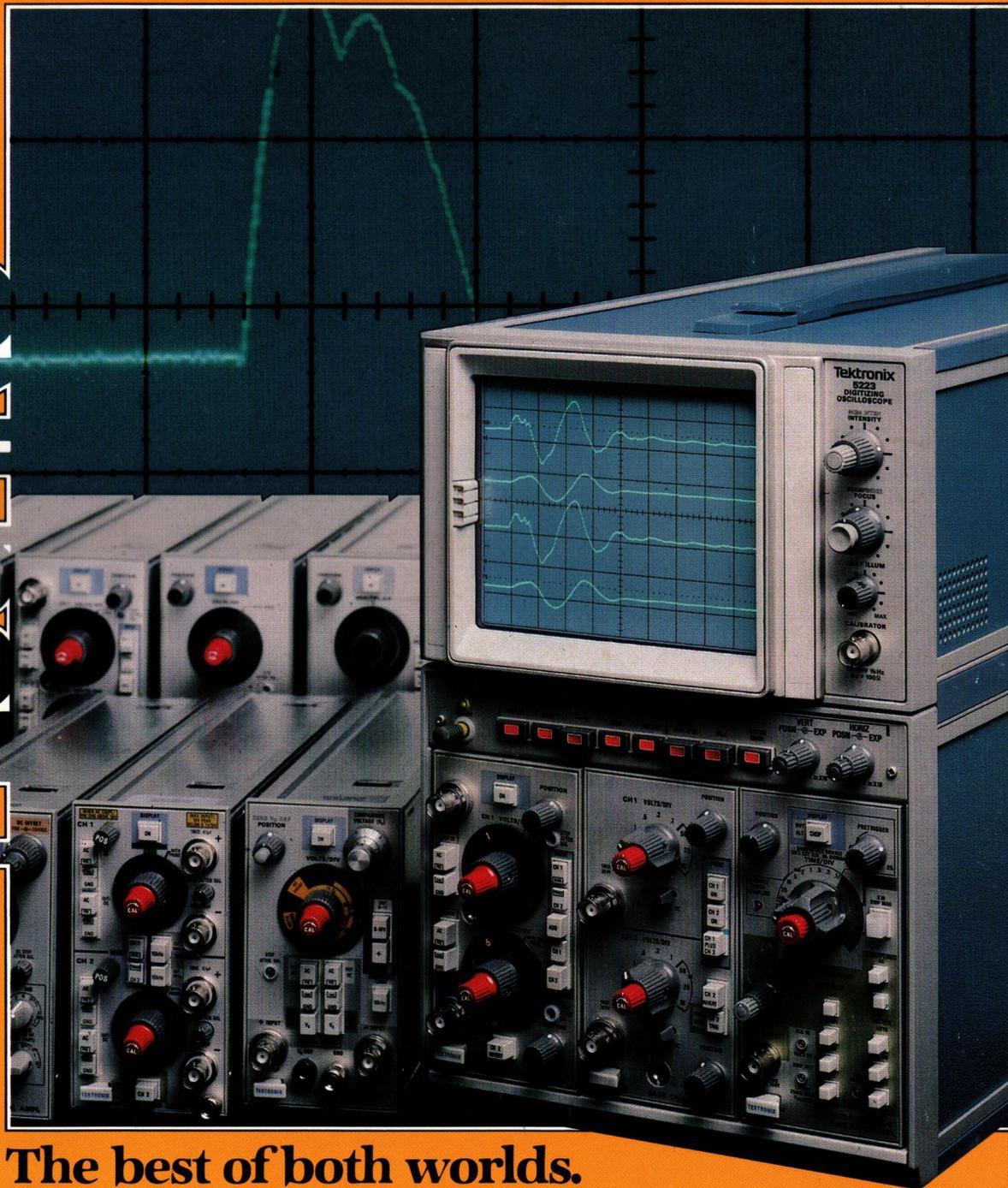


Tektronix 5223 Digitizing Oscilloscope.

PLUG-INS



The best of both worlds.

Digital storage in a 10 MHz plug-in scope.

You can get the benefits of digital storage, along with the time-tested advantages of a conventional analog scope, in Tektronix 10 MHz 5223 Digitizing Oscilloscope. Combined in one powerful, convenient oscilloscope are pushbutton ease, high quality waveform display, pretrigger, signal manipulation, and optional GPIB interface, plus real-time analog display capability.

Use the 5223 in the digital storage mode to capture repetitive events at speeds of up to 10 MHz or single-shot events at speeds of up to 100 kHz. The 5223's maximum sample rate is 1 MHz; storage capacity is 1024 bits per vertical compartment.

The digitized display will never fade or bloom, so you get more accurate measurements, more conveniently. High 10-bit vertical resolution gives you an accurate representation of your signals. The 5223 vector generator connects the dots to ensure complete displays of complex signals.

You can always go back and track down the source of a problem ... because pretrigger data is stored in memory along with events that happen after the trigger. The trigger point is continuously variable, so you can display up to one full screen width of pretrigger information. The pretrigger portion of the display is intensified for easy interpretation and documentation. And for elusive or one-time-only problems, you can set up the 5223 to do the "babysitting."

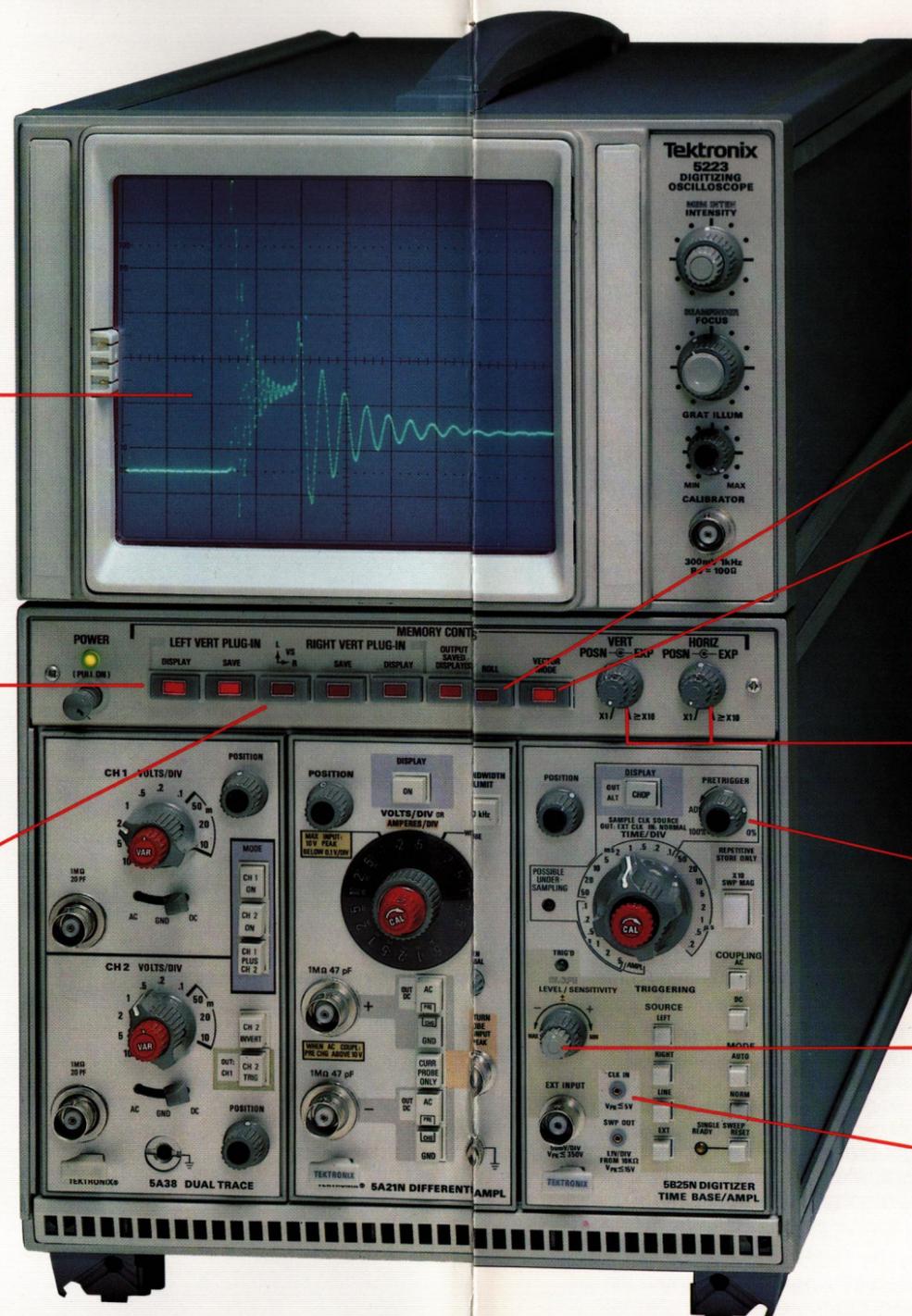
You have access to stored data. A front-panel control enables you to expand a portion of the waveform by up to ten times for detailed analysis. Another control lets you position waveforms on the CRT for reference or comparison.

In the digital storage mode, the 5223 digitizes waveforms as they're acquired, and then freezes them in memory for display, manipulation, or transfer of data for extended processing via the GPIB option. For convenience, digital storage controls are grouped under the CRT. The display is always bright and crisp for as long as you need it without fading or blooming.

Only digital storage offers bright, crisp, high resolution displays like this. The large-screen (15.6 cm; 6.5 in) CRT and 10-bit vertical resolution mean signals are accurate and easy to view.

Digital storage made pushbutton easy.

Generate X-Y displays of signals at the push of a button.



The roll mode lets you look at the continually updated contents of memory, presented in a manner much like a strip chart recording.

Get an accurate picture of complex waveforms... the vector mode connects the dots and lets you look at a continuous trace.

Expand digitized waveforms by up to ten times for detailed analysis. Or position waveforms vertically or horizontally on the CRT.

Pretrigger capability means you can capture information leading up to the trigger event.

Use bislope triggering when unsure of the slope of your transient events.

Synchronize waveform storage with external devices via the external sample clock input.

Using the roll mode, you can get a continually updated display of memory contents similar to a strip chart recording. The roll mode gives you a comprehensive view of signals at slow sweep rates.

You can display signals with respect to time (Y-T), or in an X-Y mode - memory contents of the left compartment vs memory contents of the right compartment - all by the simple push of a button. You can even display Y-T and X-Y plots at the same time.

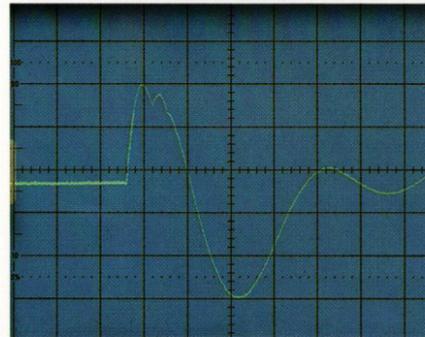
And you can output stored waveforms to your X-Y plotter for hard copies. There is a "Plotter Out" speed adjustment to ensure interfacing with any analog plotter. The 5223 allows you to extend the range of your plotters up to 10 MHz for repetitive signals.

Add the GPIB (General-Purpose Interface Buss) option and you can interface the 5223 with a desktop calculator or mini-computer. The 5223 has full talk/listen capability, so you can output signals for processing and data reduction or input signals for reference. With the GPIB option you can "oversee" front-panel memory display controls for automated operation of the 5223.

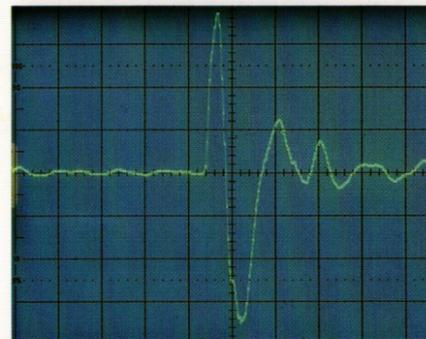
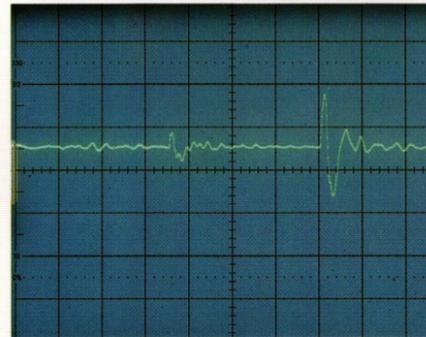
What's more, you can use the 5223 in the analog mode for signals at speeds of up to 10 MHz bandwidth. This means you have real-time capability in addition to the benefits of digital storage. You can even display real-time and digitized signals simultaneously.

Digital storage and analog capabilities combined in the 5223 makes a powerful measurement tool ... one you can add to at any time, by choosing from among the wide range of compatible 5000-Series plug-ins.

An unbeatable combination.



Single-shot data can be captured and stored automatically without the operator's presence. Pretrigger signal portion has an intensified trace for easy reference.



Signal expansion is easily accomplished once the waveform is stored in memory. Vertical and horizontal repositioning are also possible.

Digital plus analog equals measurement solutions.

Digital storage technology and analog capability each have their own complementary strengths. Together they make an unbeatable combination for a wide variety of measurements. The advantages of combining both measurement techniques in a single oscilloscope are illustrated in the following brief discussion.

A conventional scope provides you with a true-to-life representation of your signals, and is adequate for many applications. However, you may find that flicker is a problem with low repetition rate signals. And you won't be able to view single-shot signals continually.

That's where digital storage can be useful. You can store real-time data and redisplay it any time you like. You'll be able to eliminate flicker on low repetition rate signals because digitized displays are always bright and crisp. You'll be assured of capturing single-shot events in memory, and you'll be able to examine them in detail whenever you're ready.

With digital storage and analog modes together, you can choose the measurement approach that's best for the task at hand. And you're no longer restricted by the limitations of one technology over the other.

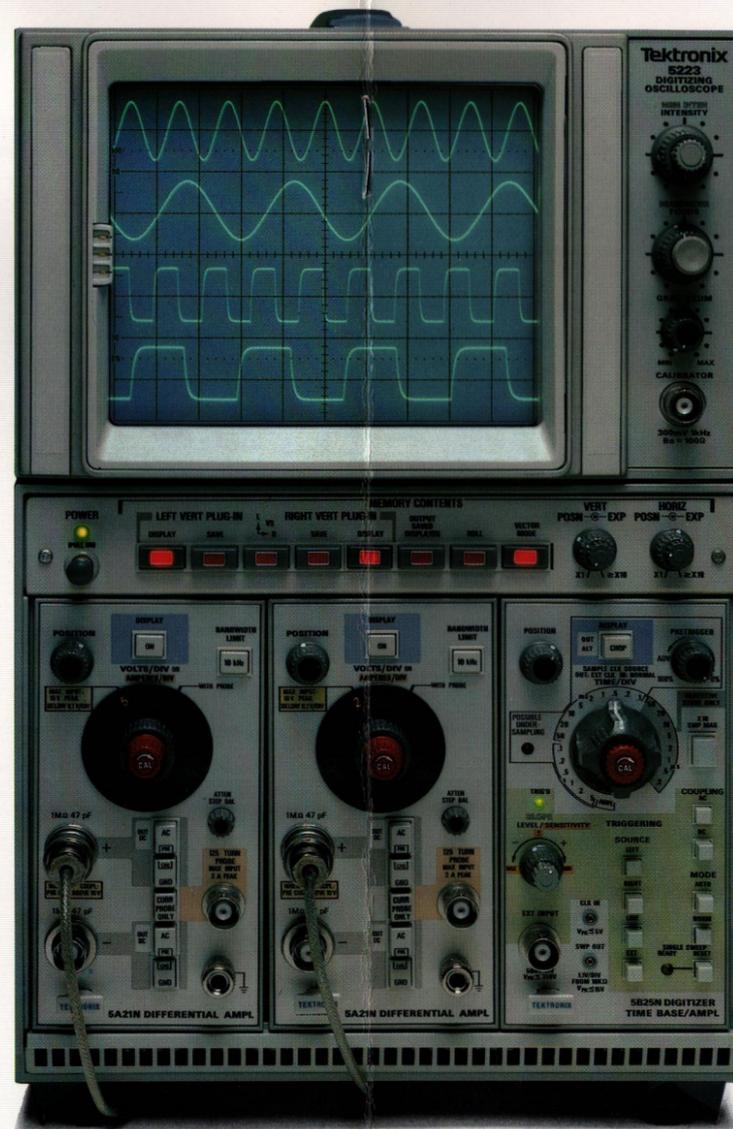
Take a look at how the 5223 handles repetitive and single-shot events.

You'll really be able to use the 5223's ability to produce a stable, high-contrast display of slow repetitive signals at sweep speeds of up to 200 ns/div. The equivalent-time sampling technique used in the digital storage mode builds up and stores the trace over a series of sweeps... and digital storage technology eliminates signal degradation over time. That means you see, and have time to analyze, all the data.

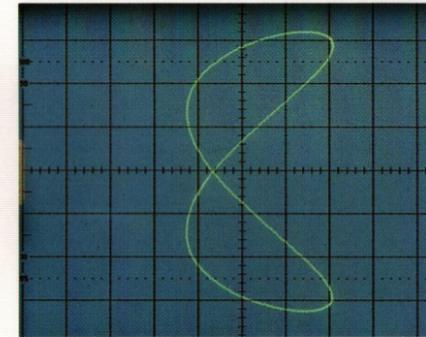
Another digital capability you'll really use: You can always be sure of cap-

turing a fast single-shot event... as fast as 100 kHz. And, because the event is frozen in memory, you can display and analyze it at your convenience. Now it's easy to capture and view signals like those found in switch bounce and biomedical stimulus response measurements.

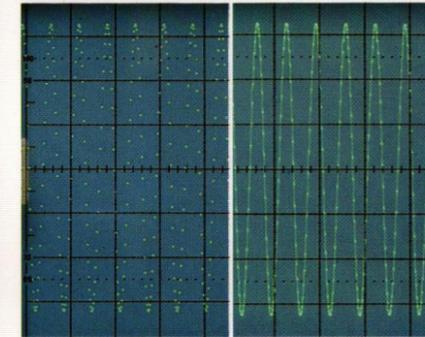
With the bislope trigger mode provided by the 5B25N Time Base, you'll be assured of triggering on any single-shot signal, even when the



Simultaneous display of stored and real-time signals allows easy comparisons of reference and text information. Up to four traces, two real-time and two stored, are displayed at once.



By pressing the **X-Y** button, the memory contents of one vertical compartment are displayed against that of the other.



Vector mode connects stored data points to clearly define complex waveforms.

as those found in drop or shock testing, because, at slower sweep speeds, the 5223 can acquire, digitize, and display up to four signals at one time.

You can also display up to four real-time signals at the same time as four stored signals... a nice feature for calibration, test, and quality control applications when you need to compare real-time and reference signals.

And you'll always be able to capture pretrigger information at speeds of up to 100 μ s/div - an invaluable aid in troubleshooting situations. In an SCR motor control application, for example, you can see a double triggering condition... and be assured of capturing data leading up to a failure. The 5B25N Time Base Plug-in with continuously variable pretrigger control makes it possible.

When you're waiting for a transient or single-shot event, you can set trigger conditions and leave the 5223 in attendance in the "babysitting" mode. When you're ready, you call up the display at the touch of a button. You'll see the events on both sides of the trigger; pretrigger data will be intensified in the display.

Imagine the added power of manipulating stored data.

One of the most useful features of digital storage is that you can redisplay digitized data in several formats.

Being able to expand and reposition waveforms on the CRT can make rise time measurements easier and more accurate. Even if you're working with a low-level signal or a single-shot event, you can manipulate the digitized data until you've pinpointed the 10% and 90% portions of interest.

The roll mode allows data stored in memory to "free run" from right to left across the CRT... a capability useful in biomedical and physical science applications. When using the roll mode, you can view slow signals continuously and then freeze the data at a point of particular interest for further diagnosis.

You can also display data stored in memory in an X-Y format... and each axis will be at full signal bandwidth. For phase measurements, two X-Y plots may be displayed at one time. And for more difficult phase measurements such as those found in switching power supply testing, you can obtain X-Y plots of repetitive signals as fast as 10 MHz. For simultaneous timing and phase measurements like those performed in seismic amplifier design, you can even display X-Y and Y-T plots together.

slope is unknown. You select a voltage "window" within which the trigger will occur. A rising or falling edge exceeding your level setting will trigger the oscilloscope. This is an important capability for many measurements such as those found in fault analysis, for example, when you're watching for troublesome transients on power lines.

It's easy to view and analyze multiple force and displacement signals such

An excellent choice for physical, mechanical, and biomedical measurements...to name just a few.

Signal output and optional GPIB data processing expand your measurement capabilities.

You can use the standard 5223 interface to output stored data to a wide variety of recorders. With this feature you can plot X-Y signals as fast as 10 MHz - well beyond the stand-alone



capabilities of X-Y plotters. In addition, you can separately output real-time signals, one from each vertical compartment and one from the horizontal compartment. The GPIB option allows the digital functions of the oscilloscope to be controlled via an intelligent terminal. Because the 5223 is both a "talker" and a "listener," you can output waveforms for signal processing and data reduction or input them back into the scope for comparison or reference.

Simply through software selection, you can output data in binary code or in ASCII II.

Digital storage with plug-in flexibility is often required in switching power supply design.



The 5223, featuring bislope and pretriggering, is ideal for environmental testing applications.

Meet all your measurement needs with 5000-Series plug-in flexibility.

You can configure the 5223 to suit your measurement needs...and expand as your needs grow...with 5000-Series plug-in flexibility.

By choosing from the 5000-Series family, you can combine a high frequency, dual trace amplifier plug-in and a high gain differential amplifier plug-in for viewing both digital and transducer signals.

Combine several differential amplifiers to display multiple transducer signals.

Select the 5L4N Spectrum Analyzer Plug-in for digitizing frequency components of your signals.

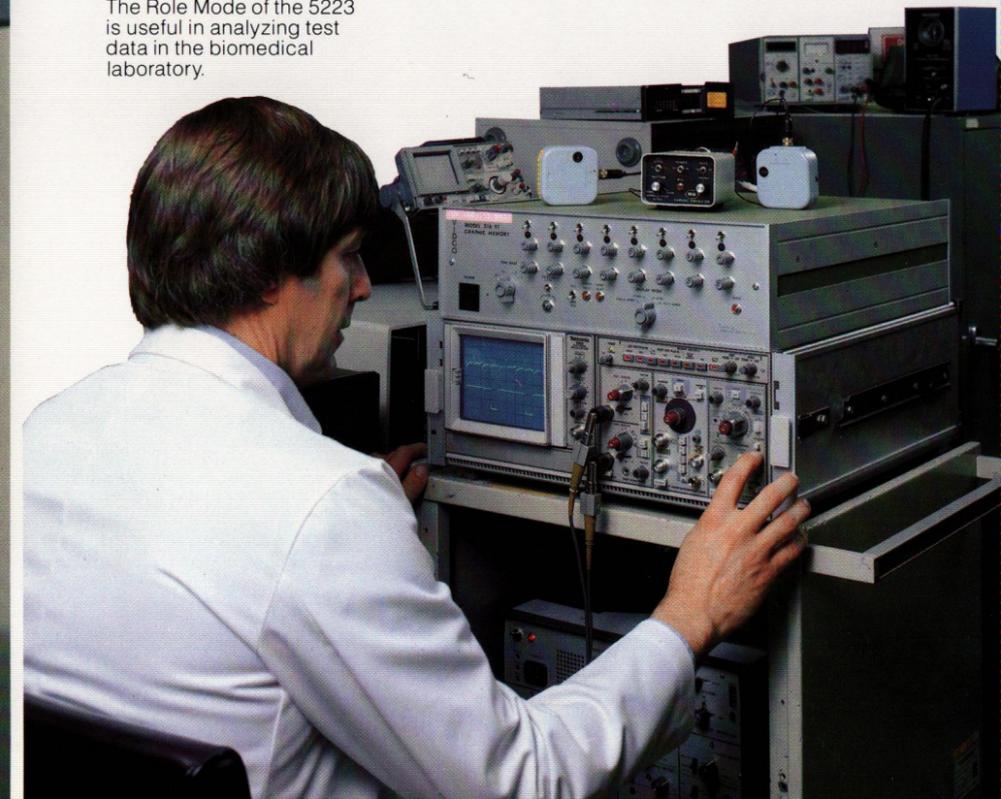
Or digitize up to 1 GHz signals with our sampling plug-in.

The Role Mode of the 5223 is useful in analyzing test data in the biomedical laboratory.



These are just a few of the capabilities available. No matter what your measurement needs, you'll find a 5000-Series Plug-in that fits.

Contact your Tektronix Sales Engineer for a demonstration of the 5223 and start taking advantage of the best of both worlds.



5223 Specifications

VERTICAL REAL TIME SYSTEM

Input — Two plug-in compartments; compatible with 5000-Series Plug-ins.

Mainframe Bandwidth — 10 MHz with 5A38, 5A45 or 5A48.

Mainframe Step Response — 35 ns.

Chop Mode — Rep rate is approximately 300 kHz without 5B25N or 100 chop. Segments/division unexpanded with 5B25N Time Base.

Delay Line — Permits viewing leading edge of displayed waveform.

HORIZONTAL REAL TIME SYSTEM

Input — Single compartment compatible with 5000 Series time bases and amplifiers. 5B25N must be used in storage modes.

Fastest Calibrated Sweep Rate — 20 ns/div.

X-Y Mode — Less than 2° phase shift, dc to 20 kHz between either vertical compartment and horizontal compartment.

CRT AND DISPLAY FEATURES

CRT — 8x10 divisions with 1.22 cm/div. Internal illuminated graticule.

Phosphor — P31.

Acceleration Potential — 15 kV.

Camera Power — Compatible with C-59 Tektronix camera.

PLUG-IN COMPATIBILITY

All 5000-Series Plug-ins are compatible in the standard oscilloscope display mode. The 5L4N, 5A18N, 5A26, 5A48 Plug-ins may require modification for optimum use with digital storage operation. The 5A14N is not recommended for use in storage mode.

OUTPUT/INPUTS

Plug-in Outputs:

Left vertical, right vertical, horizontal compartments — 50 mV/division $\pm 5\%$ from 50 Ω .

Left, right vertical compartments — dc ≥ 10 MHz; horizontal compartment — dc ≥ 7 MHz.

Time base gate — TTL compatible, positive going.



5223 REAR PANEL without optional GPIB: signal outputs from the horizontal and vertical plug-in compartments, single sweep reset, and analog plotter output from memory (including pen lift).

Remote Single Sweep Reset — Rear panel BNC closure to ground resets sweep.

External Z Axis Input — Usable, dc ≥ 5 MHz. Voltage swing of 5 volts will fully modulate beam dc ≥ 1 MHz. Negative voltage will blank trace. Maximum input voltage is 40 V (dc + peak ac).

Calibrator:

Voltage Output — Square wave, positive going from ground. Amplitude is 300 mV $\pm 1\%$.

Current Output — 3 mA $\pm 1\%$ available through calibrator output with optional BNC to current loop adapter.

DIGITAL STORAGE

Vertical Resolution — 10 bits (100 pts/div unexpanded).

Display Memory Size — 1K points per vertical compartment, shared by multiple trace plug-ins.

Sample Rate — Maximum of 1 μ s/pt (1 MS/s). Actual sample rate depends on time base setting.

Fastest Single Shot Sweep Speed — 100 μ s/div (with 5B25N Time Base).

External Clock In — Maximum of 1 MS/s (1 μ s/pt). TTL compatible.

Equivalent Time Bandwidth — 10 MHz.

Acquisition Window — ± 4 divisions vertically and ± 5 divisions horizontally from center screen.

Accuracy — Determined by plug-ins. Refer to plug-in specifications.

X-Y — (Left vs right single channel mode only excluding 100 μ s/division sweep range). Maximum of 5° phase shift between vertical compartments up to 10 MHz using same two 5400 Series vertical plug-ins.

MEMORY CONTROLS

Display — Save controls for each vertical compartment. X-Y (left vs right), Data Out, Roll, Vector Mode, Horizontal and Vertical positioning and expansion ($\geq 10:1$).

Data Out — Analog voltage of stored signal. 200 mV/div $\pm 5\%$. Output rate variable with rear panel control. Pen lift available on rear panel (normally open).

GPIB — OPTIONAL

Implemented Interface Functions:

- SH1 Complete Source Handshake
 - AH1 Complete Acceptor Handshake
 - T5 Talker Function
 - L4 Listener Function
 - SR1 Complete Service Request Capability
 - RL2 Remote/Local Capability
 - DC1 Complete Device Clear Capability
 - I/O Records — Waveforms
- Device Address — Selectable via rear panel switch
- Talk Only — Continuous output of digitized waveform to maximum sweep of 20 ms/div (dependent on other instruments on bus).

5B25N TIME BASE HIGHLIGHTS

Pretrigger — Continuously variable to 10 divisions. Pretrigger information intensified.

Triggering — +, -, bislope.

Under Sampling Indicator — Illuminated when less than eight samples per waveform period occurs.

Modes — Auto, Normal, Single Sweep.

Repetitive Store Only — Sampling changes to equivalent time sampling at sweep speeds of ≥ 50 μ s/div.

POWER REQUIREMENTS

Line Voltage Range — 90-117 V, 102-132 V, 191-249 V, 204-250 V max.

Line Frequency — 48-62 Hz (48-440 Hz, Option 5)

Max Power Consumption — 145 W at 120 V, 60 Hz.

DIMENSIONS AND WEIGHT

Dimensions:

Cabinet (with handle and feet)
Height — 32.8 cm (12.9 in)
Width — 21.4 cm (8.4 in)
Length — 57.2 cm (22.5 in)

Rackmount

Height — 17.8 cm (7 in)
Width — 48.3 cm (19 in)
Length — 56.9 cm (22.4 in)

Weights:

Cabinet — 16.9 kg (37.25 lbs)
Rackmount — 19.1 kg (42 lbs)

ORDERING INFORMATION

5223 Digitizing Oscilloscope
R5223 Digitizing Oscilloscope (Rackmount)
Option 05 — 48-440 Hz operation
(R5223 only)

Option 10 — Add GPIB

Line cord options available for International operation:

- Option A1 — European Universal 220 V
- Option A2 — United Kingdom 240 V
- Option A3 — Australian 240 V
- Option A4 — North American 240 V

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