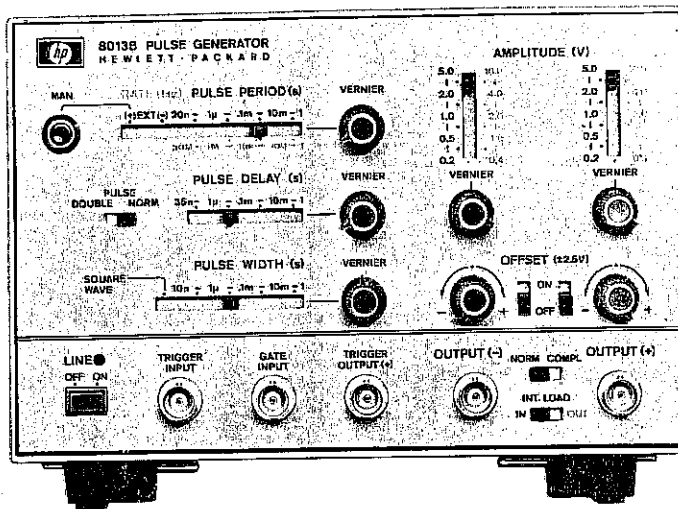


# 8013B PULSE GENERATOR



HEWLETT **hp** PACKARD



# OPERATING AND SERVICE MANUAL

## MODEL 8013B PULSE GENERATOR

### SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1441A.

For additional information about serial numbers see INSTRUMENT AND MANUAL IDENTIFICATION in Section I.

**CALIBRATION LAB**  
**INSTRUCTION MANUAL FOR**  
PULSE GENERATOR

Model #: 8013 B Date: 21 MAY 98  
Cal Tech: J. S. Clark

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## 1-1 INTRODUCTION

1-2 The 8013B is an extremely versatile, easy to operate pulse generator with a wide range of applications. It has a variable repetition rate of 0-50 MHz and transition times of  $< 3.5\text{ns}$  which make it ideal for testing digital logic: HTL, RTL, DTL and most ECL can be tested. The simultaneous positive and negative outputs are useful for testing circuits with both positive and negative power supplies. Format changes from normal to complement can be made at the throw of a switch, without having to re-adjust any pulse parameters. This enables changes from positive to negative logic conventions to be made and 100% duty cycles to be obtained very easily.

1-3 The 8013B has a selectable source impedance which makes impedance matching to the circuit under test very simple. It also has a square wave facility that is independent of width and delay settings and a double pulse facility that is useful for testing device recovery times and making noise immunity measurements.

1-4 The front panel of the 8013B has been carefully designed to provide a logical layout of the controls; horizontal controls for pulse timing parameters, vertical controls for pulse amplitude parameters. Also, compatible pulse settings are guaranteed as long as the pulse delay and pulse width controls are either set to the left of the pulse period control or; if set vertically below the period control, that the delay and width verniers are set counterclockwise of the period vernier. This simple, straightforward design enables pulses to be set up extremely quickly and easily.

1-5 The 8013B will operate in three different modes as follows:

**Normal mode:** in this mode the internal rate generator determines the repetition rate of the output pulses. The generator can be triggered internally, externally or manually or can be gated. A trigger pulse is generated for each output pulse and the pulse output can be delayed with respect to the trigger output.

**RZ mode:** in this mode external pulses are applied to the input connector on the 8013B rear panel and these pulses trigger the delay generator directly, completely by-passing the internal rate generator. Thus the internal rate generator can be used separately in this mode to provide trigger pulses that are independent of the RZ output.

**External width mode:** in this mode external pulses applied to the input socket on the rear panel determine the width and repetition rate of the output pulses. In fact the output is a pulse-shaped version of the external input. The pulse available at the trigger output, being derived from the internal rate generator, is independent of the RZ output.

Table 1-1. Specifications

**PULSE CHARACTERISTICS**

**Transition times:** 3.5ns fixed with INT LOAD switched IN. < 5ns fixed with INT LOAD switched OUT.

**Overshoot and ringing:** <  $\pm 5\%$  of pulse amplitude unless INT LOAD is switched OUT and amplitude reduced to 0.4V - 4V when it may increase to  $\pm 10\%$ .

**Preshoot:** <  $\pm 5\%$  of pulse amplitude.

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

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

**Maximum duty cycle:** > 75% from 1 Hz to 10 MHz, decreasing to  $\geq 40\%$  at 50 MHz. Up to 100% in COMPL mode.

**Maximum output:** with INT LOAD switched IN, output is 5V across 50 ohms, 10V across open circuit. With INT LOAD switched OUT, output is 10V across 50 ohms. Output circuit cannot be damaged by short circuits.

**Attenuator:** 4-step attenuator reduces output to 0.2V with INT LOAD switched IN, or to 0.4V with INT LOAD switched OUT. Vernier provides continuous adjustment within ranges.

**Polarity:** dual channel, positive and negative outputs simultaneously.

**Output format:** normal or complement selectable.

**Source impedance:** 50 ohms  $\pm 3\%$  shunted by typically 20pF with INT LOAD switched IN. > 50 ohms shunted by typically 20pF with INT LOAD switched OUT.

**DC offset:** with INT LOAD switched IN, offset is  $\pm 2.5V$  across 50 ohms and is independent of amplitude settings. With INT LOAD switched OUT, offset is automatically switched off.

**Pulse delay:** < 35ns to 1s (with respect to trigger output) in four ranges, Vernier provides continuous adjustment within ranges. Min. delay 17ns typical.

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

**REPETITION RATE AND TRIGGER**

**Repetition rate:** 1 Hz to 50 MHz in four ranges, continuous adjustment within ranges.

**Period jitter:** < 0.1% + 50ps on any rate setting.

**Square wave:** 0.5 Hz to 25 MHz in four ranges. Duty cycle 50%  $\pm 5\%$  up to 1 MHz. At 25 MHz tolerance increases to  $\pm 15\%$ .

**Double pulse:** up to 25 MHz simulating 50 MHz.

**Trigger output:** > +1V across 50 ohms, 16ns  $\pm 10$ ns wide. Suitable for triggering another 8012B/13B.

**EXTERNALLY CONTROLLED OPERATION****External Triggering**

**Repetition rate:** 0 to 50 MHz. For square wave output, frequency is divided by 2.

**Trigger input:** sinewaves > 1.7 p-p (about zero) or pulses > 0.8V either polarity with a width of > 7ns.

**Maximum input amplitude:**  $\pm 7V$ .

**Delay:** 25ns  $\pm 8$ ns between leading edge of trigger input and trigger output signals.

**Input impedance:** 50 ohms  $\pm 10\%$ , dc coupled.

**Manual:** front panel pushbutton for single pulse.

**Gating**

**Synchronous gating:** gating signal turns generator on. First trigger output pulse is coincident with leading edge of gate pulse. Last output pulse is always generated with normal width even if the gate pulse ends during the generation of the pulse.

**Gate input:** dc-coupled; voltage at open connector approx. +1.8V. Shorting current  $\leq 12$ mA. Input impedance approx. 160 $\Omega$ .



Table 1-1. Specifications (cont'd)

**Gate input signal:** voltage  $> +1.5V$  or resistor  $> 1K\Omega$  to ground enables rep. rate generator. Voltage  $< +0.8V$  or resistor  $< 160\Omega$  disables rep. rate generator. Gate input TTL compatible. Maximum input:  $\pm 5V$ .

#### External Width and RZ modes

**External width:** output pulse width determined by the width of the drive input signal. Amplitude selectable. Trigger pulses, produced by the internal rate generator, are independent of the output pulses.

**RZ mode:** external input signal switched directly to delay generator. Output pulse period determined by period of RZ input signal. Delay, width, amplitude and output formats are selectable. Trigger pulses, produced by internal rate generator, are independent of the output pulses.

**Input signal:** input impedance 50 ohms, dc coupled. Signal amplitude  $> +1V$ , maximum input  $\pm 5V$ . Width  $> 7ns$ .

#### GENERAL

**Operating temperature range:**  $0^{\circ}C$  to  $55^{\circ}C$ .

**Power:** 100/120/220/240V  $+5\%$ ,  $-10\%$ , 48 to 400 Hz, 100 VA max.

**Weight:** net 4 kg (8.8 lbs); shipping 6.5 kg (14.6 lbs).

**Dimensions:** 200mm wide, 142mm high, 330mm deep (7.9" x 5.6" x 13").

**Accessories:** 15179A Adapter frame; rackmount for two units.

## 1-6 SPECIFICATIONS

1-7 Table 1-1 is a complete list of the Model 8013B critical specifications that are controlled by tolerances. Any changes in specifications due to manufacturing, design, or traceability to the U.S. National Bureau of Standards are included in table 1-1 or on a manual change sheet included with this manual. The manual and manual change sheet (if any) supersede all previous information concerning specifications of the Model 8013B.

## 1-8 INSTRUMENT AND MANUAL IDENTIFICATION

1-9 Instrument identification by serial number is located on the rear panel. Hewlett-Packard uses a two-

section serial number consisting of a four-digit prefix and a five-digit suffix, separated by a letter designating the country in which the instrument was manufactured. (A=U.S.A.; G=West Germany; J=Japan; U=United Kingdom.)

1-10 This manual applies to instruments with a serial prefix number as shown on the title page. If changes have been made in the instrument since this manual was printed, a "Manual Changes" supplement supplies with the manual will define these changes. Be sure to record these changes in your manual. Backdating information in Section VII adapts the manual to instruments with serial numbers lower than that shown on the title page. Part numbers for the manual and the microfiche copy of the manual are also shown on the title page.