7104/R7103

- 1 GHz at 10 mV/Div
- 350 ps Rise Time
- 200 ps/Div Fastest Calibrated Sweep Rate
- Horizontal Bandwidth 350 MHz
- Ultra High Photographic Writing Speed—at Least 20 cm/ns
- CRT Readout
- 7 Inch Rackmount (R7103 Only)
- Phase Compensation Option—Phase Matching to 250 MHz (7104 Only)

TYPICAL APPLICATIONS

High Speed Semiconductor Design
Laser and High Energy Research
Digital Communications

See page 220 for available Application Notes.

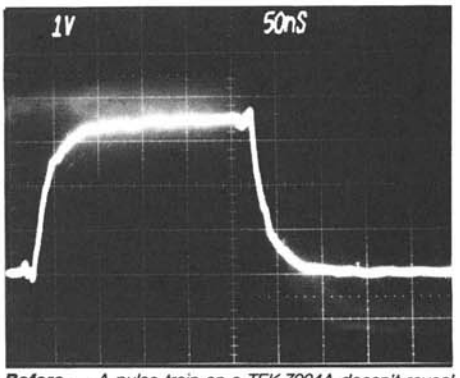
The capabilities of the 7104 and the seven inch rackmount R7103 are of substantial value in numerous high technology environments. The 7104/R7103 have both the highest writing speed and highest bandwidth available in a general purpose oscilloscope today.

The 7104/R7103's outstanding writing speed means unsurpassed single shot capability, with trace brightness about **one-thousand** times that of conventional oscilloscopes. Any single shot signal within the 1 GHz bandwidth can be seen directly on the CRT in average room light. Also, singleshot photography is now simple and straightforward, using standard oscillographic cameras and film without high speed enhancement techniques.

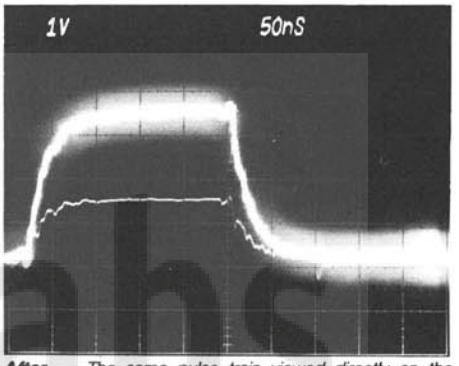
It is by no means unusual to see 250 MHz data rates and 900 MHz analog frequencies outside the lab and on the production line. In digital design, too, anomalies such as ringing and overshoot can only be dealt with by evaluating the signal's analog characteristics.

You can capture the fastest transients without expensive high speed film or other time consuming and complex techniques like fogging or reducing the scan. In fact, you can see those signals on the CRT, and eliminate costly time consuming photographs.

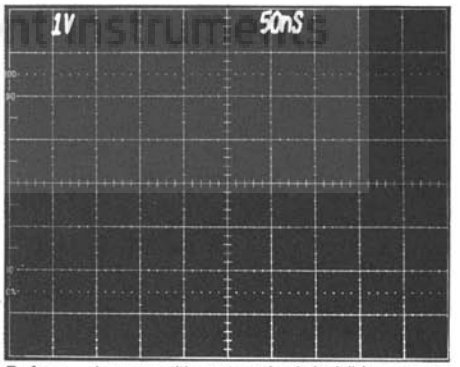
See What You Could Never See Before.



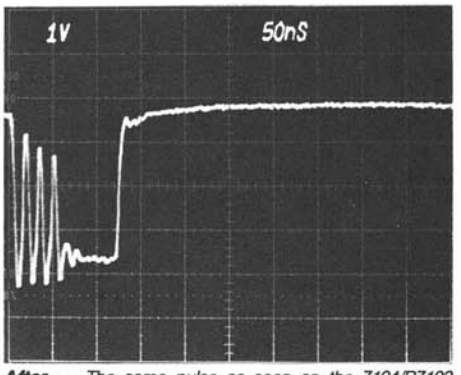
Before *— A pulse train on a TEK 7904A doesn't reveal the low level glitch occurring every ten-thousandth pulse. (The TEK 7904A was previously the world's fastest-writing-rate scope.)*



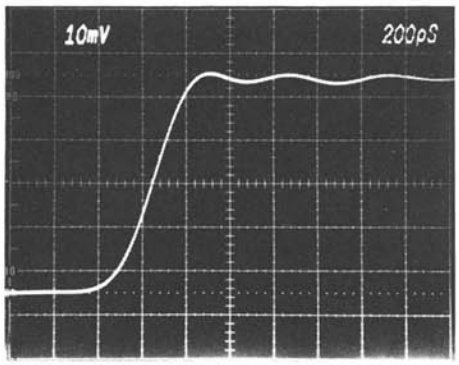
After *— The same pulse train viewed directly on the 7104/R7103, with one-thousand times the brightness of conventional scopes. The researcher can now analyze the pulse with the naked eye and take pictures with ease.*



Before *— Low repetition rate pulse is invisible on a conventional oscilloscope.*



After *— The same pulse as seen on the 7104/R7103 readily indicates that the problem is input signal bounce.*



With its sweep speed of 200 ps/div, the 7104/R7103 clearly shows a single-shot, 350-ps step, five divisions in amplitude.

Horizontal bandwidth of 350 MHz, with the X-Y phase compensation Option 02 (7104), gives accurate X-Y displays to 250 MHz. Designers can now directly obtain V-I curves for high speed switching power supply evaluation or monitor performance of digital communication systems using phase constellation displays.

CHARACTERISTICS

The following characteristics are common to the 7104 and the R7103, except those noted under the R7103.

VERTICAL SYSTEM

Channels — Two left-hand plug-in compartments. Compatible with all 7000 Series plug-ins (except 7D01, 7D02, and 7D20).

Bandwidth — Determined by mainframe and plug-in unit. See page 218.

Rise Time — Determined by mainframe and plug-in unit. See page 218.

Deflection Factor — Determined by plug-in unit. See page 218.

Display Modes — Left, Alt, Add, Chop, Right. Chopped mode repetition rate is ≈1 MHz.

Trace Separation — (7104 only) In dual sweep modes positions B trace at least four divisions above and below A trace.

Delay Line — Permits viewing leading edge of displayed waveform.

HORIZONTAL SYSTEM

Channels — Two right-hand plug-in compartments. Compatible with the 7B10 Series, 7B80 Series, 7B50A, 7B92A, 7000 Series vertical amplifiers and specialized plug-ins (7B92, 7D01, 7D02, and 7D20 not recommended).

Bandwidth — Dc to 350 MHz.

Display Modes — (7104 only) A, Alt, Chop, B. Chopped mode repetition rate is ≈200 kHz.

Fastest Calibrated Sweep Rate — 200 ps/div with the 7B10 or 7B15.

X-Y Mode — With Option 02, X-Y Phase Compensation (7104 only, using 7A19s or 7A29s at least one having Variable Delay Option, B horizontal compartment only): Phase shift is 2° from dc to 50 MHz (after adjusting variable delay for balance at 35 MHz). Phase balance can be obtained at any frequency up to 250 MHz. Without Option 02, X-Y Phase Compensation: Phase shift is 2° from dc to 50 kHz.

CRT AND DISPLAY FEATURES

For CRT phosphor data see page 186.

CRT — Internal 8 x 10 division (0.85 cm/div) graticule with variable illumination. Accelerating potential is 12.5 kV. GH (P31) phosphor standard.

Readout and Graticule Modes — Each continuous or pulsed. Pulse Source Front Panel Selectable: +Gate, External, Manual. Pulsed graticule is on for ≈0.5 s.

Typical Photographic Writing Speed*1

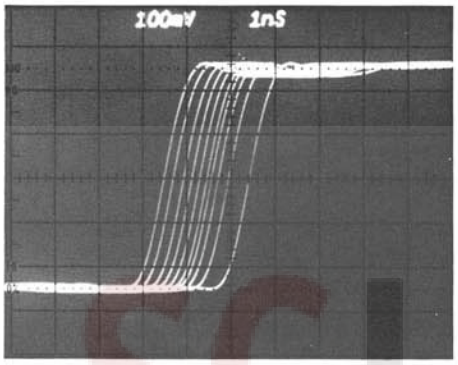
CRT	Camera	Lens	Writing Speed cm/ns
Standard 8 cm x 10 cm	C-53	f/1.9 1:0.85	20

**1 Using the standard GH (P31) phosphor and Polaroid Type 107, 3,000 ASA film without film fogging.*

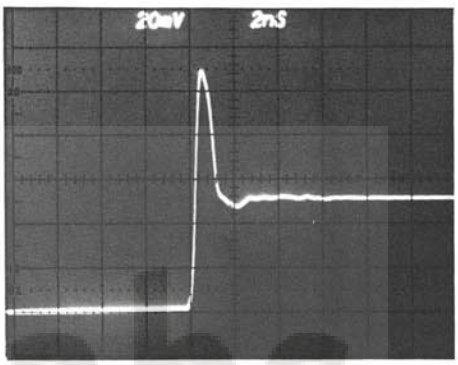
Autofocus — Reduces the need for additional manual focusing with changes in intensity after focus control has been set.

Beam Finder — Aids in locating offscreen signal.

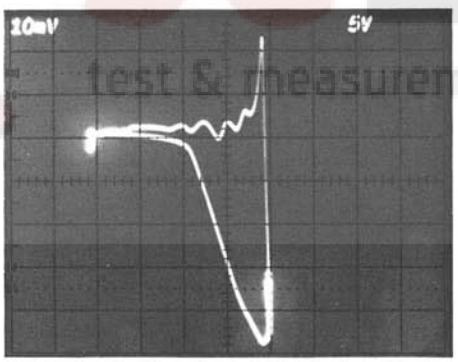
External Z-Axis Input — 2 V p-p for full intensity range. A positive signal blanks the trace. Maximum input voltage is 15 V (dc + peak ac) and p-p ac. Input is dc coupled.



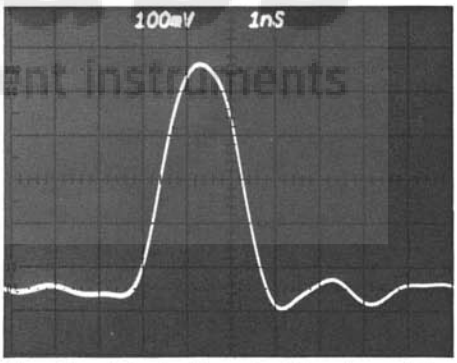
A digital circuit that shows no jitter on a conventional oscilloscope is found to have a 2.0 ns jitter when viewed with the distinct image viewing capability of the 7104/R7103.



Circuit faults such as high frequency pulse overshoot and ringing can easily be observed with the 7104/R7103's 1 GHz bandwidth.



The transient load line of a fast switching transistor in a power supply prototype (switching time = 10 ns) is easily measured for compliance with safe operating area (Horizontal = Voltage; Vertical = Current).



View of a single clocking pulse 0.8 ns rise and 2 ns pulse width.

The R7103 requires only seven inches of rack height in a standard 19 inch rack. It is fan-cooled and comes complete with slideout chassis tracks.

CALIBRATOR

Voltage Output — Squarewave positive-going from ground.

Voltage Ranges — 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%. Repetition rate is 1 kHz within 0.25%.

Current Output — 40 mA rectangular waveshape with optional current-loop accessory (012-0341-00) connected to calibrator output. Output R is 450 Ω.

OUTPUTS/INPUTS

+Sawtooth — Starts 1 V or less from ground into 1 MΩ. Output voltage is 50 mV/div (±15%) into 50 Ω, 1 V/div (±10%) into 1 MΩ. Output R is ≈950 Ω.

+Gate — Positive-going rectangular waveform. Output voltage is 0.5 V (±10%) into 50 Ω, 10 V (±10%) into 1 MΩ. Rise time is 5 ns or less into 50 Ω. Output R is ≈950 Ω.

Vertical Signal Out — Output voltage is 25 mV/div into 50 Ω, 0.5 V into 1 MΩ. Output R is ≈950 Ω. Bandwidth depends upon vertical plug-in. See page 219.

Camera Power — Three-prong connector to the left of the CRT provides power, ground, and remote single-sweep reset access for C-50 Series camera.

Probe Power — Two rear-panel connectors for active probes (i.e., P6201, P6202A, P6230).

External Single-Sweep Reset — Ground closure, rear panel BNC, input to reset sweep.

Single-Sweep Ready Indicator — Rear panel BNC provides 5 V out to indicate single-sweep ready condition.

Graticule/Readout, Single Shot — Ground closure, rear panel BNC input initiates one frame of CRT read-out. Graticule Illumination is illuminated for ≈0.5 s.

POWER REQUIREMENTS

Line Voltage Ranges — 90 V to 132 V ac and 180 V to 250 V ac.

Line Frequency — 48 Hz to 440 Hz.

Maximum Power Consumption — 215 W, 3.3 A at 90 V line, 60 Hz.

The 7D01, 7D02 Logic Analyzers and 7D20 Digitizer are not recommended for use in the 7104/R7103 mainframe. Such use will void the 7104/R7103 warranty.

ENVIRONMENTAL AND SAFETY

Ambient Temperature — Operating: 0°C to +50°C. Nonoperating: −55°C to +75°C.

Altitude — Operating: 5000 m (15,000 ft). Nonoperating: 15 000 m (50,000 ft).

Vibration — Operating: 15 minutes along each of the three major axes. 0.04 cm (0.015 in) p-p displacement 10 Hz to 50 Hz to 10 Hz in one minute cycles. Held for three minutes at 50 Hz.

Humidity — Operating and Nonoperating: 95%, five cycles (120 hours), referenced to MIL-E-16400F.

Shock — Nonoperating: 30 g's, ½ sine, 11 ms duration in each direction along each major axis. Total of six shocks.

EMC Capability — (R7103, 7104 Option 03) Meets MIL-STD-461B requirements when tested in accordance with certain test methods of MIL-STD-462. Contact your Tektronix representative for more information.

Safety — UL listed (UL 1244) and CSA certified (CSA 556B).

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in**	**mm**	**in**
Width	305	12.0	483	19.0
Height	345	13.6	178	7.0
Depth	592	23.3	704	27.7
Weights≈	**kg**	**lb**	**kg**	**lb**
Net	19.8	45.0	20.0	44.0
Shipping	25.4	56.0	30.9	68.0

CHARACTERISTICS (R7103)

The following characteristics for the R7103 are in addition to or in lieu of those listed previously.

HORIZONTAL SYSTEM

Single Channel — Right-hand plug-in compartment compatible with time bases of the 7B10 and 7B80 Series and the 7B50A and 7B92A. The 7B50 Series (except 7B50A), the 7B70 Series and the 7B92 (non-A) are not recommended. 7000 Series vertical amplifiers and specialized plug-ins (except 7D01, 7D02, and 7D20) may also be used.

Bandwidth — Dc to 350 MHz.

X-Y Mode — Phase shift is 2° from dc to 50 kHz.

OUTPUTS/INPUTS

Vertical Signal Out — Output voltage is 25 mV/div within 25% into 50 Ω, 0.5 V into 1 MΩ. Output R is ≈950 Ω.

ORDERING INFORMATION

(PLUG-INS NOT INCLUDED)

7104 Oscilloscope **$24,590**
Includes: Power cord (161-0066-00); instruction manual (070-2314-00).

R7103 Rackmount Oscilloscope **$25,125**
Includes: Power cord (161-0066-00); mask frame (426-0514-00); CRT filter (378-0625-00); drawer slide (351-0375-01); right spacer (361-0806-00); left spacer (361-0807-00); hardware kit (016-0099-00); instruction manual (070-0539-00).

OPTIONS (7104)

Option 02 — X-Y Horizontal Compensation. **+$315**
Option 03 — EMC Capability. **+$395**

CONVERSION KIT (7104)

EMC Modification — Order 040-0965-00 **$565**

INTERNATIONAL POWER PLUG OPTIONS

Option A1 — Universal Euro 220 V, 50 Hz.
Option A2 — UK 240 V, 50 Hz.
Option A3 — Australian 240 V, 50 Hz.
Option A4 — North American 240 V, 60 Hz.
Option A5 — Switzerland 220 V, 50 Hz.

RECOMMENDED PLUG-INS

7A29 — Vertical amplifier, 50 Ω input, dc to 1 GHz; 10 mV/div to 1 V/div vertical sensitivity. **$3,325**

7A42 — Four channel, 350 MHz bandwidth vertical amplifier with Boolean logic triggering capabilities. **$6,200**

7B10 — Delayed time base with 200 ps/div to 0.2 s/div calibrated sweep speed; triggering up to 1 GHz. **$2,555**

7B15 — Delaying time base with 200 ps/div to 0.2 s/div calibrated sweep speed; triggering up to 1 GHz; capable of Δtime measurements in conjunction with 7B10. **$2,900**

7B92A — Dual time base with 500 ps/div to 0.2 s/div calibrated sweep speed; triggering up to 500 MHz; capable of delay time measurements. **$3,745**

OPTIONAL ACCESSORIES

Recommended Cameras — See page 218 and 442.

NEW **DCS01**

The *NEW* DCS01 Digitizing Camera System combines CCD technology with an IBM PC, XT, AT, or compatible to acquire and digitize repetitive and transient waveforms displayed on oscilloscopes, spectrum analyzers, and other displays. Used with scopes having the microchannel plate CRT, such as the 7104 and 2467, the DCS01 can acquire repetitive and transient signals at the full bandwidth of the scope. With other scopes, the DCS01 will acquire repetitive events at the full scope bandwidth and transient events according to the photographic writing rate of the oscilloscope. See page 353.

Recommended Probes — See page 219 and 464.
Recommended Carts —
K213 Option 12 (7104), see page 462.
K217 (R7103), see page 462.