

General Information

Introduction

This service manual contains information on installing, testing, adjusting, and servicing the HP 54510B and HP 54512B Digitizing Oscilloscopes. This section of the manual includes instrument identification, description, accessories, options, specifications, characteristics, and recommended test equipment.

A microfiche part number is listed under the manual part number on the title page of this manual. This number may be used to order 4- by 6-inch microfiche transparencies of the manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also contains the latest Manual Changes supplement as well as pertinent Service Notes.

Instruments Covered by Manual

On the rear panel of the instrument is a serial number sticker. The serial number is in the form: 0000A00000. It is composed of two parts: the first four digits and letter are the serial prefix, while the last five digits are the suffix. The prefix is the same for all identical instruments, and it changes only when a change has been made to the instrument. The suffix however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefixes listed under SERIAL NUMBERS on the title page.

An instrument manufactured after the printing of this manual may have a serial number prefix different than those listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this instrument is accompanied by a yellow Manual Changes supplement. This supplement contains the necessary "change information" that explains how to adapt the manual to the newer instrument.

In addition to change information, the supplement contains information for correcting errors in the manual. To keep this manual as accurate as possible, periodically request the latest Manual Change supplement for the instrument manual. The supplement for this manual is identified with the manual part number and print date, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

For information concerning a serial prefix number not listed on the title page or in the Manual Changes supplement, contact your nearest HP office.

Instrument Description

The HP 54505B, HP 54506B, HP 54510B, and HP 54512B Digitizing Oscilloscopes are general-purpose oscilloscopes with 300-MHz bandwidth. The HP 54505B/54510B have two input channels and an external trigger input, while the HP 54506B/54512B have four input channels. The HP 54505B/54506B can digitize at a maximum rate of 500 Msa/s, while the HP 54510B/54512B can digitize at a maximum rate of 1 Gsa/s. Each oscilloscope can simultaneously digitize any input channel, each with 8000 samples of memory. All channels have 1 mV to 5 V/div sensitivity. Channel/trigger input impedance is 1 M Ω or 50 Ω , switchable.

The time base provides sweep speeds from 1 ns to 5 s/div in a 1-2-5 sequence. Pan and zoom can be used to expand a displayed waveform for a detailed view.

All channels (and the external trigger) can be combined triggers for complex triggering functions.

The oscilloscope has an Autoscale feature, 17 automatic pulse parameter measurements, and easy waveform storage. It has full programmability over the HP-IB, and when set up with a printer or plotter, the oscilloscope provides instant hardcopy output.

Accessories Supplied

The following accessories are supplied with the oscilloscope.

- Two (HP 54505B/54510B) or four (HP 54506B/54512B) HP 10441A miniature passive probes
- One miniature probe to BNC male adapter (HP 1250-1454)
- One 2.3 meter (7.5 feet) power cord (See section 2 for available power cords)
- One Front-Panel Reference and Programming Reference Set
- One Service Manual

Accessories Available

The following accessories are available for use with the oscilloscope.

- HP 10430A 10:1 1M Ω probe (1m)
- HP 10437A 1:1 50 Ω probe (2m)
- HP 10438A 1:1 probe (1m)
- HP 10439A 1:1 probe (2m)
- HP 10441A 10:1 1 M Ω probe (2m)
- HP 10002A 50:1 1 M Ω (1000 V peak) probe
- HP 10020A Resistive Divider Probe Kit
- HP 1141A/HP 1142A Differential Probe system
- HP 1143A Probe Power for Active Probe
- HP 54701 2.5 GHz/0.6 pF Active Probe
- HP 1137A 1000:1 High voltage divider probe
- HP 1133A TV/Video Sync Pod
- HP 10211A 24-pin IC Clip
- HP 10224A 16-pin IC Clip
- HP 1250-1454 BNC to Miniature Probe Adapter
- HP 1250-1737 PC Board Mini-Probe Socket (horiz)
- HP 1250-1918 PC Board Mini-Probe Socket (vert)
- HP 10240B BNC Blocking Capacitor
- HP 11094B 75 Ω Feedthrough Termination
- HP 5061-6175 Rack Mount Kit
- HP 1494-0015 Rack Mount Slide Kit
- HP 1540-1066 Soft Carrying Case
- HP 9211-2645 Transit Case
- HP 5061-6183 Front Panel Cover
- HP 1180A Tilt-tray Testmobile
- HP 92199B Power Strip

Options Available

The following options are available for the oscilloscope.

- Option 908 - Rack Mount Kit (HP 5061-6175)
- Option 910 - Additional Service Manual and Operating and Programming Manual set
- Option 090 - Deletion of probes
- Option 105 - Scopelink Software (HP 54653A)

Performance Specifications

The following are performance specifications for the Digitizing Oscilloscope.

Vertical

Bandwidth (-3dB, dc coupled):¹ dc to 300 MHz (repetitive mode)
dc to 125 MHz (realtime mode HP 54505B/54506B)
dc to 250 MHz (realtime mode HP 54510B/54512B)

Rise Time:² 1.2 ns repetitive (1.4 ns realtime HP 54510B/54512B)
(2.8 ns realtime HP 54505B/54506B)

Input R (selectable): 1 M Ω \pm 1% or 50 Ω \pm 1%

Maximum Input Voltage

1 M Ω : \pm 100 V [dc + peak ac (< 10 kHz)] 1 mV to 50 mV/div
1 M Ω : \pm 250 V [dc + peak ac (< 10 kHz)] > 50 mV to 5 V/div
50 Ω : 5 V_{rms}

Offset Accuracy:³ \pm (1% of channel offset + 2% of full scale)

Voltage Measurement Accuracy (dc)^{3,4}

Dual Cursor: \pm (1.25% of full scale + 0.032 \times V/div)
Single Cursor: \pm (1.25% of full scale + offset accuracy + 0.016 \times V/div)

Horizontal

Delta-t Accuracy⁵

Repetitive (\geq 8 averages): \pm (0.005% \times delta-t + 2E-6 \times delay setting + 100 ps)

Real Time (single acquisition):

\pm (0.005% \times delta-t + 2E-6 \times delay setting + 300 ps HP 54505B/54506B)
 \pm (0.005% \times delta-t + 2E-6 \times delay setting + 150 ps HP 54510B/54512B)

Trigger

Trigger Sensitivity³

Internal (dc to 100 MHz): 0.5 division

Internal (100 MHz to 300 MHz): 1.0 division

External (dc to 300 MHz): 100 mV_{p-p} into 50 Ω

Glitch Trigger Timing Accuracy (5 ns to 10 ns): \pm 1.5 ns

Notes:

1. Upper bandwidth reduces by 2.5 MHz for each °C above 35°C. Bandwidth in Realtime mode is typically greater than 250 MHz (tested at a 6 division reference).
2. Rise time figures are calculated from: $t_r = 0.35/\text{Bandwidth}$.
3. Magnification is used below 7 mV/div range so vertical resolution and accuracies are correspondingly reduced. Below 7 mV/div, full scale is defined as 56 mV.
4. Voltage measurement accuracy decreases 0.08% of full scale per °C from firmware calibration temperature. This specification is valid for a temperature range \pm 10°C from firmware calibration temperature. Specification applies to both modes; repetitive and real time (single acquisition).
5. Specification applies at the maximum sampling rate for bandwidth limited signals ($t_r = 1.4 \times$ sample interval). At lower sampling rates the specification is \pm (0.005% \times delta-t + $(2 \times 10^{-6}) \times$ delay setting + 0.15 \times sample interval) for bandwidth limited signals ($t_r = 1.4 \times$ sample interval). Sample interval is defined as 1/(sample rate). Specification also applies to those automatic measurements computing time intervals on pulses with identical slope edges (i.e. pos-pos, neg-neg).