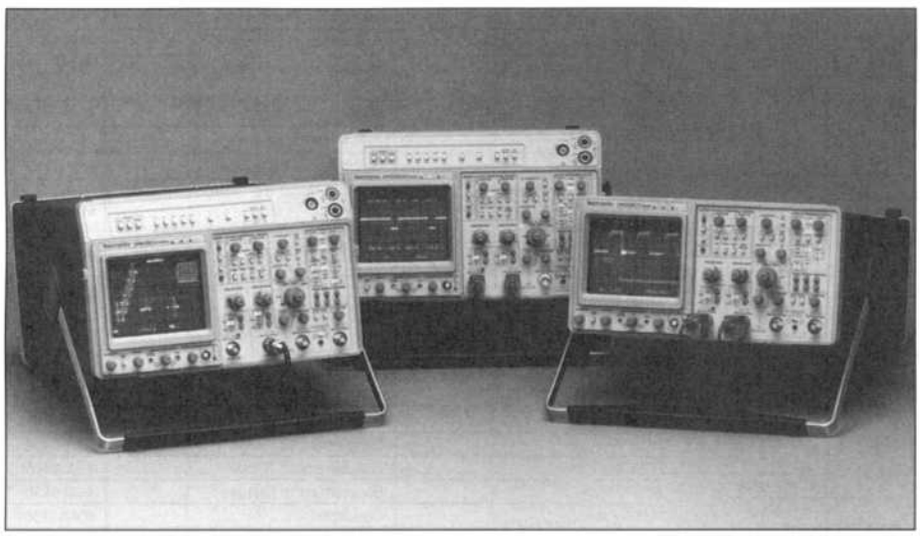
# 2400B Series Portable Analog Oscilloscopes



*2400B Series 150 to 400 MHz Four-Channel Oscilloscopes*

NEW NEW NEW

## 2467B/2465B/2445B

### TYPICAL APPLICATIONS

- Design Test and Measurements
- Production Line Testing
- Communications Equipment Design and Service
- Field Servicing

### BENEFITS

- Better Repeatability From Built-in Automation
- Faster Results From Automated Measurements
- Less Drudgery From Push-button Selections
- Better Accuracy From Reduced Operator Error

### FEATURES

- 400 MHz Bandwidth (2467B, 2465B)
- 875 ps Rise Time (2467B, 2465B)
- Push-button Measurements
- Four Independent Channels 500 ps/div Time Base (2467B, 2465B)
- Auto Setup
- Save and Recall Setups
- Set-Up Sequencing
- Volts and Time Cursors
- Cursors After Delay
- 500 MHz Trigger Bandwidth (2467B, 2465B)
- Selectable Input Impedance (1 MΩ, 50 Ω)
- 20 ps Time-Interval Resolution
- 400 MHz at 5 mV/div
- 350 MHz at 2 mV/div
- Lightweight and Rugged

**Now your top choice in portable analog scopes is more automatic than ever.** The Tek 2400B Series combines new convenience and leading-edge performance, *now up to 400 MHz.* Six scopes bring unprecedented efficiency to your design lab, production line or field service site.

**Measure signals on screen in less time—automatically.** You can measure rise time, fall time, frequency, width, voltage and time interval A to B on A sweep at the push of a button. In addition, setup and measurement functions can be initiated by pressing an ID button on the head of Tek's new P6137 passive voltage probe.

The 2400B Series features Auto Setup—a tremendous time-saver. Just attach up to four probes to signal points, press AUTO SETUP, and within seconds you have a stable, automatically triggered display of your probed waveforms. It couldn't be simpler.

Auto Setup includes Tek's proprietary Pulse Mode for viewing narrow pulses in detail. Your scope calculates the duty factor and properly displays either the low-duty-cycle pulse or several cycles of symmetrical waveforms. The scope will display, position and scale up to four waveforms.

**Instant access to complex setups means even faster measurements.**
For closer examination of your signals and for specialized setups—such as delayed sweep displays or displays using the extended measurement options—front-panel control manipulations are still necessary. But now you need to create complex setups only *once*.

Non-volatile memory for 30 setups stores all front-panel information, including trace and readout intensity, cursor locations and control settings for the measurement options. Each setup can be labeled with a descriptive name for natural association and ease of recall.

This is a fast, easy alternative to the process of re-creating a front-panel setup every time you want to change measurements. Your attention can be focused on problem-solving, not control adjustments.

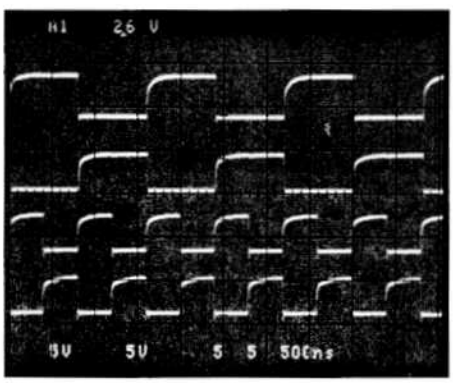
For example, by simply recalling previously saved setups, design engineers can display and make measurements on widely varying waveforms for purposes such as verifying products, demonstrating prototype behavior, generating documentation and characterizing devices, all without having to repeat time-consuming, manual front-panel setups.

Field service personnel can preset frequently used test setups and operate more effectively in much less time.

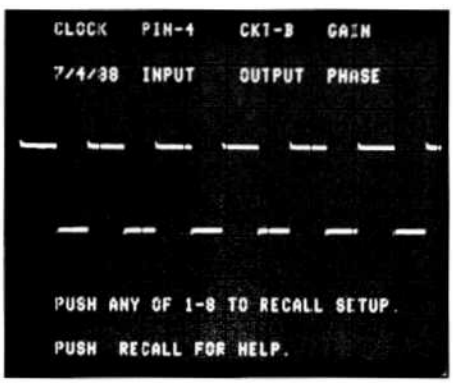
**Automate measurement sequences without an external controller.**
You can also set up, store and sequence your systematic verification procedures for engineering prototypes, final production test or field service without a computer—and without writing a single line of code. Step through up to 30 stored setups. Just press the STEP button once for each sequence step. Or plug a foot switch into the rear-panel jack for "hands-free" operation.

As a further aid, seven-character alphanumeric labels can be stored with each setup. These can be test titles or even operator prompts for test point connections. Guard your saved setups and sequences with write protection.

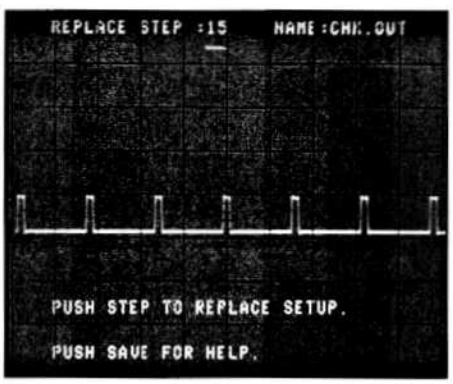
Built-in sequencing is standard throughout the 2400B Series. You can implement semi-automated procedures with a single, standalone portable oscilloscope. This also offers an excellent, price-competitive entry into automated testing. You can move from the 2445B through the 2467B and its options with complete upward mobility.




*Four waveforms were triggered, scaled and positioned by simply pressing AUTO. No other adjustments were necessary.*




*Pressing RECALL and a test number resets the 2445B/2465B controls to a previously stored setup. The first eight names appear on the CRT when you press RECALL.*




*Sequences are arranged and modified with the front-panel controls. Information about the sequence steps and directions for the operator are written on the scope display for easy reference.*

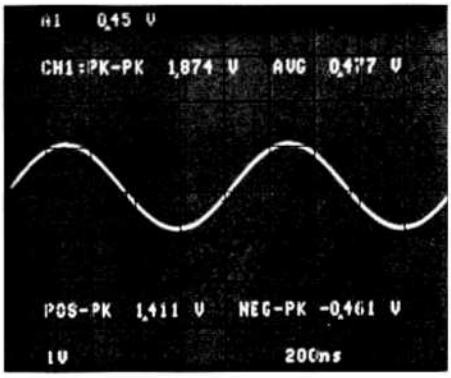
PRODUCT CONFIGURATION GUIDE

| Features | Standard Models | | | | Special Edition Models | | |
|---|---|---|---|---|---|---|---|
| | 2467B | 2465B | 2455B | 2445B | 2465B CT | 2465B DM | 2465B DV |
| Bandwidth | 400 MHz | 400 MHz | 250 MHz | 150 MHz | 400 MHz | 400 MHz | 400 MHz |
| GPIB | Option 10 | Option 10 | Option 10 | Option 10 | Included | Included | Included |
| Counter/Timer/Trigger, Word Recognizer | Option 09 | Option 09 | Option 09 | Option 09 | Included | Included | Included |
| DMM | NA | Option 01 | Option 01 | Option 01 | NA | Included | Included |
| Video Measurement System | Option 05 | Option 05 | Option 05 | Option 05 | NA | NA | Included |
| Counter/Timer/Trigger, No Word Recognizer | Option 06 | Option 06 | Option 06 | Option 06 | — | — | — |
| Two Additional Probes | Included | Option 22 | Option 22 | Option 22 | Included | Included | Included |
| Rackmount | Option 1R | Option 1R | Option 1R | Option 1R | Option 1R | | |
| Probe Power | Option 11 | Option 11 | Option 11 | — | — | — | — |

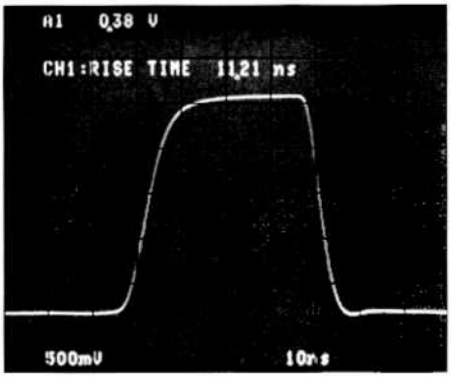
Tek state-of-the-art technology makes possible the 2465B's 400 MHz bandwidth along with new pushbutton measurements, the first in an analog instrument. In addition, new pushbutton probes take the full bandwidth to the probe tip—where you really need it.

**Get rise, fall, frequency, width, voltage and time measurements at the push of a button.**

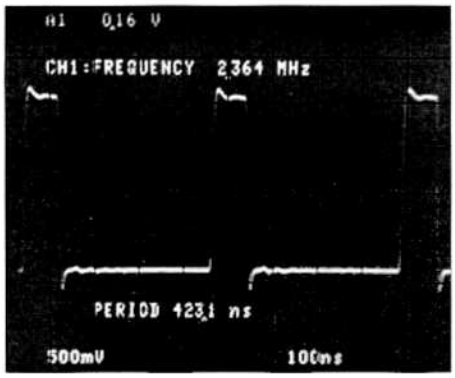
New 2400B Series pushbutton smarts offer capability previously available only with a digital storage oscilloscope or high-performance counter. No need even to press AUTO. Your scope sets itself automatically and scales a signal for display—at the push of a button.



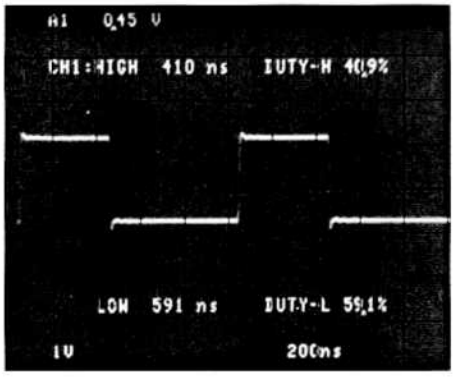

**1. Volts** Simply select VOLTS to access amplitude information such as Positive and Negative Peak, Average and Peak to Peak. With Tektronix-coded probes, scaling is automatic.



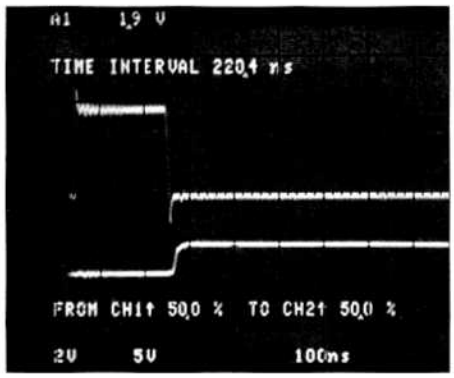

**2. Risetime/Falltime** Select RISETIME or FALLTIME and your scope presents an automatically triggered and scaled display of your probed waveform along with measurements results—either rise or fall using 10% and 90% points.

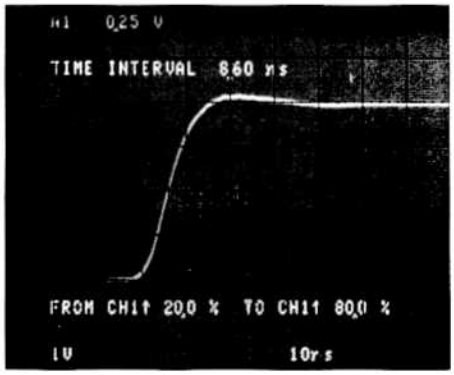



**3. Frequency** When you need a measurement "snapshot," both frequency and period are available at the touch of a button. For high accuracy measurements, include the Counter/Timer/Trigger option for expanded functions and accuracies to 0.001%.



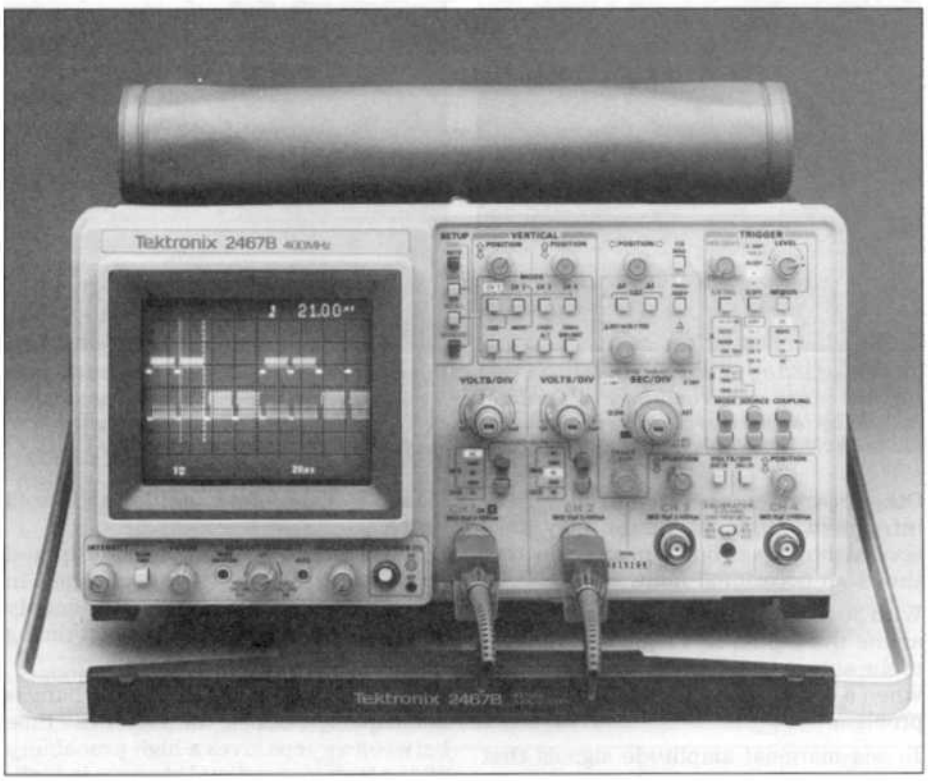

**4. Width** Both width and duty cycle are measured with a single selection.




**5. Time A to B** Channel-to-channel TIME is the most versatile of all the new pushbutton measurements. You have complete control of the triggering on channel-to-channel timing measurements. Start and stop events can be set in percent of peak-to-peak or in volts—on either rising or falling edges of CH1 and CH2. Applications include measureing risetime from other than the standard 10% and 90% points, such as 20% and 80%.

True four-channel capability includes two channels optimized for logic signals. You can also make three-channel X-Y comparisons such as multiple transducer measurements.




**NEW 2467B**

**GPIB** IEEE-488

The 2467B Option 10 complies with IEEE Standard 488.1-1987 and with Tektronix *Standard Codes and Formats.*

**• 4 ns/div Visual Writing Speed**

**4 ns/div visual writing speed—the advantage is visible!**

Writing speed has traditionally been a measure of CRT performance. However, the performance of conventional CRTs is usually specified as *photographic writing speed* and represents the point at which phosphor luminance is adequate to record a waveform using a camera and high-speed film—but still *invisible* to the eye.

On the other hand, specifying *visual writing speed* identifies a scope as being able to emit enough light to be visible to the eye in normal room light without a viewing hood.

The Tek 2467B specifies CRT visual writing speed at 4 cm/ns. Most important, its single-shot and system bandwidths are the same, 400 MHz. For the first time with a portable instrument you can use *all* of its bandwidth in single-shot applications.

The visual writing speed of conventional analog scopes is inadequate to permit full-bandwidth, single-shot use.

Visual writing speed combined with the high display update rate of the 2467B provides the quick response and high visibility necessary to see faults in today's complex, high speed systems.

**Observe faults you couldn't see before.** The 2467B with microchannel-plate (MCP) CRT instantly reveals events other scopes fail to show. At 4 cm/ns, its *visual writing speed* is approximately 100 times faster than that of *any other portable instrument.* This makes it possible to see and identify circuit faults caused by erratic or infrequent events that may occur only once in a million normal cycles. Plus, these faults can be seen in normal room light, without a viewing hood.

**Tek's exclusive microchannel-plate CRT.** Tek's unique MCP display amplifies the intensity of infrequent signals, yet limits the intensity of signals with high-repetition rates. This results in visual writing speed sufficient to display everything that happens in your circuit, whether it occurs once or repetitively.

The 2467B displays glitches that remain hidden on scopes with conventional CRTs, and that digital storage scopes fail to capture because of low trigger probability. Being able to see unexpected transients, even within highly repetitive events, makes the critical difference in many troubleshooting situations.

***The 2467B and Tek DCS01 Digitizing Camera System combine to give you 400 MHz single-shot capability along with up to 10 ps/point digitizing.***

Digital design and test engineers, for example, now have an effective and affordable tool for identifying system faults caused by troublesome design bugs such as asynchronous noise, crosstalk, bus contention, marginal timing, metastability or a one-in-a-million anomaly. This helps shorten product design cycles—and deliver more reliable products.

**Digitize, store and analyze waveforms on your IBM PC.**

The Tektronix DCS01 (Digitizing Camera System) bridges the gap between your analog scope and PC. It easily and cost-effectively adds digitizing and signal processing capability to the 2467B. The scope's microchannel-plate CRT allows the capture of transient and repetitive signals at the full 400 MHz bandwidth with 8-bit resolution (12 bits on repetitive signals).

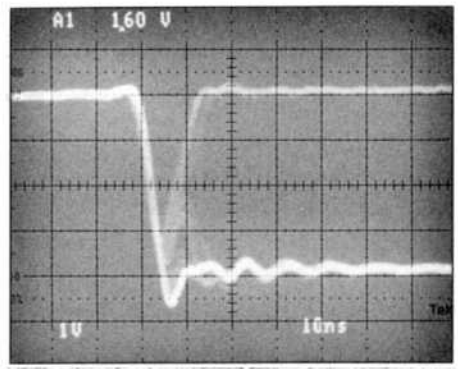
Add Tek Signal Processing and Display (SPD) software for 186 waveform analysis functions. Both DCS and SPD software are modular for solutions satisfying your unique requirements.

For additional information on DCS software see the Digitizer section. For SPD refer to the Test and Measurement Software section.

**Find circuit problems in digital systems.**

When troubleshooting a digital system, you want to see a fault immediately. When using a logic analyzer for digital troubleshooting, the perfect companion is the Tek 2467B. With the 2467B's high visual writing rate, digital glitches such as runt pulses and metastability are readily viewed—as they happen.

Due to short trigger holdoff and sweep reset times, the display update rate of analog scopes such as the 2467B is much higher than digital storage oscilloscopes. This plus Tek's exclusive MCP-enhanced CRT makes it possible for the 2467B to display intermittent variations *as they happen*, even if masked by thousands of normal traces.




*The metastability in this high-repetition rate flip-flop output occurs only once in a million normal cycles, yet it is clearly visible thanks to the 2467B's high visual writing speed.*

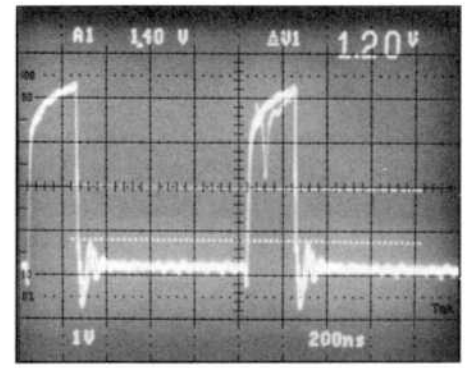
Other instruments may not display these infrequent faults at all or may take several minutes to build up a display that shows an occasional fault.

With 30 ns pretrigger display, you can examine the inputs to a logic device prior to the output transition. Seeing the inputs when a fault occurs can point to the real problem.

To see marginal amplitude signals that might otherwise go undetected, set the trigger level just above the low logic level or just below the high logic level. Trigger-level readout lets you set the trigger point where you want it, without trial and error.

**Determine actual noise margins.**

With its ability to clearly display transient events in the presence of numerous normal signals, the 2467B shows designers actual noise margins essential for reliable system operation. With the 2467B, no matter how infrequently noise pulses occur, they are clearly displayed. You can see the worst case even if it is asynchronous to the monitored signal.

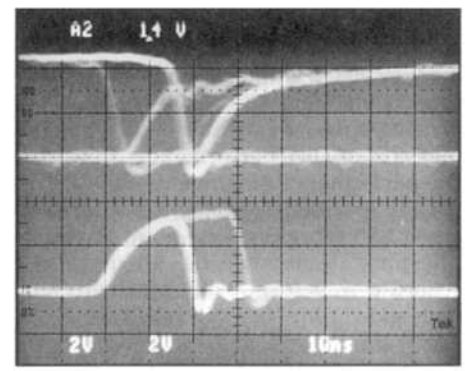



*Cursors are set to indicate input threshold limits. The high visual writing speed of the 2467B easily shows this infrequent glitch narrowly missing the upper threshold limit.*

**Measure worst-case setup and hold times.**

Digital systems rely on valid setup and hold times. Noise, timing changes in various system states, and power-supply coupling—all can cause infrequent timing violations.

The 2467B lets you see timing changes immediately, because the short dead time between sweeps gives a high probability of displaying occasional changes in high-repetition rate signals. Other instruments may require long periods to construct a display, if they can show the variations at all.




*In this display, the data (upper trace) occasionally moves into coincidence with the rising edge of the clock (lower trace), violating the timing margin. Also note the occasional change in clock pulse width.*

## 2465B Special Packages—Preconfigured Packages That Fit Specific Needs

Your choice of 2400B Series portables also includes three 400 MHz 2465B Special Editions: the 2465BCT, 2465BDM, and 2465BDV.

**Substantial Savings**

As preconfigured packages, Special Editions offer significant savings over the cost of individual enhancements. You get multi-instrument capabilities while reducing rack space, equipment cost and programming complexity.

Common to the 2465BCT, 2465BDM and 2465BDV is the GPIB interface which makes each a perfect systems choice. All front-panel controls are programmable.

The 2465BCT with CTT-Word Recognizer is ideal for making the precise timing measurements needed with communications, office and computer-related equipment.

The 2465BDM has the CTT-Word Recognizer *and* a digital multimeter that extends its applications as a self-contained, multipurpose instrument in government/military electronics, avionics, and ATE stations.

The 2465BDV has the CTT-Word Recognizer, the digital multimeter, *plus* video waveform display capability for even more extensive applications—including the design, manufacture and service of raster scan devices and high-resolution video equipment.

## Options for the 2467B, 2465B, 2455B, and 2445B

Option 01 Digital Multimeter
Option 05 Video Waveform Measurement System
Option 06 Counter/Timer/Trigger (CTT)
Option 09 CTT with Word Recognizer
Option 10 GPIB Interface
Option 1E External Clock
Option 1R Rackmounting
Option 2R Rackmount for Opt. 01

Descriptions for each of the options begin on the following page.

| | 2467B | 2465BDV | 2465BDM | 2465BCT | 2465B | 2445B |
|---|---|---|---|---|---|---|
| Bandwidth | 400 MHz | 400 MHz | 400 MHz | 400 MHz | 400 MHz | 150 MHz |
| High Visual Writing Speed | | | | | | |
| GPIB | OPT | STD | STD | STD | OPT | OPT |
| Counter/Timer/Trigger-Word Recognizer | OPT | STD | STD | STD | OPT | OPT |
| Digital Multimeter | N/A | STD | STD | N/A | OPT | OPT |
| Video Trigger | OPT | STD | N/A | N/A | OPT | OPT |
| Counter/Timer/Trigger (w/o Word Recognizer) | OPT | STD | STD | STD | OPT | OPT |
| Probes | 4 | 4 | 4 | 4 | 2 | 2 |
| Rackmount | OPT | OPT | OPT | OPT | OPT | OPT |
| Warranty | Three years on parts and labor, including the CRT | | | | | |