One High Resolution TDR Channel

Two 400 MHz (300 MHz System) Real Time Channels (7854MPS)

45 Ps System Rise Time

Distance Range To 250 Feet In Any Cable

Signal Averaging

Resolution Up To 0.01 Div (10 Bits) On Stored Data

Waveform Parameters At The Touch Of A Key

Choose 128, 256, 512, 1024 Points/Waveform

Keystroke Programming

GPIB Interface

7854TDR AND 7854MPS MEASUREMENT PACKAGES

Description

TDR and real time scope features.—The 7854TDR package is a single channel oscilloscope configured for impedance and distance measurement applications. The 7854MPS is a multi-purpose oscilloscope offering the single TDR channel plus two 300 MHz real time channels for making traditional scope measurements as well as TDR measurements.

General mainframe features.—With the 7854 mainframe, both the 7854TDR and 7854MPS packages are programmable through the GPIB using the waveform measurement software provided. The 7854 also adds digital storage, waveform processing capability, programmable measurement routines, mass data and program storage through the GPIB, plus simultaneous display of real time and stored waveforms. You can store up to 40 waveforms and 2000 keystrokes with the on-board memory.

You can recover signals buried in random noise and improve measurement accuracy with signal averaging in the mainframe. In addition, you can select one or two cursors for voltage and time measurements. One cursor provides voltage measurements referenced to ground and time measurements referenced to time zero. Using two cursors, you can make delta time and voltage measurements or bracket an area of interest for measurement consideration.

Additional features with calculator keyboard.—Buttons on the calculator keyboard duplicate mainframe functions providing for cursor control and waveform parameter information such as maximum, minimum, peak-to-peak, and rise time. Additional buttons on the calculator keyboard allow arithmetic manipulation of waveforms such as differential, integral, log, and absolute value.

Keystroke programming on the calculator keyboard stores a series of keystrokes for execution. This assures repeatable measurement results and makes these systems easier to operate. You can write measurement loops to save time, log results, and make pass/fail decisions. You also have full subroutine and conditional branching capabilities.

Software packages included.—The included software is useful in automated engineering or research environments. Both the 7854TDR and 7854MPS are provided with software to work with HP Series 200 computers and IBM PC's. Software for the HP computers is available in 5-1/4″ floppy disk (Option 01) and 3-1/2″ micro floppy disk (Option 02).

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Applications

In TDR, a pulse is sent down a conductive path and the return pulse is measured as it reflects back from any impedance changes in the device under test. Any impedance variations in the path cause a corresponding signal to be displayed on the scope. The precise location and type of impedance anomally (open, short, step change) in the conductive path is directly readable on the display.

The 7854TDR AND 7854MPS are configured to make time domain reflectometry (TDR) measurements in a variety of applications where high resolution TDR is required. The packages are typically used in microwave stripline evaluation, computer backplane measurements, and printed circuit board testing. The fast rise times of these packages make them well suited for these kinds of measurements.

CHARACTERISTICS

Characteristics are common to both packages unless otherwise noted.

TDR Characteristics

System Rise Time—35 ps or less for the incident step. 45 ps or less for the displayed reflection from a short circuited, 1 ns test line.

Time and Distance Ranges—Direct reading tape dial gives calibrated one-way distance to at least 375 ft (air line). Time range is at least 0.75 μs round trip. Both ranges are limited by the duration of the pulse from the S-52.

Pulse Amplitude—At least +200 mV into 50 Ω.

Input Characteristics—Nominal 50 Ω, feed-through signal channel (termination supplied). SMA (3 mm) connectors.

Jitter—Less than 10 ps (without signal averaging).

Aberrations—+7%, −7%, total of 10% p-p within 1.8 ns of step with reference point at 1.8 ns from step; +2%, -2%, total of 4% p-p after first 2.5 ns with reference point at 300 ns from step.

Vertical Scale—Calibrated in mρ (reflection coefficient 10^{-3}) and mV from 2 to 500 units/division in eight steps (1-2-5 sequence), accurate within 3%. Uncalibrated variable is continuous between steps.

Resolution—Reflection coefficients as low as 0.001 may be observed. Signal averaging reduces test line noise in display.

Dc Offset Range—+1 V to -1 V. Allows open circuit reflections to be displayed at full sensitivity. Monitor jack provides X10 dc offset through 10 KΩ.

Time/Distance—Tape dial is calibrated in time and distance: full scale ranges of 4900 ft, 490 ft, 49 ft (air dielectric); 3200 ft, 320 ft, 32 ft (polyethylene dielectric); and 10 μs, 1 μs, 0.1 μs (time). Accurate within 1%. Distance calibration may be preset for dielectric having propagation factors from 0.6 to 1.

Time/Div—20 ps/div to 1 μs/div (1-2-5 sequence) in three ranges with direct reading magnifier. Accurate within 3%. Uncalibrated variable is continuous between steps.

Locate Button—Provides instant return to unmagnified display showing entire full scale range. Brightened portion of trace indicates time position and duration of magnified display.

Display Modes—Repetitive or single sweep, manual or external scan.

Signal Outputs—Pin jacks provide both vertical signal and sweep outputs.

Vertical Real Time System

(7854MPS only)

Bandwidth—Mainframe and plug-in amplifier are dc to 400 MHz, system bandwidth is dc to 300 MHz.

Deflection Factor—Calibrated: 5 mV/div to 1 V/div in eight steps (1-2-5 sequence). Accuracy is within 2% with gain adjusted to 5 mV/div. Uncalibrated: variable continuously between steps to a maximum of at least 2.5 V/div.

Input Impedance—50 Ω within 0.5%.

Maximum Input Voltage—Dc coupled: 5V rms.

Dc Stability—Drift with ambient temperature (line voltage constant): 0.02 div/°C.

Common Mode Rejection Ratio—At least 10:1, dc to 50 MHz.

Horizontal Real Time System

(7854MPS only)

Sweep Rates—Calibrated: 5 s/div to 10 ns/div in 27 steps (1-2-5 sequence). X10 magnifier extends fastest calibrated sweep rate to 1 ns/div. Uncalibrated: variable is continuous to at least 2.5 times the calibrated sweep rate.

Sweep Accuracy—Measured over the center eight divisions, +15°C to +35°C.

Time/Div	Unmagnified	Magnified
5 s/div to 1 s/div	4.0%	unspecified
0.5 s/div to 50 ns/div	1.5%	2.5%
20 ns/div to 10 ns/div	2.5%	4.0%

Trigger Holdoff Time

	Minimum	Maximum with Variable
5 s/div to 1 μs/div	2 times time/div setting or less	2 times time/div setting
0.5 μs/div to 10 ns/div	2.0 μs or less	2 times time/div setting
20 ms/div or faster	2 times time/div setting	20 times time/div setting

Triggering Sensitivity From Repetitive Signals (Auto and Norm Modes)

Coupling	Triggering Frequency Range*1	Min Signal Required Int	Min Signal Required Ext
Ac	30 Hz to 50 MHz	0.3 div	50 mV
	50 MHz to 400 MHz	1.5 div	250 mV
Ac Lf Rej*2	30 kHz to 50 MHz	0.3 div	50 mV
	50 MHz to 400 MHz	1.5 div	250 mV
Ac Hf Rej	30 Hz to 50 kHz	0.3 div	50 mV
Dc*3	Dc to 50 MHz	0.3 div	50 mV
	50 MHz to 400 MHz	1.5 div	250 mV

*1 Triggering frequency ranges are limited to the frequency of the vertical system when operating in the internal mode.
*2 Will not trigger on sinewaves of less than eight divisions internal, or 3 V external, at or below 60 Hz.
*3 Triggering frequency range for dc coupling applies to frequencies above 30 Hz when operating in the auto triggering mode.

Triggering Sensitivity in P-P Auto Mode

Coupling	Triggering Frequency Range	Min Signal Required Int	Min Signal Required Ext
Ac or dc	Low frequency response at least 50 Hz	2.0 div	500 mV
Ac or dc	200 Hz to 50 MHz	0.5 div	125 mV
Ac or dc	50 MHz to 400 MHz	1.5 div	375 mV

Single Sweep—Requirements are same as for repetitive signals.
Internal Trigger Jitter—0.1 ns or less at 400 MHz.
External Trigger Input—Maximum input voltage: 250 V (dc + peak ac). Input R and C: 1 MΩ within 5% and 20 pF within 10%. Level range (excluding p-p auto): at least ±1.5 V in Ext ÷ 1, at least ±15 V in Ext ÷ 10.

Digital Storage

Equivalent Time Bandwidth—System bandwidth is 300 MHz.
Acquisition Channels—One or two simultaneous channels (plug-in chop mode not valid).
Acquisition Window—±5 div from center screen both vertical and horizontal.
Resolution—Vertical: 0.01 div. Horizontal: Selectable points/waveform on remote keyboard.

Horizontal Resolution (divs)	Points/Waveform
0.01	1024
0.02	512
0.04	256
0.08	128

Outputs/Inputs

+ Sawtooth—Positive going with baseline at 0 V ±1 V into 1 MΩ. Voltage is 1 V/div (±10%) into 1 MΩ, 50 mV/div (±15%) into 50 Ω. Output R is ≈ 950 Ω.
+ Gate—Positive pulse of the same duration and coincident with sweep. Output voltage is 10 V (±10%) into 1 MΩ, 0.5 V (±10%) into 50 Ω. Output R is ≈ 950 Ω. Source is selectable from A gate, B gate, or Delayed gate.
Vertical Signal Out—Selected by A Trigger Source switch. Output voltage is 0.5 V/div into 1 MΩ, 25 mV/div into 50 Ω. Output R is ≈ 950 Ω.
Remote Single Sweep Reset—Rear panel BNC, ground closure activated.
TTL Output—Rear panel BNC, TTL output under remote keyboard control (SWH and SWL).

External Z-Axis Input—2 V p-p for full intensity range from dc to 1 MHz. Positive signal blanks the trace. Maximum input voltage is 15 V (dc plus peak ac).
Camera Power Output—Three prong connector to the left of the CRT provides power, ground, and remote single sweep reset access for the C-50 Series cameras.
GPIB Interface Subsets Implemented—SH1, AH1, T5, L3, SR1, RL1, DC1, DT1, PP0, C0.

Calibrator

Voltage Output—Square wave, positive going from ground. Ranges are 40 mV, 0.4 V, and 4 V into 100 KΩ; 4 mV, 40 mV, and 0.4 V into 50 Ω. Amplitude accuracy is within 1%; rep rate is 1 kHz within 0.25%.
Current Output—40 mA available through calibrator output with optional BNC to current loop adaptor.

Power Requirements

Line Voltage Ranges—90 V to 132 V. 180 V to 250 V.
Line Frequency—48 Hz to 440 Hz.
Maximum Power Consumption—230 W.

Software

7854/IBM PC Communication and Control (Commute)—This software provides the following capabilities:

- **Program Transfer/Storage**—Load and save 7854 programs on diskette.
- **Waveform Transfer/Storage**—Send and receive waveforms to or from 7854 or diskette.
- **Output Commands**—Send command string to 7854 from PC keyboard.
- **Automatic Measurement Results Logging**—Execute a 7854 program from PC and record results on diskette.
- **Hardcopy Record Keeping**—Send waveform or data to PC printer for permanent records.
- **Detailed Source Code**—Customize your programs to fit your requirements.

7854/HP Series 200 TekMAP—This software provides the following capabilities:

- **Program and Waveform Transfer/Storage**—Stores 7854 programs and waveforms on diskette.
- **Computing**—Computes pulse parameters, propagation delay, and frequency spectra (FFT).
- **Logging**—Automatic logging of measurement results.
- **Editing and Listing**—Provides for editing and listing of 7854 programs.
- **Menu Driven**—Completely menu driven with softkey selections.
- **Hardcopy Record Keeping**—Waveform graphics and screen copies to a ThinkJet printer.

Ordering Information

7854TDR Option 01—HP Series 200 software with 5-1/4″ media
7854TDR Option 02—HP Series 200 software with 3-1/2″ media
7854MPS Option 01—HP Series 200 software with 5-1/4″ media
7854MPS Option 02—HP Series 200 software with 3-1/2″ media

7854 Oscilloscope, Including Waveform Calculator
Includes: Power cord (161-0066-00); BNC-to-BNC cable (012-0208-00); instruction manual (070-2873-00); two blank panels (016-0155-00) with 7854TDR.

7S12 TDR/Sampler
Includes: 750 ps rigid "U" delay line (015-1017-01); short circuit termination (015-1021-00); TDR graticule overlay (331-0296-00); TDR slide rule (003-0700-00); TDR graticule overlay (331-0297-00); instruction manual (070-1244-00).

S-6 Sampling Head
Includes: 50 Ω termination (015-1022-00); 1 ns 50 Ω cable (015-1019-00); SMA (3 mm) female-to-female adaptor (015-1012-00); combination wrench (003-0247-00); SMA male-to-GR874 adaptor (015-1007-00); instruction manual (070-1128-01).

S-52 Pulse Generator Head
Includes: 1 ns 50 Ω semirigid coax delay line (015-1023-00); instruction manual (070-1101-01). 7A24 Amplifier (7854MPS only) Includes: instruction manual (070-1485-00).

7A24 Amplifier (7854MPS only)
Includes: instruction manual (070-1485-00).

7B80 Time Base (7854MPS only)
Includes: instruction manual (070-1959-00).

S42H202 7854/HP Series 200 software with manual

S42P101 7854/IBM PC software with manual

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