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7-22

OPERATING AND SERVICE MANUAL

HEWLETT-PACKARD

8112A
PULSE GENERATOR
50 MHz

SERIAL NUMBERS

This manual applies directly to instruments with serial number 2136G00931 and higher. Any changes made in instruments having serial numbers higher than the above number will be found in a "Manual Changes" supplement supplied with this manual. Be sure to examine this supplement for changes which apply to your instrument and record these changes in your manual. Backdating information for instruments with lower serial numbers can be found in Section 7 (yellow pages).

HERRENBERGER STR. 110, D-7030 BOBLINGEN
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HEWLETT PACKARD

MANUAL CHANGES

Manual for Model Number	8112A
Manual printed on	Febr. 1984
Manual Part Number	08112-90002

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				
2343G01181	and above	1		
2343G01581	and above	1-2		
2343G01631	and above	1-3		
2343G01856	and above	1-4		

MODEL 8112A

INDEX OF MANUAL CHANGES

MANUAL CHANGE	MISCELLANEOUS	FRAME	A1	A2	A3
ERRATA	Page 1-3,4-3,4-4 Page 4-5,4-6,4-25 Page 5-5,6-7,6-8, Page 6-13,8-8, Page 8-10		CR202, R249		TP2-18
1			C7,8,9,10, C414* C541, W9,10,11	R7,55, U22	U5,6,7, U9,22
2	Page 8-20		C535*,L513*		
3	Page 8-17, 8-18		R406,408,421* C415		
4			C240*	R7*	

ERRATA

Page 1-3, Table 1-2. Specifications
PULSE PARAMETERS, change to read :

Period (PER) .....
Delay (DEL) .....
Width (WID) .....

Max. Jitter: 0.2% of progr. value ± 100ps.

Page 4-3, 4-11 DELAY
Page 4-4, 4-12 DOUBLE PULSE
Page 4-5, 4-13 WIDTH, change to read:

SPECIFICATION .....

Max.Jitter: 0.2% of progr. value ± 100 ps.

Page 4-5, PROCEDURE, change to read :

Para 3. .....

8112A		SCOPE	
PER	WID	LOW LIMIT	HIGH LIMIT
100ns	10ns	7.5ns	12.5ns

Page 4-6, PROCEDURE, change to read :

Para 3.....

8112A	COUNTER	
DTY	LOW LIMIT	HIGH LIMIT
1.0%	0.9%	1.1%
10%	9%	11%
50%	45%	55%
90%	81%	99%

add the following sentence :

Using the VERNIER rocker key, adjust the duty cycle until the counter display 99%.

Page 4-25, Table 4-1. Performance test record, change to read :

4-13	Width	Sampling scope Counter reading " " " "	7.5ns 38.0us 0.95ms 902.5ms		12.5ns 42.0us 1.05ms 997.5ms
4-14	Duty Cycle	Counter reading " " " " " " 99%	0.9% 9.0% 45.0% 81.0% yes		1.1% 11.0% 55.0% 99.0% no

ERRATA (Cont.)

Page 5-5, 5-9-3 WIDTH

Para 5. Set 8112A:

Last sentence should read:

..... Adjust with A2R8 for 10ns +/-0.2ns at 50% of amplitude.

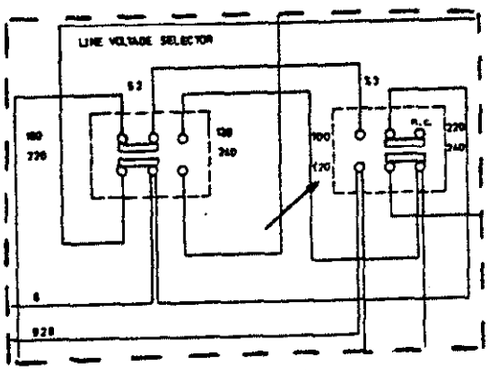
Page 6-7/6-8/6-13, Table of Replaceable Parts :

A1CR202 should read A1CR201.
A1R249 0598-3160 should read: 0698-3160
A3TP1-17 should read A3TP2-18

Page 8-10, Service Sheet 3:

In Table of REF DESIG A6 BD AY W1 should read:
A6 BD AY W2

Page 8-8, Service Sheet 2, change the Diagram of A1 to read :



MODEL 8112A

MANUAL CHANGE 1

Page 6-5 thru 6-13, change the Table of Replaceable Parts to r

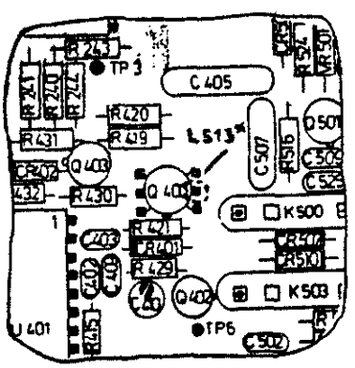
A1C7,8,9,10	0180-2984	C-FXD 470UF 50V 2
A1C414*	0160-5735	C-FXD 10PF
A1C541	0160-3879	C-FXD .01UF 100V
A1W9,10,11	08112-61690	CABLE SET
A2R7	0698-4444	R-FXD 4.87K 1% .1
A2R55	0698-3558	R-FXD 4.02K 1% .1
A2U22	1826-0635	IC LIN OP07C
A3U5	08112-13721	ROM 6
A3U6	08112-13722	ROM 5
A3U7	08112-13723	ROM 4
A3U8	08112-13724	ROM 3
A3U9	08112-13725	ROM 2
A3U22	1820-2132	IC M7218A

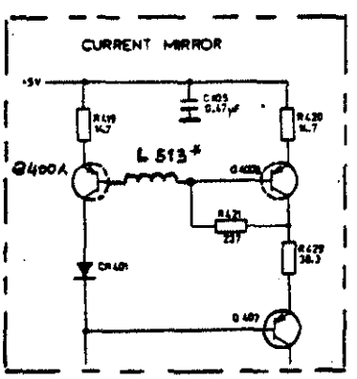
MANUAL CHANGE 2

Page 6-6, change the Table of Replaceable Parts to read :

A1C535*	0160-5737	C-FXD 68PF 5% 100
Add: A1L513*	9170-0029	FERRITE BEAD GREE

Page 8-20, Service Sheet 7, change the Component Locator and Diagram of A1 to read :





MANUAL CHANGE 3

Page 6-6/-9, change the Table of Replaceable Parts to read :

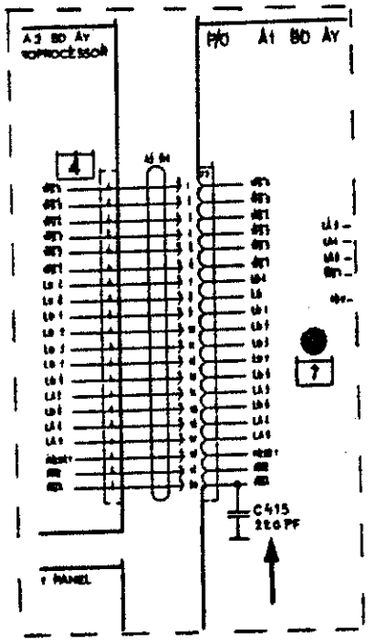
A1R406	0160-0421	R-FXD 825 1% .125W
A1R408	0698-4448	R-FXD 294 1% .125W
A1R421*	0698-7216	R-FXD 147 1% .125W
Add: A1C415	0160-5731	C-FXD 220PF 5% 100V

Page 8-17, change the Component Locator of A1 to read :

C415 is backloaded between pin 20 of connector J2 and output amplifier ground.

On GRID LOC and REF DESIG Table add: C415 J1

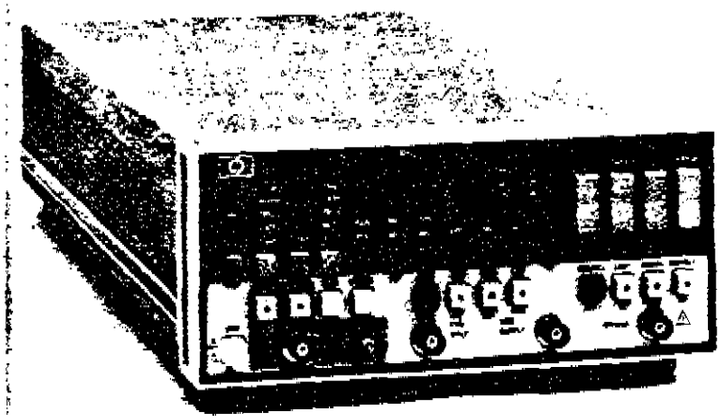
Page 8-18, change Service Sheet 6 to read :



MANUAL CHANGE 4

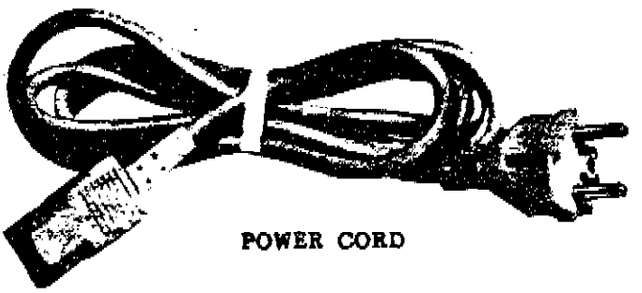
Page 6-6/6-11, change the Table of Replaceable Parts to read :

A1C240*	0160-4385	C-FXD 15PF 5% 200V
A1R7*	0698-4442	R-FXD 4.42K 1% .125W
Delete: A1C240*	0160-3874	C-FXD 10PF .5PF 200V



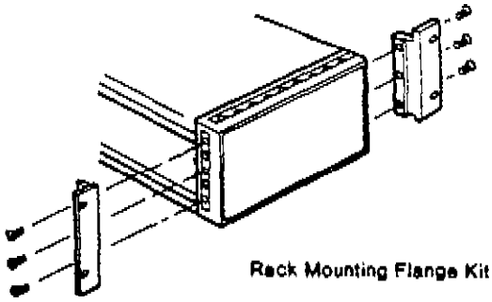
8112A

FUSE

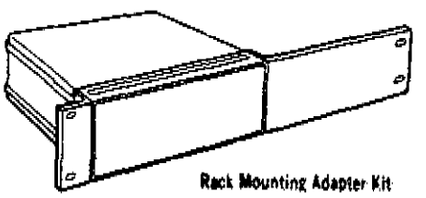


POWER CORD

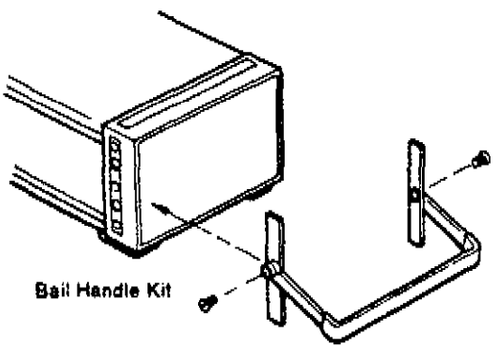
Figure 1-1. 8112A and supplied accessories.



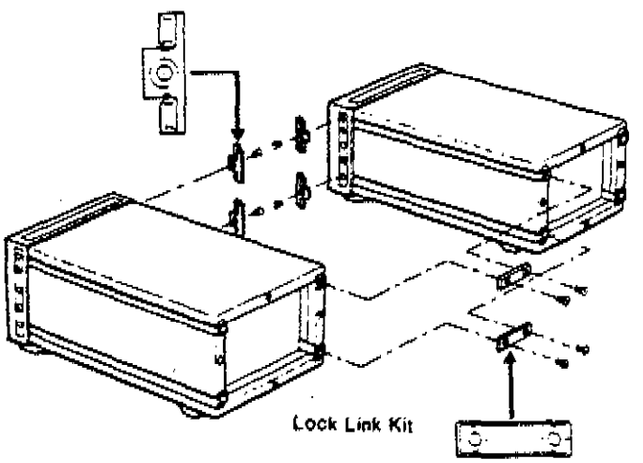
Rack Mounting Flange Kit



Rack Mounting Adapter Kit



Bail Handle Kit



Lock Link Kit

Figure 1-2. Available rack mounting accessories.

SECTION 1
GENERAL INFORMATION

1-1 INTRODUCTION

1-2 This manual contains all the information required to install, operate, test, adjust and service the Hewlett-Packard Model 8112A. This section covers instrument identification, description, accessories, specifications and other basic information. Figure 1-1 shows the mainframe and supplied accessories.

1-3 SPECIFICATIONS

1-4 A Microfiche version of this manual is available on 4 x 6 inch microfilm transparencies (order number on title page). Each microfilm contains up to 60 photoduplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

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

1-6 SAFETY CONSIDERATIONS

1-7 The 8112A is a safety Class 1 instrument (it has an exposed metal chassis that is directly connected to earth via the power supply cable). Before operation, the instrument and manual, including the red safety page, should be reviewed for safety markings and instructions. These must then be adhered to in order to ensure safe operation and to maintain the instrument in a safe condition.

1-8 INSTRUMENTS COVERED BY THIS MANUAL

1-9 Attached to the rear of this instrument is a serial number plate (Figure 1-3). The first four digits of the serial number only change when there is a significant change to the instrument. The last five digits are assigned to instruments sequentially. The contents of this manual apply directly to the instrument serial number quoted on the title page. For instruments with lower serial numbers, refer to the back-dating information in Section VII of this manual. For instruments with higher serial numbers, refer to the Manual Change sheets at the end of this manual. In addition to change information, the Manual Change sheets may contain information for correcting errors in the manual. To keep this manual as up-to-date and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Change supplement. The supplement for this manual is identified with the manual's print date and part number, both of which appear on this manual's title page. Complimentary copies of the supplement are available from Hewlett-Packard.

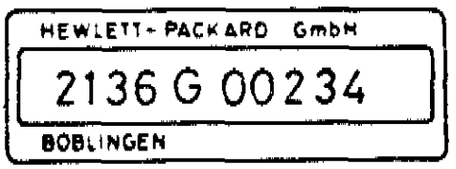


Figure 1-3. Serial Number Plate

1-10 DESCRIPTION

1-11 The HP 8112A Programmable Pulse Generator operates over the frequency range 1 Hz to 50 MHz, with a maximum 32V peak-to-peak output delivered into a high impedance load.
Instrument capabilities include:

- Fixed 5ns transition times.
- 6.5ns to 95ms variable rise and fall times.
- Variable delay in all modes.
- High and Low Level Limit for device under test (DUT) protection.
- Full HP-IB programmability.
- Easily accessible memory for up to 9 sets of mode and parameter selections.

1-12 Correct functionability is assured by the automatic self-test and error recognition capabilities. Self-test and fault diagnosis are performed each time the instrument is switched on. Error recognition helps the operator recover from an incorrect frontpanel or programming operation.

1-13 ACCESSORIES SUPPLIED

1-14 The 8112A is supplied complete with the following items:

ITEM	HP PART NUMBER
750mA fuse for 220/240V operation, or;	2110-0063
1.5A fuse for 110/120V operation	2110-0043
Power cable	see figure 2-2

1-15 ACCESSORIES AVAILABLE

ITEM	HP PART NUMBER
Carrying handle-Bail handle kit.	5061-2001
Rack mounting adaptors: Rack mounting flange and filler panel for mounting a single 8112A.	5061-0072
Rack mounting flange and Lock link kit for mounting two 8112As.	5061-0074 5061-0094

1-13 RECOMMENDED TEST EQUIPMENT

1-14 Equipment required to maintain the 8112A is given in Table 1-1. Alternative equipment may be substituted, provided that it meets or exceeds the critical specifications listed in the table.

INSTRUMENT	RECOMMENDED MODEL	REQUIRED CHARACTERISTICS	ADEQUATE SUBSTITUTE	USE *
Counter	HP5335A	50MHz start/stop T1, A to B	HP5345A	P,A
D.V.M.	HP3456A	d.c. 0.01V - 50V Pulse amplitude facility	HP3455A	P,A,T
Time Interval Probe	HP5363B	Dynamic range +9.99V to -9.99V	HP5363A	P,A
Sampling scope	TEK 7603 + 7T11/7S11 & S-3A	1GHz		P,A
Realtime scope	HP1740A	100MHz	HP1722A	P,A,T
Pulse/Function Generator	HP8116A	50MHz		P,A
Signature Analyser	HP5005A		HP5004A	T
Power supply	HP6237B	0 - 10V	HP6205B	P
Logic Probe	HP10525E	ECL		T
Logic Probe	HP545A	TTL		T
BNC Cables		30cm, 60cm.		
BNC Tees				
50 Ohm loads				

Table 1-1. Recommended Test Equipment

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

Table 1-2. Specifications

SPECIFICATIONS

(Specifications describe the instrument's warranted performance). The following specifications apply with 50 Ohm load resistance from 0 C to 55 C. Output levels double when driving into open circuit (up to 32 Vpp).

PULSE PARAMETERS

Period (PER)

Range: 20ns to 950ms.
Resolution: 3 digits. min 100ps
Accuracy: +/- 5% of progr. value +/- 2ns.
Repeatability: Factor 4 better than accuracy.
Max Jitter: 0.2% of progr. value + 100ps.

Delay, Double Pulse, Width (Specifications apply for minimum transition times, measured at 50% of amplitude. Delay is measured from trigger output to main output).

Delay (DEL)

Range: 75ns to 950ms.
Accuracy: +/- 5% of progr. value +/-5ns.
Max Delay: 1 period plus 55ns.
Repeatability: Factor 4 better than accuracy.
Resolution: 3 digits.
Max Jitter: 0.2% of progr. value + 100ps.

Double Pulse (DBL)

Range: 20ns to 950ms.
Accuracy: +/- 5% of progr. value +/- 2ns.
Repeatability: Factor 4 better than accuracy.
Resolution: 3 digits.
Max Jitter: 0.2% of progr. value + 100ps.

Width (WID)

Range: 10ns to 950ms.
Accuracy: +/- 5% of progr. value +/- 2ns.
Max Width: Actual period minus 10ns.
Repeatability: Factor 4 better than accuracy.
Resolution: 3 digits.
Max Jitter: 0.2% of progr. value + 100ps.

Constant Duty Cycle (DTY)

Range: 1% to 99%, width at least 10ns.
Max: Actual period minus 10ns.
Resolution: 1%.
Accuracy: 10% of progr. value.
Repeatability: Factor 4 better than accuracy.

Output Levels (Value in parenthesis into open circuit).

High Level (HIL) Range: -7.90 V to 8.00 V (-15.8 V to 16.0 V).
Low Level (LOL) Range: -8.00 V to 7.90 (-16.0V to 15.8 V).
Amplitude: 0.1 V to 16 V (0.2 V to 32 V).
Resolution: 3 digits. min 10mV.
Accuracy: +/- 40mV, +/- 1% of progr. value, +/- 3% of amplitude.
Repeatability: Factor 4 better than accuracy.
Settling Time: 100 ns + transition time.

Transition Times (10-90% of amplitude; leading and trailing edge transition times are independently programmable within a common range, max ratio 1:20).

Fixed Transition (⌐¬): typ. 5ns for leading and trailing edge.

Linear Transition (⌐/¬):
Leading Edge (LEE): 6.5ns to 95ms.
Trailing Edge (TRE): 6.5ns to 95ms.
Resolution: 3 digits (best case 100ps).
Accuracy: +/- 5% of progr. value +/- 2ns.
Repeatability: Factor 4 better than accuracy.
Linearity: +/- 3% (10% to 90% of amplitude) for transition times > 100ns.

Pulse Performance

Preshoot, Overshoot, Ringing: +/- 5% of amplitude +/- 10mV for linear and sinusoidal transitions; 10% of amplitude +/- 10mV for fixed transitions.

Reflections: < 10%.
Source Impedance: 50 Ohm +/- 5%.

SUPPLEMENTARY PERFORMANCE CHARACTERISTICS

(describing non-warranted typical performance parameters)

OPERATING MODES

Normal (NORM): Continuous pulse stream.

Trigger (TRIG): Each active input transition generates a single output pulse.

Gate (GATE): External signal enables period generator. First output pulse sync with leading edge. Last pulse always completed.

Table 1-2 cont. Specifications

External Width (E.WID): Restoration of external signal with selectable transition times and output levels.

External Burst (E.BUR): Each active input transition generates a pre-programmed number of pulses (1 to 1999). Min time between two bursts is 100ns.

AUXILIARY OPERATING MODES

Manual (MAN): Simulates an external input.
1 Pulse: Provides one pulse in TRIG, GATE and E.BUR.

Limit: Maximum high and low levels into 50 Ohm can be limited to protect the device under test. Pushing the LIMIT key will set the limits to the actual levels, which then can not be exceeded as long as the mode is active.

Compl: Switch-selectable normal/complement output.

Disable: Relay disconnects all output circuitry.

Sto/Rcl (STO/RCL): 9 programmable locations, 1 location with fixed mode/parameter set, 1 location for active operating state. Capacity is one complete mode/ parameter set per location.

CONTROL MODES

(external voltage controls the output signal, display shows the max. available value in the selected range or HIL).

Period Control (PERC)

Pulse Period Ratio: 1:10.
Control Voltage: 1V to 10V.
Period Ranges: 20ns to 1s in eight non-overlapping decade ranges.
Bandwidth: 20kHz.

Delay Control (DELC)

Pulse Delay Ratio: 1:10.
Control Voltage: 1V to 10V.
Delay Ranges: 10ns to 1s in eight non-overlapping decade ranges (55 ns fixed delay not included).
Bandwidth: 20kHz.

Width Control (WIDC)

Pulse Width Ratio: 1:10.
Control Voltage: 1V to 10V.
Width Ranges: 10ns to 1s in eight non-overlapping decade ranges.
Bandwidth: 20kHz.

High Level Control (HILC)

Control Voltage: -8V to +8V.
High Level Output Window: -8V to +8V into 50 Ohm independent of actual low level, which is programmable between -8.00V and +7.90V in 50mV steps.
Settling time: 200us to settle within 5% of the final level.

AUXILIARY INPUTS AND OUTPUTS

Ext. Input

Threshold level: +/- 10V adjustable.
Max input voltage: +/- 20V.
Sensitivity: 500mVpp.
Min pulse width: 10ns.
Input impedance: 10kOhm.
Trigger slope pos/neg and trigger off, in TRIG and E.BUR both slopes simultaneously available.

Control Input

Max input voltage: +/- 20V.
Input impedance: 10kOhm.

Trigger Output

Output levels: 0/2.4V into 50 Ohm, 0/4.8V into open circuit.
Output impedance: 50 Ohm.
Delay from trigger input to trigger output: 25ns.
Max external voltage: 0V to +5V.

Main Output

Output levels: -8.0V/+8.0V into 50 Ohm, -16.0V/+16.0V into open circuit.
Output impedance: 50 Ohm.
Max external voltage: -5.0V to +5.0V.

GENERAL

Recalibration Period: 1 year.
Warm-up Time: 15 min to meet all specifications.

Table 1-2 cont. Specifications

HP-IB CAPABILITY

All modes except external input threshold level can be programmed.

Data transmission times:

Note: Values in parentheses indicate excessive slope calculation is not active (SR0).

Listen (time for 8112A to receive and verify a message)

PARAMETER	TIME TO INTERPRET
DISABLE, COMPL, LIMIT, TRANSITION MODES, TRIGGER SLOPES, EXT INPUT MODES	< 4ms
CONTROL MODES	< 50ms
SET mode ON	< 90ms(< 62ms)
SET mode OFF	< 4ms
HIL, LOL	< 90ms

PARAMETER	TIME TO INTERPRET
BUR	< 12ms
PER, DEL, WID, TRE, LEE, DBL	< 50ms
DTY, PER in DTY mode	< 80ms(< 50ms)
STO	6ms
RCL	180ms(150ms)

Settling (time to execute message) : 5ms

Talk (time for 8112A to transmit a message) :1ms per character
Learn mode, error recognition : 15ms
Status : 15ms

Example

"M1 PER1MS DTY20% HIL3V LOL1V D1"

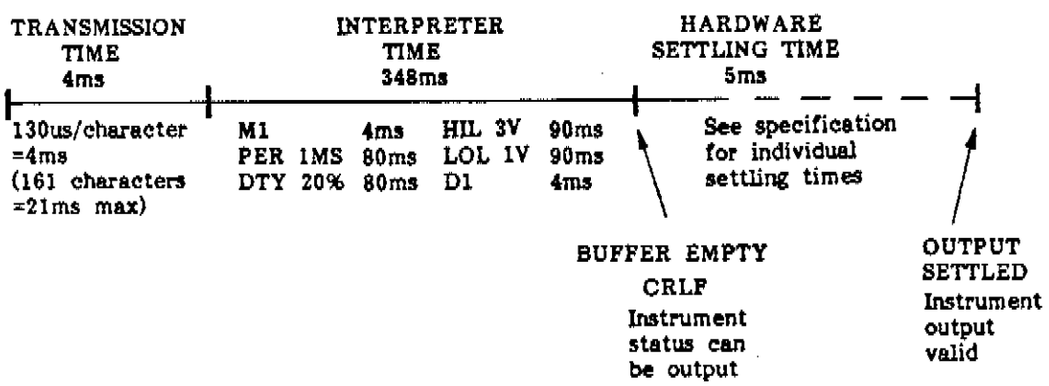


Table 1-2 cont. Specifications

Environmental

Storage Temperature: -40 C to 70 C.
Operating Temperature: 0 C to 55 C.
Accuracy Specifications apply from 0 C to 55 C.
Humidity Range: < 95% R.H. > 0 C to 40 C.

Power-off-storage.

After eight hours of operation, battery is fully charged and maintains all current mode and parameter information up to 2 weeks with instrument switched off.

Power

100/120/200/240 Vrms +5%, -10%, 48-440 Hz;
120 VA max.

Weight

Net 5.9 kg (13 lbs), Shipping 8.0 kg (18 lbs).

Dimensions

89mm high, 213mm wide, 450mm deep
(3.5 x 8.4 x 17.7 inch).

Options

910 Additional Operating and Service Manual
(part no: 08112-90001).

SECTION 4
PERFORMANCE TESTS

4-1 INTRODUCTION

4-2 The test procedures detailed in this section are for electrical performance of the 8112A, using the instrument specifications of Table 1-2 as performance standards. Access to the interior of the instrument is not necessary for any of the following tests.

4-3 EQUIPMENT REQUIRED

4-4 Equipment necessary for performance testing is listed in Table 1-1, Recommended Test Equipment. Alternative test equipment may be substituted for recommended models, provided that it satisfies the critical specifications given in the table.

4-5 TEST RECORD

4-6 A tabulated Test Record listing all of the tested specifications and their acceptable limits is provided at the end of the procedures. Test results recorded at incoming inspection will provide a reference for periodic calibration, troubleshooting and after-repair testing.

4-7 PERFORMANCE TESTS

4-8 During any performance test, all shields and connecting hardware must be in place. All tests are designed to verify the published 8112A specifications. It is recommended that tests be performed in the sequence given, and that all data be recorded on the test record provided at the end of the test procedures.

4-9 Each test is arranged in the order that its specification appears in Table 1-2. Note that the instrument should be given a 15 minute warm-up period before the commencement of any of the following tests.

4-10 PERIOD

SPECIFICATION

Range: 20ns to 950ms.
Accuracy: +/- 5% of programmed value, +/- 2ns.
Repeatability: Factor 4 better than accuracy.
Max Jitter: 0.2% of programmed value, +/- 100ps.

EQUIPMENT

Counter.
Cable assembly BNC.
Feedthrough termination 50 Ohms (if necessary).

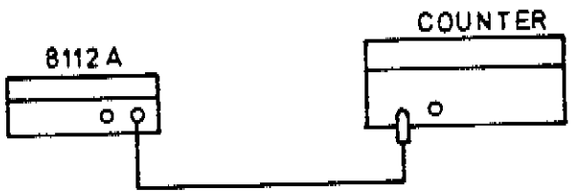


Figure 4-1. Equipment setup for PER performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-1.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
TRANSITION	FIXED
DTY	50%
HIL	1.00V
LOL	0.00V

3. Set the counter to PERIOD. Verify that for the following 8112A PER settings, the counter reading is within the specified limits.

8112A	COUNTER	
PER	LOW LIMIT	HIGH LIMIT
20ns	17.0ns	20.0ns
10us	9.5us	10.5us
10ms	9.5ms	10.5ms
950ms	902.5ms	997.5ms

4-11 DELAY

SPECIFICATION

Range: 75ns to 950ms.
Accuracy: +/- 5% of progr. value +/-5ns.
Max Delay: 1 period plus 55ns.
Repeatability: Factor 4 better than accuracy.
Max Jitter: 0.2% of programmed value +100ps.

EQUIPMENT

Counter.
2 cable assemblies BNC (same length).
Feedthrough termination 50 Ohm (if necessary).

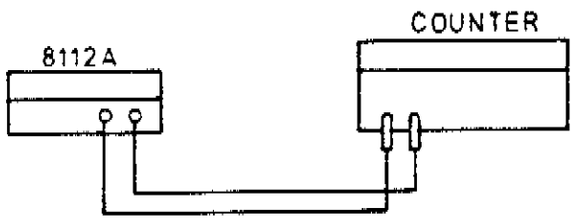


Figure 4-2. Equipment setup for DEL performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-2.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
TRANSITION	FIXED
DTY	50%
HIL	2.40V
LOL	0.00V

3. Set the counter to TIME A→B, slopes A and B positive transition, trigger levels 1.2V. Verify that for the following 8112A settings, the counter reading is within the specified limits.

8112A		COUNTER	
DEL	PER	LOW LIMIT	HIGH LIMIT
75ns	95ns	-	83.75 ns
50us	95us	47.50us	52.50us
10ms	95ms	9.50ms	10.50ms
900ms	950ms	855.0ms	945.0ms

4-12 DOUBLE PULSE

SPECIFICATION

Range: 20ns to 850ms.
Accuracy: +/- 5% of programmed value +/- 2ns.
Repeatability: Factor 4 better than accuracy.
Max Jitter: 0.2% of programmed value + 100ps.

EQUIPMENT

Sampling scope. (take into account any inaccuracies
Realtime scope. of these instruments).
2 cable assemblies BNC (same length).
Feedthrough terminations 50 Ohms (if necessary).

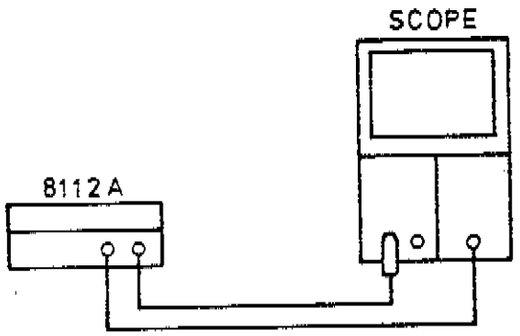


Figure 4-3. Equipment setup for DBL performance test.

PROCEDURE

1. Connect the equipment as shown in Fig. 4-3.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
TRANSITION	FIXED
DEL	65ns
HIL	1.00V
LOL	-1.00V

3. Verify that the scope display indicates that the following 8112A DBL setting is within the specified limits. NOTE: The DBL measurement is described as the time interval between the two leading edges of the double pulse, recorded at 50% amplitude.

8112A			SCOPE	
PER	DBL	WID	LOW LIMIT	HIGH LIMIT
100ns	20ns	10ns	17ns	20ns

4. Disconnect the Sampling scope from the 8112A, and connect the Realtime scope in its place. By adjustment of the scope timebase, verify that the display indicates that the following 8112A DBL settings are within the specified limits.

8112A			SCOPE	
PER	DBL	WID	LOW LIMIT	HIGH LIMIT
100us	20us	10us	19.0us	21.0us
100ms	20ms	10ms	19.0ms	21.0ms
999ms	800ms	50ms	760.0ms	840.0ms

4-13 WIDTH

SPECIFICATION

Range: 10ns to 950ms.
Accuracy: +/- 5% of programmed value +/- 2ns.
Max Width: Actual Period - 10ns.
Repeatability: Factor 4 better than accuracy.
Max Jitter: 0.2% of programmed value + 100ps.

EQUIPMENT

Sampling scope. (take into account any inaccuracies
Realtime scope. of these instruments).
2 cable assemblies (same length).
Feedthrough termination 50 Ohm (if necessary).

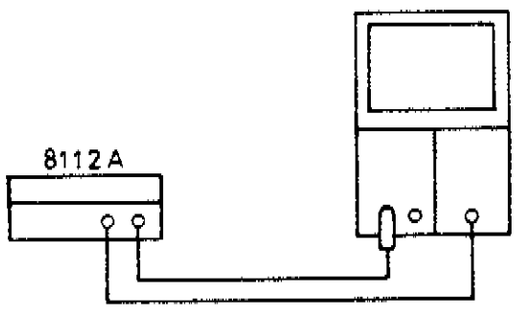


Figure 4-4. Equipment setup for WID performance test

PROCEDURE

1. Connect the equipment as shown in Fig. 4-4.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
TRANSITION	FIXED
DEL	65ns
HIL	1.00V
LOL	-1.00V

3. Verify that the scope display indicates that the following 8112A WID setting is within the specified limits. NOTE: WID is measured at 50% pulse amplitude.

8112A		SCOPE	
PER	WID	LOW LIMIT	HIGH LIMIT
100ns	10ns	7.5ns	10.0ns

4. Disconnect the Sampling scope, and connect the Realtime scope in its place. Verify that for the following WID settings, the scope display shows the 8112A output to be within the specified limits.

8112A		SCOPE	
PER	WID	LOW LIMIT	HIGH LIMIT
200us	40us	38us	42us
5ms	1ms	0.95ms	1.05ms
999ms	950 ms	902.5 ms	997.5 ms

4-14 CONSTANT DUTY CYCLE

SPECIFICATION

Range: 1% to 99% of Period. 10ns min, PER-10ns max.
Resolution: 1%.
Accuracy: 10% of programmed value.
Repeatability: Factor 4 better than accuracy.

EQUIPMENT

Counter.
Cable assembly BNC.
Feedthrough termination 50 Ohm (if necessary).

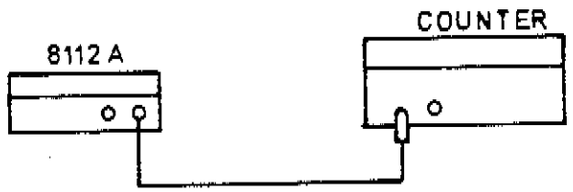


Figure 4-5. Equipment setup for DTY performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-5.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL	OFF
TRANSITION	FIXED
PER	100us
DEL	65ns
HIL	1.00V
LOL	-1.00V

3. Set the counter to DTY CY A. Verify that for the following 8112A DTY settings, the counter reading is within the specified limits.

8112A	COUNTER	
DTY	LOW LIMIT	HIGH LIMIT
1.0%	0.9%	1.1%
10%	9%	11%
50%	45%	55%
90%	81%	99%
99%	89.1%	-

4-15 OUTPUT LEVELS

SPECIFICATION (values in parenthesis into open circuit)

High Level Range: -7.90V to 8.00V (-15.8V to 16.0V)
Low Level Range: -8.00V to 7.90V (-16.0V to 15.8V)
Accuracy: +/- 40mv, +/- 1% of programmed value, +/- 3% of amplitude.
Settling Time: 100ns + transition time.
Repeatability: Factor 4 better than accuracy.

EQUIPMENT

Digital Voltmeter.
Realtime scope (note any inaccuracy of this instrument)
2 cable assemblies BNC (same length).
BNC Tee connector (2 off).
Feedthrough termination 50 Ohms (if necessary).

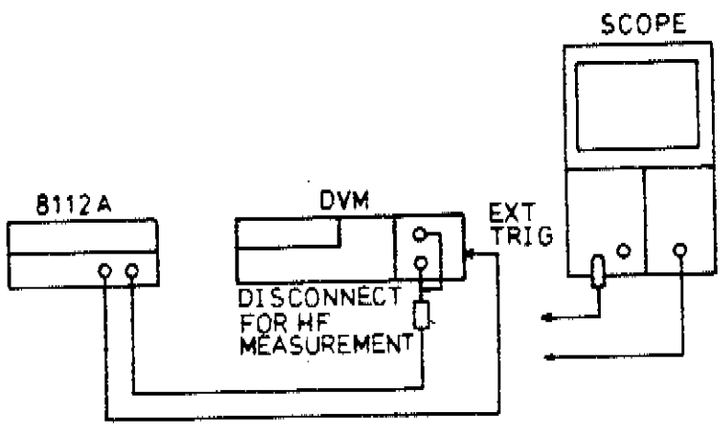


Figure 4-6. Equipment setup for Output Levels performance test

PROCEDURE

1. Connect equipment as shown in Fig. 4-6.
NOTE: Disconnect the scope when using the DVM, and vice versa.

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
TRANSITION	FIXED
PER	1.00ms
DEL	65ns
DTY	50%
HIL	+8.00V
LOL	-8.00V

3. Set the voltmeter as follows:

DC, Auto Zero, 10V, Ext Trigger,
0.1 STORE N CYC INT
0.003 STORE DELAY SEC

4. Set 8112A LOL to 0V and for each value of HIL in column A verify that the DVM readings are within the limits shown in column B..

5. Set 8112A as follows:

DEL 65ns

6. Set 8112A HIL to 0V and for each value of LOL in column A verify that the DVM readings are within the limits shown in column C.

7. Adjust the 8112A PER value to 1.0us, and recalibrate the scope, if necessary, such that the 8112A output vertically fills the graticule display. Verify that the pulse settling time does not exceed 100ns. See Fig. 4-8(B).

A	B		C	
Setting	LOL=0V		HIL=0V	
HIL (LOL)	HIL LOW LIMIT	HIL HIGH LIMIT	LOL HIGH LIMIT	LOL LOW LIMIT
(-)0.1V	0.0596V	0.1404V	-0.0596V	-0.1404V
(-)0.5V	0.44V	0.56V	-0.44V	-0.56V
(-)1V	0.92V	1.08V	-0.92V	-1.08V
(-)5V	4.76V	5.24V	-4.76V	-5.24V
(-)8V	7.7V	8.3V	-7.7V	-8.3V

4-16 TRANSITION TIMES

SPECIFICATION

10-90% of amplitude: Leading and trailing edge times are independently programmable within a common range (max ratio = 1:20).
Fixed Transition: 5ns for leading and trailing edges.
Linear Transitions: LEE and TRE, 6.5ns to 95ms.
Accuracy: +/- 5% of programmed value, +/- 2ns.
Linearity: +/- 3% for transition times greater than 100ns.

EQUIPMENT

Sampling scope. (Take any inaccuracies of these
Realtime scope. instruments into account).
Time interval probe.
Counter.
3 cable assemblies BNC (2 x 60cm., 1 x 30cm.)
Feedthrough terminations 50 Ohms (if necessary).
1 BNC Tee piece.

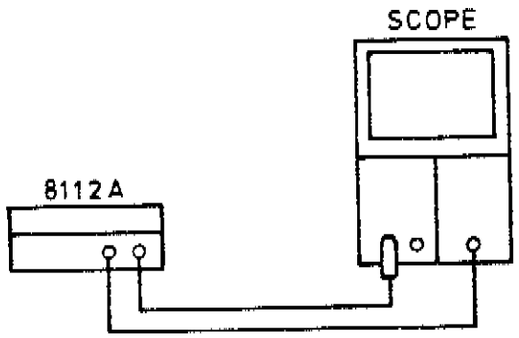


Figure 4-7(A). Equipment setup for fast Transition Times performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-7(A).

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
PER	100ns
DEL	65ns
DTY	50%
HIL	1.00V
LOL	0.00V

3. Verify that for the following 8112A settings, the scope display indicates the Transition Times are within the specified limits.

8112A				SCOPE	
TRANSITION	PER	LEE	TRE	LOW LIMIT	HIGH LIMIT
Fixed	100ns	4.5ns	4.5ns	–	5.0ns
Linear	100ns	5.5ns	5.5ns	–	6.5ns

4. Connect equipment as shown in Fig. 4-7(B).

5. Set 8112A as follows:

MODE	NORM
CONTROL	OFF
PER	500us
DEL	65ns
DTY	50%
TRANSITION	LINEAR
HIL	+5V
LOL	0V
OUTPUT	NORM
DISABLE	OFF

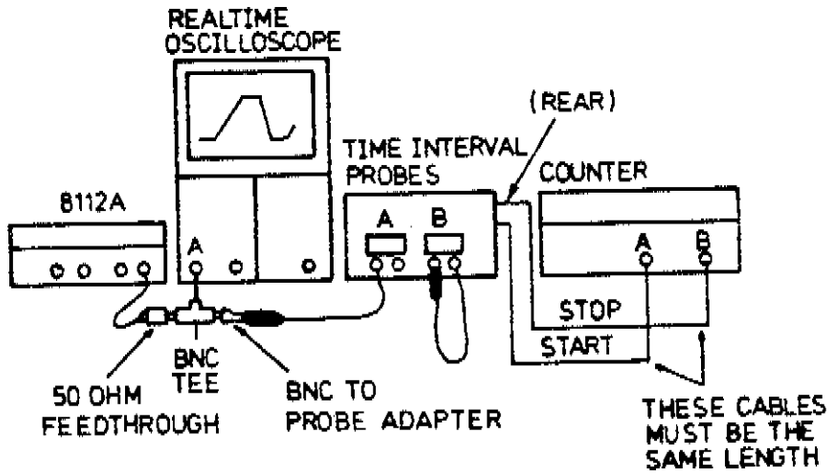


Figure 4.7(B). Equipment setup for slow Transition Times performance tests.

6. Before measuring transition times, verify that the signal amplitude is within limits (Test 4-15). (NOTE: The scope accuracy should be checked/ adjusted using an a.c. calibrator.)

7. Set the time interval probe inputs to A^+ (or B) , +0.5V and A^+ (or B), +4.5V. Set the counter to Time A→B, SEP.

8. Set the 8112A to the following settings and measure the displayed leading edges (LEE). Verify that the transition times do not exceed the specified limits.

8112A			COUNTER	
PER	LEE	TRE	LOW LIMIT	HIGH LIMIT
2us	500ns	500ns	473ns	527ns
500us	100us	100us	95us	105us
2ms	500us	500us	475us	525us
5ms	999us	999us	949us	1.048ms
5ms	1ms	1ms	0.95ms	1.05ms
50ms	10ms	10ms	9.5ms	10.5ms

9. Set the time interval probes to the opposite polarity and voltage and repeat Step 8 for the signal trailing edges (TRE).

4-17 PULSE PERFORMANCE

SPECIFICATION

Preshoot, Overshoot, Ringing: 5 % of amplitude
+/- 10 mV for both Linear and Gauss modes,
10 % of amplitude +/- 10 mV for Fixed transitions
Reflections: 10 %
Source Impedance: 50 Ohms.

EQUIPMENT

Sampling scope (note any inaccuracy of this instrument.)
2 cable assemblies BNC (same length).
Feedthrough termination 50 Ohms (if necessary).

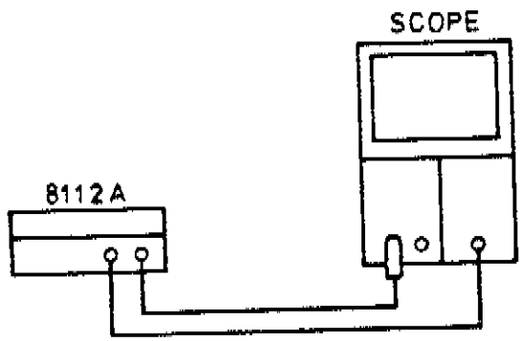


Figure 4-8(A). Equipment setup for Pulse performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-8(A).

2. Set 8112A as follows:

INPUT MODE	NORM
CTRL MODE	OFF
PER	100ns
DEL	65ns
DTY	50%
HIL	1.00V
LOL	0.00V

3. Examine the 8112A output on the scope display and verify that for the following settings, the Pulse Characteristics do not exceed the specified limits - as described in Figure 4-8(B).

8112A			SCOPE
TRANSITION	LEE	TRE	See Figure 4-8(B).
Fixed	4.5ns	4.5ns	"
Linear	6.5ns	6.5ns	"

FIXED TRANSITION: Verify that Preshoot, Overshoot and Ringing do not exceed 10% of amplitude,+/- 10mV.

LINEAR: Verify that Preshoot, Overshoot and Ringing do not exceed 5% of amplitude,+/- 10mV.

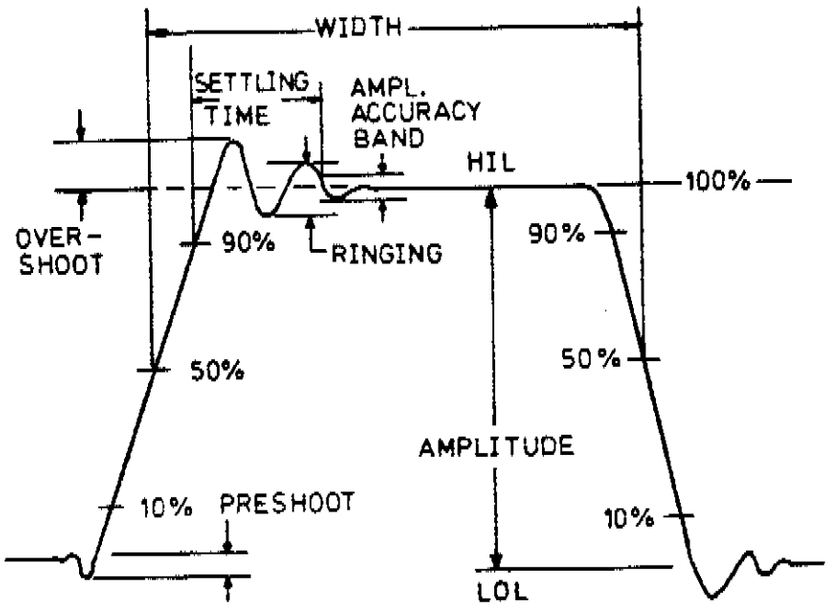


Figure 4-8(B). Pulse Performance Characteristics.

SUPPLEMENTARY PERFORMANCE TESTS

4-18 TRIGGER, GATE, E.WIDTH and E.BURST performance

PARAMETERS

TRIG: Each active input transition generates one output pulse.

GATE: External signal enables Period Generator. First output pulse synchronised with leading edge. Last pulse always completed.

E.WID: Restoration of external signal with selectable transition times and output levels.

E.BUR: Each active input transition generates a pre-programmed number of pulses (1 to 1999). Minimum time between bursts is 100ns.

Max Input: +/- 20V.

EQUIPMENT

Realtime scope (note any inaccuracy of this instrument).
Pulse Generator.
Cable assembly BNC (4 off 60cm, 1 off 30cm).
1 BNC Tee piece.
Feedthrough termination 50 Ohm (if necessary).

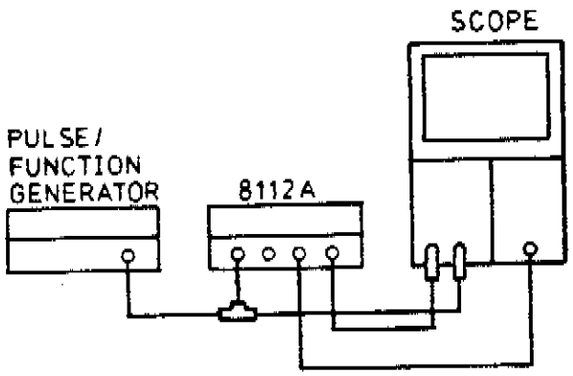


Figure 4-9. Equipment setup for TRIG, GATE, E.WID and E.BUR performance tests.

PROCEDURE

1. Connect equipment as shown in Fig. 4-9.

2. Set 8112A as follows:

INPUT MODE	TRIG
CTRL MODE	OFF
TRANSITION	FIXED
PER	2.0us
DEL	65ns
WID	1.0us
HIL	1.00V
LOL	0.00V

3. Set Pulse Generator as follows:

Frequency	50kHz
Width	5.0us
Amplitude	2.0V
Offset	0.0V

4. Adjust 8112A to trigger from the positive going edge of the external input signal. Verify that each trigger pulse generates one complete output cycle, as shown in Fig 4-9(A).

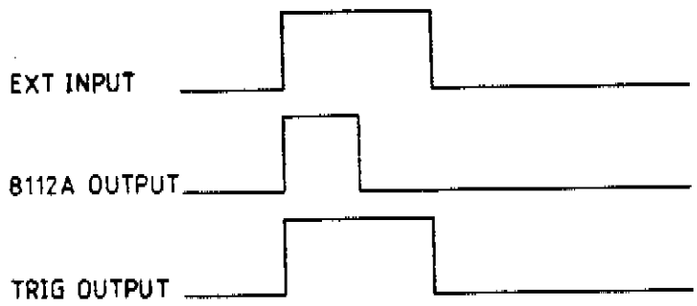


Figure 4-9(A). Example of correct trigger operation.

5. Set 8112A to GATE mode, PER = 900ns and DTY = 50%. Verify that each gate leading edge releases a train of output pulses - each cycle being completed. See Fig 4-9(B).

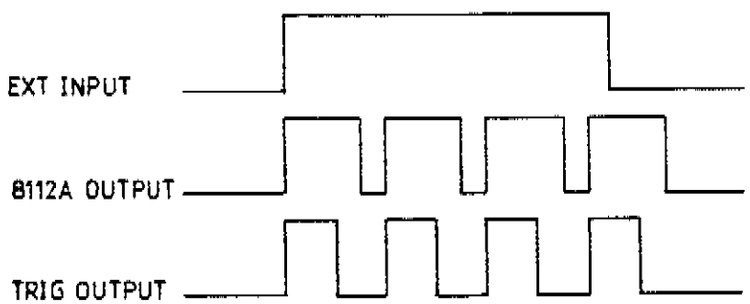


Figure 4-9(B). Example of correct gate operation.

6. Set 8112A to E.WID mode. Select Linear transition and LEE and TRE to 1.0us. Verify that each external input pulse generates an output pulse of identical width, as shown in Fig. 4-9(C).

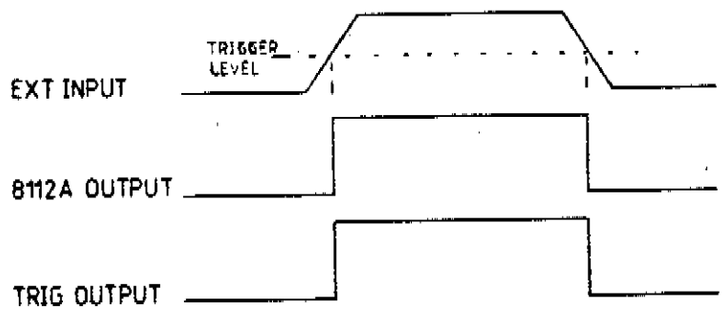


Figure 4-9(C). Example of correct E.WID operation.

7. Set the 8112A as follows:

INPUT MODE	E.BUR
CTRL MODE	OFF
TRANSITION	FIXED
BUR	50#
PER	50ns
DEL	65ns
DTY	50%
HIL	1.00V
LOL	0.00V

8. Change the Width setting on the Pulse Generator to 1.0us.

9. Adjust 8112A to trigger from the negative going edge of the external input signal. Verify that each external input pulse generates a burst of 50 output pulses as indicated in Fig 4-9(D).

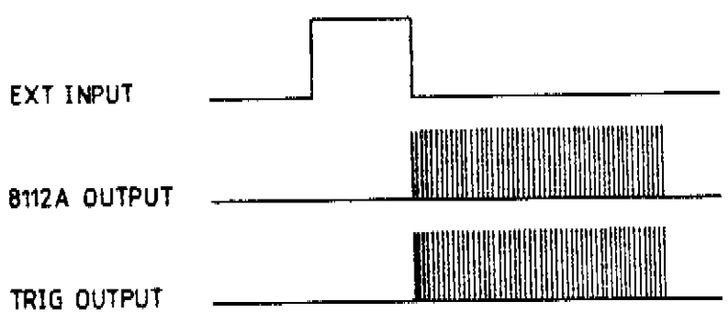


Figure 4-9(D). Example of correct E.BUR operation.

4-19 MAN, 1 PULSE, LIMIT, COMPLEMENT and DISABLE performance.

PARAMETERS

MAN: Simulates an external input.

1 PULSE: Provides one output pulse in TRIG, GATE and E.BUR modes.

LIMIT: Maximum high and low levels (displayed as value into 50 Ohm) can be limited to protect the device under test. Pushing the LIMIT key sets the limits to the actual slected value, which cannot then be exceeded as long as the key is active.

COMPLEMENT: Selects NORMAL or COMPLEMENT output pulses.

DISABLE: When active, an internal relay disconnects 8112A output.

EQUIPMENT

Realtime scope (note any inaccuracy in this instrument).
Counter.
Pulse generator.
BNC cable assemblies (3 off 60cm, 2 off 30cm).
BNC Tee connector.
Feedthrough terminations 50 Ohm (if necessary).

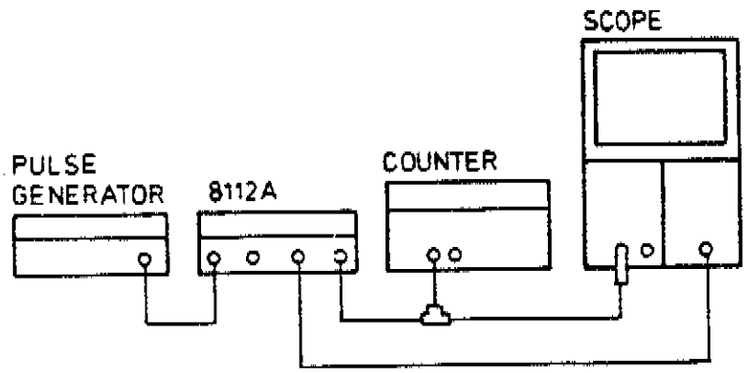


Figure 4-10. Equipment setup for MAN, 1 PULSE, LIMIT, COMPLEMENT and DISABLE performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-10.

2. Set 8112A as follows:

INPUT MODE	E.BUR
CTRL MODE	OFF
TRANSITION	FIXED
BUR	472
PER	1.0us
DEL	65ns
WID	500ns
DTY	25%
HIL	2.00V
LOL	-2.00V

3. Set Pulse Generator as follows:

Frequency	100Hz
Width	1.0ms
Amplitude	2.0V
Offset	0.0V

4. Adjust 8112A to trigger from positive-going edge of external input signal, and counter to COUNT A. Verify that the counter reading is 472. Reset counter.

5. Select MAN on 8112A frontpanel. Verify that on pressing this key, the counter display is incremented by 472.

6. Select 1 PULSE on 8112A frontpanel. Verify that each operation of this key produces a counter increment of 1. Check that the counter is also incremented by 1 when this key is pressed when TRIG or GATE modes are selected. Disconnect counter.

7. Select NORM on 8112A frontpanel. Verify that the scope displays a pulsed waveform of Period 1.0us and Duty Cycle 25%.

8. Adjust HIL and LOL to +5V and -5V respectively. Verify that the amplitude of the waveform displayed increases from +/- 2V to +/- 5V. Readjust HIL to 3.00V and LOL to 0.00V. Confirm the new amplitude settings on the scope display.

9. Select LIMIT on the 8112A frontpanel. Verify that HIL cannot be incremented past +3.00V and that LOL cannot be decremented past 0.00V while LIMIT is active

10. Select COMPL on the 8112A frontpanel. Confirm that the displayed 8112A waveform becomes complemented (inverted).

11. Select DISABLE on the 8112A frontpanel, and confirm that the output is withdrawn.

4-20 STORE and RECALL FUNCTIONABILITY.

CAPABILITY

9 programmable locations. 1 location allocated for Standard Parameter Set, 1 location for active parameter set. Capacity is for 1 complete set of mode and parameter information per location.

PROCEDURE

1. Store a parameter set in each of the Files (locations) 1 to 9. The MANUAL OPERATING EXAMPLES in Section 3 may be used as a guide.

2. When all parameter sets have been stored, recall one at a time and verify that the data recalled matches exactly that which was originally stored.

4-21 PERIOD CONTROL

PARAMETERS

Pulse Period ratio: 1:10.
Control Voltage: 1.0V to 10V.
Period Ranges: 20ns to 1.0s in eight non-overlapping decade ranges.
Bandwidth: 20kHZ.

EQUIPMENT

Counter
Power supply
Cable assembly BNC (2 off 60cm).
Feedthrough Termination 50 Ohm (if necessary).
Banana to BNC adapter

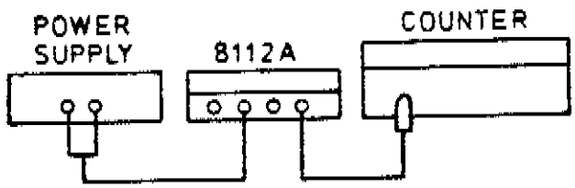


FIGURE 4-11. Equipment setup for Period Control performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-11.

2. Set 8112A as follows:

INPUT MODE	NORM
TRANSITION	FIXED
DEL	65ns
HIL	2.00V
LOL	0.00V
CTRL MODE	PERC

3. Vary the power supply between 1V and 10V and verify that the counter display indicates a range of periodic times which agree with the specified limits for each of the 8112A settings below.

8112A		COUNTER	
PER	WID	LOW LIMIT	HIGH LIMIT
100ns	10ns	20ns	100ns
10us	1us	1us	10us
10ms	1ms	1ms	10ms
999ms	100ms	100ms	1s

4-22 DELAY CONTROL

PARAMETERS

Pulse Delay ratio: 1:10.
Control Voltage: 1.0V to 10V.
Delay Ranges: 10ns to 1.0s in eight non-overlapping decade ranges. The fixed 55ns delay of the instrument has to be added to the delay induced by the CTRL Voltage.
Bandwidth: 1kHz.

EQUIPMENT

Realtime scope (note any inaccuracy in this instrument)
Power supply
Counter
Cable assembly BNC (5 off 60cm, 2 off 30cm).
BNC Tee connector.
Feedthrough termination 50 Ohms (if necessary).
Banana to BNC adapter

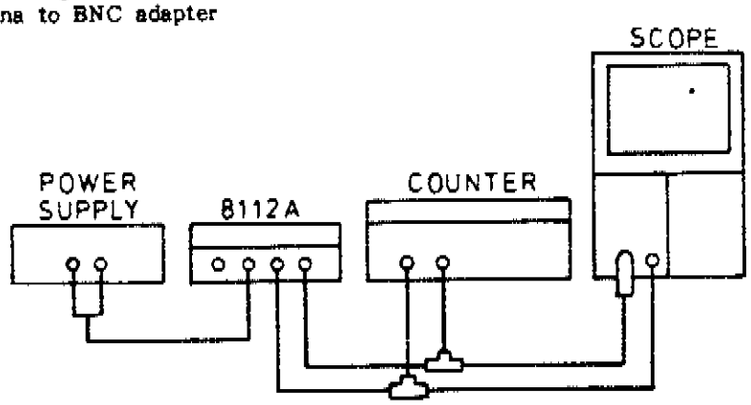


Figure 4-12. Equipment setup for Delay Control performance test.

PROCEDURE

1. Connect the equipment as shown in Fig. 4-12.

2. Set 8112A as follows:

INPUT MODE	NORM
TRANSITION	FIXED
PER	200ns
DEL	65ns
HIL	2.00V
LOL	0.00V
CTRL MODE	DELC

3. Vary the power supply between 1V and 10V and verify that the scope display indicates a delay time of between 75ns and 170ns.
See Figure 4-12(A).

4. Disconnect scope input.

5. Set 8112A as follows:

PER	900ms
WID	300ms

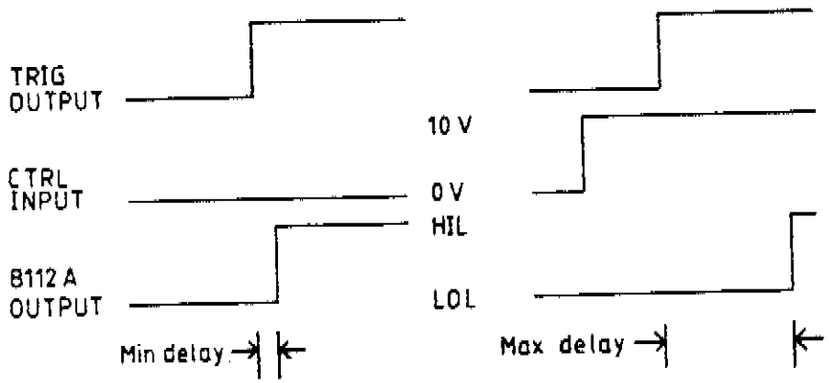


Figure 4-12(A). Example of correct Delay Control.

6. Set counter to TIME A→B. Vary the power supply output voltage between 1V and 10V and verify that for the following 8112A settings the range of times displayed agrees with the specified limits.

8112A	COUNTER	
DEL	LOW LIMIT	HIGH LIMIT
100ns	75ns	170ns
10us	1us	10us
1ms	0.1ms	1ms
999ms	0.1s	1s

4-23 WIDTH CONTROL

PARAMETERS

Pulse Width ratio: 1:10.
Control Voltage: 1.0V to 10V.
Width Ranges: 10ns to 1.0s in eight non-overlapping decade ranges.
Bandwidth: 1kHz.

EQUIPMENT

Power supply
Counter
Cable assembly BNC (2 off 60cm).
Feedthrough termination 50 Ohms (if necessary).
Banana to BNC adapter

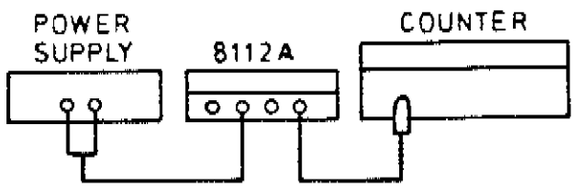


Figure 4-13. Equipment setup for Width Control performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-13.

2. Set 8112A as follows:

INPUT MODE	NORM
TRANSITION	FIXED
PER	999ms
DEL	65ns
HIL	2.00V
LOL	0.00V
CTRL MODE	WIDC

3. Set the counter to PULSE A. Vary the power supply output voltage between 1V and 10V and verify that for the following 8112A settings the pulse width range agrees with the specified limits.

8112A	COUNTER	
WID	LOW LIMIT	HIGH LIMIT
100ns	10ns	100ns
100us	10us	100us
100ms	10ms	100ms

4-24 HIGH-LEVEL CONTROL

PARAMETERS

Control Voltage: -8.0V to +8.0V.
High Level Output Window: -8.0V to +8.0V into 50 Ohms, independent of actual Low Level, which is programmable between -8.00V and +7.95V in 50mV steps.
Settling Time: 200us to settle to within 5% of final level.

EQUIPMENT

Realtime scope (note any inaccuracy of this instrument).
Pulse/Function Generator.
Cable assembly BNC (4 off 60cm, 1 off 30cm).
BNC Tee connector.
Feedthrough termination 50 Ohms (if necessary).

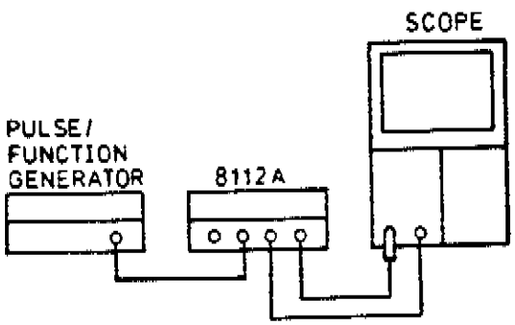


Figure 4-14. Equipment setup for High Level Control performance test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-14.

2. Set 8112A as follows:

INPUT MODE	NORM
TRANSITION	FIXED
PER	200us
DEL	65ns
DTY	50%
LOL	-2.00V
CTRL MODE	HILC

3. Set Pulse/Function Generator as follows:

Output	Sinewave
Frequency	50Hz
Amplitude	16.0V
Offset	0V

4. Verify that the High Level output voltage can be varied between +8V and -8V while the -2V level remains unchanged as indicated in Figure 14-14(A).

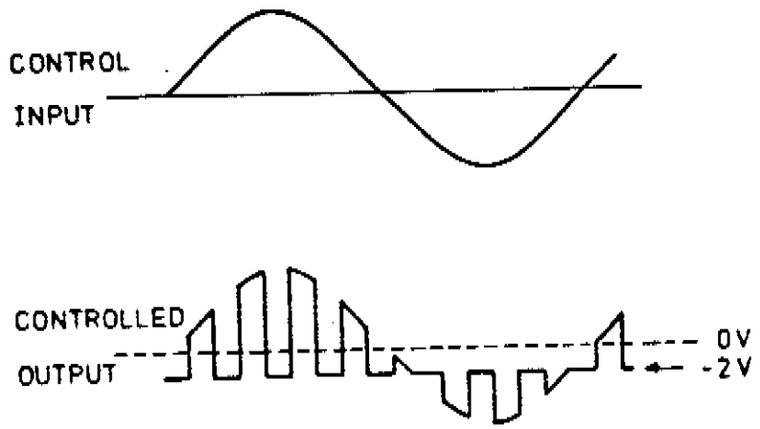


Figure 4-14(A). Example of correct High-Level Control operation.

5. Set 8112A as follows:

MODE	NORM
PER	10.0ms
DEL	65ns
WID	10ns
LOL	-2.0V
TRANSITION	FIXED
COMPL	ON

6. Set the pulse generator as follows:

Output	Square wave
Frequency	1kHz
Amplitude	2.0V
Offset	0.0V

7. Verify that the scope display indicates a settling time of less than 200us as indicated in Fig. 4-14(B).

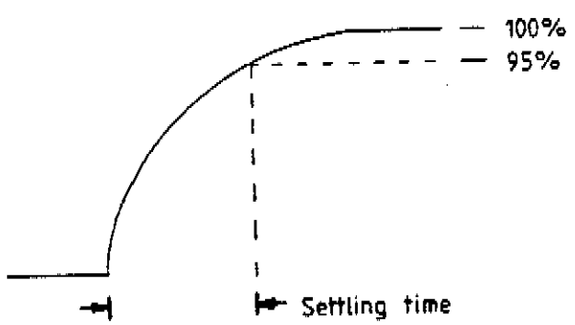


Figure 4-14(B) Example of correct High Level Control settling time.

4-25. HP-IB CAPABILITY

SPECIFICATION

Data transmission time: 130uS/ASCII character (7.6kByte/sec).

Programming times:

Values in parentheses apply when excessive slope calculation is not active (SRO).

Listen: Enable/Disable, Norm/Complement, Limit, Transition modes, Trigger slopes, Ext Input modes: < 4ms. Control modes: < 50ms. Set mode 1: 90ms (60ms) Set mode 0: 4ms. Level: < 90ms. Burst: < 12ms. Timing (not in Duty Cycle mode): < 50ms (< 25ms). Duty Cycle, Period (in Duty Cycle mode): < 80ms (< 50ms). Store: 6ms. Recall: 180ms (150ms).

Talk: Learn mode, Error reporting: 1ms/Character. Status: < 15ms.

Settling time: < 5ms.

EQUIPMENT

HP system controller.
Counter.
HP-IB cable.
Cable assembly BNC.
Feedthrough termination 50 Ohm (if necessary).

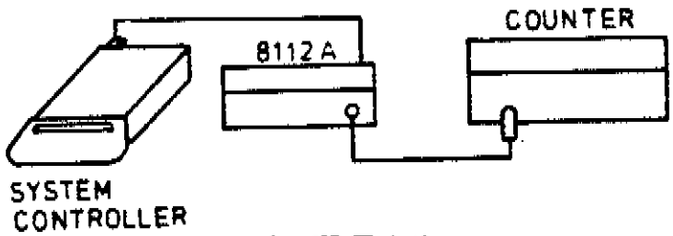


Figure 4-15. Equipment setup for HP-IB test.

PROCEDURE

1. Connect equipment as shown in Fig. 4-15.

2. Set the counter to TIME A → B.

3. Write the following instruction to the 8112A via the system controller:

```
BASIC
OUTPUT 712; "PER 126US"
EXECUTE

HPL
wrt 712, "PER 126US"
EXECUTE
```

4. Verify that the counter reading is 126us and the 8112A RMT LED is illuminated.

Table 4-1. Performance test record

HEWLETT-PACKARD COMPANY.
MODEL 8112A PROGRAMMABLE
PULSE GENERATOR.
SERIAL No._____

TESTED BY:_____
DATE:_____

TEST No	TITLE	DESCRIPTION	LOW LIMIT	ACTUAL	HIGH LIMIT
4-10	Period	Counter reading " " " " " "	17.0ns 9.5us 9.5ms 902.5ms		20.0ns 10.5us 10.5ms 997.5ms
4-11	Delay	Counter reading " " " " " "	- 47.50us 9.50ms 855.00ms		83.75 ns 52.50us 10.50ms 945.00ms
4-12	Double Pulse	Sampling scope Realtime scope " " " "	17.0ns 19.0us 19.0ms 760.0ms		20.0ns 21.0us 21.0ms 840.0ms
4-13	Width	Sampling scope Counter reading " " " "	7.5ns 38.0us 0.95ms 902.5ms		10.0ns 42.0us 1.05ms 997.5ms
4-14	Duty Cycle	Counter reading " " " " " " " "	0.9% 9.0% 45.0% 81.0% 89.1%		1.1% 11.0% 55.0% 99.0% -
4-15	Output Levels	DVM reading " " " " " " " " " " " " " " " " " " Counter reading	0.0596V 0.44V 0.92V 4.76V 7.7V -0.1404V -0.56V -1.08V -5.24V -8.3V -		0.1404V 0.56V 1.08V 5.24V 8.3V -0.0596V -0.44V -0.92V -4.76V -7.7V 100ns

Table 4-1 (cont). Performance test record

TEST No	TITLE	DESCRIPTION	LOW LIMIT	ACTUAL	HIGH LIMIT
4-16	Transition Times	Sampling scope "	- -		5.0ns 6.5ns
		Counter reading " " " " "	473ns 95us 475us 949us 0.95ms 9.5ms		527ns 105us 525us 1.048ms 1.05ms 10.5ms
		Counter reading " " " " "	473ns 95us 475us 949us 0.95ms 9.5ms		527ns 105us 525us 1.048ms 1.05ms 10.5ms
4-17	Pulse perform.	ACCEPTABLE? "		Y/N Y/N	
4-18	TRIG GATE E.WID E.BUR	FUNCTIONAL? " " "		Y/N Y/N Y/N Y/N	
4-19	MAN 1 PULSE LIMIT COMPL DISABLE	FUNCTIONAL? " " " "		Y/N Y/N Y/N Y/N Y/N	
4-20	STO/RCL check	FUNCTIONAL? "		Y/N Y/N	
4-21	PERC	FUNCTIONAL?		Y/N	
4-22	DELC	FUNCTIONAL?		Y/N	
4-23	WIDC	FUNCTIONAL?		Y/N	
4-24	HILC	FUNCTIONAL?		Y/N	
4-25	HP-IB capability	FUNCTIONAL?		Y/N	

Table 5-1. * VALUES

Related Paragraph	Component	Range of Value	Description
OVERSHOOT/ TRANSITION TIMES	A1C532	0pF (open) - 33 pF	increasing C532 decreases transition times and increases overshoot in FIXED and LINEAR Modes
	A1C409	0pF (open) - 3.3 pF	increasing C409 decreases transition times and increases overshoot in FIXED Mode
TIMING			
1. PERIOD	A2VR2	4.3 V	influences linearity of Timing IC U 200 (Period Generator)
	A2R62	51.1 kOhm	
2. DELAY	A2VR4	4.3 V	influences linearity of Timing IC U 220 (Delay Generator)
	A2R64	51.1 kOhm	
3. WIDTH	A2VR3	4.3 V	influences linearity of Timing IC U 240 (Width Generator)
	A2R63	51.1 kOhm	
	A1C240 A1C245	10 pF - 15 pF 47 pF	value change influences min. Width
	A1R243 A1R248	46.4 - 51.1 Ohm 1.96 kOhm	
SHAPER AND OFFSET			
FIXED AMPLITUDE	A1R437	9.53 - 16.2 kOhm	increasing R437 decreases difference in offset between NORM and COMPL Mode.

SECTION 5

ADJUSTMENT PROCEDURE

5-1 INTRODUCTION

This section describes the adjustments which will return the instrument to peak operating condition after repairs are completed. An adjustment location diagram is given on a fold-out page at the end of this section.

5-2 SAFETY CONSIDERATIONS

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in a safe condition (see Sections II and III).

WARNING

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

Any adjustment, maintenance, or repair of the opened instrument with voltage applied 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.

5-3 EQUIPMENT REQUIRED

The test equipment required for the adjustment procedure is listed in Table 1-1, Recommended Test Equipment. The critical specifications of substitute test instruments must meet or exceed the standards listed in the table if the instrument is to meet the standards set forth in Table 1-2, Specifications.

5-4 ADJUSTMENT PROCEDURE

The adjustment procedure is divided into the following sections:

5-6 POWER SUPPLIES
5-7 PRE-ADJUSTMENTS
5-8 OVERSHOOT/TRANSITION TIMES
5-9 TIMING
5-10 SHAPER AND OFFSET
5-11 SLOPE

When repairs have been made, paragraph 5-6 - Power Supplies should always be checked. If readjustment is necessary, the whole adjustment procedure should be carried out.

Of the remaining paragraphs, only those which the repairs could affect need to be completed. Execute a paragraph completely and in the order in which it is presented. Only the significant instrument settings are given.

Allow 1 hour warm-up time before starting the adjustments.

5-5 ADJUSTMENTS

Set 8112A into service position as shown in Figure 5-1. At beginning of the procedure load 8112A with its standard Parameter Set which is done by setting 8112A:

RCL 0

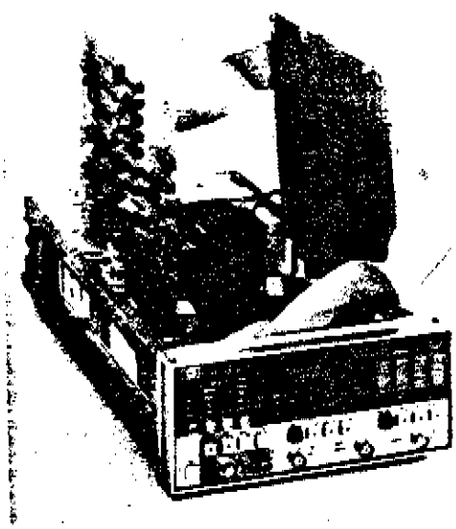


Figure 5-1. 8112A Service Position

5-6 POWER SUPPLIES

EQUIPMENT: DVM

PROCEDURE:

1. Connect DVM low terminal to GND testpoint on A1 and measure the power supply output voltages.

2. Adjust supply voltages as follows:

TP	Adjust	Result
+ 15.00 V (W2)	A1R24	+ 15.00 V +/- 15 mV
+ 23.00 V (F1)	A1R18	+ 23.00 V +/- 50 mV
- 23.00 V (F2)	A1R19	- 23.00 V +/- 50 mV
- 15.00 V (W5)	A1R25	- 15.00 V +/- 15 mV
- 5.25 V (W4)	A1R12	- 5.25 V +/- 10 mV
+ 5.00 V (W3)	check voltage	+ 5.05 V +/- 50 mV
+ 5.10 V (J3/1 redwire)	check voltage	+ 5.15 V +/- 50 mV

5-7 PRE-ADJUSTMENTS

EQUIPMENT:

Real Time Scope

PROCEDURE:

Minimum Pulse Droop

1. Set 8112A:

MODE	NORM
PER	1 ms
DEL	65 ns
DTY	50 %
TRANSITION	LINEAR, FIXED, GAUSS as required
LEE/TRE	10 ns
HIL	+ 4.99 V
LOL	- 4.99 V
OUTPUT	NORM, ENABLE

Connect 8112A output via 50 Ohm feedthrough to Real Time Scope (2V / Div).
Adjust A1R515 for best Pulse Droop in all three transition modes.

Normal/Complement

2. Set 8112A:

TRANSITION	FIXED

Switch 8112A output from NORM to COMPL and back. Adjust A1R403 for same HIL and LOL on screen.

Amplitude/Offset

3. Set 8112A:

TRANSITION	FIXED
OUTPUT	NORM

Adjust A1R410 (Ampl.) / R425 (Bal.) for a symmetrical 5 Div. signal.

4. Set 8112A:

TRANSITION	LINEAR
LEE/TRE	5.5 ns

Adjust A1R318 (Ampl.) / R407 (Bal.) for a symmetrical 5 Div. signal.

5. Set 8112A:

TRANSITION	GAUSS

Adjust A1R418 (Ampl.) / R402 (Bal.) for a symmetrical 5 Div. signal.

6. Set 8112A:

DTY	75 %
HIL	0.5 V
LOL	-0.5 V
TRANSITION	FIXED

Set Real Time Scope to 200 mV/Div., Ext. Trigger, pos.

Turn A2R46 fully cw.
Adjust A2R46 (Ampl.) / A1R416 (Bal.) for a symmetrical 5 Div. Signal.

5-8 OVERSHOOT/TRANSITION TIMES

EQUIPMENT:

Sampling Scope

PROCEDURE:

1. Set 8112A:

MODE	NORM
PER	200 ns
DEL	65 ns
DTY	50 %
TRANSITION	LINEAR
LEE/TRE	15.5 ns
HIL	8 V
LOL	-8 V
OUTPUT	NORM, ENABLE

Connect 8112A output via 20 dB/50 Ohm termination to sampling scope. Adjust A1R535 for best slope linearity in both NORM and COMPL output modes.

2. Set 8112A:

LEE/TRE 5.5 ns

Set sampling scope:

Attenuator 200 ms/Div.

Adjust sampling scope vernier to give a full screen display. Set attenuator to 1% / Div. (20 mV/Div.) and center topline of signal. Adjust A1C530 for overshoot < 5 % in NORM and COMPL modes.

Check Overshoot at return to LOL for same limit. Re-adjust A1C530 if necessary.

3. Set 8112A:

TRANSITION FIXED

Adjust A1C410 for overshoot < 10 % in both NORM and COMPL modes.

4. Set 8112A:

LOL - 2.0 V

Check the overshoot at both HIL and LOL for both FIXED and LINEAR Modes. If necessary, re-adjust A1C530 or A1C410 to achieve the above limits.

5. Set 8112A:

HIL + 0.5 V

LOL - 0.5 V

Take full screen on sampling scope. Check that transition times < 4.8 ns in both NORM and COMPL modes.
Set 8112A to LINEAR
Measure transition times < 6.2 ns.

Note: Transition times can be increased by increasing the overshoot. If Overshoot/ Transition Times Adjustment cannot be achieved within specifications, change * values A1C532/C409 (see Table 5-1) and repeat steps 1 to 4.

5-9 TIMING

5-9-1 PERIOD

EQUIPMENT:

Counter

PROCEDURE:

1. Set 8112A:

MODE	NORM
CTRTL	OFF
PER	1 ms
DEL	65 ns
DTY	50 %
TRANSITION	FIXED
HIL	+ 3 V
LOL	0.0 V
OUTPUT	NORM, ENABLE

Set counter for Period measurement. Connect 8112A trigger output via 50 Ohm feedthrough or internal 50 Ohm termination to counter. The typical period accuracy of the period decades is as shown in Fig. 5-2.

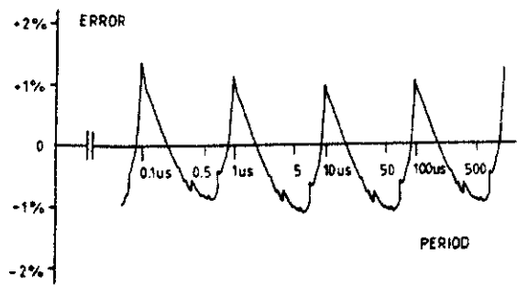


Fig. 5-2. Decade accuracy.

Adjust the range high end with A2R4 for about 1 % above the programmed value (1.01 ms).

2. Set 8112A:

PER 9.99 ms

Adjust the range low end with A2R6 for about 1 % above the programmed value (10.1 ms).

3. Set 8112A:

PER 5.00ms

Check that the mid-range deviation is about the same as the low/high range but negative (see Fig. 5-2).

4. If necessary repeat steps 1 to 3 to achieve an equal and opposite percentage deviation (up to +/- 1.5 %)

Note: If the adjustment is not possible, adjust * value of A2VR2/R62 (see Table 5-1) and repeat steps 1 to 3.

5. Set 8112A:

PER 20ns

Adjust the range high end with A2R3 for 19.5 ns +/- 0.2 ns.

6. Set 8112A:

PER 99.9 ns

Adjust the range low end with A2R57 for 102.5 ns +/- 0.2 ns.

7. Set 8112A:

PER 50ns

Check mid-range reading for 50 ns +/- 2 ns.

8. Repeat steps 5 to 7 and re-adjust if required.

5-9-2 DELAY (DOUBLE PULSE)

EQUIPMENT:

Counter, Sampling Scope

PROCEDURE:

1. Set 8112A:

MODE	NORM
CRTL	OFF
PER	50 ms
DEL	1 ms
DTY	20 %
TRANSITION	FIXED
HIL	+ 3.0 V
LOL	0 V
OUTPUT	NORM, ENABLE

Set Counter:

Time Interval A → B, Both channels to ⨍ DC, 50 Ohm, A sep B.

Connect 8112A trigger output to channel A and 8112A output to Channel B of counter via 50 Ohm feedthrough or internal 50 Ohm termination. Set trigger levels to trigger at about of 50 % of amplitudes. The typical DELAY (DBL) range characteristic is similar to Fig. 5-2.

Adjust the range high end with A2R14 for about 1 % above programmed value (1.01 ms).

2. Set 8112A:

DEL 9.99 ms

Adjust the range low end with A2R15 for about 1 % above programmed value (10.1 ms).

3. Set 8112A:

DEL 3.5 ms

Check mid-range for 3.5 ms +/- 50 us

4. Repeat steps 1 to 3 and re-adjust if necessary.

Note: If the adjustment is not possible, add * value A2VR4/R64 (see Table 5-1) and repeat steps 1 to 3.

Set 8112A:

PER	200 ns
DBL	20 ns
WID	10 ns

5. Connect 8112A trigger output to Ext. Trigger Input of sampling scope. Connect 8112A output via 20 dB/50 Ohm termination to sampling scope. Take scope time base error into account. Adjust A2R13 for 18 ns +/- .3 ns at 50 % of amplitude (see fig. 5-3)

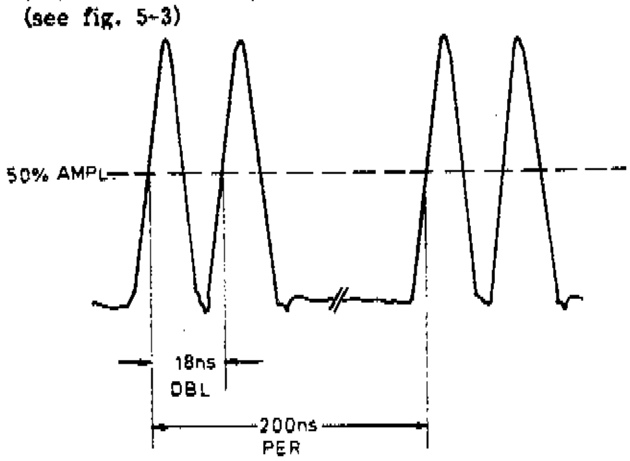


Fig. 5-3. Double Pulse Adjustment.

6. Set 8112A:

DBL 99.9 ns

Adjust A2R61 for 100 ns +/- 1 ns at 50 % of amplitude.

7. Set 8112A:

DBL 50 ns

Check mid-range for 50 ns +/- 2 ns at 50 % of amplitude.

8. Repeat steps 5 to 7 and re-adjust if necessary.

5-9-3 WIDTH

EQUIPMENT:

Counter, Sampling Scope

PROCEDURE:

1. Set 8112A:

MODE	NORM
CTRL	OFF
PER	20 ms
DEL	65 ns
WID	1 ms
TRANSITION	FIXED
HIL	+ 3 V
LOL	0 V
OUTPUT	NORM, ENABLE

Set Counter:

Time Interval A → B, Slope A ⎍, Slope B ⎏, com A, Triggerlevel 1.5 V.

The typical Width range characteristic is similar to Fig. 5-2.

Connect 8112A output via 50 Ohm feedthrough or internal 50 Ohm termination to counter channel A.

Adjust the range high end with A2R9 for about 1 % above programmed value (1.01ms).

2. Set 8112A:

WID 9.99 ms

Adjust the range low end with A2R11 for about 1 % above programmed value (10.1 ms)

3. Set 8112A:

WID 3.5 ms

Check mid-range for 3.5 ms +/- 50us.

4. Repeat steps 1-3 and re-adjust if necessary for best compromise.

Note: If the adjustment is not possible, add * value A2VR3/R63 (see Table 5-1) and repeat steps 1 to 3.

5. Set 8112A:

WID	10 ns
PER	200 ns

Connect 8112A output to sampling scope and 8112A trigger output to trigger input. Take scope time base error into account. Adjust the mid-range with A2R8 for 10 ns +/- 0.2 ns at 50 % of amplitude.

6. Set 8112A:

WID 99.9 ns

Adjust the low range end with A2R59 for 101 ns +/- 0.2 ns.

7. Repeat steps 5 and 6 and re-adjust if necessary.

8. Set 8112A:

WID 50 ns

Check Min. Width for 50 ns +/-2 ns

5-10 SHAPER AND OFFSET

Real Time Scope, Sampling Scope, Counter, DVM, Signal Generator, Low-Pass Filter test set up as shown in Fig. 5-4.
Feedthrough: 50 Ohm +/- 0.1 % > 2W (ET13164)

5-10-1 FIXED AMPLITUDE

PROCEDURE

1. Set 8112A:

MODE	NORM
PER	1 ms
DEL	65 ns
WID	500 us
TRANSITION	FIXED
HIL	0.99 V
LOL	-0.99 V
OUTPUT	NORM, ENABLE

Set Counter:

Time Interval A→B, Slope A ⎍, Slope B ⎏, Com A, Trigger level 0 V

Set DVM:

AC, 10 V Range

Connect 8112A output via 50 Ohm feedthrough or internal 50 Ohm termination to counter channel A. Observe counter while switching 8112A output from NORM to COMPL and back. Step 8112A WID with VERNIER until counter reading is the same (exactly 50 % Duty Cycle).
Set 8112A: STO 9

2. Set 8112A:

HIL	4.99 V
LOL	-4.99 V

Connect 8112A output via exact 50 Ohm feedthrough to DVM. Adjust A1R410 for 5.045 V -0/+20 mV RMS.

Set DVM:

DC, use DVM built-in filter function, otherwise use test set-up as shown in Fig. 5-4.

While switching 8112A output from NORM to COMPL and back, adjust A1R403 for same DVM reading.

Adjust A1R425 for 0 V +/- 10 mV

Note: If the adjustments are not possible, change * value A1R437 (see Table 5-1.) and repeat step 2.

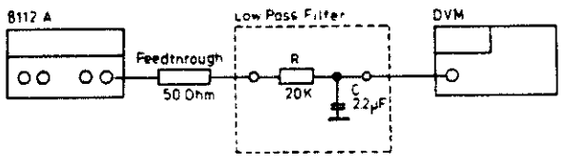


Figure 5-4. Low-Pass Filter test set-up

3. Set 8112A:

HIL	0.5 V
LOL	-0.5 V

Set DVM:

AC, 10 V Range

Adjust A2R46 for 0.506 V +/- 5 mV RMS

Set DVM:

DC, use DVM built-in filter function, otherwise use test set-up as shown in Fig. 5-4.

Adjust A1R416 for 0 V +/- 5 mV

5-10-2 LINEAR AMPLITUDE

Set 8112A:

TRANSITION	LINEAR
HIL	4.99 V
LOL	-4.99 V

While switching 8112A output from NORM to COMPL and back, adjust A1R407 for same DVM reading (0 V +/-10 mV).

Set DVM:

AC, 10 V Range

Adjust A1R318 for 5.045 V -0/+20 mV RMS same DVM reading as in FIXED transition mode.

5-10-3 GAUSS AMPLITUDE

Set 8112A:

TRANSITION GAUSS

Adjust A1R418 for 5.045 V -0/+20 mV RMS same DVM reading as in FIXED and LINEAR transition mode.

Set DVM:

DC, use DVM built-in filter function, otherwise use test set-up as shown in Fig. 5-4.

Switch 8112A output from NORM to COMPL and back. Adjust A1R402 for same DVM reading (0 V +/- 10 mV).

Set 8112A:

TRANSITION	FIXED
HIL	8.0 V
LOL	-8.0 V

Set DVM:

AC, 20 V Range

Check that the amplitude for FIXED, LINEAR and GAUSS transition mode is 8.080 V -0/+40 mV RMS.

If re-adjustment is necessary, repeat steps 5-10-1, 5-10-2, 5-10-3 as required.

5-10-4 OFFSET

Set 8112A:

RCL 9 (see 5-10-1 FIXED AMPLITUDE)

MODE	NORM
PER	1 ms
DEL	65 ns
WID	exact 50 % Duty Cycle
TRANSITION	FIXED

HIL	+8.00 V
LOL	+7.90 V

Set DVM:

DC, 10V Range, use DVM built-in filter function, otherwise use set-up as shown in Fig. 5-4.

Connect 8112A output via exact 50 Ohm feedthrough to DVM. Adjust A2R42 for 7.95 V +/- 10 mV.

Set 8112A:

LOL	-8.00 V
HIL	-7.90 V

Check accuracy of neg. offset. DVM reading -7.95 V +/- 30 mV. If necessary re-adjust A2R42.

5-10-5 HIL C

1. Set8112A:

MODE	NORM
PER	1 ms
DEL	65 ns
WID	500 us
TRANSITION	FIXED
HIL	8.0 V
LOL	0.0 V
CTRL	HIL C

Connect 8112A output via 50 Ohm feedthrough to Real Time Scope and adjust A2R50 for 0 V amplitude (no signal).

2. Set Signal Generator:

Frequency	2 Hz
Amplitude	8 V, symm.

Connect signal to 8112A CTRL INPUT. Adjust A1R506 for Minimum dc change in baseline.

5-11 SLOPE

EQUIPMENT:

Real Time Scope, Sampling Scope, Counter, DVM, Time Interval Probe, Low-Pass Filter test set-up.

PROCEDURE:

1. Set8112A:

MODE	NORM
CTRL	OFF
PER	10 ms
DEL	65 ns
WID	500 us
TRANSITION	LINEAR
LEE	100 us
TRE	500 us
HIL	4.0 V
LOL	-4.0 V
OUTPUT	NORM, ENABLE

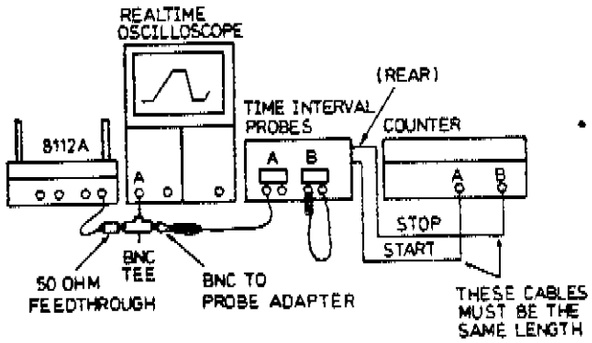


Fig. 5-5. Slope test set-up

Set DVM:

DC, use DVM built-in filter function, otherwise use Low-Pass Filter test set-up (Fig. 5-4)

Connect 8112A output via exact 50 Ohm feedthrough to DVM. Check DVM for -4.0 V reading. If not, adjust with LOL VERNIER to give -4.00 V

Change 8112A output to COMPL. Check DVM for 4.0 V reading. If not, adjust with HIL VERNIER to give 4.00 V

2. Use Slope test set-up (Fig. 5-5).

Set 8112A:

MODE	NORM
DTY	50 %
OUTPUT	NORM
STO1	

Set Time Interval Probe:

START	STOP
A -3.2 V ∫	A 3.2 V ∫

Set Counter:

Time Interval A→B, Slope A and B ⎍, DC, 50 Ohm, Trigger level 0 V, A sep B

Disconnect from 8112A output and calibrate Time Interval Probe

a.) LEVEL: Press cal. switch down, till channel LEDs are on.

b.) TIME ZERO: Press cal. switch to upper position and release.

Reconnect to 8112A output.

Set 8112A:
LEE 999us
STO 2

Set 8112A:

Lee 500 us
STO 5

Set 8112A:

TRE 100 us
STO 3

Set 8112A:

TRE 999 us
STO 4

3. Set 8112A:

RCL 1

Observe counter. Adjust A2R37 for about 0.5% below programmed value (99.5 us).

4. Set 8112A:

RCL 2

Observe counter. Adjust A2R32 for about 0.5% below programmed value (995 us). Re-check and re-adjust steps 3 and 4.

5. Set 8112A:

RCL 5

Check counter reading for < 510 us and > 480 us. Step LEE up and down using vernier keys and observe counter reading for < 2% deviation.

6. Set 8112A:

RCL 3
Set Time Interval Probe:

START STOP

A 3.2 V ⎍ A -3.2 V ⎍

Observe counter. Adjust A2R38 for about 0.5% below programmed value (99.5 us).

7. Set 8112A:

RCL 4

Observe counter. Adjust A2R35 for about 0.5 % below programmed value (995 us). Re-check and re-adjust steps 6 and 7

8. Set 8112A:

RCL 5

Check counter reading for < 510 us and > 480 us. Step TRE up and down using vernier keys and observe counter reading for < 2 % deviation.

9. Set 8112A:

LEE/TRE 1 ms

Observe counter. Adjust A2R27 for 1.000 ms +/- 5 us.

Change Time Interval Probe:

START STOP

A -3.2 V⎍ A 3.2 V⎍

Check counter reading is 1.000 ms +/- 5 us. Readjust A2R27 while switching 8112A output from NORM to COMPL and back for best compromise (1.000 ms +/- 5 us).

10. Set 8112A:

PER 50 ms
LEE/TRE 10 ms

Observe counter and adjust A2R28 while switching 8112A output from NORM to COMPL and back, for best compromise (10.00 ms +/- 50 us). If steps 9 and 10 are impossible to adjust within limit, re-check and re-adjust steps 3 to 8 for the minimum difference between LEE and TRE.

11. Set 8112A:

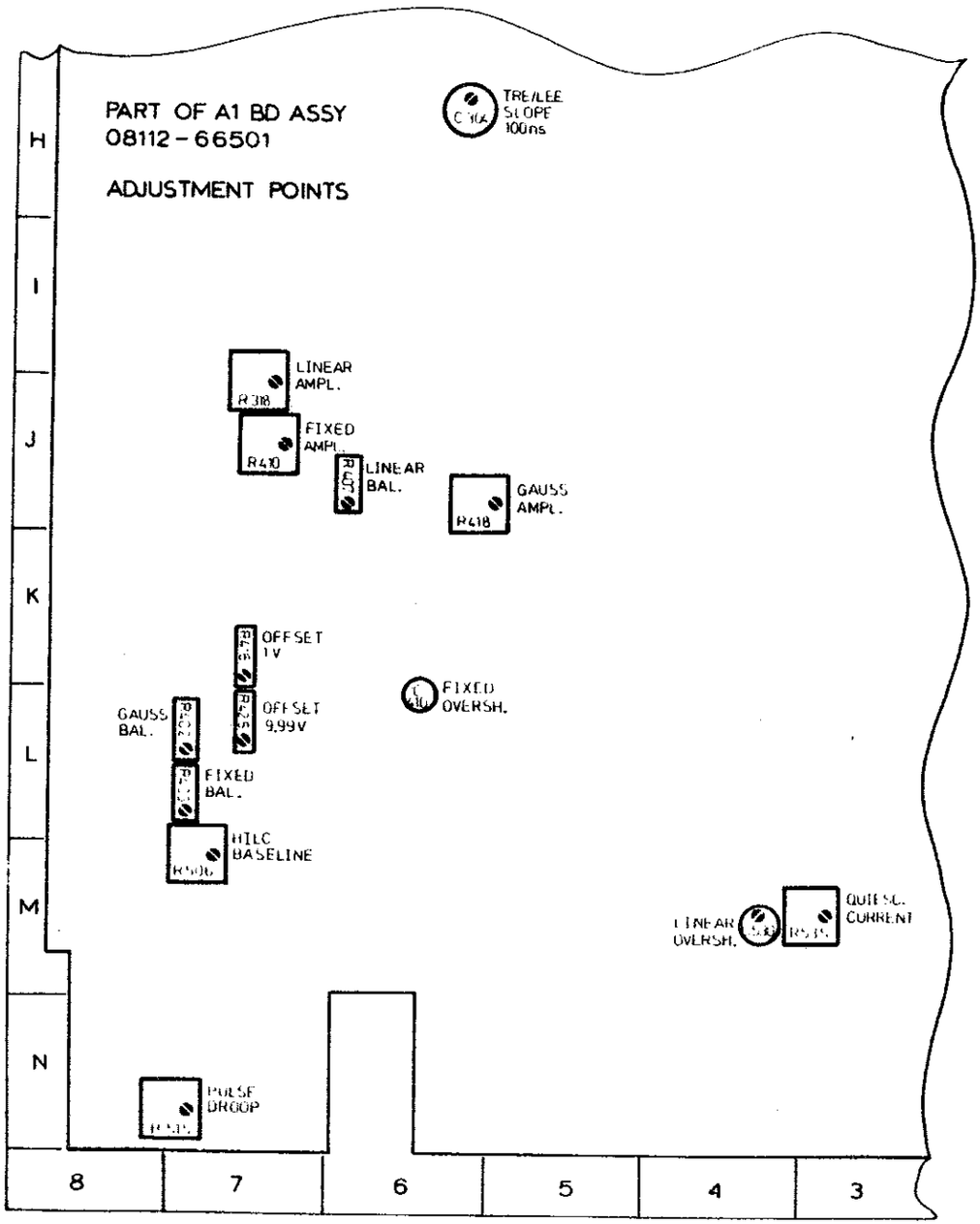
LEE/TRE 100 ns
PER 500 ns

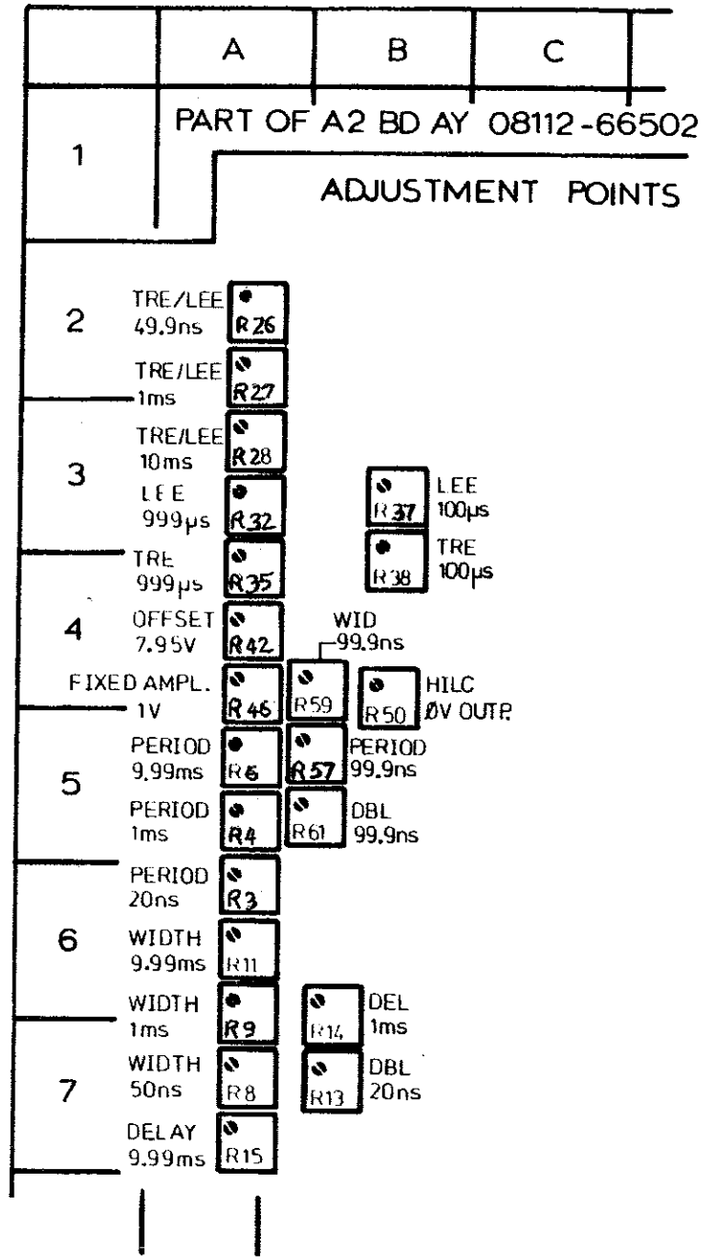
Connect 8112A output via 20 dB/50 Ohm termination to sampling scope. Adjust A1C304 for best compromise of LEE and TRE (100 ns +/- 2 ns).

12. Set 8112A:

LEE/TRE 49.9 ns

Adjust A2R26 for best compromise of LEE and TRE (50 ns +/- 1 ns).


PART OF A1 BD ASSY
08112-66501
ADJUSTMENT POINTS
TRE/LEE SLOPE 100ns
LINEAR AMPL.
R418
FIXED AMPL.
R410
LINEAR BAL.
GAUSS AMPL.
OFFSET 1V
OFFSET 9.99V
GAUSS BAL.
FIXED BAL.
HILC BASELINE
FIXED OVERSH.
LINEAR OVERSH.
QUIESC. CURRENT
PULSE DROOP
H
I
J
K
L
M
N
8
7
6
5
4
3


A
B
C
1
PART OF A2 BD AY 08112-66502
ADJUSTMENT POINTS
2
TRE/LEE 49.9ns R26
TRE/LEE 1ms R27
3
TRE/LEE 10ms R28
LEE 999µs R32
TRE 999µs R35
LEE 100µs R37
TRE 100µs R38
4
OFFSET 7.95V R42
WID 99.9ns R59
FIXED AMPL. 1V R46
HILC ØV OUTP. R50
5
PERIOD 9.99ms R6
PERIOD 99.9ns R57
PERIOD 1ms R4
DBL 99.9ns R61
6
PERIOD 20ns R3
WIDTH 9.99ms R11
7
WIDTH 1ms R9
DEL 1ms R14
WIDTH 50ns R8
DBL 20ns R13
DELAY 9.99ms R15