

HP 8990A Peak Power Analyzer Getting Started Guide



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Introduction

About this Book

There's a lot of power packed inside the HP 8990A Peak Power Analyzer, and we want to make sure that you get the most out of it. That's why we worked so hard to make the interface easy to use.

And that's why we'd like you to invest your time going through this *Getting Started Guide*. Whether you're a novice or experienced user, this book gives a working knowledge of the operation of the Peak Power Analyzer so you can start solving your measurement problems.

The items covered are:

- front-panel layout,
- applying power to the instrument,
- setting up the Peak Power Analyzer,
- making some measurements,
- using and interpreting the display, and
- using some other basic features.

To make this book easier to use, we have used the keycap symbol (**AUTOSCALE**) to indicate front panel keys. The actions (rotate the knob, press the **AUTOSCALE** key) are set off by bullets. The text indented under the bullets explains the action.

Introduction

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Don't worry ... we didn't try to cover every feature and function of the Peak Power Analyzer in this manual. That's the job of your *Operating Manual*.

Where to Begin?

To get the full benefit of the *Getting Started Guide*, it is recommended that you start with chapter one. However, it is possible to begin with any of the chapters. Whether you begin with chapter one or another chapter, always start at the beginning of the chapter.

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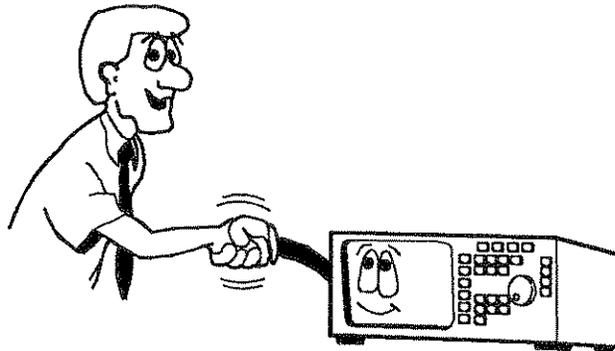
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What Is The HP 8990A Peak Power Analyzer?

Introduction

The HP 8990A Peak Power Analyzer is an accurate and easy-to-use solution for complete pulse power characterization. The Peak Power Analyzer is completely HP-IB programmable.



The Peak Power Analyzer has the following features:

- Four Channels (Two Sensor Channels and Two External Triggering/Oscilloscope Channels)
- Automatic Measurements, including User Defined Measurements and Statistics Capability
- Dual Timebase Windowing
- Advance Logic Triggering
- Visibility of signal events prior to trigger
- Autoscale for Automatic Setup
- Waveform Math (+, -, ÷, vs, only)
- Measurement Limit Test

**What Is The HP 8990A
Peak Power Analyzer?**

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- 4 Nonvolatile Waveform Memories
- 4 Nonvolatile Set-up Memories
- 2 Volatile Pixel Memories
- Full HP-IB Programmability
- Instant Hardcopy Output

Complete specifications and characteristics are listed in Section 1 of the *Operating Manual*.

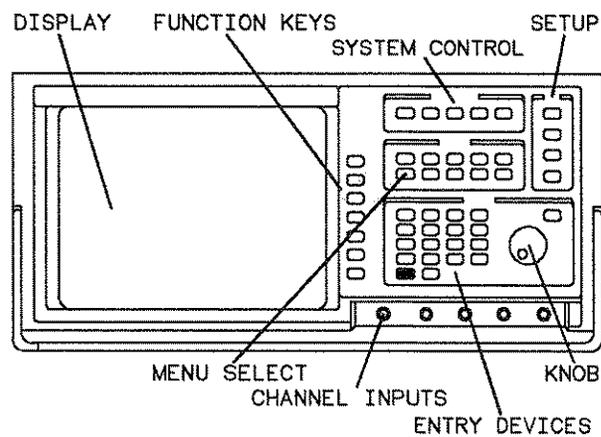
Layout and Setup

Front Panel Layout

The HP 8990A Peak Power Analyzer front panel is organized into six functional areas:

- SYSTEM CONTROL
- SETUP
- ENTRY
- MENUS
- DISPLAY and FUNCTION KEYS
- INPUT

Each of these sections are discussed in detail in the *Operating Manual*.



Layout and Setup

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Typical front panel operation consists of these three main steps:

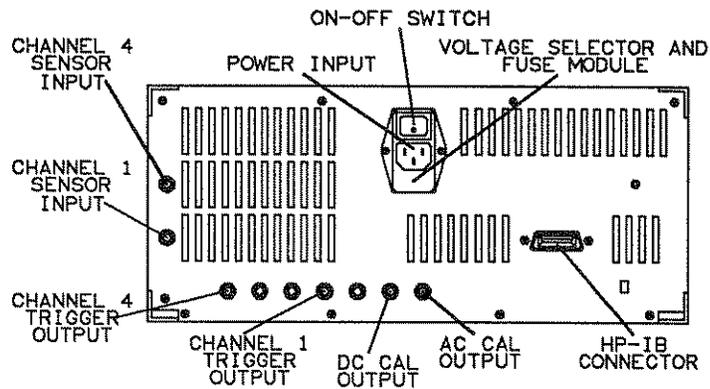
- select a menu (MENU Select),
- select a function (FUNCTION keys),
- enter a numeric value (ENTRY devices).

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Layout and Setup

Rear Panel Layout

The rear panel of the instrument contains the power input, voltage selector module, power switch, calibration outputs, triggering outputs, and HP-IB connector.



Start Up

Complete installation instructions are found in Section 2 of the *Operating Manual*.

Connecting Power

To ensure safe operation, the following items should be checked before power is applied to the instrument:

- Before connecting the instrument to an ac power source, ensure that the line voltage selector module is installed for the correct voltage. On the voltage selector module, the correct voltage selection must be at the bottom.
- Make sure that the power cord supplied with the Peak Power Analyzer provides chassis ground for the instrument when it is plugged into the power receptacle.

Applying Power

After the power cord has been connected to the instrument and appropriate power source, set the rear-panel power switch to 1 (0 indicates OFF and 1 indicates ON).

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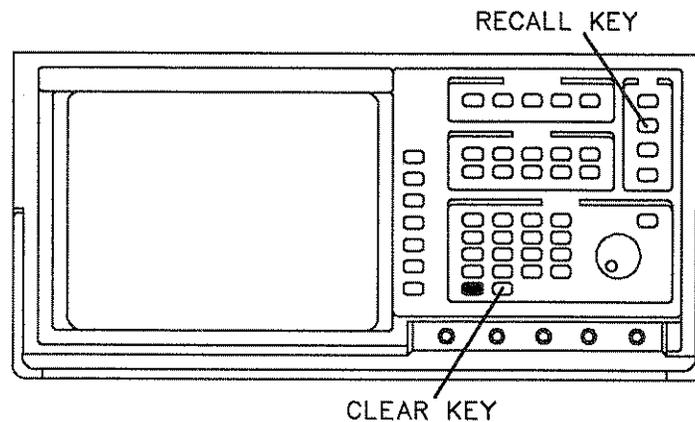
Layout and Setup

Resetting the Instrument

The Peak Power Analyzer stores all settings in nonvolatile memory when power is removed or turned off. These settings are recalled on power-up. In order to get all settings and keys to a known starting position for the following procedures, the first thing you will do is reset the instrument.

- Press the front panel **RECALL** key and then the **CLEAR** key.

The **RECALL** key is in the setup section. The **CLEAR** key is with the numeric keypad.



Layout and Setup**HP 8990A**

Listed below are some of the default settings which occur after a reset. The settings may be verified by selecting the appropriate menu:

Timebase MenuTime/division—100 μ s/division

Delay—0.0 s

Reference—cntr

Window—off

Chan/Vert Menu

Channel—1, on (When a sensor is connected.)

Scale—1.00 mW/division

Bandwidth—auto

External Loss—0 dB

Trig Menu

Mode—Auto

Trigger—Edge

Source—Channel 1

Level—0 Watts

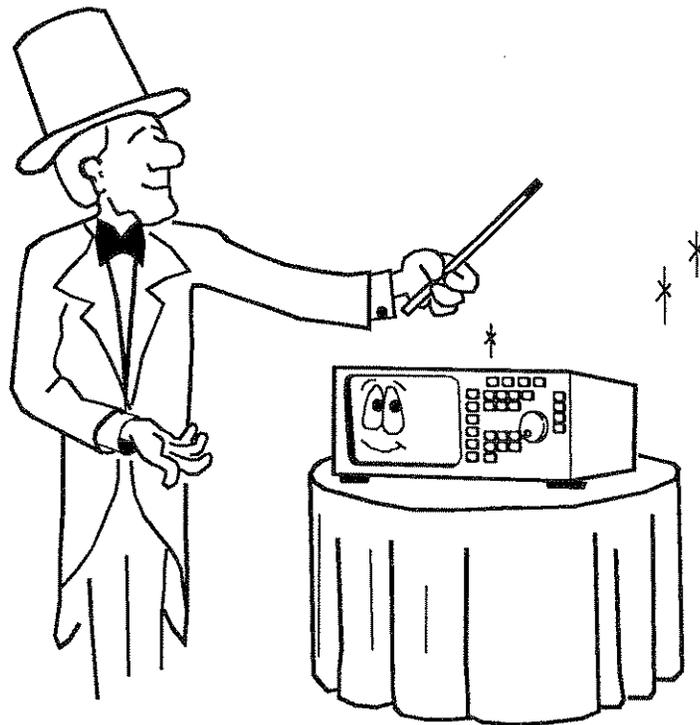
Slope—Positive

Holdoff—40.00 ns

3

Instant Setup

In this chapter you will learn how to do a basic HP 8990A Peak Power Analyzer setup. You can setup the Peak Power Analyzer either automatically or manually. Generally, the automatic setup is used on an unknown signal or signals, and then adjusted (fine tuned) manually.



Autoscale

Autoscale automatically finds, scales, and displays the input waveform.

In the following example, the Sensor Check Source is used to demonstrate the autoscale feature.

- Press the **UTIL** menu key.
- Press the **check source** function key until **pulse** is highlighted.

This turns on the Sensor Check Source. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

Once turned on, the Sensor Check Source will stay on until turned off.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the sensor being used, an adapter may be needed to make the connection to the Sensor Check Source.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until **on** is highlighted.

Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

- Press the **AUTOSCALE** key.

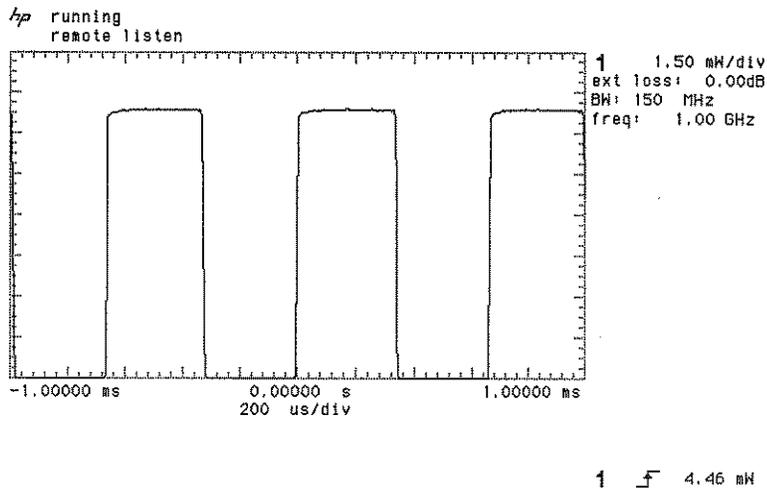
The waveform is now displayed. Notice the channel settings and trigger information on the right edge of the display.

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Instant Setup

Note

The waveform seen on your Peak Power Analyzer may appear slightly different from the waveform shown. The difference is due to the manner in which Autoscale displays the waveform.

**Carrier Frequency**

In order to achieve optimum measurement accuracy, the carrier frequency should be entered into the Peak Power Analyzer before a measurement is made. The **CARRIER FREQ** menu is used to enter this information. The carrier frequency may be entered for one channel or for both channels.

- Press the **CARRIER FREQ** menu key.
- Press the top function key to select whether the frequencies seen at channels 1 and 4 are the same or different.

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- Enter the frequency of interest.

Use the numeric keypad or the knob.

If the keypad is used, the entry must be terminated with a suffix: MHz, GHz.

Vertical Setup

The following example describes the vertical setup for sensor channels 1 and 4 and then for external trigger channels 2 and 3. Channels 2 and 3 also have limited oscilloscope capability.

Channels 1 and 4**Note**

The vertical sensitivity units for channels 1 and 4 can be either in watts or dBm. The **DISPLAY** menu is used to access the function that changes the display to linear or log mode. The following example assumes the units are in watts (linear). The Analyzer defaults to linear mode after a reset or after using autoscale.

The Sensor Check Source is used in the following example to demonstrate the vertical setup.

- Press the **CHAN/VERT** menu key.

The channel/vertical menu is displayed along the right edge of the display and **scale** is the active function (displayed in full-bright inverse video).

- Rotate the knob slowly.

The watts/division changes in a 1, 2, 5 sequence, and the waveform amplitude on the display changes. The value increases for a counter-clockwise rotation and decreases for a clockwise rotation.

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Instant Setup

When the watts/division is changed, it is normal for the waveform to disappear. There will be a short delay before the waveform reappears.

- Press the **FINE** key.

- Rotate the knob slowly.

The watts/division changes in finer steps and the waveform amplitude on the display changes.

- Enter 5 mwatts.

Press **5**, **mW** keys in order. The unit key completes the entry.

The watts/division changes, and the waveform amplitude on the display changes.

- Press the **channel off/on** function key.

Turn channel 1 display off.

The dot below the channel selection changes from inverse video to an outlined dot. This indicates that the channel is turned off.

- Press the **channel off/on** function key again.

Turn the channel 1 display back on, and the dot becomes an inverse video display.

Channels 2 and 3

The following example demonstrates the vertical setup of channels 2 and 3 using the ac calibrator output on the rear panel of the Analyzer.

- Disconnect the peak power sensor from the Peak Power Analyzer.
- Using a BNC cable, connect the ac calibrator output, on the rear panel of the Analyzer, to channel 2 on the front panel. The ac calibrator signal is a 1.5 kHz square wave.

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- Press **AUTOSCALE**.
The waveform is now displayed.
- Press the **CHAN/VERT** menu key.
The volts/division is available to change.
- Press the **FINE** key to turn it off.
- Rotate the knob slowly.
The volts/division changes, and the waveform amplitude on the display changes.
- Enter 250 mV.
Press **2**, **5**, **0**, **mV** keys in order. The unit key completes the entry.
The volts/division changes, and the waveform amplitude on the display changes.
- Press **channel off/on** function key.
Turn channel 2 display off.
The dot below the channel selection changes from inverse video to an outlined dot. This indicates that the channel is turned off.
- Press the **channel off/on** function key again.
Turns the channel 2 display back on, and the dot becomes an inverse video display.

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Instant Setup

Timebase Setup

Setting the Timebase

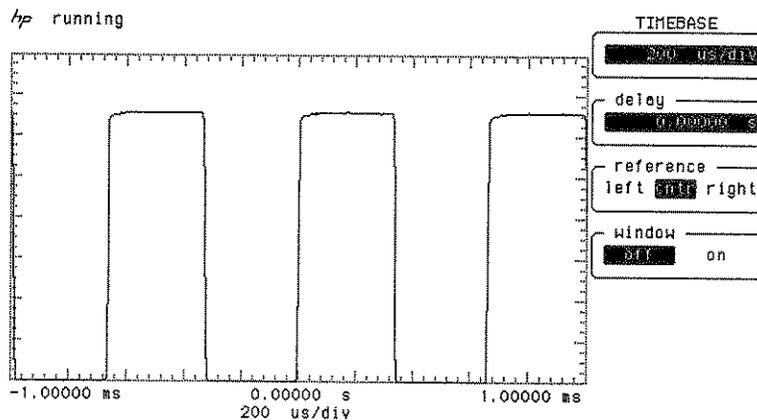
Setting the timebase displays the signal at different time/division settings.

In the following example, the Sensor Check Source is used to demonstrate the timebase setup.

- Disconnect the BNC cable from the channel 2 input.
- Reconnect the peak power sensor to the Peak Power Analyzer.
- Press **AUTOSCALE**.
- Press the **TIMEBASE** menu key.

The displayed menu changes to the timebase menu.

The selected function is time/division (top key in menu, displayed in full bright).



- Rotate the knob.

The time/division changes in a 1, 2, 5 sequence as the knob is rotated.

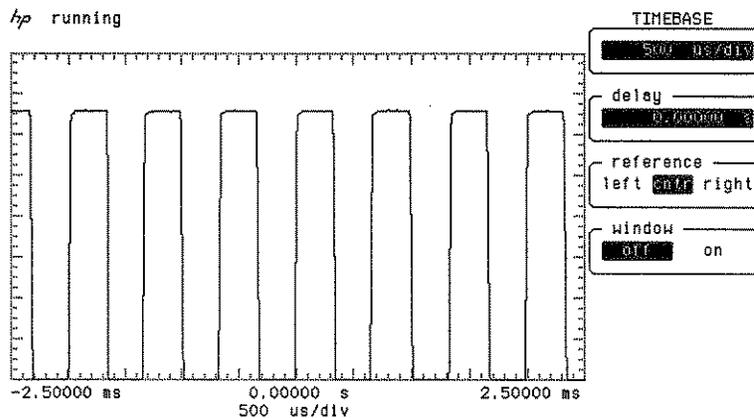
Instant Setup

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- Enter 500 μ s.

Press 5, 0, 0, μ s keys in order.

When using the keypad, press a suffix key (s, ms, μ s, or ns) to complete the entry.



Timebase Windowing

The timebase window function is similar to the dual timebase in analog oscilloscopes. This function allows you to zoom-in on a specific area of the waveform (top half of the screen) and display it (bottom half of the screen) with more accuracy and detail. The display can contain up to four main sweep waveforms and four timebase window waveforms, while using two sweep speeds.

This procedure uses the timebase window function to measure the pulse width of the Sensor Check Source.

- Press the **window** function key until **on** is selected.
- Press the window **timebase** function key.
- Rotate the knob to display an entire pulse segment.
- Press the window **position** key.

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Instant Setup

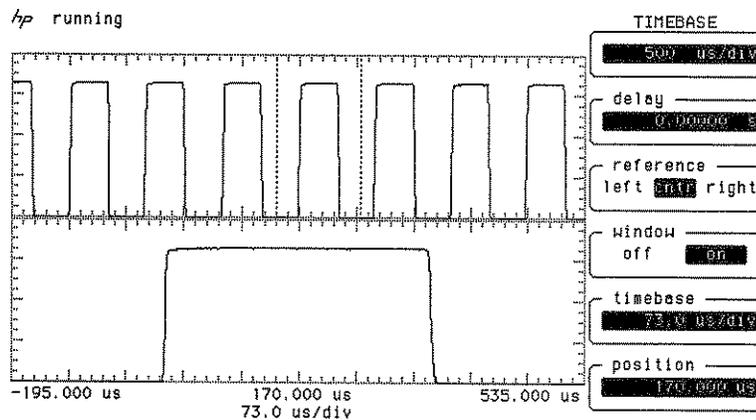
- Rotate the knob.

Position the window markers around one pulse segment of the main sweep.

While the window position value changes, the expanded pulse moves horizontally in the lower (windowed) display.

The **window position** and **window timebase** should be chosen to display the pulse segment.

All waveform information displayed is based on the windowed waveform.



Making Measurements in the Window

- Press the **SHIFT** (blue) entry key.
Selects the measurement functions.
- Press the **PULSE WIDTH [1]** entry key.
Tells the instrument which measurement to make.
- If **c#** is not displayed next to “pulsewidth” in the lower part of the display, use the knob to select **c#**.
- Press the **1** entry key.
Selects channel 1 as the measurement source.

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Read the measurement results at the bottom of the display.

- Press the **window** function key until **off** is selected.

Chapters 4 and 5 have more information about making automatic and manual measurements on the displayed waveform.

Trigger Setup

The Peak Power Analyzer can be triggered internally through channels 1 and 4 or externally through channels 2 and 3.

The following example demonstrates internal and external triggering of channel 1. The Sensor Check Source supplies the pulsed signal to channel 1, and the rear panel ac calibrator is used to provide the pulse drive signal to trigger channel 1 externally.

Note

For signals > -30 dBm, internal triggering of channels 1 and 4 has a minimum triggerable sensitivity of 25% of full scale and a bandwidth of dc to 1 MHz. At some vertical sensitivities, the Channel Menu low bandwidth setting may have to be used to achieve this minimum triggerable level. External triggering through channels 2 and 3 offers a bandwidth of dc to 100 MHz. Minimum sensitivities are 200 mV from dc to 1 MHz and 500 mV from 1 MHz to 100 MHz.

The minimum triggerable pulse width for channels 2 and 3 is 7 ns. Trigger quality for channels 1 and 4 degrades for pulses narrower than 500 ns.

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Instant Setup

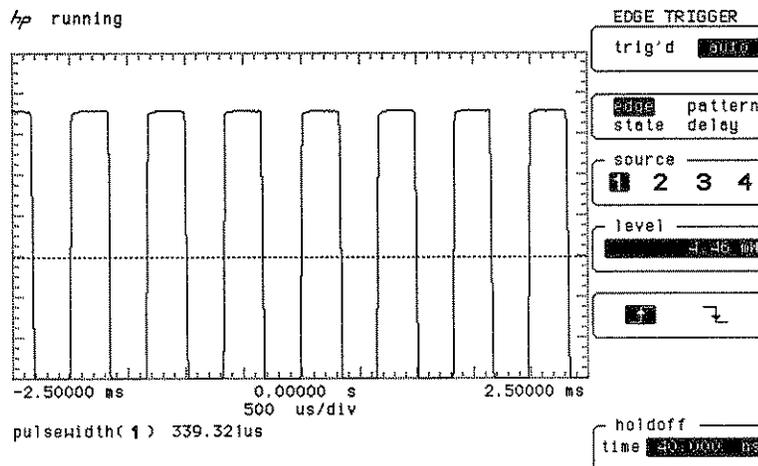
Internal Triggering

The Analyzer can be set to trigger at the desired threshold level with the trigger level function.

- Press the **TRIG** menu key.

The trigger menu is displayed on the right edge of the display.

The **level** function is selected (full-bright).



- Rotate the knob.

As the knob is turned the trigger level value changes.

The trigger level is represented by a horizontal dotted line that moves up and down as the knob is turned.

Triggering should occur with the horizontal dotted line positioned within the displayed pulse.

- Set the trigger level to 6 mW.

Enter this value with the keypad.

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External Triggering

- Connect a BNC cable to the ac calibrator output, on the rear panel, and to channel 3 on the front panel.
- Press the **CHAN/VERT** menu key.
- Press the top function key until **3** is highlighted.
- Press the second function key until **on** is highlighted.

Channels 1 and 3 are now on.

- Press the **DISPLAY** menu key.
- Press the **# of screens** function key until **2** is highlighted.

Two screens are displayed. Channel 1 is displayed in the upper screen, and channel 3 is displayed in the lower screen.

- Press the **TRIG** menu key.
- Press the **source** function key until **3** is highlighted.

This selects channel 3 as the source for external triggering.

- Rotate the knob.

As the knob turns the trigger level value is changed.

Triggering should occur when the horizontal dotted line is positioned within the displayed channel 3 pulse.

- Select the **DISPLAY** menu, and reset the number of screens to 1.
- Select the **CHAN/VERT** menu and turn channel 3 off.
- Disconnect the BNC cable from channel 3.
- Select the **TRIG** menu key.
- Select channel 1 as the trigger source.

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Instant Setup

The Show Key

The show key allows quick access to the most complete and detailed instrument setup information. The following example demonstrates how the show key operates:

- Press the **SHOW** key.

This key is located on the right of the Analyzer in the SETUP section.

Channel and trigger setup information are displayed.

- Press the **SHOW** key.

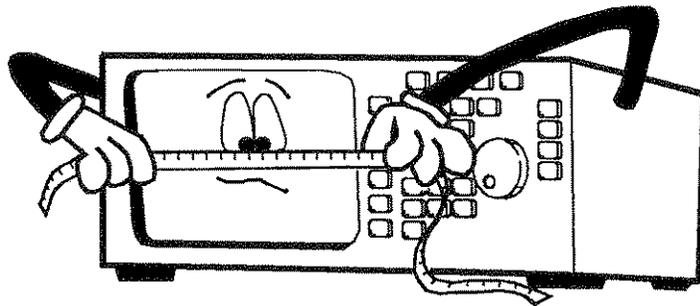
To return to the trigger menu.

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4

Making Automatic Measurements

There are 16 parametric measurements that the HP 8990A Peak Power Analyzer can make automatically. These measurements are made with preset (standard) measurement definitions or by user defined measurement thresholds. This chapter performs measurements using the standard measurement definitions. For more information on user defined measurements, refer to the Define Measure Menu chapter of the *Operating Manual*.



Making Automatic Measurements

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Note

When making a measurement, manual calibration of the Peak Power Analyzer and the peak power sensor is not required. The sensor contains an EEPROM with the necessary calibration data to characterize the sensor. The sensor supplies the Peak Power Analyzer with the calibration data when connected to Analyzer.

Periodically, the Analyzer measures the temperature of the sensor and adjusts the calibration data accordingly to maintain accurate measurements. Automatic adjustment of calibration data is specified over a sensor temperature range of 0° to 55°C.

For maximum accuracy, calibration of the Peak Power Analyzer should be performed only if the temperature of the Peak Power Analyzer (not the sensor) has changed significantly. The accuracy error for every degree Celsius deviation from the last calibration is 0.15%/deg. C (0.006 dB/deg. C). The vertical calibration procedure which performs this calibration is explained in the Utility Menu section of the *Operating Manual*.

Making the Measurements

This exercise measures the pulse repetition frequency (PRF) and peak power of the displayed waveform.

Signal Setup

- Press the **UTIL** menu key.
- Press the **check source** function key until **pulse** is highlighted.

This turns the Sensor Check Source on. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the peak power sensor being used, an adapter may be needed to make this connection.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until **on** is highlighted.

Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

The Measurement

- Press **AUTOSCALE**.

To display and trigger the signal from channel 1.

- Press the **SHIFT** (blue) entry key.

To select the alternate (blue letter) functions of the keypad.

Making Automatic Measurements

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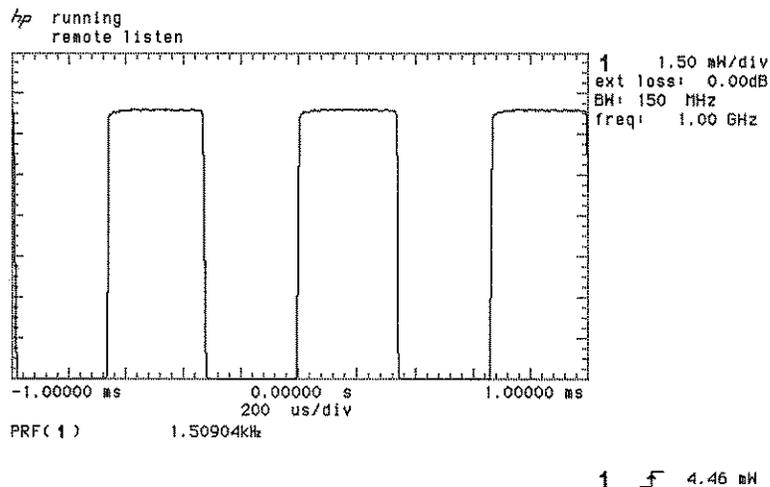
- Press the **PRF** [6] (pulse repetition frequency) entry key.

Selects pulse repetition frequency as the measurement to be made.

At least one complete cycle of the signal must be displayed.

- Press the **1** entry key to select channel 1 as the measurement source.

The result of the pulse repetition frequency measurement is displayed as shown in the figure below.



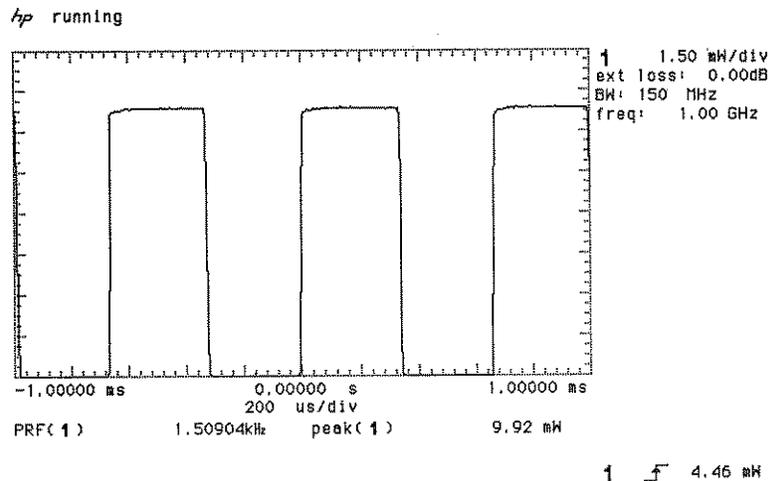
- Press the **SHIFT** key.
Selects the measurement functions.
- Press the **PEAK** [7] entry key.
To select peak power as the measurement.
- Press the **1** entry key.

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Making Automatic Measurements

To select channel 1 as the measurement source.

Time and amplitude markers will be displayed showing where the measurement was made if continuous measurements are turned off. Refer to the Define Measure Menu in the *Operating Manual* for more information about single and continuous measurements.



■ Read the measurement results.

Measurement results are displayed at the bottom of the screen. Up to eight measurements can be displayed at a time. If another measurement is made after the screen is full, it is placed on the bottom display line, and the top set of measurements is erased from the screen.

Clearing the Measurements

This portion of the exercise shows how to eliminate the measurements from the display.

- Press the **SHIFT** (blue) entry key, and then the **CLEAR** entry key.

All measurement results are erased from the display.

Measuring Other Sources

Measurements can also be made on a waveform that is stored in waveform memory or on the results of a mathematical waveform function. The following few steps describe how other sources are selected for a measurement:

- Press the **SHIFT** entry key, and then the **PEAK [7]** entry key.

At this time the measurement source prompt is **c#** (for channel number).

- Rotate the knob slowly.

The measurement source prompt cycles through **m#**, **f#**, and **c#**.

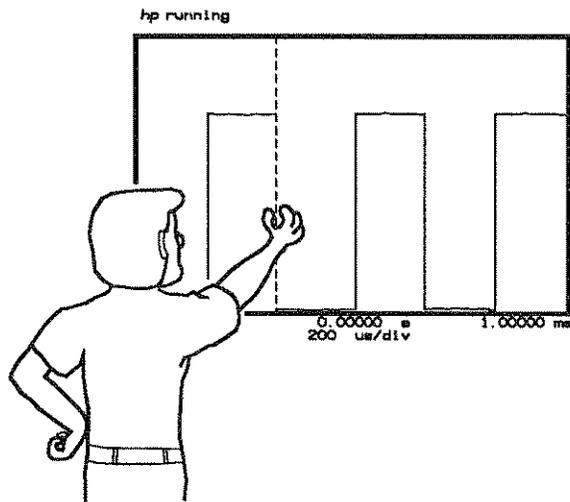
When **m#** is selected, a waveform memory number can be selected as the measurement source, and when **f#** is selected, a waveform function number can be selected as the measurement source.

- Press the **SHIFT** (blue) entry key.

This cancels the measurement.

Making Manual Measurements

Two sets of markers (cursors) are available on the HP 8990A Peak Power Analyzer to make manual time and amplitude measurements. The Analyzer also has the capability of making amplitude at time measurements. This chapter will explain how to make amplitude, time, and amplitude at time measurements using the markers



Making an Amplitude Measurement

Amplitude measurements are made with a pair of amplitude markers to determine 1 or 2 specific amplitude points on a waveform.

The Analyzer automatically calculates the difference between the two markers and displays that difference as the delta amplitude value.

The following example uses the Sensor Check Source to demonstrate how to make an amplitude difference measurement.

Signal Setup

- Press the **UTIL** menu key.
- Press the **check source** function key until **pulse** is highlighted.

This turns on the Sensor Check Source. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the peak power sensor being used, an adapter may be needed.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until **on** is highlighted.

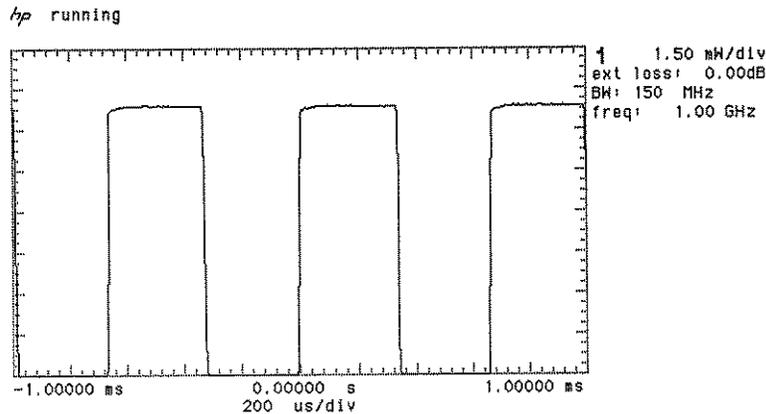
Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

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Making Manual Measurements

The Measurement ■ Press the **AUTOSCALE** key (or set up the channel display manually).

Displays and triggers the waveform.



1 \mathcal{F} 4.62 mV

- Press the **MKRS** menu key.
 - Selects the amplitude and time markers.
 - The amplitude and time markers are off by default.
 - Turn the time markers off if they are on.
- Press the **ampl markers** function key, and select **on** to enable the two markers.
- Press the **marker 2** function key.
 - The selected function (intensified display) toggles between the **marker 2 source** and the **marker 2 amplitude**.
- Select the **marker 2 source** function, and slowly rotate the knob clockwise.

Making Manual Measurements

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The selected source changes.

As the knob is rotated, all sources are displayed one at a time (channels, waveform memories, and waveform functions).

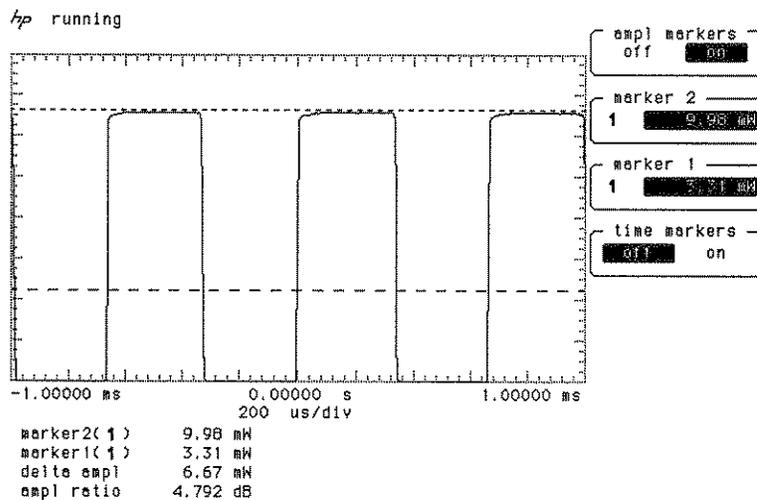
- Set the **marker 2** source to 1 (channel 1) using the knob.
- Press the **marker 2** function key to select the marker 2 **amplitude** level.
- Rotate the knob.

Place marker 2 at the top of the waveform.

- Read the amplitude at marker 2.

The actual amplitude at marker 2 with respect to the reference is displayed as “marker2(1) ≈10 mW.”

The number in parentheses is the source for the measurement.



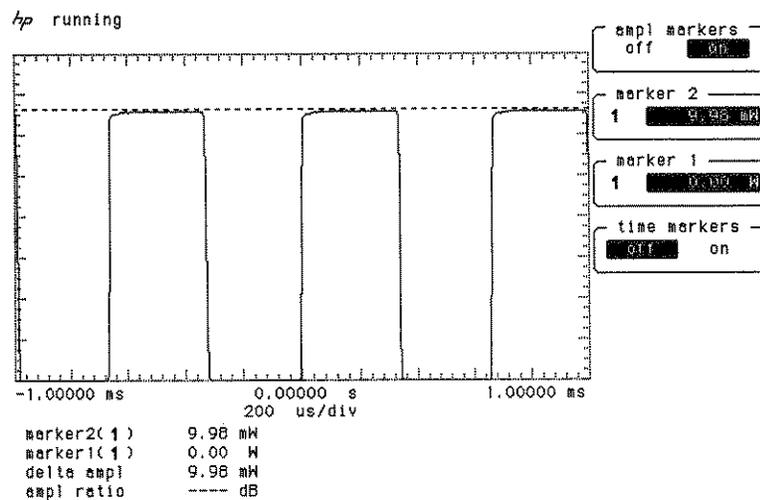
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Making Manual Measurements

- Ensure the **marker 1** source is set to 1 (channel 1).

This key also toggles between a measurement source and an amplitude level.

- Press the **marker 1** function key to select the marker 1 amplitude.
- Rotate the knob until the marker is at the bottom of the waveform.



- Read the amplitude at marker 1.
marker1 (1) \approx 0 W.
- Read the amplitude difference between marker 1 and marker 2.

The amplitude difference value is the *delta ampl* reading at the bottom of the display.

The ratio of marker 2 to marker 1 is the *ampl ratio* reading below *delta ampl*.

Making Manual Measurements

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For more information about setting and using the amplitude markers, refer to the MARKERS MENU section in the *Operating Manual*.

Making a Time Interval Measurement

Time interval measurements are made with one or both of the time markers to determine the relationship of a specific point on a waveform to the trigger point. The Analyzer also automatically calculates the time difference between the two markers. The “delta t” calculation is always made by subtracting the time at the “start marker” from the time at the “stop marker.” Therefore, it is possible to obtain negative time readings on “delta t” if the “stop marker” is placed on the display before the “start marker.”

After an Autoscale, the trigger point is displayed at the center of the display. When a time marker is placed on the left half of the display the time for that marker is negative, indicating that it is before the trigger. Any marker to the right of the trigger point is after the trigger time, and thus its reading is positive. The reference for the display (trigger point) can be changed to left, cntr (center), or right of the display in the TIMEBASE menu.

Making a Pulse Repetition Interval Measurement

The following procedure manually measures the pulse repetition interval (PRI) of a complete cycle of the Sensor Check Source.

- Turn the amplitude markers off.
- Press the **time markers** function key to turn on the time markers.
- Press the **start marker** function key.

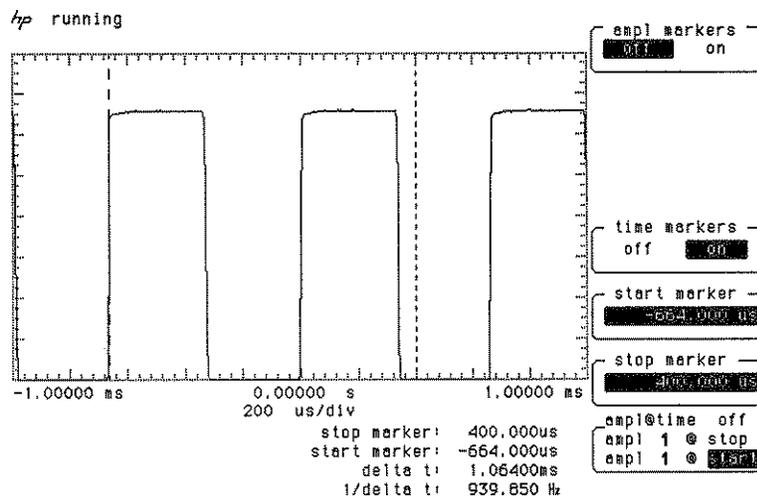
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Making Manual Measurements

The start marker is now controlled by the ENTRY devices. Full-bright inverse video indicates a function is selected.

- Rotate the knob.

Set the start marker on the first displayed rising edge.



- Press the **stop marker** function key.

Selects the stop marker as the active function.

- Rotate the knob.

Place the stop marker on the second displayed rising edge.

- Read the start marker time, stop marker time, and delta t time.

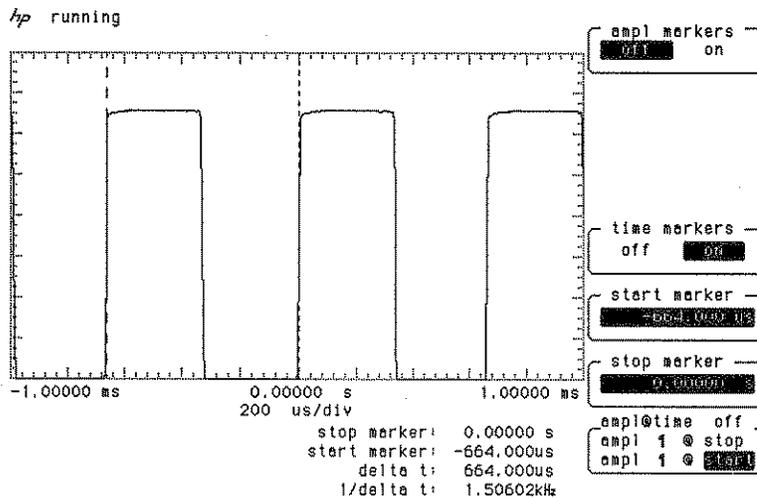
The delta t value is the time at the stop marker minus the time at the start marker. The delta

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t value is the pulse repetition interval of the waveform.

The $1/\Delta t$ reading displays the corresponding pulse repetition frequency of the measured pulse repetition interval.



Making an Amplitude at Time Measurement

The Analyzer has the capability of making amplitude measurements at specific points on the waveform. The time markers are used for this measurement. The amplitude is displayed for the start and stop markers, and from this information, delta and ratio values are calculated. The amplitude at time function can be used with timebase windowing.

The following example uses the Sensor Check Source to demonstrate the amplitude at time feature.

- Press the **apml@time** function key until the upper right box is highlighted. Turn the knob until **on** appears.

This turns the amplitude at time function on.

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- Press the **ampl@time** function key until the next area is highlighted.

This area selects the source for the measurement.
The source can be channels 1 through 4, memories 1 through 4, or functions 1 or 2.

- Turn the knob until 1 appears in the highlighted area.
- Press the **ampl@time** function key again until the next area is highlighted.

This area selects the marker, either start or stop.

- Turn the knob until **start** appears.
- Press the **ampl@time** function key again.

This area selects the source for the measurement

- Turn the knob until 1 appears in the highlighted area.
- Press the **ampl@time** function key again.

This area selects the marker, either start or stop.

- Turn the knob until **stop** appears.
- Press the **start marker** function key.

This enables the time start marker.

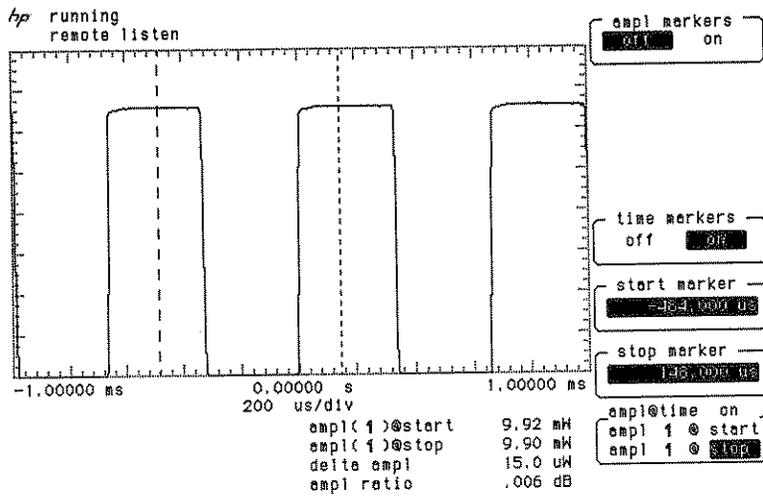
- Use the knob to position the start marker at the desired position on the waveform.
- Press the **stop marker** function key.

This enables the time stop marker.

- Place the stop marker at the desired position on the waveform.

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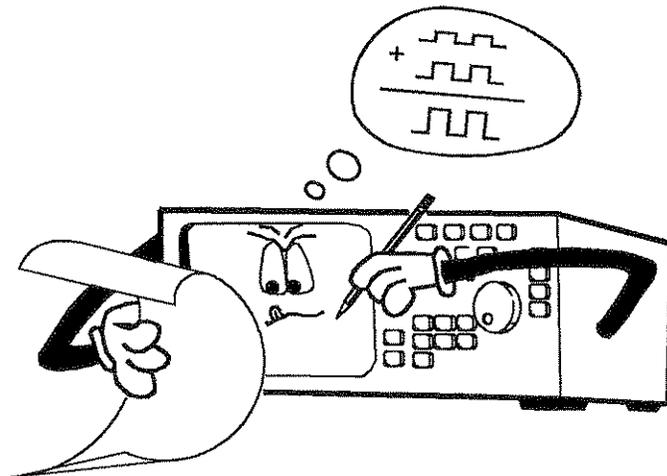
- The amplitude at each time marker is at the bottom of the display. The Analyzer also calculates the delta amplitude and amplitude ratio.
- Turn the time markers off.

Waveform Math

The Waveform Math menu allows you to define one or two functions. The functions are used on data that is displayed on screen from any of the four channels or from any of the four waveform memories.

A function is generated by mathematically manipulating one or two operands with known operations. The mathematical operations employed by the Analyzer are:

- plus (+)
- minus (-)
- divide (\div)
- versus
- only



Using Waveform Math

Using the Sensor Check Source, the following exercise demonstrates the addition of two waveforms.

Signal Setup

- Press the **UTIL** menu key.
- Press the **check source** function key until **pulse** is highlighted.

This turns on the Sensor Check Source. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the peak power sensor being used, an adapter may be needed.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until **on** is highlighted.

Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

The Exercise

- Set the Analyzer to display a waveform.
Press **AUTOSCALE**.
When autoscale is finished, it may be necessary to adjust the timebase and vertical sensitivity.
- Press the **WFORM MEMORY** menu key.
Selects the waveform memory menu.
- Select **waveform** with the **waveform/pixel** function key.

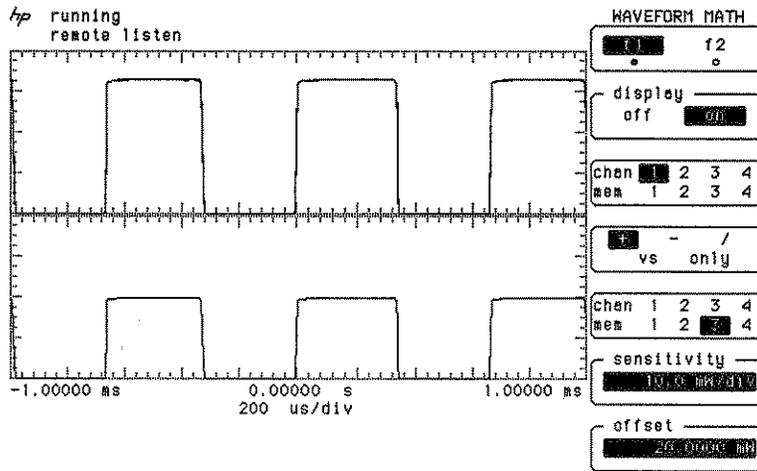
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Waveform Math

- Press the **nonvolatile** function key, and select memory 3 (**m3**).
- Press the **display** function key until **on** is highlighted.
- Press the **source** function key.
Select 1 (channel 1).
This selects the channel 1 waveform to be stored.
- Press the **store** function key.
The channel 1 waveform is now stored in nonvolatile memory.
- Press the **WFORM MATH** menu key.
- Press the **display** key until **on** is highlighted.
This key allows the function to be viewed.
- Press the third function key and select **chan 1**.
This selects channel 1 as the first operand
- Press the fourth function key until plus (+) is highlighted.
This causes the two operands to be added together.
- Press the fifth function key until **mem 3** is highlighted.
This selects memory 3 as the second operand.
Both operands are displayed in the top screen.
Since they have the same amplitude and pulse repetition interval, it looks as though there is only one waveform.
The addition of the two operands (channel 1 and memory 3) is shown at the bottom of the display.
The vertical sensitivity of the function is set with the **sensitivity** softkey.

Waveform Math

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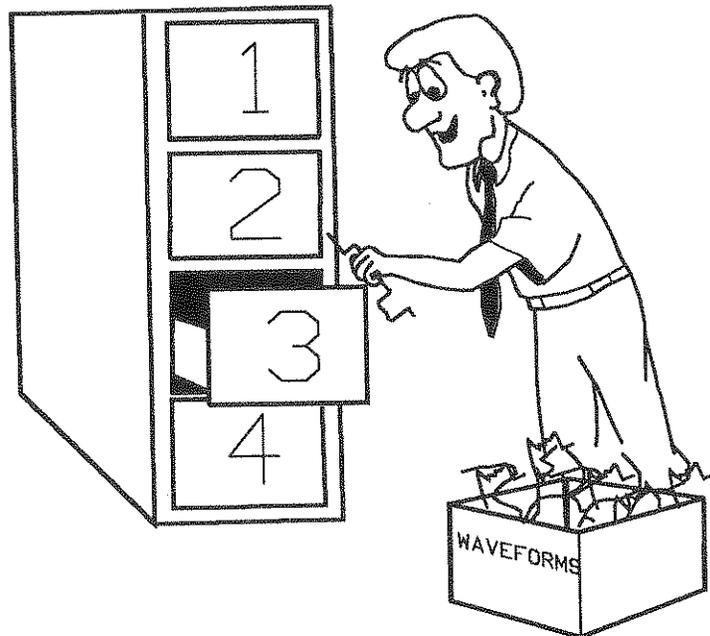


Since the amplitude of each operand is ≈ 10 mW.
Using the sensitivity of the function, it can be seen
that the function is ≈ 20 mW.

- Press the **display** function key until **off** is highlighted.
- Press the **WFORM MEMORY** menu key.
- Press the **display** function key until **off** is highlighted.

Storing Setups and Waveforms

The HP 8990A Peak Power Analyzer stores and recalls up to four front-panel setups and four waveforms in nonvolatile memories. These procedures will teach you how to save and recall front-panel setups and waveforms.



Storing Front-Panel Set Ups

Using the Sensor Check Source, the following example demonstrates how front panel settings are stored.

Signal Setup

- Press the **UTIL** menu key.
- Press the **check source** function key until **pulse** is highlighted.

This turns on the Sensor Check Source. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the peak power sensor being used, an adapter may be needed.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until **on** is highlighted.

Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

The Example

- Set the Analyzer to display the waveform.
Use **AUTOSCALE** for ease.
- Press the **SAVE** key (SETUP area) and then the 4 key.

This saves the current front-panel setup in SAVE/RECALL register number 4. There are four SAVE/RECALL memories numbered 1 through 4. Any one can be selected.

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Storing Setups and Waveforms

- Change some front-panel settings.

For example, change the time/division in the TIMEBASE menu and the scale in the CHAN/VERT menu.

- Press the **RECALL** key, and then the 4 key.

The instrument returns to the set up that was saved. The SAVE/RECALL registers save all front-panel selections and settings. The recall will not cause any actions to take place. For example, when a front-panel setting is recalled, it cannot initiate a measurement.

Storing a Waveform

In the following example, the Sensor Check Source supplies the signal. The waveform is stored, and then the vertical setting is changed. The stored waveform is recalled and compared to the currently displayed waveform.

- Press the **WFORM MEMORY** menu key.

Selects the waveform memory menu.

- Select **waveform** with the **waveform/pixel** function key.

- Press the **nonvolatile** function key, and select memory 3 (**m3**).

- Press the **source** function key.

Select 1 (channel 1).

This selects the channel 1 waveform to be stored.

- Press the **store** function key.

The channel 1 waveform is now stored in nonvolatile memory.

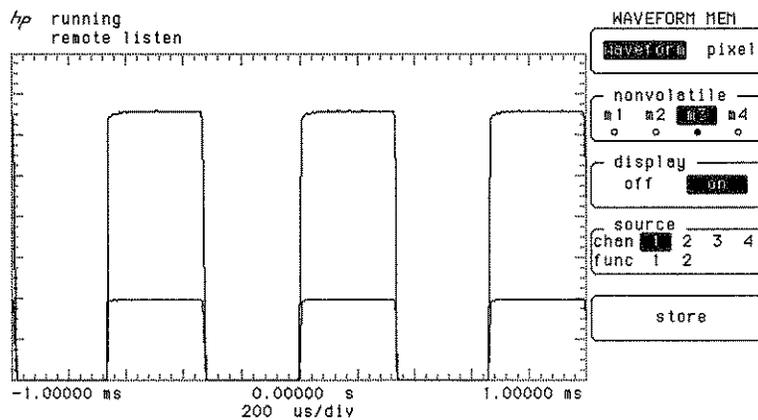
Storing Setups and Waveforms

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- Press the **CHAN/VERT** menu key.
- Rotate the knob to change the vertical sensitivity.
This step changes the currently displayed waveform to make it easier to tell the difference between it and the stored waveform.
- Reselect the **WFORM MEMORY** menu.
- If **nonvolatile m3** is not selected, select it at this time.
- Press the **display** function key until **on** is highlighted.

The memory 3 (m3) waveform is displayed.

At this time, two waveforms are displayed, the one that has the scale changed is the current waveform (displayed in fullbright) and the other the stored waveform (displayed in halfbright).



To see the stored waveform better, select the **CHAN/VERT** menu.

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Storing Setups and Waveforms

Press the second function key until **off** is highlighted. This turns channel 1 off.

- Select the **WFORM MEMORY** menu key.
- Turn the **display off**.
- Turn channel 1 back on.

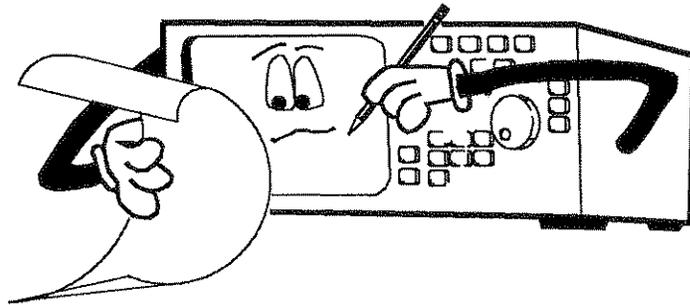


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Making a Hardcopy Output

In this chapter you will learn how to make a hardcopy output of the HP 8990A Peak Power Analyzer display. An HP-IB compatible printer can be used with the Analyzer. Our procedure uses an ®HP THINKJET printer as the output device. The first portion of the procedure will tell you how to set up the HP-IB interface for proper operation between the printer and Analyzer.

If the Analyzer and printer are already operating together, skip to the second portion of this procedure.



Setting Up the HP-IB

Connect the printer to the Analyzer with a standard HP-IB cable.

- Set the printer to LISTEN ALWAYS.

Switch 2 on the printer must be set to the up position.

- Apply power to the printer.

If any printer switches have been changed, the printer power must be cycled so the new settings are read.

- Press the **UTIL** menu key.

This selects the Utility menu functions.

- Press the top function key to select the HP-IB functions.

Displayed is a lower level menu used to set the **talk only/addressed** mode.

- If **talk only** is not selected, press the **talk only/addressed** key.

This sets the Analyzer to the **talk only** mode. In this mode, the Analyzer becomes an HP-IB talker.

The Analyzer and printer are now set to operate together.

Hardcopy Output

In the following example, the Sensor Check Source is used to demonstrate the hardcopy feature of the Analyzer.

Signal Setup

- Press the **UTIL** menu key.
- Press the **check source** function key until pulse is highlighted.

This turns on the Sensor Check Source. A 1 GHz signal pulsed at a 1.5 kHz rate is available at the front panel Sensor Check Source.

- Connect the peak power sensor on channel 1 to the Sensor Check Source. Depending on the peak power sensor being used, an adapter may be needed.
- Press the **DISPLAY** menu key.
- Press the **connect dots** function key until on is highlighted.

Connect the dots is a technique used to display a waveform with all data points connected. This makes viewing the waveforms easier because the signal is complete and has no breaks. Connect the dots does not interpolate data and generate data points. The Peak Power Analyzer connects data points linearly.

The Example

- Use **AUTOSCALE**, or set up the Analyzer manually.
- Press the **SHOW** key.

Displays the setup information. Again, this is not required to make the hardcopy.

- Press the **HARDCOPY** key (SYSTEM CONTROL area).

The printer receives an exact copy of the Analyzer display.

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