

## 5-1 GENERAL

5-2 This section contains information on the removal of covers and assemblies, performance verification and recalibration (internal checks and adjustments) procedures.

5-3 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.

## 5-4 REMOVAL OF COVERS

5-5 To gain access to all test points and assemblies remove the four screws from each of the two covers and slide the covers off.

## 5-6 REMOVAL OF ASSEMBLIES

5-7 Reference should be made to the Assembly Location diagram (6-1) before attempting to remove assemblies. Table 6-2 gives the colour code used to identify the internal wiring, e.g. wire 93 is white with an orange stripe.

## 5-8 Timing board — assembly 5

5-9 Disconnect coaxial cable W2 and wires 93 and 94 from board A5. Remove the three long securing screws and spacers and ease the board out of its connector on board A7.

## 5-10 Output board — assembly 6

5-11 Disconnect wires 93 and 94 and unsolder coaxial cables W3 and W4 from board A6.

5-12 Remove the four screws securing the rear panel to the frame. Withdraw the rear panel and board A6 through the rear of the frame as far as the power supply leads will permit.

5-13 Remove the three screws securing board A6 to the rear panel. Unsolder the two wires number 923 and the two wires number 937 from board A6. Carefully withdrawn board A6 from the frame.

5-14 When board A6 is being refitted, thermal compound (HP part no. 6040-0265) must be applied to the output amplifier heat sink where it bolts on to the rear panel. This is necessary to improve thermal conductivity between the two surfaces.

## 5-15 Mother board — assembly 7

5-16 Remove boards A5 and A6 as detailed in paragraphs 5-8 to 5-13.

5-17 Unsolder coaxial cables W5 and W6 connecting the output jacks to board A7 at the board A7 end.

5-18 Unsolder the power supply wires (W7) from the line on/off switch (S12).

5-19 Disconnect the five wires 91, 92, 93, 90 and 0 from the top rear of board A7. Disconnect wire 7 from the rear centre of board A7.

5-20 Disconnect the three wires 3, 4 and 5 from the bottom rear of board A7.

5-21 Disconnect the wires from all vernier controls, i.e. R1, R2, R3, R7, R8, R9 and R10 at the board A7 end.

5-22 Remove the six screws securing board A7 to the front panel and carefully remove the board from the frame.

## 5-23 EQUIPMENT REQUIRED

5-24 A complete list of required test equipment and accessories is given in table 5-1. Test equipment equivalent to that recommended may be substituted, provided it meets the specifications listed in table 5-1. For best results, use recently calibrated test equipment.

**5-25 PERFORMANCE TESTS**

5-26 The performance tests in tables 5-2 to 5-20 give the procedures for verifying that the instrument is working to the specifications. Rigid observance of the sequence in which the tests appear is unnecessary.

**5-27 INTERNAL CHECKS AND ADJUSTMENTS**

5-28 The internal checks and adjustments in tables 5-21 to 5-25 give the procedures for adjusting a ser-

viceable instrument to bring it within specification. The checks should be performed in the order in which they appear.

**5-29 SERVICE PRODUCT SAFETY CHECK**

5-30 This check (table 5-26) should be performed following the internal checks and adjustments to verify the instrument safety.

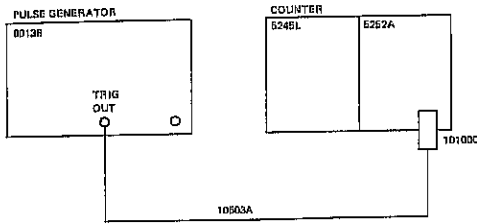
Table 5-1. Test Equipment and Accessories

| INSTRUMENT            | BRIEF SPECIFICATION   | RECOMMENDED MODEL  |
|-----------------------|---|--|
| ✓ Counter             | Frequency range 0 — 50 MHz with Prescaler plug-in   | HP 5245L<br>HP 5252A   |
| ✓ Oscilloscope        | Dual-channel 50 MHz bandwidth<br>20mV/div sensitivity, sweep speeds<br>100ns/div to 1s/div. with sweep<br>delay | HP 180C<br>with plug-ins<br>1801A, 1821A                                 |
| ✓ Digital Voltmeter   | 100V range. Accuracy<br>± (0.03% reading +0.01% range).   | HP 3470 system<br>comprising 34740A<br>display and 34702A<br>Multimeter. |
| Sampling Oscilloscope | Dual-channel, 1 GHz bandwidth<br>2mV/div. sensitivity, sweep speeds<br>100ps/div to 50μs/div.                   | HP 180C<br>with plug-in<br>1810A   |
| ✓ Test Oscillator     | Frequency range 10 Hz to 10 MHz   | HP 651B  |
| Test Oscillator       | Frequency range 10 MHz to 500 MHz   | HP 3200B   |
| ✓ Pulse Generator     | Rep. rate at least 1 MHz<br>variable width (1μs to 100ms),<br>amplitude 0V to ± 5V.                             | HP 8011A   |

### ACCESSORIES

|  |                              |
|--|------------------------------|
| ✓ 50 ohm cable assembly, 23cm long, with male BNC connectors   | HP 10502A                    |
| ✓ 50 ohm cable assembly, 122cm long, with male BNC connectors (4 required)                           | HP 10503A                    |
| ✓ Test leads for DVM — dual banana plug<br>to probe and clip   | HP 11003A                    |
| Connector, BNC male to type N female (2 required)<br>Connector, type N male to BNC male (2 required) | HP 1250-0077<br>HP 1250-0780 |
| ✓ Tee Connector, BNC   | HP 1250-0781                 |
| ✓ 50 ohm Feed-through termination  | HP 10100C                    |
| Pulse Adder  | HP 15104A                    |
| 20dB Attenuator, 50 ohm (2 required)   | HP 8491A                     |

Table 5-2. Performance Test: Pulse Period



INITIAL CONTROL SETTINGS

|                   |    |         |
|-------------------|----|---------|
| PULSE PERIOD      | 2  | 20n-1μ  |
| VERNIER           | 3  | CCW     |
| PULSE DOUBLE/NORM | 4  | NORM    |
| PULSE DELAY       | 5  | 35n-1μ  |
| VERNIER           | 6  | CCW     |
| PULSE WIDTH       | 7  | 10n-1μ  |
| VERNIER           | 8  | CCW     |
| AMPLITUDE         | 9  | 5.0-2.0 |
| VERNIER           | 10 | CW      |
| OFFSET vernier    | 11 | -       |
| OFFSET switch     | 12 | OFF     |
| AMPLITUDE         | 13 | 5.0-2.0 |
| VERNIER           | 14 | CW      |
| OFFSET vernier    | 15 | -       |
| OFFSET switch     | 16 | OFF     |
| NORM/COMPL        | 19 | NORM    |
| INT LOAD          | 20 | IN      |
| EXT WIDTH/NORM/RZ | 25 | NORM    |

5245L:

|             |                     |
|-------------|---------------------|
| FUNCTION    | FREQUENCY           |
| SENSITIVITY | 1V                  |
| TIME BASE   | adjust as necessary |

(7260 X10)

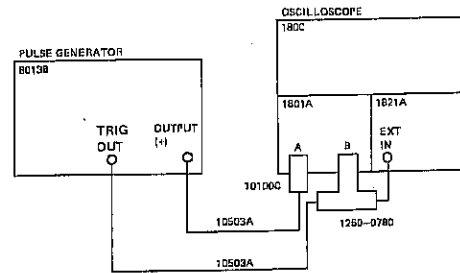
STEP INSTRUCTIONS RESULTS

- 1 Check repetition rate for each set of control settings given in table:

| PULSE PERIOD | VERNIER | PULSE WIDTH | VERNIER | REP RATE        |
|--------------|---------|-------------|---------|-----------------|
| 2            | 3       | 7           | 8       |                 |
| 20n-1μ       | CCW     | 10n-1μ      | CCW     | < 20ns > 50 MHz |
| 20n-1μ       | CW      | 1μ-.1m      | CCW     | > 1μs < 1 MHz   |
| 1μ-.1m       | CCW     | 1μ-.1m      | CCW     | < 1μs > 1 MHz   |
| 1μ-.1m       | CW      | .1m-10m     | CCW     | > .1ms < 10 KHz |
| .1m-10m      | CCW     | .1m-10m     | CCW     | < .1ms > 10 KHz |
| .1m-10m      | CW      | 10m-1       | CCW     | > 10ms < 100 Hz |
| 10m-1        | CCW     | 10m-1       | CCW     | < 10ms > 100 Hz |
| 10m-1        | CW      | 10m-1       | Center  | > 1s < 1 Hz     |

For the last setting, set the 5245L FUNCTION switch to PERIOD AVERAGE 1 and measure the pulse period.

Table 5-3. Performance Test: Pulse Delay



INITIAL CONTROL SETTINGS

|                   |    |         |
|-------------------|----|---------|
| PULSE PERIOD      | 2  | 1μ-.1m  |
| VERNIER           | 3  | CW      |
| PULSE DOUBLE/NORM | 4  | NORM    |
| PULSE DELAY       | 5  | 35n-1μ  |
| VERNIER           | 6  | CW      |
| PULSE WIDTH       | 7  | 10n-1μ  |
| VERNIER           | 8  | Center  |
| AMPLITUDE         | 9  | 5.0-2.0 |
| VERNIER           | 10 | CW      |
| OFFSET vernier    | 11 | -       |
| OFFSET switch     | 12 | OFF     |
| AMPLITUDE         | 13 | 5.0-2.0 |
| VERNIER           | 14 | CW      |
| OFFSET vernier    | 15 | -       |
| OFFSET switch     | 16 | OFF     |
| NORM/COMPL        | 19 | NORM    |
| INT LOAD          | 20 | IN      |
| EXT WIDTH/NORM/RZ | 25 | NORM    |

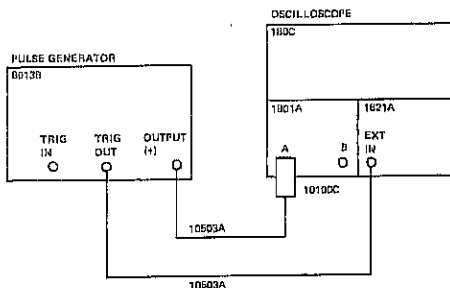
STEP INSTRUCTIONS

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- 1 Check the pulse delay for both VERNIER 6 extremities of each range setting of the PULSE DELAY switch 5 as follows:

| PULSE DELAY | VERNIER | PULSE PERIOD        | PULSE WIDTH | PULSE DELAY |
|-------------|---------|---------------------|-------------|-------------|
| 5           | 6       | 2                   | 7           |             |
| 35n-1μ      | CCW     | 1μ-.1m              | 10n-1μ      | < 35ns      |
| 35n-1μ      | CW      | 1μ-.1m              | 10n-1μ      | > 1μs       |
| 1μ-.1m      | CW      | .1m-10m             | 1μ-.1m      | > 100 μs    |
| 1μ-.1m      | CCW     | 1μ-.1m              | 1μ-.1m      | < 1μs       |
| .1m-10m     | CW      | .1m-10m             | .1m-10m     | > 10ms      |
| .1m-10m     | CCW     | .1m-10m             | .1m-10m     | < 100μs     |
| 10m-1       | CW      | EXT+ (press MAN 1 ) | 10m-1       | > 1s        |
| 10m-1       | CCW     | 10m-1               | .1m-10m     | < 10ms      |

Table 5-4. Performance Test: Pulse Width (greater than 1μs)



INITIAL CONTROL SETTINGS:

|                   |    |         |
|-------------------|----|---------|
| PULSE PERIOD      | 2  | 1μ-1m   |
| VERNIER           | 3  | CW      |
| PULSE DOUBLE/NORM | 4  | NORM    |
| PULSE DELAY       | 5  | 35n-1μ  |
| VERNIER           | 6  | CCW     |
| PULSE WIDTH       | 7  | 10n-1μ  |
| VERNIER           | 8  | CW      |
| AMPLITUDE         | 9  | 5.0-2.0 |
| VERNIER           | 10 | CW      |
| OFFSET vernier    | 11 | -       |
| OFFSET switch     | 12 | OFF     |
| AMPLITUDE         | 13 | 5.0-2.0 |
| VERNIER           | 14 | CW      |
| OFFSET vernier    | 15 | -       |
| OFFSET switch     | 16 | OFF     |
| NORM/COMPL        | 19 | NORM    |
| INT LOAD          | 20 | IN      |
| EXT WIDTH/NORM/RZ | 25 | NORM    |

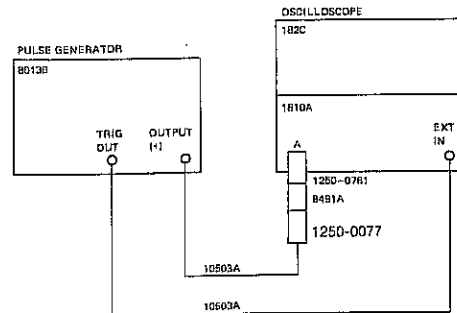
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STEP INSTRUCTIONS RESULTS

- 1 Check the pulse width for both VERNIER 8 extremities of each range setting of the PULSE WIDTH switch 7 as follows:

| PULSE WIDTH | VERNIER | PULSE PERIOD |        |
|-------------|---------|--------------|--------|
| 7           | 8       | 2            | P/W    |
| 10n-1μ      | CW      | 1μ-1m        | > 1μs  |
| 1μ-1m       | CW      | .1m-10m      | > .1ms |
| 1μ-1m       | CCW     | 1μ-1m        | < 1μs  |
| .1m-10m     | CW      | 10m-1        | > 10ms |
| .1m-10m     | CCW     | .1m-10m      | < .1ms |
| 10m-1       | CW      | EXT+(press   | > 1s   |
|             |         | MAN 1 )      |        |
| 10m-1       | CCW     | 10m-1        | > 10ms |

Table 5-5. Performance Test: Minimum Pulse Width



INITIAL CONTROL SETTINGS

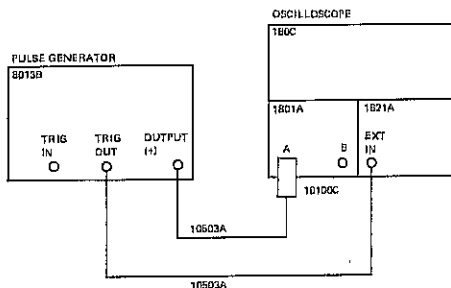
|                   |    |         |
|-------------------|----|---------|
| PULSE PERIOD      | 2  | 20ns-1μ |
| VERNIER           | 3  | Center  |
| PULSE DOUBLE/NORM | 4  | NORM    |
| PULSE DELAY       | 5  | 35n-1μ  |
| VERNIER           | 6  | CCW     |
| PULSE WIDTH       | 7  | 10n-1μ  |
| VERNIER           | 8  | CCW     |
| AMPLITUDE         | 9  | 5.0-2.0 |
| VERNIER           | 10 | CW      |
| OFFSET vernier    | 11 | -       |
| OFFSET switch     | 12 | OFF     |
| AMPLITUDE         | 13 | 5.0-2.0 |
| VERNIER           | 14 | CW      |
| OFFSET vernier    | 15 | -       |
| OFFSET switch     | 16 | OFF     |
| NORM/COMPL        | 19 | NORM    |
| INT LOAD          | 20 | IN      |
| EXT WIDTH/NORM/RZ | 25 | NORM    |

STEP INSTRUCTIONS RESULTS

- 1 Measure the pulse width: *P/W* < 10ns

*Typically = 8ns*

Table 5-6. Performance Test: Pulse Period Jitter



INITIAL CONTROL SETTINGS

|                   |    |            |
|-------------------|----|------------|
| PULSE PERIOD      | 2  | 1μ-.1m     |
| VERNIER           | 3  | see step 2 |
| PULSE DOUBLE/NORM | 4  | NORM       |
| PULSE DELAY       | 5  | 35n-1μ     |
| VERNIER           | 6  | CCW        |
| PULSE WIDTH       | 7  | 1μ-.1m     |
| VERNIER           | 8  | CENTERED   |
| AMPLITUDE         | 9  | 5.0-2.0    |
| VERNIER           | 10 | CW         |
| OFFSET vernier    | 11 | -          |
| OFFSET switch     | 12 | OFF        |
| AMPLITUDE         | 13 | 5.0-2.0    |
| VERNIER           | 14 | CW         |
| OFFSET vernier    | 15 | -          |
| OFFSET switch     | 16 | OFF        |
| NORM/COMPL        | 19 | NORM       |
| INT LOAD          | 20 | IN         |
| EXT WIDTH/NORM/RZ | 25 | NORM       |

| STEP | INSTRUCTIONS  | RESULTS  |
|------|---|----------|
| 1    | Set the 1821A controls as follows:<br>Main Sweep 0.1ms/div<br>Delayed Sweep 0.1μs/div<br>Sweep Mode Norm.<br>Delay Trigger Auto<br>CM Delay 2.0 |          |
| 2    | Adjust pulse period VERNIER 3 to obtain 0.1ms pulse period on display.  |          |
| 3    | Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of second pulse on display.                                 |          |
| 4    | Switch to Delayed Sweep and center the pulse.   |          |
| 5    | Measure pulse period jitter:  | < 1 div. |

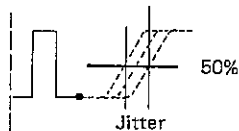
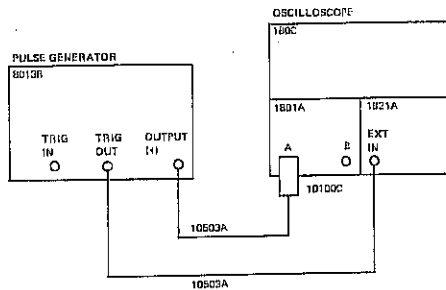


Table 5-7. Performance Test: Pulse Delay Jitter



INITIAL CONTROL SETTINGS

|                   |    |         |
|-------------------|----|---------|
| PULSE PERIOD      | 2  | .1m-10m |
| VERNIER           | 3  | CW      |
| PULSE DOUBLE/NORM | 4  | NORM    |
| PLSE DELAY        | 5  | 1μ-.1m  |
| VERNIER           | 6  | CW      |
| PULSE WIDTH       | 7  | 1μ-.1m  |
| VERNIER           | 8  | CCW     |
| AMPLITUDE         | 9  | 5.0-2.0 |
| VERNIER           | 10 | CW      |
| OFSET vernier     | 11 | -       |
| OFFSET switch     | 12 | OFF     |
| AMPLITUDE         | 13 | 5.0-2.0 |
| VENIER            | 14 | CW      |
| OFFSET vernier    | 15 | -       |
| OFFSET switch     | 16 | OFF     |
| NORM/COMPL        | 19 | NORM    |
| INT LOAD          | 20 | IN      |
| EXT WIDTH/NORM/RZ | 25 | NORM    |

STEP INSTRUCTIONS

- Set the 1821A controls as follows:  
Main Sweep 0.1mS/div  
Delayed Sweep 0.1μS/div  
Sweep Mode Norm.  
Delayed Trigger Auto.  
CM Delay 10.0
- Adjust pulse period VERNIER 3 to obtain 0.4mS pulse period on display.
- Adjust pulse delay VERNIER 6 to obtain 0.1mS pulse delay.
- Adjust 1821A Delay (Div) vernier until intensified spot coincides with leading edge of second pulse.
- Switch to Delayed Sweep and center the leading edge.
- Display should be:
- Measure pulse delay jitter: < 1 div.

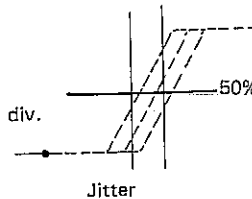
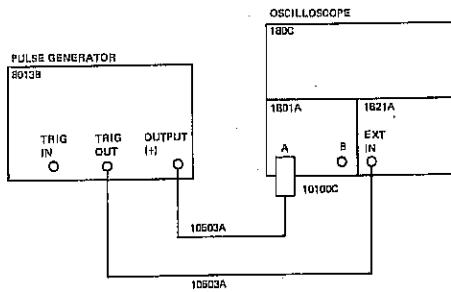


Table 5-8. Performance Test: Pulse Width Jitter



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | .1m-10m |
| VERNIER 3            | CW      |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 1μ-.1m  |
| VERNIER 8            | CW      |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

STEP INSTRUCTIONS

- 1 Set 1821A controls as follows:
 

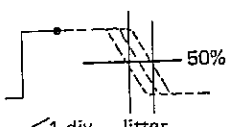
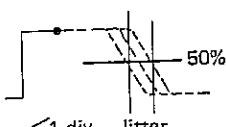
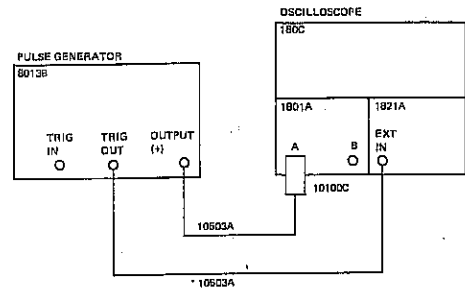
|                 |           |
|-----------------|-----------|
| Main Sweep      | 0.1mS/div |
| Delayed Sweep   | 0.1uS/div |
| Sweep Mode      | Norm.     |
| Delayed Trigger | Auto.     |
| CM Delay        | 10        |
- 2 Adjust pulse period VERNIER 3 to obtain 0.4ms pulse period on display.
- 3 Adjust pulse width VERNIER 8 to obtain 0.1ms pulse width.
- 4 Adjust 1821A Delay (Div) vernier until intensified spot coincides with trailing edge of first pulse.
- 5 Switch to Delayed Sweep and center pulse as shown.
- 6 Display should be:
 
- 7 Measure pulse width jitter:
 

Table 5-9. Performance Test: Square Wave



INITIAL CONTROL SETTINGS

|                      |             |
|----------------------|-------------|
| PULSE PERIOD 2       | 20n-1μ      |
| VERNIER 3            | CCW         |
| PULSE DOUBLE/NORM 4  | NORM        |
| PULSE DELAY 5        | 35n-1μ      |
| VERNIER 6            | CW          |
| PULSE WIDTH 7        | SQUARE WAVE |
| VERNIER 8            | CW          |
| AMPLITUDE 9          | 5.0-2.0     |
| VERNIER 10           | CW          |
| OFFSET vernier 11    | -           |
| OFFSET switch 12     | OFF         |
| AMPLITUDE 13         | 5.0-2.0     |
| VERNIER 14           | CW          |
| OFFSET vernier 15    | -           |
| OFFSET switch 16     | OFF         |
| NORM/COMPL 19        | NORM        |
| INT LOAD 20          | IN          |
| EXT WIDTH/NORM/RZ 25 | NORM        |

STEP INSTRUCTIONS

- 1 For each setting of the PULSE PERIOD switch 2, given in the table below, turn the VERNIER 3 slowly from fully CCW to fully CW and check that the PULSE DELAY 5 and VERNIER 6 controls have minimal effect on the position of the displayed pulse.
 

| PULSE PERIOD 2 | VERNIER 3 | Symmetry  |
|----------------|-----------|-----------|
| 20n - 1μ       | CCW to CW | 50% ± 15% |
| 1μ - .1m       | CCW to CW | 50% ± 5%  |
| .1m - 10m      | CCW to CW | 50% ± 5%  |
| 10m - 1        | CCW to CW | 50% ± 5%  |
- 2 For all settings of the pulse period control check that the pulse width equals pulse OFF time within the above limits.

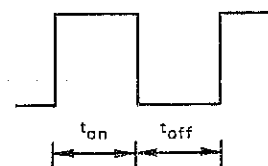
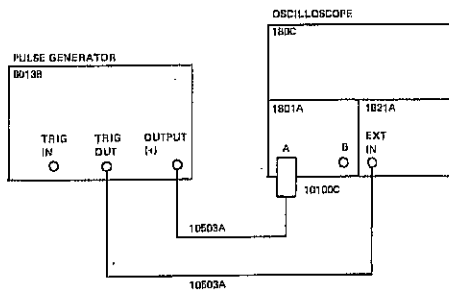


Table 5-10. Performance Test: Duty Cycle



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | 1μ-.1m  |
| VERNIER 3            | CW      |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 1μ-.1m  |
| VERNIER 8            | CCW     |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

STEP INSTRUCTIONS RESULTS

- For each set of control settings given in table below, display the output pulse so that it occupies half of the display (see diagram below).

Starting with the pulse period VERNIER 3 fully CW turn VERNIER 3 slowly CCW until the trailing edge of the pulse begins to move or the pulse divides. When this happens measure the pulse period (Tp) and use in the formula:

$$\text{Duty Cycle Max} = \frac{\text{Pulse Width (Tw)}}{\text{Pulse Period (Tp)}} \times 100\%$$

| PULSE PERIOD<br>2 | PULSE WIDTH<br>7 | VERNIER<br>8     |       |
|-------------------|------------------|------------------|-------|
| 1μ-.1m            | 1μ-.1m           | Adjust for 1μs   | > 75% |
| .1m-10m           | .1m-10m          | Adjust for 0.1ms | > 75% |
| 10m-1             | 10m-1            | Adjust for 10ms  | > 75% |

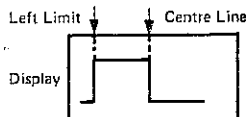
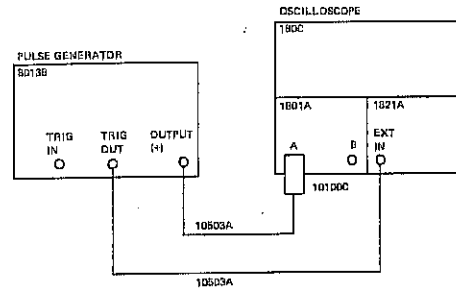


Table 5-11. Performance Test: Manual Operation



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | EXT(+)  |
| VERNIER 3            | -       |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 1μ-.1m  |
| VERNIER 8            | CW      |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

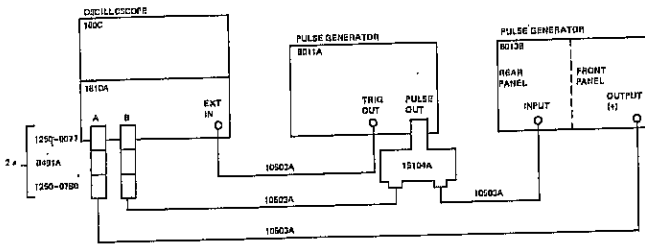
STEP INSTRUCTIONS

- Press MAN button 1

Only one output pules must occur when the button is pressed, no pulse must occur when the button is released.



Table 5-12. Performance Test: External Width Operation



INITIAL CONTROL SETTINGS

|                      |           |
|----------------------|-----------|
| PULSE PERIOD 2       | —         |
| VERNIER 3            | —         |
| PULSE DOUBLE/NORM 4  | —         |
| PULSE DELAY 5        | —         |
| VERNIER 6            | —         |
| PULSE WIDTH 7        | —         |
| VERNIER 8            | —         |
| AMPLITUDE 9          | 5.0-2.0   |
| VERNIER 10           | CW        |
| OFFSET vernier 11    | —         |
| OFFSET switch 12     | OFF       |
| AMPLITUDE 13         | 5.0-2.0   |
| VERNIER 14           | CW        |
| OFFSET vernier 15    | —         |
| OFFSET switch 16     | OFF       |
| NORM/COMPL 19        | NORM      |
| INT LOAD 20          | IN        |
| EXT WIDTH/NORM/RZ 25 | EXT WIDTH |

STEP INSTRUCTIONS

- 1 Apply external signals to INPUT 26 .

NOTE

The 1 V signal applied to 8013B INPUT 26 is displayed on the oscilloscope as 100 mV due to the HP 8491A attenuator.

- 2 Note that the leading and trailing edges of the output pulses are delayed on the input pulses by a fixed delay of approx. 30ns. This is the propagation delay of the 8013B internal circuitry.

RESULT

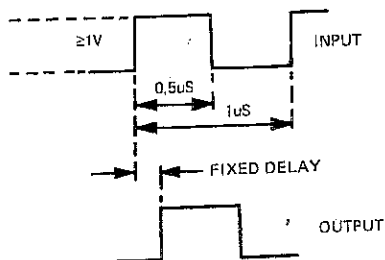
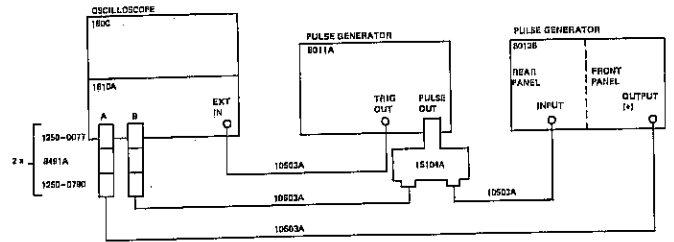


Table 5-13. Performance Test: RZ Operation



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | EXT(+)  |
| VERNIER 3            | —       |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1µ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 10n-1µ  |
| VERNIER 8            | Center  |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CCW     |
| OFFSET vernier 11    | —       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CCW     |
| OFFSET vernier 15    | —       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | RZ      |

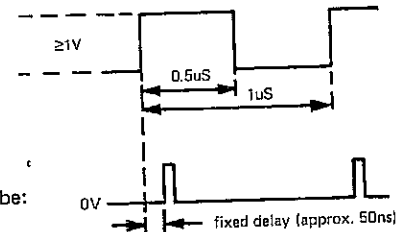
STEP INSTRUCTIONS RESULTS

- 1 Apply RZ pulses to INPUT 26

NOTE

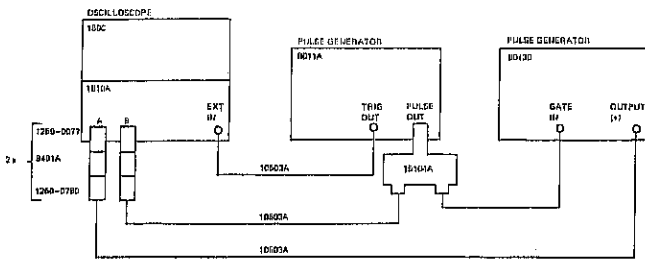
The 1 V signal applied to 8013B INPUT 26 is displayed on the oscilloscope as 100 mV due to the HP 8491A attenuator.

- 2 Output should be:



- 3 Check that pulse delay VERNIER 6 and pulse width VERNIER 8 vary the pulse delay and pulse width.

Table 5-14. Performance Test: Gate Operation



INITIAL CONTROL SETTINGS

|                      |                |
|----------------------|----------------|
| PULSE PERIOD 2       | 20n-1μ         |
| VERNIER 3            | Center         |
| PULSE DOUBLE/NORM 4  | NORM           |
| PULSE DELAY 5        | 35n-1μ         |
| VERNIER 6            | CCW            |
| PULSE WIDTH 7        | 10n-1μ         |
| VERNIER 8            | 50% duty cycle |
| AMPLITUDE 9          | 5.0-2.0        |
| VERNIER 10           | CCW            |
| OFFSET vernier 11    | -              |
| OFFSET switch 12     | OFF            |
| AMPLITUDE 13         | 5.0-2.0        |
| VERNIER 14           | CW             |
| OFFSET vernier 15    | -              |
| OFFSET switch 16     | OFF            |
| NORM/COMPL 19        | NORM           |
| INT LOAD 20          | IN             |
| EXT WIDTH/NORM/RZ 25 | NORM           |

STEP INSTRUCTIONS

- 1 Apply gate pulse to GATE INPUT 22 .
- 2 Check that output pulses at OUTPUT 17 only occur during ON time of gate pulse: Turn pulse period VERNIER 3 slowly CW and check gate operation for all pulse periods.
- 3 Move cable on OUTPUT(+) 17 to TRIGGER OUTPUT(+) 21.
- 4 Check that leading edge of first trigger output pulse (TRIGGER OUTPUT 21 ) occurs a short time (owing to fixed delay) after the leading edge of the gate pulse.
- 5 Check that last pulse width is correct even when gate pulse trailing edge occurs just before or during the last pulse (owing to the effect of the fixed delay of approx. 40ns).

RESULTS

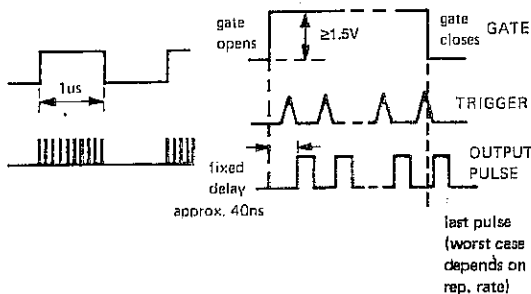
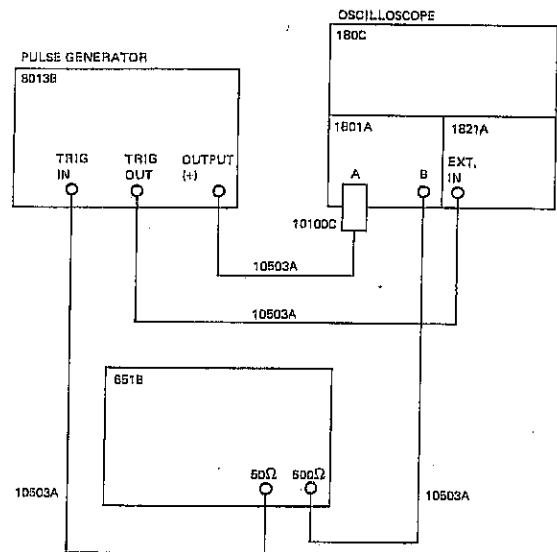


Table 5-15. Performance Test: External Trigger Operation



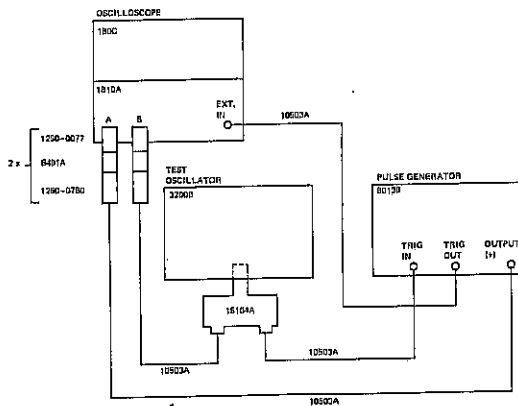
INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | EXT(+)  |
| VERNIER 3            | -       |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | .1m-10m |
| VERNIER 8            | CCW     |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

STEP INSTRUCTIONS

- 1 Set the 651B controls as follows:  
 Range X100  
 Vernier 2.5  
 Attenuator +10dB (1.0V)  
 Amplitude 0.61V RMS  
 Frequency 1kHz
- 2 Center the waveforms on the oscilloscope display and check that the leading edge of the output pulse occurs during positive slope of the sinewave.
- 3 Set PULSE PERIOD 2 to EXT (-). The leading edge of the output pulse should occur during the negative slope of the sinewave.

Table 5-16. Performance Test: High Frequency Trigger Operation



#### INITIAL CONTROL SETTINGS

|                      |             |
|----------------------|-------------|
| PULSE PERIOD 2       | EXT(+)      |
| VERNIER 3            | —           |
| PULSE DOUBLE/NORM 4  | NORM        |
| PULSE DELAY 5        | 35n-1 $\mu$ |
| VERNIER 6            | CCW         |
| PULSE WIDTH 7        | 10n-1 $\mu$ |
| VERNIER 8            | CCW         |
| AMPLITUDE 9          | 5.0-2.0     |
| VERNIER 10           | CW          |
| OFFSET vernier 11    | —           |
| OFFSET switch 12     | OFF         |
| AMPLITUDE 13         | 5.0-2.0     |
| VERNIER 14           | CW          |
| OFFSET vernier 15    | —           |
| OFFSET switch 16     | OFF         |
| NORM/COMPL 19        | NORM        |
| INT LOAD 20          | IN          |
| EXT WIDTH/NORM/RZ 25 | NORM        |

#### STEP INSTRUCTIONS

- 1 Apply a sinewave with a repetition rate of 50 MHz and amplitude of 1.7V p-p. Check that repetition rate of output is equal to repetition rate of input i.e. 50 MHz.

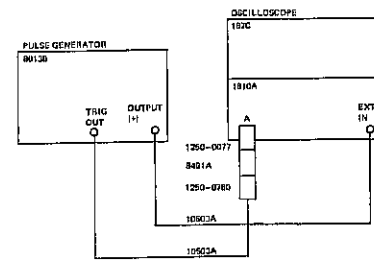
#### NOTE

The 1.7 V p-p signal applied to 8013B TRIGGER INPUT 23 is displayed on the oscilloscope as 170 mV due to the HP 8491A attenuator.

- 2 Set PULSE PERIOD 2 to EXT —.
- 3 Repeat step 1.

Note that there is a delay of 25ns  $\pm$  8ns between the trigger input and output.

Table 5-17. Performance Test: Trigger Output



#### INITIAL CONTROL SETTINGS

|                      |             |
|----------------------|-------------|
| PULSE PERIOD 2       | 20n-1 $\mu$ |
| VERNIER 3            | CCW         |
| PULSE DOUBLE/NORM 4  | NORM        |
| PULSE DELAY 5        | 35n-1 $\mu$ |
| VERNIER 6            | CCW         |
| PULSE WIDTH 7        | 10n-1 $\mu$ |
| VERNIER 8            | CCW         |
| AMPLITUDE 9          | 2.0-1.0     |
| VERNIER 10           | CW          |
| OFFSET vernier 11    | —           |
| OFFSET switch 12     | OFF         |
| AMPLITUDE 13         | 2.0-1.0     |
| VERNIER 14           | CW          |
| OFFSET vernier 15    | —           |
| OFFSET switch 16     | OFF         |
| NORM/COMPL 19        | NORM        |
| INT LOAD 20          | IN          |
| EXT WIDTH/NORM/RZ 25 | NORM        |

#### STEP INSTRUCTIONS

- 1 Measure amplitude of trigger output pulse (TRIGGER OUTPUT)

#### RESULTS

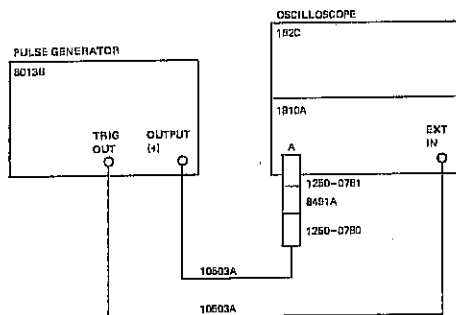
> 1.0V

#### NOTE

The 1.0 V TRIGGER OUTPUT pulse of the 8013B is displayed on the oscilloscope as 100 mV due to the HP 8491A attenuator.

- 2 Measure width of trigger output pulse at 50% of amplitude: 16ns  $\pm$  10ns
- 3 Turn VERNIER 3 slowly from CCW to CW, the amplitude and width limits given must be true for the whole range.
- 4 Switch PULSE PERIOD 2 to range 1 $\mu$ -.1m and repeat steps 1 to 3.
- 5 Switch PULSE WIDTH 7 to SQUARE WAVE and repeat steps 1 to 3.

Table 5-18. Performance Test: Preshoot, Overshoot and Ringing



INITIAL CONTROL SETTINGS

|                      |             |
|----------------------|-------------|
| PULSE PERIOD 2       | 20n-1μ      |
| VERNIER 3            | CCW         |
| PULSE DOUBLE/NORM 4  | NORM        |
| PULSE DELAY 5        | 35n-1μ      |
| VERNIER 6            | CCW         |
| PULSE WIDTH 7        | SQUARE WAVE |
| VERNIER 8            | -           |
| AMPLITUDE 9          | 5.0-2.0     |
| VERNIER 10           | CW          |
| OFFSET vernier 11    | -           |
| OFFSET switch 12     | OFF         |
| AMPLITUDE 13         | 5.0-2.0     |
| VERNIER 14           | CW          |
| OFFSET vernier 15    | -           |
| OFFSET switch 16     | OFF         |
| NORM/COMPL 19        | NORM        |
| INT LOAD 20          | IN          |
| EXT WIDTH/NORM/RZ 25 | NORM        |

STEP INSTRUCTIONS

- 1 With reference to the diagram below, measure preshoot, overshoot and ringing in turn to ensure that these are <5% of the pulse amplitude.
- 2 Disconnect the oscilloscope input from the 8013B and reconnect to the negative output connector 18. Repeat step 1.

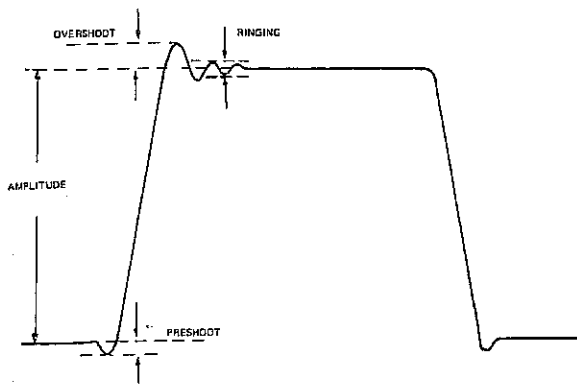
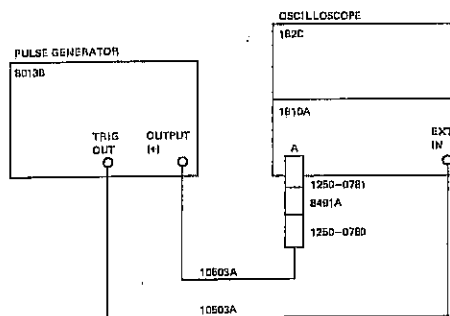


Table 5-19. Performance Test: Amplitude



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | 20n-1μ  |
| VERNIER 3            | CW      |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 10n-1μ  |
| VERNIER 8            | Center  |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

STEP INSTRUCTIONS

- 1 Check the amplitude for both VERNIER 10 and 14 extremities of each setting of the AMPLITUDE switch 9 and 13 as follows:

NOTE

Output amplitudes displayed on the oscilloscope will be decreased by a factor of 10 due to the HP 8491A attenuator.

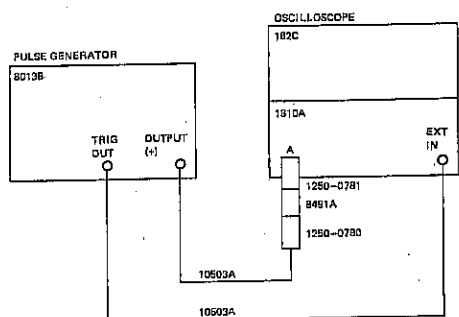
| AMPLITUDE 9 13 | VERNIER 10 14 | INT LOAD |       |
|----------------|---------------|----------|-------|
|                |               | IN       | OUT   |
| 5.0-2.0        | CW            | ≥5.0     | ≥10V  |
| 5.0-2.0        | CCW           | ≤2.0     | ≤4V   |
| 2.0-1.0        | CW            | ≥2.0     | ≥4V   |
| 2.0-1.0        | CCW           | ≤1.0     | ≤2V   |
| 1.0-.05        | CW            | ≥1.0     | ≥2V   |
| 1.0-.05        | CCW           | ≤0.5     | ≤1V   |
| 0.5-0.2        | CW            | ≥0.5     | ≥1V   |
| 0.5-0.2        | CCW           | ≤0.2     | ≤0.4V |

- 2 Move cable on OUTPUT(-) 17 to OUTPUT(-) 18 and repeat step 1.

NOTE

If OUTPUT(-) does not meet amplitude requirements, it may be necessary to change the value of A6R56 to 3.48 kohms (HP Part No. 0698-3152).

Table 5-20. Performance Test: DC Offset



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | 20n-1μ  |
| VERNIER 3            | CW      |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 10n-1μ  |
| VERNIER 8            | Center  |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

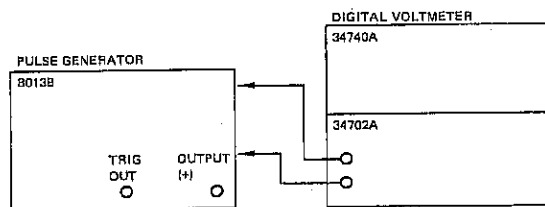
STEP INSTRUCTIONS RESULTS

NOTE

Offset amplitudes displayed on the oscilloscope will be decreased by a factor of 10 due to the HP 8491A attenuator.

- 1 Disconnect 8013B from oscilloscope.
- 2 Center the oscilloscope display trace.
- 3 Reconnect 8013B to oscilloscope.
- 4 Set OFFSET 16 to ON.
- 5 Turn VERNIER 15 fully CCW.
- 6 Measure negative offset:  $\geq 2.5V$
- 7 Turn VERNIER 15 fully CW.
- 8 Measure positive offset:  $\geq 2.5V$
- 9 Turn OFFSET 16 to OFF.
- 10 Output pulse baseline should be at center of oscilloscope display.
- 11 Connect the oscilloscope input to the 8013B negative output connector 18.
- 12 Repeat steps 1 to 8 for OFFSET 12 and VERNIER 11 but with the following limits:  
 VERNIER 11 fully CCW  $\geq 2.5V$   
 VERNIER 11 fully CW  $\geq 2.5V$

Table 5-21. Internal Checks and Adjustments - Power Supply



INITIAL CONTROL SETTINGS 8013B:

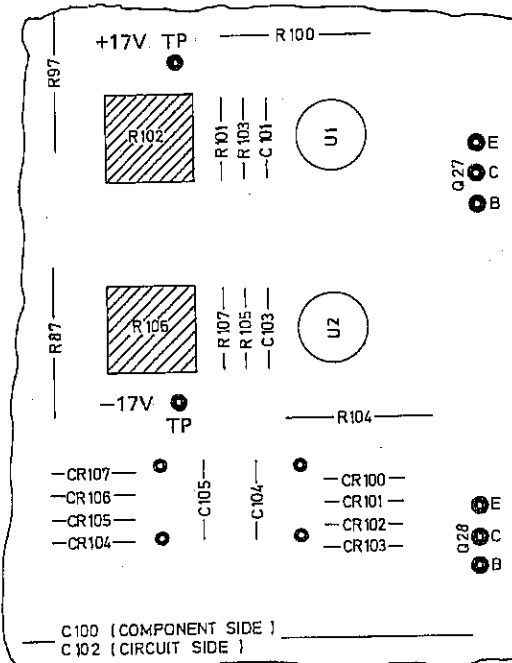
|                       |         |
|-----------------------|---------|
| PULSE PERIOD 2        | EXT+    |
| VERNIER 3             | CW      |
| PULSE DOUBLE/NORMAL 4 | NORM    |
| PULSE DELAY 5         | 1μ-0.1m |
| VERNIER 6             | CCW     |
| PULSE WIDTH 7         | 1μ-0.1m |
| VERNIER 8             | CCW     |
| AMPLITUDE 9           | 5.0-2.0 |
| VERNIER 10            | CW      |
| OFFSET switch 12      | OFF     |
| AMPLITUDE 13          | 5.0-2.0 |
| VERNIER 14            | CW      |
| OFFSET 16             | OFF     |
| NORM/COMPL 19         | NORM    |
| INT LOAD 20           | IN      |
| EXT WIDTH/NORM/RZ 25  | NORM    |

|                 |       |
|-----------------|-------|
| 3444A:          |       |
| FUNCTION switch | VOLTS |
| RANGE switch    | 100V  |

STEP INSTRUCTION

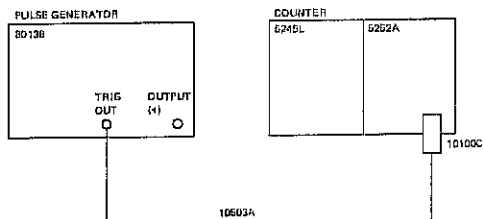
- 1 Connect the DVM between the +17VTP on board A6 and GND. Adjust A6R102 for +17V ± 100mV.
- 2 Connect the DVM between the -17V TP on board A6 and GND. Adjust A6R106 for -17V ± 100mV.

BOARD A6



51.582 MHz  
51.282 MHz

Table 5-22. Internal Checks and Adjustments - Repetition Rate



INITIAL CONTROL SETTINGS 8013B:

|                     |    |         |
|---------------------|----|---------|
| PULSE PERIOD        | 2  | 20n-1μ  |
| VERNIER             | 3  | CCW     |
| PULSE DOUBLE/NORMAL | 4  | NORM    |
| PULSE DELAY         | 5  | 35n-1μ  |
| VERNIER             | 6  | CCW     |
| PULSE WIDTH         | 7  | 10n-1μ  |
| VERNIER             | 8  | CCW     |
| AMPLITUDE           | 9  | 5.0-2.0 |
| VERNIER             | 10 | CW      |
| OFFSET switch       | 12 | OFF     |
| AMPLITUDE           | 13 | 5.0-2.0 |
| VERNIER             | 14 | CW      |
| OFFSET              | 16 | OFF     |
| NORM/COMPL          | 19 | NORM    |
| INT LOAD            | 20 | IN      |
| EXT WIDTH/NORM/RZ   | 25 | NORM    |

5252A:

MAX COUNT RATE 100MC

5245L:

SENSITIVITY 0.1V  
SIGNAL INPUT AC  
TIME BASE 0.1m  
FUNCTION FREQUENCY

STEP INSTRUCTION

- Adjust capacitor A5C24 for a nominal frequency of 51.5 MHz.  
Limits > 51 MHz < 52 MHz.

BOARD A5

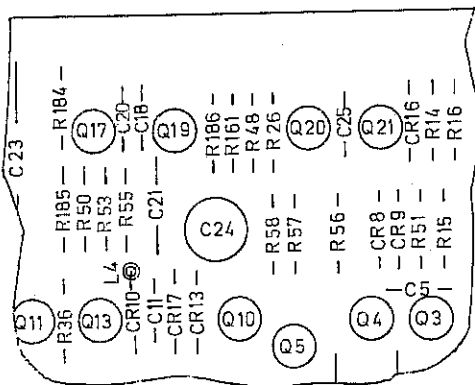
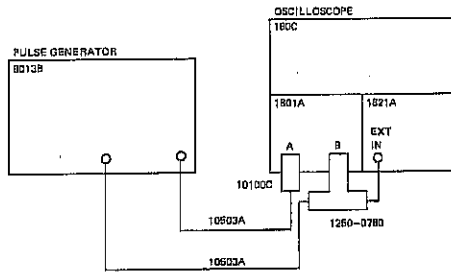


Table 5-23. Internal Checks and Adjustments — Delay and Width Timing



INITIAL CONTROL SETTINGS 8013B:

|                     |    |         |
|---------------------|----|---------|
| PULSE PERIOD        | 2  | 1μ-0.1m |
| VERNIER             | 3  | CW      |
| PULSE DOUBLE/NORMAL | 4  | NORM    |
| PULSE DELAY         | 5  | 35n-1μ  |
| VERNIER             | 6  | CW      |
| PULSE WIDTH         | 7  | 10n-1μ  |
| VERNIER             | 8  | CW      |
| AMPLITUDE           | 9  | 5.0-2.0 |
| VERNIER             | 10 | CW      |
| OFFSET switch       | 12 | OFF     |
| AMPLITUDE           | 13 | 5.0-2.0 |
| VERNIER             | 14 | CW      |
| OFFSET              | 16 | OFF     |
| NORM/COMPL          | 19 | NORM    |
| INT LOAD            | 20 | IN      |
| EXT WIDTH/NORM/RZ   | 25 | NORM    |

1. PULSE DELAY

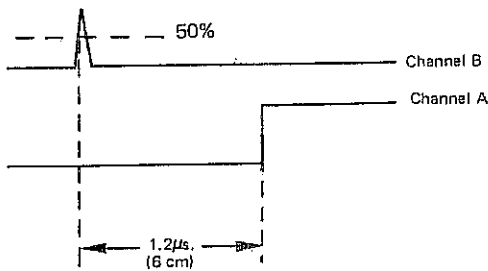
STEP INSTRUCTION

- 1 Set up the oscilloscope as follows:

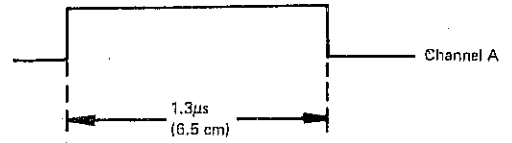
1801A:  
 DISPLAY ALT, channel B  
 VOLTS/DIV 2V  
 POLARITY + UP, DC INPUT

1821A:  
 TIME/DIV 0.2μs

- 2 Set the leading edge of the trigger output pulse on the first vertical line on the screen. Measure the time to the leading edge of the output pulse. Adjust A5C35 for a nominal 1.2μs. Limits > 1.1μs < 1.35μs.



2. PULSE WIDTH



STEP INSTRUCTION

- 1 Set the oscilloscope DISPLAY switch to CHANNEL A only.
- 2 Set the pulse leading edge on the first line of the screen. Adjust A5C45 for a nominal 1.3μs. Limits > 1.1μs < 1.5μs. (minimum width with vernier 8 in CCW position is < 10ns using a sampling oscilloscope).

BOARD A5

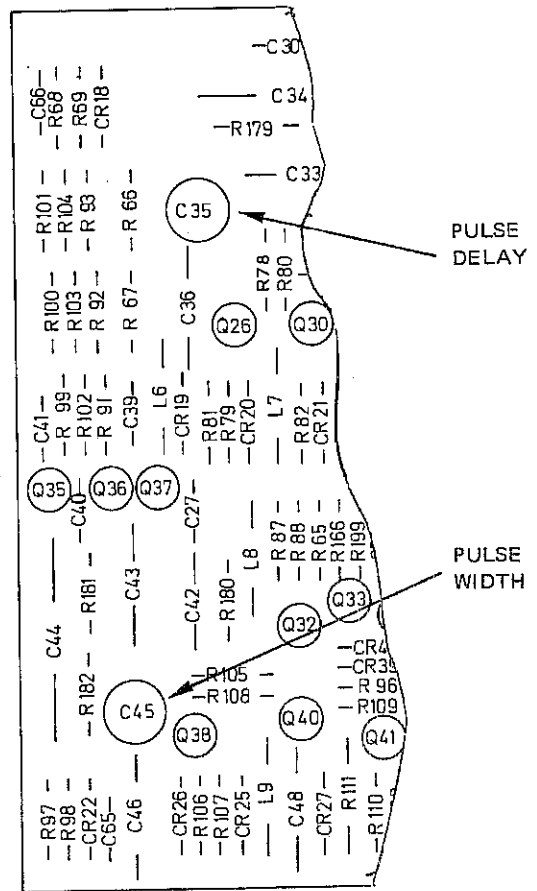
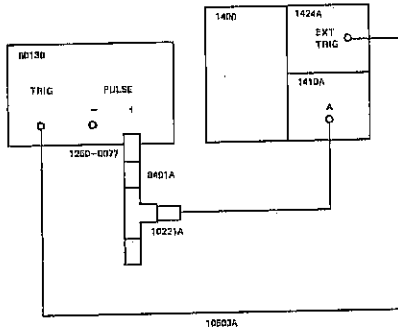


Table 5-24. Internal Checks and Adjustments - Pulse Perturbation

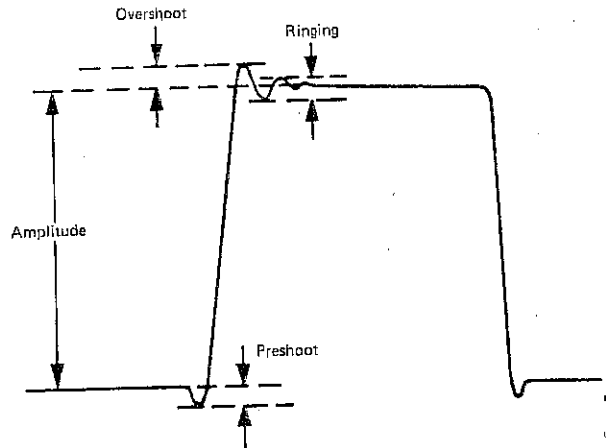


INITIAL CONTROL SETTINGS 8013B:

|                     |    |            |
|---------------------|----|------------|
| PULSE PERIOD        | 2  | 20n-1μ     |
| VERNIER             | 3  | see step 2 |
| PULSE DOUBLE/NORMAL | 4  | NORM       |
| PULSE DELAY         | 5  | 35n-1μ     |
| VERNIER             | 6  | CCW        |
| PULSE WIDTH         | 7  | 10n-1μ     |
| VERNIER             | 8  | CCW        |
| AMPLITUDE           | 9  | 5.0-2.0    |
| VERNIER             | 10 | CW         |
| OFFSET switch       | 12 | OFF        |
| AMPLITUDE           | 13 | 5.0-2.0    |
| VERNIER             | 14 | CW         |
| OFFSET              | 16 | OFF        |
| NORM/COMPL          | 19 | NORM       |
| INT LOAD            | 20 | IN         |
| EXT WIDTH/NORM/RZ   | 25 | NORM       |

STEP INSTRUCTION

- 1 Adjust the amplitude vernier 14 for the + channel to obtain a 8 cm deflection.
- 2 Adjust the period vernier 3 to display two periods on the screen.
- 3 Measure the pulse transition times; they should be < 3.5ns.
- 4 Measure the preshoot, overshoot and ringing; they should both be < 5% of pulse amplitude.
- 5 Adjust A6C25 and A6R25 for the best compromise between overshoot and rise time.
- 6 Disconnect the scope from the positive pulse output and connect it to the negative pulse output.
- 7 Repeat steps 1 to 5 for the negative channel and adjust the pulse shape using A6C65 and A6R65.



BOARD A6

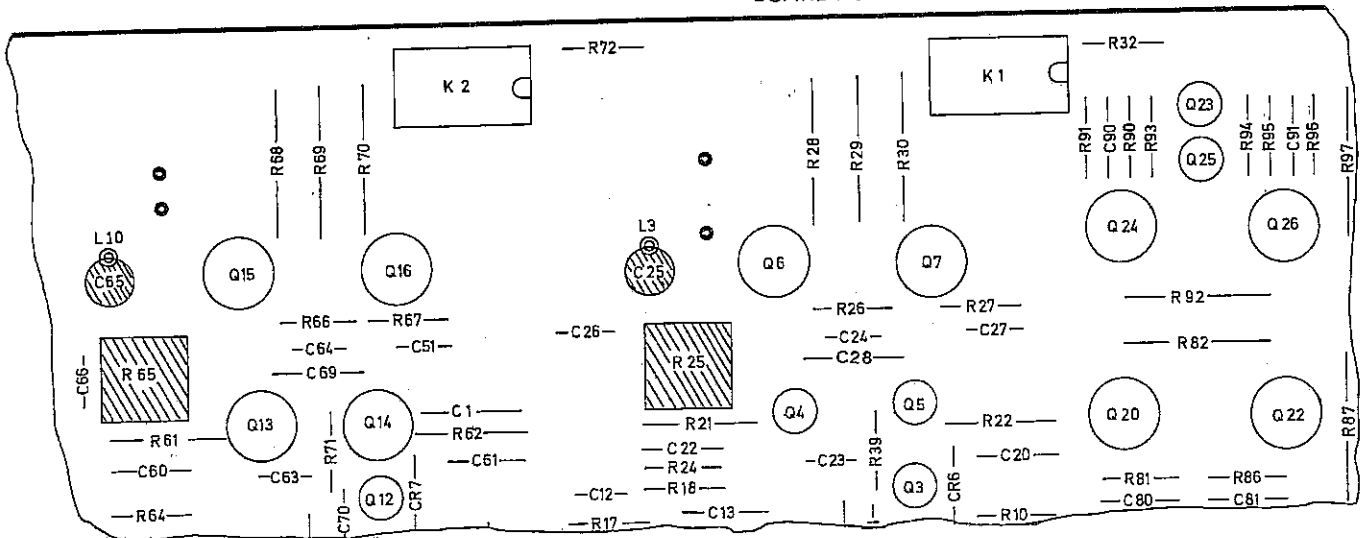
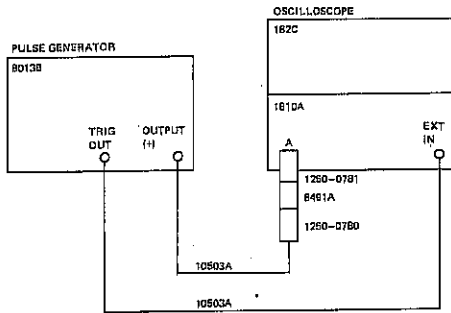




Table 5-25. Internal Checks and Adjustments - Double Pulse



INITIAL CONTROL SETTINGS

|                      |         |
|----------------------|---------|
| PULSE PERIOD 2       | 20n-1μ  |
| VERNIER 3            | center  |
| PULSE DOUBLE/NORM 4  | NORM    |
| PULSE DELAY 5        | 35n-1μ  |
| VERNIER 6            | CCW     |
| PULSE WIDTH 7        | 10n-1μ  |
| VERNIER 8            | CCW     |
| AMPLITUDE 9          | 5.0-2.0 |
| VERNIER 10           | CW      |
| OFFSET vernier 11    | -       |
| OFFSET switch 12     | OFF     |
| AMPLITUDE 13         | 5.0-2.0 |
| VERNIER 14           | CW      |
| OFFSET vernier 15    | -       |
| OFFSET switch 16     | OFF     |
| NORM/COMPL 19        | NORM    |
| INT LOAD 20          | IN      |
| EXT WIDTH/NORM/RZ 25 | NORM    |

STEP INSTRUCTION

- 1 Position the output pulse on the oscilloscope screen.
- 2 Adjust A5C45 for <math>\leq 9.5\text{ns}</math> pulse width at 50% of pulse amplitude.
- 3 Set the 8013B pulse double/norm switch to double.
- 4 Adjust PULSE DELAY VERNIER 6 to produce a first (undelayed) pulse of  $\geq 20\text{ns}$  between the pulse leading edges.
- 5 Adjust A5R188 to produce a first (undelayed) pulse of the same width as the delayed pulse (9.5ns - see step 2)

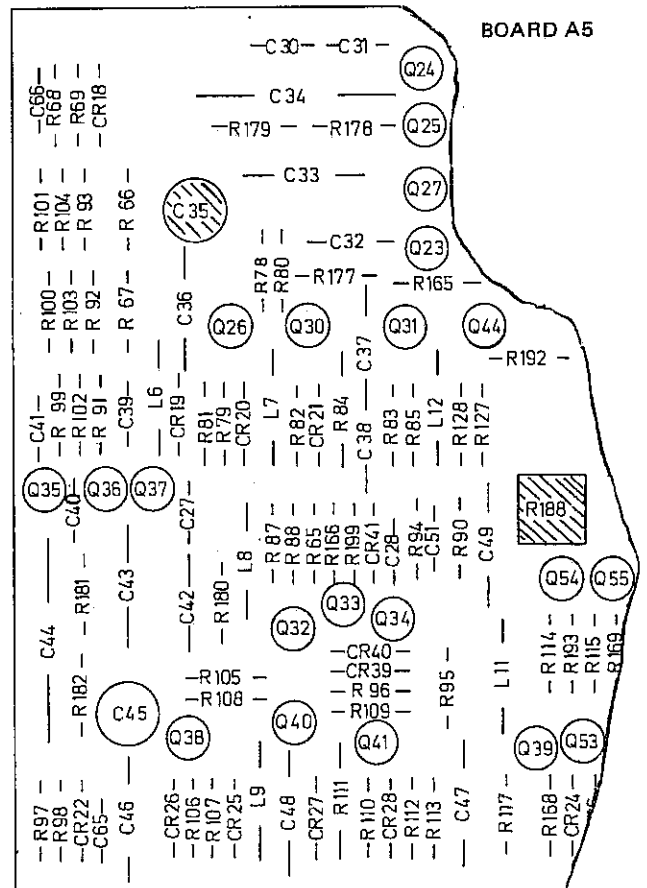
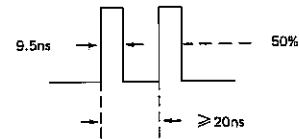
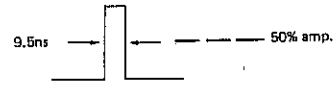


Table 5-26. Service Product Safety Check

## STEP INSTRUCTION

- | STEP | INSTRUCTION  |
|------|--|
| 1    | Visually inspect interior of 8013B for any signal 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 if the product is in warranty. Disconnect power cord from line.  |
| 2    | Check resistance from 8013B cabinet to ground pin on power plug with suitable ohmmeter. The reading must be less than one ohm. Flex the power cord while making this 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 $\perp$ . |
| 3    | Check resistance from 8013B 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 the line fuses to verify that the correct values are installed.  |
| 5    | Check that the line voltage selector is set to the customers requirements.   |
| 6    | Check that all coaxial cables and wires inside the 8013B are properly connected. Check that all boards are properly connected and that there is good thermal contact between the power supply transistors and the rear panel heat sink.  |
| 7    | Inform the responsible product division of any repeated failures in the above tests or any other safety features.  |