Errata

Title & Document Type: **8093A 1GHz Output Amplifier Module Operating and Service Manual**

Manual Part Number: **08093-90003**

Revision Date: **April 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

HEWLETT PACKARD

OPERATING AND SERVICE MANUAL
1GHz OUTPUT AMPLIFIER MODULE
8093A

PART OF THE 8080 HIGH FREQUENCY PULSE/WORD GENERATOR SYSTEM

SERIAL NUMBERS

This manual applies directly to instrument serial number

1725G00571

For instruments with lower serial numbers, refer to the backdating information in Section 8 of this module manual.

For instruments with higher serial numbers, refer to the Manual Change sheets at the end of this module manual.

MANUAL PART NO. 08093-90003
MICROFICHE PART NO. 08093-90503

Printed: April 1982 in West Germany

HEWLETT PACKARD

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

CONTENTS

TABLES

ILLUSTRATIONS

SCHEMATIC DIAGRAMS

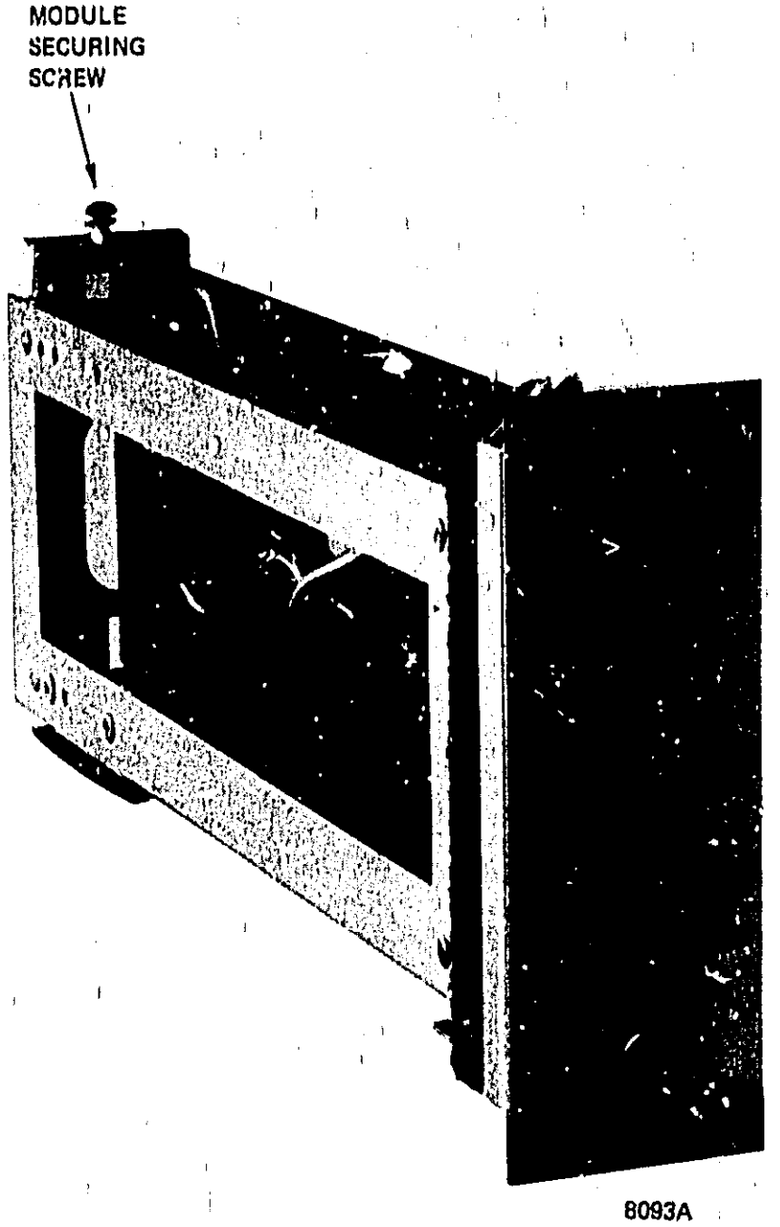


Figure 1–1. 8093A Output Amplifier Module

1–1 INTRODUCTION

1–2 This Operating and Service manual contains information required to install, operate, test, adjust and service the Hewlett-Packard Model 8093A 1GHz Output Amplifier module, Figure 1–1 shows the module and accessories supplied. This section covers instrument identification, description, accessories, specifications, and other basic information.

1–3 A microfiche version of this manual is available on 4 x 6 inch microfilm transparencies (order number on title page). Each microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1–4 SPECIFICATIONS

1–5 Instrument specifications are listed in table 1–2. These specifications are the performance standards or limits against which the instrument is tested.

1–6 SAFETY CONSIDERATIONS

1–7 The Model 8093A is a Safety Class 1 instrument (it has an exposed metal chassis that is connected to earth via the 8080 system mainframe). This instrument has been designed according to international safety standards and has been supplied in a safe condition.

1–8 This operating and service manual contains information, cautions and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

1–9 INSTRUMENTS COVERED BY MANUAL

1–10 Attached to the inside of the instrument side frame is a serial number plate (figure 1–2). The first four digits of the serial number only change when there is a significant change to the instrument. The last five digits are assigned to instruments sequentially. The contents of this manual apply directly to the instrument serial number quoted on the title page. For instruments with lower serial numbers, refer to the backdating information in Section 8 of this module manual. For instruments with higher serial numbers, refer to the Manual Change sheets at the end of this module manual. In addition to change information, the Manual sheets may contain information for correcting errors in the manual. To keep this manual as up-to-date and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Change supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on this module manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard.

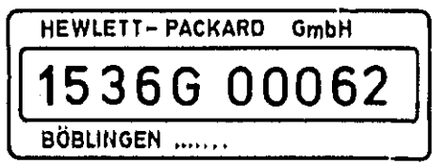


Figure 1–2. Serial Number Plate

1–11 DESCRIPTION

1–12 The Model 8093A is an Output Amplifier module for amplifying signals with repetition rates up to 1GHz. The amplifier delivers positive or negative pulses with 0.6 to 1.2V amplitude and –1 volt to +1 volt offset. The single output also has selectable normal or complement pulse formats. An additional feature is an ECL position on the amplitude vernier that provides fixed ECL output levels (–0.8V to –1.6V).

1–13 The power supplies for the 8093A are provided by the 8080A Mainframe.

1–14 OPTIONS

1–15 The only option for the 8093A is a second copy of the operating and service manual which can be obtained by ordering option 910. See HP publication no. 5952–9545 for optional factory-systemized configurations.

1–16 EQUIPMENT REQUIRED BUT NOT SUPPLIED

1–17 To operate the 8093A module, an 8080A Mainframe is required. The 8080A mainframe provides housing and power supplies for the 8093A. A rep. rate source is also required. The clock input specifications are given in Table 1–2.

1–18 EQUIPMENT AVAILABLE

1–19 The 8093A is one of a complete range of rep. rate, timing and output modules that form the 8080 high frequency pulse/word generator system. Modules are available for either 300MHz or 1GHz operation and include facilities for pulse advance/delay, interchannel delay, word generation and multichannel operation. The modules are interchangeable to enable you to purchase a system exactly tailored to your requirements.

1–20 RECOMMENDED TEST EQUIPMENT

1–21 Equipment required to maintain the 8093A is listed in Table 1–1. Other equipment can be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1–1. Recommended Test Equipment

Instrument Type	Recommended Model	Required Characteristics	Required for:
Mainframe	8080A		APT
1 GHz Rate Generator Module	8091A		APT
Pulse Generator	8082A	Risetime 1ns; positive and negative output selectable	APT
Oscilloscope Mainframe	180C/182C		AT
Vertical Plug-In	1801A	Good Pulse Performance (min overshoot)	AT
Time Base Plug-In	1821A		AT
10:1 Probe	10004D		AT
3x Feedthrough Termination	10100C		APT
Digitcl Multimeter	3465B		AT
Sampling Oscilloscope with Accessories		Bandwidth 4 GHz	APT
BNC (f) to dual banana plug	1251–2277		AT
BNC Cable Assembly	10501A		APT
6 dB Attenuator	8491A Opt. 006		APT
Wrench (open end)	8710–0946	15/64"	AT

A = Adjustment Procedure
P = Performance Test
T = Troubleshooting

Information about internal inputs and outputs, and further information useful when devising configurations are contained in the 8080A Systemizing Guide, HP Publication 5952–9546.

Specifications describe the module's warranted performance over the temperature range from 0°C to 55°C. Specifications and supplemental characteristics apply with a load and source of 50 ohms or a single 8080A Series module.

Supplemental characteristics provide information useful in applying the instrument by giving typical or nominal, but non-warranted, performance parameters.

8093A OUTPUT AMPLIFIERS

Specifications

TIMING	8093A
Frequency	dc to 1 GHz
OUTPUTS	Normal/complement selectable
Amplitude:	0.6 to 1.2 Vpp, vernier adjustment
Offset:	± 1.2 V can be switched off.
Baseline accuracy: (offset OFF)	0 V ± 20 mV
Polarity:	Positive/negative selectable
Transition Time:	< 300 ps
Preshoot, Overshoot, Ringing:	< 10 % up to 500 MHz < 15 % above 500 MHz
Output Resistance:	50 ohm ± 5 %

Supplemental Characteristics

OUTPUTS	8093A
Max Levels:	± 2.4 V (± 4 V into high impedance)
Max Ext Levels:	
Positive selected:	± 2 V
Negative selected:	± 2 V
Equivalent current:	± 40 mA
Selectable ECL Output:	
Factory levels:	−0.8 V/−1.6 V
Int offset adjust:	± 0.9 V
Int ampl adjust:	0.5 V to 0.9 V
Leading edge:	Positive (normal output)
Width: Depends on input width as follows:	
Input width < 20 ns	± 3 % ± 300 ps*
Input width > 20 ns	± 1 ns*
	*Direct input.
Variable Width	8093A H01 only. See 8092A.
Reflection Coefficient:	20 %

General

ENVIRONMENTAL: As 8080A Mainframe.

WEIGHT:	
Net	1 kg (2.2 lbs)
Shipping	1.5 kg (3.2 lbs)
DIMENSIONS:	1/8 mainframe
ACCESSORIES DELIVERED:	
Manual	08093–90003

SECTION 2

INSTALLATION

2–1 INTRODUCTION

2–2 This section provides installation instructions for the Model 8093A 1 GHz Output Amplifier module. It also includes information about initial inspection and damage claims, preparation for use, and packaging, storage and shipment.

2–3 INITIAL INSPECTION

2–4 Inspect the shipping container for damage. If the container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1–1. Procedures for checking the electrical operation are given in Section 3. If the contents are incomplete, if there is mechanical damage or defect, or if the 8093A does not pass the operator's checks, notify the nearest Hewlett-Packard Sales/Service office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2–6 PREPARATION FOR USE

2–6 Installation in 8080A Mainframe

CAUTION

The following installation procedure must only be carried out by qualified service personnel.

2–7 To operate the 8093A it must first be installed in an 8080A Mainframe as follows:

1. Switch the mainframe LINE OFF/ON switch to OFF. Disconnect the power supply cable from the rear of the 8080A mainframe.
2. Remove the upper two feet from the rear of the 8080A mainframe.
3. Remove the 8080A mainframe top cover.
4. Remove the 8080A mainframe top bracket that holds the pc boards in position.
5. Insert the 8093A in the required position in the 8080A mainframe (there are no electrical limitations on the position).
6. Secure the 8093A to the 8080A mainframe using the screw provided.
7. Connect the signal input to the 8093A input connector (on pc board).
8. Replace the 8080A mainframe top cover.
9. Replace the 8080A mainframe top cover.
10. Replace the two feet on the rear of the 8080A mainframe.

2–8 Operating Environment

2–9 The 8093A will operate within specifications when the ambient temperature is between 0°C (32°F) and 55°C (131°F).

2–10 Storage and Shipment

2–11 The 8093A can be stored or shipped at temperatures between −40°C (−40°F) and 75°C (167°F). The instrument should be protected from temperature extremes which cause condensation within the instrument.

2–12 If the instrument is to be shipped to a Hewlett-Packard Sales/Service office, attach a tag showing owner, return address, model number and full serial number and the type of service required. The original shipping carton and packaging material may be re-usable but the Hewlett-Packard Sales/Service office will also provide information and recommendations on materials to be used if the original packing is not available or re-usable. General instructions for re-packing are as follows:

1. Wrap instrument in heavy paper or plastic.

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

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

4. Seal shipping container securely.

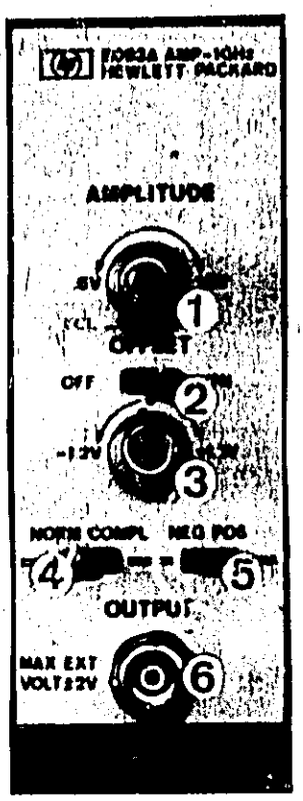
5. Mark shipping container FRAGILE to encourage careful handling.

6. In any correspondence, refer to instrument by model number and full serial number.

OPERATION

PERFORMANCE CHECK

ADJUSTMENTS



① AMPLITUDE vernier: for continuous adjustment of the amplitude from 0.6V to 1.2V. In addition there is a detent position at the extreme counter-clockwise setting of the vernier which provides fixed ECL-compatible output levels (−0.8V to −1.6V).

② OFFSET OFF/ON switch: enables/disables the OFFSET vernier. In the OFF position, the pulse baseline is at 0V. This switch has no effect when the AMPLITUDE vernier is set to ECL.

③ OFFSET vernier: for adjusting the output pulse baseline over the range −1.2V to +1.2V. This control has no effect when the OFFSET switch is set to OFF or when the AMPLITUDE vernier is set to ECL.

④ NORM/COMPL switch: reverses the duty cycle of the output; what was the normal output becomes the complement and vice versa.

⑤ NEG/POS switch: for selecting output pulses of either positive or negative polarity with respect to the pulse baseline. This switch has no effect when the AMPLITUDE vernier is set to ECL.

⑥ OUTPUT connector: BNC connector provides pulse output with 50 ohm source impedance.

Figure 3–1. 8093A Controls and Connector

3–1 INTRODUCTION

3–2 This operating section explains the function of the controls and connectors and gives operating instructions for the 8093A 1 GHz Output Amplifier module.

3–3 Panel Features

3–4 Front panel controls and connector are shown in figure 3–1. Description numbers match the numbers on the illustration.

3–5 OPERATING INSTRUCTIONS

3–6 Because the 8093A is relatively simple to operate, only a short description is given here.

3–7 Two output mode switches enable NORMal/COMPLement, POSitive/NEGative output waveforms. Switching from NORM to COMPL reverses the duty cycle of the output pulse; switching from POS to NEG changes the output pulse polarity relative to the 0 V baseline (assuming OFFSET is switched off). If OFFSET is switched on, polarity changes relative to the offset baseline. Note that if the AMPLITUDE Vernier is set to the ECL position, the POS/NEG switch and the OFFSET switch have no effect on the output pulse.

3–8 Figure 3–2 illustrates the interaction of the NORM/COMPL switch with the POS/NEG switch regarding the output pulse.

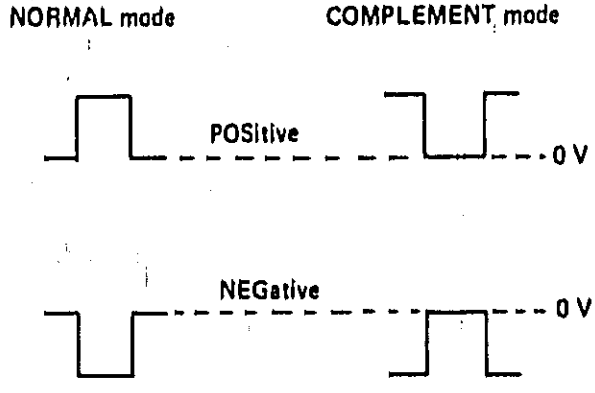


Figure 3–2. Output Signals (no offset applied).

4–1 INTRODUCTION

4–2 The procedures in this section test the instrument's electrical performance using the specifications of Table 1–2 as the performance standards. All tests can be performed without access to the interior of the instrument.

4–3 EQUIPMENT REQUIRED

4–4 Equipment required for the performance tests is listed in the Recommended Test Equipment table in section I. Any equipment that satisfies the critical specifications given in the table can be substituted for the recommended model.

4–5 TEST RECORD

4–6 The results of the performance tests can be tabulated on the Test Record at the end of the procedures. The Test Record lists all of the tested specifications and their acceptable limits. Test results recorded at incoming inspection can be used for comparison in troubleshooting and after repairs or adjustments.

PERFORMANCE TEST

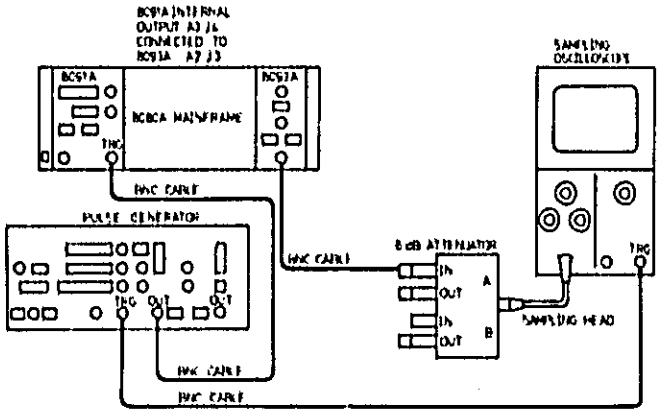


Figure 4–1.

EQUIPMENT:

- 8080A Mainframe
- 8091A Rate Module
- Sampling Oscilloscope with Sampling Head, Terminations, Adaptors
- Pulse Generator
- Three BNC Cables
- 6dB Attenuator

SETTINGS:

Pulse Generator

Period	100ns
Width	50ns
Delay	Min.
Trans. Time	Min.
Amplitude	600mV into 50 Ohm
Offset	OFF
Polarity	NEG

8091A	Rate Range	1GHz - 300MHz
	Mode Switch	EXT. GATE
	Slope	POS.
	Rate Vernier	CW
8093A	Amplitude Vernier	CW (1.2V)
	Output	NORM / POS
	Offset	OFF

1. Connect equipment as shown in Figure 4-1.
2. Vary Amplitude Vernier and check amplitude variation from <0.6 Vpp to >1.2 Vpp.
3. Set 8093A output to NEG and check amplitude variation from <0.6 Vpp to >1.2 Vpp.
4. Set Offset switch to ON and while varying the Offset Vernier ensure that the baseline of the displayed signal can be offset from -1.2V to +1.2V.
5. Set NORM / COMPL switch to COMPL and check that the signal is complemented.
6. Reset output to NORM/POS and measure the transition time of the output signal. Limit <300ps.
7. Check overshoot and ringing for <10%.
8. Turn 8091A Rate Vernier to CCW and check signal for <15% overshoot and ringing.
9. Turn 8091A Rate Vernier CW, set 8093A Output Level Vernier to ECL position and check ECL high level for approx. - 0.8V and low level for approx. -1.6V

8093A PERFORMANCE TEST RECORD

	Test Description	Result	
		Specification	Actual
	Amplitude Variation	<.6 Vpp to> 1.2 Vpp	
	Amplitude Variation	-.6 Vpp to -1.2 Vpp	
	Offset Variation	-1.2 V to +1.2 V	
	NORM COMPL. Function		
	Transition Time	< 300 ps	
	Overshoot and Ringing	< 10 %	
	Overshoot and Ringing	<15 %	
	ECL high level	approx. -.8 V	
	ECL low level	approx. -1.6 V	

5–1 INTRODUCTION

5–2 This section describes adjustments required to return the Model 8093A Repetition Rate Generator to peak operating condition. Included in this section are test setups, tests and adjustments. An adjustment locator diagram is included in this section.

5–3 SAFETY CONSIDERATIONS

5–4 Although this instrument has been designed in accordance with international safety standards, this manual contains information and warnings which must be followed to ensure safe operation and to retain the instrument in a safe condition (see Sections 2 and 3). 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 apparatus dangerous. Intentional interruption is prohibited.

5–5 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 the hazard involved. The opening of covers or removal of parts, except those to which access can be gained by hand, may expose live parts, and also accessible terminals may be live.

5–6 Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

5–7 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.

5–8 Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

5–9 TEST EQUIPMENT REQUIRED

5–10 Table 1–1 contains a list of test equipment and test accessories required in the adjustment procedures. In addition, the tables contain the required minimum specifications and a suggested manufacturer's model number.

5–11 ALIGNMENT TOOL

5–12 A non-metallic alignment tool must be used when making any adjustments to the Model 8093A.

5–13 PERFORMANCE TESTS

5–14 After making the adjustments, carry out the Performance Tests in Section 4.

5–15 RELATED ADJUSTMENTS

5–16 The following adjustments must be performed in the order indicated in the procedures. The adjustments cannot be performed individually because of interaction.

5–17 After making the adjustments, the following related adjustments should be checked. If the Model 8093A output is connected to an output amplifier, the output amplifier duty cycle must be checked and, if necessary adjusted.

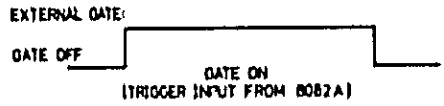
5–18 INITIAL PREPARATION

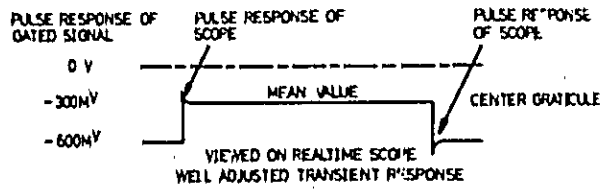
5–19 A working knowledge of amplifier calibration and measurement techniques, and the ability to interpret an output signal

displayed on an oscilloscope, are pre-requisites for carrying out adjustment procedures to obtain optimum performance.

In order to measure the amplifier output, the signal has to be displayed on an oscilloscope. The low-pass characteristics of the oscilloscope are then used to show the mean-value of the gated GHz signal which is in direct proportion to its duty cycle. The most significant characteristic displayed on the oscilloscope is the "transient response" of the 1 GHz gated signal with respect to the duty cycle variations of the input gate signal.

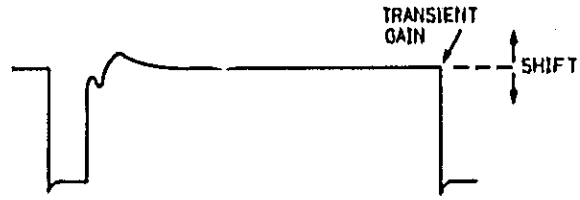
The diagrams below illustrate the areas of influence of the the various potentiometers that have to be adjusted for optimum amplifier response.



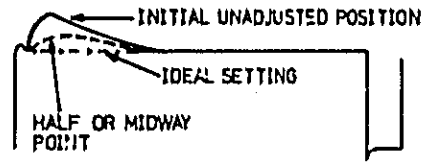


Basic Adjustment Procedure

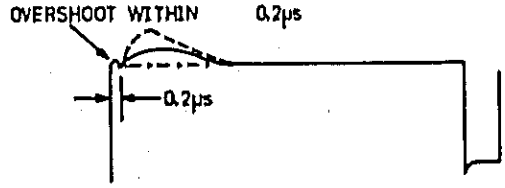
Step 1.
Increase or decrease the transient GAIN of the amplifier so that the 10% to 90% variation of the input gate signal duty cycle does not cause the high level of the waveform to shift in either direction. See diagram below.



Step 2.
Increase or decrease the transient OFFSET so that the overshoot (or undershoot) is decreased to half of its initial value. That is to say, decrease the overshoot to a point midway between the initial, unadjusted position and the ideal setting as illustrated below.



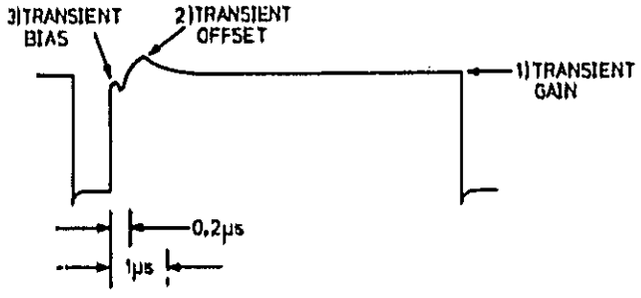
Step 3.
Increase or decrease the transient BIAS so that the overshoot, within the first 2 µs of the waveform, is decreased to obtain as flat a pulse response as possible.



The criteria for optimizing the amplifier transient response is based on a sequential adjustment of three parameters:

1) Transient GAIN
2) Transient OFFSET
3) Transient BIAS

The following diagram illustrates the effect that each adjustment has upon the waveform. At this point, it must also be noted that transient OFFSET and transient BIAS adjustments are interactive with the transient GAIN. It must be remembered, therefore, that the transient gain has to be re-adjusted after each adjustment sequence.



Step 4.
Due to the fact that transient OFFSET and BIAS adjustments are interactive with the transient GAIN, repeat step 1 and, if necessary, the whole sequence until optimum flatness and minimum high level shift is obtained.

ADJUSTMENT PROCEDURE

INPUT AMPLIFIER (A2U1) ADJUSTMENT

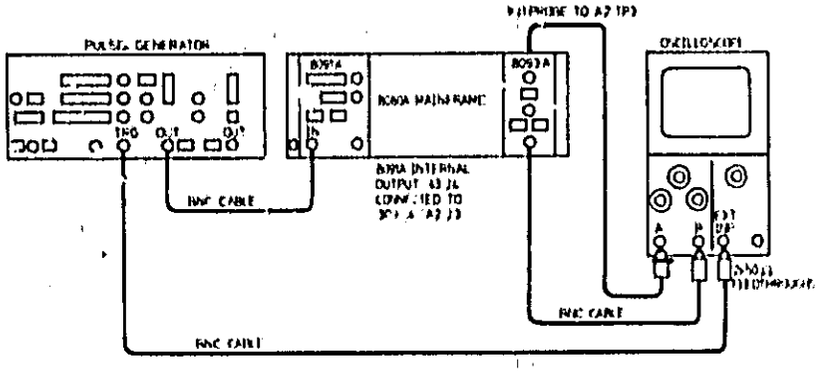


Figure 5–1

EQUIPMENT

8080A Mainframe
8091A 1GHz Rate Module
Realtime oscilloscope
Pulse generator
One 10:1 Probe
Two 50 Ohm feedthroughs
Three BNC cables.

SETTINGS

Pulse generator	
Pulse period	50 µs
Delay	Minimum
Width	25 µs
Transition time	1 ns
Amplitude	600 mV into 50 Ohms
Output polarity	NEG (high level = 0V)
Mode switch	NORM

8091A	
RATE range	1 GHz – 300 MHz
Rate VERNIER	CCW
Mode switch	EXT WIDTH
RISETIME	<1 ns
SLOPE	NEG

8093A	
AMPLITUDE VERNIER	CW
NORM / COMPL	NORM
NEG / POS	POS

PROCEDURE

1. Connect the equipment as shown in Figure 5–1 and adjust the 8091A EXT INPUT LEVEL vernier and the oscilloscope trigger level to obtain a gate signal on the oscilloscope.
2. Connect 10:1 probe to A2TP1 and adjust threshold potentiometer A2 R16 for maximum signal.

3. Set the signal symmetrical about the center graticule and set the 8091A mode switch to EXT GATE.
4. Trigger the oscilloscope with the negative-going edge and vary the duty cycle of the gate signal between 90% and 10%. Observe and reduce the low level shift at the right end of the displayed pulse by means of A2R10.
5. With a duty cycle of 90%, set the waveform low level onto the center graticule by means of A2R16.
6. With a duty cycle of 90%, decrease the over-or undershoot to half of its initial, unadjusted value by means of A2R11 and A2R1.
7. Vary the duty cycle of the gate pulse between 90% and 10% and adjust A2R10 for minimum mean value shift.
8. Repeat steps 5 to 7 until optimum flatness and minimum high level shift is maintained when the duty cycle of the gate pulse is varied between 10% and 90%.
9. Disconnect 10:1 probe.

OUTPUT LEVEL ADJUSTMENT

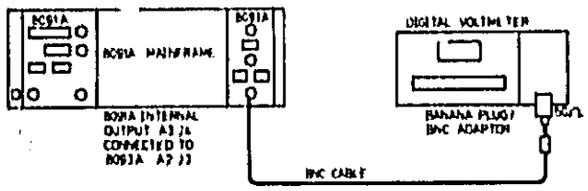


Figure 5–2.

EQUIPMENT:

8080A Mainframe
8091A Rate Module
Digital Voltmeter
50 Ohm Feedthrough
BNC to Dual Banana Adaptor
BNC Cable

SETTINGS:

8091A Mode switch EXT. WIDTH (TRIG)
Slope switch MAN
8093A Output NORM / NEG
Offset Off

1. Connect equipment as shown in Figure 5–2.
2. While turning the 8093A amplitude vernier, adjust A2R84 so that the DC variation is less than ±20mV.
3. Set 8093A output to NORM / POS and adjust A2R24 for less than ±20mV change when turning the amplitude vernier from CW to CCW.
4. With 8093A output set to NORM/POS, set 8093A amplitude vernier to ECL (detent position) and adjust A2R69 for – 1.6V ± 30mV.
5. Switch output to COMPL / POS and adjust A2 R73 for –0.8V ± 30mV.
6. Repeat steps 4 and 5 and readjust if necessary.

OUTPUT AMPLIFIER A2U2 ADJUSTMENT

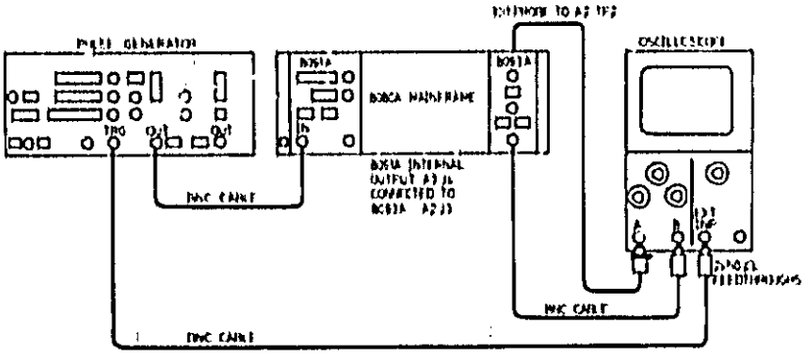


Figure 5–3.

EQUIPMENT:

8080A Mainframe
8091A Rate Module
Realtime Oscilloscope
10:1 Probe
Two 50 Ohm Feedthroughs
Three BNC cables
Pulse Generator

SETTINGS:

Pulse Generator	Period	50µs
	Width	25µs
	Delay	Min
	Trans. Time	Min
	Amplitude	600mV into 50 Ohms
	Offset	Off
	Polarity	Pos
8091A	Rate Range	10KHz – 1KHz
	Mode Switch	NORM
	SLOPE	POS
	Rate Vernier	CCW
8093A	Amplitude Vernier	CCW (not ECL)
	Output	COMP. / NEG
	Offset	OFF
Oscilloscope	Channel A	10mV / DIV AC
	Channel B	200mV / DIV DC
	Time Base	5µs / DIV
	Trigger	EXT.

1. Connect equipment as shown in Figure 5–3.
2. With oscilloscope channel A selected, adjust A2R80 for minimum amplitude.
3. Set 8093A output to NORM/NEG and adjust A2R81 for minimum amplitude.
4. Disconnect 10:1 probe from A2TP2 and select channel B on oscilloscope.
5. Set 8091A to:

Rate Mode	Range Switch	1GHz – 300MHz
	Slope	EXT. WIDTH (TRIG) POS.

Set 8093A to:

Output	COMPL/NEG
Amplitude Vernier	CW

6. Position the gate signal symmetrical about center graticule and switch 8091A to EXT. GATE.
7. When switching the 8093A output from NORM to COMPL, adjust A2R78 for minimum movement of the mean value around center graticule.

OVERSHOOT AND SCHMITT-TRIGGER ADJUSTMENT

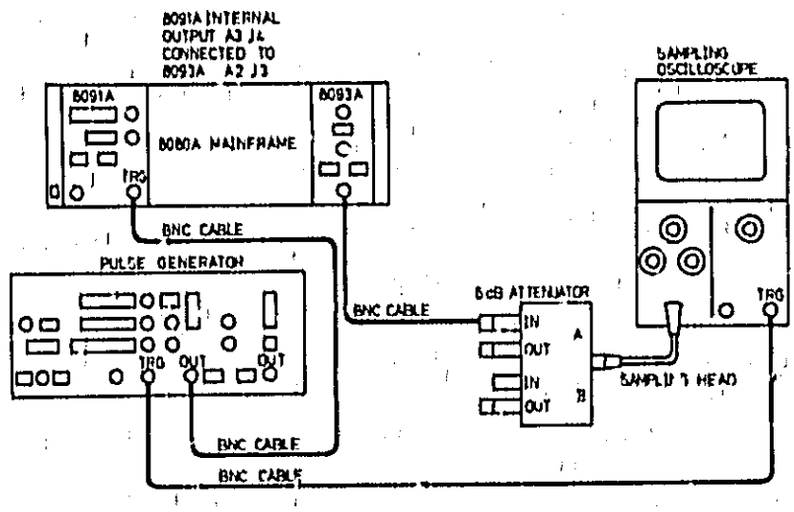


Figure 5–4.

EQUIPMENT:

8080A Mainframe
8091A Rate Module
Sampling Oscilloscope with Sampling Head, Termination, Adaptors
Pulse Generator
Three BNC Cables
6dB Attenuator

SETTINGS:

Pulse Generator	Period	100ns
	Width	50ns
	Delay	Min.
	Trans. Time	Min.
	Amplitude	600mV into 50 Ohm
	Offset	OFF
	Polarity	NEG
8091A	Rate Range	1GHz – 300MHz
	Mode Switch	EXT. GATE
	Slope	POS.
	Rate Vernier	CW
8093A	Amplitude	
	Vernier	CW (1.2V)
	Output	NORM / POS
	Offset	OFF

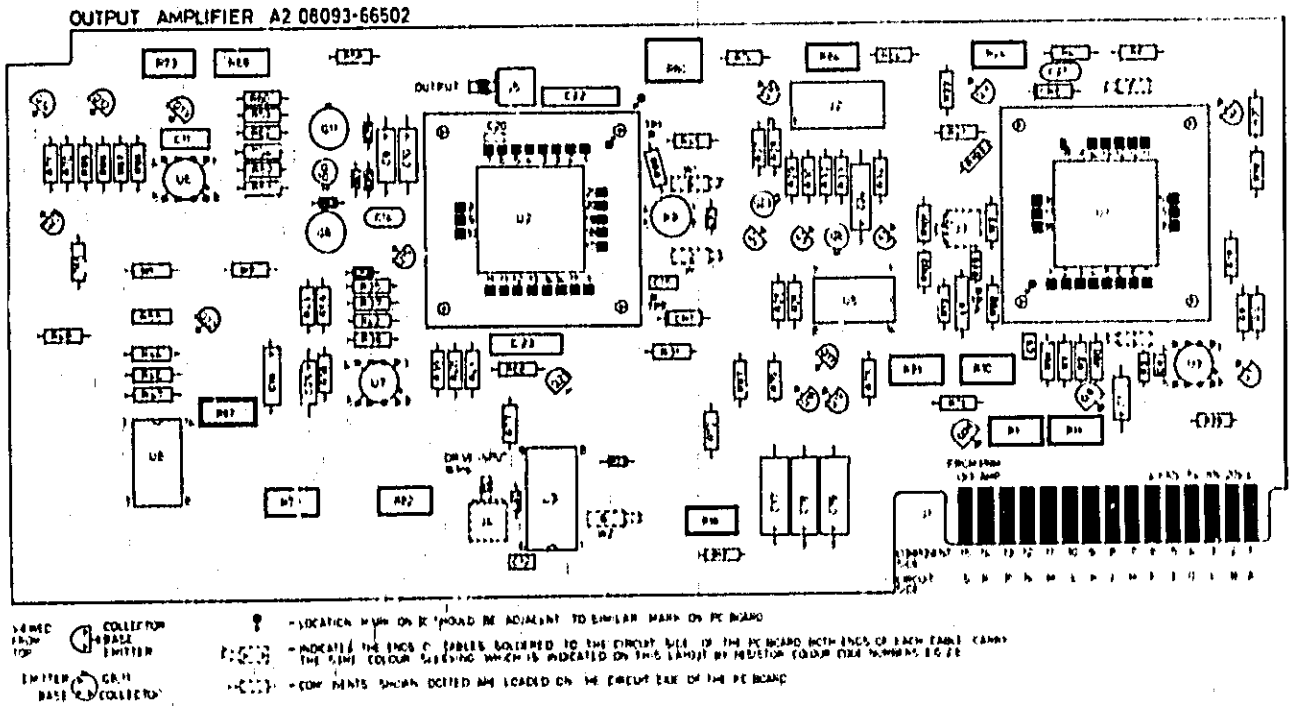
PROCEDURE

1. Connect equipment as shown in Figure 5–4, and adjust A2R57 for less than 10% overshoot.
2. Check rise-time for 300ps and readjust A2R57 if necessary.

Schmitt-Trigger Adjustment

3. Disconnect 8091A output from 8093A A2J3 and connect Schmitt-Trigger output cable A2W2 to drive input connector A2J3.
4. Connect 8091A output cable to 8093A Schmitt-Trigger input A2J4.
5. Adjust A2R82 for 50% duty cycle.
6. Reconnect Schmitt-Trigger output cable A2W2 to A2J4

OUTPUT AMPLIFIER A2 08093-66502



NOTE: In older instruments, some of the presently incorporated adjustment pots may not have been implemented. In such cases, the adjustment procedure given in this manual is still effective by carrying out the procedure using the pots which are available.

PARTS LIST

6–1 INTRODUCTION

6–2 This section contains information for ordering parts. Table 6–1 lists abbreviations used in the parts lists and elsewhere in the manual. Table 6–2 lists all replaceable parts in reference designator order.

6–3 ABBREVIATIONS

6–4 Table 6–1 lists abbreviations used in the parts lists, schematics and elsewhere in the manual. In some cases two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts lists are always all capitals. However, in the schematics and other parts of the manual, the same abbreviations may have upper and lower case letters.

6–5 REPLACEABLE PARTS

6–6 Table 6–2 is the list of replaceable parts and is organised as follows:

a. Illustrated parts breakdowns for chassis mounted parts.
b. Chassis mounted parts in alphanumerical order by reference designator.
c. Electrical assemblies and their components in alphanumerical order by reference designator.

6–7 The information given for each part consists of the following:

a. The Hewlett-Packard part number.
b. A check digit.
c. The description of the part.

6–8 ORDERING INFORMATION

6–9 To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office (list of Sales/Service offices at the rear of the 8080A Mainframe manual). The check digit will ensure accurate and timely processing of your order.

6–10 To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6–1. Abbreviations for Replaceable Parts List

A	AMPERE(S)
ASSY	ASSEMBLY
BD	BOARD(S)
BH	BINDER HEAD
BP	BANDPASS
C	CENTI (10^{-2})
	CERMET
CAR	CARBON
CC	CARBON COMPOSITION
CCW	COUNTERCLOCKWISE
CER	CERAMIC
CMO	CABINET MOUNT ONLY
COAX	COAXIAL
COEF	COEFFICIENT
COMP	COMPOSITION
CONN	CONNECTOR(S)
CRT	CATHODE-RAY TUBE
CW	CLOCKWISE
D	DECI (10^{-1})
DEPC	DEPOSITED CARBON
DP	DOUBLE POLE
DT	DOUBLE THROW
ELECT	ELECTROLYTIC
ENCAP	ENCAPSULATED
EXT	EXTERNAL
F	FARAD(S), METAL FILM (FOR RESISTORS)
FC	CARBON FILM/COMPOSITION
FET	FIELD-EFFECT TRANSISTOR(S)
FT	TRANSIT FREQUENCY
FH	FLAT HEAD
FIL H	FILLISTER HEAD
FXD	FIXED
G	GIGA (10^{9})
GE	GERMANIUM
GL	GLASS
GRD	GROUNDED
H	HENRY(IES)
HG	MERCURY
HP	HEWLETT-PACKARD
HZ	HERTZ
IF	INTERMEDIATE FREQ.
IMPG	IMPREGNATED
INCD	INCANDESCENT
INCL	INCLUDE(S)
INS	INSULATION(ED)
INT	INTERNAL
K	KILO (10^{3})
KG	KILOGRAM
LB	POUND(S)
LH	LEFT HAND
LIN	LINEAR TAPER
LOG	LOGARITHMIC TAPER
LPF	LOW-PASS FILTER(S)
LVR	LEVER
M	MILLI (10^{-3})
MEG	MEGA (10^{6})
MET FILM	METAL FILM
MET OX	METAL OXIDE
MFR	MANUFACTURER
MINAT	MINIATURE
MOM	MOMENTARY
MTG	MOUNTING
MY	MYLAR
N	NANO (10^{-9})
N/C	NORMALLY CLOSED
NE	NEON
N/O	NORMALLY OPEN
NOP	NEGATIVE POSITIVE ZERO (ZERO TEMPERATURE COEFFICIENT)
NPN	NEGATIVE-POSITIVE-NEGATIVE
NSR	NOT SEPARATELY REPLACEABLE
OBD	ORDER BY DESCRIPTION
OH	OVAL HEAD
OX	OXIDE
P	PEAK
PC	PRINTED (ETCHED) CIRCUIT(S)
PD	POWER DISSIPATION
PF	PICOFARADS
PHL	PHILLIPS
PIV	PEAK INVERSE VOLTAGE(S)
PNP	POSITIVE-NEGATIVE-POSITIVE
P/O	PART OF
PORC	PORCELAIN
POS	POSITION(S)
POT	POTENTIOMETER(S)
P-P	PEAK-TO-PEAK
PRGM	PROGRAM
PS	POLYSTYRENE
PWV	PEAK WORKING VOLTAGE
RECT	RECTIFIER(S)
RF	RADIO FREQUENCY
RFI	RADIO FREQUENCY INTERFERENCE
RH	ROUND HEAD
	OR
	RIGHT HAND
RMO	RACK MOUNT ONLY
RMS	ROOT MEAN SQUARE
RWV	REVERSE WORKING VOLTAGE
S-B	SLOW-BLOW
SCR	SILICON CONTROLLED RECTIFIER
SE	SELENIUM
SEC	SECOND(S)
SECT	SECTION(S)
SI	SILICON
SIL	SILVER
SL	SLIDE
SP	SINGLE POLE
SPL	SPECIAL
ST	SINGLE THROW
STD	STANDARD
TA	TANTALUM
TC	TEMPERATURE COEFFICIENT
TD	TIME DELAY
TFL	TEFLON
TGL	TOGGLE
THYR	THYRISTOR
TI	TITANIUM
TNLDIO	TUNNEL DIODE(S)
TOL	TOLERANCE
TRIM	TRIMMER
U	MICRO (10^{-6})
V	VOLTS
VAR	VARIABLE
VDCW	DC WORKING VOLT(S)
W	WATT(S)
W/	WITH
WIV	WORKING INVERSE VOLTAGE
W/O	WITHOUT
WVDC	WORKING VOLTAGE DIRECT CURRENT
WW	WIREWOUND

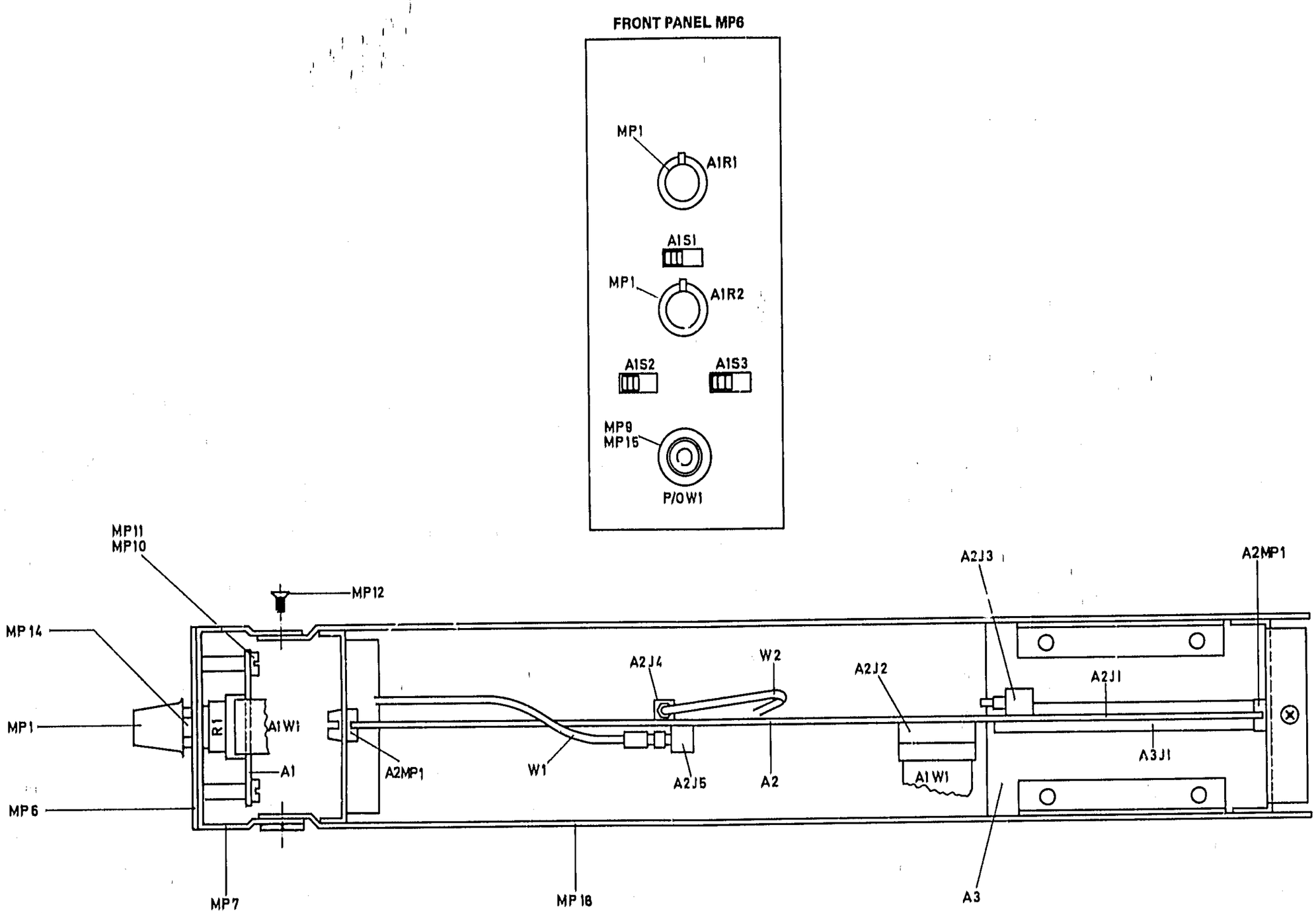


Figure 6–1. 8093A Replaceable Parts

Table 6–2. Replaceable Parts

MODEL 8093A
INSTRUMENT SERIAL PREFIX

FRAME

REFERENCE DESIGNATOR	C D	H-P PART NUMBER	DESCRIPTION
A1		08093-66501	BD AY CONTROL
A2	8	08093-66502	BD AY OUTP AMPL
MP1	2	0370-1005	KNOB BASE PTR
MP6		08093-00201	PANEL FRONT
MP7		08093-00202	PANEL SUB
MP9	7	2190-0383	WASH-LOCK .115ID
MP10	4	2190-0108	WASH-LOCK .115ID
MP11	8	2200-0141	SCR MCH 4-40X.31
MP12	8	2200-0770	SCR MCH 4-40
MP13	7	2360-0332	SCR 6-32X.312
MP14	3	2950-0072	NUT HEX .25-32
MP15	5	5020-6779	NUT-SPCLT
MP18		08093-60101	CHASSIS ASSEMBLY

MODEL 8093A
INSTRUMENT SERIAL PREFIX

A1 08093-66501 BD AY CONTROL

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A1	R1	6	2100-3[illegible]	R-VAR 10K 20%
A1	R2	4	2100-240[illegible]	R-VAR 5K 20% .5W
A1	S1	7	3101-1311	SW SLIDE DPDT
A1	S2	7	3101-1311	SW SLIDE DPDT
A1	S3	7	3101-1311	SW SLIDE DPDT
A1	W1	4	5081-1964	CBL RB 16C 305MM

MODEL 8093A
INSTRUMENT SERIAL PREFIX

A2 08093-66502 BD AY OUTP AMPL

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	C1	4	0180-1745	C-F 1.5UF 20V
A2	C4	3	0160-4386	C-F 33PF 5% 200V
A2	C5		0160-4752	C-F .033UF 20%
A2	C9	6	0180-0228	C-F 22UF 15V
A2	C10	6	0180-0228	C-F 22UF 15V
A2	C11	2	0160-0127	C-F 1UF+-20% CER
A2	C12	4	0160-3470	C-F .01UF 50V
A2	C14	8	0160-3466	C-F 100PF 250V
A2	C15	6	0160-3878	C-F .001UF 100V
A2	C16	6	0180-0228	C-F 22UF 15V
A2	C17	7	0180-0229	C-F 33UF 10V
A2	C18	6	0180-0228	C-F 22UF 15V
A2	C19	3	0180-0374	C-F 10UF 20V
A2	C20	4	0160-3785	C-F .1UF 20% 50V
A2	C21	8	0160-3466	C-F 100PF 250V
A2	C22	8	0160-0174	C-F .47UF 25VCER
A2	C23	8	0160-0174	C-F .47UF 25VCER
A2	C24	7	0180-0229	C-F 33UF 10V
A2	C25	4	0180-1745	C-F 1.5UF 20V
A2	CR2	8	1901-0460	DIO 15V 150MA
A2	CR4	1	1901-0040	DIO SI .05A 30V
A2	CR5	1	1901-0040	DIO SI .05A 30V
A2	CR7	3	1901-0050	DIO SW 80V 200MA
A2	J2	6	1200-0588	SOCKET IC
A2	J2		5040-9316	LOCK,-CLIP 16POL
A2	J3	2	1250-0836	JACK RECEPT-RT
A2	J4	2	1250-0836	JACK RECEPT-RT
A2	J5	2	1250-0836	JACK RECEPT-RT
A2	J27	0	8159-0005	JUMPER
A2	K3	1	0490-1034	RELAY 12V .5A
A2	L4	6	9100-1647	COIL-CHOKE 470UH
A2	MP1	7	1600-0341	CTCT 9FINGER
A2	Q1	1	1854-0215	XSTR SI 2N3904
A2	Q2	5	1854-0392	XSTR ST 2N 5088
A2	Q3	1	1854-0215	XSTR SI 2N3904
A2	Q4	2	1853-0036	XSTR SI 2N3906
A2	Q5	2	1853-0036	XSTR SI 2N3906
A2	Q6	7	1854-0477	XSTR NPN 2N2222A
A2	Q7	5	1854-0392	XSTR ST 2N 5088
A2	Q8	9	1853-0314	XSTR 2N2905A PNP
A2	Q9	2	1853-0036	XSTR SI 2N3906
A2	Q10	9	1853-0281	XSTR SI 2907A
A2	Q11	1	1854-0637	XSTR SI 2219A
A2	Q12	2	1853-0036	XSTR SI 2N3906
A2	Q13	1	1854-0215	XSTR SI 2N3904
A2	Q14	2	1853-0036	XSTR SI 2N3906
A2	Q15	5	1854-0392	XSTR ST 2N 5088
A2	Q16	2	1853-0036	XSTR SI 2N3906
A2	Q17	2	1853-0036	XSTR SI 2N3906
A2	Q18	1	1854-0215	XSTR SI 2N3904
A2	Q19	1	1854-0215	XSTR SI 2N3904
A2	Q20	1	1854-0215	XSTR SI 2N3904
A2	Q21	1	1854-0215	XSTR SI 2N3904
A2	Q22	1	1854-0215	XSTR SI 2N3904
A2	Q23	9	1855-0386	XSTR NFET 2N4392
A2	Q24	1	1854-0215	XSTR SI 2N3904
A2	R1	1	2100-3207	R-VAR 5K 10%
A2	R2	3	0757-0420	R-F 750 1% .125W
A2	R3	7	0698-7236	R-F 1K 1% .05W
A2	R3	0	8159-0005	JUMPER
A2	R4	8	0698-3540	R-F 15.4K1%
A2	R6	3	0757-0438	R-F 5.11K1%
A2	R7	8	0698-3558	R-F 4.02K1%
A2	R8	2	0698-4435	R-F 2.49K1%
A2	R9	6	0757-0283	R-F 2K1% .125W F
A2	R10	1	2100-3207	R-VAR 5K 10%
A2	R11	6	2100-3351	RES TRMR 500 10%
A2	R13	6	0757-0283	R-F 2K1% .125W F
A2	R14	4	0757-0273	R-F 3.01K1%
A2	R15	9	0698-7212	R-F 100 1% .05W
A2	R16	5	2100-3350	R-VAR 200 10%
A2	R17		0698-4421	R-F 249 1% .125W
A2	R18	7	0698-4422	R-F 1.27K1%
A2	R19	6	0757-0283	R-F 2K1% .125W F
A2	R20	5	0757-0399	R-F 82.5 1%
A2	R21	3	0698-3438	R-F 147 1% .125W
A2	R22	3	0757-0420	R-F 750 1% .125W
A2	R23	2	0698-7223	R-F 287 1% .05W
A2	R24	6	2100-3351	RES TRMR 500 10%
A2	R25	3	0757-0438	R-F 5.11K1%
A2	R27	3	0757-0438	R-F 5.11K1%
A2	R28	6	0757-0283	R-F 2K1% .125W F
A2	R29	6	0757-0283	R-F 2K1% .125W F
A2	R30	8	0698-3152	R-F 3.48K 1%
A2	R31	6	0757-0449	R-F 20K1% .125W
A2	R32	3	0757-0438	R-F 5.11K1%
A2	R33	3	0757-0438	R-F 5.11K1%
A2	R34	3	0757-0420	R-F 750 1% .125W
A2	R35	0	0698-3435	R-F 38.3 1%
A2	R36	6	0757-0283	R-F 2K1% .125W F
A2	R37	1	0757-0410	R-F 301 1% .125W
A2	R38	9	0757-0442	R-F 10K1% .125W
A2	R39	8	0698-4308	R-F 16.9K 1%1/8W
A2	R40	1	0757-0460	R-F 61.9K 1%
A2	R41	5	0698-3266	R-F 237K1% .125W
A2	R42	9	0757-1094	R-F 1.47K1%
A2	R43	6	0757-0465	R-F 100K1% .125W
A2	R44	1	0698-4442	R-F 4.42K1%
A2	R45	7	0757-0416	R-F 511 1% .125W
A2	R46	0	0757-0401	R-F 100 1% .125W
A2	R47	1	0698-3428	R-F 14.7 1%
A2	R48	2	0757-0346	R-F 10 1% .125W
A2	R49	6	0698-7243	R-F 1.96K 1%.05
A2	R50	9	0698-7288	R-F 147K 1% .05W
A2	R51	7	0698-4422	R-F 1.27K1%
A2	R52	8	0698-3540	R-F 15.4K1%
A2	R53	8	0698-3558	R-F 4.02K1%
A2	R54	9	0698-3484	R-F 6.65K1%
A2	R55	8	0698-3459	R-F 383K1% .125W
A2	R56	1	0757-0410	R-F 301 1% .125W
A2	R57	2	2100-3349	R-VAR 100 -+10%
A2	R58	8	0757-0384	R-F 20 1% .125W
A2	R59	1	0757-0410	R-F 301 1% .125W
A2	R60	7	0698-3268	R-F 11.5K1%
A2	R61	8	0698-7253	R-F 5.11K 1%.05
A2	R62	0	0698-4475	R-F 9.76K1%
A2	R63	7	0698-5561	R-F 6.8 5% .125W
A2	R64	8	0757-0433	R-F 3.32K1%
A2	R65	6	0698-3449	R-F 28.7K1%
A2	R66	6	0698-3449	R-F 28.7K1%
A2	R67	1	0698-4442	R-F 4.42K1%
A2	R68	5	0757-0274	R-F 1.21K1%
A2	R69	8	2100-3353	R-VAR 20K .5W
A2	R70	2	0698-3156	R-F 14.7K1%
A2	R71	6	0698-3449	R-F 28.7K1%
A2	R72	8	0698-3558	R-F 4.02K1%
A2	R73	7	2100-3352	R-VAR 1K .5W
A2	R74	9	0757-0442	R-F 10K1% .125W
A2	R75	9	0757-0442	R-F 10K1% .125W
A2	R76	9	0757-0442	R-F 10K1% .125W
A2	R77	6	0757-0407	R-F 200 1% .125W

Table 6-2. Replaceable Parts (cont'd)

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	R78	8	2100-3353	R-VAR 20K .5W
A2	R79	9	0757-0442	R-F 10K1% .125W
A2	R80	7	2100-1760	R-VAR 5K 1W WW
A2	R81	2	2100-3274	R-VAR 10K 10%
A2	R82	2	2100-3274	R-VAR 10K 10%
A2	R83	0	0698-7238	R-F 1.33K 1%.05
A2	R84	6	2100-3351	RES TRMR 500 10%
A2	R85	2	0698-3156	R-F 14.7K1%
A2	R86	6	0698-7243	R-F 1.96K 1%.05
A2	R87	9	0757-0442	R-F 10K1% .125W
A2	R88	6	0757-0407	R-F 200 1% .125W
A2	R101	2	0698-7223	R-F 287 1% .05W
A2	R102	2	0698-7223	R-F 287 1% .05W
A2	R103	0	0698-7205	R-F 51.1 1%.05W
A2	TP1	0	0360-0535	TERM-TEST POINT
A2	TP2	0	0360-0535	TERM-TEST POINT
A2	TP3	0	0360-0535	TERM-TEST POINT
A2	U1	2	5081-1070	IC AY-HYB GHZ A
A2	U2	9	5081-1069	IC AY-HYB GHZ O
A2	U3	7	1826-0111	IC-DUAL OP AMPL
A2	U5	8	1820-1197	IC SN74LS00
A2	U6	4	1826-0043	IC LM307H
A2	U7	4	1826-0043	IC LM307H
A2	U8	4	1821-0001	XSTR ARRAY
A2	U9	4	1820-0285	IC 250MHZ 16PIN
A2	VR1	1	1902-3092	DIO 4.99V 2% .4W
A2	VR6	1	1902-3092	DIO 4.99V 2% .4W
A2	W1		08093-61601	CBL AY-SHLD #1
A2	W2		08093-61603	CBL AY SHLD #3

SERVICE INFORMATION

7–1 INTRODUCTION

7–2 This section contains the component layouts and schematic diagrams for the Model 8093A Output Amplifier. Tables listing the reference designators and schematic symbols used are also given. Refer to section 6 for the replaceable parts information.

7–3 RECOMMENDED TEST EQUIPMENT

7–4 Test equipment and test equipment accessories required to maintain the Model 8093A are listed in table 1–1. Equipment other than that listed can be used if it meets the listed critical specifications.

TROUBLESHOOTING

The adjustment procedure for this module has been written such that any defective circuits can easily be localized when performing the procedure. For this reason, it is suggested that the adjustment procedure given in SECTION 5 of this manual be used as a troubleshooting aid.

Table 7–1. Reference Designators

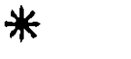
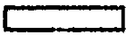
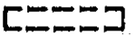
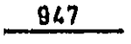
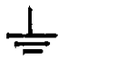
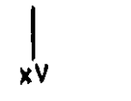
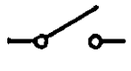
A	=	assembly	U	=	micro-circuit
B	=	motor	P	=	plug
BT	=	battery	Q	=	transistor
C	=	capacitor	R	=	resistor
CP	=	coupler	RT	=	thermistor
CR	=	diode	S	=	switch
DL	=	delay line	T	=	transformer
DS	=	lamp	TB	=	terminal board
F	=	fuse	V	=	vacuum, tube, neon bulb, photocell, etc.
FL	=	filter			
HR	=	heater	VR	=	voltage regulator
J	=	jack	W	=	cable
K	=	relay	X	=	socket
L	=	inductor	Y	=	crystal
M	=	meter	TP	=	test point

HG	MERCURY	PNP	POSITIVE-NEGATIVE-POSITIVE		
HP	HEWLETT-PACKARD	P/O	PART OF		
HZ	HERTZ	PORC	PORCELAIN	W	WATT(S)
		POS	POSITION(S)	W/	WITH
IF	INTERMEDIATE FREQ.	POT	POTENTIOMETER(S)	WIV	WORKING INVERSE VOLTAGE
IMPG	IMPREGNATED	P-P	PEAK-TO-PEAK	W/O	WITHOUT
INCD	INCANDESCENT	PROM	PROGRAM	WVDC	WORKING VOLTAGE DIRECT CURRENT
INCL	INCLUDE(S)	PS	POLYSTYRENE	WW	WIREWOUND
INS	INSULATION(ED)	PWV	PEAK WORKING VOLTAGE		
INT	INTERNAL				

Table 7–2 Schematic Diagram Symbols

The following symbols conform, as far as possible, with ANSI Y32.2, IEEE No. 315 and ANSI Y32.14 (for the logic symbols). These standards should be consulted when further information is required.

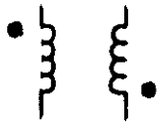
Resistance values are in ohms, capacitance values in microfarads and inductance values in microhenries unless otherwise noted.

P/O	Part of
	Asterisk denotes a factory selected value. The value shown is the nominal value.
	Encloses front panel nomenclature
	Encloses rear panel nomenclature
	Heavy line indicates signal path
	Heavy dashed line indicates primary feedback path
	Wire colour code. Same as resistor colour code. First number is wire body colour.
	Wire our plug used as link.
	Test point in a circuit. Point may/may not be identified on P. C. board.
	Used with trimmer potentiometers or capacitors to indicate screwdriver adjustment.
	Direct connection to earth.
	Ground connection to instrument chassis or frame.
	Used when a number of common-return connections are at the same potential. If there is more than one such system in the same circuit, numbers are written in the triangles so that all connections with the same potential have the same number.
	Specific potential difference with respect to a potential reference level, eg. 
	Normally open toggle switch. Circles (O) are used for the contacts to indicate a locking type switch.

Spring return, 2-position transfer switch. Triangles (▲) are used for the contacts to indicate a non-locking type switch.

2-position, 2-pole slide switch.

Air cored inductor.



Air cored transformer. The dot (●) is used, when necessary, to indicate instantaneous polarity.

Iron core

Ferrite core

Ferrite bead

Varactor diode

Multi-junction diode

Diode

Zener diode

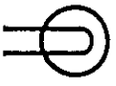
Schottky diode

Light Emitting Diode (LED)

Photodiode

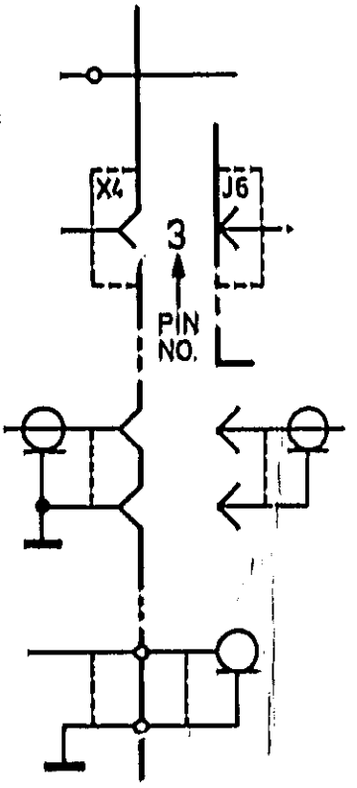
Fuse

Neon



Filament lamp

Terminals and Connectors



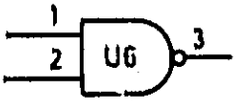
Soldered connection.

Example of fixed male and female connectors with plug and socket and contact designators, eg. P. C. board edge connector and socket.

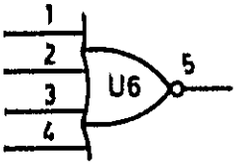
example of bulkhead mounted coaxial socket with free coaxial plug and cable.

example of coaxial cable with termination soldered to P. C. board.

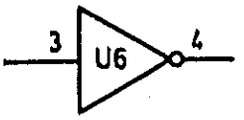
Analog/Digital logic symbols



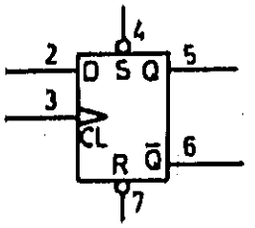
2-Input NAND gate



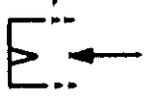
4-Input NOR gate



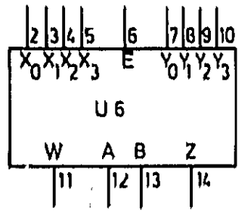
Inverter



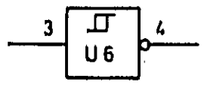
Flip-flop.



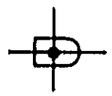
The dynamic indicator denotes that this is a dynamic input and operates on a transition, not a level.



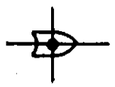
Complex functions represented by rectangular box. Letters can be used inside the rectangle to clarify the function. A truth table should be included, as close as possible to the circuit.



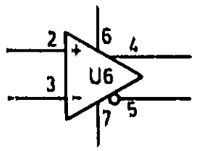
Schmitt trigger



Wired AND connection

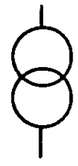


Wired OR connection

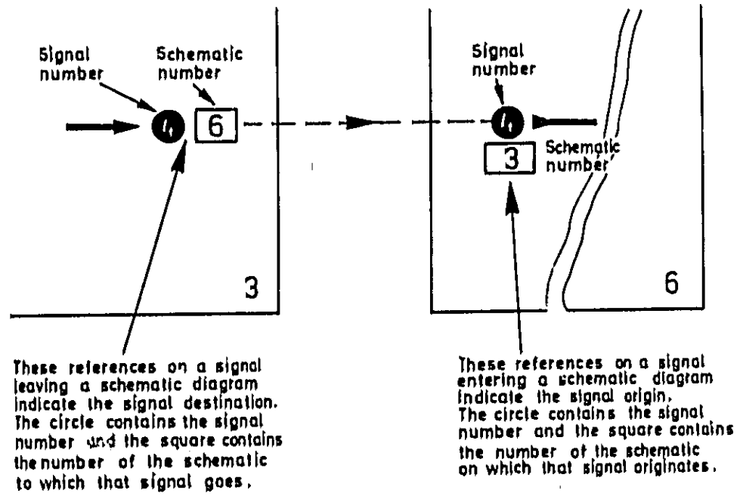


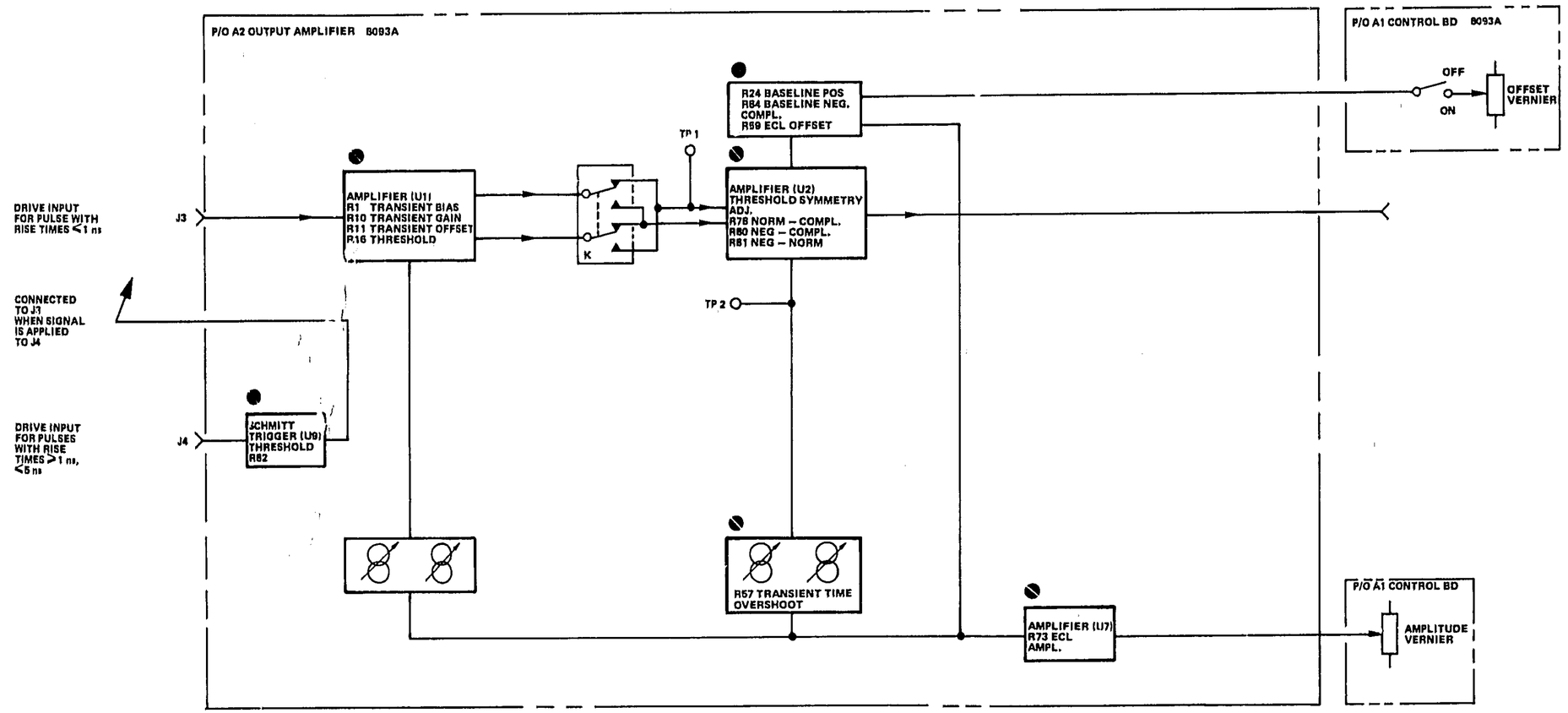
Operational amplifier

Voltage source



Current source





8093A
BLOCK DIAGRAM

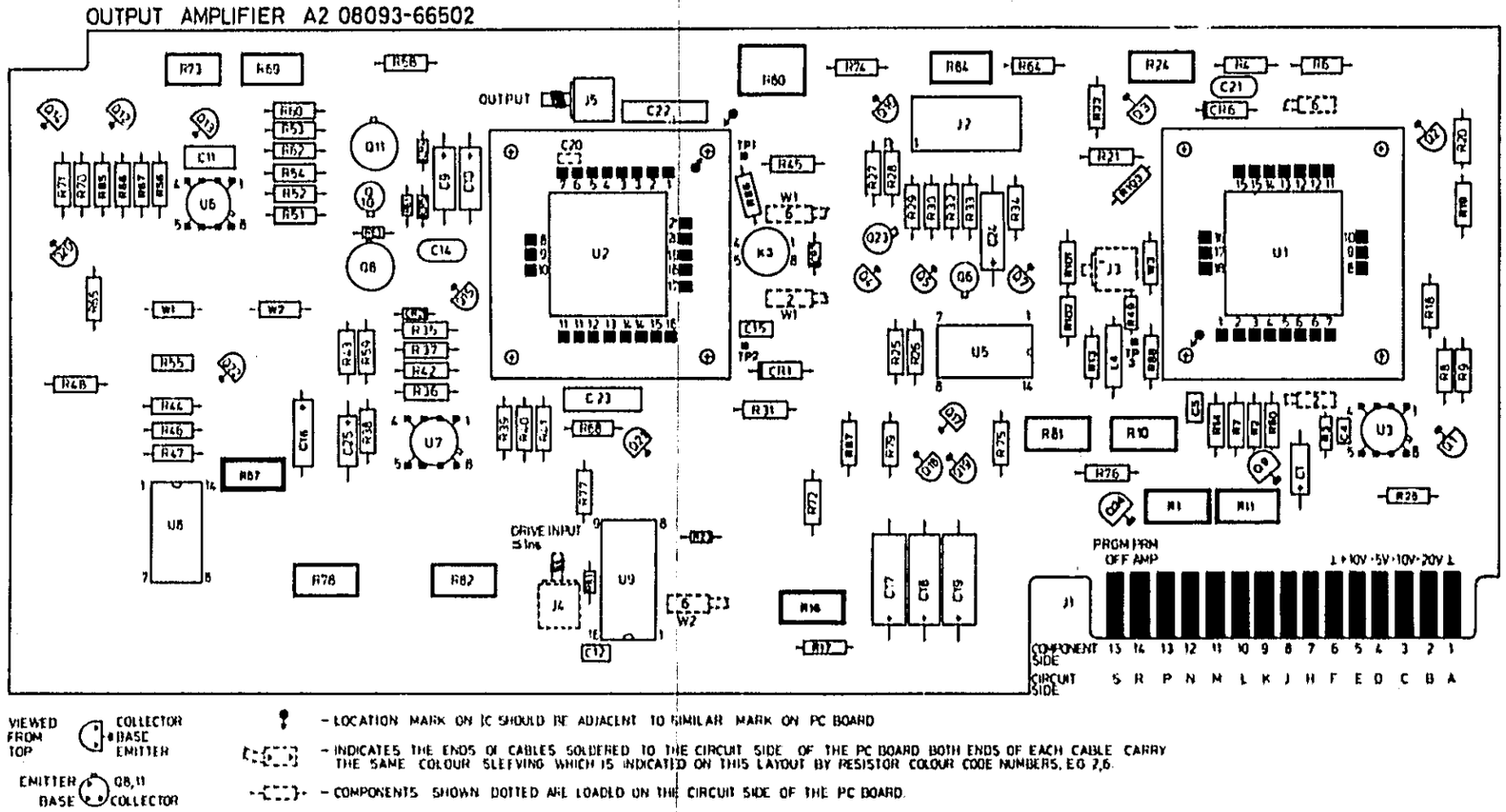
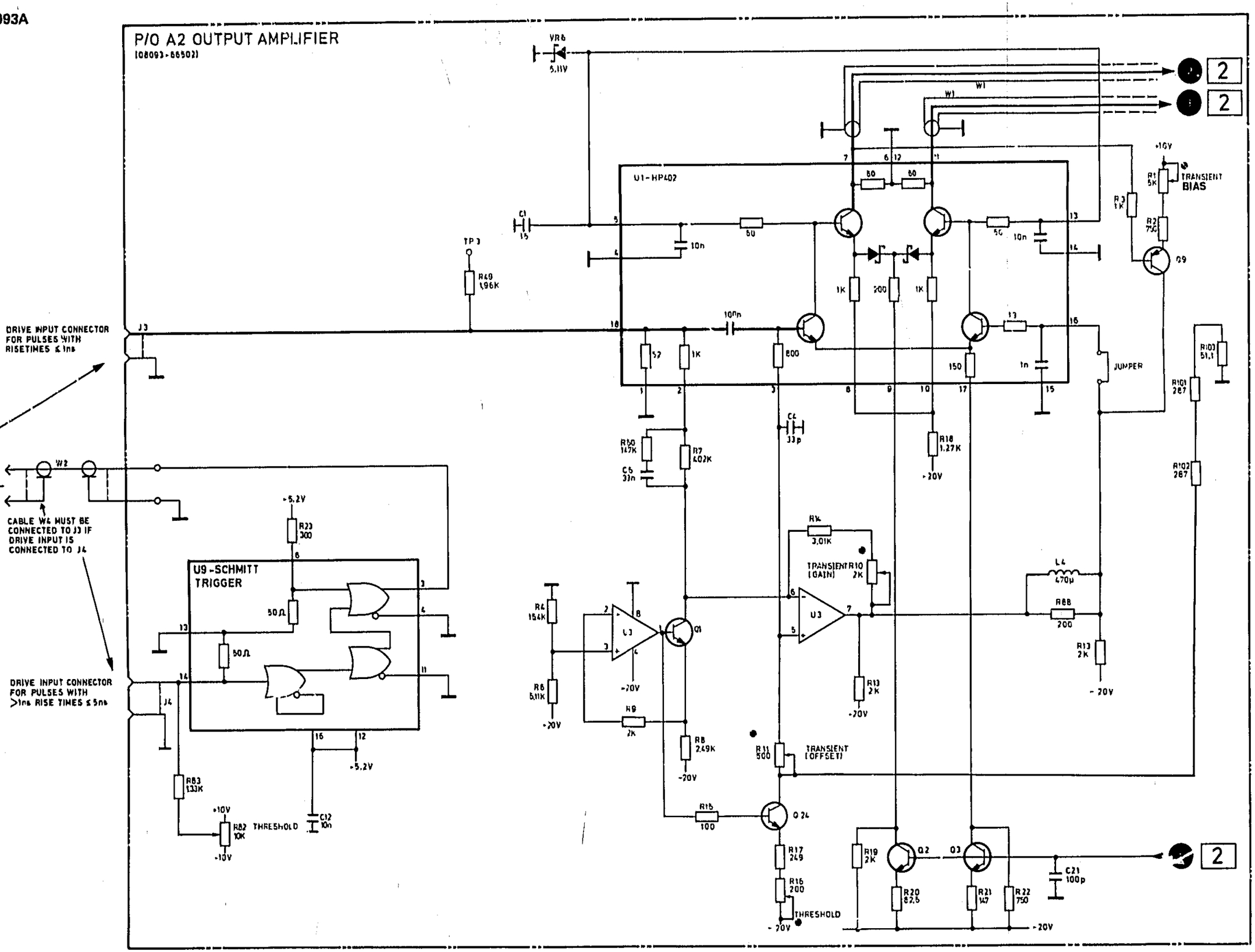


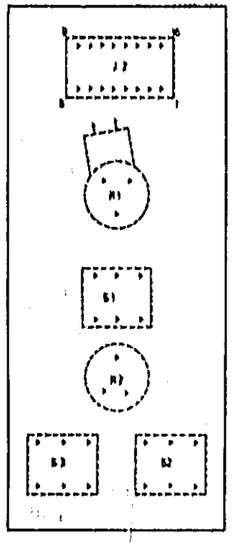
Figure 7–1. A2 Output Amplifier Component Layout.



P/O OUTPUT AMPLIFIER BOARD A2

1

08093–66501
CONTROL BOARD A1



BOARD A1 VIEWED
FROM
REAR OF MODULE

08093–66502 OUTPUT AMPLIFIER A2

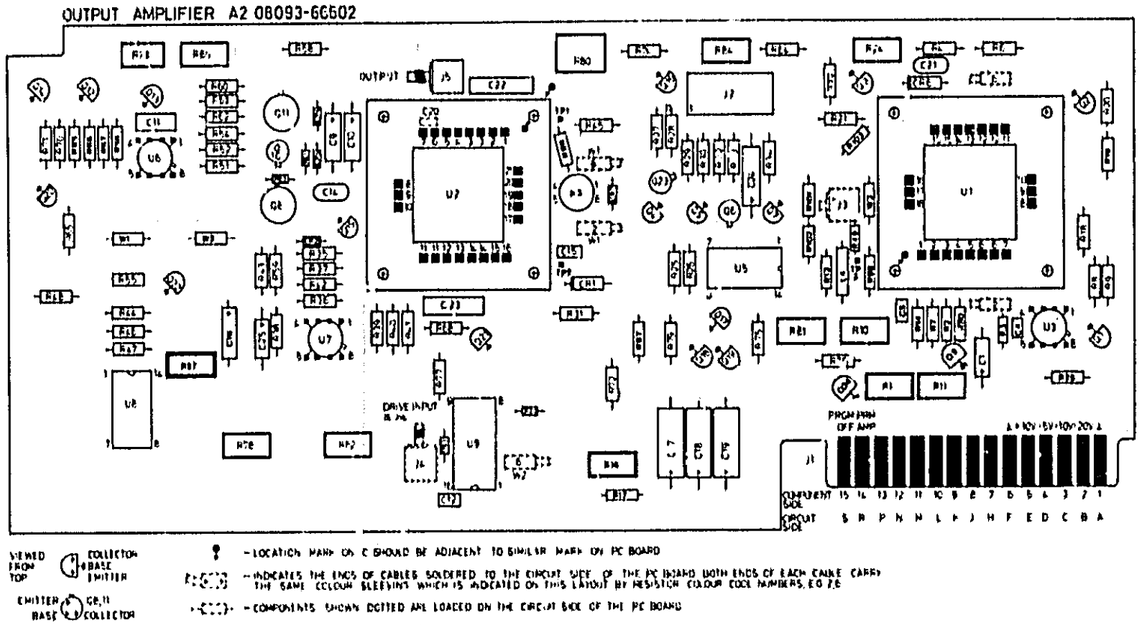


Figure 7–2. A1 Control Board and A2 Output Amplifier Component Layouts.

P/O A2 OUTPUT AMPLIFIER (08093-66502)

P/O FRONT PANEL

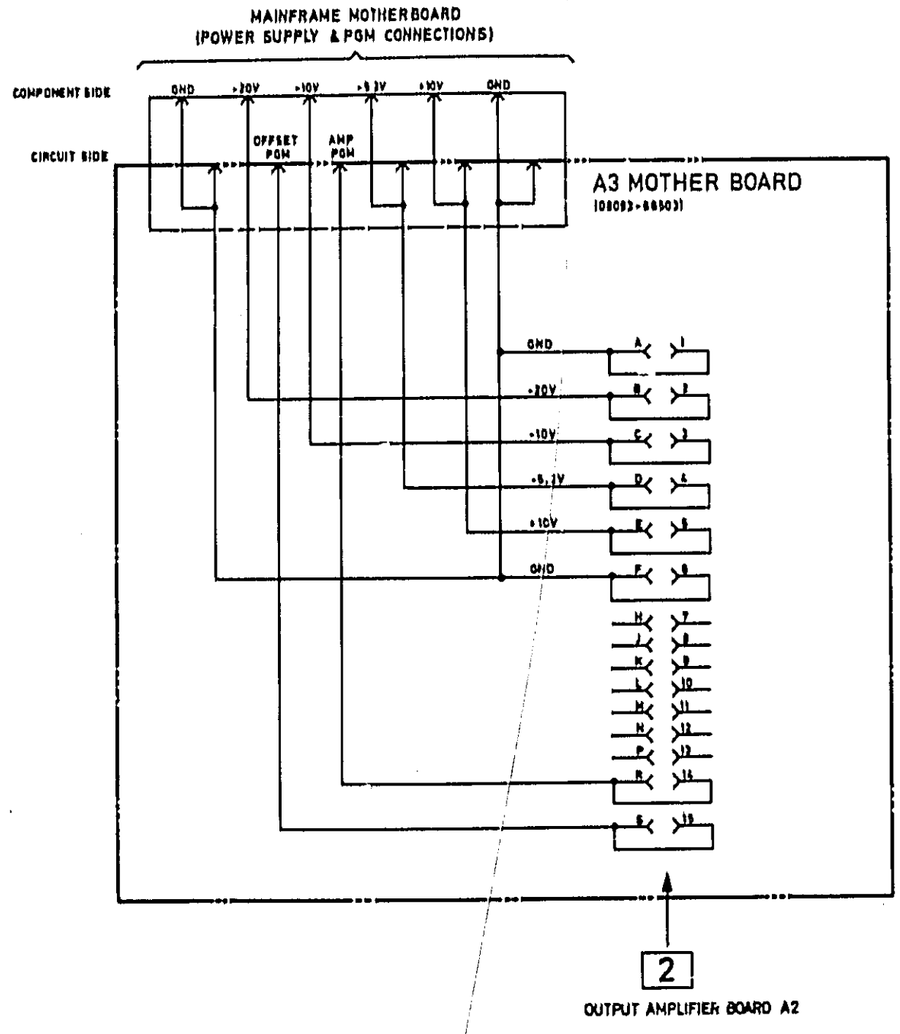
U2-HP 204

A1 CONTROL BOARD (08093-66501)

P/O A3 MOTHER BOARD (08093-66503)

CONTROL BOARD A1 AND PART OF OUTPUT AMPLIFIER BOARD A2

2


MAINFRAME MOTHERBOARD
(POWER SUPPLY & PGM CONNECTIONS)
COMPONENT SIDE
CIRCUIT SIDE
GND
+20V
-10V
-5.2V
+10V
GND
OFFSET PGM
AMP PGM
A3 MOTHER BOARD
(08093-66503)
GND
+20V
-10V
-5.2V
+10V
GND
2
OUTPUT AMPLIFIER BOARD A2

BACK DATING MANUAL CHANGES

8–1 INTRODUCTION

8–2 The purpose of this section is to provide supplementary information for instruments with serial numbers lower than shown on the title page of this manual.

8–3 The table of replaceable parts, the schematic and component layout diagrams contained in this section are applicable to instruments with serial numbers: 1725G00440 to 1725G00570.

NOTE

Following changes are to be made to the table of replaceable parts, schematics and layout diagrams contained in this section only (not to Section 7).

8–4 Changes are listed in the serial number order that they occured in the manufacture of the instrument. However, in adapting this backdating information to an instrument with a particular serial number, apply the changes in the reverse order. That is, begin with the latest change and progress to the earliest change that applies to the serial number in question. Table 8–1 lists the serial numbers to which each change applies.

Table 8–1. Backdating Changes

Instrument Serial Number	Make Backdating Changes
1614G00101, 102	3 to 9
1614G00103	2 to 9
1614G00104	3 to 9
1614G00105, 106	2 to 9
1614G00107	3 to 9
1614G00108	2 to 9
1614G00109	3 to 9
1614G00110	2 to 9
1614G00111 to –00124	1 to 9
1614G00125 to –00131	2 to 9
1614G00132	3 to 9
1614G00133 to –00140	2 to 9
1614G00141 to –00145	3 to 9
1614G00146 to –00180	4 to 9
1725G00181 to –00220	5 to 9
1725G00221 to –00260	6 to 9
1725G00261 to –00390	7 to 9
1725G00391 to –00420	8 and 9
1725G00421 to –00439	9
1725G00440 to –00570	see para. 8–3

CHANGE 1 (for serial numbers 1614G00111 to 00124)

Change the following component

A1R2	2100–2086	R-VAR 5K .5W
A2C4	Delete	
A2R21	0698–4401	R–F 95.3 1 %

Delete capacitor C4 (connected to U3).
Delete capacitor C4 (connected between U1 pin 3 and ground). Change R21 to 95.3 ohms.

CHANGE 2 (for serial numbers see Table 8–1)

Change the following components.

A2C2	0160–3779	C–F 1NF 20 %
A2C3	0160–4210	C–F .022UF 20 %
A2C4	0160–3779	C–F 1NF 20 %
A2R12	0757–0421	R–F 825 1 %
A2R14	0698–4442	R–F 4.42K 1 %
Delete	A2R13	

Delete R13 (connected to U3).
Change: C2 to 1nF; C3 to 0.022μF; C4 to 1nF; R12 to 825 and R14 to 4.42K. Delete R13

CHANGE 3 (for serial numbers 00101 to 00144)

Change the following components

A2R21	0698–4409	R–F 127 1 %
R2R22	0698–4435	R–F 2.49 K 1 %

Change R21 to 127 ohms and R22 to 2.45 K ohms.

CHANCE 4 (for serial numbers 00101 to 00180)

Change the following components

Add		
A2C2	0160–4386	C–F 33PF 200 V
Change		
A2C4	0160–3876	C–F 47PF 200 V
A2R12	0757–0420	R–F 750 1 %
A2R13	0698–5180	R–F 2 K 1 %
A2R14	0698–3155	R–F 4.64K 1 %

Delete A2 R10 and A2 R11. R13 is back-loaded.
Add C2 between Q3 and CR6.
Add C2 33pF connected between U2 pins 16 and 17.
Change the value of C4 to 47pF. Change R12 to 750;

CHANGE 5 (for serial numbers 00101 to 00220)

On Table 8–2, change the Table of Replaceable Parts to read:

Delete:

A2C2	0160–4386	C–F 33PF 5 % 200 V

Make the appropriate changes to the schematic and layout diagrams located at the end of this section.

CHANGE 6 (for serial numbers 00101 to 00260)

On Table 8–2, change the Table of Replaceable Parts to read:

MP2	0403–0164	GUIDE PC

CHANGE 7 (for serial numbers 00101 to 00390)

On Table 8–2, change the Table of Replaceable Parts to read:

MP18	5000–8925	BRACKET 1/8 MOD

CHANGE 8 (for serial numbers 00101 to 00420)

On Table 8–2, change the Table of Replaceable Parts to read:

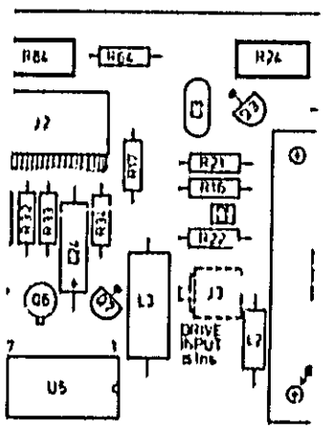
MP15	2950–0145	NUT HEX

CHANGE 9(for serial numbers 00101 to 00439)

On Table 8–2, change the Table of Replaceable Parts to read:

A2L2	5081–1972	INDUCTOR AY (2)
A2L3	5081–1972	INDUCTOR AY (2)
A2R17	0757–0401	R–F 100 1 % .125 W

Make the appropriate changes to the schematic and layout diagrams as shown below:



P/O ASSY A2

Connect L2, L3 and R17 in series between U1 pin 18 and ground.

FRAME

REFERENCE DESIGNATOR	C D	H-P PART NUMBER	DESCRIPTION
A1		08093-66501	BD AY CONTROL
A2	8	08093-66502	BD AY OUTP AMPL
MP1	2	0370-1005	KNOB BASE PTR
MP6		08093-00201	PANEL FRONT
MP7		08093-00202	PANEL SUB
MP9	7	2190-0383	WASH-LOCK .115ID
MP10	4	2190-0108	WASH-LOCK .115ID
MP11	8	2200-0141	SCR MCH 4-40X.31
MP12	9	2200-0770	SCR MCH 4-40
MP13	7	2360-0332	SCR 6-32X.312
MP14	3	2950-0072	NUT HEX .25-32
MP15	5	5020-8779	NUT-SPCLT
MP18		08093-60101	CHASSIS ASSEMBLY

A1 08093-66501 BD AY CONTROL

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A1	R1	6	2100-3228	R-VAR 10K 20%
A1	R2	4	2100-2492	R-VAR 5K 20% .5W
A1	S1	7	3101-1311	SW SLIDE DPDT
A1	S2	7	3101-1311	SW SLIDE DPDT
A1	S3	7	3101-1311	SW SLIDE DPDT
A1	W1	4	5081-1964	CBL RB 16C 305MM

A2 08093-66502 BD AY OUTP AMPL

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	C1	4	0180-1745	C-F 1.5UF 20V
A2	C2	3	0160-4386	C-F 33PF 5% 200V
A2	C3	4	0160-4212	C-F .068UF 20%
A2	C4	4	0160-4387	C-F 47PF 200V
A2	C9	6	0180-0228	C-F 22UF 15V
A2	C10	6	0180-0228	C-F 22UF 15V
A2	C11	2	0160-0127	C-F 1UF 25V
A2	C12	4	0160-3470	C-F .01UF 50V
A2	C14	8	0160-3466	C-F 100PF 250V
A2	C15	6	0160-3878	C-F .001UF 100V
A2	C16	6	0180-0228	C-F 22UF 15V
A2	C17	7	0180-0229	C-F 33UF 10V
A2	C18	6	0180-0228	C-F 22UF 15V
A2	C19	3	0180-0374	C-F 100[illegible] 20V
A2	C20	4	0160-3785	C-F .1UF 20% 50V
A2	C21	8	0160-3466	C-F 100PF 250V
A2	C22	9	0160-0174	C-F .47UF 25V
A2	C23	9	0160-0174	C-F .47UF 25V
A2	C24	7	0180-0229	C-F 33UF 10V
A2	C25	4	0180-1745	C-F 1.5UF 20V
A2	CR2	9	1901-0460	DIO 15V 150MA
A2	CR4	1	1901-0040	DIO SI .05A 30V
A2	CR5	1	1901-0040	DIO SI .05A 30V
A2	CR7	3	1901-0050	DIO SW 80V 200MA
A2	J2	6	1200-0588	SOCKET IC
A2	J2		5040-9316	LOCK.-CLIP 16POL
A2	J3	2	1250-0836	JACK RECEPT-RT
A2	J4	2	1250-0836	JACK RECEPT-RT
A2	J5	2	1250-0836	JACK RECEPT-RT
A2	K3	1	0490-1034	RELAY 12V .5A
A2	L1	5	5081-1973	INDUCTANCE 3READ
A2	MP1	7	1600-0341	CTCT 9FINGER
A2	Q1	1	1854-0215	XSTR SI 2N3904
A2	Q2	5	1854-0392	XSTR ST 2N 5088
A2	Q3	1	1854-0215	XSTR SI 2N3904
A2	Q4	2	1853-0036	XSTR SI 2N3906
A2	Q5	2	1853-0036	XSTR SI 2N3906
A2	Q6	7	1854-0477	XSTR NPN 2N2222A
A2	Q7	5	1854-0392	XSTR ST 2N 5088
A2	Q8	9	1853-0314	XSTR 2N2905A PNP
A2	Q10	9	1853-0281	XSTR SI 2907A
A2	Q11	1	1854-0637	XSTR SI 2219A
A2	Q12	2	1853-0036	XSTR SI 2N3906
A2	Q13	1	1854-0215	XSTR SI 2N3904

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	Q14	2	1853-0036	XSTR SI 2N3906
A2	Q15	5	1854-0392	XSTR ST 2N 5088
A2	Q16	2	1853-0036	XSTR SI 2N3906
A2	Q17	2	1853-0036	XSTR SI 2N3906
A2	Q18	1	1854-0215	XSTR SI 2N3904
A2	Q19	1	1854-0215	XSTR SI 2N3904
A2	Q20	1	1854-0215	XSTR SI 2N3904
A2	Q21	1	1854-0215	XSTR SI 2N3904
A2	Q22	1	1854-0215	XSTR SI 2N3904
A2	Q23	9	1855-0386	XSTR NFET 2N4392
A2	R4	5	0698-3498	R-F 8.66K1%
A2	R5	7	2100-3352	R-VAR 1K .5W
A2	R6	0	0698-0085	R-F 2.61K1%
A2	R7	8	0698-3558	R-F 4.02K1%
A2	R8	2	0698-4435	R-F 2.49K1%
A2	R9	6	0757-0283	R-F 2K1% .125W F
A2	R10	1	2100-3273	R-VAR 2K 10%
A2	R11	5	2100-3350	R-VAR 200 10%
A2	R12	3	0698-4460	R-F 649 1% .125W
A2	R13	6	0757-0283	R-F 2K1% .125W F
A2	R14	8	0698-3558	R-F 4.02K1%
A2	R16	8	0757-0384	R-F 20 1% .125W
A2	R18	7	0698-4422	R-F 1.27K1%
A2	R20	2	0698-4386	R-F 59.0 1/8W 1%
A2	R21	3	0698-3438	R-F 147 1% .125W
A2	R22	3	0757-0420	R-F 750 1% .125W
A2	R23	2	0698-3114	R-F 300 5% .125W
A2	R24	6	2100-3351	RES TRMR 500 10%
A2	R25	3	0757-0438	R-F 5.11K1%
A2	R26	3	0757-0438	R-F 5.11K1%
A2	R27	3	0757-0438	R-F 5.11K1%
A2	R28	6	0757-0283	R-F 2K1% .125W F
A2	R29	6	0757-0283	R-F 2K1% .125W F
A2	R30	8	0698-3152	R-F 3.48K 1%
A2	R31	6	0757-0449	R-F 20K1% .125W
A2	R32	3	0757-0438	R-F 5.11K1%
A2	R33	3	0757-0438	R-F 5.11K1%
A2	R34	3	0757-0420	R-F 750 1% .125W
A2	R35	0	0698-3435	R-F 38.3 1%
A2	R36	6	0757-0283	R-F 2K1% .125W F
A2	R37	1	0757-0410	R-F 301 1% .125W
A2	R38	9	0757-0442	R-F 10K1% .125W

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	R39	8	0698-4308	R-F 16.9K 1%1/8W
A2	R40	1	0757-0460	R-F 61.9K 1%
A2	R41	5	0698-3266	R-F 237K1% .125W
A2	R42	9	0757-1094	R-F 1.47K1%
A2	R43	6	0757-0465	R-F 100K1% .125W
A2	R44	1	0698-4442	R-F 4.42K1%
A2	R45	7	0757-0416	R-F 511 1% .125W
A2	R46	0	0757-0401	R-F 100 1% .125W
A2	R47	1	0698-3262	R-F 40.2 1%
A2	R48	2	0757-0346	R-F 10 1% .125W
A2	R51	7	0698-4422	R-F 1.27K1%
A2	R52	8	0698-3540	R-F 15.4K1%
A2	R53	8	0698-3558	R-F 4.02K1%
A2	R54	9	0698-3484	R-F 6.65K1%
A2	R55	8	0698-3459	R-F 383K1% .125W
A2	R56	1	0757-0410	R-F 301 1% .125W
A2	R58	8	0757-0384	R-F 20 1% .125W
A2	R59	1	0757-0410	R-F 301 1% .125W
A2	R60	7	0698-3268	R-F 11.5K1%
A2	R61	8	0698-7253	R-F 5.11K 1%.05
A2	R62	0	0698-4475	R-F 9.76K1%
A2	R63	7	0698-5561	R-F 6.8 5% .125W
A2	R64	8	0757-0433	R-F 3.32K1%
A2	R65	6	0698-3449	R-F 28.7K1%
A2	R66	6	0698-3449	R-F 28.7K1%
A2	R67	1	0698-4442	R-F 4.42K1%
A2	R68	5	0757-0274	R-F 1.21K1%
A2	R69	8	2100-3353	R-VAR 20K .5W
A2	R70	2	0698-3156	R-F 14.7K1%
A2	R71	6	0698-3449	R-F 28.7K1%
A2	R72	0	0698-0085	R-F 2.61K1%
A2	R73	7	2100-3352	R-VAR 1K .5W
A2	R74	9	0757-0442	R-F 10K1% .125W
A2	R75	6	0698-3499	R-F 40.2K1%
A2	R76	6	0698-3499	R-F 40.2K1%
A2	R77	6	0757-0407	R-F 200 1% .125W
A2	R78	8	2100-3353	R-VAR 20K .5W
A2	R79	9	0757-0442	R-F 10K1% .125W
A2	R80	7	2100-1760	R-VAR 5K 1W WW
A2	R81	2	2100-3274	R-VAR 10K 10%
A2	R82	2	2100-3274	R-VAR 10K 10%
A2	R83	0	0698-7239	R-F 1.33K 1%.05
A2	R84	6	2100-3351	RES TRMR 500 10%

REFERENCE DESIGNATOR		C D	H-P PART NUMBER	DESCRIPTION
A2	U1	2	5081-1970	IC AY-HYB GHZ A
A2	U2	9	5081-1969	IC AY-HYB GHZ D
A2	U3	7	1826-0111	IC-DUAL OP AMPL
A2	U5	9	1820-1197	IC SN74LS00
A2	U6	4	1826-0043	IC LM307H
A2	U7	4	1826-0043	IC LM307H
A2	U8	4	1821-0001	XSTR ARRAY
A2	U9	4	1820-0285	IC 250MHZ 16PIN
A2	VR1	1	1902-3092	DIO 4.99V 2% .4W
A2	VR6	1	1902-3092	DIO 4.99V 2% .4W
A2	W1		08093-61601	CBL AY-SHLD #1
A2	W2		08093-61603	CBL AY SHLD #3

P/O A2 OUTPUT AMPLIFIER
(08093-66503)

DRIVE INPUT CONNECTOR FOR PULSES WITH RISETIMES ≤ 1ns

CABLE W4 MUST BE CONNECTED TO J3 IF DRIVE INPUT IS CONNECTED TO J4

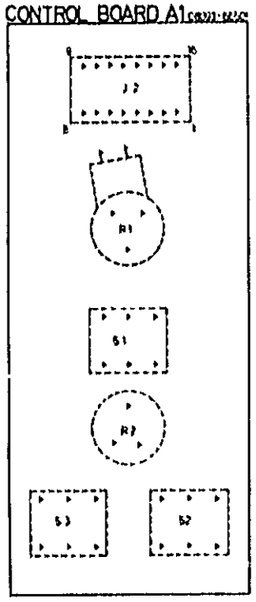
DRIVE INPUT CONNECTOR FOR PULSES WITH 1ns < RISE TIMES ≤ 5ns

U9-SCHMITT TRIGGER

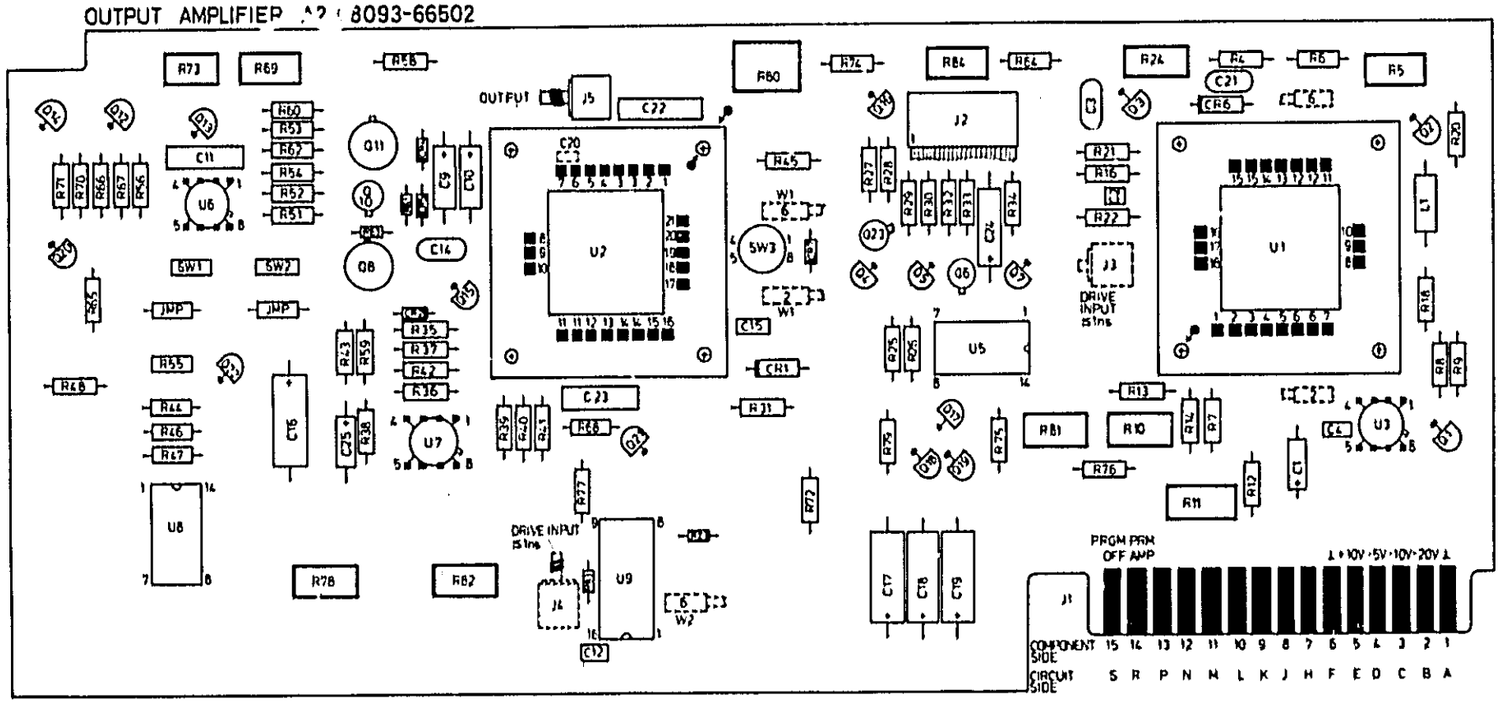
U1-HP402

PART OF OUTPUT AMPLIFIER BOARD A2 1

CONTROL BOARD A1 8093-66501



OUTPUT AMPLIFIER A2 : 8093-66502



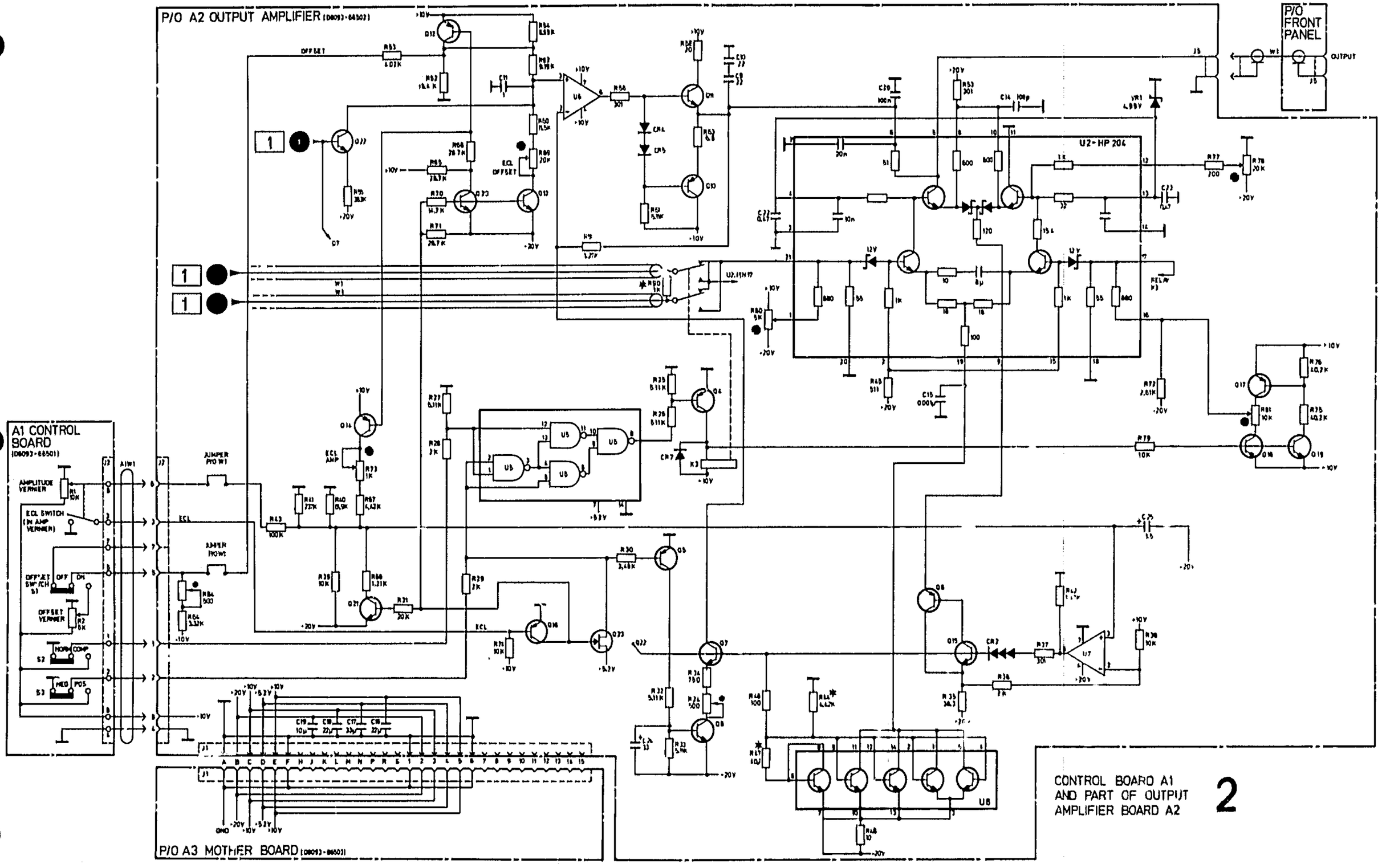
VIEWED FROM TOP — COLLECTOR, BASE, EMITTER

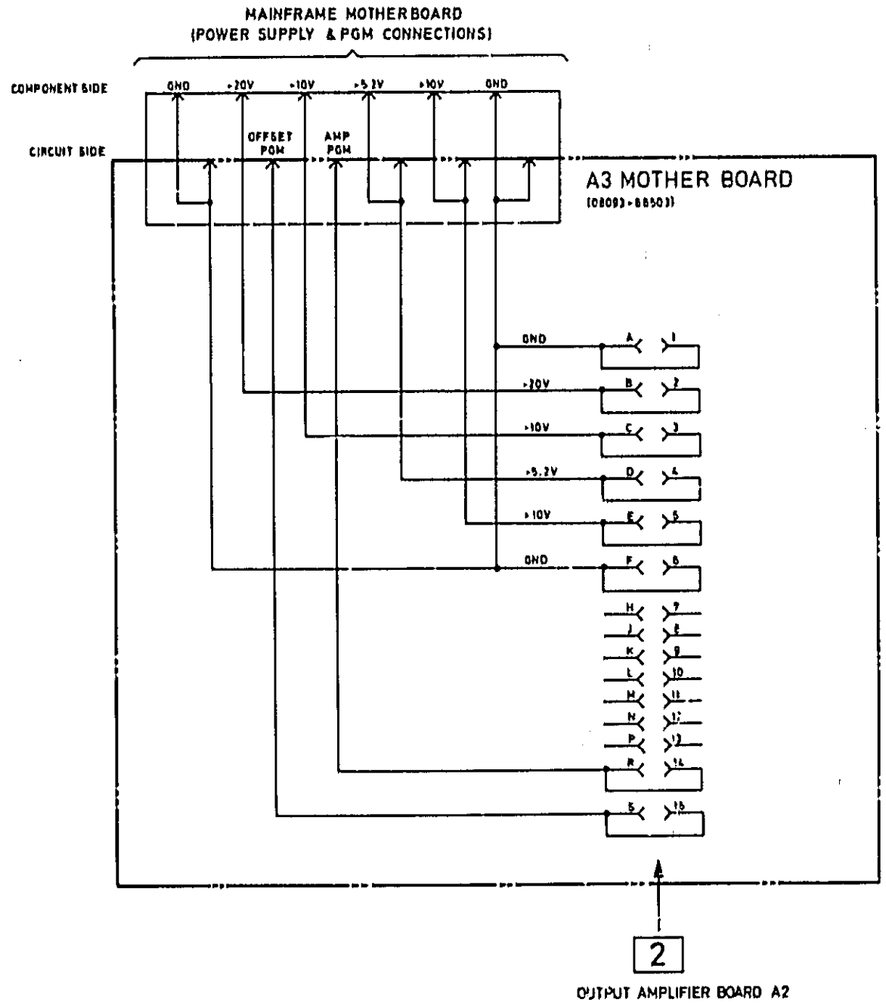
EMITTER, BASE — Q8,11 COLLECTOR

– LOCATION MARK ON IC SHOULD BE ADJACENT TO SIMILAR MARK ON PC BOARD

– INDICATES THE ENDS OF CABLES SOLDERED TO THE CIRCUIT SIDE OF THE PC BOARD BOTH ENDS OF EACH CABLE CARRY THE SAME COLOUR SLEEVING WHICH IS INDICATED ON THIS LAYOUT BY RESISTOR COLOUR CODE NUMBERS, E.G. 2,6.

– COMPONENTS SHOWN DOTTED ARE LOADED ON THE CIRCUIT SIDE OF THE PC BOARD


P/O A2 OUTPUT AMPLIFIER (08093-66503)
P/O FRONT PANEL
OUTPUT
U2-HP 204
A1 CONTROL BOARD (08093-66501)
AMPLITUDE VERNIER
ECL SWITCH (IN AMP VERNIER)
OFFSET SWITCH
OFFSET VERNIER
NORM COMP
NEG POS
JUMPER P10 W1
JUMPER P10 W5
ECL
ECL OFFSET
ECL AMP
P/O A3 MOTHER BOARD (08093-66503)
CONTROL BOARD A1 AND PART OF OUTPUT AMPLIFIER BOARD A2
2


MAINFRAME MOTHERBOARD
(POWER SUPPLY & PGM CONNECTIONS)
COMPONENT SIDE
CIRCUIT SIDE
GND
+20V
+10V
+5.2V
+10V
GND
OFFSET PGM
AMP PGM
A3 MOTHER BOARD
(08093-88503)
GND
+20V
+10V
+5.2V
+10V
GND
2
OUTPUT AMPLIFIER BOARD A2

MANUAL CHANGES

HEWLETT PACKARD

MANUAL CHANGES

Manual for: Model Number	8093A
Manual printed on	April 1982
Manual Part Number	08093-90003

Make all ERRATA corrections.

Check the following table for your instrument serial prefix/serial number and make the listed changes to your manual.

▶ New item

Serial Prefix or Serial Number		Manual Changes	Serial Prefix or Serial Number	Manual Changes
2134G00676	and above	1		

INDEX OF MANUAL CHANGES

MANUAL CHANGE	MISCELLANEOUS	FRAME	A1	A2
1				R60,69

MANUAL CHANGE 1

On Page 6-6, Table 6-2, Replaceable Parts List, change to read :

A2R60	0698-3359	R-FXD 12.7K 1% .125W
A2R69	2100-3273	R-VAR 2K 10%