Tektronix redefines the oscilloscope

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The 11000-Family from Tektronix includes four new mainframes, five new plug-ins, and three new probes.

When you first see a new 11000-Series Oscilloscope from Tektronix, you know this is something different. The simple, clean lines of the front panel, the large display screen, and the new form factor tell you that these are instruments like none you've ever seen before.

But beneath this simple, yet exciting, exterior is more measurement power than ever before designed into a stand-alone oscilloscope. The following article describes the common features and design goals of the new 11000-Family. Companion articles provide details on the new analog oscilloscopes, digital oscilloscopes, amplifier plug-ins, and probes which make up the initial offering in this exciting new oscilloscope family.

Oscilloscopes exist for one reason only — to make measurements. However, the measurement requirements of today's technologies are quickly outpacing the capabilities of conventional oscilloscope architecture.

For example, four-channel scopes are no longer adequate for many applications. Today's circuits — especially digital circuitry — often require simultaneous viewing of up to eight waveforms. There also needs to be a faster way to get more information about each waveform and its inter-relationship to others without resorting to computers and extensive software support. Detailed and complete measurement results need to appear on the oscilloscope screen — directly, in real-time, and with minimum bother.

But meeting today's multiple waveform display and processing requirements with traditional oscilloscope architecture leads to overwhelming front-panel complexity and confusion. Look at a traditional four-channel laboratory oscilloscope. Then just consider doubling its basic capability. There wouldn't be enough room for the necessary controls in the conventional format, let alone room for additional measurement capability. Even if such a scope were built, imagine the confusion in using it.

Breaking this capability/complexity barrier requires a completely new oscilloscope architecture. That architecture has been implemented in a new generation of oscilloscopes from Tektronix, the 11000-Family.

Introducing the 11000-Family

The 11000-Family includes four new mainframes, five new plug-ins, and three new probes. Both analog and digitizing oscilloscopes are included, providing bandwidths ranging from 400 MHz to 1 GHz. All of these scopes combine advanced measurement power with a new touch-screen human interface on a large-format display screen. The result is a series of advanced oscilloscopes with extremely clean front-panels (Figure 1) providing faster user access to all capabilities. At the same time, up to eight traces can be displayed simultaneously.

What's more, there's been absolutely no compromise in performance. In fact, bandwidth, accuracy, resolution, record length — all the familiar performance criteria — have been either maintained at state of the art levels or advanced to new levels. And all 11000-Series scopes — analog scopes included — offer automatic set up and measurement of common waveform parameters such as period, frequency, peak-to-peak amplitude, and minimum, maximum, and middle levels.

At the same time, prices have been kept extremely low, considering the capabilities provided on a per channel basis. For example, the 11300-Series analog scopes contain a built-in universal counter-timer that compares with some of the most sophisticated in the world. Yet these analog scopes, with the counter-timer included, cost about the same as the nearest comparable stand-alone counter-timer. Moreover, the 11300-Series counter-timer is far easier to use than stand-alone units while providing new and unique measurement features.

In addition, the cost of ownership of these new scopes has been reduced through at least a doubling of the recommended time-between-calibrations — a statement of Tek's confidence in the performance of these new instruments. When it is time to recalibrate, the process is significantly reduced through the extensive use of on-board diagnostics and calibration aids. Finally, the enhanced accuracy mode, which is standard on all 11000-Series scopes, ensures that you can make the most accurate measurements possible with any oscilloscope system.

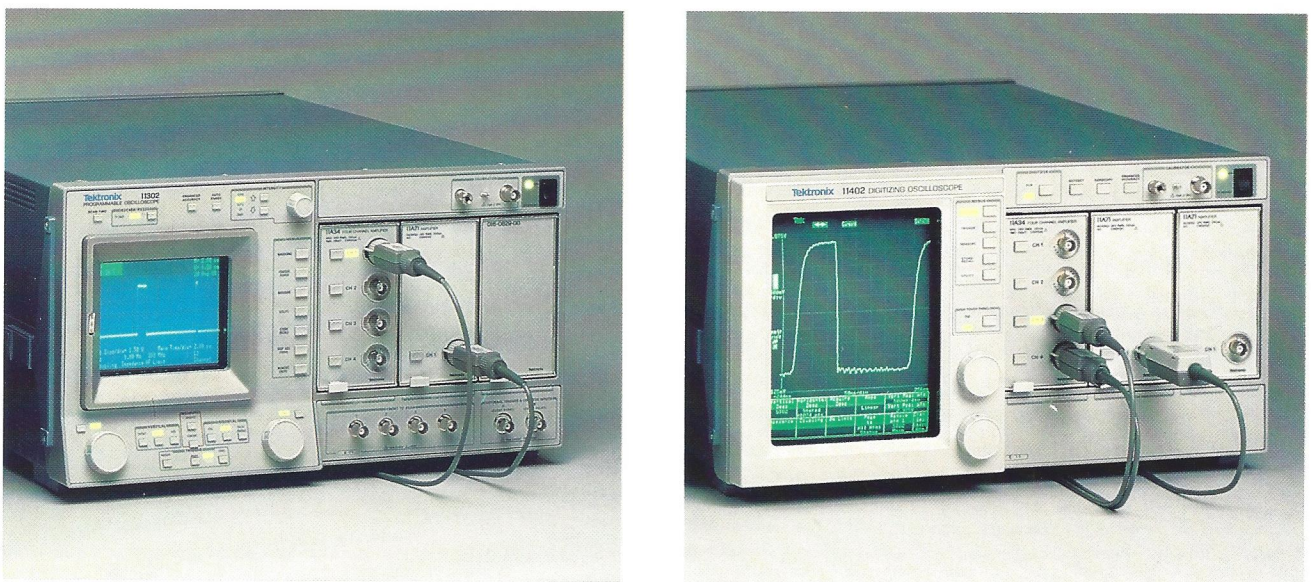

Figure 1. *Front panels of the 11000-Family are clean and uncluttered. The 500 MHz 11302 Programmable Oscilloscope is on the left and the 1 GHz 11402 is on the right.*

Human interface at the measurement plane

Providing advanced capabilities with quick and easy user access required numerous engineering innovations, including a completely new approach to oscilloscope operation and architecture. Multiple microprocessors handle the complexities of switching and interfacing while making operation simple and straight forward. A computer-bus architecture with distributed processing was literally designed into the oscilloscope mainframes and plug-ins. A bus structure is even included in the probe leads to handle SRQs (GPIB service requests) and other automatic functions that can be invoked by pressing a button available on all new 11000-Series probes.

A primary goal in overall 11000-Family design was to move user access to scope control away from the myriad of knobs and down to the measurement plane — the area where your focus is directed during a measurement. For example, the first area of attention when making a measurement is attaching probes to test points. After a 11000-Series probe is attached, pressing a button near the probe tip automatically sets up the basic scope functions to bring a usable signal display onto the screen. The same button can also be assigned to sequence through a stored series of up to 10 complete front-panel settings, to issue an SRQ to an external computer, or to invoke automatic waveform measurements.

The next and most important measurement plane is the oscilloscope display itself. This is where actual waveform observations and measurements take place. To concentrate measurement access on and around the screen, the traditional method of dealing with mainframe and plug-in switches and controls was redefined. Instead of one knob or switch per function, control was moved to a few knobs and buttons next to the display screen — and to the screen itself (Figure 2). Full control is concentrated at the screen, where measurements are taking place to allow you to keep your eyes on the trace and your attention on the measurement.

Most selections are made by touching a label, icon, or waveform on the screen. Details of the touch screen are given in the sidebar **Touch screen provides front-panel simplicity**. Control is simplified through a scheme of parallel on-screen pop-up menus (Figure 3). This menu scheme is similar to user-friendly software designed for personal computers. Except, with the 11000-Family, you don't press function keys or click a mouse. Access is more direct and much faster. Just touch the screen menu for the functions you want and touch the waveforms or labels you want the functions to apply to. It all happens at the screen where your attention is focused during measurements. And it happens in real time, with function changes and measurement results appearing as quickly as you select them.

An added benefit from this approach is that each menu presents only the selections that are currently valid for the measurement at hand. You don't need to decide which knob in which area of the panel will produce the desired affect. Nor do you need to be concerned about turning the wrong knob and upsetting your measurement setup.

As you select different menus, the two large control knobs are assigned separate functions. For one menu, these knobs may provide vertical positioning and select vertical deflection factor; for another, cursor positioning; and so on.

Automatic setup

Getting a display on the screen has never been easier. Just touch the probe tip to the signal source and press the button on the probe body. The selected signal is automatically scaled both vertically and horizontally, a trigger point is chosen on the selected waveform, and the waveform is positioned on the CRT. You can also push the front-panel AUTOSET button to get the same results.

The autoset display may not be ideal for all measurements. In such cases, just press AUTOSET (or the button on the probe) to get a preliminary setup. Then refine individual settings to provide a display that meets your measurement needs.

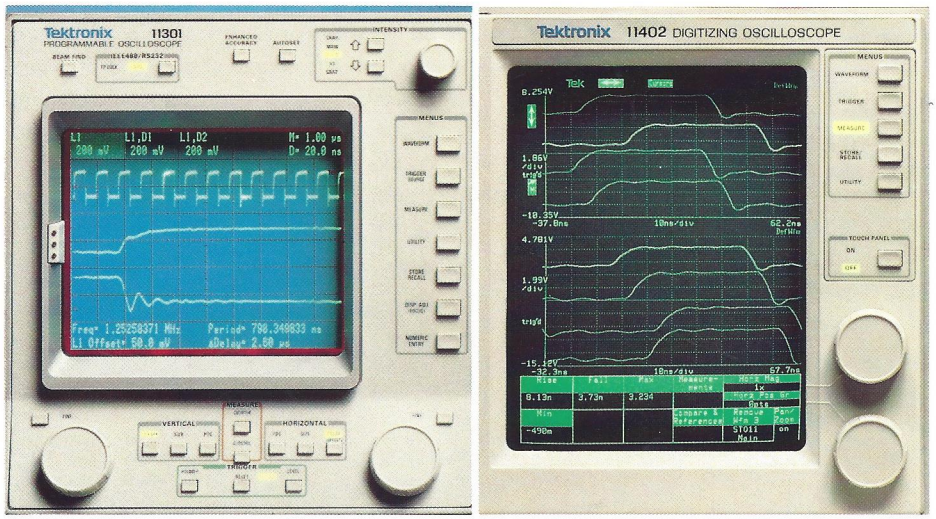

Figure 2. *Controls for the 11000-Family are grouped around the display. Notice the two large redefinable control knobs below the 11301 CRT (left) and beside the 11402 CRT (right).*

Case of the missing horizontals

The new 11000-Series mainframes accept up to three new 11000-Series plug-ins. The 11300-Series can display up to eight traces from any combination of plug-ins in the left and center

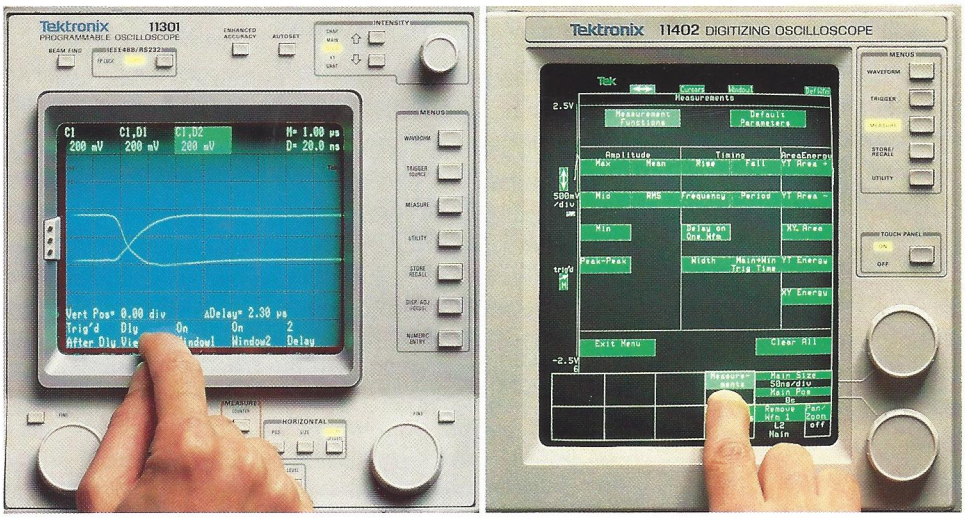

Figure 3. *Pop-up menus provide quick, easy access to measurement functions. A simple touch selects a menu item.*

compartments while the 11400-Series can display signals from the right compartment as well (up to a maximum of eight). For more detail on available plug-ins, see **Select your performance with 11000-Series plug-ins** in this issue.

One apparent omission from this new plug-in line-up is a time base plug-in. In analyzing use of earlier plug-in instruments, it was found that the horizontal plug-ins were rarely, if ever, interchanged. As a result in the 11000-Family, accurate time bases were designed into the mainframe circuitry. However, provision is made for all functions that need an amplifier in the horizontal channel such as X-Y displays and external horizontal input.

Automatic measurements

Through the "measure" menu on the touch screen, up to six pulse-parameter measurements can be selected on the 11400-Series and up to eight on the 11300-Series. Then as a signal is displayed, the selected parameter measurements for that signal are automatically performed and the results displayed on the CRT. These values are also available over the GPIB or RS-232C bus for automatic data logging, for making process control decisions, etc.

Need more accuracy?

Before the 11000-Series oscilloscopes, special calibration techniques have always been required in order to get oscilloscope measurement accuracies better than the traditional 2 or 3%. But this has all been changed. Each 11000-Series mainframe contains a precision voltage and timing reference for self-calibration. Once the instrument reaches operating temperature, a simple press of a front-panel button (or an instruction via GPIB or RS-232C) invokes a self-calibration of all gain and timing-related functions — from input connector to display screen. A special probe-calibration routine even allows automatic calibration all the way to the probe tip. And this enhanced-accuracy state applies to all measurements until the instrument is turned off, until an internal sensor detects an ambient temperature change of ±5 degrees C, or a plug-in unit is changed. A warning message is issued to the screen when the instrument can no longer make enhanced-accuracy measurements.

Provision is also made to guide you through probe compensation. One of these probe-calibration steps allows you to "deskew" probes as well as the associated channel to match delay through any two channels for precision time-delay measurements.

Designed for systems ... but at home on the bench

With all of the built-in measurement power, the 11000-Family is a system in itself. But there are times when these powerful new instruments need to be part of a larger measurement system. The 11000-Family was designed with system applications in mind to allow an easy move to computer augmentation and programmed control when needed.

All of the 11000-Series scopes come standard with both an IEEE-488 (GPIB) and an RS-232C interface. They are fully programmable over both interfaces and, in the case of the digitizing versions, full bi-directional waveform transfers are supported. This allows complete integration of these scopes into fully automated test and measurement systems, or into any level of engineering bench automation supported by a personal computer, workstation, or mainframe. GPIB and RS-232C commands are identical and comply with Tek Standard Codes and Formats to allow the ease of programming and compatibility typical of Tektronix programmable instruments.

Also, since all 11000-Series scopes come standard with an RS-232C interface — the same interface found on most personal computers — the communication hardware is already in place for many engineering bench applications.

Setting up the interface between the 11000-Family and a computer has also been simplified. A "pop-up" menu allows you to select all the interfacing parameters with a simple touch or a turn of a knob. To reduce software development time, utility software which provides pre-programmed modules covering many standard instrument functions is available for the IBM PC and the Hewlett-Packard Series 200 computers.

To make system applications easier, these instruments can be easily converted from bench to rackmount use. All that is needed for rackmounting is removal of the feet and replacement of the side panels with rackmounting hardware. Cable feed-throughs for routing signals from rear to front — an important feature in system applications — are either standard or can be added with a simple option.

Supported by Tektronix

Behind these new instruments you have all the support you've come to expect from Tektronix — and more! Each instrument is supported by complete documentation — comprehensive operator's, programming, and service manuals (optional). Measurement software is also available for a variety of computers. If your application requires a customized approach, trained Tektronix Application Engineers are available to assist — just call your local Tektronix Field Office and ask for information on our Technical Assistance Services. Or call 1-800-426-2200, ext 7446 for the name and number of the nearest Tektronix Application Engineer. In Oregon, call 1-627-9000, ext 7446 collect.

A new feature with the 11000-Family is the first on-site service for oscilloscopes. Installation, preventive maintenance, performance verification, and fast troubleshooting can now all be performed at your location, making back-up instruments virtually unnecessary. See the article **On-site service available for 11000-Series** in this issue for further information.

A base for the future

Now you've met the new 11000-Family from Tektronix. But this is only the beginning of a whole new way of making measurements. These new scopes will change your world of oscilloscope measurements forever — you'll never make measurements the old way again. And this measurement capability is built around an oscilloscope architecture designed to not only meet the measurement needs of the '80s and '90s, but to carry over into the 21st century.

But these few pages don't allow enough room for us to tell you everything about these new instruments. For more information, read the accompanying articles on the new 11000-Family in this issue. Then, check the appropriate boxes on the **HANDSHAKE** reply card for a detailed brochure on the products that will best fill your measurement needs. Or call your local Tektronix Field Office or sales representative for a demonstration. And be sure to tell them you saw it in **HANDSHAKE.**

Touch screen provides front-panel simplicity

The designers of the new 11000-Series oscilloscopes were faced with a real dilemma — how to expand the functionality of these new oscilloscopes far beyond anything previously available while maintaining a simple, friendly approach to operation. The solution was found in a touch-screen CRT.

The touch screen is made up of a bank of infrared LEDs along two sides of the CRT with corresponding infrared sensors along the other two sides (see Figure A). This overlays the CRT screen with an invisible grid spaced so you cannot touch the screen without breaking at least one of the beams. The LED/sensor pairs are scanned one pair at a time every six milliseconds. Any interruption of the LED-to-sensor beam is detected, mapped as to location, and processed to activate the desired function based on the menu that is displayed.

Menus are generally called up by the buttons located adjacent to the CRT. Some menu selections call up an additional sub-menu. In no case, however, is it necessary to "back out" of a menu. You can always move directly from any level in any menu to the top level of any other menu with a single press of a button or a single touch on the screen. No menu is more than three levels deep.

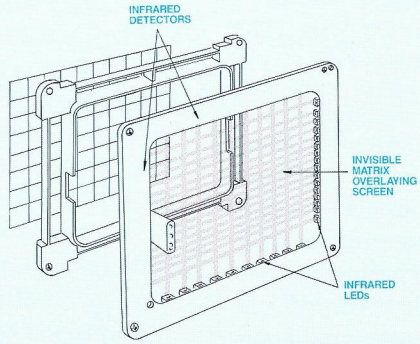

Figure A. *Detail of touch-screen matrix overlaying the CRT.*

To prevent the touch screen from showing fingerprints or smudges which might obscure the display, a special non-glare surface was put on the CRT. The result is an easy-to-read display even after extended periods of use.

It only takes a few minutes of introduction to feel right at home with touch-screen operation. A touch in the main menu area selects a pop-up menu which presents only the selections applicable to current operations. Further selection of the main menu choices is provided by the menu selection buttons to the right of the display. Before you know it, you'll be making measurements with these scopes. In fact, you'll probably find the touch-screen interface so convenient and easy to use that you'll have trouble going back to conventional knobs and switches.