-122. The X-Y External Program uses states 63 through 100 of the flowchart. This subroutine is specifically designed for remote programming by other HP products. The X and Y qualifiers are determined by the rear panel BNC jacks and override thumbwheel (or HP-IB) control of Probe, Slope, and Level. The table in *Figure 3-2* indicates the X and Y qualifier relationship to the enforced fixed Start and Stop selection modes for the probes.

8-123. The Calibration subroutine begins by turning off four channel indicator lights at states 161 through 164. States 165 and 166 zero the A2 DAC assembly. States 167 through 169 first reset the calibration counters, then clock each once to get the calibration DACs slightly off zero volts. States 170 through 173 load the combined voltage from the A2 DAC (0.00 volts) and the offset calibration DAC (-100 mV) into the start channel reference. State 174 insures the start channel comparator has not yet triggered.

8-124. States 175 through 179 and 210 through 212 perform the start channel calibration. the routine loops around, incrementing the start calibration DAC one step with each pass. Each time a new voltage is loaded, the start channel comparator is examined. This routine will continue until the timer runs out or the comparator triggers. The voltage present when the comparator triggers is retained as the offset for the start channel.

8-125. State 180 checks the status of the RMTCAL (remote calibration) line. States 181 and 182 verify that the front panel level switch is still activated. This insures that the probe tip was grounded throughout the calibration and the offset value is accurate.

8-126. States 183 through 196 perform the calibration as previously described for the stop channel comparator. States 197 through 200 turn on all four channel indicator lights signaling calibration is complete. States 201 through 204 keep the lights on until the front panel switch is released. States 205 through 209 turn out lights and return to the main program.

8-127. The calibration error subroutine will provide a visual indication of flashing channel lights (in local operation) if any of the following calibration errors occur:

1. Channel comparator triggers before the calibration begins.
2. Channel comparator fails to trigger within one timer cycle.
3. Front panel calibration level switch is released before calibration is completed.

8-128. State 217 determines the status of REMOTE. If REMOTE is true, states 245 and 246 clear RMTCAL and set the ERROR FLAG on the A5 HP-IB assembly.

8-129. States 218 through 223 turn on the four channel lights and keep them on until the front panel calibration level switch is released. States 224 through 228 start the timer cycle and turn on the lights. States 229 through 232 and states 241 and 242 loop around, continually checking the front panel level switch until it is pressed or the timer cycle completes. States 233 through 240 turn off all lights, and again look for either a remote or local calibration request. Only if a level calibration is requested will the Calibration Error subroutine return to the main program. Otherwise, the subroutine will continue to loop, flashing the lights on and off.

8-130. The Trigger Light subroutine examines qualifiers and operates the four indicator lights. The subroutine allows the lights to identify the probe selected for Start and Stop Channels.

8-131. The trigger light subroutine is bypassed whenever the timer is running. When the timer runs out, the five qualifiers in states 101 through 105 are examined, by priority, to update the indicator lights. State 101 checks the status of the Start Lite qualifier. If neither channel start light is on, the program starts the timer (state 135), and proceeds to state 138. States 138 through 148 form a branch that examines the X-Y qualifier and the stop and start probe select switches. The branch routine turns on the stop and start channel selected, and turns off the lights not selected. With the timer running, state 148 jumps to state 136 where the Stop Pulse qualifier is checked. If no stop pulse has occurred, state 137 jumps to state 120 which starts the timer and returns to the main program.

8-132. States 103 through 108 and 131 through 134 form another branch. This branch reacts to a transition by a start pulse (state 103) or a stop pulse (state 104) by turning off the appropriate light. If both a start and stop pulse have occurred, the First qualifier (state 105) determines which was first. After the light is turned off, the program jumps to state 120 which starts the timer and returns to the main program. The main program will continuously cycle through the idle loop until the timer circuit times out, at which time the trigger light subroutine can be reentered and the lights updated.

8-133. The Time Zero subroutine consists of states 247 through 252. This command string is entered when the front panel TIME ZERO/LEVEL switch is raised to TIME ZERO position. Command LATCH 15 (state 247) drives output 15 (pin 17) of A1U10 low, effectively zeroing all four thumbwheel switch output data lines through diodes CR9 through CR12. State 248 resets the A2 DAC assembly to zero. States 249 through 252 now load zeros in as reference voltage for Start and Stop channels. The DAC will continue to be reset and zeroed as long as the TIME ZERO switch is raised.

8-134. TROUBLESHOOTING

8-135. For troubleshooting purposes, the operation of the 5363B may be divided into two major functional area; the RF section and the logic control section. The RF section includes the probes, channel switches, comparators, output drivers, and power supply. It contains the complete signal path from probe tip to output BNC. The logic control section includes the state machine with associated circuitry, calibration and reference DACs, and Sample and Hold Reference Amplifiers.

8-136. To localize a problem, first determine which of two major functional areas is a fault. The functional operation of the RF section can be verified by simulating a Time Zero calibration, paragraph 3-13. This procedure injects a stream of pulses (6 μs negative pulses at 20 kHz) into both probe tips. These pulses can be traced through the individual channel stages using an oscilloscope and standard signal tracing procedures.

8-137. Troubleshooting the logic control section requires a thorough knowledge of both the hardware operation and the state machine program. Refer to Theory of Operation, paragraph 8-57, for an overall instrument block diagram discussion, as well as detailed descriptions of the state machine and flowchart operation (paragraph 8-95).

8-138. State Machine Troubleshooting Techniques

8-139. The following paragraphs describe two separate methods of troubleshooting the state machine. The first method uses the 5004A Signature Analyzer. This involves a simple hookup procedure and a node-by-node examination, using the signature tables provided. The second methods uses the 1600A Logic Analyzer and requires a more comprehensive understanding of the flowchart and state machine theory.

8-140. Signature Analysis

8-141. Signature analysis employs a unique data compression technique that reduces a long, complex data stream pattern on a logic node into a four character symbol signature. By examining a logic node whose correct "signature" is known, a comparison can be made with the circuit running at full operating speed. By probing various nodes, finding bad signatures, and then tracing them back to the functional origin, the actual fault source can be found. The signatures in *Table 8-2* have been determined empirically from a known good product.

NOTE

No signature appearing on the 5004B Signature Analyzer display has any particular significance beyond being a correct expected signature or an incorrect signature. The number is, however, a count residue in the 5004A shift register, converted to and displayed in a modified hexadecimal.

8-142. *Table 8-2* Contains the hookup procedure for troubleshooting the 5363B using Signature Analysis. Separate procedures are given for the A1 Motherboard and the A5 HP-IB Interface.

8-143. Logic Analyzer

8-144. The 1600A Logic Analzyer can be used to monitor the state machine. Using the following hookup procedure and the detailed flowcharts in *Figure 8-9*. a state-by-state examination of state machine operation can be observed.

8-145. Clock Stopped

a. Disconnect the 5363B power cord, and remove cabinet covers.

b. Carefully place IC clips on A1U22, U25, and U28.

8-146. Clock Running

a. To check any particular address with clock running, set TRIGGER WORD switches to the desired address, TRIGGER MODE to WORD and remove the jumper from TP1 and TP2 step f . The selected address will be "enhanced" and appear at the top of the column. If the 1600A does not display, either the state machine does not normally step through that address or trouble exists.

b. An additional technique which proves helpful uses the DELAY mode of the 1600A. Set DELAY to ON, END, DISPLAY and thumbwheel switches to 00007. This displays the selected address enchanced , the eight states that precede it and the seven states that follow it.

Table 8-2. 5363B Signature Analyzer Hook-Up Procedure

A1 MOTHERBOARD

a. Disconnect the 5363B power cord, and remove cabinet cover.

b. Using an IC clip on A1U28, connect the 5004A test pod inputs as follows:

START ..... U28 pin 15
STOP ..... U28 pin 15
CLOCK ..... U28 pin 2
GND ..... U28 pin 8

c. Place a jumper wire from U28 pin 9 to U28 pin 16. This disables the "jump" capability and forces the state counters to increment through all ROM addresses in order. This connection will cause all four-channel indicators to light dimly.

d. Place a jumper wire from U10 pin 17 to U14 pin 14. This disables the feedback loop through diodes CR9 through CR12.

e. Place a jumper wire from pin 1 of A1U14 to ground (pin 8). This will disable the asynchronous inputs to the MUX A1U21, resulting in stable signatures.

f. Set 5004A controls as follows:

LINE ..... IN (ON)
START, STOP, CLOCK ..... ⨍
HOLD, SELF-TEST ..... OUT (OFF)

g. Set 5363B controls as follows:

LINE ..... IN (O)
START ..... A; +0.00 ⨍
STOP ..... B; +0.00 ⨍
PULL TO ADD 10 ns ..... IN

h. Connect power to 5363B.

i. For each signature, press RESET on Signature Analyzer probe to insure stability.

S.A.: START/STOP/CLOCK "⨍"
5363B: "A+0.00 ⨍ B+0.00 ⨍"

A1 MOTHERBOARD

PIN	U10	U11	U15	U16	U20	U21	U25	U26	U28	U29	U30
1	40P6	A70A	0000	0000	0000	P980	CC34	87C7	CC34	6F54	0000
2	5AUA	AH9A	CC34	0000	0000	ACFA	*	U669	*	H760	CC34
3	876F	822P	CC34	*	5241	CC34	87C7	F11U	2FUC	PUH6	59CF
4	C36U	0089	CC34	CC34	3HUH	3F35	U669	7A47	7U57	54P2	9458
5	6695	55F2	CC34	CC34	7H94	C56P	F11U	863H	470F	7A47	2HH8
6	695F	00PP	A52U	0000	7C6H	CC34	U559	C56P	7H2U	F173	U669
7	4U2H	974U	A434	0000	974U	0000	CC34	3F35	2799	0000	U559
8	APA2	CC34	0000	A434	0000	0000	0000	0000	0000	8701	7U57
9	H19P	PUH6	CC34	P79U	0000	CC34	CC34	P79U	CC34	3F35	7H2U
10	CC34	6F54	FP65	HA6F	0000	980U	CC34	HA6F	2799	OP5A	0000
11	6177	769F	C9UP	A52U	U559	C9UP	4C5P	C579	H1U1	C56P	P93C
12	0000	0000	P93C	C579	F11U	P93C	9458	8472	HH4H	3H09	FP65
13	P362	CA36	AUA4	8472	U669	AUA4	5U83	U559	245C	863H	85H0
14	F5C8	CC34	7C39	CC34	87C7	2376	2HH8	A70A	59CF	CC34	H1U1
15	3F0P	3043	F00H		0000	9842	2799	CC34	66AP		HH4H
16	7216	06CP	CC34		CC34	CC34	CC34	CC34	CC34		0000
17	CC34	0H65									PH08
18	0000	85H0									AUA4
19	0000	*									C9UP
20	7C6H	FP65									980U
21	7H94	AUA4									470F
22	3HUH	P93C									2FUC
23	5241	C9UP									F11U
24	CC34	CC34									87C7
25											5U83
26											4C5P
27											245C
28											CC34

*: Clock Signature (0000 or CC34). Check for flashing probe.

Table 8-2. 5363B Signature Analyzer Hook-Up Procedure (Continued)

A5 HP-IB INTERFACE

a. Disconnect the 5363B power cord, and remove cabinet cover.

b. Remove A5 HP-IB Interface assembly and reinstall on extender board.

NOTE

The lower hex nut stud and HP-IB address switch must be removed to extract A5.

c. Set HP-IB address switch to 0000000 and reinstall in A5 assembly.

d. Using an IC clip on A5U8, connect the 5004A test pod inputs as follows:

START ..... U8 pin 15
STOP ..... U8 pin 15
CLOCK ..... U8 pin 2
GND ..... U8 pin 8

e. Place a jumper wire from A5U8 pin 9 to pin 16. This disables the "jump" capability and forces the state counters to increment sequentially through all ROM addresses. Disregard any front panel lights.

*f. Place a jumper wire from A1TP1 to A1TP2 (located between R130 and U10). This halts the motherboard clock, stopping the asynchronous data to the ASCII board and allows more stable signatures.

*g. Connect a jumper across A1C10 to put the A1 board state machine into its reset state.

h. Set 5004A controls in step "e" of A1 Motherboard hook-up procedure.

i. Set 5363B controls in step "f" of A1 Motherboard hook-up procedure.

j. Connect power to 5363B.

*k. Pulse high pin 7 of A1U20 with a logic pulser several times to reset this register. Check for the reset condition by confirming that pins 3, 4, 5, and 6 of A1U20 are at a logic 0.

*l. Pulse low pin 1 of A5U16 several times to reset the SR flip-flop. Check for this reset condition by confirming that pins 3 and 9 of A5U12 are at a logic 1, and pin 2 is at a logic 0.

m. For each signature, press RESET on Signature Analyzer probe to insure stability.

NOTE

An extender board, P/N 5060-0049, can be modified as shown above to eliminate steps f, g, k, l of the New Signature Analysis Procedures for the HP-IB Board. This modification sets all of the A5 input states to their proper values on instrument power-up, thus providing the same signatures as the A5 Signature Analysis table - located on page.

*See *Figure 8-8* "Extender Board Modification".

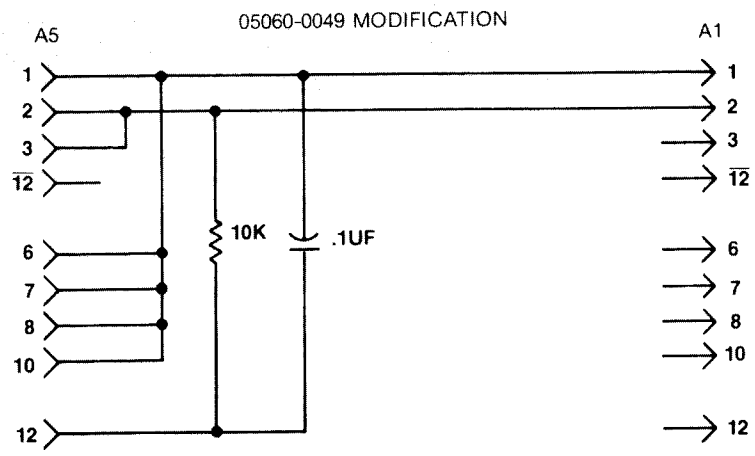
Table 8-2. 5363B Signature Analyzer Hook-Up Procedure (Continued)

S.A.: START/STOP/CLOCK " ⨍ "
5363B: A+0.00 ⨍ B+0.00 ⨍
Address: 0000000

A5 HP-IB INTERFACE

PIN	U1	U3	U4	U7	U8	U10	U11	U12	U13	U15	U17	U19
1	0000	F0UF	F0UF	6688	CC34	0377	0377	UFP3	0000	CC34	CC34	F8U5
2	CC34	AAFP	AAFP	8366	*	0C16	F0UF	0000	CC34	*	96FC	0000
3	59CF	45H1	45H1	CC34	8P77	UC1C	0000	CC34	CC34	F0UF	CC34	0377
4	9458	0000	0000	5HUC	57AU	CC30	F8U5	66AU	CC34	AAFP	917P	CC34
5	2HH8	61P0	487C	229U	55C2	8863	AAFP	8021	CC34	45H1	4PP2	0000
6	AAFP	5C44	66AU	CC34	1H1F	229U	0000	5C44	CC34	112P	U5H6	CC34
7	112P	8021	UFP3	1AFH	2799	CC34	PH54	61P0	5HC8	CC34	0000	0000
8	57AU	0000	0000	0000	0000	0000	0000	0000	0000	0000	CC34	0000
9	1H1F	HF70	6688	CC34	CC34	73F8	A5H2	CC34	2785	CC34	0000	0000
10	0377	8366	9FC1	171H	2799	50U2	0000	66FC	P3HU	CC34	CC34	CC34
11	2525	P6FU	P68F	P511	H1U1	58C8	112P	P511	P511	4C5P	CC30	0000
12	171H	55UA	81U9	2525	HH4H	917P	P7H5	2525	2525	9458	0000	CC34
13	2A4A	112P	112P	AUA6	245C	AUA6	0000	AUA6	AUA6	5U83	CC34	A5H2
14	H1U1	0C16	UC1C	391F	59CF	2525	45H1	U539	P1HA	2HH8	CC34	P7H5
15	HH4H	229U	8863	8228	66AP	P511	0000	4P0H	5APP	2799		PH54
16	0000	CC34	CC34	CC34	CC34	CC34	CC34	CC34	CC34	CC34		CC34
17	08F0											
18	AUA6											
19	P511											
20	P3HU											
21	55C2											
22	8P77											
23	45H1											
24	F0UF											
25	5U83											
26	4C5P											
27	245C											
28	CC34											

*: Clock Signature (0000 or CC34). Check for flashing probe.

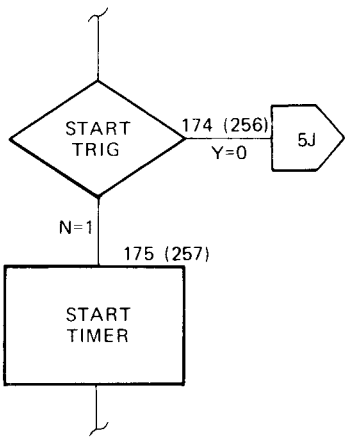


An extender board, P/N 5060-0049, can be modified as shown above to eliminate steps f, g, k, and l of the New Signature Analysis Procedures for the HP-IB board. This modification sets all of the A5 input states to their proper values on instrument power-up, thus providing the same signatures as the table.

Figure 8-8. Extender Board P N 5060-0049 Modification

8-147. Flowchart Documentation

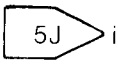
8-148. The 5363B flowcharts are annotated in the following format:



a. Program addresses are given in decimal and octal (e.g., 174_{10} (256_8)).

b. START TRIG is the qualifier examined at program address 174_{10} (256_8).

c. START TIMER is the command executed at state 175_{10} (257_8).

d. 

is an off-page indicator, with J as the destination on sheet 5.

e. Y=0 and N=1 identify the operation mode of the qualifier. If START TRIG is true (Y=YES) then the qualifier bit (U22A pin 2) will be 0 (low), and the program will jump to different address. If START TRIG is false (N=NO) then the qualifier bit will be 1 (high) and the program will increment to the next sequential address. The state machine operation modes are given in *Table 8-3* below.

Table 8-3. State Machine Operation Modes

OPERATION MODES	MOTHERBOARD ROM		HP-IB ROM	
	0_{15}	0_{14}	0_{15}	0_{14}
Execute Command and Count	0	0	1	0
Execute Command and Jump (GO TO)	0	1	1	1
Examine Qualifier/Jump if High	1	1	0	1
Examine Qualifier/Jump if Low	1	0	0	0

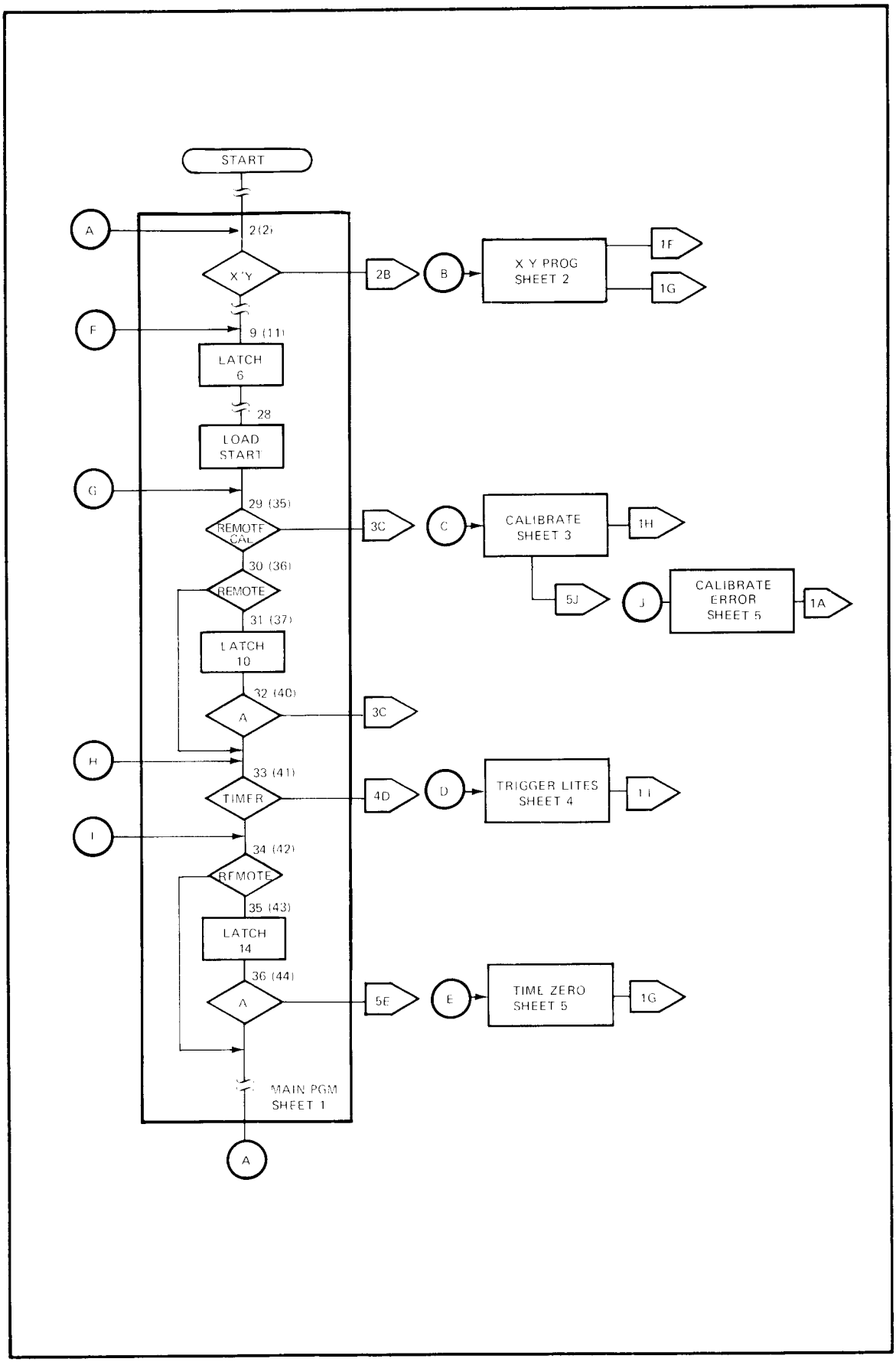
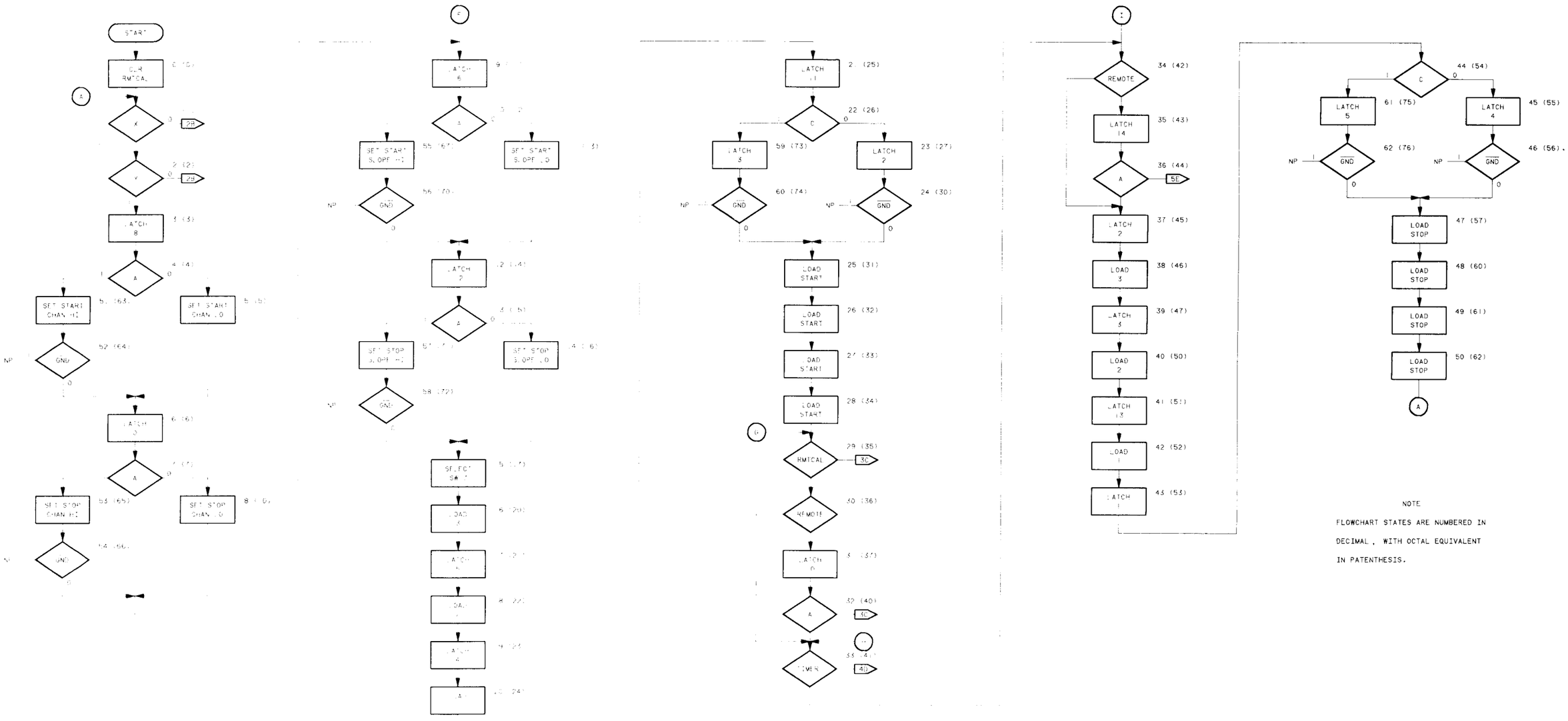


Figure 8-9. Main Program (Legend)



NOTE

FLOWCHART STATES ARE NUMBERED IN DECIMAL , WITH OCTAL EQUIVALENT IN PATENTHESIS.

Figure 8-9. Main Program (Idle Loop Routine) Flowchart
Sheet 1 of 5

Figure 8-9
MAIN PROGRAM (IDLE LOOP ROUTINE) FLOWCHART
Sheet 1 of 5

See Page 8-39

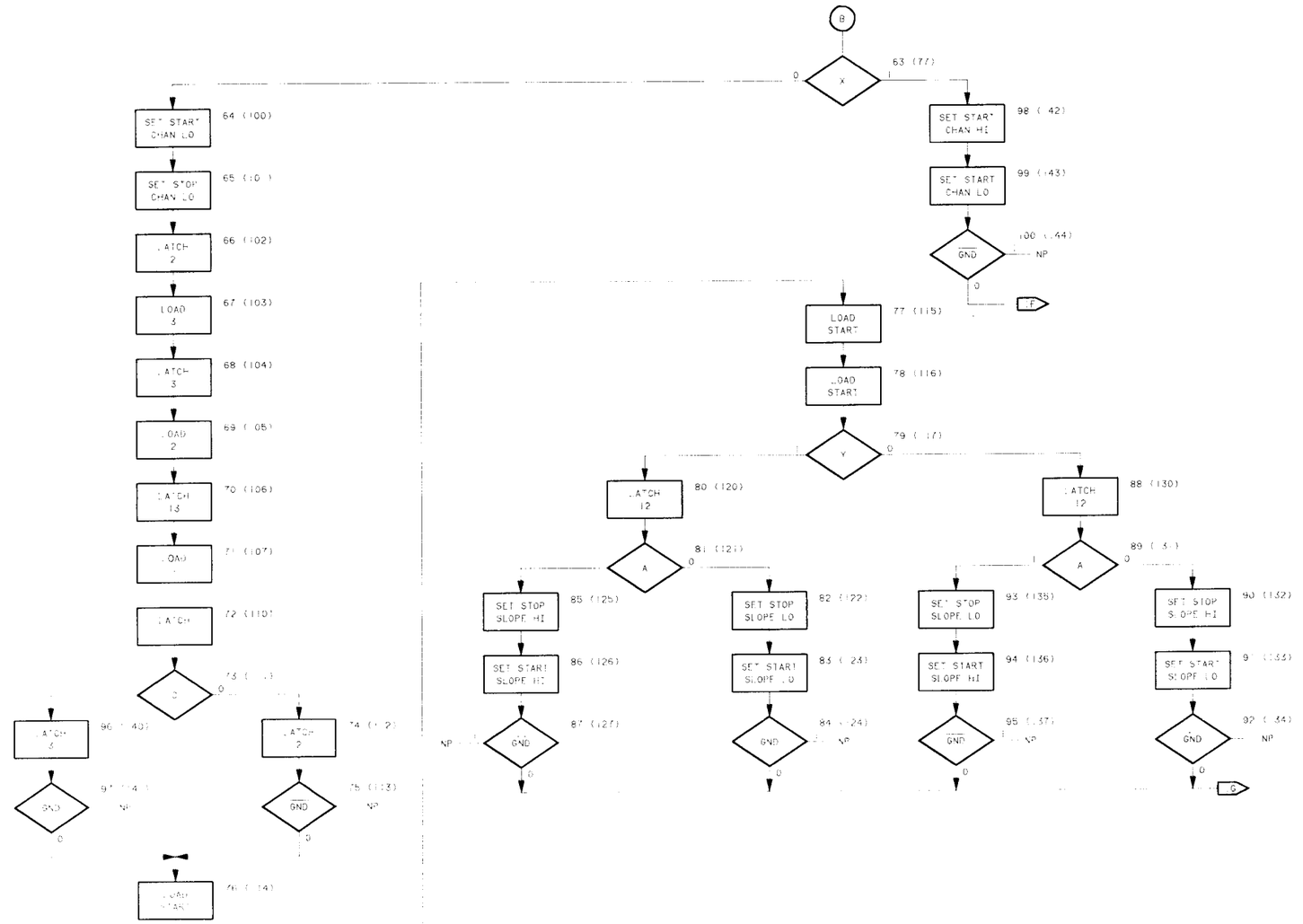


Figure 8-9. Main Program (Idle Loop Routine) Flowchart
Sheet 2 of 5

Figure 8-9
MAIN PROGRAM (IDLE LOOP ROUTINE) FLOWCHART
Sheet 2 of 5

See Page 8-41

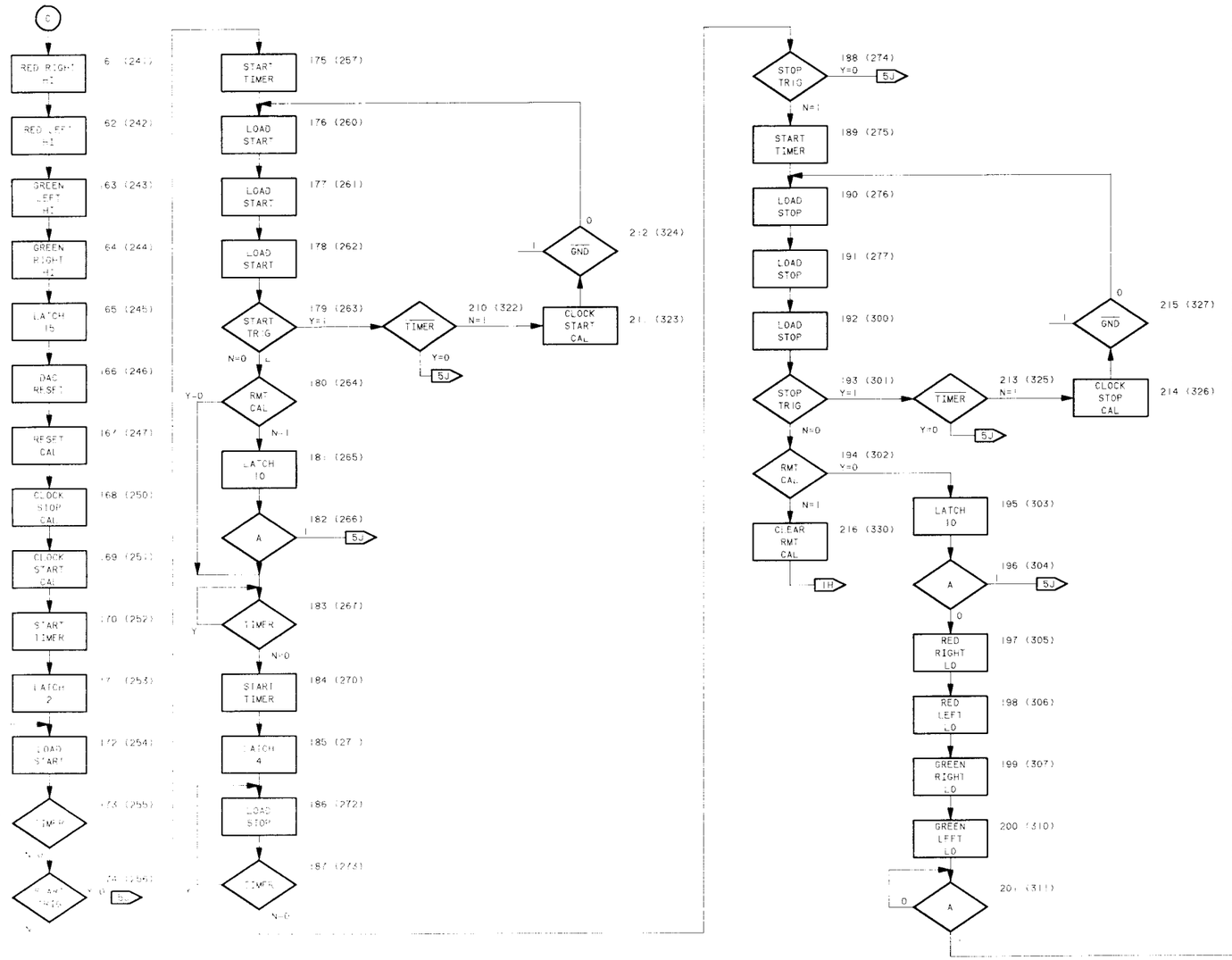


Figure 8-9. Main Program (Idle Loop Routine) Flowchart
Sheet 3 of 5

Figure 8-9
MAIN PROGRAM (IDLE LOOP ROUTINE) FLOWCHART
Sheet 3 of 5

See Page 8-43

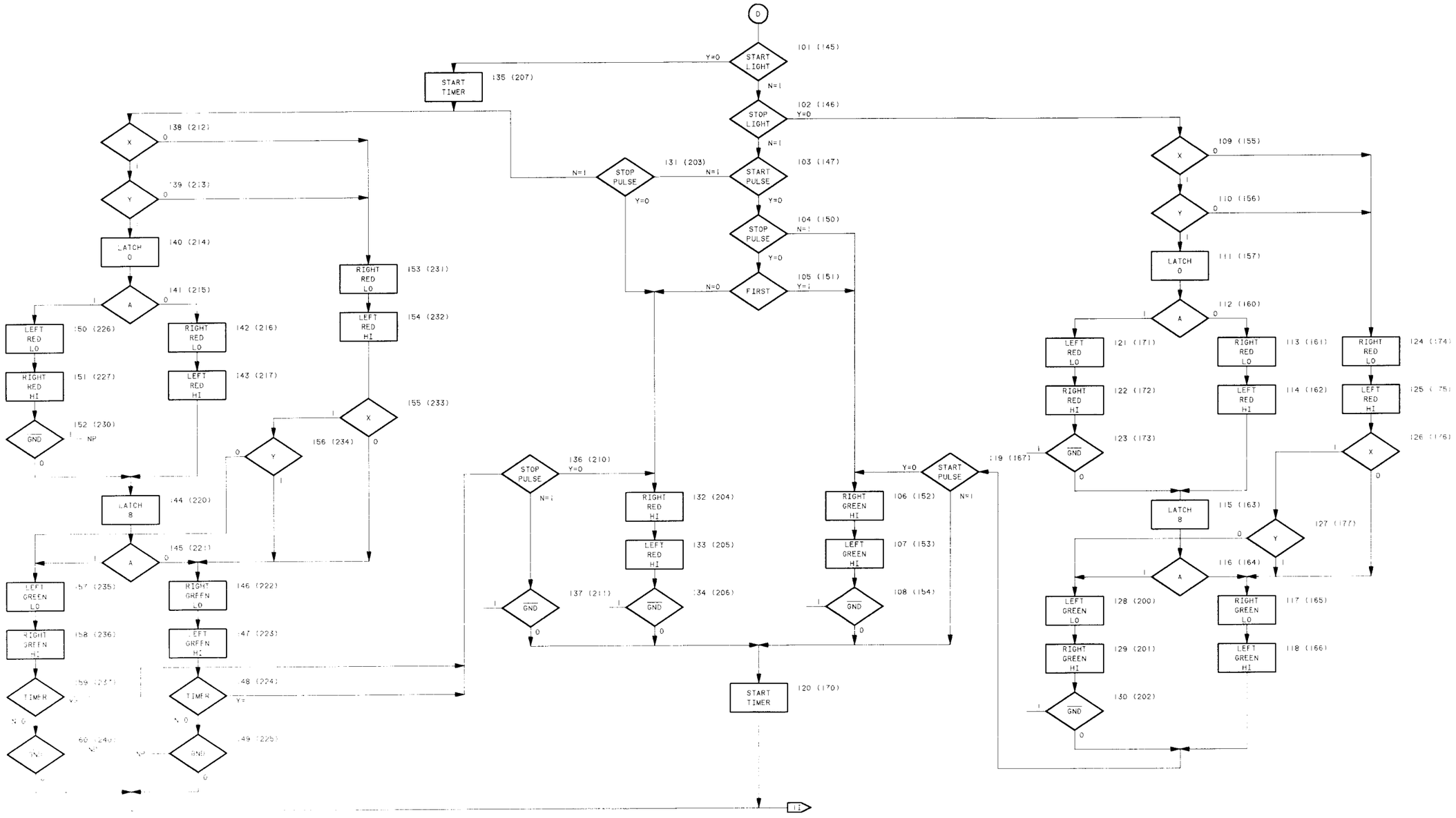


Figure 8-9. Main Program (Idle Loop Routine) Flowchart
Sheet 4 of 5

Figure 8-9
MAIN PROGRAM (IDLE LOOP ROUTINE) FLOWCHART
Sheet 4 of 5

See Page 8-45

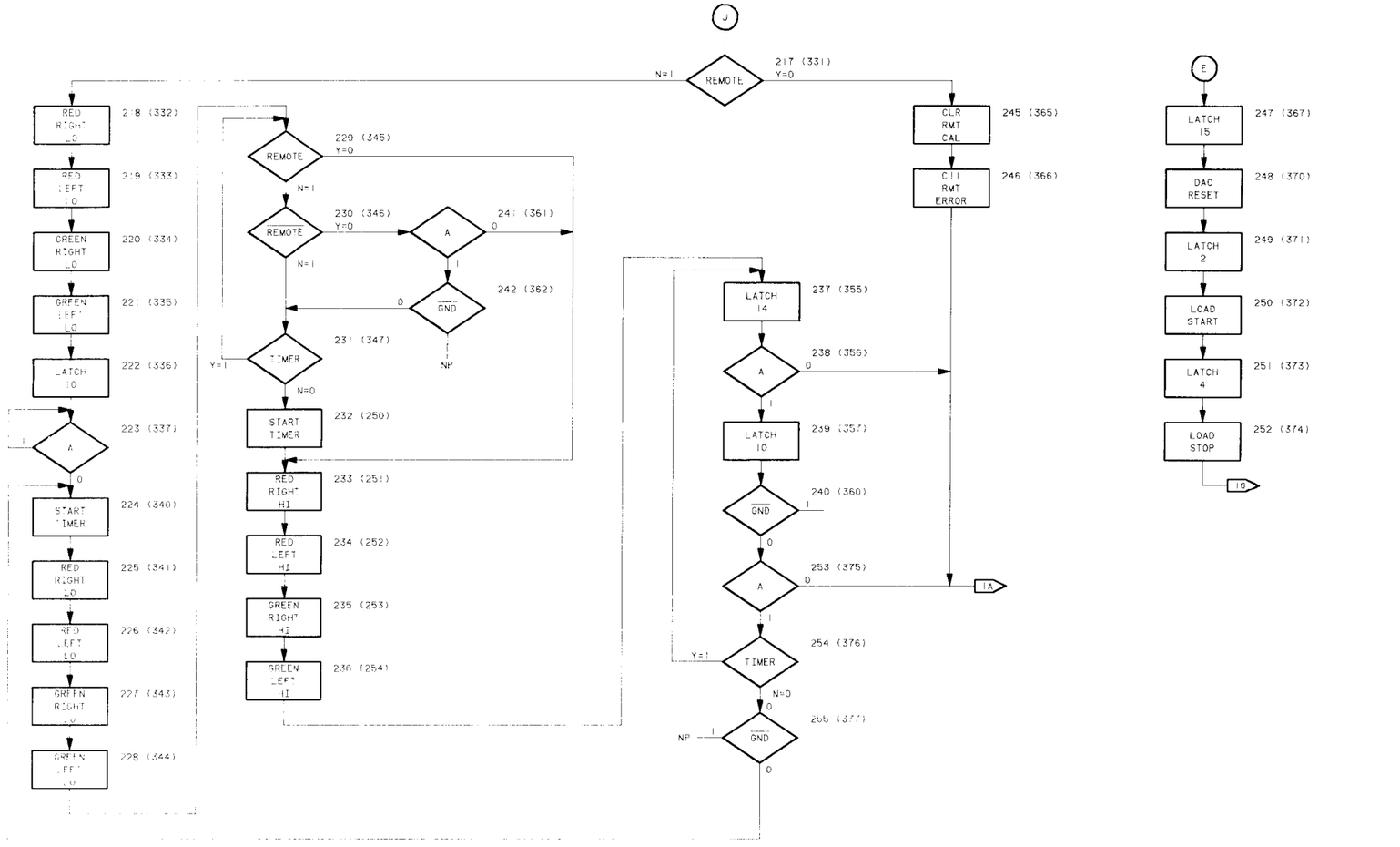
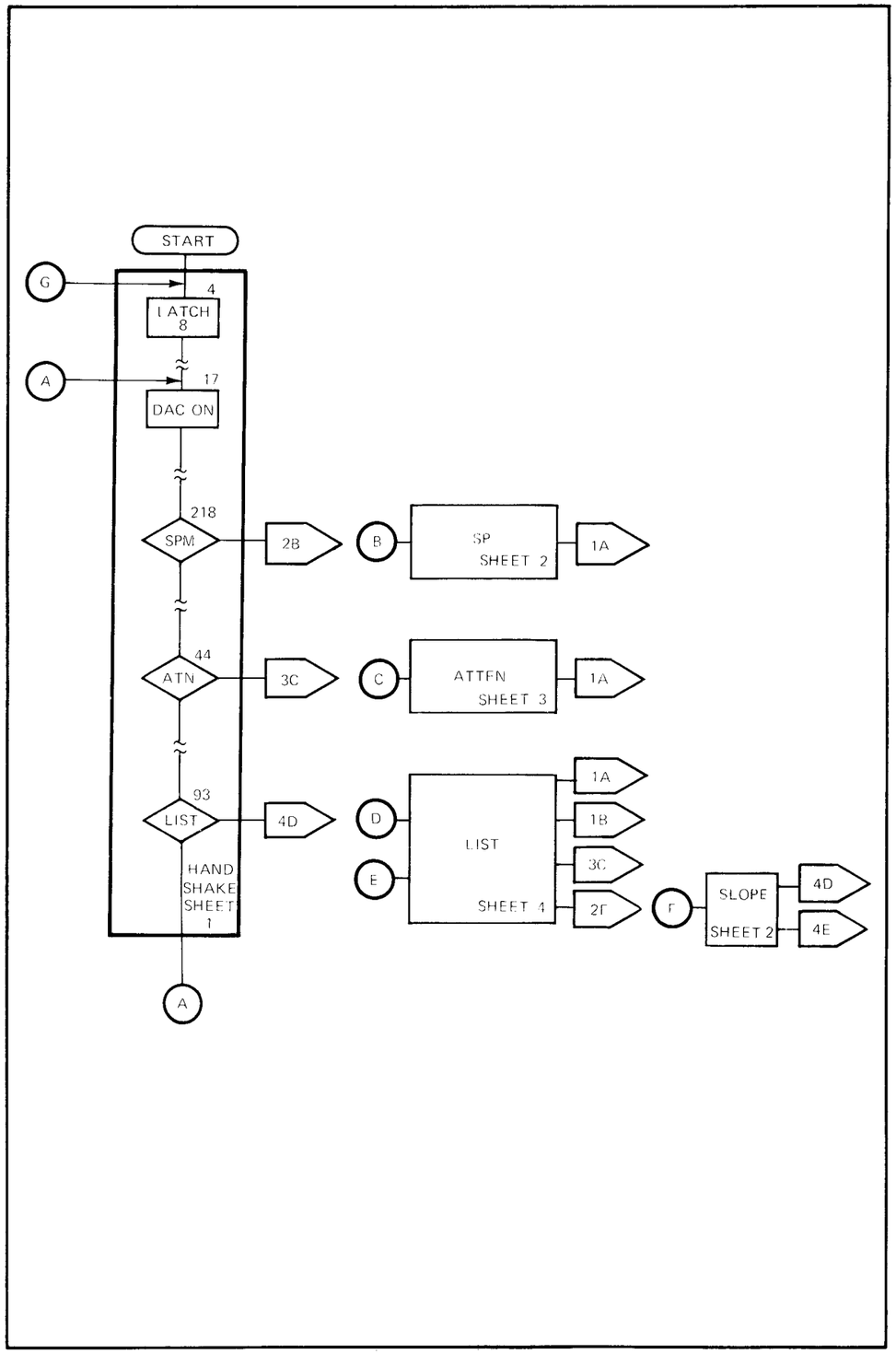


Figure 8-9. Main Program (Idle Loop Routine) Flowchart
Sheet 5 of 5



Part of Figure 8-10. HP-IB Program (Legend)

Figure 8-9
MAIN PROGRAM (IDLE LOOP ROUTINE) FLOWCHART
Sheet 5 of 5

See Page 8-47

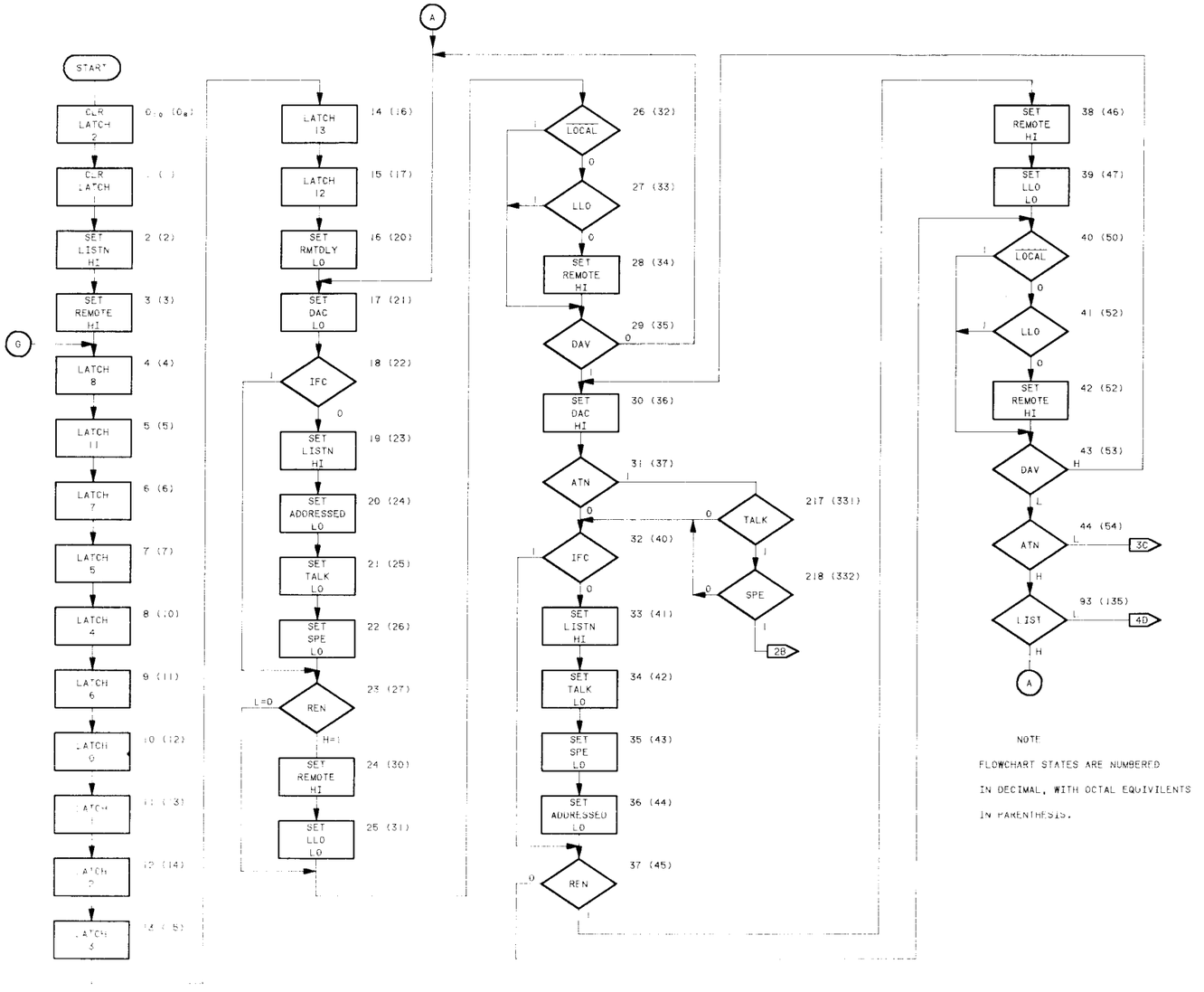
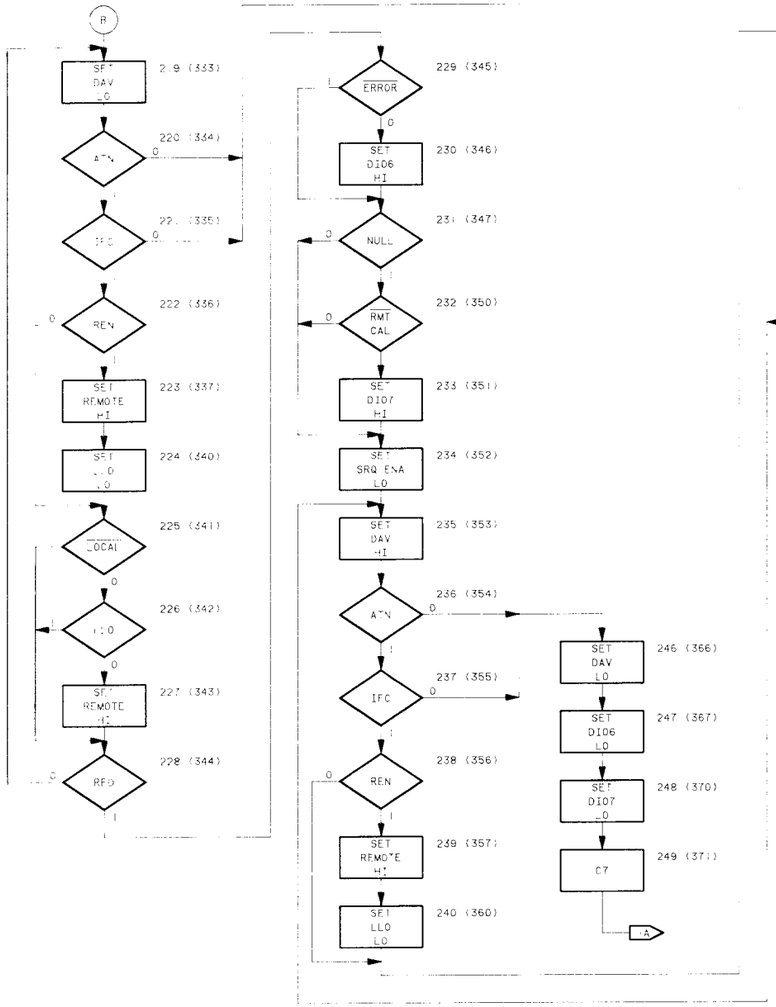
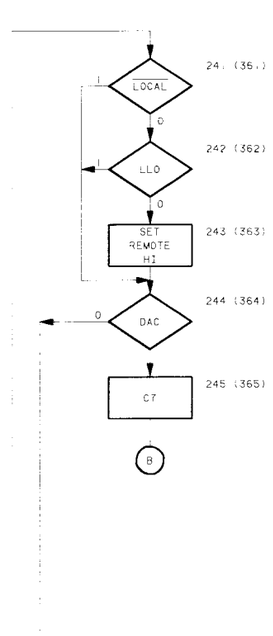


Figure 8-10. HP-IB Program (Handshake Routine) Flowchart
Sheet 1 of 4

Figure 8-10
HP-IB PROGRAM (HANDSHAKE ROUTINE) FLOWCHART
Sheet 1 of 4

See Page 8-49





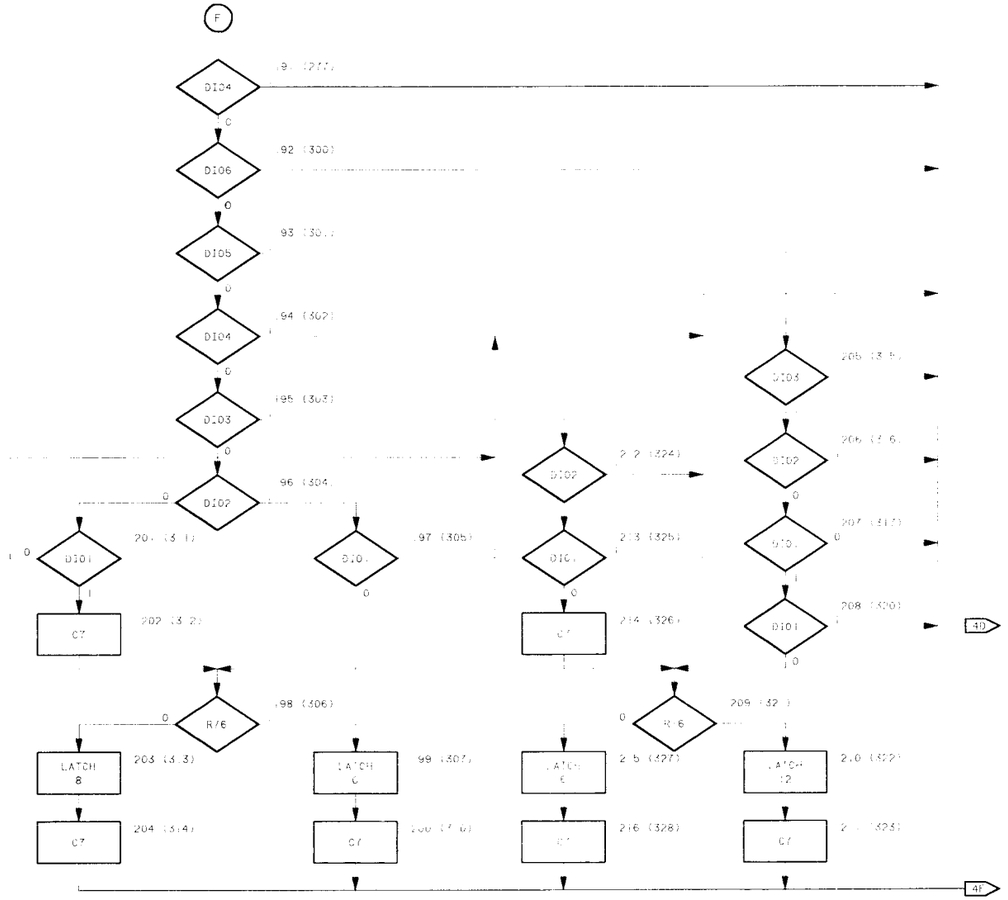


Figure 8-10. HP-IB Program (Handshake Routine) Flowchart
Sheet 2 of 4

Figure 8-10
HP-IB PROGRAM (HANDSHAKE ROUTINE) FLOWCHART
(Sheet 2 of 4)

(See Page 8-51)

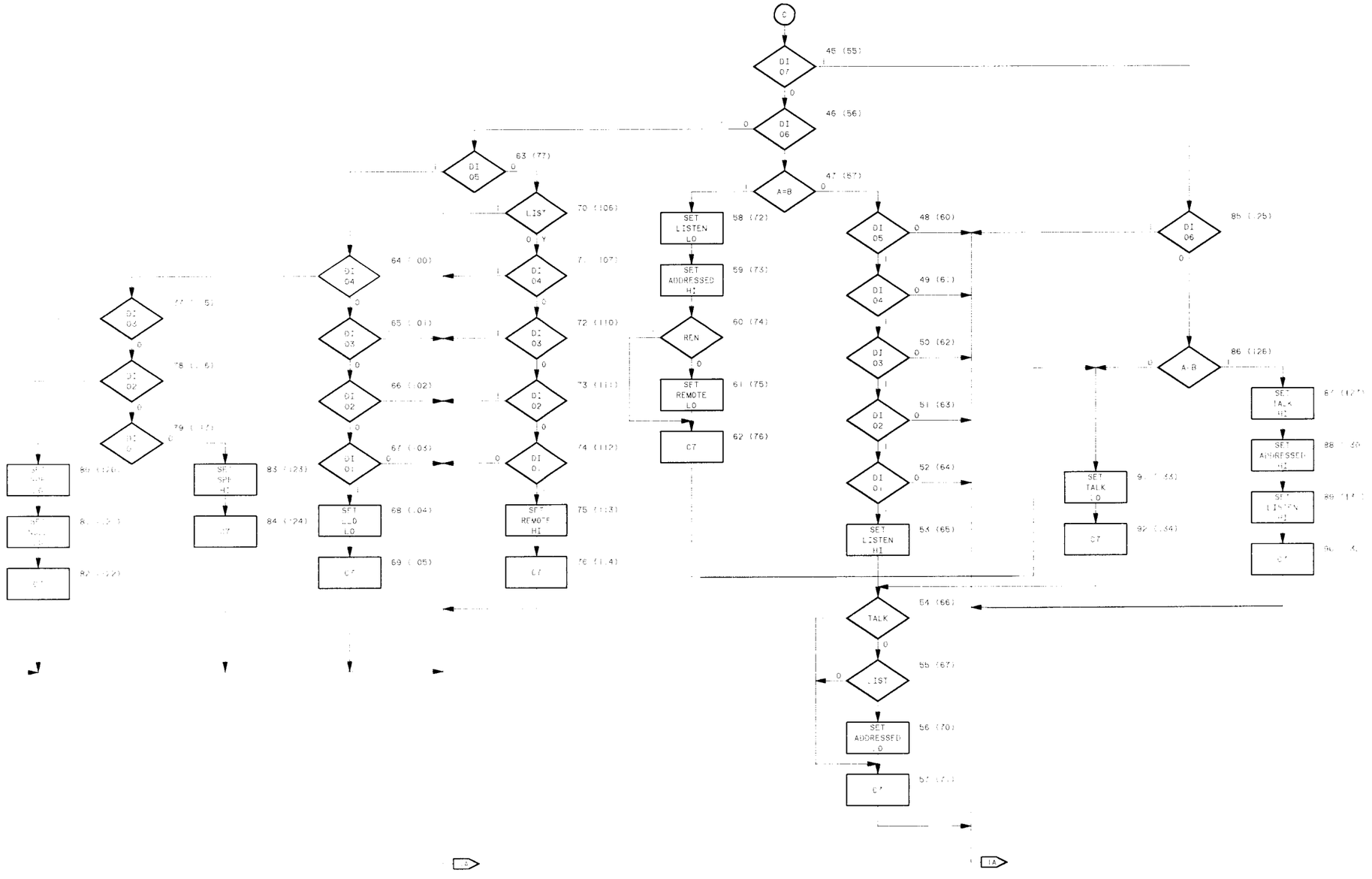


Figure 8-10. HP-IB Program (Handshake Routine) Flowchart
(Sheet 3 of 4)

Figure 8-10
HP-IB PROGRAM (HANDSHAKE ROUTINE) FLOWCHART
Sheet 3 of 4

See Page 8-53

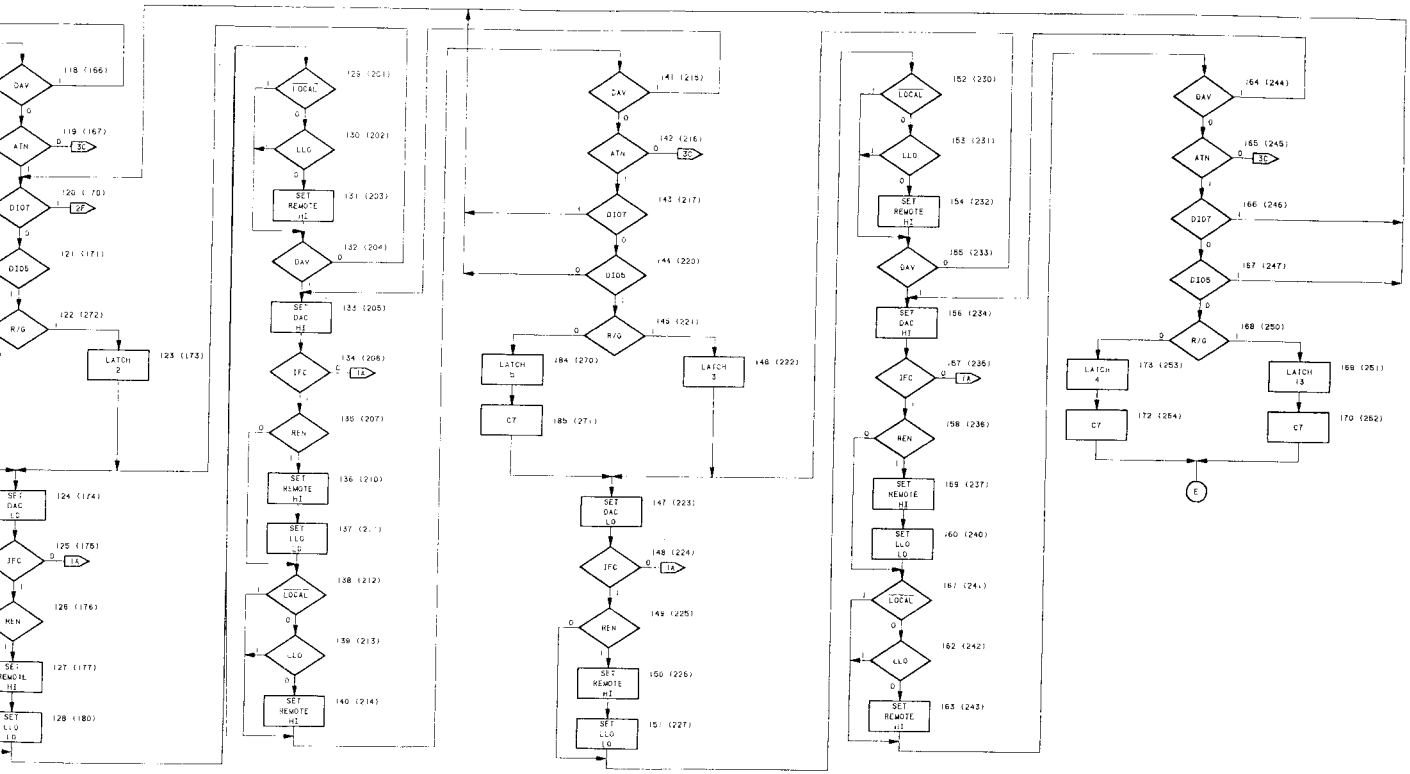
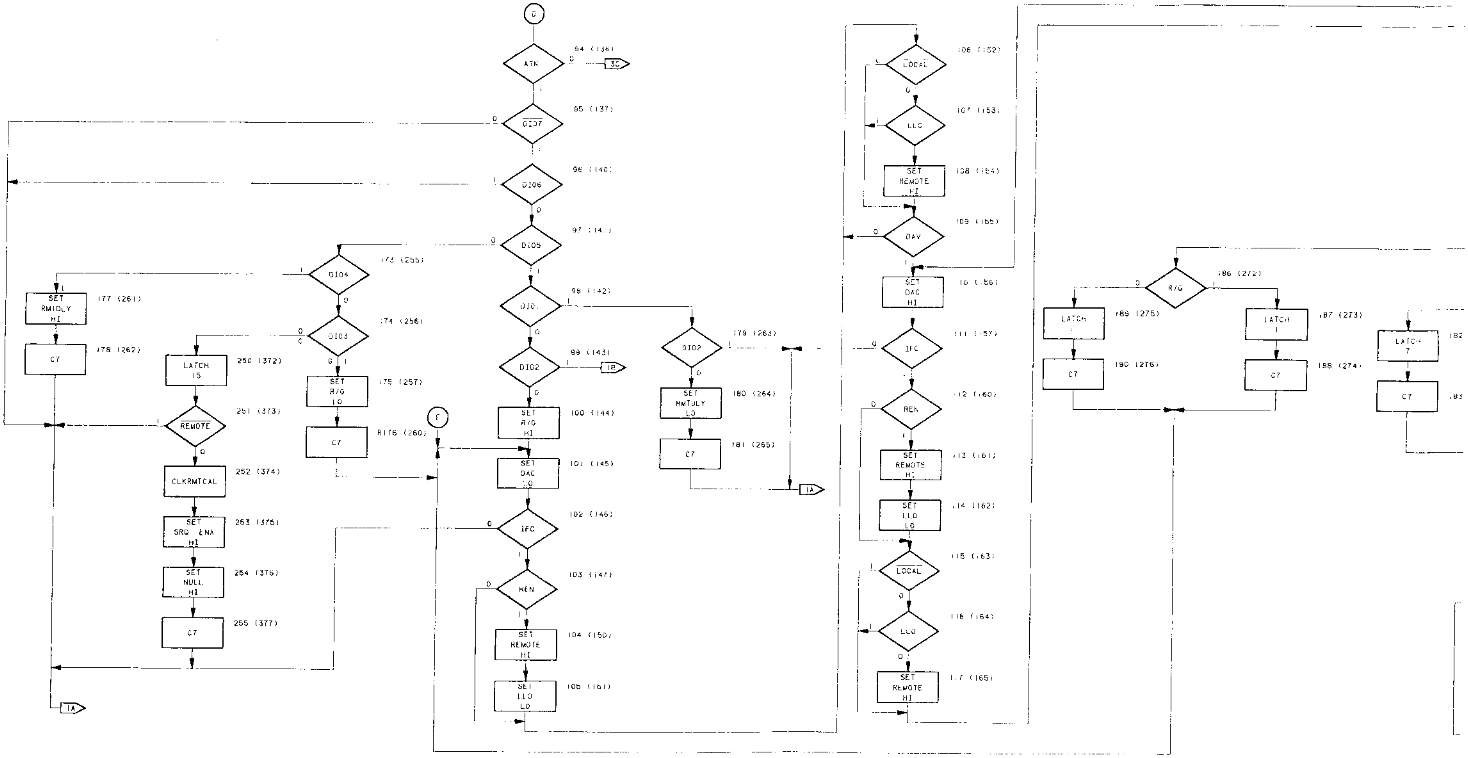


Figure 8-10. HP-IB Program (Handshake Routine) Flowchart
(Sheet 4 of 4)



ATN
DIO7
DIO6
DIO5
DIO4
DIO3
DIO2
DIO?
SET RMIDLY HI
C7
LATCH 15
REMOTE
CLKRMTCAL
SET SRQ ENA HI
SET NULL HI
SET R/G LO
SET R/G HI
SET DAC LO
IFC
REN
SET REMOTE HI
SET LLO LO
SET RMTDLY LO
LOCAL
LLO
DAV
SET DAC HI
R/G
LATCH
IA
IB
3C

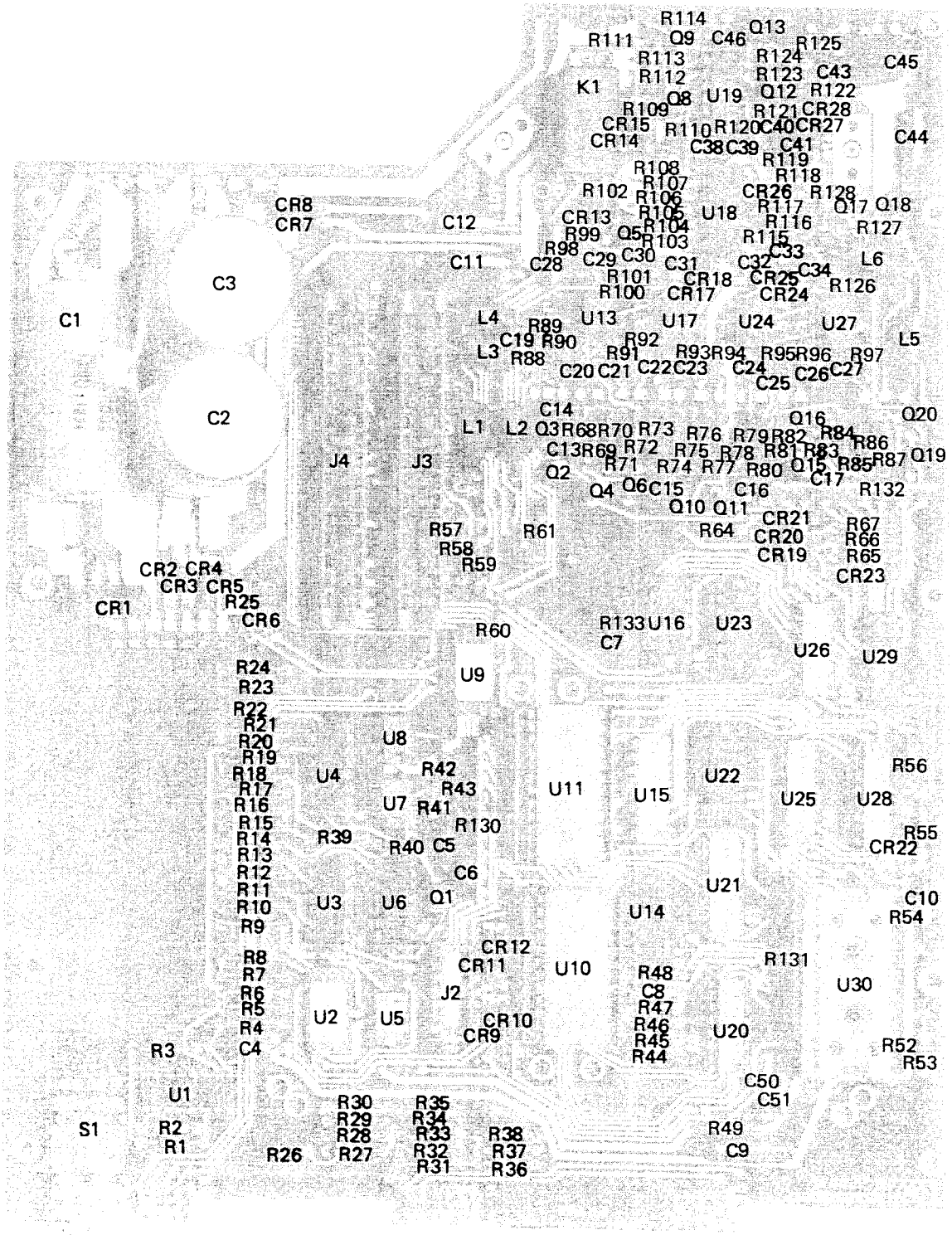
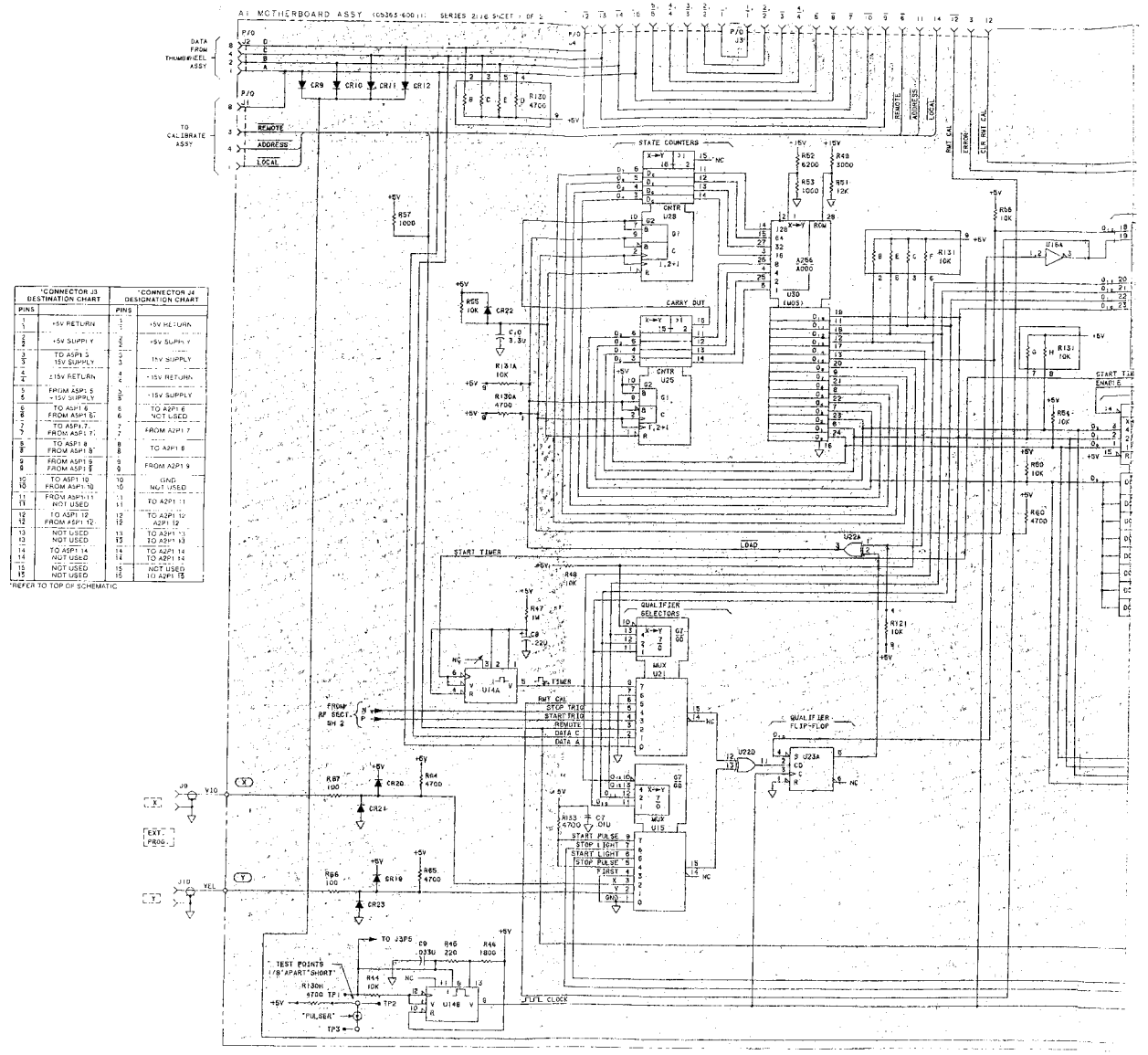
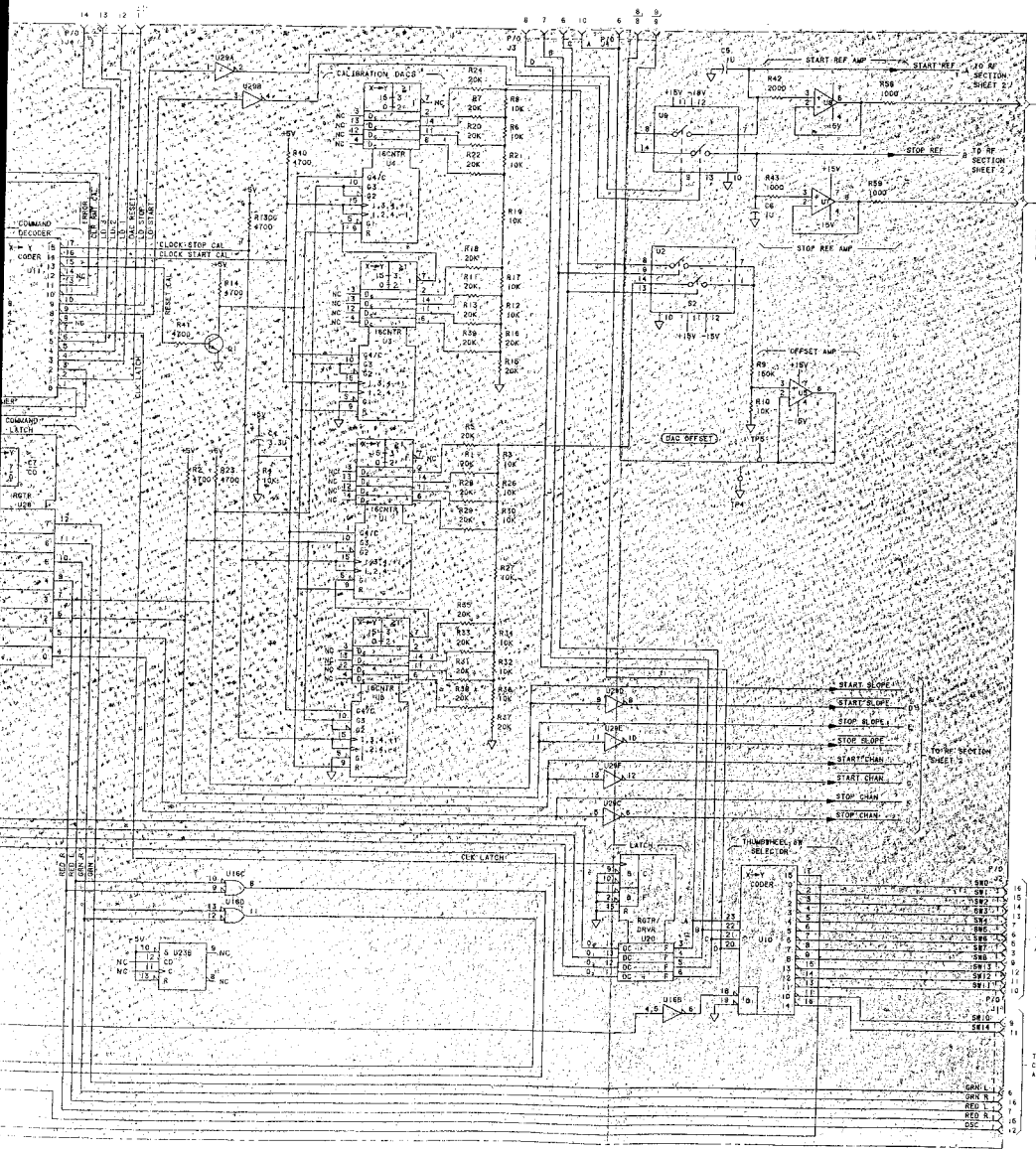


Figure 8-11. A1 Motherboard Schematic Diagram (Sheet 1 of 2)



*CONNECTOR J3 DESTINATION CHART		*CONNECTOR J4 DESIGNATION CHART
PINS		PINS
1 1	+5V RETURN	1 1 +5V RETURN
2 2	+5V SUPPLY	2 2 +5V SUPPLY
3 3	TO A5P1 3 15V SUPPLY	3 3 15V SUPPLY
4 4	-15V RETURN	4 4 -15V RETURN
5 5	FROM A5P1 5 -15V SUPPLY	5 5 -15V SUPPLY
6 6	TO A5P1 6 FROM A5P1 6	6 6 TO A2P1 6 NOT USED
7 7	TO A5P1 7 FROM A5P1 7	7 7 FROM A2P1 7
8 8	TO A5P1 8 FROM A5P1 8	8 8 TO A2P1 8
9 9	FROM A5P1 9 FROM A5P1 9	9 9 FROM A2P1 9
10 10	TO A5P1 10 FROM A5P1 10	10 10 GND NOT USED
11 11	FROM A5P1 11 NOT USED	11 11 TO A2P1 11
12 12	TO A5P1 12 FROM A5P1 12	12 12 TO A2P1 12 A2P1 12
13 13	NOT USED NOT USED	13 13 TO A2P1 13 TO A2P1 13
14 14	TO A5P1 14 NOT USED	14 14 TO A2P1 14 TO A2P1 14
15 15	NOT USED NOT USED	15 15 TO A2P1 15

*REFER TO TOP OF SCHEMATIC



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. REFERENCE DESIGNATORS Q7, Q14, R62, R63, AND R158 ARE NOT ASSIGNED.

REFERENCE DESIGNATIONS

NO PREFIX	A1
J1-J10	C1-C45
U1-U5	CR1-CR28
Z1	J11-J4
T1	L1-L6
	Q1-Q6
	Q7 & Q14 DELETED
	Q8-Q13
	Q15-Q20
	R1-R61
	R64-R128
	R130-R133
	R1
	U1-U11
	U13-U39

SW		
0	A/B PROBE SELECT	CHAN
1	+/- SIGN	STOP
2	MSD	STOP
3	MD	STOP
4	LSD	STOP
5	MD	START
6	SLOPE SELECT	START
7	MSD	START
8	A/B PROBE SELECT	START
10	LEVEL CALIBRATION	BOTH
11	+/- SIGN	START
12	SLOPE SELECT	STOP
13	LSD	STOP
14	TIME ZERO CALIBRATION	BOTH
15	ZERO THMB DATA	

Figure 8-11. A1 Motherboard Schematic Diagram
(Sheet 1 of 2)

A1 MOTHERBOARD ASSEMBLY (Sheet 2 of 2)

Much of the circuitry shown in sheet 2 of *Figure 8-11* conditions the output signals from the probes before sending them to the rear panel jacks. Excluding the power supply circuitry, the schematic can be divided in half with the upper half being the start channel and the bottom half being the stop channel. The text will refer to the start channel.

Since either A probe or B probe can receive the start signal, the inverting and noninverting outputs from the A and B probe "start" FETs enter A1 and feed U24 and U27 (U24 controls channel A and U27 controls channel B). only one of these ICs will be active at a time: the one selected as the start channel by the thumbwheel switch. The purpose of these ICs is to switch the inverting and noninverting signals that go to comparator U18B. The START SLOPE and $\overline{\text{START SLOPE}}$ lines come from the state machine, but their states are actually a result of the slope thumbwheel. These lines control the state of Q16 and Q15, which, in turn, control the transistors within U24.

Assume the thumbwheel is set for the positive slope. The $\overline{\text{START SLOPE}}$ line is high and the START SLOPE line is low. This turns Q16 on and Q15 off, which results in a high (≈12.2V) on U24(8) and a low (≈11.5V) on U24(4). This allows the inverting signal to pass through U24Q4 to the negative input of U18B and the noninverting signal through U24Q1 to the positive input of U18B. U19B gives the signal a faster rise time before Q13 and Q12 shift the signal level to ±1V for the rear panel START jack (output to counter).

The stop portion of the schematic is similar, with the exception of the delay circuitry. When the front panel PULL TO ADD 10.0 ns switch is pulled out, it activates relay K1 through Q5. The relay adds a 10 ns delay line in series with the signal before the signal exits through the rear panel STOP jack. The front panel pot can perform a fine adjustment to compensate for probe and system time delay differences. This is done by varying the voltage across varactor CR16.

Probe Turnoff

Each probe contains a "start" pair of FETs and a "stop" pair. Only one start and one stop pair can be active at a time. The start and stop FET pairs that are not selected must be turned off. This is done through Q2, Q3, Q4, and Q6 (for the start channel and Q17, Q18, Q19, and Q20 for the stop channel). Assume A channel has been selected to detect a start. In this case, the $\overline{\text{START CHAN}}$ line is high and START CHAN is low. This causes the A PROBE -15V START line to go to -15V, which turns on the A probe start circuit. The B PROBE -15V START line rests at 0V and keeps the B probe start circuit off.

Power Supply

The power supply circuit contains five fixed regulators: U4 for +20V, U1 for -15V, U2 for +5V, U3 for +15V, and U5 for +9.8V. U5 subtracts 5.2V from the 15V supply to give +9.8V. Clamp diodes CR6 and CR26 protect the comparators from damage should a failure occur in one of the supplies that feed the comparator. If one of the supplies become accidently shorted to ground, for example, the other supply will shutdown to prevent damage.

CAUTION

U18 and U19 are standard ECL integrated circuits operating with their ground reference floating at +15V. Care must be exercised to avoid accidental shorting of pins of these ICs to chassis ground.

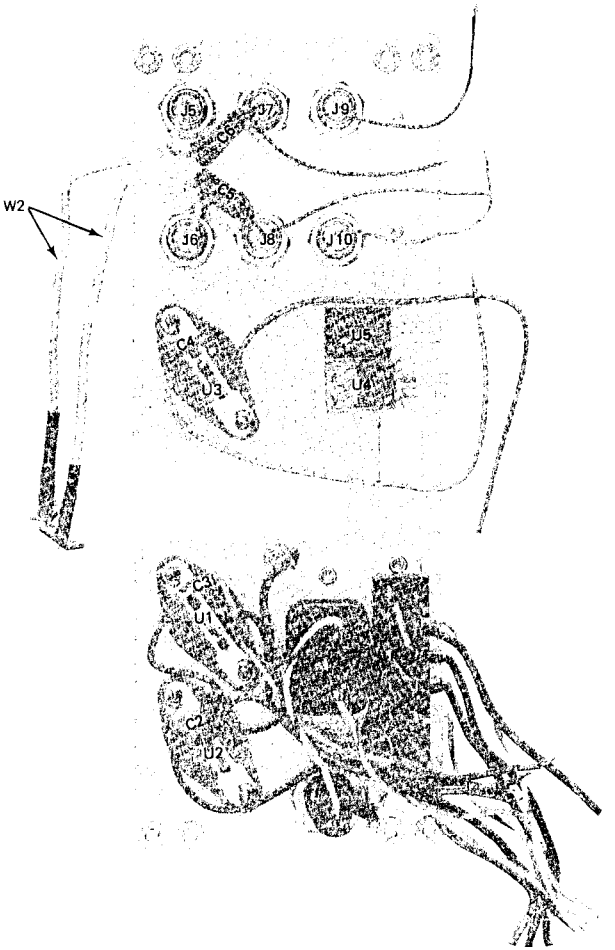
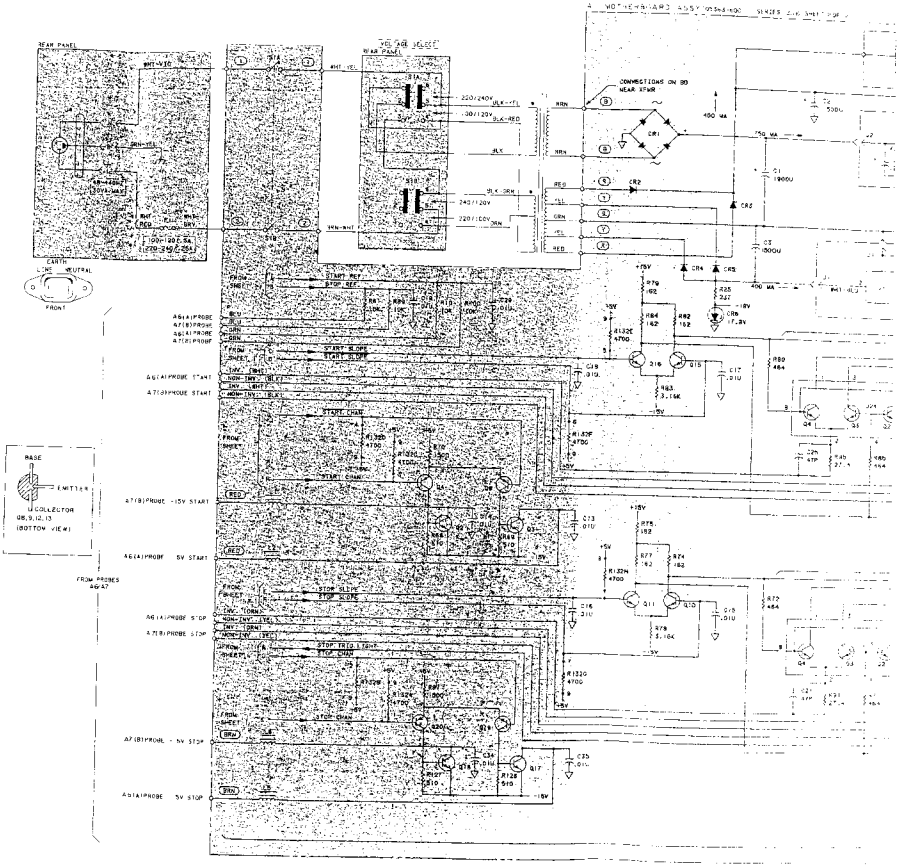


Figure 8-11. A1 Motherboard Schematic Diagram (Sheet 2 of 2)



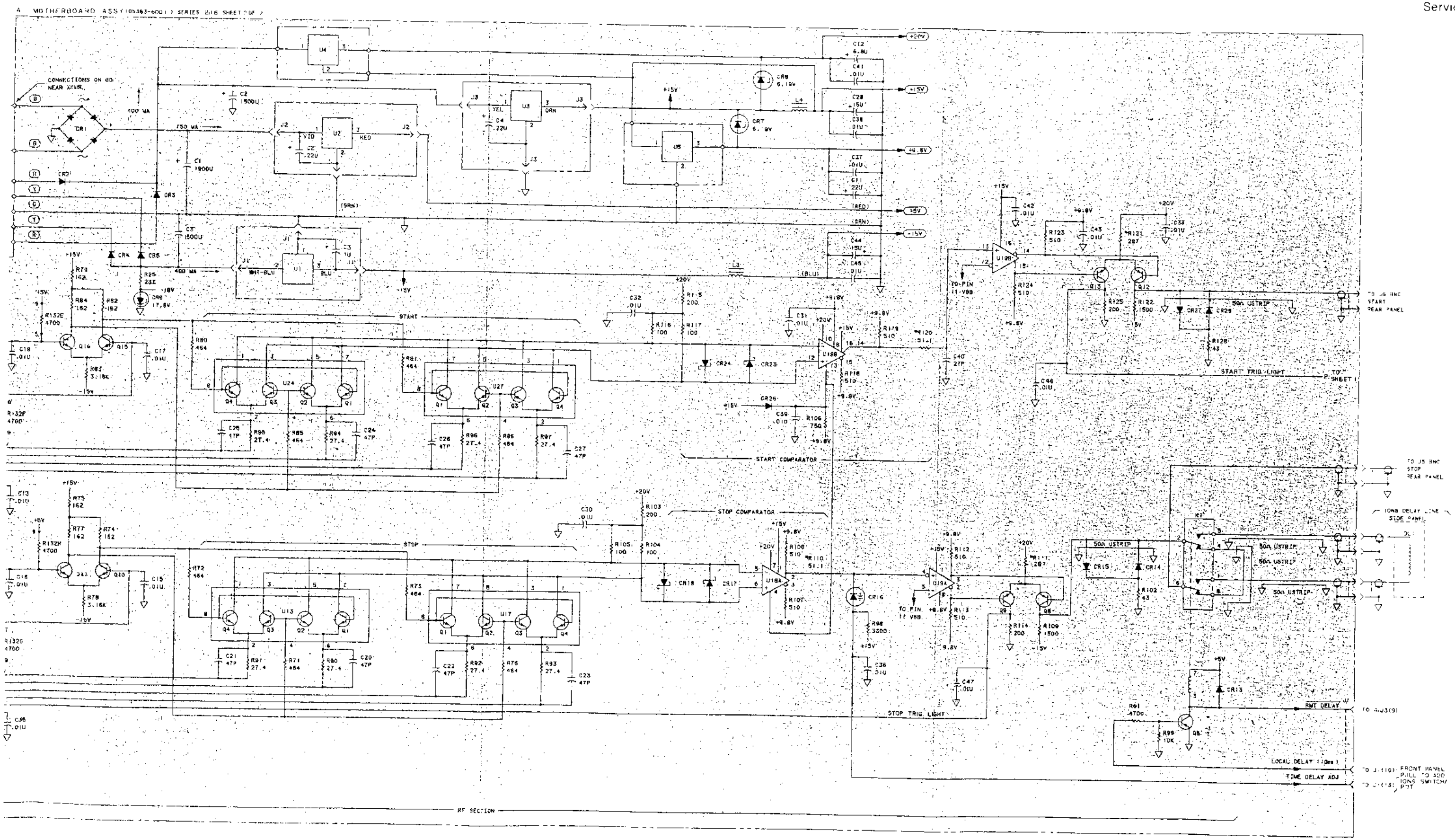


Figure 8-11. A1 Motherboard Schematic Diagram
Sheet 2 of 2

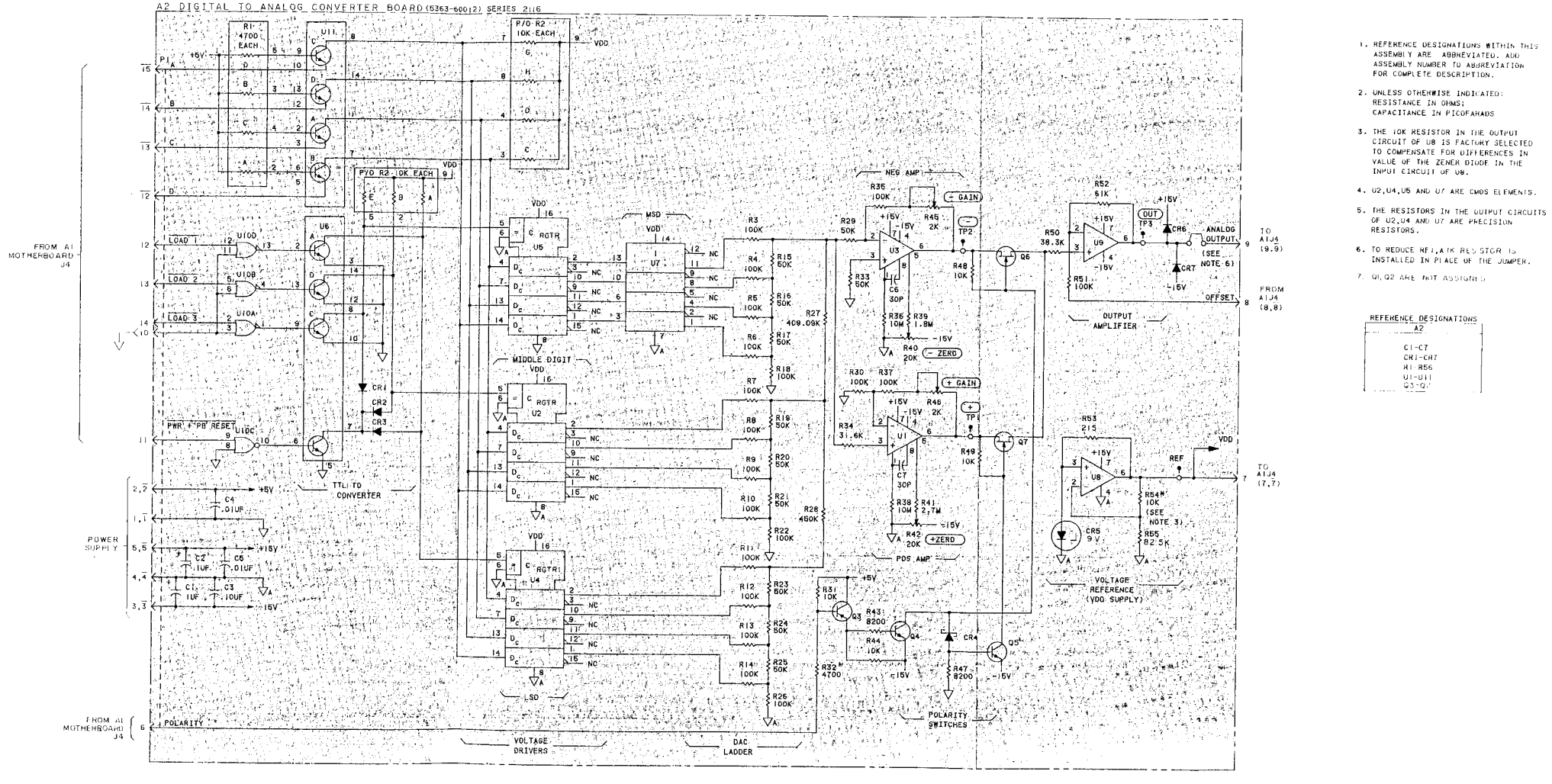
A2 DIGITAL-TO-ANALOG CONVERTER BOARD

The DAC board converts a BCD number, from the thumbwheel switches or HP-IB, to an analog output voltage. This dc output is fed as a reference level to the appropriate differential amplifier in the probe.

U6 and U11 are TTL to CMOS converters. Load commands, through U10, sequentially load and store the BCD number for each of the three digits into Voltage Drivers U5, U2, and U4. The Voltage Drivers provide outputs in BCD format to precision resistors that develop an analog voltage. The least significant digit is supplied by U4 and the most significant digit is supplied by U7. Buffer U7 compensates for the high "on" resistance of U5.

The DAC Ladder is a resistive network connected to the outputs of the Voltage Drivers. The resistors of the output of U4 (LSD) have a tolerance of 1%, the resistors at the output of U2 are 0.1% and the resistors at the output of U7 (MSD) are 0.01%. The scaled analog voltage from the DAC Ladder is applied to the Negative Amplifier U3 and the Positive Amplifier U1. The output of one or the other amplifier is connected to the noninverting input of Output Amplifier U9, depending upon which FET (Q6, Q7) is turned on by the Polarity Switch circuit. An offset voltage, from the Calibration DACs, is applied to the inverting input of U9. The sum of these two voltages is the final analog output voltage.

U8 and associated circuitry form a precision Voltage Reference to ensure the accuracy of the DAC. The exact value of R54 is factory selected to compensate for differences in the breakdown value of Zener diode CR5.



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 PICOFARADS
3. THE 10K RESISTOR IN THE OUTPUT CIRCUIT OF U8 IS FACTORY SELECTED TO COMPENSATE FOR DIFFERENCES IN VALUE OF THE ZENER DIODE IN THE INPUT CIRCUIT OF U8.
4. U2,U4,U5 AND U7 ARE CMOS ELEMENTS.
5. THE RESISTORS IN THE OUTPUT CIRCUITS OF U2,U4 AND U7 ARE PRECISION RESISTORS.
6. TO REDUCE REFLATK RESISTOR IS INSTALLED IN PLACE OF THE JUMPER.
7. Q1,Q2 ARE NOT ASSIGNED

REFERENCE DESIGNATIONS
A2
C1-C7
CR1-CR7
R1-R56
U1-U11
Q3-Q7

Figure 8-12. A2 Digital-to-Analog Converter Board

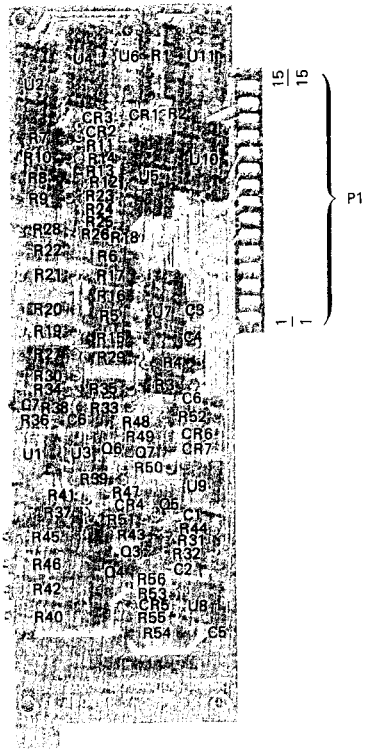
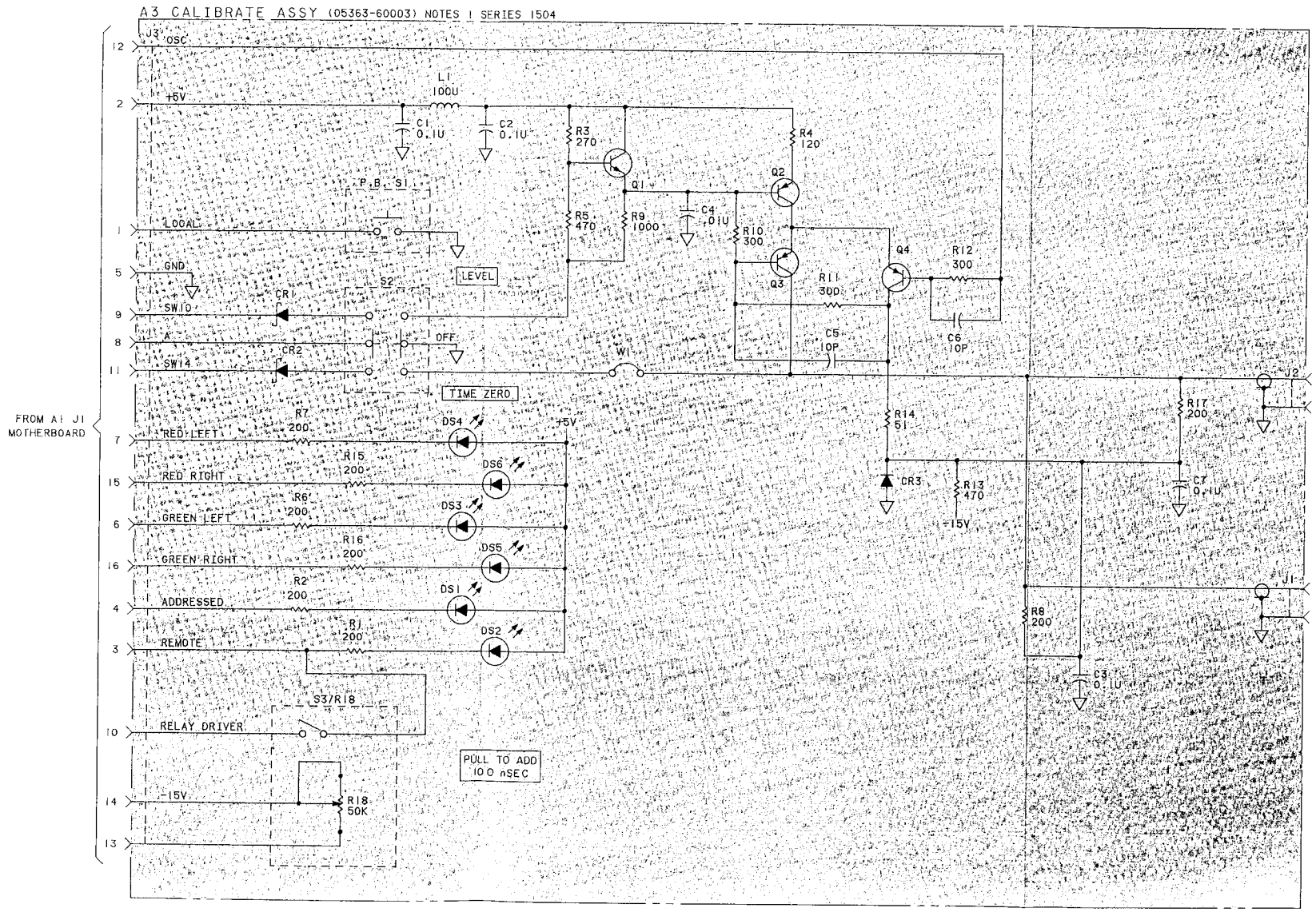


Figure 8-12. A2 Digital-to-Analog Converter Assembly

A3 CALIBRATE ASSEMBLY

The Calibrate Assembly contains the front panel switches and indicator lights, as well as the Time Zero pulse circuitry. Switch S1 is the front panel LOCAL pushbutton, S2* is the TIME ZERO/LEVEL switch and S3 is the PULL TO ADD 10.0 ns switch. When switch S2 is in the TIME ZERO position, transistor Q1 is turned on, enabling transistors Q2, Q3, and Q4. Clock pulses on J3 pin 12 are fed through Q4 and are converted into high-speed pulses which are output on front panel jacks J1 and J2. When switch S2 is in the LEVEL position, the pulse network is disabled and front panel jacks are grounded. R18 controls the delay on Stop Channel comparator A1U19A by varying the voltage at A1CR16. S3, when pulled out, turns on A1Q5, enabling relay A1K1. This connects 10 ns fixed delay line DL1 to the Stop Channel output.

*S2 is a reversible action toggle switch.



NOTE

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.

REFERENCE DESIGNATIONS
A3
C1-7 CR1-3 DS1-6 J1-3 L1,2 Q1,4 R1-17 S1-3

Figure 8-13. A3 Calibrate Assembly

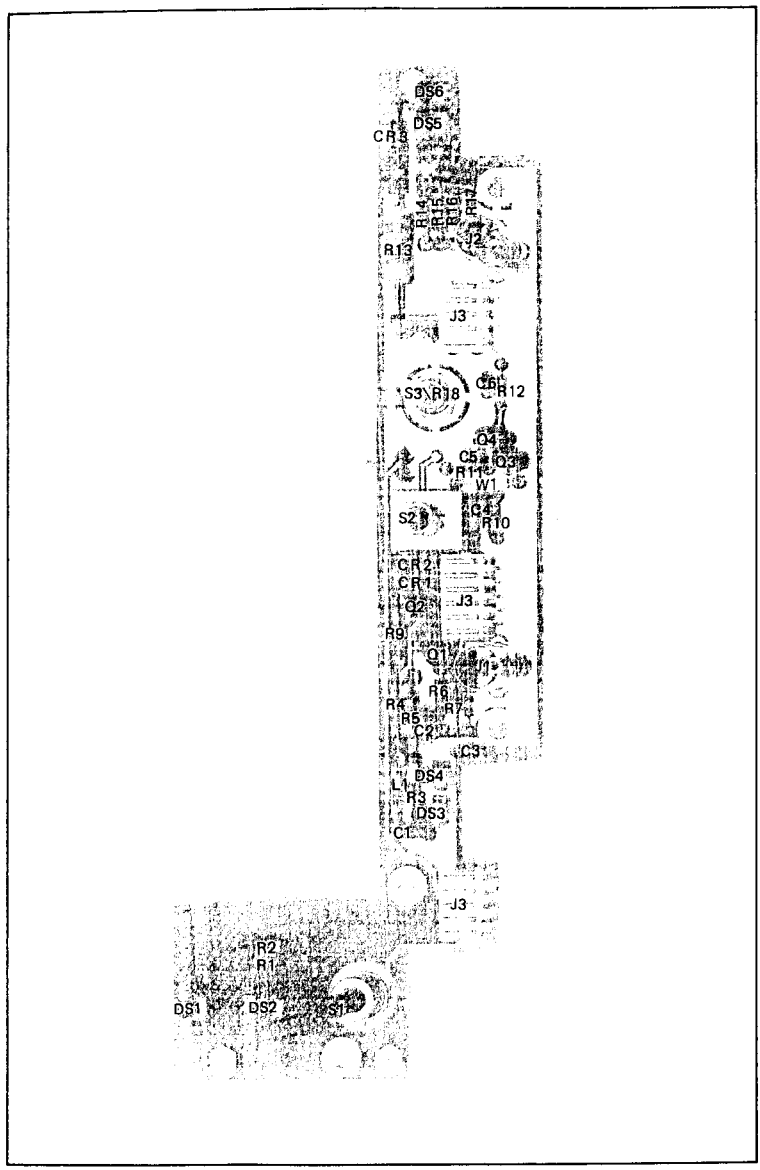
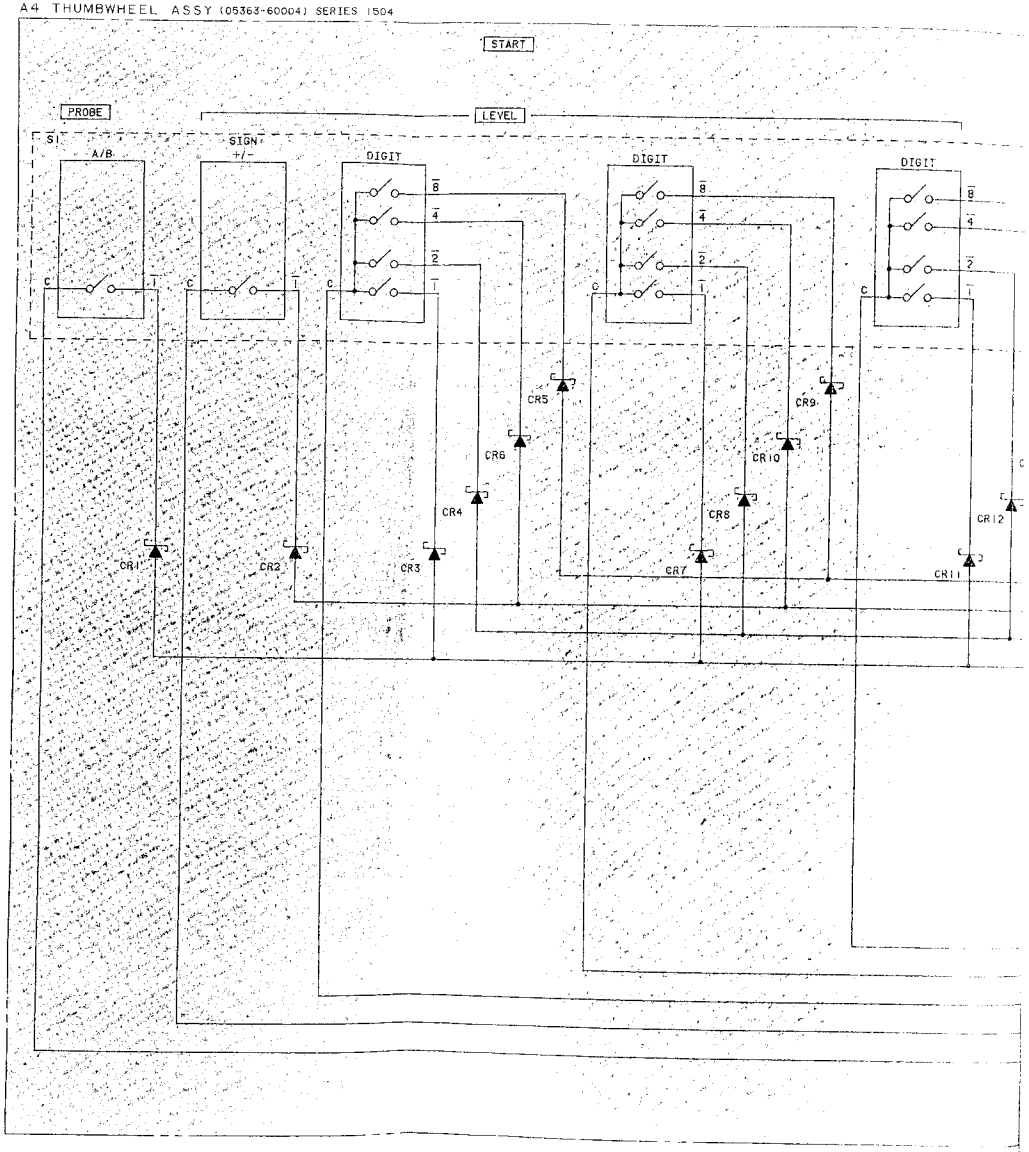


Figure 8-13. A3 Calibrate Assembly

A4 THUMBWHEEL ASSY (05363-60004) SERIES 1504



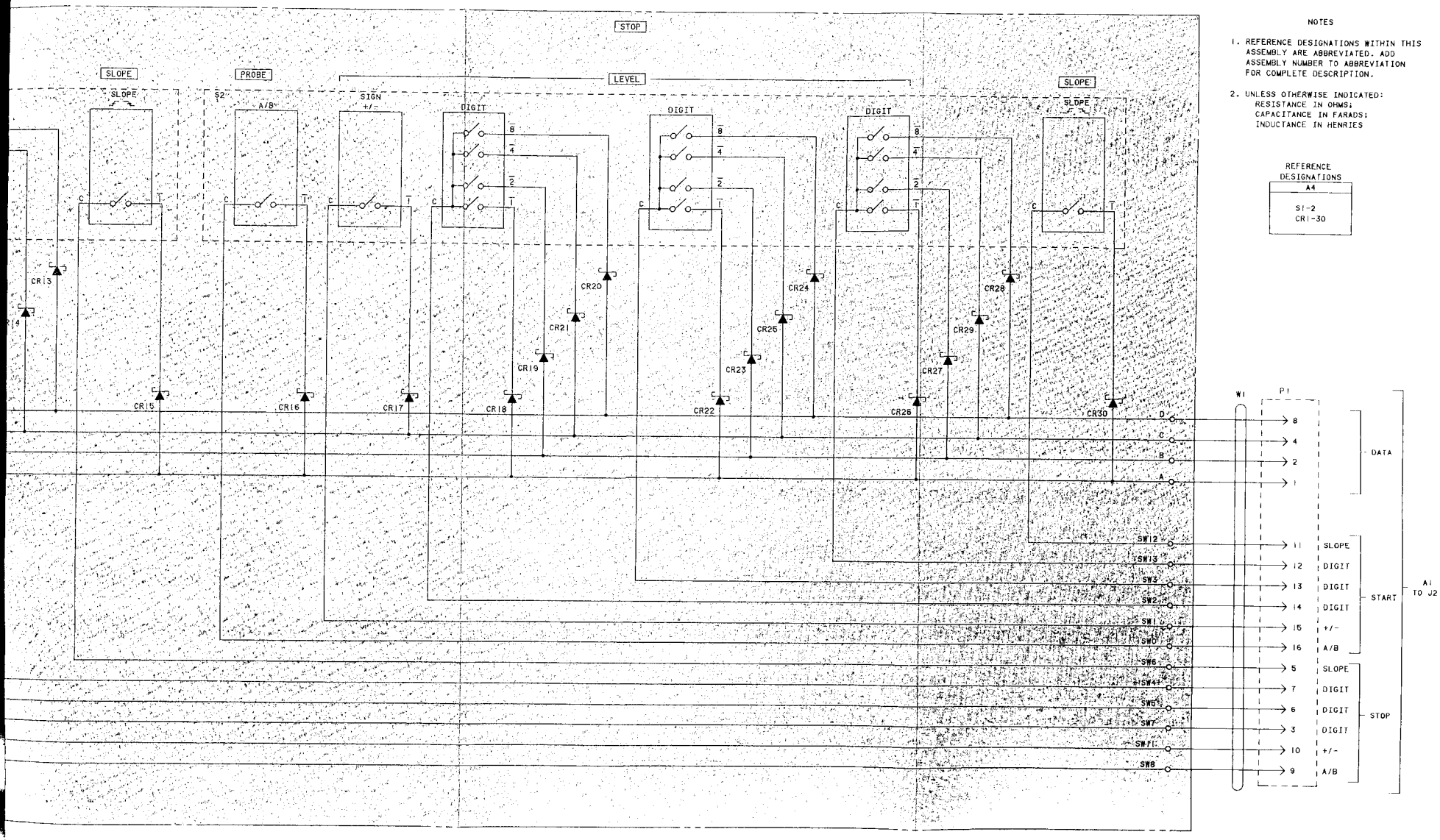


Figure 8-14. A4 Thumbwheel Assembly

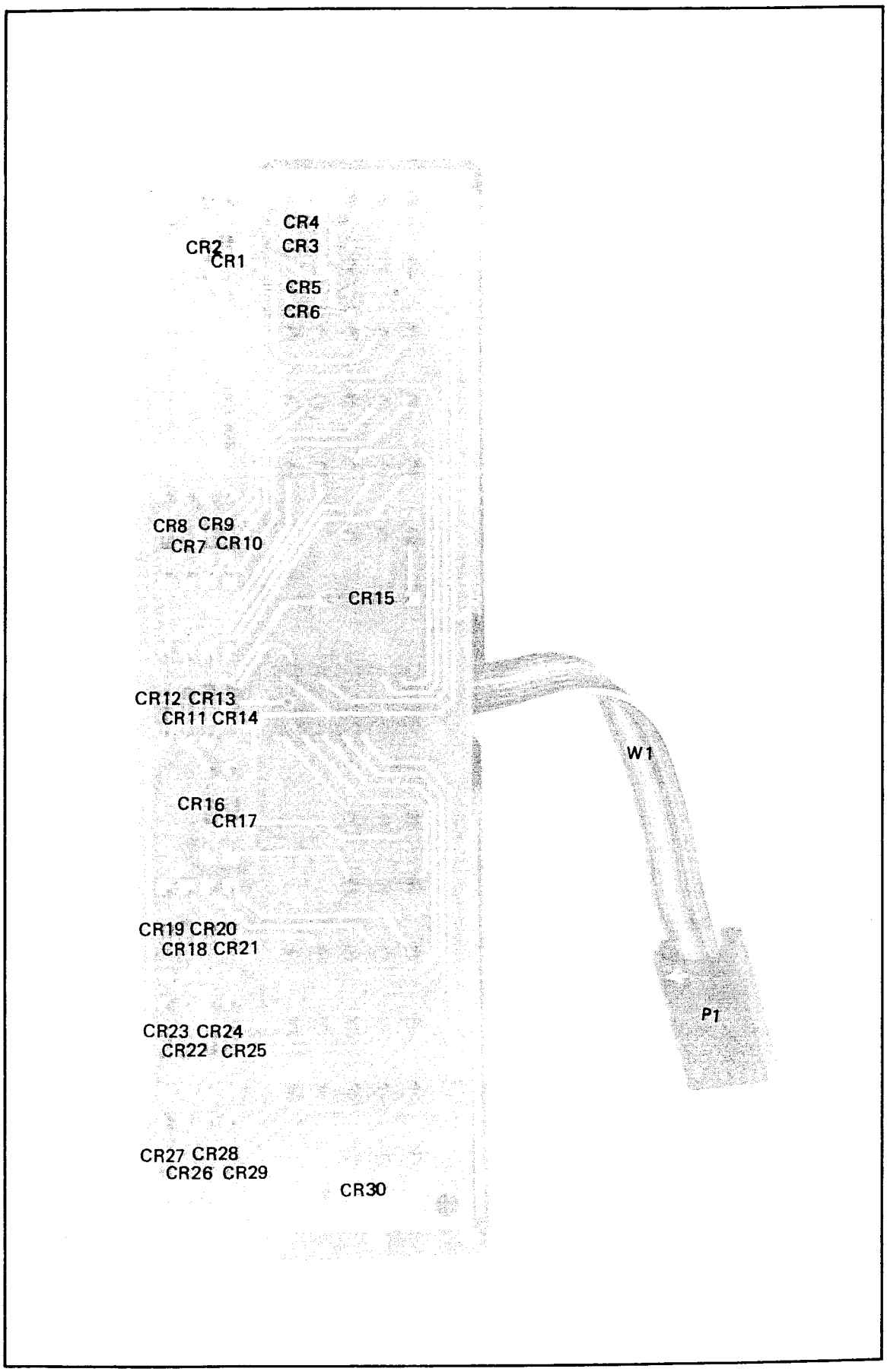


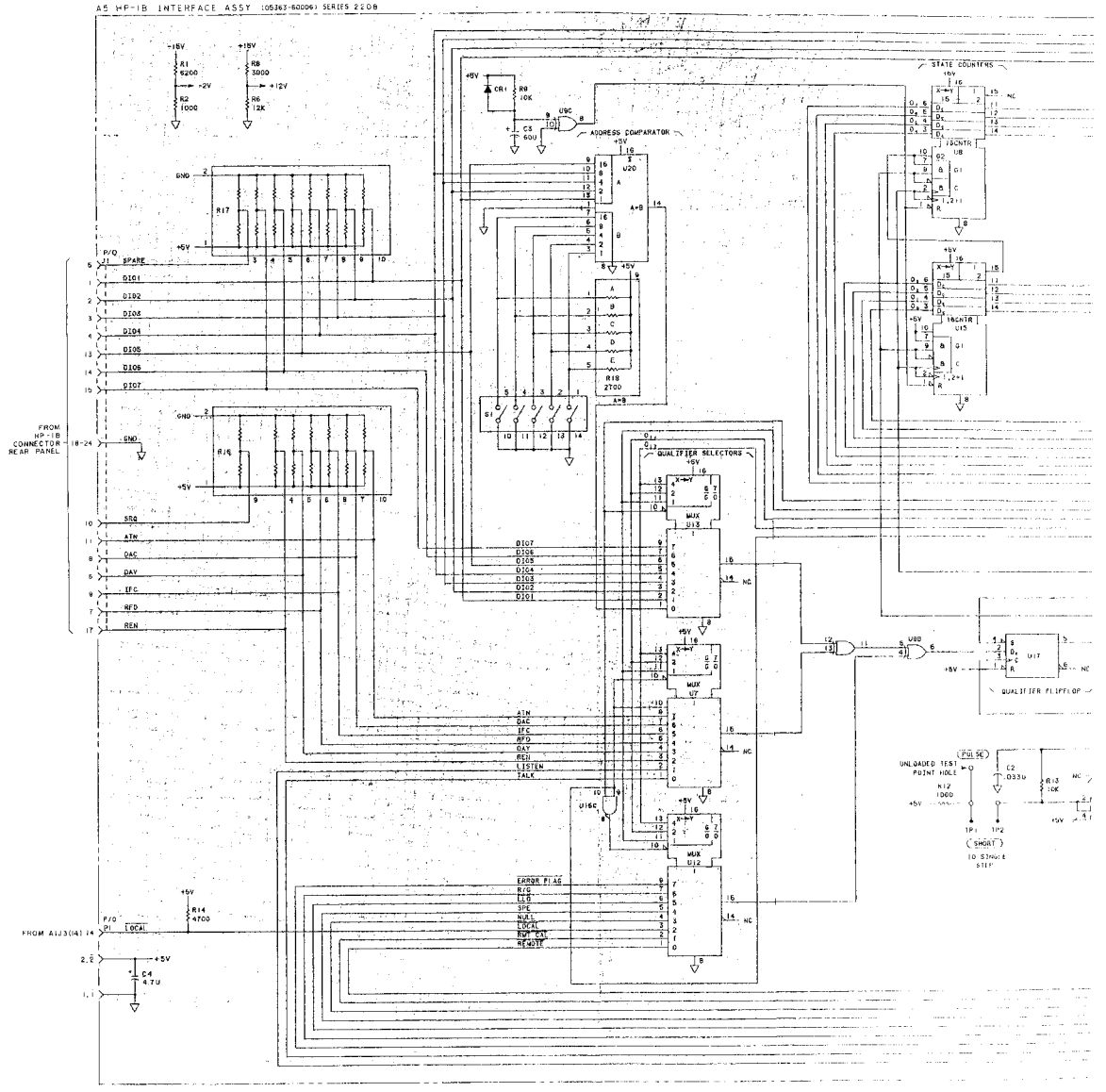
Figure 8-14. A4 Thumbwheel Assembly

A5 HP-IB INTERFACE ASSEMBLY

The HP-IB Interface Assembly contains an algorithmic state machine similar to the A1 motherboard. The state machine consists of ROM U1, and state counters U15 and U8. U13, U7, and U12 are input qualifier decoders, U3 and U4 are output data latches, and U10 is a command decoder. The interface address comparator is U20, and the address switch is S1.

U19 is a 4- × 16-bit RAM which stores bus data, representing the front panel thumbwheel switches, in the same address locations as the front panel. The A1 Motherboard state machine will address and sample the data from either the front panel thumbwheel switches or RAM U19, Through U11, depending on the status of REMOTE. The data in U19 is isolated from the A1 main state machine in local operation by open collector drivers in U18.

U17 is the Remote Calibration F-F, and U16 is the ERROR FLAG F-F. U18 is the clock, which can be halted and single stepped in the same manner as the motherboard clock.


A5 HP-IB INTERFACE ASSY (05363-60006) SERIES 2208
STATE COUNTERS
ADDRESS COMPARATOR
QUALIFIER SELECTORS
QUALIFIER FLIPFLOP
FROM HP-IB CONNECTOR REAR PANEL
P/O J1
SPARE
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
GND
SRQ
ATN
DAC
DAV
EOI
RFD
REN
ERROR FLAG
R/C
LLO
SPE
MLA
LOCAL
RUN CAT
REMOTE
LISTEN
TALK
FROM A1J3(14) J4
LOCAL
UNLOADED TEST POINT HOLE
PULSE
SHORT
TO SINGLE STEP

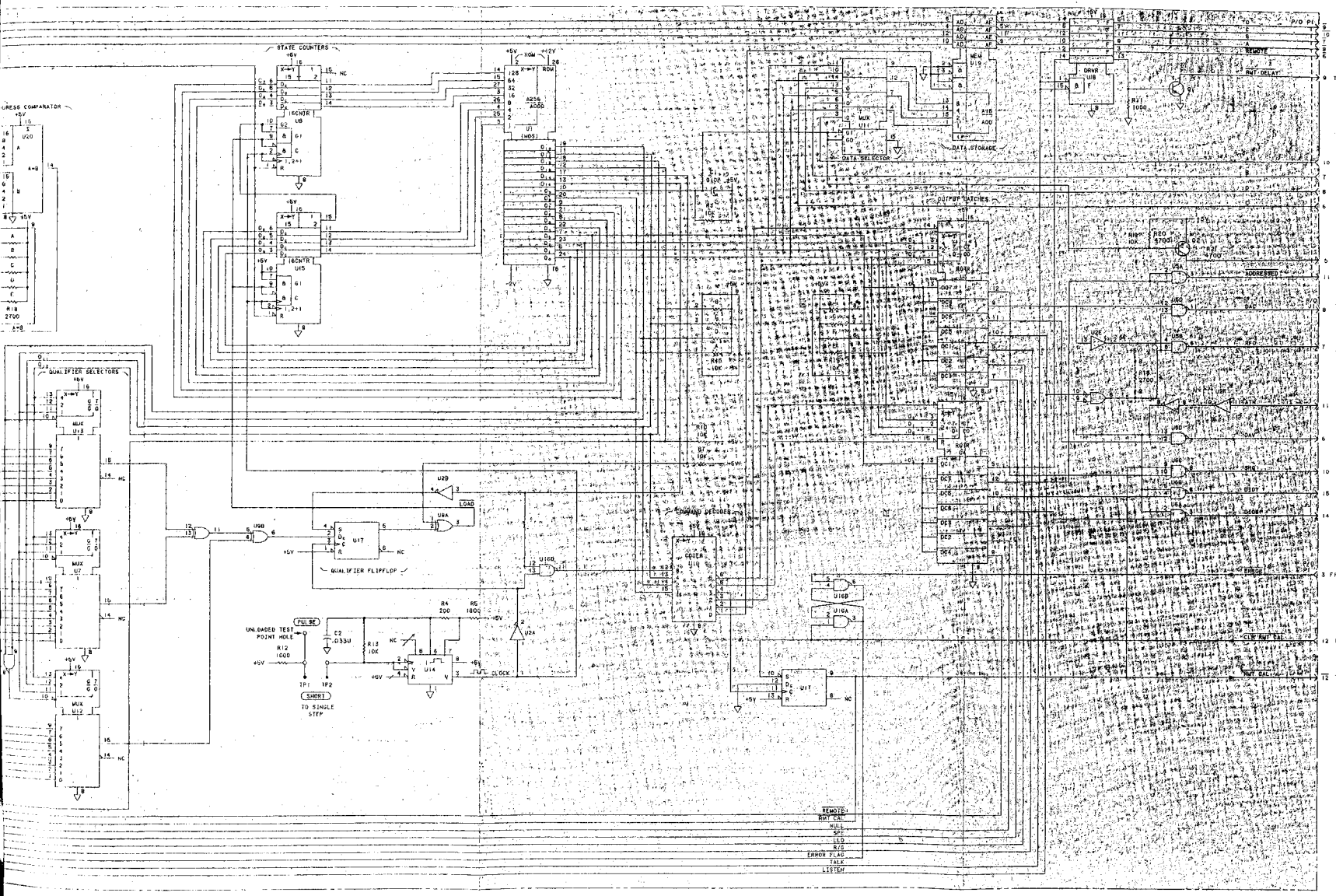
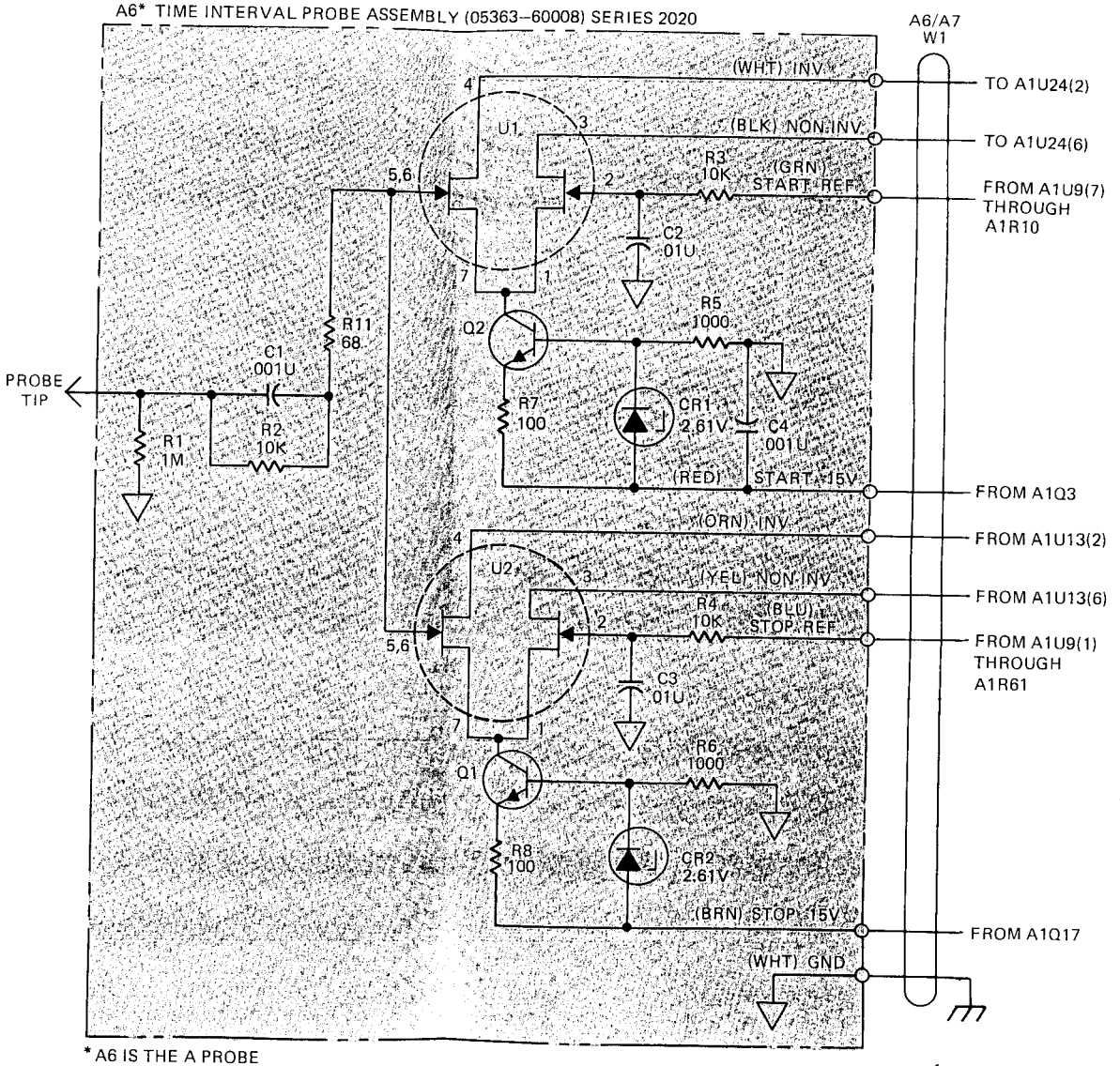
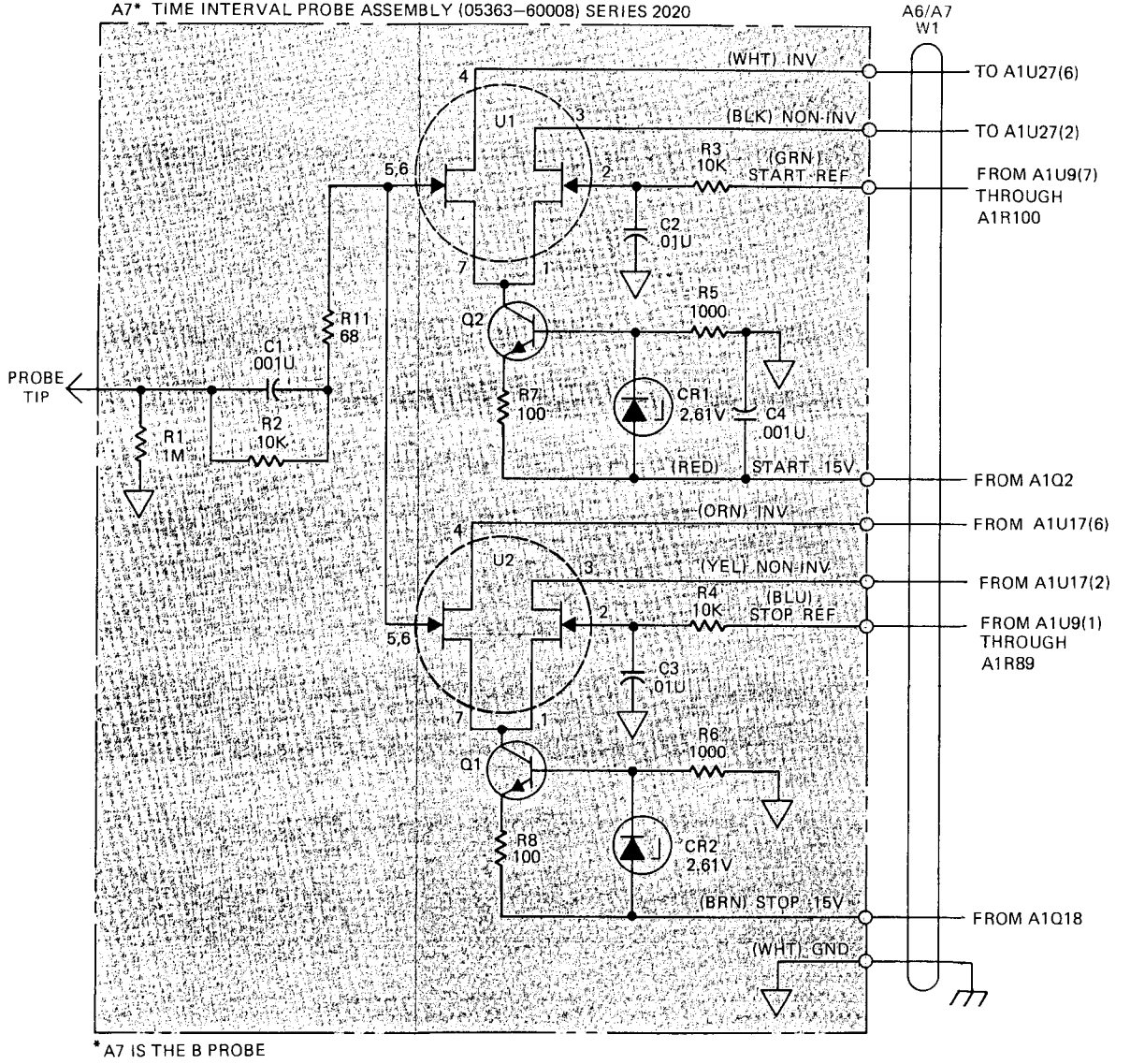


Figure 8-15. A5 HP-IB Schematic Diagram



*A6 IS THE A PROBE



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 MICROFARADS; INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATORS

A6/A7
C1-4
CR1-2
Q1-2
R1-11
U1-2

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1, 2	1902-0126
U1, 2	1855-0219
Q1, 2	1854-0210

Figure 8-16. A6/A7 Probe Assembly Schematic Diagram

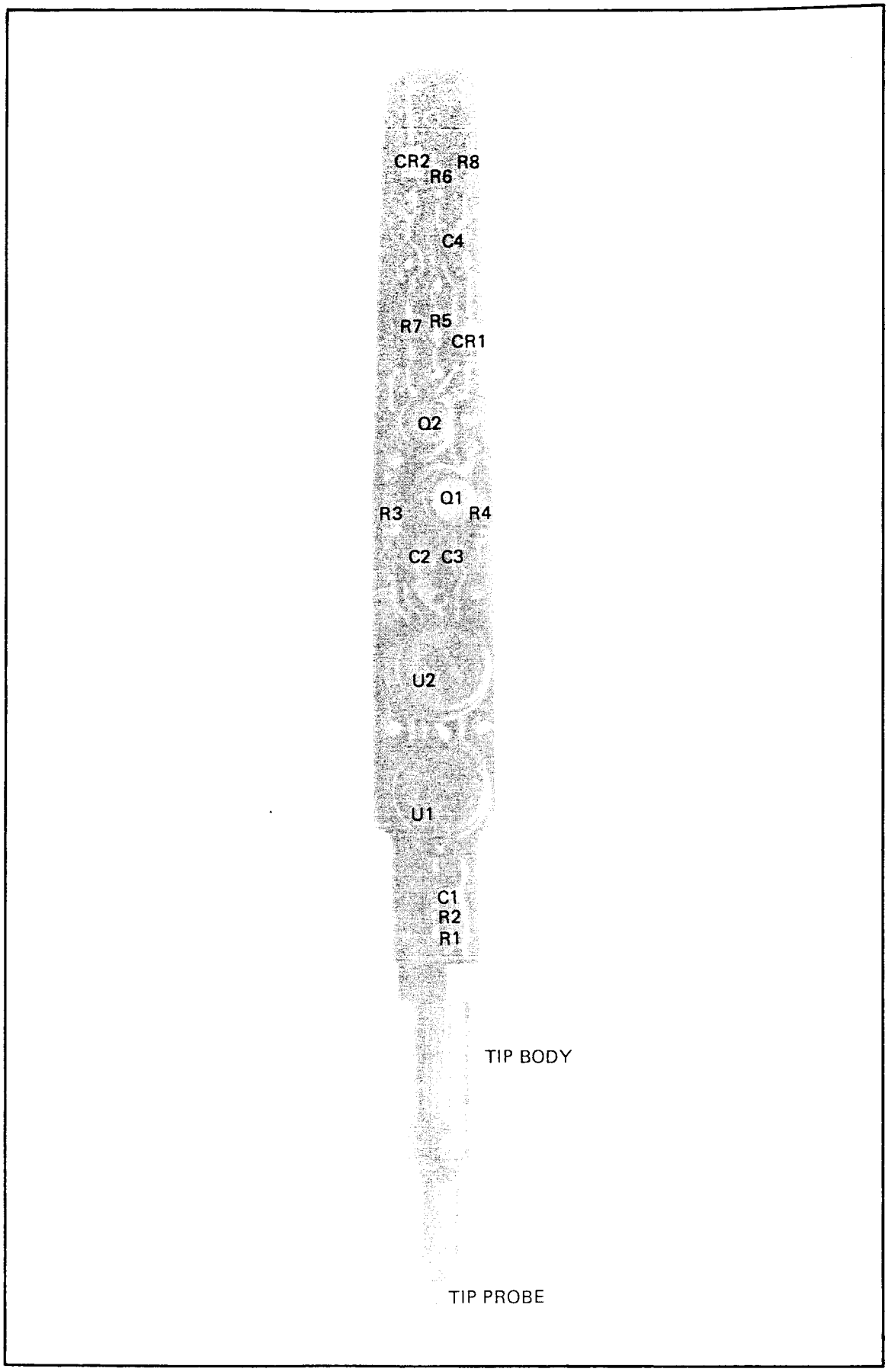


Figure 8-16. A6/A7 Probe Assembly

A6/A7 TIME INTERVAL PROBES

The A6 and A7 Probe Assemblies, are with the exception of channel color rings, identical, so only one will be described. U1 and U2 are dual JFETs which are essentially differential amplifiers; U1 is for the START signal and U2 for the STOP. Q1 and Q2, along with their associated circuitry, are the current sources for the differential amplifiers. A signal on the probe tip is routed through input compensation network C1 and R2 to input gates (pins 5, 6) of both differential amplifiers. Stop and Start dc reference voltage levels are fed through R3 and R4 to their respective input gates (pin 2). When the input exceeds the reference level, the differential amplifier will change states, providing complementary outputs to the A1 Motherboard. Each probe contains both a start and stop converter. The state machine selects one start and one stop by turning on or turning off the -15V power to the appropriate current sources.

37281

MANUAL CHANGES

CHANGE DATE: June 29, 1983

This change supersedes all earlier dated changes.

*** Make all corrections listed under ERRATA before making other changes.

*** Check following table for your instrument's serial prefix or series number and make listed change(s) to manual.

MANUAL DESCRIPTION

INSTRUMENT: 5363B
TIME INTERVAL PROBES
OPERATING &
SERVICE MANUAL

SERIAL PREFIX: 2208A

DATE PRINTED: DECEMBER 1982
HP PART NO: 05363-90020
MICROFICHE NO: 05363-90021

# INDICATES NEW OR REVISED ITEM

> INDICATES ACTION TO BE TAKEN

SERIAL PREFIX OR SERIES NUMBER	MANUAL CHANGE(S)
#2248A	1

SERIAL PREFIX OR SERIES NUMBER	MANUAL CHANGE(S)

Information for any optional circuit boards described in this manual agrees with the series numbers on the circuit board(s) for the option, which may not be the same as the Serial Prefix Number on the rear of the instrument.

(C5363BOS) 1=14558

HEWLETT PACKARD

#CHANGE 1

Page 6-13, Table 6-2. A5 (05363-60006) Replaceable Parts:
>Change A5 SERIES from 2116A to 2248A.
>Add R50 1810-0055 NETWORK-RESISTOR 10K.

Page 8-67, Figure 8-15. A5 HP-IB SCHEMATIC DIAGRAM
>Change A5 SERIES from 2116 to 2248.
>Add a 10K RESISTOR from U1 Pin 13 to +5V.
>Add a 10K RESISTOR from U1 Pin 8 to +5V.
>Add a 10K RESISTOR from U1 Pin 9 to +5V.
>Add a 10K RESISTOR from U1 Pin 21 to +5V.
>Add a 10K RESISTOR from U1 Pin 22 to +5V.
This is a NETWORK-RESISTOR with reference designation R50.