Errata

Title & Document Type: 4140A pA Meter/DC Voltage Source Service Manual

Manual Part Number: 04140-90010

Revision Date: December 1979

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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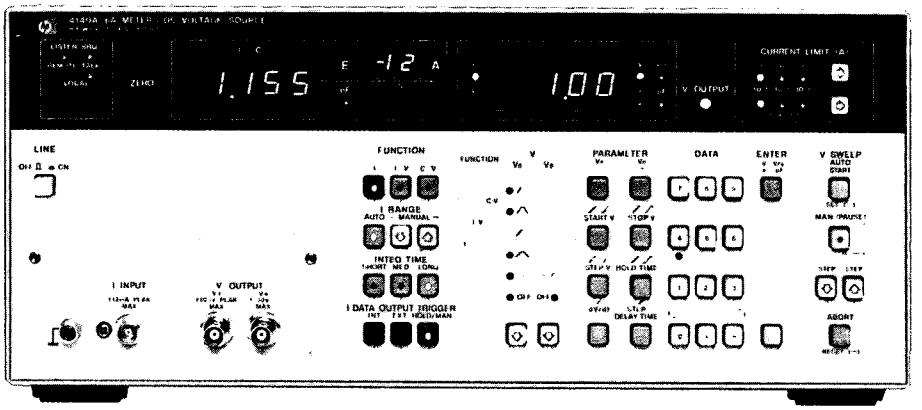
SERVICE MANUAL

4140A
pA METER/DC VOLTAGE SOURCE



HEWLETT PACKARD

HP 4140A

HEWLETT PACKARD

SERVICE MANUAL

MODEL 4140A

pA METER/DC VOLTAGE SOURCE

(including Options 001 and 101)

SERIAL NUMBERS

This manual applies directry to instruments with serial numbers prefixed 1917J

Manual Part No. 04140-90010
Microfiche Part No. 04140-90060

Printed: DEC 1979

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SECTION IV

PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test instrument electrical performance using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in section III under Self Test. The performance test procedures in this section can also be used to do an incoming inspection of the instrument or to verify whether the instrument meets its specified performance after troubleshooting or making adjustments. If specifications are found to be out of limits, check that controls are properly set, and then proceed to adjustments or troubleshooting.

Note

Allow a 60 minute warm up and stabilization period before conducting any performance test.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for performance tests is listed in Table 4-1 Recommended Performance Test Equipment. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model(s).

Note

Decade resistor and standard resistors should be calibrated by an instrument whose specifications are traceable to NBS, PTB, LNE, NRC, JEMIC or equivalent standards group; or they should be directly calibrated by an authorized calibration organization such as NBS. The calibration cycle should be determined by the stability specification for each resistor.

4-5. TEST RECORD

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

4-7. CALIBRATION CYCLE

4-8. This instrument requires periodic verification of performance. Depending on the use and environmental conditions, the instrument should be checked using the following performance tests at least every six months.

4-9. AUTO SETTING MODES

4-10. The 4140A provides thirteen auto setting modes as given in Table 4-2 for performance tests and adjustments. To set any one of these modes, proceed as follows:

(1) Press "Blue, SELF TEST 1" to set 4140A to Self Test mode.

(2) Press "Blue" and select and press desired control key from Table 4-2 to set the mode.

(3) To cancel any of the above modes, press "Blue, SELF TEST 1".

Table 4-1. Recommended Test Equipment.

Equipment	Critical Specifications	Recommended Model	Use*
DC Voltmeter	Voltage range: 100mV to 1000V f.s. Sensitivity: 1μV min. Accuracy : 0.001% Input impedance: >10MΩ Remote Control: via HP-IB	HP 3455A	P,A,T
Test Leads	Triaxial (Male) - Triaxial (Male) Cable (1ea) BNC (Male) - BNC (Male) Cable (2ea)	HP 16053A	P,A,T
Test Cable	BNC (Male) - Dual Banana Plug Cable	HP 11001A	P,A,T
Adapter	Dual Banana Plug - Alligator Clip Cable	HP 11002A	A,T,
	BNC T Type Adapter	HP Part No.: 1250-0781	P,A,T
	BNC (Female) - Banana Plug Adapter	HP 10111A (2ea)	P,A,T
	BNC (Male) - Triaxial (Female) Adapter	TROMPTER AD-BJ77-E3-PL20	P,A,T
	BNC (Female) - Triaxial (Male) Adapter	TROMPTER AD-BJ20-E3-PL75	A
Decade Resistor	Range: $10^2\Omega \sim 10^7\Omega$ Accuracy: 0.01%	GR1433H	P,A,T
Standard Resistors	Range: $10^9\Omega \sim 10^{13}\Omega$ Accuracy: ±0.2%	KEITHLEY 5155	P,T
Desktop Computer	for HP-IB Controller	HP 9835A with 98332A	P,A
HP-IB Interface Card with Cable	Cable Length: approximately 4 m	HP 98034A	P,A
HP-IB Cable	Cable Length: approximately 0.5m	HP 16031D (2ea)	P,A
Timing Generator	Time Accuracy: ±100ns Pulse Width: >1μs Rise Time: 50ns Remote Control: via HP-IB	HP 59308A	P,A
Extender Board	22pin x 2	HP Part No.: 5060-4025	A,T
Clip-Clip Cable		2ea	A,T
Signature Analyzer		HP 5004A	T
Current Tracer		HP 547A	T
Oscilloscope	Bandwidth: 10MHz min. Voltage Sensitivity: 500mV/div. Horizontal Sweep Rate: 1μs/div.	HP 1220A	T
10:1 Probe	Input Impedance: 10MΩ	HP 10013A	T

*P = Performance Test, A = Adjustment, T = Troubleshooting.

Table 4-2. Auto Setting Modes for Performance Tests and Adjustments.

Mode*	Control key	Description
S-1	V_B m	Both V_A and V_B output 0.00V. With Option 001, both I/C OUTPUT and V_A OUTPUT on the rear panel output 0.000v.
S-2	V_B m	Both V_A and V_B output -0.01V. With Option 001 both I/C OUTPUT and V_A OUTPUT output -0.001V.
S-3	7	Both V_A and V_B output -10.00V. With Option 001, both I/C OUTPUT and V_A OUTPUT output -1.000V.
S-4	8	Both V_A and V_B output +10.00V. With Option 001, both I/C OUTPUT and V_A OUTPUT output +1.000V.
S-5	9	Both V_A and V_B output 0.0V. With Option 001, both I/C OUTPUT and V_A OUTPUT output 0.00V.
S-6	ENTER V_A/V_B	Both V_A and V_B output -100.0V. With Option 001, both I/C OUTPUT and V_A OUTPUT output -10.00V.
S-7	AUTO START SET (-)	Both V_A and V_B output +100.0V. With Option 001, both I/C OUTPUT and V_A OUTPUT output +10.00V.
S-A	START V	Both ZERO and HOLD (pA Meter section control signals) are set to High.
S-H	STOP V	ZERO is set to Low and HOLD is set to High.
S-0	4	ZERO is set to High and Hold is set to Low.
S-F	5	Both ZERO and HOLD are set to High.
S-C	6	Comparator circuit in pA Meter section alternately outputs high or low level signal.
S-P	MAN (PAUSE) 0	The pA Meter section is set to measurement mode with internal trigger and auto range. Both V_A and V_B output +1.800V. With Option 001, both I/C OUTPUT and V_A OUTPUT output +1.800V.

* Mode name is displayed in I·C DISPLAY when its mode is set.

PERFORMANCE TESTS

4-11. VOLTAGE OUTPUT ACCURACY TEST.

4-12. This test verifies DC Voltage Source output voltages for all ranges.

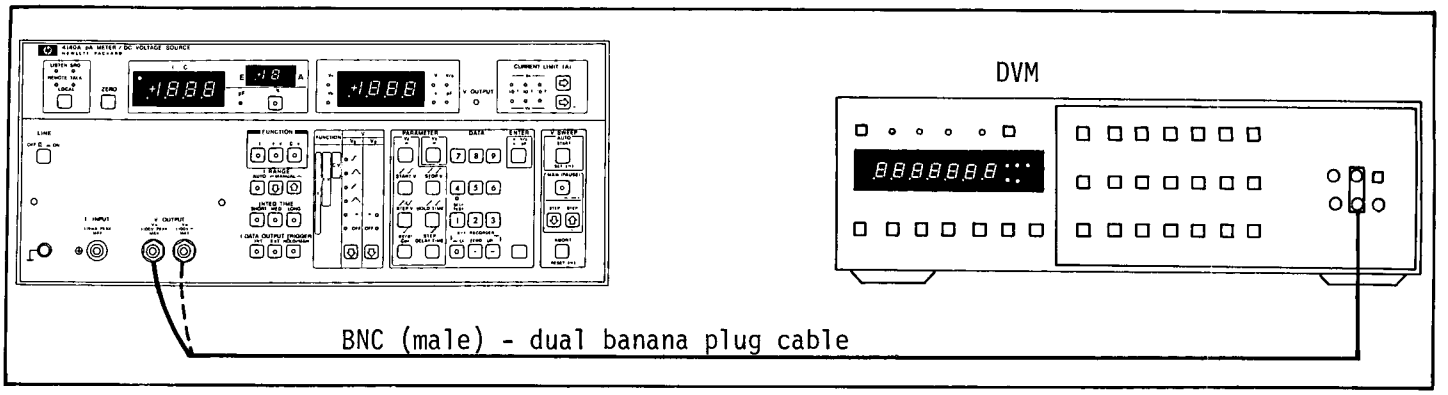

Figure 4-1. Voltage Output Accuracy Test Setup.

EQUIPMENT:

DVM	HP 3455A
BNC (Male) - Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Connect BNC (Male) - dual banana plug cable between 4140A V_A OUTPUT connector and DVM (see Figure 4-1).

2. Set DVM controls as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. Set 4140A controls as follows:

FUNCTION	I
V_A	⎓ (DC)
V_B	⎓ (DC)
CURRENT LIMIT (V_A and V_B)	10mA

4. Set PARAMETER (⎓) to a voltage in Table 4-3.

5. Press SET (⎓) key and read display output of DVM.

6. Press RESET (⎓) key.

7. Repeat steps 4 thru 6 and confirm that Table 4-3 is satisfied (change output voltage as appropriate).

8. Connect BNC (male) - dual banana plug cable between 4140A V_B OUTPUT and DVM.

9. Repeat steps 4 thru 7.

TEST LIMIT:

Table 4-3. Output Voltage Accuracy Test.

Voltage Setting (V)	Test Limits (V)
+100	+99.80 ∿ +100.20
+10	+9.982 ∿ +10.018
+1	+0.9883 ∿ +1.0117
0	-0.011 ∿ +0.011
-1	-1.0117 ∿ -0.9883
-10	-10.018 ∿ -9.982
-100	-100.20 ∿ -99.80

4-13. CURRENT MEASUREMENT ACCURACY TEST

4-14. This test verifies pA Meter measurement currents for all ranges.

Note

This test uses DC Voltage Source of 4140A. Therefore, Voltage Output Accuracy Test in paragraph 4-11 should be done before this test.

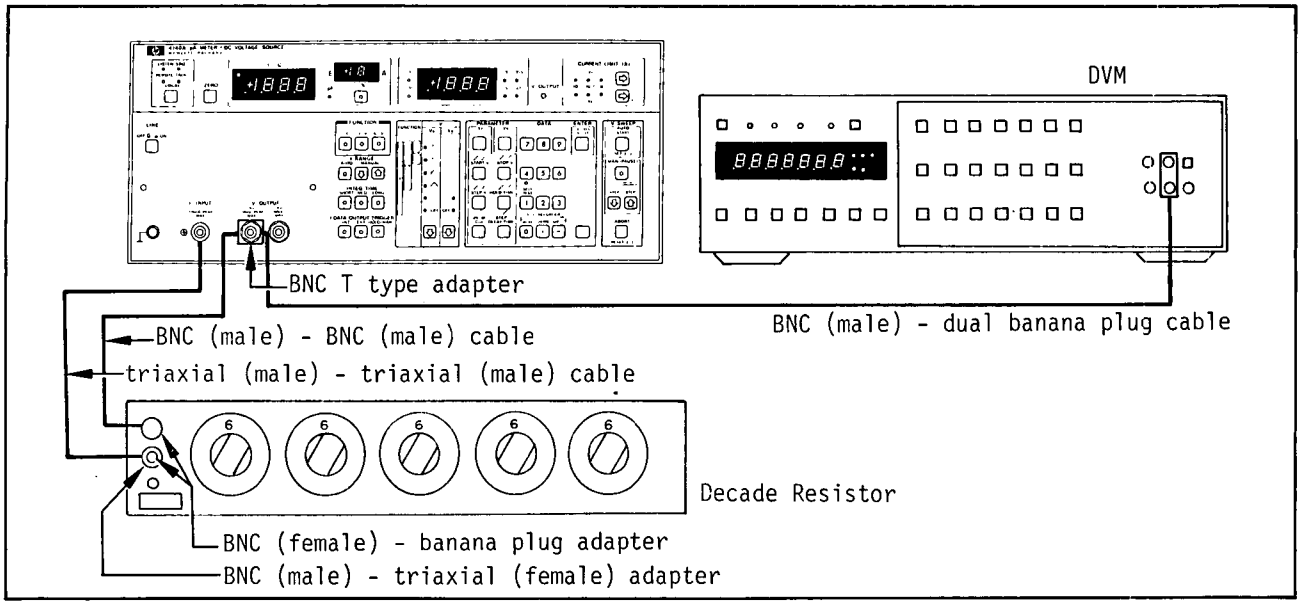

Figure 4-2. Current Measurement Accuracy Test Setup (10^{-2}A∿10^{-7}A Ranges).

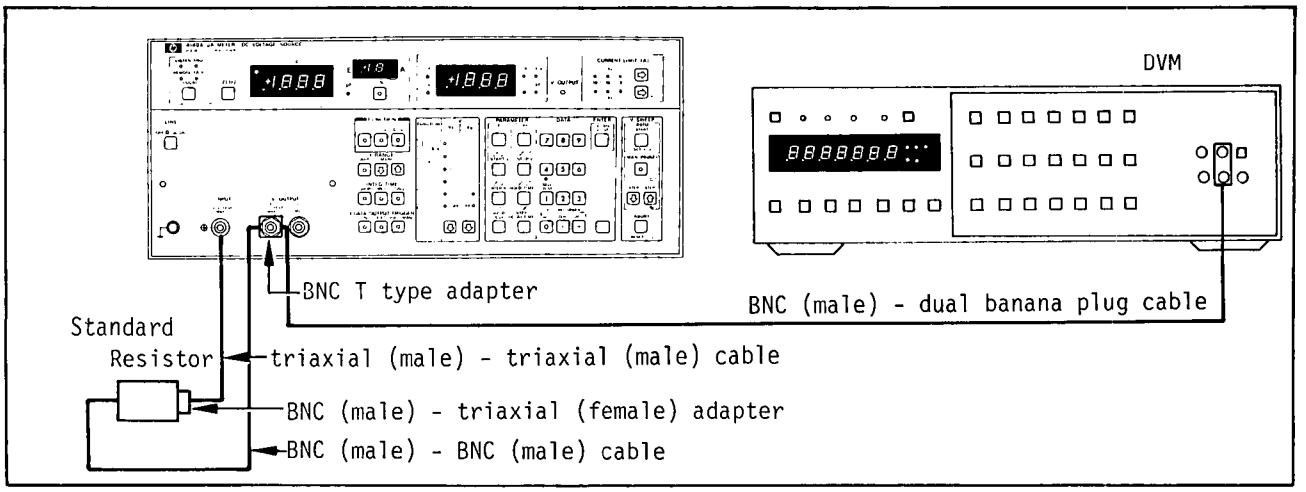

Figure 4-3. Current Accuracy Test Setup (10^{-8}A∿10^{-12}A Ranges).

EQUIPMENT:

Decade Resistor	GR1433H
Standard Resistors	KEITHLEY 5155
BNC T Type Adapter	HP Parts No: 1250-0781
BNC (Female) - Banana Plug Adapter	HP 10111A (2ea)
BNC (Male) - Triaxial (Female) Adapter	TROMPETER AD-BJ77-E3-PL20

Triaxial Cable ..... Part of HP 16053A (HP Part No.: 16053-61002)

BNC (Male) - BNC (Male) Cable ..... Part of HP 16053A (HP Part No.: 16053-61003)

BNC (Male) - Dual Banana Plug Cable ..... HP 11001A

PROCEDURE:

1. Connect 4140A, DVM and Standard Resistor as shown in Figure 4-2 or 4-3

2. Set the DVM as follows:

   FUNCTION ..... DCV
   RANGE ..... AUTO
   HIGH RESOLUTION ..... OFF
   AUTO CAL ..... ON
   GUARD ..... ON
   TRIGGER ..... INTERNAL

3. Set the 4140A as follows:

   FUNCTION I
   I RANGE ..... AUTO
   INTEG TIME ..... LONG
   I DATA OUTPUT TRIGGER ..... INT
   V_A ..... ⎓ (DC)

4. Set PARAMETER (⎓) to a voltage in Table 4-4.

5. Push SET (⎓) key and read display outputs of the DVM and I·C DISPLAY of 4140A.

6. Push RESET (⎓) key.

7. Repeat steps 1 thru 6 and confirm that Table 4-4 is satisfied (change V_A output voltage and standard resistor as appropriate).

TEST LIMIT:

Table 4-4. Current Measurement Accuracy Test.

Current Measurement Range	V_A Output Voltage (V)	Standard Resistor (Ω)	Test Limit
10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7}	1V	10^{2} 10^{3} 10^{4} 10^{5} 10^{6} 10^{7}	S.C.V.* ±7counts
10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12}	10V	10^{9} 10^{10} 10^{11} 10^{12} 10^{13}	} S.C.V.* ±7counts S.C.V.* ±22counts S.C.V.* ±53counts S.C.V.* ±58counts

*S.C.V. (Supplied Current Value) = (Standard Resistor Value)/(Measured Voltage of DVM)

PERFORMANCE TESTS

4-15. CURRENT LIMIT TEST

4-16. This test verifies current limit function of DC Voltage Source for all ranges.

Note

This test uses pA Meter of 4140A. Therefore, Current Measurement Accuracy Test in paragraph 4-13 should be done before this test.

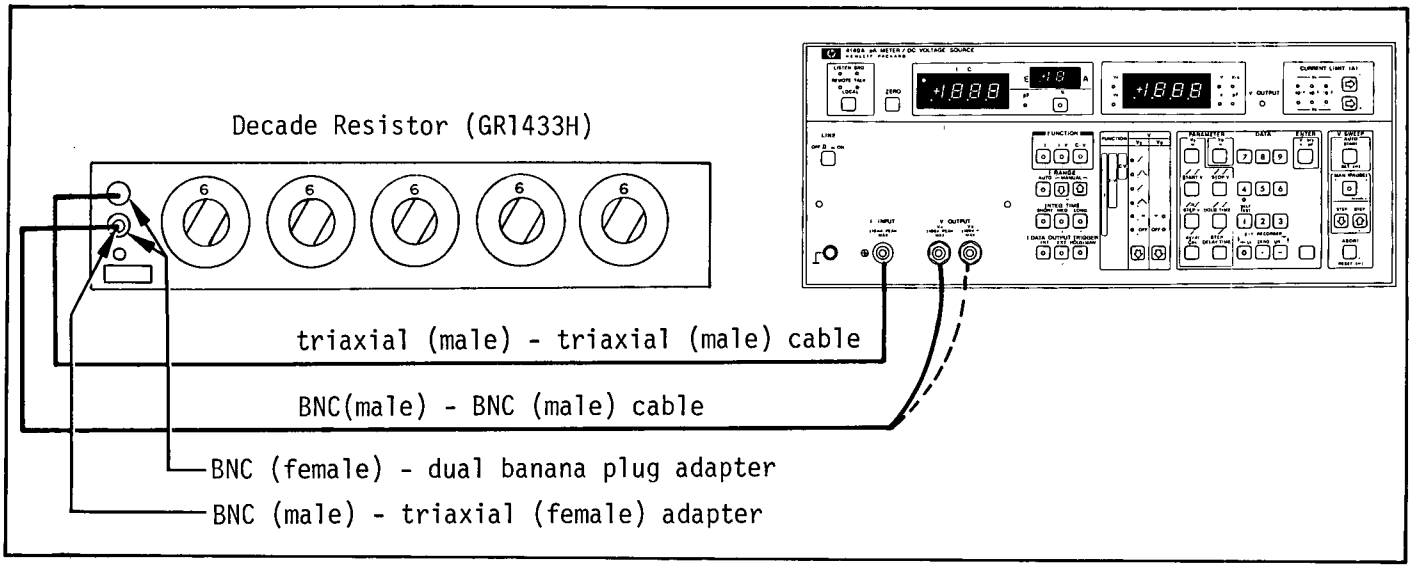

Figure 4-4. Current Limit Test Setup.

EQUIPMENT:

Decade Resistor	GR1433H
BNC (Female) - Banana Plug Adapter	HP 10111A (2ea)
BNC (Male) - Triaxial (Female) Adapter	TROMPETER AD-BJ77-E3-PL20
Triaxial (Male) - Triaxial (Male) Cable	Part of HP 16053A (HP Parts No.: 16053-61002)
BNC (Male) - BNC (Male) Cable	Part of HP 16053A (HP Parts No.: 16053-61003)

PROCEDURE:

1. Connect Decade Resistor between V_A OUTPUT and I INPUT connectors of 4140A as shown in Figure 4-4.

2. Set 4140A as follows:

FUNCTION	I
I RANGE	AUTO
INTEG TIME	LONG
I DATA OUTPUT TRIGGER	INT
V_A	⎓ (DC)
V_B	⎓ (DC)

3. Set CURRENT LIMIT to a current from Table 4-5.

4. Set PARAMETER (⎓) to a voltage from Table 4-5.

5. Push SET (⎓) key and read display output of I•C DISPLAY.

6. Push RESET (⎓) key.

7. Repeat steps 3 thru 6 and confirm that Table 4-5 (change CURRENT LIMIT and setting of V output voltage as appropriate).

8. Connect Decade Resistor between V_B OUTPUT and I INPUT connectors.

9. Repeat steps 3 thru 7.

TEST LIMIT:

Table 4-5. Current Limit Test.

Current Limit (A)	Setting V Output Voltage (V)	Test Limit (A)
10^{-2}	+10	$+0.9 \times 10^{-2} \sim +1.1 \times 10^{-2}$
10^{-3}		$+0.9 \times 10^{-3} \sim +1.1 \times 10^{-3}$
10^{-4}		$+0.9 \times 10^{-4} \sim +1.1 \times 10^{-4}$
10^{-2}	-10	$-1.1 \times 10^{-2} \sim -0.9 \times 10^{-2}$
10^{-3}		$-1.1 \times 10^{-3} \sim -0.9 \times 10^{-3}$
10^{-4}		$-1.1 \times 10^{-4} \sim -0.9 \times 10^{-4}$

4-17. RAMP WAVE START VOLTAGE ACCURACY TEST.

4-18. This test verifies ramp wave start voltage accuracy for the various combinations of start and stop voltages.

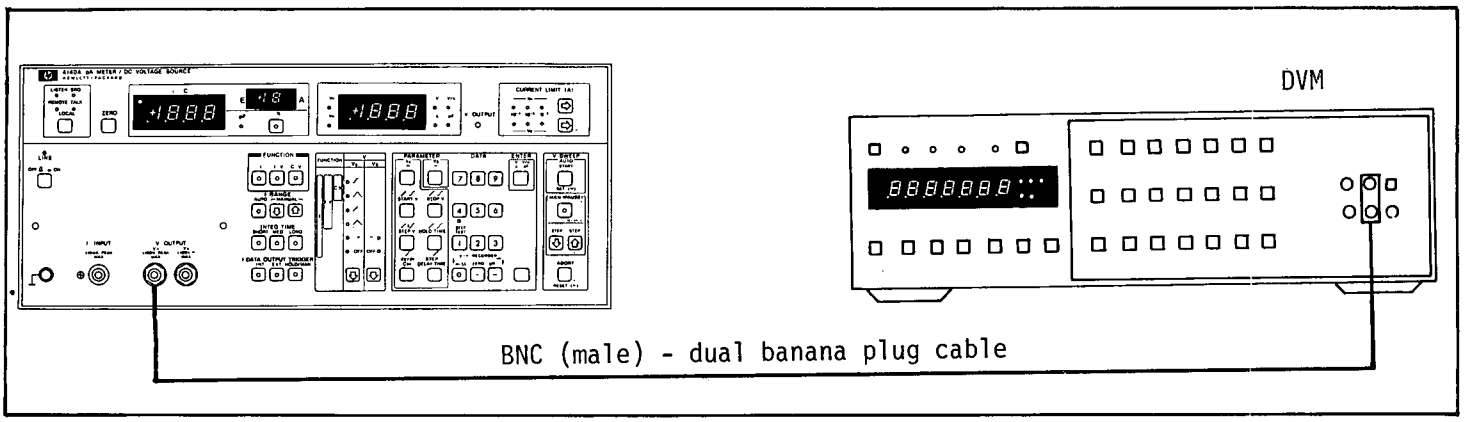

Figure 4-5. Ramp Wave Start Voltage Accuracy Test Setup.

EQUIPMENT:

DVM	HP 3455A
BNC - Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Connect BNC (male) - dual banana plug cable between 4140A VA OUTPUT connector and DVM (see Figure 4-5).

2. Set DVM controls as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
GUARD	ON
TRIGGER	INTERNAL

3. Set 4140A controls as follows:

FUNCTION	I
V_A	⎍
V_B	OFF
V_A CURRENT LIMIT	10mA

4. Set V_A parameter as follows:

START V	a voltage from Table 4-6
STOP V	a voltage from Table 4-6
STEP V	0.1V
HOLD TIME	100s
dV/dt	1V/s

5. Press "AUTO START" key and read display output of DVM.

6. Press "ABORT" key.

7. Repeat steps 4 thru 6 and confirm that Table 4-6 is satisfied (change output voltage as appropriate).

TEST LIMIT:

Table 4-6. RAMP WAVE START VOLTAGE ACCURACY TEST.

Start Voltage (V)	Stop Voltage (V)	Test Limit (V)
0.00 +10.00 -10.00	+5.00	-0.02∿+0.02 +9.98∿+10.02 -10.02∿-9.98
0.0 +10.0 -10.0 +100.0 -100.0	+50.0	-0.2∿+0.2 +9.8∿+10.2 -10.2∿-9.8 +99.8∿+100.2 -100.2∿-99.8

4-19. RAMP RATE ACCURACY TEST.

4-20. This test verifies ramp rate accuracy for various combinations of start and stop voltages.

Note

This test requires Option 101 HP-IB Interface as the test is made with the HP-IB system (including HP 9835A Desktop Computer, HP 3455A DVM and HP 59308A Timing Generator, etc.). Therefore, the HP-IB Interface Test in paragraph 4-23 should be done before this test.

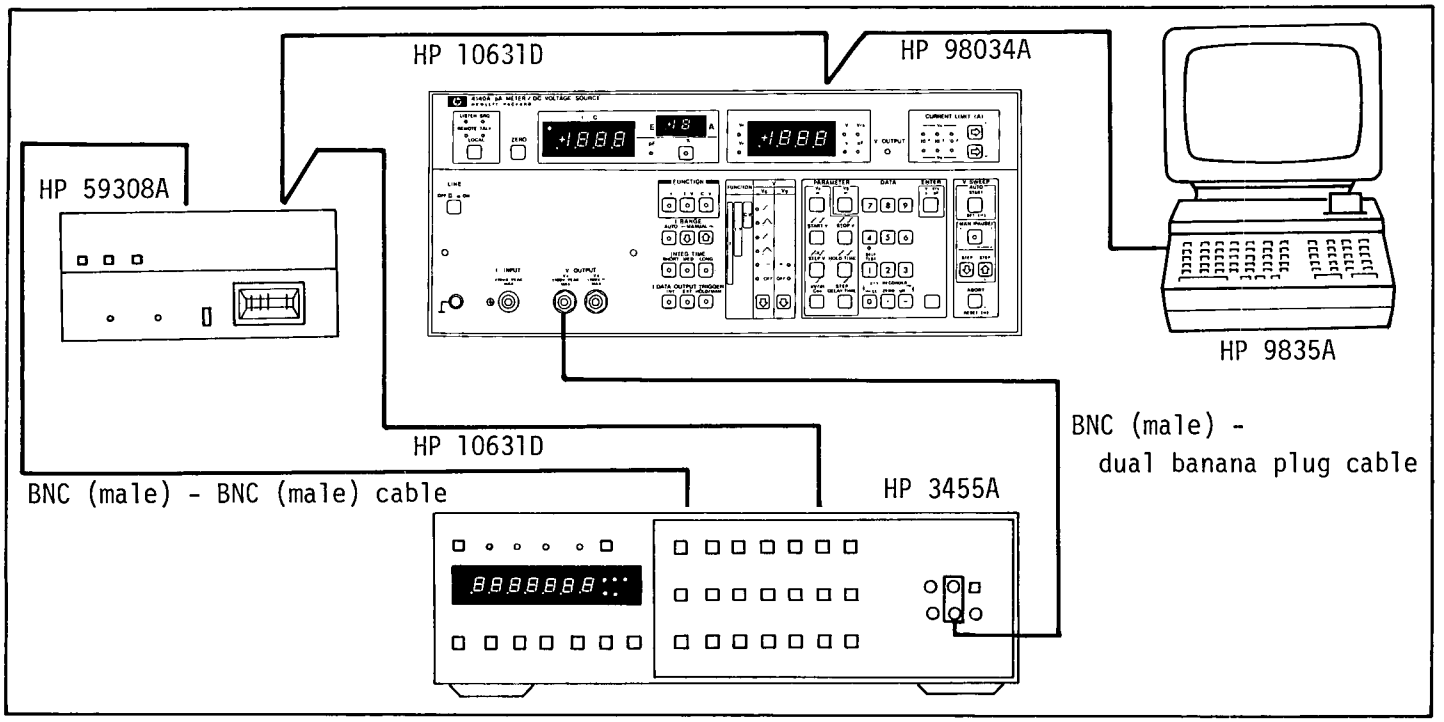

Figure 4-6. Ramp Rate Accuracy Test Setup.

EQUIPMENT:

Desktop Computer	HP 9835A
General I/O ROM	HP 98332A
HP-IB Interface Card with Cable	HP 98034A
HP-IB Cable	HP 10631D (2ea)
DVM (with HP-IB Interface capability)	HP 3455A
Timing Generator (with HP-IB Interface capability)	HP 59308A
BNC (Male) - BNC (Male) Cable	Part of HP 16053A (HP Part No.: 16053-61003)
BNC (Male) - Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Turn power switches of 4140A, 9835A, 3455A, and 59308A to OFF.

2. Install Option 101 HP-IB Interface in 4140A. Refer to Option Installation in Section II.

3. Connect 98034A HP-IB Interface Card with Cable between 9835A I/O slot and 4140A rear panel HP-IB connector as shown in Figure 4-6.

4. Install 98332A ROM in 9835A ROM slot.

5. Set 98034A select code switch dial to select code 7 (using a screwdriver).

6. Set HP-IB addresses of instruments as follows:

   4140A: 10001 (17 in binary code).
   3455A: 00110 (6 in binary code).
   59308A: 10000 (16 in binary code).

7. Connect 4140A, 3455A and 59308A with 10631D HP-IB cables as shown in Figure 4-6.

8. Connct BNC (male) - BNC (male) cable between 59308A OUTPUT connector and 3455A EXT TRIGGER INPUT connector as shown in Figure 4-6.

9. Turn 4140A, 9835A, 3455A and 59308A to ON.

10. Load test program (as shown in Figure 4-7) in controller.

11. Execute the program.

12. Check that 9835A CRT is in accord with Table 4-7 Controller Instructions and Operator Responses and confirm that Table 4-8 is satisfied.

[PROGRAMMING]

```
10   ! 4140A RAMP RATE ACCURACY TEST "40RAMP"(21MAY79)
20     DIM A(-1:1)
30     PRINT "RAMP RATE ACCURACY TEST";LIN(1)
40     REMOTE 7
50     ABORTIO 7
60     CLEAR 717
70     IMAGE 2D.6D,"V/s"
80     IMAGE "PS",D,";PT",4D,";PE",.D,";PH",D,";PV",D.3D
90     WAIT 2000
100    OUTPUT 706;"F1T2M3A0H1"
110    OUTPUT 716;"P100E4R"
120    OUTPUT 717;"F1RA1I3T3A1B2L3M3"
130    S=0
140    E=.1
150    H=3
160    FOR I=1 TO 4
170    OUTPUT 706;"R3"
180    IF I=1 THEN T=10
190    IF I=2 THEN T=-10
200    IF I=3 THEN T=100
210    IF I=4 THEN T=-100
220    FOR K=1 TO 4
230    V=10^(1-K)
240    IF K=2 THEN OUTPUT 706;"R2"
250    PRINT USING 80;S,T,E,H,V
260    PAUSE
270    OUTPUT 717 USING 80;S,T,E,H,V
280    OUTPUT 717;"W1"
290    WAIT 5000
300    FOR J=-1 TO 1
310    ENTER 706;A(J)
320    IF J<1 THEN 350
330    PRINT USING 70;A(J)-A(J-1)
340    PRINT LIN(1)
350    NEXT J
360    OUTPUT 717;"W7"
370    NEXT K
380    NEXT I
390    OUTPUT 716;"R"
400    PRINT "END"
410    END
```

(100) Transfers remote program codes from 9835A to 3455A.

(110) Transfers remote program codes from 9835A to 59308A.

(120) Transfers remote program codes from 9835A to 4140A.

(130) Sets START V to 0V.

(140) Sets STEP V to 0.1V.

(150) Sets HOLD TIME to 3s.

(180) ~ (210) Sets STOP V.

(230) Sets dV/dt (Ramp Rate).

(270) Transfers operating parameters from 9835A to 4140A.

(310) Transfers output data from 3455A to 9835A.

Figure 4-7. Ramp Rate Accuracy Test Program Using 9835A.

Table 4-7. Controller Instructions and Operator Responses for Ramp Rate Accuracy Test Program.

Controller Instruction	CRT Area	Operator Response
RAMP RATE ACCURACY TEST	Print	
PSO; PT 10; PE.1; PH3 PV1.000		STOP V = 10V, dV/dt = 1V/S. Press "CONTINUE"
N.NNNNNNV/S		Confirm that Table 4-8 is satisfied
The above two steps are repeated fifteen times more (for each STOP V and dV/dt in Table 4-8).		
END	Print	

TEST LIMIT:

Table 4-8. Ramp Rate Accuracy Test.

STOP V (V)	dV/dt (V/S)	Test Limit (V/S)
+10	1	+0.99799 ∿ +1.00201
	0.1	+0.09979 ∿ +0.10021
	0.01	+0.00997 ∿ +0.01003
	0.001	+0.000988 ∿ +0.001012
-10	1	-1.00201 ∿ -0.99799
	0.1	-0.10021 ∿ -0.09979
	0.01	-0.01003 ∿ -0.00997
	0.001	-0.001012 ∿ -0.000988
+100	1	+0.99792 ∿ +1.00208
	0.1	+0.00990 ∿ +0.10028
	0.01	+0.00990 ∿ +0.01010
	0.001	+0.000918 ∿ +0.001082
	1	-1.00208 ∿ -0.99792
-100	0.1	-0.10028 ∿ -0.09972
	0.01	-0.01010 ∿ -0.00990
	0.001	-0.001082 ∿ -0.000918

PERFORMANCE TESTS

4-21. ANALOG OUTPUT ACCURACY TEST (OPTION 001 ONLY).

4-22. This test verifies that the Option 001 Analog Output outputs specified analog output data to external device (e.g. X-Y Recorder).

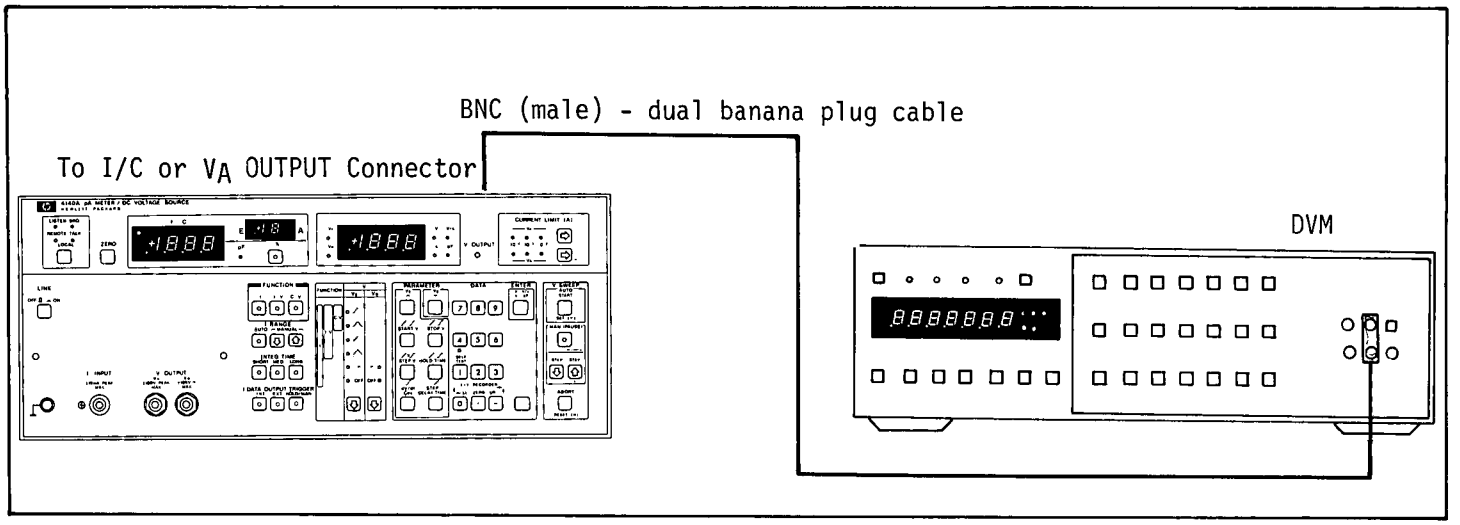

Figure 4-8. Analog Output Accuracy Test Setup.

EQUIPMENT:

DVM	HP 3455A
BNC (Male) - Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Connect BNC (male) - dual banana plug cable between the 4140A Option 001 V_A Output connector on rear panel and the DVM (see Figure 4-8).

2. Set the DVM controls as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. This test can be made by using auto setting modes of 4140A (refer to paragraph 4-9).

4. Press " Blue , SELF TEST 1 " to set 4140A to Self Test mode.

5. Press " Blue " and a control key from Table 4-9 (to set mode) and read display output of DVM.

6. Repeat step 5 and confirm that the Table 4-9 is satisfied (change auto setting mode as appropriate).

7. Press " Blue , SELF TEST 1 " to cancel auto setting mode.

8. Connect BNC (male) - dual banana plug cable between the 4140A Option 001 I/C OUTPUT connector on rear panel and DUM.

9. Repeat steps 4 thru 7.

TEST LIMITS:

Table 4-9. Analog Output Accuracy Test.

Auto Setting Mode	Control Key	Analog Output Setting (V)	Test Limit (V)
S-1	$V_{\overline{a}}$	0.000	-0.020 ∿ +0.020
S-2	$V_{\overline{a}}$	-0.001	-0.021 ∿ +0.019
S-3	7	-1.000	-1.025 ∿ -0.975
S-4	8	+1.000	+0.975 ∿ +1.025
S-5	9	0.00	-0.02 ∿ +0.02
S-6	ENTER V $V_{\overline{a}}$ Ω	-10.00	-10.07 ∿ -9.93
S-7	AUTO START	+10.00	+9.93 ∿ +10.07

4-23. HP-IB INTERFACE TEST (OPTION 101 ONLY)

4-24. This test verifies that the Option 101 HP-IB Interface has the capabilities (as listed in Table 3-11) to correctly communicate between external HP-IB devices and the 4140A through the interface bus cable.

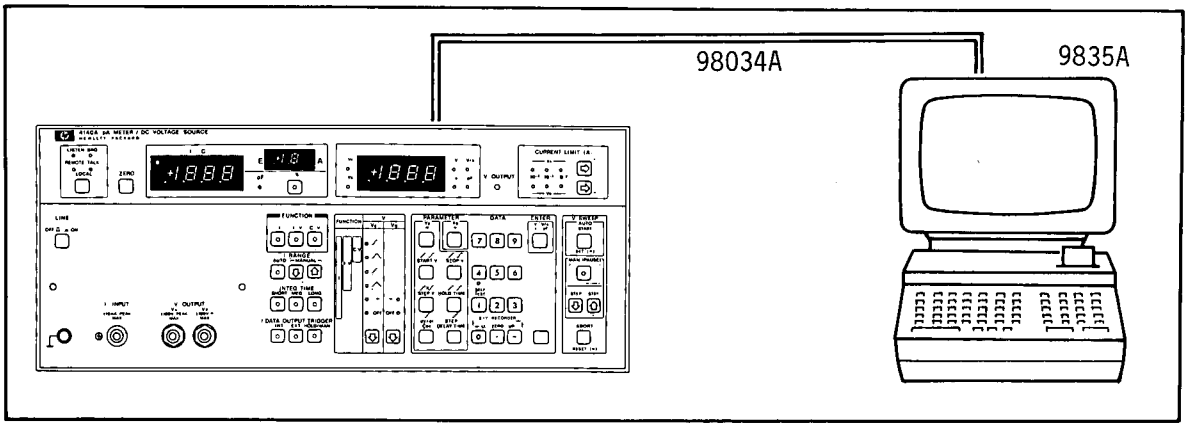

Figure 4-9. HP-IB Interface Test Setup.

EQUIPMENT:

Desktop Computer	HP 9835A
General I/O ROM	HP 98332A
HP-IB Interface Card with cable	HP 98034A

PROCEDURE:

1. Turn power switches of both the 4140A and 9835A to OFF.

2. Connect 98034A HP-IB Interface Card with cable between 9835A I/O slot and 4140A rear panel HP-IB connector as shown in Figure 4-9.

3. Install 98332A ROM in 9835A ROM slot.

4. Set 98034A Select Code Switch dial to select code 7 (using a screwdriver).

5. Set 4140A rear panel HP-IB Control Switch to following settings:

   bit 1∿5: 10001 (17 in binary code).
   bit 6: 0
   bit 7: 0

6. Connect nothing to I.C INPUT and VS OUTPUT connectors.

7. Turn 4140A and 9835A ON.

8. Load test program (given in Figures 4-10 through 4-14) in calculator.

9. Execute the program.

10. Check that 4140A display, 9835A display, and printed data are in accord with Tables 4-10 through 4-14 Controller Instructions and Operator Responses for each test program.

11. Perform steps 9 thru 11 with respect to individual test programs and verify that 4140A and 9835A correctly communicate through the HP-IB interface.

TEST PROGRM 1

[PURPOSE]

This test verifies that 4140A Opt. 101 has the following capabilities:

(1) Remote/Local Capability
(2) Local Lockout
(3) Talk Address Disabled by Listen Address
(4) Listen Address Disabled

[PROGRAMMING]

```
10   ! 4140A REMOTE/LOCAL TEST(20MAR79)
20   DIM A$[1]
30   A=0
40   STATUS 717;B
50   PRINT "REMOTE/LOCAL TEST";LIN(1)
60   REMOTE 7
70   OUTPUT 717;"T1"
80   INPUT "LISTEN=1,TALK=0,REMOTE=1",A$
90   IF A$="N" THEN A=1
100  LOCAL 7
110  INPUT "LISTEN=1,TALK=0,REMOTE=0",A$
120  IF A$="N" THEN A=1
130  ABORTIO 7
140  INPUT "LISTEN=0,TALK=0,REMOTE=0",A$
150  IF A$="N" THEN A=1
160  REMOTE 717
170  INPUT "LISTEN=0,TALK=0,REMOTE=1",A$
180  IF A$="N" THEN A=1
190  LOCAL LOCKOUT 7
200  LOCAL 717
210  INPUT "LISTEN=0,TALK=0,REMOTE=0",A$
220  IF A$="N" THEN A=1
230  OUTPUT 717;"T1"
240  INPUT "LISTEN=1,TALK=0,REMOTE=1",A$
250  IF A$="N" THEN A=1
260  IF A=1 THEN 290
270  PRINT "REMOTE/LOCAL TEST PASS";LIN(1)
280  GOTO 300
290  PRINT "REMOTE/LOCAL TEST FAIL";LIN(1)
300  A=0
310  PRINT "LISTEN/TALK TEST";LIN(1)
320  ENTER 717;A,B
330  INPUT "LISTEN=0,TALK=1,REMOTE=1",A$
340  IF A$="N" THEN A=1
350  OUTPUT 717;"T1"
360  INPUT "LISTEN=1,TALK=0,REMOTE=1",A$
370  IF A$="N" THEN A=1
380  IF A=1 THEN 410
390  PRINT "LISTEN/TALK TEST PASS";LIN(1)
400  GOTO 420
410  PRINT "LISTEN/TALK TEST FAIL";LIN(1)
420  PRINT "END";LIN(1)
430  ABORTIO 7
440  END
```

(40) Clears 4140A SRQ Status Byte.
(60) Sets REN (Remote Enable) line of the bus line to "1". Switches selected devices (Interface Select Code 7) to remote operation allowing parameters and device characteristics to be controlled by data message.
(70) Addresses 9835A to talk and 4140A to listen.
(100) Sets REN to "0". Removes all devices (Interface Select Code 7) from local lockout mode and causes all devices to revert to local.
(130) Sets IFC (Interface Clear) line of the bus line to "1". Unconditionally causes control to pass back to 9835A (independent of the device currently in control) and stops all comunication.
(160) Sets REN to "1". Switches 4140A to remote operation.
(190) Prevents the device operator from switching the unit to manual control
(200) Causes 4140A to revert to manual control for future parameter modifications (REN remains at "1").
(230) Returns to the status of Step 190.
(320) Disables listen address by talk address.
(350) Disables talk address by listen address.

Figure 4-10. HP-IB Interface Test Program 1 Using 9835A.

Table 4-10. Controller Instructions and Operator Responses for Test Program 1.

Controller Instruction	CRT Area	Operator Response
REMOTE/LOCAL TEST	Print	
LISTEN = 1, TALK = 0, REMOTE = 1	Display	If 4140A HP-IB Status Indicators and Controller Instruction are same, press "[Y], [CONTINUE]" for each step. If not, press "[N], [CONTINUE]".
LISTEN = 1, TALK = 0, REMOTE = 0		
LISTEN = 0, TALK = 0, REMOTE = 0		
LISTEN = 0, TALK = 0, REMOTE = 1		
LISTEN = 0, TALK = 0, REMOTE = 0		
LISTEN = 1, TALK = 0, REMOTE = 1		
REMOTE/LOCAL TEST PASS	Print	If all steps are correct, this message is outputted.
REMOTE/LOCAL TEST FAIL		If any step fails, this message is outputted.
LISTEN/TALK TEST	Print	
LISTEN = 0, TALK = 1, REMOTE = 1	Display	If 4140A HP-IB Status Indicators and Controller Instruction are same, press "[Y], [CONTINUE]" for each step. If not, press "[N], [CONTINUE]".
LISTEN = 1, TALK = 0, REMOTE = 1		
LISTEN/TALK TEST PASS	Print	If both steps are correct, this message is outputted.
LISTEN/TALK TEST FAIL		If any step fails, this message is outputted.
END	Print	

TEST PROGRAM 2

[PURPOSE]

This test verifies that 4140A Opt. 101 has following capabilities:

(1) Listener
(2) Device Clear

[PROGRAMMING]

```
10   ! 4140A LISTENER TEST(15MRY79)
20   DIM F$[2],R$[3],I$[2],T$[2],C$[2],A$[2],B$[2],L$[2],M$[2],S$[2],U$[1],X$[50
]
30   PRINT "LISTENER TEST";LIN(1)
40   REMOTE 7
50   ABORTIO 7
60   INPUT "FUNCTION ? (F1 thru F4)",F$
70   PRINT F$
80   IF (F$="F1") OR (F$="F4") THEN F1=1
90   IF F$="F2" THEN F2=1
100  IF F$="F3" THEN F3=1
110  INPUT "I RANGE ? (RA0,RA1,R02 thru R12)",R$
120  PRINT R$
130  INPUT "INTEG TIME ? (I1 thru I3)",I$
140  PRINT I$
150  IF F1=1 THEN INPUT "I DATA OUTPUT TRIGGER ? (T1 thru T3)",T$
160  IF F1=1 THEN PRINT T$
170  IF F3=1 THEN INPUT "pF or % ? (C0 or C1)",C$
180  IF F3=1 THEN PRINT C$
190  IF F1=1 THEN INPUT "VA FUNCTION ? (A1 thru A6)",A$
200  IF F2=1 THEN INPUT "VA FUNCTION ? (A1 thru A4)",A$
210  IF F3=1 THEN INPUT "VA FUNCTION ? (A1 or A2)",A$
220  PRINT A$
230  INPUT "VB FUNCTION ? (B1 or B2)",B$
240  PRINT B$
250  INPUT "VA CURRENT LIMIT ? (L1 thru L3)",L$
260  PRINT L$
270  INPUT "VB CURRENT LIMIT ? (M1 thru M3)",M$
280  PRINT M$
290  INPUT "CONTROL MASK ? (D0 or D7)",D$
300  PRINT D$
310  INPUT "SELF TEST ? (S0 or S1)",S$
320  PRINT S$
330  OUTPUT 717;F$,R$,I$,T$,C$,A$,B$,L$,M$,D$,S$
340  GOSUB K
350  INPUT "Is key status true ? (Y or N)",U$
360  IF U$="N" THEN 390
370  PRINT "LISTENER TEST PASS";LIN(1)
380  GOTO 400
390  PRINT "LISTENER TEST FAIL";LIN(1)
400  PRINT "DEVICE CLEAR TEST";LIN(1)
410  CLEAR 717
420  GOSUB K
430  INPUT "Is key status true ? (Y or N)",U$
440  IF U$="N" THEN 470
450  PRINT "DEVICE CLEAR TEST PASS";LIN(1)
460  GOTO 480
470  PRINT "DEVICE CLEAR TEST FAIL";LIN(1)
480  PRINT "END";LIN(1)
490  END
500 K: OUTPUT 717;"K"
510  ENTER 717;X$
520  PRINT X$;LIN(1)
530  RETURN
```

(330) Transfers remote program codes from 9835A to 4140A.
(410) Initializes device-dependent functions to a predefined state.
(510) Transfers outputted data from 4140A to 9835A.

Figure 4-11. HP-IB Interface Test Program 2 Using 9835A.

Table 4-11. Controller Instructions and Operator Responses for Test Program 2.

Controller Instruction	CRT Area	Operator Response
LISTENER TEST	Print	
FUNCTION? (F1 thru F4)	Display	Input HP-IB program code in each step (see Table 3-12). Example: F3, R10, I2, C1, A2, B1, L2, M3, D2, S0 F3 ..... C-V R10 ..... 10^{-10}A I2 ..... MED C1 ..... % A2 ..... ⩘ B1 ..... ⎓ L2 ..... 10^{-3}A M3 ..... 10^{-4}A D2 ..... See Table 3-12 S0 ..... OFF * This step is only done when FUNCTION is set to I or HSI (High Speed I function). ** This step is only done when FUNCTION is set to I-V. *** This step is only done when FUNCTION is set to C-V.
F3	Print	
I RANGE? (RA0, RA1, R02 thru R12)	Display	
R10	Print	
INTEG TIME? (I1 thru I3)	Display	
I2	Print	
I DATA OUTPUT TRIGGER? (T1 thru T3)*	Display	
T1*	Print	
pF or %? (C0 or C1)***	Display	
C1***	Print	
V_A FUNCTION? (A1 thru A6)*	Display	
V_A FUNCTION? (A1 thru A4)**		
V_A FUNCTION? (A1 or A2)***		
A2	Print	
V_B FUNCTION? (B1 or B2)	Display	
B1	Print	
V_A CURRENT LIMIT? (L1 thru L3)	Display	
L2	Print	
V_B CURRENT LIMIT? (M1 thru M3)	Display	
M3	Print	
CONTROL MASK? (D0 or D7)	Display	
D2	Print	
SELF TEST? (S0 or S1)	Display	
S0	Print	
F3R10I2T1C1A2B1L2M3D2S0	Print	This is the key status data of 4140A when it accepts input remote program codes from controller.
Is key status true? (Y or N)	Display	If input remote codes and outputted key status data are same, press "[Y], [CONTINUE]". If not, press "[N], [CONTINUE]".
LISTENER TEST PASS	Print	
LISTENER TEST FAIL		
DEVICE CLEAK TEST	Print	
F1RA1I3T1C0A3B2L1M1D0S0		This is the key status data of 4140A when it accepts SDC (Selected Device Clear) command from controller.
Is key status true? (Y or N)	Display	If outputted key status data and initial control settings (F1RA1I3T1C0A3B2L1M1D0S0) are same, press "[Y], [CONTINUE]". If not, press "[N], [CONTINUE]".
DEVICE CLEAR TEST PASS	Print	
DIVICE CLEAR TEST FAIL		
END	Print	

TEST PROGRAM 3

[PURPOSE]

This test verifies that 4140A Opt. 101 has following capabilities:

(1) Talker
(2) Device Trigger

[PROGRAMMING]

```
10   ! 4140A TALKER TEST(20MAR79)
20   PRINT "TALKER TEST";LIN(1)
30   PRINT "DATA OUTPUT TEST"
40   DIM A$[30],B$[30],C$[30],F$[1]
50   STATUS 717;C
60   LOCAL 7
70   FLOAT 5
80   REMOTE 7
90   ABORTIO 7
100  CLEAR 717
110  OUTPUT 717;"F1I1T3A5"
120  OUTPUT 717;"PA-10"
130  OUTPUT 717;"W1E"
140  ENTER 717;A,B
150  PRINT A,B;LIN(1)
160  INPUT "Is output data true ? (Y or N)",F$
170  IF F$="N" THEN 200
180  PRINT "DATA OUTPUT TEST PASS";LIN(1)
190  GOTO 210
200  PRINT "DATA OUTPUT TEST FAIL";LIN(1)
210  PRINT "COMPLETE DATA OUTPUT TEST"
220  OUTPUT 717;"E"
230  ENTER 717;A$
240  PRINT A$;LIN(1)
250  INPUT "Is output data true ? (Y or N)",F$
260  IF F$="N" THEN 290
270  PRINT "COMPLETE DATA OUTPUT TEST";LIN(1)
280  GOTO 300
290  PRINT "COMPLETE DATA OUTPUT TEST PASS";LIN(1)
300  PRINT "DEVICE TRIGGER TEST"
310  TRIGGER 717
320  ENTER 717;B$
330  PRINT B$;LIN(1)
340  INPUT "Is output data true ? (Y or N)",F$
350  IF F$="N" THEN 380
360  PRINT "DEVICE TRIGGER TEST PASS";LIN(1)
370  GOTO 390
380  PRINT "DEVICE TRIGGER TEST FAIL";LIN(1)
390  PRINT "PARAMETER OUTPUT TEST"
400  OUTPUT 717;"PA"
410  ENTER 717;C$
420  PRINT C$;LIN(1)
430  INPUT "Is output data true ? (Y or N)",F$
440  IF F$="N" THEN 470
450  PRINT "PARAMETER OUTPUT TEST PASS";LIN(1)
460  GOTO 480
470  PRINT "PARAMETER OUTPUT TEST FAIL";LIN(1)
480  PRINT "END"
490  END
```

(310) Causes 4140A to simultaneously initiate a device - dependent action.

Figure 4-12. HP-IB Interface Test Program 3 Using 9835A.

Table 4-12. Controller Instructions and Operator Responses for Test Program 3.

Controller Instruction	CRT Area	Operator Response
TALKER TEST	Print	
DATA OUTPUT TEST	Print	
±N.NNNE-NN ±NNN.NN	Print	
Is output data true? (Y or N)	Display	If outputted data and values of I.C DISPLAY and VS DISPLAY are same, press "[Y], [CONTINUE]". If not, press "[N], [CONTINUE]".
DATA OUTPUT TEST PASS	Print	
DATA OUTPUT TEST FAIL		
COMPLETE DATA OUTPUT TEST	Print	
XX±N.NNNE-NN,A±NNN.NN	Print	
Is output data true? (Y or N)	Display	If outputted data is true, press "[Y], [CONTINUE]". If not, press "[N]. [CONTINUE]".
COMPLETE DATA OUTPUT TEST PASS	Print	
COMPLETE DATA OUTPUT TEST FAIL		
DEVICE TRIGGER TEST	Print	
XX±N.NNNE-NN,A±NNN.NN	Print	
Is output data true? (Y or N)	Display	If outputted data is true, press "[Y], [CONTINUE]". If not, press "[N], [CONTINUE]".
DEVICE TRIGGER TEST PASS	Print	
DEVICE TRIGGER TEST FAIL		
PARAMETER OUTPUT TEST	Print	
XX±NNNN.NNN	Print	
Is output data true? (Y or N)	Display	If outputted data is true, press "[Y], [CONTINUE]". If not, press "[N], [CONTINUE]".
PARAMETER OUTPUT TEST PASS	Print	
PARAMETER OUTPUT TEST FAIL		
END	Print	

TEST PROGRAM 4

[PURPOSE]

This test program verifies that 4140A Opt. 101 has following capabilities:

(1) Service Request
(2) Serial Poll

[PROGRAMMING]

```
10   ! 4140A SRQ TEST(15MAY79)
20   PRINT "SRQ TEST";LIN(1)
30   FIXED 0
40   ON INT #7 GOSUB Srq
50   REMOTE 7
60   ABORTIO 7
70   CLEAR 717
80   STATUS 717;A
90   A=0
100  PRINT "DATA READY"
110  OUTPUT 717;"T3D7E"
120  GOSUB Loop
130  A=0
140  PRINT "SELF TEST END"
150  OUTPUT 717;"S1"
160  OUTPUT 717;"S0"
170  GOSUB Loop
180  A=0
190  PRINT "SYNTAX ERROR"
200  OUTPUT 717;"D0S0I5"
210  GOSUB Loop
220  A=0
230  PRINT "PARAMETER OVER FLOW ERROR"
240  OUTPUT 717;"PA1000;"
250  GOSUB Loop
260  A=0
270  PRINT "ILLEGAL ERROR"
280  OUTPUT 717;"W1"
290  GOSUB Loop
300  PRINT "END"
310  END
320 Loop: CONTROL MASK 7;128
330  CARD ENABLE 7
340  IF BIT(A,0)=1 THEN 380
350  IF BIT(A,2)=1 THEN 380
360  IF BIT(A,3)=1 THEN 380
370  GOTO Loop
380  PRINT A;LIN(1)
390  RETURN
400 Srq: STATUS 717;A
410  IF BIT(A,6)=1 THEN 430
420  PRINT "OTHER DEVICE SRQ";LIN(1)
430  RETURN
```

(40) Designates label (SRQ) for service routing to be performed when an instrument is set by a device on select code 7 bus line.

(320) ∿ (330) Labels Loop. Enables service request to be sent from device on select code 7 bus line. Checks status of SRQ line on the bus line.

Figure 4-13. HP-IB Interface Test Program 4 Using 9835A.

Table 4-13. Controller Instructions and Operator Responses for Test Program 4.

Controller Instruction	CRT Area	Operator Response
SRQ TEST	Print	
DATA READY		Outputted SRQ Status Byte data should be 65 (=01000001).
65		
SELF TEST END		Outputted SRQ Status Byte data should be 68 (=01000100).
68		
SYNTAX ERROR		Outputted SRQ Status Byte data should be 72 (=010010000).
72		
PARAMETER OVER FLOW ERROR		Outputted SRQ Status Byte data should be 72 (=010010000).
72		
ILLEGAL ERROR		Outputted SRQ Status Byte data should be 72 (=01001000).
72		
END		

TEST PROGRAM 5

[PURPOSE]

This test verifies 4140A HP-IB Control Switch has the following capabilities:

(1) Address
(2) Output Format B

[PROGRAMMING]

```
10   ! 4140A HP-IB CONTROL SWITCH TEST(15MAY79)
20   PRINT "HP-IB CONTROL SWITCH TEST";LIN(1)
30   DIM A$[7],B$[1],C$[30],D$[30]
40   PRINT "ADDRESS TEST"
50   L=0
60   FOR I=1 TO 6
70   IF I=1 THEN A=700
80   IF I=1 THEN A$="0000000"
90   IF I=2 THEN A=701
100  IF I=2 THEN A$="0000001"
110  IF I=3 THEN A=702
120  IF I=3 THEN A$="0000010"
130  IF I=4 THEN A=704
140  IF I=4 THEN A$="0000100"
150  IF I=5 THEN A=708
160  IF I=5 THEN A$="0001000"
170  IF I=6 THEN A=716
180  IF I=6 THEN A$="0010000"
190  DISP "Turn off 4140A"
200  BEEP
210  PAUSE
220  DISP "Set HP-IB control switch to ",A$
230  BEEP
240  PAUSE
250  DISP "Turn on 4140A"
260  BEEP
270  PAUSE
280  WAIT 1000
290  OUTPUT A;"I1"
300  INPUT "LISTEN=1,TALK=0,REMOTE=1",B$
310  IF B$="N" THEN L=1
320  ENTER A;M,N
330  INPUT "LISTEN=0,TALK=1,REMOTE=1",B$
340  IF B$="N" THEN L=1
350  NEXT I
360  IF L=1 THEN 390
370  PRINT "ADDRESS TEST PASS";LIN(1)
380  GOTO 400
390  PRINT "ADDRESS TEST FAIL";LIN(1)
400  PRINT "OUTPUT DATA FORMAT B TEST"
410  DISP "Turn off 4140A"
420  BEEP
430  PAUSE
440  DISP "Set HP-IB control switch to 0110001"
450  BEEP
460  PAUSE
470  DISP "Turn on 4140A"
480  BEEP
490  PAUSE
500  WAIT 1000
510  ENTER 717;C$,D$
520  PRINT C$
530  PRINT D$
540  INPUT "Is output data true ? (Y or N)",B$
550  IF B$="N" THEN 580
560  PRINT "OUTPUT DATA FORMAT B TEST PASS";LIN(1)
570  GOTO 620
580  PRINT "OUTPUT DATA FORMAT B TEST FAIL";LIN(1)
590  DISP "Turn off 4140A"
600  BEEP
610  PAUSE
620  DISP "Set HP-IB control switch to 0010001"
630  BEEP
640  PAUSE
650  PRINT "END"
660  END
```

Figure 4-14. HP-IB Interface Test Program 5 Using 9835A.

Table 4-14. Controller Instructions and Operator Responses for Test Program 5.

Controller Instrction	CRT Area	Operator Response
HP-IB CONTROL SWITCH TEST	Print	
ADDRESS TEST	Print	
Turn off 4140A	Display	Turn the 4140A OFF and press " [CONTINUE] "
Set HP-IB control switch to 0000000		Set HP-IB Control Switch to "0000000" and press " [CONTINUE] ".
Turn on 4140A		Turn the 4140A ON and Press " [CONTINUE] ".
LISTEN = 1, TALK = 0, REMOTE = 1 LISTEN = 0, TALK = 1, REMOTE = 1		If 4140A HP-IB Status Indicators and Controller Instruction are same, press " [Y] , [CONTINUE] " in each step. If not, press " [N] , [CONTINUE] ".
The above five steps are repeated five more times (for each of the following addresses): (1) 0000001 (2) 0000010 (3) 0000100 (4) 0001000 (5) 0010000		
ADDRESS TEST PASS	Print	If all steps are correct, this message is outputted.
ADDRESS TEST FAIL		If any step fails, this message is outputted.
OUTPUT DATA FORMAT B TEST	Print	
Turn off 4140A	Display	Turn the 4140A OFF and press " [CONTINUE] ".
Set HP-IB control switch to 0110001		Set HP-IB Control switch to "0110001" and press " [CONTINUE] ".
Turn on 4140A		Turn the 4140A ON and press " [CONTINUE] ".
XXN.NNN-NN A±NNN.NN	Print	
Is output data true? (Y or N)	Display	If outputted data is true, press " [Y] , [CONTINUE] ". If not, press " [N] , [CONTINUE] ".
OUTPUT DATA FORMAT B TEST PASS	Print	
OUTPUT DATA FORMAT B TEST FAIL		
Turn off 4140A	Display	Turn the 4140A OFF and press " [CONTINUE] ".
Set HP-IB Control switch to 0010001		Set HP-IB Control Switch to "0010001" and press " [CONTINUE] ".
END		

PERFORMANCE TEST RECORD

Hewlett-Packard
Model 4140A
pA METER/DC VOLTAGE SOURCE
Serial No.

Tested by

Date

Paragraph Number	TEST	Results		
		Minimum	Actual	Maximum
4-11	VOLTAGE OUTPUT ACCURACY TEST			
	Voltage Setting			
	+100V	+99.80V		+100.20V
	+10V	+9.982V		+10.018V
	+1V	0.9883V		+1.0117V
	0V	-0.011V		0.011V
	-1V	-1.0117V		-9.883V
	-10V	-10.018V		-9.982V
	-100V	-100.20V		-99.80V
4-13.	CURRENT MEASUREMENT ACCURACY TEST			
	Current Measurement Range Setting			
	10^{-2}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-3}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-4}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-5}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-6}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-7}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-8}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-9}A	S.C.V. -7counts		S.C.V. +7counts
	10^{-10}A	S.C.V.-22counts		S.C.V.+22counts
	10^{-11}A	S.C.V.-53counts		S.C.V.+53counts
	10^{-12}A	S.C.V.-58counts		S.C.V.+58counts
4-15	CURRENT LIMIT TEST			
	Current Limit Setting			
	$+10^{-2}$A	$+0.9\times10^{-2}$A		$+1.1\times10^{-2}$A
	$+10^{-3}$A	$+0.9\times10^{-3}$A		$+1.1\times10^{-3}$A
	$+10^{-4}$A	$+0.9\times10^{-4}$A		$+1.1\times10^{-4}$A
	-10^{-2}A	-1.1×10^{-2}A		-0.9×10^{-2}A
	-10^{-3}A	-1.1×10^{-3}A		-0.9×10^{-3}A
	-10^{-4}A	-1.1×10^{-4}A		-0.9×10^{-4}A
4-17	RAMP WAVE START VOLTAGE ACCURACY TEST			
	Start Voltage Setting			
	0.00V	-0.02V		+0.02V
	+10.00V	+9.98V		+10.02V

PERFORMANCE TEST RECORD

Paragraph Number	TEST		Results		
			Minimum	Actual	Maximum
4-17	RAMP WAVE START VOLTAGE ACCURACY TEST (Continued)				
		-10.00V	-10.02V		-9.98V
		0.0V	-0.2V		+0.2V
		+10.0V	+9.8V		+10.2V
		-10.0V	-10.2V		-9.8V
		+100.0V	+99.8V		+100.2V
		-100.0V	-100.2V		-99.8V
4-19	RAMP RATE ACCURACY TEST				
	dV/dt Setting				
	STOP V = +10V	1V/s	+0.99799V/s		+1.00201V/s
		0.1V/s	+0.09979V/s		+0.10021V/s
		0.01V/s	+0.00997V/s		+0.01003V/s
		0.001V/s	+0.000998V/s		+0.001012V/s
	STOP V = -10V	1V/s	-1.00201V/s		-0.99799V/s
		0.1V/s	-0.10021V/s		-0.09979V/s
		0.01V/s	-0.01003V/s		-0.00997V/s
		0.001V/s	-0.001012V/s		-0.000988V/s
	STOP V = +100V	1V/s	+0.99792V/s		+1.00208V/s
		0.1V/s	+0.09972V/s		+0.10028V/s
		0.01V/s	+0.00990V/s		+0.01010V/s
		0.001V/s	+0.000918V/s		+0.001082V/s
	STOP V = -100V	1V/s	-1.00208V/s		-0.99792V/s
		0.1V/s	0.10028V/s		-0.09972V/s
		0.01V/s	-0.01010V/s		-0.00990V/s
		0.001V/s	-0.001082V/s		-0.000918V/s
4-21	ANALOG OUTPUT ACCURACY TEST (OPTION 001 ONLY)				
	Analog Output Setting				
		0.000V	-0.020V		+0.020V
		-0.001V	-0.021V		+0.019V
		-1.000V	-1.025V		-0.975V
		+1.000V	+0.975V		-0.975V
		0.00V	-0.02V		+0.002V
		-10.00V	-10.07V		-9.93V
		+10.00V	+9.93V		+10.07V

SECTION V
ADJUSTMENT

5-1. INTRODUCTION.

5-2. This section provides the information needed to adjust the 4140A to its specifications (listed in Table 1-1). Prime purpose of adjustment is to return the instrument to its peak operating capabilities after repairs have been made. The instrument should be tested and adjusted when a part or component has been replaced. Adjustments sometimes restore an instrument to its normal operating conditions without the necessity of repairs. Adjustment procedures can also be performed periodically to maintain top operating performance. Recommended adjustment schedule for the 4140A is every six months. All adjustable components referred to individual tests are summarized in Table 5-1 and adjustment locations are identified pictorially on the foldout sheets in Section VIII. If proper performance cannot be achieved after adjustment procedures have been performed, refer to troubleshooting in Section VIII.

Note

Before performing any adjustments, warm up instrument for more than 60 minutes to stabilize operating conditions.

5-3. SAFETY REQUIREMENTS.

5-4. Although the 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 keep the instrument in safe condition (see Sections II and III). Adjustments described in this section should be performed only by qualified service personnel.

WARNING

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

5-5. The opening of covers for removal of parts, except those to which access can be gained by hand, is likely to expose line parts. Accessible terminals may also be live.

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

WARNING

ADJUSTMENTS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT AFTER PROTECTIVE COVERS HAVE BEEN REMOVED. ENERGY EXISTING AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

5-7. EQUIPMENT REQUIRED.

5-8. The equipment needed to adjust the Model 4140A is listed in Table 4-1. This equipment should always be calibrated to satisfy its own specifications and those of the required characteristics. If the recommended model is not available, any instrument that has specifications equal to or better than required specifications may be substituted.

5-9. ADJUSTMENT RELATIONSHIPS.

5-10. The adjustment procedures, beginning with paragraph 5-15, should be performed in step sequence as they are interactive. Neglecting or changing procedures may make it impossible to gain best 4140A performance. Table 5-2 shows alignment procedures required when repairing the instrument (replacement of a component or board). The adjustments in Table 5-2 assume that no other adjustments were attempted prior to board or component replacement.

5-11. ADJUSTMENT LOCATIONS.

5-12. For reference, overall adjustment location illustrations are given in Section VIII. The locations of individual board assemblies are denoted in board assembly component location illustrations included on each foldout service sheet.

Table 5-1. Adjustable Components.

Reference Designator	Name of Control	Purpose
A1R5 (Para. 5-17)	SWS R ADJ	To eliminate any dc voltage offset in integrator circuit of DC amplifier.
A1R24 (Para. 5-17)	OFFSET ADJ	To eliminate any dc voltage offset in DC amplifier of I-V Converter.
A2R20 (Para. 5-19)	pA GAIN	To adjust total gain of I-V Converter for pA Meter.
A5R19 (Para. 5-21)	x10 ZERO	To eliminate any dc voltage offset in V_A power amplifier on x10 range.
A5R24 (Para. 5-21)	x1 ZERO	To eliminate any dc voltage offset in V_A power amplifier.
A5R31 (Para. 5-21)	x10 GAIN	To adjust V_A power amplifier gain on x10 range.
A5R64 (Para. 5-21)	x10 ZERO	To eliminate any dc voltage offset in V_B power amplifier on x10 range.
A5R69 (Para. 5-21)	x1 ZERO	To eliminate any dc voltage offset in V_B power amplifier.
A5R76 (Para. 5-21)	x10 GAIN	To adjust V_B power amplifier gain on x10 range.
A5R91 (Para. 5-21)	DA ZERO	To eliminate any dc voltage offset in DAC (D-A Converter) for DC voltage source.
A5R94 (Para. 5-21)	DA GAIN	To adjust gain of DAC for DC voltage source.
A6R11 (Para. 5-23)	COMP ZERO	To eliminate any dc voltage offset in comparator.
A6R12 (Para. 5-23)	dV/dt BUF ZERO	To eliminate any dc voltage offset in dV/dt buffer amplifier.
A6R13 (Para. 5-25)	dV/dt ADJ	To adjust ramp rate (dV/dt) of ramp wave in V_A ramp generator.
A7R1 (Para. 5-15)	-15VF	To set output of regulated, floated -15V dc power supply.
A7R2 (Para. 5-15)	+15VF	To set output of regulated, floated +15V dc power supply.
A31R4 (Para. 5-27)	ZERO	To eliminate any dc voltage offset in DAC for analog output (Option 001 only).
A31R5 (Para. 5-27)	GAIN	To adjust gain of DAC for analog output (Option 001 only).
A32R5 (Para. 5-27)	x1/10 ZERO	To eliminate any dc voltage offset in 1/10 amplifier (Option 001 only).

5-13. TOP COVER REMOVAL.

5-14. Remove top cover to locate and to gain access to the adjustment controls as follows:

(1) Loosen the retaining screw at rear of top cover until screw is free.

(2) Pull top cover towards the rear and lift off.

WARNING

WHEN TOP COVER IS REMOVED, LIVE PARTS ARE EXPOSED.

WARNING

TO INSURE PERSONAL SAFETY FROM POSSIBLE ELECTRICAL SHOCK HAZARDS AND RESULTANT INJURY, USE INSULATED ADJUSTMENT TOOL.

Table 5-2. Adjustment Requirements.

Assembly Repaired or Replaced	Required Adjustment
A1 I-V Converter (HP Part No.: 04140-66501)	Paragraph 5-17. pA Meter Amplifier Offset Adjustment. Paragraph 5-19. pA Meter Gain Adjustment.
A2 A-D Converter (HP Part No.: 04140-66502)	Paragraph 5-19. pA Meter Gain Adjustment.
A3 MPU (HP Part No.: 04140-66513)	None.
A4 I/O Control (HP Part No.: 04140-66504)	
A5 VS Output (HP Part No.: 04140-66505)	Paragraph 5-21. VS (Voltage Source) DC Adjustment.
A6 Ramp Generator (HP Part No.: 04140-66506)	Paragraph 5-23. VS Ramp Generator Adjustment. Paragraph 5-25. VS Ramp Rate Adjustment.
A7 Power Supply (HP Part No.: 04140-66507)	Paragraph 5-15. DC Power Supply Adjustment.
A8 Display (HP Part No.: 04140-66508)	None.
A9 Mother board (HP Part No.: 04140-66509)	
A21 HP-IB Interface (HP Part No.: 04140-66521)	
A31 Analog Output Control (HP Part No.: 04140-66531)	Paragraph 5-27. Analog Output Adjustment.
A32 Analog Output Distributor (HP Part No.: 04140-66532)	

ADJUSTMENTS

5-15. DC POWER SUPPLY ADJUSTMENT.

5-16. This adjustment adjusts regulated, floated ±15V DC Supply (A7).

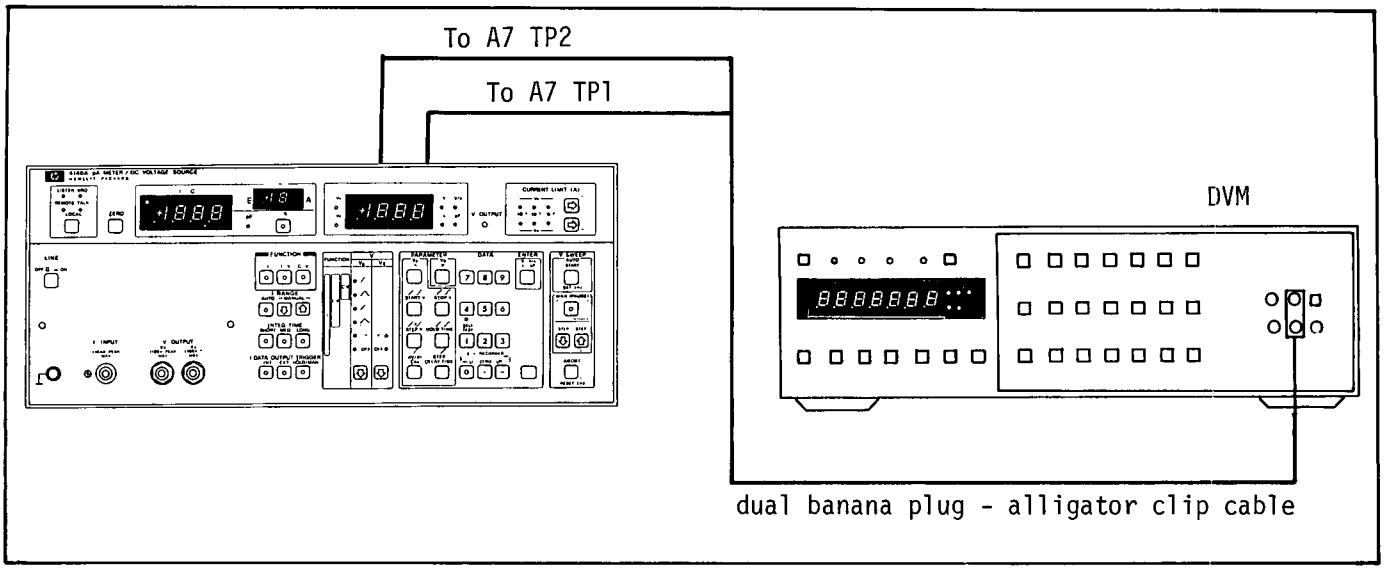

Figure 5-1. Power Supply Voltage Adjustment Setup.

EQUIPMENT:

DVM	HP 3455A
Dual Banana Plug - Alligator Clip Cable	HP 11002A

PROCEDURE:

1. Connect DVM plus input to A7TP2 (-15VF) and minus input to A7TP1 (F COMM) with dual banana plug - alligator clip cable. See Figure 5-1.

2. Set the DVM as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. Adjust "-15VF" potentiometer A7R1 for -15volts ±0.1volts (see Figure 8-22 for location).

4. Connect DVM plus input to A7TP3 (+15VF) and minus input to A7TP1 (F COMM).

5. Adjust "+15VF" potentiometer A7R2 for +15volts ±0.1volts (see Figure 8-22 for location).

6. Connect DVM plus input to test points listed in Table 5-3 and minus input to 4140A chassis.

7. Confirm the dc voltages at test points listed in Table 5-3.

Table 5-3. DC Voltage Check at Test Points.

Test Points	Voltage Limits
A7TP6 (+5V)	+4.85V ∿ +5.20V
A7TP4 (+15V)	+14.10V ∿ +15.90V
A7TP5 (-15V)	-15.90V ∿ -14.10V
A7TP7 (+120V)	+115.0V ∿ +127.0V
A7TP8 (-120V)	-130.7V ∿ -118.3V

ADJUSTMENTS

5-17. pA METER AMPLIFIER OFFSET ADJUSTMENT.

5-18. This adjustment eliminates any DC amplifier offset in pA Meter (A1).

Note

Allow a 30 minute warm up and stabilization period before this adjustment.

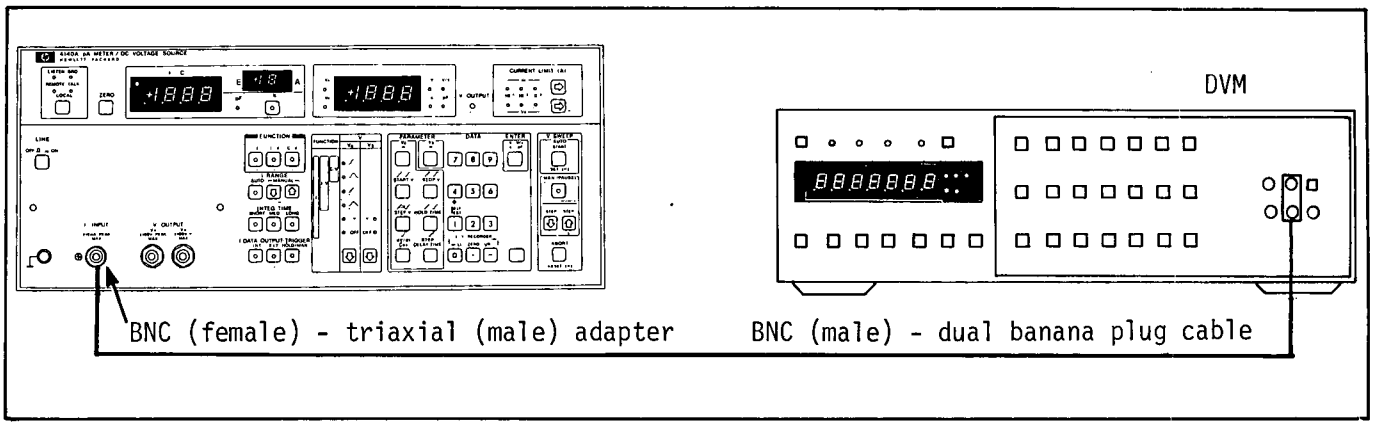

Figure 5-2. pA Meter Amplifier Offset Adjustment Setup.

EQUIPMENT:

DVM ..... HP 3455A
BNC (Female) - Triaxial (Male) Adapter ... TROMPETER AD-BJ20-E3-PL75
BNC (Male) -Dual Banana Plug Cable ..... HP 11001A

PROCEDURE:

1. Connect DVM input and the 4140A I INPUT connector with BNC (female) - triaxial (male) adapter and BNC (male) - dual banana plug cable. See Figure 5-2.

2. Set DVM as follows:

FUNCTION	DCV
RANGE E	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. Set 4140A I RANGE to 10^{-6}.

4. Set 4140A A1S1 and S2 to right hand position (see Figure 8-25 for location).

5. Adjust "SWS R ADJ" potentiometer A1R5 for 0 volts ±1.0 millivolts (see Figure 8-22 for location).

6. Reset 4140A A1S1 and S2 to left hand position.

7. Adjust "OFFSET ADJ" potentiometer A1R24 for 0 volts ±0.020 millivolts (see Figure 8-22 for location).

Note

After this adjustment, the 4140A switches A1S1 and S2 should be in their left hand positions.

5-19. pA METER GAIN ADJUSTMENT.

5-20. This adjustment adjusts DC amplifier gain of pA Meter (A2).

Note

Allow a 30 minute warm up and stabilization period before this adjustment.

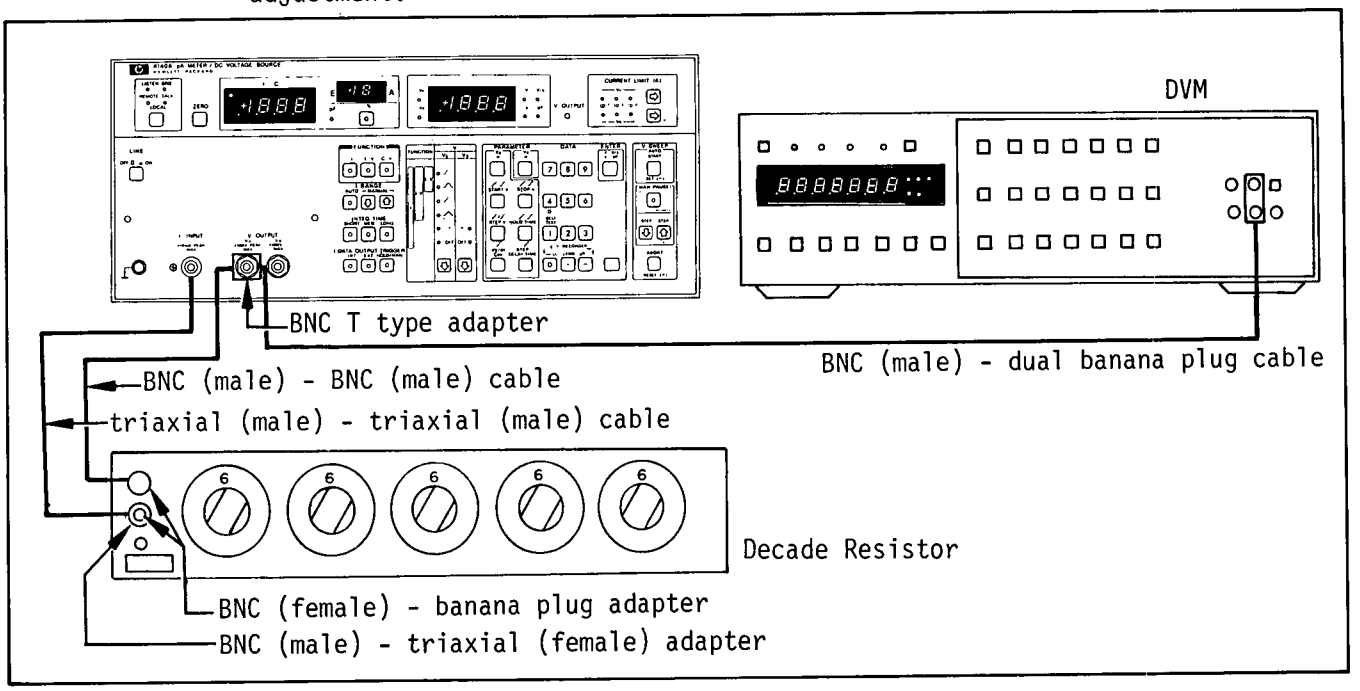

Figure 5-3. pA Meter Gain Adjustment Setup.

EQUIPMENT:

DVM	HP 3455A
Decade Resistor	GR 1433A
BNC T Type Adapter	HP Part No.: 1250-0781
BNC (Female) - Banana Plug Adapter	HP 10111A (2ea)
BNC (Male) - Triaxial (Female) Adapter	TROMPTER AD-BJ77-E3-PL20
Triaxial (Male) - Triaxial (Male) Cable	Part of HP 16053A (HP Part No.: 16053-61002)
BNC (Male) - BNC (Male) Cable	Part of HP 16053A (HP Part No.: 16053-61003)
BNC (Male) - Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Connect 4140A, DVM and Decade Resistor as shown in Figure 5-3.

2. Set the DVM as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. Set the 4140A as follows:

FUNCTION	I
I RANGE	AUTO
INTEG TIME	LONG
I DATA OUTPUT TRIGGER	INT
V_A	⎓ (DC)

4. Set the Decade Resistor to $10^4\Omega$.

5. Set PARAMETER (⎓) to 1.8 volts.

6. Push SET (⎓) key and read display outputs of the DVM and I·C DISPLAY of 4140A.

7. Adjust "pA GAIN" potentiometer A2R20 for *S.C.V. ±1 count (See Figure 8-22 for location) on I·C DISPLAY.

   *S.C.V. (Supplied Current Value) = (Decade Resistor Value)/(Measured Voltage Value of DVM).

8. Set the Decade Resistor to $10^5\Omega$.

9. Read display outputs and confirm that the I·C DISPLAY displays S.C.V. ±1 count.

10. If not, adjust "pA GAIN" potentiometer A2R20 for S.C.V. ±1 count and repeat steps 7 thru 9.

ADJUSTMENTS

5-21. VS (VOLTAGE SOURCE) DC ADJUSTMENT.

5-22. This adjustment adjusts DC voltage sources (V_A and V_B) (A5). The adjustment is divided into five parts, which are:

(1) V_A Amplifier Offset Zero Adjustment.
(2) V_B Amplifier Offset Zero Adjustment.
(3) DAC Adjustment.
(4) V_A Amplifier Gain Adjustment.
(5) V_B Amplifier Gain Adjustment.

Note

Allow a 15 minute warm up and stabilization period before these adjustments.

Note

This adjustment should be done with no air blowing across the instrument.

WARNING

THE A5 BOARD IS EXTENDED WITH THE EXTENDER BOARD FOR THIS ADJUSTMENT SO THAT THE 120V DC LINES APPEAR. TO AVOID AN ELECTRIC SHOCK, DON'T TOUCH ANY COMPONENTS EXCEPT THOSE TO BE ADJUSTED!

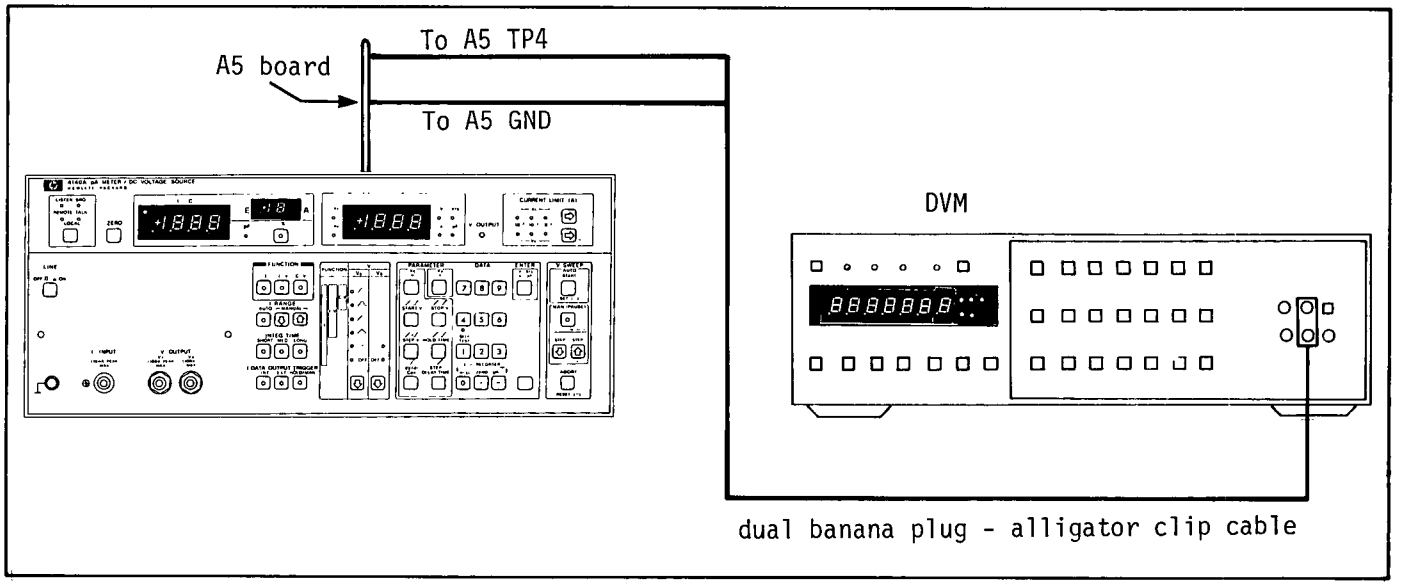

Figure 5-4. VS (Voltage Source) DC Adjustment Setup.

ADJUSTMENTS

EQUIPMENT:

DVM ..... HP 3455A
Dual Banana Plug - Alligator Clip Cable ..... HP 11002A
Extender Board (22pin x 2) ..... HP Part No.: 5060-4025
Clip - Clip Cable

PROCDURE:

(1) V_A Amplifier Offset Zero Adjustment

1. Turn 4140A power switch to OFF. Remove A5 board from 4140A.

2. Install extender board in place of A5 board. Put A5 Board in extender. Set power 4140A switch to on.

3. Connect DVM plus input to A5TP4 (see Figure 8-42 for location) and minus input to A5GND pin with dual banana plug - alligator clip cable. See Figure 5-4.

4. Set the DVM as follows:

   FUNCTION ..... DCV
   RANGE ..... AUTO
   HIGH RESOLUTION ..... OFF
   AUTO CAL ..... ON
   GUARD ..... ON
   TRIGGER ..... INTERNAL

5. Short leads of the 1 F capacitor A5 C13 with a clip-to-clip cable (see Figure 8-42 for location).

6. This adjustment can be made by using auto setting mode of 4140A (refer to paragraph 4-9).

7. Press " Blue , SELF TEST 1 " to set 4140A to Self Test mode.

8. Press " Blue , V_A " to set 4140A to " S-1 " mode.

9. Adjust "X1ZERO" potentiometer A5R24 for 0 volts ±0.1 millivolt (see Figure 8-42 for location).

10. Press " Blue , 9 " to set 4140A to " S-5 " mode.

11. Adjust "X10ZERO" potentiometer A5R19 for 0 volts ±1 millivolt (see Figure 8-42 for location).

12. Remove clip-to-clip cable from A5C13.

(2) V_B Amplifier Offset Zero Adjustment.

13. Connect DVM plus input to A5TP9 (see Figure 8-42 for location) and minus input to A5GND pin with dual banana plug-to-alligator clip cable.

14. Short leads of the 1 F capacitor A5C27 with clip-to-clip cable (see Figure 8-42 for location).

15. Press " Blue , V_B " to set 4140A to " S-1 " mode.

16. Adjust "X1ZERO" potentiometer A5R69 for 0 volts ±0.1 millivolt (see Figure 8-42 for location).

17. Press " Blue , 9 " to set 4140A to " S-5 " mode.

18. Adjust "X10ZERO" potentiometer A5R64 for 0 volts ±1 millivolt (see Figure 8-42 for location).

19. Remove clip-to-clip cable.

(3) DAC Adjustment

20. Connect DVM plus input to "VA IN" A5TP3 (see Figure 8-42 for location and minus input to A5 GND pin with dual banana plug-to-alligator clip cable.

21. Press " Blue , V_B " to set 4140A to " S-1 " mode.

22. Adjust "DA ZERO" potentiometer A5R91 for 0 volts ±0.2 millivolts (see Figure 8-42 for location).

23. Press " Blue , V_B " to set 4140A to " S-2 " mode.

24. Adjust "DA ZERO" potentiometer A5R91 for -10 millivolts ±1 millivolt.

25. Press " Blue , 7 " to set 4140A to " S-3 " mode.

26. Adjust "DA GAIN" potentiometer A5R94 for -10 volts ±1 millivolt.

(4) V_A Amplifier Gain Adjustment.

27. Connect DVM plus input to A5TP4 (see Figure 8-42 for location) and minus input to A5GND pin with dual banana plug-to-alligator clip cable.

28. Press " Blue , ENTER " to set 4140A to " S-6 " mode.

29. Adjust "x10 GAIN" potentiometer A5R31 for -100 volts ±10 millivolts (see Figure 8-42 for location).

(5) V_B Amplifier Gain Adjustment.

30. Connect DVM plus input to A5TP9 (see Figure 8-42 for location) and minus input to A5 GND pin with dual banana plug-to-alligator clip cable.

31. Adjust "x10 GAIN" potentiometer A5R76 for -100 volts ±10 millivolts (see Figure 8-42 for location).

ADJUSTMENTS

5-23. VS (VOLTAGE SOURCE) RAMP GENERATOR ADJUSTMENT

5-24. This adjutment adjusts ramp generator of V_A (A6). The adjustment is divided into two parts:

(1) dV/dt Buffer Zero Adjustment.
(2) Comparator Zero Adjustment.

Note

Allow a 15 minute warm up and stabilization period before this adjustment.

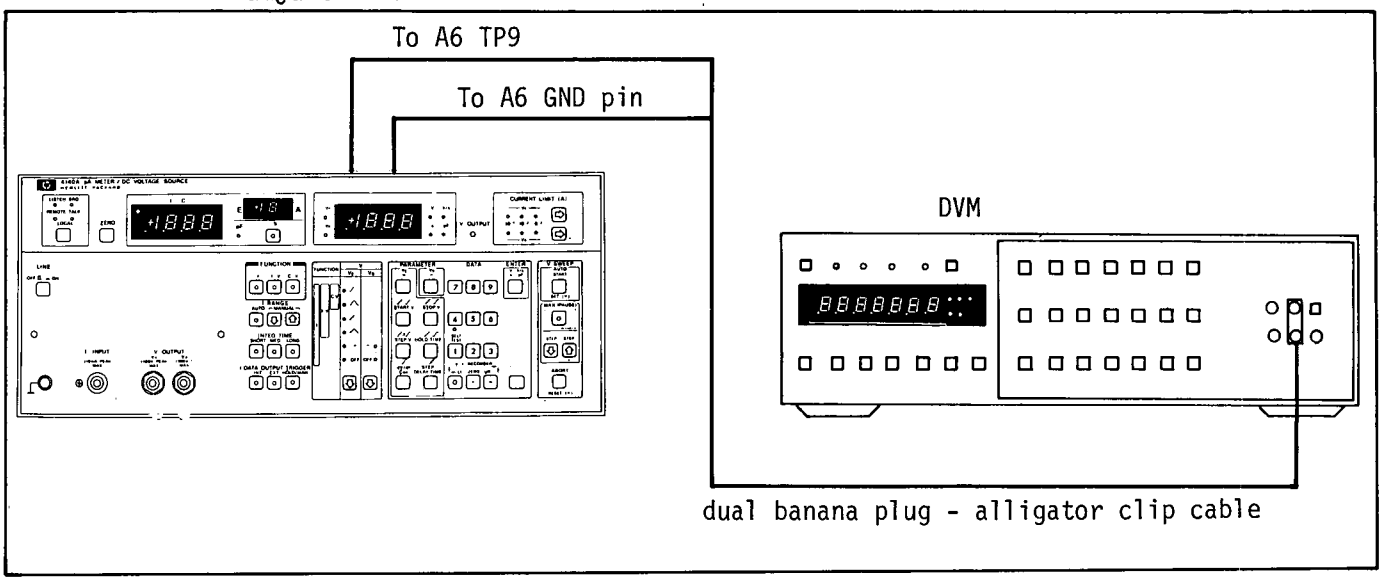

Figure 5-5. VS (Voltage Source) Ramp Generator Adjustment Setup.

EQUIPMENT:

DVM ..... HP 3455A
Dual Banana Plug-to-Alligator Clip Cable ..... HP 11002A
Clip-to-Clip Cable (2ea)

PROCEDURE:

(1) dV/dt Buffer Zero Adjustment.

1. Set 4140A power switch to OFF. Remove A5 board from 4140A.
2. Connect A5TP5, A5TP7 and A5GND pin with clip-to-clip cables.
3. Reinstall A5 board in 4140A. Set 4140A power switch to ON.
4. Connect DVM plus input to "dV/dt BUF. OUT" A6TP9 (see Figure 8-22 for location) and minus input to A6GND pin with dual banana plug to alligator clip cable. See Figure 5-5.
5. Set the DVM as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

6. Adjust "dV/dt BUF ZERO" potentiometer A6R12 for 0 volts ±0.2 millivolts (see Figure 8-22 for location).

(2) Comparator Zero Adjustment.

7. Connect DVM plus input to "RAMP OUT" A6TP7 (see Figure 8-45 for location) and minus input to A6 GND pin with dual banana plug to alligator clip cable.
8. Press "ABORT" key.
9. Adjust "COMP ZERO" potentiometer A6R11 for 0 volts ±0.2 millivolts (see Figure 8-22 for location).
10. Set 4140A power switch to OFF. Remove A5 board from 4140A.
11. Remove clip-to-clip cables and reinstall A5 board in 4140A.

5-25. VS (VOLTAGE SOURCE) RAMP RATE ADJUSTMENT.

5-26. This adjustment adjusts ramp rate for ramp wave (⟋ , ⟋⟍) in the VA ramp generator (A6).

Note

This adjustment requires Option 101 HP-IB Interface as the adjustment is made with the HP-IB system (including HP 9835A Desktop computer, HP 3455A DVM and HP 59308A Timing Generator, etc.).

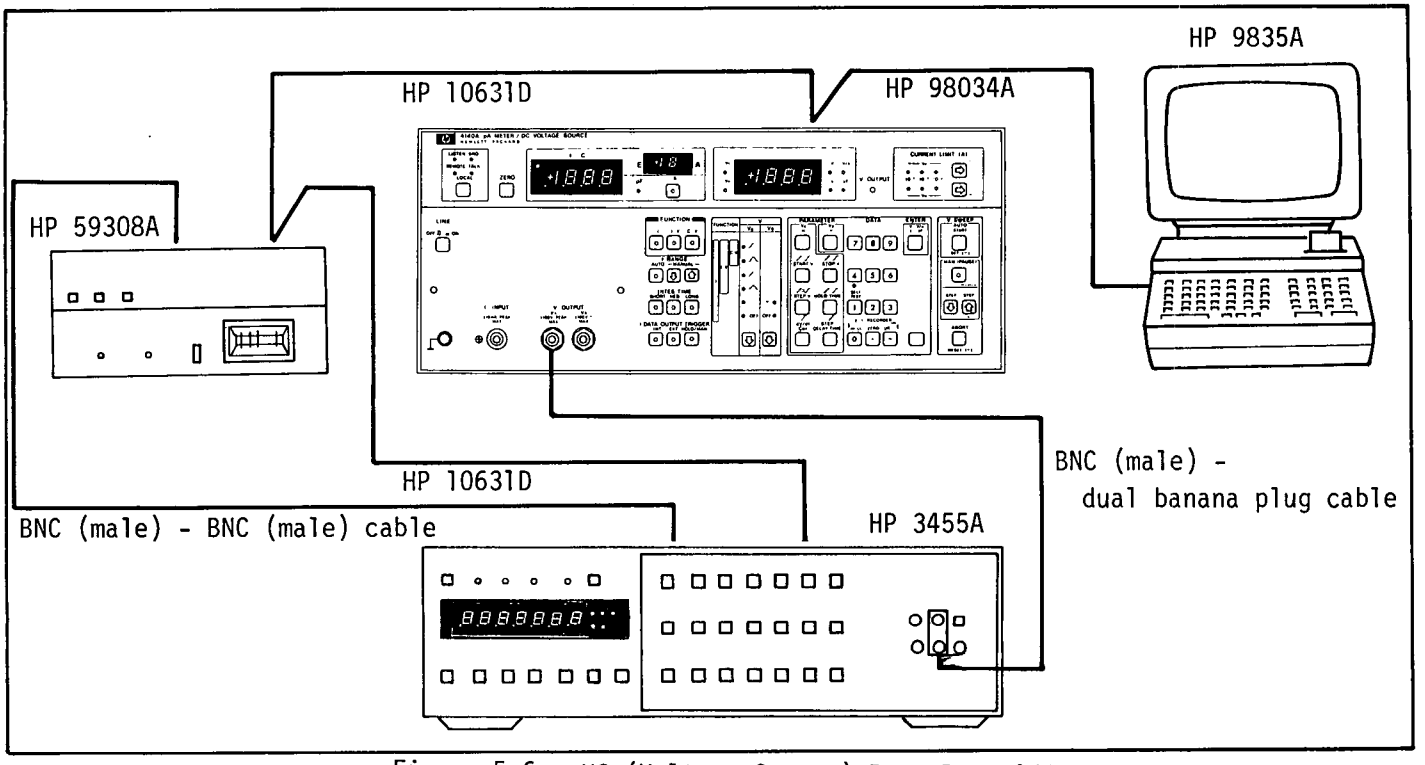

Figure 5-6. VS (Voltage Source) Ramp Rate Adjustment Setup.

EQUIPMENT:

Desktop Computer	HP 9835A
General I/O ROM	HP 98332A
HP-IB Interface Card with Cable	HP 98034A
HP-IB Cable	HP 10631D (2ea)
DVM (with HP-IB Interface capability)	HP 3455A
Timing Generator (with HP-IB Interface capability)	HP 59308A
BNC (Male)-to-BNC (Male) Cable	Part of HP 16053A (HP Part No.: 16053-61003)
BNC (Male)-to-Dual Banana Plug Cable	HP 11001A

PROCEDURE:

1. Turn power switches of 4140A, 9835A, 3455A and 59308A to OFF.
2. Install Option 101 HP-IB Interface in 4140A. Refer to Option Installation in Section II.
3. Connect 98034A HP-IB Interface Card with Cable between 9835A I/O slot and 4140A rear panel HP-IB connector as shown in Figure 5-6.
4. Install 98332A ROM in 9835A ROM slot.
5. Set 98034A Selct Code switch dial to select code 7 (using a screwdriver).
6. Set HP-IB addresses of instruments as follows:

   4140A: 10001 (17 in binary code).
   3455A: 00110 (6 in binary code).
   59308A: 10000 (16 in binary code).

7. Connect 4140A, 3455A and 59308A with 10631D HP-IB cables as shown in Figure 5-6.
8. Connect BNC (male) to BNC (male) cable between 59308A OUTPUT connector and 3455A EXT TRIGGER INPUT connector as shown in Figure 5-6.
9. Set 4140A 9835A, 3455A and 59308A power switches to ON.
10. Load test program (as shown in Figure 5-7) in controller.
11. Execute the program.
12. Check that 9835A CRT is in accord with Table 5-4 Controller Instructions and Operator Responses and adjust ramp rate of the V_A ramp generator in accord with programmed instructions.

```
   [PROGRAMMING]


10    ! 4140A RAMP RATE ADJUSTMENT "40RADJ" (26JUL79)
20      DIM A(-4:400)
30      PRINT PAGE
40      PRINT "RAMP RATE ADJUSTMENT";LIN(1)
50      REMOTE 7
60      ABORTIO 7
70      CLEAR 717
80      IMAGE 3DX,2D.4D,"V/s"
90      WAIT 2000
100     OUTPUT 706;"F1R3T2M3A0H0"
110     OUTPUT 716;"P200E3R"
120     OUTPUT 717;"F1RA1I3T3A2B2L3M3"
130     OUTPUT 717;"PS-10;PT10;PE.5;PV.5;PH3"
140     OUTPUT 717;"W1"
150     B=0
160     FOR J=-4 TO 400
170     ENTER 706;A(J)
180     IF J<1 THEN 250
190     IF J=50 THEN DISP "Adjust ramp rate to .4999 - .5001V/s with A6R13 (dV/dt
 ADJ)"
200     IF J<201 THEN PRINT USING 80;J,A(J)-A(J-5)
210     IF (J=200) AND ((A(J)-A(J-5)<.4999) OR (A(J)-A(J-5)>.5001)) THEN B=1
220     IF J=201 THEN DISP "Waiting"
230     IF (J>250) AND ((A(J)-A(J-5)>-.4995) OR (A(J)-A(J-5)<-.5005)) THEN B=1
240     IF B=1 THEN 260
250     NEXT J
260     OUTPUT 717;"W7"
270     OUTPUT 716;"R"
280     IF B=1 THEN DISP "Adjust again!!"
290     IF B=1 THEN 30
300     PRINT PAGE
310     DISP "END"
320     END
```

Figure 5-7. Ramp Rate Adjustment Program Using 9835A.

Table 5-4. Controller Instructions and Operator Responses for Ramp Rate Adjustment Program.

Controller Instruction	CRT Area	Operator Response
RAMP RATE ADJUSTMENT	Print	
Adjust ramp rate to .4999-.5001 V/s with A6R13 (dV/dt ADJ)	Display	Adjust ramp rate to .4999 .5001V/s with AR13 (dV/dt ADJ) potentiometer.
NNN NN.NNNNV/s	Print	
WAITING	Display	Stop ramp rate adjustment and wait.
Adjust again!!		If ramp rate adjustment is not completed, this annunciation is displayed. In this case, press " RUN " and try ramp rate adjustment again.
END		

ADJUSTMENTS

5-27. ANALOG OUTPUT ADJUSTMENT (OPTION 001 ONLY).

5-28. This adjustment adjusts the Option 001 Analog Output (A31 and A32). The adjustment is divided into three parts:

(1) DAC (D-A Converter) Zero adjustment.
(2) x1/10 Buffer Zero Adjustment.
(3) DAC Gain Adjustment.

Note

Allow a 15 minute warm up and stabilization period before this adjustment.

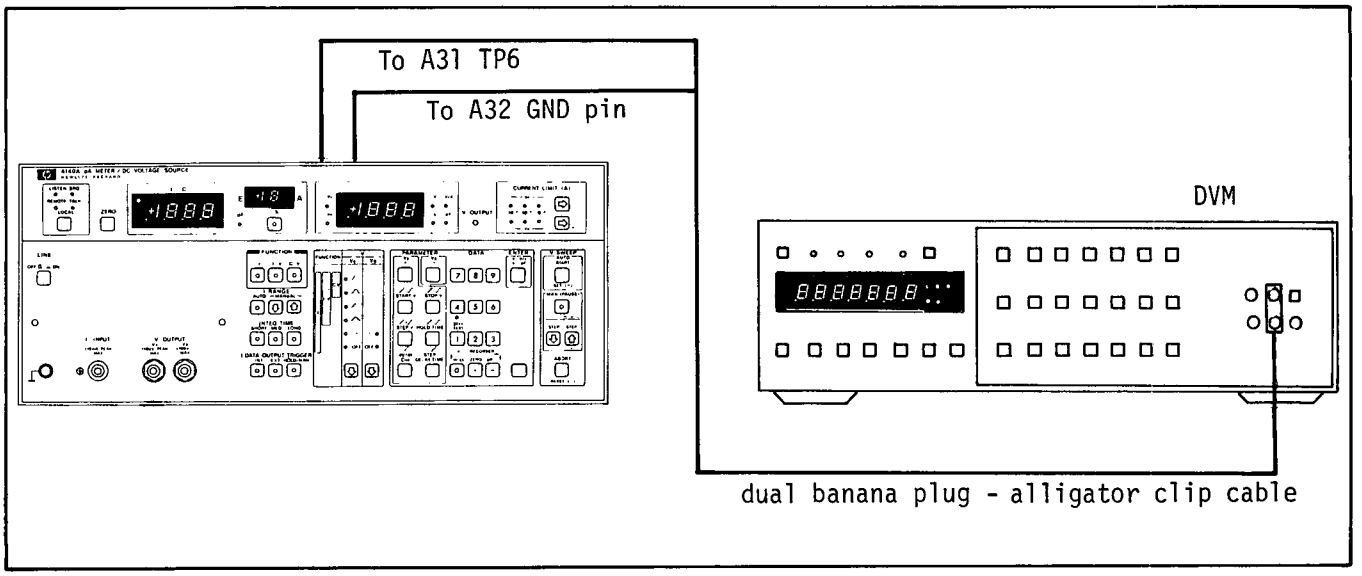

Figure 5-8. Analog Output Adjustment Setup.

EQUIPMENT:

DVM ..... HP 3455A
Dual Banana Plug-to-Alligator Clip Cable ..... HP 11002A

PROCEDURE:

(1) DAC Zero Adjustment

1. Connect DVM plus input to A31TP6 and minus input to A32GND pin with dual banana plug to alligator clip cable. See Figure 5-8.

2. Set the DVM as follows:

FUNCTION	DCV
RANGE	AUTO
HIGH RESOLUTION	OFF
AUTO CAL	ON
GUARD	ON
TRIGGER	INTERNAL

3. This adjustment can be made by using auto setting modes of 4140A (refer to paragraph 4-9).

4. Press " [blue] , [SELF TEST 1] " to set 4140A to Self Test mode.

5. Press " [blue] , [9] " to set 4140A to " S-5 " mode.

6. Adjust "ZERO" potentiometer A31R4 for 0 volts ±0.5 millivolts (see Figure 8-22 for location).

(2) x1/10 Buffer Zero Adjustment

7. Connect DVM plus input to A32TP1 and minus input to A32GND pin with dual banana plug to alligator clip cable.

8. Adjust "x1/10 ZERO" potentiometer A32R5 for 0 volts ±0.5 millivolts (see Figure 8-22 for location).

(3) DAC Gain Adjustment

9. Connect DVM plus input to A31TP6 and minus input to A32GND pin with dual banana plug to alligator clip cable.

10. Press " [blue] , [ENTER] " to set 4140A to " S-6 " mode.

11. Adjust "GAIN" potentiometer A31R5 for -10 volts ±1 millivolt (see Figure 8-22 for location).

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

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

6-3. ABBREVIATIONS.

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

6-5. REPLACEABLE PARTS LIST.

6-6. Table 6-3 is a list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alphanumerical order by reference designation.

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

c. Miscellaneous parts.

d. Illustrated parts breakdowns, if appropriate.

The information for each part includes:

a. The Hewlett-Packard part number.

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

Table 6-1. List of Reference Designators and Abbreviations

REFERENCE DESIGNATORS

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

ABBREVIATIONS

A	= amperes	H	= henries	NPN	= negative-positive-negative	RWV	= reverse working voltage
A. F. C.	= automatic frequency control	HEX	= hexagonal	NRFR	= not recommended for field replacement		
AMPL	= amplifier	HG	= mercury	NSR	= not separately replaceable	S-B	= slow-blow
B. F. O.	= beat frequency oscillator	HR	= hour(s)			SCR	= screw
BE CU	= beryllium copper	Hz	= hertz			SE	= selenium
BH	= binder head	IF	= intermediate freq.	OBD	= order by description	SECT	= section(s)
BP	= bandpass	IMPG	= impregnated	OH	= oval head	SEMICON	= semiconductor
BRS	= brass	INCD	= incandescent	OX	= oxide	SI	= silicon
BWO	= backward wave oscillator	INCL	= include(s)			SIL	= silver
CCW	= counter-clockwise	INS	= insulation(ed)	P	= peak	SL	= slide
CER	= ceramic	INT	= internal	PC	= printed circuit	SPG	= spring
CMO	= cabinet mount only	k	= kilo = 1000	p	= pico = 10^{-12}	SPL	= special
COEF	= coefficient	LH	= left hand	PH BRZ	= phosphor bronze	SST	= stainless steel
COM	= common	LIN	= linear taper	PHL	= Phillips	SR	= split ring
COMP	= composition	LK WASH	= lock washer	PIV	= peak inverse voltage	STL	= steel
COMPL	= complete	LOG	= logarithmic taper	PNP	= positive-negative-positive	TA	= tantalum
CONN	= connector	LPF	= low pass filter	P/O	= part of	TD	= time delay
CP	= cadmium plate	m	= milli = 10^{-3}	POLY	= polystyrene	TGL	= toggle
CRT	= cathode-ray tube	M	= meg = 10^{6}	PORC	= porcelain	THD	= thread
CW	= clockwise	MET FLM	= metal film	POS	= position(s)	TI	= titanium
DEPC	= deposited carbon	MET OX	= metallic oxide	POT	= potentiometer	TOL	= tolerance
DR	= drive	MFR	= manufacturer	PP	= peak-to-peak	TRIM	= trimmer
ELECT	= electrolytic	MINAT	= miniature	PT	= point	TWT	= traveling wave tube
ENCAP	= encapsulated	MOM	= momentary	PWV	= peak working voltage	μ	= micro = 10^{-6}
EXT	= external	MTG	= mounting			VAR	= variable
F	= farads	MY	= "mylar"	RECT	= rectifier	VDCW	= dc working volts
f	= femto = 10^{-15}	n	= nano = 10^{-9}	RF	= radio frequency	W/	= with
FH	= flat head	N/C	= normally closed	RH	= round head or right hand	W	= watts
FIL H	= fillister head	NE	= neon	RMO	= rack mount only	WIV	= working inverse voltage
FXD	= fixed	NI PL	= nickel plate	RMS	= root-mean square	WW	= wirewound
G	= giga = 10^{9}	N/O	= normally open			W/O	= without
GE	= germanium	NPO	= negative positive zero (zero temperature coefficient)				
GL	= glass						
GRD	= ground(ed)						

0001-9700

c. A description of the part.

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

e. The manufacturer's number for the part.

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

6-7. ORDERING INFORMATION.

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

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

6-10. SPARE PARTS KIT.

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

6-12. DIRECT MAIL ORDER SYSTEM.

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

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

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

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

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

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

Table 6-2. Manufacturers Code Lists.

MFR NO.	MANUFACTURER NAME	ADDRESS		ZIP CODE
00000	ANY SATISFACTORY SUPPLIER			
01121	ALLEN-BRADLEY CO	MILWAUKEE	WI	53204
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS	TX	75222
01928	RCA CORP SOLID STATE DIV	SOMERVILLE	NJ	08876
02111	SPECTROL ELECTRONICS CORP	CITY OF IND	CA	91745
03888	KDI PYROFILM CORP	WHIPPANY	NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX	AZ	85062
07933	RAYTHEON CO SEMICONDUCTOR DIV HQ	MOUNTAIN VIEW	CA	94040
19701	MEPCO/ELECTRA CORP	MINERAL WELLS	TX	76067
24355	ANALOG DEVICES INC	NORWOOD	MA	02062
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD	PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE	CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS	MA	01247
71279	CAMBRIDGE THERMIONIC CORP	CAMBRIDGE	MA	02138
72136	ELECTRO MOTIVE CORP SUB IEC	WILLIMANTIC	CT	06226
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA	RA	19108
75915	LITTELFUSE INC	DES PLAINES	IL	60016
8E175	BURR BROWN CO	HUNTSVILLE	AL	35801
98291	SEALECTRO CORP	MAMARONECK	NY	10544

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	04140-66501	7	1	PC BOARD, I/V CONVERTER	28480	04140-66501
A1C1	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A1C2	0150-0121	5	8	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C3	0160-2117	4	1	CAPACITOR-FXD .12UF +-10% 200VDC POLYE	28480	0160-2117
A1C4	0160-4084	8	1	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1C5	0180-1083	3	6	CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C6	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C7	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C8	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C9	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C10	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C11	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C12	0160-0127	2	2	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A1C13	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C14	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C15	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C16	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A1C17	0160-0157	8	1	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A1C18	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C19	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A1C20	0160-1583	6	1	CAPACITOR-FXD 20pF +-10% 125V	28480	0160-1583
A1C21	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A1C22	0160-1688	2	1	CAPACITOR-FXD 2pF +-5% 150WVDC PULTE	28480	0160-1688
A1C23	0160-5064	6	1	CAPACITOR-FXD 51pF +-5% 125WVDC	28480	0160-5064
A1C24	0160-0153	4	1	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A1CR1	1902-0041	4	3	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A1CR2	1902-0041	4		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A1CR3	1901-0025	2	9	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR5	1902-0041	4		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	28480	1902-0041
A1CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR7	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR8	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR9	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR10	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR11	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1CR12	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A1K1	0490-0191	9	3	COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8	3	SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A1K2	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A1K3	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A1K4	0490-1137	5	3	RELAY-REED 1A 500MA 200VAC 5VDC-COIL	28480	0490-1137
A1K5	0490-1137	5		RELAY-REED 1A 500MA 200VAC 5VDC-COIL	28480	0490-1137
A1K6	0490-1137	5		RELAY-REED 1A 500MA 200VAC 5VDC-COIL	28480	0490-1137
A1L1	9140-0137	1	3	COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A1L2	9170-0029	3	1	CORE-SHIELDING BEAD	28480	9170-0029
A1L3	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A1L4	9140-0137	1		COIL-MLD 1MH 5% Q=60 .19DX.44LG-NOM	28480	9140-0137
A1P1	1250-0687	1	1	CONNECTOR-RF TRAXL FEM SGL-HOLE-RR	28480	1250-0687
A1Q1	1855-0112	9	4	TSTR;FET (2SK23A)	28480	1855-0112
A1Q2	1855-0112	9		TSTR;FET (2SK23A)	28480	1855-0112
A1Q3	1855-0112	9		TSTR;FET (2SK23A)	28480	1855-0112
A1Q4	1855-0112	9		TSTR;FET (2SK23A)	28480	1855-0112
A1Q5	1854-0071	7	9	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q6	1853-0020	4	2	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q7	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A1Q8	5080-3063	5	1	DUAL J-FET N-CH Silicon PD=300mWmax	28480	5080-3063
A1Q9	1855-0119	6	1	J-FET N-CHANNEL Silicon	28480	1855-0119
A1Q10	1853-0354	7	2	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A1Q11	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q12	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A1Q13	1854-0296	8	1	TRANSISTOR NPN SI TO-92 PD=310MW	28480	1854-0296
A1Q14	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
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	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q20	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1R1	0683-1535	6	3	RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A1R2	0757-0401	0	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R3	0698-3160	8	4	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A1R4	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A1R5	2100-3306	1	1	RESISTOR-TRMR 50K 10% C SIDE-ADJ 17-TRN	28480	2100-3306

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1R6	0698-0083	8	5	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R7	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R8	0683-3955	8	1	RESISTOR 3.9M 5% .25W FC TC=-900/+1100	01121	CB3955
A1R9	0683-1045	3	1	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A1R10	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A1R11	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A1R12	0683-1015	7	2	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R13	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A1R14	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A1R15	0757-1090	5	1	RESISTOR 261 1% .5W F TC=0+-100	28480	0757-1090
A1R16	0683-0275	9	2	RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A1R17	0683-0275	9		RESISTOR 2.7 5% .25W FC TC=-400/+500	01121	CB27G5
A1R18	0757-0346	2	3	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R19	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R20	0757-0274	5	2	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1R21	0757-0274	5		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A1R22	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R23	0757-0346	2		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A1R24	2100-3154	7	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 17-TRN	02111	43P102
A1R25	0683-3325	6	3	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A1R26	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A1R27	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A1R28	0683-3315	4	2	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A1R29	0683-1525	4	2	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A1R30	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A1R31	0683-1525	4		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A1R32	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1R33	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A1R34	0757-0317	7	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A1R35	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R36	0757-0394	0	1	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A1R37	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A1R38	0698-3150	6	1	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A1R39	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A1R40	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A1R41	0757-0438	3	2	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R42	0698-3154	0	1	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A1R43	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A1R44	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A1R45	0683-1065	7	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A1R46	0698-0082	7	1	RESISTOR 464 1% .125W F TC=0+-100	24546	C4-1/8-T0-4640-F
A1R47	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1961-F
A1R48	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A1R49	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R6-F
A1R50	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A1R51	0757-0488	3	1	RESISTOR 909K 1% .125W F TC=0+-100	28480	0757-0488
A1R52	0699-0420	9	1	RESISTOR-FXD 99 +-1% 3W	28480	0699-0420
A1R53	0699-0423	2	1	RESISTOR-FXD 11G +-1% 1W	28480	0699-0423
A1R54	0699-0488	3	1	RESISTOR-FXD 100M +-.1% 1W	28480	0699-0488
A1R55	0698-6369	5	1	RESISTOR 1M .1% .25W F TC=0+-25	28480	0698-6369
A1R56	0698-6360	6	1	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A1R57	0698-1381	1	1	RESISTOR-FXD 100 +-.1% 1/2W	28480	0698-1381
A1R58	0698-3160	8		RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A1R59	0683-1025	9	3	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R60	0683-2235	5	6	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1R61	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R62	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1R63	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A1R64	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1R65	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1R66	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1R67	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A1S1	3101-2125	3	2	SWITCH-SL SPDT SUBMIN .3A 125VAC PC	28480	3101-2125
A1S2	3101-2125	3		SWITCH-SL SPDT SUBMIN .3A 125VAC PC	28480	3101-2125
A1T1	9100-0820	5	2	TRANSFORMER:PULSE	28480	9100-0820
A1T2	9100-0820	5		TRANSFORMER:PULSE	28480	9100-0820
A1T3	9100-0822	7	2	TRANSFORMER:PULSE(11307)	28480	9100-0822
A1T4	9100-0822	7		TRANSFORMER:PULSE(11307)	28480	9100-0822
A1U1	1826-0319	7	1	IC OP AMP TO-99	27014	LF356H
A1U2	1820-1112	8	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A1U3	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A1U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
	0410-0465	2	1	CRYSTAL-QUARTZ 4.00000 MHZ	28480	0410-0465
				MISCELLANEOUS PARTS		

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0340-0060	4	1	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	011-6809-00-0-200
	0340-0078	4	9	TERMINAL-STUD FKD-TUR PRESS-MTG	28480	0340-0078
	0380-0584	1	3	STANDOFF-RVT-ON .875-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-BZ SQ	28480	1251-0600
	1400-0249	0	1	CABLE TIE .062-.625-DIA .091-WD NYL	28480	1400-0249
	2200-0105	4	5	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0115	4	6	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0123	4	3	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0194	9	1	SCREW-MACH 6-32 .312-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
	8150-0447	6		WIRE 24AWG BK 300V PVC 7X32 80C	28480	8150-0447
	8150-0448	7		WIRE 24AWG BR 300V PVC 7X32 80C	28480	8150-0448
	8150-0449	8		WIRE 24AWG R 300V PVC 7X32 80C	28480	8150-0449
	8150-0450	1		WIRE 24AWG O 300V PVC 7X32 80C	28480	8150-0450
	8150-0451	2		WIRE 24AWG Y 300V PVC 7X32 80C	28480	8150-0451
	8150-0452	3		WIRE 24AWG G 300V PVC 7X32 80C	28480	8150-0452
	04140-00603	2	1	PLATE	28480	04140-00603
	04140-00604	3	1	SHIELD	28480	04140-00604
	04140-00605	4	1	SHIELD	28480	04140-00605
	04140-00606	5	1	COVER, SHIELD	28480	04140-00606
	04140-00607	6	1	PLATE	28480	04140-00607
	04140-01202	9	1	ANGLE	28480	04140-01202
	04140-01203	0	1	ANGLE	28480	04140-01203
	04140-20001	6	6	HOUSING	28480	04140-20001
	04140-21001	8	6	SCREW	28480	04140-21001
	04140-21002	9	1	BUSHING	28480	04140-21002
	04140-23001	2	3	SHAFT	28480	04140-23001
	04140-24001	4	1	SPACER	28480	04140-24001
	04140-26501	3	1	PC BOARD, BLANK-A1	28480	04140-26501
	04140-40003	0	1	INSULATOR	28480	04140-40003

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	04140-66502	8	1	A-D CONVERTER BOARD ASSEMBLY	28480	04140-66502
A2C1	0150-0121	5	2	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C2	0180-1083	3	3	CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A2C3	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C4	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A2C5	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A2C6	0160-5063	5	1	CAPACITOR-FXD .015uF +-10% 150WVDC POLYE	28480	0160-5063
A2C7	0140-0198	5	2	CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A2C8	0140-0198	5		CAPACITOR-FXD 200PF +-5% 300VDC MICA	72136	DM15F201J0300WV1CR
A2CR1	1901-0040	1	6	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	1902-3182	0	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	28480	1902-3182
A2CR5	1902-3136	4	1	DIODE-ZNR 8.06V 5% DO-7 PD=.4W TC=+.052%	28480	1902-3136
A2CR6	1902-0057	2	1	DIODE-ZNR 6.49V 5% DO-7 PD=.4W TC=+.029%	28480	1902-0057
A2CR7	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR8	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR9	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR10	1902-3171	8	2	DIODE-ZNR 11V 5% DO-7 PD=.4W TC=+.062%	28480	1902-3171
A2CR11	1902-3171	8		DIODE-ZNR 11V 5% DO-7 PD=.4W TC=+.062%	28480	1902-3171
A2IC1	1820-1486	9	2	IC GATE CMOS AND QUAD 2-INP	01928	CD40818F
A2IC5	1820-1486	9		IC GATE CMOS AND QUAD 2-INP	01928	CD40818F
A2IC11	1820-1746	4	1	IC BFR CMOS INV HEX	04713	MC14049UBCP
A2K1	0490-0240	9	1	RELAY-REED .1AMAX 50VMAX	28480	0490-0240
A2Q1	1854-0071	7	7	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q3	1854-0019	3	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A2Q4	1853-0354	7	3	TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A2Q5	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A2Q6	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A2Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A2Q8	1853-0354	7		TRANSISTOR PNP SI TO-92 PD=350MW	28480	1853-0354
A2Q9	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q10	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q11	1855-0093	5	1	TRANSISTOR J-FET N-CHAN D-MODE TO-18 SI	28480	1855-0093
A2Q12	1855-0081	1	3	TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A2Q13	1853-0020	4	2	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A2Q14	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q15	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A2Q16	1855-0081	1		TRANSISTOR J-FET N-CHAN D-MODE SI	01295	2N5245
A2Q17	1853-0020	4		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A2Q18	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q19	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2R1	0683-1535	6	12	RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R2	0683-3335	8	8	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R3	0683-3325	6	2	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R4	0683-2215	1	3	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A2R5	0683-2725	8	3	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R6	0683-4725	2	3	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R7	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A2R8	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R9	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R10	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A2R11	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A2R12	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A2R13	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A2R14	0683-1015	7	3	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R15	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R16	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A2R17	0683-5615	1	1	RESISTOR 560 5% .25W FC TC=-400/+600	01121	CB5615
A2R18	0683-1525	4	1	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A2R19	0683-1065	7	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A2R20	2100-3355	0	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
A2R21	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R22	0698-6360	6	3	RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A2R23	0698-7847	6	1	RESISTOR 1.111K .1% .125W F TC=0+-25	19701	MF4C1/8-T9-1111R-B
A2R24	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A2R25	0698-7681	6	1	RESISTOR 15.33K .1% .125W F TC=0+-50	19701	MF4C1/8-T2-15331-B
A2R26	0698-3458	7	1	RESISTOR 348K 1% .125W F TC=0+-100	28480	0698-3458
A2R27	0698-6360	6		RESISTOR 10K .1% .125W F TC=0+-25	28480	0698-6360
A2R28	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R29	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R30	0683-5625	3	2	RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R31	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R32	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R33	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R34	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R35	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R36	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R37	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R38	0683-4705	8	2	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R39	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A2R40	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R41	0683-1055	5	1	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A2R42	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R43	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R44	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R45	0683-1535	6		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A2R46	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A2R47	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R48	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A2R49	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
R50	0683-1045			100KΩ		
R51	0683-1045			100KΩ		
R52	0683-1045			100KΩ		
A2U2	1820-1956	8	4	IC LCH CMOS COM CLOCK QUAD	01928	CD40428E
A2U3	1820-1956	8		IC LCH CMOS COM CLOCK QUAD	01928	CD40428E
A2U4	1820-1962	6	2	IC DCDR CMOS BCD-TO-DEC	04713	MC140288CP
A2U6	1820-1956	8		IC LCH CMOS COM CLOCK QUAD	01928	CD40428E
A2U7	1820-1956	8		IC LCH CMOS COM CLOCK QUAD	01928	CD40428E
A2U8	1820-2008	3	1	IC SHF-RGTR CMOS D-M/S SERIAL-IN PRL-OUT	04713	MC140158CP
A2U9	1820-1963	7	1	IC FF CMOS D-TYPE POS-EDGE-TRIG DUAL	01928	CD40138AE
A2U10	1820-1962	6		IC DCDR CMOS BCD-TO-DEC	04713	MC140288CP
A2U12	1990-0444	6	4	OPTO-ISOLATOR LED-PDIO/X8TR IF=25MA-MAX	28480	6N136
A2U13	1990-0444	6		OPTO-ISOLATOR LED-PDIO/X8TR IF=25MA-MAX	28480	6N136
A2U14	1990-0444	6		OPTO-ISOLATOR LED-PDIO/X8TR IF=25MA-MAX	28480	6N136
A2U15	1990-0444	6		OPTO-ISOLATOR LED-PDIO/X8TR IF=25MA-MAX	28480	6N136
A2U16	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P	01295	SN72311P
A2U17	1826-0319	7	1	IC OP AMP TO-99	27014	LF356M
A2U18	1826-0326	6	1	IC OP AMP GP DUAL 8-DIP-P	07933	RC4558NB
A2U19	1813-0105	2	1	IC CONV 12-B-D/A 24-DIP-C	8E175	DAC80-CBI-V
				MISCELLANEOUS PARTS		
	1200-0541	1	1	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
	1251-0600	0	10	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-8Z SQ	28480	1251-0600
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0750	7	1	EXTR-PC BD RED POLYC .062-BD-THKNS	28480	4040-0750
	04140-26502	4	1	PC BOARD, BLANK-A2	28480	04140-26502
	6340-1244	4	1	INSULATOR	28480	6340-1244

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	04140-66513	1	1	MPU BOARD ASSEMBLY	28480	04140-66513
A3C1	0160-2055	9	9	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C9	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A3C10	0160-0134	1	2	CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A3C11	0150-0121	5	2	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A3C12	0160-2150	5	2	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A3C13	0160-0134	1		CAPACITOR-FXD 220PF +-5% 300VDC MICA	28480	0160-0134
A3C14	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A3C15	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A3C16	0180-0228	6	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A3C17	0180-1085	5	9	CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C18	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C19	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C20	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C21	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C22	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C23	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C24	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C25	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A3C26	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A3CR1	1901-0040	1	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR2	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR3	1901-0040	1		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3Q1	1853-0015	7	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q2	1854-0071	7	2	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q3	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A3Q4	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3R1	0683-4725	2	9	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R2	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R3	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R4	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R5	0683-2715	6	3	RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A3R6	0683-1005	5	2	RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R7	0683-1035	1	2	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3R8	0683-2205	9	2	RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R9	0683-3325	6	2	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A3R10	0683-1025	9	2	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A3R11	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R12	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A3R13	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R14	0683-2715	6		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A3R15	0683-1005	5		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A3R16	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3R17	0683-2205	9		RESISTOR 22 5% .25W FC TC=-400/+500	01121	CB2205
A3R18	0683-3325	6		RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A3R19	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A3R20	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R21	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R22	0683-4735	4	1	RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A3R23	0683-1245	5	1	RESISTOR 120K 5% .25W FC TC=-800/+900	01121	CB1245
A3R24	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A3R25	0683-3925	2	1	RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A3R26	0683-2225	3	1	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A3R30	1810-0279	5	1	NETWORK-RES 10-SIP4.7K OHM X 9	01121	210A472
A3U3	04140-85003	4	1	IC, P-ROM	28480	04140-85003
A3U4	04140-85004	5	1	IC, P-ROM	28480	04140-85004
A3U5	04140-85005	6	1	IC, P-ROM	28480	04140-85005
A3U6	04140-85006	7	1	IC, P-ROM	28480	04140-85006
A3U7	04140-85007	8	1	IC, P-ROM	28480	04140-85007
A3U8	04140-85008	9	1	IC, P-ROM	28480	04140-85008
A3U9	1820-2075	4	2	IC MISC TTL LS	01295	SN74LS245N
A3U10	1818-0438	4	2	IC NMOS 4K RAM STAT 450-NS 3-S	01295	TM84045-45JL
A3U11	1818-0438	4		IC NMOS 4K RAM STAT 450-NS 3-S	01295	TM84045-45JL
A3U12	1820-2024	3	2	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3U13	1820-1480	3	1	IC MICPROC NMOS 8-BIT	04713	MC6800L
A3U14	1820-2075	4		IC MISC TTL LS	01295	SN74LS245N
A3U15	1820-1568	8	2	IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A3U16	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A3U17	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
A3U18	1820-1975	1	1	IC SHF-RGTR TTL LS NEG-EDGE-TRIG PRL-IN	01295	SN74LS165N
A3U19	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U20	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A3U21	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A3U22	1820-1197	9	3	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3U23	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3U24	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A3U25	1820-1443	8	1	IC CNTR TTL LS BIN ASYNCHRO	01295	SN74LS293N
A3U26	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A3U27	1820-1199	1	3	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A3U28	1820-1568	8		IC BFR TTL LS BUS QUAD	01295	SN74LS125AN
A3U29	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A3U30	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A3U31	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
A3U32	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
				MISCELLANEOUS PARTS		
	1200-0608	1	1	SOCKET INTEGRATOR CIRCUIT	28480	1200-0608
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0751	8	1	EXTR-PC BD ORN POLYC .062-BD-THKNS	28480	4040-0751
	7120-7673	0	1	LABEL, IDNET -66513	28480	7120-7673
	04140-26503	5	1	PC BOARD, BLANK-A3	28480	04140-26503

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	04140-66504	0	1	I/O BOARD ASSEMBLY	28480	04140-66504
A4C1	0140-0192	0	1	CAPACITOR-FXD 68PF +-5% 300VDC MICA		
A4C2	0160-2199	2	1	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A4C3	0160-2055	9	6	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C6	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C7	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C8	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A4C9	0180-1085	5	11	CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C10	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C11	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C12	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C13	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C14	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C15	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C16	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C17	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C18	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C19	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A4C20	0160-2204			CAPACITOR-FXD 100pF 300VW		
A4CR1	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=.009%	28480	1902-0041
A4J1	1251-0541	8	1	CONNECTOR 34-PIN M RECTANGULAR	28480	1251-0541
A4R1	0683-4725	2	6	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R2	0683-5625	3	2	RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A4R3	0683-5625	3		RESISTOR 5.6K 5% .25W FC TC=-400/+700	01121	CB5625
A4R4	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R5	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R6	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R7	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R8	0683-4725	2		RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A4R9	0683-1825	7	1	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A4R10	0683-3325	6	1	RESISTOR 3.3K 5% .25W FC TC=-400/+700	01121	CB3325
A4R30	1810-0279	5	3	NETWORK-RES 10-8IP4.7K OHM X 9	01121	210A472
A4R31	1810-0279	5		NETWORK-RES 10-8IP4.7K OHM X 9	01121	210A472
A4R32	1810-0279	5		NETWORK-RES 10-8IP4.7K OHM X 9	01121	210A472
A4U1	1820-1204	9	1	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74L820N
A4U2	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74L800N
A4U3	1820-1416	5	4	IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74L814N
A4U4	1820-1144	6	2	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74L802N
A4U5	1820-1112	8	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A4U6	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A4U7	1820-1198	0	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74L803N
A4U8	1820-0628	9	3	IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A4U9	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A4U10	1820-0628	9		IC TTL 64-BIT RAM 60-NS 0-C	01295	SN7489N
A4U11	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74L814N
A4U12	1820-1470	1	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74L8157N
A4U13	1820-1443	8	4	IC CNTR TTL LS BIN ASYNCHRO	01295	SN74L8293N
A4U14	1820-1443	8		IC CNTR TTL LS BIN ASYNCHRO	01295	SN74L8293N
A4U15	1820-1443	8		IC CNTR TTL LS BIN ASYNCHRO	01295	SN74L8293N
A4U16	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A4U17	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A4U18	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A4U19	1820-1436	9	3	IC TTL LS 16-BIT RAM 45-NS 0-C	01295	SN74LS170N
A4U20	1820-1443	8		IC CNTR TTL LS BIN ASYNCHRO	01295	SN74L8293N
A4U21	1820-1245	8	1	IC DCDR TTL LS 2-TO-4-LINE DUAL 2-INP	01295	SN74LS155N
A4U22	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A4U23	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A4U24	1820-1217	4	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE	01295	SN74LS151N
A4U25	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A4U26	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A4U27	1820-1442	7	1	IC CNTR TTL LS DECD ASYNCHRO	01295	SN74LS290N
A4U28	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A4U29	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A4U30	1820-1436	9		IC TTL LS 16-BIT RAM 45-NS 0-C	01295	SN74LS170N
A4U31	1820-1436	9		IC TTL LS 16-BIT RAM 45-NS 0-C	01295	SN74LS170N
A4U32	1820-1196	8	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A4U33	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A4U34	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A4U35	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4U36	1820-1438	1	2	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
A4U37	1820-1438	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
A4U38	1820-1416	5		IC SCHMITT-TRIG TTL LS INV HEX 1-INP	01295	SN74LS14N
A4U39	1820-1144	6		IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A4U40	1820-1211	8	1	IC GATE TTL LS EXCL-OR QUAD 2-INP	01295	SN74LS86N
				MISCELLANEOUS PARTS		
	1251-0600	0	14	CONNECTOR-SGL CONT PIN 1.14-MM-SSC-SZ SD	28480	1251-0600
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0752	9	1	EXTR-PC BD YEL POLYC .062-BD-THKNS	28480	4040-0752
	04140-26504	6	1	PC BOARD, BLANK-A4	28480	04140-26504

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	04140-66505	1	1	DAC OUTPUT BOARD ASSEMBLY	28480	04140-66505
A5C1	0160-3456	6	4	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A5C2	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A5C3	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C4	0150-0121	5	6	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C5	0160-2204	0	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A5C6	0160-0127	2	4	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C7	0160-0137	4	2	CAPACITOR-FXD .33UF +-20% 25VDC CER	28480	0160-0137
A5C8	0160-2230	2	2	CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A5C9	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C10	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C13	0160-1676	8	2	CAPACITOR, FXD 1 MF 5% 100V	28480	0160-1676
A5C14	0160-2199	2	2	CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A5C15	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A5C16	0160-3456	6		CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A5C17	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C18	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C19	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A5C20	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C21	0160-0137	4		CAPACITOR-FXD .33UF +-20% 25VDC CER	28480	0160-0137
A5C22	0160-2230	2		CAPACITOR-FXD 3300PF +-5% 300VDC MICA	28480	0160-2230
A5C23	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A5C24	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A5C25	0160-2144	7	2	CAPACITOR-FXD 3300PF +80-20% 1KVDC CER	28480	0160-2144
A5C27	0160-1676	8		CAPACITOR, FXD 1 MF 5% 100V	28480	0160-1676
A5C28	0160-2199	2		CAPACITOR-FXD 30PF +-5% 300VDC MICA	28480	0160-2199
A5C29	0180-1083	3	3	CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A5C30	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A5C31	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C32	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C33	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C34	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A5C35	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A5C61	0160-2144	7		CAPACITOR-FXD 3300PF +80-20% 1KVDC CER	28480	0160-2144
A5CR1	1901-0025	2	14	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR2	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR3	1902-0049	2	2	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A5CR4	1902-3104	6	2	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A5CR7	5080-3064	4	4	DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	5080-3064
A5CR8	5080-3064	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	5080-3064
A5CR9	1902-3193	3	4	DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	28480	1902-3193
A5CR10	1902-3193	3		DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	28480	1902-3193
A5CR11	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR12	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR13	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR14	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR15	1902-0041	4	2	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=+.009%	28480	1902-0041
A5CR16	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR17	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR18	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR19	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A5CR20	1902-3104	6		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	28480	1902-3104
A5CR21	1901-0033	2	2	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR22	1901-0033	2		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A5CR23	5060-3064	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	5080-3064
A5CR24	5060-3064	4		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.06%	28480	5080-3064
A5CR25	1902-3193	3		DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	28480	1902-3193
A5CR26	1902-3193	3		DIODE-ZNR 13.3V 5% DO-7 PD=.4W TC=+.059%	28480	1902-3193
A5CR27	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR28	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR29	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR30	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR31	1902-0041	4		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=+.009%	28480	1902-0041
A5CR32	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5K1	0490-0191	9	8	COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8	6	SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189
A5K2	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189
A5K3	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189
A5K4	0490-0234	1	2	RELAY, REED	28480	0490-0234
A5K5	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8	2	SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A5K6	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5K7	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189
A5K8	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0189	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0189
A5K9	0490-0234	1		RELAY, REED	28480	0490-0234
A5K10	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A5Q1	1853-0336	5	6	TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q2	1854-0575	6	16	TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q3	1854-0232	2	2	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A5Q4	1853-0221	7	2	TRANSISTOR PNP 2N5416 SI TO-5 PD=1W	01928	2N5416
A5Q5	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q6	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q7	1855-0049	1	2	TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A5Q8	1853-0336	5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q9	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q10	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q11	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q12	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q13	1853-0015	7	2	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A5Q14	1853-0336	5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q15	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q16	1854-0092	2	2	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q17	1854-0071	7	4	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q18	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q19	1853-0281	9	2	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5Q20	1853-0336	5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q21	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q22	1854-0232	2		TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A5Q23	1853-0221	7		TRANSISTOR PNP 2N5416 SI TO-5 PD=1W	01928	2N5416
A5Q24	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q25	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q26	1855-0049	1		TRANSISTOR-JFET DUAL N-CHAN D-MODE SI	28480	1855-0049
A5Q27	1853-0336	5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q28	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q29	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q30	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q31	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q32	1853-0015	7		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A5Q33	1853-0336	5		TRANSISTOR PNP SI PD=625MW FT=50MHZ	04713	MPSA92
A5Q34	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A5Q35	1854-0092	2		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A5Q36	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q37	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q38	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A5R1	0683-1235	3	2	RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A5R2	0683-1225	1	2	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A5R3	0683-1015	7	4	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A5R4	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A5R5	0757-0465	6	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R6	0757-0442	9	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R7	0757-0424	7	2	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A5R8	0683-1035	1	5	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R9	0683-1055	5	4	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R10	0683-2735	0	2	RESISTOR 27K 5% .25W FC TC=-400/+800	01121	CB2735
A5R11	0683-2745	2	2	RESISTOR 270K 5% .25W FC TC=-800/+900	01121	CB2745
A5R12	0683-1025	9	15	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R13	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R14	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R15	0683-3935	4	2	RESISTOR 39K 5% .25W FC TC=-400/+800	01121	CB3935
A5R16	0683-2215	1	4	RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A5R17	0683-1545	8	4	RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A5R18	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R19	2100-0554	5	4	RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A5R20	0683-2235	5	8	RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R21	0683-5635	5	2	RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A5R22	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R23	0683-3345	0	2	RESISTOR 330K 5% .25W FC TC=-800/+900	01121	CB3345
A5R24	2100-0558	9	2	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A5R25	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R26	0683-3945	6	8	RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R27	0683-1545	8		RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A5R28	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R29	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R30	0683-5655	9	2	RESISTOR 5.6M 5% .25W FC TC=-900/+1100	01121	CB5655

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5R31	2100-0554	5		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A5R32	0698-6688	1	2	RESISTOR 99.8K .1% .125W F TC=0+-25	28480	0698-6688
A5R33	0698-6305	9	2	RESISTOR 900K .1% .25W F TC=0+-25	28480	0698-6305
A5R34	0683-1825	7	2	RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A5R35	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R36	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R37	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R38	0683-3335	8	2	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A5R39	0683-4735	4	2	RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A5R40	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R41	0683-3315	4	2	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A5R42	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A5R43	0683-1515	2	8	RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R44	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R45	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R46	0683-1235	3		RESISTOR 12K 5% .25W FC TC=-400/+800	01121	CB1235
A5R47	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A5R48	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A5R49	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A5R50	0757-0465	6		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R51	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R52	0757-0424	7		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A5R53	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R54	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R55	0683-2735	0		RESISTOR 27K 5% .25W FC TC=-400/+800	01121	CB2735
A5R56	0683-2745	2		RESISTOR 270K 5% .25W FC TC=-800/+900	01121	CB2745
A5R57	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R58	0683-1055	5		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R59	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R60	0683-3935	4		RESISTOR 39K 5% .25W FC TC=-400/+800	01121	CB3935
A5R61	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A5R62	0683-1545	8		RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A5R63	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R64	2100-0554	5		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A5R65	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R66	0683-5635	5		RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A5R67	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R68	0683-3345	0		RESISTOR 330K 5% .25W FC TC=-800/+900	01121	CB3345
A5R69	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A5R70	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R71	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R72	0683-1545	8		RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A5R73	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R74	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R75	0683-5655	9		RESISTOR 5.6M 5% .25W FC TC=-900/+1100	01121	CB5655
A5R76	2100-0554	5		RESISTOR-TRMR 500 10% C TOP-ADJ 1-TRN	28480	2100-0554
A5R77	0698-6688	1		RESISTOR 99.8K .1% .125W F TC=0+-25	28480	0698-6688
A5R78	0698-6305	9		RESISTOR 900K .1% .25W F TC=0+-25	28480	0698-6305
A5R79	0683-1825	7		RESISTOR 1.8K 5% .25W FC TC=-400/+700	01121	CB1825
A5R80	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R81	0683-3945	6		RESISTOR 390K 5% .25W FC TC=-800/+900	01121	CB3945
A5R82	0683-2235	5		RESISTOR 22K 5% .25W FC TC=-400/+800	01121	CB2235
A5R83	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A5R84	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A5R85	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R86	0683-3315	4		RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A5R87	0683-2215	1		RESISTOR 220 5% .25W FC TC=-400/+600	01121	CB2215
A5R88	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R89	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R90	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R91	2100-3214	0	1	RESISTOR-TRMR 100K 10% C TOP-ADJ 1-TRN	28480	2100-3214
A5R92	0683-2265	1	1	RESISTOR 22M 5% .25W FC TC=-900/+1200	01121	CB2265
A5R93	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A5R94	2100-3212	8	1	RESISTOR-TRMR 200 10% C TOP-ADJ 1-TRN	28480	2100-3212
A5R95	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R96	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R97	0683-1515	2		RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A5R98	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R99	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R100	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R101	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R102	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R103	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R104	0683-1025	9		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5U1	5080-3061	4	2	OP AMP, 100PA MAX	28480	5080-3061
A5U2	5080-3061	4		OP AMP, 100PA MAX	28480	5080-3061
A5U3	1813-0105	2	1	IC CONV 12-B-D/A 24-DIP-C	8E175	DAC80-CBI-V
A5U4	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A5U5	1820-0471	0	2	IC INV TTL HEX 1-INP	01295	SN7406N
A5U6	1820-0471	0		IC INV TTL HEX 1-INP	01295	SN7406N
A5U7	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A5U8	1820-1374	4	2	IC SWITCH ANLG QUAD 16-DIP-P	24355	AD7510DIJN
A5U9	1820-1374	4		IC SWITCH ANLG QUAD 16-DIP-P	24355	AD7510DIJN
				MISCELLANEOUS PARTS		
	0340-0060	4	2	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	011-6809-00-0-200
	1200-0541	1	1	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
	1205-0095	6	4	HEAT SINK	28480	1205-0095
	1250-0835	1	2	CONNECTOR-RF SMC M PC 50-OHM	28480	1250-0835
	1251-0600	0	13	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	04140-26505	7	1	PC BOARD, BLANK-A5	28480	04140-26505
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0753	0	1	EXTR-PC BD GRN POLYC .062-BD-THKNS	28480	4040-0753

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	04140-66506	2	1	RAMP GENERATOR BOARD ASSEMBLY	28480	04140-66506
A6C1	0180-1085	5	1	CAPACITOR-FXD 33pF -10+75% 25WVDC	28480	0180-1085
A6C2	0150-0121	5	1	CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A6C3	0160-2150	5	5	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A6C4	0160-0127	2	2	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C5	0160-3456	6	1	CAPACITOR-FXD 1000PF +-10% 1KVDC CER	28480	0160-3456
A6C6	0160-0889	3	1	CAPACITOR-FXD .33UF +-10% 80VDC POLYE	28480	0160-0889
A6C7	0160-1673	5	1	CAPACITOR-FXD .33uF +-.5% 50WVDC POLYE	28480	0160-1673
A6C8	0160-1676	8	1	CAPACITOR, FXD 1 MF 5% 100V	28480	0160-1676
A6C9	0160-1103	6	1	C-F 500P 35V K	28480	0160-1103
A6C10	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A6C11	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A6C12	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A6C13	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A6C14	0180-1066	2	6	CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6C15	0180-1066	2		CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6C16	0180-1066	2		CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6C17	0180-1066	2		CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6C18	0160-1548	3	3	C:FXD MY 0.22 UF 10% 100VDCW	28480	0160-1548
A6C19	0160-1548	3		C:FXD MY 0.22 UF 10% 100VDCW	28480	0160-1548
A6C20	0160-1548	3		C:FXD MY 0.22 UF 10% 100VDCW	28480	0160-1548
A6C21	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A6C22	0180-1066	2		CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6C23	0180-1066	2		CAPACITOR, FXD 47 MF AL	28480	0180-1066
A6CR1	1902-3205	8	1	DIODE-ZNR 15V 5% DO-7 PD=.4W TC=+.057%	28480	1902-3205
A6CR2	1901-0025	2	5	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR4	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR5	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR6	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A6CR7	1902-0049	2	4	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A6CR8	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A6CR9	1902-3129	5	2	DIODE-ZNR 7.5V 2% DO-7 PD=.4W TC=+.05%	28480	1902-3129
A6CR10	1902-3129	5		DIODE-ZNR 7.5V 2% DO-7 PD=.4W TC=+.05%	28480	1902-3129
A6CR11	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A6CR12	1902-0049	2		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	28480	1902-0049
A6K1	0490-0191	9	5	COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8	5	SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A6K2	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A6K3	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A6K4	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A6K5	0490-0191	9		COIL-REED RELAY MAG REED; 12 VDC; 6300	28480	0490-0191
	0490-0801	8		SWITCH-REED 1A DRY 1A 300V 35-AT	28480	0490-0801
A6Q1	1853-0281	9	3	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q2	1854-0477	7	3	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q3	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q4	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6Q5	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A6Q6	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A6R1	0683-1035	1	9	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R2	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R3	0683-1045	3	1	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A6R4	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R5	0683-3335	8	1	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A6R6	0683-1025	9	1	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A6R7	0683-2725	8	2	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A6R8	0683-4755	8	2	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A6R9	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R10	0683-2725	8		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A6R11	2100-3207	1	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	28480	2100-3207
A6R12	2100-3353	8	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A6R13	2100-3349	2	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	28480	2100-3349
A6R14	0683-1225	1	5	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A6R15	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A6R16	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A6R17	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A6R18	0683-1225	1		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A6R19	0683-4705	8	1	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A6R20	0683-1015	7	2	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6R21	0683-1065	7	1	RESISTOR 10M 5% .25W FC TC=-900/+1100	01121	CB1065
A6R22	0683-4755	8		RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A6R23	0699-0421	0	1	R-FXD 20.8M 1%	28480	0699-0421
A6R24	0683-4715	0	2	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R25	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R26	0683-1015	7		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A6R27	0699-0422	1	1	RESISTOR-FXD 100 +-5% .25W	28480	0699-0422
A6R28	0698-3488	3	1	RESISTOR 442 1% .125W F TC=0+-100	24546	C4-1/8-T0-422R-F
A6R29	0757-0428	1	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A6R30	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R31	0683-5635	5	2	RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A6R32	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R33	0683-4735	4	2	RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R34	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R35	0683-5635	5		RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A6R36	0683-1035	1		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A6R37	0683-4735	4		RESISTOR 47K 5% .25W FC TC=-400/+800	01121	CB4735
A6R38	0683-2225	3	4	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R39	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R40	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R41	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A6R42	0698-3260	9	3	RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R43	0683-4715	0		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A6R44	0683-3305	2	1	RESISTOR 33 5% .25W FC TC=-400/+500	01121	CB3305
A6R45	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6R46	0698-3260	9		RESISTOR 464K 1% .125W F TC=0+-100	28480	0698-3260
A6U1	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N
A6U2	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P	01295	SN72311P
A6U3	1826-0319	7	2	IC OP AMP TO-99	27014	LF356H
A6U4	1826-0319	7		IC OP AMP TO-99	27014	LF356H
A6U5	5080-3065	5	1	IC-LINEAR OP-AMP Vos=30MVmax Ig=1pAmax	28480	5080-3065
A6U6	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A6U7	1820-1958	0	1	IC SWITCH ANLG QUAD 14-DIP-P	01928	CD4016BE
				MISCELLANEOUS PARTS		
	0340-0060	4	3	TERMINAL-STUD SPCL-FDTHRU PRESS-MTG	98291	011-6809-00-0-200
	0340-0078	4	5	TERMINAL-STUD FKD-TUR PRESS-MTG	28480	0340-0078
	0360-1819	5	5	TERMINAL-STUD FKD-TUR SWGFRM-MTG	71279	1025-2
	1200-0474	9	1	SOCKET-IC 14-CONT DIP-SLDR	28480	1200-0474
	1251-0600	0	12	CONNECTOR-SGL CONT PIN 1.14-MM-88C-SZ SQ	28480	1251-0600
	1400-0493	6	1	CABLE TIE .062-1.25-DIA .14-WD NYL	28480	1400-0493
	1480-0116	8	2	PIN-GRV .062-IN-DIA .25-IN-LG STL	28480	1480-0116
	2200-0105	4	4	SCREW-MACH 4-40 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0754	1	1	EXTR-PC BD BLU POLYC .062-BD-THKNS	28480	4040-0754
	7174-0215	5	12	FUSE .5A 250V	28480	7174-0215
	04140-00608	7	1	PLATE, SHIELD	28480	04140-00608
	04140-26506	8	1	PC BOARD, BLANK-A6	28480	04140-26506

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7	04140-66507	3	1	DC POWER SUPPLY BOARD ASSEMBLY	28480	04140-66507
A7C1	0160-0362	7	4	CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-0362
A7C2	0160-0362	7		CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-0362
A7C3	0160-0362	7		CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-0362
A7C4	0160-0362	7		CAPACITOR-FXD 510PF +-5% 300VDC MICA	28480	0160-0362
A7C5	0180-1056	0	4	CAPACITOR-FXD 1000 UF 25VDC AL ELECT	28480	0180-1056
A7C6	0180-1056	0		CAPACITOR-FXD 1000 UF 25VDC AL ELECT	28480	0180-1056
A7C7	0180-1056	0		CAPACITOR-FXD 1000 UF 25VDC AL ELECT	28480	0180-1056
A7C8	0180-3003	1	4	CAPACITOR-FXD 33uF -10+100% 250VDC	28480	0180-3003
A7C9	0180-3003	1		CAPACITOR-FXD 33uF -10+100% 250VDC	28480	0180-3003
A7C10	0180-0094	4	4	CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A7C11	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A7C12	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A7C13	0180-0094	4		CAPACITOR-FXD 100UF+75-10% 25VDC AL	56289	30D107G025DD2
A7C14	0180-3003	1		CAPACITOR-FXD 33uF -10+100% 250VDC	28480	0180-3003
A7C15	0180-3003	1		CAPACITOR-FXD 33uF -10+100% 250VDC	28480	0180-3003
A7C16	0160-0166	9	2	CAPACITOR-FXD .068UF +-10% 200VDC POLYE	28480	0160-0166
A7C17	0160-0166	9		CAPACITOR-FXD .068UF +-10% 200VDC POLYE	28480	0160-0166
A7C18	0180-1057	1	1	CAPACITOR-FXD 2200 UF 16VDCW AL ELECT	28480	0180-1057
A7C19	0160-0159	0	1	CAPACITOR-FXD 6800PF +-10% 200VDC POLYE	28480	0160-0159
A7C20	0180-1056	0		CAPACITOR-FXD 1000 UF 25VDC AL ELECT	28480	0180-1056
A7CR1	1902-3346	8	2	DIODE-ZNR 51.1V 2% DO-7 PD=.4W TC=+.081%	28480	1902-3346
A7CR2	1902-3346	8		DIODE-ZNR 51.1V 2% DO-7 PD=.4W TC=+.081%	28480	1902-3346
A7CR3	1902-3234	3	2	DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A7CR4	1902-1292	9	4	DIODE-ZNR 1N53728 62V 5% PD=5W IR=500NA	04713	1N53728
A7CR5	1902-1292	9		DIODE-ZNR 1N53728 62V 5% PD=5W IR=500NA	04713	1N53728
A7CR6	1902-3234	3		DIODE-ZNR 19.6V 5% DO-7 PD=.4W TC=+.073%	28480	1902-3234
A7CR7	1902-1292	9		DIODE-ZNR 1N53728 62V 5% PD=5W IR=500NA	04713	1N53728
A7CR8	1902-1292	9		DIODE-ZNR 1N53728 62V 5% PD=5W IR=500NA	04713	1N53728
A7CR9	1902-3094	3	1	DIODE-ZNR 5.11V 2% DO-7 PD=.4W TC=-.009%	28480	1902-3094
A7CR10	1901-0237	8	4	DIODE-SI, RECTIFIER BRIDGE, 200V	28480	1901-0237
A7CR11	1901-0237	8		DIODE-SI, RECTIFIER BRIDGE, 200V	28480	1901-0237
A7CR12	1901-0237	8		DIODE-SI, RECTIFIER BRIDGE, 200V	28480	1901-0237
A7CR13	1901-0237	8		DIODE-SI, RECTIFIER BRIDGE, 200V	28480	1901-0237
A7CR14	1901-0028	5	8	DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR15	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR16	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR17	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR18	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR19	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR20	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR21	1901-0028	5		DIODE-PWR RECT 400V 750MA DO-29	28480	1901-0028
A7CR22	1902-0040	3	2	DIODE-ZNR 14V 5% DO-7 PD=.4W TC=+.056%	28480	1902-0040
A7CR23	1902-0040	3		DIODE-ZNR 14V 5% DO-7 PD=.4W TC=+.056%	28480	1902-0040
A7CR24	1902-1217	8	1	DIODE-ZNR 6.2V 5% DO-4 PD=10W TC=+.035%	28480	1902-1217
A7F1	2110-0107	5	4	FUSE .5A 250V	28480	2110-0107
A7F2	2110-0107	5		FUSE .5A 250V	28480	2110-0107
A7F3	2110-0422	7	1	FUSE 6.25A 250V SLO-BLO 1.25X.25 UL IEC	28480	2110-0422
A7F4	2110-0107	5		FUSE .5A 250V	28480	2110-0107
A7F5	2110-0107	5		FUSE .5A 250V	28480	2110-0107
A7F6	2110-0201	0	2	FUSE .25A 250V SLO-BLO 1.25X.25 UL	75915	313.250
A7F7	2110-0201	0		FUSE .25A 250V SLO-BLO 1.25X.25 UL	75915	313.250
A7Q1	1854-0389	0	5	TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A7Q2	1854-0389	0		TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A7Q3	1854-0389	0		TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A7Q4	1854-0389	0		TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A7Q5	1854-0389	0		TRANSISTOR NPN 2N4922 SI PD=30W FT=3MHZ	04713	2N4922
A7Q6	1854-0330	1	2	TRANSISTOR NPN SI PD=21W FT=10MHZ	28480	1854-0330
A7Q7	1854-0330	1		TRANSISTOR NPN SI PD=21W FT=10MHZ	28480	1854-0330
A7Q8	1854-0575	6	2	TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A7Q9	1854-0232	2	4	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A7Q10	1854-0232	2		TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A7Q11	1854-0575	6		TRANSISTOR NPN SI PD=625MW FT=50MHZ	04713	MPS-A42
A7Q12	1854-0232	2		TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A7Q13	1854-0232	2		TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0232
A7R1	2100-3352	7	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A7R2	2100-3352	7		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	28480	2100-3352
A7R3	0811-1670	3	4	RESISTOR 2.2 5% 2W PW TC=0+-400	75042	BWH2-2R2-J
A7R4	0811-1670	3		RESISTOR 2.2 5% 2W PW TC=0+-400	75042	BWH2-2R2-J
A7R5	0811-1670	3		RESISTOR 2.2 5% 2W PW TC=0+-400	75042	BWH2-2R2-J

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7R6	0811-1670	3		RESISTOR 2.2 5% 2W PW TC=0+-400	75042	BWH2-2R2-J
A7R7	0757-0438	3	4	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R8	0757-0200	7	2	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R10	0698-3155	1	2	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A7R11	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R12	0698-3155	1		RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A7R13	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R14	0757-0200	7		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R15	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A7R16	0757-0461	2	2	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A7R17	0683-3335	8	2	RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A7R18	0683-5635	5	2	RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A7R19	0686-1505	6	2	RESISTOR 15 5% .5W CC TC=0+412	01121	EB1505
A7R20	0764-0012	4	2	RESISTOR 6.8K 5% 2W MO TC=0+-200	28480	0764-0012
A7R21	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A7R22	0686-1505	6		RESISTOR 15 5% .5W CC TC=0+412	01121	EB1505
A7R23	0764-0012	4		RESISTOR 6.8K 5% 2W MO TC=0+-200	28480	0764-0012
A7R24	0683-5635	5		RESISTOR 56K 5% .25W FC TC=-400/+800	01121	CB5635
A7R25	0683-3335	8		RESISTOR 33K 5% .25W FC TC=-400/+800	01121	CB3335
A7R28	0683-4725	2	1	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A7R29	0683-2225	3	3	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A7R30	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A7R31	0683-2225	3		RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A7R32	0698-4497	6	1	RESISTOR 48.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4872-F
A7R33	0811-2490	7	1	RESISTOR .1 3% 5W PW TC=0+-50	28480	0811-2490
A7U1	1820-0196	6	5	IC 723 V RGLTR TO-100	04713	MC1723CG
A7U2	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
A7U3	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
A7U4	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
A7U5	1826-0065	0	1	IC COMPARATOR PRCN 8-DIP-P	01295	SN72311P
A7U6	1820-0196	6		IC 723 V RGLTR TO-100	04713	MC1723CG
				MISCELLANEOUS PARTS		
	1251-0600	0	9	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
	2110-0269	0	14	FUSEHOLDER-CLIP TYPE.25D-FUSE	28480	2110-0269
	2200-0107	6	8	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2260-0009	3	8	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	2740-0003	5	1	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
	3050-0239	2	1	WASHER-FLAT	28480	3050-0239
	3050-0250	2	7	WASHER-FL NM NO. 4 .13-IN-ID .5-IN-OD	28480	3050-0250
	4040-0748	3	1	EXTR-PC BD BLK POLYC .062-BD-THKNS	28480	4040-0748
	4040-0755	2	1	EXTR-PC BD VIO POLYC .062-BD-THKNS	28480	4040-0755
	04140-01204	1	1	HEAT SINK	28480	04140-01204
	04140-26507	9	1	PC BOARD, BLANK-A7	28480	04140-26507
	8159-0005	0	1	WIRE 22AWG W PVC 1X22 80C	28480	8159-0005

See introduction to this section for ordering information
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Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8	04140-66508	4	1	KEY & DISPLAY BOARD ASSEMBLY	28480	04140-66508
A8C1	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C4	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A8C5	0180-1051	5	1	CAPACITOR, FXD 100 UF 16V M	28480	0180-1051
A8C6	0180-1743	2	1	CAPACITOR-FXD .1UF+-10% 35VDC TA	56289	150D104X9035A2
A8D81	1990-0487	7	38	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D82	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D83	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D84	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D85	1990-0486	6	1	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A8D86	1990-0681	3	2	DISPLAY-AN-SEG 1-CHAR .408-H RED	28480	5082-7656
A8D87	1990-0540	3	6	DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D88	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D89	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D810	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D811	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D812	1990-0649	3	1	DISPLAY-NUM-SEG	28480	5082-7616
A8D813	1990-0531	2	1	DISPLAY-NUM-SEG 1-CHAR .3-H	28480	5082-7610
A8D814	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D815	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D816	1990-0681	3		DISPLAY-AN-SEG 1-CHAR .408-H RED	28480	5082-7656
A8D817	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D818	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D819	1990-0540	3		DISPLAY-NUM-SEG 1-CHAR .43-H	28480	5082-7650
A8D820	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D821	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D822	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D823	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D824	1990-0517	4	1	LED-VISIBLE LUM-INT=3MCD IF=20MA-MAX	28480	5082-4655
A8D825	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D826	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D827	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D828	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D829	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D830	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D831	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D832	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D833	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D834	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D835	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D836	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D837	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D838	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D839	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D840	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D841	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D842	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D843	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D844	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D845	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D846	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D847	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D848	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D849	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8D850	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A8Q1	1854-0071	7	12	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q2	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q3	1853-0318	3	16	TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q4	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q5	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q6	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q7	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q8	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q9	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q10	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q11	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q12	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q13	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q14	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562
A8Q15	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MPS6562

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8Q16	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MP86562
A8Q17	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MP86562
A8Q18	1853-0318	3		TRANSISTOR PNP SI PD=500MW FT=60MHZ	04713	MP86562
A8Q19	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q20	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q21	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q22	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q23	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q24	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q25	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q26	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q27	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8Q28	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8R1	0683-4705	8	12	RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R2	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R3	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R4	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R5	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R6	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R7	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R8	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R9	0683-3315	4	1	RESISTOR 330 5% .25W FC TC=-400/+600	01121	CB3315
A8R10	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R11	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R12	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R13	0683-4705	8		RESISTOR 47 5% .25W FC TC=-400/+500	01121	CB4705
A8R14	0683-4725	2	1	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A8R15	0683-1045	3	1	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A8R30	1810-0275	1	3	NETWORK-RES 10-SIP1.0K OHM X 9	01121	210A102
A8R31	1810-0283	1	2	NETWORK-RES 16-DIP270.0 OHM X 8	28480	1810-0283
A8R32	1810-0283	1		NETWORK-RES 16-DIP270.0 OHM X 8	28480	1810-0283
A8R33	1810-0275	1		NETWORK-RES 10-SIP1.0K OHM X 9	01121	210A102
A8R34	1810-0275	1		NETWORK-RES 10-SIP1.0K OHM X 9	01121	210A102
A8S1	5060-9436	7	46	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0408	5	1	KEY CAP	28480	5041-0408
A8S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0375	5	1	KEY CAP, QUARTER, SMK-RES DIP	28480	5041-0375
A8S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0384	6	5	KEY CAP, QUARTER, SMOKE GRAY	28480	5041-0384
A8S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8	8	KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0384	6		KEY CAP, QUARTER, SMOKE GRAY	28480	5041-0384
A8S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6	6	KEY CAP	28480	5041-0318
A8S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6		KEY CAP	28480	5041-0318
A8S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6		KEY CAP	28480	5041-0318
A8S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6		KEY CAP	28480	5041-0318
A8S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6		KEY CAP	28480	5041-0318
A8S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0318	6		KEY CAP	28480	5041-0318
A8S15	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0384	6		KEY CAP, QUARTER, SMOKE GRAY	28480	5041-0384
A8S16	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0384	6		KEY CAP, QUARTER, SMOKE GRAY	28480	5041-0384
A8S17	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0384	6		KEY CAP, QUARTER, SMOKE GRAY	28480	5041-0384
A8S18	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S19	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S20	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5	10	KEY CAP	28480	5041-0309
A8S21	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A8S22	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1763	7	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1763
A8S23	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1764	8	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1764
A8S24	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1762	6	2	KEY CAP, QUARTER, EBY PEARL	28480	5041-1762
A8S25	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S26	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0474	5	1	KEY CAP, QUARTER, BSC	28480	5041-0474
A8S27	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S28	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S29	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1760	4	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1760
A8S30	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1761	5	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1761
A8S31	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1762	6		KEY CAP, QUARTER, EBY PEARL	28480	5041-1762
A8S32	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0285	6	1	KEY CAP, QUARTER, LITE PEARL	28480	5041-0285
A8S33	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S34	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S35	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1757	9	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1757
A8S36	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1758	0	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1758
A8S37	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1759	1	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1759
A8S38	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S39	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0922	8		KEY CAP, QUARTER, EBY PEARL	28480	5041-0922
A8S40	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S41	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8S42	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1756	8	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1756
A8S43	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1755	7	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1755
A8S44	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-1770	6	1	KEY CAP, QUARTER, EBY PEARL	28480	5041-1770
A8S45	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0441	6	1	KEY CAP, QUARTER, SKY BLUE	28480	5041-0441
A8S46	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
	5041-0309	5		KEY CAP	28480	5041-0309
A8U1	1820-0495	8	1	IC DCDR TTL 4-TO-16-LINE 4-INP	01295	SN74154N
A8U2	1820-1443	8	1	IC CNTR TTL LS BIN ASYNCHRO	01295	SN74LS293N
A8U3	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A8U4	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A8U5	1820-1473	4	1	IC ENCDR TTL 8-INP	01295	SN74148N
A8U6	1820-1423	4	1	IC MV TTL LS MONOSTBL RETRIG DUAL	01295	SN74LS123N
A8W1	04140-61604	1	1	CABLE ASSEMBLY	28480	04140-61604
	0360-1901	6	1	CABLE, TRANSITION	28480	0360-1901
				MISCELLANEOUS PARTS		
	1251-1998	1	2	CONNECTOR-SGL CONT SKT .025-IN-BSC-SZ	28480	1251-1998
	04140-26508	0	1	PC BOARD, BLANK-A8	28480	04140-26508
	04140-40002	9	3	INSULATOR	28480	04140-40002
	04274-40003	1	5	INSULATOR	28480	04274-40003
	04262-25003	5	1	INSULATOR	28480	04262-25003

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A9	04140-66509	5	1	MOTHER BOARD ASSEMBLY	28480	04140-66509
	1251-2034	8	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	28480	1251-2034
	1251-3197	6	1	CONNECTOR 12-PIN M POST TYPE	28480	1251-3197
	1251-3198	7	1	CONNECTOR 15-PIN M POST TYPE	28480	1251-3198
	1251-5564	5	9	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	28480	1251-5564
	04140-26509	1	1	PC BOARD, BLANK-A9	28480	04140-26509
	04140-40001	8	4	GUIDE	28480	04140-40001

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A21	04140-66521	1	1	HP-IB BOARD ASSEMBLY (OPTION 101 ONLY)	28480	04140-66521
A21C1	0180-1085	5	3	CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A21C2	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A21C3	0180-1085	5		CAPACITOR-FXD 4.7uF +-20% 16WVDC SOLID TANTALUM	28480	0180-1085
A21J1	1200-0485	2	1	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0485
A21J3	1251-3283	1	1	CONNECTOR 24-PIN F MICRORIBBON	28480	1251-3283
A21J4	1200-0608	1	1	SOCKET INTEGRATOR CIRCUIT	28480	1200-0608
A21R1	1810-0275	1	1	NETWORK-RES 10-SIP1.0K OHM X 9	01121	210A102
A2181	3101-1973	7	1	SWITCH-SL 7-1A DIP-SLIDE-ASSY .1A 50VDC	28480	3101-1973
A21U1	1820-1759	9	1	IC BFR TTL LS NON-INV OCTL	27014	DM81L897N
A21U2	1820-1199	1	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A21U3	1820-2113	1	1	IC MICPROC-ACCESS NMOS	04713	MC68488L
A21U4	1820-2058	3	4	IC MISC TTL S QUAD	28480	1820-2058
A21U5	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
A21U6	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
A21U7	1820-2058	3		IC MISC TTL S QUAD	28480	1820-2058
				MISCELLANEOUS PARTS		
	0361-0079	9	2	RIVET-SEMITUBULAR	28480	0361-0079
	0380-0643	3	2	STANDOFF-HEX .255-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	1530-1098	4	2	CLEVIS 0.070-IN W SLT: 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
	2190-0017	4	2	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
	04140-00610	1	1	PLATE, OPTION 101	28480	04140-00610
	04140-26521	7	1	PC BOARD, BLANK-A21	28480	04140-26521
	8159-0005	0	1	WIRE 22AWG W PVC 1X22 80C	28480	8159-0005

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31	04140-66531	3	1	ANALOG OUTPUT CONTROL BOARD ASSEMBLY (OPTION 001 ONLY)	28480	04140-66531
A31C1	0160-2055	9	4	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A31C2	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A31C3	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A31C4	0140-0196	3	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J0300WV1CR
A31C5	0160-2055	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2055
A31J1	1251-1959	4	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-1959
A31J2	1251-4695	1	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-4695
A31J3	1251-0600	0	6	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A31R1	0683-1035	1	1	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A31R2	0683-4755	8	1	RESISTOR 4.7M 5% .25W FC TC=-900/+1100	01121	CB4755
A31R3	0698-3438	3	1	RESISTOR 147 1% .125W F TC=0+-100	24546	C4-1/8-T0-147R-F
A31R4	2100-3355	0	1	RESISTOR-TRMR 100K 10% C SIDE-ADJ 1-TRN	28480	2100-3355
A31R5	2100-3350	5	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	28480	2100-3350
A31U1	1820-1201	6	1	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A31U2	1820-1195	7	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A31U3	1820-1112	8	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A31U4	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A31U5	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A31U6	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A31U7	1820-1195	7		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A31U8	1820-1438	1	3	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
A31U9	1813-0105	2	1	IC CONV 12-B-D/A 24-DIP-C	8E175	DAC80-CBI-V
A31U10	1820-1730	6	2	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A31U11	1820-1730	6		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS273N
A31U12	1820-1438	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
A31U13	1820-1438	1		IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS257AN
				MISCELLANEOUS PARTS		
	0361-0079	9	2	RIVET-SEMITUBULAR	28480	0361-0079
	1200-0541	1	1	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
	1530-1098	4	2	CLEVIS 0.070-IN W SLT; 0.454-IN PIN CTR	00000	ORDER BY DESCRIPTION
	04140-26531	9	1	PC BOARD, BLANK-A31	28480	04140-26531
	5020-3742	2	1	BOARD, BLANK (STANDARD B)	28480	5020-3742

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A32	04140-66532	4	1	ANALOG OUTPUT BOARD ASSEMBLY (OPTION 001 ONLY)	28480	04140-66532
A32C1	0160-0153	4	2	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A32C2	0160-1548	3	2	CAPACITOR-FXD MY 0.22 UF 10% 100VDCW	28480	0160-1548
A32C3	0160-1603	1	2	CAPACITOR-FXD MY 1 UF 10% 100VDCW	28480	0160-1603
A32C4	0160-0127	2	2	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A32C5	0160-0127	2		CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A32C6	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A32C7	0160-1548	3		CAPACITOR-FXD MY 0.22 UF 10% 100VDCW	28480	0160-1548
A32C8	0160-1603	1		CAPACITOR-FXD MY 1 UF 10% 100VDCW	28480	0160-1603
A32C9	0180-1083	3	2	CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A32C10	0180-1083	3		CAPACITOR-FXD 33uF -10+75% 25WVDC	28480	0180-1083
A32R1	0683-1055	5	2	RESISTOR 1M 5% .25W FC TC=800/+900	01121	CB1055
A32R2	0683-1025	9	2	RESISTOR 1K 5% .25W FC TC=400/+600	01121	CB1025
A32R3	0683-1055	5		RESISTOR 1M 5% .25W FC TC=800/+900	01121	CB1055
A32R4	0683-1025	9		RESISTOR 1K 5% .25W FC TC=400/+600	01121	CB1025
A32R5	2100-3353	8	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-203
A32R6	0698-3491	8	1	RESISTOR 1K .1% .125W F TC=0+-50	28480	0698-3491
A32R7	0698-5454	7	1	RESISTOR 9K .1% .125W F TC=0+-50	28480	0698-5454
A3281	3101-1951	1	1	SWITCH-SL DP3T MINTR .5A 125VAC/DC PC	28480	3101-1951
A32U1	1826-0319	7	3	IC OP AMP TO-99	27014	LF356H
A32U2	1826-0319	7		IC OP AMP TO-99	27014	LF356H
A32U3	1820-1374	4	1	IC SWITCH ANLG QUAD 16-DIP-P	24355	AD7510DIJN
A32U4	1826-0319	7		IC OP AMP TO-99	27014	LF356H
				MISCELLANEOUS PARTS		
	0380-0111	0	3	STANDOFF-RVT-ON .25-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-MM-BBC-BZ BQ	28480	1251-0600
	1251-3361	6	1	CONNECTOR 10-PIN F POST TYPE	28480	1251-3361
	04140-26532	0	1	PC BOARD, BLANK-A32	28480	04140-26532
	5020-3742	2	1	BOARD, BLANK (STANDARD B)	28480	5020-3742

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

Table 6-3. Replaceable Parts (Cont'd).

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A31	04140-66531	3		ANALOG OUTPUT CONTROL BOARD ASSEMBLY	28480	04140-66531
A32	04140-66532	4		ANALOG OUTPUT BOARD ASSEMBLY	28480	04140-66532
				MISCELLANEOUS PARTS		
	0361-0079	9	2	RIVET-SEMITUBULAR	28480	0361-0079
	0510-0741	9	2	BRACKET-RTANG .344-LG X .407-LG .312-WD	28480	0510-0741
	1250-0083	1	3	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	28480	1250-0083
	2190-0016	3	3	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
	2360-0115	4	7	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	2950-0001	8	3	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
	8150-0456	7	3	WIRE 24AWG W 300V PVC 7X32 80C	28480	8150-0456
	04140-00611	2	1	PLATE (OPTION 001)	28480	04140-00611

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

Table 6-3. Replaceable Parts (Cont'd).

Ref.	HP Part No.	Q'ty	Description
1	2360-0115		SCREW-MACHINE
2	2510-0192		SCREW-MACHINE
3	5020-8837		CORNER STRUT 18"
4	04274-40002		GUIDE BLACK
5	2510-0192		SCREW-MACHINE
6	2360-0115		SCREW-MACHINE
7	04274-01202		ANGLE
8	5020-8837		CORNER STRUT 18"
9	04274-40002		GUIDE BLACK
10	04274-40002		GUIDE BLACK
11	5040-7219		STRAP HDL CAP FRONT
12	2680-0172		SCREW-MACHINE
13	5060-9942		COVER-SIDE-PERF
14	5060-9804		STRP HNDL AY 18"
15	2680-0172		SCREW-MACHINE
16	5040-7220		STRAP HDL CAP REAR
17	2110-0569		NUT-FUSEHOLDER
18	0570-0368		SCREW
19	3050-0235		WASHER-FLAT
20	2110-0565		FUSEHOLDER CAP
21	2110-0564		FUSE HOLDER BODY
22	2950-0001		NUT-HEXAGONAL
23	2190-0016		WASHER-LOCK
24	2360-0113		SCREW-MACHINE
25(C1)	0180-3004		CAPACITOR-FXD .022F -10+50% 25VDDC ALMINUM
26	1250-0001		CONNECTER-BF BNC
27	2190-0008		WASHER-LOCK
28	0624-0260		SCREW-TAPPIONG
29	04140-00609		PLATE REAR
30	2360-0115		SCREW-MACHINE
31	04140-00609		PLATE REAR
32	2360-0115		SCREW-MACHINE
33	2360-0115		SCREW-MACHINE
34	04140-04001		COVER FAN
35	2360-0115		SCREW-MACHINE
36	0624-0260		SCREW-TAPPIONG
37	2190-0008		WASHER-LOCK
38	1854-0063		TRANSISTOR NPN PD=115Wmax FT=800kHzmax
39	0340-0458		INSLATOR-TRANSISTOR MICA
40	2740-0003		NUT-HEXAGONAL
41	2740-0003		NUT-HEXAGONAL
42	3050-0226		WASHER-FLAT
43	3050-0226		WASHER-FLAT
44	1200-0080		WASHER-INSULATING
45	1200-0080		WASHER-INSULATING

Table 6-3. Replaceable Parts (Cont'd).

Ref.	HP Part No.	Q'ty	Description
46	2360-0117		SCREW-MACHINE
47	04140-00204		PANNEL-REAR
48	2420-0006		NUT-HEX-W/LOCKWASHER
49	1200-0080		WASHER-INSULATING
50	1200-0080		WASHER-INSULATING
51	5000-4207		LUG-SHORTING
52 (CR1,CR2)	1901-0496		DIODE-RECTIFIER Silicon
53	2510-0045		SCREW-MACHINE
54	3160-0209		FAN-TUBEAXIAL
55(T1)	9100-0886		XFMR-POWER
56	2360-0113		SCREW-MACHINE
57	5020-8806		REAR FRAME 7"FM
58	2360-0115		SCREW-MACHINE
59(A1)	04140-66501		PCBD-I-V CONV
60	2360-0115		SCREW-MACHINE
61	5060-9835		COVER TOP 18"FM
62	2360-0333		SCREW-MACHINE
63	04140-00612		PLATE
64	2200-0107		SCREW-MACHINE
65	04140-01206		ANGLE
66	2360-0333		SCREW-MACHINE
67	5020-8805		FRT-FRA 7xFM
68	04140-60203		PANNEL FRONT SUB
69	04140-00201		PANNEL-FRONT
69	04140-00202		PANNEL-REAR
70	0360-1158		TERMINAL-SOLDER LUG
71	04271-50024		INSULATOR-BNC
72	2950-0035		NUT-HEXAGONAL
73	3050-0010		WASHER-FLAT
74	2360-0115		SCREW-MACHINE
75	1510-0038		BINDING POST ASSEMBLY
76	3050-0014		WASHER-FLAT
77	3050-0014		WASHER-FLAT
78	3050-0014		WASHER-FLAT
79	0360-1158		TERMINAL-SOLDER LUG
80	2190-0054		WASHER-LOCK
81	1250-1579		CONNECTER-RF BNC
82	2190-0084		WASHER-LOCK
83	2950-0006		NUT-HEXAGONAL
84	5040-7021		FOOT FL & HF MOD
85	1460-1345		WIRE FORM
86	5060-9847		COVER BOTTOM 18"FM

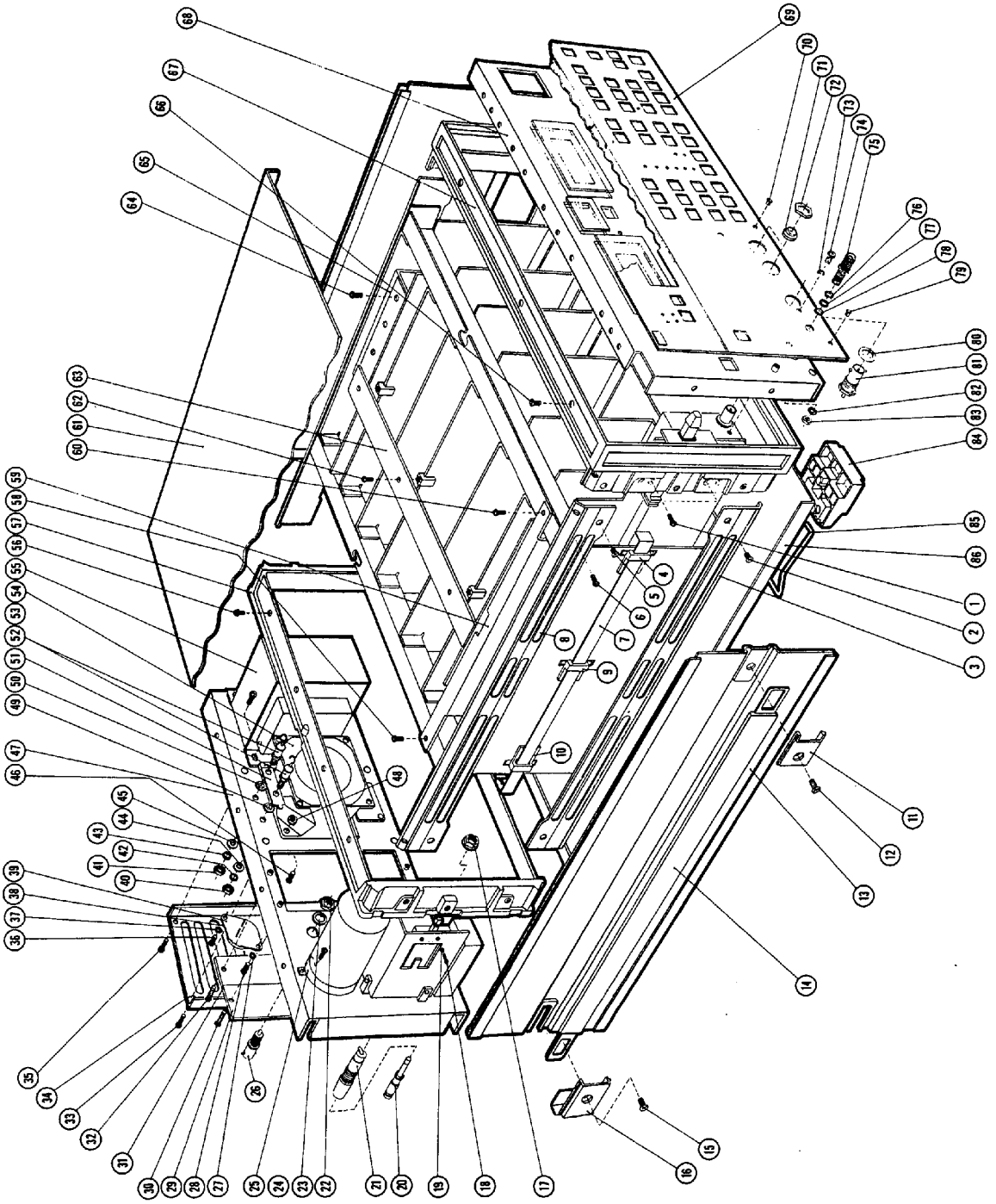


Figure 6-1. Major Mechanical Parts (Exploded View)

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information for adapting this manual to instruments for which the content does not apply directly. In addition, information about recommended modifications for improvements to the instruments is provided.

7-3. MANUAL CHANGES

7-4. To adapt this manual to your instrument refer to Table 7-1 and make all of the manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed. Table 7-2 gives a manual changes summary by assembly.

7-5. If your instrument serial number is not listed on the title page of this manual or in Table 7-1 below, it may be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage refer to INSTRUMENTS COVERED BY MANUAL in Section I.

Table 7-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
1917J 00110 and below	A, B, C, D
1917J 00145 and below	B, C, D
1917J 00170 and below	C, D
1917J 00195 and below	D

Table 7-2. Summary of Changes by Assembly.

Change	Assembly												
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A21	A31	A32	No plefix
A	Q8			C20	K1∿3 6∿8		CR1, 2						
B				C1	CR7, 8,23, 24								
C	R54				Heat Sink								
D		R50∿ 52	R31			U5							

CHANGE A

Page 6-3, Table 6-3, Replaceable Parts,
Delete following part:
A1Q8; HP P/N: 5080-3063, DUAL J-FET, N-CH.
Add following part:
A1Q8; HP P/N: 1855-0126, DUAL J-FET, N-CH.

Page 6-10, Table 6-3, Replaceable Parts,

Page 8-31, Figure 8-36, Component Locations,

Page 8-33, Figure 8-39, Component Locations,

Page 8-33, Figure 8-40, Schematic Diagram,
Delete following part:
A4C20; HP P/N: 0160-2204, C-FXD 100pF 300VW.

Page 6-12, 13, Table 6-3, Replaceable Parts,
Delete following parts:
A5K1~3, 6~8; HP P/N: 0490-0189, SWITCH-REED.
Add following parts:
A5K1~3, 6~8; HP P/N: 0490-0801, SWITCH-REED.

Page 6-18, Table 6-3, Replaceable Parts,
Delete following parts:
A7CR1, 2; HP P/N: 1902-3346, DIO-ZNR, 51.1V, 2%.
Add following parts:
A7CR1, 2; HP P/N: 1902-3345, DIO-ZNR, 51.1V, 5%.

CHANGE B

Page 6-10, Table 6-3, Replaceable Parts,

Page 8-31, Figure 8-37, Schematic Diagram,
Delete following part:
A4C1; HP P/N: 0140-0192, C-FXD, 68pF.
Add following part:
A4C1; HP P/N: 0140-0193, C-FXD, 82pF.

Page 6-12, Table 6-3, Replaceable Parts,
Delete following parts:
A5CR7, 8, 23, 24; HP P/N: 5080-3064, DIO-ZNR, 10V.
Add following part:
A5CR7, 8, 23, 24; HP P/N: 1902-3160, DIO-ZNR, 10V.

CHANGE C

Page 6-4, Table 6-3, Replaceable Parts,
Delete following part:
A1R54; HP P/N: 0699-0488, R-FXD, 100MΩ, 0.1%.
Add following part:
A1R54; HP P/N: 0699-0424, R-RXD, 100MΩ, 0.25%.

Page 6-15, Table 6-3, Replaceable Parts,
Delete following parts:
Heat Sink (4ea); HP P/N: 1205-0095.
Add following parts:
Heat Sink (4ea); HP P/N: 1205-0033.

CHANGE D

Page 6-7, Table 6-3, Replaceable Rarts,

Page 8-27, Figure 8-28, Component Location,

Page 8-27, Figure 8-29, Schematic Diagram,
Delete following parts:
A2R50~52; HP P/N: 0683-1045, R-FXD, 100KΩ.

Page 6-8, Table 6-3, Replaceable Parts,

Page 8-29, Figure 8-32, Component Locations,

Page 8-29, Figure 8-33, Schematic Diagram,
Delete following part:
A3R31; HP P/N: 1810-0279, R-NETWORK, 4.7KΩ.

Page 6-17, Table 6-3, Replaceable Parts,
Delete following part:
A6U5; HP P/N: 5080-3065, IC-LIN.
Add following part:
A6U5; HP P/N: 1826-0664, IC-LIN.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides the information and instructions required for servicing the Model 4140A pA Meter/DC Voltage Source. Included are the Theory of Operation and Troubleshooting Guide with Circuit Schematics. The Theory of Operation describes fundamental principles and circuit operating theory of the 4140A with block diagrams. Circuit schematics, locator illustrations, troubleshooting guide, circuit analysis and other technical data necessary for repairs are integrated into the service sheet foldouts. An illustration of the instrument interior is shown in Figure 8-23.

Note

When the instrument circuitry includes expanded capabilities provided by optional equipment, refer to paragraph entitled OPTIONS for specific option service information.

8-3. SAFETY CONSIDERATIONS.

8-4. This section contain warnings and cautions that must be followed for your protection and to avoid damage to the equipment.

WARNING

MAINTENANCE DESCRIBED HEREIN IS PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT AND PROTECTIVE COVERS REMOVED. SUCH MAINTENANCE SHOULD BE PERFORMED ONLY BY SERVICE-TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRICAL SHOCK). WHERE MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER SHOULD BE REMOVED.

BEFORE ANY REPAIR IS COMPLETED, ENSURE THAT ALL SAFETY FEATURES ARE INTACT AND FUNCTIONING AND THAT ALL NECESSARY PARTS ARE CONNECTED TO THEIR MEANS OF PROTECTIVE GROUNDING.

8-5. THEORY OF OPERATION.

8-6. This theory of operation has been organized into three sections: basic theory, block diagram discussions, and circuit analysis. The basic theory, beginning with paragraph 8-13, explains the concepts and fundamental theory of the 4140A instrument technique adapted for accurately measuring the DUT and for fully achieving automated measurement performance. The block diagram discussion describes the overall circuit operating theory of the 4140A with block-to-block signal flow. Included are block and timing diagrams. The circuit analysis provides a detailed description of how the circuit on each board functions. For reference convenience when servicing the instrument, a circuit description is included in the service sheets.

8-7. RECOMMENDED TEST EQUIPMENT.

8-8. The test equipment required to perform operations outlined in this section is listed in Table 4-1 (Page 4-2). The table includes: type of instrument required, critical specifications, use, and recommended model. If the recommended model is not available, equipment which meets or exceeds critical specifications listed may be substituted.

8-9. TROUBLESHOOTING.

8-10. This troubleshooting guide provides instructions and information for locating a faulty circuit instrument component that requires service. All instructions consider the safety of service personnel who will perform the procedures. These diagnostic guides are in the form of step-by-step procedures with flow diagrams. The board level troubleshooting diagrams are the procedures for isolating the problem to an individual malfunctioning circuit board assembly. The guides for locating a defective component are given on the individual board service sheets and integrate service support data--test point locations, waveform illustrations, voltage data, timing diagrams, and other technical information in addition to providing schematic diagrams for each board. To facilitate easy troubleshooting of the 4140A

digital section, the troubleshooting guide for the logic circuit employs a signature analysis technique incorporating the concept of data stream analysis. A guideline to signature analysis is provided in Figure 8-20.

8-11. REPAIR.

8-12. Repair explanations tell how to replace defective circuit components. The recommended replacement procedures for components and parts which require special repair, replacement tools, or test equipment should be observed. Correct disassembly and the exchange procedures for such special parts are outlined in Paragraphs 8-64 through 8-68. To prevent damage from improper repair procedure, refer to the appropriate manual section before proceeding with repair.

8-13. BASIC THEORY.

8-14. Figure 8-1 is the Basic Block Diagram of the Model 4140A pA Meter DC Voltage Source. In the following several paragraphs, the 4140A basic theory is explained. The explanation is separated into the following two parts: Current Measurement and DC Voltage Output. The explanation of the actual circuitry of the 4140A is described in paragraphs 8-47 thru 8-61, Block Diagram Discussion.

8-15. Current Measurement.

8-16. The 4140A Current Measurement is done in three stages: I-V Conversion, A-D Conversion with successive approximation technique and digital integration using a moving average technique.

(1) I-V Converter.

The basic circuit of the I-V Converter of the 4140A pA meter section is given in Figure 8-2. If operational amplifier A is an ideal amplifier (gain = ∞, input impedance = ∞), the circuit satisfies the following equation:

$$Vo = \frac{Rr}{Rx} Vx \quad (\because Vi = 0, \text{ virtual ground})$$

$$\therefore Ix = \frac{Vx}{Rx} = \frac{Vo}{Rr}$$

Where Ix: Unknown current.
Rx: Source resistance.
Vx: Source voltage.
Rr: Range resistance.
Vo: Output voltage.

Therefore, Ix can be calculated from the measured Vo value.

(2) A-D Converter with Successive Approximation Technique.

The Basic circuit of the 4140A A-D converter section is given in Figure 8-3. A-D conversion is done in the following manner:

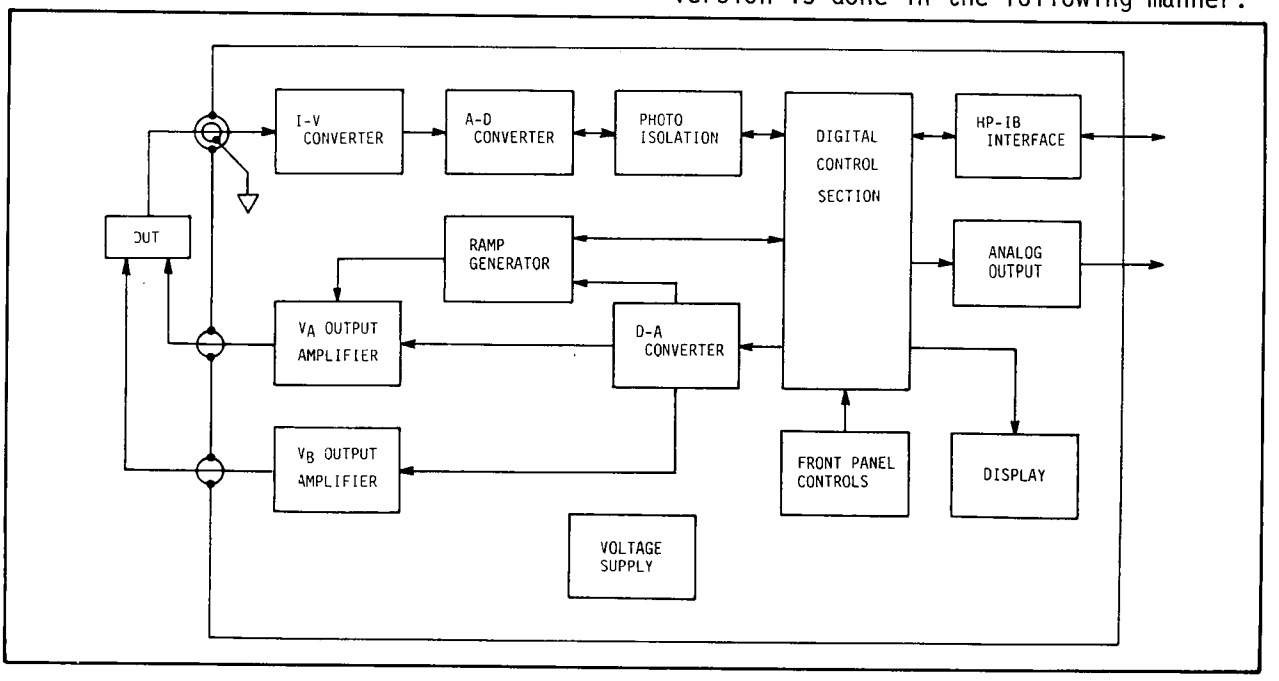


Figure 8-1. Model 4140A Basic Block Diagram.

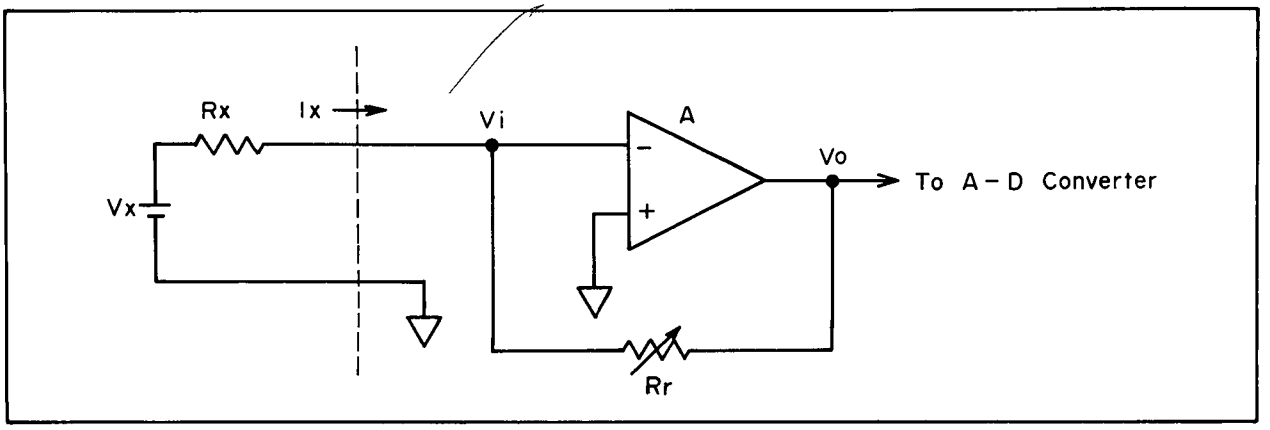


Figure 8-2. I-v Converter.

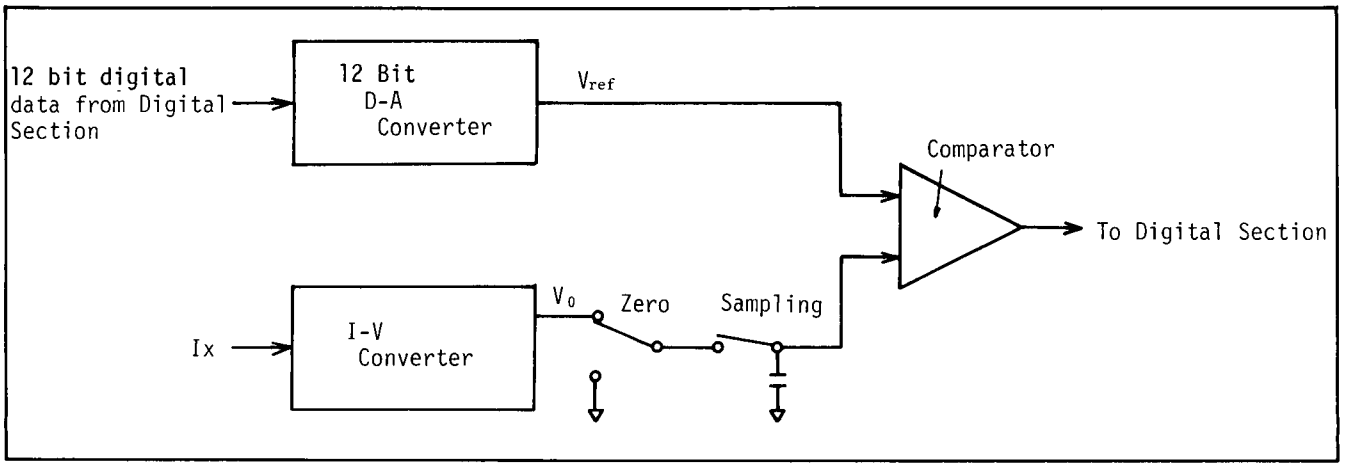


Figure 8-3. A-D Converter.

Table 8-1. Successive Approximation.

I-V Converter Output Voltage (V)	Comparator Result	D-A Converter	
		Analog Output (V)*	Digital Input
3.65	>	0.0000	011111111111
	>	2.5000	001111111111
	<	3.7500	000111111111
	>	3.1250	001011111111
	>	3.4375	001001111111
	>	3.5938	001000111111
	<	3.6719	001000011111
	>	3.6328	001000101111
	<	3.6523	001000100111
	>	3.6426	001000101011
	>	3.6475	001000101001
	>	3.6499	001000101000

* Typical Values.

① Vo (I-V converter output voltage) which is proportional to Ix (unknown current) is sampled with the sample/hold circuit (sampling interval = 10ms*).
*at 50Hz line frequency (8.3ms at 60Hz).

② V_{ref} (DAC output voltage) is set to 0V.

③ Vo is compared with V_{ref} and the polarity (+ or -) of Vo is detected.

④ Each bit is changed from MSB and Vo is compared with V_{ref} in each step. An Example of this process is given in Table 8-1 [Vo = 3.65V, Ix = 1.495×10^{N} A (N = -2 ∿ -12)].

⑤ Steps 1 thru 4 are done when the A-D Converter is connected to circuit common instead of the I-V converter. This result is used to compensate the A-D converter for offset voltage error.

(3) Digital Integration with Moving Average Technique.

Current measurement Digital data which is sampled in the D-A Converter is stored in a RAM (Address: 0 ∿ 255). This data is digitally integrated by the following procedure (see Figure 8-4.):

① Number for digital integration (2 ∿ 256) is fixed (example in Figure 8-4 is 4).

② First current measurement data, Io, is stored in the RAM (Address: 0).

③ Currents I_1 thru I_3 are stored in the RAM (Address: 1 ∿ 3) in order.

④ Ia (result of moving average) is calculated by the following formula:

$$Ia = \frac{I_0 + I_1 + I_2 + I_3}{4}$$

⑤ Steps ②∿④ are repeated every 10 (8.3)ms.

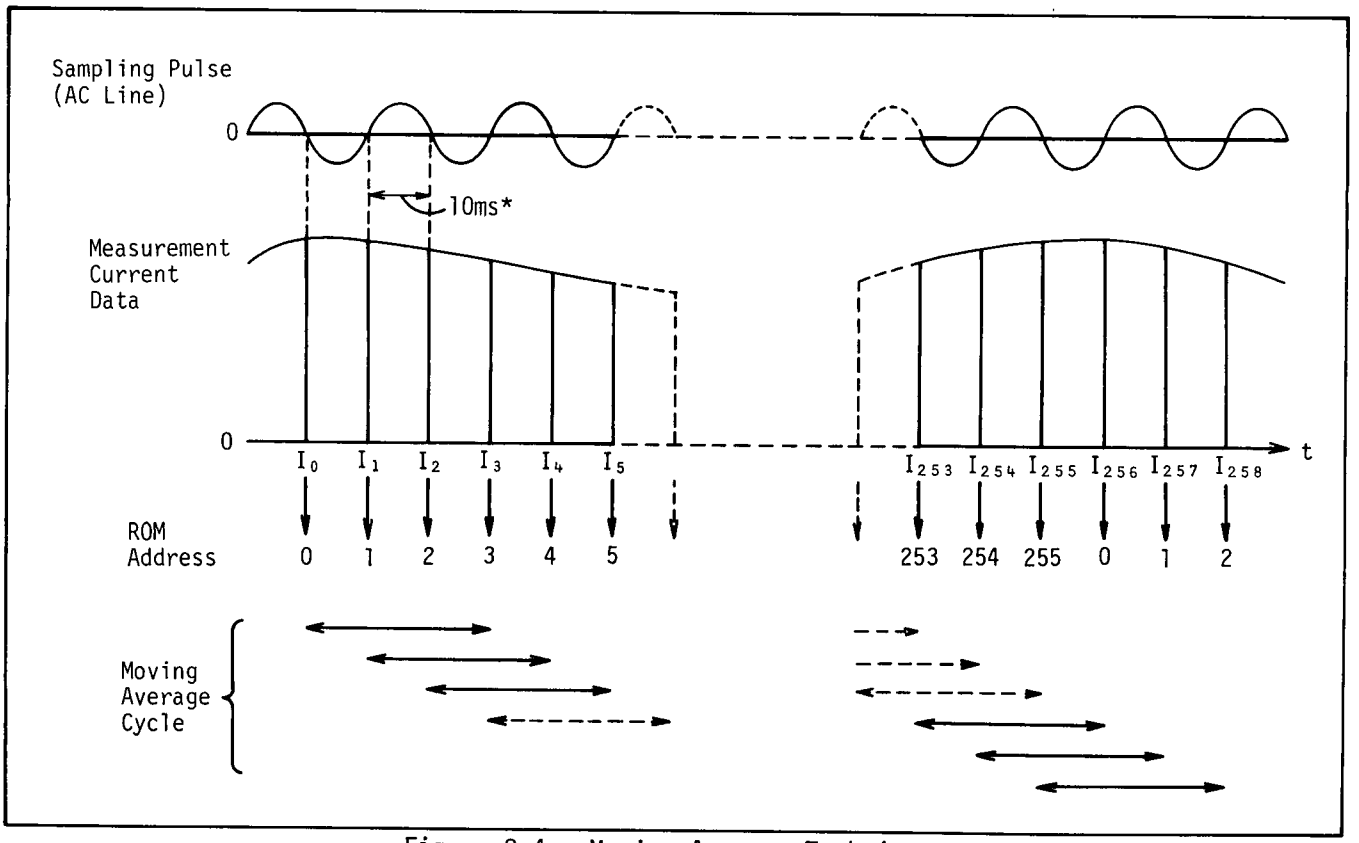


Figure 8-4. Moving Average Technique.

8-17. DC Voltage Output.

8-18. Basic circuit of V_A (V_B) DC Voltage Source is given in Figure 8-5. The DC voltage output is accomplished by three stages: a D-A Converter, V_A (V_B) power amplifier and a current limiter.

(1) D-A Converter.
This 12 Bit DAC is controlled by a digital input (see Table 8-2). Its output is a dc voltage (±10 Vmax).

Table 8-2. D-A Converter.

Digital Input*	Output Voltage (V)
000000101111	+10.00
000000110001	+9.99
011111111101	+0.01
011111111111	0.00
100000000001	-0.01
111111001101	-9.99
111111001111	-10.00

*12 bits, complementary two's complement, MSB is on inverted input.

(2) V_A (V_B) Power Amplifier.
The output voltage of the V_A (V_B) DC voltage source is fixed by the DAC output voltage and amplitude gain of the V_A (V_B) Power Amplifier as given in Table 8-3.

Table 8-3. V_A (V_B) Output Voltage.

V_A (V_B) Output Voltage (V)	DAC Output Voltage (V)	V_A (V_B) Power Amplifier Gain
100.0	10.00	10
10.1	1.01	
10.00	10.00	1

(3) Current Limiter.
The V_A (V_B) DC Voltage Source is a constant voltage supply. However, if the output current exceeds the current limit (10^{-2}, 10^{-3}, 10^{-4}A), the output V_A (V_B) is controlled by the Current Limiter and V_A (V_B) operates as a sort of constant current source.

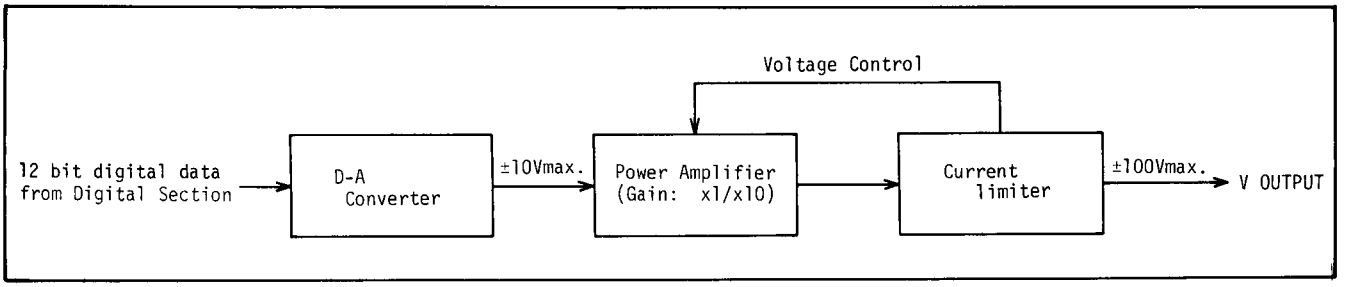


Figure 8-5. V_A (V_B) DC Voltage Source.

8-19. BLOCK DIAGRAM DISCUSSION.

8-20. In the following several paragraphs, block diagrams and explanations of the pA Meter section, Voltage Source section, Digital section and Options are provided. The construction of these diagrams and the explanations are based on the actual printed circuit board assemblies. These are useful for board level troubleshooting.

8-21. pA METER SECTION.

8-22. Figure 8-6 is a detailed block diagram of the 4140A pA Meter Section. The 4140A pA Meter Section is made up of the A1 I-V Converter board and the A2 A-D Converter board. This section produces the stable measurement of very small currents and sends the current measurement data to the Digital section.

8-23. A1 I-V Converter.

8-24. The Converter board stably detects the very small unknown current and generates a voltage which is proportional to the unknown current. The I-V Converter board contains a High Input Impedance Amplifier, Oscillator, Range Resistor, and other related circuitry.
High Input Impedance Amplifier (A1Q1∿6, 8∿14, A1U1, A1T1, 3, 4, etc.) is a high input impedance, small bias current, low offset voltage amplifier. The amplifier has a high gain to maintain the low input inpedance (for the pA Meter) and low noise to ensure stable measurements. A more specific explanation of this amplifier is given in Service Sheet 1.
Oscillator (A1Y1, U2∿4, etc) is used in both the pA Meter section and the Digital section. The output of 4MHz Quartz Oscillator is divided down to a 1MHz square wave by Frequency Divider (A1U3). This square wave is transmitted to the Digital Section to be used as the clock signal. In addition, the 1MHz signal is further divided down to 500kHz by Frequency Divider (A1U2) and supplied to Phase Detector (A1Q1∿4) and the Varactor circuit (A1Q8, A1T3, 4). The 500kHz signal, which is supplied to the Varactor circuit, is attenuated 20mVp-p by an attenuator (A1R18∿24). A1U2 and A1U2 use -5V power for driving the Phase Detector directly.
Range Resistor (A1R52∿58) of the 4140A is selected so as to cause voltage at A2TP8 to be 2.44V (typical) when 4140A I·C DISPLAY shows "1.000". Relationship between Range Resistor and current measurement range is given in Table 8-5.

Table 8-4. Relationship between Range Resistor and Current Measurement Range.

Current Measurement Range [A]	Relay Switch Range Resistor*						Range Resistor [Ω]
	K1	K2	K3	K4	K5	K6	
10^{-2}** 10^{-3}***	O	O	O	O	O	X	99G
10^{-4}** 10^{-5}***	O	O	O	O	X	X	9.9K
10^{-6}** 10^{-7}***	O	O	O	X	X	O	990K
10^{-8}** 10^{-9}***	O	O	X	O	X	O	99M
10^{-10}** 10^{-11}***	O	X	O	O	X	O	9.9G
10^{-12}***	X	O	O	O	X	O	99G

* o: Relay switch is ON.
x: Relay switch is OFF.

** On these ranges, A2K1 is ON (gain of X1/X10 Amplifier on A2 board is 1).

*** On these ranges, A2K1 is ON (gain of X1/X10 Amplifier on A2 board is 10).

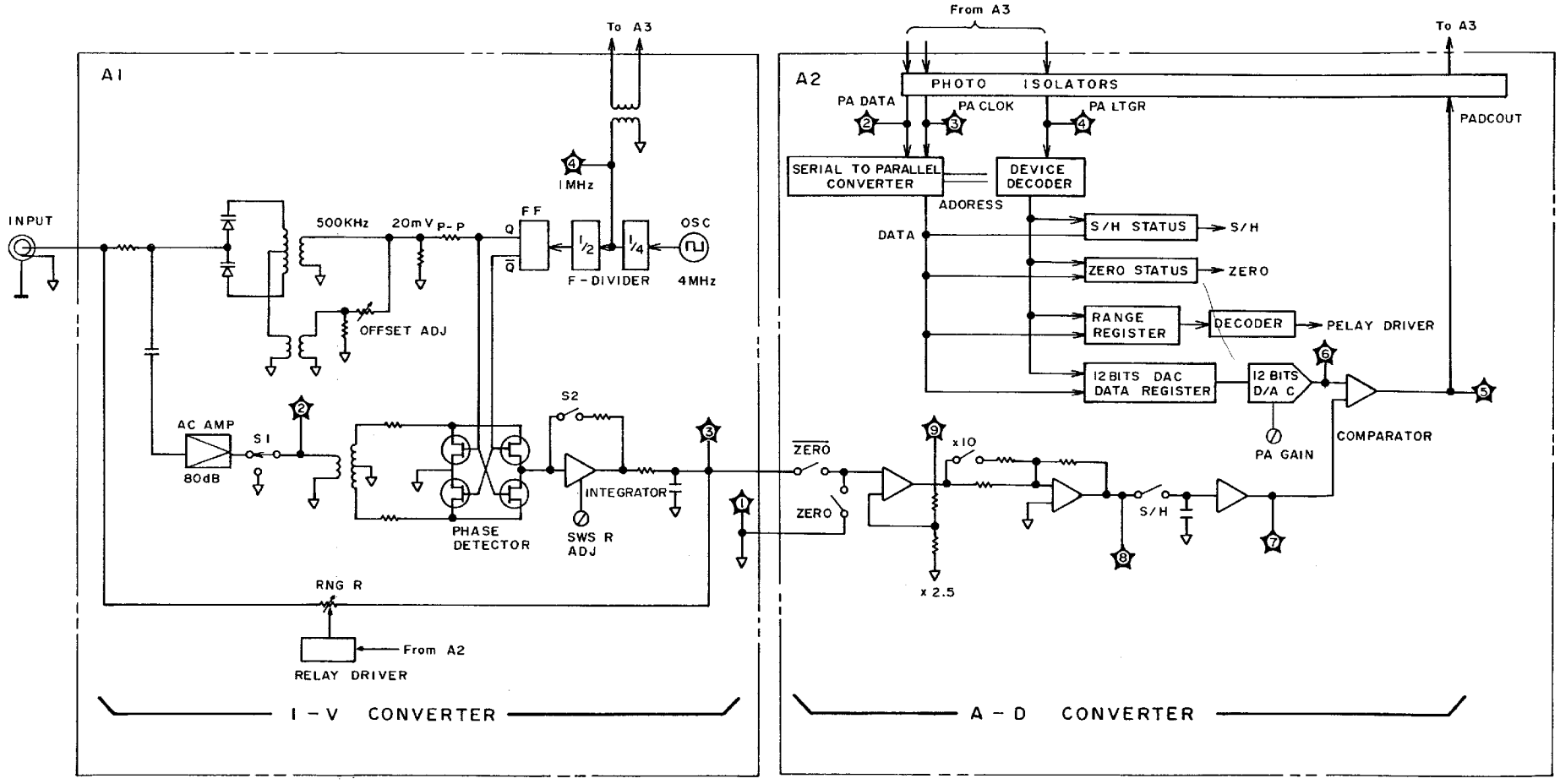


Figure 8-6. pA Meter Section Block Diagram.

8-25. A2 A-D Converter.

8-26. The A-D Converter board does a stable and fast A-D conversion using a successive approximation technique with auto zero compensation (refer to paragraph 8-15). The A-D converter board contains a Photo Isolator, Serial-to-Parallel Converter, Device Decoder, Sample/Hold Status Register, Zero Status Register, Range Status Register and Decoder, 12 Bit DAC Data Register, 12 Bit DAC (Digital-to-Parallel Converter), Auto Zero circuit, X1/X10 Amplifier, Sample/Hold circuit, Comparator, and related circuitry.

Photo Isolator (A2U12∿15) provides electric isolation between the Digital section and the pA Meter section for suppressing noise from the Digital section which would increase current measurement error. The common signal circuit in the isolator floats. The Serial-to-Parallel Converter (A2U8) changes the serial data from the Digital section ($\overline{\text{PADATA}}$) to parallel data which is separated into 4 bit data and a 3 bit address for the Device Decoder. The Device Decoder (A2U4) receives the 3 bit address and selects either the Sample/Hold Status Register, Zero Status Register, Range Status Register or the 12 Bit DAC Data Register. The Sample/Hold Status Register (A2U9) generates a signal (S/$\overline{\text{H}}$) for the Sample/Hold circuit which is synchronized with $\overline{\text{PALTGR}}$. Specific timing for S/$\overline{\text{H}}$ is given in Figure 8-7.

The Zero Status Register (A2U9) generates a signal ($\overline{\text{Zero}}$) for the Auto Zero circuit which is synchronized with $\overline{\text{PALTGR}}$. Specific timing of $\overline{\text{Zero}}$ is given in Figure 8-7. Range Status Register (A2U6) and Decoder (A2U10) generate signals (SW1∿7) to operate relay switches (A1K1∿6, A2K2) in the Range Register on the A1 board which are synchronized with $\overline{\text{PALTGR}}$. Relationships between the Range Resistors (relay switches) and the current measurement ranges are given in Table 8-5.

A 12 Bit DAC Data Register (A1U2, 3, 7) provides 12 bits of DAC data which is synchronized with $\overline{\text{PALTGR}}$.
The 12 Bit DAC (A1U16) converts the 12 bit digital data to analog data (±10Vmax) which is compared with a voltage which is proportional to the unknown current value.
An Auto Zero circuit (A2U19, A2Q15∿19) compensates the circuit to produce a zero offset error in the A-D Converter. THe A-D Converter is disconnected from the I-V Converter on the A1 board (A2U16: off) and is connected to circuit common (A2Q15: ON) for about 1.5ms. The zero offset error is measured during time interval Ⓑ in Figure 8-7. This zero offset error data is stored in the Digital section and used to correct the measured value of the unknown current during time interval Ⓐ.
X1/X10 Amplifier (A2U19, etc.) selects its amplitude gain (1 or 10) to cause the voltage at A2TP8 to be 2.44V (typical) when the 4140A I C DISPLAY shows "1.000". Relationship between this amplitude gain and current measurement range is given in Table 8-5.
Sample/Hold circuit (A2U18, A2Q11 14, etc.) holds the voltage (which is proportional to unknown current) between sucssessive approximation periods. When this circuit is set to SAMPLE (A2Q12: ON), memory capacitor A2C7 is charged with voltage which is proportional to the unknown current. Subsequently, when this circuit is set to HOLD, (A2Q12: OFF) between 1.2ms (time interval Ⓐ in Figure 8-7), voltage across A2C7 is held to a constant value and converted to digital data by the succsessive approximation technique.
Comparator (A2U17, etc.) compares the voltages which are proportional to the unknown current with the 12 Bit DAC output voltage and sends the result of this comparison to the Digital section.

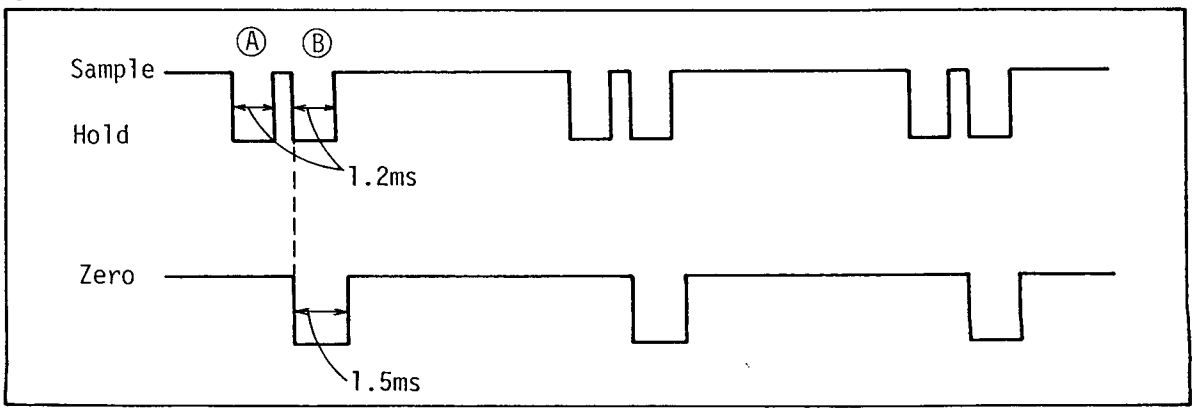


Figure 8-7. Sample Hold and Zero Timing Signal.

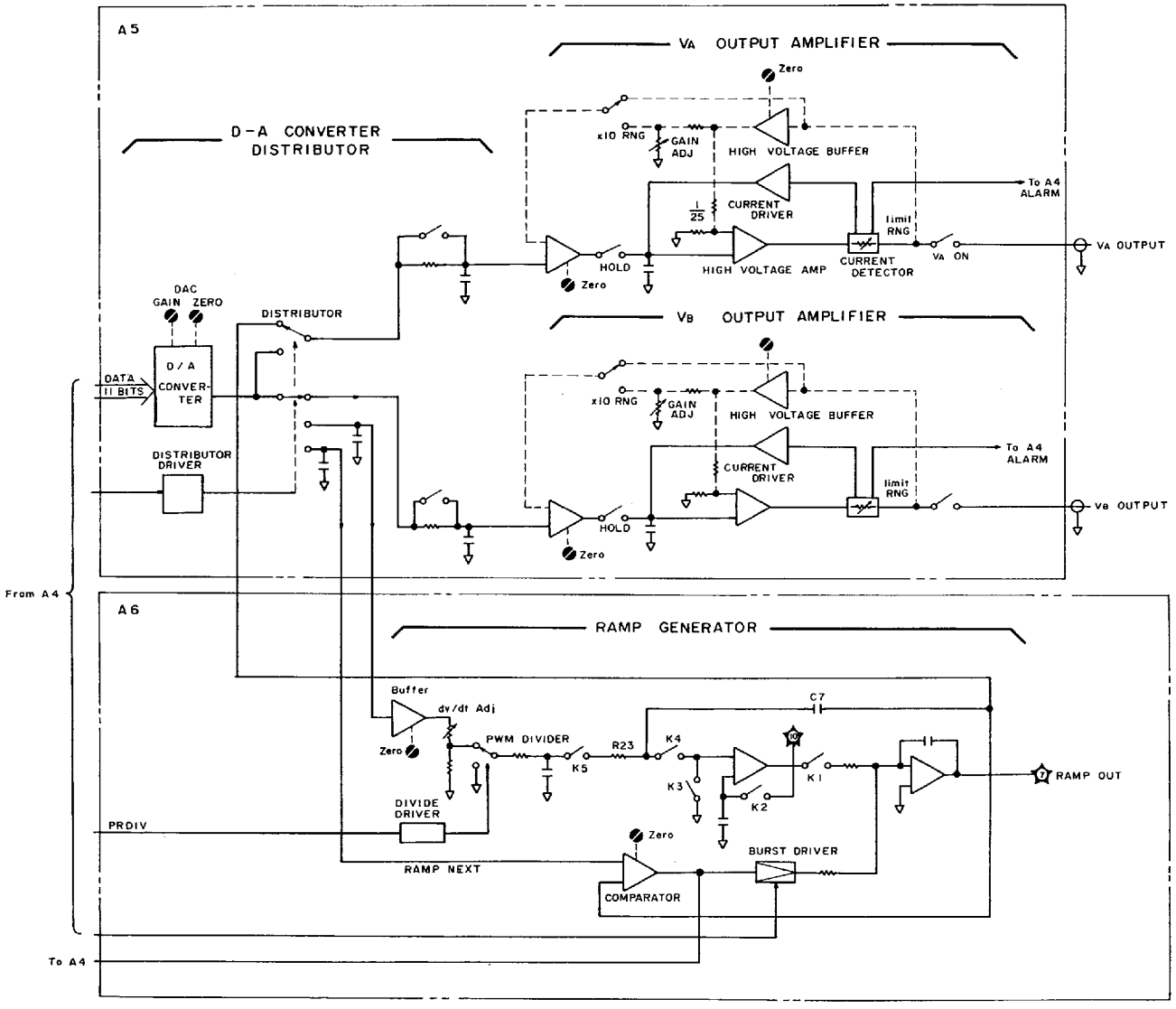


Figure 8-8. VS Section Block Diagram.

8-27. VOLTAGE SOURCE SECTION.

8-28. Figure 8-8 is a detailed block diagram of the 4140A VS (Voltage Source) section. This section is made up of the A5 VS Output board and the A6 Ramp Generator board. The section generates two DC voltage outputs (V_A and V_B). In addition, one of the voltage sources (V_A) generates not only a DC voltage, but also a staircase/ramp wave.

8-29. A5 VS (Voltage Source) Output.

8-30. The VS Output board outputs DC voltage (V_A and V_B) and the staircase/ramp wave (V only). The board contains a 12 Bit DAC (Digital-to-Analog Converter), Distributor, V_A (V_B) LPF (Low Pass Filter), V_A (V_B) Power Amplifier, and V_A (V_B) Current Limiter. The 12 Bit DAC (A5U3) converts 12 bit digital data from the Digital section to analog data (±10Vmax) which has four separate parts: V_A, V_B, dV/dt and Next Ramp data (refer to Figure 8-9). The Distributor (A5U4, 7∿9, etc.) distributes the four pieces of analog data from the DAC to the V_A Power Amplifier, V_B Power Amplifier or A6 Ramp Generator as in Figure 8-9. These analog data (V_A, V_B, dV/dt or Next Ramp) are each held in a charged capacitor (A5C31 ∿ 34). The V_A (V_B) LPF (A5R30, A5C13, A5R75, A5C27) is a 10sec LPF (low pass filter) to reduce the DAC output voltage noise before supplying it to the V_A (V_B) Amplifier. If the input voltage value of the V_A (V_B) Power Amplifier (part of DAC output voltage) changes, a 10sec LPF is shorted for between 20 ∿ 30msec by switch A5K5(K10) to improve the response of V_A (V_B) Power Amplifier.
V_A (V_B) Power Amplifier (A5U1, A5Q1 ∿ 12, A5U2, A5Q20∿31, etc.) operates as a voltage follower when the output voltage is within ±10V. If output voltage is more than ±10V, the amplitude gain of this amplifier is set to 10. In addition, V_A (V_B) Amplifier provides a Hold circuit (A5U8, A5C7; A5U9, A5C21) to reduce spike noise which is generated when V_A (V_B) output voltage range is changed. More specific explanation of this circuit is given in Service Sheet 5.

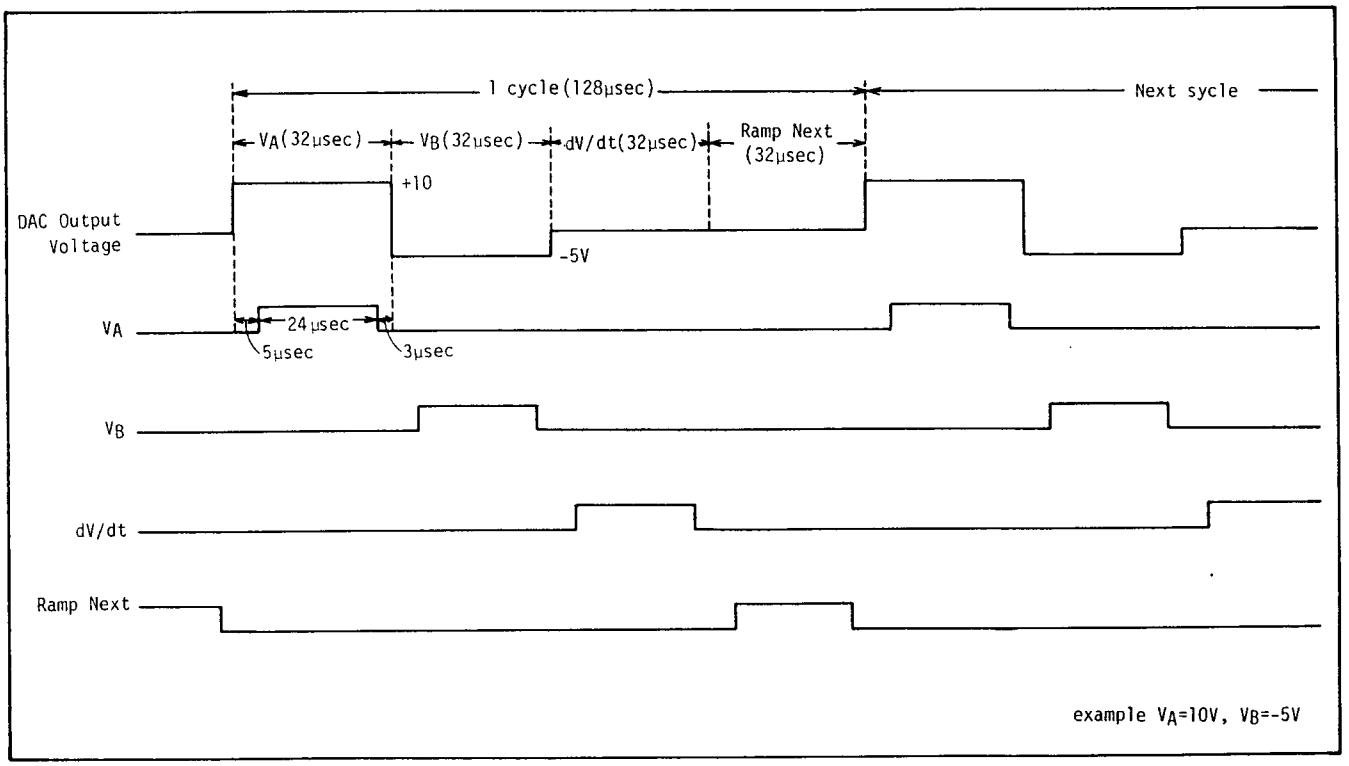


Figure 8-9. Dynamics of DAC is VS section.

8-31. A6 Ramp Generator.

8-32. The Ramp Generator board generates an accurate ramp wave which has various ramp rates (from 0.001V/s to 1V/s). The Ramp Generator board contains a P.W.M. Divider (Pulse Width Modulation Divider), Auto Offset Voltage Compensated Integrator, Ramp Comparator, and a Burst Driver. The P.W.M. Divider (A6U7, A6Q3 ∿ 6) generates a voltage which determines the ramp rate of the ramp generator output wave. If the DAC output voltage (dV/dt) is used directly as ramp rate data, the DAC noise error would increase the error of ramp rate accuracy for small DAC output voltage values. Therefore, the DAC output voltage is set to an $X2^N$ value of the true ramp rate data (N = 0, 1, 2, ..., 7). This value, through dV/dt Buffer (A6U3) is attenuated to $X1/2^N$ value in the P.W.M. Divider as in Figure 8-10. This value is also attenuated to X1/10 value when ramp wave START V or STOP V is set to more than ±10V (see Figure 8-10). In this case, the output voltage of Ramp Generator (RAMP OUT) is amplified to X10 value in the V_A Power Amplifier on the A5 board. This voltage is supplied to the Integrator via a smoothing circuit (A6R42 ∿ 46, A6C18 ∿ 20). An Auto Offset-Voltage Compensated-Integrator (A6U1, 4, 5, A6K1 ∿5) generates an accurate ramp wave by minimizing its offset voltage error. The generated ramp wave (RAMP OUT) is outputted through V_A Power Amplifier or A5 board. More specific explanation for this integrator is given in Service Sheet 6. Ramp Comparator (A6U2, etc.) compares the output voltage of Ramp Generator (RAMP OUT) with the reference signal from A5 board (NEXT RAMP) and sends result of this comparison to Digital section. This result is used to determine timing of VS DISPLAY changes.

Burst Driver (A6U1, 6, A6Q1, 2) sets RAMP OUT to START V by setting the voltage at A6TP6 MAX RAMP) to +15V or -15V. In like manner, this circuit also sets RAMP OUT to 0V when ramp wave generation is complete. MAX RAMP is held to 0V during the time that the ramp wave is being generated. Similarly, the circuit is also used to hold RAMP OUT to 0V by setting RAMP NEXT to 0V when the Ramp Generator isn't being used.

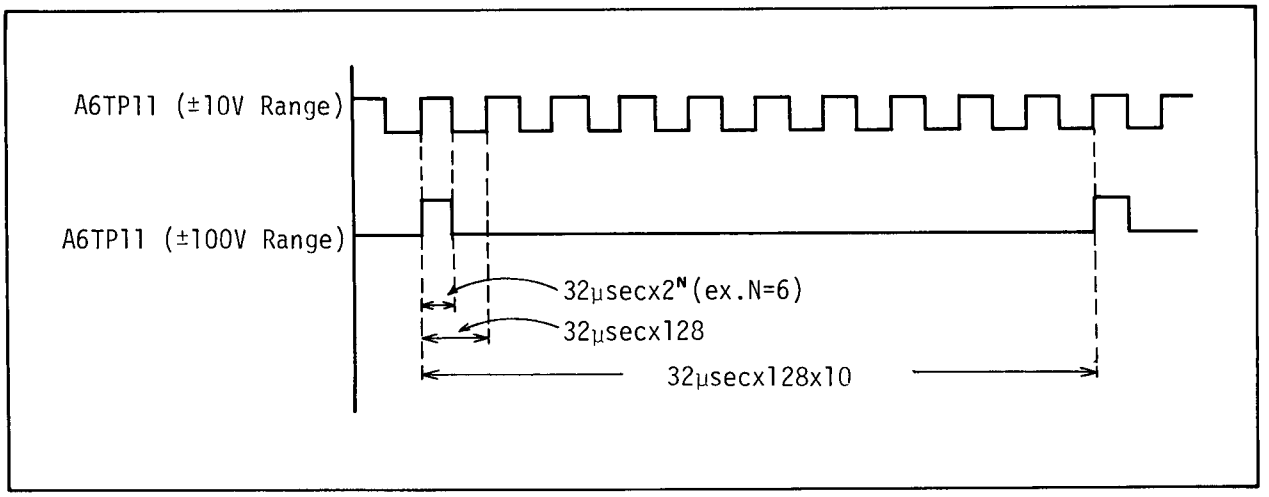


Figure 8-10. Duty Cycle of P.W.M. Divider.

8-33. DIGITAL SECTION.

8-34. Figure 8-11 is a detailed block diagram of the 4140A Digital section. The 4140A Digital section is made up of the A3 MPU board and the A4 I/O Control board. This section controls all 4140A operations and boards, the A1 I-V Converter, A2 A-D Converter, A5 VS Output, A6 Ramp Generator, A8 Key & Display, A21 HP-IB (option 101), A31 Analog Output Control (Option 001) and A32 Analog Output (Option 001).

8-35. A3 MPU.

8-36. The MPU board is the main digital control circuit and consists of the MPU (Micro Processing Unit) itself, ROM (Read Only Memory), RAM (Random Access Memory), Bus Buffer, Device Decoder, and related circuitry. This board also contains the Clock circuit, Reset circuit, Interrupt Receiver, Data Bus Extender, and pA Interface Parallel/Serial Converter.
The MPU (A3U13) handles the central control functions of the 4140A digital circuitry. In addition, the MPU includes a bidirectional 3-state 8 bit parallel data bus for transferring data to and from the memory and peripheral devices, a 3-state 16 bit parallel address bus for addressing the memory (max. 65K bytes), and other I/O lines.
The ROM's (A3U3∿8) are six 2K X 8 bit memories for storing various management instructions for the 4140A operations. These include:

a. pA Meter section control.
b. VS (Voltage Source) section control.
c. Timing control for I-V/C-V measurements.
d. Key control.
e. Display control.
f. Utility program.
g. Mathematic pack.
h. Computation program.
i. Look-up table.
j. Main program.
k. Analog output control.
l. HP-IB control.

The RAM's (A3U10, 11) are two 512 X 8 bit memories for storing the data (e. g. current measurement data, digital data for DAC, etc.).
The Bus Buffer consists of two 8 bit address bus buffers (A3U12, 21) and one 8 bit data bus transceiver (A3U14). THe Address bus buffers transfer address bus signals from the MPU to the memory and peripheral devices. Data bus buffer transfers data bus signals from/to MPU to/from the memory and peripheral devices.

Device Decoders (A3U19, 20) select ROM's, RAM's and peripheral devices to be addressed by the MPU. The Clock circuit (A3U22, 29, etc.) modifies the 1MHz Clock signal from the A1 board to a 2-phase Clock pulse (ϕ1, ϕ2) for use in the MPU. The Clock circuit also supplies a DBE (Data Bus Enable) signal for the MPU.

A Reset circuit (A3U32, A3CR3, A3R22, 23, A3C16) generates a $\overline{\text{RESET}}$ signal to restart the MPU when the instrument is turned on. The Data Bus Extender (A3U9) is an 8 bit bidirectional 3 state bus extender for transferring data bus signals from/to A3 MPU board to/from A4 I/O Control board. The pA Interface Parallel/Serial Converter (A3U16, 18, 23 ∿ 25, 30, 31, etc.) generates control signals ($\overline{\text{PACLK}}$, $\overline{\text{PADATA}}$, $\overline{\text{PALTRG}}$) for the pA Meter section. In particular, the Parallel/Serial Converter (A3U18) changes the 8 bit parallel data (EBD 0 ∿ 7 = Extended Buffered Data) to serial data (PADATA).

8-37. A4 I/O Control.

8-38. The A4 I/O Control board receives 8 bit data signals (EBD 0∿7 = Extended Buffered Data), 5 bit address signals (BA 0 ∿ 4 = Buffered Address) and other control signals from the A3 MPU board and generates control signals for the VS section, Control keys and Displays. The I/O Control board also contains a Frequency Divider, Blanking circuit, Display Address Selector, Display Refresh Memory, Interrupt Control Circuit, trigger LED latch, Data Input Buffer, VS Register Selector, Distributor Control, VS Control Status Register, VS DAC Data Register, and VS Precision Divider Strobe Generator. Frequency Divider (A4U13 15, 17, 18, 38, 39, etc.) modifies the clock pulse Bϕ2 (Buffered ϕ2) to 11 clock pulses (244Hz ∿ 500KHz) for use in peripheral devices as clock signals. The Blanking circuit (A4U1,11) generates a BLANK signal for the A8 Key & Display board. Display Address Selector (A4U12) is used to select Display Refresh Memory and Anode Driver Selector on A8 board.
Display Refresh Memory (A4U8 ∿ 10) controls Cathode Driver on A8 board.

Interrupt Control Circuit (A4U2 ∿ 7, 16, 17, 28, 39, 40) receives interrupt signals (e. g KIRQ, EXTRG, $\overline{\text{LFC}}$, etc.) and generates interrupt signals ($\overline{\text{BIRQ}}$) for the MPU on the A3 board.

Trigger LED Latch (A4U29) generates control signals for the TRIGGER LED lamp on the A8 board. Data Input Buffer (A4U36, 37) receives front panel key status data, interrupt data, current Limiter data and changes it to 8 bit parallel data for use in the MPU on the A3 board.

VS Register Selector (A4U22) is used to select VS Control Status Register and VS DAC Data Register. Distributor Control (A4U2 ∿ 4, 20, 21) generates control signals for the Distributor on the A5 VS Output board. VS Control Status Register (A4U32 ∿ 35) generates control signals for the A5 VS Output board and A6 Ramp Generator board.
VS Precision Divider Strobe Generator (A4U23, 24, 26, 27, 38) generates divide duty cycle data for Precision Divider on A6 board.

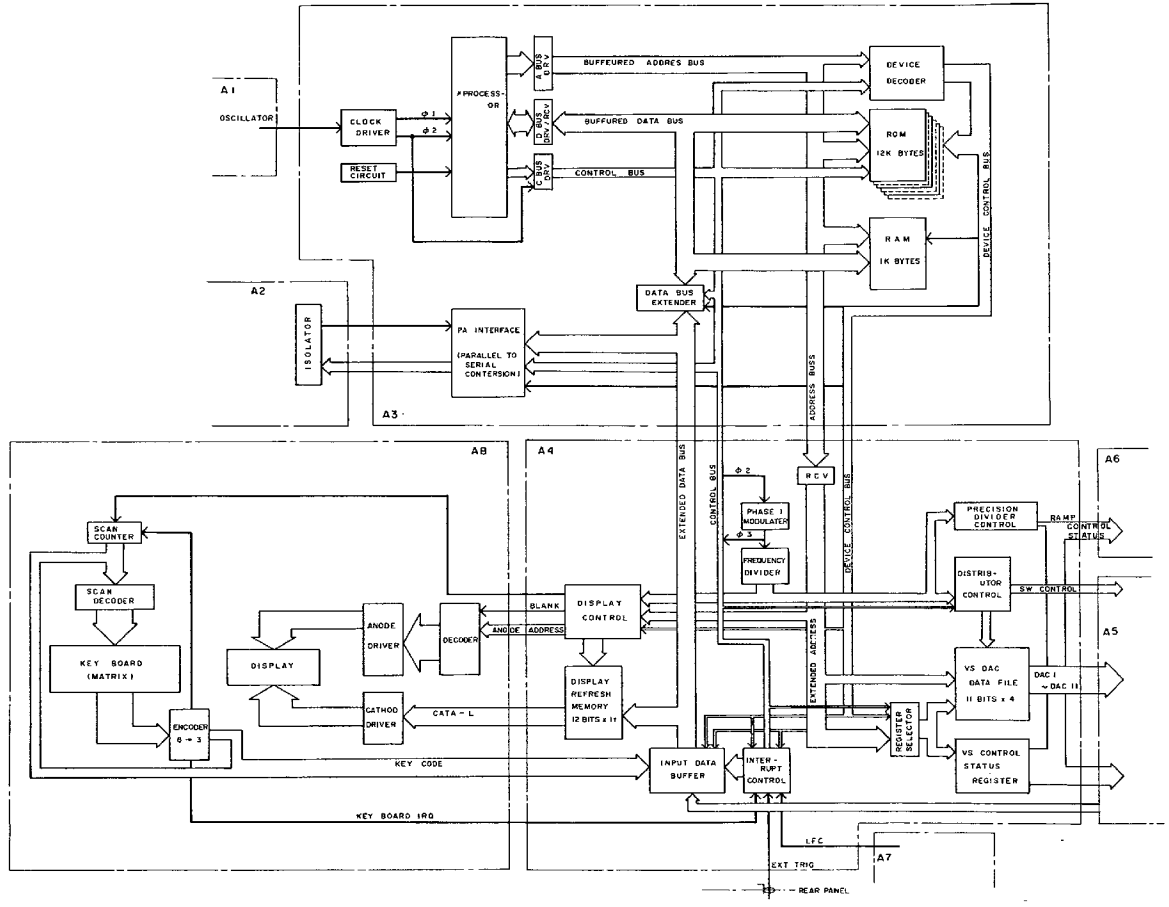


Figure 8-11. Digital Section Block Diagram.

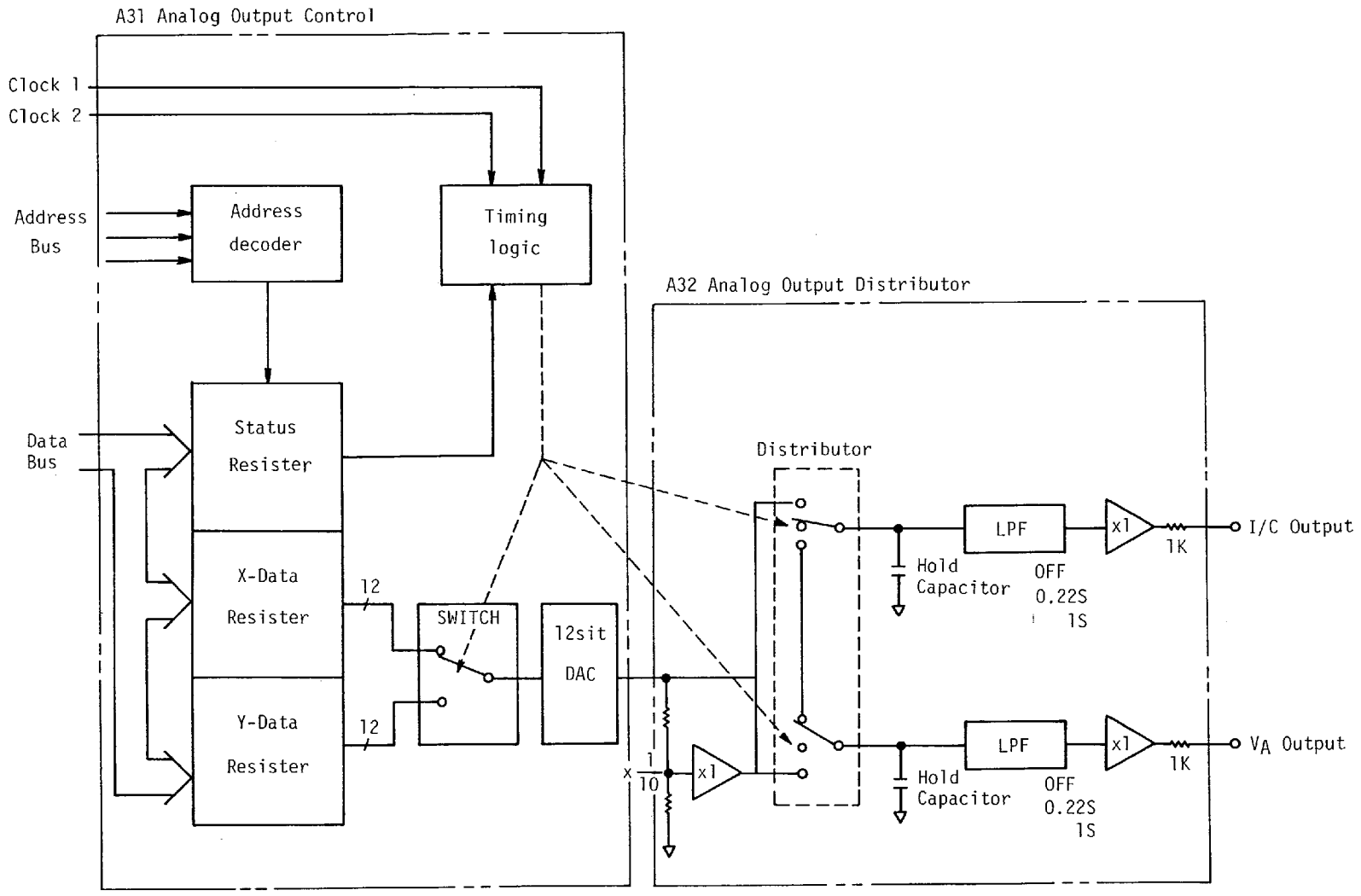


Figure 8-12. Option 001 Analog Output Block Diagram.

8-39. OPTIONS.

8-40. The Model 4140A pA Meter/DC Voltage Source provides two options: Option 001 Analog Output and Option 101 HP-IB interface. Option 001 contains two boards, the A31 Analog Output Control board and the A32 Analog Output board. Option 101 contains, the A21 HP-IB board.

8-41. A31 Analog Output Control (Option 001).

8-42. Figure 8-12 is a detailed block diagram of the Option 001 Analog Output. A31 Analog Output Control board does Digital-to-Analog conversion of the Analog Output data and generates control signals for the A32 Analog Output board. A31 board contains an Address Decoder, Status Register, Distributor Timing Control, X Data Register, Y Data Register, Multiplexer and the 12 Bit DAC (Digital-to-Analog Converter).
Address Decoder (A31U5) selects Status Register, X Data Register or Y Data Register. Status Register (A31U2) generates control signals for Distributor Timing Control and supplies pen up/down signals.
Distributor Timing Control (A31U1, 3, 4) generates control signals for the Distributor on the A32 board.

X Data Register (A31U6, 10) provides X-axis (I/C Analog Output) digital data for the 12 Bit DAC. Y Data Register (A31U7, 11) provides Y-axis (V_A Analog Output) digital data for the 12 Bit DAC. Multiplexer (A31U8, 12, 13) selects digital data for the 12 bit DAC, and X or Y-axis information. The 12 Bit DAC (A31U9) converts 12 bit digital data to analog data (±10Vmax).

8-43. A32 Analog Output Distributor (Option 001).

8-44. The Analog Output board modifies the analog data from the 12 Bit DAC on A31 board to two analog outputs: An I/C Analog Output or a V_A Analog Output. THe A32 board contain a X 1/10 Buffer, Distributor, LPE (Low Pass Filter) and a Buffer. The X 1/10 Buffer (A31U4, etc.) amplifies (gain = 1/10) analog data from the 12 Bit DAC on the A31 board when output voltage is smaller than ±1V.

The Distributor (A32U3) distributes the analog data from the 12 Bit DAC on the A31 board to either the I/C Analog Output or the V_A Analog Output. The LPF (A32S1, R1,3, C1∿8) reduces the noise on both the I/C and V_A Analog Output data. The Buffer (A32U1,2) lowers the output impedances of both the I/C and V_A Analog Output data.

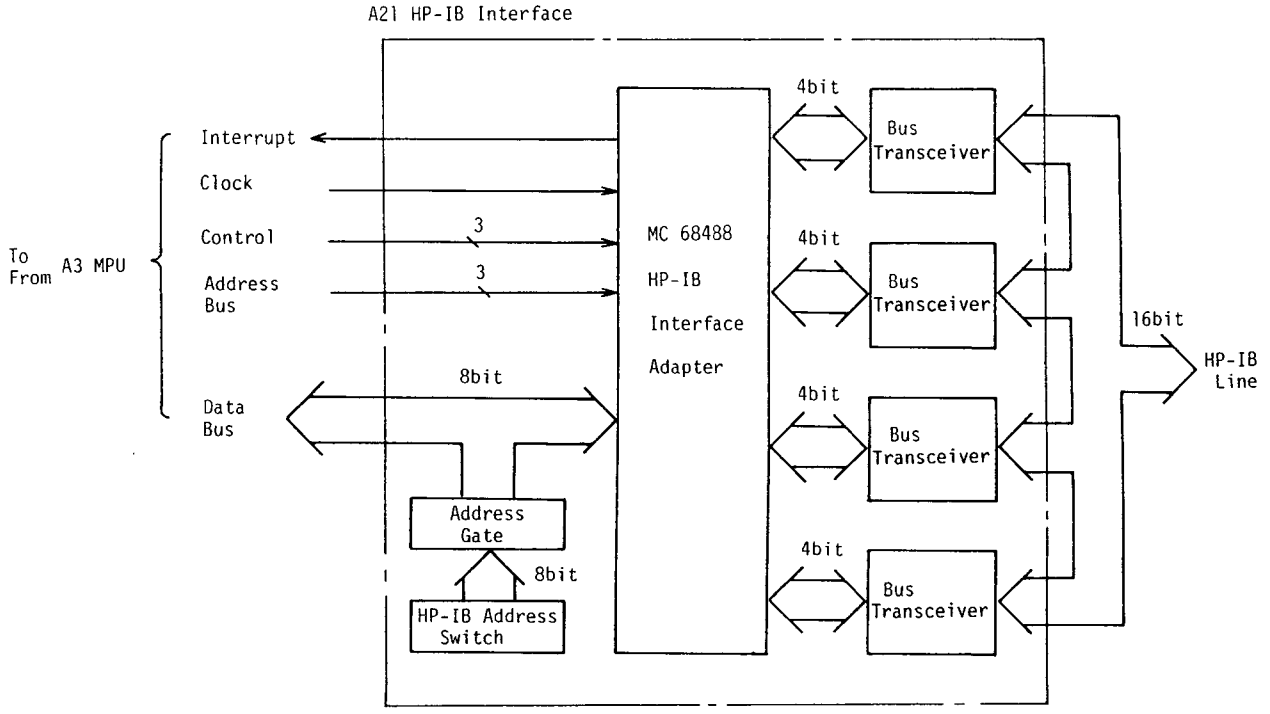


Figure 8-13. Opition 101 HP-IB Interface Block Diagram.

8-45. A21 HP-IB Interface (Option 101).

8-46. Figure 8-13 is a detailed block diagram of the Option 101 HP-IB Interface. A21 HP-IB transfers remote control program from HP-IB Controller to MPU on A3 board and measurement data from MPU to an HP-IB device (e. g. controller, Listen Only devices, etc.). A21 board contains MC68488 HP-IB Interface Adapter (A21U3), HP-IB Bus Transceiver (A21U4~7), HP-IB Address Switch (A21S1), etc. The Hewlett-Packard Interface Bus (HP-IB) is a carefully defined instrumentation interface which simplifies the integration of instruments, calculators, and computers into systems. The HP-IB employs a 16-line Bus to interconnect up to 15 instruments. Normally, this Bus is the sole communication link between the interconnected units. Each instrument on the Bus is connected in parallel to the 16 Bus lines. Eight of the lines are used to transmit data while the remaining eight lines are used for communication timing (Handshake) and control. Data is transmitted on the eight data lines as a series of eight-bit characters ("bytes"). Normally, a seven-bit ASCII code is used with an eighth bit available for a parity check. Data is transferred by means of an interlocked "handshake" technique which permits asynchronous communication over a wide range of data rates. Figure 8-14 illustrates the HP-IB interface connections and overall Bus structure. Bus communication is controlled by the five general interface management (control) lines. These lines determine how information will be interpreter by devices on the Bus. The data bus (lines DI01 through DI08) is used to transfer information between devices on the Bus. The three data byte transfer control (handshake) lines permit synchronization of the data transfer on the data bus.

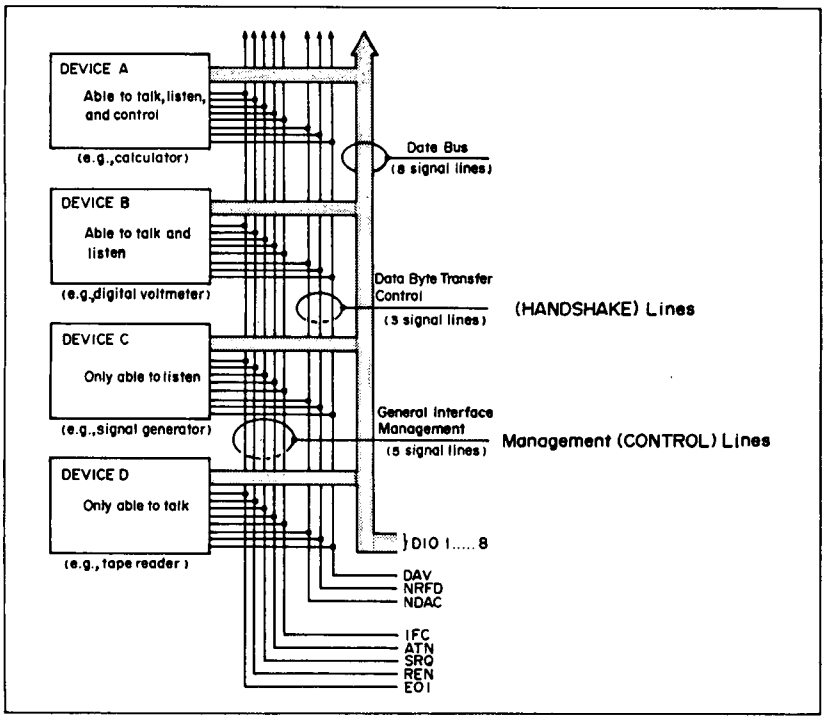


Figure 8-14. Interface Connections and Bus Structure.

8-47. TROUBLESHOOTING.

CAUTION

THE OPENING OF COVERS OR THE REMOVAL OF PARTS, EXCEPT THOSE TO WHICH ACCESS CAN BE GAINED BY HAND, IS LIKELY TO EXPOSE LIVE PARTS. IN ADDITION, ACCESSIBLE TERMINALS MAY ALSO BE LIVE.

THE APPARATUS SHALL BE DISCONNECTED FROM ALL VOLTAGE SOURCES BEFORE ANY ANY ADJUSTMENT, PARTS REPLACEMENT, OR MAINTENANCE AND REPAIR ARE PERFORMED FOR WHICH THE INSTRUMENT MUST BE OPENED. IF, AFTERWARDS, ANY ADJUSTMENT, MAINTENANCE OR REPAIR OF THE OPENED INSTRUMENT UNDER VOLTAGE IS REQUIRED, IT SHALL BE CARRED OUT ONLY BY A SKILLED PERSON WHO IS AWARE OF THE HAZARD INVOLVED.

8-48. Troubleshooting guide.

8-49. Figure 8-15 is helpful when starting to troubleshoot the 4140A. This flow diagram shows the fundamental procedures which breakdown the trouble possibilities to the component level.

8-50. Power Supply Isolation Procedure (P/O Figure 8-16.)

8-51. The Power Supply Isolation Procedure is basically used for checking the internal power supply voltages of the instrument. A guide for checking the power supply section is included in Figure 8-16.

8-52. Option Section Isolation Procedure (P/O Figure 8-16).

8-53. The Option Section Isolation Procedure, which is used to isolate the option section from the overall unit, is included in Figure 8-16. If the instrument is a standard unit equipped with no option, omit this procedure.

8-54. Circuit Block Isolation Procedure (Figure 8-16).

8-55. The troubleshooting guide in Figure 8-16 describes how to distinguish whether the faulty assembly is located in the pA Meter section, VS (Voltage Source) section or Digital section.

8-56. Digital Section Troubleshooting Procedure (Figure 8-17).

8-57. The troubleshooting flow diagram in Figure 8-17 helps to isolate a faulty board assembly in the VS (Voltage Source) Section. Component level troubleshooting guides are provided for each assembly in the Service sheets.

8-58. pA Section Troubleshooting Procedure (Figure 8-18).

8-59. The troubleshooting flow diagram in Figure 8-18 helps to isolate a faulty board assembly in the pA Meter section. Component level troubleshooting guides are provided for each assembly in the Service Sheets.

8-60. VS Section Troubleshooting Procedure (Figure 8-19).

8-61. The troubleshooting flow diagram in Figure 8-19 helps to isolate a faulty board assembly in the VS (Voltage Source) section. Component level troubleshooting guides are provided for each assembly in the Service Sheets.

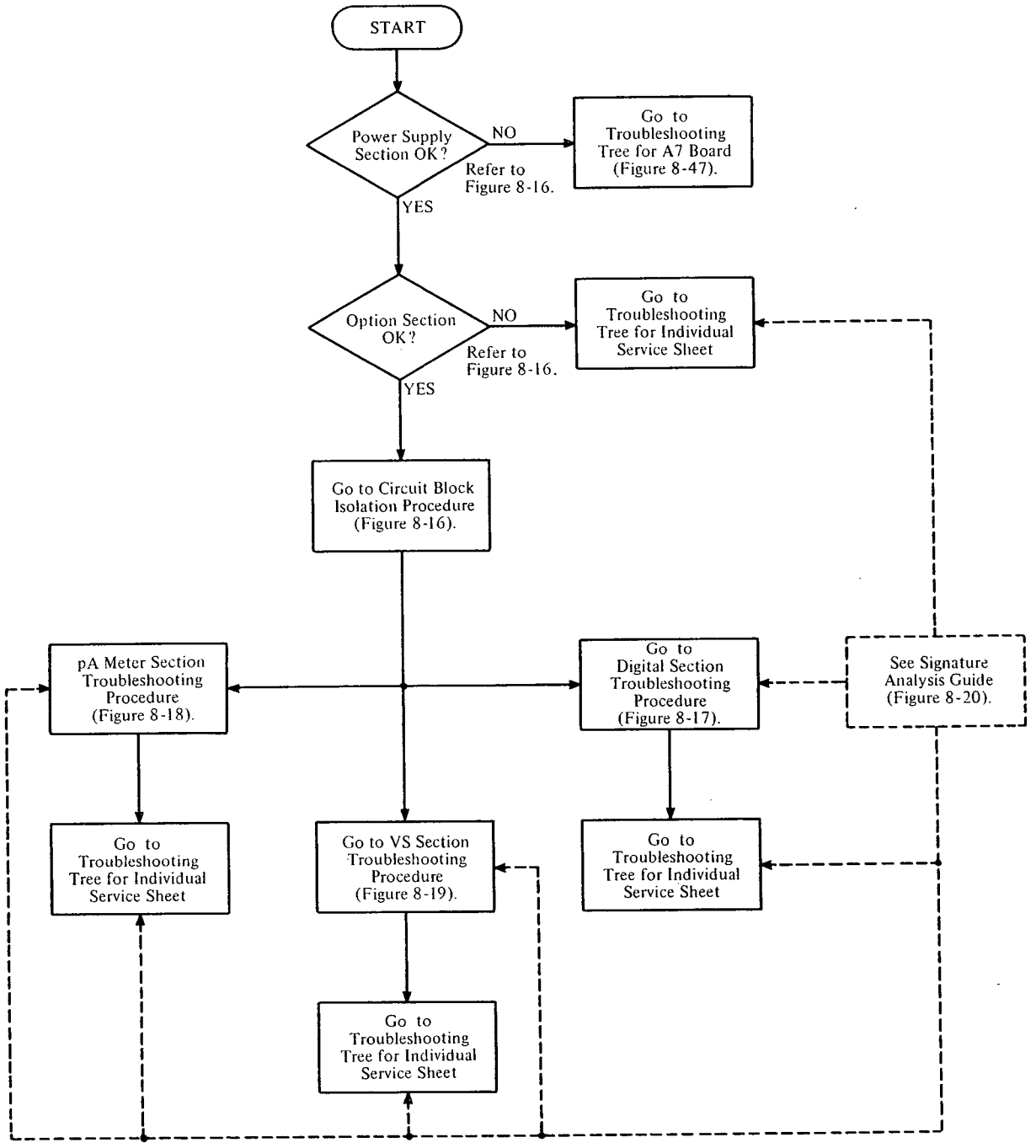


Figure 8-15. How to Use Troubleshooting Flow.

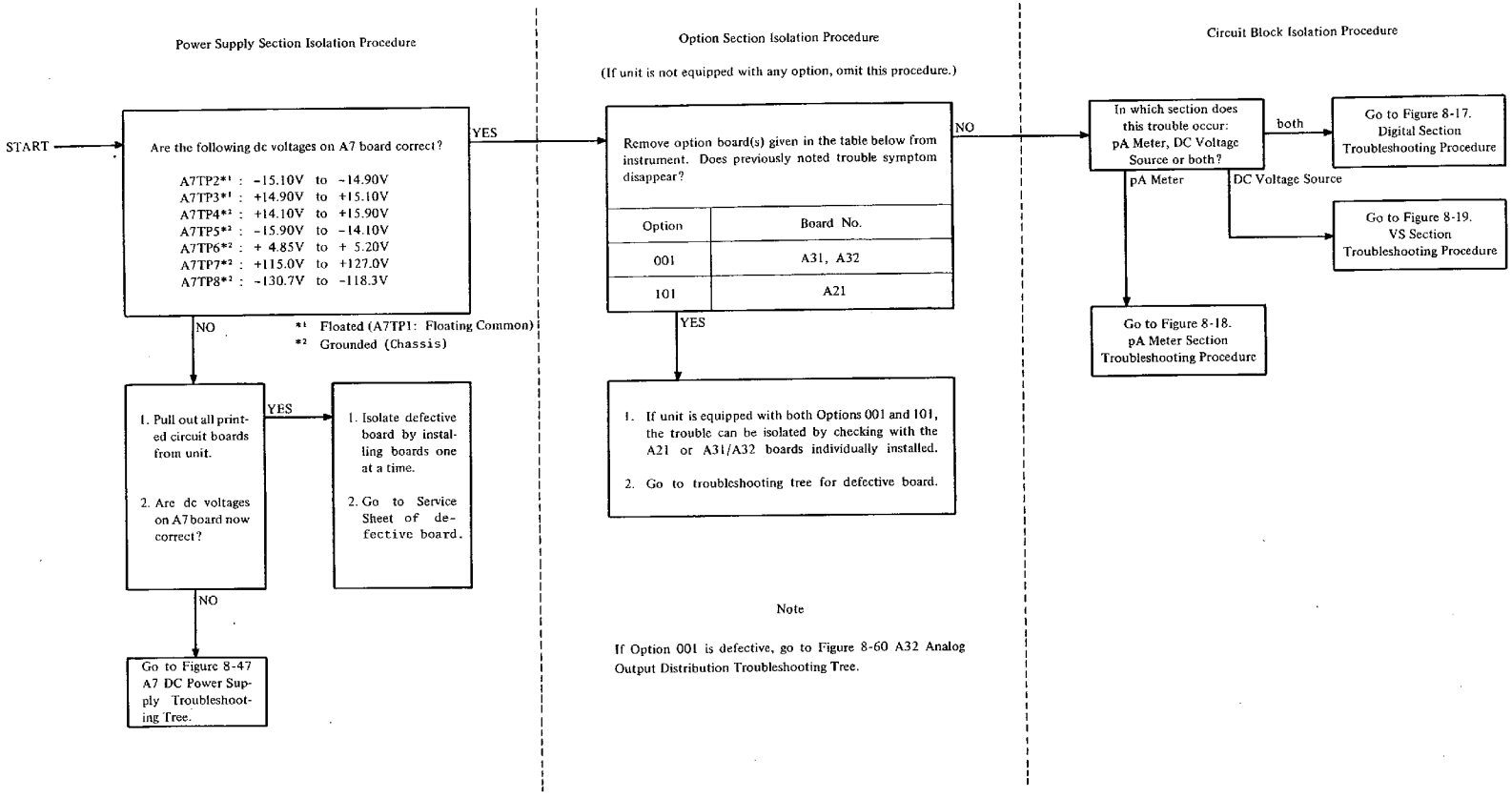


Figure 8-16. Circuit Block Isolation Procedure.

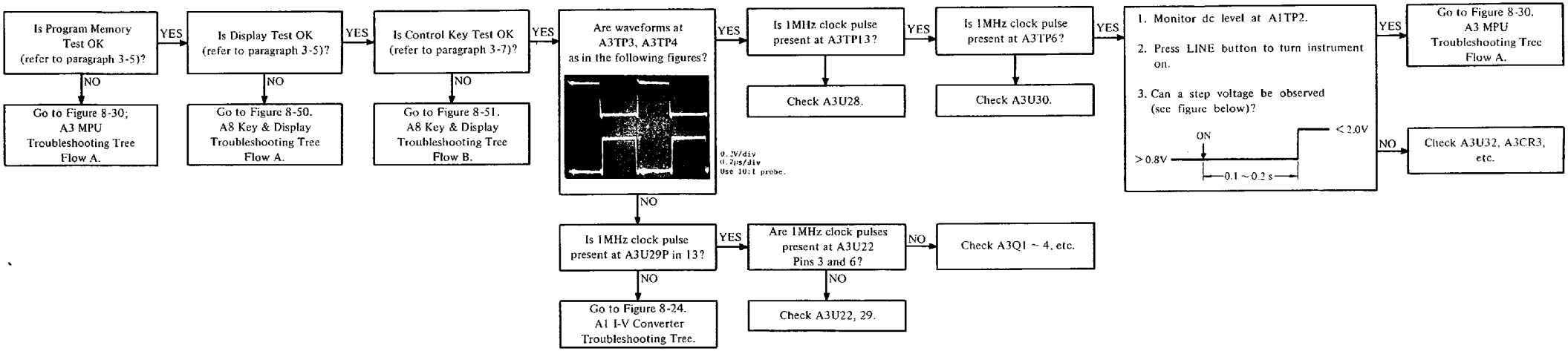


Figure 8-17. Digital Section Isolation Procedure.

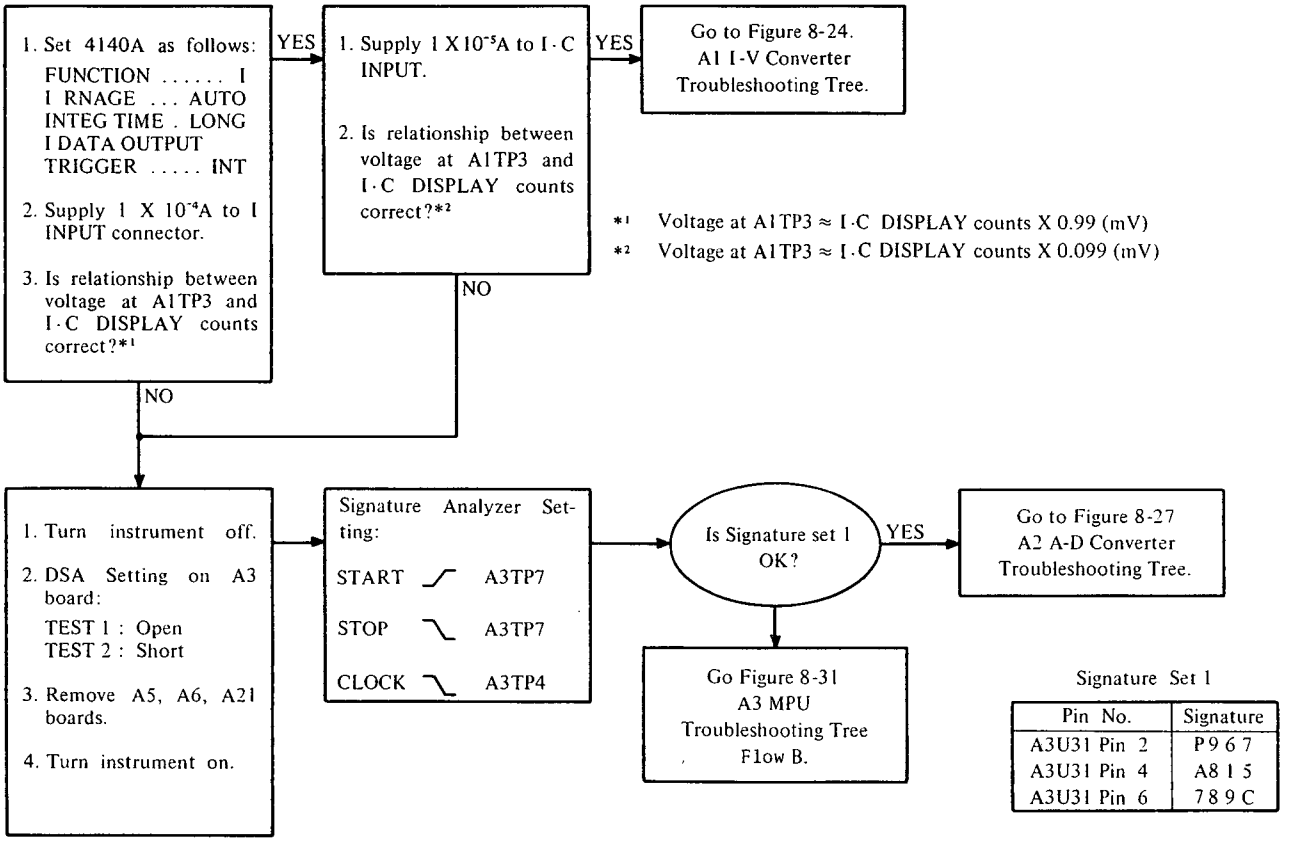
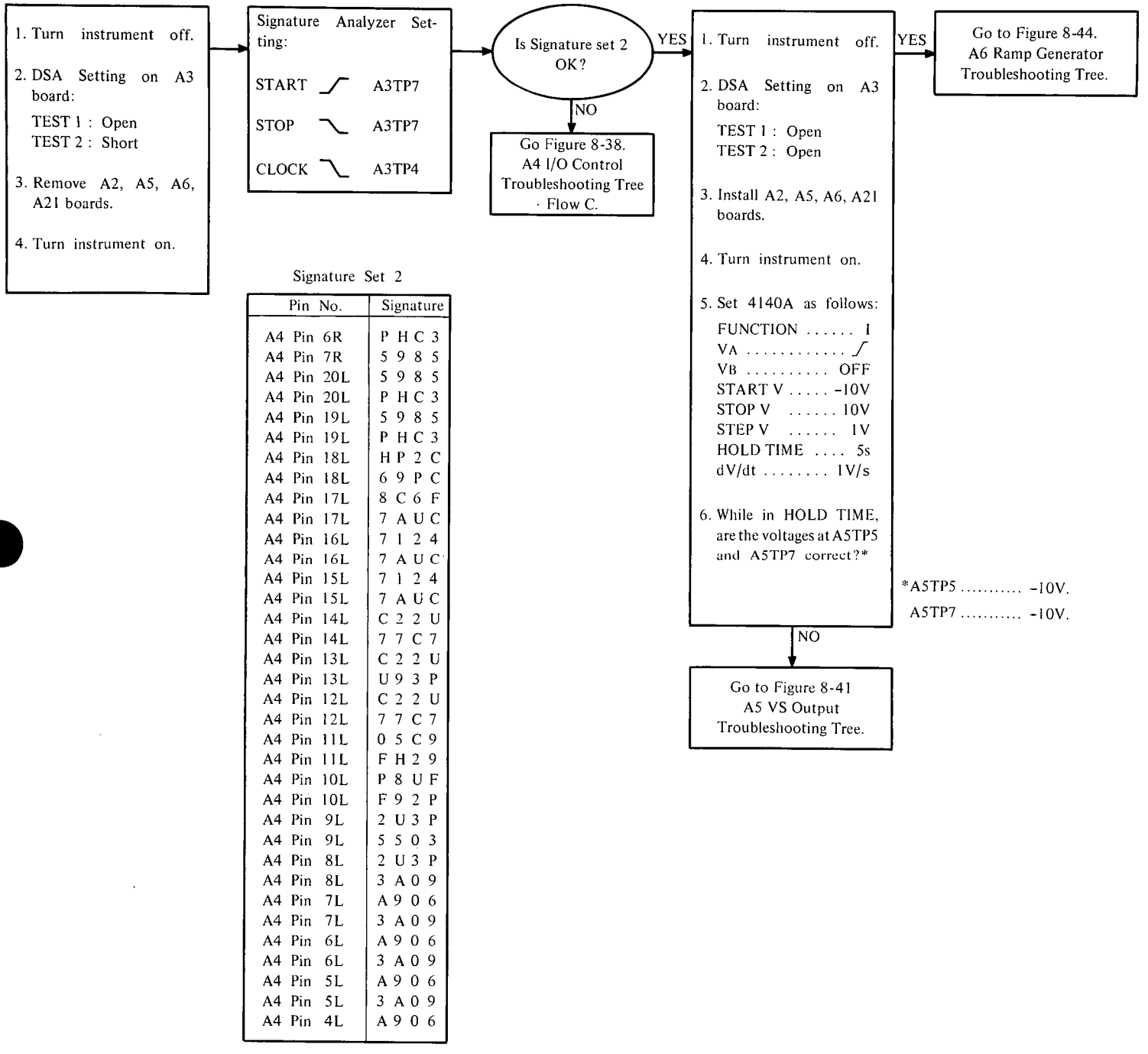


Figure 8-18. pA Meter Section Isolation Procedure.



Signature Set 2

Pin No.	Signature
A4 Pin 6R	P H C 3
A4 Pin 7R	5 9 8 5
A4 Pin 20L	5 9 8 5
A4 Pin 20L	P H C 3
A4 Pin 19L	5 9 8 5
A4 Pin 19L	P H C 3
A4 Pin 18L	H P 2 C
A4 Pin 18L	6 9 P C
A4 Pin 17L	8 C 6 F
A4 Pin 17L	7 A U C
A4 Pin 16L	7 1 2 4
A4 Pin 16L	7 A U C
A4 Pin 15L	7 1 2 4
A4 Pin 15L	7 A U C
A4 Pin 14L	C 2 2 U
A4 Pin 14L	7 7 C 7
A4 Pin 13L	C 2 2 U
A4 Pin 13L	U 9 3 P
A4 Pin 12L	C 2 2 U
A4 Pin 12L	7 7 C 7
A4 Pin 11L	0 5 C 9
A4 Pin 11L	F H 2 9
A4 Pin 10L	P 8 U F
A4 Pin 10L	F 9 2 P
A4 Pin 9L	2 U 3 P
A4 Pin 9L	5 5 0 3
A4 Pin 8L	2 U 3 P
A4 Pin 8L	3 A 0 9
A4 Pin 7L	A 9 0 6
A4 Pin 7L	3 A 0 9
A4 Pin 6L	A 9 0 6
A4 Pin 6L	3 A 0 9
A4 Pin 5L	A 9 0 6
A4 Pin 5L	3 A 0 9
A4 Pin 4L	A 9 0 6

Figure 8-19. VS Section Isolation Procedure.

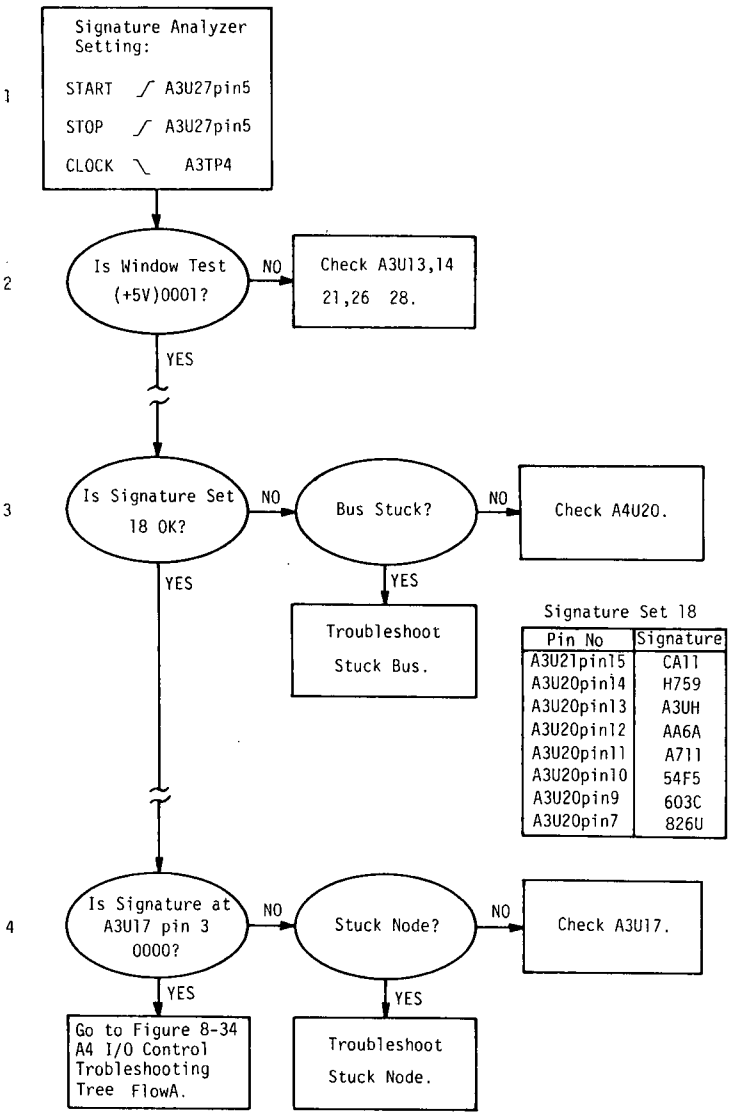
8-62. Digital Circuit Troubleshooting Using Signature Analysis

8-63. Troubleshooting of the 4140A digital circuit uses "Signature Analysis". The advantage of troubleshooting based on "Signature Analysis" is accuracy and ease in finding failures. It is generally difficult to search for an error by means of observing waveforms on an oscilloscope for the reason that bit trains in a digital circuit seem to be much the same whichever is observed. Specifically, to find the errors in streams of large bit size (or word length) data takes much time and requires the use of an instrument such as a logic state analyzer. Hewlett-Packard has proposed a method called "Signature Analysis" which recognizes the bit pattern measured in a 4 digit hexa-decimal code (signature) for running an easy diagnostic test program. With the Signature Analyzer (HP 5004A), the signatures are displayed in a readable 4 digit-figure set of alphanumeric figures (0 1 2 3 4 5 6 7 8 9 A C F H P U). The signature analysis is based the usual signal tracing method followed in troubleshooting an analog circuit. According to signature analysis, devices in a digital circuit are checked with the signal input and output signatures to and from each device for the "correct" signature denoted in the service manual signature map. If a signature is not identical, the troubleshooter need only trace the bit train in opposite direction to the signal flow and, when a device is noted which generates an erratic signature despite a correct input, the component may be regarded as faulty. Refer to Figure 8-20 for "Signature Analysis" guidelines.

SIGNATURE ANALYZER TECHNIQUE

An active digital hand-held logic tracer coupled with an active pod (with four miniature clip connection leads) is sufficient for detecting the test signal and for development of the signature on the Signature Analyzer display. The active probe has access to the desired node in the circuit being tested and transfers this input data to the analyzer. The four input leads of the test cable active pod connect the gate signals - START, STOP, and CLOCK - from the instrument being tested to the analyzer. The remaining lead is connected to instrument GND. The START signal is an open "window" (measurement gate) signal which causes the signature analyzer to prepare for receiving data via the active probe. The STOP signal causes the window to close. The CLOCK is taken from the time base of the instrument and permits receiving input data and gate signals in synchronization. Polarity of the gate signal active (enable) edges (positive or negative) can be selected by the front panel controls of the signature analyzer. Probing points and connection locations of START, STOP and CLOCK leads are designated on the troubleshooting flow diagrams.

Figure 8-20. Signature Analysis Guide. (Sheet 1 of 2)



1. Both START and STOP signals are taken from A3U27 Pin 5. CLOCK signal is taken from A3TP4. Front panel control settings for Signature Analyzer are:

   START button: released (▀▁)

   STOP button: released (▀▁)

   CLOCK button: depressed (▁▀)

2. Checks that signature of +5V supply is 0001.

3. Compares actual signatures with signature set 18 in the table and on the signature map (see Figure B). If incorrect, use a HP Model 547A Current Tracer to correct a "stuck" bus.

4. Checks that signature of A3U17 pin 3 is 0000. If incorrect, use the Current Tracer to find "stuck" node. If correct, go to Figure 8-34 I/O Control Troubleshooting Tree Flow A.

Figure A. Signature Analysis Diagnostic Flow Diagram Notes.

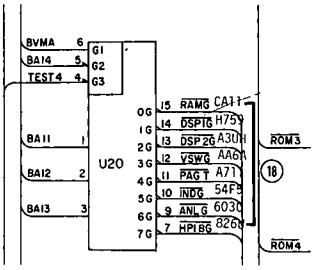


Figure B. Signature Map Notes on Schematic Diagram.

Figure 8-20. Signature Analysis Guide. (Sheet 2 of 2)

8-64. BOARD REMOVAL PROCEDURE.

8-65. A1 Board Removal:

a. Fully loosen top cover retaining screw located at rear of instrument and lift off top cover.

b. Remove board support mounting screws (3) and take off board support.

c. Remove the A1 board mounting screws (2).

d. Remove the screw next to I INPUT Connector.

e. Lift off A1 board from motherboard.

f. Pull out the A1 board from front panel.

8-66. A3 and A21 Boards Removal (Opt. 101 Only):

a. Fully loosen top cover retaining screw located at rear of instrument and lift off top cover.

b. Remove A21 board mounting screws (2) located at rear panel.

c. Remove A21 board from rear edge connection on the A3 board.

d. Remove board support mounting screw (3) and take off board support.

e. Remove the A3 board.

8-67. A4 and Analog Output Assembly Removal (Opt. 001 Only):

a. Fully loosen top cover retaining screw located at rear of instrument and lift off top cover.

b. Remove Analog Output Assembly (HP Part No: 04140-61001) mounting screws (2) located at rear panel.

c. Remove Analog Output Assembly from rear edge connector on the A4 board.

d. Remove board support mounting screws (3) and take off board support.

e. Remove the A4 board.

8-68. A8 Board Removal:

a. Fully loosen top cover retaining screw located at rear of instrument and lift off top cover.

b. Remove the screw next to I INPUT Connector.

c. Carefully strip off adhesive-backed trim strips from left side of front frame.

d. Remove the two screws from left side of front frame.

e. Carefully remove trim strip from top of front frame (without bending trim strip).

f. Remove the three (3) screws from top of front frame.

g. Remove the two (2) foot assemblies and the three screws from bottom of front frame.

h. Press front panel assembly forward (from inside) without adding stress to the cable assemblies which are connected between front panel and main body.

i. Remove the A8 board mounting screws (8).

j. Remove the A8 board.

8-69. PRODUCT SAFETY CHECKS.

WARNING

WHENEVER IT APPEARS LIKELY THAT SAFETY PROTECTIVE PROVISIONS HAVE BEEN IMPAIRED, THE APPARATUS SHALL BE MADE INOPERATIVE AND BE SECURED AGAINST ANY UNINTENDED OPERATION. THE PROTECTION IS LIKELY TO BE COMPROMISED IF, FOR EXAMPLE:

--- THE APPARATUS SHOWS VISIBLE DAMAGE.

--- THE INSTRUMENT FAILS TO PERFORM THE INTENDED MEASUREMENT.

--- THE UNIT HAS UNDERGONE PROLONGED STORAGE UNDER UNFAVORABLE CONDITIONS.

--- THE INSTRUMENT HAS SUFFERED SEVERE TRANSPORT STRESS.

8-70. The following five checks are recommended to verify the product safety of the 4140A pA Meter/DC Voltage Source (these checks may also be done to check for product safety after troubleshooting and repair). When such checks are needed, perform the following:

1. Visually inspect interior of instrument for any signs of abnormal internally generated heat such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy cause of any such condition.

2. Using a suitable ohmmeter, check resistance from instrument enclosure to ground pin on power cord plug. The reading must be less than 0.5ohm. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.

3. Check GUARD terminal on front panel using Procedure (2).

4. Disconnect instrument from power source. Turn power switch to on. Check resistance from instrument enclosure to line and neutral (tied together). The minimum acceptable resistance is two megohms. Replace any component which fails or causes a failure.

5. Check line fuse to verify that a correctly rated fuse is installed.

8-71. GENERAL NOTES.

a. Unless otherwise indicated, resistance is in ohms, capacitance in microfarads and inductance in microhenries.

b. Components assigned an asterisk (*) are factory selected with average values shown.

c. The components mounted on chassis or mainframe parts are not assigned an assembly designation (e.g. R1, Q1, etc.). Within an assembly, (A1, A2 ----etc.) use assembly designation as prefix to form complete designation (e.g. R1, in A1 assembly is A1R1).

8-72. Additional notes are shown in Figure 8-21.

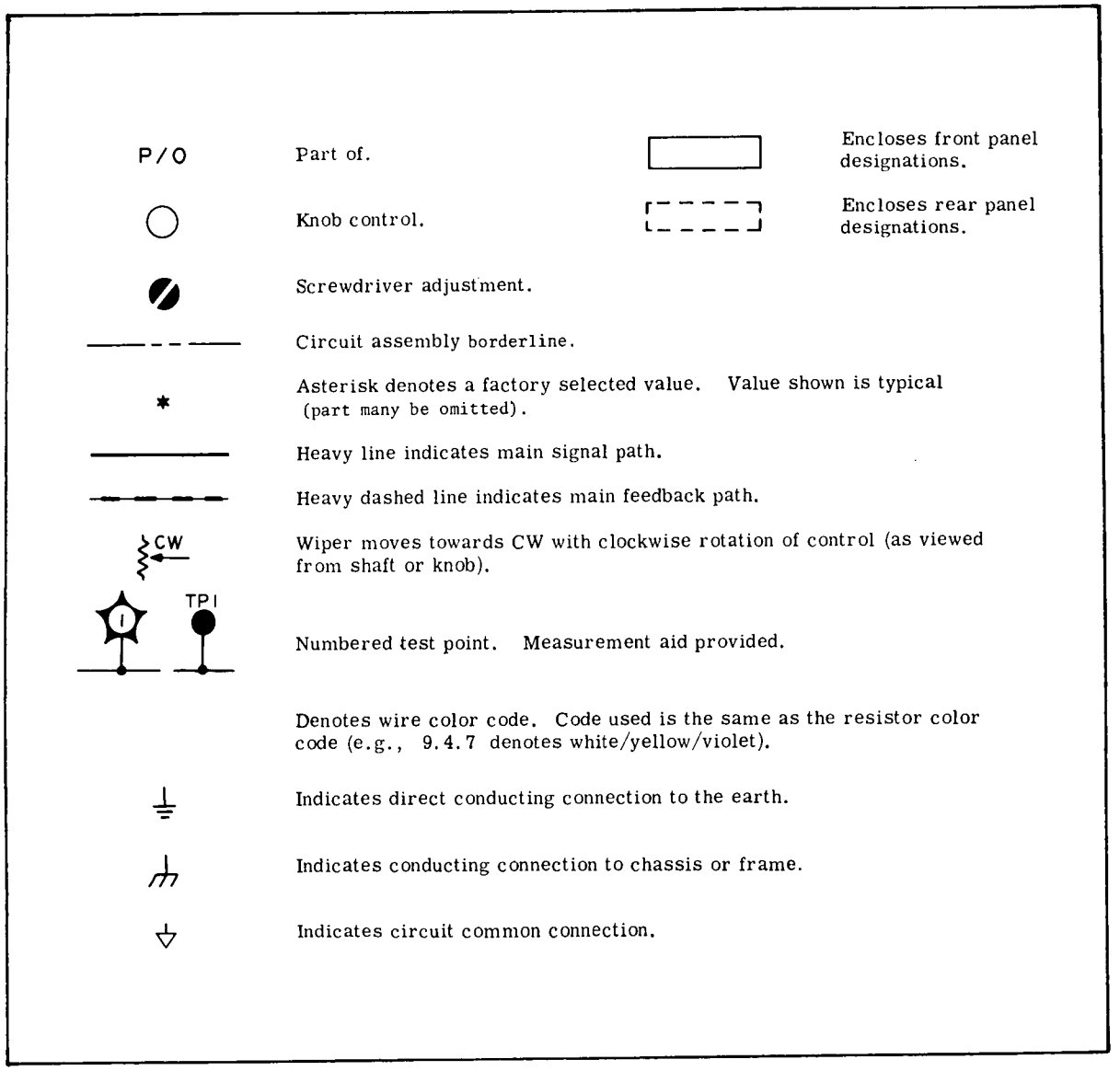
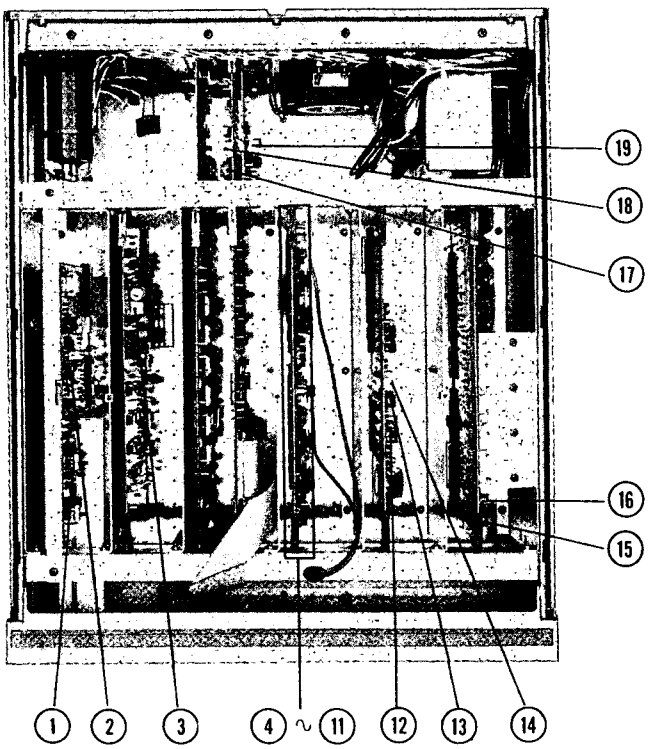
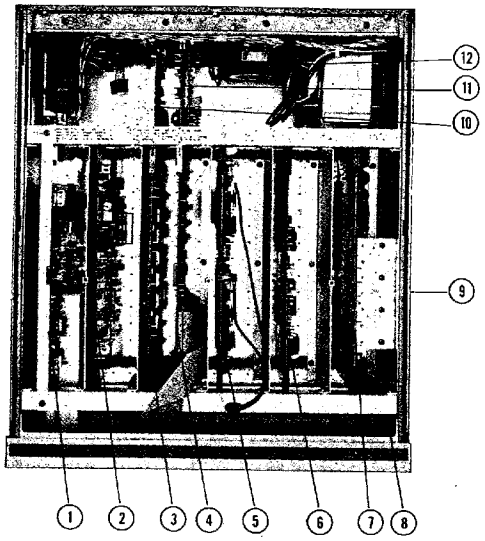


Figure 8-21. Schematic Diagram Notes.



1	A1R5	(SWS R ADJ)
2	A1R24	(OFFSET ADJ)
3	A2R20	(pA GAIN)
4	A5R19	(x10 ZERO)
5	A5R24	(x1 ZERO)
6	A5R31	(x10 GAIN)
7	A5R64	(x10 ZERO)
8	A5R69	(x1 ZERO)
9	A5R76	(x10 GAIN)
10	A5R91	(DA ZERO)
11	A5R94	(DA GAIN)
12	A6R11	(COMP ZERO)
13	A6R12	(dV/dt BUF ZERO)
14	A6R13	(dV/dt ADJ)
15	A7R1	(-15VF)
16	A7R2	(+15VF)
17	A31R4	(ZERO)
18	A31R5	(GAIN)
19	A32R5	(x1/10 ZERO)

Figure 8-22. Adjustment Location.



(1) A1 I-V Converter (HP Part No.: 04140-66501)
(2) A2 A-D Converter (HP Part No.: 04140-66502)
(3) A3 MPU (HP Part No.: 04140-66513)
(4) A4 I/O Control (HP Part No.: 04140-66504)
(5) A5 DAC & Power Amplifiers (HP Part No.: 04140-66505)
(6) A6 Ramp Generator (HP Part No.: 04140-66506)
(7) A7 Power Supply (HP Part No.: 04140-66507)
(8) A8 Display (HP Part No.: 04140-66508)
(9) A9 Mother board (HP Part No.: 04140-66509)
(10) A21 HP-IB Interface (HP Part No.: 04140-66521)
(11) A31 Analog Output Control (HP Part No.: 04140-66531)
(12) A32 Analog Output Amplifier (HP Part No.: 04140-66532)

Figure 8-23. Assembly Location.

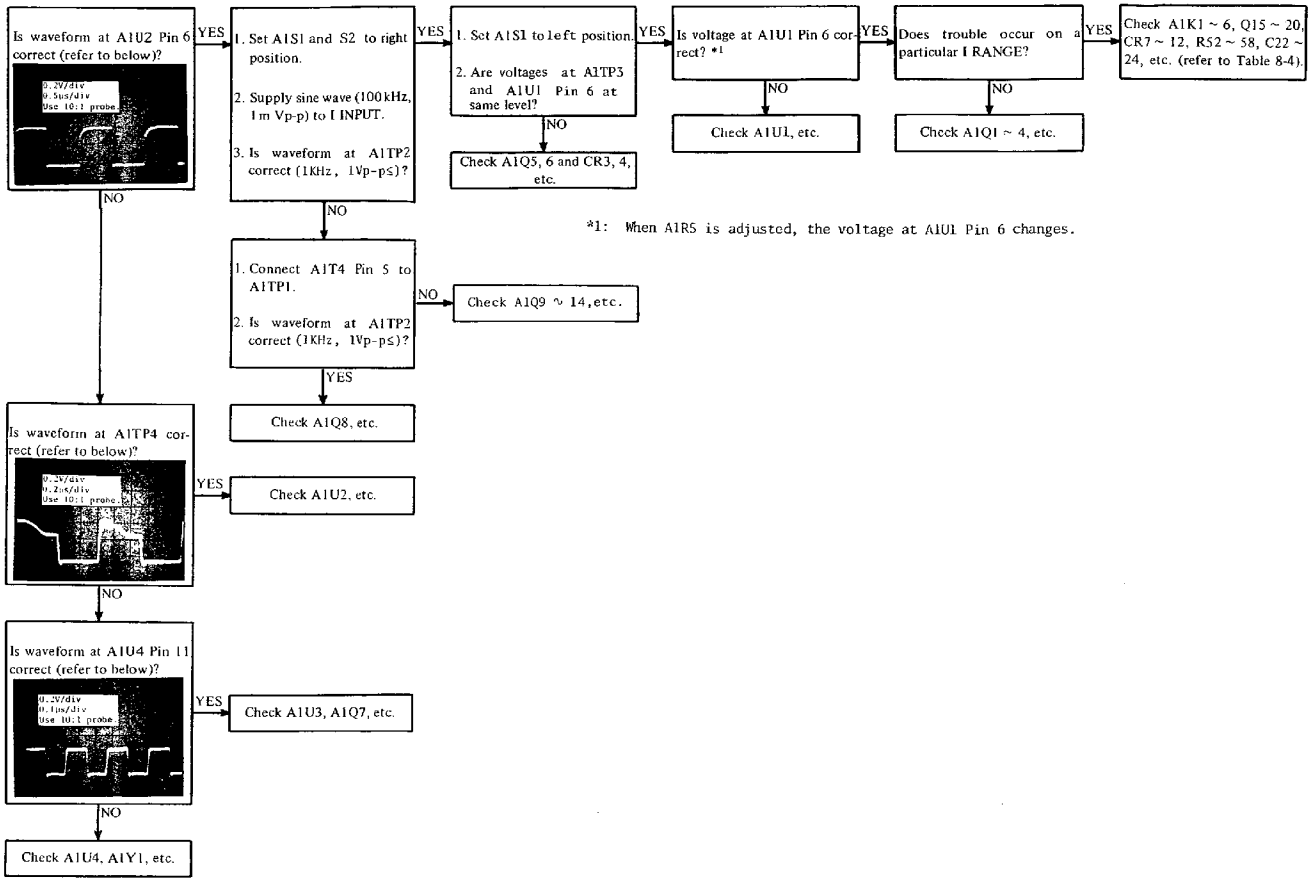


Figure 8-24. A1 I-V Converter Troubleshooting Tree.

High Input Impedance Amplifier

Amplifiers for small current detection require high input impedances, small bias currents as well as low offset voltages. In addition, high gain is required to maintain the low input impedance of the pA-Meter as well as low noise circuitry for stable measurement. The 4140A features such a high input impedance amplifier as shown in Figure A as its current detector. C1 and C2 are the gate capacitances of a dual-junction FET and these two capacitors change differentially to each other with the bias voltage. The capacitance bridge consists of C1 and C2 and center tapped transformer T1 which is driven by a 20mVp-p 500KHz AC Signal. Initial adjustments to T2 are made in the bridge to satisfy the equation below when the input DC bias (Vi) is zero:

$$C1\ V1 + C2\ V2 = 0$$

When Vi is applied, the bridge is unbalanced and generates unbalance voltage Vx which is proportional to input DC bias Vi. Vx is amplified by AC amplifier A1 whose gain is approximately 80dB. This signal is converted to a DC voltage by a 500KHz P.S.D. (phase sensitive detector) and generates DC output voltage Vo through integrator A2. Total gain of this amplifier (Vo/Vi) is more than 100 dB.

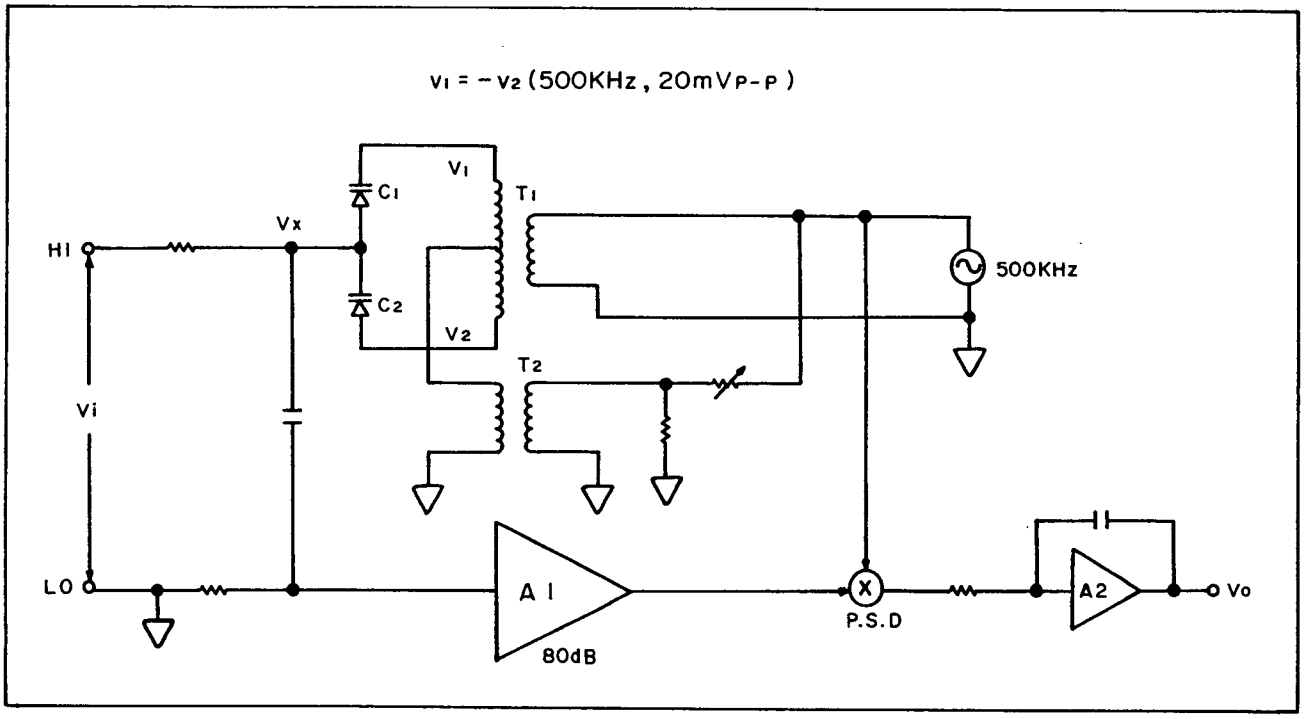


Figure A

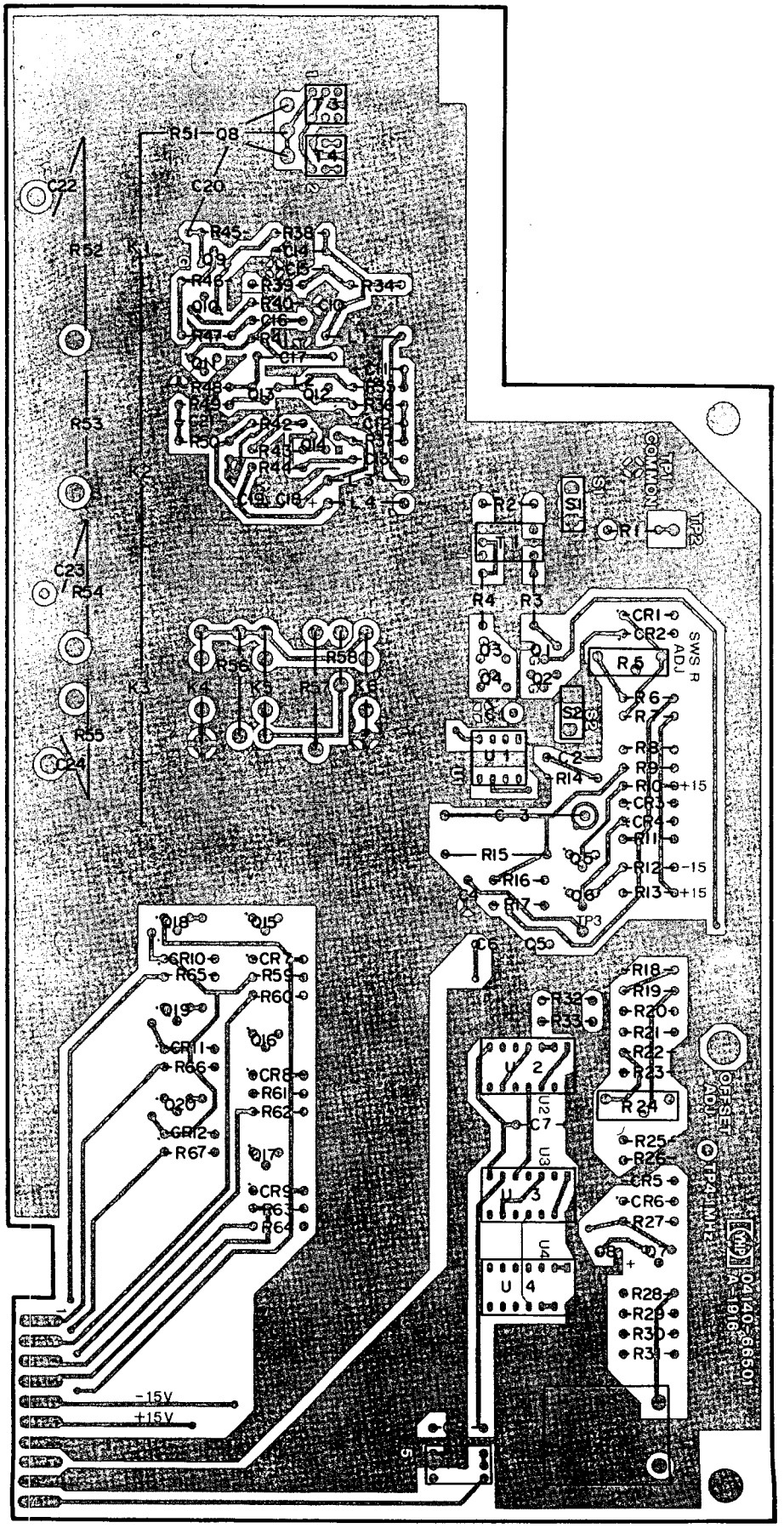


Figure 8-25. A1 I-V Converter Assembly Component Locations.

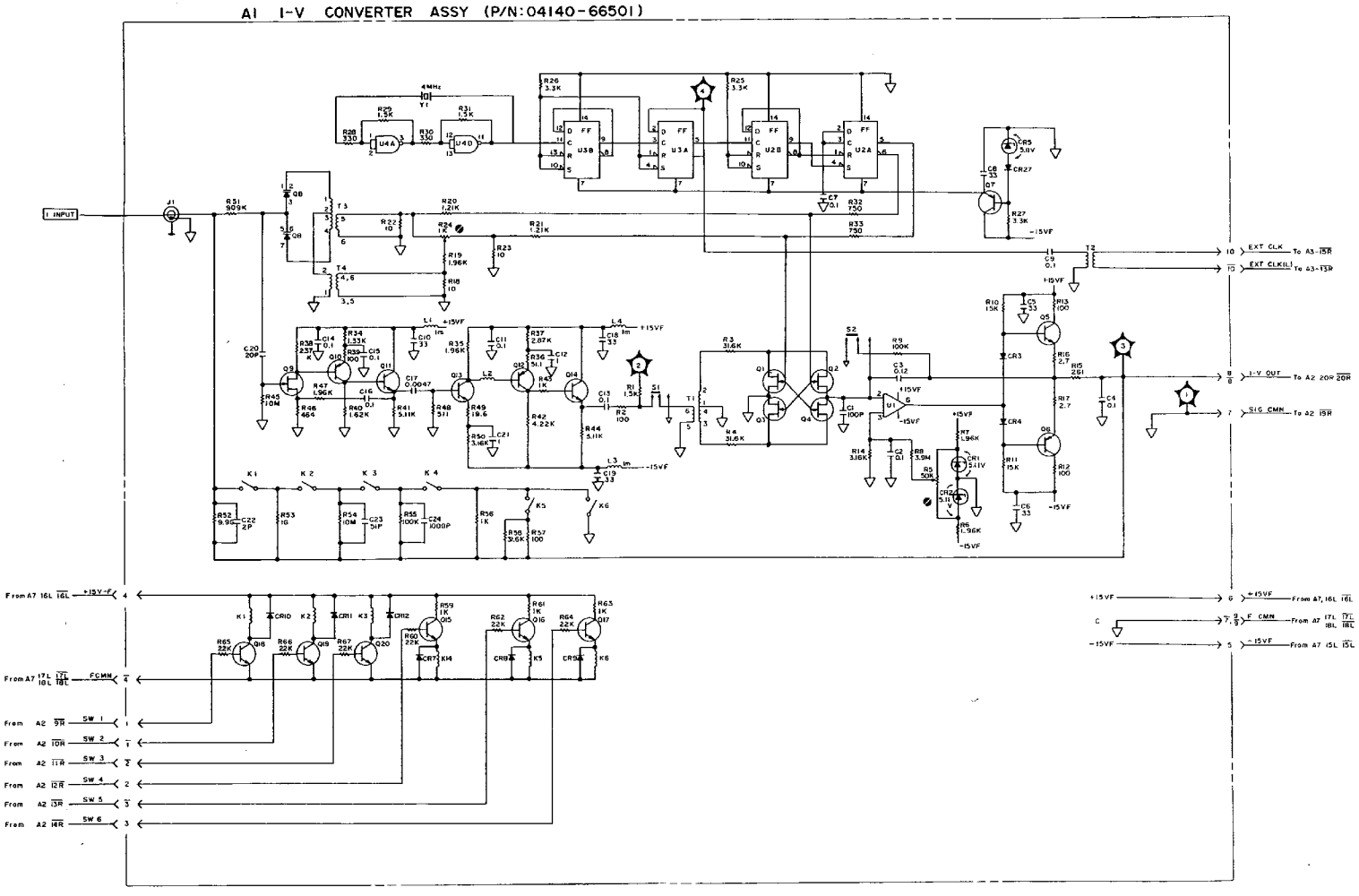


Figure 8-26. A1 I-V Converter Assembly Schematic Diagram.

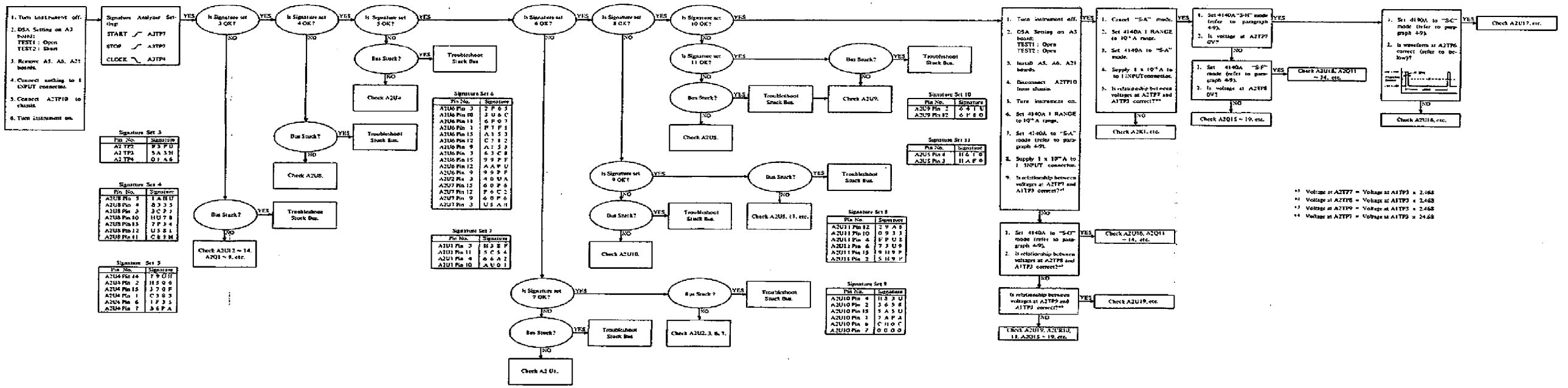


Figure 8-27. A2 A-D Converter Troubleshooting Tree.

I-V Converter
SERVICE SHEET 1
SEE INSIDE

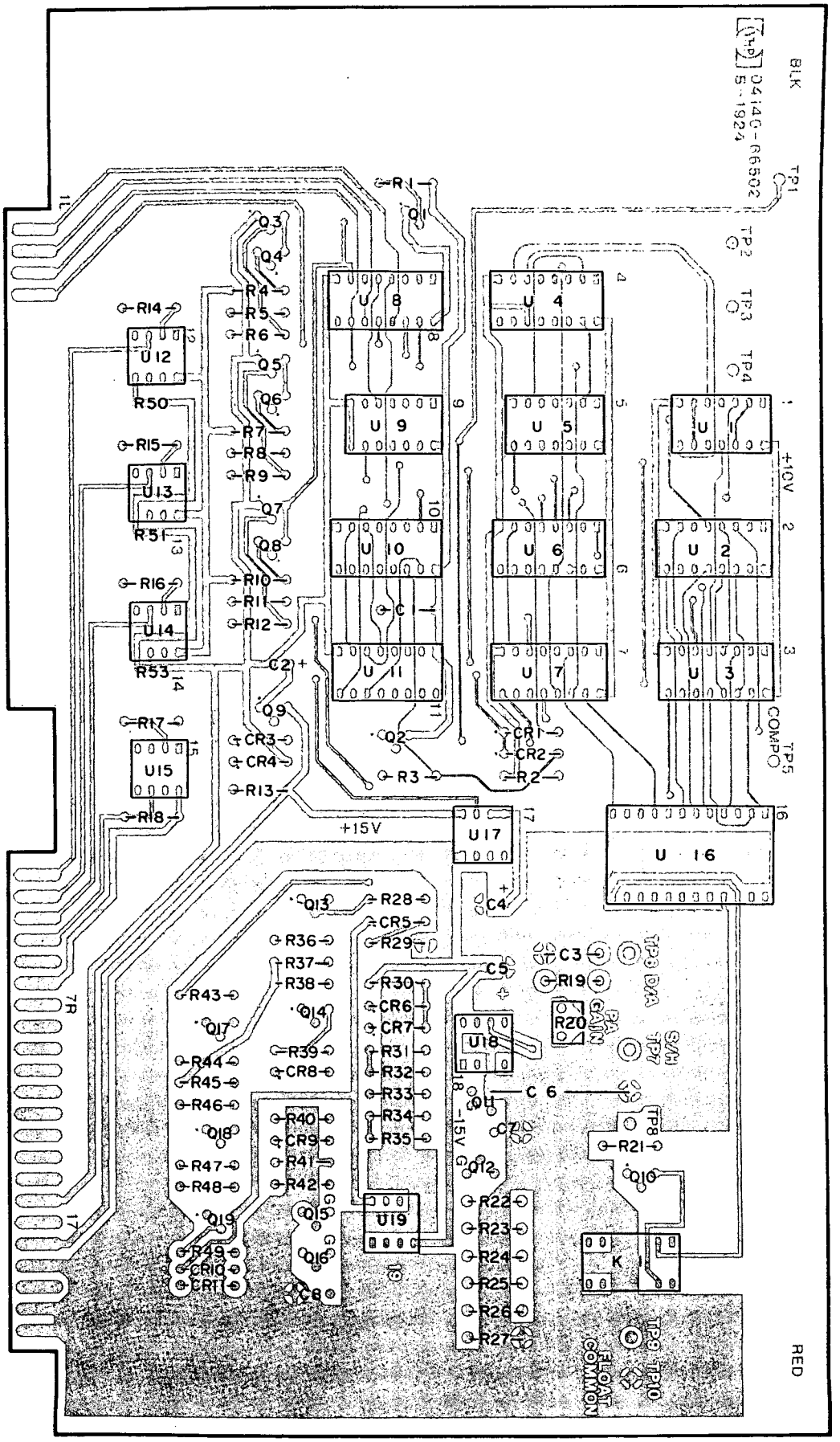


Figure 8-28. A2 A-D Converter Assembly Component Locations.

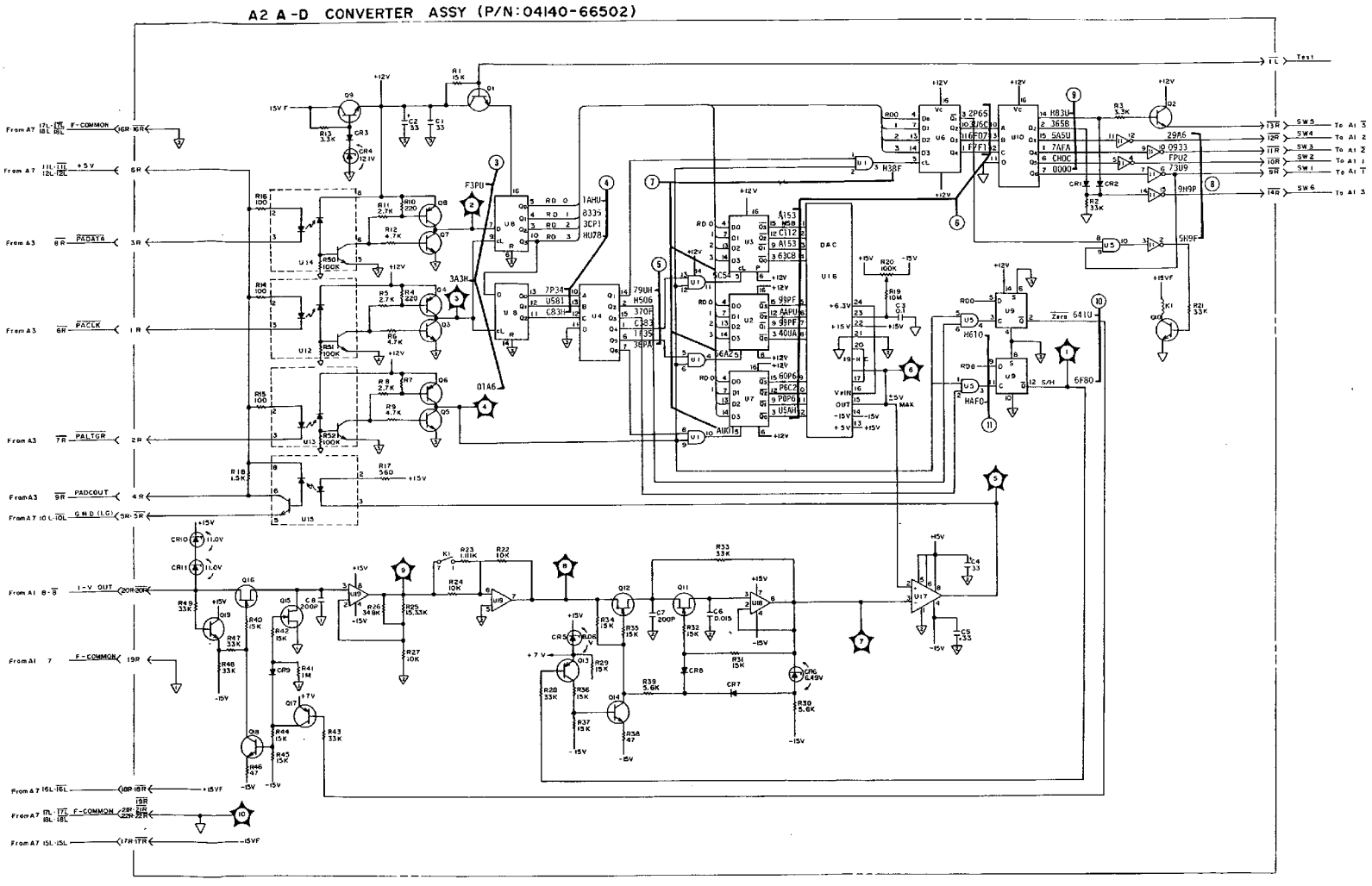


Figure 8-29. A2 A-D Converter Assembly Schematic Diagram.

Figure 8-30. A3 MPU Troubleshooting Tree Flow A.

Figure 8-31. A3 MPU Troubleshooting Tree Flow B.

Section VIII
Figures 8-30 and 8-31

Model 4140A

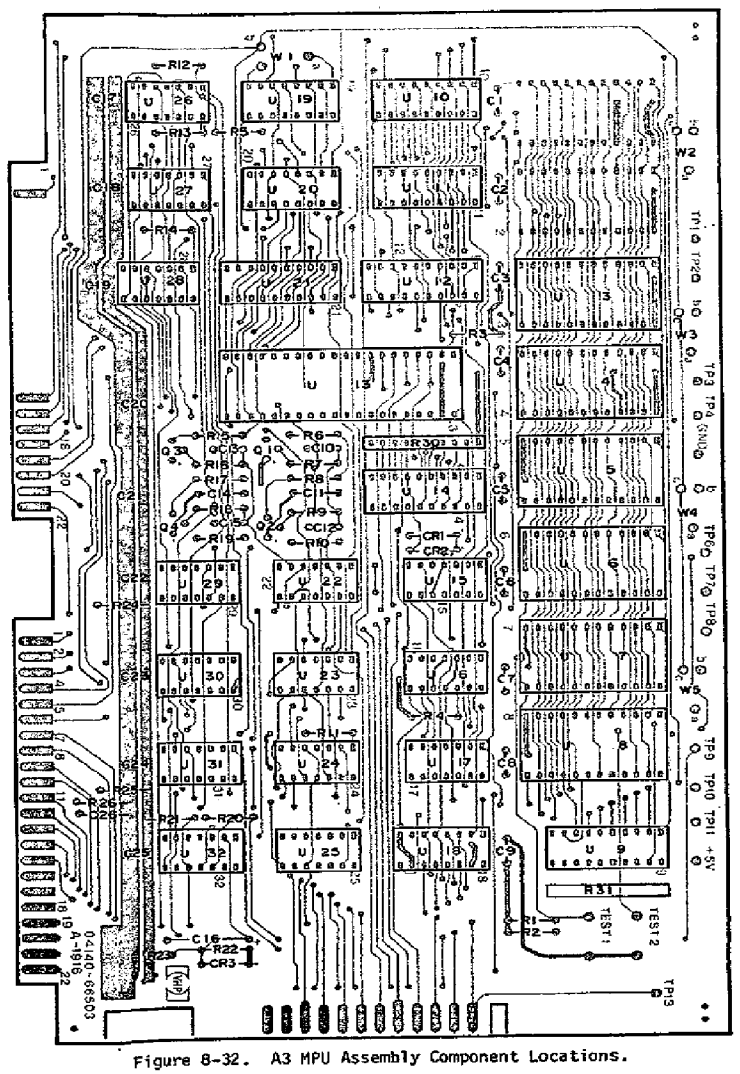


Figure 8-32. A3 MPU Assembly Component Locations.

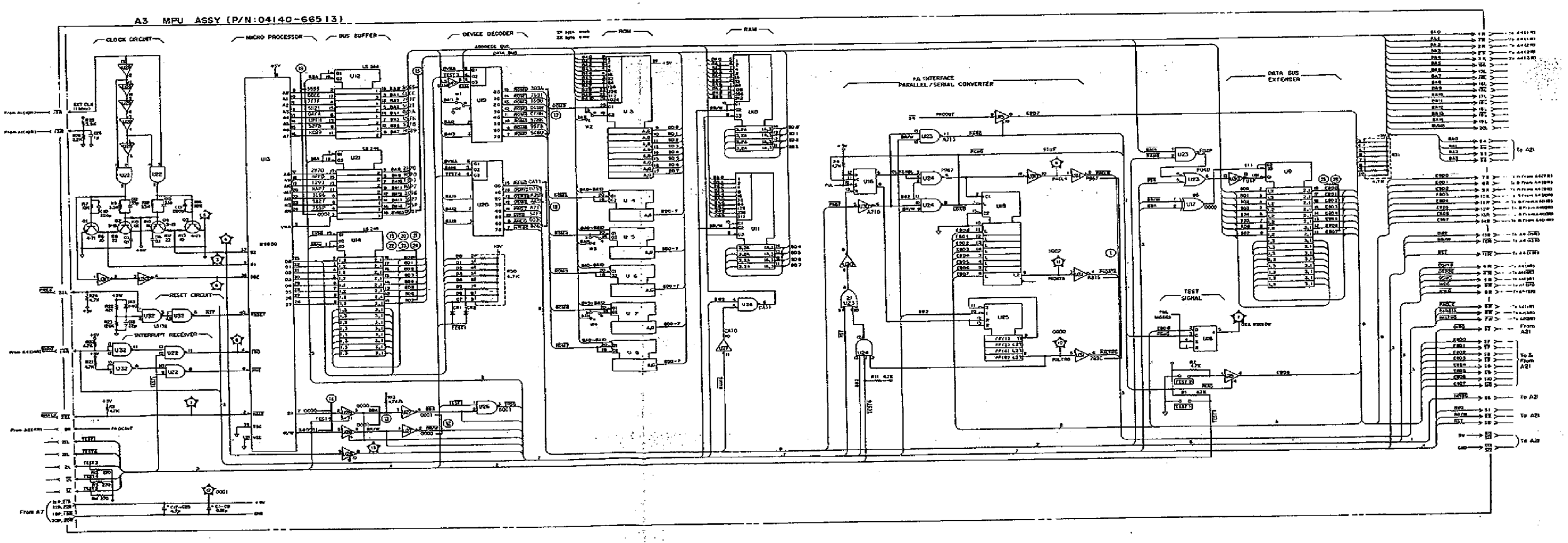


Figure 8-33. A3 MPU Assembly Schematic Diagram.

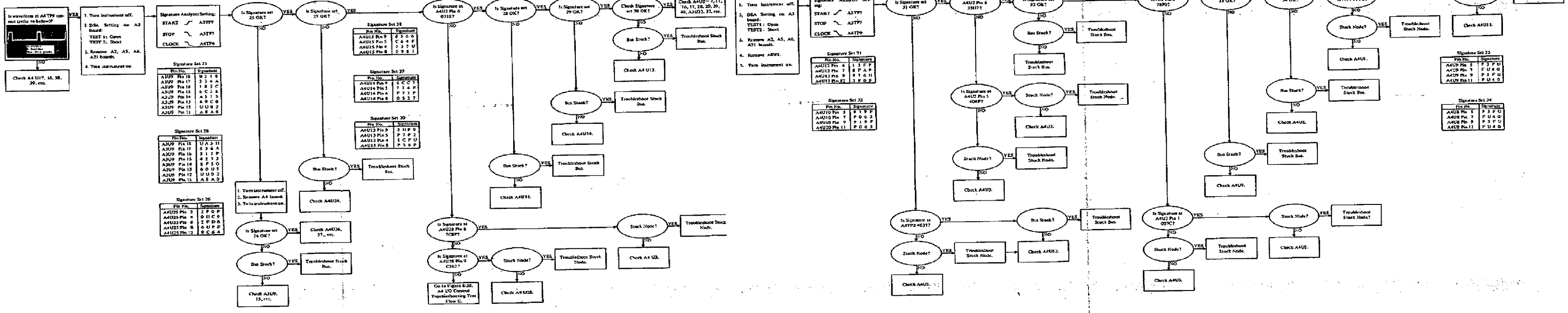


Figure 8-34. A4 I/O Control Troubleshooting Tree Flow A.

Figure 8-35. A4 I/O Control Troubleshooting Tree Flow B.

MPU
SERVICE SHEET 3
SEE INSIDE

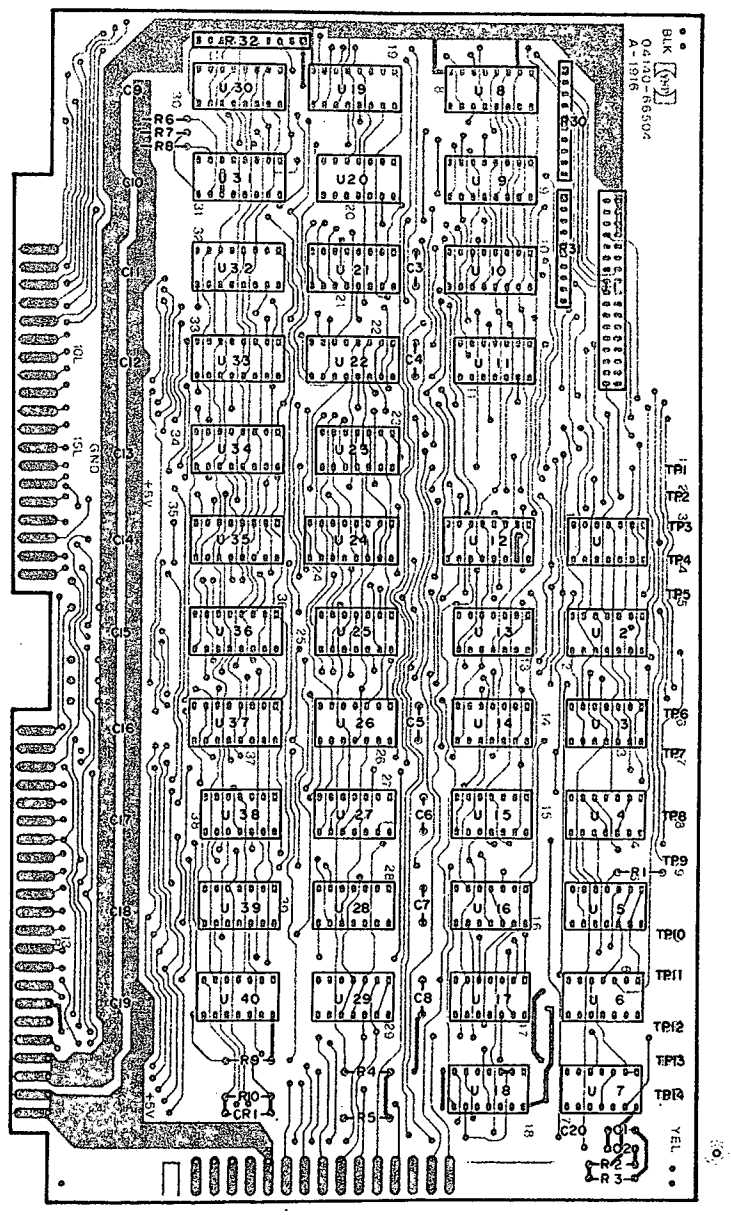


Figure 8-36. A4 I/O Control Assembly Component Locations.

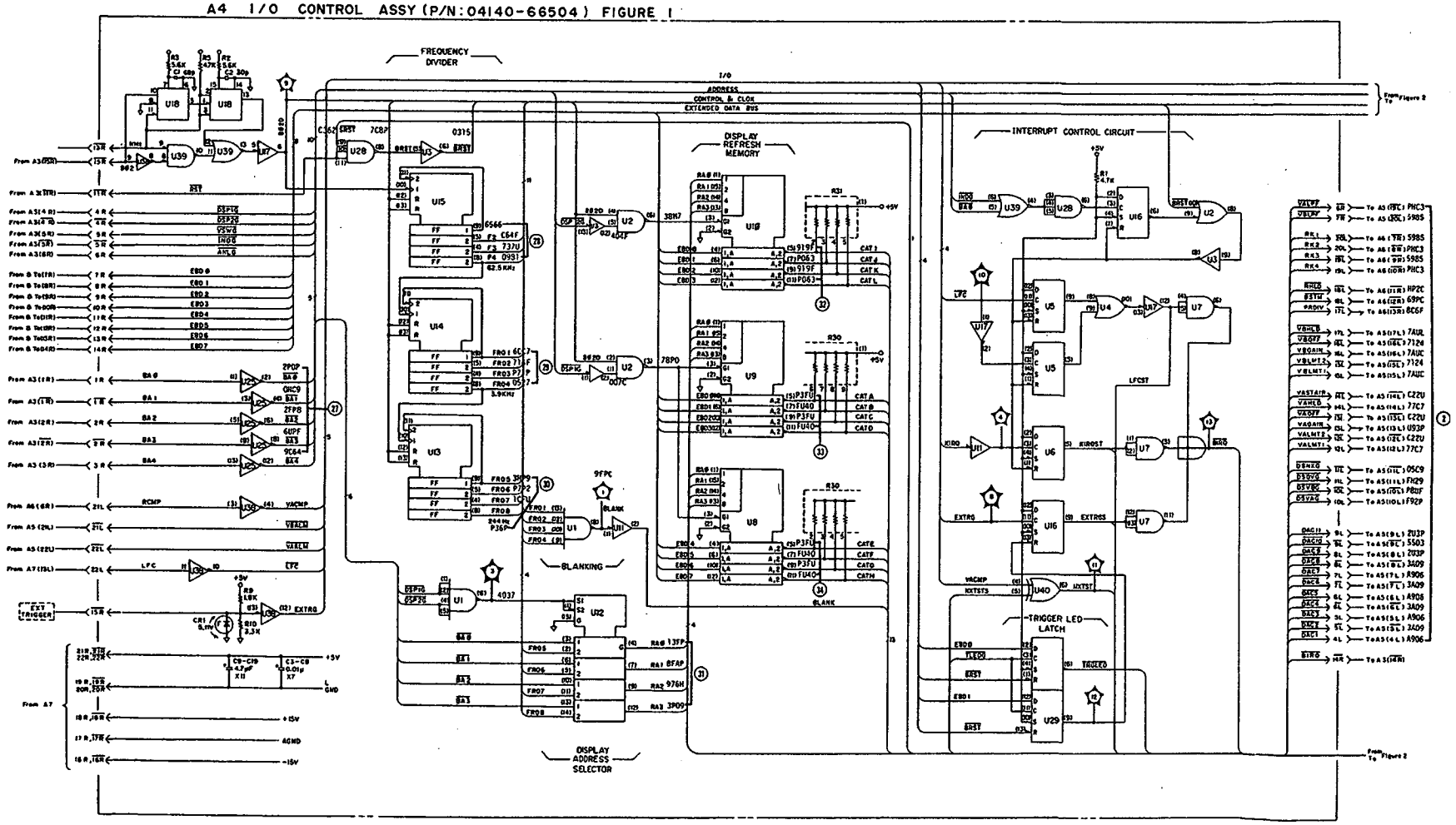


Figure 8-37. A4 I/O Control Assembly Schematic Diagram Figure 1.

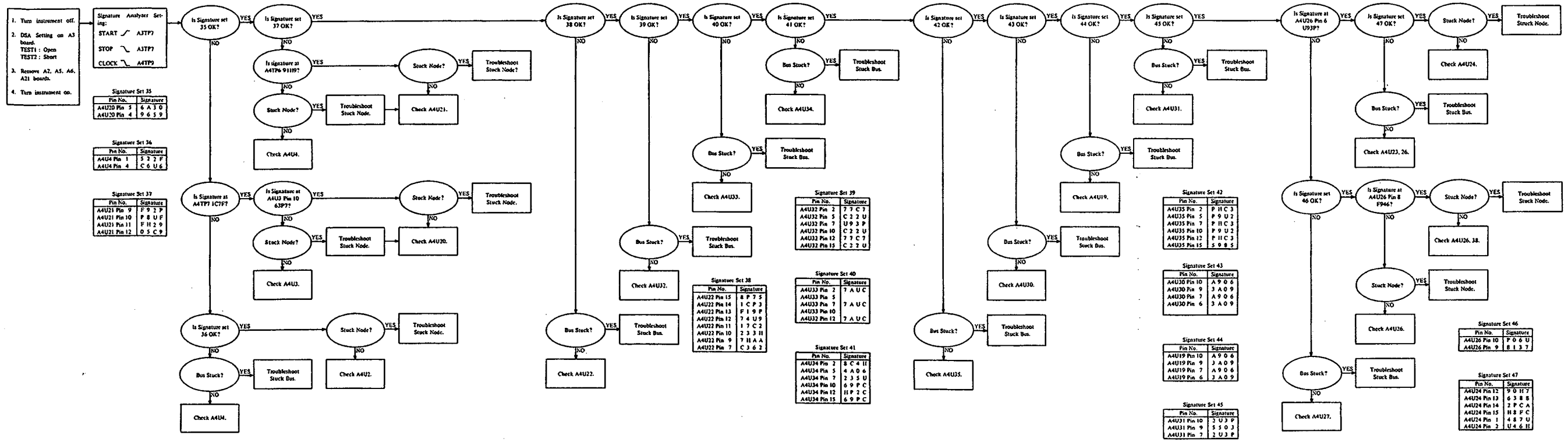


Figure 8-38. A4 I/O Control Troubleshooting Tree Flow C.

I/O Control
SERVICE SHEET 4-1
SEE INSIDE

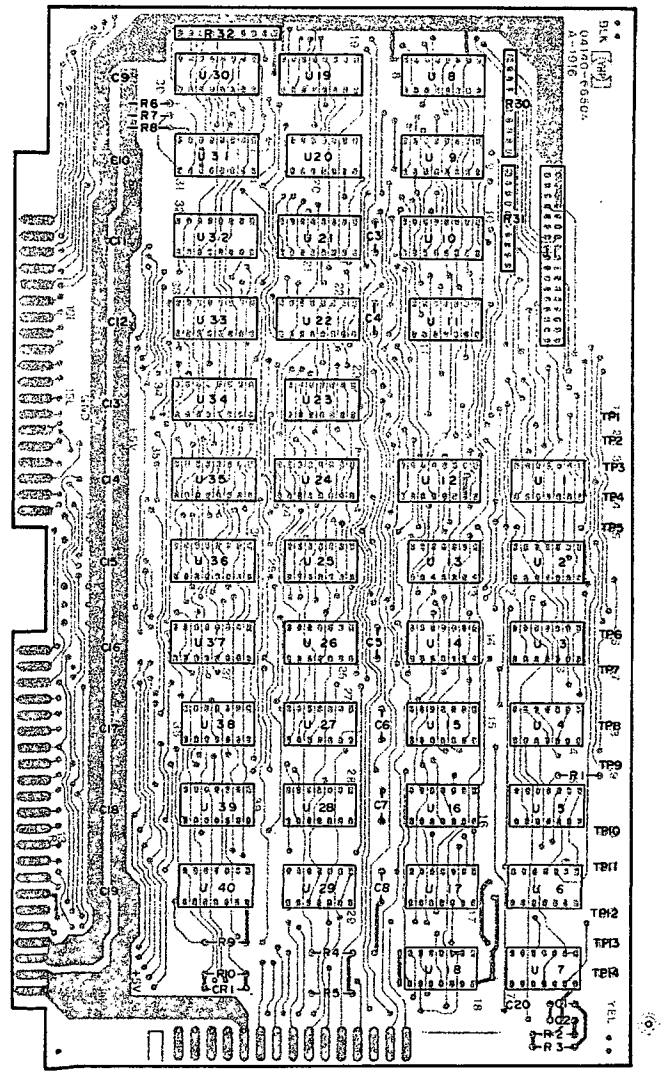


Figure 8-39. A4 I/O Control Assembly Component Locations.

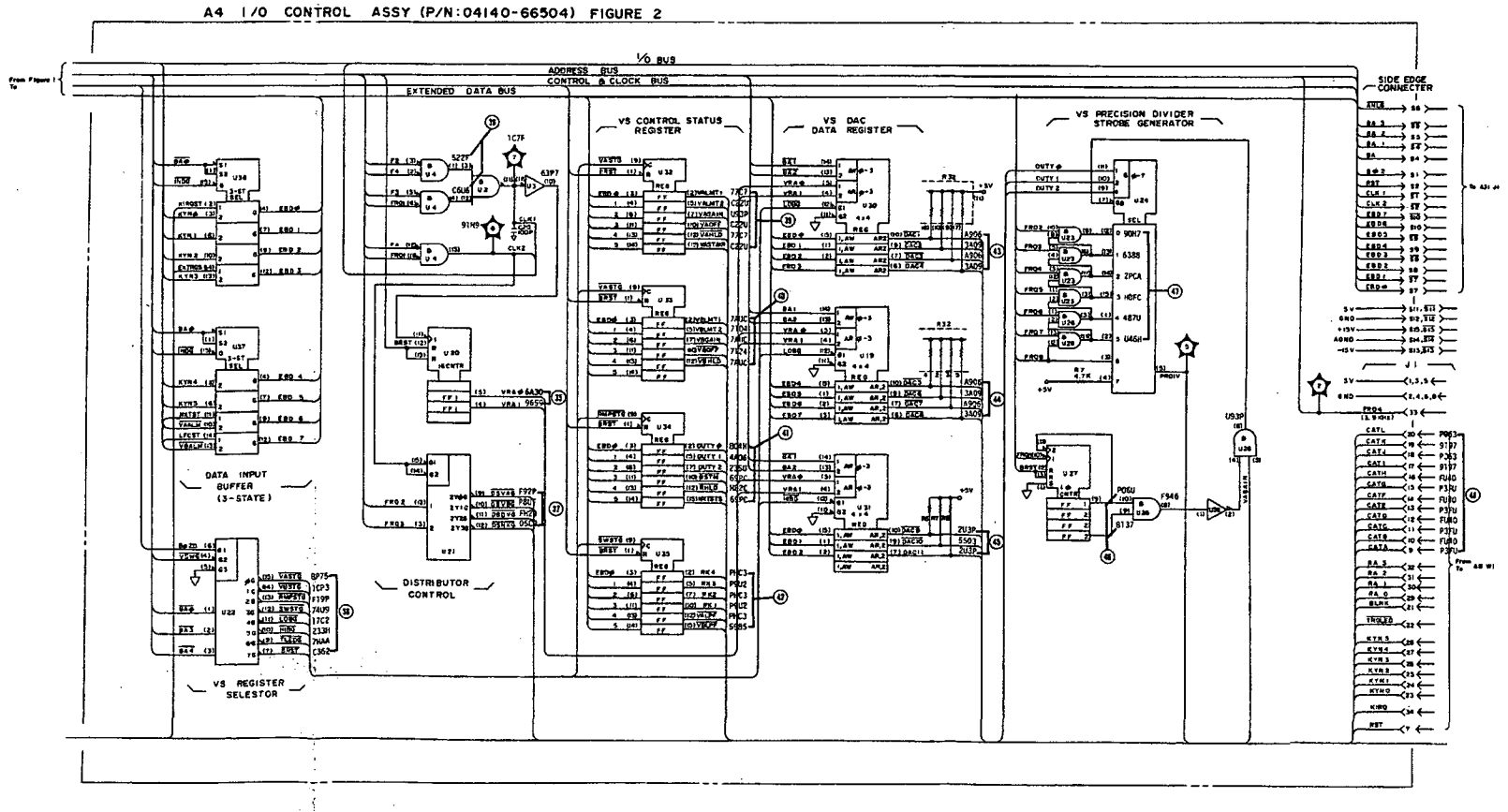


Figure 8-40. A4 I/O Control Assembly Schematic Diagram Figure 2.

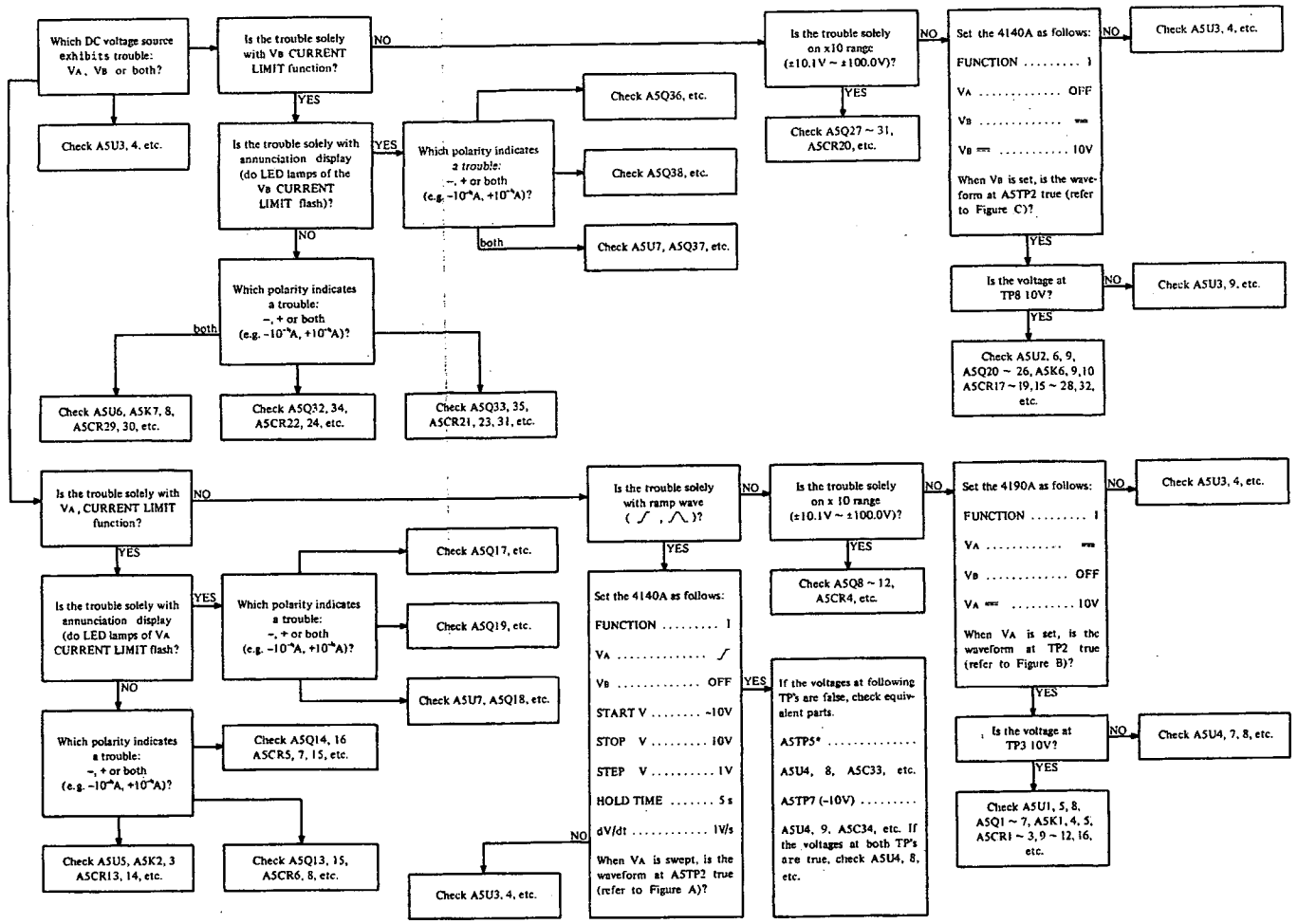


Figure 8-41. A5 VS Output Troubleshooting Tree.

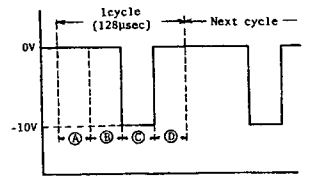


Figure A

*This voltage changes step-by-step from -10V to +10V.

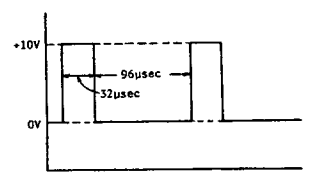


Figure B

Section VIII
Circuit Description

Power Amplifier with Hold Circuit

VA (VB) power amplifier includes a hold circuit to reduce spike noise which is generated when VA (VB) output voltage range is changed. Figure A is a simplified block diagram of the VA (VB) power amplifier with hold circuit and Figure B is a timing chart of this circuit during range changing. For explanation, the VA (VB) OUTPUT voltage is assumed to be changing from +10.00V to +10.1V. Firstly, S1 is set to "X 10" position and S2 is set to ON and DAC OUTPUT voltage is set to +10.00V. Here, A1 and A2 amplifiers collectively work as a voltage follower to bring the VA (VB) OUTPUT voltage to +10.00V. At this time, the voltage at both ends of C (voltage hold capacitor) is +0.4V (+10.00/25). Next, S2 is set to OFF before the DAC OUTPUT voltage is set to +1.01V and S1 is set to its "X 10) position. At this time, the VA (VB) OUTPUT voltage is held at +10.00V by C. S2 is set to OFF after the DAC OUTPUT is stabilized. Total amplification is 10 times and brings the VA (VB) OUTPUT voltage to +10.1V. If this hold circuit is not provided, spike noise as shown by the dotted line in Figure B is generated.

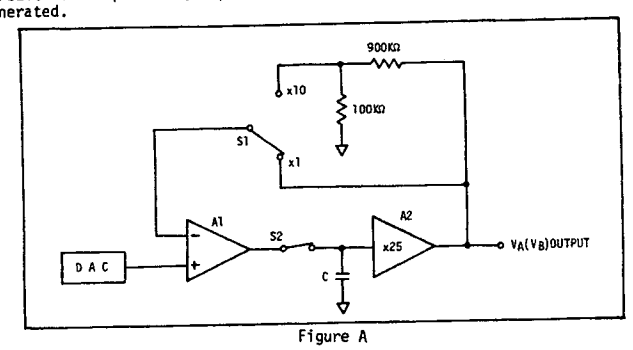


Figure A

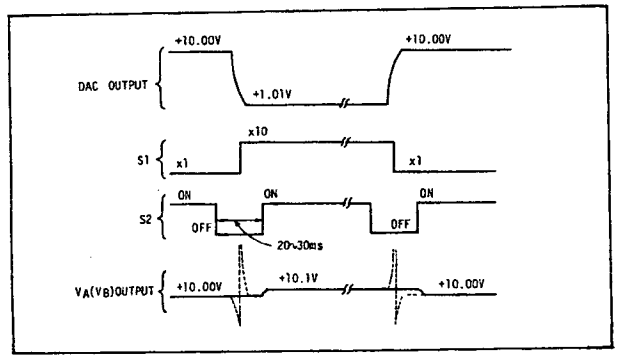


Figure B

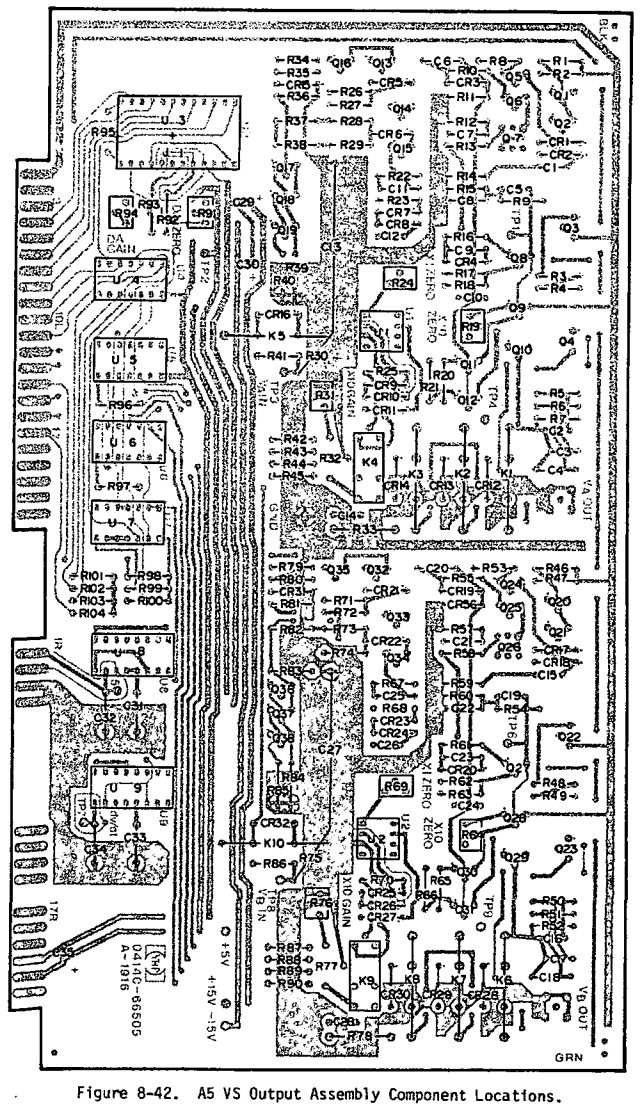


Figure 8-42. A5 VS Output Assembly Component Locations.

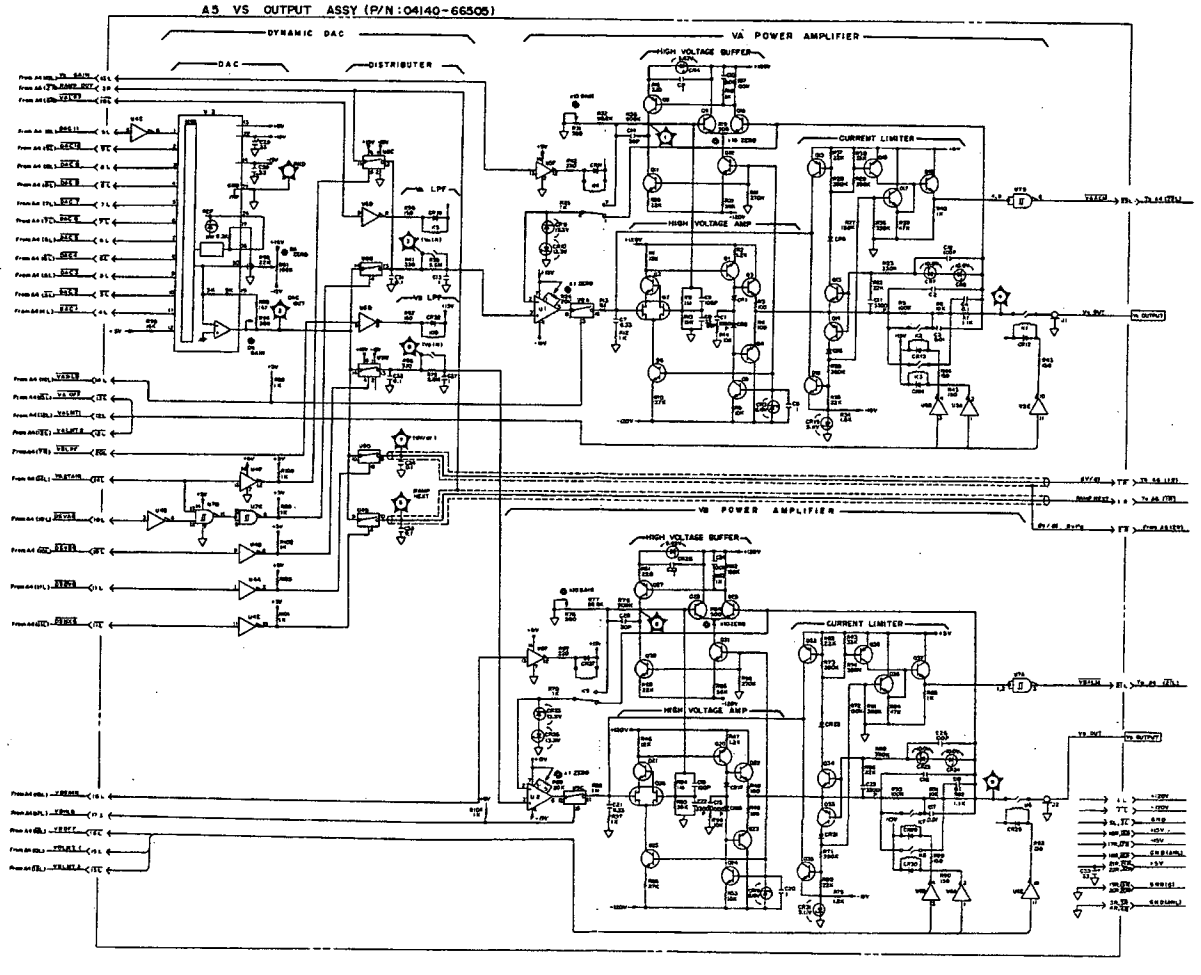


Figure 8-43. A5 VS Output Assembly Schematic Diagram.

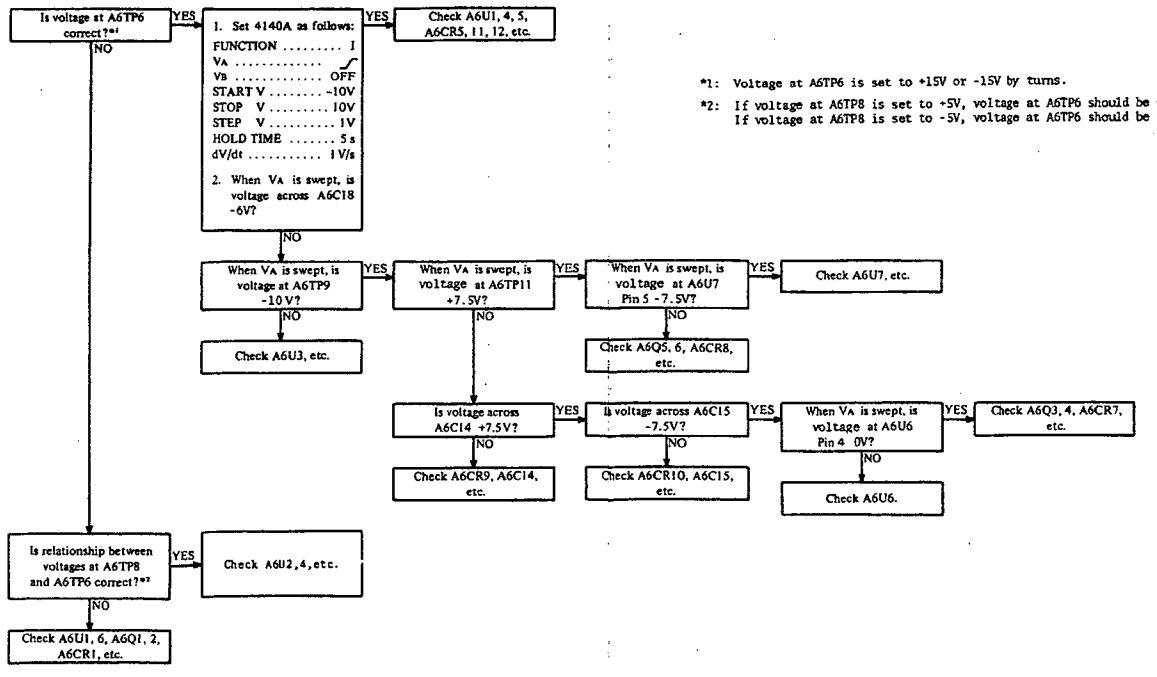


Figure 8-44. A6 Ramp Generator Troubleshooting Tree.

*1: Voltage at A6TP6 is set to +15V or -15V by turns.

*2: If voltage at A6TP8 is set to +5V, voltage at A6TP6 should be +15V.
If voltage at A6TP8 is set to -5V, voltage at A6TP6 should be -15V.

VS Output
SERVICE SHEET 5
SEE INSIDE

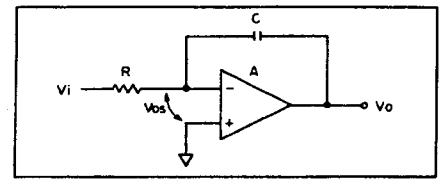


Figure A

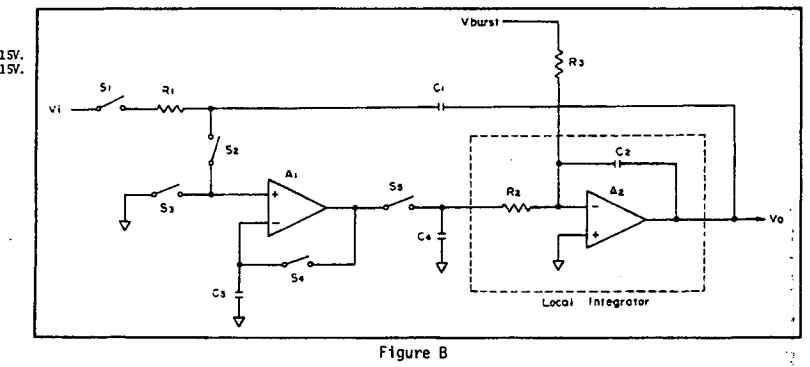


Figure B

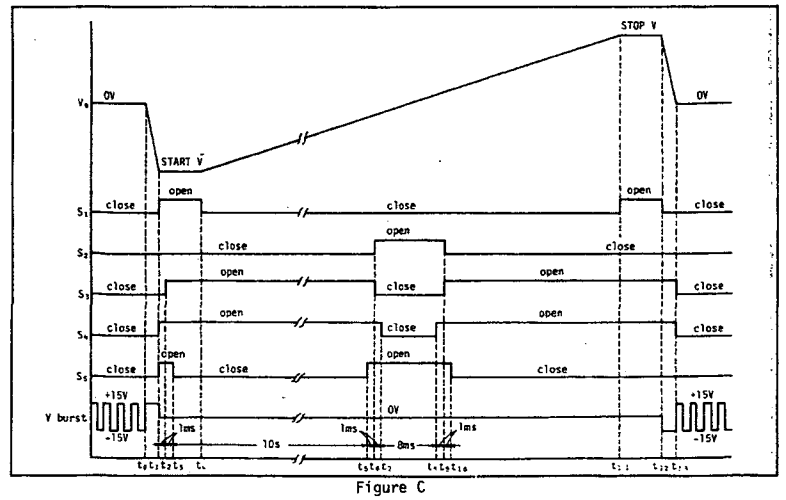


Figure C

Auto Offset voltage Compensated Integrator

A block diagram of a typical integrator circuit is given as Figure A. If this integrator does ideal integration, the ramp rate of output voltage is:

$$\frac{dVo}{dt} = -\frac{Vi}{CR}$$

But an actual integrator includes some errors such as:

$$\frac{dVo}{dt} = -\frac{Vi}{CR}\left(1 - \frac{Vos}{Vi} + \frac{Vo}{AVi}\right)$$

Where Vos: Offset voltage of amplifier

A: Gain of amplifier

Therefore, the 4140A, without halting the ramp, incorporates an auto offset voltage compensated integrator to minimize offset error as shown in Figure B. Figure C is the timing chart for this circuit:

t1: All switches are closed and the A1 amplifier output voltage, which is generated by the offset voltage, is stored in C3.

t1~t4: S1 is opened and Vo is held to START V. S3 and S4 are opened and S2 and S1 are still closed.

t4,t5: S1 is closed and ramp wave Vo is generated. Ramp rate depends on the values of R1. Offset voltage error is compensated by the charge voltage stored in C3.

t5~t10: S5 is opened. A1 amplifier output voltage is held in C4 and a ramp wave is generated by local integrator using voltage VO (during this period).

t6: S2 is opened and S3 is closed.

t7~t8: S4 is closed. A1 amplifier output voltage, which is generated by offset voltage, is stored in C3 during this period.

t8: S4 is opened.

t9: S2 is closed and S3 is opened.

t10: S5 is opened. The integrator is returned to its normal ramp wave generating mode (t4, t5).

t10,t11: The integrator generates a ramp wave and repeats the auto zero mode (t5~t10) every ten seconds.

t11,t12: S1 is opened and Vo is held at STOP V.

t13: All switches are closed.

Additionally, A1 and A2 maintain the main loop gain at an extremely high level which, consequently, contributes to minimize the nonlinearity of the ramp wave.

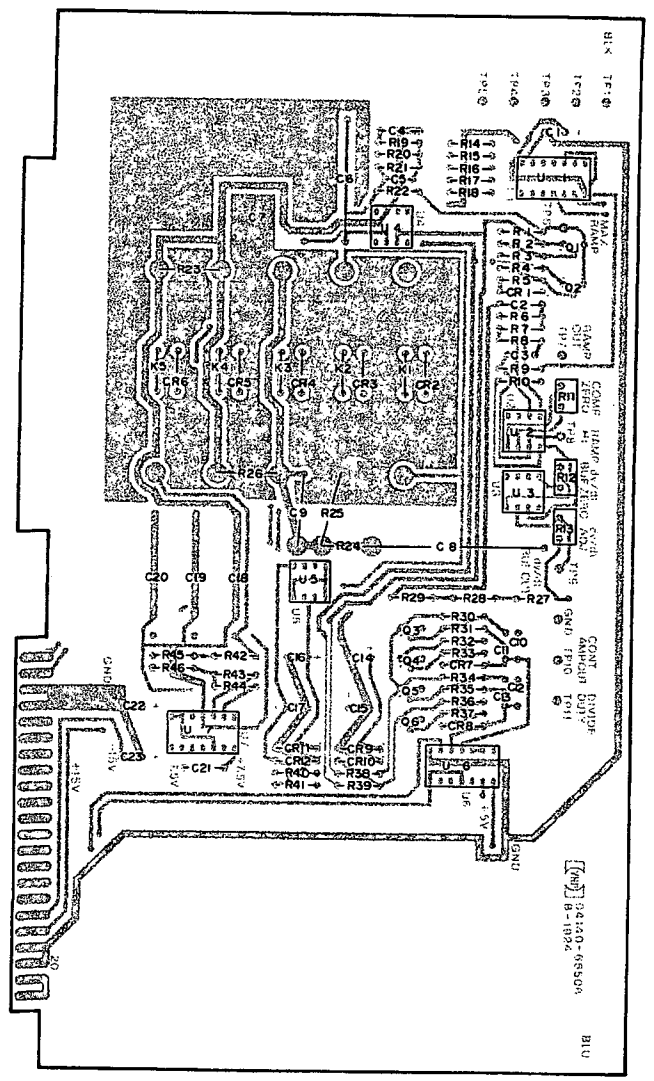


Figure 8-45. A6 Ramp Generator Assembly Component Locations.

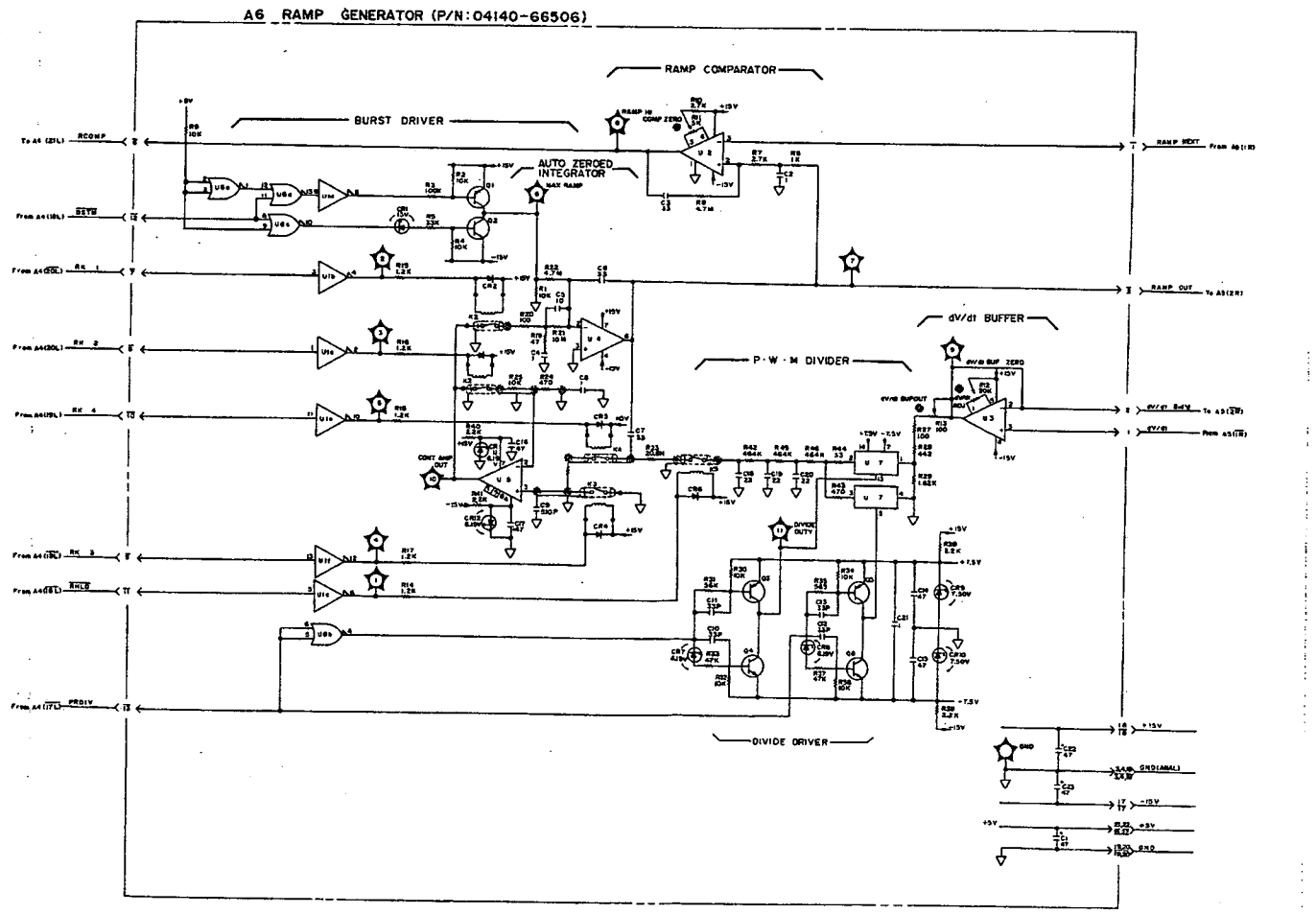
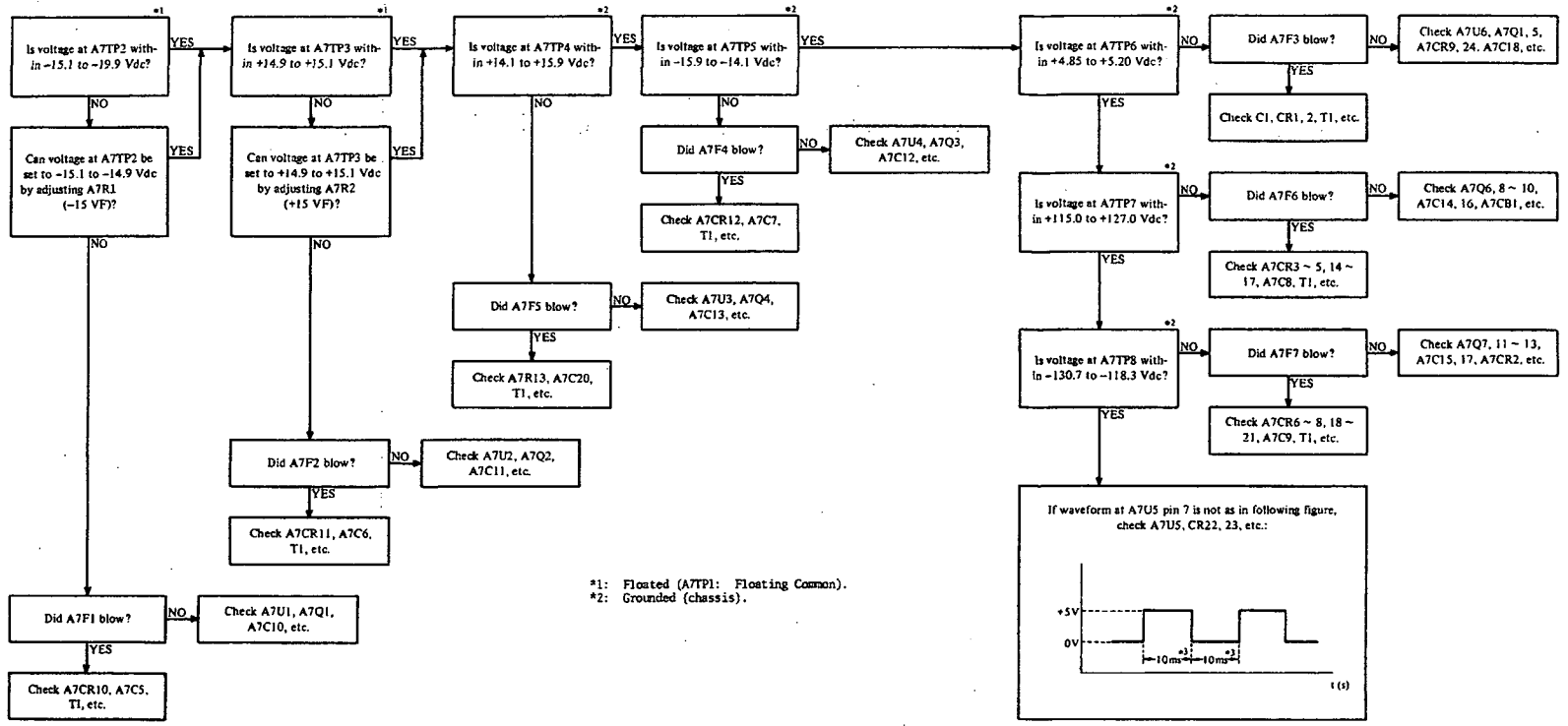


Figure 8-46. A6 Ramp Generator Assembly Schematic Diaagram.



*1: Floated (A7TP1: Floating Common).
*2: Grounded (chassis).

*3: at the 50Hz line frequency (8.3ms at the 60Hz).

Figure 8-47. A7 DC Volatage Supply Troubleshooting Tree.

Ramp Generator
SERVICE SHEET 6
SEE INSIDE

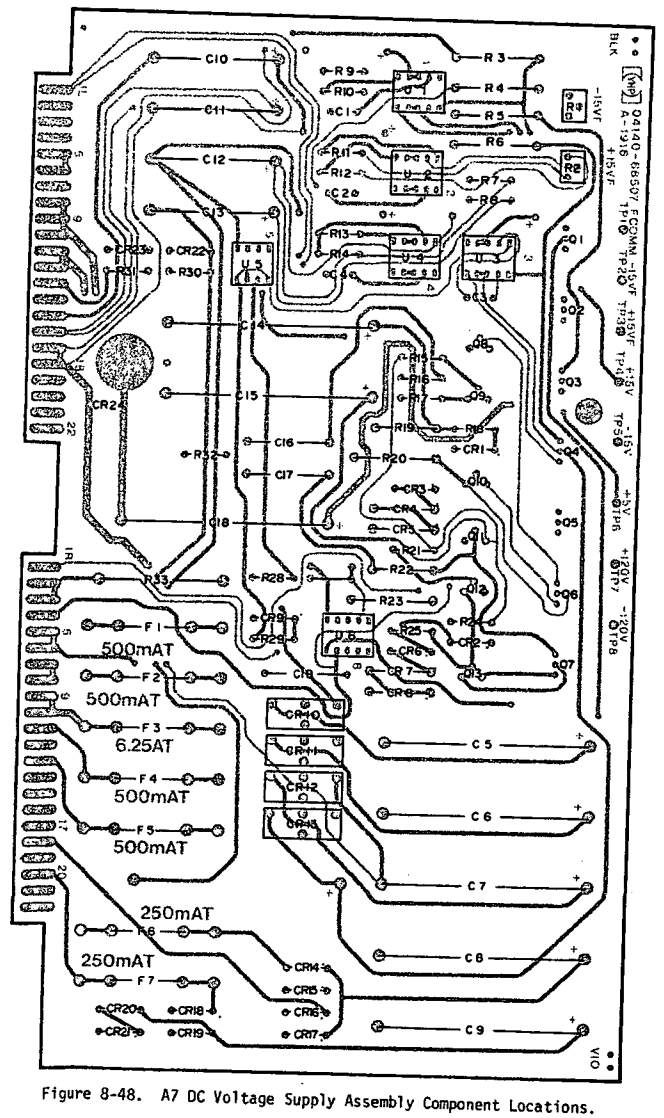


Figure 8-48. A7 DC Voltage Supply Assembly Component Locations.

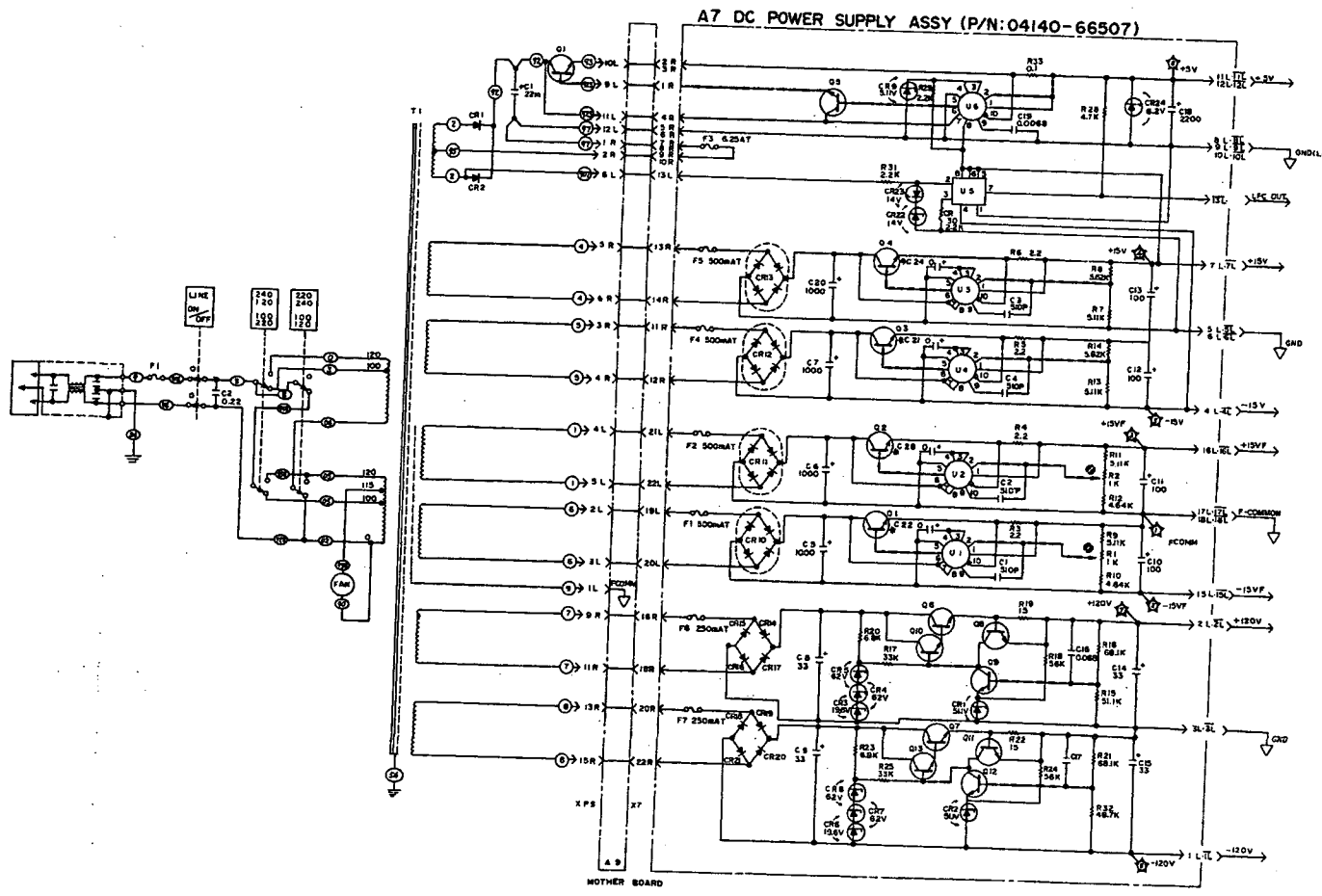


Figure 8-49. A7 DC Voltage Supply Assembly Schematic Diagram.

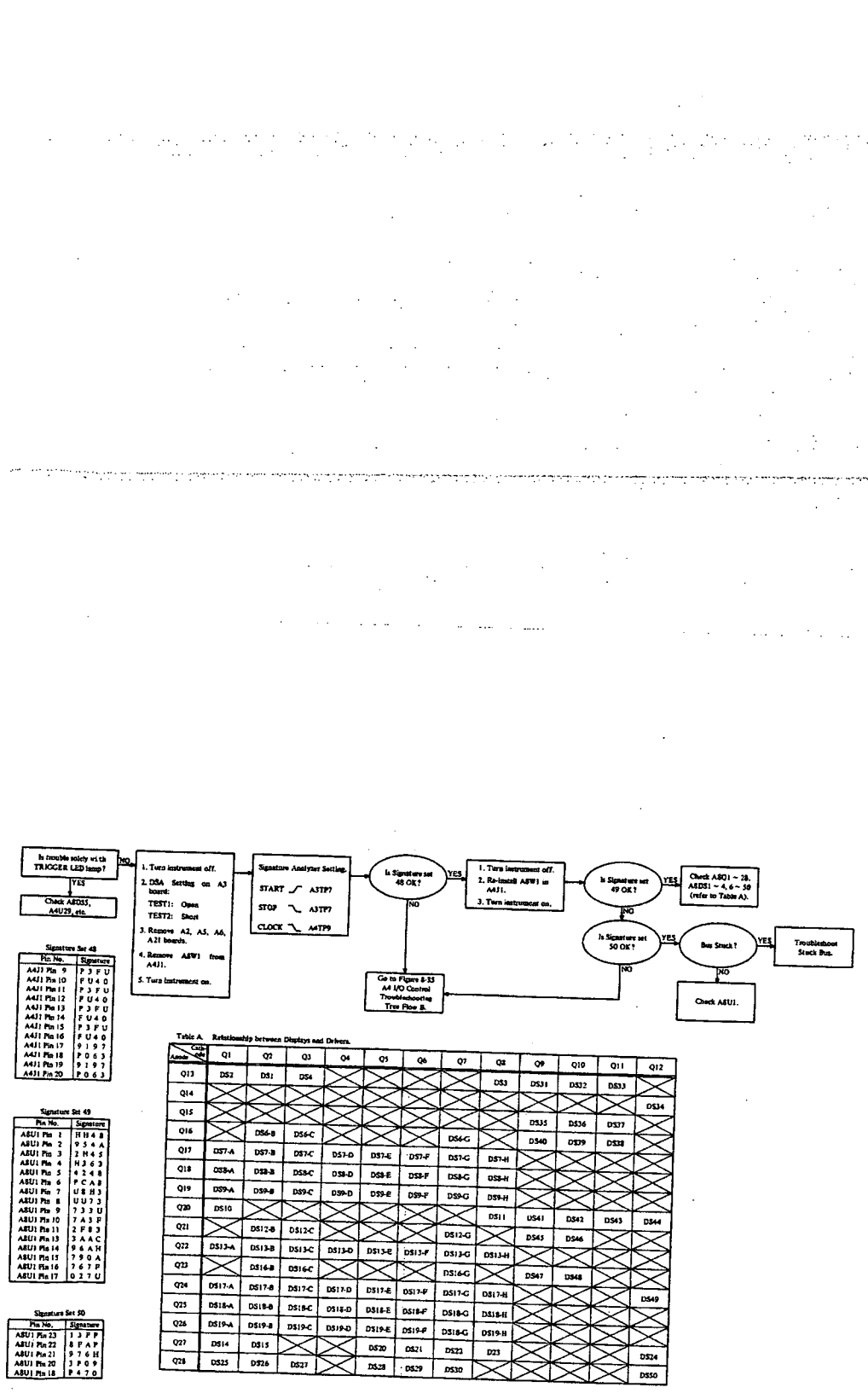


Table A. Relationship between Displays and Drivers.

Anode / Cathode	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Q13	DS2	DS1	DS6					DS3	DS31	DS32	DS33	
Q14												DS34
Q15												
Q16									DS35	DS36	DS37	
Q17	DS7-A	DS7-B	DS7-C	DS7-D	DS7-E	DS7-F	DS7-G	DS7-H	DS40	DS29	DS28	
Q18	DS8-A	DS8-B	DS8-C	DS8-D	DS8-E	DS8-F	DS8-G	DS8-H				
Q19	DS9-A	DS9-B	DS9-C	DS9-D	DS9-E	DS9-F	DS9-G	DS9-H				
Q20	DS10							DS11	DS41	DS42	DS43	DS44
Q21		DS12-B	DS12-C				DS12-G		DS45	DS46		
Q22	DS13-A	DS13-B	DS13-C	DS13-D	DS13-E	DS13-F	DS13-G	DS13-H				
Q23		DS16-B	DS16-C				DS16-G		DS47	DS48		
Q24	DS17-A	DS17-B	DS17-C	DS17-D	DS17-E	DS17-F	DS17-G	DS17-H				DS49
Q25	DS18-A	DS18-B	DS18-C	DS18-D	DS18-E	DS18-F	DS18-G	DS18-H				
Q26	DS19-A	DS19-B	DS19-C	DS19-D	DS19-E	DS19-F	DS18-G	DS19-H				
Q27	DS14	DS15			DS20	DS21	DS22	D23				DS24
Q28	DS25	DS26	DS27		DS28	DS29	DS30					DS50

Figure 8-50. A8 Key & Display Troubleshooting Tree Flow A.

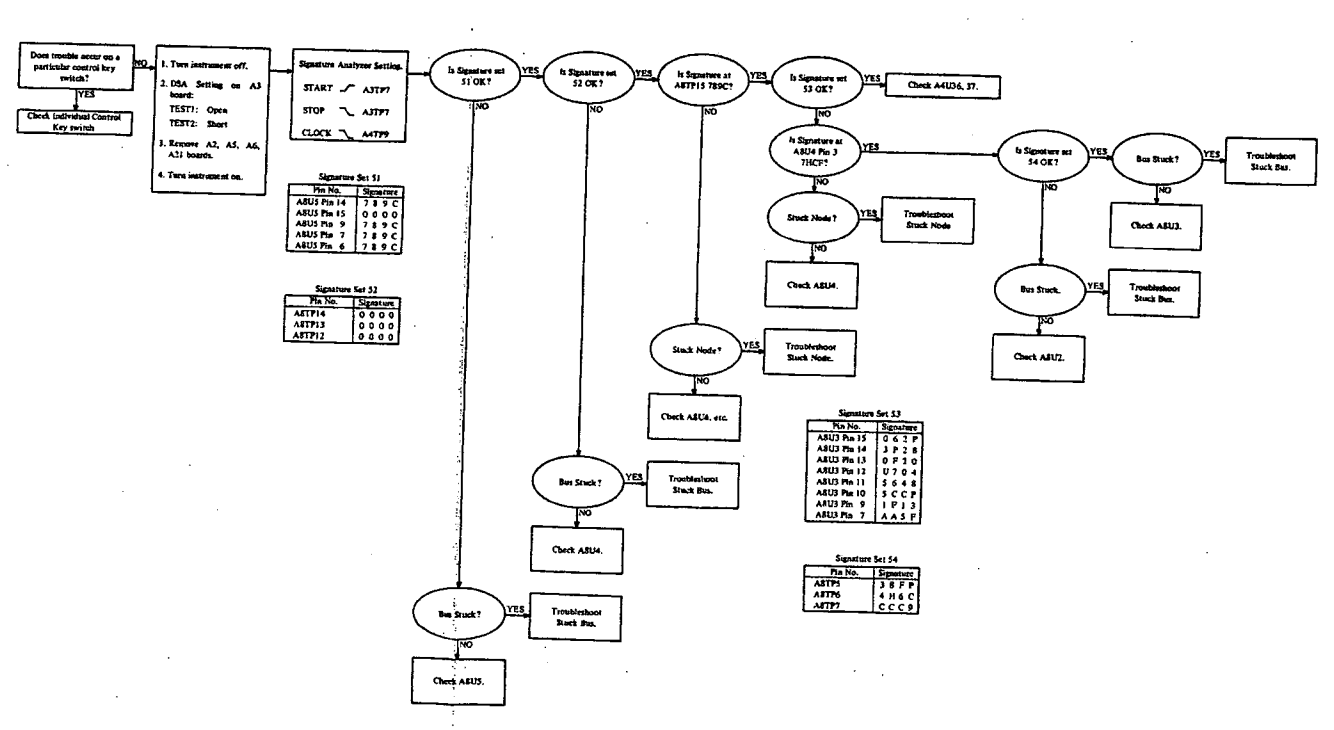


Figure 8-51. A8 Key & Display Troubleshooting Tree Flow B.

DC Power Supply
SERVICE SHEET 7
SEE INSIDE

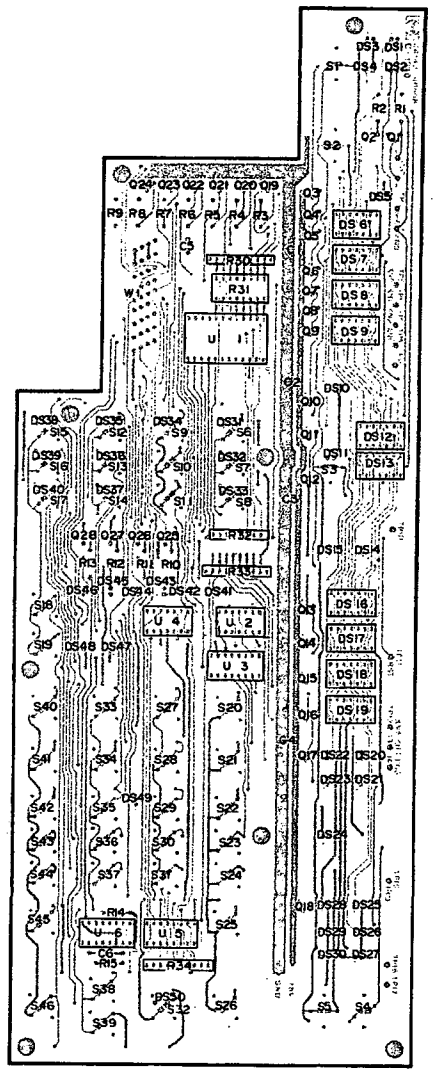


Figure 8-52. A8 Key & Display Assembly Component Locations.

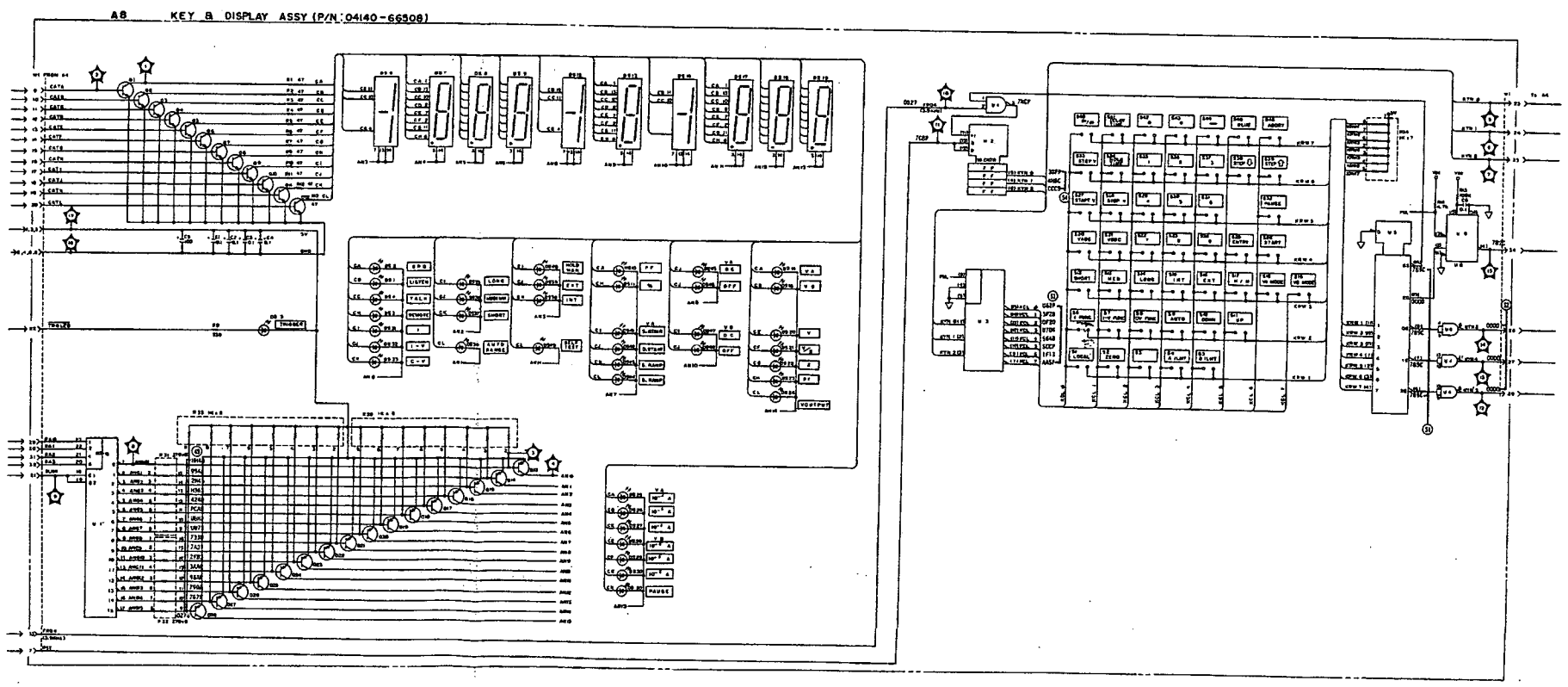


Figure 8-53. A8 Key & Display Assembly Schematic Diagram.

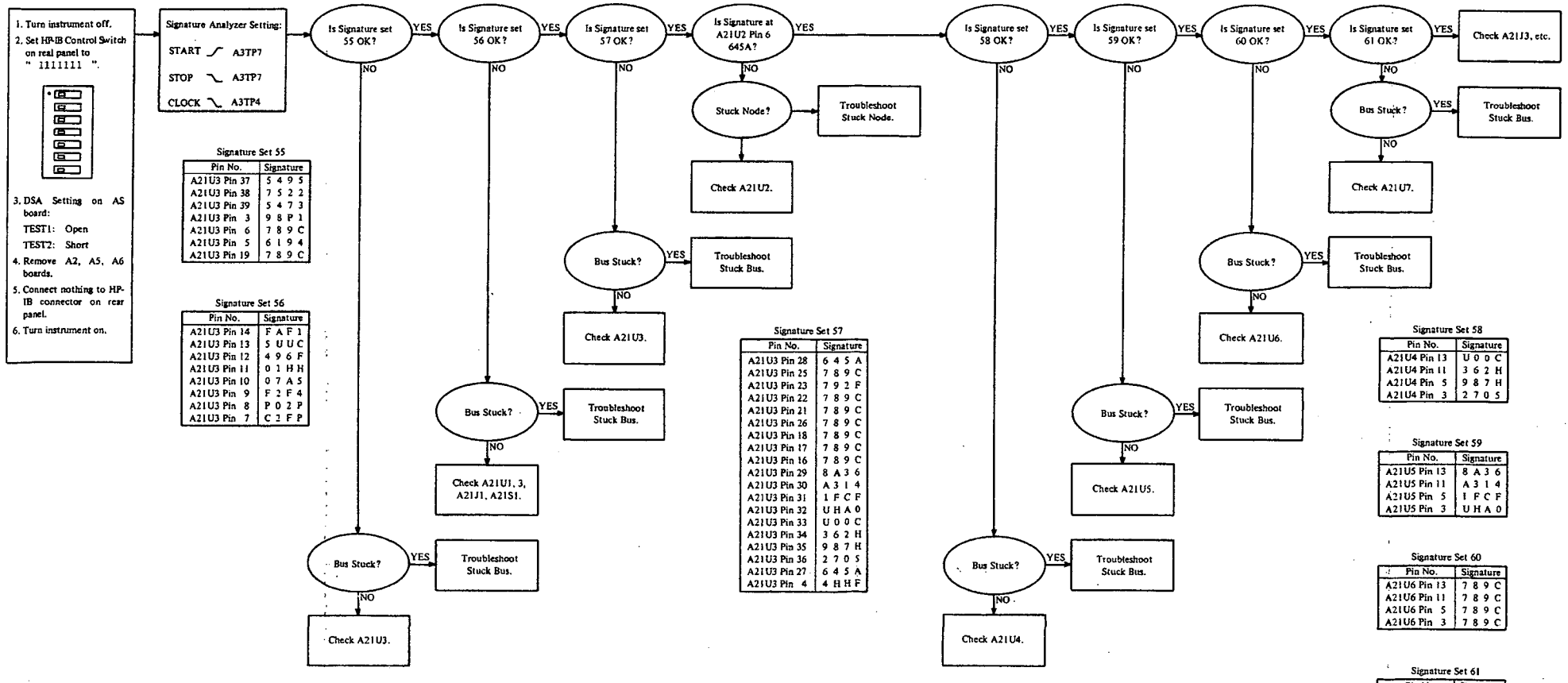


Figure 8-54. A21 HP-IB Interface Troubleshooting Tree.

Key & Display
SERVICE SHEET 8
SEE INSIDE

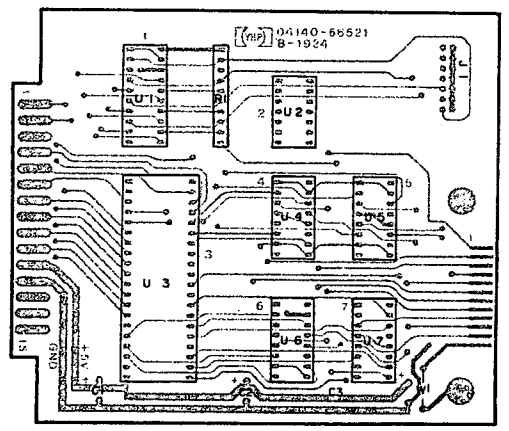


Figure 8-55. A21 HP-IB Interface Assembly Component Locations.

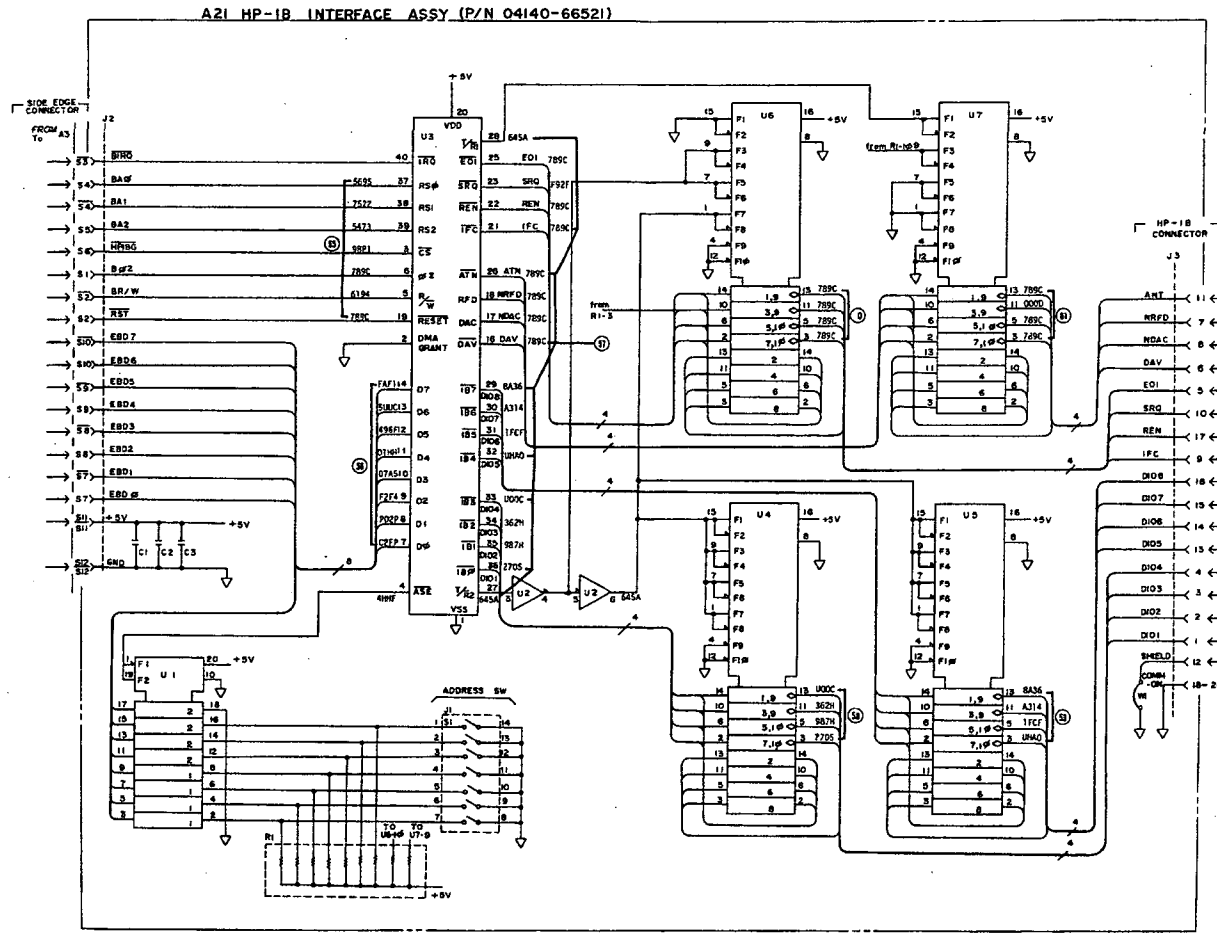


Figure 8-56. A21 HP-IB Interface Assembly Schematic Diagram.

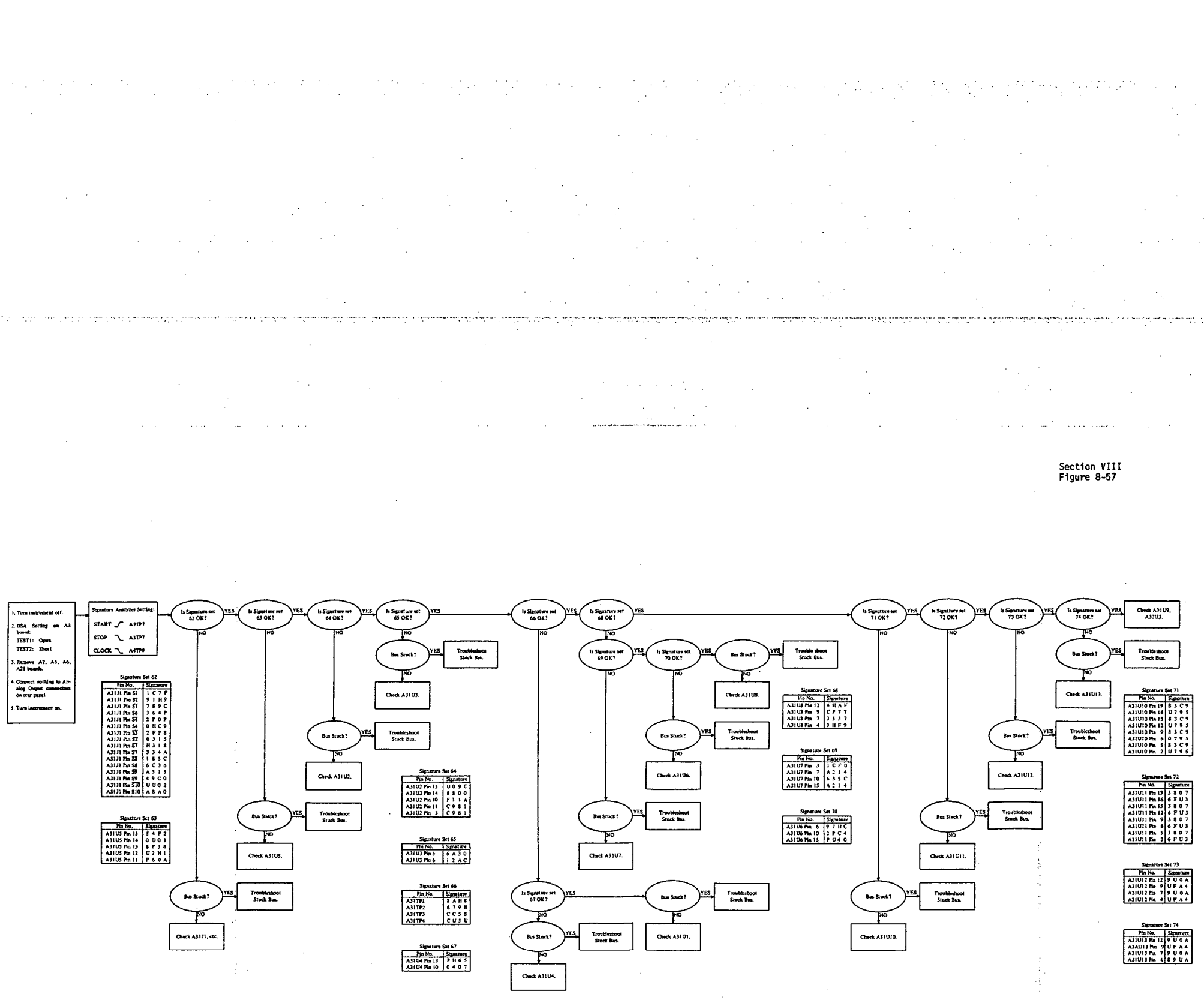


Figure 8-57. A31 Analog Output Control Troubleshooting Tree.

HP-IB Interface
SERVICE SHEET 21
SEE INSIDE

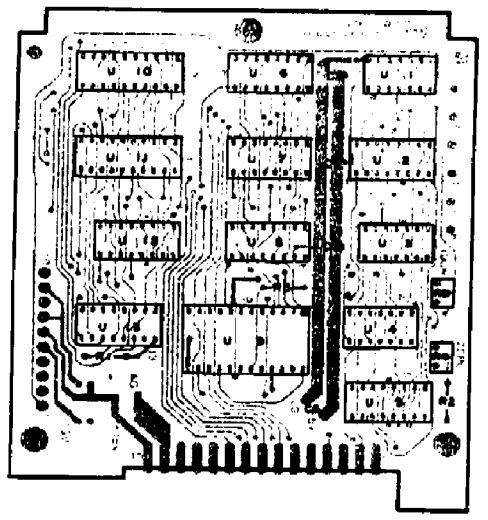


Figure 8-58. A31 Analog Output Control Assembly Component Locations.

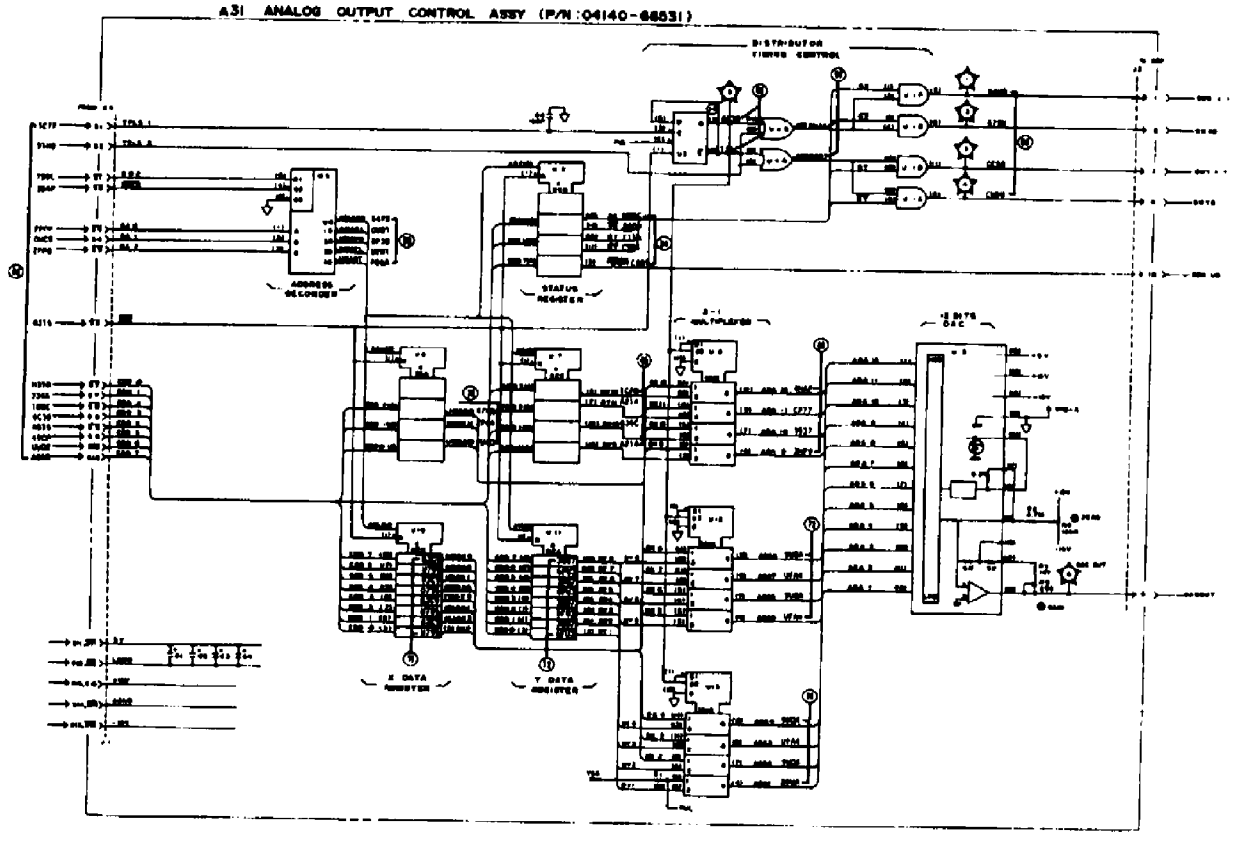
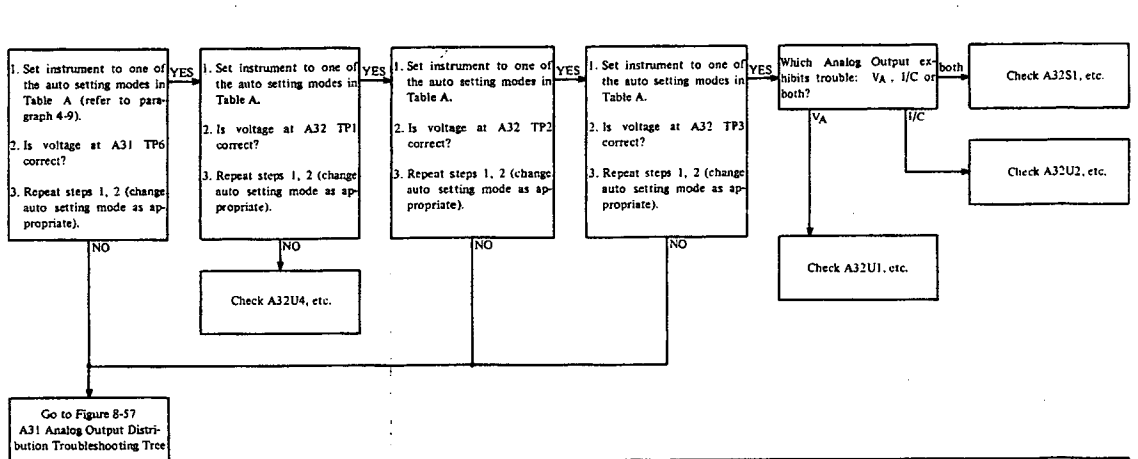


Figure 8-59. A31 Analog Output Control Assembly Schematic Diagram.



Auto Setting Mode	A31TP6 Test Limits (V)	A32TP1 Test Limits (V)	A32TP2 Test Limits (V)	A32TP3 Test Limits (V)
S – 1	– 0.02 ~ + 0.02	–0.020 ~ +0.020	– 0.020 ~ + 0.020	– 0.020 ~ + 0.020
S – 2	– 0.03 ~ + 0.01	–0.021 ~ +0.019	– 0.021 ~ + 0.019	– 0.021 ~ + 0.019
S – 3	–10.07 ~ – 9.93	–1.025 ~ –0.975	– 1.025 ~ – 0.975	– 1.025 ~ – 0.975
S – 4	+ 9.93 ~ +10.07	+0.975 ~ +1.025	+ 0.975 ~ – 1.025	+ 0.975 ~ – 1.025
S – 5	– 0.02 ~ + 0.02	–0.020 ~ +0.020	– 0.02 ~ + 0.02	– 0.02 ~ + 0.02
S – 6	–10.07 ~ – 9.93	–1.025 ~ –0.975	–10.07 ~ – 9.93	–10.07 ~ – 9.93
S – 7	+ 9.93 ~ +10.07	+0.975 ~ +1.025	+ 9.93 ~ +10.07	+ 9.93 ~ +10.07

Figure 8-60. A32 Analog Output Distributor Troubleshooting Tree.

SEE INSIDE
Analog Output Control
SERVICE SHEET 31

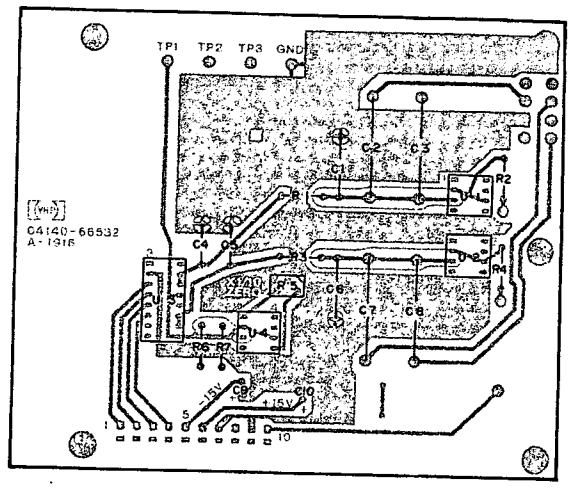


Figure 8-61. A32 Analog Output Distributor Assembly Component Locations.

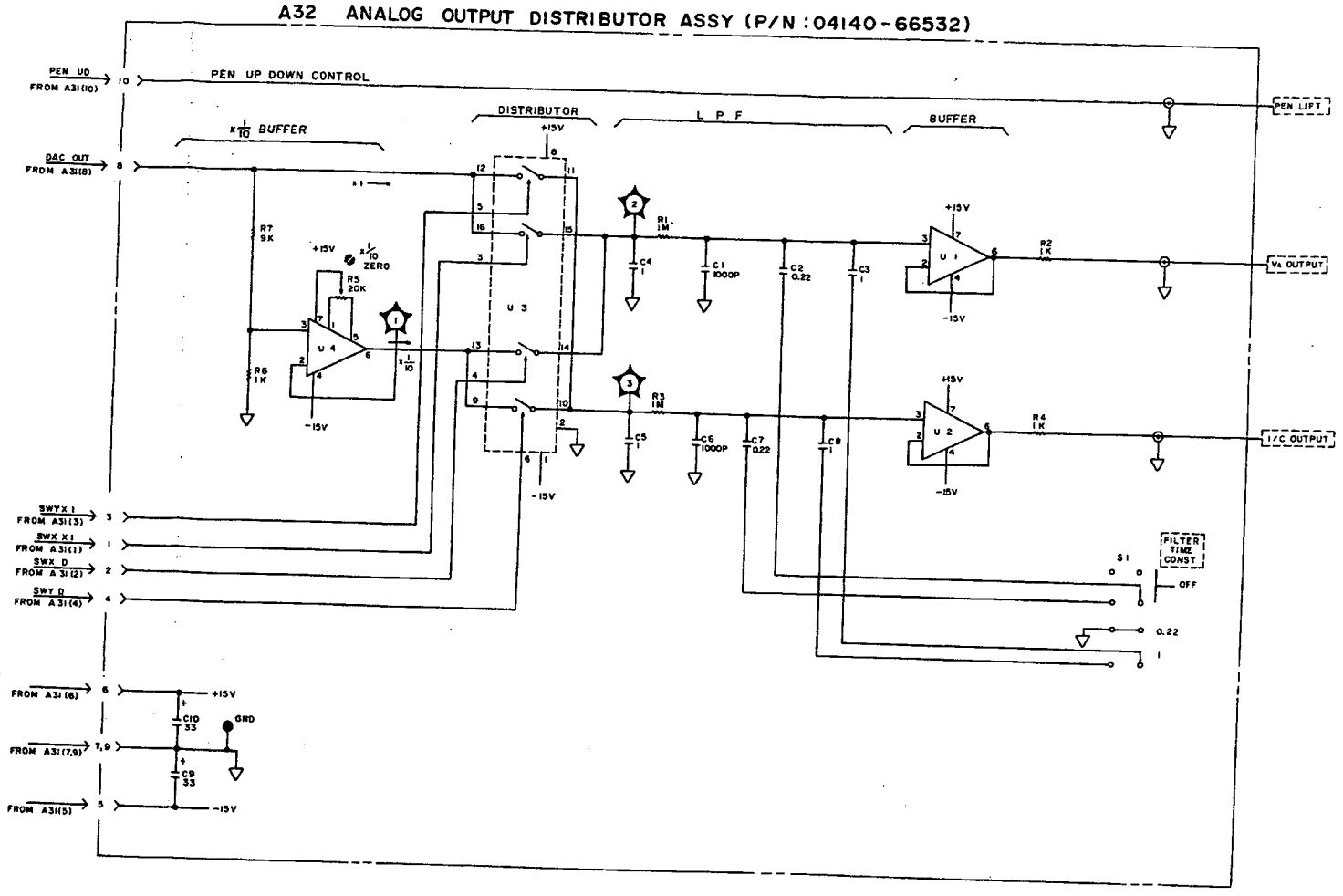


Figure 8-62. A32 Analog Output Distributor Assembly Schematic Diagram.

Analog Output Distributor
SERVICE SHEET 32

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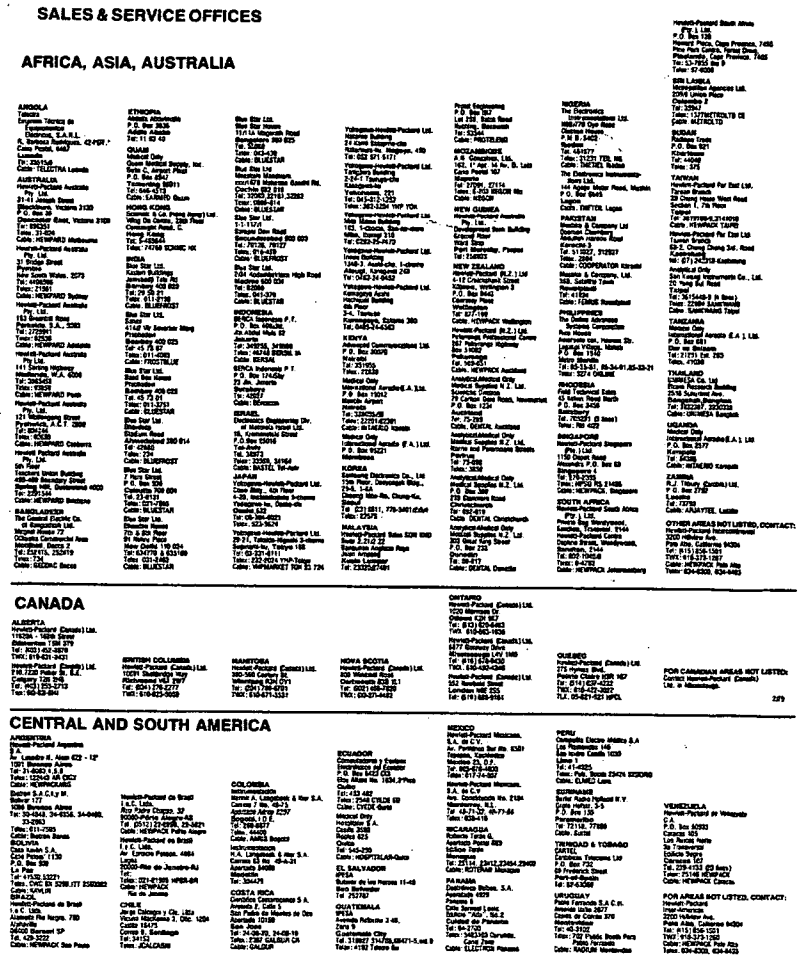

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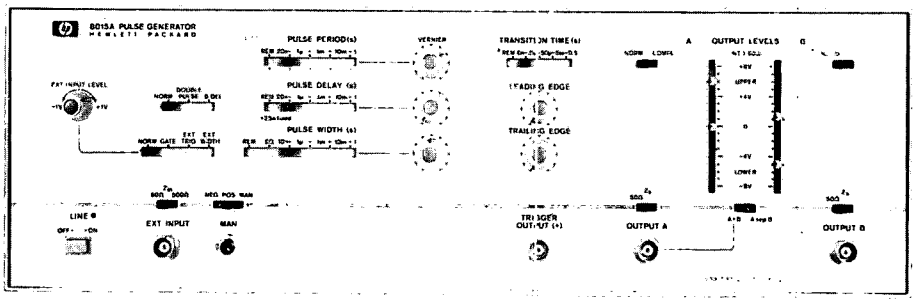
OPERATING AND SERVICE MANUAL

8015A PULSE GENERATOR



HEWLETT hp PACKARD

HP 8015A

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

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

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OPERATING AND SERVICE MANUAL
8015A
PULSE GENERATOR
(Including Options 001, 002, 003, 004, 005 and 006)

For instruments with serial numbers

1538 G 00926 on

For instruments with lower serial numbers, refer to Section 8 and the yellow backdating pages.

For higher serial numbers, refer to the Manual Change sheets supplied with the instrument.

Options are described in Section 7 and on the blue pages (or pages printed in blue).

7030 BÖBLINGEN, HERRENBERGER STR. 110, WEST GERMANY

8015–90008
MICROFICHE NO. 08015–90058

PRINTED: AUG. 1976

CONTENTS

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ILLUSTRATIONS

TABLES

SAFETY CONSIDERATIONS

GENERAL – This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

OPERATION – BEFORE APPLYING POWER
comply with the installation section. Additionally, the following shall be observed.

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal is likely to make this instrument dangerous. Intentional interruption is prohibited.

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

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.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

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.

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

SAFETY SYMBOLS

The apparatus will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the apparatus against damage.

Indicates dangerous voltages.

Earth terminal (sometimes used in manual to indicated circuit common connected to grounded chassis).

WARNING The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the equipment. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SECTION 1

INTRODUCTION

1–1 GENERAL

1–2 The model 8015A is a 50 MHz pulse generator which features dual outputs each capable of delivering pulses up to 16V in amplitude. When the outputs are combined (A + B mode), up to 30V is available. Great care has been taken to ensure that 8015A is easy to use – the front panel layout is clear and unambiguous. Controls are positioned so that parameters are easily identified and invalid combinations of parameters can be avoided.

1–3 Delay, double pulse and square wave modes of operation are available. Another feature of the 8015A is the B DEL mode where channel B output is delayed with respect to channel A output. This can be combined with A + B mode so that complex and 3-level waveforms can be synthesized. Also, the external input has a threshold level variable between +1V and –1V with 50Ω input impedance and variable between +10V and –10V with 500Ω input impedance. A push-button permits manual simulation of input signals for all external modes of operation.

1–4 The standard model 8015A has four trigger modes of operation: NORM (internal), GATE, EXT TRIG and EXT WIDTH.

NORM: in this mode all pulse parameters are defined by the front panel controls and no external signal source is required.

GATE: an externally applied signal source enables and disables the internal repetition rate generator. Gating is synchronous; the first pulse is initiated by the start of the gate signal and the last pulse is always complete even if the gate signal ends during generation.

All pulse parameters, other than the duration of the gate, are defined by the front panel controls. A synchronous trigger output is available for the duration of the pulses.

EXT TRIG: pulse rate and trigger output frequency are defined by the frequency of an externally derived signal source. All other pulse parameters are varied by the front panel controls.

EXT WIDTH: pulse rate and width are defined by the frequency and width of an applied signal. The frequency of the trigger output pulses can be varied independent of the pulse output frequency.

1–5 OPTIONAL VERSIONS

1–6 Refer to Specifications and Section 7.

Table 1–1. Specifications

PULSE CHARACTERISTICS

Transition times: minimum to 0.5s in four ranges. Minimum transition times dependent on source and load impedances (see table). Ranges common for leading and trailing edge transition times within each range up to maximum ratios of 100:1 or 1:100.

Linearity: for transition times > 30ns, maximum deviation from a straight line between the 10% and 90% points is less than 5% of pulse amplitude.

Overshoot and ringing: ± 5% of pulse amplitude, possibly increasing to < ± 10% at minimum amplitude.

Preshoot: < 5% of pulse amplitude.

Pulse top perturbations: droop <5% of pulse amplitude.

Pulse width: < 10ns to 1s in four ranges. Vernier provides continuous adjustment within each range.

Width jitter: < 0.1% + 50ps for any width setting.

Table 1–1. Specifications continued.

Maximum duty cycle: > 75% from 1 Hz to 1 MHz, decreasing to ⩾ 50% at 50 MHz (can be increased to 100% by switching to complementary output). Square wave; 50%, ± 5% from 1 Hz to 1 MHz, ±15% at 25MHz (internal modes only).

Pulse delay: 20ns (+25ns fixed) to 1s, with respect to trigger output in four ranges. Vernier provides continuous adjustment within each range.

Delay jitter: < 0.1% + 50ps for any delay setting.

Pulse output: two outputs with separate normal/complement and source impedance switches and individual controls for adjustment of pulse upper and lower level. Outputs can be combined (A+B) to provide greater output current capability (see table) and pulse is available at output A with no load on output B. In combined mode, level and normal/complement controls of channel B disabled (except in A+B with B DEL), pulse controlled by Channel A controls. In combined mode with B DEL, level and normal/complement controls of both channels enabled to provide independent control of first and second pulses.

MODE	SOURCE IMPEDANCE	LOAD IMPEDANCE	TRANSITION TIMES	UPPER LEVEL VOLTAGE (V_{UL})	LOWER LEVEL VOLTAGE (V_{LL})	UPPER LEVEL CURRENT (I_{UL})	LOWER LEVEL CURRENT (I_{LL})	$V_{UL} - V_{LL}$ MAX	$V_{UL} - V_{LL}$ MIN	$I_{UL} - I_{LL}$ MAX	$I_{UL} - I_{LL}$ MIN	Max. Rep. Rate
A sep B	50Ω/30pF	50Ω	< 6ns* – 0.5s	+8V to –7V	+7V to –8V			8V	1V			50 MHz
↓	1kΩ/30pF	50Ω	< 8ns – 0.5s	+16V to –14V	+14V to –16V			16V	2V			50 MHz
↓	1kΩ/30pF		< 8ns – 0.5s	Depends on load	Depends on load	+320mA to –280mA	+280mA to –320mA			320mA	40mA	40 MHz
A + B	50Ω/30pF	50Ω	<15ns – 0.5s	+16V to –14V	+14V to –16V			16V	2V			20 MHz
↓	1kΩ/30pF	50Ω	<15ns – 0.5s	+16V to –12V	+12V to –16V			30V	4V			20 MHz
↓	1kΩ/30pF		<15ns – 0.5s	Depends on load	Depends on load	+640mA to –560mA	+560mA to –640mA			640mA	80mA	20 MHz

* 6ns at 8V, may increase to 6.5ns at 4V.

Maximum output: upper level internally limited to +16V maximum, lower level internally limited to –16V.

Maximum input: ± 7V with 50Ω input impedance, ± 25V with 500Ω input impedance.

Trigger polarity: positive or negative slope selectable.

Threshold level: continuously adjustable from +1V to –1V with 50Ω input impedance or from +10V to –10V with 500Ω input impedance.

Sensitivity: 50Ω input impedance, sinewaves 1V peak-to-peak, pulses ± 0.5V; 500Ω input impedance, sinewaves 10V peak-to-peak, pulses ± 5V.

Manual: front panel push-button for manually generating input signals.

REPETITION RATE AND TRIGGER

Repetition rate: 1 Hz to 50 MHz in four ranges (maximum repetition rate depends on output configuration, see table). Vernier provides continuous adjustment within each range.

Period jitter: < 0.1% + 50ps for any repetition rate setting.

Square Wave: 0.5 Hz to 25 MHz.

Double pulse: 25 MHz max. (simulates 50 MHz). Spacing between pulses defined by delay controls.

B Delay: 20 MHz max. Channel B pulse delayed with respect to channel A pulse. Spacing between pulses defined by delay controls.

Trigger output: dc coupled, 50Ω (typ.) source impedance, delivering ⩾ 1V across 50Ω load.

Trigger pulse width: 9ns± 5ns

EXTERNALLY CONTROLLED OPERATION

External Input

Input impedance: 50Ω ± 10% or 500Ω ± 10%, switch selectable, dc-coupled.

External Triggering

Repetition rate: 0 to 50 MHz.

Delay: < 50ns between trigger input and trigger output.

Trigger source: external signal or manual.

External width: output pulse width and rate determined by width and rate of drive signal. Drive signal source: external signal or manual. Repetition rate generator provides indpendent trigger output.

Table 1–1. Specifications (cond't)

Synchronous gating: gating signal turns on repetition rate. First pulse occurs after start of gate signal, time between start of gate and first pulse defined by delay controls. Last pulse is always completed even if gate ends during generation of last pulse. Gate signal source: external signal or manual. Max. pulse rate: 40 MHz.

Burst mode (optional): preselected number of pulses generated on receipt of trigger signal. Trigger source: external signal or manual. Number of pulses: 1 to 9999. Repetition rate: 0 to 40 MHz. Minimum time between bursts: 200ns. Min. time between trigger input and first pulse: 100ns.

GENERAL

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

Power: 100V, 120V, 220V or 240V, +5%, −10%, 48 to 440 Hz. 180VA maximum.

Weight: net 11 kg (24.26 lbs), shipping 12 kg (26.46 lbs)

Dimensions: 426 mm wide, 145 mm high, 380 mm deep, (16 3/4 ins. x 5 11/16 ins. x 15 ins).

Accessories provided: fuses, power cord and Operating and Service manual.

OPTIONS

001: single channel version.
002: pulse burst option.
003: remote control option.
004: direct access to output amplifiers.
005: TTL output.
006: upper-level tracking.
Refer to Section 7 for specifications of the above options.
907: front handles.
908: rack flanges.
909: rack flange with front handle.

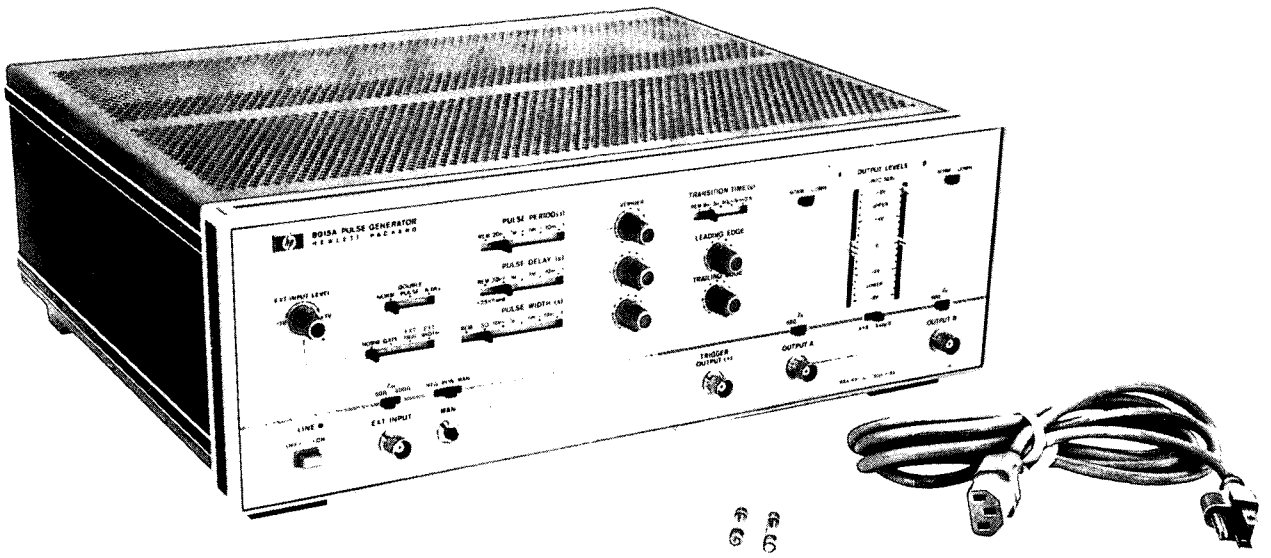
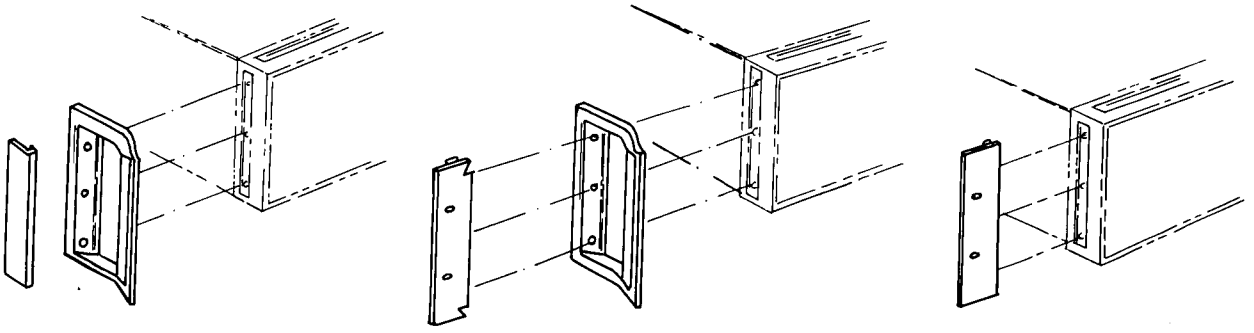


Figure 2–1. 8015A and supplied Accessories



Front handle
Order Option 907
Kit 5061–0089

Rack flange with front handle
Order Option 909
Kit 5061–0083

Rack flange
Order Option 908
Kit 5061–0077

Figure 2–2. Available Accessories

2–1 GENERAL

2–2 Initial Inspection

2–3 Inspect the instrument and accessories for physical damage, and if damage is evident, refer to paragraph 2–19 for the recommended claim procedure and repacking information.

WARNING

To avoid the possibility of injury or death, the following precautions must be followed before the instrument is switched on:

a. If this instrument is to be energized via an autotransformer for voltage reduction, make sure that the common terminal is connected to the earthed pole of the power source.

b. The power cable plug shall only be inserted into a socket outlet provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor (grounding).

c. Before switching on the instrument, the protective earth terminal of the instrument must be connected to a protective conductor of the power cord.

d. The safety check in Table 5–12 shall be executed.

2–4 Accessories

2–5 The following accessories are supplied with the standard instrument (Figure 2–1):

	HP Part Number
1A fuse (for 220/240V operation)	2110–0007
2A fuse (for 110/120V operation)	2110–0303
Power cord	see Figure 2–3
Operating and Service Manual	

An additional manual is delivered if option 910 is ordered at the same time.

Handles and rack mounting flanges are delivered with the instrument only if the appropriate option (Figure 2–2) is ordered at the same time. For retrospective fitting order kit number shown.

2–6 Power Cords

2–7 The power cord delivered with the 8015A will be one of those illustrated in Figure 2–3.

2–8 INSTALLATION

2–9 Power Cord

2–10 The 3-wire power cable supplied with the 8015A, when connected to the appropriate power out-

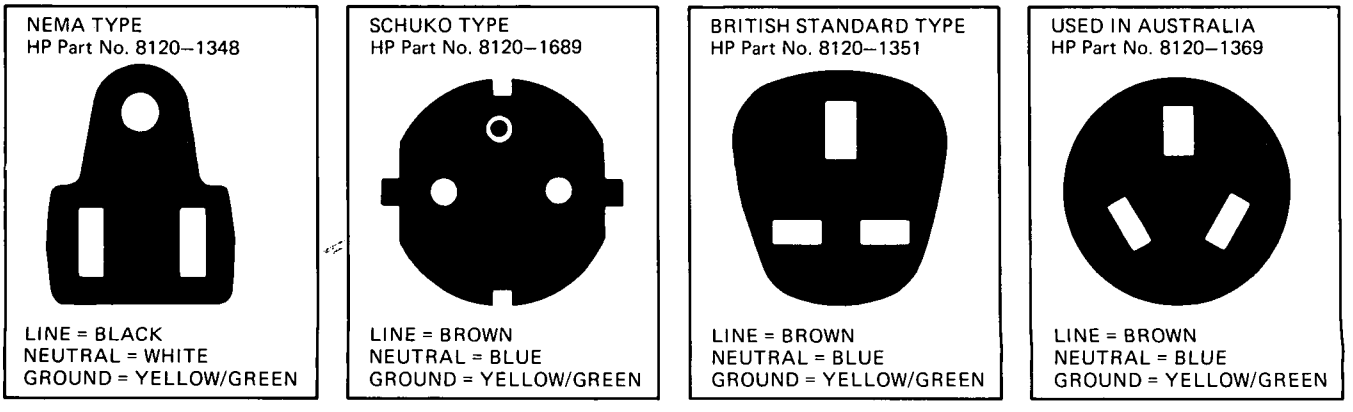


Figure 2–3. Power Cords

let, grounds the instrument cabinet and panels. To preserve this safety feature when operating the instrument from an outlet without a ground connection, use an appropriate adapter and connect the ground lead (green/yellow) to an external ground.

2–11 If the plug on the cable does not fit your power outlet, then cut the cable at the plug end and connect a suitable plug. The plug should meet local safety requirement and include the following features:

a. Minimum current rating of 2A
b. Ground connection
c. Cable clamp

The colour coding used in the cable will depend on the cable supplied (see Figure 2–3).

2–12 Power Source requirements

2–13 The model 8015A will operate from nominal ac line supplies of 100V, 120V, 220V or 240V (–10%, +5%) at 48 Hz to 66 Hz. Two switches on the rear panel allow one of the four voltages to be selected.

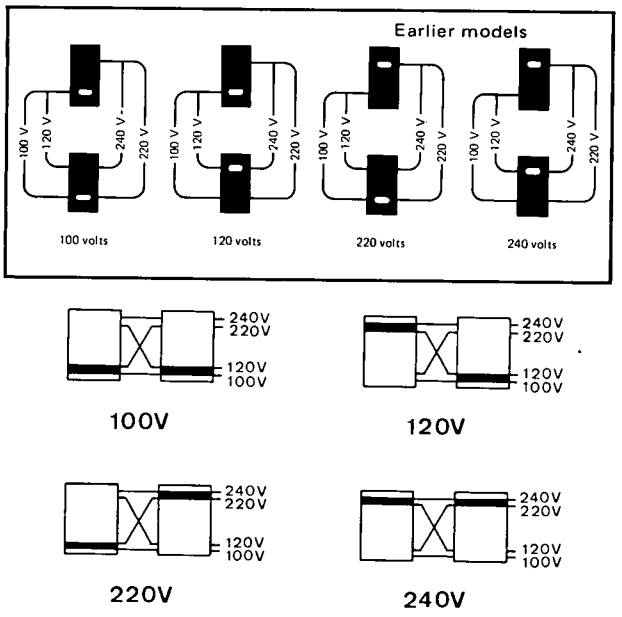


Figure 2–4. Switch Settings for the various Nominal Powerline Voltages

CAUTION

Before applying power to the instrument, check on the rear panel that the 8015A is set in accordance with local supply conditions.

2–14 To check the power requirements proceed as follows:

a. Remove the fuse and check its value:
for 220V/240V operation 1A
for 100V/120V option 2A

b. Check that the line selector switch positions corresponds to the local supply voltage. If they do not correspond use a screwdriver to change the switch positions.

c. Insert the correct fuse into the fuseholder.

d. Connect the power cable to the rear connector.

2–15 Temperature Requirements

2–16 The model 8015A operates within specifications when the ambient temperature is between 0°C (32°F) and 50°C (122°F). The instrument may be stored between –40°C (–40°F) and 75° (167°F).

2–17 RACK MOUNTING

2–18 Figure 2–2 shows the possible handle/rack-mounting configurations. If handle are fitted and subsequently need to be removed, the plastic trim must first be taken off as shown in Figure 2–5.

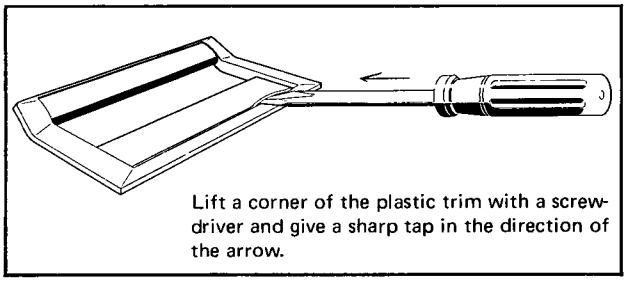
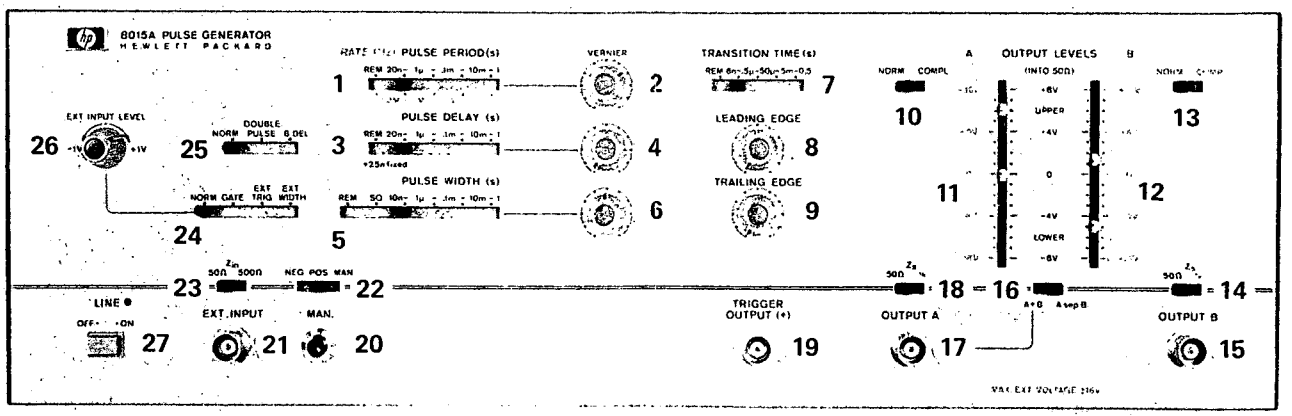


Figure 2–5. Removing Plastic Trim

2–19 CLAIMS AND REPACKAGING

2–20 Claims for Damage

2–21 If physical damage is evident or if the instrument does not meet specification when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office. The Sales/Service Office will arrange for repair or replacement of the unit without waiting for settlement of the claim against the carrier.



1 RATE switch: for selecting the range of pulse rate in the NORM, GATE and BURST mode.

2 Rate VERNIER: for continuous adjustment of the repetition rate between the limits of the range selected. Clockwise rotation increases the pulse period (i.e. reduces the rate). In the EXT WIDTH mode the rate controls define the frequency of the trigger output pulses only.

3 PULSE DELAY switch: selects the range of pulse delay with respect to trigger output in NORM, GATE and EXT TRIG modes. Selects the range of delay of second pulse with respect to first in DOUBLE PULSE. Selects the range of delay of output B with respect to output A in the B DEL mode.

4 Pulse Delay VERNIER: for continuous adjustment of pulse delay between the limits of the range selected. Clockwise rotation increases the delay.

5 PULSE WIDTH switch: for selecting the range of pulse width and square wave in the NORM, GATE, EXT TRIG and BURST modes.

6 Pulse Width VERNIER: for continuous adjustment of pulse width between the limits of the range selected (not square wave).

7 TRANSITION TIME switch: for selecting the range of leading and trailing edge transition times.

8 & 9 LEADING EDGE and TRAILING EDGE verniers: for continous adjustment of transition times between the limits of the range selected.

10 NORM-COMP switch: for selecting normal pulses (leading edge is positive transition) or their complement (leading edge is negative transition) from output A.

11 OUTPUT LEVELS – A: two sliders for setting output pulse levels. Scaling depends on output configuration (A+B/A sep B and internal and external impedances. See operation instructions).

12 OUTPUT LEVELS – B : same as A above.

13 NORM-COMP switch: same as 10.

14 Zs – 50Ω/1kΩ switch: for selecting source impedance of output B (affects scaling of OUTPUT LEVEL – B sliders. See operation instructions).

15 OUTPUT B: BNC connector.

16 A + B/A sep B switch: for selecting separate or combined outputs. When outputs combined (A+B) use output A only. Also, see operation instructions.

17 OUTPUT A: BNC connector.

18 Zs – 50Ω/1kΩ switch: for selecting source impedance of output A (affects scaling of OUTPUT LEVEL – A sliders. See operation instructions).

19 TRIGGER OUTPUT (+): BNC connector. Positive trigger pulses present in all modes.

20 MAN push-button: for generating external trigger signals when in the GATE, EXT TRIG and EXT WIDTH modes. Effective only when NEG–POS–MAN switch 22 is in the MAN position.

21 EXT INPUT connector: DC coupled input to which external triggering/gating signals are applied. Input impedance either 50Ω or 500Ω with corresponding maximum input levels of ± 7V or ± 25V respectively.

22 NEG–POS–MAN switch: for selecting the polarity/slope and/or source of external trigger signals. In the POS (slope/polarity) and NEG (slope/polarity) positions, signals are applied to EXT INPUT connector 21.

23 Z_{IN} 50Ω/500Ω switch: selects input impedance of EXT INPUT.

24 NORM, GATE, EXT TRIG and EXT WIDTH switch: for selecting mode of operation of 8015A.

25 NORM, DOUBLE PULSE, B DEL switch: in DOUBLE PULSE 8015A delivers two pulses/trigger output – one in phase with the trigger and one delayed by delay control. In B DEL, the pulse defined by channel A output controls occurs immediately after the trigger output while the pulse defined by channel B output controls occurs after the time set on the delay controls.

26 EXT INPUT LEVEL control: defines the threshold level of the external input over a range of +1V to –1V (Z_{IN} – 50Ω) or +10V to –10V (Z_{IN} – 500Ω).

27 LINE ON-OFF: press-for-on-press-for-off switch.

Figure 3–1. Front Panel Controls and Connectors

2–22 Repackaging for Shipment and Storage

2–23 If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office, attach a tag showing owner, address, model and serial number, and the repair 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.

3–1 SWITCH-ON

3–2 To protect the device under test, the levels at the outputs rise gradually to the set levels when the LINE button is pressed on. When switching off, the levels decay slowly. For this reason, at least 8 seconds should be allowed between switching off and switching on again (see also §4–58).

CAUTION

If instrument serial number is 1538 G 00685 or below, connect device under test AFTER switching on, disconnect device BEFORE switching off (see Section 8, Change 1).

3–3 TRIGGER MODES

3–4 Control (**24**) selects one of the following modes:

NORM where the rep rate is generated internally,

GATE where an external signal enables the internal rep rate generator,

EXT where the rep rate is determined by an external signal,

EXT WIDTH where rep rate and pulse width are determined by an external signal.

3–5 Internal (normal) Mode

3–6 When the mode control (**24**) is set to NORM, the internal rep rate generator runs continuously at a rate set by controls (**1**) and (**2**). A positive output pulse is available at connector (**19**) and an output pulse (whose shape depends on the setting of controls (**3**) to (**9**) as shown in Figure 3–2) appears at the channel A and channel B outlets (**17**), (**15**). Output levels and format are described later.

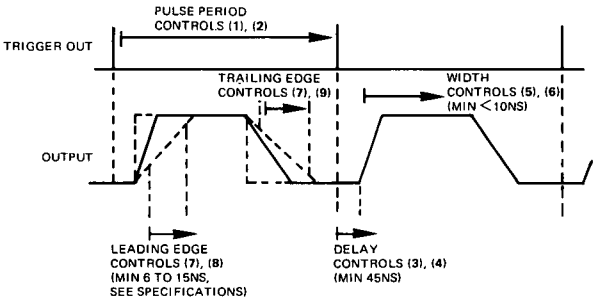


Figure 3–2. Pulse Generation in the Normal (internal) Mode

3–7 External Modes

3–8 Operation in all external modes is initiated by a signal applied to connector (**21**). The trigger point on the input signal is selected by controls (**22**), (**23**) and (**26**) which, as shown in Figure 3–3, can be adjusted so that the trigger point is immune to baseline noise and pulse top ringing.

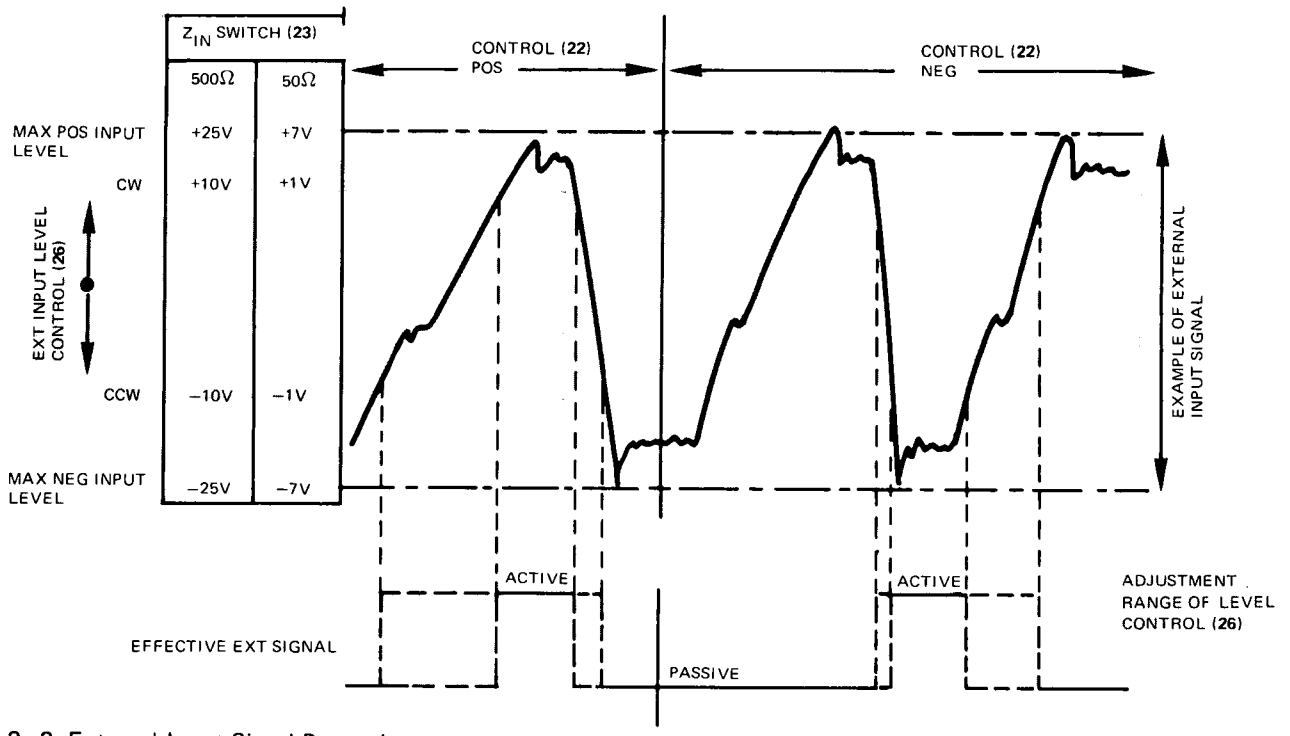


Figure 3–3. External Input Signal Processing

When the control (**22**) is set to MAN, the external modes can be driven manually by pressing the MAN button (**20**) (button released corresponds to the 'passive' condition).

3–9 Gate Mode

3–10 In this mode, the internal rep rate generator only runs when the external signal is active. In other respects, operation is the same as in the NORM (internal) mode.

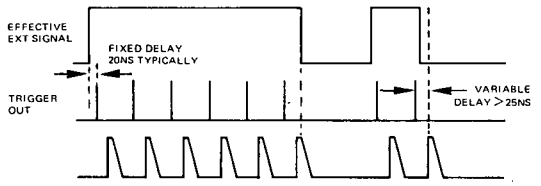


Figure 3–4. Gate Mode

Note that the last pulse is always complete, even if the external signal returns to passive during the pulse itself; indeed, an output pulse can occur completely outside the gate if the pulse delay is long enough.

3–11 External Trigger Mode

3–12 Here, the internal rep rate generator is inoperative and the output rate is that of the external signal. In other respects, operation is the same as in the NORM (internal) mode.

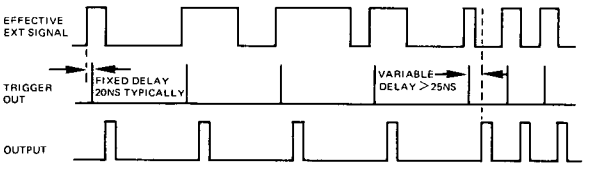


Figure 3–5. External Trigger Mode

3–13 External Width Mode

3–14 Both rate and width of the output pulse are determined directly by the external signal in the EXT WIDTH mode. The internal rep rate generator provides an entirely indepedent signal source at the TRIG OUT connector (**19**); this may be switched off by setting the WIDTH switch (**5**) to SQ. Transition times can be set with controls (**7**) to (**9**) as in the NORM (internal) mode.

NOTE: With 8015A rate in fastest range, jitter may increase. (set rate to slower position.)

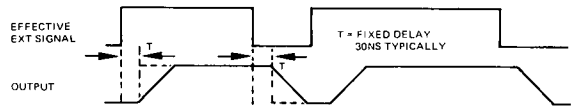


Figure 3–6. External Width Mode.

3–15 PULSE MODES

3–16 Control (**25**) selects: NORM (the normal pulse mode tacitly assumed in the foregoing), DOUBLE PULSE or B DEL (channel B delayed with respect to channel A). Additionally, a square wave mode can be selected using control (**5**).

3–17 Double Pulse Mode

3–18 The double pulse mode provides two pulses: the first follows the TRIG OUT pulse by a small, fixed delay; the second is spaced from the first by the amount set on the delay controls (**3**), (**4**). The pulses are non-overlapping. Note that the max pulse rate is 50MHz, equivalent to a max rep rate of 25MHz.

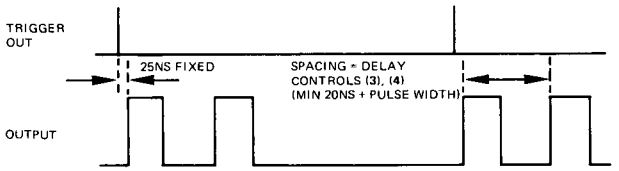


Figure 3–7. Double Pulse Mode

3–19 B Delay Mode

3–20 Here, the pulses of the double pulse mode are steered so that the first pulse is delivered by channel A the second by channel B. Note that the max rep rate is 20MHz.

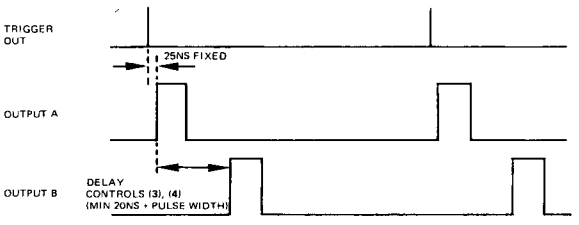


Figure 3–8. Delay Mode

3–21 Square Wave Mode

3–22 In this mode, the TRIG OUT rate is divided by 2, alternate trigger pulses putting the output level high and low. Note that, when combined with gate mode, the level between pulse trains will depend on whether the number of trigger pulses within the gate is even or odd. Transition times are variable, max frequency is half max trigger rate, i. e., 25MHz.

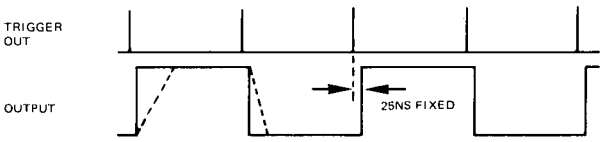


Figure 3–9. Square Wave Mode

3–23 OUTPUT CONTROLS

3–24 Pulse amplitude and baseline are controlled by means of upper and lower level controls.

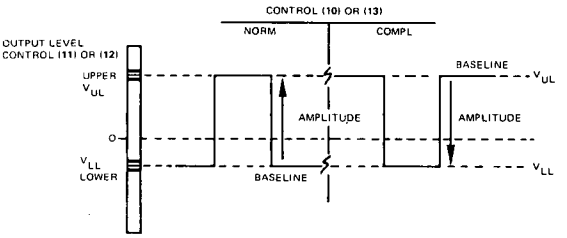


Figure 3–10. Level Controls

Note. The output amplifiers are current sources and should normally be terminated, internally or externally, by 50Ω.

3–25 A sep B Operation

3–26 In A sep B (control (**16**)), the pulse levels in the two channels are independently variable. The pulse timing, however, is identical.

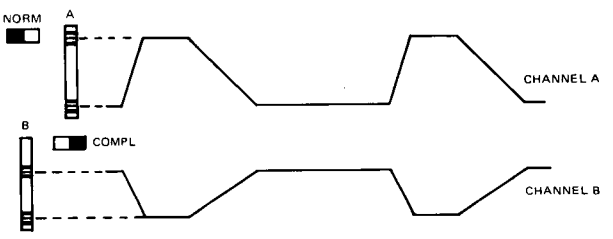


Figure 3–11. A sep B Operation

As shown in the following table, a maximum pulse amplitude of 8V is available if the source impedance (Z_S switch (**18**), (**14**)) and load impedance are both 50Ω whereas 16V can be obtained if one of them is 1kΩ:

Table 3–1. Maximum A sep B Levels

Z_S setting	Load	Max amplitude	V_{UL}		V_{LL}	
Ω	Ω	V	Max	Min	Max	Min
50	50	8	+8	−7	+7	−8
50	1k	16	+16	−14	+14	−16
1k	50	16	+16	−14	+14	−16

For small capacitive loads (<20pF), the 50Ω termination should be located at the load. For larger capacitances, reflections are absorbed better by using the internal 50Ω load of the 8015A.

3–27 A + B Operation

3–28 By setting the control (**16**) to A + B, levels of twice the value set on the A OUTPUT LEVELS control are available at OUTPUT A. Ensure that OUTPUT B is disconnected.

Channel B OUTPUT LEVELS and COMPL switch are inoperative. Source impedance can be set to 50Ω by setting either or both Z_S switches to 50Ω. For a 1kΩ source impedance, BOTH switches must be set to 1kΩ. As shown in the following table, a maximum amplitude of 16V is realized if source and load are each 50Ω whereas 30V can be obtained if one of them is 1kΩ.

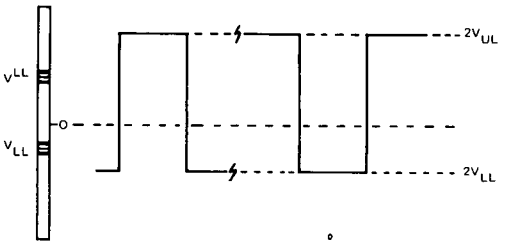


Figure 3–12. A + B Operation

Table 3–2. Maximum A + B Levels

Z_S setting	Load	Max amplitude	V_{UL}		V_{LL}	
Ω	Ω	V	Max	Min	Max	Min
50	50	16	+16	−14	+14	−16
50	1k	30	+16	−12	+12	−16
1k	50	30	+16	−12	+12	−16

3–29 A + B with B DEL Operation

3–30 By setting the control (**16**) to A + B and control (**25**) to B DEL, 3-level signals are generated at OUTPUT A. The amplitude of the undelayed pulse is determined by the difference between the level settings of channel A; the delayed pulse's amplitude by the level settings of channel B. The baseline represents the algebraic sum of the A and B baselines, where the baseline is V_{UL} in complement and V_{LL} in normal operation. Load considerations and voltages are as for A sep B operation. OUTPUT B should not be connected.

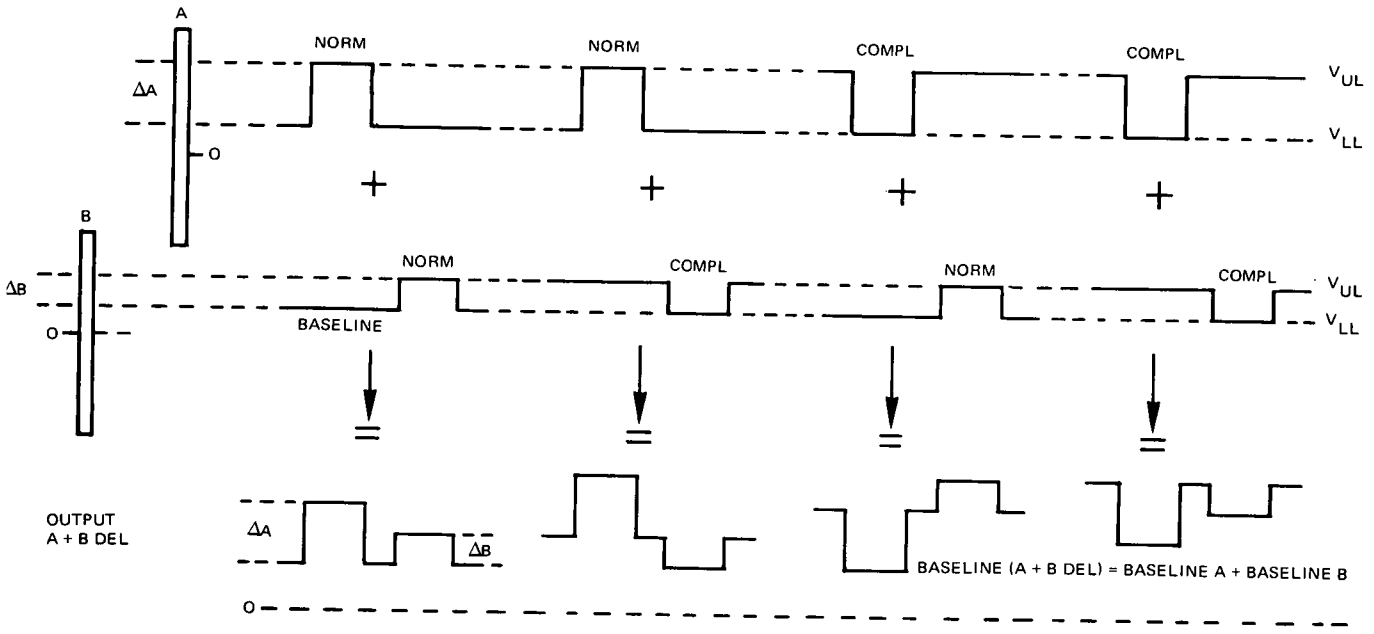


Figure 3–13. The Synthesis of 3-level Signals

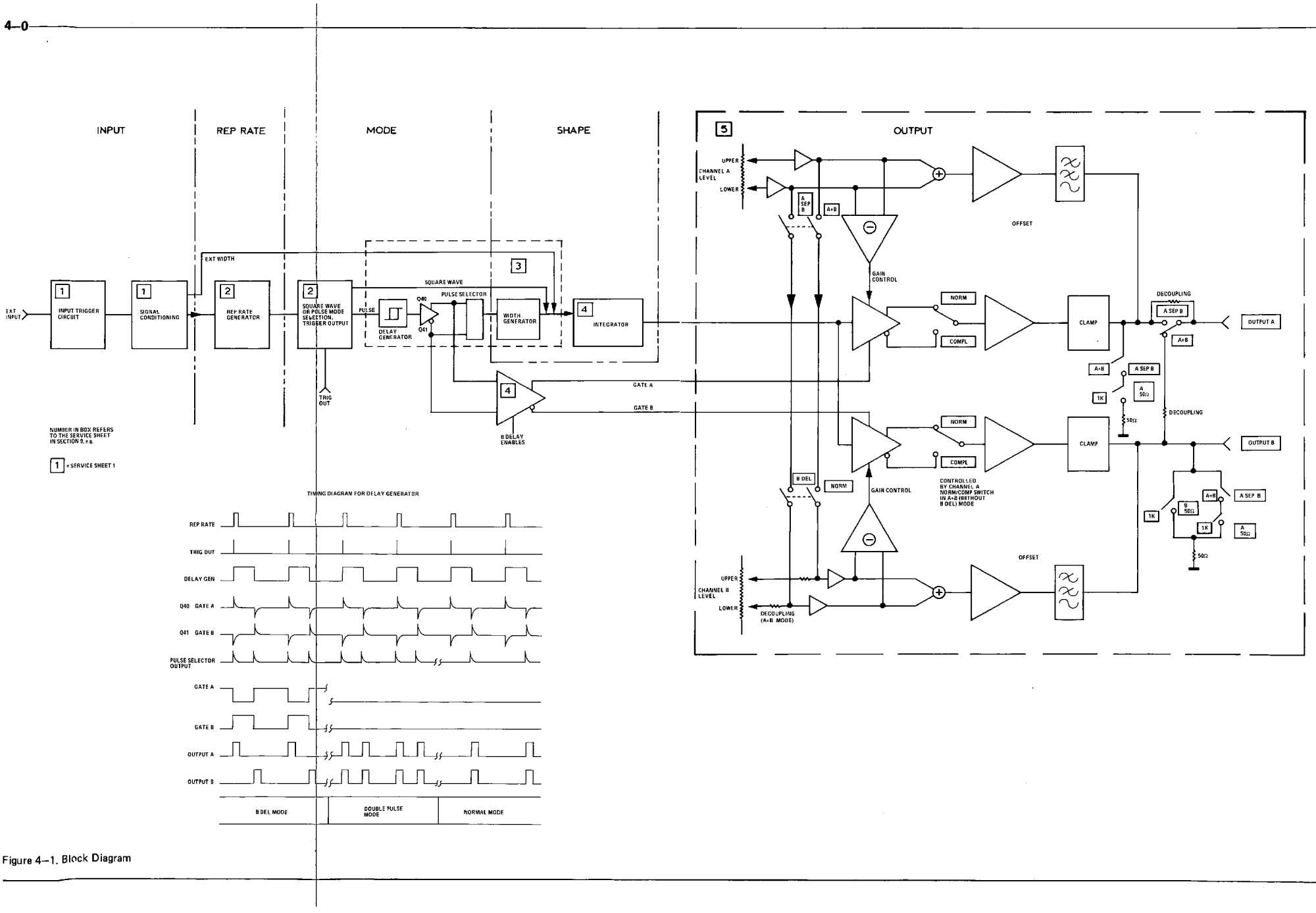


Figure 4–1. Block Diagram

4–1 INTRODUCTION

4–2 As figure 4–1 illustrates, the 8015A can be separated into a number of sections: Input Trigger, Signal Conditioning (i. e. defining what the purpose of the external signal is – gating, trigger or external width drive), Repetition Rate Generator, Square/Pulse mode selection, Burst mode (if fitted), Delay, Width and Integrator circuits. The output section covers all the time-independent characteristics such as amplitude and output format.

4–3 GENERAL PRINCIPLES OF OPERATION (fig. 4–1)

4–4 The pulse repetition rate is generated either internally or by an external source. When generated internally by the repetition rate generator the pulse train can be gated by an external signal which is used to turn the Repetition Rate Generator on and off.

4–5 When the repetition rate is derived externally, the signal (either applied to EXT INPUT or derived by pressing the MAN button) can be used to drive the Repetition Rate Generator or, in the EXT WIDTH mode, to drive the Integrator. In the latter case the external signal defines not only the frequency but also the pulse width. In all the external (GATE, EXT TRIG, EXT WIDTH and BURST) modes the Signal Conditioning circuits define the purpose and destination of the external signal.

4–6 In the Square Wave/Pulse Selection circuit, the Repetition Rate Generator output is applied to either a flip-flop or the Delay Generator. In the square wave mode the pulses drive the flip-flop which in turn drives the Integrator (i. e. in the square wave mode delay and width are not variable parameters). The trigger output is also derived from the flip-flop. In the pulse mode (i. e. when the pulse width is defined by the Width Integrator and not by a flip-flop) the rate signal by-passes the flip-flop and is applied to the Delay Generator. The trigger output is also derived from the rate signal.

4–7 The functions of the Delay and Width Generators are fairly obvious and these circuits are described in detail later in the theory of operation. However, because of its affect on later circuits, the function of the Delay Generator in the B DEL (B output delayed with respect to A) mode is described here. In the B DEL mode the Delay Generator produces two pulses – one in phase with the rate signal and another delayed with respect to the rate signal. While this would normally result in two output pulses per trigger (as in Double Pulse), this is not the case in the B DEL mode. This is because the signal Gate B turns off Channel B Amplifier after the delay, and the Gate A signal turns off the A Channel Amplifier during the delay.

4–8 The integrator is a variable time constant device which modifies the transition time of incoming pulses and applies the result simultaneously to channel A and Channel B output stage. The output stages are described later in the theory of operation.

4–9 DETAILED DESCRIPTION

4–10 Input trigger circuits (Service Sheet 1)

4–11 An Input Impedance Selector circuit (Z_{IN} – 50Ω/500Ω) is followed by a Bridge Limiter which limits signal amplitude to ± 1.5V maximum. The amplitude limited signal is compared at a differential comparator with the output from the EXT INPUT LEVEL vernier. This defines the threshold level. The output (inverted or non-inverted) to be used is determined by the Comparator Output Selector (S4A, CR5 & CR6) and applied, via the Common Base stage (Q4), to the Signal Conditioning Circuits. If MAN triggering is selected, the comparator is disabled and trigger pulses occur only when the MAN button is pressed. The Inverter (Q3) is cut off when the MAN button is pressed and turned on when it is released.

4–12 Signal Conditioning circuit (Service Sheet 1)

4–13 The Signal Conditioning Circuit is controlled from the mode switch S5A, and, under this control, defines the purpose and destination of external signals – if applied. The mode switch controls the Transmission Gates Q9, Q10 and Q35 so that:

a. in the GATE mode, only Q9 is enabled and the external signal is defined as a gating signal which enables and disables the Repetition Rate Generator.

b. in the EXT TRIG mode, only Q10 is enabled and the external signal is defined as a trigger signal which triggers the Repetition Rate Generator. To create the difference between gating and triggering signals the external signal is differentiated by L1 in EXT TRIG mode.

c. In the EXT WIDTH mode, only Q35 is enabled so that the external signal is routed to the Width Generator.

d. In the NORM mode none of the transmission gates are enabled but Common Base stage Q6 conducts to set Schmitt trigger Q7/8 so that input signals have no affect.

e. in the BURST mode, again, none of the Transmission Gates are enabled but the Common Base Stage Q6 is cut off so that the external signal is applied as START BURST to the BURST BOARD. The BURST mode is enabled from S5A. In the other external modes (GATE, EXT TRIG and EXT WIDTH) although the external signal reaches the BURST BOARD, and appears to be a START BURST signal, it is ignored if the BURST mode is disabled – as is the case.

4–14 Repetition Rate Generator (Service Sheet 2)

4–15 The Repetition Rate Generator consists of a ramp generator (Range Capacitors and Current Source) and a current switch (Q14, Q15). The Current Source draws current from the selected Range Capacitor(s) until the voltage reaches the threshold level of the Switch. When its threshold level is reached, the Switch turns on and supplies the ramp capacitors (and the current source) with current. The voltage rises until the current through the Switch falls below its maintaining level and results in the Switch turning off (the connection of Q14 and Q15 is similar to a Silicon Controlled Rectifier in which conduction ceases when the current falls below a level sufficient to maintain the device in an 'on' state). This sequence repeats at a rate determined by the value of the Range Capacitor, the current drawn by the Current Source and the threshold voltage of the Switch. The current drawn by the source is varied by the RATE VERNIER (R2) which, via the Threshold Level Control (Q17, Q18), also modifies the threshold level of the Switch. Thus, when the RATE VERNIER is at the lower end of the RATE range selected, the threshold level of the switch is increased (i. e. made more negative) so that the ramp has to reach a more negative potential (and hence takes longer to do so) before the switch turns on.

4–16 In the NORM and EXT WIDTH modes, the Repetition Rate Generator is always running (in the EXT WIDTH mode this is to provide an asynchronous trigger output) as described. In the BURST and GATE modes the Rep Rate Generator runs only when enabled (by high level at I/P) by the gating or ENABLE signals from the signal conditioning Circuit or the BURST BOARD respectively. In the EXT TRIG mode, the Rep Rate Generator is disabled (mode switch S5B applies –18V to the switch) and the Switch is driven by the external trigger signal from the signal conditioning circuit. The output from the Rep Rate Generator is via a Common Base Stage (Q16) and differentiator (L2). The signal is ac coupled to the Square/Pulse Mode selector circuits.

4–17 Square/Pulse Selection (Service Sheet 2)

4–18 The purpose of this circuit is:

either a. to provide the square wave signal and correct frequency related trigger in the Square Wave mode.

or b. to apply the rate output to the delay generator when not in the Square Wave mode (i. e. when width is defined by the Width Generator) and provide a 1:1 rep rate to trigger output frequency relationship.

4–19 SQUARE WAVE MODE

4–20 In the BURST, NORM, GATE and EXT TRIG modes with SQ (Square Wave) selected, –18V (from WIDTH switch S3C via mode switch S5D and X5 pin 12) is simultaneously applied to Q27 and the flip-flop (Q23, Q24) which the rate signal, from the inverted output of the Phase Splitter (Q26, Q29) consequently

drives. Because the bias on the base of Q27 is negative, its emitter is also negative; this cuts off the Pulse Mode Transmission Gate (Q28). The rate signal is halved in frequency by the Flip-Flop and one output provides the Square Wave signal to the Width Generator (via the Square Wave Buffer Q34) while the other output provides the trigger output via the Square Wave Trigger Buffer (Q25, Q31) and the Trigger Output Buffer (Q30, Q33). The Trigger Transmission Gate (Q32) is disabled in the Square Wave mode.

4–21 When Square wave and EXT WIDTH are selected, Q27 receives –18V from mode switch S5C via X5 pin K, but Q23/24 are disabled because X5 pin 12 no longer carries –18V. Thus, when EXT WIDTH and SQ are selected the EXT WIDTH mode is in operation and no trigger output occurs.

4–22 PULSE MODE

4–23 Pulse mode refers to the BURST, NORM, GATE and EXT TRIG modes when the WIDTH switch is in a position other than SQ. Under these conditions, no signal is applied to X5 pin K and 12. Q27 is disabled because the voltage at its base in positive. The emitter of Q27 is slightly less positive and this enables the Pulse Mode Transmission Gate (Q28). The rate signal from the inverted output from Q26 is applied to the Delay Generator via the Pulse Mode Transmission Gate. Also, the Trigger Transmission Gate (Q32) is enabled and the non-inverted output of the Phase Splitter provides the trigger output via Q32 and the Trigger Output Buffer (Q30, Q33).

4–24 When the mode switch is set to EXT WIDTH and the PULSE WIDTH switch is set to a range other than SQ, –18V is applied at X5 pin K from mode switch S5C. This disables the Pulse Mode Transmission Gate (Q28), enables the Square Mode Transmission Gate and disables the Flip-Flop. Thus, no signal goes to the Delay Generator and (because the Flip-Flop is disabled) no square wave output can occur. Because the PULSE WIDTH switch is not in the SQ position, the Trigger Transmission Gate (Q32) is enabled and a trigger output occurs. The trigger output is the same frequency as the rate signal.

4–25 Delay Generator (Service Sheet 3)

4–26 The Delay Generator consists of a ramp generator (Current Source and Range Capacitors), a Schmitt Trigger and a Capacitor Discharge Switch (Q46). Before a positive pulse from the Square/Pulse Selector Circuit is received, the Schmitt Trigger (Q38, Q39) holds the Capacitor Discharge Switch on so that it draws current from the selected Range Capacitor(s). The voltage Clamp limits the potential to which the capacitors discharge to about –8V. When a positive pulse is received from the Square/Pulse Selector the Schmitt Trigger changes state and turns off the Capacitor Discharge Switch. The Range Capacitor(s) now draw(s) current from the Current Source at a linear rate dependent on the resistance of the Delay VERNIER (R3). When the ramp reaches the threshold of the Schmitt Trigger the circuit reverts to its previous state. The output from the Schmitt Trigger is a pulse whose leading edge falls when the signal from the Square/Pulse Select Circuit is received and whose trailing edge rises when the Schmitt is reset. Thus, the width of this pulse equals the delay time. The pulse is then applied to the Phase Splitter. As well as phase splitting, this circuit differentiates so that, from the inverted output, a positive spike is followed by a negative spike; and, from the non-inverted output, a positive spike is followed by a negative spike. The separation of the spikes equals the delay time. These spikes are applied to the Double/Single Pulse Selector Circuit which is controlled by the NORM-DOUBLE PULSE-DEL switch (S6B). When S6B is switched to NORM, –18V is applied to the Double/Single Pulse Selector (via X5pin14) and only the negative spike from the inverted output of the Phase Splitter has an effect. This spike, the latter of the two (i. e. the delayed) from the Phase Splitter, is inverted by the Double/Single Pulse selector and applied to the Width Generator.

4–27 Width Generator (Service Sheet 3)

4–28 The only difference between the Width and Delay Generators is in their different output stages.

4–29 Integrator (Service Sheet 4)

4–30 The Integrator is a variable time-constant circuit which modifies the transition times of the pulses from the Width Generator.

4–31 On negative input transitions Current Source Q6 draws current (via Q8 of Diff Amp Q7, Q8) from the selected Range Capacitors. When the voltage at the Range Capacitor falls to the potential of the NEGATIVE CLAMP, CR6 conducts and clamps the signal until a positive transition occurs. The current demanded by the current source is now supplied by the Clamp Voltage Source (Neg) – Q11, Q12. The rate of fall of the voltage

at the Range Capacitor is linearly dependent on the value of the capacitor and the current drawn from it. The amount of current drawn is determined by the LEADING EDGE VERNIER.

4–32 While the leading edge transition time is being defined, Current Source Q3 supplies current (via Q4 of Diff Amp Q4, Q5) to the positive Clamp Voltage Source Q9, Q10.

4–33 On positive input transitions Current Source Q3 supplies current (via Q5 of Diff Amp Q4, Q5) to the Range Capacitor. When the voltage rises to the potential of the POSITIVE CLAMP, CR5 conducts and clamps the signal (until the next negative transition). The unwanted current now being supplied by the Current Source is drawn by the Clamp Voltage Source (Pos) – Q9, Q10. The rate of rise of the voltage at the capacitor is linearly dependent on the value of the capacitor and the current supplied to it. The amount of current supplied is determined by the TRAILING EDGE VERNIER.

4–34 While the trailing edge transition time is being defined, Current Source Q6 supplies current (via Q7 of Diff Amp Q7, Q8) to the Negative Clamp Voltage Source Q11, Q12.

4–35 The signal is buffered to the Channel A and Channel B output stages via the Emitter Follower stages Q17, Q18, Q19 and Q20. Q17 and Q18 use Current Sources Q15 and Q16, respectively, as loads.

4–36 Output Stages (Service Sheet 5)

4–37 PULSE AMPLIFIERS

4–38 Each channel comprises three cascaded differential amplifier stages and a cascaded common base output stage. Normal or complement pulses are Selected from the appropriate side of the differential amplifiers by relay K1. At the output of the common base stages are two voltage clamps which restrict the output swing to ± 16V maximum. Gain control of the amplifier is achieved by the active attenuator stages between each of the differential amplifiers. These attenuators are controlled from the variable current sources (Q19, Q21) which are in turn controlled by the difference between the position of the two sliders of each OUTPUT LEVEL control.

4–39 The attenuators operate on the current-sharing principle of a differential amplifier; i. e., the current flowing in each collector is proportional to the potential difference between the two bases. The input signal (figure 4–2) controls the share of current I which flows through each input transistor. Similarly, the signal delivered by Q19/21 controls the division of current in U10b/11b and 10c/11c. Suppose an attenuation factor of 2:1 and (for simplicity) I = 1mA. If the INPUT is such that I is shared equally then I_1 = 0.5mA and $I-I_1$ = 0.5mA. Also, Ix = 1/2 $(I-I_1)$ = 0.25mA and Ix′ = 1/2 (I_1) = 0.25mA. Now, suppose that the INPUT changes the sharing of current I so that I_1 = 0.2mA and $I-I_1$ = 0.8mA, then, Ix = 0.4mA and Ix′ = 0.1mA. In both cases the sum Ix + Ix′ = 0.5mA or Ix + Ix′ = k (constant). This is true for all INPUT current sharing and attenuation ratios.

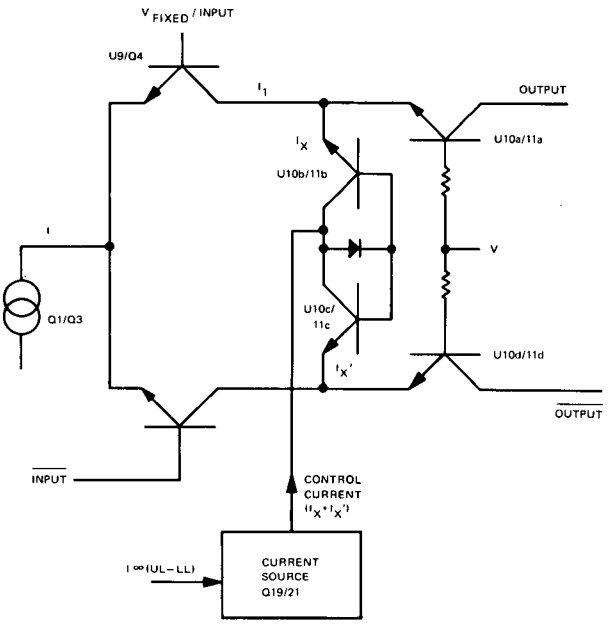


Figure 4–2. Attenuator and Gain Control

4–40 Non linearity due to emitter-bulk resistances and h_{FE} is compensated. In the first current source, by a two-line approximation to the non-linear curve achieved by R114, R115 and CR9. In the second attenuator current source, a five segment approximation is achieved by the diode-resistor arrangement at the input of U3.

4–41 The voltage source Q22 is controlled by a voltage proportional to the difference between the slider positions and shifts the pulses to maintain constant power dissipation of the differential amplifier transistors.

4–42 Because of a slight shift in the mean dc operating point at low duty cycles, an error signal is obtained by filtering the signal. This error signal is used to adjust the offset voltage to compensate for the dc shift.

4–43 A SEP B MODE

4–44 In this configuration relay K1 on Bd Ay Switch (Service Sheet 6) is de-energised and the Channels A and B operate independently and in identical fashion. The NORM–COMP logic enables both NORM–COMP switches so that independent control is available. The source impedance switching circuit enables the source impedances of both channels to be selected independently.

4–45 A + B MODE

4–46 In this configuration OUTPUT A and OUTPUT B are connected together and the A + B/A sep B/B DEL control section does the following:

a. when A + B is selected without B DEL, the A+B/A sep B/B DEL control energises relay K1 on Bd Ay Switch (Service Sheet 6) so that both A and B channels are controlled by channel A output level sliders. Also, the NORM–COMP LOGIC is instructed to transfer control of NORM–COMP switching of both amplifiers to channel A NORM–COMP switch. Finally, the source impedance switching circuit is instructed to disconnect the channel A internal 50Ω load so that an internal 25Ω load cannot occur. In the A+B mode the source impedance switching circuit is arranged so that, if either one or both of the Zs switches are set to 50Ω, only channel B 50Ω internal load is present. If both Zs switches are set to 1K there is no internal 50Ω load.

b. when A + B is selected in conjunction with B DEL, relay K1 is de-energised so that individual control of both channels is possible. Similarly, the NORM/COMP LOGIC enables individual control of both NORM–COMP switches. The source impedance switching is the same as for A+B without B DEL.

4–47 B DEL MODE

4–48 In this mode the antiphase outputs from the phase splitter in the Delay Generator drive the B DEL gate amplifier. This amplifier disables Channel B during the first pulse and disables Channel A during the second pulse. Thus, an output pulse occurs first from Channel A and then, after the Delay Time, from Channel B. When B DEL is not selected, the B DEL gate amplifier is disabled.

4–49 Power Supplies (Service Sheet 7)

4–50 POWER SUPPLY INTERDEPENDENCY

4–51 Common regulation is used so that jitter and drift are minimized. The supplies are consequently interdependent as shown in fig. 4–3.

4–52 CURRENT LIMIT CIRCUITS

4–53 Current sensing circuits in each regulator pull the COMP input of U1 (Voltage regulator IC of the

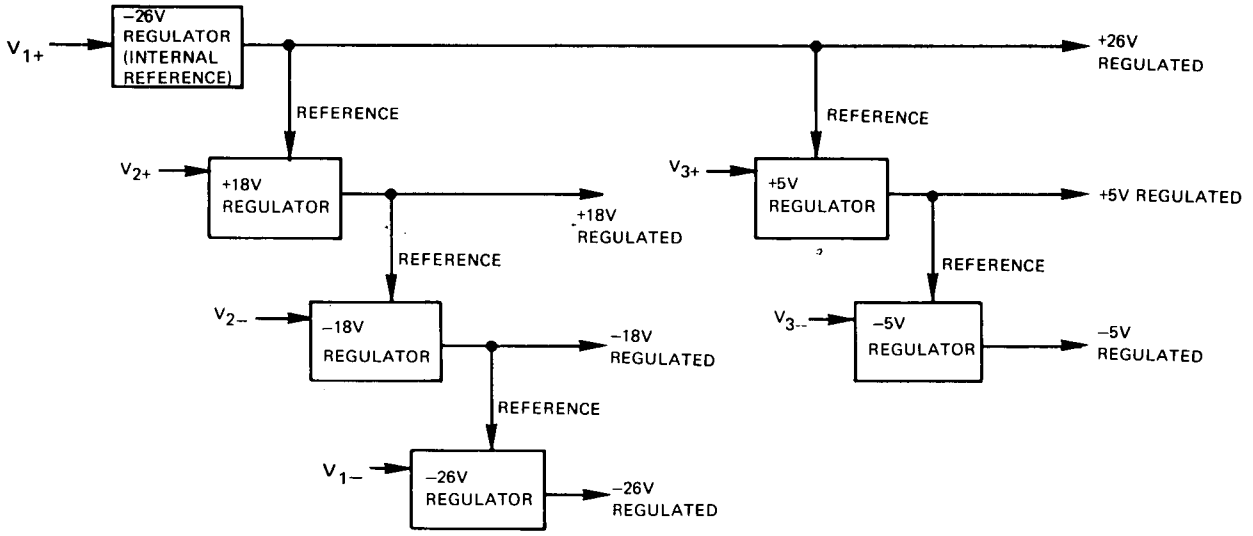


Figure 4–3. Power Supply interdependency

+26V regulator) down in the event of a short circuit. This causes the +26V supply to be pulled down and consequently (because of the interdependency) all other supplies as well. In other words, a short circuit in any supply causes all power supplies to be pulled down; in particular, this safeguards the output amplifier.

4–54 CURRENT FOLDBACK CIRCUITS

4–55 The foldback characteristic of all power supplies is determined by that of the +26V supply. When current sensing pulls the +26V supply down to about +12V, the internal current limit transistor of U1 is forward biased by the voltage at pin 2 and the +26V supply is then pulled down to zero.

4–56 Note that the foldback circuit is effective for about 8 seconds after switching off. This means there should be an interval of at least this time between switching off and switching on.

4–57 CR33 and 34 in the –26V regulator ensure a zero-volt bias on U4 pin 3 during operation of the foldback.

4–58 SWITCH ON/OFF CIRCUIT

4–59 At switch-off, this circuit applies a decay characteristic to U1 so that all power supplies turn off slowly and together.

4–60 The line cycle detector normally holds off the integrator (Q11, C2). When no further negative cycle is detected, the integrator runs down in about 10ms and pulls down the reference voltage applied from U1 pin 6 via R4 and R5 to U1 pin 5.

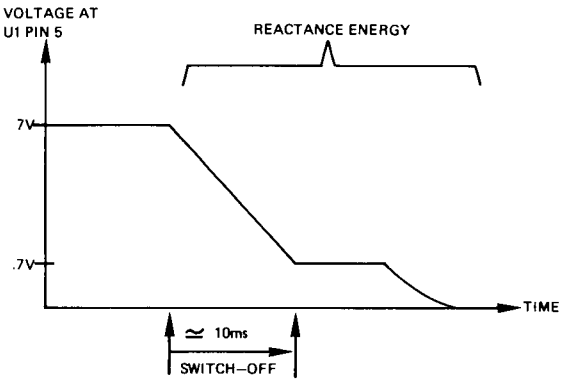


Figure 4–4. Turn-off characteristic

4–61 At switch-on, a slowly-rising voltage at U1 pin 5 is obtained by the time-constant R4/C7/CR4 decouples C7 for switch-off, and R7 discharges C7 when instrument is switched off.

4–62 ± 5V SUPPLY SPEED-UP CIRCUIT

4–63 The ± 5V supplies are switched on faster than the other supplies so that the relays for the internal 50Ω loads are actuated before the output amplifiers deliver power. Output transients are thus minimized.

4–64 At switch-on, a spike is fed from C22 to the divider R17/18 (the regulator reference point). This results in a step of about +3.7V which turns on the +5V supply which, in turn, turns on the –5V supply.

4–65 CR9 suppresses the negative-going part of the spike and, when turn-on is completed, decouples the reference point from C22. CR10 and R77 discharges C22 when the instrument is switched off.

5–1 GENERAL

5–2 This section contains information on the removal of covers and assemblies, performance verification and recalibration procedures.

WARNING

Before attempting removal of covers, assemblies or components, disconnect the instrument from the ac line supply. It is advisable also to leave the instrument for a few minutes after disconnecting from the line, to enable capacitors to discharge.

CAUTION

The output power of the 8015A can destroy an ordinary 50 termination. Make sure to use either a 50Ω power termination or a 20dB power attenuator with an ordinary termination. If using an attenuator, insert an additional 6dB when operating in the A + B mode.

5–3 REMOVAL OF COVERS

5–4 The top, bottom and side covers can be removed by releasing the captive screw at the rear of each cover and sliding the respective cover to the rear.

5–5 REMOVAL OF ASSEMBLIES

5–6 General

5–7 Remove top, bottom and side covers and the top board retaining strip (MP27, Figure 6–1).

5–8 Power Supply Board – Assembly 4

5–9 Remove connector from the bottom of the board, then ease the board out of the connector on the switch board.

5–10 Burst Board – Assembly 6

5–11 Remove the timing board (Assembly 3) and remove the two screws which hold the timing and burst boards together. Carefully separate the two boards.

5–12 Integrator Board – Assembly 5

5–13 Disconnect the single wire which connects between the integrator and timing boards. Disconnect the two coaxial cables. Disconnect the cable at the switch-board. From underneath, remove the two screws which fix the Integrator to the output amplifier boards. With the instrument inverted, lift the integrator board free from the amplifiers.

5–14 Output Amplifier Board(s) – Assembly 2

5–15 Disconnect the 7 connections to the power transistors and unsolder the wire to the pulse output connector. Remove the integrator board and ease the output amplifier board from its connector on the switch-board.

5–16 PERFORMANCE CHECKS

5–17 Tables 5–2 to 5–12 give the procedures for verifying that the instrument is working to the specifications. Rigid observance of the sequence in which the checks appear is unnecessary.

5–18 INTERNAL CHECKS AND ADJUSTMENTS

5–19 Tables 5–13 to 5–14 give the procedure for bringing a servicable instrument within specifications. These tests must be completed in the order in which they appear. The locations of the adjustment controls are shown in Figure 5–1 at the end of this Section and Tables 5–14, 5–16 and 5–18.

Table 5–1. Test Equipment for Performance Tests

INSTRUMENT	BRIEF SPECIFICATION	RECOMMENDED MODEL
Oscilloscope	Dual Channel, 50 MHz bandwidth, 5mV/div. sensitivity, sweep speeds 0.5μs/div. to 2s/div. with sweep delay.	HP 180C with plug-ins 1801A and 1820C
Sampling Oscilloscope	Dual Channel, 1 GHz bandwidth, 2mV/div. sensitivity, sweep speeds 10ps/div. to 50μs/div.	HP 180C with plug-in 1810A
Digital Voltmeter	100V range to 4 significant figures. Accuracy ±0.05% ± 1 digit.	HP 3465A
AC Voltmeter	Sensitivity 100μV to 300V rms.	HP 3400A
Test Oscillator	Frequency Range 10 Hz to > 200 MHz	HP 3200A
Pulse Generator	Rep. Rate 100 Hz – 20 MHz	HP 8011A

ACCESSORIES	
50Ω co-axial cable terminated with BNC male connectors (4 required)	HP 10100C
BNC Tee (1 male, 2 female)	HP 1250–0781
50Ω Feed-through (2 required)	HP 11048B
20dB 20 W Power Attenuator	Microline 766–20
6dB Attenuator	HP 8491B Option 006
Connector BNC male to N female	HP 1250–0077
Connector BNC male to N male	HP 1250–0780

PERFORMANCE CHECK

Table 5–2. Repetition Rate Test

PROCEDURE

1. Set up the equipment as shown and set the controls as follows:

8015A:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CCW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	10n–1μ
VERNIER **6**	CCW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMP **10**	NORM
CH A UPPER LEVEL > **11**	MIN SEPARATION
CH A LOWER LEVEL > **11**	MIN SEPARATION
CH B UPPER LEVEL > **12**	MIN SEPARATION
CH B LOWER LEVEL > **12**	MIN SEPARATION
CH B NORM/COMP **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL	–

Test Equipment: set counter to corresponding settings to get best resolution

2. Check repetition rate for each setting listed below:

PULSE PERIOD **1**	VERNIER **2**	RESULT
20n – 1μ	CCW	$\geqslant$ 50 MHz
20n – 1μ	CW	$\leqslant$ 1 MHz

PULSE PERIOD **1**	VERNIER **2**	RESULT
1μ – 0.1 m	CCW	$\geqslant$ 1 MHz
1μ – 0.1 m	CW	$\leqslant$ 10 KHz

Set counter to period measurement

0.1 m – 10 m	CCW	$\leqslant$ 0.1 ms
0.1 m – 10 m	CW	$\geqslant$ 10 ms
10 m – 1	CCW	$\leqslant$ 10 ms
10 m – 1	CW	$\geqslant$ 1 s

3. Set function to ext trig and counter to frequency

4. Press manual button once: one pulse only must be counted.

SPECIFICATION

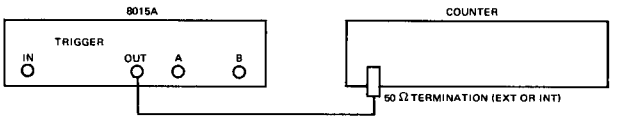
Repetition rate .....
1 Hz – 50 MHz in four ranges
vernier provides continuous adjustment

DESCRIPTION

Checks frequency ranges and manual trigger function

EQUIPMENT

Counter capability .....$\geqslant$ 50 MHz
Frequency and period measurement



PERFORMANCE CHECK

Table 5–3. Pulse Delay Test

PROCEDURE

1. Set up the equipment as shown and set the controls as follows:

8015A:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	10n–1μ
VERNIER **6**	CCW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL >**11**	MIN SEPARATION
CH A LOWER LEVEL	
CH B UPPER LEVEL >**12**	MIN SEPARATION
CH B LOWER LEVEL	
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	B-DEL
EXT INPUT LEVEL **26**	–

Test equipment: Set scope to corresponding settings to get best resolution.

2. Adjust scope controls so that channel A leading edge is coincident with the first line of graticule. Check movement of the channel B pulse leading edge for settings listed below. (**Note:** avoid excessive timing.)

3. Set mode switch to double pulse and repeat with settings of step 2. Measure distance between pulses, should be same as result in B-delay.

SPECIFICATION

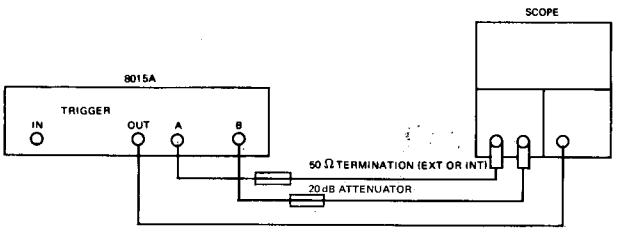
Pulse delay .....
20 ns (+25 ns fixed) to 1 s in four ranges
vernier provides continuous adjustment

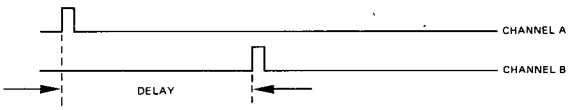
DESCRIPTION

Checks delay ranges in B-delay mode

EQUIPMENT

Oscilloscope capability .....Bandwidth ⩾ 50 MHz





PULSE **1** PERIOD	VERNIER **2**	PULSE **3** DELAY	VERNIER **4**	PULSE **5** WIDTH	VERNIER **6**	RESULT
20n–1μ	CW	20n–1μ	CW	10n–1μ	CCW	⩾ 1μs
1μ–0.1m	CW	1μ–0.1m	CCW	1μ–0.1m	CCW	⩽ 1μs
1μ–0.1m	CW	1μ–0.1m	CW	1μ–0.1m	CCW	⩾ 0.1ms
0.1m–10m	CW	0.1m–10m	CCW	0.1m–10m	CCW	⩽ 0.1ms
0.1m–10m	CW	0.1m–10m	CW	0.1m–10m	CCW	⩾ 10ms
10m–1	CW	10m–1	CCW	10m–1	CCW	⩽ 10ms
10m–1	CW	10m–1	CW	10m–1	CCW	⩾ 1s

PERFORMANCE CHECK

Table 5–4. Pulse Width Test

PROCEDURE

1. Set up the equipment as shown in Figure A and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CCW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	10n–1μ
VERNIER **6**	CCW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEBEL / CH A LOWER LEVEL **11**	MIN SEPARATION
CH B UPPER LEVEL / CH B LOWER LEVEL **12**	MIN SEPARATION
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: Set scope to corresponding ranges and best resolution

2. Set output level for a full screen display. Measure pulse width at 50% of amplitude: ⩽ 10ns

3. Turn width vernier slowly cw till pulse moves or divides. Measure duty cycle: > 50%

4. Set pulse width to square wave. Measure duty cycle: 50 % ± 15 %

SPECIFICATION

Pulse Width . . . . . .
< 10ns to 1 s in four ranges
vernier provides continuous adjustment

DESCRIPTION

Checks width ranges, square wave and duty cycle

EQUIPMENT

Sampling Oscilloscope . . . . . > 1GHz
Oscilloscope . . . . . > 50 MHz

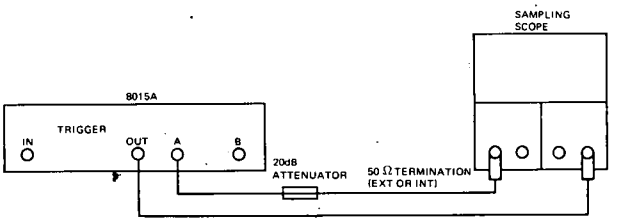


FIGURE A

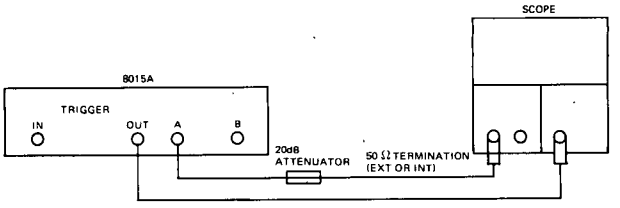


FIGURE B

5. Set equipment as shown in Figure B and measure pulse width for each of the settings listed below:

PULSE PERIOD	VERNIER	PULSE DELAY	VERNIER	PULSE WIDTH	VERNIER	RESULT
1μ–0.1m	CW	20n–1μ	CCW	10n–1μ	CW	> 1μs
1μ–0.1m	CW	20n–1μ	CCW	1μ–0.1m	CCW	< 1μs
0.1m–10m	CW	20n–1μ	CCW	1μ–0.1m	CW	> 0.1ms
0.1m–10m	CW	20n–1μ	CCW	0.1m–10m	CCW	< 0.1ms
10m–1	mid pos	20n–1μ	CCW	0.1m–10m	CW	> 10ms
10m–1	CW	20n–1μ	CCW	10m–1	CCW	< 10ms
10m–1	CW	20n–1μ	CCW	10m–1	CW	> 1s

6. Set pulse width to square wave. Measure duty cycle in following ranges:

PULSE PERIOD	VERNIER	
20n–1μ	cw	
1μ–0.1m	cw to ccw	
0.1m–10m	ccw to cw	50 % ± 5 %
10m–1	cw to ccw	

PERFORMANCE CHECK

Table 5–5. Jitter Test

PROCEDURE

1. Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	SEE STEP 2
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	1μ–0.1m
VERNIER **6**	CCW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL > **11** CH A LOWER LEVEL	MIN SEPARATION
CH B UPPER LEVEL > **12** CH B LOWER LEVEL	MIN SEPARATION
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test equipment: Main sweep 0.1ms/div
Delay sweep 0.1μ/div
Delay Trigger AUTO

2. Adjust pulse period vernier to obtain a 0.1ms period.
3. Set mode switch on time base to mixed.
4. Adjust scope delay vernier till leading edge of second pulse is expanded.
5. Measure pulse period jitter < 0.1% + 50ps. Set scope mode switch back to norm.
6. Set pulse period to 0.1m–10m and adjust rate vernier to obtain a 0.4ms period.
7. Set pulse delay to 1μ–0.1m and vernier to 0.1 delay.
8. Set scope mode switch to mixed.
9. Adjust scope delay vernier till leading edge of first pulse is expanded.
10. Measure pulse delay jitter < 0.1% + 50ps. Set scope mode switch back to norm.
11. Set pulse period vernier to obtain a 0.4ms period.
12. Set delay to 20n–1μ vernier ccw.
13. Adjust pulse width vernier to obtain a 0.1ms pulse width.
14. Set scope mode switch to mixed.
15. Adjust scope delay vernier till trailing edge of first pulse is expanded.
16. Measure pulse width jitter < 0.1% + 50ps.

SPECIFICATION

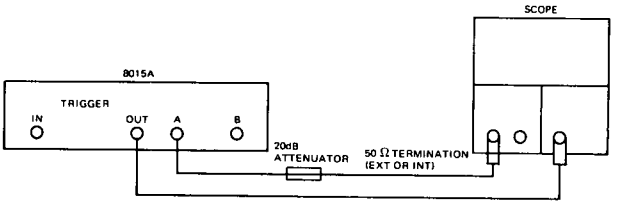
Period Jitter < 0.1% + 50 ps for any rate setting
Delay Jitter < 0.1% + 50 ps for any delay setting
Width Jitter < 0.1% + 50 ps for any width setting

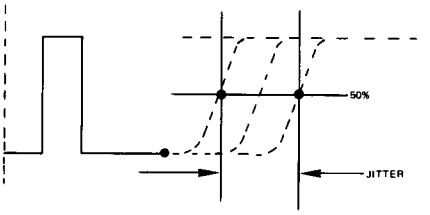
DESCRIPTION

Checks period jitter, delay jitter, width jitter.

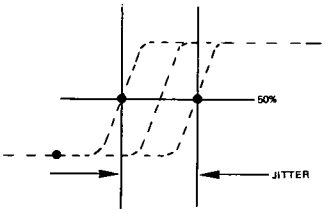
EQUIPMENT

Oscilloscope . . . . . > 50 MHz, Main and Delayed sweep
A sampling oscilloscope with direct and expand can be used instead.

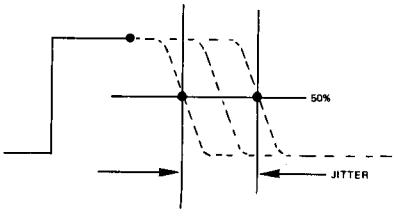




RATE



DELAY



WIDTH

PERFORMANCE CHECK

Table 5–6. External Mode Check (Trigger and Gate)

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	MID-POSITION
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	10n–1μ
VERNIER **6**	CW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMP **10**	NORM
CH A UPPER LEVEL > **11** / CH A LOWER LEVEL	MIN SEPARATION
CH B UPPER LEVEL > **12** / CH B LOWER LEVEL	MIN SEPARATION
CH B NORM/COMP **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	EXT TRIGGER
EXT INPUT LEVEL **26**	MID-POSITION

Test Equipment: Set Ext Pulse Generator to a square wave frequency of 5 KHz and a 1 V output amplitude.

SPECIFICATION

External Trigger .....
Each external pulse (positive and negative slope selectable) will initiate an output pulse.

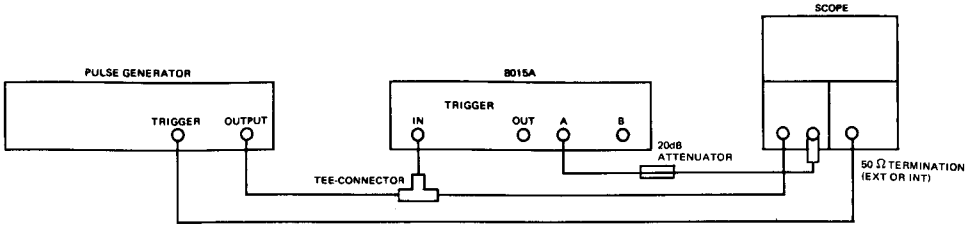
External Gate .....
Each external pulse (positive and negative slope selectable) will initiate and terminate a train of output pulses.

DESCRIPTION

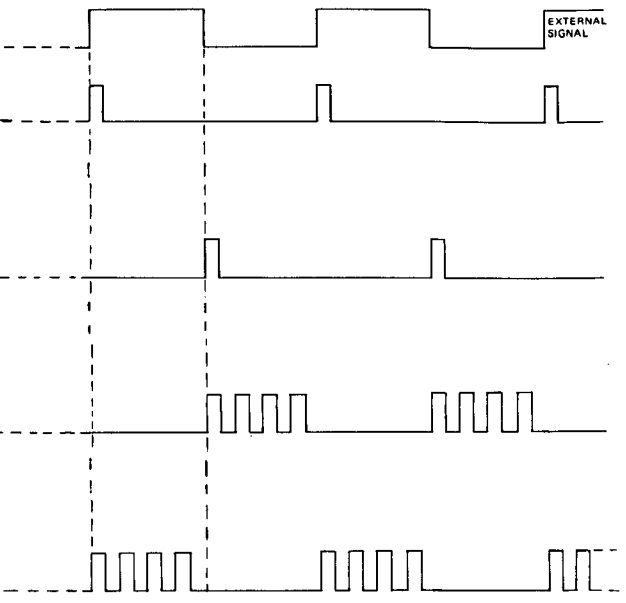
Checks external trigger and external gate using an ext pulse generator.

EQUIPMENT

Oscilloscope .....≥ 50 MHz
Pulse Generator .....≥ 20 MHz



1. Set scope to obtain about 3 periods on screen.
2. Each positive transition from the external pulse generator should release a pos 8015A pulse.
3. Set trigger input polarity to NEG.
4. Each negative transition from the external pulse generator should release a pos 8015A pulse.
5. Set mode switch to EXT GATE.
6. During each low pulse level, a pulse train should be released.
7. Set trigger input polarity to positive.
8. During each high level of the external pulse, a pulse train should be released.



PERFORMANCE CHECK

Table 5–7. External Mode Check (External Width)

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	MID-POSITION
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	10n–1μ
VERNIER **6**	CW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL > **11** CH A LOWER LEVEL	MIN SEPARATION
CH B UPPER LEVEL > **12** CH B LOWER LEVEL	MIN SEPARATION
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	EXT WIDTH
EXT INPUT LEVEL **26**	SEE BELOW

Test Equipment: Set sine wave generator to a frequency of 5 KHz and 1 V rms output amplitude.

SPECIFICATION

External width .....
Output pulse width and rate determined by width and rate of drive signal.

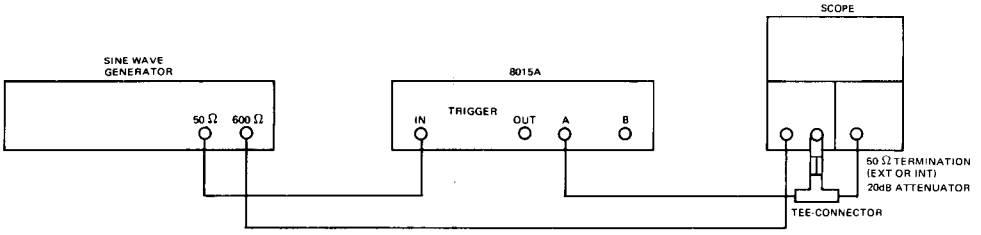
NOTE: To avoid excessive jitter, set 8015A rate to a lower range.

DESCRIPTION

Checks external width by using an external sine wave generator and operating the trigger input level control.

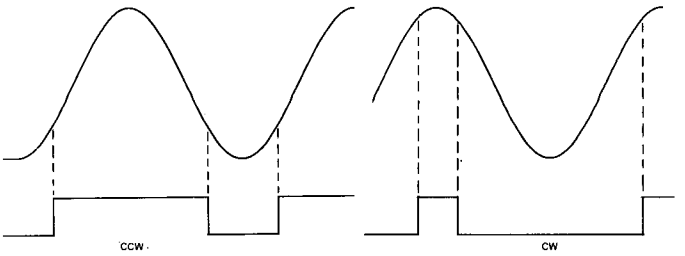
EQUIPMENT

Oscilloscope .....≥ 50 MHz
Sine Wave Generator .....> 10 KHz



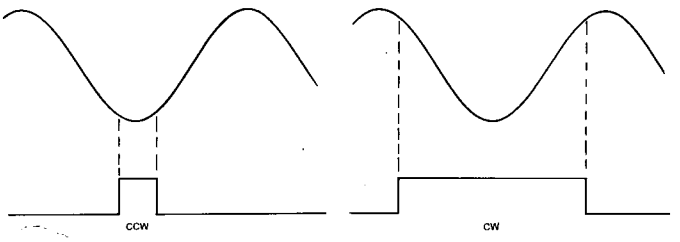
1. Set scope to obtain 3 periods on screen.

2. Move the ext trigger input level knob from ccw to cw and observe display:
   During the positive sine wave a positive pulse should appear whose width is adjustable by the trigger input level control.



3. Set trigger polarity to NEG.

4. Repeat step 2.
   During the negative sine wave a positive pulse should appear whose width is adjustable by the trigger input level control.



PERFORMANCE CHECK

Table 5–8. Transition Time Check

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	+4V
CH A LOWER LEVEL **11**	–4V
CH B UPPER LEVEL **12**	+4V
CH B LOWER LEVEL **12**	–4V
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: Adjust sampling scope for full screen display. Measure transition between 10% and 90% of amplitude.

1. Measure leading and trailing edges: ⩽ 6ns
2. Set norm/compl to compl and repeat step 1.
3. Set leading and trailing edge vernier cw.
4. Measure leading and trailing edges in norm and compl: ⩾ 0.5μs
5. Set Zs switch to 1 KΩ and leading and trailing edge verniers ccw.
6. Readjust sampling scope for a full display.

SPECIFICATION

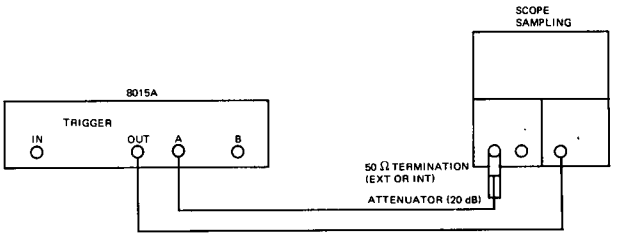
Transition times . . . . . 6n–0.5s in four ranges. Minimum transition times dependent on source and load impedances.

DESCRIPTION

Checks transition times under several conditions.

EQUIPMENT

Sampling Oscilloscope . . . . . > 1 GHz
Oscilloscope . . . . . > 50 MHz



7. Measure leading and trailing edges in norm and compl: ⩽ 8ns
8. Set channel summing to A+B and ZS switch to 50 Ω.
9. Readjust sampling scope for a full-screen display.
10. Measure leading and trailing edges in norm and compl: ⩽ 15ns
11. Replace sampling scope by a real time scope, connect it in the same way, set it for a full screen display.
12. Set controls as follows and check transition times:

PULSE PERIOD	VERNIER	TRANSITION TIME	LEADING EDGE TRAILING EDGE		
20n–1μ	CW	0.5μ–50μ	CCW	⩽ 0.5μs	.38
0.1m–10m	CW	0.5μ–50μ	CW	⩾ 50μs	70 uS
0.1m–10m	CW	50μ–5m	CCW	⩽ 50μs	40 uS
0.1m–10m	CW	50μ–5m	CW	⩾ 5ms	.74 mS
10m–1	mid-pos.	5m–0.5	CCW	⩽ 5ms	4 mS
10m–1	CW	5m–0.5	CW	⩾ 0.5s	.75

13. Repeat steps 1 to 7 for channel B.

PERFORMANCE CHECK

Table 5–9. Pulse Perturbation

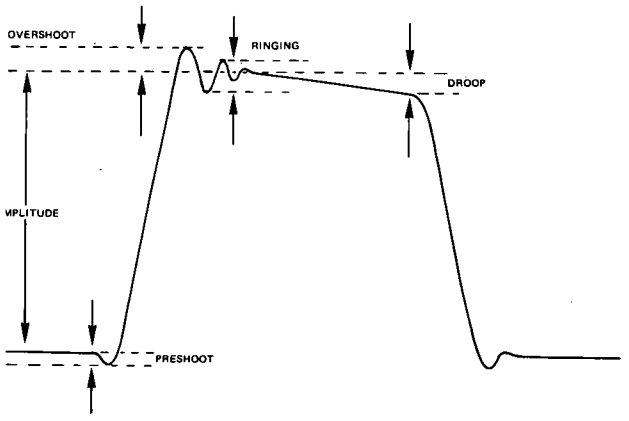
PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	MID-POSITION
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	+4V
CH A LOWER LEVEL **11**	–4V
CH B UPPER LEVEL **12**	+4V
CH B LOWER LEVEL **12**	–4V
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	POS
TRIG INPUT IMPEDANCE **23**	50 Ω
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: set scope for best resolution.

1. Measure overshoot, ringing:
   ⩽ ± 5% (± 10% at min amplitude)
2. Measure preshoot, droop, linearity: < 5%
3. Repeat in compl.
4. Repeat for channel B.



SPECIFICATION

Overshoot and ringing . . . . . .
± 5% of pulse amplitude possibly increasing < ± 10% at minimum amplitude.

Preshoot . . . . . .
< 5% of pulse amplitude.

Pulse top perturbation . . . . . .
droop < 5% of pulse amplitude.

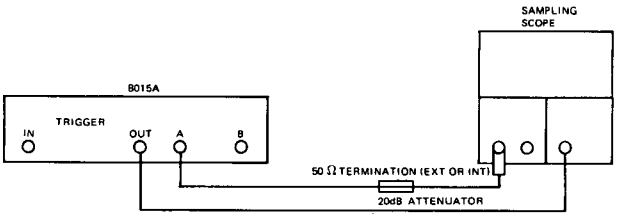
Linearity . . . . . .
for transition times > 30ns better than 5% of pulse amplitude.

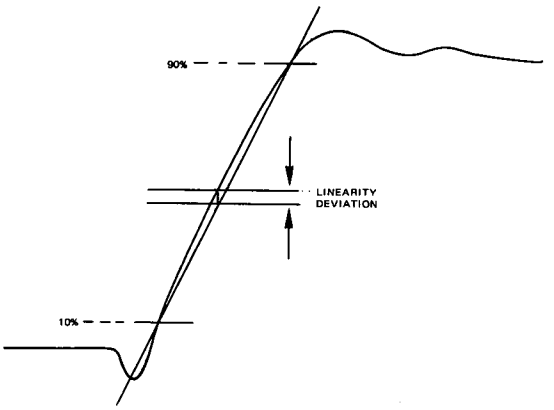
DESCRIPTION

Checks pulse shape specifications.

EQUIPMENT

Sampling oscilloscope . . . . . > 1 GHz





PERFORMANCE CHECK

Table 5–10. Pulse Amplitude

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	SEE BELOW
CH A LOWER LEVEL **11**	SEE BELOW
CH B UPPER LEVEL **12**	
CH B LOWER LEVEL **12**	
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	SEE BELOW
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	SEE BELOW
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: set scope for corresponding setting and best resolution.

NOTE: Excessive current may destroy the 50 Ω load (Power ratio) – use attenuator.

SPECIFICATION

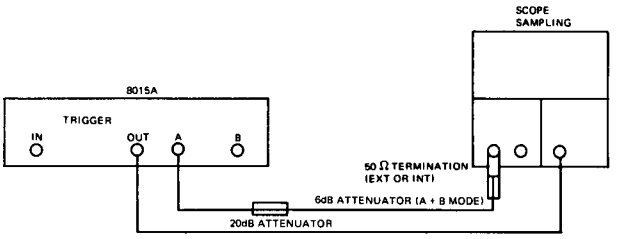
< 1V to > 8V from int 50 Ω into ext 50 Ω
< 2V to > 16V from int open (1 KΩ) into ext 50 Ω
< 2V to > 16V from int 50 Ω into ext 50 Ω (A+B mode)
< 4V to > 30V from int open (1 KΩ) into ext 50 Ω (A+B mode)

DESCRIPTION

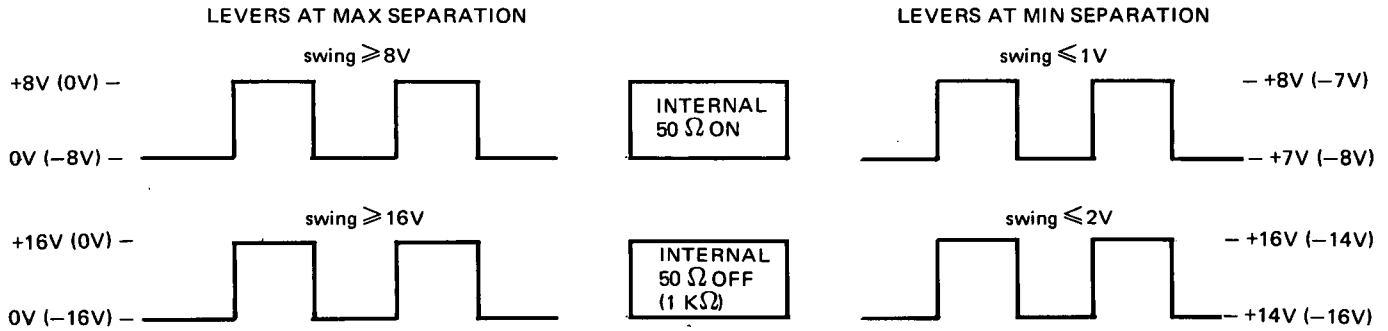
Checks amplitude and offset levels under different load conditions.

EQUIPMENT

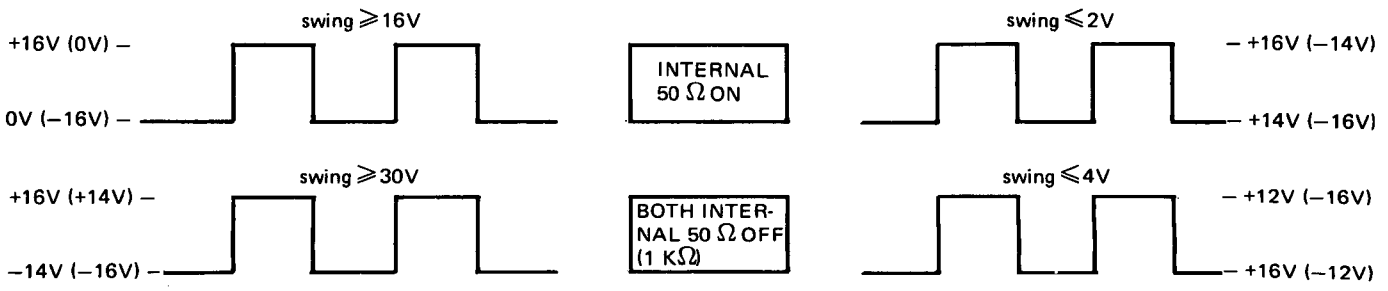
Oscilloscope ..... 50 MHz



1. Push levers slowly to the upper and lower limit positions and measure swing in all positions shown below.
   Voltage without brackets: most positive level.
   Voltage in brackets: most negative voltage.



2. Set Zs back to 50 Ω and channel summing to A+B.



3. Set Zs switches back to 50 Ω and repeat step 1 for channel B.

PERFORMANCE CHECK

Table 5–11. Trigger Output Test

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
DELAY **3**	–
VERNIER **4**	–
WIDTH **5**	10n–1μ
VERNIER **6**	CCW
FUNCTION **24**	NORM
MODE **25**	NORM

SPECIFICATION

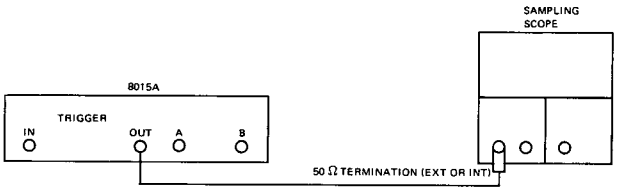
Trigger output . . . . . ⩾ 1V across 50 Ω, 9ns ± 5ns

DESCRIPTION

Checks trigger output.

EQUIPMENT

Sampling Oscilloscope . . . . . > 1G Hz



1. Measure trigger pulse amplitude ⩾ 1V
   Measure trigger pulse width 9ns ± 5ns

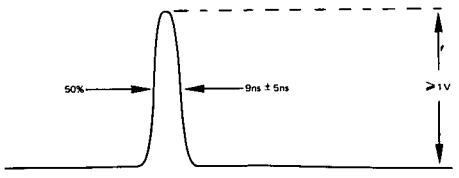


Table 5–12. Safety Check

1. Disconnect power cord from line. Visually inspect interior for any sign of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine cause and remedy.

2. Check resistance from cabinet to ground pin on power plug with suitable ohmmeter. The reading must be less than one ohm. Flex the power cord while making the measurement to detect any intermittent discontinuity. Check internal ground connections on boards and frame. Also check resistance of any front or rear panel ground terminals marked. ⏚

3. Check resistance from cabinet to line and neutral (tied together) with the power switch on and the power source disconnected. The minimum acceptable resistance is two megohms. Replace any component which results in a failure or refer to production Memo or Service Note issued by product division for alternate action.

4. Check line fuse to verify that the proper value is installed.

5. Check that the plastic safety cover for the line fuse is installed.

6. Check that all coaxial and flat cables inside are properly connected. Check that all boards and the heatsink on the chassis are properly connected.

7. Inform Hewlett-Packard (internally, the responsible product division) of any repeated failures in the above tests or any other safety features.

Table 5–12a. Performance Test Record

Hewlett-Packard
HP MODEL 8015A option .....
PULSE GENERATOR
Serial No. .....

Tested by .....

Date .....

5–2 Repetition Rate Test			
Rate Setting	Vernier	Specific.	Result
20n–1μ	CCW	⩾50MHz	.....
20n–1μ	CW	⩽1MHz	.....
1μ–0.1m	CCW	⩾1MHz	.....
1μ–0.1m	CW	⩽10KHz	.....
0.1m–10m	CCW	⩽0.1ms	.....
0.1m–10m	CW	⩾10ms	.....
10m–1	CCW	⩽10ms	.....
10m–1	CW	⩾1s	.....
Man. funktion			☐

5–3 Pulse Delay Test			
Delay Setting	Vernier	Specific.	Result
20n–1μ	CW	⩾1μs	.....
1μ–0.1m	CCW	⩽1μs	.....
1μ–0.1m	CW	⩾0.1ms	.....
0.1m–10m	CCW	⩽0.1ms	.....
0.1m–10m	CW	⩾10ms	.....
10m–1	CCW	⩽10ms	.....
10m–1	CW	⩾1s	.....

5–4 Pulse Width Test			
Width Setting	Vernier	Specific.	Result
10ns–1μ	CCW	⩽10ns	.....
Duty Cycle	CCW	50%±15%	.....
10n–1μ	CW	⩾1μs	.....
1μ–0.1m	CCW	⩽1μs	.....
1μ–0.1m	CW	⩾0.1ms	.....
0.1m–10m	CCW	⩽0.1ms	.....
0.1m–10m	CW	⩾10ms	.....
10m–1	CCW	⩽10ms	.....
10m–1	CW	⩾1s	.....
Duty cycle			
20n–1μ	CW	50%±5%	.....
1μ–0.1m	CW + CCW	50%±5%	.....
0.1m–10m	CCW to CW	50%±5%	.....
10m–1s	CW to CCW	50%±5%	.....

5–5 Jitter Test			
Range	–	Specific.	Result
Rate	–	⩽0.1%+50ps	.....
Delay	–	⩽0.1%+50ps	.....
Width	–	⩽0.1%+50ps	.....

5–6/7 External Mode Check		
Ext. Trigger		
POS		☐
NEG		☐
Ext. Gate		
POS		☐
NEG		☐
Ext. Width		
POS		☐
NEG		☐

5–8 Transition Time Check				
Setting	LE Vernier	TE Vernier	Specif.	Result
6n–0.5μ	CCW	CCW	⩽6ns	.....
6n–0.5μ	CW	CW	⩾0.5μ	.....
Zs to 1KΩ				
6n–0.5μ				
NORM	CCW	CCW	⩽8ns	.....
COMPL	CCW	CCW	⩽8ns	.....
A+B, Zs 50Ω				
6n–0.5μ				
NORM	CCW	CCW	⩽15ns	.....
COMPL	CCW	CCW	⩽15ns	.....
0.5μ–50μ	CCW	CCW	⩽0.5μs	.....
0.5μ–50μ	CW	CW	⩾50μs	.....
50μ–5m	CCW	CCW	⩽50μs	.....
50μ–5m	CW	CW	⩾5ms	.....
5m–0.5	CCW	CCW	⩽5ms	.....
5m–0.5	CW	CW	⩾0.5s	.....

5–9 Pulse Perturbation		
	Specific.	Result A/B
Overshoot, Ringing	⩽±5%(±10%)	.....
Preshoot, droop, linearity	<5 %	.....

5–10 Pulse Amplitude			
Int Zs	Levers (separation)	Swing	Result A/B
50Ω	max	⩾8V	.....
50Ω	min	⩽1V	.....
1KΩ	max	⩾16V	.....
1KΩ	min	⩽2V	.....
A + B			
50Ω	max	⩾16V	.....
50Ω	min	⩽2V	.....
1KΩ (both)	max	⩾30V	.....
	min	⩽4V	.....

5–11 Trigger Output Test		
	Specific.	Result
Trigger Output width	9ns±5ns	.....

5–12 SAFETY CHECK ☐

7–2–1 OPTION 002 ☐

7–3–2/3/4 OPTION 003 ☐

7–4–2 OPTION 004 ☐

7–5–1 OPTION 005 ☐

7–6–1 OPTION 006 ☐

Table 5–13. Test Equipment for Adjustments

INSTRUMENT	BRIEF SPECIFICATION	RECOMMENDED MODEL
Oscilloscope	Dual Channel, 50 MHz bandwidth, 5mV/div. sensitivity, sweep speeds 0.5μs/div. to 2s/div. with sweep delay.	HP 180C with plug-ins 1801A and 1820C
Sampling Oscilloscope	Dual Channel, 1 GHz bandwidth, 2mV/div. sensitivity, sweep speeds 10ps/div. to 50μs/div.	HP 180C with plug-in 1810A
Digital Voltmeter	100V range to 4 significant figures. Accuracy ±0.05% ± 1 digit.	HP 3465A
AC Voltmeter	Sensitivity 100μV to 300V rms.	HP 3400A
Test Oscillator	Frequency Range 10 Hz to > 200 MHz	HP 3200A.
Pulse Generator	Rep. Rate 100 Hz – 20 MHz	HP 8011A

ACCESSORIES	
50Ω co-axial cable terminated with BNC male connectors (4 required)	HP 10100C
BNC Tee (1 male, 2 female)	HP 1250–0781
50Ω Feed-through (2 required)	HP 11048B
20dB 20 W Power Attenuator	Microline 766–20
Connector BNC male to N female	HP 1250–0077
Connector BNC male to N male	HP 1250–0780

ADJUSTMENTS

Table 5–14. Power Supply

INITIAL CONTROL SETTINGS NOT SIGNIFICANT

Test Equipment: DVM

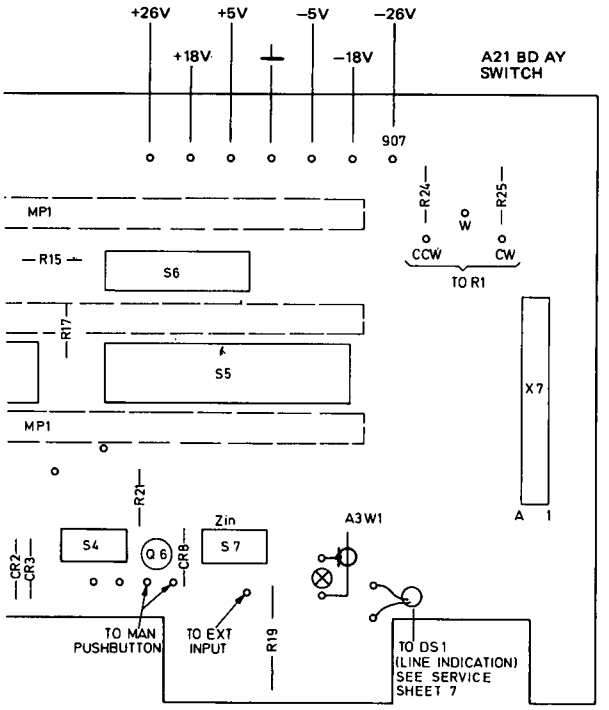
1. Connect DVM between TP +26V on A21 and chassis

2. Adjust A24 (A4 on earlier instruments) R12 for: +26V ± 100mV

3. Check following voltages

A21 TP	+18V	+18V ± 100mV
A21 TP	+ 5V	+ 5V ± 50mV
A21 TP	– 5V	– 5V ± 50mV
A21 TP	–18V	–18V ± 100mV
A21 TP	–26V	–26V ± 100mV

The test points are located on A21 (A11, A31 on options) behind front panel.



WARNING

Any interuption 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. 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.

Capacitors inside the instrument may still be charged even in the instrument has been disconnected from its source of supply.

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.

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

ADJUSTMENTS

Table 5–15. Rate, Delay, Width

Refer to Figure 5–1 (page 5–25) for adjustment locations on A2 and A3.

INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	20n–1μ	CH B Zs **14**	50 Ω
VERNIER **2**	CCW	CHANNEL SUMMING **16**	A sep B
PULSE DELAY **3**	20n–1μ	CH A Zs **18**	50 Ω
VERNIER **4**	CCW	TRIG POLARITY **22**	POS
PULSE WIDTH **5**	10n–1μ	TRIG INPUT IMPEDANCE **23**	50 Ω
VERNIER **6**	CCW	FUNCTION **24**	NORM
TRANSITION TIME **7**	6n–0.5μ	MODE **25**	NORM
LEADING EDGE **8**	CCW	EXT INPUT LEVEL **26**	CENTER
TRAILING EDGE **9**	CCW		
CH A NORM/COMPL **10**	NORM		
CH A UPPER LEVEL **11** / CH A LOWER LEVEL	CENTER		
CH B UPPER LEVEL **12** / CH B LOWER LEVEL	CENTER		
CH B NORM/COMPL **13**	NORM		

Test Equipment: Counter
Oscilloscope
Sampling Oscilloscope

RATE ADJUST

1. Connect trigger output via a 50 Ω termination to a counter.

2. Adjust A3 C20 for: 51.5 MHz ± 0.2 MHz.

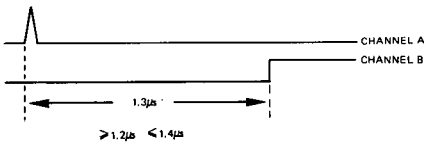
If Option 002 is fitted, A6 must be removed to gain access to the following adjustments.

DELAY ADJUST

1. Set Rate to 1μ–0.5m vernier cw, set delay vernier cw Set Width vernier cw.

2. Connect trigger output to a scope (channel B and ext trigger input via T-connector and 50 Ω feedthru load), connect output A to scope channel A.

3. Measure the time between the trigger pulse and the leading edge of the output pulse: $\geqslant 1.2\mu s \leqslant 1.4\mu s$. Adjust A3 C39 for 1.3$\mu$s.

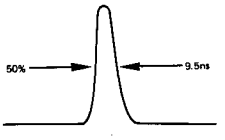


WIDTH ADJUST

1. Set rate to 20n-1μ vernier mid-position. Set Delay vernier ccw, Width vernier ccw.

2. Connect output A to a sampling oscilloscope, use trigger output for ext scope trigger. Adjust A3 C46 for 9.5ns.

   NOTE: If the first pulse in Ext Gate mode or Burst mode is not satisfactory, a compromise may be necessary (< 10ns > 9ns).



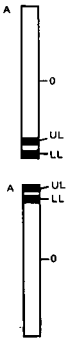
ADJUSTMENTS

Table 5–16. Pulse Level Voltage Adjust

INITIAL CONTROL SETTINGS NOT SIGNIFICANT

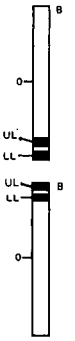
Test Equipment: DVM

This adjustment calibrates the max positive and max negative output pulse levels.



1. Set channel A levers for minimum separation with channel A upper level to max negative position.
   Connect DVM to **1** and chassis,
   adjust A21 R8 for .....–3.70V ± 10mV

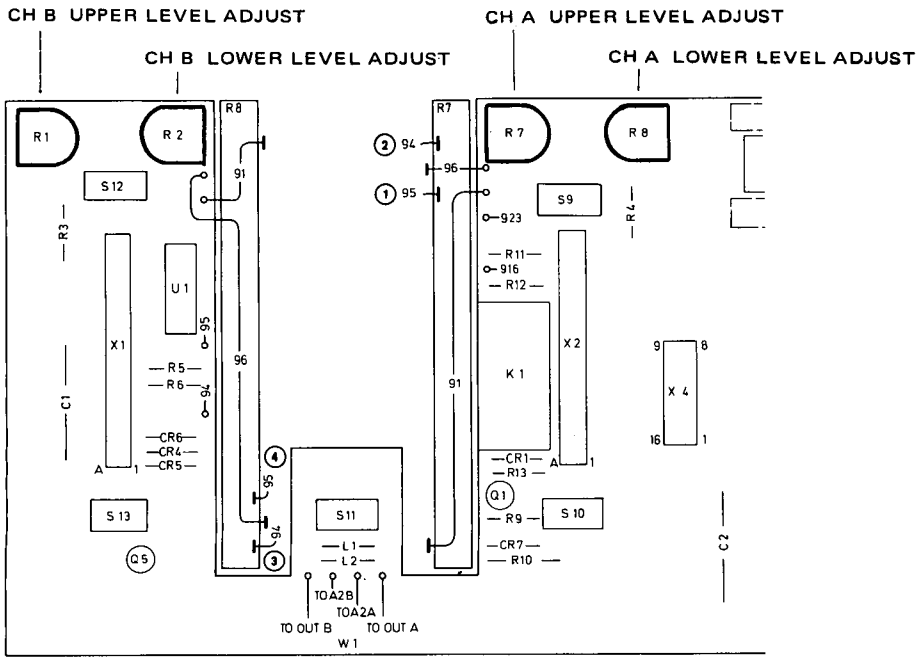
2. Set channel A levers for minimum separation with channel A lower level to max positive position.
   Connect DVM to **2** and chassis,
   adjust A21 R7 for .....+3.70V ± 10mV
   Repeat steps 1 and 2.



3. Set channel B levers for minimum separation with channel B upper level to max negative position.
   Connect DVM to **3** and chassis,
   adjust A21 R2 for .....–3.70V ± 10mV

4. Set channel 3 levers for minimum separation with channel B lower level to max positive position.
   Connect DVM to **4** and chassis,
   adjust A21 R1 for .....+3.70V ± 10mV
   Repeat steps 3 and 4.

A21 BD AY SWITCH 08015-66521



ADJUSTMENTS

Table 5–17. Clamp Voltage

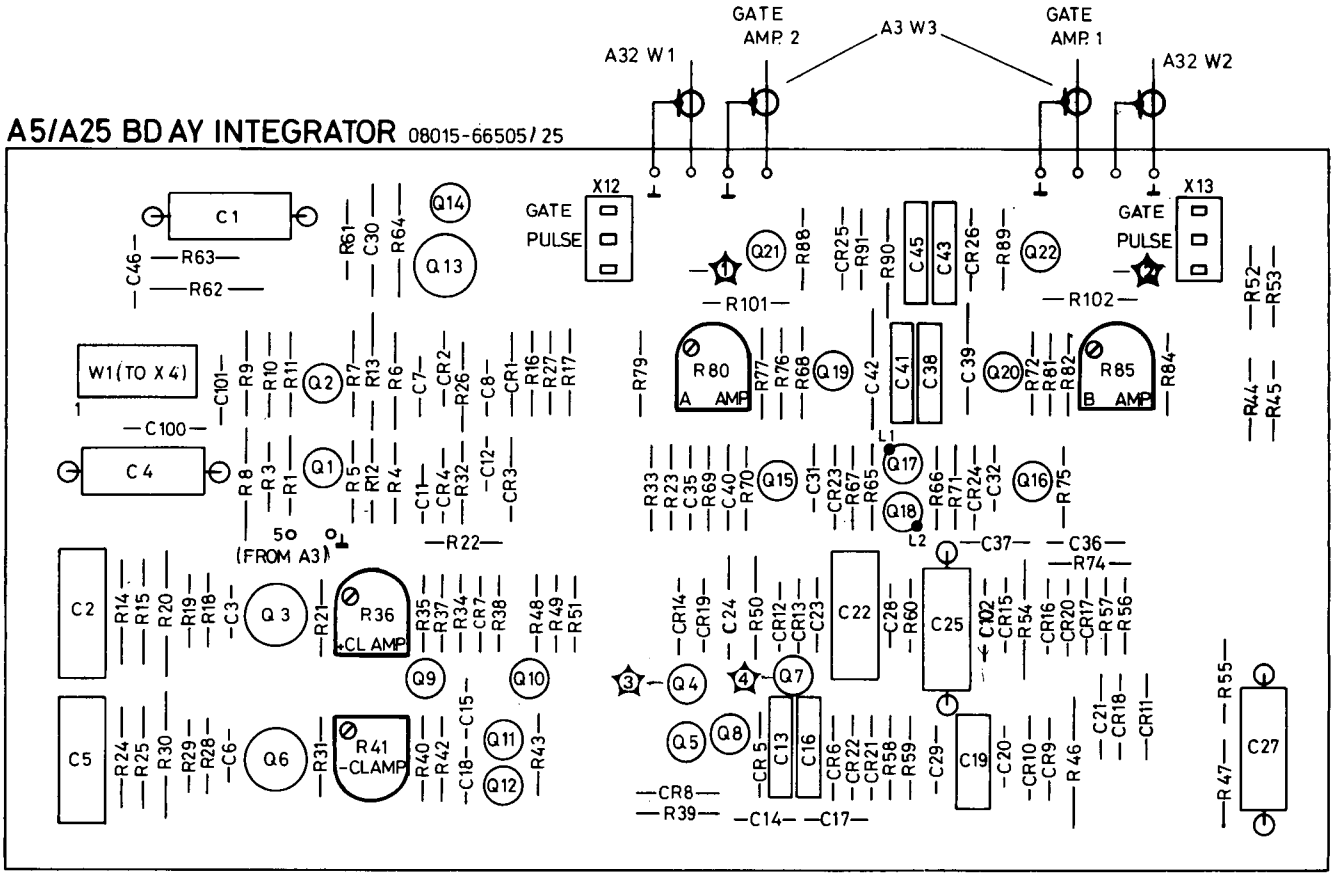
INITIAL CONTROL SETTINGS NOT SIGNIFICANT

Test Equipment: DVM

Purpose of this adjustment is to get an equal positive and negative integrator output.

1. Connect a DVM to ③ (coll of A5 Q4) and chassis.
   Adjust A5 R36 for +3.1V ± 10mV

2. Connect a DVM to ④ (coll of A5 Q7) and chassis.
   Adjust A5 R41 for −3.1V ± 10mV



ADJUSTMENTS

Table 5–18. Maximum and Minimum Amplitude

INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	1μ–0.1m	CH B NORM/COMPL **13**	–
VERNIER **2**	CCW	CH B Zs **14**	1 KΩ
PULSE DELAY **3**	1μ–0.1m	CHANNEL SUMMING **16**	–
VERNIER **4**	CCW	CH A Zs **18**	1 KΩ
PULSE WIDTH **5**	SQ	TRIG POLARITY **22**	–
VERNIER **6**	–	TRIG INPUT IMPEDANCE **23**	–
TRANSITION TIME **7**	6n–0.5μ	FUNCTION **24**	NORM
LEADING EDGE **8**	CCW	MODE **25**	NORM
TRAILING EDGE **9**	CCW	EXT INPUT LEVEL **26**	–
CH A NORM/COMPL **10**	NORM		
CH A UPPER LEVEL **11**	MAX SEPARATION		
CH A LOWER LEVEL **11**	SYMETRICAL TO ZERO		
CH B UPPER LEVEL **12**	MAX SEPARATION		
CH B LOWER LEVEL **12**	SYMETRICAL TO ZERO	Test Equipment: Oscilloscope	

1. Connect output A via a 20 dB power attenuator and a 50 Ω termination to the vertical input of an oscilloscope.
2. Adjust A5 R80 (see opposite) for an amplitude of 16.5V ± 100mV.
3. Connect output B via a 20 dB power attenuator and a 50 Ω termination to the vertical input of an oscilloscope.
4. Adjust A5 R85 for an amplitude of 16.5V ± 100mV.
5. Set channel A and B levers for minimum separation around zero.
6. Adjust A2 A R117 (see page 5–25) for a Channel A amplitude of: 1.8V ± 50mV.
7. Adjust A2 B R117 for a Channel B amplitude of: 1.8V ± 50mV.

ADJUSTMENTS

Table 5–19. Amplifier Zero-Adjust

INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	–
VERNIER **2**	–
PULSE DELAY **3**	–
VERNIER **4**	–
PULSE WIDTH **5**	–
VERNIER **6**	–
TRANSITION TIME **7**	–
LEADING EDGE **8**	–
TRAILING EDGE **9**	–
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	+ 4V
CH A LOWER LEVEL **11**	– 4V
CH B UPPER LEVEL **12**	+ 4V
CH B LOWER LEVEL **12**	– 4V
CH B NORM/COMPL **13**	–
CH B Zs **14**	–
CHANNEL SUMMING **16**	–
CH A Zs **18**	–
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	–
MODE **25**	NORM
EXT INPUT LEVEL **26**	MID POSITION

Test Equipment: Short circuit cable
DVM

These adjustments set the amplifier bias for symmetrical operation.

1. Connect a DVM with floating inputs between ⑥ (U11 pin 3) and ⑦ (U11 pin 14) on channel A board A2A.

   NOTE: a logic clip might be necessary to make these connections. Connect A5 TP1 to chassis (see page 5–18).

2. Adjust A2A R9 (page 5–25) for: 0V ± 50mV. Remove chassis connection.

3. Repeat steps 1, 2 on board A2B adjusting A2B R9 and shorting A5 TP2 respectively.

If it is not possible to achieve the above result carry out Table 5–22.

ADJUSTMENTS

Table 5–20. Norm/Compl Adjust

INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	1μ–0.1m
VERNIER **6**	CCW
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL CH A LOWER LEVEL **11**	MAX SYM
CH B UPPER LEVEL CH B LOWER LEVEL **12**	MAX SYM
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment:
- Short circuit cable
- Digital Voltmeter
- Oscilloscope
- 50 Ω Termination
- 20dB Attenuator

These adjustments equalize norm and compl lower levels.

1. Connect A5 TP1 to GND (see illustration in Table 5–17).
2. Connect a DVM to A2A TP1 (rear side) and chassis (page 5–25).
3. Adjust A2A R60 for 0V ± 10mV.
4. Remove short-circuit cable and DVM.
5. Connect channel A to oscilloscope.
   Set level controls for a symmetrical 4V amplitude signal.
6. Set pulse (in norm mode) to center of display as reference.
7. Switch norm-compl to compl and observe baseline. Adjust A2A R61 for minimum shift (⩽ 20mV).
8. Connect channel B to oscilloscope.
9. Repeat step 1 to 7 with A5 TP2 and A2B TP1, R60, R61 respectively.

These adjustments may be verified by performing Table 5–22.

ADJUSTMENTS

Table 5–21. Offset Gain

INITIAL CONTROL SETTINGS

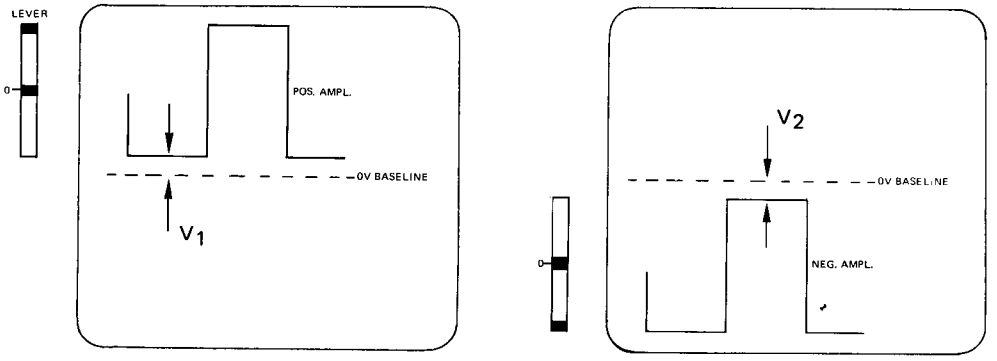
PULSE PERIOD **1**	1μ–0.1m
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	SEE BELOW
CH A LOWER LEVEL **11**	SEE BELOW
CH B UPPER LEVEL **12**	SEE BELOW
CH B LOWER LEVEL **12**	SEE BELOW
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	–
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: Oscilloscope
50 Ω Termination
20dB Attenuator

These adjustments equalize the baseline offsets of the negative and positive output amplifiers.

1. Center oscilloscope beam for zero volt reference and apply 8015A channel A to oscilloscope.

2. With channel A level controls held at maximum separation, move them repeatedly up and down to the limits shown:



3. Adjust A2AR159 (page 5–25) so that the baseline offset voltages V_1 and V_2 are equal.

4. Adjust A2AR152 for zero baseline offset. Optimize R159/R152 settings.

5. Repeat for channel B.

ADJUSTMENTS

Table 5–22. Pulse Level Adjustments

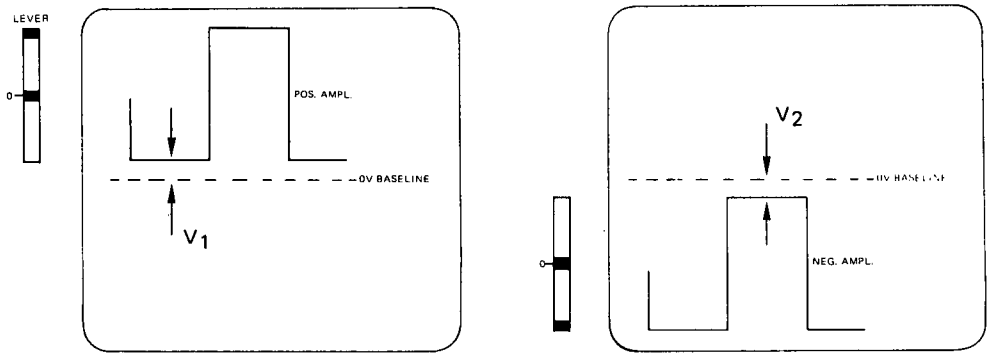
INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	1μ–0.1m	CH B NORM/COMPL **13**	NORM
VERNIER **2**	CW	CH B Zs **14**	50 Ω
PULSE DELAY **3**	20n–1μ	CHANNEL SUMMING **16**	A sep B
VERNIER **4**	CCW	CH A Zs **18**	50 Ω
PULSE WIDTH **5**	SQUARE WAVE	TRIG POLARITY **22**	–
VERNIER **6**	–	TRIG INPUT IMPEDANCE **23**	–
TRANSITION TIME **7**	6n–0.5μ	FUNCTION **24**	NORM
LEADING EDGE **8**	CCW	MODE **25**	NORM
TRAILING EDGE **9**	CCW	EXT INPUT LEVEL **26**	–
CH A NORM/COMPL **10**	NORM		
CH A UPPER LEVEL **11**	SEE BELOW		
CH A LOWER LEVEL			
CH B UPPER LEVEL **12**	SEE BELOW		
CH B LOWER LEVEL			

Test Equipment: Oscilloscope
50 Ω Termination
20dB Attenuator

These adjustments may be performed instead of Tables 5–19/20/21.

1. Center oscilloscope beam for zero volt reference.
2. Set channel A level controls for max separation with UL max positive.
3. Connect channel A to oscilloscope.
4. Observe display while switching norm/compl.
5. Adjust A2A R9 (page 5–25) for zero change in level when switching norm/compl.
6. Select NORM. Move level controls (max separation) repeatedly up and down from max positive to max negative and back



7. Adjust A2A R159 for equal and opposite baseline offset voltages ($V_1 = V_2$)
8. Adjust A2A R152 (page 5–25) so that the baseline offset voltages are zero. Optimize R159/R152 settings.
9. Set UL to +4V, LL to zero volts.
10. Adjust low level with A2A R60 to the zero-volt baseline.
11. Switch norm/compl. to compl.
12. Adjust low level with A2A R61 to the zero-volt baseline.
13. Repent for channel B.

ADJUSTMENTS

Table 5–23. Transition Time, Overshoot

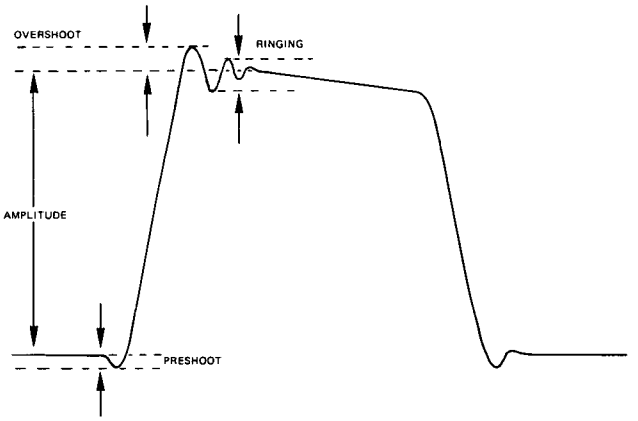
INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	20n–1μ	CH B NORM/COMPL **13**	NORM
VERNIER **2**	CW	CH B Zs **14**	50 Ω
PULSE DELAY **3**	20n–1μ	CHANNEL SUMMING **16**	A sep B
VERNIER **4**	CCW	CH A Zs **18**	50 Ω
PULSE WIDTH **5**	SQUARE WAVE	TRIG POLARITY **22**	–
VERNIER **6**	–	TRIG INPUT IMPEDANCE **23**	–
TRANSITION TIME **7**	6n–0.5μ	FUNCTION **24**	NORM
LEADING EDGE **8**	CCW	MODE **25**	NORM
TRAILING EDGE **9**	CCW	EXT INPUT LEVEL **26**	–
CH A NORM/COMPL **10**	NORM		
CH A UPPER LEVEL **11**	+4V		
CH A LOWER LEVEL **11**	–4V		
CH B UPPER LEVEL **12**	+4V		
CH B LOWER LEVEL **12**	–4V		

Test Equipment: Sampling Oscilloscope
50 Ω Termination
20dB Attenuator

These adjustments optimize transition and overshoot.

1. Connect channel A to a sampling scope and set scope for best resolution in terms of transition times (10% to 90%).
2. Adjust A2A C22 for a transition time in norm and compl of ⩽ 6ns.
3. Set UL/LL to +4.0V/–4.0V.
4. Measure overshoot, ringing ⩽ ± 5 %.
5. If necessary, re-adjust A2A C22 for the best compromise between steps 2 and 4.
6. Connect channel B to the sampling scope.
7. Repeat steps 2 to 5 with A2B C22 respectively.



ADJUSTMENTS

Table 5–24. B-Del Baseline Adjust

INITIAL CONTROL SETTINGS

PULSE PERIOD **1**	1μ–0.1m	CH B NORM/COMPL **13**	NORM
VERNIER **2**	MID POSITION	CH B Zs **14**	50 Ω
PULSE DELAY **3**	20n–1μ	CHANNEL SUMMING **16**	A sep B
VERNIER **4**	CW	CH A Zs **18**	50 Ω
PULSE WIDTH **5**	1μ–0.1m	TRIG POLARITY **22**	–
VERNIER **6**	CCW	TRIG INPUT IMPEDANCE **23**	–
TRANSITION TIME **7**	6n–0.5m	FUNCTION **24**	B-DEL
LEADING EDGE **8**	CCW	MODE **25**	NORM
TRAILING EDGE **9**	CCW	EXT INPUT LEVEL **26**	–
CH A NORM/COMPL **10**	NORM		
CH A UPPER LEVEL **11**	MIN SEPARATION		
CH A LOWER LEVEL			
CH B UPPER LEVEL **12**	MIN SEPARATION		
CH A LOWER LEVEL			

Test Equipment: Oscilloscope
50 Ω Termination
20dB Attenuator

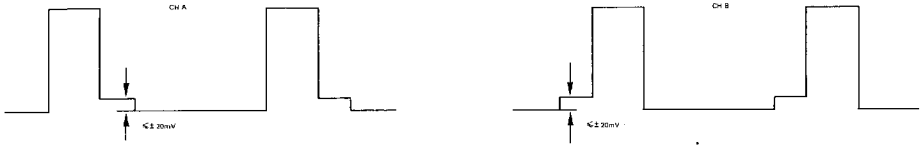
This adjustment equalizes A and B gate levels at the amplifier input.

1. Connect channel A to the scope.
   Set sensitivity to 100mV/div.

2. Adjust A2A R14 for a minimum baseline step of channel A pulse train.

3. Connect channel B to scope.

4. Adjust A2B R14 for a minimum baseline step of channel B pulse train.



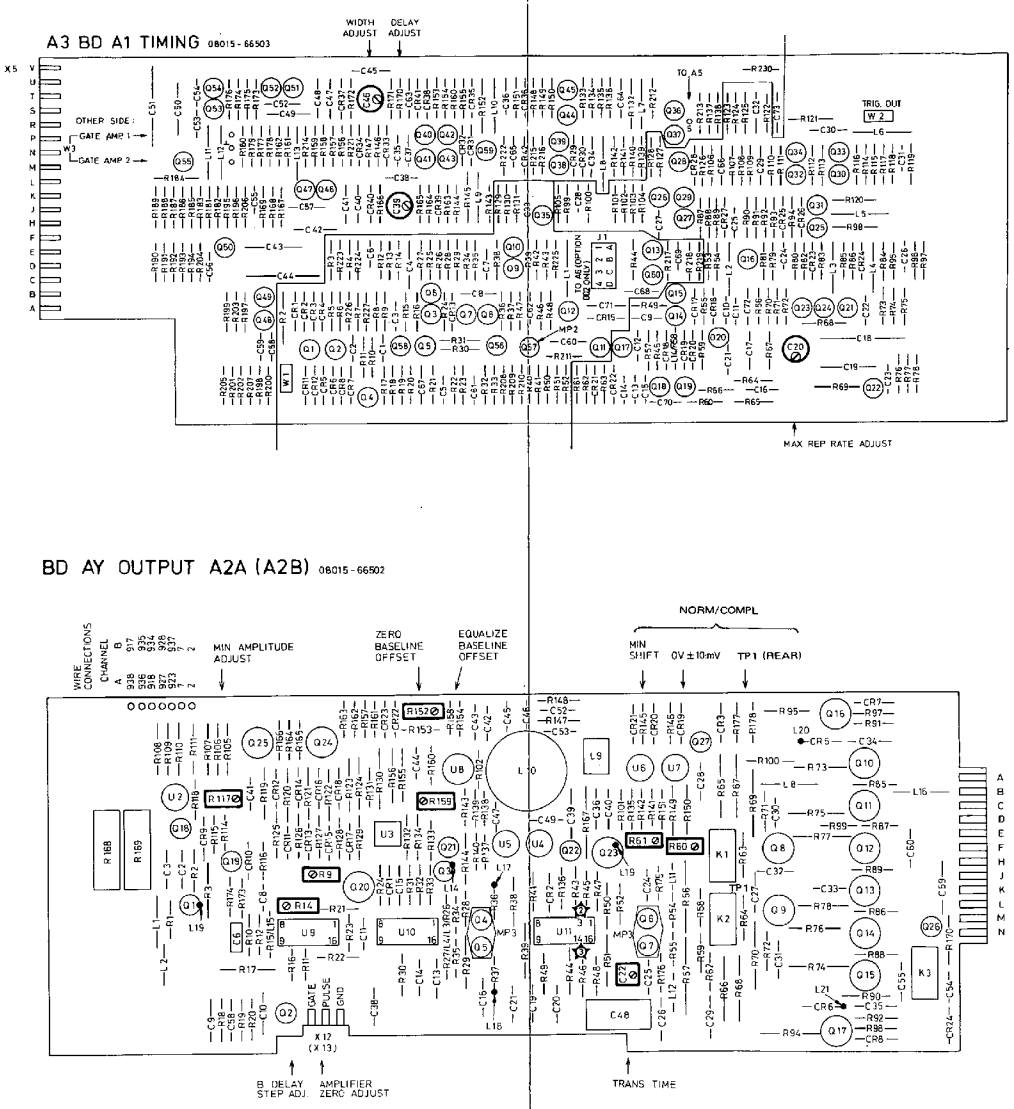


Figure 5–1. Location of A2 and A3 Adjustments

6–1 GENERAL

6–2 This section is organized as follows:

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

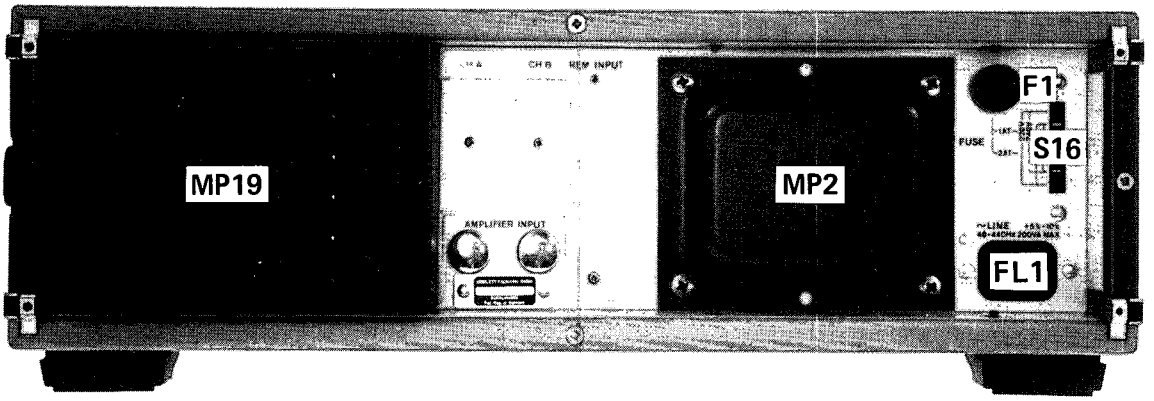
6–3 The information given for each part consists of the following:

a. The Hewlett-Packard part number.
b. The total quantity (Qty) in the instrument. This is given only once for each part – at the first appearance of the part in the list.
c. The description of the part.
d. A typical manufacturer of the part in a five-digit code.
e. The manufacturers' part number.
The manufacturers' code numbers, names and addresses are listed at the beginning of the parts list (page 6–7) followed by list of abbreviations used in the parts list. Refer to Table 9–1 for the reference designator.

6–4 ORDERING INFORMATION

6–5 To order a part listed in the replaceable parts table, quote the Hewlett-Packard part numer, indicate the quantity required, and address the order to the nearest Hewlett-Packard office (list of Sales/Service offices at the rear of the manual).

6–6 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.



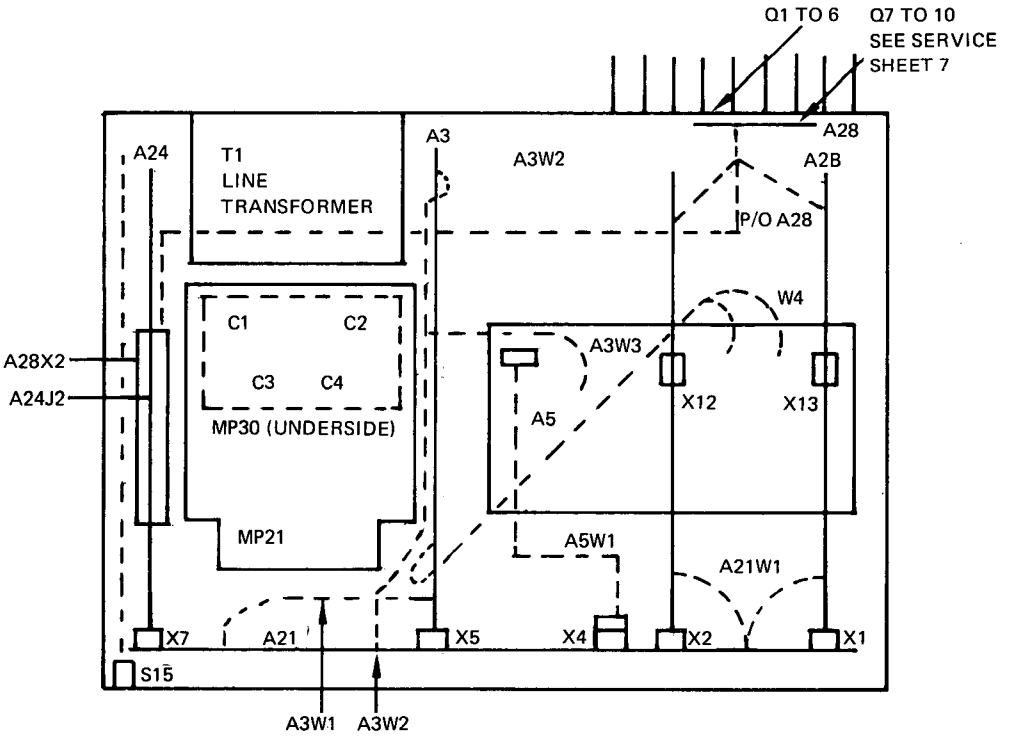
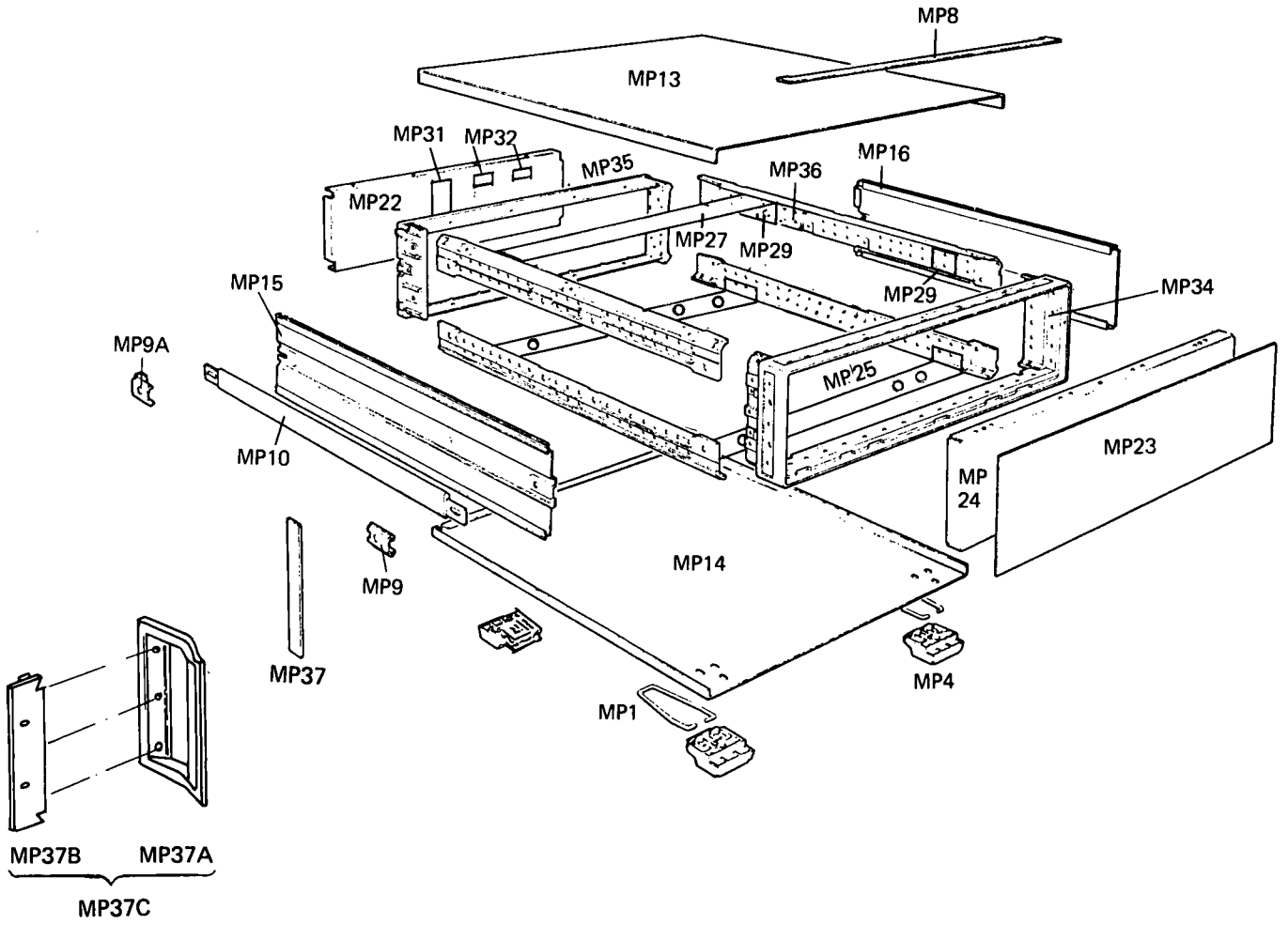
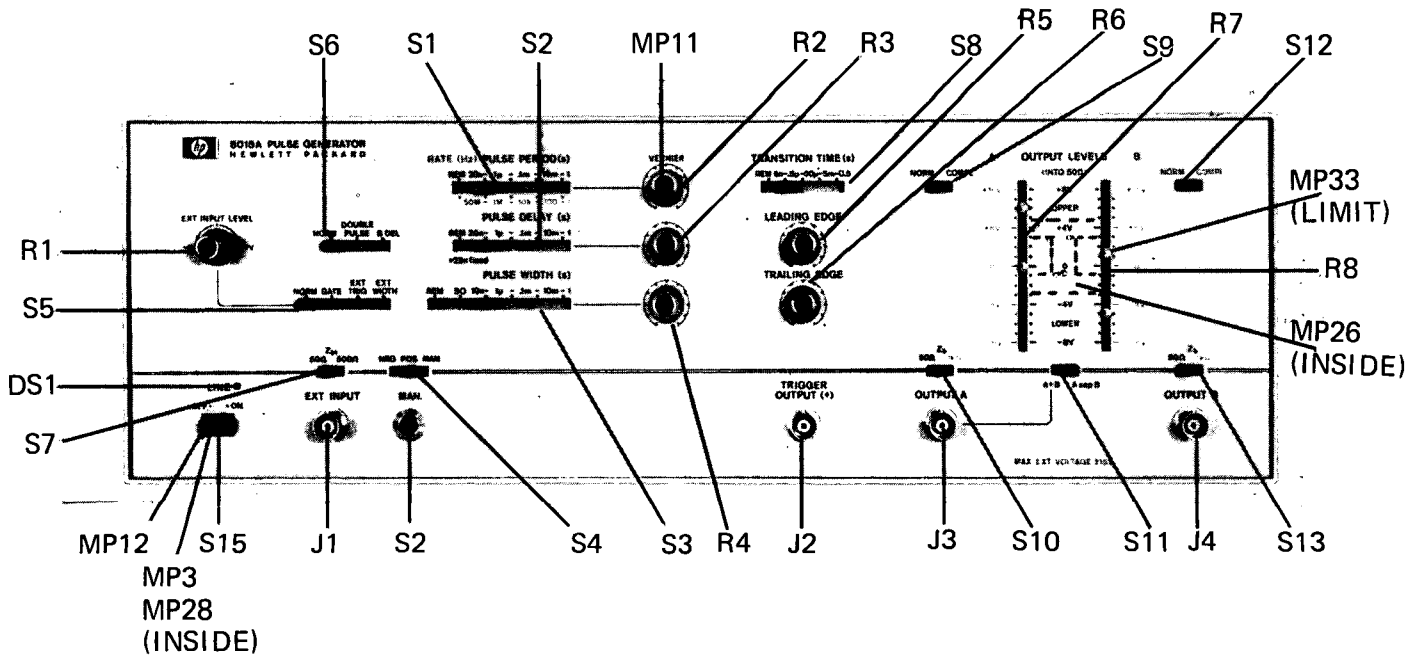


Figure 6–1. Location diagram of assemblies and frame parts for 8015A with serial number 1538G00686 and above.


MP8
MP13
MP31
MP32
MP35
MP36
MP16
MP22
MP27
MP29
MP29
MP15
MP34
MP9A
MP25
MP10
MP23
MP 24
MP14
MP9
MP37
MP4
MP1
MP37B
MP37A
MP37C


S6
S1
S2
MP11
R2
R3
S8
R5
R6
S9
R7
S12
R1
S5
DS1
S7
MP33
(LIMIT)
R8
MP26
(INSIDE)
MP12
S15
J1
S2
S4
S3
R4
J2
J3
S10
S11
J4
S13
MP3
MP28
(INSIDE)

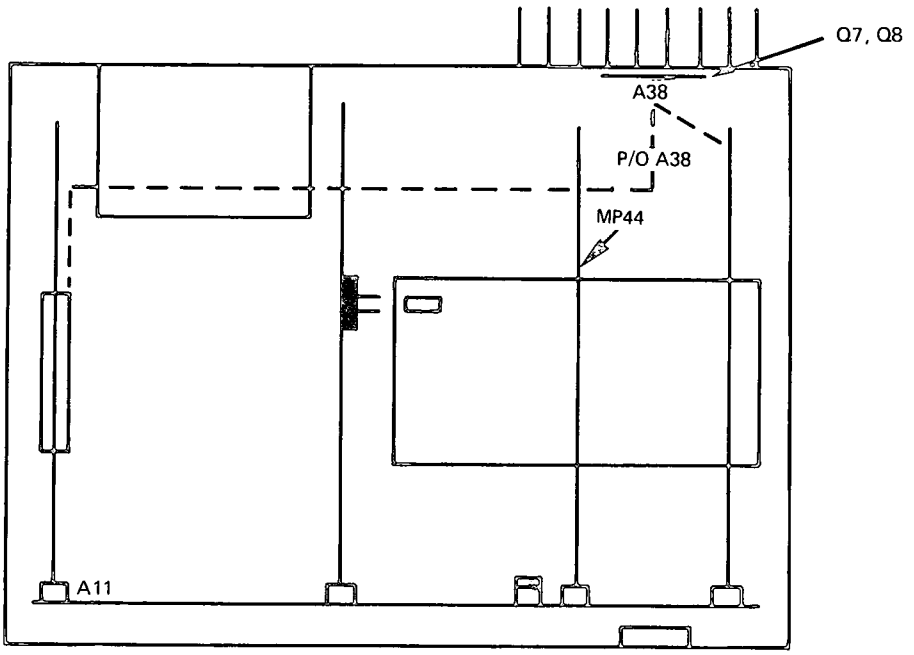


Figure 6–2. Location of changed parts and assemblies for 8015A Option 001

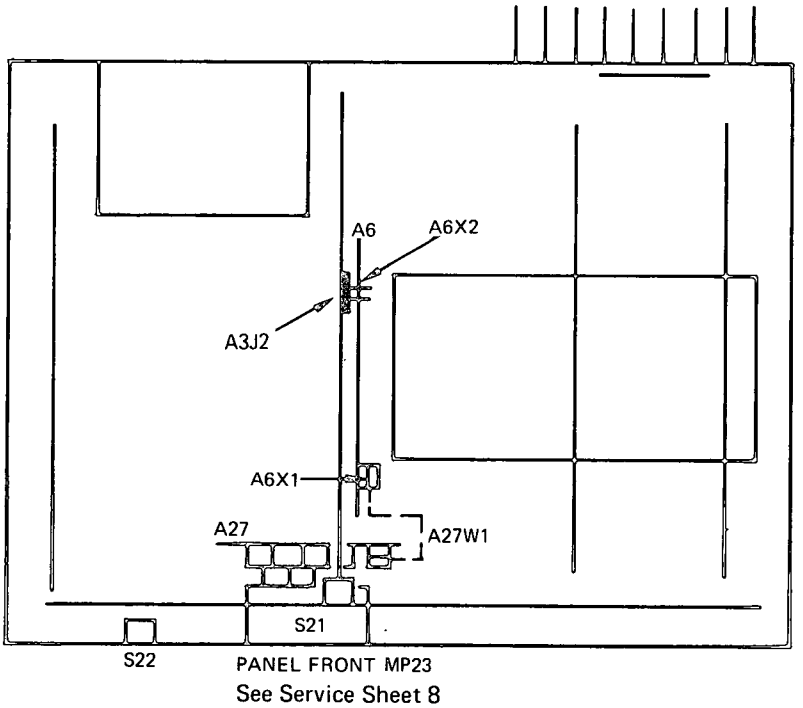
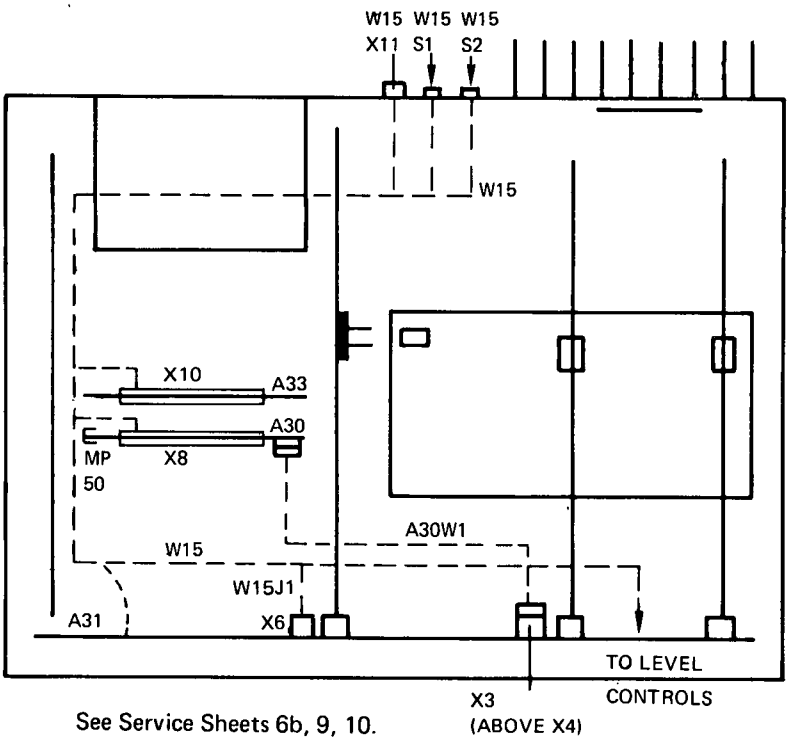
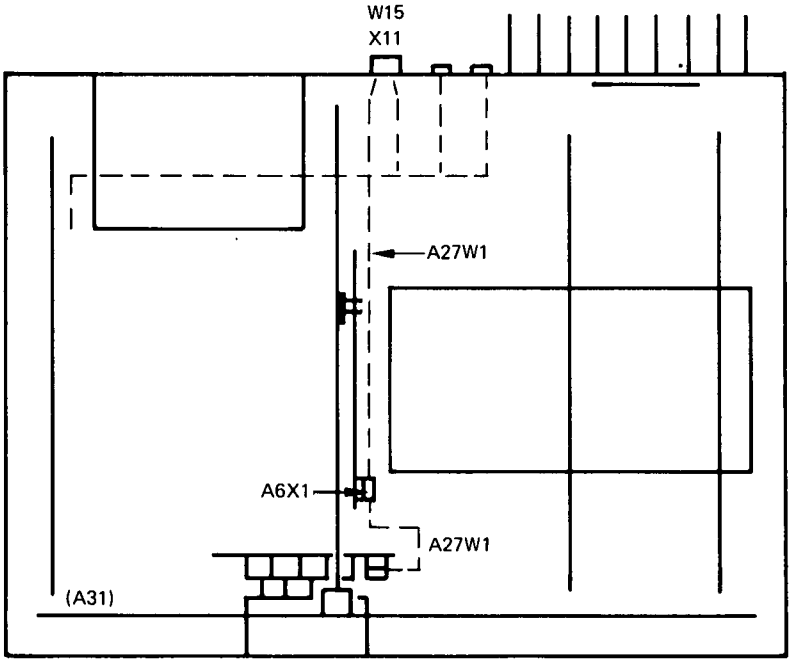


Figure 6–3. Location of additional/changed parts and assemblies for 8015A Option 002.



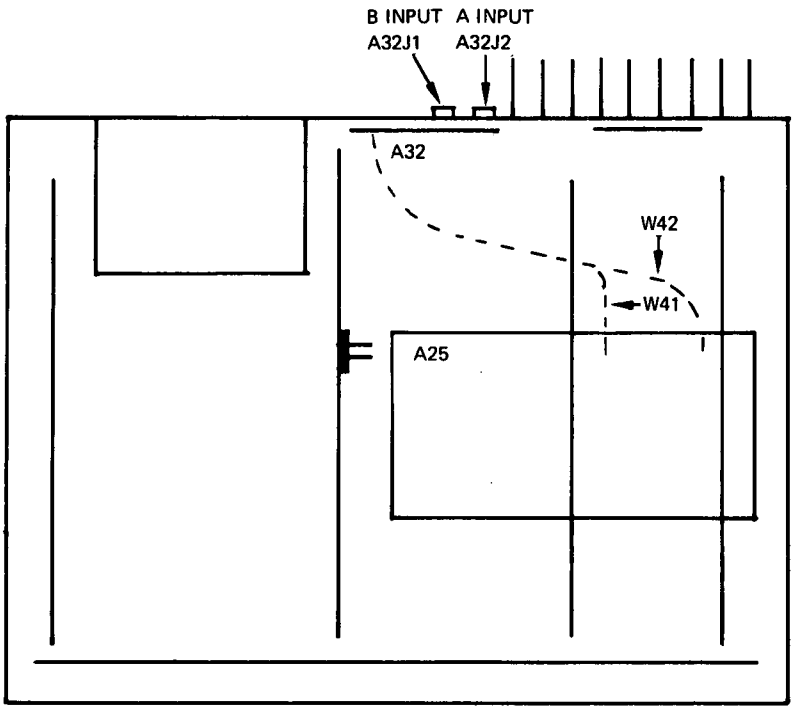
See Service Sheets 6b, 9, 10.

Figure 6–4. Location of additional parts and assemblies for 8015A option 003



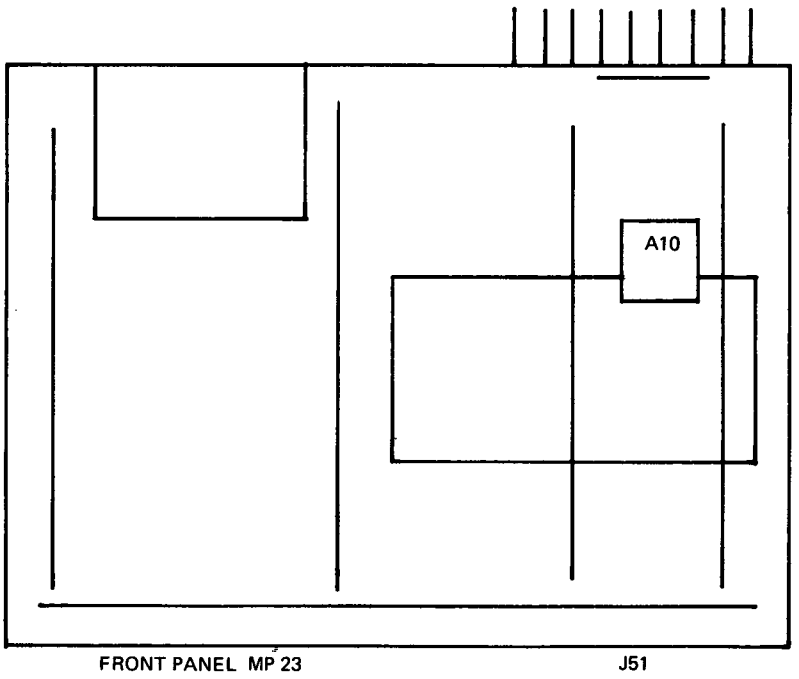
Replacement A27W1 must be soldered to Remote connector (W15X11) See Service Sheet 8

Figure 6–5. Ribbon cable for 8015A option 002 + 003



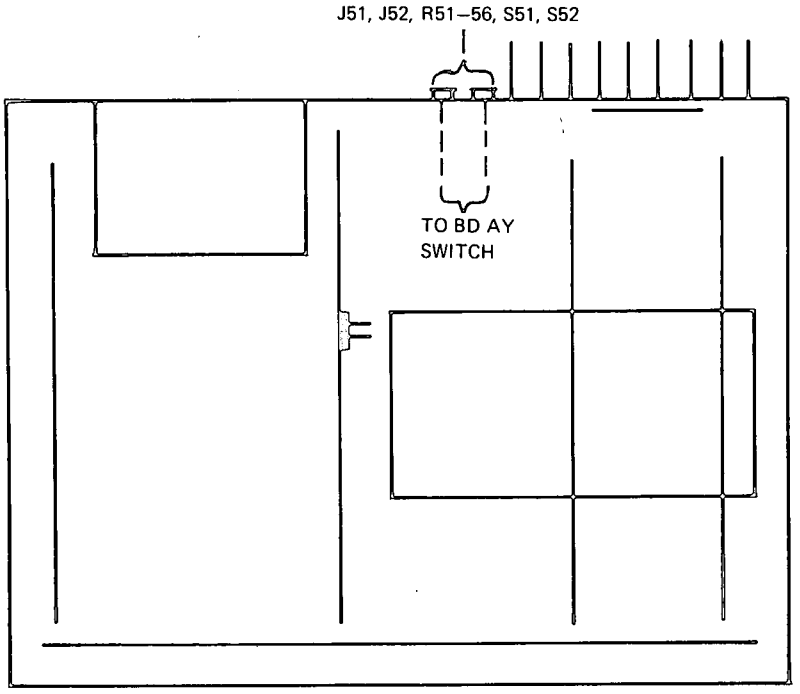
See Service Sheet 4

Figure 6–6. Location of additional/changed parts and assemblies for 8015A Option 004



See Service Sheet 4

Figure 6–7. Location of additional/changed parts and assemblies for 8015A option 005



See Service Sheet 6

Figure 6–8. Location of additional parts for 8015A Option 006

Table 6–1. Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
FR003	SOVCOR ELECTRONIQUE	LE VESINET FRANCE	
FR009	GAM	MEAUX FRANCE	77
GM032	SIEMENS AG	MUNICH GERMANY	8000
SW005	CONDENSATEURS FRIBOURG, SA	FRIBOURG,SWITZERLAND	
00002U	UNITRODE COMPUTER PRODUCTS CORP	METHUEN MA	
00086S	STETTNER-TRUSH INC	CAZENOVIA NY	13035
01121	ALLEN-BRADLEY CO	MILWAUKEE WI	53212
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02114	FERROXCUBE CORP	SAUGERTIES NY	12477
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
03888	KDI PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
07088	KELVIN ELECTRIC /CO	VAN NUYS CA	91401
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
07716	TRW INC BURLINGTON DIV	BURLINGTON IA	52601
12697	CLAROSTAT MFG CO INC	DOVER NH	03820
13103	THERMALLOY CO	DALLAS TX	75247
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW CA	94040
16299	CORNING GL WK ELEC CMPNT DIV	RALEIGH NC	27604
19701	MEPCO/ELECTRA CORP	MINERAL WELLS TX	76067
23880	STANFORD APPLIED ENGINEERING INC	SANTA CLARA CA	95050
24226	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON NC	28401
27264	MOLEX PRODUCTS CO	DOWNERS GROVE IL	60515
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
32997	BOURNS INC TRIMPOT PROD DIV	RIVERSIDE CA	92507
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71400	BUSSMAN MFG DIV OF MCGRAW-EDISON CO	ST LOUIS MO	63017
71468	ITT CANNON ELECTRIC CO	SANTA ANA CA	92702
71744	CHICAGO MINIATURE/DRAKE	CHICAGO IL	60640
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	FULLERTON CA	92634
75915	LITTELFUSE INC	DES PLAINES IL	60016
79727	C-W INDUSTRIES	WARMINSTER PA	18974
82389	SWITCHCRAFT INC	CHICAGO IL	60630
84411	TRW CAPACITOR DIV	OGALLALA NE	69153
90949	AMPHENOL SALES DIV OF BUNKER-RAMO	HAZELWOOD MO	63042
91637	DALE ELECTRONICS INC	COLUMBUS NE	68601

Table 6–2. 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

Table 6–3. Replaceable Parts – Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2A	08015-66502	2	BOARD ASSEMBLY, OUTPUT	28480	08015-66502
A2B	08015-66502		BOARD ASSEMBLY, OUTPUT	28480	08015-66502
A3	08015-66503	1	BOARD ASSEMBLY, TIMING	28480	08015-66503
A5	08015-66505	1	BOARD ASSEMBLY, INTEGRATOR	28480	08015-66505
A21	08015-66521	1	BOARD ASSEMBLY, SWITCH	28480	08015-66521
A24	08015-66524	1	BOARD ASSEMBLY, POWER SUPPLY	28480	08015-66524
A28	08015-66528	1	BOARD ASSEMBLY, RESISTOR	28480	08015-66528
C1	0180-1919	2	CAPACITOR-FXD 5000UF+75-10% 45VDC AL	28480	0180-1919
C2	0180-1919		CAPACITOR-FXD 5000UF+75-10% 45VDC AL	28480	0180-1919
C3	0180-1949	2	CAPACITOR-FXD 5500UF+75-10% 40VDC AL	56289	36D552G040AC2A
C4	0180-1949		CAPACITOR-FXD 5500UF+75-10% 40VDC AL	56289	36D552G040AC2A
DS1	2140-0346	1	LAMP-INCAND T-1 BULB 5V	71744	7210(ANSI 7210)
F1	2110-0007	1	FUSE,1A 250V SLO-BLO 1.25 X .25 IEC	71400	AGC-1
F1	2110-0303	1	FUSE 2A 250V SLO-BLO 1.25X.25 UL IEC	71400	MDX-2A
F1	2110-0465	1	FUSEHOLDER-EXTR POST UL/IEC .25X1.25FUSE	28480	2110-0465
F1	2110-0467	1	NUT, HEX SINGLE CHAMFER 1/2-28 THREAD	75915	903-070
F1	2110-0470	1	FUSEHOLDER-EXTR POST 20A 200V UL/IEC	75915	345003-010
FL1	9100-3121	1	FILTER-LINE CEE-TERMS	28480	9100-3121
J1	1251-0118	4	CONNECTOR 6-PIN M CIRC K	71468	WK-6-32S
J2	1251-0118		CONNECTOR 6-PIN M CIRC K	71468	WK-6-32S
J3	1251-0118		CONNECTOR 6-PIN M CIRC K	71468	WK-6-32S
J4	1251-0118		CONNECTOR 6-PIN M CIRC K	71468	WK-6-32S
MP1	1460-1345	1	WIREFORM 1.34-W 3-LG SST	28480	1460-1345
MP2	5000-8915	1	COVER TRANSFORMER	28480	5000-8915
MP3	5040-1124	1	KNOB PUSHBUTTON POWER	28480	5040-1124
MP4	5040-7201	1	FOOT(STANDARD)	28480	5040-7201
MP8	5040-7202	1	TRIM STRIP TOP	28480	5040-7202
MP9	5040-7219	1	CAP, HANDLE, FRONT	28480	5040-7219
MP9A	5040-7220	1	CAP, HANDLE, REAR	28480	5040-7220
MP10	5060-9802	1	STRAP HANDLE AY	28480	5060-9802
MP11	0370-1005	1	KNOB-BASE-PTR .375 IN JGK SGI-DECAL	28480	0370-1005
MP12	0370-0914	1	BEZEL:PUSHBUTTON KNOB, JADE GREY	28480	0370-0914
MP13	08015-04102	1	COVER, TOP	28480	08015-04102
MP14	08015-04103	1	COVER, BOTTOM	28480	08015-04103
MP15	5060-9935	1	COVER, SIDE	28480	5060-9935
MP16	5060-9910	1	COVER, SIDE	28480	5060-9910
MP19	08015-21103	1	HEAT SINK	28480	08015-21103
MP21	08015-00101	1	DECK, CAPACITOR	28480	08015-00101
MP22	08015-00214	1	PANEL, REAR	28480	08015-00214
MP23	08015-00206	1	PANEL, FRONT	28480	08015-00206
MP24	08015-00207	1	PANEL, SUB	28480	08015-00207
MP25	08015-01201	1	BRACKET, BOARD P.C.	28480	08015-01201
MP26	08015-01202	1	CLAMP, RESISTOR, VAR.	28480	08015-01202
MP27	08015-01203	1	BRACKET, P.C. BOARD	28480	08015-01203
MP28	08015-01205	1	PLATE, MOUNTING	28480	08015-01205
MP29	08015-04105	1	PLATE	28480	08015-04105
MP30	08015-04106	1	COVER, CAPACITOR	28480	08015-04106
MP31	08015-04107	1	BLANK, CONNECTOR, HOLE	28480	08015-04107
MP32	08015-04108	1	BLANK, SWITCH, HOLE	28480	08015-04108
MP33	08015-06301	1	PLATE, LIMIT	28480	08015-06301
MP34	5020-8803	1	FRAME, FRONT	28480	5020-8803
MP35	5020-8804	1	FRAME, REAR	28480	5020-8804
MP36	5020-8835	1	CORNER STRUTS	28480	5020-8835
MP37	5001-0439	1	TRIM, FRONT SIDE	28480	5001-0439
MP37A	5061-0089		HANDLE KIT (OPTION 907)		
MP37B	5061-0077		RACK FLANGE KIT (OPTION 908)		
MP37C	5061-0083		RACK FLANGE WITH FRONT HANDLE KIT (OPTION 909)		
Q1	1853-0251	5	TRANSISTOR PNP SI PD=90W FT=2MHZ	28480	1853-0251
Q2	1853-0251		TRANSISTOR PNP SI PD=90W FT=2MHZ	28480	1853-0251
Q3	1853-0251		TRANSISTOR PNP SI PD=90W FT=2MHZ	28480	1853-0251
Q4	1854-0433	5	TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q5	1854-0433		TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q6	1854-0433		TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q7	1854-0433		TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q8	1853-0251		TRANSISTOR PNP SI PD=90W FT=2MHZ	28480	1853-0251
Q9	1854-0433		TRANSISTOR NPN SI PD=90W FT=2MHZ	28480	1854-0433
Q10	1853-0251		TRANSISTOR PNP SI PD=90W FT=2MHZ	28480	1853-0251
R1	2100-2290	1	RESISTOR-VAR CONTROL CC 500 10% LIN	12697	382
R2	2100-3081	5	RESISTOR-VAR CONTROL CC 50K 10% 10CW	12697	SERIES 63M
R3	2100-3081		RESISTOR-VAR CONTROL CC 50K 10% 10CW	12697	SERIES 63M
R4	2100-3081		RESISTOR-VAR CONTROL CC 50K 10% 10CW	12697	SERIES 63M
R5	2100-3081		RESISTOR-VAR CONTROL CC 50K 10% 10CW	12697	SERIES 63M

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
R6	2100-3081		RESISTOR-VAR CONTROL CC 5K 10% 1/2W	12697	SERIES 63M
R7	5080-0966	2	RESISTOR, VAR 1K OHM/INCH	28480	5080-0966
R8	5080-0966		RESISTOR, VAR 1K OHM/INCH	28480	5080-0966
S2	3101-0126	1	NUT-REVD FOR 1/4-32 THD BUSHINGS; BRASS	28480	3101-0126
S2	3101-0124	1	SWITCH-PB SPST NC MOM	82389	962
S15	3101-1720	1	SWITCH-PB DPDT P-P 4A 250VAC	28480	3101-1720
S16	3101-1740	2	SWITCH-SL DPDT-NS STD 1.5A 250VAC SLDR	86845	4021.0211
S17	3101-1740		SWITCH-SL DPDT-NS STD 1.5A 250VAC SLDR	86845	4021.0211
T1	08015-61101	1	TRANSFORMER, POWER	28480	08015-61101
W3	08015-61602	1	CABLE ASSEMBLY, POWER	28480	08015-61602
W4	08015-61609	1	CABLE ASSEMBLY, GATE	28480	08015-61609
A2	08015-66502	1	BOARD ASSEMBLY, OUTPUT	28480	08015-66502
A2C2	0160-0174	52	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C3	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C6	0160-4210	12	CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A2C8	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A2C9	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C10	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C11	0160-2265	1	CAPACITOR-FXD 22PF +-5% 500WVDC CER	28480	0160-2265
A2C13	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C14	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C15	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C16	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C19	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C20	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C21	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C22	0121-0105	1	CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	00865	304324 9/35PF N650
A2C24	0160-4209	17	CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C25	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C26	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C27	0160-2306	1	CAPACITOR-FXD 27PF +-5% 300WVDC MICA	28480	0160-2306
A2C28	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C29	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C30	0160-2204	4	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A2C31	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A2C32	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C33	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C34	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C35	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C36	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C38	0180-0229	3	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A2C39	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A2C40	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C41	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C42	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C43	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A2C44	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C45	0160-4211	4	CAPACITOR-FXD .047UF +-20% 50WVDC POLYE	28480	0160-4211
A2C46	0160-4211		CAPACITOR-FXD .047UF +-20% 50WVDC POLYE	28480	0160-4211
A2C47	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A2C48	0160-3720	1	CAPACITOR-FXD .1UF +-10% 160WVDC MET	28480	0160-3720
A2C49	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C52	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A2C53	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A2C54	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C55	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A2C56	0160-4211		CAPACITOR-FXD .047UF +-20% 50WVDC POLYE	28480	0160-4211
A2C57	0160-4211		CAPACITOR-FXD .047UF +-20% 50WVDC POLYE	28480	0160-4211
A2C58	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A2C59	0180-0106	3	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A2C60	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A2CR1	1901-0533	6	DIODE-SCHOTTKY	28480	1901-0533
A2CR2	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A2CR3	1901-0040	45	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR5	1901-0620	2	DIODE-SWITCHING 60V 400MA DO-35	0002U	NDP 250
A2CR6	1901-0620		DIODE-SWITCHING 60V 400MA DO-35	0002U	NDP 250
A2CR7	1902-0589	2	DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.066%	28480	1902-0589
A2CR8	1902-0589		DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.066%	28480	1902-0589
A2CR9	1902-3072	1	DIODE-ZNR 2.37V 5% DO-7 PD=.4W TC=-.074%	04713	SZ 10939-2
A2CR10	1902-3149	1	DIODE-ZNR 9.09V 5% DO-7 PD=.4W TC=+.057%	04713	SZ 10939-170
A2CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

Replaceable Parts – Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR19	1901-0033	27	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR20	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR21	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A2CR22	1902-3203	2	DIODE-ZNR 14.7V 5% DO-7 PD=.4W TC=+.057%	04713	SZ 10939-230
A2CR23	1902-3203		DIODE-ZNR 14.7V 5% DO-7 PD=.4W TC=+.057%	04713	SZ 10939-230
A2CR24	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2CR29	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A2K1	0490-0617	2	RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A2K2	0490-0617		RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A2K3	0490-1079	1	RELAY-REED 1A .5A 100V CUNT 5V-COIL	28480	0490-1079
A2L1	9140-0210	3	COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A2L2	08015-86003	3	COIL	28480	08015-86003
A2L3	9100-0346	2	COIL-FXD MOLDED RF CHOKE .05UH 20%	28480	9100-0346
A2L4	9100-0346		COIL-FXD MOLDED RF CHOKE .05UH 20%	28480	9100-0346
A2L6	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A2L9	08015-86001	1	COIL	28480	08015-86001
A2L10	08015-86002	1	COIL	28480	08015-86002
A2L11	08015-86003		COIL	28480	08015-86003
A2L12	08015-86003		COIL	28480	08015-86003
A2L14	9170-0029	9	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2L15	9100-2249	2	COIL-FXD MOLDED RF CHOKE .15UH 10%	24226	10/150
A2L16	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A2L17	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2L18	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2L19	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2L20	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2L21	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A2MP1	08015-21101	1	HEAT SINK	28480	08015-21101
A2MP2	1200-0185	2	INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED
A2MP3	1205-0204	1	HEAT-DISSIPATOR DUAL TO-18 PKG	28480	1205-0204
A2MP4	1205-0236	1	ADAPTER-TRANSISTOR CASE TO-5	28480	1205-0236
A2Q1	1854-0630	5	TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A2Q2	1854-0345	12	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A2Q3	1853-0357	30	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A2Q4	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A2Q5	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A2Q6	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A2Q7	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A2Q8	1854-0344	1	TRANSISTOR NPN SI TO-39 PD=700MW	28480	1854-0344
A2Q9	1853-0315	1	TRANSISTOR PNP SI TO-39 PD=1W FT=1GHZ	28480	1853-0315
A2Q10	1853-0312	3	TRANSISTOR PNP SI TO-39 PD=5W FT=500MHZ	28480	1853-0312
A2Q11	1853-0312		TRANSISTOR PNP SI TO-39 PD=5W FT=500MHZ	28480	1853-0312
A2Q12	1853-0312		TRANSISTOR PNP SI TO-39 PD=5W FT=500MHZ	28480	1853-0312
A2Q13	1854-0612	3	TRANSISTOR NPN SI TO-39 PD=3.5W	02735	40608
A2Q14	1854-0612		TRANSISTOR NPN SI TO-39 PD=3.5W	02735	40608
A2Q15	1854-0612		TRANSISTOR NPN SI TO-39 PD=3.5W	02735	40608
A2Q16	1853-0051	1	TRANSISTOR PNP 2N4037 SI TO-5 PD=1W	02735	2N4037
A2Q17	1854-0274	8	TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A2Q18	1854-0307	7	TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A2Q19	1853-0090	10	TSTR:SI PNP	28480	1853-0090
A2Q20	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A2Q21	1853-0090		TSTR:SI PNP	28480	1853-0090
A2Q22	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A2Q23	1853-0012	4	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A2Q24	1853-0012		TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A2Q25	1854-0254	1	TRANSISTOR NPN SI TO-5 PD=800MW	28480	1854-0254
A2Q26	1853-0090		TSTR:SI PNP	28480	1853-0090
A2Q27	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A2R1	0757-0421	4	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A2R2	0757-0384	12	RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A2R3	0758-0092	3	RESISTOR 560 5% .25W F TC=0+-100	24546	C5-1/4-T0-561-J
A2R9	2100-2787	2	RESISTOR, VAR 220 OHM 20% C LIN 0.5W	28480	2100-2787
A2R10	0757-0434	1	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A2R11	0757-0401	40	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R12	0757-0276	5	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A2R14	2100-2787		RESISTOR, VAR 220 OHM 20% C LIN 0.5W	28480	2100-2787
A2R15	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R16	0757-0402	6	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R17	0757-0362	1	RESISTOR 16.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-16R2-F
A2R18	0698-3442	2	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A2R19	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A2R20	0698-3437	1	RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A2R21	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A2R22	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A2R23	0757-0280	30	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R24	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R26	0757-0400	9	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R27	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R28	0757-0346	30	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R29	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R30	0757-0394	14	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2R31	0757-0417	7	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A2R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R33	0698-3441	1	RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A2R34	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2R35	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2R36	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R37	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R38	0757-0809	2	RESISTOR 332 1% .5W F TC=0+-100	19701	MF7C1/2-T0-332R-F
A2R39	0757-0809		RESISTOR 332 1% .5W F TC=0+-100	19701	MF7C1/2-T0-332R-F
A2R41	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R43	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R44	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R45	0757-0388	10	RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A2R46	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A2R47	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R48	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R49	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A2R50	0698-3431	2	RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-23R7-F
A2R51	0698-3431		RESISTOR 23.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-23R7-F
A2R52	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R54	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R55	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R56	0698-5031	2	RESISTOR 160 1% .5W F TC=0+-100	24546	NA6
A2R57	0698-5031		RESISTOR 160 1% .5W F TC=0+-100	24546	NA6
A2R58	0757-0437	11	RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A2R59	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A2R60	2100-2788	4	RESISTOR, VAR 4.7K OHM 20% C LIN 0.5W	28480	2100-2788
A2R61	2100-2788		RESISTOR, VAR 4.7K OHM 20% C LIN 0.5W	28480	2100-2788
A2R62	0757-0444	8	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A2R63	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R64	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R65	0757-0794	4	RESISTOR 68.1 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-68R1-F
A2R66	0757-0794		RESISTOR 68.1 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-68R1-F
A2R67	0757-0794		RESISTOR 68.1 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-68R1-F
A2R68	0757-0794		RESISTOR 68.1 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-68R1-F
A2R69	0698-6792	2	RESISTOR 37.5 .5% .25W F TC=0+-50	07716	CCA-993
A2R70	0698-6792		RESISTOR 37.5 .5% .25W F TC=0+-50	07716	CCA-993
A2R71	0757-0416	2	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A2R72	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A2R73	0758-0013	9	RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R74	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R75	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R76	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R77	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R78	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A2R79	0761-0046	6	RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R80	0761-0046		RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R81	0761-0046		RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R82	0761-0046		RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R83	0761-0046		RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R84	0761-0046		RESISTOR 110 5% 1W MO TC=0+-200	24546	FP32-1-T00-111-J
A2R85	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R86	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R87	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R88	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R89	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R90	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A2R91	0757-0415	5	RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A2R92	0757-0415		RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A2R93	0758-0023	3	RESISTOR 240 5% .25W F TC=0+-100	24546	C5-1/4-T0-241-J
A2R94	0758-0023		RESISTOR 240 5% .25W F TC=0+-100	24546	C5-1/4-T0-241-J
A2R95	0811-1202	2	RESISTOR 50 5% 3W PW TC=0+-20	07088	KH-300

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R96	0811-1282		RESISTOR 50 5% 3W PW TC=0+-20	07088	KM-300
A2R97	0698-3443	2	RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A2R98	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A2R99	0757-0420	5	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-TO-751-F
A2R100	0757-0290	3	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A2R101	0757-0426	7	RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1301-F
A2R102	0757-0273	5	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3011-F
A2R105	0757-0461	3	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6812-F
A2R106	0698-3162	2	RESISTOR 46.4K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4642-F
A2R107	0757-0443	5	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A2R108	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A2R109	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6812-F
A2R110	0698-3162		RESISTOR 46.4K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4642-F
A2R111	0758-0030	1	RESISTOR 510 5% .25W F TC=0+-100	24546	C5-1/4-TO-511-J
A2R114	0757-0412	1	RESISTOR 365 1% .125W F TC=0+-100	24546	C4-1/8-TO-365R-F
A2R115	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1301-F
A2R116	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A2R117	2100-2786	1	RESISTOR, VAR 100 OHM 20% C LIN 0.5W	28480	2100-2786
A2R118	0757-0406	4	RESISTOR 182 1% .125W F TC=0+-100	24546	C4-1/8-TO-182R-F
A2R119	0757-0123	1	RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-TO-3482-F
A2R120	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A2R121	0698-3161	1	RESISTOR 38.3K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3832-F
A2R122	0698-3449	2	RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2872-F
A2R123	0698-3159	2	RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2612-F
A2R124	0698-3158	8	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2372-F
A2R125	0698-7357	1	RESISTOR 422K .25% .125W F TC=0+-100	19701	MF4C1/8-TO-4223-C
A2R126	0698-3454	1	RESISTOR 215K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2153-F
A2R127	0698-3243	1	RESISTOR 178K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1783-F
A2R128	0757-0472	2	RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2003-F
A2R129	0757-0463	1	RESISTOR 82.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8252-F
A2R130	0758-0001	1	RESISTOR 3.3K 5% .25W F TC=0+-100	24546	C5-1/4-TO-3301-J
A2R131	0757-0407	17	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-TO-201-F
A2R132	0698-3157	1	RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1962-F
A2R133	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A2R134	0757-0284	7	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-TO-151-F
A2R135	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-TO-151-F
A2R136	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A2R137	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2872-F
A2R138	0757-0458	3	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A2R139	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A2R140	0757-0441	1	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A2R141	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A2R142	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-TO-111-F
A2R143	0698-3155	2	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A2R144	0757-0442	27	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R145	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R146	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R147	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R148	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R149	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R150	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R151	0757-0472		RESISTOR 200K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2003-F
A2R152	2100-2788		RESISTOR, VAR 4.7K OHM 20% C LIN 0.5W	28480	2100-2788
A2R153	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A2R154	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A2R155	0698-6960	2	RESISTOR 27K .1% .125W F TC=0+-50	24546	NC55
A2R156	0698-6960		RESISTOR 27K .1% .125W F TC=0+-50	24546	NC55
A2R157	0757-0435	5	RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3921-F
A2R158	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A2R159	2100-2788		RESISTOR, VAR 4.7K OHM 20% C LIN 0.5W	28480	2100-2788
A2R160	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5112-F
A2R161	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3921-F
A2R162	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1301-F
A2R163	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1301-F
A2R164	0757-0283	5	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A2R165	0757-0410	4	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-TO-301R-F
A2R166	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-TO-301R-F
A2R167	0698-3332	1	RESISTOR 80.6 1% .5W F TC=0+-100	24546	NA6
A2R168	0766-0025	2	RESISTOR 101 2% 3W MO TC=0+-250	27167	FP3-3-250-101R-G
A2R169	0766-0025		RESISTOR 101 2% 3W MO TC=0+-250	27167	FP3-3-250-101R-G
A2R170	0757-0456	1	RESISTOR 43.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4322-F
A2R171	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R172	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R173	0698-4398	1	RESISTOR 86.6 1% .125W F TC=0+-100	16299	C4-1/8-TO-86R6-F
A2R174	0698-4460	1	RESISTOR 649 1% .125W F TC=0+-100	24546	C4-1/8-TO-649R-F

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Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R175	0757-0[illegible]		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R176	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A2R177	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A2R178	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A2U2	1826-0092	1	IC MC 1458 OP AMP	28480	1826-0092
A2U3	1826-0043	3	IC LM 307 OP AMP	27014	LM307H
A2U4	1826-0043		IC LM 307 OP AMP	27014	LM307H
A2U5	1826-0043		IC LM 307 OP AMP	27014	LM307H
A2U6	1820-0203	7	IC, AMPL. OPERATIONAL	15818	741CE009
A2U7	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009
A2U8	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009
A2U9	1858-0030	3	TRANSISTOR ARRAY, QUAD-HI-FREQ, POWER	28480	1858-0030
A2U10	1858-0030		TRANSISTOR ARRAY, QUAD-HI-FREQ, POWER	28480	1858-0030
A2U11	1858-0030		TRANSISTOR ARRAY, QUAD-HI-FREQ, POWER	28480	1858-0030
A2W1	08015-61607	1	CABLE ASSEMBLY, COAX	28480	08015-61607
A3	08015-66503	1	BOARD ASSEMBLY, TIMING	28480	08015-66503
A3C1	0160-2930	40	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C2	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C3	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C4	0180-0291	3	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A3C5	0160-2197	3	CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A3C6	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C7	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C8	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C9	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C10	0160-2198	1	CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A3C11	0160-2197		CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A3C12	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C13	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C14	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C15	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C16	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C17	0160-3714	1	CAPACITOR-FXD 5600PF +-10% 250WVDC MET	28480	0160-3714
A3C18	0180-0375	3	CAPACITOR-FXD 68UF+-10% 20VDC TA	56289	150D686X902082
A3C19	0160-3725	3	CAPACITOR-FXD .68UF +-10% 40WVDC MET	28480	0160-3725
A3C20	0121-0046	3	CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	0086S	304322 9/35PF N650
A3C21	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C22	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C23	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C24	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C25	0140-0191	2	CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A3C26	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C27	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C28	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C29	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C30	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C31	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C32	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C33	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C34	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C35	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C36	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C37	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C38	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C39	0121-0046		CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	0086S	304322 9/35PF N650
A3C40	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C41	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C42	0160-3229	2	CAPACITOR-FXD 6800PF +-5% 250WVDC MET	FR009	CKB-68
A3C43	0160-3725		CAPACITOR-FXD .68UF +-10% 40WVDC MET	28480	0160-3725
A3C44	0180-0375		CAPACITOR-FXD 68UF+-10% 20VDC TA	56289	150D686X902082
A3C45	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C46	0121-0046		CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	0086S	304322 9/35PF N650
A3C47	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C48	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C49	0160-3229		CAPACITOR-FXD 6800PF +-5% 250WVDC MET	FR009	CKB-68
A3C50	0160-3725		CAPACITOR-FXD .68UF +-10% 40WVDC MET	28480	0160-3725
A3C51	0180-0375		CAPACITOR-FXD 68UF+-10% 20VDC TA	56289	150D686X902082
A3C52	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C53	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C54	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C55	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930

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Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3C56	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C57	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C58	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C59	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C60	0160-2139	3	CAPACITOR-FXD 220PF +80-20% 1000WVDC CER	28480	0160-2139
A3C61	0160-2197		CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A3C62	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C63	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C64	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C65	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C66	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C67	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C68	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A3C69	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C70	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A3C71	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C72	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3C73	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A3CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR11	1902-3139	3	DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A3CR12	1902-3139		DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A3CR13	1902-0126	3	DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.073%	04713	SZ 10939-14
A3CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR16	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR18	1901-0179	13	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3CR19	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR20	1910-0022	1	DIODE-GE 5V 60NA 3.5NS DO-7	28480	1910-0022
A3CR21	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR22	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR23	1902-3104	4	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A3CR24	1902-3104		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A3CR25	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR26	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR27	1902-0025	3	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A3CR28	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR29	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR30	1902-0126		DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.073%	04713	SZ 10939-14
A3CR31	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3CR32	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A3CR33	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR34	1902-3139		DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A3CR35	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR36	1902-0126		DIODE-ZNR 2.61V 5% DO-7 PD=.4W TC=-.073%	04713	SZ 10939-14
A3CR37	1902-0049	2	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-122
A3CR38	1910-0034	5	DIODE-GE 30V 80MA 8NS DO-7	28480	1910-0034
A3CR39	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR40	1902-0049		DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-122
A3CR41	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A3CR42	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A3J1	1251-3488	1	CONNECTOR, P.C. EDGE	28480	1251-3488
A3L1	9100-1614	2	COIL-FXD MOLDED RF CHOKE .82UH 10%	24226	15/820
A3L2	9100-1613	4	COIL-FXD MOLDED RF CHOKE .47UH 20%	24226	15/470
A3L3	9100-1613		COIL-FXD MOLDED RF CHOKE .47UH 20%	24226	15/470
A3L4	9100-1613		COIL-FXD MOLDED RF CHOKE .47UH 20%	24226	15/470
A3L5	9140-0112	1	COIL-FXD MOLDED RF CHOKE 4.7UH 10%	24226	15/471
A3L6	9100-1614		COIL-FXD MOLDED RF CHOKE .82UH 10%	24226	15/820
A3L7	9100-1612	1	COIL-FXD MOLDED RF CHOKE .33UH 20%	24226	15/330
A3L8	9100-1613		COIL-FXD MOLDED RF CHOKE .47UH 20%	24226	15/470
A3L9	9140-0179	2	COIL-FXD MOLDED RF CHOKE 22UH 10%	24226	15/222
A3L10	9140-0179		COIL-FXD MOLDED RF CHOKE 22UH 10%	24226	15/222
A3L11	9100-1611	2	COIL-FXD MOLDED RF CHOKE .22UH 20%	24226	15/220
A3L12	9100-2249		COIL-FXD MOLDED RF CHOKE .15UH 10%	24226	10/150
A3L13	9100-1611		COIL-FXD MOLDED RF CHOKE .22UH 20%	24226	15/220
A3L14	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A3MP57	1200-0185		INSULATOR-XSTR TO-5 .075-THK	13103	7717-86N RED

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Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3Q1	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q2	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q3	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q4	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q6	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q7	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q8	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q9	1854-0019	8	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q10	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q11	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q12	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q13	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q14	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q15	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q16	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q17	1853-0090		TSTR:SI PNP	28480	1853-0090
A3Q18	1853-0090		TSTR:SI PNP	28480	1853-0090
A3Q19	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q20	1854-0215	5	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q21	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q22	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q23	1854-0092	2	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q24	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A3Q25	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q26	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q27	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q28	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q29	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q30	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q31	1854-0009	2	TRANSISTOR NPN 2N709 SI TO-18 PD=300MW	28480	1854-0009
A3Q32	1854-0009		TRANSISTOR NPN 2N709 SI TO-18 PD=300MW	28480	1854-0009
A3Q33	1853-0034	1	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
	1205-0037	1	HEAT-DISSIPATOR SGL TO-36 PKG	28480	1205-0037
A3Q34	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A3Q35	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A3Q36	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q37	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q38	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q39	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q40	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q41	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q42	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q43	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q44	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q45	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q46	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q47	1853-0036	6	TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q48	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q49	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q50	1853-0090		TSTR:SI PNP	28480	1853-0090
A3Q51	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q52	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q53	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q54	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A3Q55	1853-0090		TSTR:SI PNP	28480	1853-0090
A3Q56	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A3Q57	1853-0012		TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A3Q58	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A3Q59	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3Q60	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A3R2	0758-0083	1	RESISTOR 68 5% .25W F TC=0+-100	24546	C5-1/4-T0-68R0-J
A3R3	0757-0424	9	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R4	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R5	0757-0394	5	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R6	0757-0422		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R7	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3R8	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R11	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

Replaceable Parts – Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R14	0757-0288	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A3R15	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R16	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R17	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R18	0698-3242	5	RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A3R19	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A3R20	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R21	0757-0415		RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A3R22	0757-0408	4	RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A3R23	0757-0414	2	RESISTOR 432 1% .125W F TC=0+-100	24546	C4-1/8-T0-432R-F
A3R24	0757-0409	4	RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A3R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R26	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R27	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A3R28	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R29	0757-0274	7	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R30	0757-0413	2	RESISTOR 392 1% .125W F TC=0+-100	24546	C4-1/8-T0-392R-F
A3R31	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R32	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A3R33	0698-4455	1	RESISTOR 536 1% .125W F TC=0+-100	24546	C4-1/8-T0-536R-F
A3R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R35	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R36	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R37	0757-0428	5	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3R38	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R39	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R40	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3R41	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R42	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R43	0757-0406		RESISTOR 182 1% .125W F TC=0+-100	24546	C4-1/8-T0-182R-F
A3R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R45	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A3R46	0757-0404	4	RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-T0-131-F
A3R47	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R48	0757-0413		RESISTOR 392 1% .125W F TC=0+-100	24546	C4-1/8-T0-392R-F
A3R49	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1301-F
A3R50	0757-0411	4	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R51	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3R52	0757-0419	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A3R53	0757-0400		RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A3R54	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R55	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R56	0757-0404		RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-T0-131-F
A3R57	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R58	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R59	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R60	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R61	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R62	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R63	0757-0439	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A3R64	0757-0433	4	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R65	0757-0438	11	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R66	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R67	0683-1055	9	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R68	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R69	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R70	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R72	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R71	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3R73	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R74	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3R75	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R76	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R77	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3R78	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R79	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3R80	0698-3492	10	RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R81	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A3R82	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-56R2-F
A3R83	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R84	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R85	0757-0427	4	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A3R86	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A3R87	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R88	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R89	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3R90	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R91	0757-0424	7	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R92	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R93	0757-0398	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R94	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A3R95	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R96	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R97	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R98	0757-0414		RESISTOR 432 1% .125W F TC=0+-100	24546	C4-1/8-T0-432R-F
A3R99	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A3R100	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R101	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R102	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R103	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A3R104	0757-0430	5	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A3R105	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A3R106	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R107	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R108	0757-0430		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A3R109	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R110	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R111	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A3R112	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R113	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R114	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A3R115	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R116	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A3R117	0757-0409		RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A3R118	0757-0430		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A3R119	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A3R120	0757-0406		RESISTOR 182 1% .125W F TC=0+-100	24546	C4-1/8-T0-182R-F
A3R121	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R122	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A3R123	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A3R124	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R125	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R126	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R127	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A3R128	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R129	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A3R130	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A3R131	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R132	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1301-F
A3R133	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R134	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R135	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R136	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R137	0698-3496	5	RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A3R138	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R139	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A3R140	0757-0429	4	RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A3R141	0757-0404		RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-T0-131-F
A3R142	0757-0409		RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A3R143	0757-0393	2	RESISTOR 47.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-47R5-F
A3R144	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A3R145	0758-0002		RESISTOR 560 5% .25W F TC=0+-100	24546	C5-1/4-T0-561-J
A3R146	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R147	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R148	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R149	0757-0404		RESISTOR 130 1% .125W F TC=0+-100	24546	C4-1/8-T0-131-F
A3R150	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A3R151	0757-0409		RESISTOR 274 1% .125W F TC=0+-100	24546	C4-1/8-T0-274R-F
A3R152	0758-0002		RESISTOR 560 5% .25W F TC=0+-100	24546	C5-1/4-T0-561-J
A3R153	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A3R154	0757-0393		RESISTOR 47.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-47R5-F
A3R155	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A3R156	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R157	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R158	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A3R159	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R160	0757-0390	4	RESISTOR 36.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-36R5-F
A3R161	0757-0406		RESISTOR 182 1% .125W F TC=0+-100	24546	C4-1/8-T0-182R-F
A3R162	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R163	0757-0390		RESISTOR 36.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-36R5-F

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3R164	0757-0430		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A3R165	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A3R166	0757-0390		RESISTOR 36.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-36R5-F
A3R167	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R168	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R169	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R170	0757-0430		RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A3R171	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A3R172	0757-0390		RESISTOR 36.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-36R5-F
A3R173	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R174	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R175	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A3R176	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R177	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A3R178	0757-0415		RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A3R179	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R180	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A3R181	0757-0200	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A3R182	0757-0426		RESISTOR 1.3K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1301-F
A3R183	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R184	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R185	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R186	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R187	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R188	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R189	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R190	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R191	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R192	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R193	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R194	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R195	0698-4430	1	RESISTOR 1.91K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1911-F
A3R196	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A3R197	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R198	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R199	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R200	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A3R201	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R202	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R203	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R204	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R205	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R206	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A3R207	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A3R208	0757-0435		RESISTOR 3.92K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3921-F
A3R209	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A3R210	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R211	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A3R212	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R213	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R214	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A3R215	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A3R216	0757-0273		RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A3R217	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R218	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R219	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A3R221	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A3R222	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A3R223	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R224	0757-0424		RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A3R225	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A3R226	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A3R227	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A3R230	0758-0023		RESISTOR 240 5% .25W F TC=0+-100	24546	C5-1/4-T0-241-J
A3W1	08015-61604	1	CABLE ASSEMBLY, TRIGGER INPUT	28480	08015-61604
A3W2	08015-61605	1	CABLE ASSEMBLY, TRIGGER OUTPUT	28480	08015-61605
A5	08015-66505	1	BOARD ASSEMBLY, INTEGRATOR	28480	08015-66505
A5C1	0180-0098	5	CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	1500107X0020S2
A5C2	0160-3724	2	CAPACITOR-FXD .47UF +-10% 400WVDC MET	28480	0160-3724
A5C3	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C4	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	1500107X0020S2
A5C5	0160-3724		CAPACITOR-FXD .47UF +-10% 400WVDC MET	28480	0160-3724

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5C6	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C7	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C8	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C11	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C12	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C13	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C14	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C15	0160-2139		CAPACITOR-FXD 220PF +80-20% 1000WVDC CER	28480	0160-2139
A5C16	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C17	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C18	0160-2139		CAPACITOR-FXD 220PF +80-20% 1000WVDC CER	28480	0160-2139
A5C19	0160-0600	1	CAPACITOR-FXD 3900PF +-10% 250WVDC MET	28480	0160-0600
A5C20	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C21	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C22	0160-4041	1	CAPACITOR-FXD .39UF +-10% 400WVDC MET	28480	0160-4041
A5C23	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C24	0180-0374	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A5C25	0180-1779	1	CAPACITOR-FXD 18UF+-10% 35VDC TA	56289	150D186X9035R2
A5C27	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A5C28	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A5C29	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C30	0180-0229		CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A5C31	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C32	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C35	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C36	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C37	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C38	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C39	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A5C40	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C41	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C42	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A5C43	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C45	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A5C46	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C100	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C101	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A5C102	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A5CR1	1902-3105	4	DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A5CR2	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A5CR3	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A5CR4	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A5CR5	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A5CR6	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A5CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR9	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR10	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR12	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR13	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR15	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR16	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR19	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR20	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A5CR21	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR22	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR23	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A5CR24	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A5CR25	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5CR26	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A5L1	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A5L2	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A5Q1	1854-0260	2	TRANSISTOR NPN 2N3227 SI TO-18 PD=360MW	04713	2N3227
A5Q2	1854-0260		TRANSISTOR NPN 2N3227 SI TO-18 PD=360MW	04713	2N3227
A5Q3	1853-0012		TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A5Q4	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5Q5	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5Q6	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A5Q7	1854-0631		TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A5Q8	1854-0631		TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A5Q9	1853-0090		TSTR:SI PNP	28480	1853-0090
A5Q10	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5Q11	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A5Q12	1853-0090		TSTR:SI PNP	28480	1853-0090
A5Q13	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A5Q14	1853-0090		TSTR:SI PNP	28480	1853-0090
A5Q15	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5Q16	1854-0630		TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A5Q17	5080-1083	2	TRANSISTOR, MATCHED PAIR	28480	5080-1083
A5Q18	5080-1083		TRANSISTOR, MATCHED PAIR	28480	5080-1083
A5Q19	1854-0630		TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A5Q20	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5Q21	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5Q22	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A5R1	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R3	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A5R4	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A5R5	0757-0392	6	RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R6	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A5R7	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R8	0758-0127	1	RESISTOR 430 5% .25W F TC=0+-100	24546	C5-1/4-T0-431-J
A5R9	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R11	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R12	0757-0405	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A5R13	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A5R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R15	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A5R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R17	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R18	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R19	0757-0467	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R20	0758-0062	2	RESISTOR 200 5% .25W F TC=0+-100	24546	C5-1/4-T0-201-J
A5R21	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R23	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R25	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A5R26	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R27	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R28	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R29	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A5R30	0758-0062		RESISTOR 200 5% .25W F TC=0+-100	24546	C5-1/4-T0-201-J
A5R31	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R33	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R34	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R35	0757-0449	2	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A5R36	2100-2800	2	R:VAR CERMET 1000 OHM 20%	28480	2100-2800
A5R37	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R38	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R39	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R40	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A5R41	2100-2800		R:VAR CERMET 1000 OHM 20%	28480	2100-2800
A5R42	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R43	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A5R44	0757-0450	4	RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A5R45	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R46	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A5R47	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R48	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A5R49	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R50	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A5R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R52	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A5R53	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R54	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A5R55	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R56	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A5R57	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A5R58	0757-0408		RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A5R59	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A5R60	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A5R61	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5R62	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A5R63	0757-0411		RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A5R64	0758-0024	2	RESISTOR 100 5% .25W F TC=0+-100	24546	C5-1/4-T0-101-J
A5R65	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R66	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R67	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R68	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R69	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A5R70	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R71	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5R72	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R74	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A5R75	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A5R76	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R77	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R79	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R80	2100-2739	2	R:VAR 220 OHM	28480	2100-2739
A5R81	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A5R82	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R84	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R85	2100-2739		R:VAR 220 OHM	28480	2100-2739
A5R88	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R89	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A5R90	0758-0068	1	RESISTOR 910 5% .25W F TC=0+-100	24546	C5-1/4-T0-911-J
A5R91	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A5X12	1251-2675	2	CONNECTOR, P.C. 3-MALE CONTACT	28480	1251-2675
A5X13	1251-2675		CONNECTOR, P.C. 3-MALE CONTACT	28480	1251-2675
A21	08015-66521	1	BOARD ASSEMBLY, SWITCH	28480	08015-66521
A21C1	0180-0097		CAPACITOR-FXD 47UF+-10% 35VDC TA	56289	150D476X9035S2
A21C2	0180-0137	2	CAPACITOR-FXD 100UF+-20% 10VDC TA	56289	150D107X0010R2
A21C3	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A21C4	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A21C5	0180-0097	2	CAPACITOR-FXD 47UF+-10% 35VDC TA	56289	150D476X9035S2
A21C6	0180-0137		CAPACITOR-FXD 100UF+-20% 10VDC TA	56289	150D107X0010R2
A21CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A21CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A21CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A21CR4	1910-0034		DIODE-GE 30V 80MA 8NS DO-7	28480	1910-0034
A21CR5	1910-0034		DIODE-GE 30V 80MA 8NS DO-7	28480	1910-0034
A21CR6	1910-0034		DIODE-GE 30V 80MA 8NS DO-7	28480	1910-0034
A21CR7	1910-0034		DIODE-GE 30V 80MA 8NS DO-7	28480	1910-0034
A21CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A21K1	0490-0730	1	RELAY-REED DPST-NO 18VDC	28480	0490-0730
A21L1	08015-86004	2	L/R ASSEMBLY, COMBINED	28480	08015-86004
A21L2	08015-86004		L/R ASSEMBLY, COMBINED	28480	08015-86004
A21Q1	1854-0329	2	TSTR:SI NPN	28480	1854-0329
A21Q5	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A21Q6	1854-0329		TSTR:SI NPN	28480	1854-0329
A21R1	2100-2795	4	R:VAR CERMET 470 OHM 20%	28480	2100-2795
A21R2	2100-2795		R:VAR CERMET 470 OHM 20%	28480	2100-2795
A21R3	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A21R4	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A21R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R6	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R7	2100-2795		R:VAR CERMET 470 OHM 20%	28480	2100-2795
A21R8	2100-2795		R:VAR CERMET 470 OHM 20%	28480	2100-2795
A21R9	0757-0457	1	RESISTOR 47.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4752-F
A21R10	0758-0024		RESISTOR 100 5% .25W F TC=0+-100	24546	C5-1/4-T0-101-J
A21R11	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R13	0757-0415		RESISTOR 475 1% .125W F TC=0+-100	24546	C4-1/8-T0-475R-F
A21R15	0757-0391	1	RESISTOR 39.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-39R2-F
A21R17	0757-0389	1	RESISTOR 33.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-33R2-F
A21R19	0760-0008	1	RESISTOR 470 5% 1W MO TC=0+-200	FR003	C32
A21R21	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A21R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A21R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Replaceable Parts – Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A21S1	08015-61903	1	SLIDE ASSEMBLY	28480	08015-61903
	08015-43101	1	GUIDE, SLIDE	28480	08015-43101
	5020-3440	6	SPRING:DETENT	28480	5020-3440
A21S2	08015-61902	3	SLIDE ASSEMBLY	28480	08015-61902
	5020-3440		SPRING:DETENT	28480	5020-3440
	08015-43103	1	GUIDE, SLIDE	28480	08015-43103
A21S3	08015-61901	1	SLIDE ASSEMBLY	28480	08015-61901
	5020-3440		SPRING:DETENT	28480	5020-3440
	08015-43104	1	GUIDE, SLIDE	28480	08015-43104
A21S4	3101-1313	1	SWITCH-SL DP3T-NS MINTR .5A 125VAC/DC PC	79727	G128S-0004
A21S5	5040-1110	1	SLIDE ASSEMBLY, P.C. SWITCH	28480	5040-1110
	5020-3440		SPRING:DETENT	28480	5020-3440
A21S6	08015-61902		SLIDE ASSEMBLY	28480	08015-61902
	5020-3440		SPRING:DETENT	28480	5020-3440
A21S7	3101-1596	6	SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21S8	08015-61904	1	SLIDE ASSEMBLY	28480	08015-61904
	5020-3440		SPRING:DETENT	28480	5020-3440
A21S9	08015-61902		SLIDE ASSEMBLY	28480	08015-61902
A21S9	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21S10	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21S11	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21S12	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21S13	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A21U1	1820-0054	1	IC SN74 00 N GATE	01295	SN7400N
A21W1	08015-61608	1	CABLE ASSEMBLY, SIGNAL OUTPUT	28480	08015-61608
A21X1	1251-1626	2	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A21X2	1251-1626		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A21X4	1200-0423	1	SOCKET-IC 16-CONT DIP-PKG DIP-SLDR-TERMS	28480	1200-0423
A21X5	1251-2026	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A21X7	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	71785	252-10-30-300
A21XU1	1200-0424	1	SOCKET:IC BLK 14 CONTACT	23880	CSA2900-148
A24	08015-66524	1	BOARD ASSEMBLY, POWER SUPPLY	28480	08015-66524
A24C1	0160-4212	18	CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C2	0160-3721	2	CAPACITOR-FXD .15UF +-10% 100WVDC MET	SW005	BGIPM 5150K
A24C3	0160-0596	1	CAPACITOR-FXD 1000PF +-10% 250WVDC MET	28480	0160-0596
A24C4	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A24C5	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C6	0180-1745	2	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A24C7	0180-1954	3	CAPACITOR-FXD 4.7UF+-5% 6VDC TA	56289	150D475X5006A2
A24C8	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C9	0160-3721		CAPACITOR-FXD .15UF +-10% 100WVDC MET	SW005	BGIPM 5150K
A24C10	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C11	0180-1745		CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A24C12	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C14	0160-2208	1	CAPACITOR-FXD 330PF +-5% 300WVDC MICA	28480	0160-2208
A24C15	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A24C16	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C17	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C18	0180-2352	2	CAPACITOR-FXD 6000UF+75-10% 15VDC AL	28480	0180-2352
A24C19	0180-2352		CAPACITOR-FXD 6000UF+75-10% 15VDC AL	28480	0180-2352
A24C20	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C21	0180-1954		CAPACITOR-FXD 4.7UF+-5% 6VDC TA	56289	150D475X5006A2
A24C22	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A24C23	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C24	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C25	0180-1954		CAPACITOR-FXD 4.7UF+-5% 6VDC TA	56289	150D475X5006A2
A24C26	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C27	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C28	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C29	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C30	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C31	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C32	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C33	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C34	0160-4212	2	CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C35	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C36	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212

Replaceable Parts — Standard Instruments

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24C37	0160-4212		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	28480	0160-4212
A24C40	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C42	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C43	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C44	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24C45	0160-4210		CAPACITOR-FXD .022UF +-20% 50WVDC POLYE	28480	0160-4210
A24CR1	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A24CR2	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR3	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR4	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR5	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR6	1902-3104		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A24CR7	1902-3104		DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A24CR8	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR9	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR10	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR11	1901-0460	1	DIODE- STABISTOR 15V 150MA DO-7	28480	1901-0460
A24CR13	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR14	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR15	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR17	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR18	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR19	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR21	1902-3214		DIODE-ZNR 16.2V 2% DO-7 PD=.4W TC=+.066%	04713	SZ 10939-243
A24CR22	1902-3214		DIODE-ZNR 16.2V 2% DO-7 PD=.4W TC=+.066%	04713	SZ 10939-243
A24CR23	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR24	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR25	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR26	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR28	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR29	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR30	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR31	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR32	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR33	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR34	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A24CR35	1901-0522	12	DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR36	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR37	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR38	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR39	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR40	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR41	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR42	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR43	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR44	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR45	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR46	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A24CR47	1902-3315	1	DIODE-ZNR 39.2V 2% DO-7 PD=.4W TC=+.081%	04713	SZ 10939-354
A24Q1	1854-0477	4	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q2	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A24Q3	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A24Q4	1853-0045	2	TRANSISTOR PNP 2N4036 SI TO-5 PD=1W	02735	2N4036
A24Q5	1853-0045		TRANSISTOR PNP 2N4036 SI TO-5 PD=1W	02735	2N4036
A24Q6	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A24Q7	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q8	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q9	1853-0281	1	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A24Q10	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A24Q11	1854-0392	1	TRANSISTOR NPN SI PD=310MW FT=50MHZ	28480	1854-0392
A24Q12	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A24Q13	1853-0086	1	TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A24R1	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A24R2	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A24R3	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A24R4	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A24R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A24R6	0757-0453	1	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3012-F
A24R7	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A24R8	0812-0019	3	RESISTOR .33 5% 3W PW TC=0+-90	07088	KM-300
A24R9	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4751-F
A24R10	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F

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Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24R11	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A24R12	2100-3207	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	73138	72-145-0
A24R13	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A24R14	0698-3498	1	RESISTOR 8.66K 1% .125W F TC=0+-100	16299	C4-1/8-T0-866R-F
A24R15	0698-6322	4	RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A24R16	0698-6343	4	RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A24R17	0696-7563	1	RESISTOR 13.3K .5% .125W F TC=0+-50	19701	MF4C1/8-T2-1332-D
A24R18	0698-6835	1	RESISTOR 3.16K .5% .125W F TC=0+-50	24546	NC4-1/8-T2-3161-D
A24R19	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R20	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R21	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A24R22	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R23	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A24R24	0812-0021	2	RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A24R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R26	0758-0017	2	RESISTOR 1.5K 5% .25W F TC=0+-100	24546	C5-1/4-T0-1501-J
A24R27	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R29	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R30	6698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A24R31	0698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A24R32	0812-0021		RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A24R33	0758-0016	2	RESISTOR 300 5% .25W F TC=0+-100	24546	C5-1/4-T0-301-J
A24R34	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R36	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R37	0812-0019		RESISTOR .33 5% 3W PW TC=0+-90	07088	KM-300
A24R38	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R39	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A24R40	0698-4366	1	RESISTOR 19.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-19R1-F
A24R42	0758-0017		RESISTOR 1.5K 5% .25W F TC=0+-100	24546	C5-1/4-T0-1501-J
A24R43	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R45	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R46	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A24R47	0698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A24R48	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A24R49	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R50	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A24R51	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A24R52	0812-0017	1	RESISTOR .25 5% 3W PW TC=0+-90	07088	KM-300
A24R53	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A24R54	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R56	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R57	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R58	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A24R59	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R60	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A24R61	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A24R62	0758-0016		RESISTOR 300 5% .25W F TC=0+-100	24546	C5-1/4-T0-301-J
A24R63	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R64	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A24R65	0812-0019		RESISTOR .33 5% 3W PW TC=0+-90	07088	KM-300
A24R66	0758-0067	1	RESISTOR 750 5% .25W F TC=0+-100	24546	C5-1/4-T0-751-J
A24R67	0698-3156	2	RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A24R68	0757-1094	1	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1471-F
A24R69	0757-0461		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A24R70	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R71	0698-3451	1	RESISTOR 133K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1333-F
A24R72	0698-3159		RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2612-F
A24R73	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A24R74	0757-0460	1	RESISTOR 61.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A24R75	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R76	0698-3154	1	RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A24R77	0757-0428		RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A24R78	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A24R79	0698-3453	1	RESISTOR 196K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1963-F
A24R80	0698-3160	2	RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
A24R81	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
A24R82	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A24R83	0698-3640	1	RESISTOR 1.8K 5% 2W MD TC=0+-200	16299	FP42-2-T00-1801-J
A24U1	1820-0439	1	IC UA 723C V RGLTR	07263	723PC
A24U2	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009
A24U3	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009
A24U4	1820-0216	1	IC UA 741 OP AMP	28480	1820-0216
A24U5	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009

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Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24U6	1820-0203		IC, AMPL. OPERATIONAL	15818	741CE009
A28	08015-66528	1	BOARD ASSEMBLY, RESISTOR	28480	08015-66528
A28C1	0180-0100	2	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A28C2	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A28R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R2	0757-1004	16	RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R3	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R4	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R5	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R6	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R7	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R8	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R9	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R10	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R11	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R12	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R13	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R14	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R15	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R16	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28R17	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A28X2	1251-0335	1	CONNECTOR-PC EDGE 24-CONT/ROW 2-ROWS	28480	1251-0335
A28X3	1251-3246	10	CONNECTOR 3-PIN F	27264	09-52-3030
A28X4	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X5	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X6	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X7	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X8	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X9	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X10	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X11	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A28X12	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030

Additional/Changed Replaceable Parts Option 001

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 001		
A11	08015-66511	1	BOARD ASSEMBLY, SWITCH (OPT ^01)	28480	08015-66511
A11C1	0180-0097	2	CAPACITOR-FXD 47UF+-10% 35VDC TA	56289	150D476X9035S2
A11C2	0180-0137	2	CAPACITOR-FXD 100UF+-20% 10VDC TA	56289	150D107X0010R2
A11C3	0180-0098	2	CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A11C4	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A11C5	0180-0097		CAPACITOR-FXD 47UF+-10% 35VDC TA	56289	150D476X9035S2
A11C6	0180-0137		CAPACITOR-FXD 100UF+-20% 10VDC TA	56289	150D107X0010R2
A11CR2	1901-0040	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A11MP23	08015-00205	1	PANEL, FRONT	28480	08015-00205
A11MP44	08015-04109	1	BOARD, BLIND	28480	08015-04109
A11Q6	1854-0329	1	TSTR:SI NPN	28480	1854-0329
A11R1	2100-2795	2	R:VAR CERMET 470 OHM 20%	28480	2100-2795
A11R2	2100-2795		R:VAR CERMET 470 OHM 20%	28480	2100-2795
A11R3	0757-0284	1	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A11R5	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R6	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R15	0757-0391	1	RESISTOR 39.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-39R2-F
A11R17	0757-0389	1	RESISTOR 33.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-33R2-F
A11R19	0760-0008	1	RESISTOR 470 5% 1W MO TC=0+-200	FR003	C32
A11R21	0757-0465	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A11R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A11S1	08015-61903	1	SLIDE ASSEMBLY	28480	08015-61903
	08015-43101	1	GUIDE, SLIDE	28480	08015-43101
	5020-3440	6	SPRING:DETENT	28480	5020-3440
A11S2	08015-61902	2	SLIDE ASSEMBLY	28480	08015-61902
	5020-3440		SPRING:DETENT	28480	5020-3440
	08015-43103	1	GUIDE, SLIDE	28480	08015-43103
A11S3	08015-61901	1	SLIDE ASSEMBLY	28480	08015-61901
	5020-3440		SPRING:DETENT	28480	5020-3440
	08015-43104	1	GUIDE, SLIDE	28480	08015-43104
A11S4	3101-1313	1	SWITCH-SL DP3T-NS MINTR .5A 125VAC/DC PC	79727	G128S-0004
A11S5	5040-1110	1	SLIDE ASSEMBLY, P.C. SWITCH	28480	5040-1110
	5020-3440		SPRING:DETENT	28480	5020-3440
A11S6	08015-61902		SLIDE ASSEMBLY	28480	08015-61902
	5020-3440		SPRING:DETENT	28480	5020-3440
A11S7	3101-1596	3	SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A11S8	08015-61904	1	SLIDE ASSEMBLY	28480	08015-61904
	5020-3440		SPRING:DETENT	28480	5020-3440
A11S12	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A11S13	3101-1596		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	28480	3101-1596
A11X1	1251-1626	2	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A11X2	1251-1626		CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A11X5	1251-2026	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	71785	252-18-30-300
A11X7	1251-2034	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	71785	252-10-30-300
A11X24	1200-0423	1	SOCKET-IC 16-CONT DIP-PKG DIP-SLDR-TERMS	28480	1200-0423
A38	08015-66538	1	BOARD/CABLE ASSEMBLY, RESISTOR	28480	08015-66538
A38	08015-66528	1	BOARD/CABLE ASSEMBLY, RESISTOR	28480	08015-66528
A38C1	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A38C2	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A38R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A38R10	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R11	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R12	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R13	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R14	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R15	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R16	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38R17	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A38X2	1251-0335	2	CONNECTOR-PC EDGE 24-CONT/ROW 2-ROWS	28480	1251-0335
A38X3	1251-3246	8	CONNECTOR 3-PIN F	27264	09-52-3030
A38X4	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X5	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X6	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X7	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X8	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X9	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
A38X10	1251-3246		CONNECTOR 3-PIN F	27264	09-52-3030
MP23	08015-00205		PANEL FRONT (OPT 001)	28480	08015-00205
MP44	08015-04109		BOARD BLIND	28480	08015-04109

Additional Replaceable Parts Option 002

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 002		
A6	08015-66506	1	BOARD ASSEMBLY, BURST	28480	08015-66506
A6C1	0160-0174	4	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A6C2	0160-2259	2	CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A6C3	0160-2259		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A6C4	0160-2930	8	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C5	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930.
A6C6	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C7	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C8	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C9	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C10	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C11	0160-2930		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0160-2930
A6C12	0180-0116	1	CAPACITOR-FXD 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A6C13	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A6C14	0141-0190	1	CAPACITOR-FXD 39PF +-5% 300WVDC MICA	72136	DM15E390J0300WV1CR
A6C15	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A6C16	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A6C17	0180-0106	1	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A6CR1	1901-0179	11	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR2	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR3	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR4	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR5	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR6	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR7	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR8	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR9	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR10	1901-0535	2	DIODE-SCHOTTKY	28480	1901-0535
A6CR11	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR12	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A6CR13	1902-0025	1	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A6CR14	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A6CR15	1901-0040	3	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A6MP3	1200-0474	1	SOCKET: ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A6Q1	1854-0019	5	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q2	1853-0357	3	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A6Q3	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A6Q4	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A6Q5	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q6	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6Q8	1854-0345	1	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A6Q9	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A6R1	0757-0394	2	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A6R2	0698-3242	1	RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A6R3	0757-0388	2	RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A6R4	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A6R5	0698-3442	2	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A6R6	0757-0417	2	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A6R7	0698-3442		RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A6R8	0757-0410	1	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A6R9	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A6R10	0757-0449	1	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A6R11	0757-0460	1	RESISTOR 90.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-90R9-F
A6R12	0698-3437	1	RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A6R13	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A6R14	0757-0407	2	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A6R15	0757-0280	2	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R16	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A6R17	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R18	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A6R19	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A6R20	0757-0407		RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A6R21	0757-0414	1	RESISTOR 432 1% .125W F TC=0+-100	24546	C4-1/8-T0-432R-F
A6R22	1810-0055	2	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A6R23	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A6R24	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A6R25	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F

Additional Replaceable Parts Option 002

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R26	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A6U1	1820-0070	4	IC SN74 30 N GATE	01295	SN7430N
A6U2	1820-0070		IC SN74 30 N GATE	01295	SN7430N
A6U3	1820-0174	6	IC SN74 04 N INV	01295	SN7404N
A6U4	1820-0174		IC SN74 04 N INV	01295	SN7404N
A6U5	1820-0282	4	IC SN74 86 N GATE	01295	SN7486N
A6U6	1820-0282		IC SN74 86 N GATE	01295	SN7486N
A6U7	1820-0282		IC SN74 86 N GATE	01295	SN7486N
A6U8	1820-0282		IC SN74 86 N GATE	01295	SN7486N
A6U9	1820-0070		IC SN74 30 N GATE	01295	SN7430N
A6U10	1820-0174		IC SN74 04 N INV	01295	SN7404N
A6U11	1820-0070		IC SN74 30 N GATE	01295	SN7430N
A6U12	1820-0328	1	IC SN74 02 N GATE	01295	SN7402N
A6U13	1820-0174		IC SN74 04 N INV	01295	SN7404N
A6U14	1820-0054	3	IC SN74 00 N GATE	01295	SN7400N
A6U15	1820-0546	3	IC SN74 192 N COUNTER	01295	SN74192N
A6U16	1820-0371	1	IC:TTL TRIPLE 3-INPT NAND GATE	01295	SN74H10N
A6U17	1820-0076	1	IC SN74 76 N FLIP-FLOP	01295	SN7476N
A6U18	1820-0629	1	IC SN74S 112 N FLIP-FLOP	01295	SN74S112N
A6U19	1820-0075	1	IC SN74 73 N FLIP-FLOP	01295	SN7473N
A6U20	1820-0054		IC SN74 00 N GATE	01295	SN7400N
A6U21	1820-0174		IC SN74 04 N INV	01295	SN7404N
A6U22	1820-0546		IC SN74 192 N COUNTER	01295	SN74192N
A6U23	1820-0174		IC SN74 04 N INV	01295	SN7404N
A6U24	1820-0546		IC SN74 192 N COUNTER	01295	SN74192N
A6U25	1820-0054		IC SN74 00 N GATE	01295	SN7400N
A6X1	1200-0423	1	SOCKET-IC 16-CONT DIP-PKG DIP-SLDR-TERMS	28480	1200-0423
A6X2	1251-3011	1	CONTACT,PC CONNECTOR,FEMALE, SGL	28480	1251-3011
A27	08015-66527	1	BOARD ASSEMBLY, THUMBWHEEL (OPT 002)	28480	08015-66527
A27	08015-66537		BOARD ASSEMBLY, THUMBWHEEL (OPT 002 + 003)	28480	08015-66537
A27CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A27CR2	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A27Q1	1854-0307	1	TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A27R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A27R2	0757-0450		RESTISTOR 22.1K 1% .125W F TC=0+-100		
A27W1	5081-1952	1	CABLE, AY RIBBON (OPT 002)	28480	5081-1952
A27W1	5081-1953		CABLE, AY RIBBON (OPT 002 + 003)	28480	5081-1953
A27X1	1251-0472	4	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	71785	252-06-30-300
A27X2	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	71785	252-06-30-300
A27X3	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	71785	252-06-30-300
A27X4	1251-0472		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	71785	252-06-30-300
MP23A	08015-00208	1	PANEL, FRONT (OPTION 002)	28480	08015-00208
MP23B	08015-00211	1	PANEL, FRONT (OPTION 002, OPT 005)	28480	08015-00211
S21	3100-0552	1	SWITCH, ROTARY 1 SECT. 8 POSITION	28480	3100-0552
S22	3101-0977	1	SWITCH-PB DPDT MOM .25A 30VAC	82389	976+GOLD PLATE

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 003		
A30	08015-66530	1	BOARD ASSEMBLY, DIGITAL CONTROL	28480	08015-66530
A30CR1	1901-0033	21	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR2	1901-0460	3	DIODE- STABISTOR 15V 150MA DO-7	28480	1901-0460
A30CR3	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR4	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR5	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR6	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR7	1901-0460		DIODE- STABISTOR 15V 150MA DO-7	28480	1901-0460
A30CR8	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR9	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR10	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR11	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR12	1901-0460		DIODE- STABISTOR 15V 150MA DO-7	28480	1901-0460
A30CR13	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR14	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR15	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR16	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR17	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR18	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR19	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR20	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR21	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR22	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR23	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR24	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A30CR25	1901-0159	1	DIODE-PWR RECT 400V 750MA DO-41	04713	SR1358-4
A30Q1	1854-0215	18	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q2	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q3	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q4	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q5	1853-0036	18	TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q6	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q7	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q8	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q9	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q10	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q11	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q12	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q13	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q14	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q15	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q16	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q17	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q18	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q19	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q20	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q21	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q22	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q23	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q24	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q25	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q26	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q27	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q28	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A30Q29	1854-0477	6	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A30Q30	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A30Q31	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q32	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q33	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q34	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q35	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q36	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q37	1853-0281	5	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A30Q38	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A30Q39	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A30Q40	1853-0036		TRANSISTOR, PNP SI PD=310MW FT=250MHZ	04713	SPS-3612
A30Q41	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A30Q42	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A30Q43	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A30Q44	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A30R1	0698-3156	12	RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R2	0698-3492	24	RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R3	0757-0280	45	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R6	0698-3155	6	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R7	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R8	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R9	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R11	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R12	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R13	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R15	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R16	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R17	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R18	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R19	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R20	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R21	0757-0439	6	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A30R22	0757-0447	3	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A30R23	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R25	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R26	0698-3558	11	RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R27	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R28	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R29	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R30	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R31	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R33	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R34	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R35	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R36	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R37	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R38	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R39	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R40	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R41	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A30R42	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A30R43	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R45	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R46	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R47	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R48	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R49	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R50	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R51	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R52	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R53	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R54	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R55	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R56	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R57	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R58	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R59	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R60	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R61	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A30R62	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A30R63	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R64	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R65	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R66	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R67	0698-4457	1	RESISTOR 576 1% .125W F TC=0+-100	24546	C4-1/8-T0-576R-F
A30R68	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R69	0698-3226	1	RESISTOR 6.49K 1% .125W F TC=0+-100	16299	C4-1/8-T0-6491-F
A30R70	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R71	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R72	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R73	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R74	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R75	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A30R76	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R77	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R78	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R79	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R80	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R81	0757-0421	3	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A30R82	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A30R83	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A30R84	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R85	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R86	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R87	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R88	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A30R89	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A30R90	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R91	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R92	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A30R93	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R94	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R95	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R96	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R97	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R98	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R99	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R100	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R101	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A30R102	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A30R103	0757-0283	3	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A30U1	1820-0328	4	IC SN74 02 N GATE	01295	SN7402N
A30U2	1820-0328		IC SN74 02 N GATE	01295	SN7402N
A30U3	1820-0328		IC SN74 02 N GATE	01295	SN7402N
A30U4	1820-0328		IC SN74 02 N GATE	01295	SN7402N
A31	08015-66531	1	BOARD ASSEMBLY, SWITCH	28480	08015-66531
A31K2	0490-1079	7	RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A31K3	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A31Q2	1854-0477		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	07263	2N2222A
A31Q3	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A31Q4	1853-0281		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A31R14	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A31R16	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A31R18	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A31X6	1251-1626	1	CONNECTOR-PC EDGE 12-CONT/ROW 2-ROWS	71785	252-12-30-300
A31XU3	1200-0424	1	SOCKET:IC BLK 14 CONTACT	23880	CSA2900-148
A33	08015-66533	1	BOARD ASSEMBLY, ANALOG	28480	08015-66533
A33C1	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A33C3	0160-3879	13	CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C4	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A33C7	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A33C8	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A33C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C15	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C18	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C21	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C22	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C26	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C27	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C28	0160-3745	4	CAPACITOR-FXD 470PF +-20% 50WVDC CER	28480	0160-3745
A33C29	0160-3745		CAPACITOR-FXD 470PF +-20% 50WVDC CER	28480	0160-3745
A33C30	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C31	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A33C33	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C34	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C37	0160-3879		CAPACITOR-FXD .01UF +-20% 100WVDC CER	28480	0160-3879
A33C38	0160-3745		CAPACITOR-FXD 470PF +-20% 50WVDC CER	28480	0160-3745
A33C39	0160-3745		CAPACITOR-FXD 470PF +-20% 50WVDC CER	28480	0160-3745
A33CR1	1902-3139	2	DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A33CR2	1901-0040	13	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR3	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR4	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR5	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A33CR6	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR9	1902-3139		DIODE-ZNR 8.25V 5% DO-7 PD=.4W TC=+.053%	04713	SZ 10939-158
A33CR10	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR12	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR13	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33CR15	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A33K1	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A33K2	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A33K3	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A33K4	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A33K5	0490-1079		RELAY-REED 1A .5A 100V CONT 5V-COIL	28480	0490-1079
A33Q1	1854-0071	6	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q4	1853-0020	5	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A33Q5	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A33Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A33Q9	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A33Q10	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A33Q11	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A33R1	0698-6361	1	RESISTOR 8K .1% .125W F TC=0+-25	24546	NE55
A33R2	0698-6360	1	RESISTOR 10K .1% .125W F TC=0+-25	24546	NE55
A33R3	0698-4442	5	RESISTOR 4.42K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4421-F
A33R4	0757-0442	19	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R5	2100-3351	2	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-501
A33R6	0757-0281	2	RESISTOR 2.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2741-F
A33R7	0698-4428	2	RESISTOR 1.69K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1691-F
A33R8	0698-3484	2	RESISTOR 6.65K 1% .125W F TC=0+-100	16299	C4-1/8-T0-6651-F
A33R9	0757-0465	6	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R10	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R11	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R12	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R13	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A33R14	0757-0433	2	RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A33R15	0757-0438	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A33R16	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A33R17	2100-3350	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-201
A33R18	0757-0405	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A33R19	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A33R20	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A33R21	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A33R22	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R23	2100-3207	2	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	73138	72-145-0
A33R24	0698-3540	2	RESISTOR 15.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1542-F
A33R25	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A33R26	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A33R27	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A33R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R29	0698-4508	2	RESISTOR 78.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7872-F
A33R30	0757-0220	1	RESISTOR 715 1% .5W F TC=0+-50	19701	MF7C1/2-T2-715R-F
A33R31	2100-3352	2	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-102
A33R32	0757-0410	1	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A33R33	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R34	2100-3207		RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	73138	72-145-0
A33R35	0698-3540		RESISTOR 15.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1542-F
A33R36	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A33R37	0757-0349	1	RESISTOR 22.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2262-F
A33R38	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A33R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R40	0698-4508		RESISTOR 78.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7872-F
A33R41	0757-0158	1	RESISTOR 619 1% .5W F TC=0+-100	19701	MF7C1/2-T0-619R-F
A33R42	2100-3352		RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-102
A33R43	0698-4421	1	RESISTOR 249 1% .125W F TC=0+-100	16299	C4-1/8-T0-249R-F
A33R44	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R45	2100-3351		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-501
A33R46	0757-0281		RESISTOR 2.74K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2741-F
A33R47	0698-4428		RESISTOR 1.69K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1691-F
A33R48	0698-3484		RESISTOR 6.65K 1% .125W F TC=0+-100	16299	C4-1/8-T0-6651-F
A33R49	0698-3136	4	RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A33R50	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A33R51	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A33R52	0698-3136		RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A33R53	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A33R54	0757-0433		RESISTOR 3.32K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3321-F
A33R55	0698-3512	1	RESISTOR 1.18K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1181-F
A33R56	0698-4392	4	RESISTOR 71.5 1% .125W F TC=0+-100	16299	C4-1/8-T0-71R5-F
A33R57	0757-0398	4	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A33R58	2100-3349	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-101
A33R59	0698-4392		RESISTOR 71.5 1% .125W F TC=0+-100	16299	C4-1/8-T0-71R5-F
A33R60	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A33R61	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A33R62	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A33R63	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R64	0698-0085	1	RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A33R65	0757-0441	5	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A33R66	2100-3273	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-202
A33R67	0698-3515	2	RESISTOR 5.9K 1% .125W F TC=0+-100	16299	C4-1/8-T0-5901-F
A33R68	0757-0434	1	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A33R69	0698-3160	1	RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
A33R70	0698-3493	2	RESISTOR 4.12K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4121-F
A33R71	0698-3515		RESISTOR 5.9K 1% .125W F TC=0+-100	16299	C4-1/8-T0-5901-F
A33R72	0698-3493		RESISTOR 4.12K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4121-F
A33R73	0698-4469	1	RESISTOR 1.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1151-F
A33R74	0698-4392		RESISTOR 71.5 1% .125W F TC=0+-100	16299	C4-1/8-T0-71R5-F
A33R75	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A33R76	2100-3349		RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-101
A33R77	0698-4392		RESISTOR 71.5 1% .125W F TC=0+-100	16299	C4-1/8-T0-71R5-F
A33R78	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A33R79	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A33R80	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A33R81	0757-0200	4	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A33R82	0698-4442		RESISTOR 4.42K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4421-F
A33R83	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A33R84	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A33R85	0698-4442		RESISTOR 4.42K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4421-F
A33R86	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A33R87	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R88	0757-0449	6	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R89	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R90	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R91	0698-4490	2	RESISTOR 29.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2942-F
A33R92	0698-4205	2	RESISTOR 21K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2102-F
A33R93	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R94	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R95	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R96	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R97	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R98	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R99	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A33R100	0698-4442		RESISTOR 4.42K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4421-F
A33R101	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A33R102	0757-0200		RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A33R103	0698-4442		RESISTOR 4.42K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4421-F
A33R104	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A33R105	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R106	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R107	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R108	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R109	0698-4490		RESISTOR 29.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2942-F
A33R110	0698-4205		RESISTOR 21K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2102-F
A33R111	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R112	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A33R113	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R114	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A33R115	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33R116	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A33U1	1826-0043	1	IC LM 307 OP AMP	27014	LM307H
A33U2	1826-0111	8	IC MC 1458 OP AMP	04713	MC1458G
A33U3	1826-0161	1	IC LM 324 OP AMP	27014	LM324N
A33U4	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U5	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U6	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U7	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U8	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U9	1826-0111		IC MC 1458 OP AMP	04713	MC1458G
A33U10	1826-0111		IC MC 1458 OP AMP	04713	MC1458G

Additional Replaceable Parts Option 003

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP50	5040-0170	1	GUIDE:PLUG-IN PC BOARD	28480	5040-0170
W15	08015-61612	1	CABLE ASSEMBLY, REMOTE CONTROL	28480	08015-61612
W15J8	1251-0233	2	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	251-22-30-261
W15J10	1251-0233		CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	71785	251-22-30-261
W15J11	1251-0087	1	CONNECTOR 50-PIN F MICRO RIBBON	71785	57-40500-375
W15S1	3101-0070	2	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	79727	GF-126-0000
W15S2	3101-0070		SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	79727	GF-126-0000

Additional Replaceable Parts Option 004

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 004		
A25	08015-66525	1	BOARD ASSEMBLY, INTEGRATOR	28480	08015-66525
A25	08015-66505	1	BOARD ASSEMBLY, INTEGRATOR	28480	08015-66505
A25C1	0180-0098	3	CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A25C2	0160-3724	2	CAPACITOR-FXD .47UF +-10% 400WVDC MET	28480	0160-3724
A25C3	0160-4209	11	CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C4	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A25C5	0160-3724		CAPACITOR-FXD .47UF +-10% 400WVDC MET	28480	0160-3724
A25C6	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C7	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C8	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C11	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C12	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C13	0160-0174	18	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C14	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C15	0160-2139	2	CAPACITOR-FXD 220PF +80-20% 1000WVDC CER	28480	0160-2139
A25C16	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C17	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C18	0160-2139		CAPACITOR-FXD 220PF +80-20% 1000WVDC CER	28480	0160-2139
A25C19	0160-0600	1	CAPACITOR-FXD 3900PF +-10% 250WVDC MET	28480	0160-0600
A25C20	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C21	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C22	0160-4041	1	CAPACITOR-FXD .39UF +-10% 400WVDC MET	28480	0160-4041
A25C23	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C24	0180-0374	1	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A25C25	0180-1779	1	CAPACITOR-FXD 18UF+-10% 35VDC TA	56289	150D186X9035R2
A25C27	0180-0098		CAPACITOR-FXD 100UF+-20% 20VDC TA	56289	150D107X0020S2
A25C28	0160-2204	1	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	93790	RDM15F101J3C
A25C29	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C30	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A25C31	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C32	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C35	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C36	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C37	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C38	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C39	0180-0106	2	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A25C40	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C41	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C42	0180-0106		CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A25C43	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C45	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A25C46	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C100	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C101	0160-4209		CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	28480	0160-4209
A25C102	0180-0228	1	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A25CR1	1902-3105	4	DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A25CR2	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A25CR3	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A25CR4	1902-3105		DIODE-ZNR 5.62V 2% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-111
A25CR5	1901-0533	4	DIODE-SCHOTTKY	28480	1901-0533
A25CR6	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A25CR7	1901-0040	8	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR8	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR9	1901-0179	20	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR10	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR11	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR12	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR13	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR14	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR15	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR16	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR17	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR18	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR19	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR20	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A25CR21	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR22	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR23	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A25CR24	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A25CR25	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A25CR26	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179

Additional Replaceable Parts Option 004

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A25L1	9170-0029	2	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A25L2	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A25Q1	1854-0260	2	TRANSISTOR NPN 2N3227 SI TO-18 PD=360MW	04713	2N3227
A25Q2	1854-0260		TRANSISTOR NPN 2N3227 SI TO-18 PD=360MW	04713	2N3227
A25Q3	1853-0012	1	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A25Q4	1853-0357	6	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25Q5	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25Q6	1854-0274	2	TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A25Q7	1854-0960	2	TRANSISTOR	28480	1854-0960
A25Q8	1854-0960		TRANSISTOR	28480	1854-0960
A25Q9	1853-0090	3	TSTR:SI PNP	28480	1853-0090
A25Q10	1854-0307	2	TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A25Q11	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A25Q12	1853-0090		TSTR:SI PNP	28480	1853-0090
A25Q13	1854-0274		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A25Q14	1853-0090		TSTR:SI PNP	28480	1853-0090
A25Q15	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25Q16	1854-0630	2	TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A25Q17	5080-1083	2	TRANSISTOR, MATCHED PAIR	28480	5080-1083
A25Q18	5080-1083		TRANSISTOR, MATCHED PAIR	28480	5080-1083
A25Q19	1854-0630		TRANSISTOR NPN SI TO-52 PD=360MW	04713	SS2077
A25Q20	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25Q21	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25Q22	1853-0357		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0357
A25R1	0757-0384	9	RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R3	0757-0284	1	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A25R4	0757-0276	3	RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A25R5	0757-0392	6	RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R6	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A25R7	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R8	0758-0127	1	RESISTOR 430 5% .25W F TC=0+-100	24546	C5-1/4-T0-431-J
A25R9	0698-3242	3	RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R10	0757-0401	5	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A25R11	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R12	0757-0405	2	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A25R13	0757-0405		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A25R14	0757-0280	6	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R15	0757-0422	2	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A25R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R17	0757-0388	6	RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R18	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A25R19	0757-0467	2	RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A25R20	0758-0062	2	RESISTOR 200 5% .25W F TC=0+-100	24546	C5-1/4-T0-201-J
A25R21	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R23	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R24	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R25	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A25R26	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R27	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R28	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A25R29	0757-0467		RESISTOR 121K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A25R30	0758-0062		RESISTOR 200 5% .25W F TC=0+-100	24546	C5-1/4-T0-201-J
A25R31	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A25R33	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R34	0698-3496	4	RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R35	0757-0449	2	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A25R36	2100-2800	2	R:VAR CERMET 1000 OHM 20%	28480	2100-2800
A25R37	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R38	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R39	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R40	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A25R41	2100-2800		R:VAR CERMET 1000 OHM 20%	28480	2100-2800
A25R42	0698-3496		RESISTOR 3.57K 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R43	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A25R44	0757-0459	4	RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A25R45	0757-0444	4	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A25R46	0758-0013	3	RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A25R47	0757-0442	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A25R48	0757-0459		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A25R49	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A25R50	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A25R51	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F

Additional Replaceable Parts Option 004

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A25R52	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A25R53	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A25R54	0758-0013		RESISTOR 120 5% .25W F TC=0+-100	24546	C5-1/4-T0-121-J
A25R55	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A25R56	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A25R57	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A25R58	0757-0408	1	RESISTOR 243 1% .125W F TC=0+-100	24546	C4-1/8-T0-243R-F
A25R59	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A25R60	0757-0276		RESISTOR 61.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-6192-F
A25R61	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3831-F
A25R62	0698-3155	1	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A25R63	0757-0411	1	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A25R64	0758-0024	1	RESISTOR 100 5% .25W F TC=0+-100	24546	C5-1/4-T0-101-J
A25R65	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R66	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R67	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R68	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R69	0757-0421	2	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A25R70	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R71	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R72	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R74	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A25R75	0757-0392		RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A25R76	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R77	0757-0394	6	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25R79	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A25R80	2100-2739	2	R:VAR 220 OHM	28480	2100-2739
A25R81	0757-0388		RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A25R82	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25R84	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A25R85	2100-2739		R:VAR 220 OHM	28480	2100-2739
A25R88	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25R89	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25R90	0758-0068	1	RESISTOR 910 5% .25W F TC=0+-100	24546	C5-1/4-T0-911-J
A25R91	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A25R101	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25R102	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A25S41	3101-0569	2	SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	GM032	C42315-A60-A2
A25S42	3101-0569		SWITCH-SL DPDT-NS MINTR 1A 125VAC PC	GM032	C42315-A60-A2
A25X12	1251-2675	2	CONNECTOR, P.C. 3-MALE CONTACT	28480	1251-2675
A25X13	1251-2675		CONNECTOR, P.C. 3-MALE CONTACT	28480	1251-2675
A32	08015-66532	1	BOARD, DIRECT OUTPUT ACC	28480	08015-66532
A32C1	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A32C3	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A32CR1	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR2	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR3	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR4	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR5	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR6	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR7	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR8	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR9	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32CR10	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A32J1	1250-1163	2	CONNECTOR-RF BNC FEM SGL HOLE RR	28480	1250-1163
A32J2	1250-1163		CONNECTOR-RF BNC FEM SGL HOLE RR	28480	1250-1163
A32Q1	1854-0354	2	TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A32Q2	1854-0354		TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A32R1	0698-4458	2	RESISTOR 590 1% .125W F TC=0+-100	24546	C4-1/8-T0-590R-F
A32R2	0698-3441	4	RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A32R3	0698-3439	6	RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R4	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R5	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R6	0698-4014	1	RESISTOR 787 1% .125W F TC=0+-100	16299	C4-1/8-T0-787R-F
A32R7	0698-3447	1	RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422R-F
A32R8	0698-3443	1	RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-T0-287R-F
A32R9	2100-3349	2	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-101
A32R10	0698-3437	2	RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F

Additional Replaceable Parts Option 004

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A32R11	0698-4458		RESISTOR 590 1% .125W F TC=0+-100	24546	C4-1/8-T0-590R-F
A32R12	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R13	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R14	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A32R15	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A32R16	2100-3349		RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	32997	3386X-Y46-101
A32R17	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-T0-133R-F
A32R18	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A32R19	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
W41	08015-61613	2	CABLE ASSEMBLY, SIGNAL INPUT	28480	08015-61613
W42	08015-61613		CABLE ASSEMBLY, SIGNAL INPUT	28480	08015-61613

Additional Replaceable Parts Option 005

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 005		
A10	08015-66510	1	BOARD ASSEMBLY, TTL OUTPUT	28480	08015-66510
A10C1	0160-0174	3	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A10C2	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A10C3	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	28480	0160-0174
A10CR1	1902-0049	1	DIODE-ZNR 6.19V 5% DO-7 PD=.4W TC=+.022%	04713	SZ 10939-122
A10CR2	1902-0064	1	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A10CR3	1901-0533	2	DIODE-SCHOTTKY	28480	1901-0533
A10CR4	1901-0533		DIODE-SCHOTTKY	28480	1901-0533
A10CR5	1901-0040	1	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A10K1	0490-0617	1	RELAY-REED 1C 250MA 28VDC 5VDC-COIL	28480	0490-0617
A10Q1	1854-0354	2	TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A10Q2	1854-0354		TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A10Q3	1854-0637	1	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	28480	1854-0637
A10Q4	1853-0315	2	TRANSISTOR PNP SI TO-39 PD=1W FT=1GHZ	28480	1853-0315
A10Q5	1853-0315		TRANSISTOR PNP SI TO-39 PD=1W FT=1GHZ	28480	1853-0315
A10R1	0757-0457	1	RESISTOR 200 1% .125W F TC=0+-100	24546	C4-1/8-T0-201-F
A10R2	0757-0398	2	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R3	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A10R4	0698-4411	2	RESISTOR 140 1% .125W F TC=0+-100	24546	C4-1/8-T0-140R-F
A10R5	0698-4411		RESISTOR 140 1% .125W F TC=0+-100	24546	C4-1/8-T0-140R-F
A10R6	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A10R7	0757-0283	1	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A10R8	0757-0724	1	RESISTOR 392 1% .25W F TC=0+-100	24546	C5-1/4-T0-392R-F
A10R9	0757-0796	1	RESISTOR 82.5 1% .5W F TC=0+-100	19701	MF7C-1/2-T0-82R5-F
A10R10	0757-0590	2	RESISTOR 30.1 1% .25W F TC=0+-100	24546	C5-1/4-T0-30R1-F
A10R11	0757-0500		RESISTOR 30.1 1% .25W F TC=0+-100	24546	C5-1/4-T0-30R1-F
A10R12	0698-5965	2	RESISTOR 50 1% .5W F TC=0+-100	24546	NA6
A10R13	0698-5965		RESISTOR 50 1% .5W F TC=0+-100	24546	NA6
J51	1250-0118	1	CONNECTOR-RF BNC FEM SGL HOLE FR	9D949	31-2221-1022
MP23A	08015-00210	1	PANEL, FRONT (OPT 005)	28480	08015-00210
MP23B	08015-00211	1	PANEL, FRONT (OPT 002 AND 005)	28480	08015-00211

Additional Replaceable Parts Option 006

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
J51	1250-0118	2	CONNECTOR-RF BNC FEM SGL HOLE FR	9D949	31-2221-1022
J52	1250-0118		CONNECTOR-RF BNC FEM SGL HOLE FR	9D949	31-2221-1022
R51	0698-4473	2	RESISTOR 8.06K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8061-F
R52	0698-4473		RESISTOR 8.06K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8061-F
R53	0698-4434	4	RESISTOR 2.32K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2321-F
R54	0698-4434		RESISTOR 2.32K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2321-F
R55	0698-4434		RESISTOR 2.32K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2321-F
R56	0698-4434		RESISTOR 2.32K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2321-F
S51	3101-0070	2	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	79727	GF-126-0000
S52	3101-0070		SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	79727	GF-126-0000

7–1–1 OPTION 001 – SINGLE CHANNEL VERSION

7–1–2 Specifications and General

7–1–3 The 8015A Option 001 is an 8015A less channel A; the modes (with respect to Channel A) A + B, A SEP B DEL/associated with the standard version are consequently not available. Other specifications are identical except:

Power: 140VA
Weight: net 10.5kg (23.3lbs), shipping 11.5kg (25.5lbs).

7–1–4 Differences in assemblies and parts are indicated in fig. 6–2, the Option 001 Part List (Section 6) and Service Sheets 4, 5, 6a and 7 (Section 9). Option 001 precludes Option 003, 004, 005 and 006.

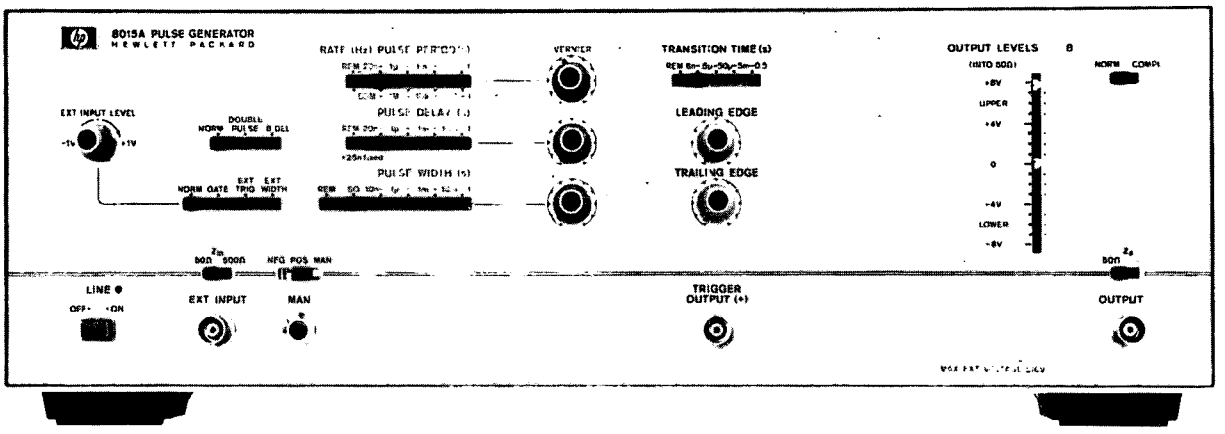
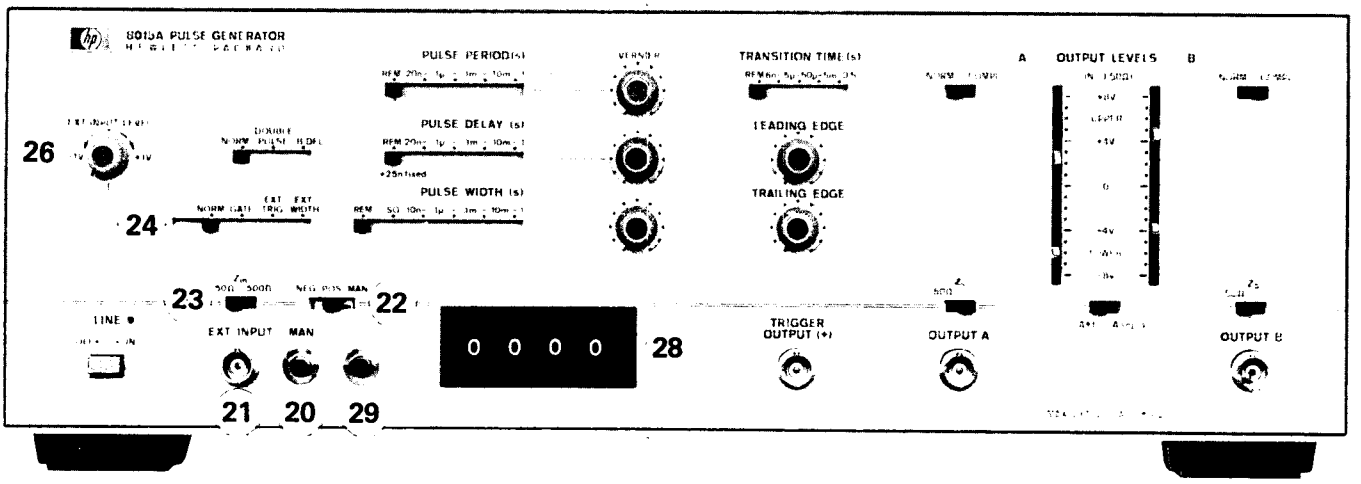


Figure 7–1–1. 8015A Option 001



Controls in standard instruments which affect burst:

20 MAN push-button: for generating external trigger signals when in the GATE, EXT TRIG and EXT WIDTH modes, and to initate a burst in the BURST mode. Effective only when NEG–POS–MAN switch 22 is in the MAN position.

21 EXT INPUT connector: DC coupled input to which external triggering/gating burst-initiating signals are applied. Input impedance either 50Ω or 500Ω with corresponding maximum input levels of ± 7V or ± 25V respectively.

22 NEG–POS–MAN switch: for selecting the polarity/slope and/or source of external trigger signals. In the POS (slope/polarity) and NEG (slope/polarity) positions, signals are applied to EXT INPUT connector 21.

23 Z_{IN} 50Ω/500Ω switch: selects input impedance of EXT INPUT.

24 BURST NORM, GATE, EXT TRIG and EXT WIDTH switch: for selecting mode of operation of 8015A.

26 EXT INPUT LEVEL control: defines the threshold level of the external input over a range of +1V to −1V (Z_{IN}–50Ω) or +10V to −10V (Z_{IN}–500Ω).

Controls of Option 002 only:

28 NUMBER OF PULSES: Thumbwheel switches on which the required number of pulses in a burst is programmed. See operation instructions.

29 SINGLE PULSE: Pushbutton switch for generating single pulse while still in BURST mode.

Figure 7–2–1. 8015A Option 002

7–2–1 OPTION 002 – PULSE BURST

7–2–2 Specifications and General

7–2–3 The 8015A Option 002 is an 8015A plus a pulse burst capability. When the burst mode is selected, a preset number of pulses is generated on receipt of an external trigger pulse or manual trigger. The number of pulses (between 1 and 9999) is set on a 4-digit thumbwheel switch on the front panel. An additional single pulse can be generated manually. Specifications are identical to the standard version except:

Burst Mode
Preselected number of pulses (1 to 9999) generated on receipt of a trigger signal.

Trigger source: external or manual, min width ⩾ 20ns.
Repetition rate: 0 to 40MHz.
Minimum time between bursts: 200ns.
Minimum time between trigger input and first pulse: 100ns.

Burst Mode, Single Pulse.
Single pulse generated on manual command, irrespective of selected number of pulses.

General
Power: 200 VA
Weight: net 11.5kg (25.2lbs), shipping 12.5kg (27.4lbs).

7–2–4 Operating Instructions

7–2–5 This is similar to the NORM mode in that the pulse parameters (rate, width, etc.) are set on the front panel controls, however, the required NUMBER OF PULSES is set on the thumbwheel switches (**28**). A burst can be started externally or manually.

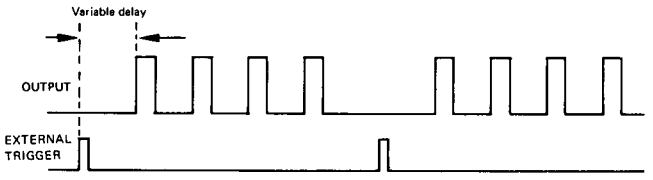


Figure 7–2–2. Burst Repetition

Figure 7–2–3. Manual Initiation of Burst

7–2–6 BURST can be selected in conjunction with NORM, DOUBLE PULSE, B DEL or Square Wave (SQ). When selected with NORM (i. e. NORM-DOUBLE PULSE – B DEL switch 25 set to NORM) the burst will cease after the preset number of pulses have been generated. In conjunction with DOUBLE PULSE twice the preset number of pulses will be generated. In conjunction with B DEL, the burst from OUTPUT A (**17**) will start immediately after the trigger input and the burst from OUTPUT B will start after the time set on the DELAY controls (3 & 4). At the end of a burst, pulses can be added individually by pressing the SINGLE PULSE button.

7–2–7 If burst is selected in conjunction with square wave, the output frequency will be half that set on the RATE controls and only half the number of pulses set on the thumbwheel switches will be generated. Also, if the output level at the end of the burst is required to be the same as it was at the beginning, then an even number must be set on the thumbwheel switches. To set a desired start level, switch the NEG–POS–MAN switch (**22**) to MAN, the Mode switch (**24**) to NORM and PULSE WIDTH switch (**5**) to SQ. Press the MAN button to set either an upper or lower level than switch back to BURST mode and the desired trigger input condition.

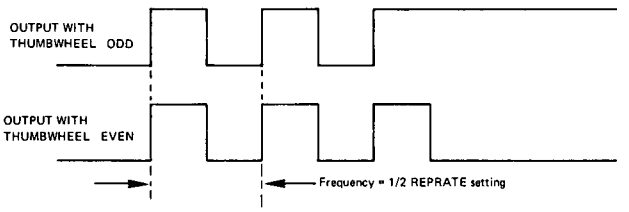


Figure 7–2–4. Burst with Square Wave

7–2–8 Principles of Operation (Service Sheet 8)

7–2–9 Burst generation is controlled by a counter which is loaded from the thumbwheel switches. On receipt of the externally- or manually-initiated 'start burst' signal, the rep rate generator is enabled and the burst commences. Each pulse decrements the counter by one. When the counter is empty, a zero-state detector disables the rep rate generator – thus terminating the burst – and initiates the reloading of the counter in readiness for the next 'start burst' signal.

7–2–10 Initial Conditions

7–2–11 To illustrate how the burst circuit operates, assume that burst mode is selected and that the 8015A

has just been switched on; the start circuit will then provide a pulse which clears U19, consequently:

a low is applied to U12 pin 8 which enables counter reloading,

Q2 emitter goes high, causing Q1 to conduct. This disables the rep rate generator.

7–2–12 Loading the Burst Counter

7–2–13 When the counter contents are not equal to the thumbwheel switch outputs, the comparator outputs a low at U12 pin 13. This means that, with U12 pin 8 low:

units data from the thumbwheel switch is applied as clear (or set) to the flip-flops U17/18 (these form a high-speed counter with feedback to force a decade count),

U10 pin 4 goes low so that the BCD counters U15, 22, 24 accept the data applied from the 10's, 100's, 1000's decades of the thumbwheel switch.

Consequently, the counter assumes the value set on the thumbwheel switch.

7–2–14 Start Burst

7–2–15 On receipt of the start burst signal, U19 is clocked causing:

a high to be applied to U12 pin 8 which prevents the counter from reloading. The counter consequently decrements due to the rep rate signal applied via Q4, 5 and 8,

a low is applied to Q2 emitter via CR12 so that the hold-off signal is terminated (Q1 cuts off, rep rate generator runs).

7–2–16 Zero Detection

7–2–17 The zero-state detector must be capable of:

fast response – so that the rep rate generator is stopped as soon as the last pulse of the burst has been generated,

holding off the rep rate generator until the next burst is required,

initiating counter reload.

To do this, fast and slow channels are used.

7–2–18 The fast zero detector generates the leading edge of the hold-off signal (when the counter is zero, a positive level exists on the cathodes of diodes cr2 to 10, consequently, a positive voltage exists at Q3 emitter and Q1 is turned on). CR10, carrying the first units (fastet-changing) bit is a hot-carrier diode for fast response.

7–2–19 Q1 is held conducting by the action of U9 and U11 which, in clearing U19, provides a positive level at Q2 emitter. At the same time, a low is applied to U12 pin 8 to enable counter reloading.

7–2–20 Single Pulse

7–2–21 The SINGLE PULSE pushbutton removes the ground connection from the thumbwheel switch and causes A27Q1 to current-sink the first bit of the thumbwheel switch. This results in a 1 being loaded into the counter.

7–2–22 The SINGLE PULSE pushbutton also initiates a start burst signal (see Q6 on Service Sheet 6) and a burst of one pulse is consequently generated.

7–2–23 Normal Mode

7–2–24 If burst operation is not required, the burst enable line goes open. This means:

Q9 goes open and the rep rate signal to the counter is disabled,

U13 pin 2 goes low which inhibits the action of the fast zero detector (Q3-side of OR-gate) and, via CR11, the Q2-side of the OR-gate. The hold-off signal is, therefore, inhibited,

Q7 goes open, disabling the start-burst signal to the clock input of U19.

7–2–25 Replaceable Parts and Service Information

7–2–26 Refer to the Option 002 Replaceable Parts list (Section 6), fig. 6–3 Service Sheet 8 and table 7–2–1.

PERFORMANCE CHECK

Table 7–2–1. Burst Function (Option 002)

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	20n–1μ
VERNIER **6**	MID POSITION
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL CH A LOWER LEVEL > **11**	MIN
CH B UPPER LEVEL CH B LOWER LEVEL > **12**	MIN
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	BURST
MODE **25**	NORM
EXT INPUT LEVEL **26** NEG POS MAN	– MAN

Test Equipment:

1. Set number of pulses to 8015 or any number wanted.
2. Press MAN button.
3. Counter should show the same number as set on the burst selector.

SPECIFICATION

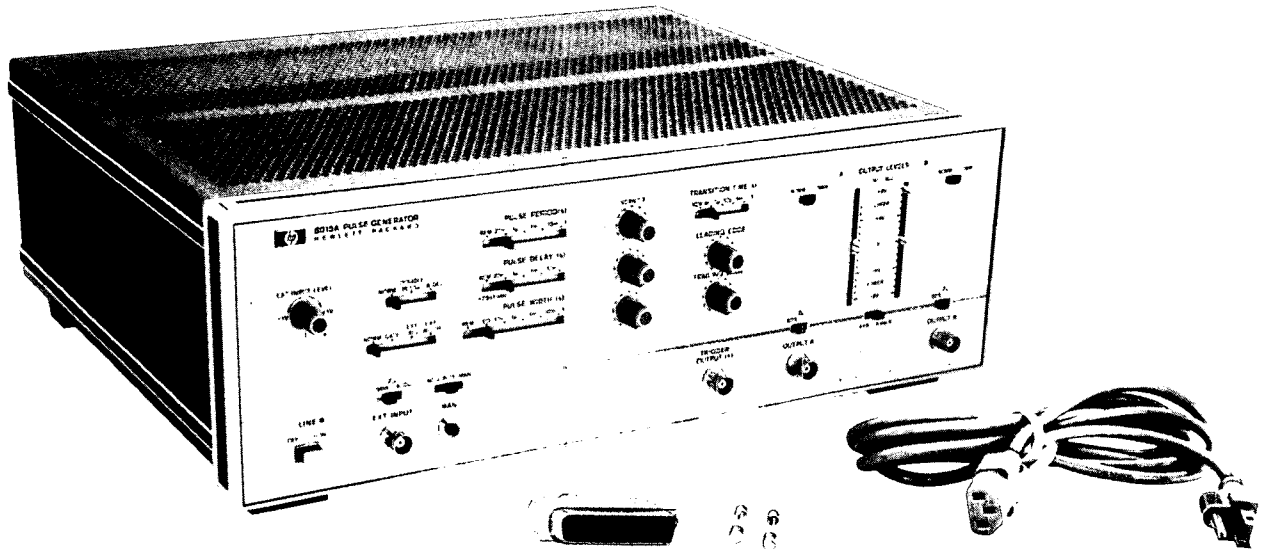
Option 002 Pulse Burst .....
Number of pulse 1–9999
1 Hz – 40 MHz minimum time between bursts 200ns

DESCRIPTION

Check pulse burst.

EQUIPMENT

Counter	⩾ 50 MHz Frequency



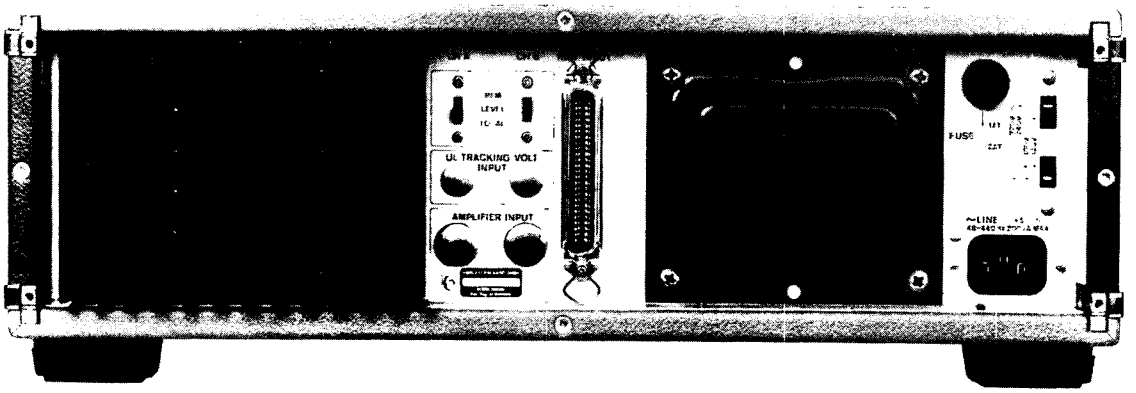


Figure 7–3–1 8015A Option 003

7–3–1 OPTION 003 – REMOTE CONTROL

7–3–2 Specifications and General

7–3–3 Option 003 permits pulse period, delay, width, transition times, output levels and (when combined with option 002) burst length to be remote controlled. Range switching and burst length selection are TTL compatible. Verniers and levels are analog-controlled. Control of the various parameters is independente and any desired mix of manual and remote operation can be achieved. See specifications table 7–3–1.

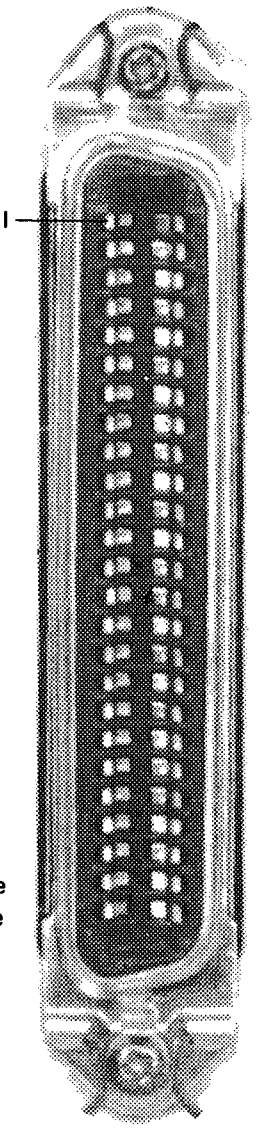
7–3–4 As shown in fig. 6–4, the option consists of the following additional assemblies:

Board assembly analog A33
Board assembly digital A30
Cable assembly remote control W15 (includes rear panel REMOTE connector W15 X 11 and LEVEL – LOCAL/REM switches W15 S1/2)

and board assembly switch A31 instead of A21. If option 002 is fitted as well, cable assembly A27W1 (fig. 6–5) has a different part number, see option 002 parts list.

7–3–5 The option is factory installed and is delivered with accessory plug, part number 1251–0086 for the remote control socket on the rear panel (see fig. 7–3–1).

7–3–6 This option precludes Options 001 and 006.



1	Rep. Rate Range 3		
2	Rep. Rate Range 2		
3	Rep. Rate Range 1		
4	Delay Range 3		
5	Delay Range 2		
6	Delay Range 1		
7	Width Range 3		
8	Width Range 2		
9	Width Range 1		
10	Square W.		
11	Trans. T. Range 3		
12	Trans. T. Range 2		
13	Trans. T. Range 1		
14	Ground (OV)		
15	Ground (OV)		
16	Ground (OV)		
17	Vernier	Rep. Rate	
18		Delay	
19		Width	
20		Leading Edge	
21		Trailing Edge	
22	$V_{UL}A$		
23	$V_{LL}A$		
24	$V_{UL}B$		
25	$V_{LL}B$		
26	1 Burst 10^0		
27	2 Burst 10^0		
28	4 Burst 10^0		
29	8 Burst 10^0		
30	1 Burst 10^1		
31	2 Burst 10^1		
32	4 Burst 10^1		
33	8 Burst 10^1		
34	1 Burst 10^2		
35	2 Burst 10^2		
36	4 Burst 10^2		
37	8 Burst 10^2		
38	1 Burst 10^3		
39	2 Burst 10^3		
40	4 Burst 10^3		
41	8 Burst 10^3		
42	Ground (OV)		
43	Ground (OV)		
44	–		
45	–		
46	–		
47	–		
48	–		
49	–		
50	–		

Figure 7–3–2. Remote Control Connections

Table 7–3–1. Remote control specifications for option 003

REP RATE: 40 MHz max.
PULSE WIDTH: 13ns min

TIMING RANGES

Period, width, delay and transition time ranges are independently programmable by separate control lines. Ranges 1, 2, 3 of a function (1 is slowest) are selected by contact closure to ground of the corresponding line. The fastest range is automatically selected when the lines for ranges 1, 2 and 3 are all open. Contact closure on more than one line is illegal. When the square wave line is grounded, square wave is selected and the width and delay settings are automatically inhibited.

Levels: TTL compatible,

Range selected, contact closure
Range not selected, contact open
Open control line voltage +5V.

TIMING VERNIERS

Period, width delay, leading edge and trailing edge are independently controllable by separate control lines connected to a voltage source (open circuit voltage 10V ± 100mV, source resistance = 10 K ± 200Ω).

Continuous vernier adjustment from minimum (T min) to maximum (T max) can be simulated in one of three modes:

	T_{max}	T_{min}	**Absolute Max input excursion**
current sink	−1 mA	−0.1 mA	0 to −1.1 mA
voltage sink	0V	9V	0 to +10V
resistor	0Ω	90kΩ	—

Refer to figures 7–3–3 to –10 for characteristics. Open line is equivalent to a minimum time slightly below that achieved by setting the corresponding vernier control fully counter clockwise.

Output levels

Lower and upper levels of each channel are independently controllable (voltage sink mode) by separate control lines each connected to a buffer amplifier (R_{in} = 10 K ± 200Ω).

	Control voltage	Pulse generator output voltage (50Ω into 50Ω)
Upper level	+ 8V	+ 8V (max +)
	0	0
	− 7V	− 7V (max −)
Lower level	+ 7V	+ 7V (max +)
	0	0
	− 8V	− 8V (max −)

Conditions: upper level − lower level ⩾ 1V ⩽ 8V (Differences smaller than 1V or greater than 8V are invalid. Due to internal clamping, upper level takes precedence and the lower level limits at 1V/8V below upper level.) Open line puts upper level at zero volts and lower level to −1V.

MANUAL REMOTE CONTROL OPERATION

Programmable operation can be selected for each function independently by setting the desired range switch (or, in the case of the output levels, the appropriate rear panel LEVEL switch) to REM. When combined with option 002 (burst), remote operation is enabled by setting the burst length switch to zero.

GENERAL

Power: 200 VA
Weight: net 11.5kg (25.3lbs), shipping 12.5kg (27.4lbs).

7–3–7 Operating Instructions

7–3–8 The pulse parameters can be selected independently for remote control by setting the corresponding range switch to REM or, for output level, by setting the appropriate LEVEL switch (rear panel) to REM. If option 002 (burst) is fitted, the burst length switch must be set to zero to obtain remote control; conversely, the control lines for burst length must be open if the burst length is to be set manually. When burst is remote-controlled, the single pulse pushbutton should not be used.

7–3–9 Remote control signal levels are defined in the specifications and the following curves show typical remote control/output characteristics of the verniers.

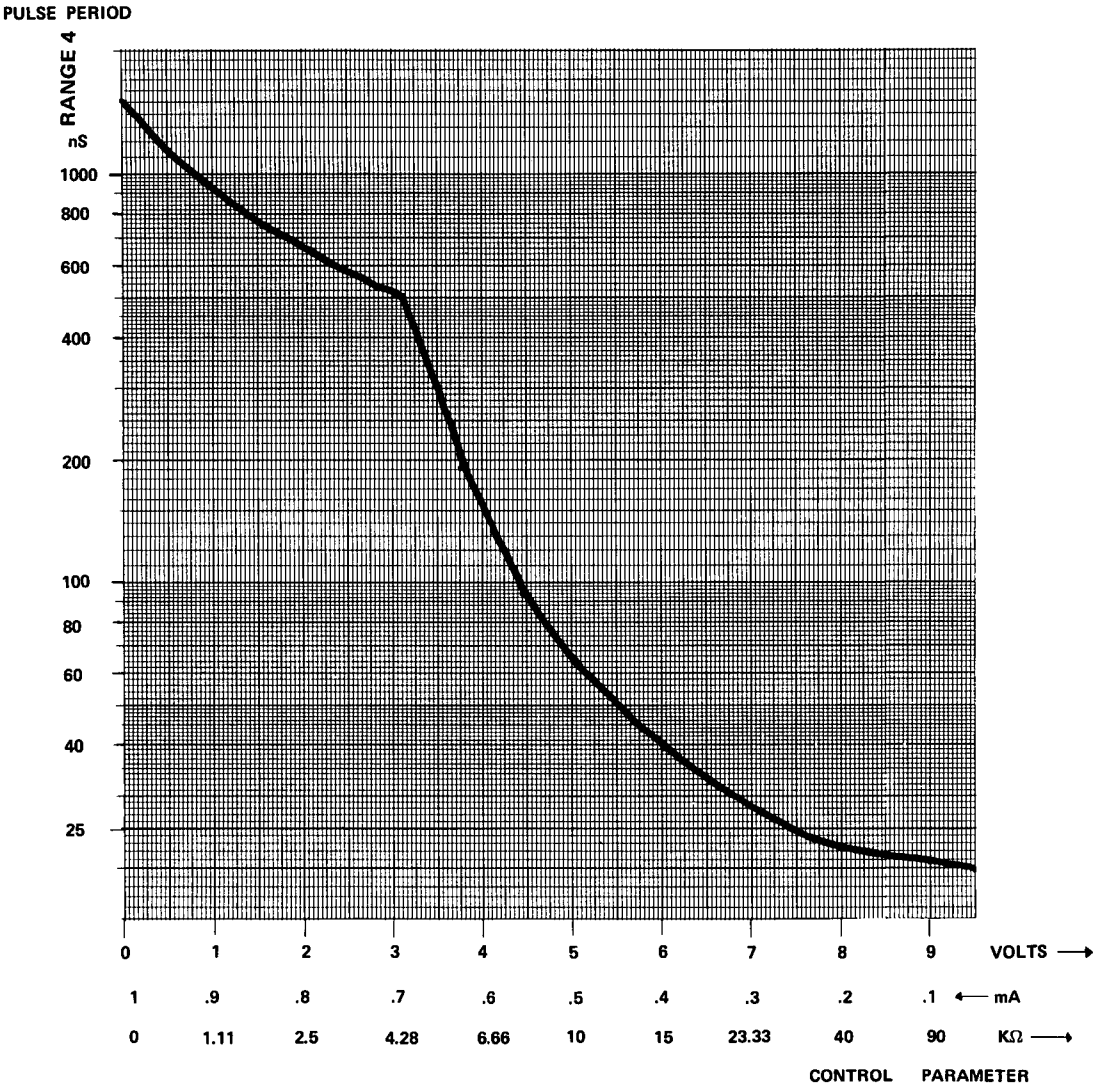


Figure 7–3–3. Pulse period remote control: range 4

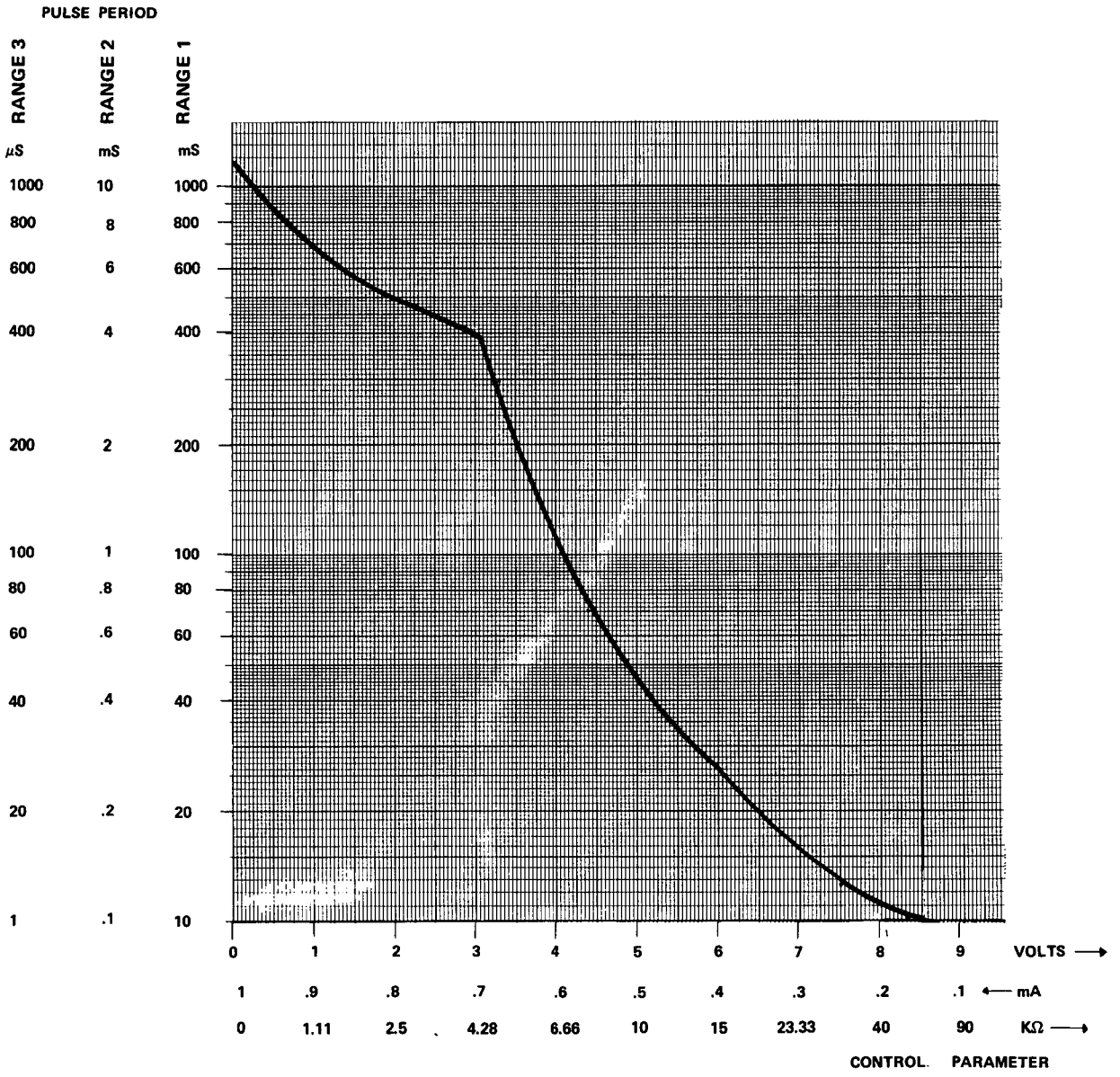


Figure 7–3–4. Pulse period remote control range: ranges 1, 2 and 3

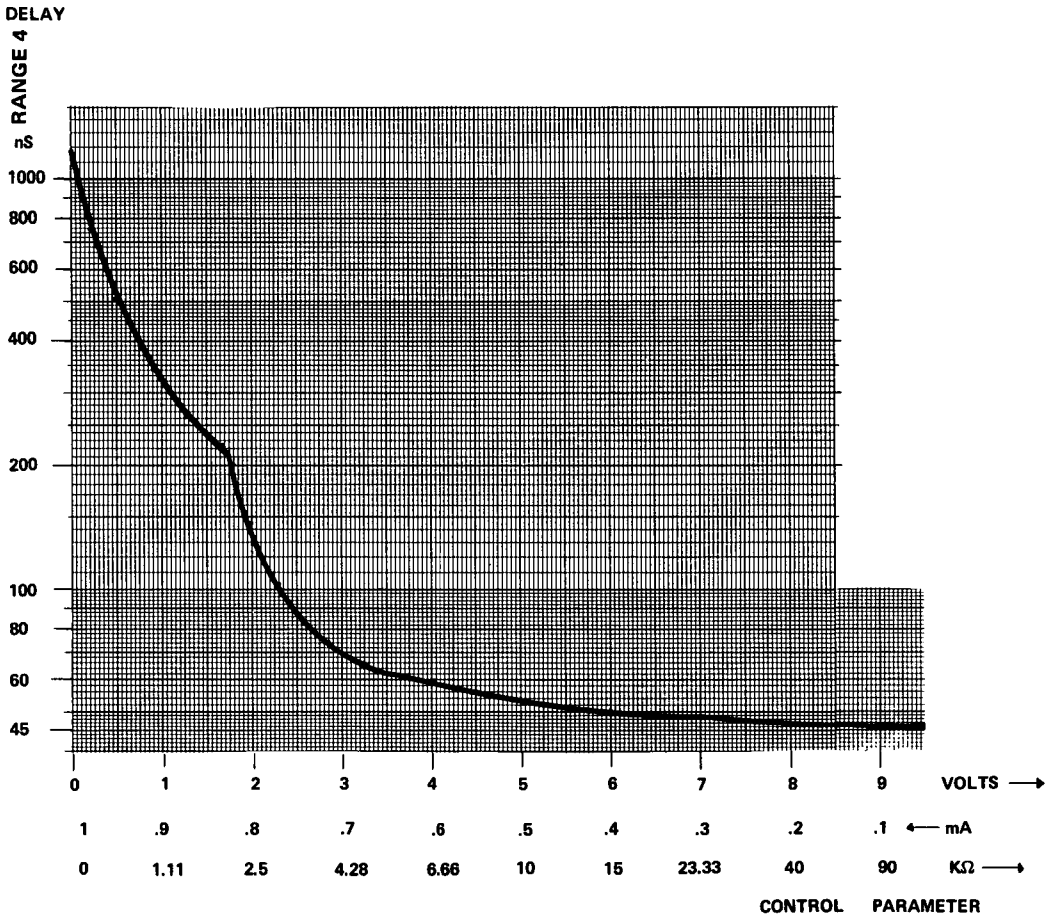


Figure 7–3–5. Delay remote control: range 4

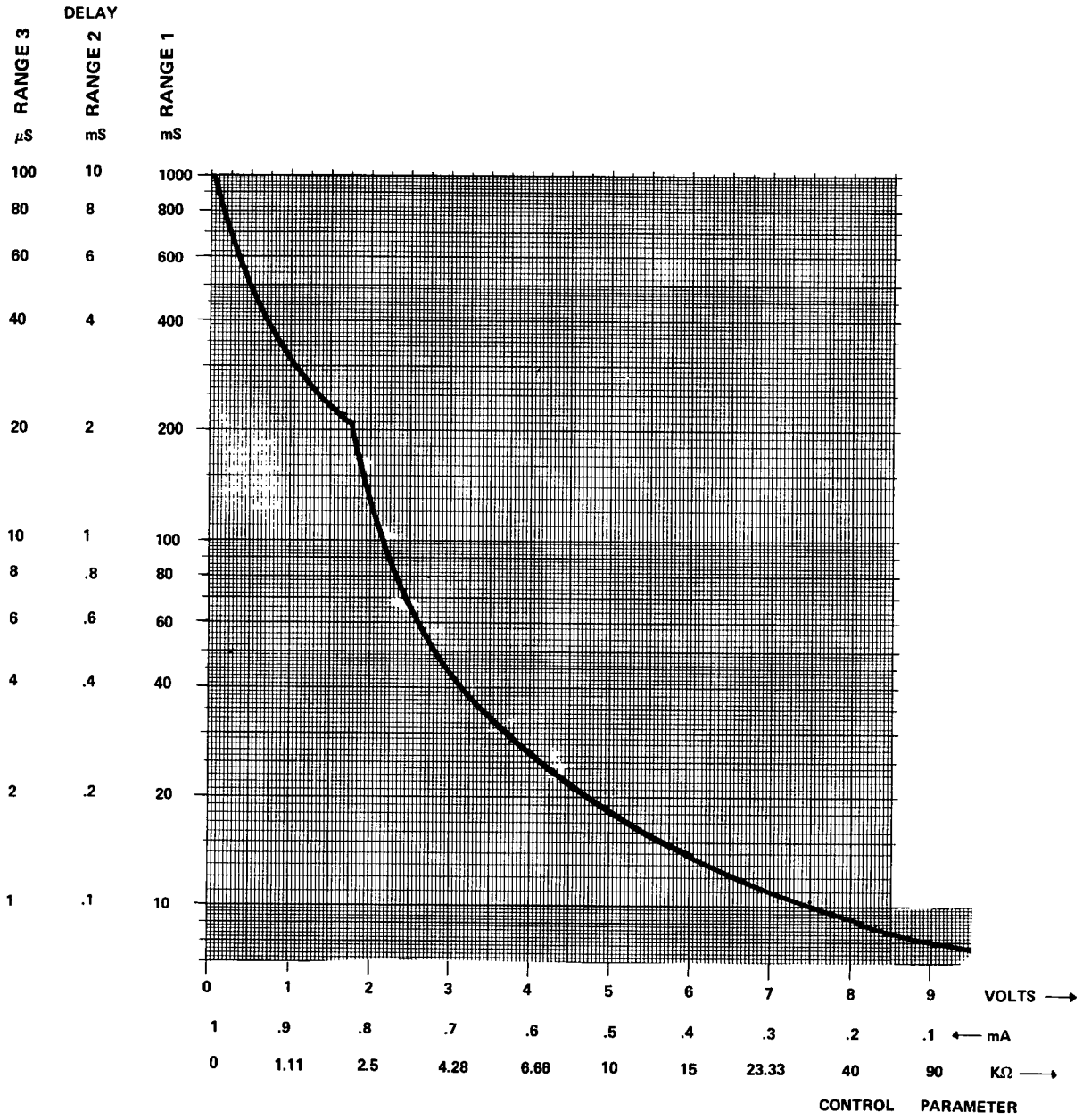


Figure 7–3–6. Delay remote control: ranges 1, 2 and 3

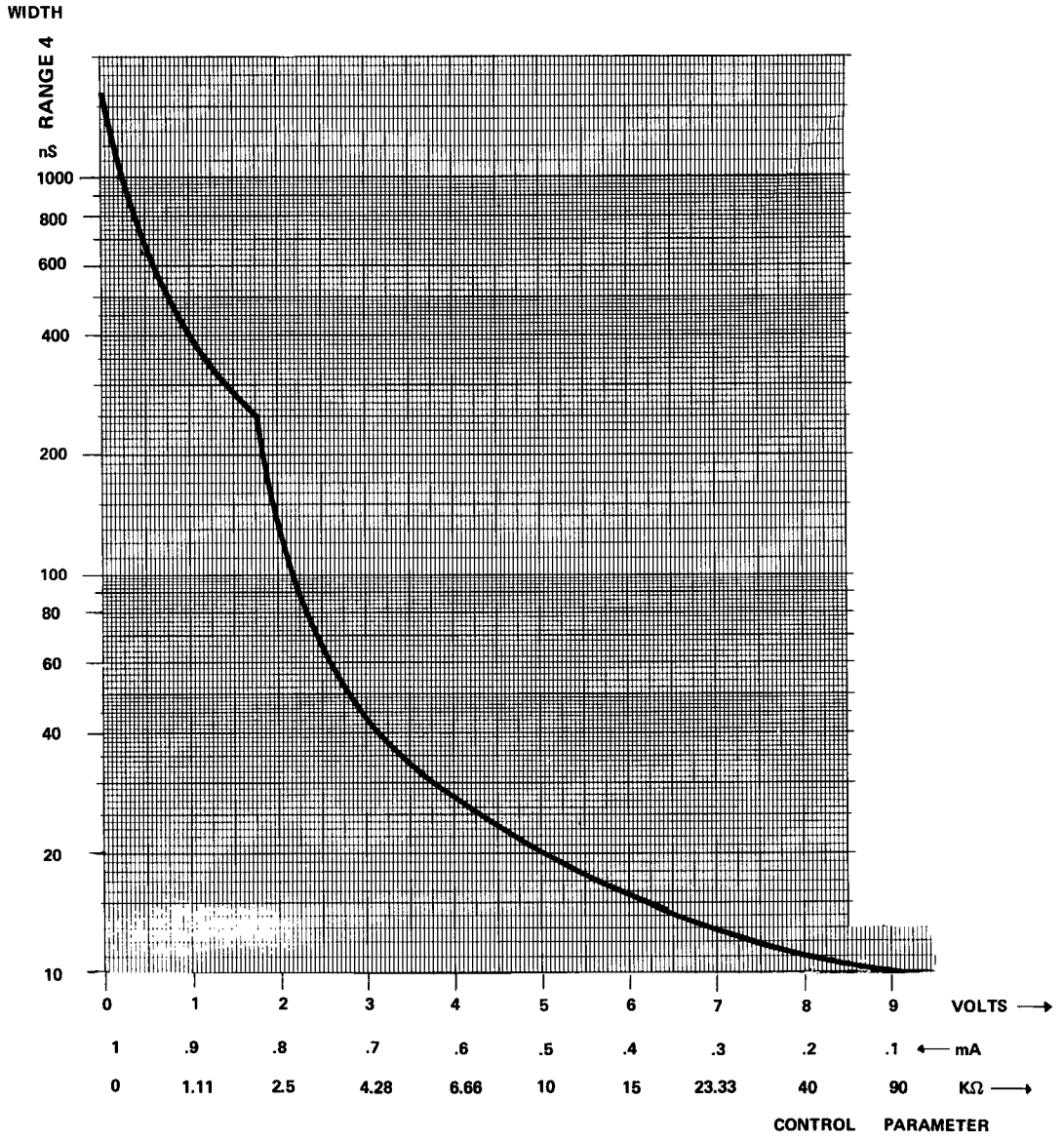


Figure 7–3–7. Width remote control: range 4

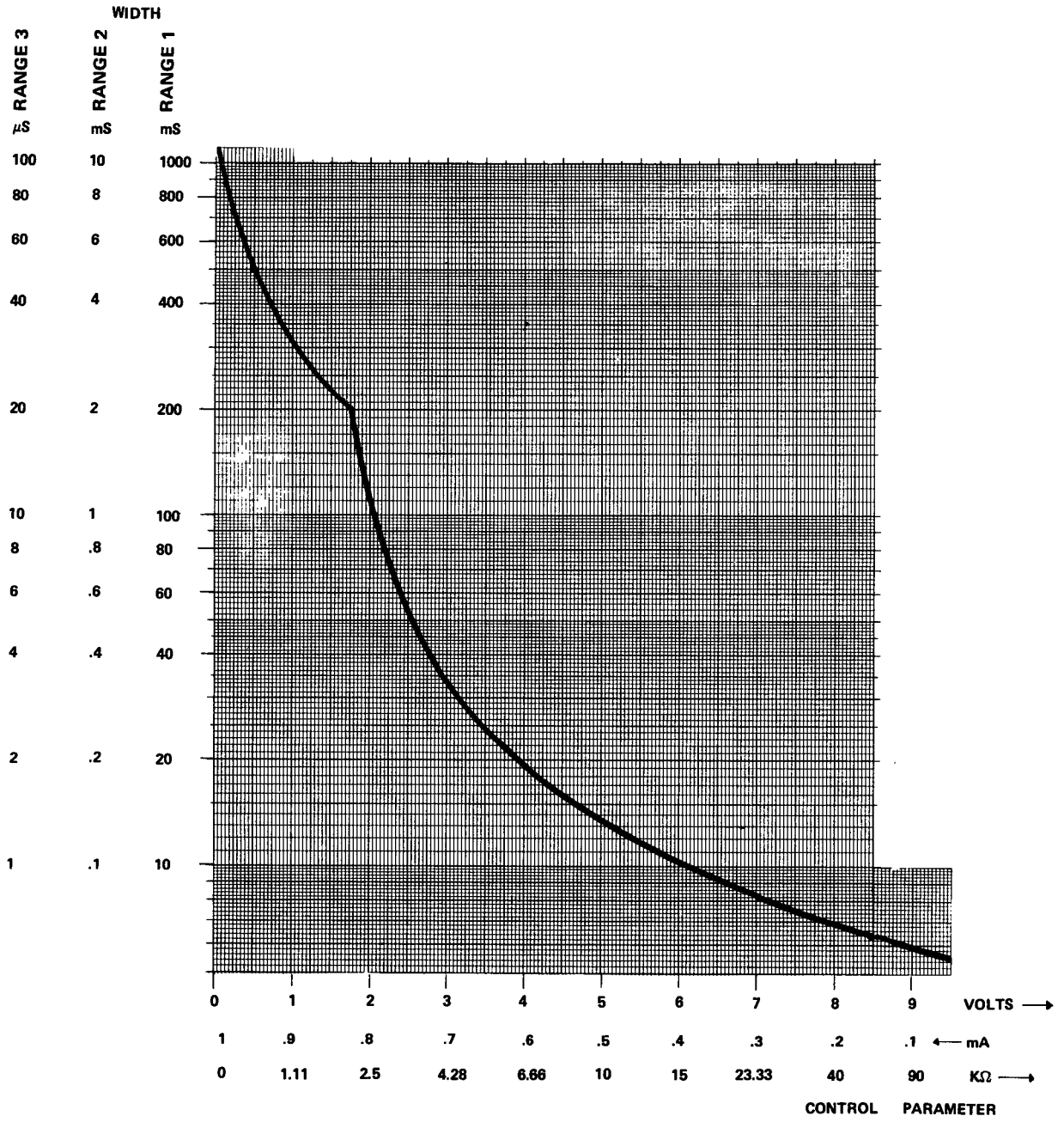


Figure 7–3–8. Width remote control: ranges 1, 2 and 3

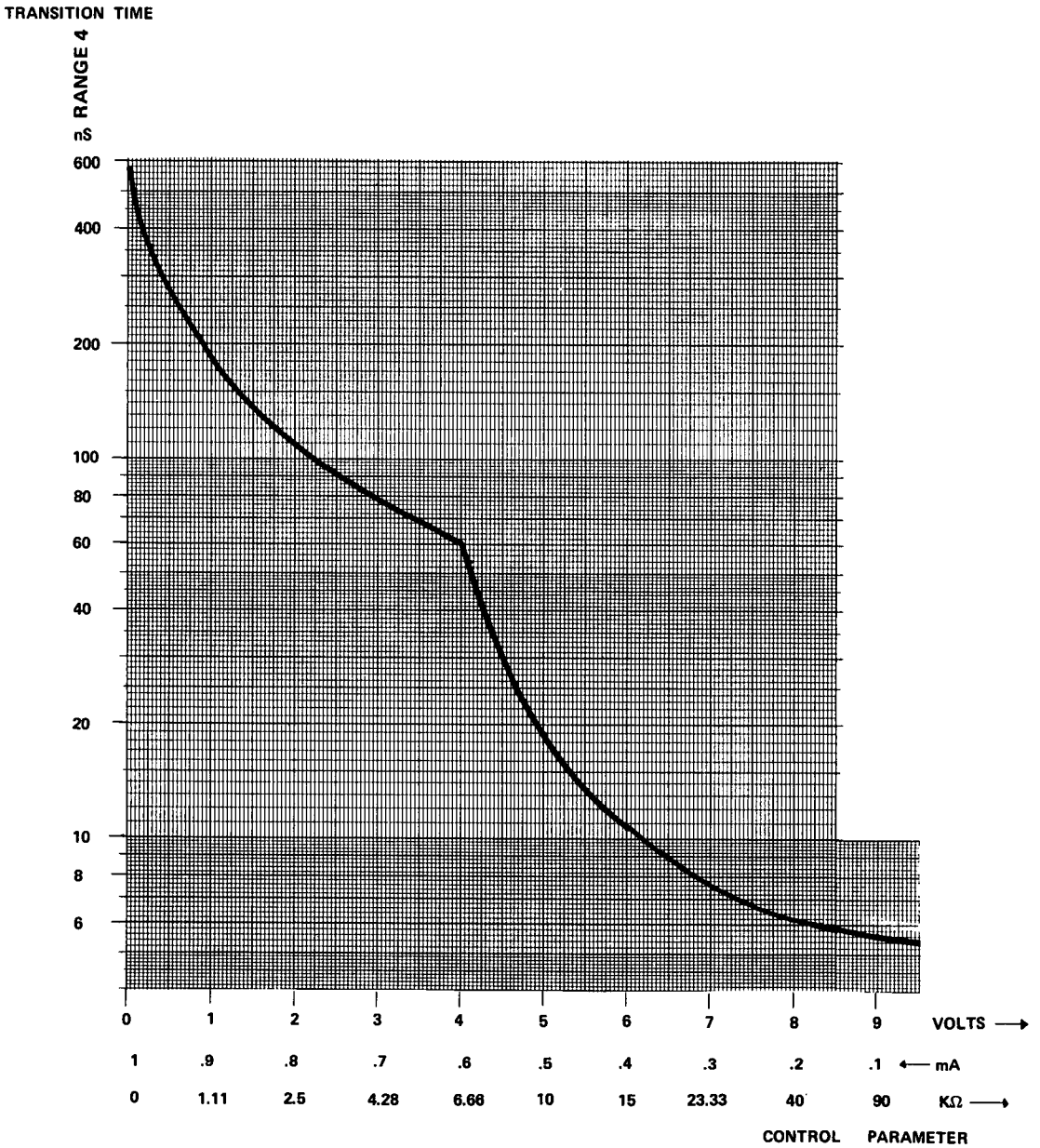


Figure 7–3–9. Transition time remote control: range 4

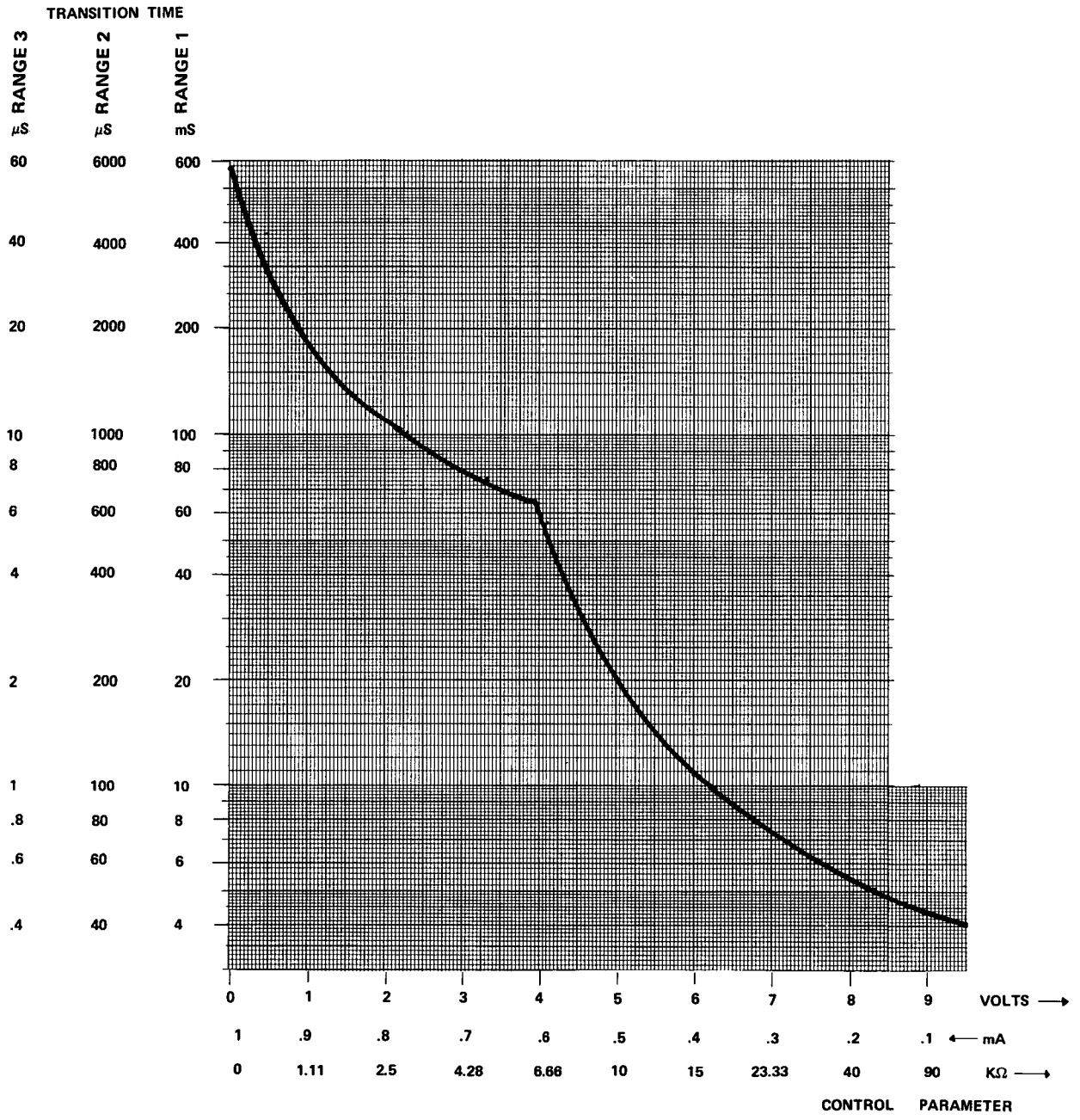


Figure 7–3–10. Transition time remote control: ranges 1, 2 and 3

7–3–10 Principles of Operation

7–3–11 REMOTE RANGE CONTROL

7–3–12 Remote control lines for pulse period, width, delay and transition time range are fed from the rear panel control connector to decoding circuits on A30. These circuits generate steering signals which simulate the front panel range switches. The steering signals are fed to the period, width, delay, square wave and transition time circuits on A3 via A31. See service sheets 6b and 9 of Section 9.

7–3–13 REMOTE VERNIER CONTROL

7–3–14 The vernier control lines are fed from the rear panel connector to A33 where they control non-linear current sources which simulate the front panel vernier controls. These sources are brought into operation by relays which close when the range switch in question is set to REM.

7–3–15 A typical current source and its characteristic are shown in figure 7–3–11.

7–3–16 The outputs of the current sources are taken to the appropriate timing circuits on A3 via A31. Refer to service sheets 6b and 10 of Section 9.

7–3–17 REMOTE OUTPUT LEVEL CONTROL

7–3–18 The output level control lines are fed to A33 where they are buffered. Clamping ensures that the lower level cannot be less than 1V, or more than 8V, negative with respect to the upper level – even if the control voltages are outside these limits. The buffered and clamped outputs are fed via A31 to A2A and A2B.

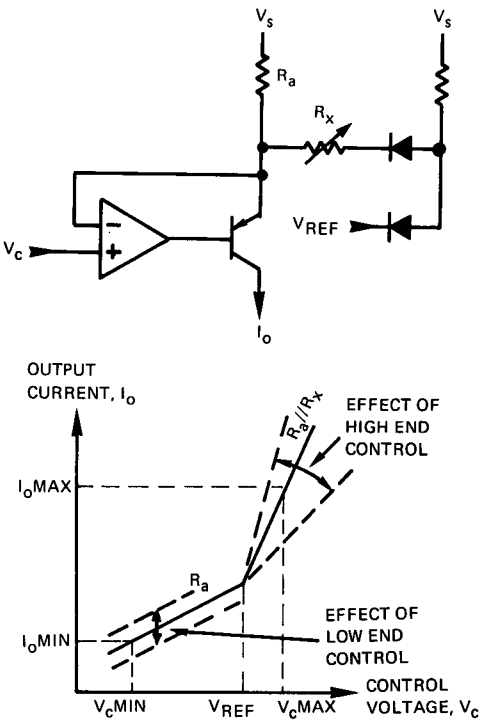


Figure 7–3–11. Principles of current source for vernier remote control

7–3–19 REMOTE BURST CONTROL

7–3–20 When fitted with the burst option, the burst control lines are fed by A27 W2 to A6 in parallel with the outputs of the front panel burst length control.

7–3–21 Replaceable Parts and Service Information

7–3–22 Refer to figs. 6–4, 6–5, the Option 003 Replaceable Parts List (Section 6), Service Sheets 6b, 9 and 10 and tables 7–3–2, 7–3–3 and 7–3–4.

ADJUSTMENTS

Table 7–3–2. Adjustment procedure 1 for Option 003

Test Equipment: Oscilloscope arrangement as for rate, delay width adjustments.

	Remote Connector XII				Adjustment A33		
	Rate	Delay	Width		Rate	Delay	Width
Range 2	1	4	7	Minimum adj.	R17	R31	R42
Range 3	2	5	8				
Range 4	3	6	9	Maximum adj.	R5	R23	R34

NOTE: The standard instrument must be in specification.

PROCEDURE

Set corresponding switch to REM.

1. Set your ext vernier to the min limit (90 KΩ, 9V, 0.1mA).

2. Enable required circuit with a TTL high level ⩾ +2.4V.

3. Lower limit: Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

   Example: Rate (Vernier min)
   Range 1 0.16 m
   Range 2 14 m
   Range 3 1.5 s

   Range 2 has the lowest deviation, so this range will be adjusted 10% above the setting value (11ms in this case).

4. Upper Limit: Set your ext vernier to max limit (0 Ω, 0V, 1mA). Select the 3 lower ranges one after the other and measure which range has the highest relative value (to setting).

   Example: Rate (Vernier max)
   Range 1 0.88 μs
   Range 2 85 μs
   Range 3 8.7 ms

   Range 1 has the highest deviation so this range will be adjusted 10% above the setting value (0.90μs in this case).

5. Set 8015A via opt 003 to min width.
   If necessary readjust A3 R42 for (best compromise)
   ⩽ 13ns

ADJUSTMENTS

Table 7–3–3. Adjustment procedure 2 for Option 003

Test Equipment: Oscilloscope
Arrangement as for transition time

Remote Connector XII Transition Time XII			Adjustment A33 leading edge	 trailing edge
Range 2	11	Minimum adjust	R58	R76
Range 3	12			
Range 4	13	Maximum adjust	R45	R66

NOTE: The standard instrument must be in specification.

PROCEDURE

1. Set transition time switch to REM.

2. Set ext vernier to min limit (90 KΩ, 9V, 0.1mA).

3. Enable needed ranges with a TTL high level ⩾ +2.4V.

4. Lower limit:
Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

   Example: (Vernier min)
   Range 1 55μ
   Range 2 5.8m
   Range 3 0.53s

   Range 2 has the lowest deviation, so this range has to be adjusted 10% below the setting value (0.55s in this case).

5. Upper limit:
Set ext vernier to max limit (0 Ω, 0V, 1mA).
Select the 2 lower ranges one after the other and measure which range has the highest relative value (to setting).

   Example: (Vernier max)
   Range 1 0.48μ
   Range 2 45 μ
   Range 3 4.6m

   Range 1 has the highest deviation so this range has to be adjusted 10% above the setting value (0.45μ in this case).

ADJUSTMENTS

Table 7–3–4. Adjustment procedure 3 for Option 003

Test Equipment: Oscilloscope, variable voltage source (dual) check and, if necessary, adjust of offset gain and zero.

NOTE: Standard instrument should be okay.

PULSE PERIOD **1**	1μ–0.1m	CH A NORM/COMPL **10**	NORM
VERNIER **2**	CW	CH B NORM/COMPL **13**	NORM
PULSE DELAY **3**	20n–1μ	CH B Zs **14**	1 KΩ
VERNIER **4**	CCW	CH A NORM/COMPL **16**	A sep B
PULSE WIDTH **5**	SQUARE WAVE	CH A Zs **18** -	1 KΩ
VERNIER **6**	–	TRIG POLARITY **22**	–
TRANSITION TIME **7**	6n–0.5μ	TRIG INPUT IMPEDANCE **23**	–
LEADING EDGE **8**	CCW	FUNCTION **24**	NORM
TRAILING EDGE **9**	CCW	MODE **25**	NORM
		EXT INPUT LEVEL **26**	–

1. Center scope beam for zero volt reference, connect it to channel A output.

2. Set dual voltage source to +4 and −4V (via 20 dB attenuator, 50 Ω Term).

Remote connector

	XII		max ampl	min ampl
pin	22	lower level channel A	apply −4V	−0.5V
	23	upper level channel A	apply +4V	+0.5V
	24	lower level channel B	apply −4V	−0.5V
	25	upper level channel B	apply +4V	+0.5V

3. Check and if necessary adjust A5 R for a may CH A Amplitude of 16.5V ± 0.1V.

4. Check and if necessary adjust A5 R for a max CH B amplitude of 16.5V ± 0.1V.

5. Check and if necessary adjust A2A R117 for a min CH A amplitude of 1.8V ± 0.1V.

6. Check and if necessary adjust A2B R117 for a min CH B amplitude of 1. V ± 0.1V.
   Set Zs switches to 50 Ω.

7. Set upper level voltage to +8V and lower level voltage to 0V.

8. Operate norm-compl switch. If necessary adjust A2A (B) R9 for not shift on lower level.

9. Apply +8V to upper level, 0V to lower level.

10. Change to 0V to upper level, −8V to lower level.

11. Observe display and watch sym to zero.

12. If necessary adjust A2A (B) R159 for sym display.

13. If display is sym now, but not at the zero volt baseline adjust A2A (B) R152 to zero.

14. Apply +4 to upper level, 0V to lower level.

15. If lower level is not on zero V baseline:
    adjust A2A (B) R60 for norm mode to zero
    adjust A2A (B) R61 for compl mode to zero.

If necessary check same procedure (5–22) for the standard instrument and if necessary find best compromise.

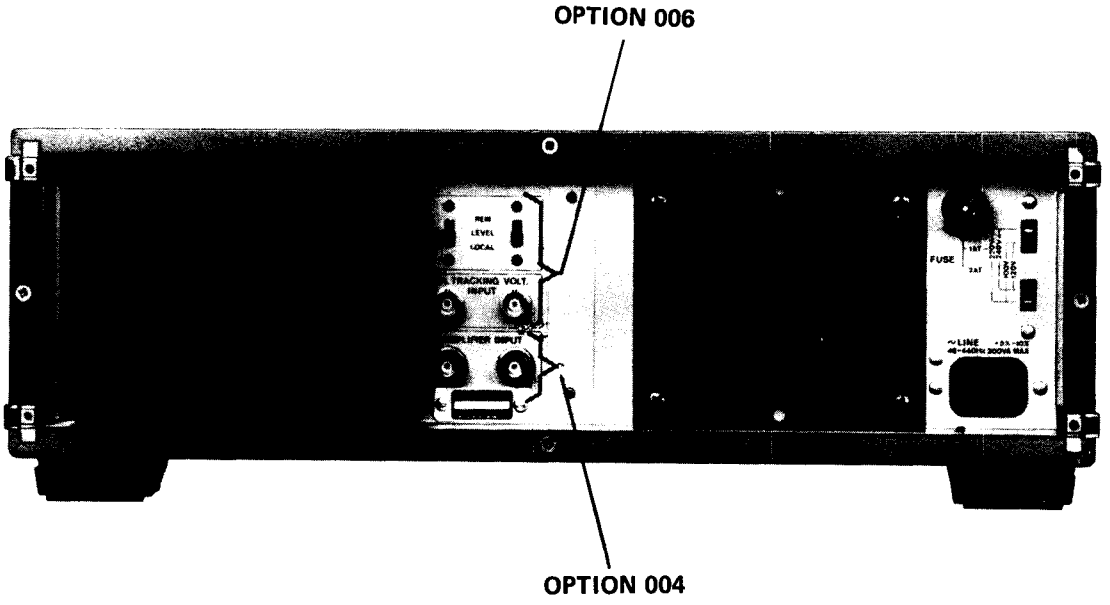


Figure 7–4–1. 8015A Option 004 (with Option 006) – Rear Panel

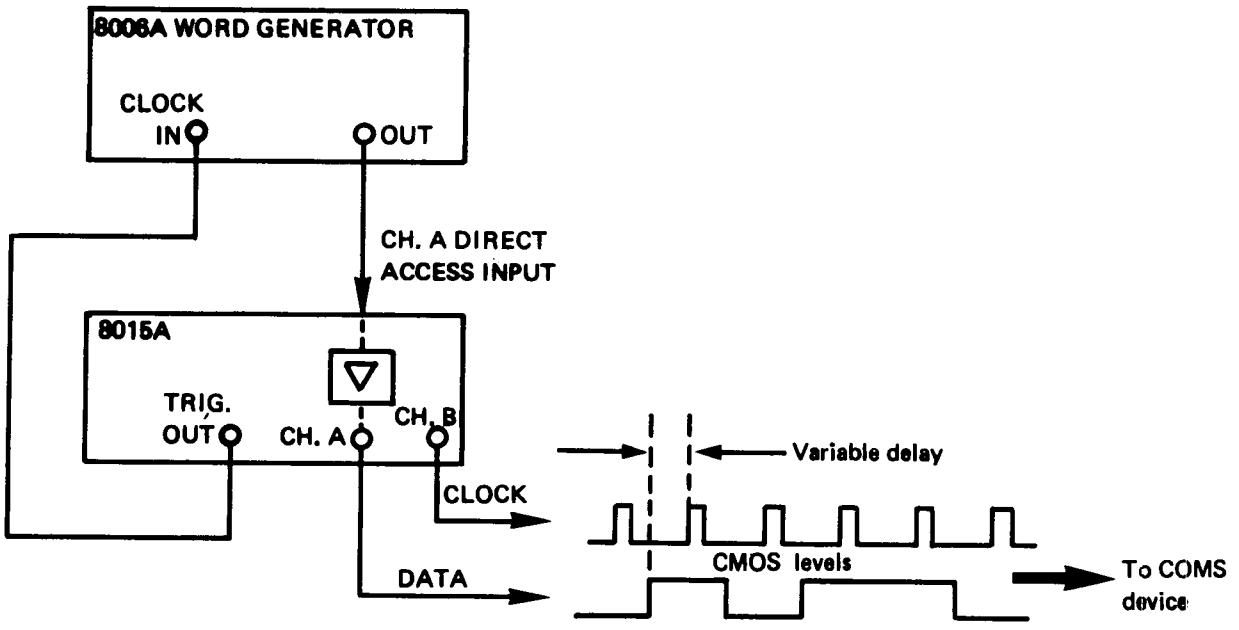


Figure 7–4–2. CMOS Test Set-up

7–4–1 OPTION 004 – DIRECT ACCESS TO OUTPUT AMPLIFIERS

7–4–2 Specifications and General

7–4–3 Option 004 allows direct access to both of the 8015A's output amplifiers. The amplifiers are linear, and any waveforms within a certain voltage swing (see specifications) can be applied to the inputs. The waveforms will be amplified to a level determined by the 8015A amplitude controls. This enables, for example, TTL signals or low-level word generator outputs to be converted to higher amplitude levels for driving CMOS circuits. The option is enabled/disabled using two switches situated on the 8015A Option 004 Integrator board (replaces the normal Integrator board). The option operates with assymetrical input voltage swings (see specification) but can be modified for symmetrical inputs as described in paragraph 7–4–5.

7–4–4 This option precludes Option 001.

7–4–5 Conversion for Symmetrical Operation

7–4–6 The output amplifiers can be driven by input signals that are symmetrical about 0 volts if the following modification is made (refer to figure 6–5 and Service Sheet 4 when reading the following description).

1. Remove from the 8015A rear panel by unscrewing the two BNC connectors.

2. Disconnect the +5V and –5V power supply cables and insulate the ends of the cables.

3. Unsolder and remove transistors Q1 and Q2 from A32.

4. Link the +5V and –5V pins on A32 to ground.

5. Refit A3 to the 8015A rear panel.

7–4–7 Replaceable Parts and Service Information

7–4–8 Refer to the Option 004 Replaceable Parts table in Section 6, figure 6–5, Service Sheet 4 and tables 7–4–2 and 7–4–3.

Table 7–4–1. Specifications

All specifications apply for an 8015A output source impedance of 50 ohms and no load.

Input impedance: 50 ohms ± 5 %.

Operation: assymetrical (symmetrical with modification).

Input voltage swing for full output swing: ⩾ 2.5Vpp (to +2.5V, baseline 0V).

Maximum input voltage: ± 5V.

Output signal: can be shifted within a window of 0V to 16V.

Voltage gain (typical): continuously variable between 0.8 and 6.4 using level controls.

Clipping: occurs if upper level of input signal exceeds +2.5V or if lower level of input signal goes negative.

Frequency response (–3dB): 0 to 50MHz (50 ohm source, no load), 0 to 80MHz (50 ohm source, 50 ohm load).

Polarity: inverting for NORM mode, non-inverting for COMPL mode.

A+B mode: both outputs can be paralleled (A+B mode) when both inputs are being driven. In this case the maximum output swing can be 30Vpp symmetrical about 0V.

PERFORMANCE CHECK

Table 7–4–2. Direct Output Amplifier Access (Option 004)

PROCEDURE

Set up equipment as shown and set controls as follow:

PULSE PERIOD **1**	–
VERNIER **2**	–
PULSE DELAY **3**	–
VERNIER **4**	–
PULSE WIDTH **5**	–
VERNIER **6**	–
TRANSITION TIME **7**	–
LEADING EDGE **8**	–
TRAILING EDGE **9**	–
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	+4V
CH A LOWER LEVEL	0V
CH B UPPER LEVEL **12**	+4V
CH B LOWER LEVEL	0V
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: Set ext pulse generator to 10 MHz and amplitude to positive 2.5V.

1. Verify switches S41 and S42 on A5 are in direct access (EXT) position (Service Sheet 4).

2. Check output with level controls at min and max separation.

SPECIFICATION

Option 004 direct output access . . . . . .
Input impedance 50 ± 5%, asymmetrical operation input voltage for max output 2.5V pp baseline 0V top +2.5V polarity: inverting for norm, non-inverting for compl.

DESCRIPTION

Check of direct output amplifier access function.

EQUIPMENT

Oscilloscope:	50 MHz bandwidth
Pulse Generator:	20 MHz Repetition Rate

ADJUSTMENTS

Table 7–4–3. Adjustment Procedure for Option 004

Test Equipment: Oscilloscope

CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

1. Set switches A5 S44, S42 to EXT.

2. Set scope to zero volt reference.

3. Apply channel A to scope (leave 8015A rear panel inputs open).

4. Set levers in min separation to exact sym zero.

5. Adjust A32 R9 for zero baseline.
If zero adjust is not possible move levers in maximum separation from full positive to full negative and adjust A32 R9 for sym voltage to zero.

6. Repeat step 4 and 5 for channel B adjusting A32 R16.

7–5–1 OPTION 005 – TTL OUTPUT

7–5–2 Specifications and General

7–5–3 The 8015A TTL Output option (005) provides a TTL compatible output at a front panel BNC connector (see figure 7–5–1). The logic levels of this output are ⩾ 4.5V for a logic 1 and 0V for a logic 0; all other pulse parameters remain variable.

7–5–4 This option greatly increases the speed and ease with which pulses can be set up when testing TTL circuitry. A further advantage is that because the TTL output has a 50 ohm source impedance, no external 50 ohm termination is required.

7–5–5 The specifications for the TTL output pulse parameters are the same as for the channel A output except for pulse amplitude.

Output levels (into an open circuit): logic 1 ⩾ 4.5V; logic 0 zero volts.

Format: normal and complement (switched by Channel A NORM/COMP switch).
Output impedance: 50 ohms.

7–5–6 Differences in assemblies and parts are indicated in figure 6–7, the Option 005 Replaceable Parts list (Section 6) and Service Sheet 4. Option 005 precludes Option 001.

7–5–7 Operating Instructions

7–5–8 When it is required to switch the TTL output from normal to complement, or vice versa, use the NORM/COMP switch for channel A.

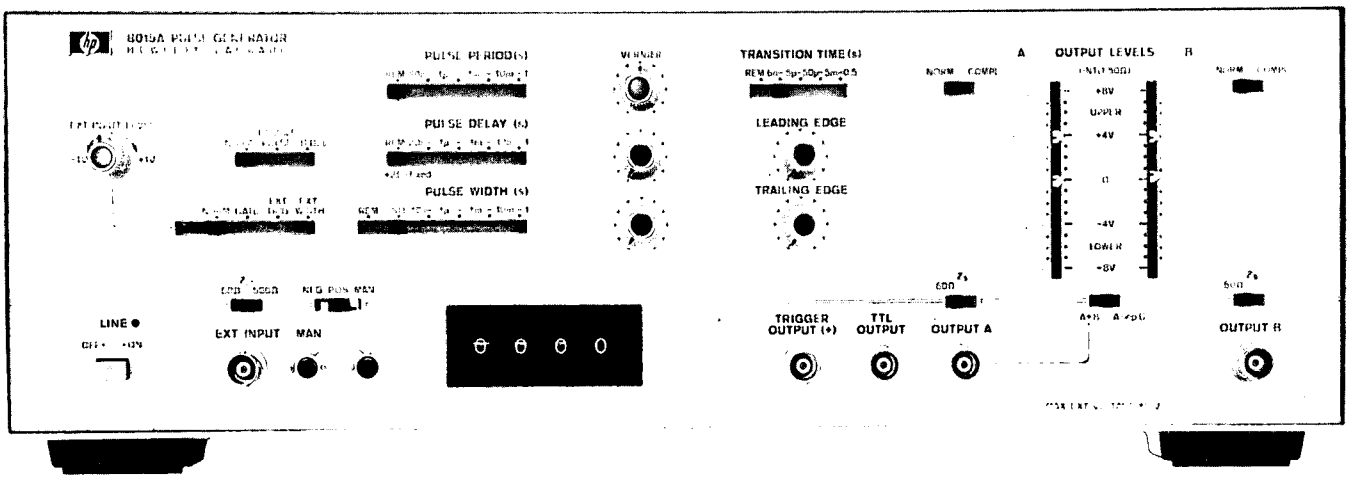


Figure 7–5–1. 8015A Option 005 (with Option 002)

7–5–9 Principles of Operation (Service Sheet 4)

7–5–10 The output of the integrator (emitter followers Q19/Q20) is applied to differential amplifier Q1/Q2 with constant current source Q3. The normal and complement outputs of this differential amplifier are applied to a second differential amplifier, Q4/Q5, where the TTL output levels are established. Both amplifiers are linear so that the variable transition time feature B retained in the TTL output.

7–5–11 The TTL output levels (logical 1: ⩾ 4.5V, logical 0: 0V) are generated across two 50 ohm loads (R12, R13). These loads form the 50 ohm source impedance and either one or the other is selected by relay K1. This relay is controlled by the Channel A NORM/COMPL switch on the front panel.

7–5–12 Replaceable Parts and Service Information

7–5–13 Refer to figure 6–7, the Option 005 Replaceable Parts list (Section 6), Service Sheet 4 and table 7–5–1.

PERFORMANCE CHECK

Table 7–5–1. TTL Output (Option 005)

PROCEDURE

Set up equipment as shown and set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	–
CH A LOWER LEVEL **11**	–
CH B UPPER LEVEL **12**	–
CH B LOWER LEVEL **12**	–
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

Test Equipment: Set scope for best resolution.

1. Check level of output signal.

2. Set channel A Norm-Compl to Compl and check level.

SPECIFICATION

Option 005 extra TTL Output .....
logic 1 ⩾ 4.5V, logic 0 ⩽ 0.2V
source impedance 50 Ω
coincident with channel A
(Norm-Compl)

DESCRIPTION

Check of TTL levels.

EQUIPMENT

Oscilloscope	⩾ 50 MHz Bandwidth

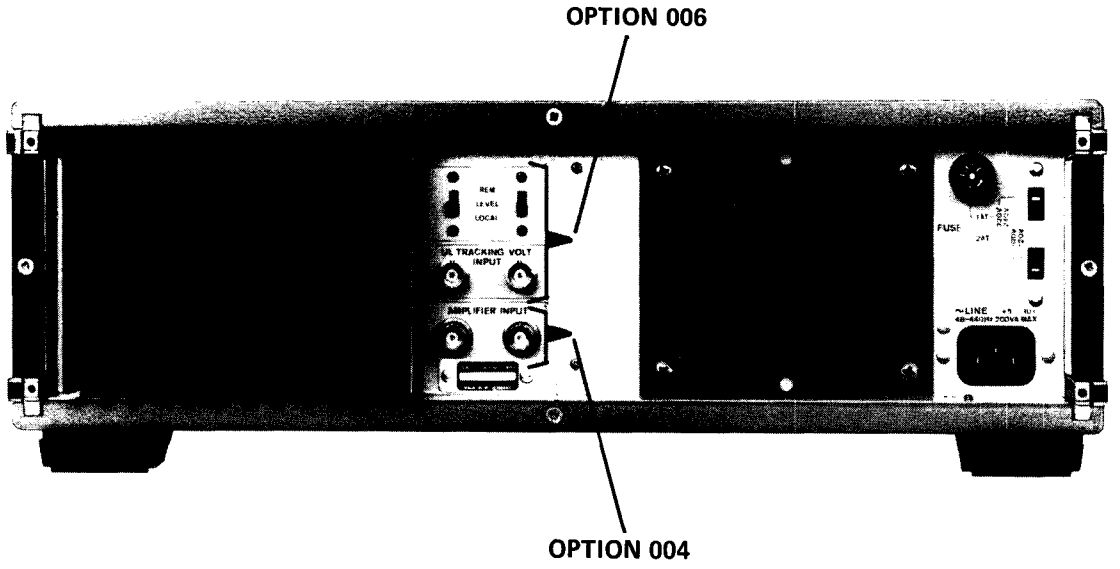


Figure 7–6–1. 8015A Option 006 (with Option 004) – Rear Panel

7–6–1 OPTION 006 – UPPER–LEVEL TRACKING

7–6–2 Specifications and General

7–6–2 This option provides upper level control of the output pulse amplitude by means of an external control voltage. The upper level of the output pulse is equal to the control voltage when the 8015A is set to 50 ohms source impedance and no external termination is used. The lower level of the output pulse is held at 0V.

7–6–3 The input connectors for the control signal are situated on the 8015A rear panel and each connector has a REMOTE/LOCAL switch so that the option can be used with either one or both channels.

7–6–4 This option is particularly useful when testing CMOS circuits; the CMOS supply voltage is used as the control input and the 8015A output is used as the CMOS gate supply (see figure 7–6–2). This arrangement ensures that if the CMOS supply voltage fails or is changed there is no danger of the gate voltage exceeding the supply voltage and damaging the CMOS circuit.

7–6–5 All 8015A output pulse parameters, except amplitude, remain variable from the front panel controls. The following specifications apply to both control inputs for an 8015A source impedance of 50 ohms into an open circuit.

Upper level control voltage: +2V to +16V for a pulse output of +2V to +16V.
Upper level output accuracy: ± 5% of control voltage.
Lower level of output pulse held at 0V ± 250mV.

Control input impedance: 10K ohms ± 7%
Maximum control voltage: +20V
Minimum control voltage: 0V
Settling time to ± 5% of final value: 400μs.
Option 006 precludes Options 001 and 003.

7–6–6 Operating Instructions

7–6–7 The control voltage is applied to one or both upper Level Tracking connectors on the rear panel and the appropriate REMOTE/LOCAL switch is set to REMOTE. The control voltage must not exceed the limits given in the Specifications.

7–6–8 Replaceable Parts and Service Information

7–6–9 Refer to figure 6–8, the Option 006 Replaceable Parts list (Section 6), Service Sheet 6, and table 7–6–1.

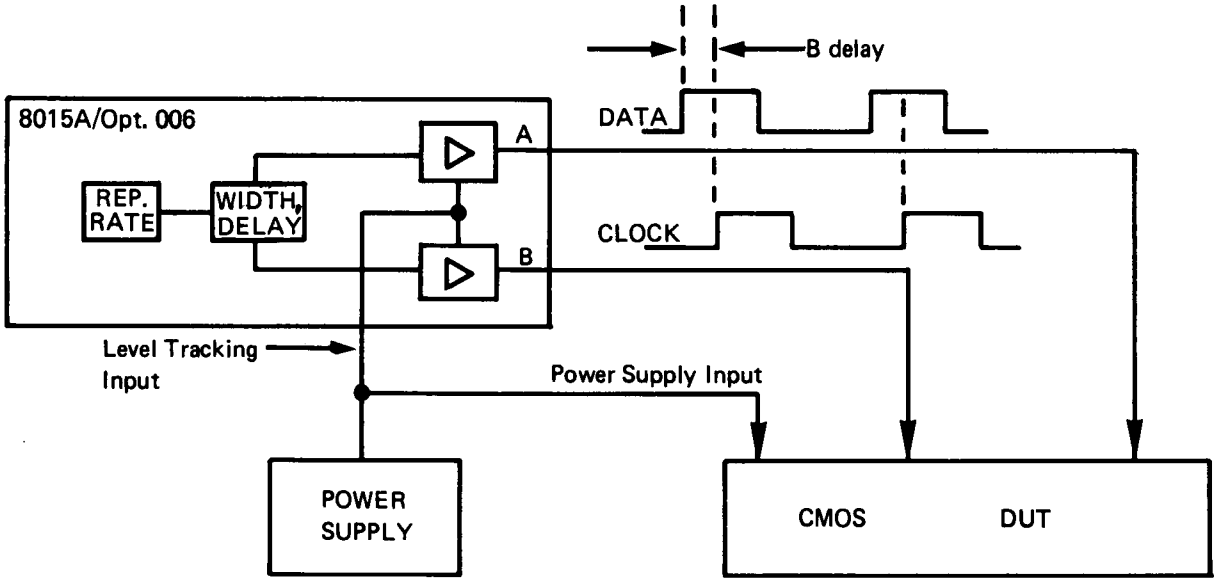


Figure 7–6–2. CMOS test circuit

PERFORMANCE CHECK

Table 7–6–1. Upper Output Level Tracking (Option 006)

PROCEDURE

Set controls as follows:

PULSE PERIOD **1**	20n–1μ
VERNIER **2**	CW
PULSE DELAY **3**	20n–1μ
VERNIER **4**	CCW
PULSE WIDTH **5**	SQUARE WAVE
VERNIER **6**	–
TRANSITION TIME **7**	6n–0.5μ
LEADING EDGE **8**	CCW
TRAILING EDGE **9**	CCW
CH A NORM/COMPL **10**	NORM
CH A UPPER LEVEL **11**	–
CH A LOWER LEVEL **11**	–
CH B UPPER LEVEL **12**	–
CH B LOWER LEVEL **12**	–
CH B NORM/COMPL **13**	NORM
CH B Zs **14**	50 Ω
CHANNEL SUMMING **16**	A sep B
CH A Zs **18**	50 Ω
TRIG POLARITY **22**	–
TRIG INPUT IMPEDANCE **23**	–
FUNCTION **24**	NORM
MODE **25**	NORM
EXT INPUT LEVEL **26**	–

1. Connect oscilloscope to channel A.
2. Apply tracking voltage. Vary slowly from +2V to +16V.
3. Verify output amplitude follows.
4. Connect oscilloscope to channel B and repeat steps 2 and 3.

SPECIFICATION

Option 006 upper output level tracking .....
Input voltage +2V to +16V
Input Impedance 10 kΩ ± 5%.
Upper level accuracy
± 5% of control voltage
lower level accuracy
0V ± 250mV.

DESCRIPTION

Check of Option 006 upper output level tracking.

EQUIPMENT

Oscilloscope .....≥ 50 MHz
Variable voltage source ..... +2V to +16V

8–1 Serial Numbers 1538G 00685 and below

8–2 A24 is replaced by A4, A28 by W8 (or A38 by W18 for option 001). Refer to Service Sheet 7a, Figure 8–1 and the following Replaceable Part list.

CAUTION

Connect device-under-test to outputs AFTER switching ON.
Disconnect device-under-test BEFORE switching OFF.

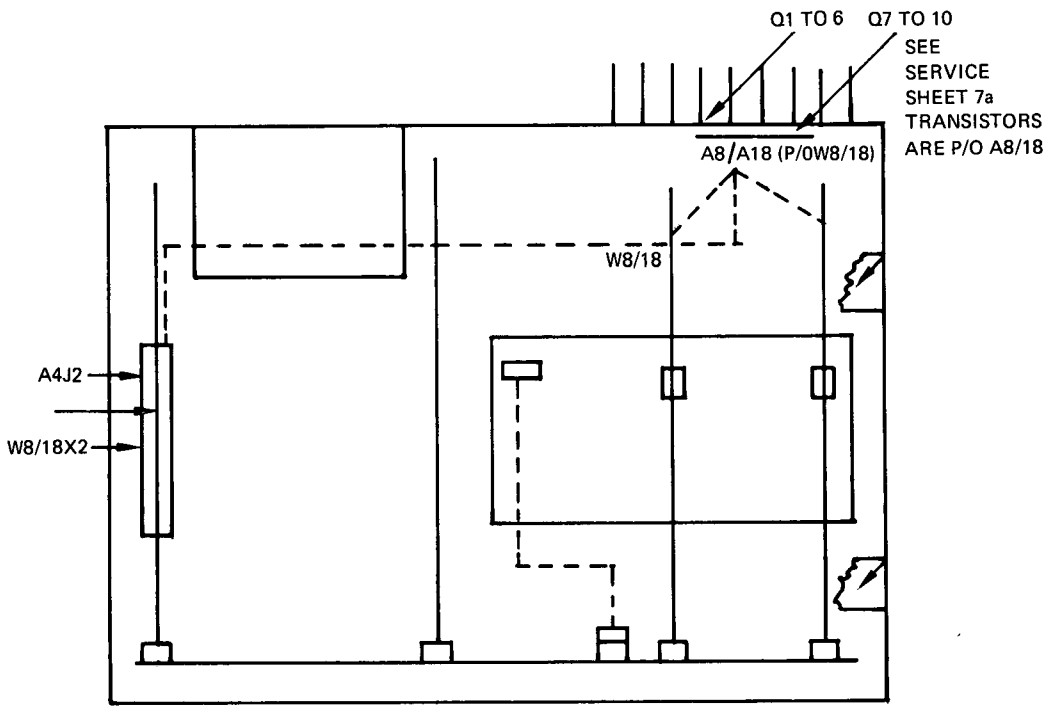


Figure 8–1. Changed Assemblies – Serial Numbers 1538G 00685 and below

Changed Replaceable Parts (Serial Numbers 1538G00685 and below)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP19	08015-21102	1	HEATSINK	28480	08015-21102
MP22	08015-00203	1	PANEL REAR	28480	08015-00203
W8	08015-61601	1	CABLE ASSEMBLY, MAIN	28480	08015-61601
W8X2	1251-0335	1	CONNECTOR-PC EDGE 24-CONT/ROW 2-ROWS	28480	1251-0335
W8A8	08015-66508	1	BOARD ASSEMBLY, RESISTOR	28480	08015-66508
A8C1	0180-0100	2	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A8C2	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A8Q1	1853-0212	5	TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A8Q2	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A8Q3	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A8Q4	1854-0368	5	TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A8Q5	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A8Q6	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A8Q7	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A8Q8	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A8Q9	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A8Q10	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A8R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8R2	0757-1004	16	RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R3	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R4	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R5	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R6	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R7	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R8	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R9	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R10	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R11	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R12	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R13	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R14	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R15	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R16	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A8R17	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
W16	08015-61611	1	CABLE ASSEMBLY, MAIN (OPTION 001)	28480	08015-61611
W16X2	1251-0335		CONNECTOR-PC EDGE 24-CONT/ROW 2-ROWS	28480	1251-0335
A18	08015-66518	1	BOARD ASSEMBLY, RESISTOR (OPTION 001)	28480	08015-66518
A18C1	0180-0100	4	CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A18C2	0180-0100		CAPACITOR-FXD 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A18Q1	1853-0212	4	TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A18Q2	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A18Q3	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A18Q4	1854-0368	4	TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A18Q5	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A18Q6	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A18Q7	1854-0368		TRANSISTOR NPN 2N5191 SI PD=40W FT=2MHZ	04713	2N5191
A18Q8	1853-0212		TRANSISTOR PNP 2N5194 SI PD=40W FT=2MHZ	04713	2N5194
A18R1	0757-0442	2	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A18R10	0757-1004	16	RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R11	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R12	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R13	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R14	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R15	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R16	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C
A18R17	0757-1004		RESISTOR 53.27 .25% .5W F TC=0+-100	19701	MF7C1/2-T0-53R27-C

Changed Replaceable Parts (Serial Numbers 1538G00685 and below)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	08015-66504		BOARD ASSEMBLY POWER SUPPLY	28480	08015-66504
A4C1	0170-0084	21	CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C3	0140-0200	1	CAPACITOR-FXD 390PF +-5% 300WVDC MICA	72136	DM15F391J0300WV1CR
A4C4	0180-0291	2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4C5	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C6	0180-1745	2	CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A4C8	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C10	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C11	0180-1745		CAPACITOR-FXD 1.5UF+-10% 20VDC TA	56289	150D155X9020A2
A4C12	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C14	0160-2938	1	CAPACITOR-FXD .01UF +-20% 100WVDC POLYE	28480	0160-2938
A4C15	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A4C16	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C17	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C18	0180-2352	2	CAPACITOR-FXD 6000UF+75-10% 15VDC AL	28480	0180-2352
A4C19	0180-2352		CAPACITOR-FXD 6000UF+75-10% 15VDC AL	28480	0180-2352
A4C20	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C21	0180-1954	2	CAPACITOR-FXD 4.7UF+-5% 6VDC TA	56289	150D475X5006A2
A4C22	0160-2205	1	CAPACITOR-FXD 120PF +-5% 300WVDC MICA	28480	0160-2205
A4C23	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C25	0180-1954		CAPACITOR-FXD 4.7UF+-5% 6VDC TA	56289	150D475X5006A2
A4C26	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C27	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C28	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C29	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C30	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C31	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C32	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C33	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C34	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C35	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C36	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4C37	0170-0084		CAPACITOR-FXD .068UF +-20% 50WVDC POLYE	84411	601PE6830R5W3
A4CR1	1901-0522	12	DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR2	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR3	1901-0025	1	DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A4CR4	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR5	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR6	1902-0025	1	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A4CR7	1902-3256	1	DIODE-ZNR 23.7V 5% DO-7 PD=.4W TC=+.076%	04713	SZ 10939-290
A4CR8	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR9	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR10	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR11	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR12	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR13	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR14	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR15	1901-0522		DIODE-GEN PRP 200V 3A 2US	28480	1901-0522
A4CR16	1902-3290	2	DIODE-ZNR 31.6V 5% DO-7 PD=.4W TC=+.074%	04713	SZ 10939-326
A4CR17	1901-0033	3	DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4CR18	1901-0033		DIODE-GEN PRP 180V 200MA DO-7	28480	1901-0033
A4CR19	1901-0040	5	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR21	1902-3290		DIODE-ZNR 31.6V 5% DO-7 PD=.4W TC=+.074%	04713	SZ 10939-326
A4CR22	1902-3224	1	DIODE-ZNR 17.8V 5% DO-7 PD=.4W TC=+.067%	04713	SZ 10939-254
A4CR23	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR24	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR25	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4CR26	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A4Q1	1854-0307	2	TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A4Q2	1854-0090	2	TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0090
A4Q3	1854-0274	1	TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0274
A4Q4	1853-0012	2	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A4Q5	1853-0012		TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A4Q6	1854-0090		TRANSISTOR NPN SI TO-39 PD=1W FT=100MHZ	28480	1854-0090
A4Q7	1854-0329	2	TSTR:SI NPN	28480	1854-0329
A4Q8	1854-0307		TRANSISTOR NPN SI TO-18 PD=300MW	28480	1854-0307
A4Q9	1853-0090	1	TSTR:SI PNP	28480	1853-0090
A4Q10	1854-0329		TSTR:SI NPN	28480	1854-0329

Changed Replaceable Parts (Serial Numbers 1538G00685 and below)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R1	0757-0283	2	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A4R2	0757-0273	1	RESISTOR 3.01K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3011-F
A4R3	0757-0439	1	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A4R4	0757-0440	1	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4R5	0757-0346	2	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4R6	0757-0455	1	RESISTOR 36.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3652-F
A4R7	0757-0280	4	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R8	1812-0019	1	INTEGRATED CIRCUIT	28480	1812-0019
A4R9	0757-0437	7	RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R10	0757-0401	7	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R11	0698-3158	1	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A4R12	2100-2788	1	RESISTOR, VAR 4.7K OHM 20% C LIN 0.5W	28480	2100-2788
A4R13	0757-0317	1	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A4R14	0698-3498	1	RESISTOR 8.66K 1% .125W F TC=0+-100	16299	C4-1/8-T0-866R-F
A4R15	0698-6322	4	RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A4R16	0698-6343	4	RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A4R17	0698-7563	1	RESISTOR 13.3K .5% .125W F TC=0+-50	19701	MF4C1/8-T2-1332-D
A4R18	0698-6835	1	RESISTOR 3.16K .5% .125W F TC=0+-50	24546	NC4-1/8-T2-3161-D
A4R19	0757-0442	7	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R20	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R21	0698-3492	3	RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A4R22	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R23	0757-0417	5	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R24	0812-0021	5	RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A4R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R26	0686-1025	1	RESISTOR 1K 5% .5W CC TC=0+647	01121	EB1025
A4R27	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R29	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R30	0698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A4R31	0698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A4R32	0812-0021		RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A4R33	0758-0016	2	RESISTOR 300 5% .25W F TC=0+-100	24546	C5-1/4-T0-301-J
A4R34	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R36	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R37	0812-0021		RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A4R38	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R39	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R40	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R41	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4R42	0758-0032	1	RESISTOR 820 5% .25W F TC=0+-100	24546	C5-1/4-T0-821-J
A4R43	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R44	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R45	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R46	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A4R47	0698-6343		RESISTOR 9K .1% .125W F TC=0+-25	24546	NE55
A4R48	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A4R49	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R50	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A4R51	0698-6322		RESISTOR 4K .1% .125W F TC=0+-25	24546	NE55
A4R52	0812-0021		RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A4R53	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R54	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R56	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R57	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R58	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A4R59	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R60	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R61	0698-3492		RESISTOR 2.67K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2671-F
A4R62	0758-0016		RESISTOR 300 5% .25W F TC=0+-100	24546	C5-1/4-T0-301-J
A4R63	0757-0437		RESISTOR 4.75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4751-F
A4R64	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R65	0812-0021		RESISTOR .47 5% 3W PW TC=0+-90	91637	CW2B1-3-T2-47/100-J
A4R66	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4U1	1820-0439	1	IC UA 723C V RGLTR	07263	723PC
A4U2	1826-0092	2	IC MC 1458 OP AMP	28480	1826-0092
A4U3	1826-0092		IC MC 1458 OP AMP	28480	1826-0092
A4U4	1820-0216	1	IC UA 741 OP AMP	28480	1820-0216

8–3 Serial Number 1342G 00510 and below

8–4 Mainframe capacitors C1, C2, C3, C4 and MP21, 30 are replaced by A9 Capacitor Assembly and Capacitor Clamp MP5.

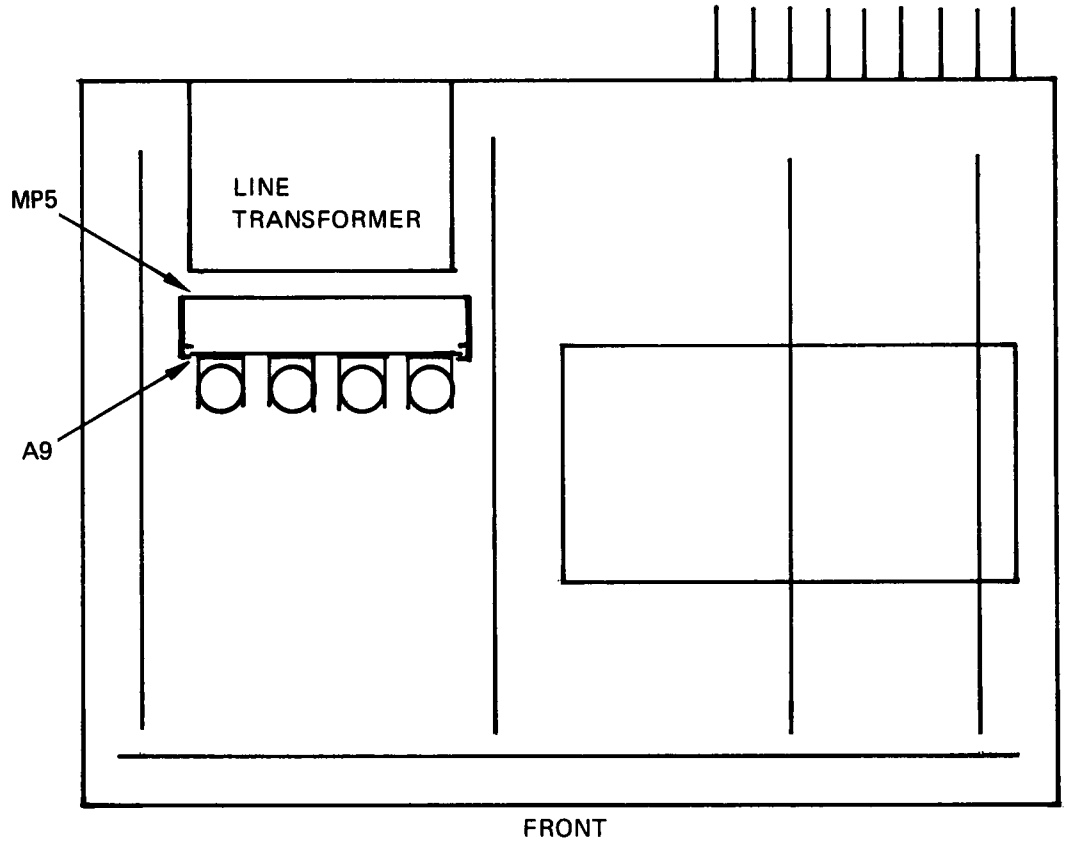


Figure 8–2. Changed Assemblies – Serial Numbers 1342G 00685 and below

Changed Repleaceable Parts (Serial Numbers 1342G 00685 and below).

Delete: C1, C2, C3, C4, MP21, MP30 from Mainframe List.

Add:

MP5	08015–01204	BRACKET CAPACITOR BD
A9	08015–66509	ASSEMBLY CAPACITOR
A9 C1 to C4	0180–2406	C–F 5000UF 40V
A9MP1 to 4	1400–0040	CLIP CAPACITOR

8–5 Serial Number 1538G 00925

8–6 Rear panel and line voltage selector are changed, S16 and S17 being replaced by a double pole switch, S16.

MP22	08015–00209	REAR PANEL
S16	3101–1609	SWITCH DUAL DPDT

9–1 INTRODUCTION

9–2 This section contains the component layouts and schematic diagrams. Tables listing the reference designators and schematic symbols used are also given. Refer to section 6 for the replaceable parts information.

9–3 RECOMMENDED TEST EQUIPMENT

9–4 Test equipment and test equipment accessories required are listed in tables 5–1 and 5–13. Equipment other than that listed can be used if it meets the listed critical specifications.

Table 9–1. Reference Designators

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

Table 9–2. Index to Service Sheets

A2	Output	5
A3	Timing	1, 2, 3
A4	Power supply	7a
A5	Integrator	4
A6	Burst (002)	8
W8A8	Power/offset supply	7a, 5
A10	TTL (005)	4
A11	Switch Bd Ay (001)	6y
W18A18	Power/offset supply (001)	7a, 5
A21	Switch Bd Ay	6
A24	Power supply	7
A25	Integrator (004)	4
A27	Burst (002)	8
A28	Power/offset supply	7, 5
A30	Rem control, digital (003)	9
A31	Switch Bd Ay (003)	6b
A32	Amplifier access (004)	4
A33	Rem control, analog (003)	10
A38	Power/offset supply (001)	7, 5
Option 001		6a, 7
002		6, 8
003		6b, 9, 10
004		4
005		6, 4
006		6

Table 9–3. Schematic Diagram Notes (1 of 2)

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 informations is required.

General

Units — 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

947 — Wire colour code. Same as resistor colour code. First number is wire body colour.

Wire or plug used as link.

① — 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.

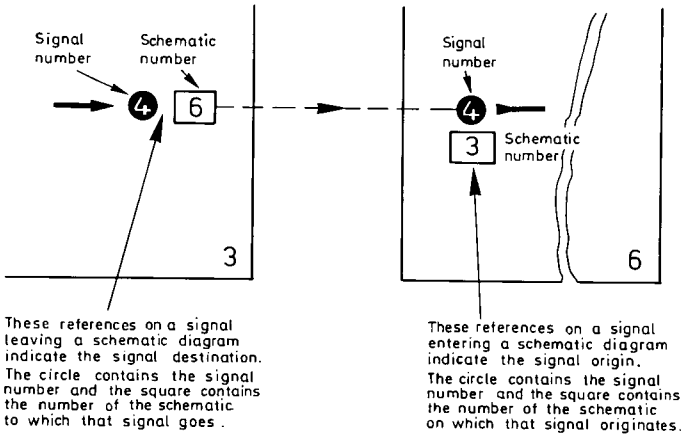
Direct connection to earth.

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.

xV — Specific potential difference with respect to a potential reference level, eg. +10V

Schematic Referencing



These references on a signal leaving a schematic diagram indicate the signal destination. The circle contains the signal number and the square contains the number of the schematic to which that signal goes.

These references on a signal entering a schematic diagram indicate the signal origin. The circle contains the signal number and the square contains the number of the schematic on which that signal originates.

Components

Normally open toggle switch. Circles (○) 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

bead — Ferrite bead

Varactor diode

Multi-junction diode

Diode

Zener diode

Schottky diode

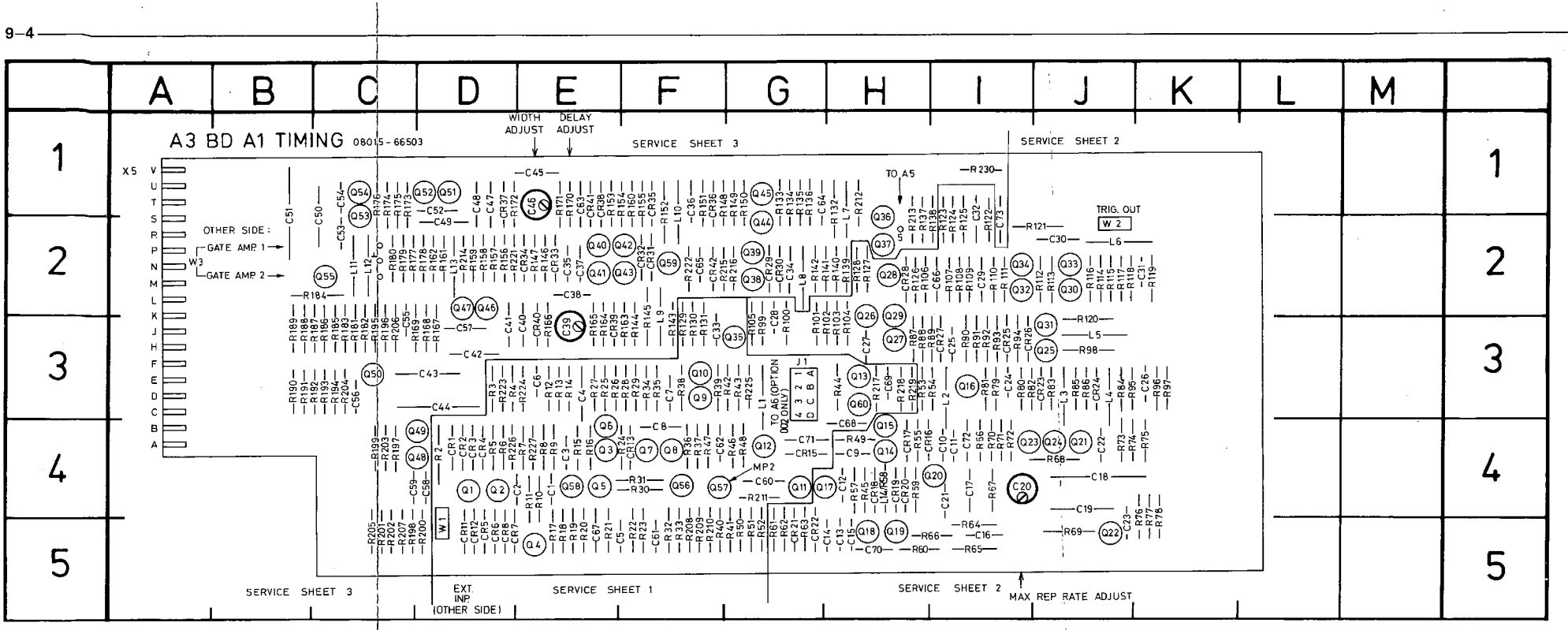
Light Emitting Diode (LED)

Photodiode

Fuse

Neon

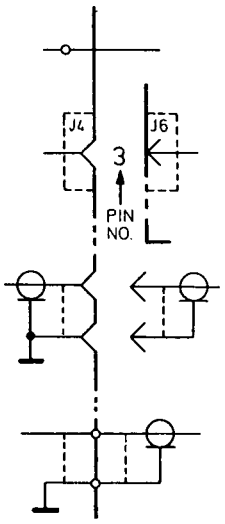
Filament lamp



C1	E4	C31	K2	C61	F5	CR19	H4	L6	J2	Q21	J4	Q50	C3	R19	E5	R49	H4	R79	I3	R109	I2	R139	H2	R169	C3	R199	C4	W1	D5
C2	D4	C32	I1	C62	F4	CR20	H4	L7	H1	Q22	J5	Q51	D1	R20	E5	R50	G5	R80	I3	R110	I2	R140	H2	R170	E1	R200	C5	W2	J2
C3	E4	C33	F3	C63	E1	CR21	G5	L8	G2	Q23	I4	Q52	D1	R21	E5	R51	G5	R81	I3	R111	I2	R141	G2	R171	E1	R201	C5		
C4	E3	C34	G2	C64	G1	CR22	G5	L9	F3	Q24	J4	Q53	C1	R22	F5	R52	G5	R82	I3	R112	J2	R142	G2	R172	D1	R202	C5		
C5	E5	C35	E2	C65	F2	CR23	J3	L10	F1	Q25	J3	Q54	C1	R23	F5	R53	H3	R83	J3	R113	J2	R143	F3	R173	C1	R203	C4		
C6	E3	C36	F1	C66	I2	CR24	J3	L11	C2	Q26	H3	Q55	C2	R24	E4	R54	H3	R84	J3	R114	J2	R144	F3	R174	C1	R204	C3		
C7	F3	C37	E2	C67	E5	CR25	I3	L12	C2	Q27	H3	Q56	F4	R25	E3	R55	H4	R85	J3	R115	J2	R145	F3	R175	C1	R205	C5		
C8	F4	C38	E2	C68	H4	CR26	I3	L13	D2	Q28	H2	Q57	F4	R26	E3	R56	I4	R86	J3	R116	J2	R146	E2	R176	C1	R206	C3		
C9	H4	C39	E3	C69	H3	CR27	I3	L14	H4	Q29	H3	Q58	E4	R27	E3	R57	H4	R87	H3	R117	J2	R147	E2	R177	C2	R207	C5		
C10	I4	C40	D3	C70	H5	CR28	H2			Q30	J2	Q59	F2	R28	E3	R58	H4	R88	H3	R118	J2	R148	F1	R178	C2	R208	F5		
								Q1	D4																				
C11	I4	C41	D3	C71	G4	CR29	G2	Q2	D4	Q31	J3	Q60	H3	R29	F3	R59	H4	R89	H3	R119	K2	R149	G1	R179	C2	R209	F5		
C12	H4	C42	D3	C72	I4	CR30	G2	Q3	E4	Q32	I2			R30	F4	R60	H5	R90	I3	R120	J3	R150	G1	R180	C2	R210	F5		
C13	H5	C43	D3	C73	I1	CR31	F2	Q4	E5	Q33	J2	R2	D4	R31	F4	R61	G5	R91	I3	R121	J2	R151	F1	R181	C3	R211	G4		
C14	H5	C44	D3			CR32	F2	Q5	E4			R3	D3	R32	F5	R62	G5	R92	I3	R122	I1	R152	F1	R182	C3	R212	H1		
C15	H5	C45	E1	CR1	D4	CR33	E2			Q34	I2			R33	F5	R63	G5	R93	I3	R123	I1	R153	E1	R183	C3	R213	H1		
				CR2	D4			Q6	E4			R4	D3																
C16	I5	C46	E1	CR3	D4	CR34	E2	A7	F4	Q35	G3	R5	D4	R34	F3	R64	I5	R94	I3	R124	I1	R154	E1	R184	C2	R214	D2		
C17	I4	C47	D1	CR4	D4	CR35	F1	Q8	F4	Q36	H2	R6	D4	R35	F3	R65	I5	R95	J3	R125	I1	R155	F1	R185	C3	R215	F2		
C18	J4	C48	D1	CR5	D5	CR36	F1	Q9	F3	Q37	H2	R7	D4	R36	F4	R66	H5	R96	K3	R126	H2	R156	D2	R186	C3	R216	G2		
C19	J4	C49	D2			CR37	D1	Q10	F3	Q38	G2	R8	E4	R37	F4	R67	I4	R97	K3	R127	H2	R157	D2	R187	B3	R217	H3		
C20	I4	C50	C1	CR6	D5	CR38	E1			Q39	G2			R38	F3	R68	J4	R98	J3	R128	H2	R158	D2	R188	B3	R218	H3		
				CR7	D5			Q11	G4			R9	E4																
C21	I4	C51	B1	CR8	D5	CR39	E3	Q12	G4	Q40	E1	R10	E4	R39	F3	R69	J5	R99	G3	R129	F3	R159	D2	R189	B3	R219	H3		
C22	J4	C52	D1	CR11	D5	CR40	E3	Q13	H3	Q41	E1	R11	E4	R40	F5	R70	I4	R100	G3	R130	F3	R160	F1	R190	B3	R221	D2		
C24	J5	C53	C2	CR12	D5	CR41	E1	Q14	H4	Q42	E1	R12	E3	R41	F5	R71	I4	R101	G3	R131	F3	R161	D2	R191	B3	R222	F2		
C24	I3	C54	C1			CR42	F2	Q15	H4	Q43	E1	R13	E3	R42	F3	R72	I4	R102	G3	R132	H1	R162	D2	R192	B3	R223	D3		
C25	I3	C55	C3	CR13	F4					Q44	G1			R43	G3	R73	J4	R103	H3	R133	G1	R163	E3	R193	C3	R224	E3		
				CR15	G4	J1	G3	Q16	I3			R14	E3																
C26	K3	C56	C3	CR16	H4			Q17	G4	Q45	D1	R15	E4	R44	H3	R74	J4	R104	H3	R134	G1	R164	E3	R194	C3	R225	G3		
C27	H3	C57	D3	CR17	H4	L1	G3	Q18	H5	Q46	D2	R16	E4	R45	H4	R75	K4	R105	G3	R135	G1	R165	E3	R195	C3	R226	D4		
C28	G3	C58	D4	CR18	H4	L2	I3	Q19	H5	Q47	D2	R17	E5	R46	F4	R76	K5	R106	H2	R136	G1	R166	E3	R196	C3	R227	E4		
C29	I2	C59	C4			L3	J3	Q20	H4	Q48	C4	R18	E5	R47	F4	R77	K5	R107	I2	R137	H1	R167	D3	R197	C4	R230	I1		
C30	J2	C60	G4			L4	J3			Q49	C4			R48	G4	R78	K5	R108	I2	R138	H1	R168	D3	R198	C5				
						L5	J3																						

Table 9–3. Schematic Diagram Notes (2 of 2)

Terminals and Connectors



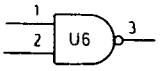
Soldered connection.

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

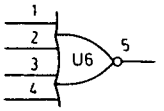
example of bulkhead mounted coaxial socket with free coaxial plug and cable.

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

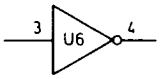
Logic Symbols



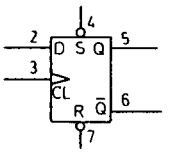
2-input NAND gate



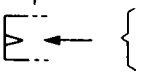
4-input NOR gate



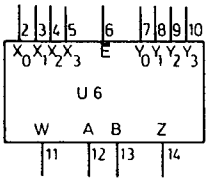
Inverter



Flip-flop.

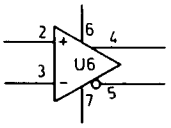


The dynamic indicator denotes that this is a dynamic input and operates on a transition, not a level.



Complex functions represented by rectangular box. Letters inside the rectangle indicate the function which may be further clarified by a truth table.

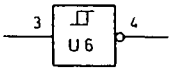
Analog Symbols



Operational amplifier

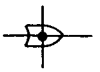
Voltage source

Current source



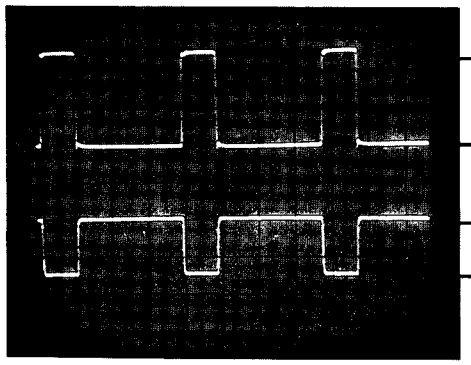
Schmitt trigger

Wired AND connection

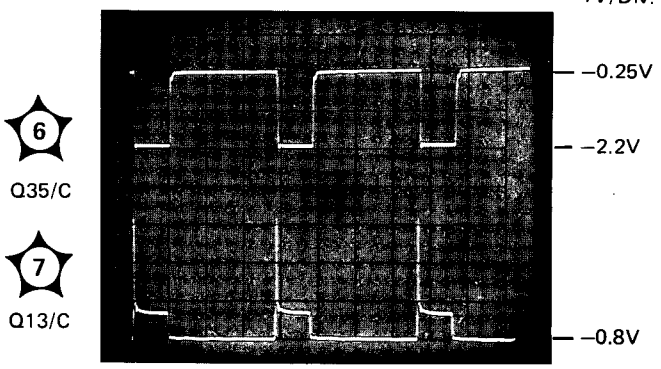


Wired OR connection

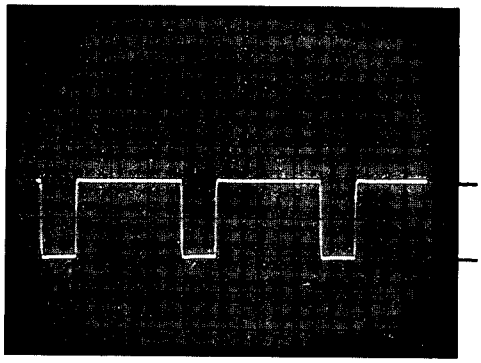
EXT TRIG



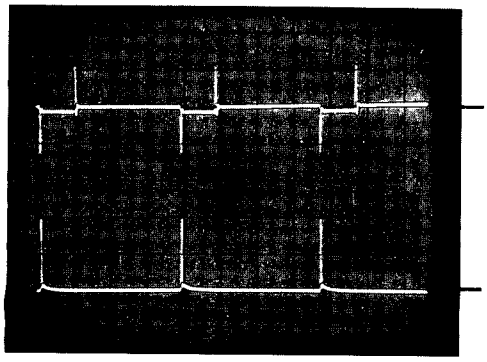
EXT WIDTH



EXT TRIG



EXT TRIG



TEST EQUIPMENT:

Digital Voltmeter	3465A
Oscilloscope	180C/1801A/1821A
Ext Pulse Generator	8015A

Settings for waveforms 1–5

Rate	20n–1μ
Vernier	CW
Delay	20n–1μ
Vernier	CCW
Width	10n–1μ
Vernier	mid position
Trans. Time	6n–0.5μ
Verniers	CCW
Neg-pos-man	pos
Zin	50Ω
Function	Ext Trigger

Settings for waveform 6
same exept:

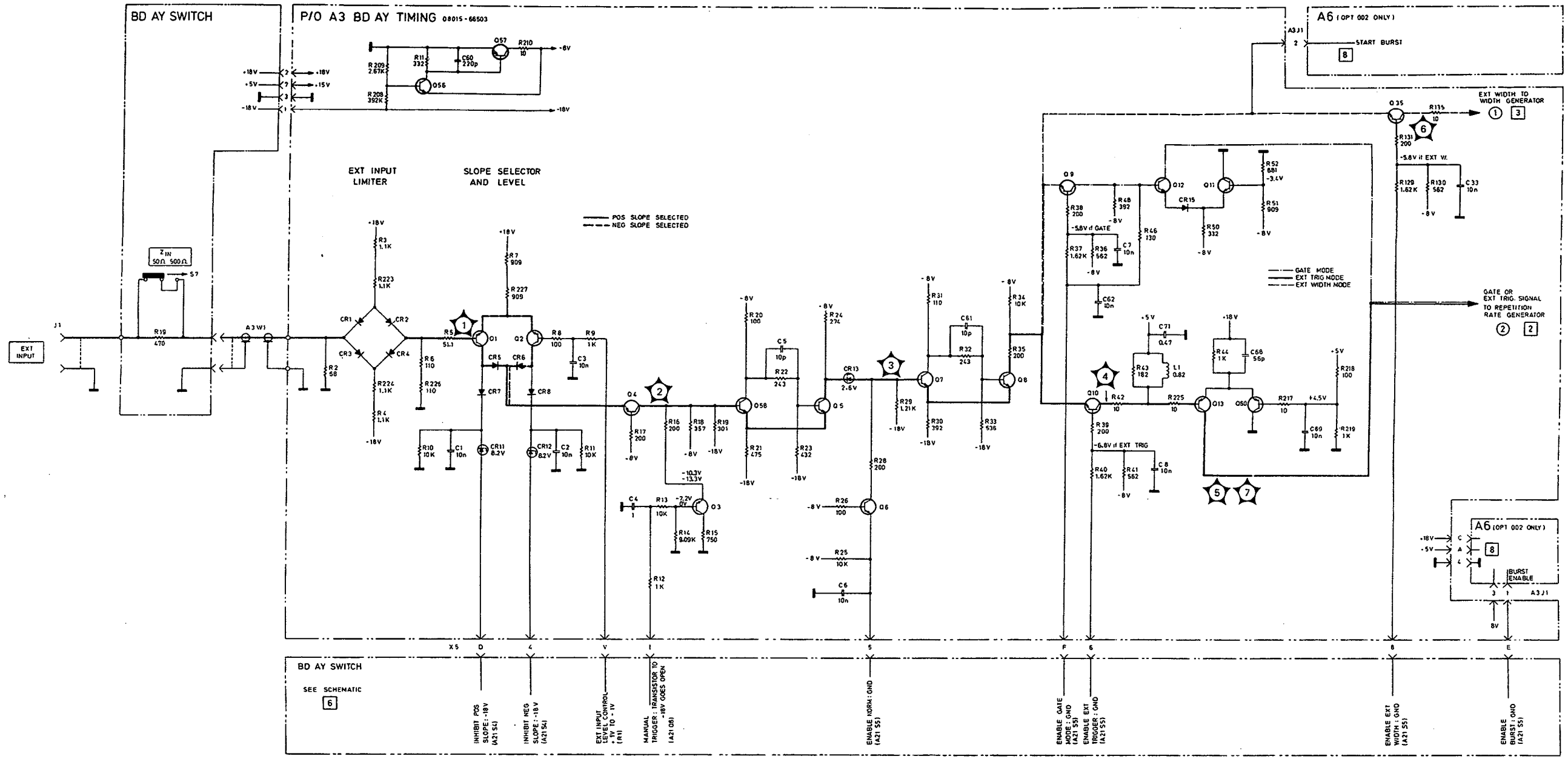
Function	Ext Width

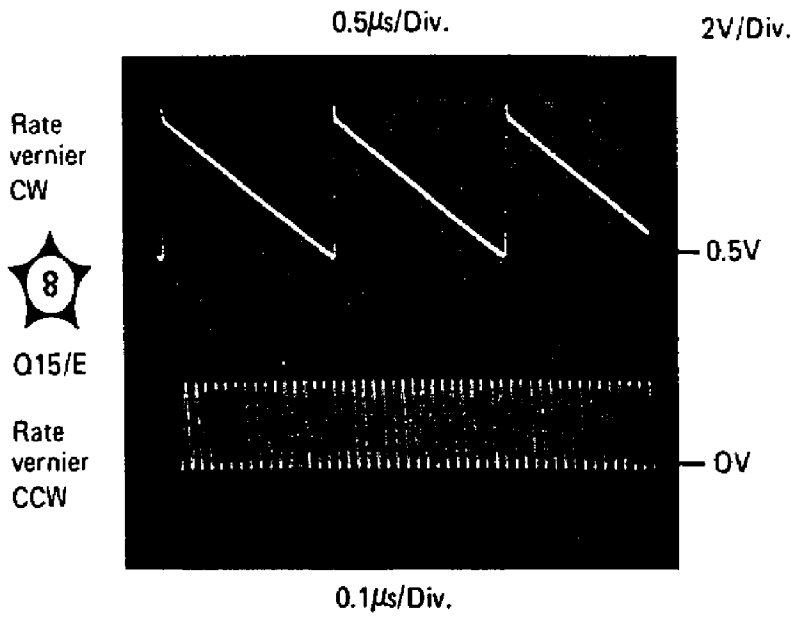
Settings for wave form 7
same exept:

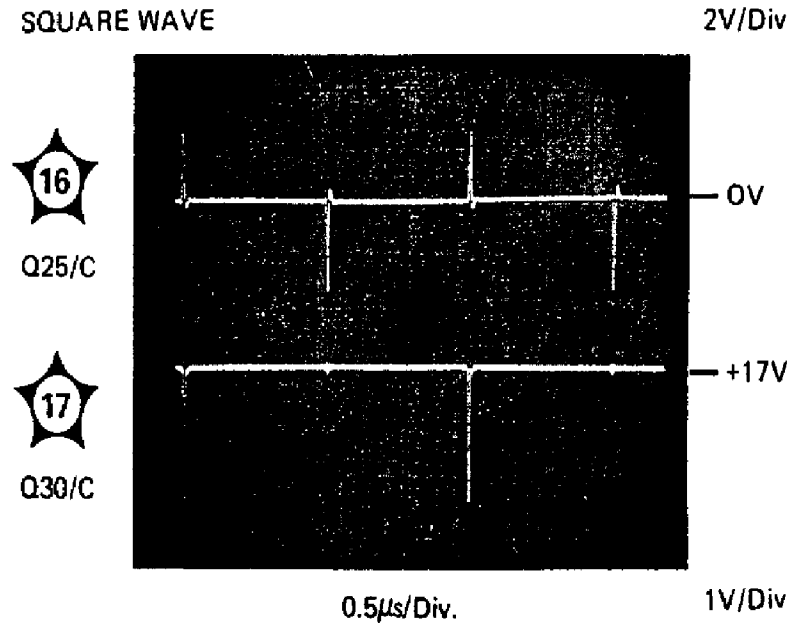
Function	Gate

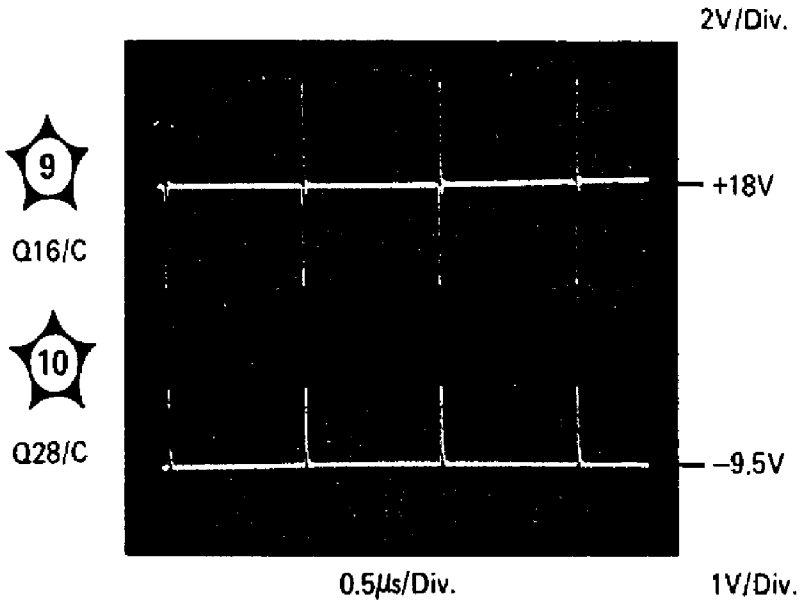
External Pulse Generator:

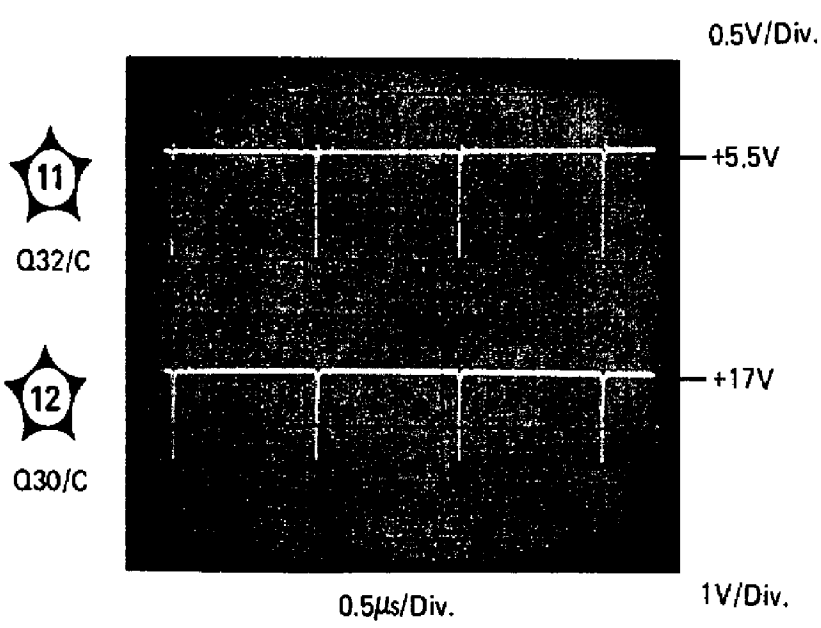
Rate	20n–1μ
Vernier	CW
Delay	20n–1μ
Vernier	CCW
Width	10n–1μ
Vernier	mid position
Amplitude	2V
Lower Level	zero

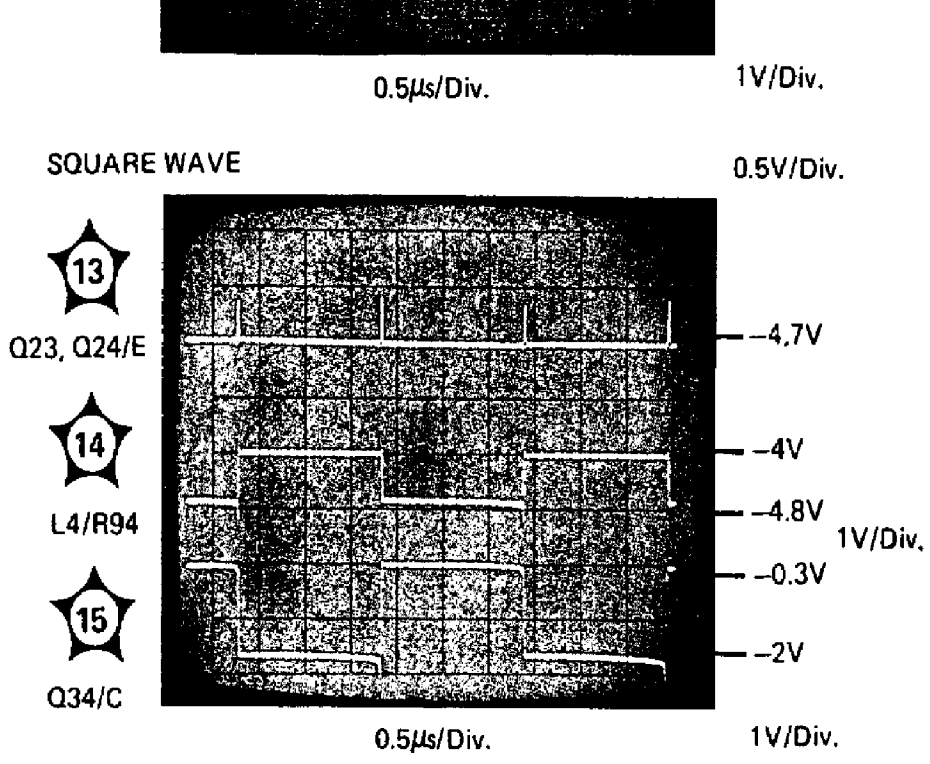

BD AY SWITCH
P/O A3 BD AY TIMING 08015-66503
A6 (OPT 002 ONLY)
A3J1
2
START BURST
8
EXT INPUT LIMITER
SLOPE SELECTOR AND LEVEL
POS SLOPE SELECTED
NEG SLOPE SELECTED
+18V
+5V
-18V
Q57
R210
10
-8V
R209
2.67K
R11
332
C60
220p
Q56
R208
392K
EXT INPUT
J1
Z IN
50Ω 500Ω
S7
R19
470
A3 W1
R3
1.1K
R223
1.1K
CR1
CR2
CR3
CR4
R224
1.1K
R4
1.1K
R2
58
R6
110
R225
110
R5
51.3
Q1
Q2
R8
100
R9
1K
C3
10n
R7
909
R227
909
CR5
CR6
CR7
CR8
R10
10K
C1
10n
CR11
8.2V
CR12
8.2V
C2
10n
R11
10K
Q4
R17
200
R16
200
R18
357
R19
301
-10.3V
-13.3V
C4
1
R13
10K
-7.2V
Q3
R14
9.09K
R15
750
R12
1K
Q58
R20
100
C5
10p
R22
243
R21
475
R23
432
Q5
CR13
2.6V
R24
274
R28
200
Q6
R26
100
R25
10K
C6
10n
Q7
R31
110
C61
10p
R32
243
R29
1.21K
R30
392
R33
536
R34
10K
R35
200
Q8
Q9
R38
200
R48
392
-5.8V if GATE
R37
1.62K
R36
562
C7
10n
R46
130
C62
10n
Q12
Q11
CR15
R52
681
-3.4V
R51
909
R50
332
GATE MODE
EXT TRIG MODE
EXT WIDTH MODE
GATE OR EXT TRIG. SIGNAL TO REPETITION RATE GENERATOR
2
2
Q35
R135
10
EXT WIDTH TO WIDTH GENERATOR
1
3
6
R131
200
-5.8V if EXT W.
R129
1.62K
R130
562
C33
10n
+5V
C71
0.47
L1
0.82
R43
182
+18V
R44
1K
C66
56p
Q10
R42
10
R39
200
-6.8V if EXT TRIG
R40
1.62K
R41
562
C8
10n
R225
10
Q13
Q50
R217
10
+4.5V
C69
10n
R218
100
R219
1K
4
5
7
A6 (OPT 002 ONLY)
+18V
-5V
C
A
C
8
BURST ENABLE
3
1
A3J1
8V
X5
D
4
V
I
5
F
6
8
E
BD AY SWITCH
SEE SCHEMATIC
6
INHIBIT POS SLOPE: -18V (A2I 54)
INHIBIT NEG SLOPE: -18 V (A2I 54)
EXT INPUT LEVEL CONTROL + 1V TO - 1V (A1)
MANUAL TRIGGER: TRANSISTOR TO -18V GOES OPEN (A2I 58)
ENABLE NORM: GND (A2I 55)
ENABLE GATE MODE: GND (A2I 55)
ENABLE EXT TRIGGER: GND (A2I 55)
ENABLE EXT WIDTH: GND (A2I 55)
ENABLE BURST: GND (A2I 55)











TEST EQUIPMENT

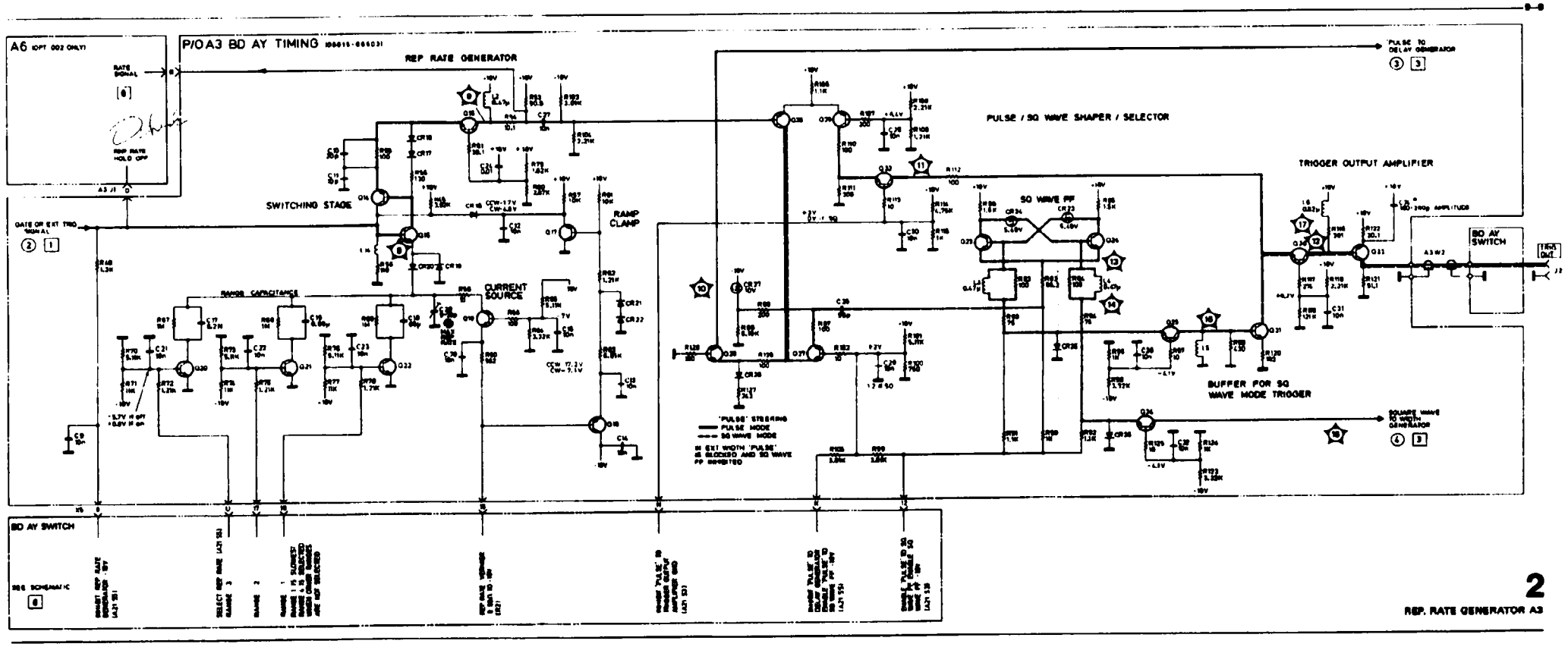
Digital voltmeter	3465A
Oscilloscope	180C/1801A/1821A

Settings for wave forms 1–5

Rate	20n–1μ
Vernier	CW
Delay	20n–1μ
Vernier	CCW
Width	10n–1μ
Vernier	mid position
Trans. Times	6n–0.5μs
Verniers	CCW
Function	NORM

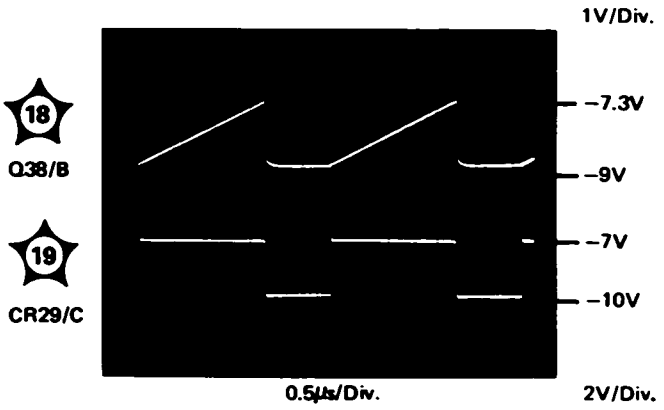
Settings for waveforms 6–10
same exept:

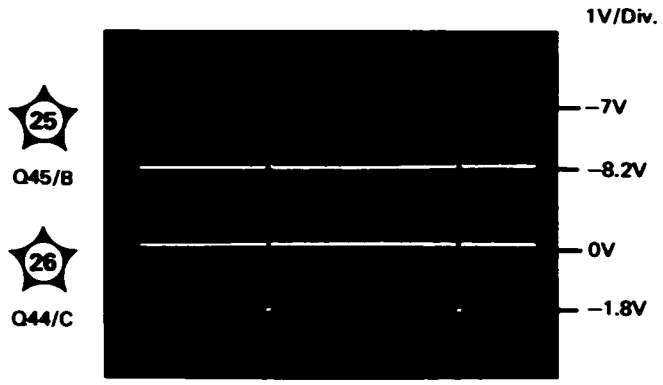
Width	square wave

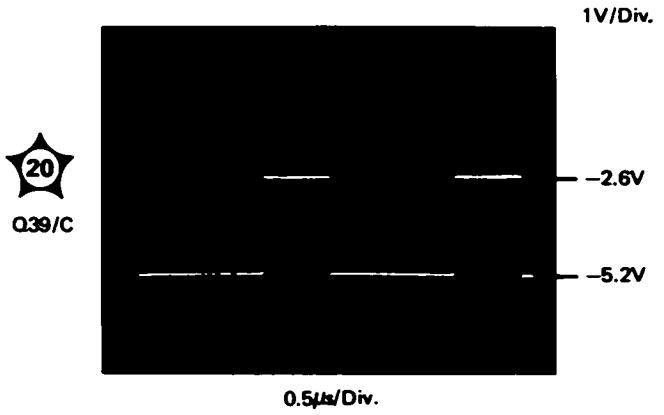


2

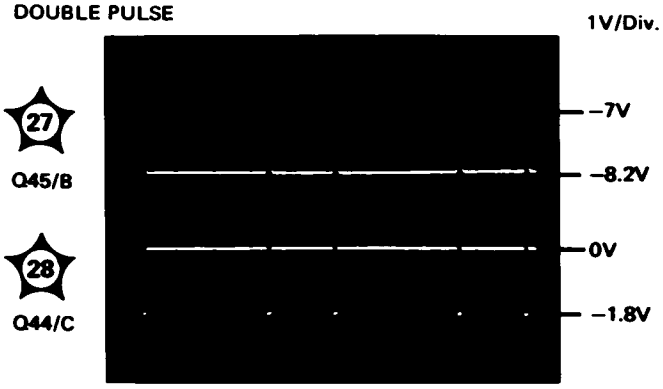
REP. RATE GENERATOR A3

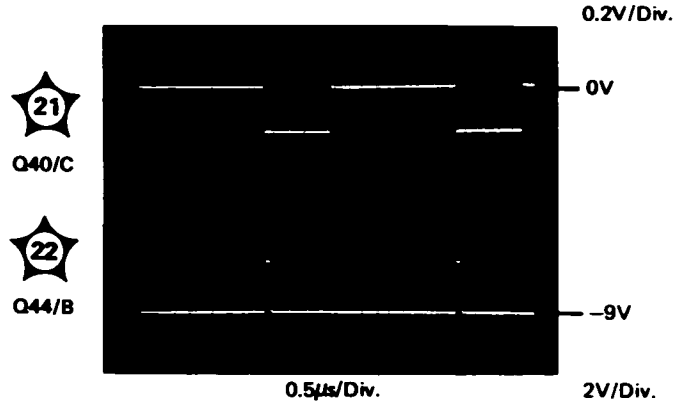






DOUBLE PULSE





TEST EQUIPMENT:

Digital Voltmeter	3465A
Oscilloscope	180C/1801A/1821A

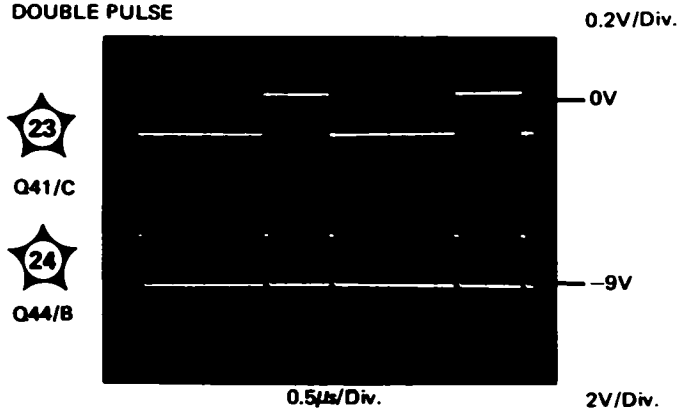
Settings for wave forms 1–5, 8–9 first

Rate	1μ–0.1m
Vernier	mid position
Delay	1μ–0.1m
Vernier	mid position
Width	1μ–0.1m
Vernier	CCW

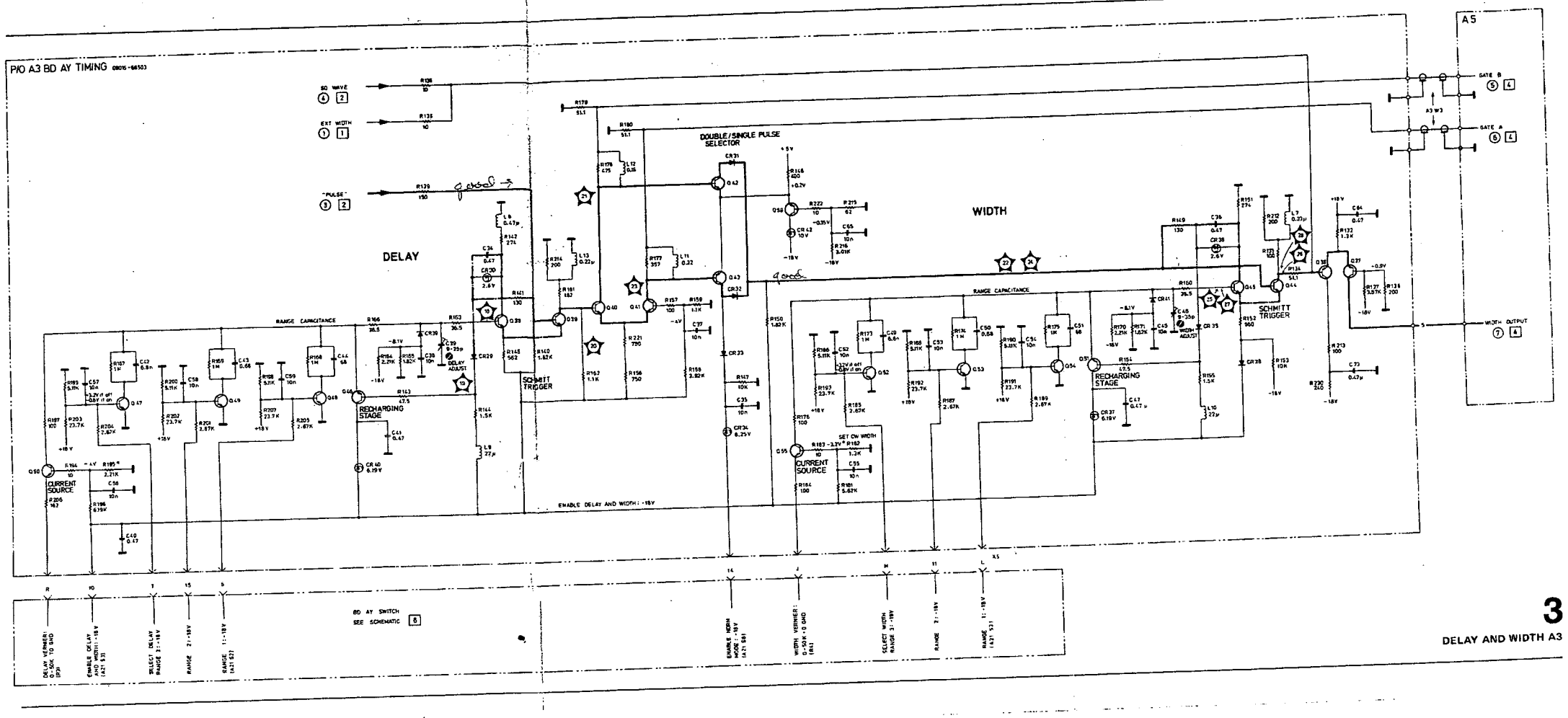
Settings for wave forms 6–7, 8–9 second same as above except:

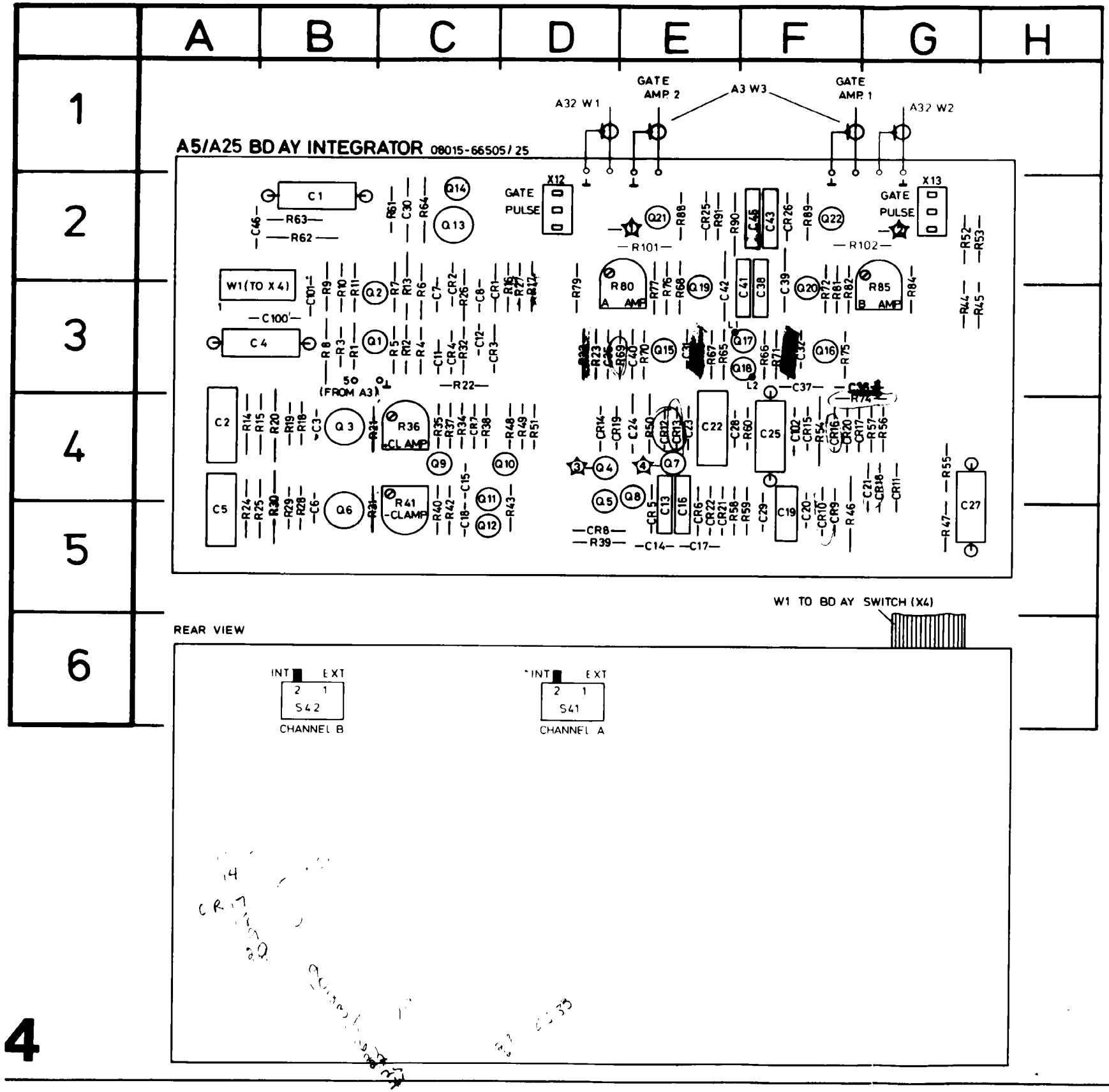
Mode	Double Pulse

DOUBLE PULSE



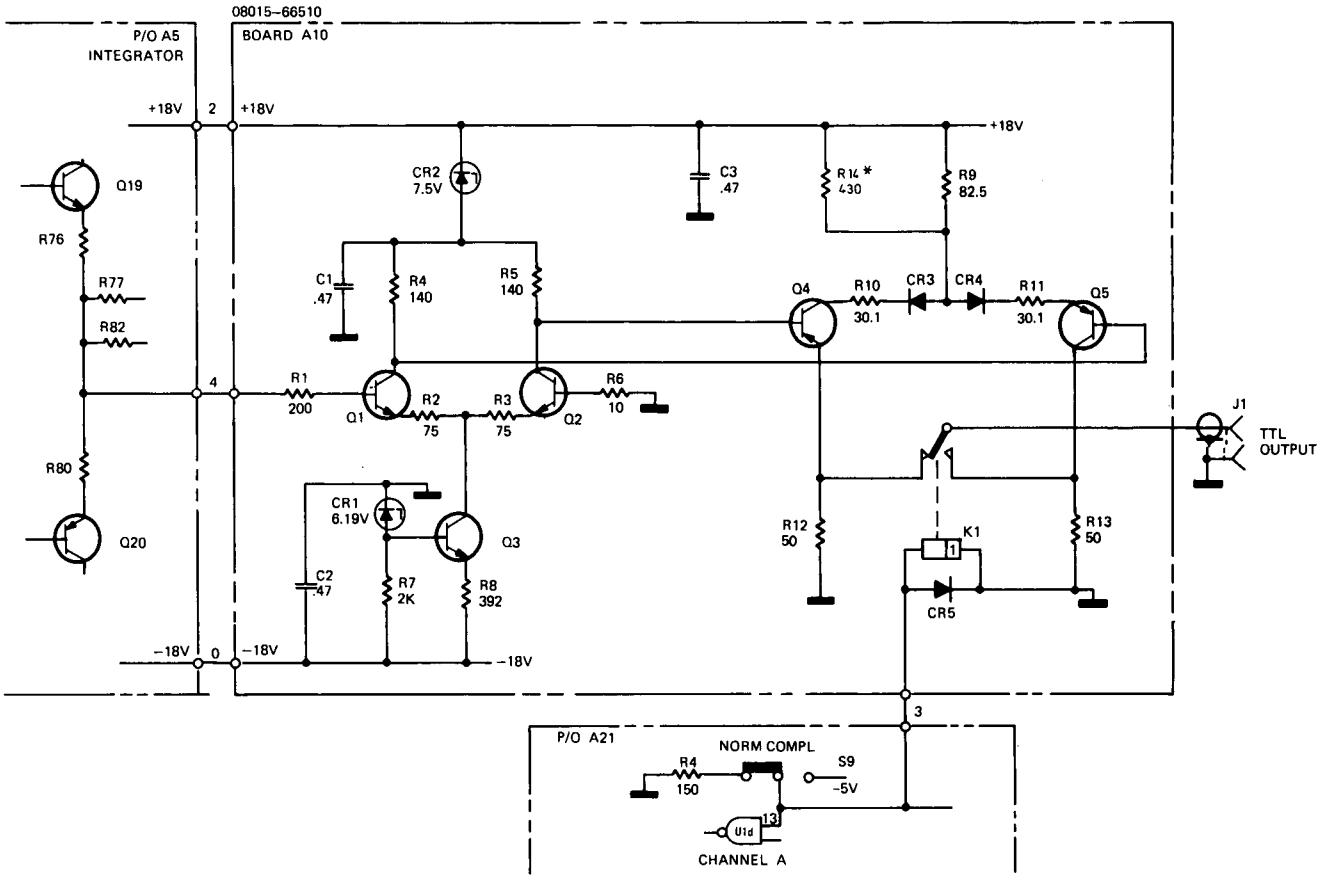
P/O A3 BD AY TIMING 08015-66503





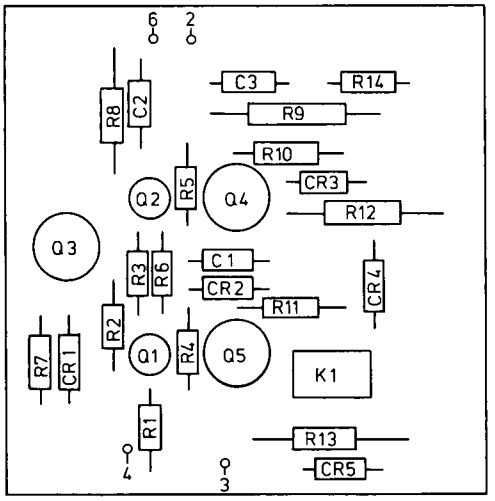
C1	B2	CR25	F2	R42	C4
C2	A4	CR26	F2	R43	D4
C3	B4			R44	G2
C4	B3	L1	E3	R45	H2
C5	B4	L2	F3	R46	F4
C6	B4	Q1	B3	R47	G4
C7	C2	Q2	C2	R48	D4
C8	C2	Q3	B4	R49	D4
C11	C3	Q4	D4	R50	E4
C12	C3	Q5	D4	R51	D4
C13	E4	Q6	B4	R52	G2
C14	E5	Q7	E4	R53	H2
C15	C4	Q8	E4	R54	F4
C16	E4	Q9	C4	R55	G4
C17	E5	Q10	D4	R56	G4
C18	C4	Q11	C4	R57	G4
C19	F4	Q12	C4	R58	F4
C20	F4	Q13	C2	R59	F4
C21	G4	Q14	C1	R60	F4
C22	E4	Q15	E3	R61	C2
C23	E4	Q16	F3	R62	B2
C24	E4	Q17	F3	R63	B2
C25	F4	Q18	F3	R64	C2
C27	G4	Q19	E2	R65	E3
		Q20	F2	R66	F3
C28	E4				
C29	F4	Q21	E2	R67	E3
C30	C2	Q22	F2	R68	E2
C31	E3			R69	D3
C32	F3	R1	B3	R70	E3
		R3	B2	R71	F3
C35	D3	R4	C3		
C36	G3	R5	C3	R72	F2
C37	F3	R6	C2	R74	G3
C38	F2			R75	F3
C39	F2	R7	C2	R76	E2
		R8	B3	R77	E2
C40	E3	R9	B2		
C41	F2	R10	B2	R79	D2
C42	E2	R11	B2	R80	E2
C43	F2			R81	F2
C45	F2	R12	C3	R82	F2
		R13	C2	R84	G2
C46	B2	R14	A4		
C100	B3	R15	B4	R85	G2
C101	B2	R16	D2	R88	E2
C102	F4			R89	F2
		R17	D2	R90	E2
CR1	C2	R18	B4	R91	E2
CR2	C2	R19	B4		
CR3	C3	R20	B4	R101	E2
CR4	C3	R21	B4	R102	G2
CR5	E4	R22	C3	S41	D6
CR6	E4	R23	D3	S42	B6
CR7	C4	R24	A4		
CR8	D5	R25	B4	X12	D2
CR9	F4	R26	C2	X13	G2
CR10	F4	R27	D2		
CR11	G4	R28	B4		
CR12	E4	R29	B4		
CR13	E4	R30	B4		
CR14	D4	R31	B4		
CR15	F4	R32	C3		
CR16	F4	R33	D3		
CR17	G4	R34	C4		
CR18	G4	R35	C4		
CR19	D4	R36	C4		
CR20	F4	R37	C4		
CR21	E4	R38	C4		
CR22	E4	R39	D5		
CR24	E3	R40	C4		
CR24	F3	R41	C4		

8015A OPTION 005 ONLY
TTL OUTPUT

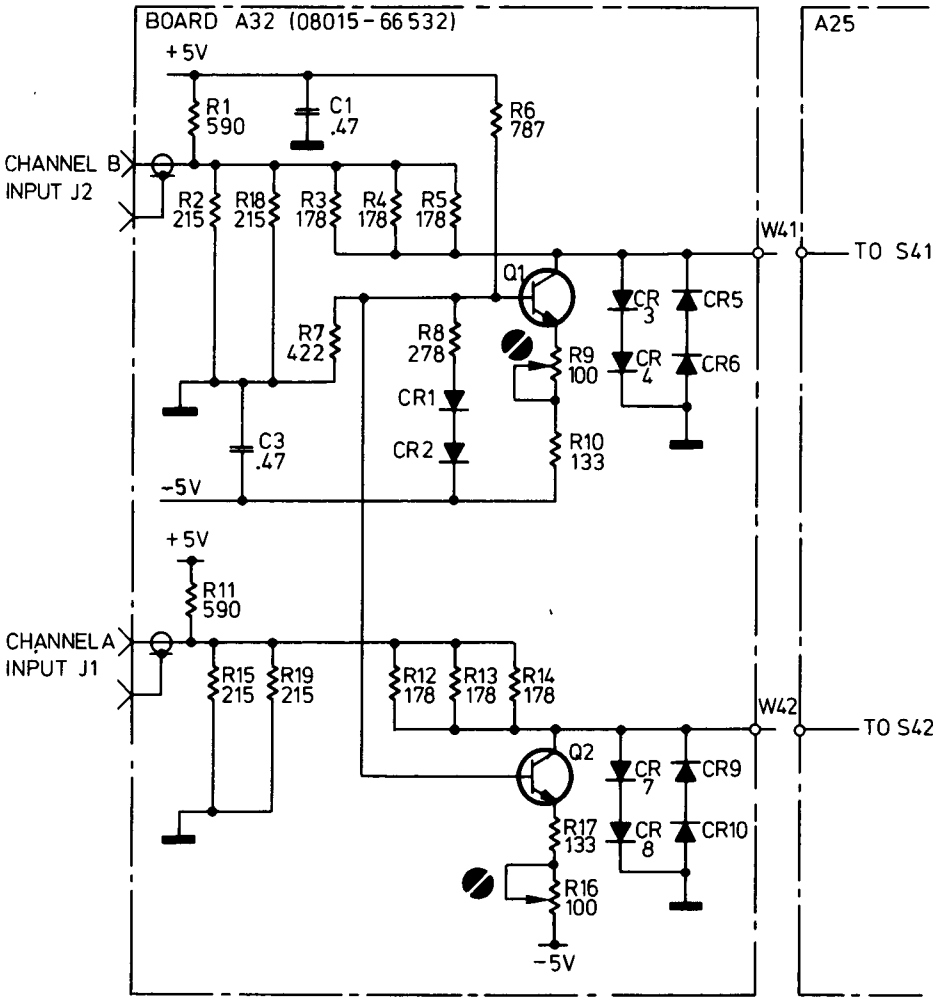


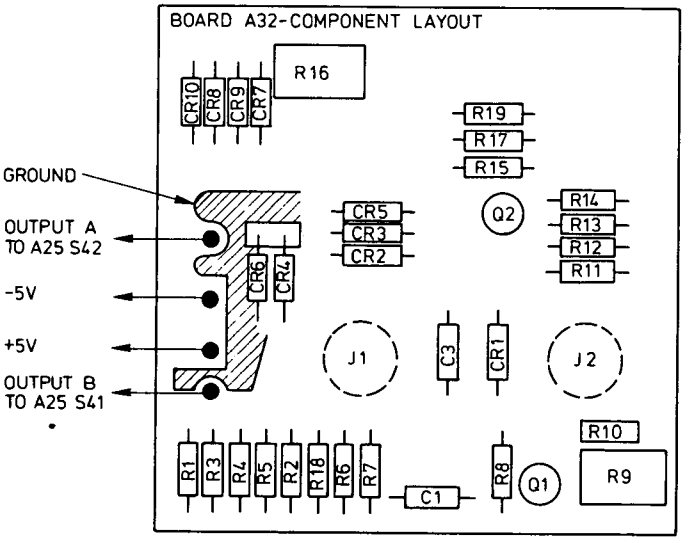
* R14 350–500Ω TTL Output voltage adjust (4.8 to 5.0V without load)

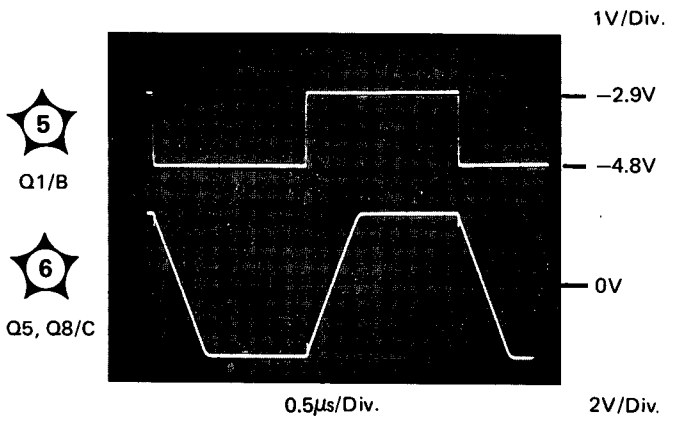
A10 BD A4 TTL OUTPUT 08015–65510

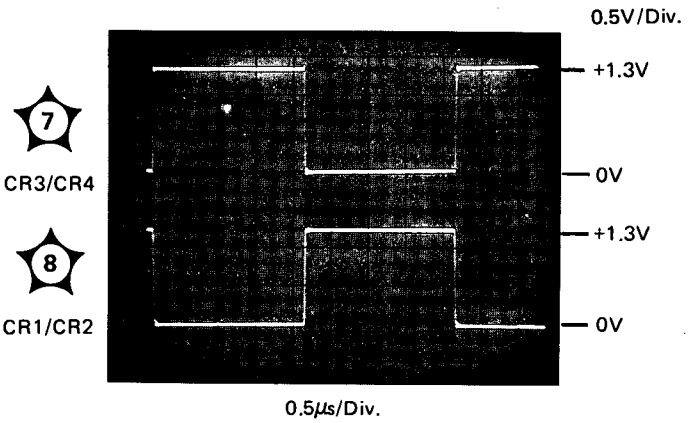


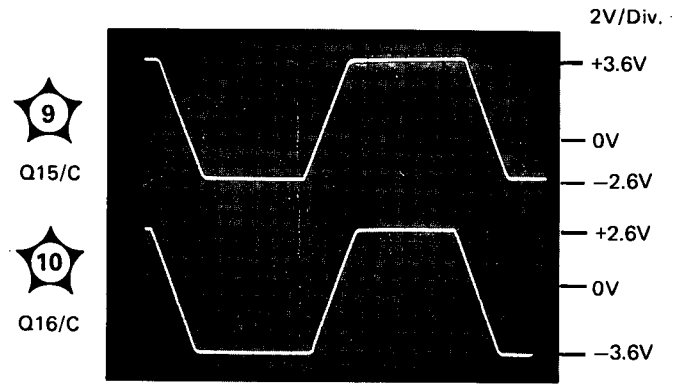
8015A OPTION 004 ONLY
DIRECT AMPLIFIER ACCESS
A32 BD AY DIRECT AMP ACCESS 08015–66532
(mounted on rear panel)

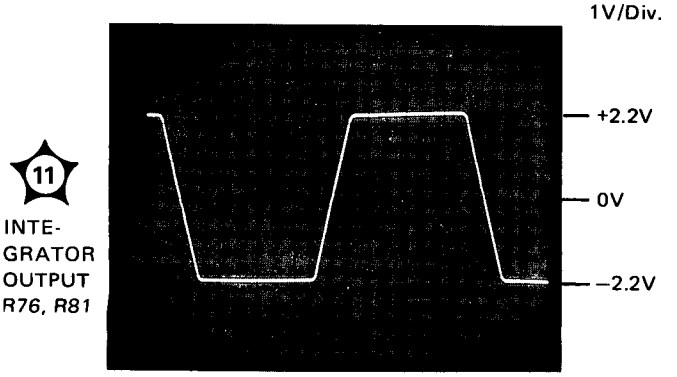


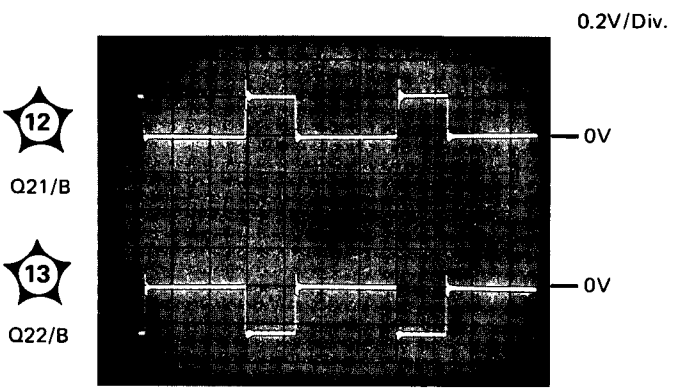


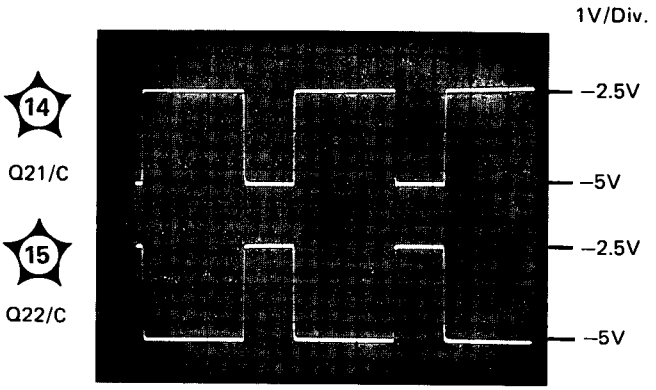












TEST EQUIPMENT:

Digital Voltmeter	3465A
Oscilloscope	180C/1801A/1821A

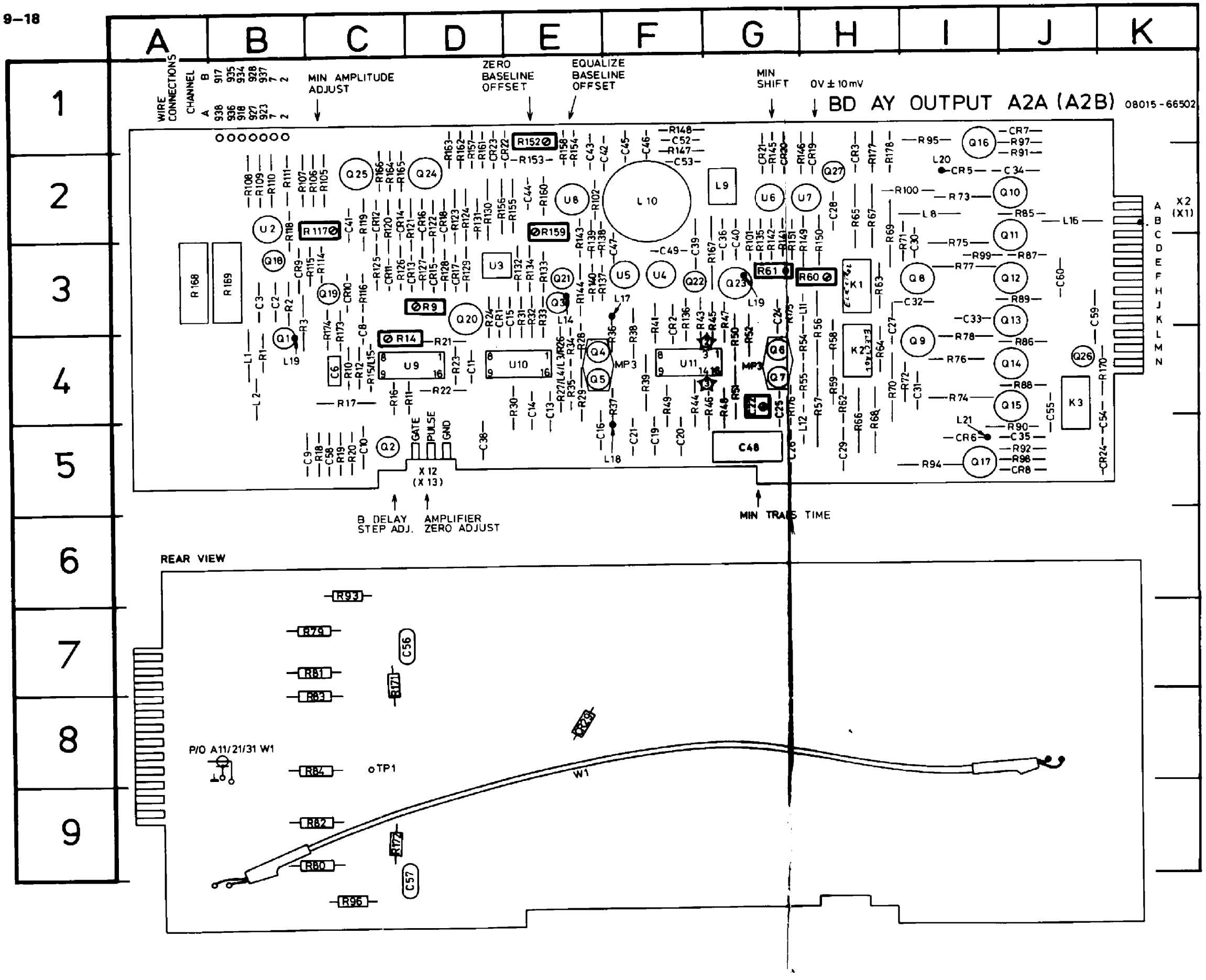
Settings for wave forms 1–7

Rate	1μ–0.1m
Vernier	mid position
Delay	20n–1μ
Vernier	C+
Width	square wave
Trans. Time	5μ–50μ
Verniers	CCW

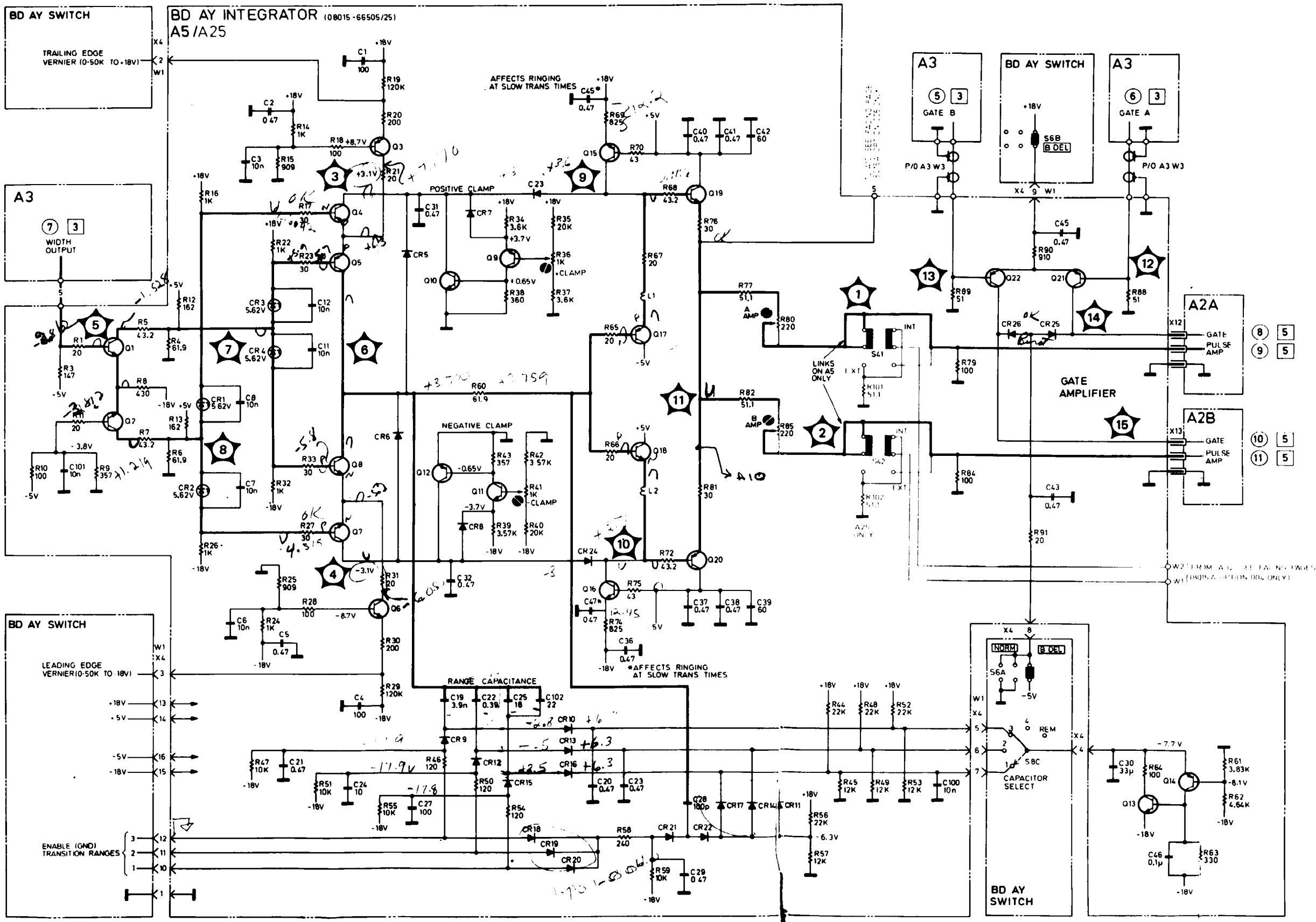
Settings for wave forms 8–11 same exept:

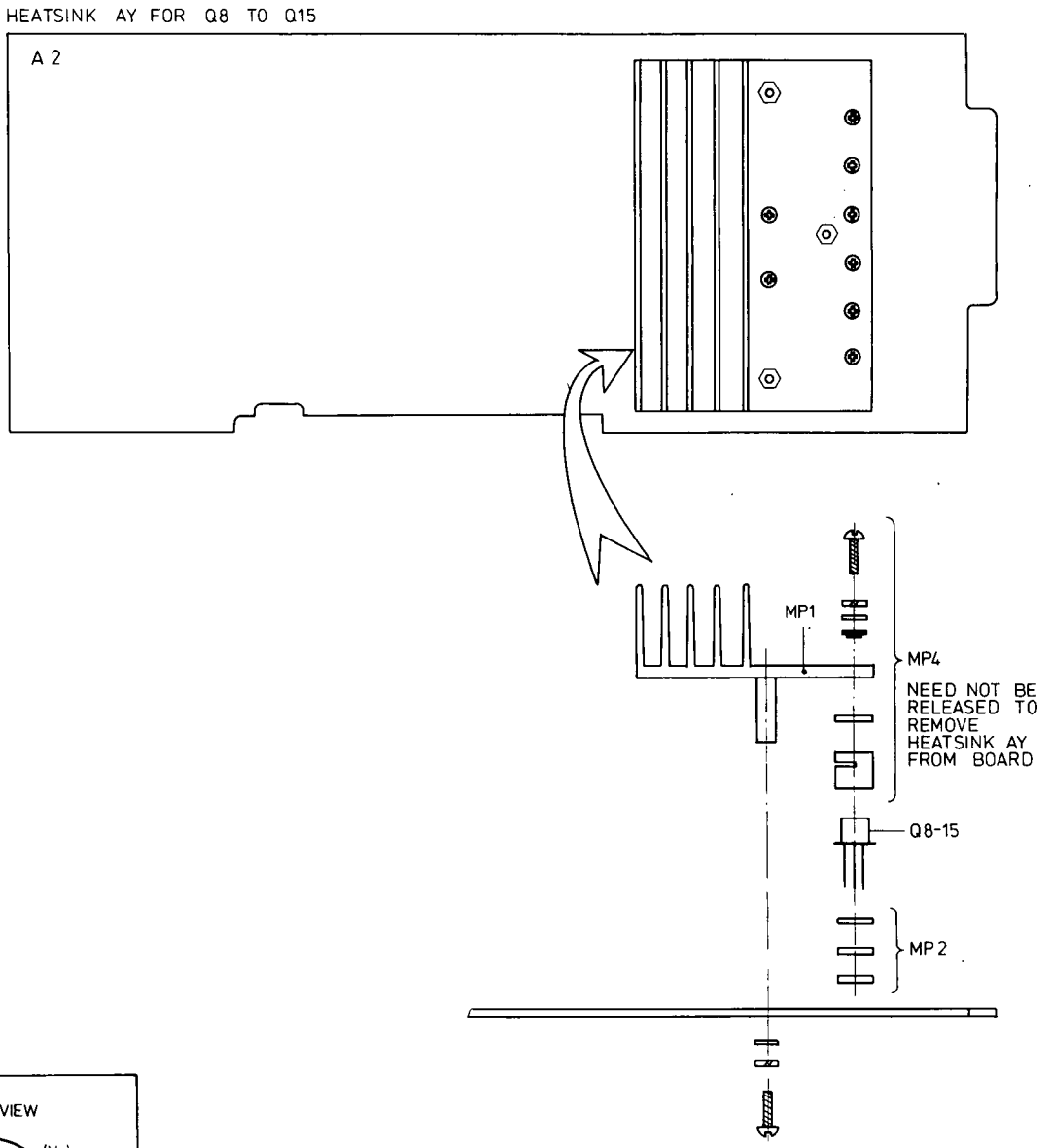
Width	10n–1μ
Vernier	CCW
Mode	B-DEL

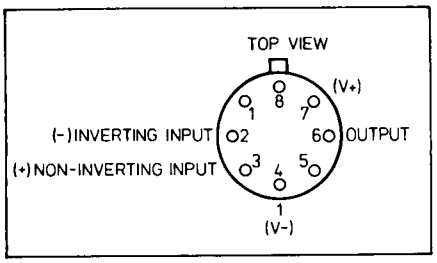
NOTE: A wrong clamp voltage will cause a bad integrator output.



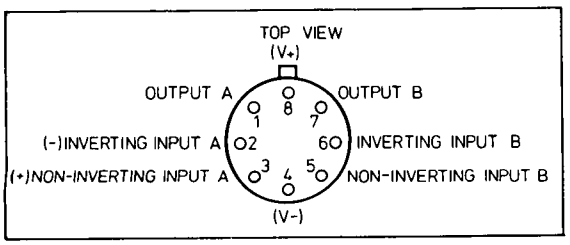
C2	B3	K1	H3	R23	E3	R115	C3	CR1	D3	R1	B4
C3	B3	K2	H4	R34	E4	R116	C3	CR2	F3	R2	B3
C6	C4	K3	J4	R35	E4	R117	C2	CR3	H1	R3	B3
C8	C3			R36	F3	R118	B2	CR5	I2	R9	D3
C9	B5	L1	J4	R37	F4	R119	C2	CR6	I5	R10	C4
		L2	J4							R11	C4
C10	C5	L3	E4	R38	F3	R120	C2	CR7	J1	R12	C4
C11	D4	L4	E4	R39	F4	R121	D2	CR8	J5	R14	C3
C13	E4	L8	I2	R41	F3	R122	D2	CR9	B3	R15	C4
C14	E4			R43	F3	R123	D2	CR10	C3	R16	C4
C15	E3	L9	G2	R44	F4	R124	D2	CR11	C3		
		L10	F2							R17	C4
C16	E5	L11	H3	R45	G3	R125	C3	CR12	C2	R18	C5
C19	F5	L12	H4	R46	G4	R126	C3	CR13	C3	R19	C5
C20	F5	L14	E3	R47	G3	R127	D3	CR14	C2	R20	C5
C21	F5			R48	G4	R128	D3	CR15	D3	R21	D4
C22	G4	L15	C4	R49	F4	R129	D3	CR16	D2		
		L16	J2							R22	D4
C24	G3	L17	F3	R50	G3	R130	D2	CR17	D3	R23	D4
C25	G4	L18	F5	R51	G4	R131	D2	CR18	D2	R24	D3
C26	G5	L19	B3,G3	R52	G3	R132	E3	CR19	H1	R26	E4
C27	H3			R54	H4	R133	E3	CR29	G1	R27	E4
C28	H2	L20	I2	R55	H4	R134	E3	CR21	G1		
		L21	I5							R28	E4
C29	H5			R56	H3	R135	G2			R29	E4
C30	I3	Q1	B3	R57	H4	R136	F3	CR22	E1	R30	E4
C31	I4	Q2	C5	R58	H3	R137	E3	CR23	D1	R31	E3
C32	I3	Q3	E3	R59	H4	R138	E2	CR24	K5	R32	E3
C33	I3	Q4	E4	R60	H3	R139	E2	CR29	E8		
		Q5	E4								
C34	J2			R61	G3	R140	E3				
C35	J5	Q6	G4	R62	H4	R141	G2				
C36	G2	Q7	G4	R63	H3	R142	G2				
C38	D5	Q8	I3	R64	H4	R143	E2				
C39	F2	Q9	I4	R65	H2	R144	E3				
		Q10	J2								
C40	G2			R66	H4	R145	G1				
C41	C2	Q11	J2	R67	H2	R146	H1				
C42	E1	Q12	J3	R68	H4	R147	F1				
C43	E1	Q13	J3	R69	H2	R148	F1				
C44	E2	Q14	J4	R70	H4	R149	H2				
		Q15	J4								
C45	F1			R71	I2	R150	H2				
C46	F1	Q16	I1	R72	I4	R151	G2				
C47	F2	Q17	I5	R73	I2	R152	E1				
C48	G5	Q18	B3	R74	I4	R153	E2				
C49	F3	Q19	C3	R75	I3	R154	E1				
		Q20	D3								
C52	F1			R76	I4	R155	E2				
C53	F2	Q21	E3	R77	I3	R156	D2				
C54	K4	Q22	F3	R78	I4	R157	D1				
C55	J4	Q23	G3	R79	C7	R158	E1				
C56	C7	Q24	D2	R80	C9	R159	E2				
		Q25	C2								
C57	C9			R81	C7	R160	E2				
C58	C5	Q26	J4	R82	C9	R161	D1				
C59	J3	Q27	H2	R83	C7	R162	D1				
C60	J3			R84	C8	R163	D1				
		R1	B4	R85	J2	R164	C2				
CR1	D3	R2	B3								
CR2	F3	R3	B3	R86	J4	R165	C2				
CR3	H1	R9	D3	R87	J3	R166	C2				
CR5	I2	R10	C4	R88	J4	R167	G2				
CR6	I5			R89	J3	R168	A3				
		R11	C4	R90	J5	R169	B3				
CR7	J1	R12	C4								
CR8	J5	R14	C3	R91	J2	R170	K4				
CR9	B3	R15	C4	R92	J5	R171	C7				
CR10	C3	R16	C4	R93	C6	R172	C9				
CR11	C3			R94	I5	R173	C3				
		R17	C4	R95	I1	R174	C3				
CR12	C2	R18	C5								
CR13	C3	R19	C5	R96	C9	R175	G3				
CR14	C2	R20	C5	R97	J1	R176	G4				
CR15	D3	R21	D4	R98	J5	R177	H1				
CR16	D2			R99	I3	R178	H1				
		R22	D4	R100	I2						
CR17	D3	R23	D4			U2	B2				
CR18	D2	R24	D3	R101	G2	U3	D3				
CR19	H1	R26	E4	R102	E2	U4	F3				
CR29	G1	R27	E4	R105	C2	U5	F3				
CR21	G1			R106	C2	U6	G2				
		R28	E4	R107	B2						
CR22	E1	R29	E4			U7	H2				
CR23	D1	R30	E4	R108	B2	U8	E2				
CR24	K5	R31	E3	R109	B2	U9	C4				
CR29	E8	R32	E3	R110	B2	U10	E4				
				R111	B2	U11	F4				
				R114	C3						
						W1	E9				


BD AY SWITCH
TRAILING EDGE VERNIER (0-50K TO +18V)
BD AY INTEGRATOR (08015-66505/25)
A5/A25
A3
WIDTH OUTPUT
AFFECTS RINGING AT SLOW TRANS TIMES
POSITIVE CLAMP
NEGATIVE CLAMP
RANGE CAPACITANCE
*AFFECTS RINGING AT SLOW TRANS TIMES
LEADING EDGE VERNIER (0-50K TO 18V)
ENABLE (GND) TRANSITION RANGES
LINKS ON A5 ONLY
INT
EXT
A AMP
B AMP
A3
GATE B
GATE A
P/O A3 W3
BD AY SWITCH
S6B B DEL
A2A
GATE PULSE AMP
A2B
GATE PULSE AMP
GATE AMPLIFIER
W2 FROM A3 (SEE DELTA NO. PAGE)
W1 (DELTA OPTION 004 ONLY)
BD AY SWITCH
NORM
B DEL
S6A
REM
S6C
CAPACITOR SELECT
BD AY SWITCH

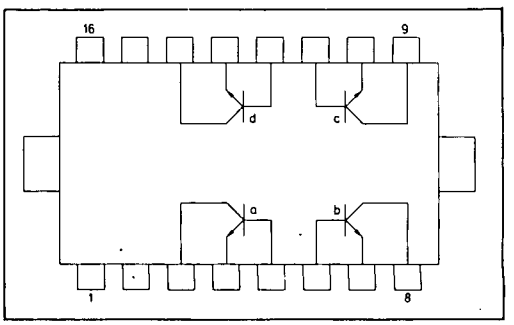




U3, U4, U5 (1820–0043)
U6, U7, U8 (1820–0203)



U2 (1826–0092)



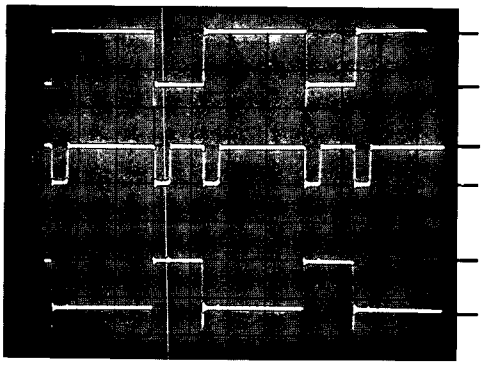
U9, U10, U11 (1858–0030)

1V/Div

① CHANN. A GAT. Q2/C

② U9/D (pin 12) PULSE TR. Same A+B (B-DEL mode)

③ CHANN. B GAT. Q2/C



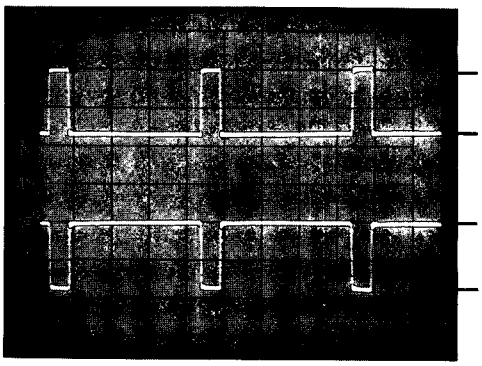
0.5µs/Div.

2V/Div

⑥ U11a/C (pin 3)

levers in max seperat. (max Ampl.)

⑦ U11d/C 9pin 14)



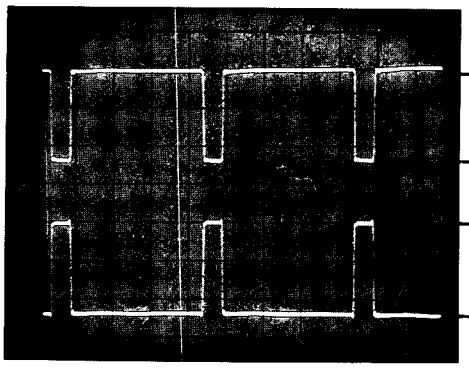
0.5µs/Div.

0.5V/Div.

④ U10a/C (pin 3)

levers in max sep. (max Ampl.)

⑤ U10d/C (pin 14)

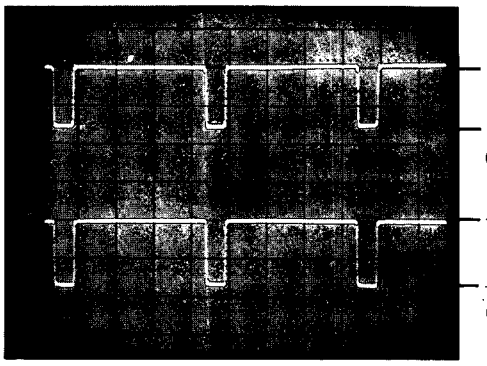


0.5µs/Div.

0.2V/Div.

⑧ A2 TP1 levers in min seperat. (min Ampl.)

⑨ A2TP1 levers in max seperat. (max Ampl.)



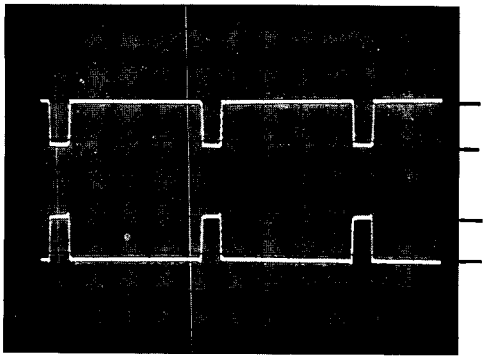
0.5µs/Div. 2V/Div

0.5V/Div.

④ U10a/C (pin 3)

levers in min sep. (min Ampl.)

⑤ U10d/C (pin 14)



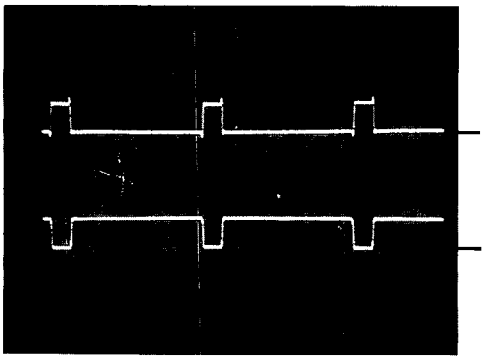
0.5µs/Div.

0.2V/Div.

⑥ U11a/C (pin 3)

levers in min sep. (min Ampl.)

⑦ U11d/C (pin 14)



0.5µs/Div.

TEST EQUIPMENT:

Digital Voltmeter	3465A
Oscilloscope	180C/1801A/1821A

Settings for waveforms 1–3

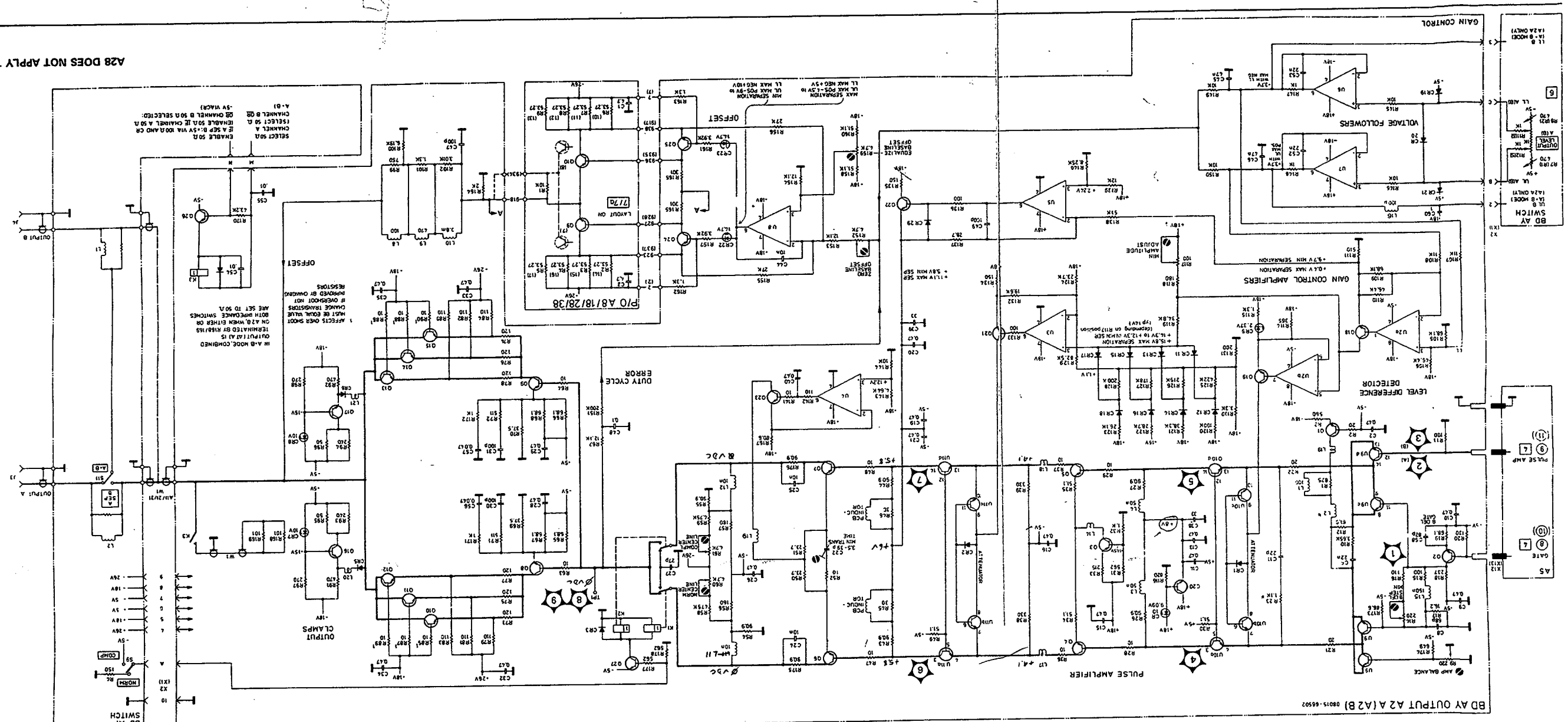
Rate	1µ–0,1m
Vernier	mid position
Delay	20n–1µ
Vernier	CW
Width	10n–1µ
Vernier	mid position
Trans. Time	6n–0.5µs
Verniers	CCW
Mode	B-Del

Settings for waveforms 4–10 same exept:

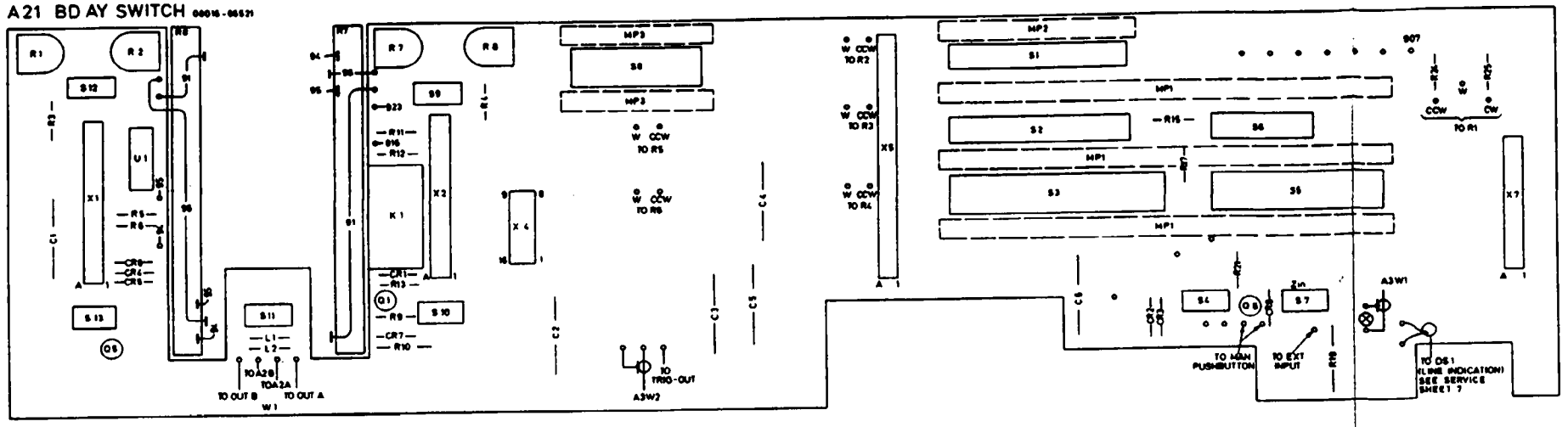
Mode	NORM

NOTE: Amplitudes are average values and may vary depending on min. amplitude adjust A2 R117 and max. amplitude adjust A5 R80/R85.

A28 DOES NOT APPLY TO OPTION 001
OUTPUT A2

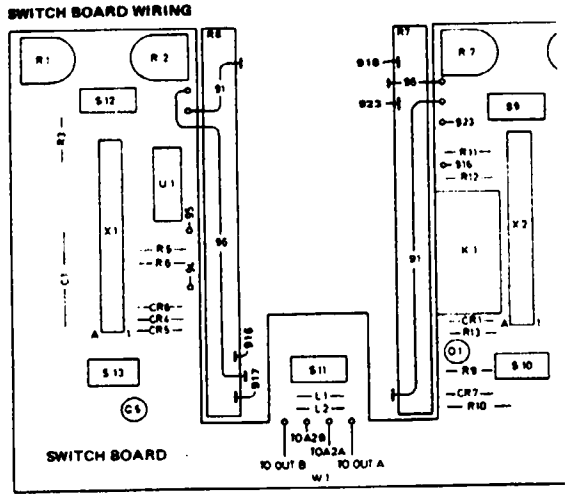


A21 BD AY SWITCH 08016-66521

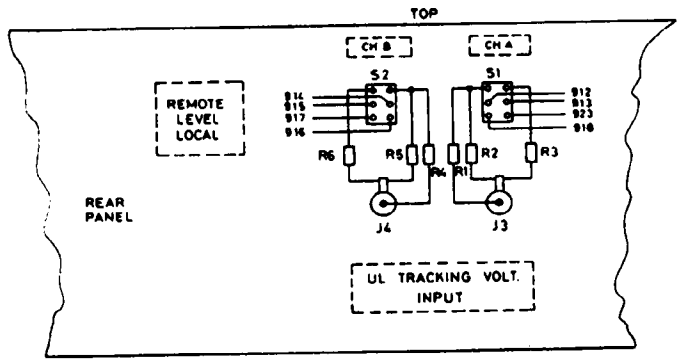


8015A OPTION 006 (UPPER LEVEL TRACKING)

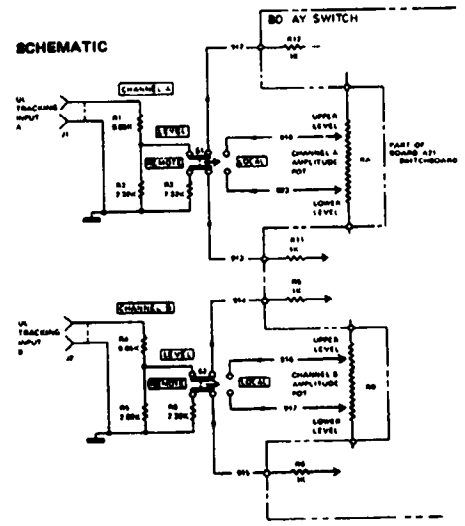
SWITCH BOARD WIRING



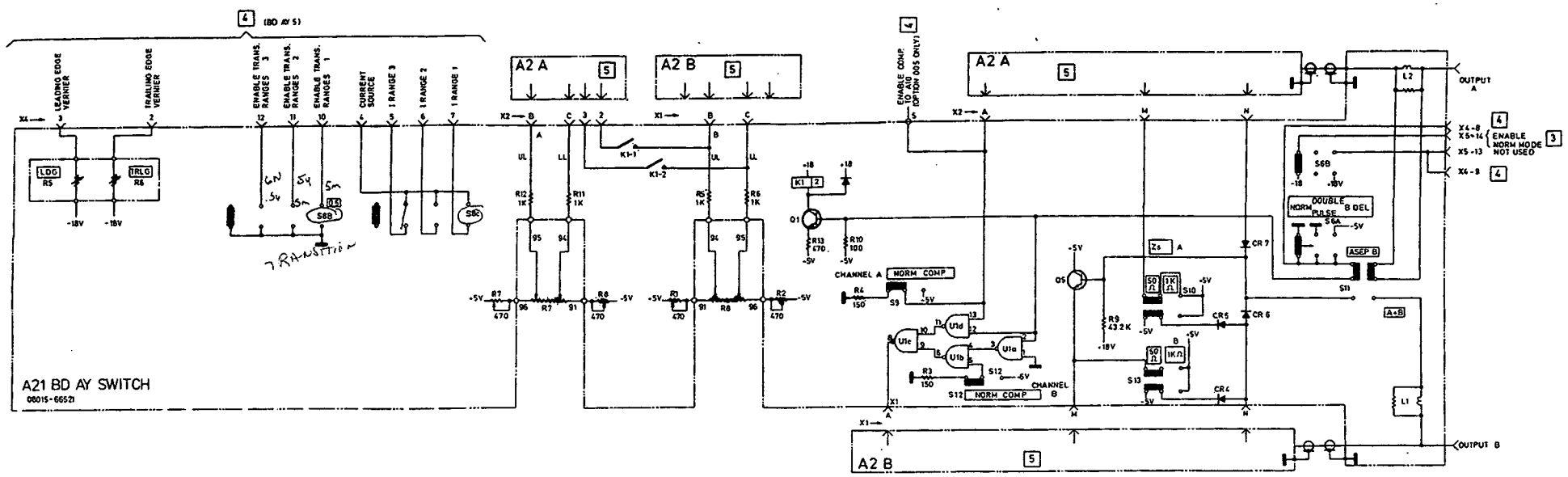
REAR PANEL WIRING

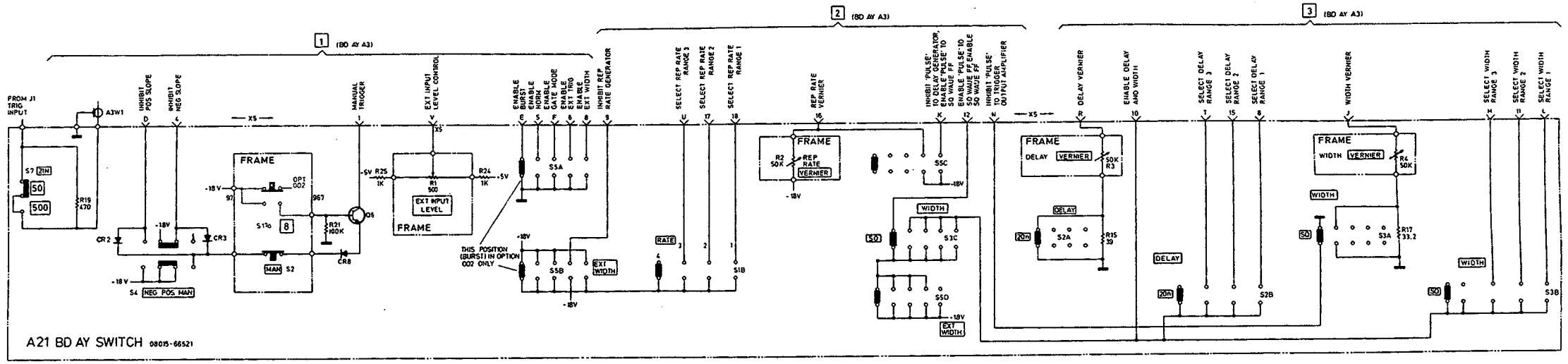


SCHEMATIC

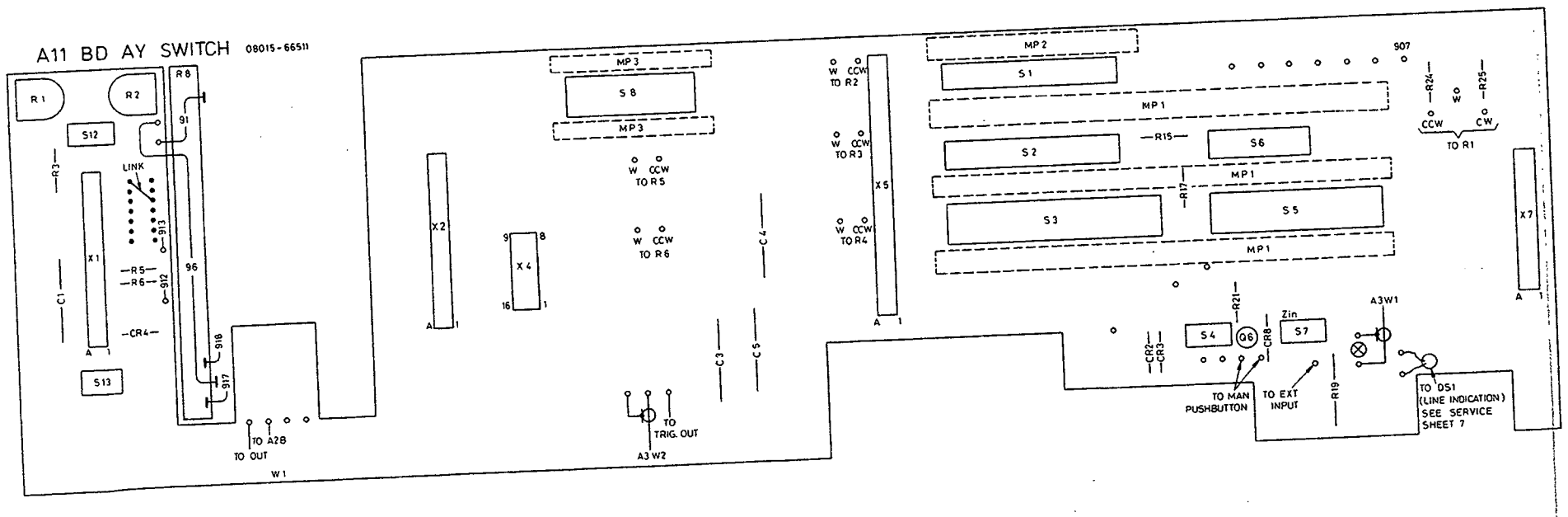


6
DOES NOT APPLY TO OPTIONS 001 AND 003


A21 BD AY SWITCH
08015-66521
A2 A
A2 B
LEADING EDGE VERNIER
TRAILING EDGE VERNIER
ENABLE TRANS. RANGES 3
ENABLE TRANS. RANGES 2
ENABLE TRANS. RANGES 1
CURRENT SOURCE
I RANGE 3
I RANGE 2
I RANGE 1
ENABLE COMP TO AUX (OPTION 005 ONLY)
OUTPUT A
OUTPUT B
ENABLE NORM MODE NOT USED
DOUBLE PULSE
CHANNEL A NORM COMP
CHANNEL B NORM COMP
TRANSITION

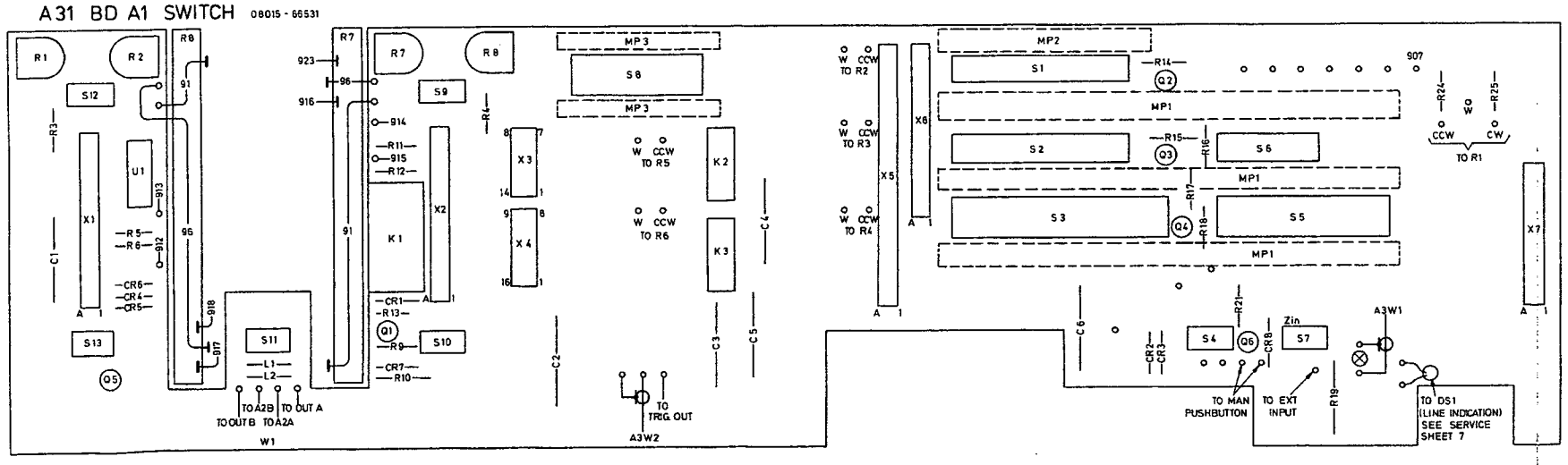

A21 BD AY SWITCH 08015-66521
FROM J1 TRIG INPUT
INHIBIT POS SLOPE
INHIBIT NEG SLOPE
MANUAL TRIGGER
EXT INPUT LEVEL CONTROL
ENABLE EXT TRIG
ENABLE GATE MODE
ENABLE EXT TRIG
ENABLE EXT WIDTH
INHIBIT REP RATE GENERATOR
SELECT REP RATE RANGE 3
SELECT REP RATE RANGE 2
SELECT REP RATE RANGE 1
REP RATE VERNIER
DELAY VERNIER
ENABLE DELAY AND WIDTH
SELECT DELAY RANGE 3
SELECT DELAY RANGE 2
SELECT DELAY RANGE 1
WIDTH VERNIER
SELECT WIDTH RANGE 3
SELECT WIDTH RANGE 2
SELECT WIDTH RANGE 1
FRAME
EXT INPUT LEVEL
REP RATE VERNIER
DELAY VERNIER
WIDTH VERNIER
NEG POS MAN
MAN
EXT WIDTH

A11 BD AY SWITCH 08015-66511

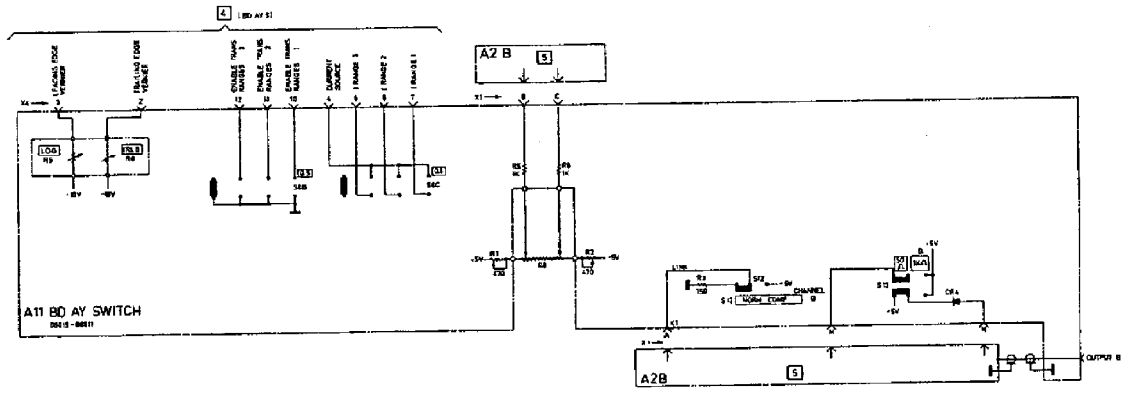


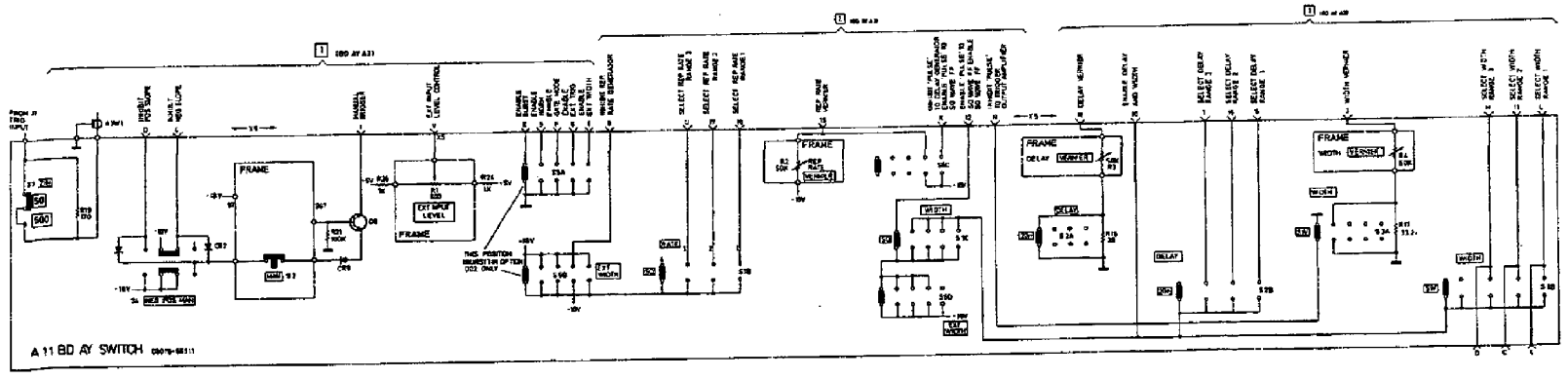
6a

OPTION 001 ONLY



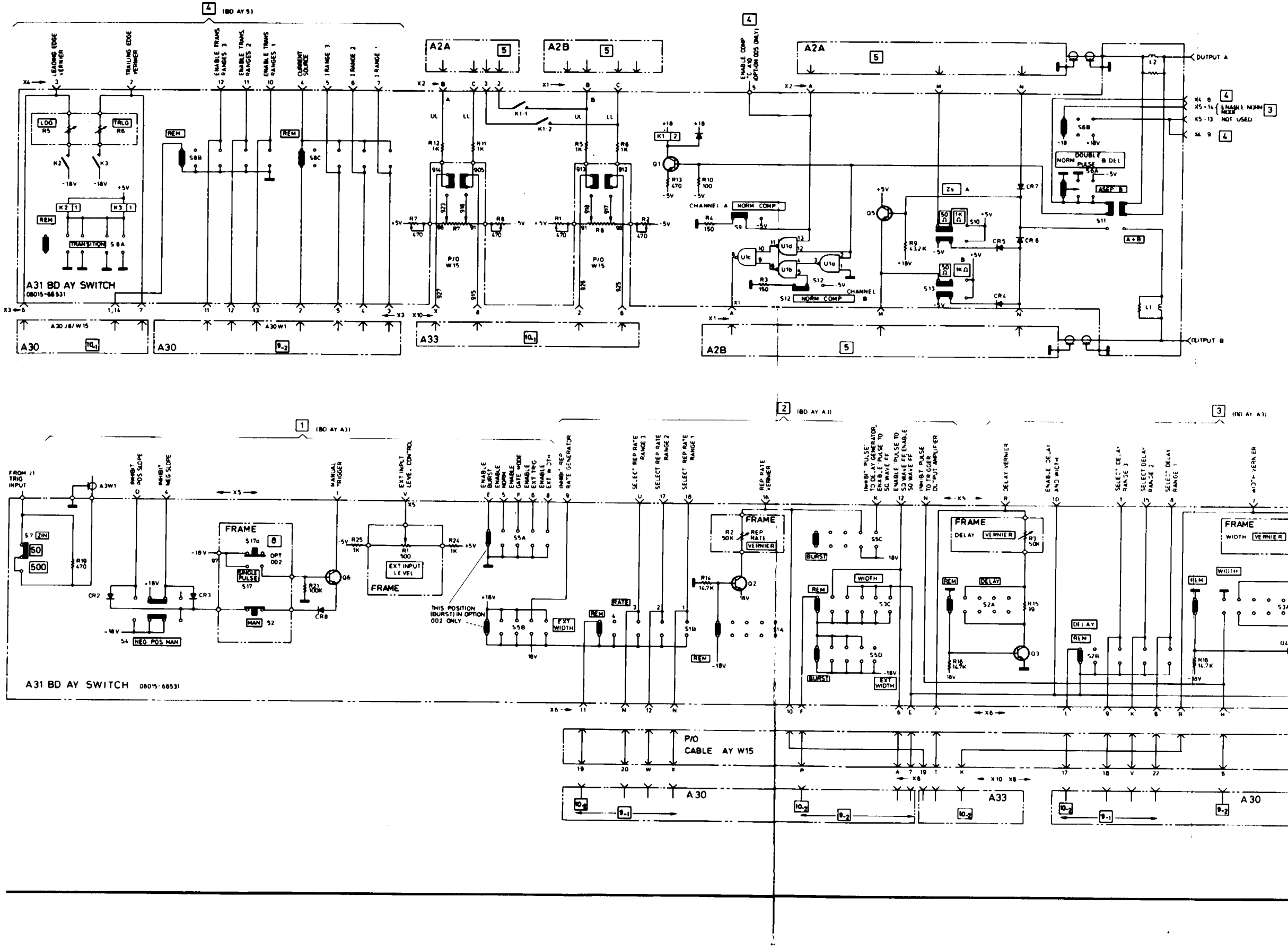
6b
OPTION 003 ONLY





6a

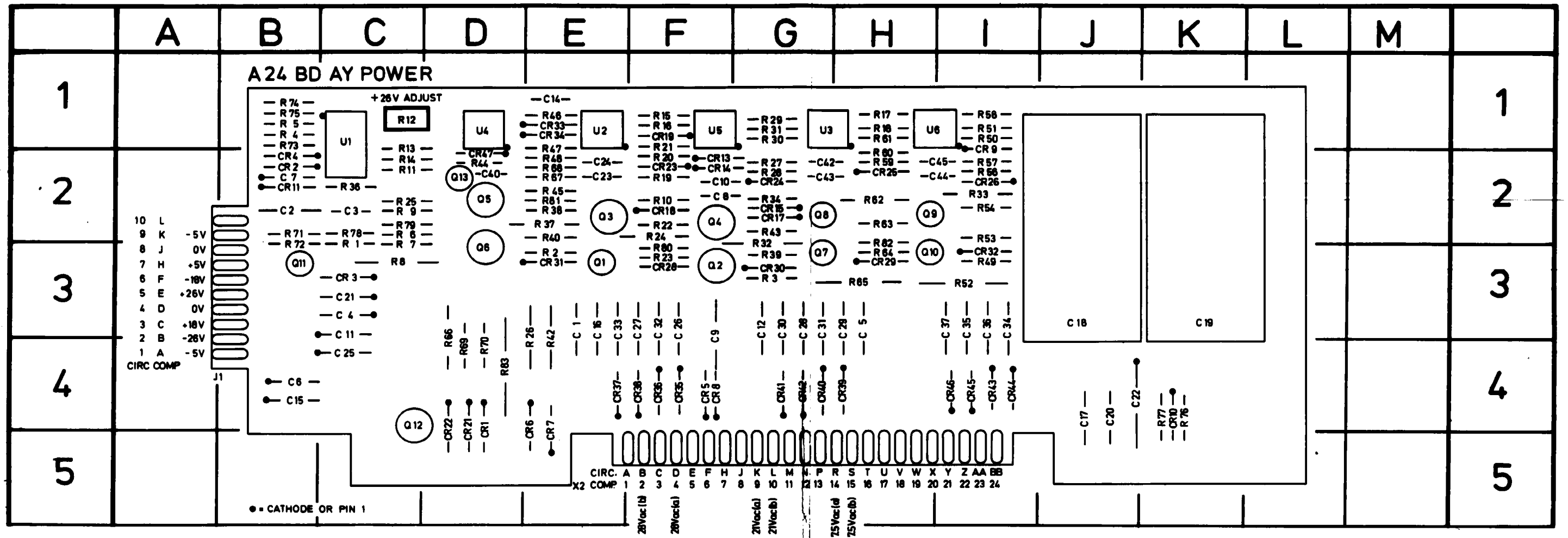
8016A OPTION 001 ONLY
SWITCHING A11



6b

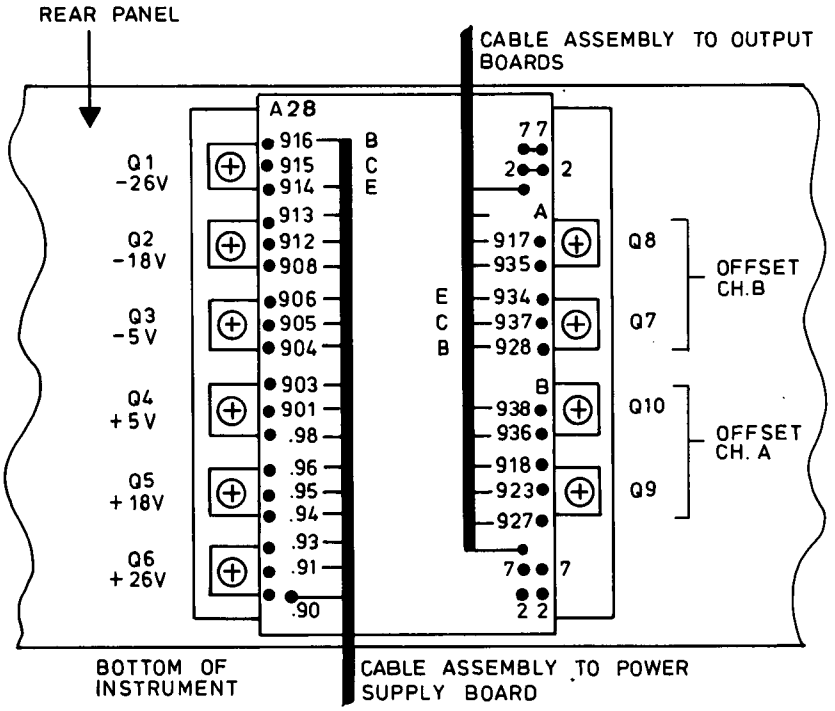
8015A OPTION 003 ONLY
SWITCHING A31

A24 BD AY POWER

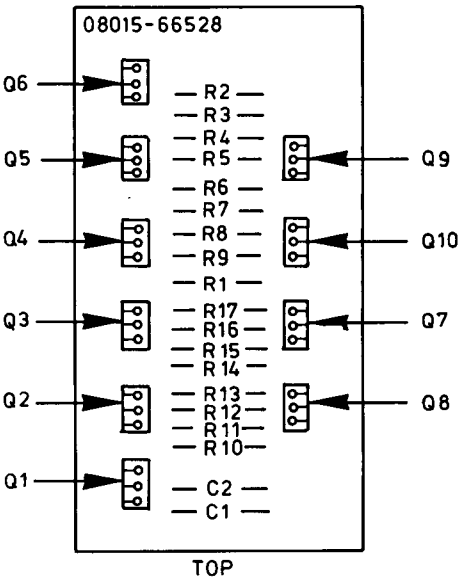


C1	E3	C27	F3	CR6	E4	CR35	F4	Q11	B3	R21	F2	R48	E2	R69	D3
C2	B2	C28	G3	CR7	E4	CR36	F4	Q12	C4	R22	F2	R49	I3	R70	D3
C3	C2	C29	H3	CR8	F4	CR37	E4	Q13	D2	R23	F3	R50	I1	R71	B2
C4	C3	C30	G3	CR9	I1	CR38	F4			R24	F2	R51	I1	R72	B2
C5	H3	C31	G3	CR10	K4	CR39	H4	R1	C2	R25	C2	R52	I3	R73	B1
								R2	E3						
C6	B4	C32	F3	CR11	B2	CR40	G4	R3	G3	R26	E3	R53	I2	R74	B1
C7	B2	C33	E3	CR13	F2	CR41	G4	R4	B1	R27	G2	R54	I2	R75	B1
C8	F2	C34	I3	CR14	F2	CR42	G4	R5	B1	R28	G2	R56	I2	R76	K4
C9	F3	C35	I3	CR15	G2	CR43	I4			R29	G1	R57	I2	R77	K4
C10	F2	C36	I3	CR17	G2	CR44	I4	R6	C2	R30	G1	R58	I1	R78	C2
								R7	C2						
C11	C3	C37	I3	CR18	F2	CR45	I4	R8	G3	R31	G1			R79	C2
C12	G3	C40	D2	CR19	F1	CR46	I4	R9	G2	R32	G2	R59	H2	R80	F3
C14	E1	C42	G2	CR21	D4	CR47	D2	R10	F2	R33	I2	R60	H2	R81	E2
C15	B4	C43	G2	CR22	D4					R34	G2	R61	H1	R82	H2
C16	E3	C44	H2	CR23	F2	Q1	E3	R11	C2	R36	C2	R62	H2	R83	D4
						Q2	F3	R12	C1			R63	H2		
C17	J4	C45	H2	CR24	G2	Q3	E2	R13	C1	R37	E2			U1	C1
C18	J3			CR25	H2	Q4	F2	R14	C2	R38	E2	R64	H3	U2	E1
C19	K3	CR1	D4	CR26	I2	Q5	D2	R15	F1	R39	G3	R65	H3	U3	G1
C20	J4	CR2	B2	CR28	F3					R40	E2	R66	D3	U4	D1
C21	C3	CR3	C3	CR29	H3	Q6	D3	R16	F1	R42	E3	R67	E2	U5	F1
		CR4	B2			Q7	G3	R17	H1			R68	E2		
C22	J4	CR5	F4	CR30	G3	Q8	G2	R18	H1	R43	G2				
C23	E2			CR31	D3	Q9	H2	R19	F2	R44	D2				
C24	B2			CR32	I3	Q10	H3	R20	F2	R45	E2				
C25	C4			CR33	E1					R46	E1				
C26	F3			CR34	E1					R47	E2				

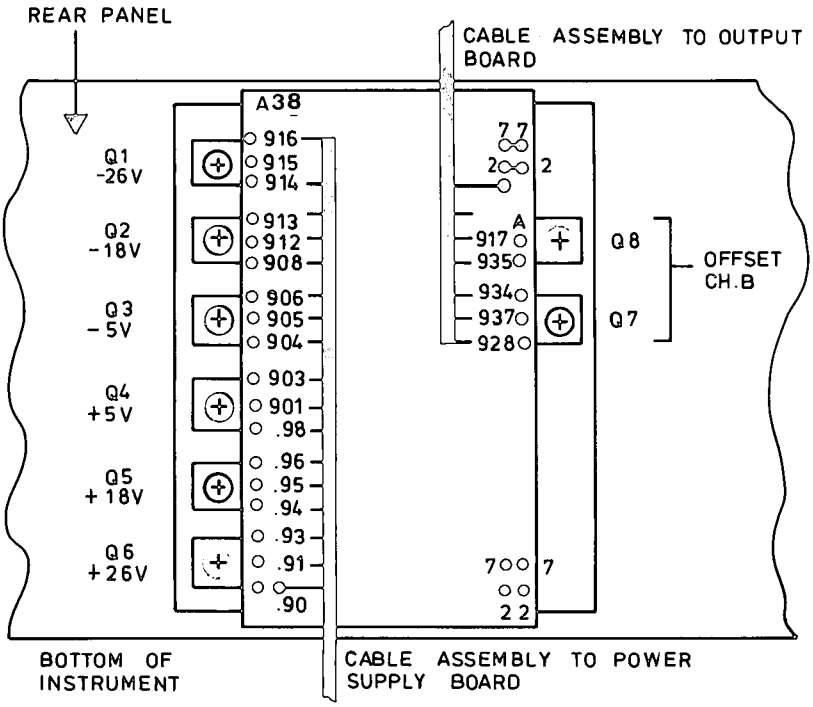
A28 BD AY RESISTOR 07015–66528
VIEW OF INSIDE OF REAR PANEL

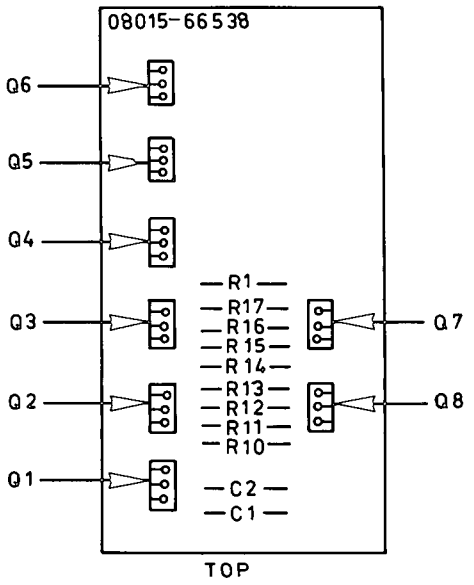


VIEW ON COMPONENT SIDE



8015A OPTION 001
A38 BD AY RESISTOR 07015–66538
VIEW OF INSIDE OF REAR PANEL





A24 BD AY POWER SUPPLY 08015-66524

+18V REGULATOR

+5V REGULATOR

-18V REGULATOR

-5V REGULATOR

-25V REGULATOR

SWITCH BOARD

TOP VIEW

NC 1 14 NC
(CL) CURRENT LIMIT 2 13 FREQUENCY COMPENSATION (COMP)
(CS) CURRENT SENSE 3 12 V(+)
INVERTING INPUT 4 11 Vc
NON-INVERTING INPUT 5 10 V OUT
V REF 6 9 V2
(V-) 7 8 NC

U1
1820-0439

TOP VIEW

(V+)
OUTPUT A 1 8 OUTPUT B
(-)INVERTING INPUT A 2 7 INVERTING INPUT B
(+)NON-INVERTING INPUT A 3 6 NON-INVERTING INPUT B
(V-) 4 5

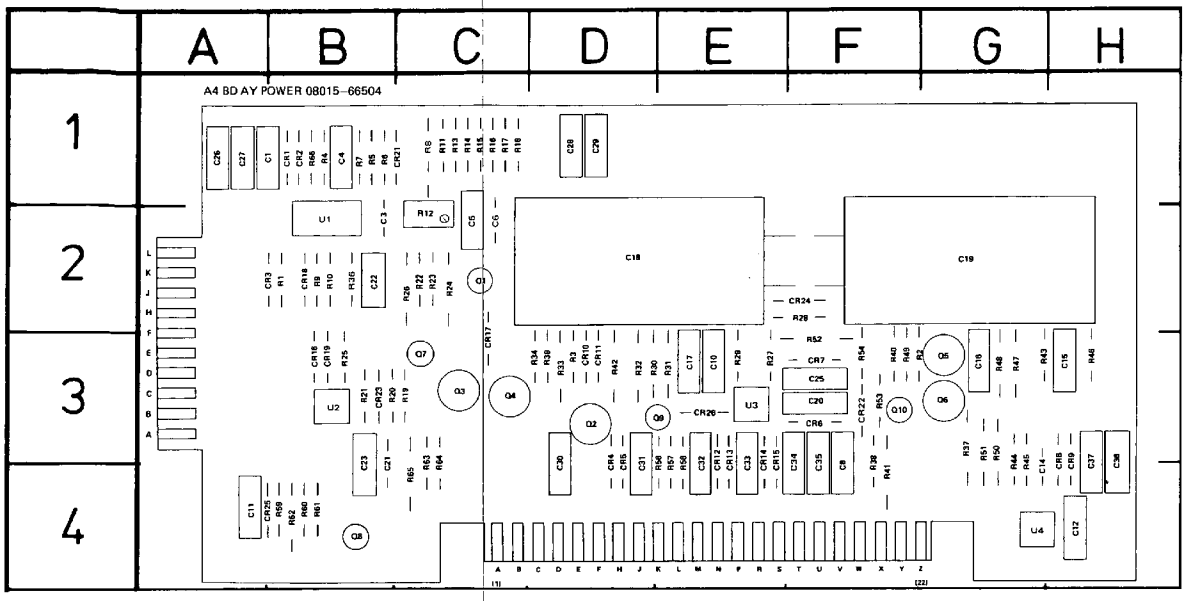
U2, U3
1826-0092

TOP VIEW

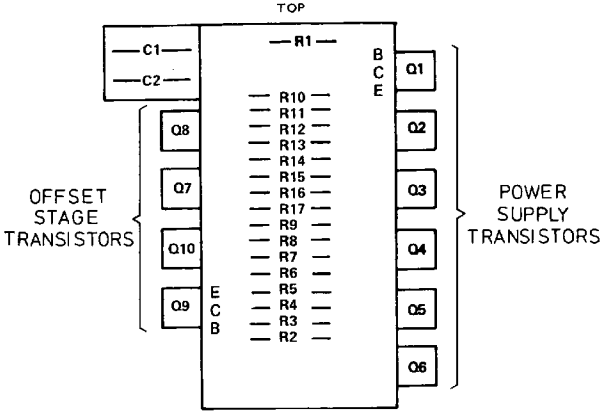
(V+) 8
(-)INVERTING INPUT 2 6 OUTPUT
(+)NON-INVERTING INPUT 3 4
(V-) 1

U4
1820-0216

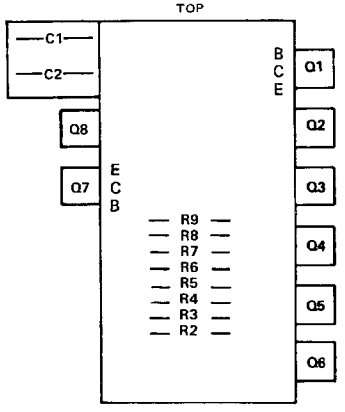
A4 BD AY POWER 08015–66504



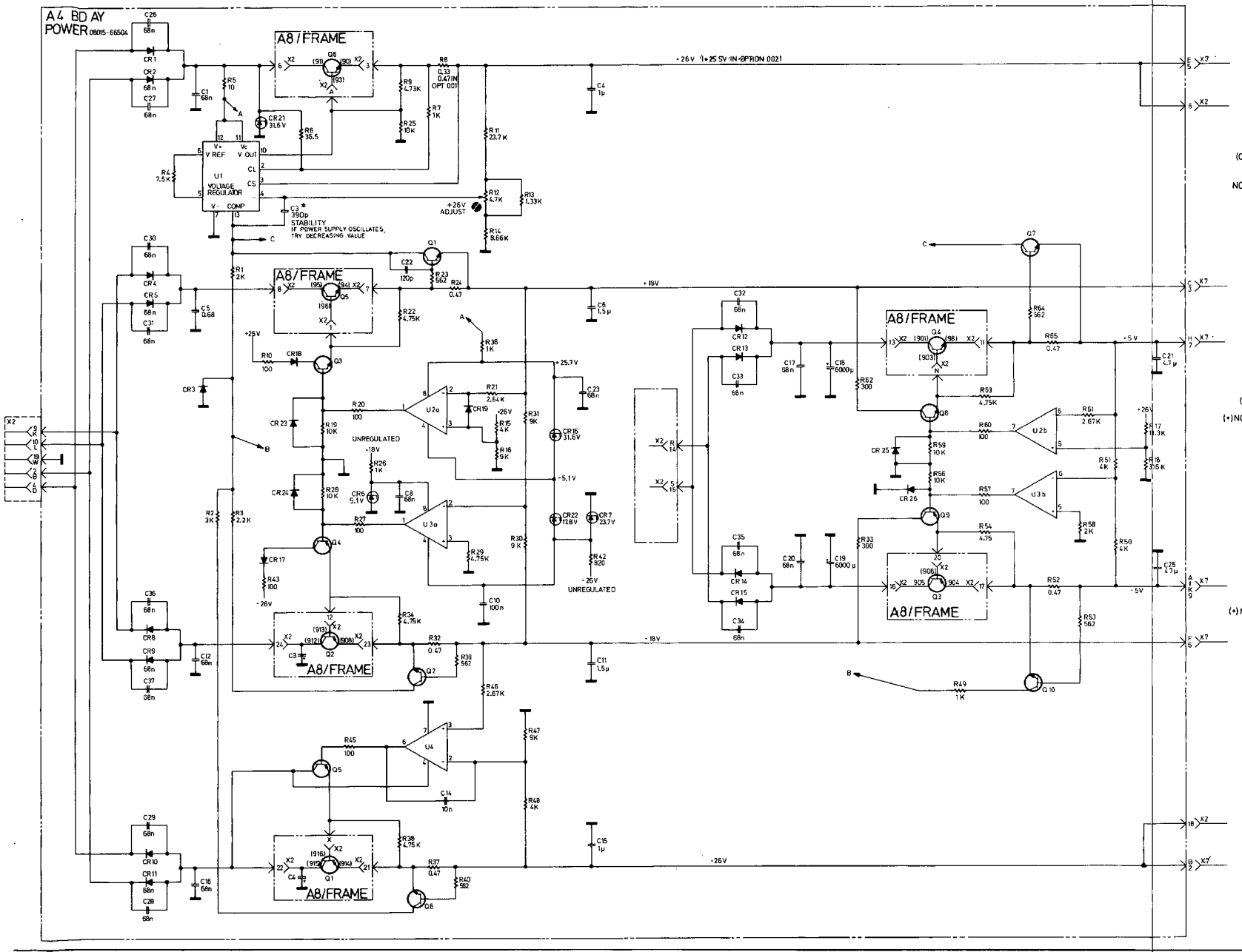
A8 BD AY RESISTOR 08015–66508 (COMPONENT SIDE)

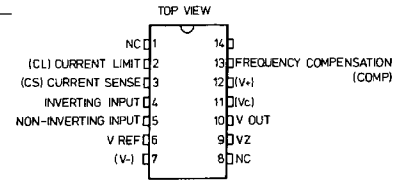


A18 BD AY RESISTOR 08015–66518 (COMPONENT SIDE)
(8015A OPTION 001)

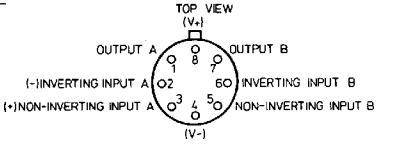


C1	A1	C36	H4	Q1	C2	R21	B3	R52	F3
C3	B2	C37	H4	Q2	D3	R22	C2	R53	F3
C4	B1			Q3	C3	R23	C2	R54	F3
C5	C2	CR1	B1	Q4	C3	R24	C2	R56	E4
C6	C2	CR2	B1	Q5	G3	R25	B3	R57	E4
		CR3	B2						
C8	F4	CR4	D4	Q6	G3	R26	C2	R58	E4
C10	E3	CR5	D4	Q7	C3	R27	E3	R59	B4
C11	A4			Q8	B4	R28	F2	R60	B4
C12	H4	CR6	F3	Q9	E3	R29	E3	R61	B4
C14	G4	CR7	F3	Q10	F3	R30	D3	R62	B4
		CR8	H4						
C15	H3	CR9	H4	R1	B2	R31	E3	R63	C4
C16	G3	CR10	D3	R2	G3	R32	D3	R64	C4
C17	E3			R3	D3	R33	D3	R65	C4
C18	D2	CR11	D3	R4	B1	R34	D3	R66	B1
C19	G2	CR12	E4	R5	B1	R36	B2		
		CR13	E4					U1	B2
C20	F3	CR14	E4	R6	B1	R37	G4	U2	B3
C21	B4	CR15	E4	R7	B1	R38	F4	U3	E3
C22	B2			R8	C1	R39	D3	U4	G4
C23	B4	CR16	B3	R9	B2	R40	F3		
C25	F3	CR17	C3	R10	B2	R41	F4		
		CR18	B2						
C26	A1	CR19	B3	R11	C1	R42	D3		
C27	A1			R12	C2	R43	H3		
C28	D1	CR21	C1	R13	C1	R44	G4		
C29	D1	CR22	F3	R14	C1	R45	G4		
C30	D4	CR23	B3	R15	C1	R46	H3		
		CR24	F2						
C31	D4	CR25	A4	R16	C1	R47	G3		
C32	E4			R17	C1	R48	G3		
C33	E4	CR26	E3	R18	C1	R49	F3		
C34	F4			R19	C3	R50	G4		
C35	F4			R20	B3	R51	G4		

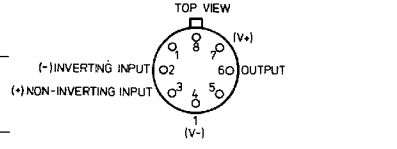




U1
1820–0439



U2, U3
1826–0092

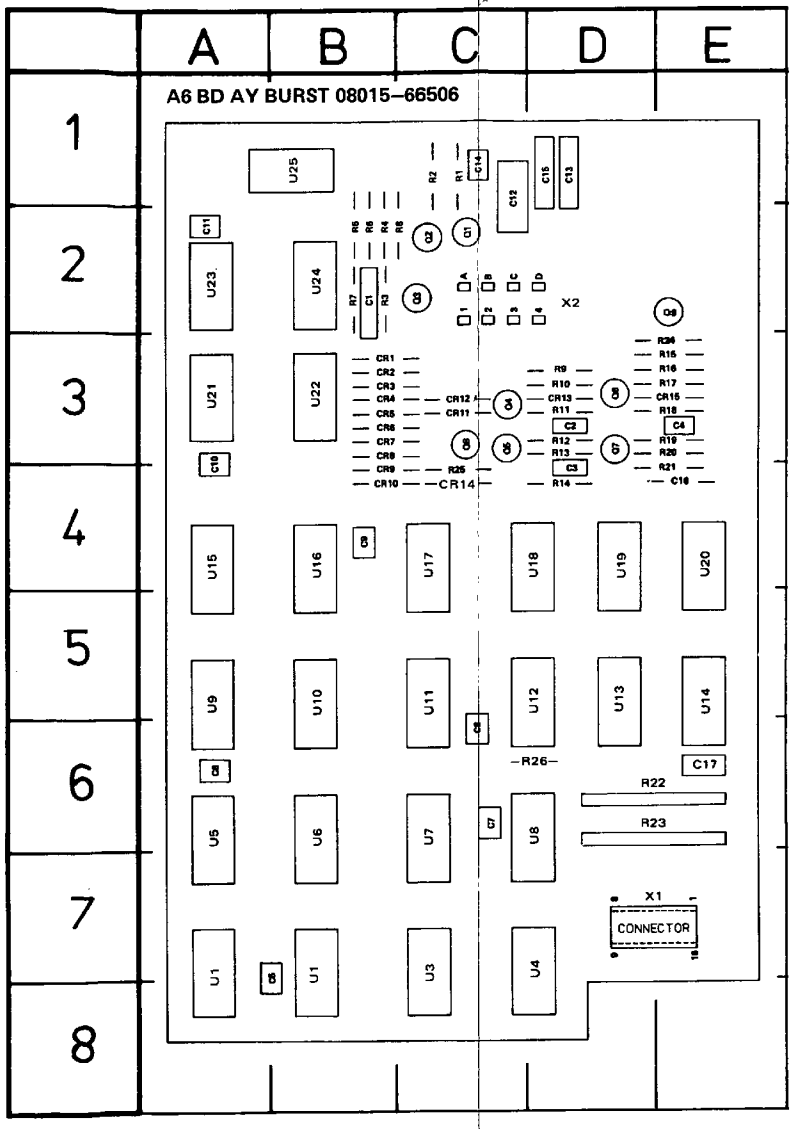


U4
1826–0216

7a

8015A SERIAL NUMBERS 1538G00685 AND BELOW

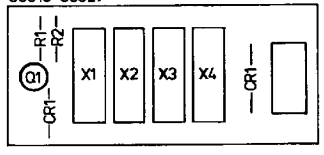
POWER SUPPLIES A4/A8

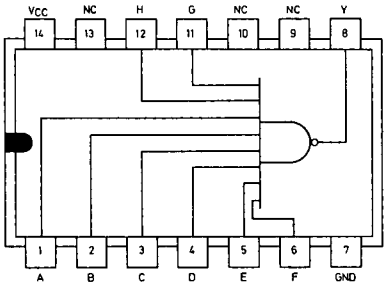


C1	B2	R1	C1	U16	B4
C2	D3	R2	C1	U17	C4
C3	D4	R3	B2	U18	C4
C4	E3	R4	B2	U19	D4
C5	B7	R5	B2	U20	E4
C6	A6	R6	B2	U21	A3
C7	C6	R7	B2	U22	B3
C8	C6	R8	B2	U23	A2
C9	B4	R9	D3	U24	B2
C10	A3	R10	D3	U25	B1
C11	A2	R11	D3	X1	D7
C12	C1	R12	D3	X2	C2
C13	D1	R13	D3		
C14	C1	R14	D4		
C15	D1	R15	E3		
C16	E4	R16	E3		
C17	E6	R17	E4		
		R18	E3		
CR1	B3	R19	E3		
CR2	B3	R20	E3		
CR3	B3				
CR4	B3	R21	E4		
CR5	B3	R22	E6		
		R23	E6		
CR6	B3	R24	E3		
CR7	B3	R25	C4		
CR8	B3				
CR9	B4	R26	C6		
CR10	B4				
		U1	A7		
CR11	C3	U2	B7		
CR12	C3	U3	C7		
CR13	D3	U4	D7		
CR14	C4	U5	A6		
CR15	E3				
		U6	B6		
MP3		U7	C6		
		U8	D6		
Q1	C2	U9	A5		
Q2	C2	U10	B5		
Q3	C2				
Q4	C3	U11	C5		
Q5	C3	U12	D5		
		U13	D5		
Q6	D3	U14	E5		
Q7	D3	U15	A4		
Q8	C3				
Q9	E2				

A27 BD AY THUMBWHEEL CONN.

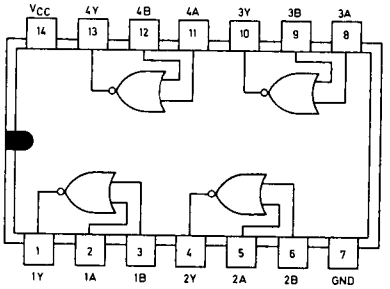
08015-66527





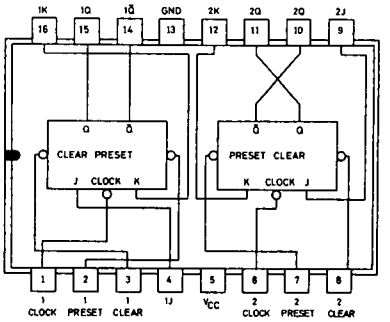
U1, U2, U9, U11

1820–0070



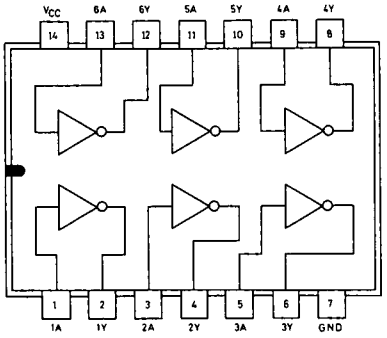
U12

1820–0328



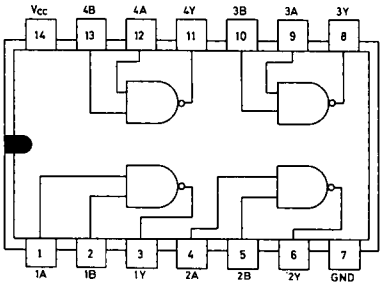
U17

1820–0076



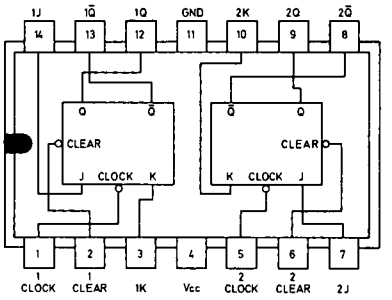
U3, U4, U10, U13, U21, U23

1820–0174



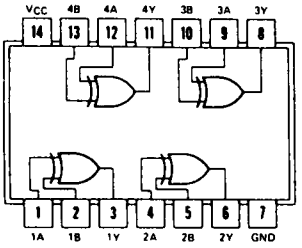
U14, U25, U20

1820–0054



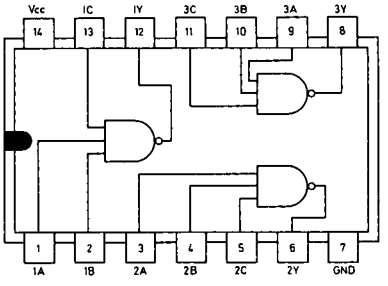
U19

1820–0075



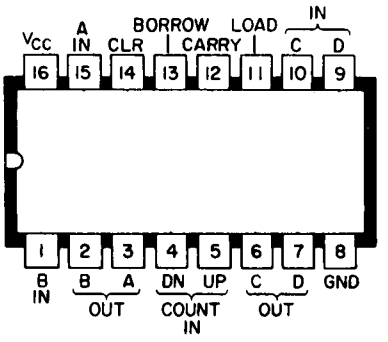
U5, U6, U7, U8

1820–0282



U16

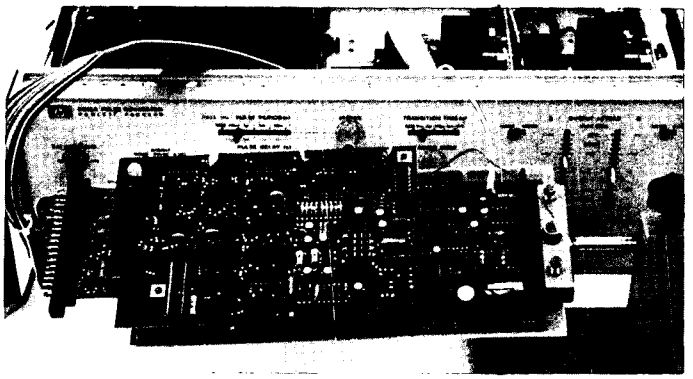
1820–0371



U15, U22, U24

1820–0546

Burst option troubleshooting



TEST SETUP

This procedure tests the burst board by interrupting the load loop and making the counter operate constantly. Thus an easy check of counter chain and gates (zero detect, comparator, load enable) is possible.

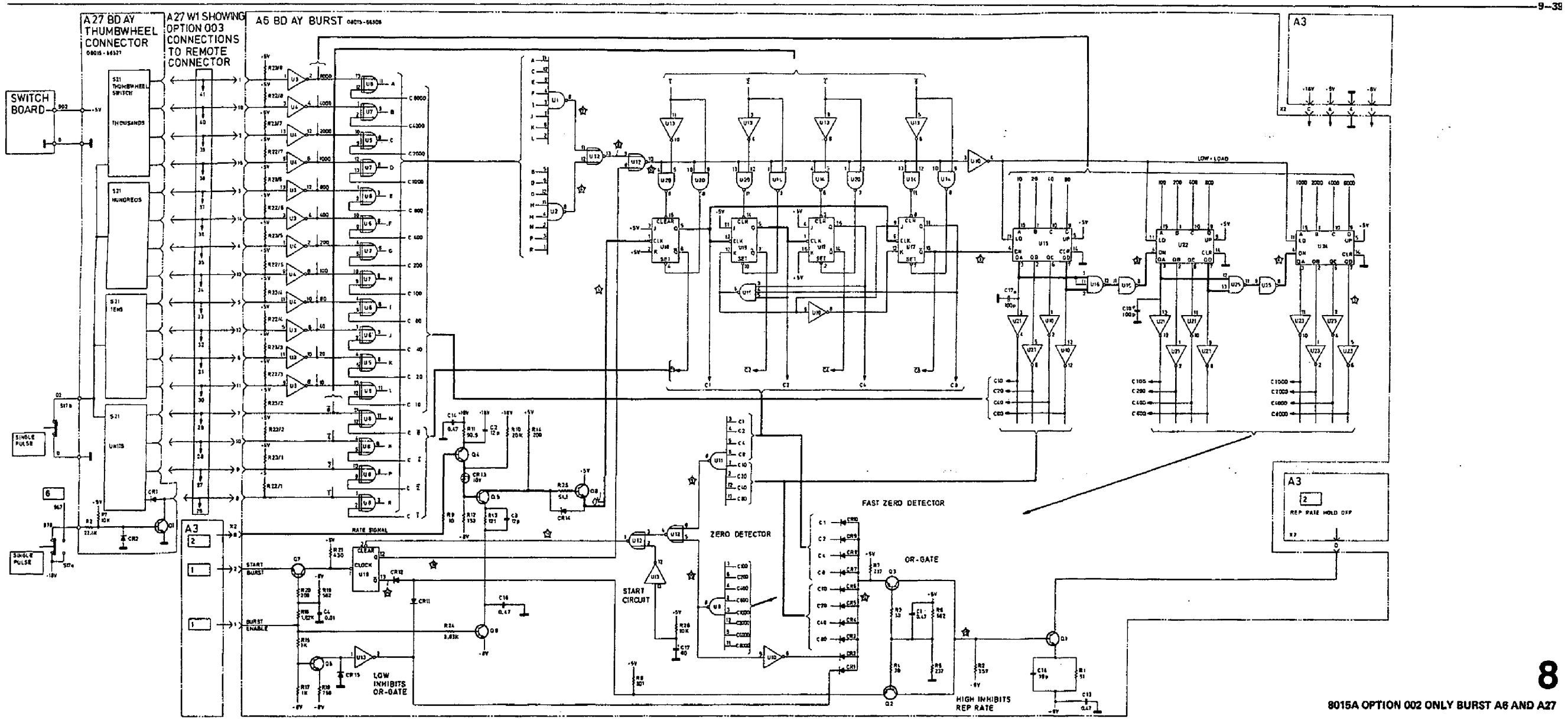
PROCEDURE

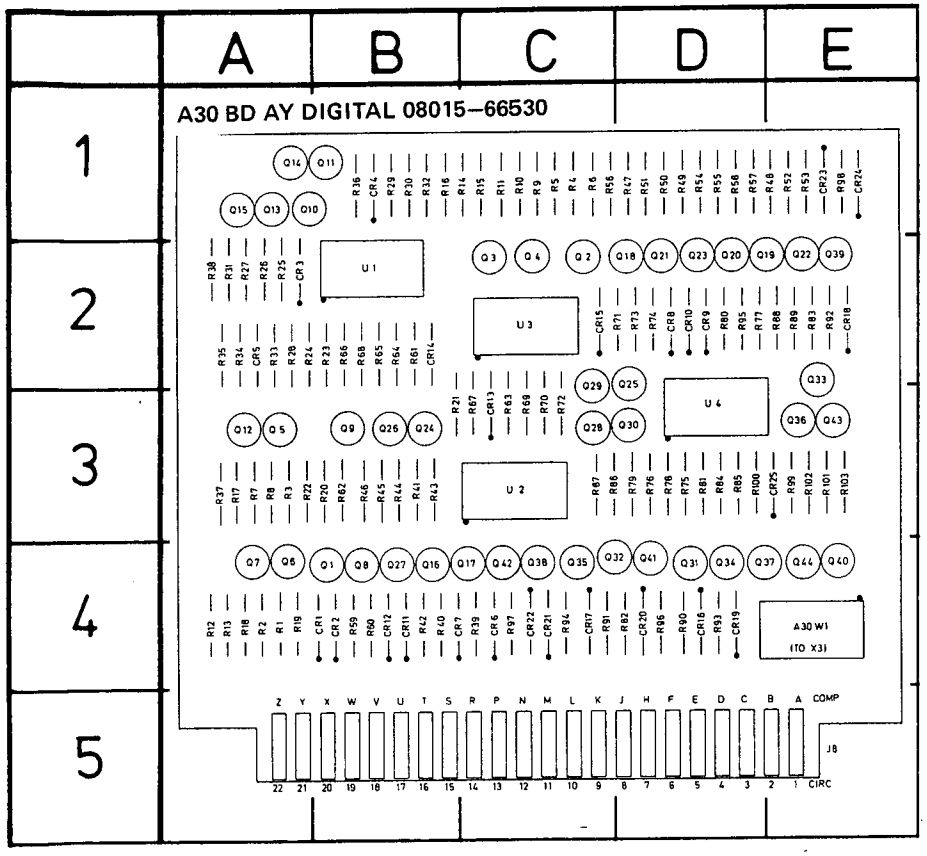
1. Set scope to 1μs/div adjust 8015A rate to exactly 1 MHz, width to about 25μs.
2. Set 8015A to burst, adjust Ext trigg. input for signal.
3. Connect trigger output to trigger input cable of A3 (use of an external trigger source is also possible).
4. Disconnect the base connection of transistor A6 Q1 and leave it as open base (rate generator now enabled).
5. Disconnect pin 13 of A6 U12 from socket X2 and leave as open circuit.
6. Wire-connect the open track (from which A6U12 pin 13 is disconnected) to GND on A6.
7. Set scope time base to internal trigger.
8. Check the waveforms detailed in the following list:

Test Point	Burst board reference point	Oscilloscope display (10 div)	Time/div	Slope trigger
1	U18 Pin 1		1μs	–
2	U15 Pin 4	20 % screen width	1μs	–
3	U22 Pin 4	10 % screen width	10μs	–
4	U24 Pin 4	10 % screen width	0,1ms	–
5	U24 Pin 7	20 % screen width	1ms	–
6	U2 Pin 8	10 %	50μs*	–
	U2 Pin 8		10μs	–
7	U1 Pin 8	10 %	0,5ms*	–
8	U12 Pin 13	1/100 % screen width	1ms	+
9	U11 Pin 8	1 %	10μs	–
10	U9 Pin 8	1 %	1ms	–
11	U19 Pin 2	1/100 %	1ms	–
12	Q3 E	1/100 %	1ms	+
13	Q7 C		1μs	–
14	U19 Pin 13	1/100 %	1ms	+
15	Q3 C	1/100 %	1ms	+
16	U19 Pin 12	1/100 %	1ms	–
17	U12 Pin 10	1/100 %	1ms	+

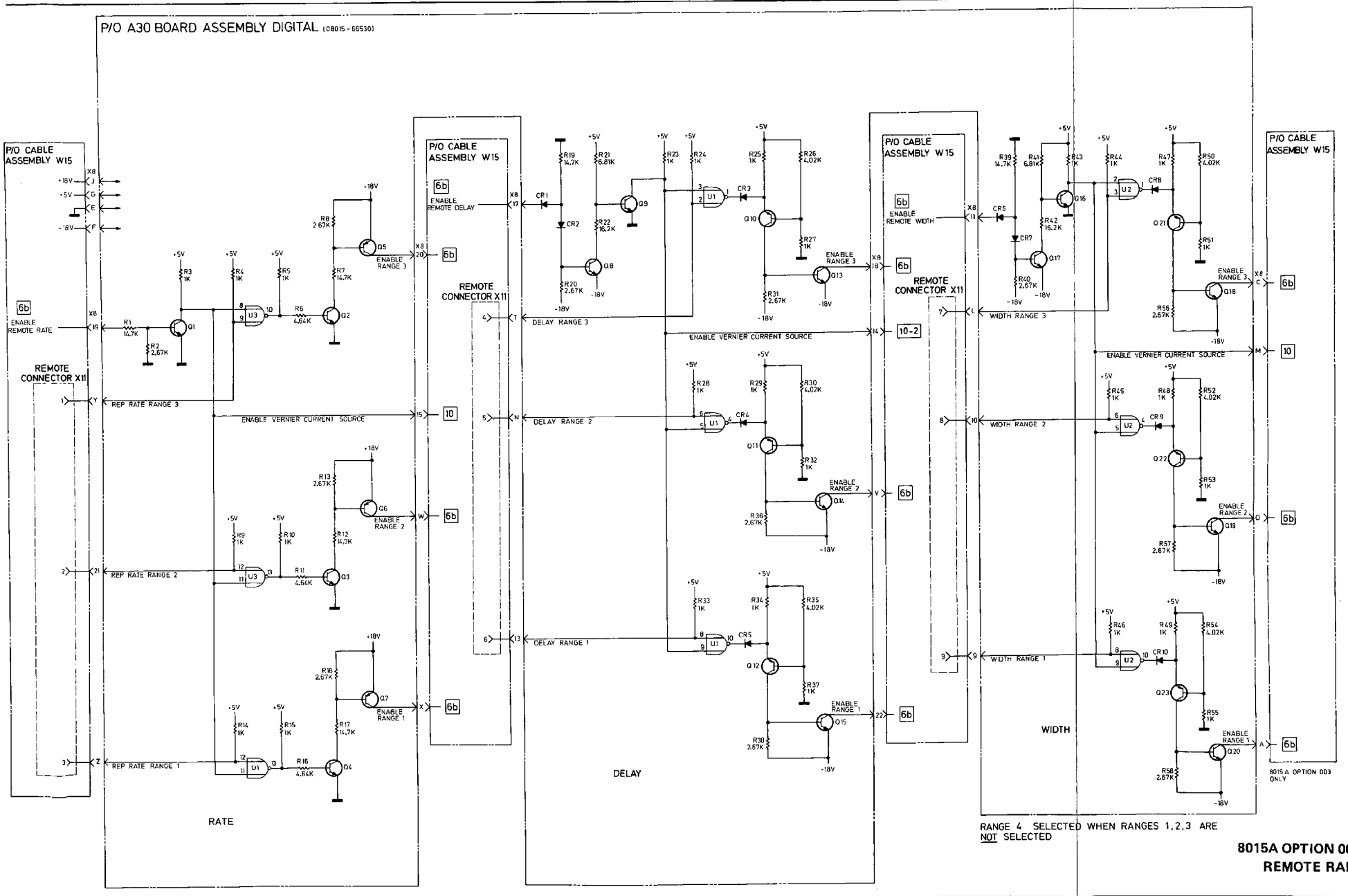
* Signals may show differently, depending on trigger.

Note: Some signals are difficult to see due to low duty cycle.


A27 BD AY THUMBWHEEL CONNECTOR
A27 W1 SHOWING OPTION 003 CONNECTIONS TO REMOTE CONNECTOR
A5 BD AY BURST
A3
SWITCH BOARD
S21 THUMBWHEEL SWITCH
THOUSANDS
HUNDREDS
TENS
UNITS
SINGLE PULSE
RATE SIGNAL
START BURST
BURST ENABLE
CLEAR
CLOCK
LOW = LOAD
ZERO DETECTOR
FAST ZERO DETECTOR
OR-GATE
START CIRCUIT
LOW INHIBITS OR-GATE
HIGH INHIBITS REP RATE
REP RATE HOLD OFF



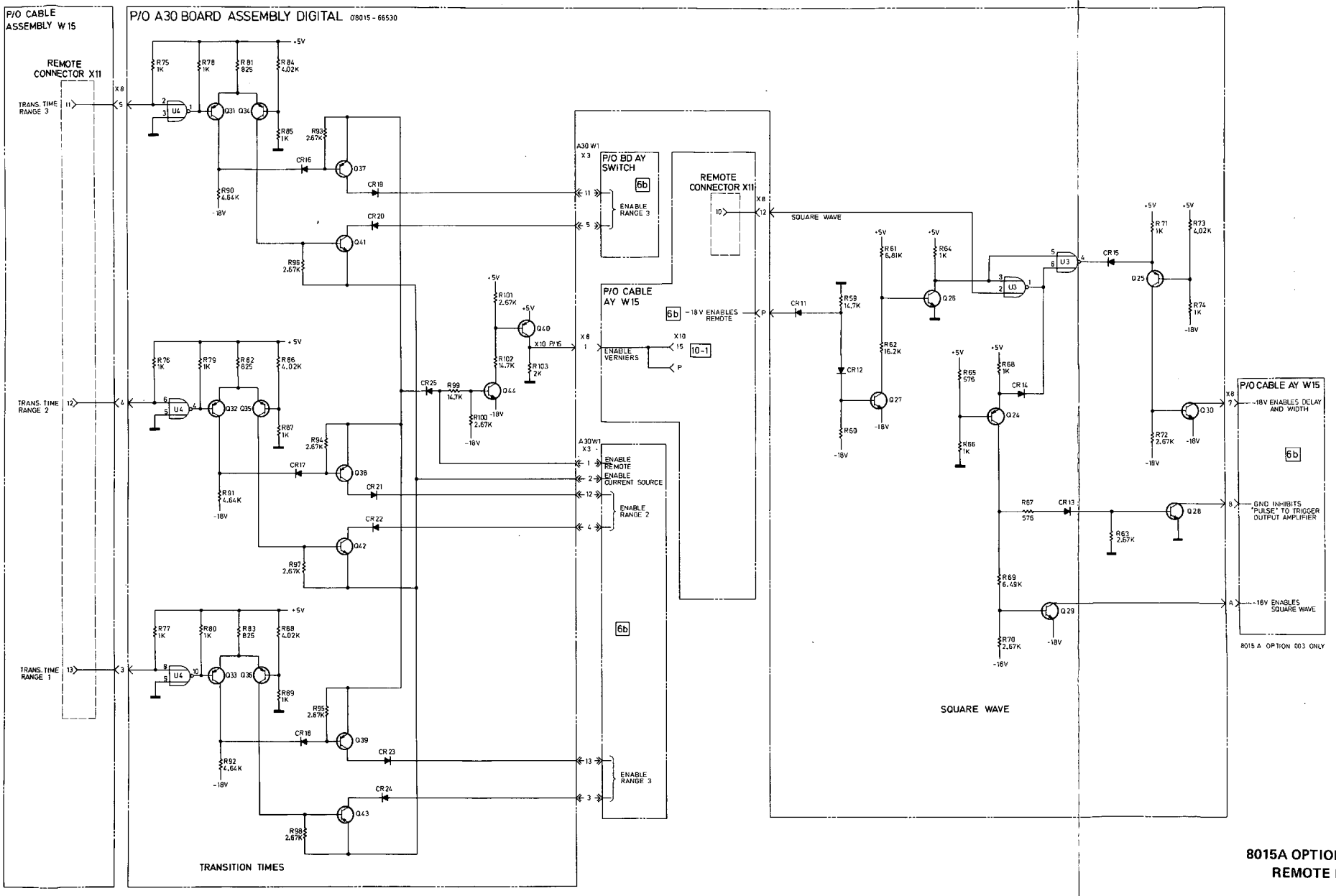
CR1	A3	Q31	D4	R41	B3	R96	D4
CR2	B4	Q32	C4	R42	B4	R97	C4
CR3	A2	Q33	E2	R43	B3	R98	E1
CR4	B1	Q34	D4	R44	B3	R99	E3
CR5	A2	Q35	C4	R45	B3	R100	D3
CR6	C4	Q36	E3	R46	B3	R101	E3
CR7	B4	Q37	D4	R47	D1	R102	E3
CR8	D2	Q38	C4	R48	D1	R103	E3
CR9	D2	Q39	E2	R49	D1		
CR10	D2	Q40	E4	R50	D1	U1	B2
CR11	B4	Q41	D4	R51	D1	U2	C3
CR12	B4	Q42	C4	R52	E1	U3	C2
CR13	C4	Q43	E3	R53	E1	U4	D3
CR14	B2	Q44	E4	R54	D1		
CR15	C2			R55	D1		
CR16	D4	R1	A4	R56	C1		
CR17	C4	R2	A4	R57	D1		
CR18	E2	R3	A3	R58	D1		
CR19	D4	R4	C1	R59	B4		
CR20	D4	R5	C1	R60	B4		
CR21	C4	R6	C1	R61	B2		
CR22	C4	R7	A3	R62	B3		
CR23	E1	R8	A3	R63	C3		
CR24	E1	R9	C1	R64	B2		
CR25	D3	R10	C1	R65	B2		
Q1	B4	R11	C1	R66	B2		
Q2	C2	R12	A4	R67	C3		
Q3	C2	R13	A4	R68	B2		
Q4	C2	R14	B1	R69	C3		
Q5	A3	R15	C1	R70	C3		
Q6	A4	R16	B1	R71	C2		
Q7	A4	R17	A3	R72	C3		
Q8	B4	R18	A4	R73	D2		
Q9	B3	R19	A4	R74	D2		
Q10	A1	R20	A3	R75	D3		
Q11	A1	R21	B3	R76	D3		
Q12	A3	R22	A3	R77	D2		
Q13	A1	R23	B2	R78	D3		
Q14	A1	R24	A2	R79	D3		
Q15	A1	R25	A2	R80	D2		
Q16	B4	R26	A2	R81	D3		
Q17	B4	R27	A2	R82	C4		
Q18	D2	R28	A2	R83	E2		
Q19	D2	R29	B1	R84	D3		
Q20	D2	R30	B1	R85	D3		
Q21	D2	R31	A2	R86	C3		
Q22	E2	R32	B1	R87	C3		
Q23	D2	R33	A2	R88	D2		
Q24	B3	R34	A2	R89	E2		
Q25	C2	R35	A2	R90	D4		
Q26	B3	R36	B1	R91	C4		
Q27	B4	R37	A3	R92	E2		
Q28	C3	R38	A2	R93	D4		
Q29	C2	R39	C4	R94	C4		
Q30	C3	R40	B4	R95	D2		



RANGE 4 SELECTED WHEN RANGES 1,2,3 ARE NOT SELECTED

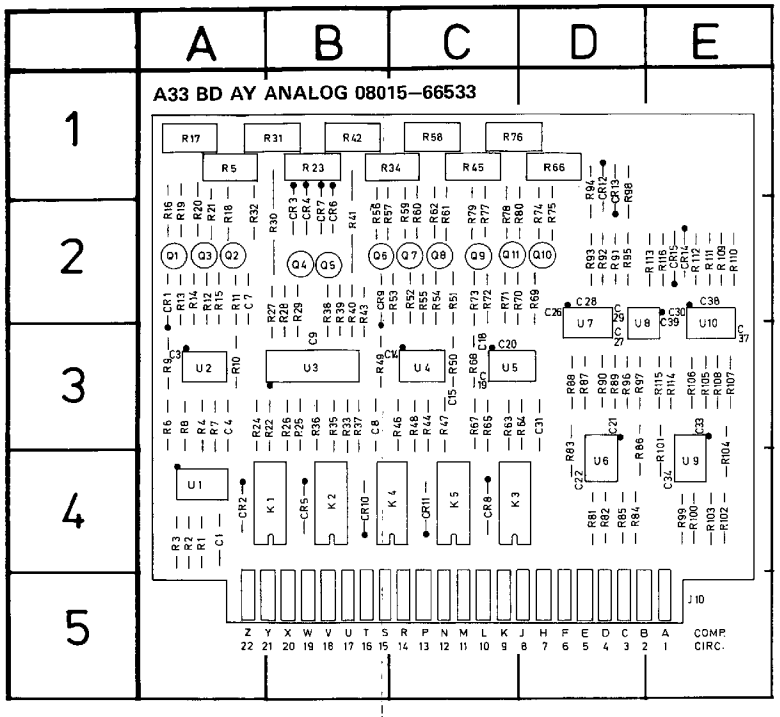
9-1

8015A OPTION 003 ONLY
REMOTE RANGE A30

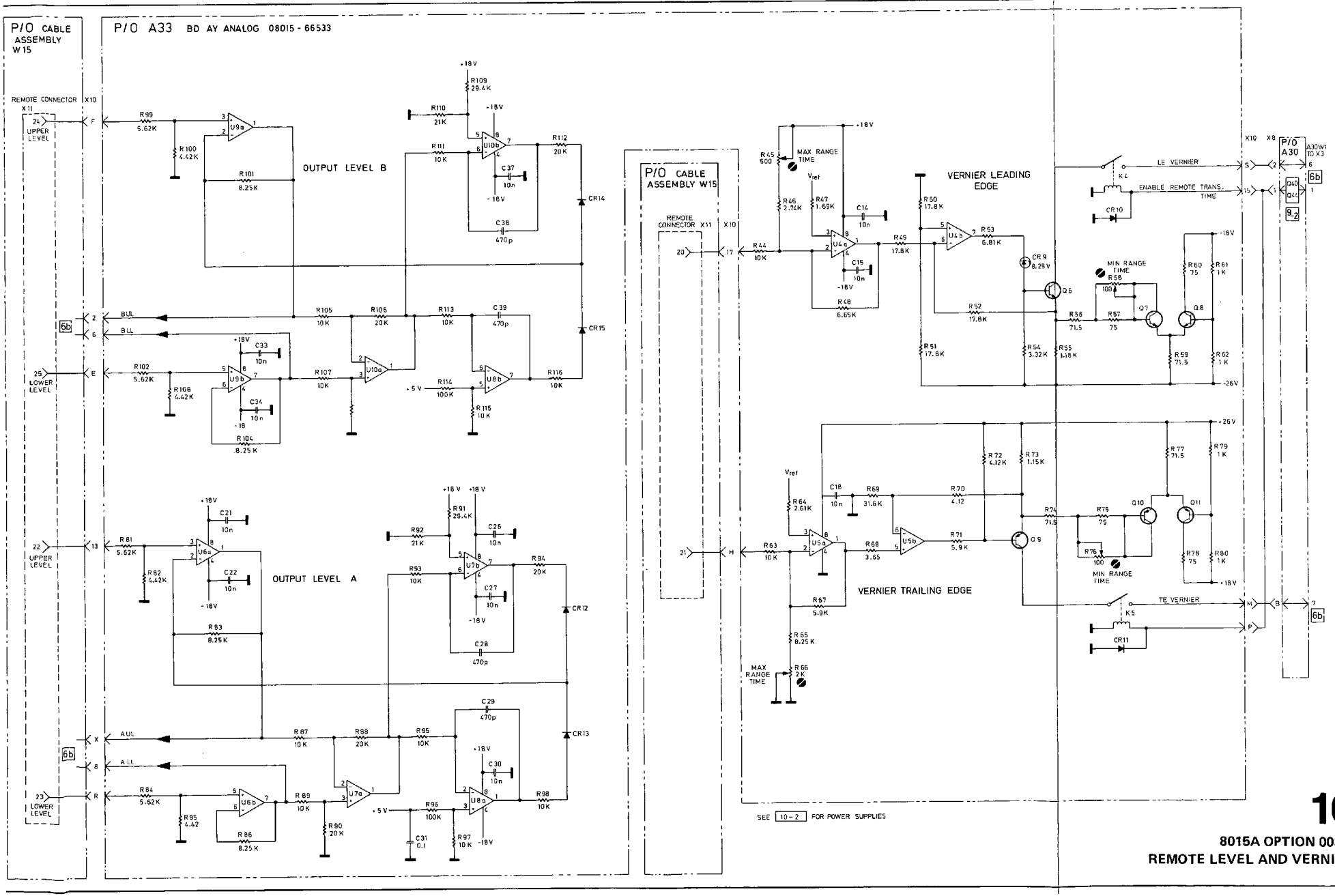


9-2

8015A OPTION 003 ONLY
REMOTE RANGE A30

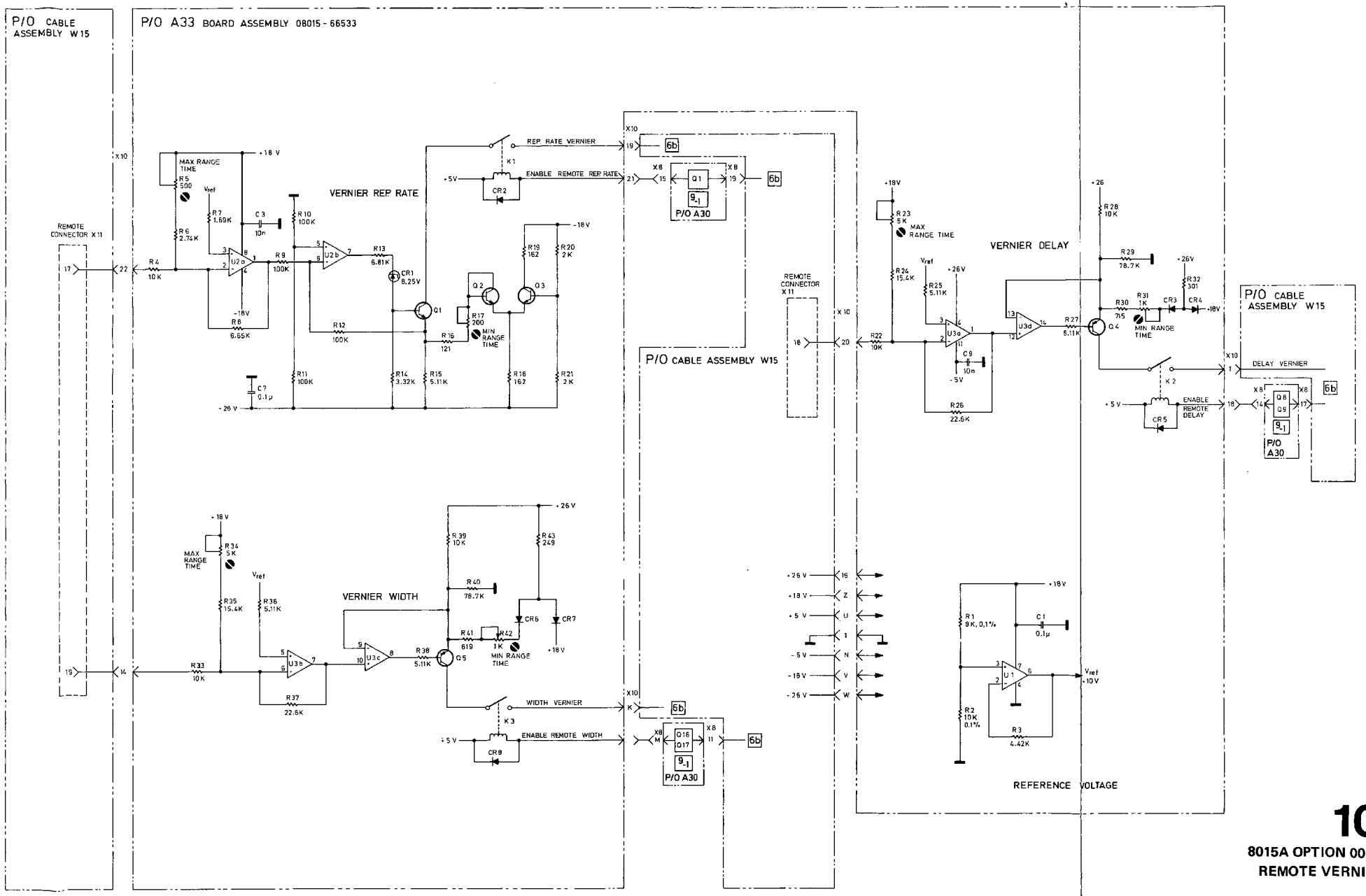


C1	A4	R1	A4	R56	B2	R111	E2		
C3	A3	R2	A4	R57	B2	R112	E2		
C7	A2	R3	A4	R58	C1	R113	E2		
C8	B3	R4	A3	R59	C2	R114	E3		
		R5	A1	R60	C2	R115	E3		
C9	B3								
C14	C3	R6	A3	R61	C2	R116	E2		
C15	C3	R7	A3	R62	C2				
C18	C3	R8	A3	R63	C3	U1	A4		
C21	D3	R9	A3	R64	C3	U2	A3		
		R10	A3	R65	C3	U3	B3		
C22	D4					U4	C3		
C26	D2	R11	A2	R66	D1	U5	C3		
C27	D3	R12	A2	R67	C3				
C28	D2	R13	A2	R68	C3	U6	D3		
C29	D2	R14	A2	R69	D2	U7	D2		
		R15	A2	R70	C2	U8	D2		
C30	E2					U9	E3		
C31	D3	R16	A2	R71	C2	U10	E2		
C33	E3	R17	A1	R72	C2				
C34	E4	R18	A2	R73	C2				
C37	E2	R19	A2	R74	D2				
		R20	A2	R75	D2				
C38	E2								
C39	E2	R21	A2	R76	C1				
		R22	B3	R77	C2				
CR1	A2	R23	B1	R78	C2				
CR2	A4	R24	A3	R79	C2				
CR3	B2	R25	B3	R80	C2				
CR4	B2								
CR5	B4	R26	B3	R81	D4				
		R27	B2	R82	D4				
CR6	B2	R28	B2	R83	D3				
CR7	B2	R29	B2	R84	D3				
CR8	C4	R30	B2	R85	D4				
CR9	B2								
CR10	B4	R31	A1	R86	D3				
		R32	A2	R87	D3				
CR11	C4	R33	B3	R88	D3				
CR12	D1	R34	B1	R89	D3				
CR13	D1	R35	B3	R90	D3				
CR14	E2								
CR15	E2	R36	B3	R91	D2				
		R37	B3	R92	D2				
K1	B4	R38	B2	R93	D2				
K2	B4	R39	B2	R94	D1				
K3	C4	R40	B2	R95	D2				
K4	B4								
K5	C4	R41	B2	R96	D3				
		R42	B1	R97	D3				
Q1	A2	R43	B2	R98	D1				
Q2	A2	R44	C3	R99	E3				
Q3	A2	R45	C1	R100	E4				
Q4	B2								
Q5	B2	R46	C3	R101	E3				
		R47	C3	R102	E4				
Q6	B2	R48	C3	R103	E4				
Q7	C2	R49	B3	R104	E3				
Q8	C2	R50	C3	R105	E3				
Q9	C2								
C10	D2	R51	C2	R106	E3				
		R52	C2	R107	E3				
Q11	C2	R53	C2	R108	E3				
		R54	C2	R109	E2				
		R55	C2	R110	E2				



10-1

8015A OPTION 003 ONLY
REMOTE LEVEL AND VERNIER A33



10-2

8015A OPTION 003 ONLY
REMOTE VERNIER A33

HEWLETT PACKARD

MANUAL CHANGES

Manual for Model Number	8015A
Manual printed on	Aug. 1976
Manual Part Number	08015-90008

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
ERRATA		1822G01796 on	1-13
1538G00976	1	01876 on	1-14
1538G01001	1,2	02001 on	1-15
1538G01076	1-3	2027G02241 on	1-16
1538G01126	1-4		
01127-01129	1-3		
01130-01137	1-4		
01138-01141	1-3		
01142	1-4		
01143-01146	1-3		
01147	1-4		
01148	1-3		
01149 on	1-4		
01276 on	1-5		
01456 on	1-6		
1822G01486 on	1-7		
01576 on	1-8		
01606 on	1-9		
01646 on	1-10		
01736 on	1-11		
01766 on	1-12		

MODEL 8015A

INDEX OF MANUAL CHANGES

MANUAL CHANGE	FRAME	MISCELLANEOUS	A2	A3	A4	A5	A6	A8	A10	A11
ERRATA		Page 1-3, Page 2-2 " 6-2, 6-29, 6-40 " 9-7, " 9-9 " 9-16, " 9-17 " 9-22, " 9-23 " 9-27, " 9-31 " 9-36, " 9-39 " 9-45 " 7-10 " 7-18 " 7-19				W1	U15,22			
1	MP38,39,40,41									
2	MP22									
3		Page 6-23, Page9-22 Page 9-26								
4		Page 9-4, Page 9-7		L17, R133 R231						
5	FL1									
6			U2							
7	W3	Page 9-31								
8		Page 9-18, Page 9-21	C4							
9			C40							

MODEL 8015A

INDEX OF MANUAL CHANGES

MANUAL CHANGE	FRAME	MISCELLANEOUS	A2	A3	A4	A5	A6	A8	A10	A11
10		Page 9-18,Page9-21	C4,R153	C74						
11	F1									
12		Page 9-44,Page9-47								
13	MP14									
14				C14						
15			R153*							
16	MP23	Page 6-29,Opt.002								

Model 8015A

ERRATA

To specifications add: minimum pulse width for external input 10 us. To Section 1 and 7 and specifications add: Option 001 no longer available. To Table 7-3-1, Output Levels, add: Absolute max input voltage level ±20V.

Page 6-2 Rear panel illustration should show line selector switches as S17 as well as S16.

Page 9-16 On A10 schematic, at connection to A21, add reference "see page 9-23"

Page 9-17 A5/A25 schematic, below blue printing "to A10 .... OPTION 005 only", change pin number from 5 to 4

Page 9-23 A21 schematic, below blue printing "ENABLE COMP TO A10....." change pin number from 5 to 3.

Page 9-22 A21 layout (standord and Option 006), change wire number 923 to 94 and 916 to 95. Transfer DS 1 from page 6 to this page.

Page 9-27 A31 schematic, change wire numbers 905 to 915 (Channel A lower level connection) and 915 to 985, transpose pin numbers X10-X with X10-8, X10-6 with X10-2.

Page 9-39 Schematic 8, change reference designator of SINGLE PULSE switch (lower left) to S22.

Page 9-45 Schematic 10-1, Remote connector (X11) transpose "24 UPPER LEVEL" with "25 LOWER LEVEL". Transpose the signal titles "BLL" with "BUL" and "ALL" with "AUL".

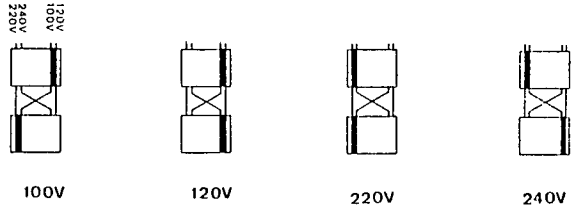
Page 9-7 Schematic 1, top left change +15V to +5V.

Page 9-9 Schematic 2, left, middle, change value of C17 to 5.6n

Page 6-29 Parts list, change description of A27S21 to "SWITCH THUMBWHEEL".

Page 1-3 Specifications: dimensions 425.5mm (16.75 in) wide, 132.6mm (5.219 in.) high, 345.4mm (13.6 in.) deep.

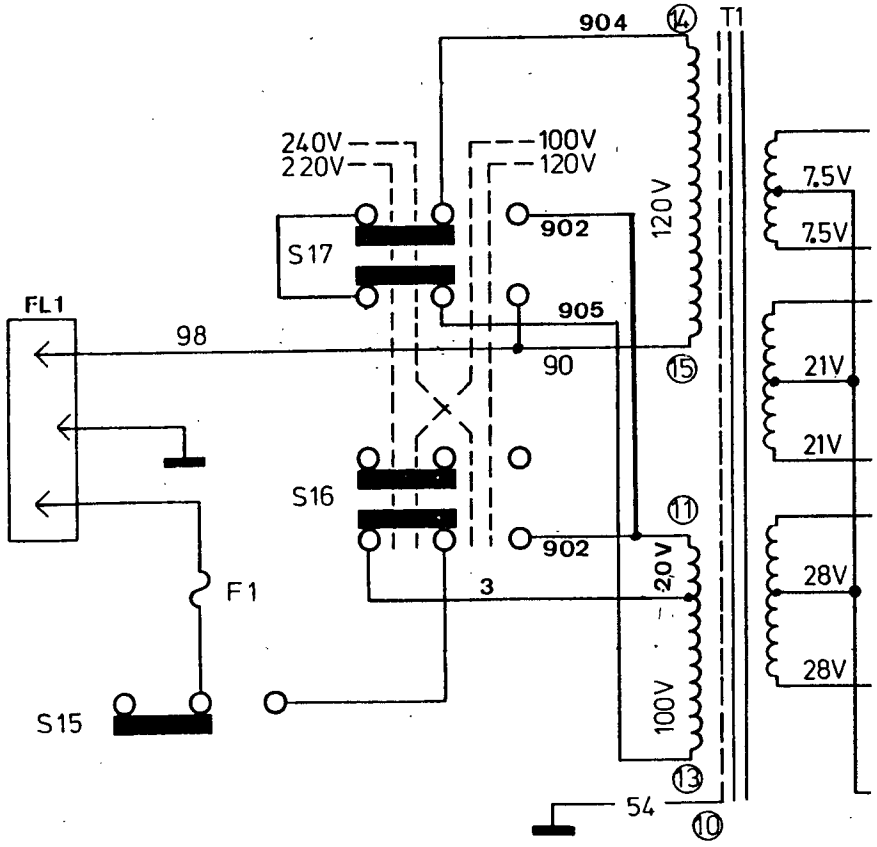
Page 2-2 Change lower part of Figure 2-4 as follows:



Model 8o15A

ERRATA (continued)

Page 9-31 Change U3 pin number 2 to 3 and pin number 3 to 2. Throughout diagram, add minus sign to all op amp pin 2 connections, plus sign to all op amp pin 3 connections.
Page 9-36 In gr id reference 7B, change U1 to U2.
Page 6-29 Change part number of A6U15,22 and 24 to 182o-1277.
Page 9-31 Change T1 primary connections as shown: -



Page 9-21 Upper, middle, change L19 to L13, L17 to L11.
Lower left, MIN AMPL ADJUST R117, add C41 0.47 between +18V and ground. Lower middle, change U8 pin 4 connection to -18V.

Model 8015A

ERRATA (continued)

Page 6-22 add

A5 W1	5081-1963	CABLE AY

Page 7-10, Figure 7-3-4. Pulse period range 3 should read : 100 to 1 us instead of 1000 to 1 us.

Replace page 7-18 and 7-19 as shown on the attached pages 7 and 8 of this manual change sheet.

Page 6-40 add :

A10R14	0698-3178	R-F 487 1% .125W

ADJUSTMENTS

Table 7–3–2. Adjustment procedure 1 for Option 003

Test Equipment: Oscilloscope arrangement as for rate, delay width adjustments.

	Remote Connector XII				Adjustment A33		
	Rate	Delay	Width		Rate	Delay	Width
Range 1	1	4	7	Minimum adj.	R17	R31	R42
Range 2	2	5	8				
Range 3	3	6	9	Maximum adj.	R5	R23	R34

NOTE: The standard instrument must be in specification.

PROCEDURE

Set corresponding switch to REM.

1. Set your ext vernier to the min limit (90 KΩ, 9V, 0.1mA).
2. Enable required circuit with a TTL high level ≥ +2.4V.
3. Lower limit: Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

   Example: Rate (Vernier min)
   Range 1 0.87s
   Range 2 9.5 ms
   Range 3 97 µs

   Range 3 has the lowest deviation, so this range will be adjusted 10% above the setting value (97µs in this case).
4. Upper Limit: Set your ext vernier to max limit (0 Ω, 0V, 1mA). Select the 3 lower ranges one after the other and measure which range has the highest relative value (to setting).

   Example: Rate (Vernier max)
   Range 1 12 ms
   Range 2 125 µs
   Range 3 1.3 µs

   Range 1 has the lowest deviation so this range will be adjusted 10% above the setting value (12 ms in this case).
5. Set 8015A via opt 003 to min width.
   If necessary readjust A3 R42 for (best compromise)
   ≤ 13ns

ADJUSTMENTS

Table 7–3–3. Adjustment procedure 2 for Option 003

Test Equipment: Oscilloscope
Arrangement as for transition time

Remote Connector XII Transition Time XII			Adjustment A33 leading edge	trailing edge
Range 1	11	Minimum adjust	R58	R76
Range 2	12			
Range 3	13	Maximum adjust	R45	R66

NOTE: The standard instrument must be in specification.

PROCEDURE

1. Set transition time switch to REM.
2. Set ext vernier to min limit (90 KΩ, 9V, 0.1mA).
3. Enable needed ranges with a TTL high level ≥ +2.4V.
4. Lower limit:
   Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

   Example: (Vernier min)
   Range 1 0.53 s
   Range 2 4.8ms
   Range 3 54 µs

   Range 2 has the lowest deviation, so this range has to be adjusted 10% below the setting value (4.8msin this case).
5. Upper limit:
   Set ext vernier to max limit (0 Ω, 0V, 1mA).
   Select the 3 lower ranges one after the other and measure which range has the highest relative value (to setting).

   Example: (Vernier max)
   Range 1 5.2 ms
   Range 2 55 µs
   Range 3 530 ns

   Range 1 has the lowest deviation so this range has to be adjusted 10% above the setting value (5.2msin this case).

CHANGE 1

To Rear Panel Assembly add:

MP38	5040-7221	FOOT	(4 off)
MP39	2360-0201	SCREW	(4 off)
MP40	2190-0918	WASHER	(4 off)
MP41	3050-0016	WASHER	(4 off)

CHANGE 2

Delete

MP22 08015-00214 PANEL REAR

Add

MP22 08015-60201 ASSEMBLY, REAR PANEL
of which S16, S17 and FL1 are part.

CHANGE 3

Page 9-22, 9-26, 6-23: A21/31 W1 is replaced by two indentical cdble assemblies: W1/W2 08015-61608 CABLE AY DUAL CO-AX.

CHANGE 4

On board A3 parts list change the following components.

Change	A3 R133	0698-3437	R-F	133 1% .125W
Add	A3 R231	0757-0410	R-F	301 1% .125W
	A3 L17	9140-0114	COIL	10UH 10%

On board A3 component layout and on schematic. L17 and R231 are connected in series. L17 to Q14 collector and R231 to ground.

CHANGE 5

Page 6-9

Change FL1 9135-0035 FILTER LINE

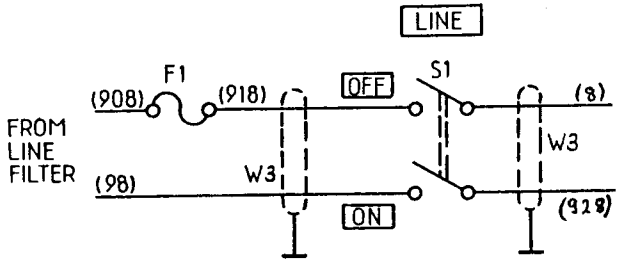
CHANGE 6

Page 6-14. Change A2U2 part number to 1826-0111.

CHANGE 7

Page 6-10, change W3 08015-61616 CABLE AY POWER

Service Sheet 7 (Page 9-31), change LINE ON/OFF switch wiring as follows:



CHANGE 8

Page 6-10, add A2C4 0160-0576 C-F 0.1uF
Page 9-18, add C4 between U4 pin 3 and ground at layout reference F3.

Page 9-21, (Service Sheet 5), center of diagram, add C4 between U4 pin 3 and ground.

CHANGE 9

Delete all information given in change 8 and change A2C40 on page 6-10 to 2.2uF, part no. 0160-0128.

CHANGE 10

Re-insert all information in change 8.
Also: On page 6-13 change R153 to 0698-3540 R-F 15.4 K
On page 6-15 add C74 0180-1974 C-F 10 UF

MANUAL CHANGE 11

On Table 6-3, change the Table of Replaceable Parts to read :

F1	2110-0564	FUSEHOLDER BODY
F1	2110-0565	FUSEHOLDER CAP
F1	2110-0569	NUT HEX

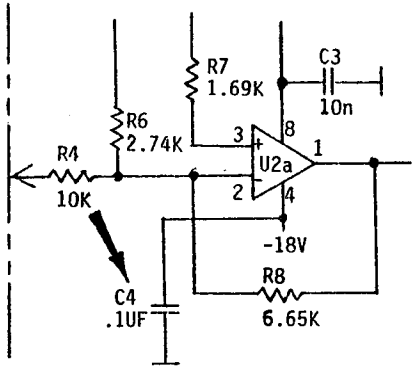
MANUAL CHANGE 12

On Page 9-44, Service Sheet 10 add :

C4A3

On Page 9-47, Service Sheet 10-2, change the diagram to read :

P/O A33 BD AY 08015-66533



MANUAL CHANGE 13

On Table 6-3, change the Table of Replaceable Parts to read :

MP14	5061-1964	COVER BOTTOM

MANUAL CHANGE 14

On Table 6-3, change the Table of Replaceable Parts to read :

A3C17	0160-5105	C-FXD 6200PF 400V ± 5%

MANUAL CHANGE 15

On Page 6-13, Replaceable Parts and on Page 9-21, Service Sheet 5, change to read :

A2R153*	0698-3540	R-FXD 15.4K

MANUAL CHANGE 16

On Page 6-3, change the Table of Replaceable Parts to read :

MP23	08015-00210	PANEL FRONT

On Page 6-29. Replaceable Parts, Option 002 :

MP23B	08015-00211	PANEL FRONT (for Option 002 only)

Delete: MP23A

Note that Option 005 is now integrated in the 8015A Standard instrument. Option 004 and Option 006 are always combined and will be called Option 007.

HEWLETT PACKARD

MANUAL CHANGES

Manual for Model Number	8015A
Manual printed on	February 1981
Manual Part Number	08015-90008

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
ERRATA		
1538G00976		1
1538G01001		1,2
1538G01076		1-3
1538G01126		1-4
01127-01129		1-3
01130-01137		1-4
01138-01141		1-3
01142		1-4
01143-01146		1-3
01147		1-4
01148		1-3
01149	on	1-4
01276	on	1-5
01456	on	1-6
1822G01486	on	1-7
01576	on	1-8
01606	on	1-9
01646	on	1-10
01736	on	1-11
01766	on	1-12
1822G01796	on	1-13
01876	on	1-14
02001	on	1-15
2027G02241	on	1-16
02361	on	1-17
02451	on	1-18
02511	on	1-19
02571	on	1-20
02891	on	1-21
03011	on	1-22
03111	on	1-23
2528G03171	on	1-24
2528G03211	on	1-25
2528G03231	on	1-26
2528G03291	on	1-27
2528G03331	on	1-28
2528G03351	on	1-29
2528G03361	on	1-30
2528G03381	on	1-31
2528G03421	on	1-32
2528G03471	on	1-33

MODEL 8015A

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MANUAL CHANGE	FRAME	MISCELLANEOUS	A2	A3	A4	A5	A6	A8	A10	A11
ERRATA	Page 7-29	Page 1-3,Page 2-2 " 6-2,6-29,6-40 " 9-7, 9-9 " 9-16, " 9-17 " 9-22, " 9-23 " 9-27, " 9-31 " 9-36, " 9-39 " 9-45 " 7-10 " 7-18 " 7-19				W1	U15,22			
1	MP38,39,40,41									
2	MP22									
3		Page 6-23,Page9-22 Page 9-26								
4		Page 9-4,Page 9-7		L17,R133, R231						
5	FL1									
6			U2							
7	W3	Page 9-31								
8		Page 9-18, Page 9-21	C4							
9			C40							

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MANUAL CHANGE	MISCELLANEOUS	FRAME	A2	A3	A4	A5	A6	A8	A10	A11	A21
10	Page 9-18,9-21		C4,R153	C74							
11		F1									
12	Page 9-44,9-47										
13		MP14									
14				C14							
15			R153*								
16	Page 6-29,Opt.002	MP23									
17			MP4								
18	Page 9-7			R90,L18							
19		R2thru R6									
20			Q13,14,15								
21											R26
22	Page 9-12,9-17 Page 9-18,9-21		C4,18,40 R179,180 R181			C47*,48*					
23				C74							
24	Page 2-0,Figure2-2	MP9,9A, MP13,14, MP16,24, MP34,35, MP36									

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MANUAL CHANGE	MISCELLANEOUS	FRAME	A2	A3	A4	A5	A6	A8	A10	A11	A21
25	Page 6-22										R5,6,11,12, R24,25
26	Page 6-10 Page 6-21		C62 Q16								
27	Page 6-23										S7,9,10,11 S12,13
28	Page 6-11 Page 6-20		Q1			Q7,8,19					
29	Page 6-14		U3,4,5								
30	Page 6-11 Page 6-20/21		Q1			Q7,8,19					
31	Page 6-28						J3				
32			C2,3,9, C10,13, C14,15, C16,19, C20,21, C26,28, C29,32, C33,34, C35,36, C40,41, C42,43, C62	C34,36, C40,41, C47,48, C63,64, C66,67, C71,72, C73		C13,16, C20,21, C23,29, C31,32, C35,36, C37,38, C40,41, C43,45	C1,13, C15,16,		C1,2,3		
33		S15									

MODEL 8015A
INDEX OF MANUAL CHANGES

MANUAL CHANGE	MISCELLANEOUS	FRAME	A24	A28	A33	
25	Page 6-24		CR35-46			
29					U1	

ERRATA

To specifications add: minimum pulse width for external input 10 us. To Section 1 and 7 and specifications add: Option 001 no longer available. To Table 7-3-1, Output Levels, add: Absolute max input voltage level ±20V.

Page 6-2 Rear panel illustration should show line selector switches as S17 as well as S16.

Page 9-16 On A10 schematic, at connection to A21, add reference "see page 9-23"

Page 9-17 A5/A25 schematic, below blue printing "to A10 .... OPTION 005 only", change pin number from 5 to 4

Page 9-23 A21 schematic, below blue printing "ENABLE COMP TO A10....." change pin number from 5 to 3.

Page 9-22 A21 layout (standord and Option 006), change wire number 923 to 94 and 916 to 95. Transfer DS 1 from page 6-9 to this page.

Page 9-27 A31 schematic, change wire numbers 905 to 915 (Channel A lower level connection) and 915 to 985, transpose pin numbers X10-X with X10-8, X10-6 with X10-2.

Page 9-39 Schematic 8, change reference designator of SINGLE PULSE switch (lower left) to S22.

Page 9-45 Schematic 10-1, Remote connector (X11) transpose "24 UPPER LEVEL" with "25 LOWER LEVEL". Transpose the signal titles "BLL" with "BUL" and "ALL" with "AUL".

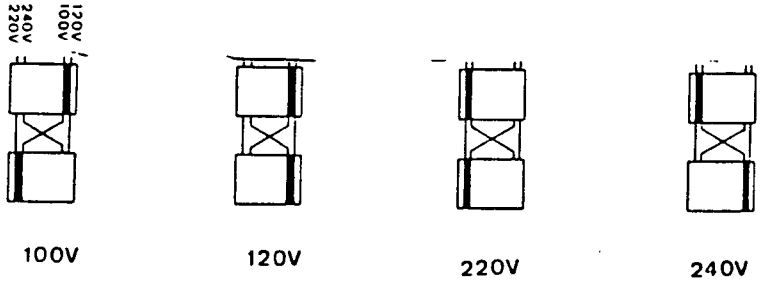
Page 9-7 Schematic 1, top left change +15V to +5V.

Page 9-9 Schematic 2, left, middle, change value of C17 to 5.6n

Page 6-29 Parts list, change description of A27S21 to "SWITCH THUMBWHEEL".

Page 1-3 Specifications: dimensions 425.5mm (16.75 in) wide, 132.6mm (5.219 in.) high, 345.4mm (13.6 in.) deep.

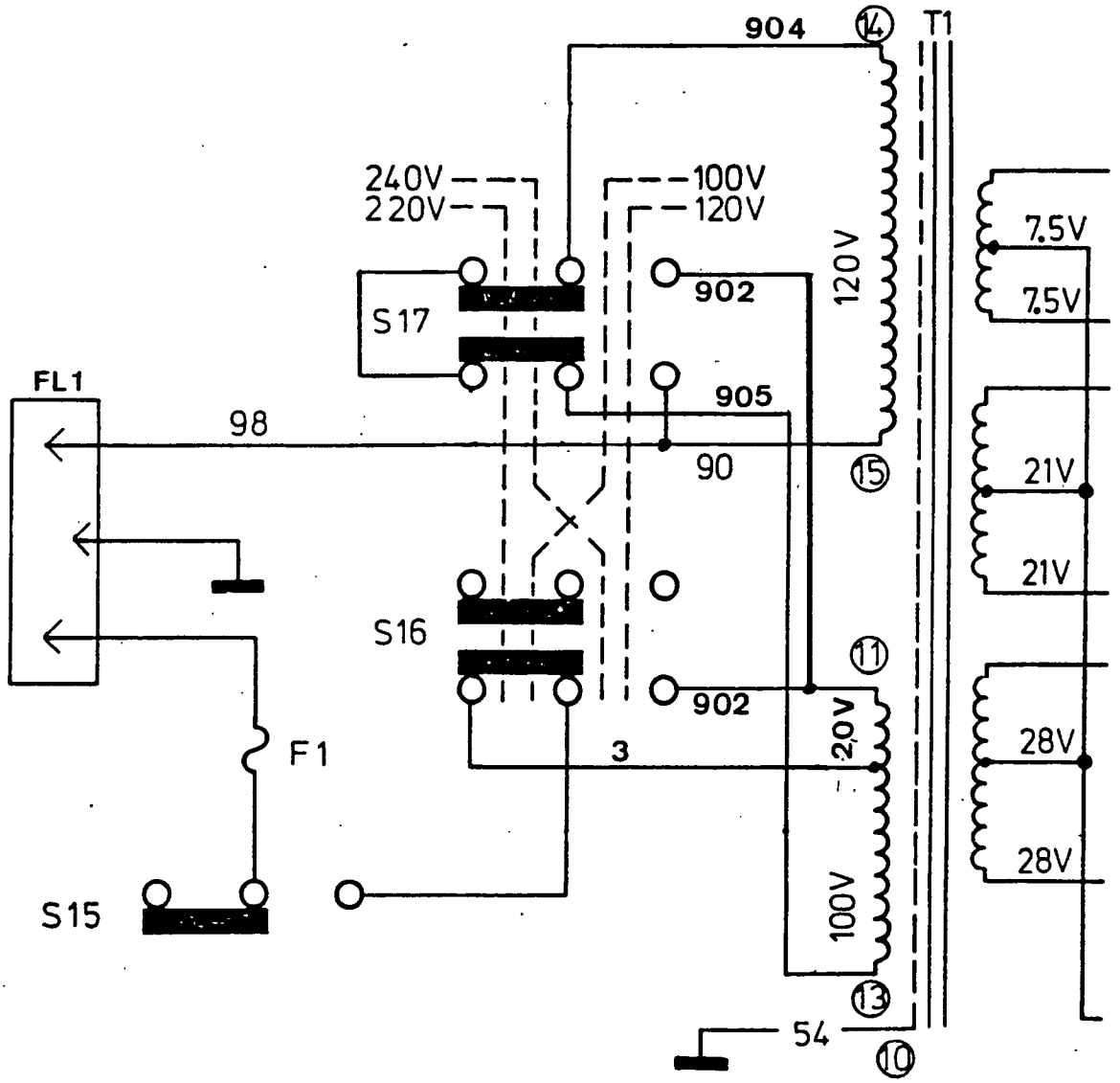
Page 2-2 Change lower part of Figure 2-4 as follows:



Model 8o15A

ERRATA (continued)

Page 9-31 Change U3 pin number 2 to 3 and pin number 3 to 2. Throughout diagram, add minus sign to all op amp pin 2 connections, plus sign to all op amp pin 3 connections.
Page 9-36 In grid reference 7B, change U1 to U2.
Page 6-29 Change part number of A6U15,22 and 24 to 182o-1277.
Page 9-31 Change T1 primary connections as shown: -



Page 9-21 Upper, middle, change L19 to L13, L17 to L11.
Lower left, MIN AMPL ADJUST R117, add C41 0.47 between +18V and ground. Lower middle, change U8 pin 4 connection to -18V.

ERRATA (continued)

Page 6-22 add

A5 W1	5081-1963	CABLE AY

Page 7-10, Figure 7-3-4. Pulse period range 3 should read :
100 to 1 us instead of 1000 to 1 us.

Replace page 7-18 and 7-19 as shown on the attached pages 7 and 8 of this manual change sheet.

Page 6-40 add :

A10R14	0698-3178	R-F 487 1% .125W

Page 7-29, step 7-6-5 delete :

Upper level output accuracy : $\pm$ 5% of control voltage.
Lower level of output pulse : held at 0V $\pm$ 250 mV.

Page 9-31, Service Sheet 7 :

Add to SWITCH BOARD Assy, reference A21.

ADJUSTMENTS

Table 7–3–2. Adjustment procedure 1 for Option 003

Test Equipment: Oscilloscope arrangement as for rate, delay width adjustments.

	Remote Connector XII				Adjustment A33		
	Rate	Delay	Width		Rate	Delay	Width
Range 1	3	6	9	Minimum adj.	R17	R31	R42
Range 2	2	5	8				
Range 3	1	4	7	Maximum adj.	R5	R23	R34

NOTE: The standard instrument must be in specification.

PROCEDURE

Set corresponding switch to REM.

1. Set your ext vernier to the min limit (0 Ω, 0V, 1mA).

2. Enable required circuit with a TTL high level ≥ +2.4V.

3. Lower limit: Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

   Example: Rate (Vernier min)
   Range 1 0.87s
   Range 2 9.5 ms
   Range 3 97 µs

   Range 3 has the lowest deviation, so this range will be adjusted 10% above the setting value (97µs in this case).

4. Upper Limit: Set your ext vernier to max limit (90kΩ, 9V 0.1mA). Select the 3 lower ranges one after the other and measure which range has the highest relative value (to setting).

   Example: Rate (Vernier max)
   Range 1 12 ms
   Range 2 125 µs
   Range 3 1.3 µs

   Range 1 has the lowest deviation so this range will be adjusted 10% above the setting value (12 ms in this case).

5. Set 8015A via opt 003 to min width.
   If necessary readjust A3 R42 for (best compromise)
   ≤ 13ns

ADJUSTMENTS

Table 7-3-3. Adjustment procedure 2 for Option 003

Test Equipment: Oscilloscope
Arrangement as for transition time

Remote Connector XII Transition Time XII			Adjustment A33 leading edge	 trailing edge
Range 1	13	Minimum adjust	R58	R76
Range 2	12			
Range 3	11	Maximum adjust	R45	R66

NOTE: The standard instrument must be in specification.

PROCEDURE

1. Set transition time switch to REM.

2. Set ext vernier to min limit (0 Ω, 0V, 1mA).

3. Enable needed ranges with a TTL high level ≥ +2.4V.

4. Lower limit:
Select the 3 lower ranges one after the other and measure on scope which range has the lowest relative value (to setting).

Example: (Vernier min)

Range 1	0.53 s
Range 2	4.8 ms
Range 3	54 µs

Range 2 has the lowest deviation, so this range has to be adjusted 10% below the setting value (4.8msin this case).

5. Upper limit:
Set ext vernier to max limit (90KΩ, 9V, 0.1mA).
Select the 3 lower ranges one after the other and measure which range has the highest relative value (to setting).

Example: (Vernier max)

Range 1	5.2 ms
Range 2	55 µs
Range 3	530 ns

Range 1 has the lowest deviation so this range has to be adjusted 10% above the setting value (5.2msin this case).

Model 8015A

CHANGE 1

To Rear Panel Assembly add:

MP38	5040-7221	FOOT	(4 off)
MP39	2360-0201	SCREW	(4 off)
MP40	2190-0918	WASHER	(4 off)
MP41	3050-0016	WASHER	(4 off)

CHANGE 2

Delete

MP22 08015-00214 PANEL REAR

Add

MP22 08015-60201 ASSEMBLY, REAR PANEL
of which S16, S17 and FL1 are part.

CHANGE 3

Page 9-22, 9-26, 6-23: A21/31 W1 is replaced by two indentical cable assemblies: W1/W2 08015-61608 CABLE AY DUAL CO-AX.

CHANGE 4

On board A3 parts list change the following components.

Change	A3 R133	0698-3437	R-F 133 1% .125W
Add	A3 R231	0757-0410	R-F 301 1% .125W
	A3 L17	9140-0114	COIL 10UH 10%

On board A3 component layout and on schematic. L17 and R231 are connected in series. L17 to Q14 collector and R231 to ground.

CHANGE 5

Page 6-9

Change FL1 9135-0035 FILTER LINE

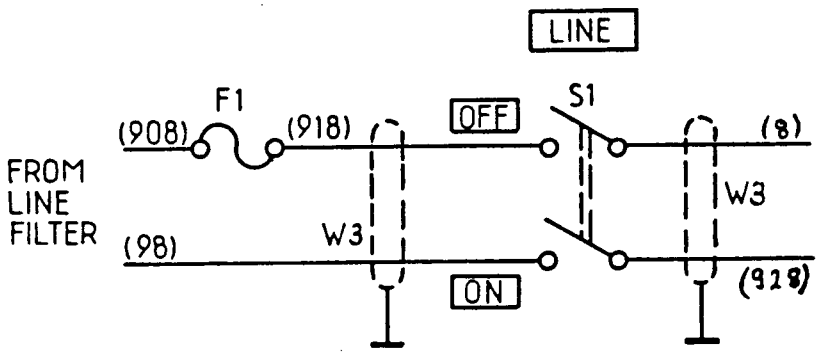
CHANGE 6

Page 6-14. Change A2U2 part number to 1826-0111.

CHANGE 7

Page 6-10, change W3 08015-61616 CABLE AY POWER

Service Sheet 7 (Page 9-31), change LINE ON/OFF switch wiring as follows:



CHANGE 8

Page 6-10, add A2C4 0160-0576 C-F 0.1uF
Page 9-18, add C4 between U4 pin 3 and ground at layout reference F3.

Page 9-21, (Service Sheet 5), center of diagram, add C4 between U4 pin 3 and ground.

CHANGE 9

Delete all information given in change 8 and change A2C40 on page 6-10 to 2.2uF, part no. 0160-0128.

CHANGE 10

Re-insert all information in change 8.
Also: On page 6-13 change R153 to 0698-3540 R-F 15.4 K
On page 6-15 add C74 0180-1974 C-F 10 UF

MANUAL CHANGE 11

On Table 6-3, change the Table of Replaceable Parts to read :

F1	2110-0564	FUSEHOLDER BODY
F1	2110-0565	FUSEHOLDER CAP
F1	2110-0569	NUT HEX

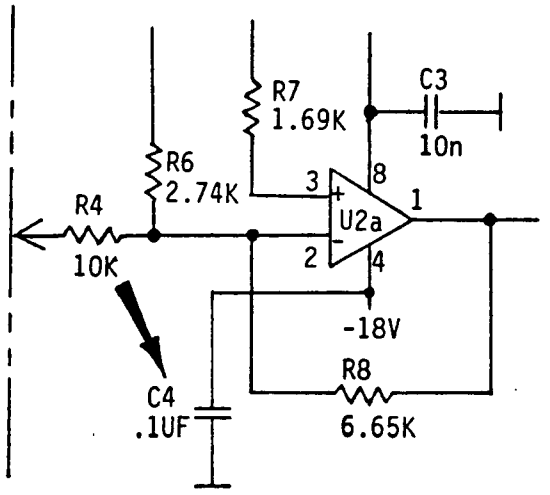
MANUAL CHANGE 12

On Page 9-44, Service Sheet 10 add :

C4A3

On Page 9-47, change the Service Sheet 10-2 to read :

P/O A33 BD AY 08015-66533



MANUAL CHANGE 13

On Page 6-9, change the Table of Replaceable Parts to read :

MP14	5061-1964	COVER BOTTOM

MANUAL CHANGE 14

On Page 6-14, change the Table of Replaceable Parts to read :

A3C17	0160-5105	C-FXD 6200PF 400V ± 5%

MANUAL CHANGE 15

On Page 6-13, Replaceable Parts and on Page 9-21, Service Sheet 5, change to read :

A2R153*	0698-3540	R-FXD 15.4K

MANUAL CHANGE 16

On Page 6-9, change the Table of Replaceable Parts to read :

MP23	08015-00210	PANEL FRONT

On Page 6-29. Replaceable Parts, Option 002 :

MP23B	08015-00211	PANEL FRONT (for Option 002 only)

Delete: MP23A

Note that Option 005 is now integrated in the 8015A Standard instrument. Option 004 and Option 006 are always combined and will be called Option 007.

MANUAL CHANGE 17

On Page 6-11, change the Table of Replaceable Parts to read :

A2MP4	1205-0425	HEAT SINK

MANUAL CHANGE 18

On Page 6-15, Replaceable Parts :

Add:	A3L18	9170-0029	CORE SHIELDING BEAD

On Page 6-18, change the Table of Replaceable Parts to read :

A3R30	0757-0424	R-FXD 1.1K 1%

On Page 9-7, Service Sheet 1 :

Add: L18 is connected in series to the base of Q51.

MANUAL CHANGE 19

On Table 6-3, change the Table of Replaceable Parts to read :

R2,3,4,5,6	2100-3861	R-VAR 50K 10% 10W

MANUAL CHANGE 20

On Page 6-11, change the Table of Replaceable Parts to read :

A2Q13,14,15	1854-0784	XSTR NPN 2N 3866A

MANUAL CHANGE 21

On Page 6-22, Replaceable Parts List :

Add:	A21R26	0698-3262	R-FXD 40.2 1% .125W

On Page 9-22, Service Sheet 6 and
On Page 9-31, Service Sheet 7, change to read :

R26 is connected in series between -5V and DS1.

MANUAL CHANGE 22

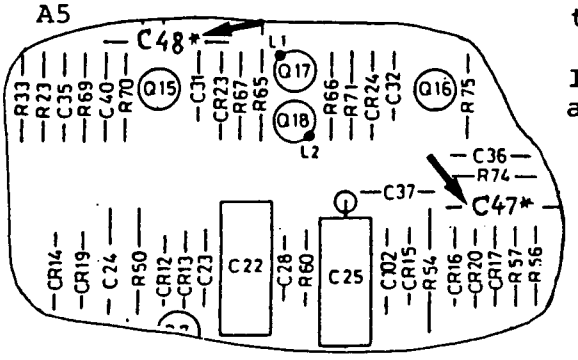
On Page 6-10/-14/-20, change the Table of Replaceable Parts to read :

	A2C40	0160-0174	C-FXD 0.47UF 50V CER
Add:	A2C18	0140-0190	C-FXD 39PF 5% 300V
	A2R179	0757-0276	R-FXD 61.9 1% .125W
	A2R180,181	0757-0401	R-FXD 100 1% .125W
	A5C47*,48*	0150-0121	C-FXD 0.1UF 20% 50V

Delete: A2C4

On Page 9-12, Service Sheet 4, change the Component Locator A5 to read :

A5



In Ref.Des.Table and Grid Location add :

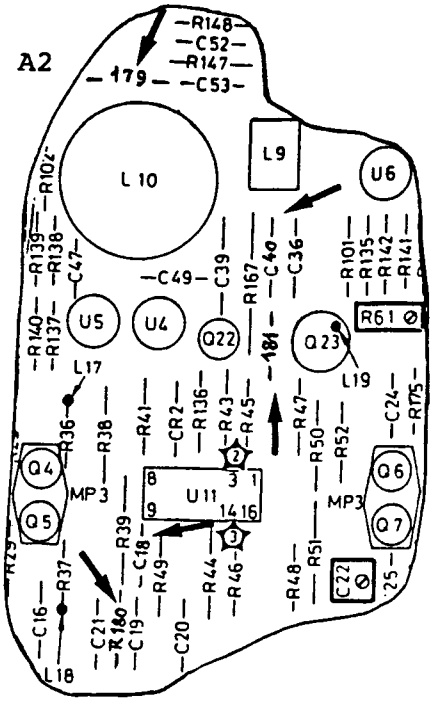
C47*	G3
C48*	E3

MANUAL CHANGE 22 (Cont.)

On Page 9-17, Service Sheet 4 (A5) to read :

C47 is connected between Q16 emitter and ground and
C48 is connected between Q15 emitter and ground as a factory selected value.

On Page 9-18, Service Sheet 4, change the Component Locator A2 to read :



In Ref.Des.Table and Grid Location add :

C18	F2
R179	F2
R180	F5
R181	G3

On Page 9-21, Service Sheet 5 (A2), change to read :

R181 is connected in series to C40,
R179 is connected in series to C53,
R180 is connected in series to C18 between Q21 collector and ground.

MANUAL CHANGE 23

On Page 6-15, change the Table of Replaceable Parts to read:

A3C74	0180-1794	C-FXD 22UF 35V

MANUAL CHANGE 24

IMPORTANT NOTE: New part numbers assigned to the following items since all threaded holes or screws are now METRIC!

On Page 2-0, Figure 2-2. Available Accessories, change:

Option 907 to read	Kit 5061-9689
Option 908 to read	Kit 5061-9677
Option 909 to read	Kit 5061-9683

On Page 6-9, change the Table of Replaceable Parts to read:

MP 9	5041-6819	CAP STP HNDL FNT
MP 9A	5041-6820	CAP STP HNDL RR
MP13	5001-1230	COVER TOP
MP14	5001-1231	COVER BOTTOM
MP16	5061-9510	COVER SIDE 132.6
MP24	08015-00217	PANEL SUB
MP34	5021-5803	FRAME FRNT 132.6
MP35	5021-5804	FRAME REAR 132.6
MP36	5021-5835	STRUT CRNR

MANUAL CHANGE 25

On Page 6-22, change the Table of Replaceable Parts to read:

A21	R5,6,11,12, R24,25	0757-0422	R-F 909 1% .125W

On Page 6-24, change the Table of Replaceable Parts to read:

A24	CR 35-46	1901-0871	DIO-PWR RECT

MANUAL CHANGE 26

On Page 6-10, Replaceable Parts List:

ADD:

A2	C62	0160-3097	C-FXD .47UF CER

On Page 6-21, change the Table of Replaceable Parts to read:

A5	Q16	1854-0498	XSTR 1.4 GHz 400M

On Schematic BD AY OUTPUT A2 Page 9-21

ADD: C62 is connected from the +5V SIDE of A2 R49 to ground (Ground Point of A2 C20)

MANUAL CHANGE 27

On Page 6-23, change the Table of Replaceable Parts to read:

A21	S7,9,10,11,12,13	3101-2334	SW SLIDE DPDT

MANUAL CHANGE 28

On Page 6-11, change the Table of Replaceable Parts to read:

A2	Q1	1854-0354	XSTR SI NPN

On Page 6-20, change the Table of Replaceable Parts to read:

A5	Q7,8,19	1854-0354	XSTR SI NPN

MANUAL CHANGE 29

On Page 6-14, change the Table of Replaceable Parts to read:

A2	U3,4,5	1820-0493	IC 307 N

On Page 6-34, change the Table of Replaceable Parts to read:

A33	U1	1820-0493	IC 307 N

MANUAL CHANGE 30

On Page 6-11, change the Table of Replaceable Parts to read:

A2	Q1	5180-2468	SELECT XSTR

On Page 6-20/21, change the Table of Replaceable Parts to read:

A5	Q7,8,19	5180-2468	SELECT XSTR

MANUAL CHANGE 31

On Page 6-28, change the Table of Replaceable Parts to read:

A6	J3	1200-0508	Socket IC-14 CONT.

MANUAL CHANGE 32

On Replaceable Parts List, change to read:

A2	C2,3,9,10,13,14,15, C16,19,20,21,26,28, C29,32,33,34,35,36, C40,41,42,43,46		
A3	C34,36,40,41,47,48, C63,64,66,67,71,72,73	0160-6596	C-FXD .47UF 20%
A5	C13,16,20,21,23,29,31, C32,35,36,37,38,40,41, C43,45		
A6	C1,13,15,16		
A10	C1,2,3,		
A32	C1,3		

MANUAL CHANGE 33

On Page 6-10, change the Table of Replaceable Parts to read:

	S15	3101-2954	SW-LINE

Table 5–12a. Performance Test Record

Hewlett-Packard
HP MODEL 8015A option .....
PULSE GENERATOR
Serial No. .....

Tested by .....

Date .....

5–2 Repetition Rate Test			
Rate Setting	Vernier	Specific.	Result
20n–1μ	CCW	≥50MHz	.....
20n–1μ	CW	≤1MHz	.....
1μ–0.1m	CCW	≥1MHz	.....
1μ–0.1m	CW	≤10KHz	.....
0.1m–10m	CCW	≤0.1ms	.....
0.1m–10m	CW	≥10ms	.....
10m–1	CCW	≤10ms	.....
10m–1	CW	≥1s	.....
Man. funktion			☐

5–3 Pulse Delay Test			
Delay Setting	Vernier	Specific.	Result
20n–1μ	CW	≥1μs	.....
1μ–0.1m	CCW	≤1μs	.....
1μ–0.1m	CW	≥0.1ms	.....
0.1m–10m	CCW	≤0.1ms	.....
0.1m–10m	CW	≥10ms	.....
10m–1	CCW	≤10ms	.....
10m–1	CW	≥1s	.....

5–4 Pulse Width Test			
Width Setting	Vernier	Specific.	Result
10ns–1μ	CCW	≤10ns	.....
Duty Cycle	CCW	50%±15%	.....
10n–1μ	CW	≥1μs	.....
1μ–0.1m	CCW	≤1μs	.....
1μ–0.1m	CW	≥0.1ms	.....
0.1m–10m	CCW	≤0.1ms	.....
0.1m–10m	CW	≥10ms	.....
10m–1	CCW	≤10ms	.....
10m–1	CW	≥1s	.....
Duty cycle			
20n–1μ	CW	50%±5%	.....
1μ–0.1m	CW + CCW	50%±5%	.....
0.1m–10m	CCW to CW	50%±5%	.....
10m–1s	CW to CCW	50%±5%	.....

5–5 Jitter Test			
Range	–	Specific.	Result
Rate	–	≤0.1%+50ps	.....
Delay	–	≤0.1%+50ps	.....
Width	–	≤0.1%+50ps	.....

5–6/7 External Mode Check		
Ext. Trigger		
POS		☐
NEG		☐
Ext. Gate		
POS		☐
NEG		☐
Ext. Width		
POS		☐
NEG		☐

5–8 Transition Time Check				
Setting	LE Vernier	TE Vernier	Specif.	Result
6n–0.5μ	CCW	CCW	≤6ns	.....
6n–0.5μ	CW	CW	≥0.5μ	.....
Zs to 1KΩ				
6n–0.5μ				
NORM	CCW	CCW	≤8ns	.....
COMPL	CCW	CCW	≤8ns	.....
A+B, Zs 50Ω				
6n–0.5μ				
NORM	CCW	CCW	≤15ns	.....
COMPL	CCW	CCW	≤15ns	.....
0.5μ–50μ	CCW	CCW	≤0.5μs	.....
0.5μ–50μ	CW	CW	≥50μs	.....
50μ–5m	CCW	CCW	≤50μs	.....
50μ–5m	CW	CW	≥5ms	.....
5m–0.5	CCW	CCW	≤5ms	.....
5m–0.5	CW	CW	≥0.5s	.....

5–9 Pulse Perturbation		
	Specific.	Result A/B
Overshoot, Ringing	≤±5%(±10%)	.....
Preshoot, droop, linearity	<5 %	.....

5–10 Pulse Amplitude			
Int Zs	Levers (separation)	Swing	Result A/B
50Ω	max	≥8V	.....
50Ω	min	≤1V	.....
1KΩ	max	≥16V	.....
1KΩ	min	≤2V	.....
A + B			
50Ω	max	≥16V	.....
50Ω	min	≤2V	.....
1KΩ (both)	max	≥30V	.....
	min	≤4V	.....

5–11 Trigger Output Test		
	Specific.	Result
Trigger Output width	9ns±5ns	.....

5–12 SAFETY CHECK ☐

7–2–1 OPTION 002 ☐

7–3–2/3/4 OPTION 003 ☐

7–4–2 OPTION 004 ☐

7–5–1 OPTION 005 ☐

7–6–1 OPTION 006 ☐