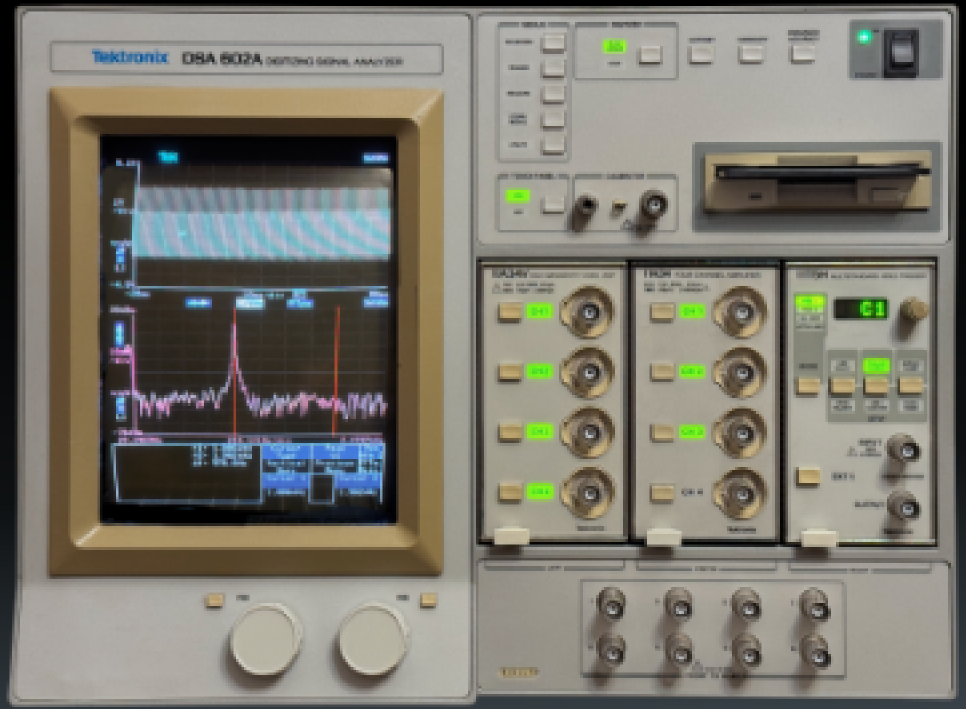


DSA 602A Oscilloscope

Digitizing Signal Analyzers

Probably what the 11400s should have been.

DSA 602A

I Made a Mistake

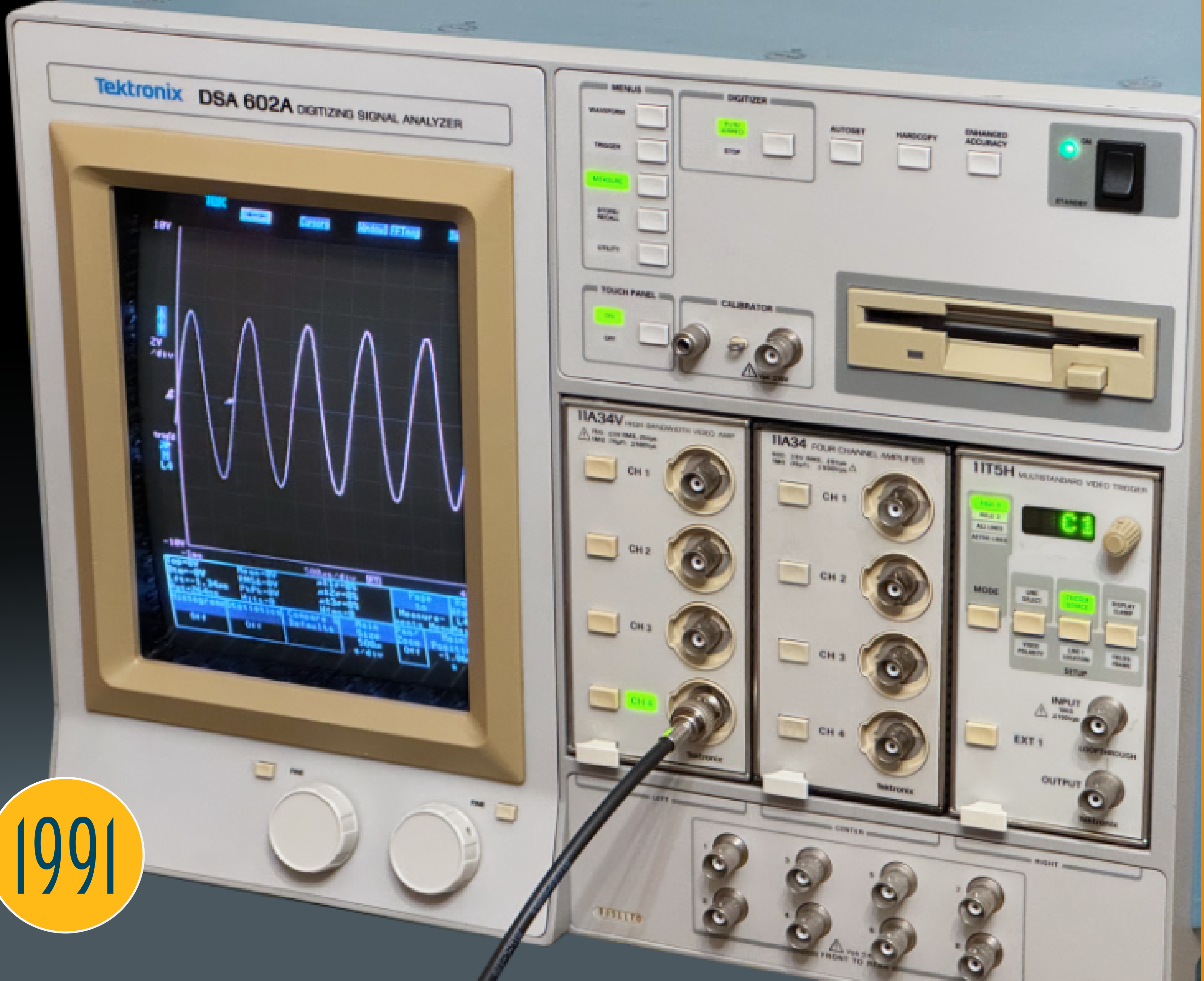
When the **Digitizing Signal Analyzer DSA 602A** arrived, I realized that I had made a mistake by using the term **monster** several times in this and other books, and now I lacked an appropriate adjective for the DSA 602A. For example, I defined the 62 dm^3 **11302** as a *monster*, but the DSA 602A exceeds 100 dm^3; it is like to say that you need almost two 11302 to make one DSA 602A. That is why I decided to call it **Super-Monster**.

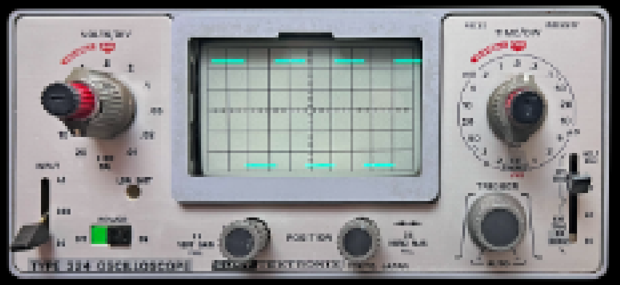
Its monstrosities don't stop to volume; the maximum power consumption of the DSA 602A, which has as many as three fans, is 585 W, while the 11302 settles for "only" 240 W. Even the glorious 1955 **545** was defeated (+15 dm^3, +3 kg, same power), but it had a more favorable form factor.

Prices were also **record-breaking**. When the 602 was introduced in 1989 it cost $28,500 ($68,795 in 2024), but just one year later the 602A was introduced and its price rose to $32,635 ($75,595 in 2024); in the same year you could save by buying the little brother 601A. Both the 601A and the 602A had 1 GHz bandwidth, but the former offered 1 GSa/s while the latter offered 2. The price of the 601A was "only" $24,745 ($57,319 in 2024).

In 1994, the year of the unit you see here, the price rose again to $34,600, $80,147 in 2024, more than inflation, thus. My DSA 602 also has the options 1C (cable feedthrough), 1R (rack mount) and 4C (non-volatile RAM), so its price with the plug-ins came to $49,200 ($104,738 in 2024), making it the originally **most expensive** unit in my collection. Today, it is not difficult to find a DSA on eBay for prices varying from 500 to 1,000 USD.

1991

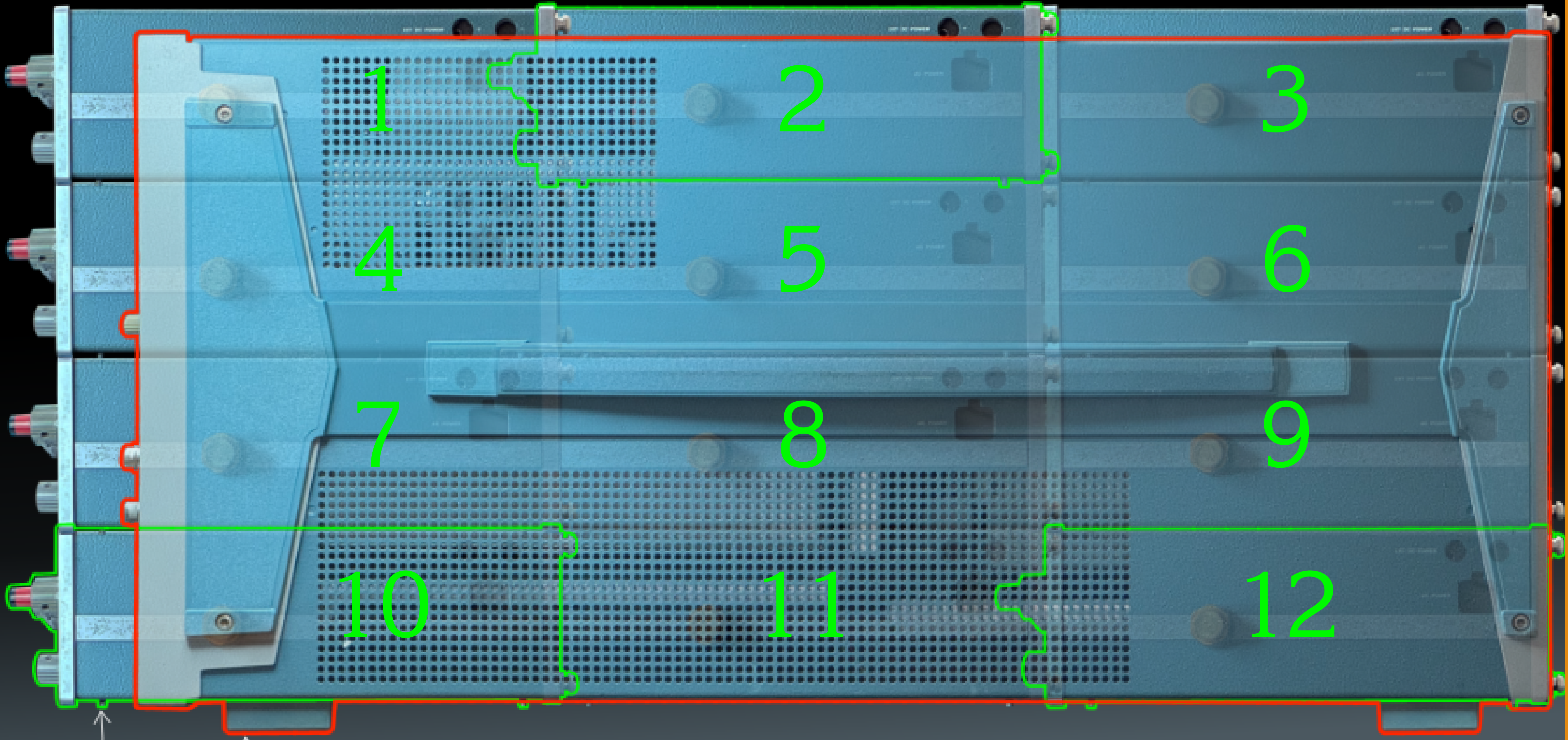




The battery-powered **Tektronix-Sony 324** is also described in this book, and it is the smallest oscilloscope I have dealt with.

If you ignore the knobs, it would take nearly **thirty** 324 oscilloscopes to match the volume of the DSA 602A.

That's a joke, of course, but it gives you an idea of the immense displacement of the DSAs!



Almost Thirty 324!

Digitizing Signal Analyzers

When Tektronix introduced the **DSA 601** and **602** in 1991, they didn't simply call them "oscilloscopes," but created the new term **digitizing signal analyzers** to emphasize their ability to apply complex waveform processing and analysis functions to the acquired time-domain data in real time; in a sense, the DSA could be logically considered the heir to the legendary **7854**, with its waveform processing capabilities greatly enhanced.

The DSA Series

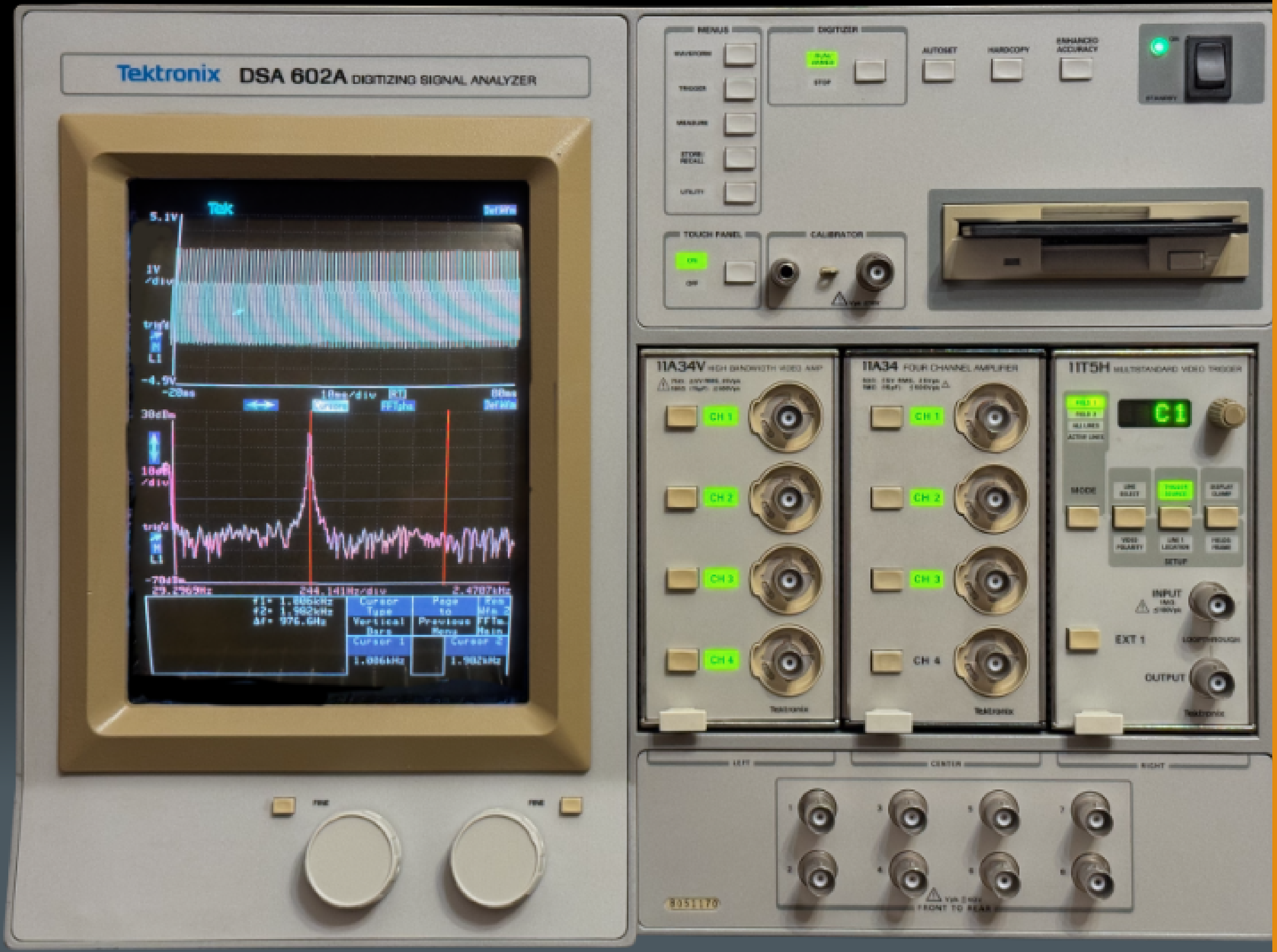
Offering real-time digitizing up to 2 GS/s, the DSA 600s were the **most powerful** members of the 11000 Series in the early 1990s. They contained a dedicated Digital Signal Processor (DSP) to process waveforms at unprecedented speeds.

The DSAs offered **live FFT**, signal **dejitter**, **fast averaging** at more than 180 waveforms per second, and more. For the highest level of performance in **single-shot acquisition** and **signal processing**, the DSA Series promised to provide the measurement solution.

These mainframes offered 1 GHz bandwidth and up to 2 GSa/s sampling rate. Within these limits, they could exploit the capabilities of the various 11000 series plug-ins, and were aimed at research, design / debug, characterization, and automated test (and, I might add, at those willing to spend that mountain of money on an oscilloscope).

DSA-Series Main Specifications

- **Mode of operation**: digital storage only;
- **Bandwidth**: fast rise time and bandwidth up to 1 GHz, depending on the plug-in amplifier you use;
- **Sweep**: speeds from 50 ps/div to 100 s/div, adjustable in a calibrated 1-2-5 sequence;
- **Sampling Rate**: 1 GSa/s (DSA 601A) or 2 GSa/s (DSA 602A);
- **Waveform number**: simultaneous display of up to eight waveforms. Each waveform can represent a single input channel, or a complex expression that mathematically combines multiple input channels, or an expanded window of another waveform;
- **Input channels**: up to 12 using four-channel plug-in amplifiers;
- **Advanced Trigger**: it is possible to define complex combinations of signals and time constraints;
- **Floppy Disk**: 3.5 inch PC compatible disk drive for storing and recalling waveforms and settings.
- **Vertical Resolution**: 8 bit;
- **Memory Depth**: each waveform can have from 512 to 32,768 points;
- **Automatic Measurements**: wide variety of complex measurements on a waveform with real-time updating.
- **Autoset function**: it allows quick adjustment of settings by pressing a single button;
- **User Interface**: menu driven touch-screen operation; only the choices that are appropriate are available for selection;
- **Remote Control**: via the RS-232-C or GPIB interfaces;
- **Enhanced Accuracy**: it assures accurate, stable waveform data and measurement results.
- **Display**: 10" (552 x 704 pixels).

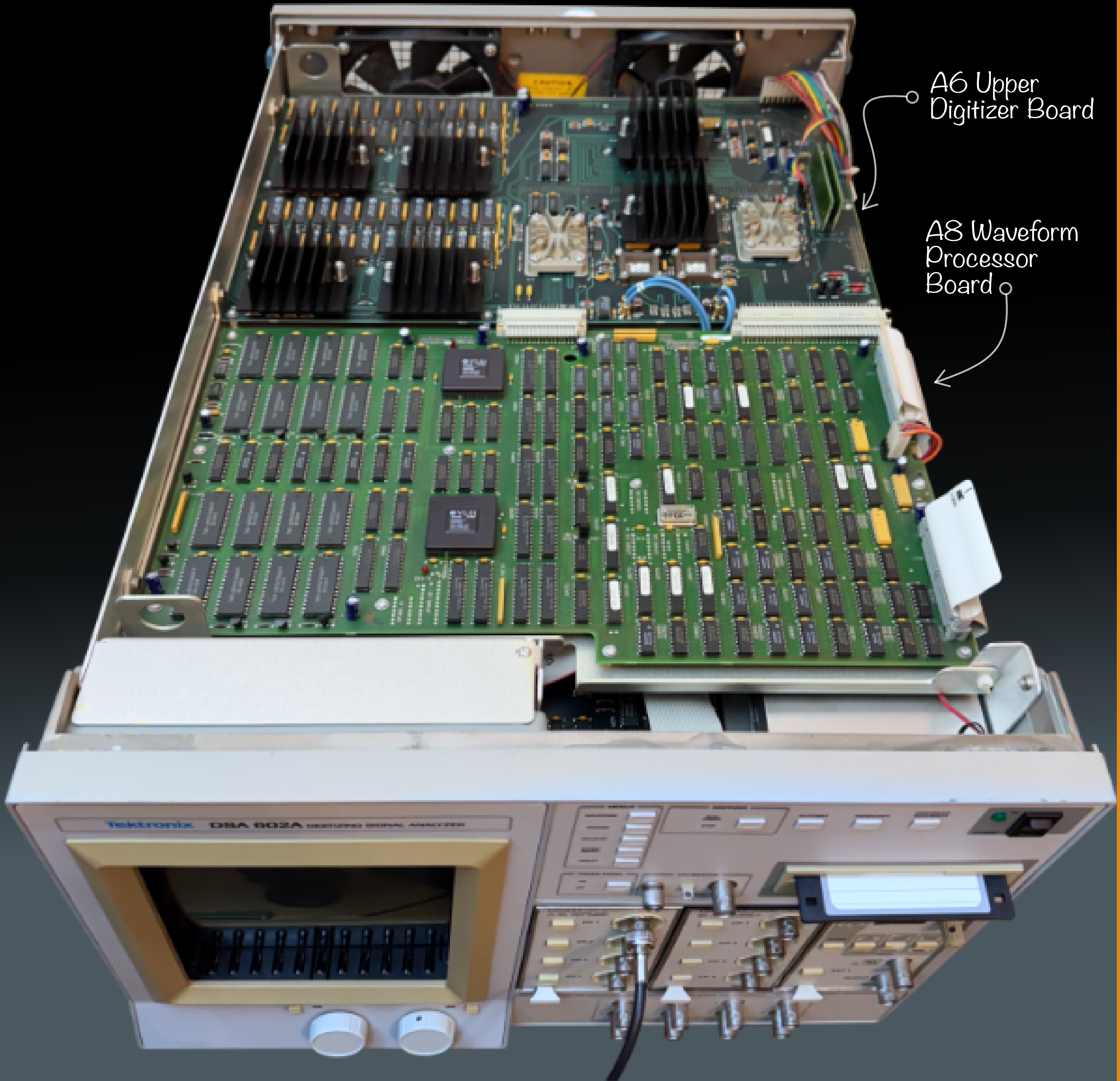


A Beautiful Construction

I remember when I was a boy, car engines were, under the hood, a mess of mechanics, pipes, wires, etc. In the 1970s, a neighbor of mine bought a BMW car and showed me the engine. I was very impressed: for the first time I saw style design principles applied to it, and it looked as beautiful and "clean" as ever.

When I first opened the DSA, I got the same impression. True, it is very large, but the designers have at least made use of the space with a really very nice and clean construction and, all in all, with a good accessibility to the various boards that make it up.

But this is only the most apparent part of a magnificent design where probably Tektronix tried to concentrate the best of their experience.



Three Innovations

New Requirements

In my Tektronix Epic Oscilloscopes book (that we call simply **TEO1** in this book), I had the opportunity to point out that the "old" 11400 Series was very innovative but was basically too slow; with its 20 MSa/s sampling rate, it was great for repetitive analysis, but practically unusable for real time. Within a few years, digitizers had made tremendous progress, and DSAs could run up to 2 GSa/s. However, these increased digitizers capabilities created also the problem of how to process and interpret the vast amounts of data being captured, quickly and accurately enough to produce timely and meaningful results.

Tektronix' Answer

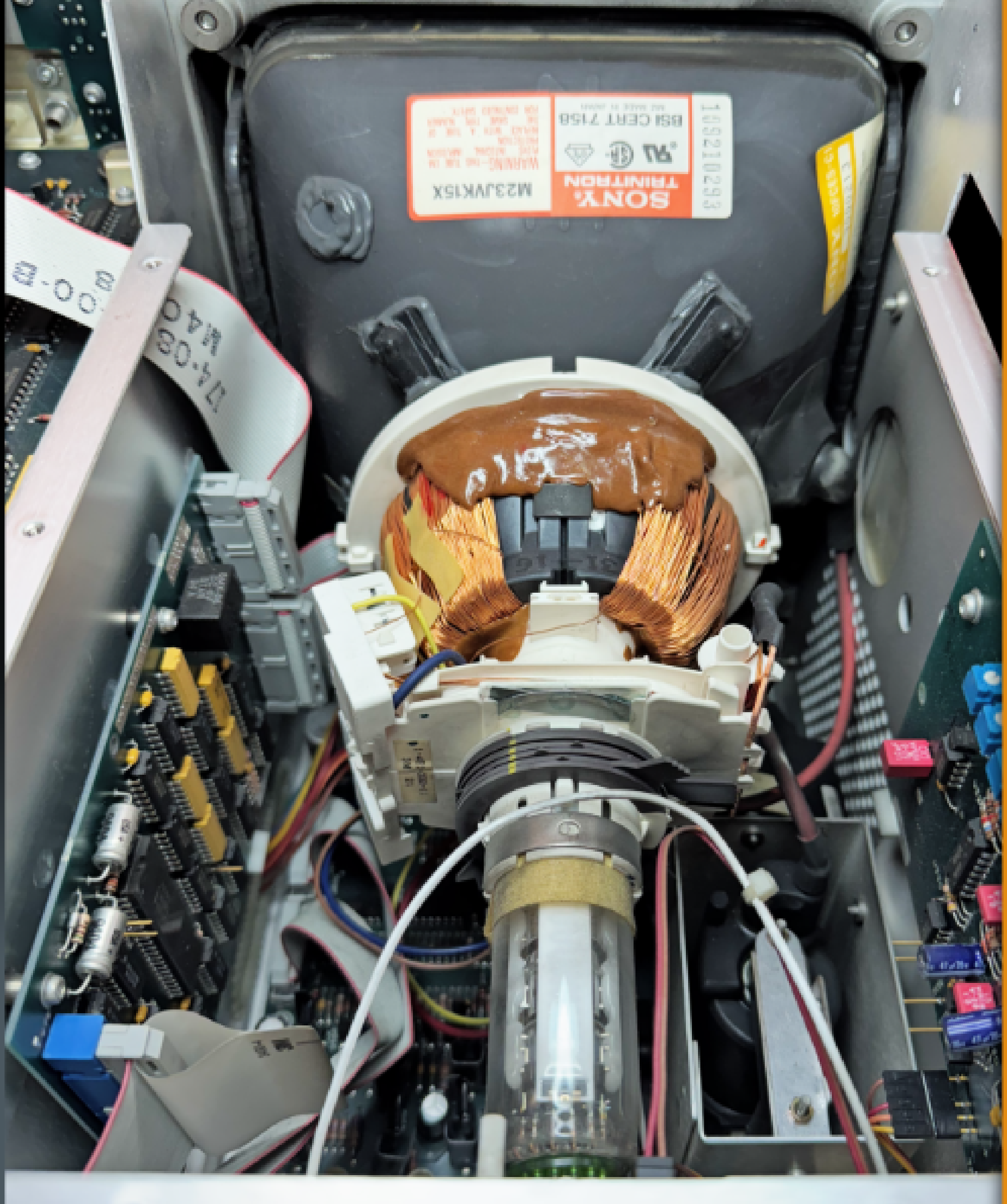
In a word, Tektronix's answer was **power**, the power embedded in the new DSA Series, which, as mentioned, they wanted to call **Digitizing Signal Analyzers** rather than simply "oscilloscopes": by incorporating proprietary advances in digital signal processing technology into an improved 11400 Series acquisition platform, the user could, for the first time in a DSO, see "live" updates of not only the acquisition, but also the results of complex waveform processing and analysis functions.

The Three Innovations

Trying to schematize, the DSAs introduced three kind of innovations that we are going to investigate on the following pages:

- new ultra-fast digitizers;
- new waveform processing power;
- new functions.

Photo: a minor innovation - looking at the interior, I had the impression that the DSA 602A CRT was much bigger than the 11403's one, but, I said to myself, you probably don't remember it well. On the contrary, the DSA CRT is indeed larger (10" vs. 8.5"), but the difference inside is more evident than outside.



Innovation #1

Ultra-Fast Digitizers

You get two samples in less time than it takes light to travel across this page!

The first innovation mentioned above were the new high-speed **digitizers**. Thanks to them, the DSA Series became equally useful for high-speed real-time acquisition, or for precision equivalent-time sampling of repetitive signals.

Howsoever, the DSA series abandoned the 11000 Series' dream of 10-bit A/D conversion, which caused so many problems at the time, and returned to a more modest 8-bit, still sufficient for most applications.

Up To Four Digitizers

The **DSA 601** had **two** 8-bit, 500 MSa/s digitizers. These digitizing "pipes" could be configured through instrument controls to allow simultaneous, 500 MSa/s, single-shot acquisition from two channels; or, they could be interleaved in order to obtain a 1 GSa/s sample rate from a single channel. Interleaving is a process in which the digitizers are internally linked such that the net sampling rate equals the sum of the rates of the individual digitizers. The **DSA 602** had **four** 8-bit digitizers in two boards, each capable of 500 MSa/s simultaneous single-shot acquisition on four independent channels. With interleaving, you could achieve 1 GSa/s on two channels, or 2 GSa/s on a single channel.

With both the DSA 601 and the DSA 602, up to **12 channels** could be acquired simultaneously for repetitive signals. Either real-time sampling or multi-point, random, equivalent-time sampling is internally selected, depending upon sweep speed, record length, and number of channels being acquired, to optimize acquisition accuracy. *When I read this statement, excerpted from Handshake Summer 1989, I thought it was a typo, since we know that the DSA can display "only" eight waveforms. But it is true if you use waveform arithmetic and, for example, define a waveform as the sum of more input channels.*

Photo: twelve lights on; despite the 18-traces limit, it is possible to acquire up to 12 channels at the same time by combining more channels in one waveform.

Innovation #2 TriStar Digital Signal Processor

TriStar Processor

To reach their ambitious targets, Tektronix engineers developed the **TriStar Digital Signal Processor** (DSP), a high-speed CMOS, Reduced Instruction Set Chip (RISC) processor designed specifically for digital signal processing on board the DSA 600 Series Digitizing Signal Analyzers. It consists of an arithmetic unit, an address computation unit, and an instruction fetch unit. These three units operate in parallel to process data simultaneously in a single clock cycle. For example, complex operations such as 16-bit x 16-bit multiplication can be performed in the same clock cycle as register shifts.

Under Emphasized?

Almost confirming some of our doubts, which we will explain in more detail below, the TriStar novelty was very little emphasized by Tektronix and our distant friends left us almost no information about it, despite the fact that it was later used even in more popular series such as the TDS.

More Details Later

In the subsequent part of this document dedicated to the description of the DSA architecture, you will find a detailed analysis of hardware of the beautiful Super-Monster.

Innovation #3
Functions and the User Interface

A Subdued Innovation

Of the three innovations we schematized, surely the least appealing is this one. The new DSAs shared the same user interface with the **11400 Series**, introduced three years earlier. From the CRT screen, they are so similar that they could be confused. Nevertheless, the DSAs were technically **very innovative** and far ahead of the "old" 11000 series, but the too similar user interface perhaps dampened the impression of novelty. I wonder if this similarity to the 11400 was a marketing mistake, since the DSAs were almost completely new, and if such electronic monuments deserved instead a more significant departure from the previous series to emphasize the great **leap in technology**, or at least a bigger **marketing effort** to highlight what had actually been done. Tektronix was introducing a lot of new models at the time, and their teams were probably overbooked, or they simply didn't want to add another battle front for a new firmware.

What's Really New?

Reading the catalogs, some of the innovations of the DSA series are "drowned" in descriptions "11400-like". So I tried to confront the "old" 11403 and the "new" DSA 602A and created a table, here on the right, to distinguish in **green** what I understood it was really new; it was not straightforward and this is already an answer to my doubts. This way we can concentrate on describing the most interesting novelties introduced by the DSAs, and precisely (I remind you that the 11403 has already been described in my TEO1 book):

- FFT
- Flexible Triggering
- Dejitter
- Trace Labels
- Histograms
- Act On Delta
- Floppy Disk

Feature	11403	DSA 602A
Bandwidth	1 GHz	1 GHz
Real-Time Sampling Rate	20 MSa/s	2 GSa/s
Resolution	10 bit	8 bit
Record Length	512 to 10k	512 to 32k
Acquisition Channels	Up to 12	Up to 12
Waveform Number	Up to 8	Up to 8
Sweep Speed	500 ps/div to 100 s/div	50 ps/div to 100 s/div
Main record plus two window records may be acquired and displayed	●	●
Differentiate, Integrate, Interpolate, Smooth, Average, Envelope, Square Root, Logarithm, Natural Log, Absolute Value, Exponential, and Signum.	●	●
Convolution, Correlation, Delay, Dejitter, FFT Filter, IFFT Integrate, Pulse		●
Add, Subtract, Multiply, and Divide	●	●
Min, Max, Mid, Mean, Gain, P-P, Undershoot, Overshoot, and RMS.	●	●
Rise, Fall, Width, Delay, Main to Window Trigger Time, Phase, Period, Duty Cycle, Skew, Propagation Delay, Cross, and Frequency.	●	●
Min, Max, Mean, and Standard Deviation of all active measurements.	●	●
Area +, Area –, and Energy.	●	●
FFT		●
Live Waveforms can be changed by using adjustable parameters.		●
Act On Delta		●
Histograms		●
Trace Labels		●
Two independent trigger circuits (Main and Window) can derive triggers from the Left, Center, and Right plug-in compartments. Main time base may also be triggered from the AC line.	●	●
Boolean Trigger, Time Qualified Trigger, Edge Qualified Trigger,		●
Floppy disk Drive		●
CRT	8.5"	10"
Resolution	552 x 704	552 x 704
Volume	59 dm^3	100 dm^3
Weight	22 kg	32.7 kg
Power Consumption, max.	320 W	585 W

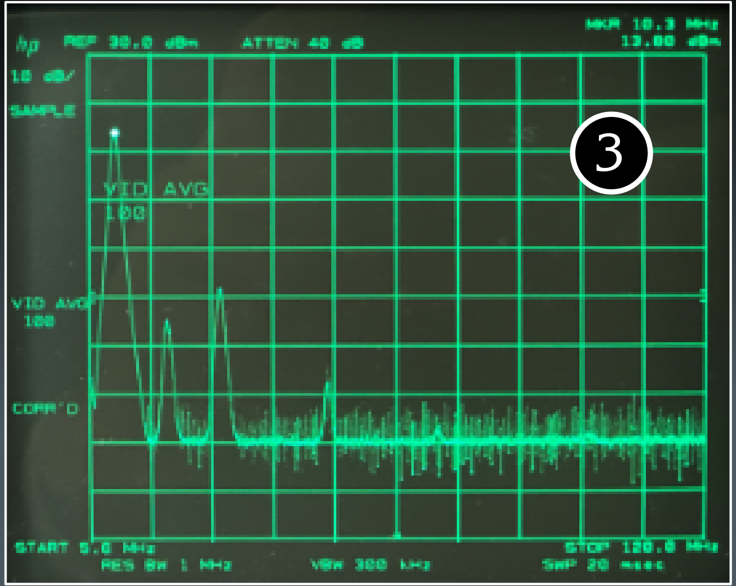
Fast Fourier Transform

A Fourier transform converts a signal from its original domain (often time or space) to a representation in the frequency domain and vice versa. A fast Fourier transform (FFT) is an algorithm that computes the Discrete Fourier Transform (DFT) of a sequence, or its inverse (IDFT).

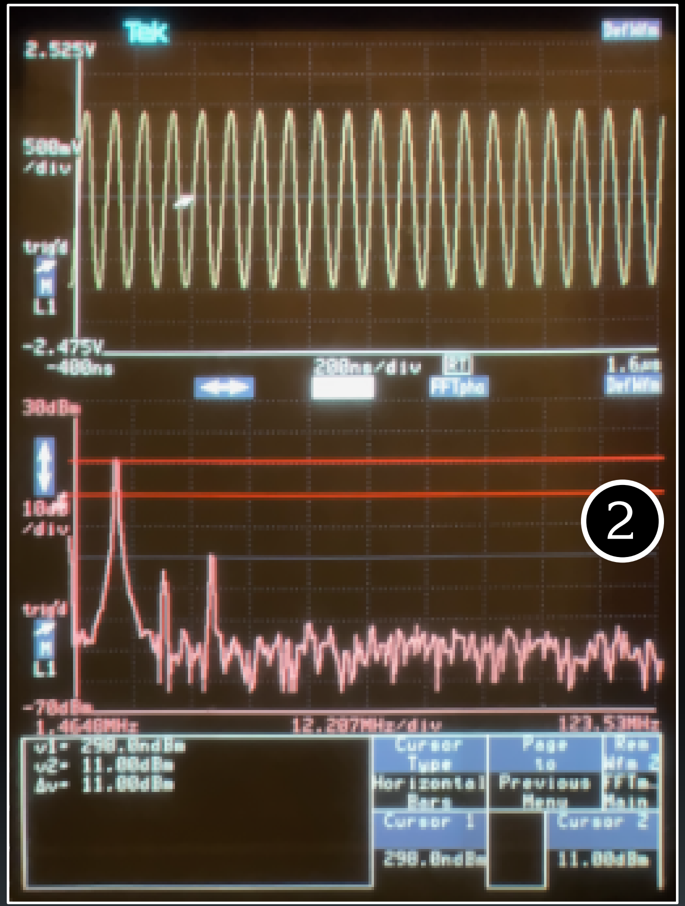
If you need to examine the frequency spectrum of a waveform, TriStar's FFT function provides a means to transform time-domain acquisitions into the frequency domain for spectral analysis.

Both the magnitude and phase of the acquired signal's frequency components can be examined, and measurement cursors can be used for basic magnitude and frequency measurements. Both time- and frequency-domain signals can be acquired single-shot.

The DSA 600 Series allows the user to select from six FFT windowing functions: Rectangular, Triangular, Hamming, Hanning, Blackman, and Blackman-Harris. The windowing function used depends upon what is to be accomplished in the frequency domain. The DSA 601 and DSA 602 automatically generate and apply the selected windowing function to the acquired time-domain signal. Noise floor is -60 dB and can be improved to -70 dB with averaging prior to the FFT.



Of course, using an oscilloscope instead of a real spectrum is not the same thing, and you can find tons of opinions regarding this comparison. The most convincing one is that if an FFT oscilloscope were as good as a real spectrum analyzer, the latter would not be sold, as they are generally much more expensive... However, having FFT analysis on your oscilloscope is much better than not having it, and in many cases it can replace the SA.



❶ The time- and frequency-domain analysis of my OCXO on the DSA 602A. Note that the cursors "understand" the type of window they are over and change their measurements accordingly. ❷ The same, but in this case the cursors are horizontal and measure the signal amplitude. For some reason, it is not possible to "center" the 0 dBm value and it is displayed as 298 ndBm (nano). The same plot executed on a Hewlett Packard 8568B spectrum analyzer.

Here in these photos I show you the signal coming from an inexpensive OCXO (Oven Controlled Crystal Oscillator), bought on Amazon for 20 Euros. It is very stable, but its output is not a perfect sine wave, so you have some harmonics. You can compare the analysis of the DSA 602A with a real SA, the Hewlett Packard 8568B. The DSA shows 11 dBm and the HP 13.8, probably because I used the 11A34V which has 75 ohms impedance instead of 50 ohms, but the plots are quite similar.

Flexible Triggering

Certainly, the DSA 600 Series trigger system is another feature that has been improved over the 11400 Series.

As before, each of the dual independent time bases has a separate dedicated trigger circuit which can derive a trigger source from any one of the plug-in compartments, or from the internal AC source and channels within a plug-in can be combined through addition or subtraction to define the trigger source.

Triggering capabilities are divided into two categories: **basic triggering** and **extended triggering**. For basic trigger operation, one trigger is associated with the main record, and the other is associated with the window record(s).

In the new more sophisticated extended trigger operation, trigger sources are compared to their trigger levels, or thresholds, and are determined to be either high- or low-logic levels. The user may then choose to combine the trigger sources **using Boolean algebra**, qualify one with a transition of the other (**level-qualified triggering**), qualify one or both by time (**time-qualified triggering**), or qualify one or both by an event count (**event triggering**) to form the main and window triggers. All of these extended trigger operations may be used alone or in combination for added flexibility in defining trigger events.

The figures show the new trigger source window, compared to the old one of the 11403.

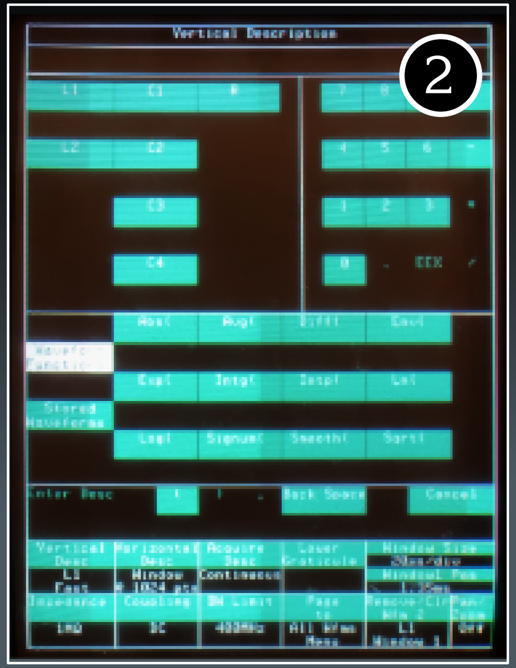
New Functions

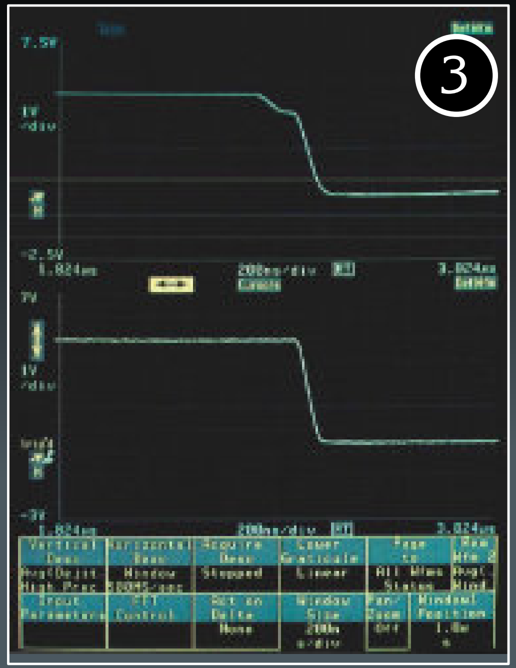
Twice The 11403

The Vertical Description windows offers many new functions, now subdivided in three pages, as shown in the figure ❶ on the right. The other two pages contain **Abs, Avg, Diff, Env, Exp, Filter, Intg, Intp, Ln, Log, FFTreal, FFTimag, FIRfilt, IFFT**. The figure ❷ here below shows the Vertical Description window of the 11403; they are only 12, versus the 24 of the new model.

Dejitter

Among these new functions, it is very interesting the dejitter function which reduces the effect of time jitter in repetitive signals caused by a noisy input signal (see figure ❸). Dejitter is especially beneficial when used in conjunction with signal averaging. Because time jitter in a signal has the effect of rapidly changing the phase, averaging the signal normally smooths out what may be very important high-frequency components in a jittery display. This results in an inaccurate measurement.





With the dejitter function enabled, random noise due to an unstable trigger source is averaged out, but the high-frequency components are retained, resulting in a more accurate measurement.

❶ The new Vertical Description window of the DSA 602A. There are as many as 12 new functions, and thus they have been subdivided in three pages. ❷ The previous window on the 11403 oscilloscope. ❸ The effect of the Dejitter function described in the text.

Averaging and Smoothing

Fast averaging and smoothing selectively remove noise from the display, allowing the user to see the true behavior of circuits and devices. These are not new, but they are clearly among those that benefit more from the performance improvements of the new waveform processor. Averaging rates of up to 180 waveforms/s for repetitive integer waveforms and up to 90 waveforms/s for repetitive floating-point waveforms are possible. Single-shot acquisitions can be smoothed by the TriStar processor at up to 30 waveforms/s. This exceptional smoothing rate is particularly beneficial to the performance of integration and differentiation operations.

Math Operations and Functions

Similarly, integer waveforms, addition, subtraction, and negation operations are now processed at a maximum rate of about 150 waveforms/s. All other math operations convert the integer waveform array to a floating-point array. All floating-point math operations, with the exception of averaging and enveloping, are processed at a maximum rate of about 30 waveforms/s.

Envelope Acquisition

An envelope display is constructed by storing both the maximum and minimum values for each data point of the acquired waveform. This shows how a signal varies over time. The resulting envelope can be used as a template for the Act On Delta function. For integer arrays, envelope acquisition is possible at a maximum rate of about 140 waveforms/s. For floating-point arrays, the maximum rate is about 80 waveforms/s.

Single-shot Modes

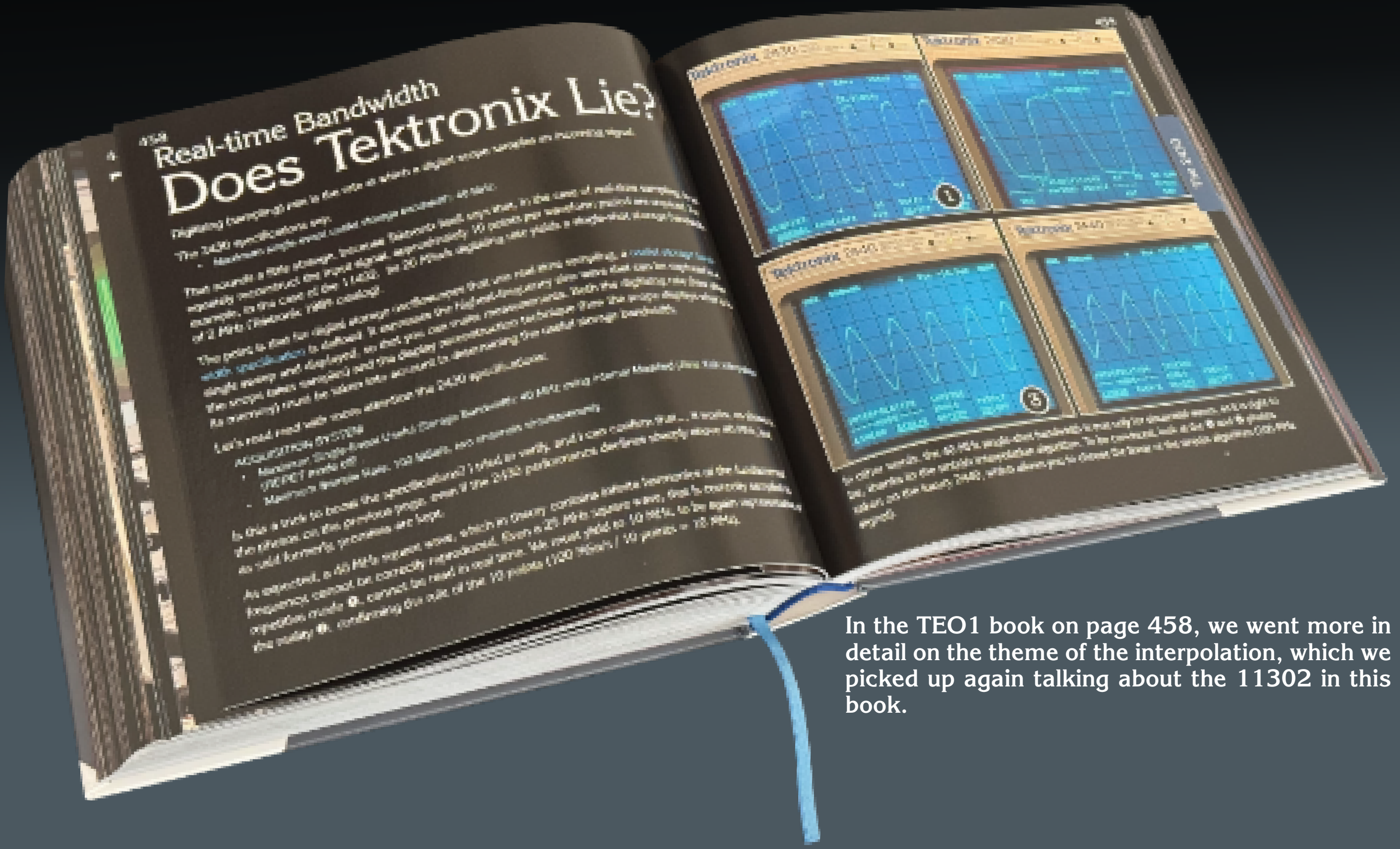
In **single-shot mode**, the DSA 600 Series captures as many data points as possible from a single trigger event. The captured waveform is displayed on the CRT, the acquisition stops, and further trigger events are ignored until the instrument is re-armed. In single-shot mode, the user manually stores the waveform and re-arms the instrument.

With **repetitive single-shot** acquisition, the DSA 600 Series automatically captures, stores, labels, time/date stamps the waveform, re-arms the trigger, and then repeats the process up to 918 times, at a rate of up to 60 repetitions/second. Automatic repetitive capture means that more waveforms could be captured in real-time faster than the previous models..

Interpolation.

This is not a new subject for us; we have already dealt with it in the TEO1 on page 458 (figure ❶), and we have picked it up again talking about the 11302.

The interpolate function replaces null points (data points not yet acquired or defined) with the linear interpolation of the two nearest valid points, one from each side of the null point. TriStar enhances interpolation speed over the world's most advanced oscilloscopes by more than 30 times. This increased speed is particularly noticeable in equivalent-time acquisitions with a very fast sweep speed, a low trigger repetition rate, or a long record length. Without interpolation the waveform record may fill very slowly. Using interpolation, the record between acquired points is filled rapidly until actual acquired values replace the interpolated values. Increased interpolation speed is also important for single-shot, real-time acquisitions when the time/division is set too fast to allow a complete record to fill. In this case, the DSA 600 interpolation function fills the points between valid data.



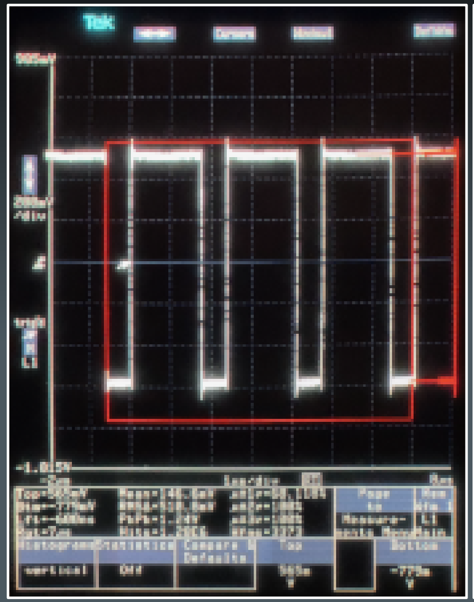
In the TEO1 book on page 458, we went more in detail on the theme of the interpolation, which we picked up again talking about the 11302 in this book.

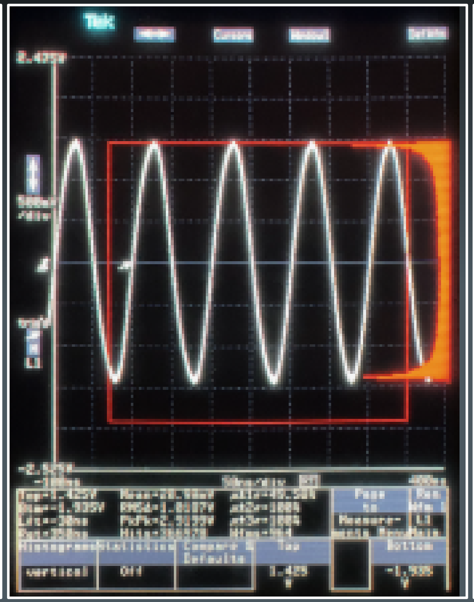
Labeling

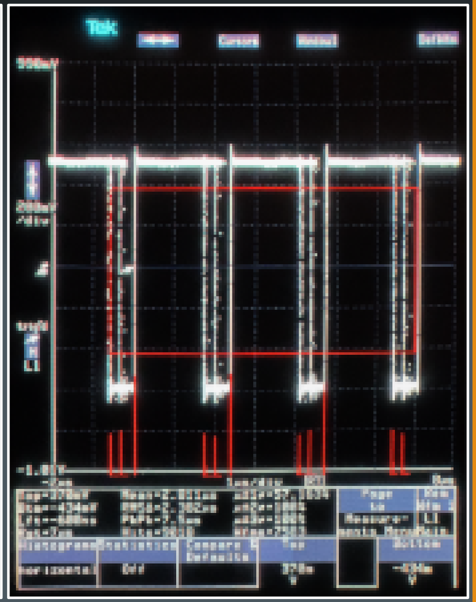
This is one of the new features I liked the most. Finally, I can avoid getting confused by the waveforms on the screen, which in this case can be as many as eight. Not only can you give each trace a name, but you can also place them individually where you want, as shown in the photo on the left (or let DSA manage them automatically). A small novelty, but effective!

Histograms

Histograms is another matter where the manual does not help very much: it is rather confused and does not explain what are they for. Histograms are graphical representations of data which divides it into intervals or bins (Tektronix calls them “buckets”). These intervals/bins are plotted on a bar chart such that the bar height relates to the number of data points inside each interval/bin as a function of the data value. Figure 1, 2 and 3 provide examples of histograms. In figure 1 and 2 you can see two vertical histograms, where the red bars are as long as many points you have on the x-axis. In figure 3, there is a horizontal histogram.







Act on Delta

The Act on Delta function lets users automatically compare an acquired waveform against either a displayed or stored envelope waveform or template and initiate a user-defined action when an out of range event occurs. It represents an improvement over the Compare function present in the 11400, where you could monitor a circuit by checking the measured values (see TEO1 book).

The user defines an event by specifying both the total number of points and the number of consecutive points which must fall outside the template. When an event occurs, acquisition stops and the DSA 600 Series automatically initiates any user-defined combination of the following five actions:

- Save screen as a stored waveform
- Sound chime
- SRQ over IEEE 488
- Hardcopy of screen
- Repeat

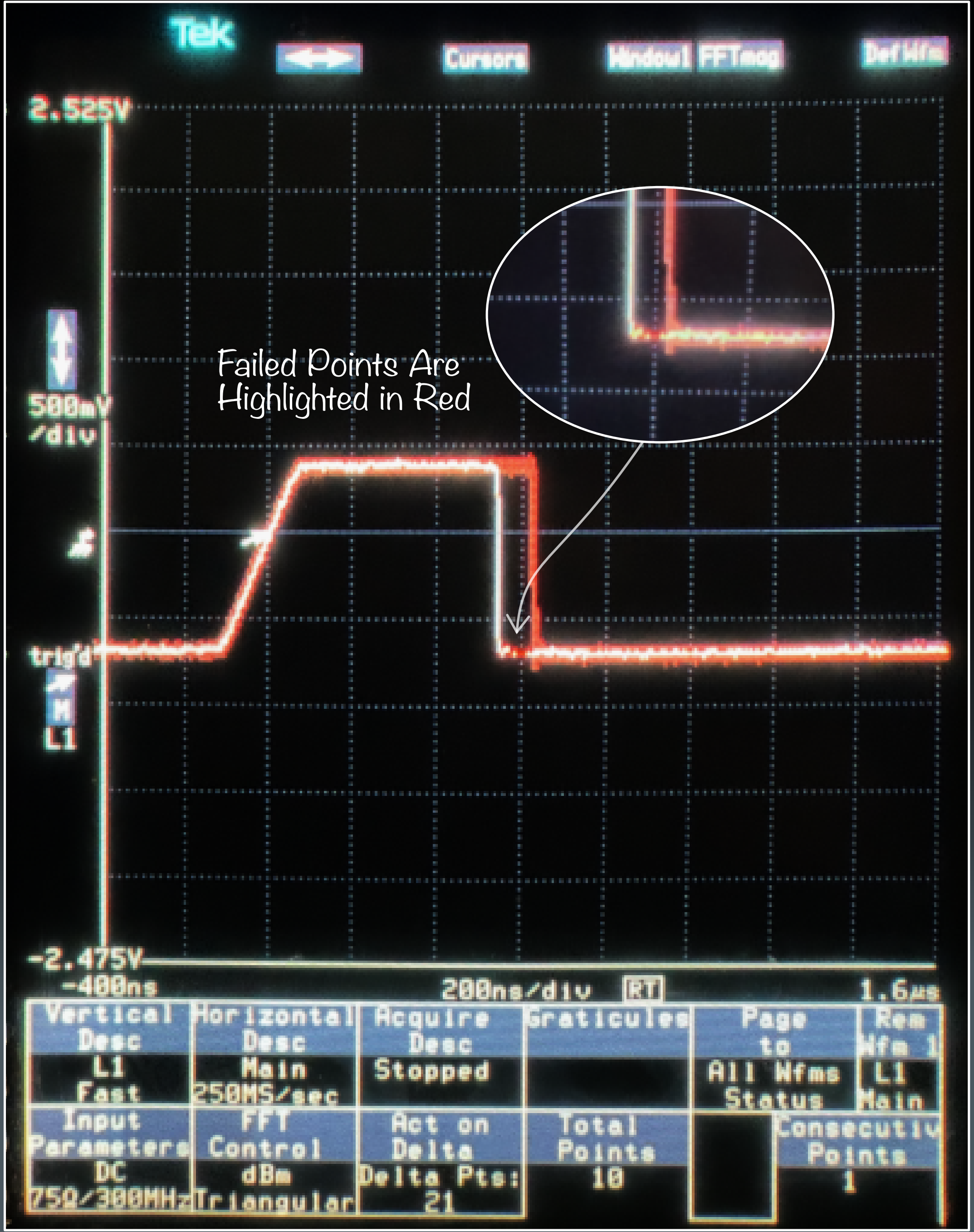
If repeat is selected, the mainframe repeats the other four actions when the out-of-bounds condition is met. With the Act on Delta function, the instrument can effectively "stand guard", monitoring a circuit for unpredictable transients or anomalous events and recording them as they occur. This combination is perfect for digital design and debug, or manufacturing test pass/ fail applications.

An Example

I wanted to test this feature, but I was confused by the manual, which uses too many words to describe something that is not very complex. These are the steps I suggest you take:

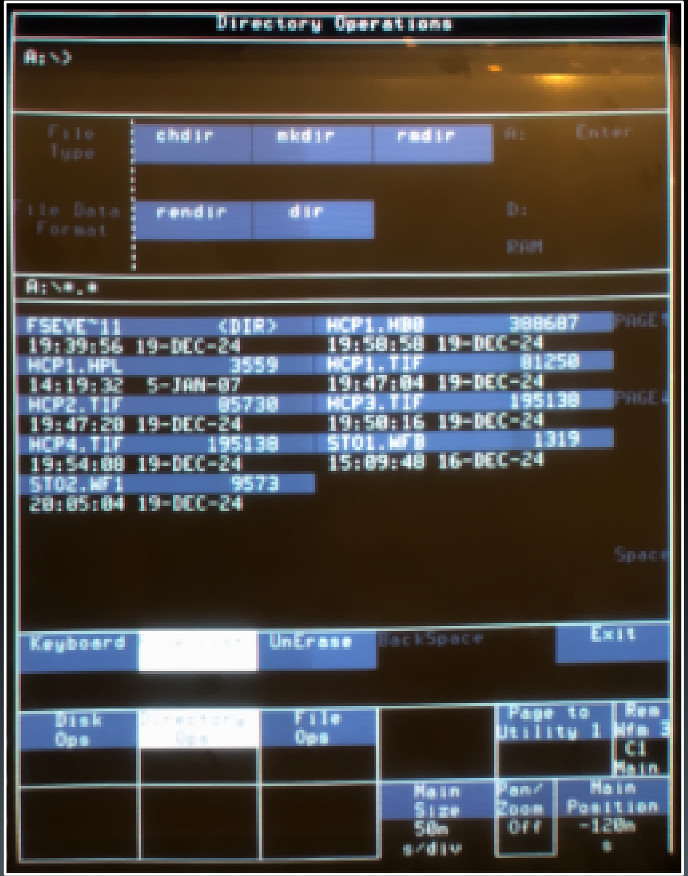
- create an **envelope trace**. Display a trace on the screen, then use Waveform/Acquire Desc and enable envelope capture. As we described above, the envelope is something like infinite persistence; each point of the waveform leaves a mark on the screen that is never erased. You could change the frequency or amplitude of the signal to make a thick mark around the waveform;
- **save** and display the envelope waveform;
- return to **normal** capture; the live waveform will remain approximately in the center of the thick marker, as shown in the photo at right;
- from the Waveform menu, select **Act On Delta** and set the trigger conditions. I chose "Chime" as the desired action and 20 failures before the alarm.

We saw something similar in the TEO1 book in the 2440 Series (page 462).



A More Evident Novelty
A Floppy In A Scope

A **floppy disk drive** in an oscilloscope was very innovative in 1991. I checked the Hewlett Packard catalog and can confirm that they didn't have a similar solution until a few years later.



My sons laugh now when they see floppy disks, but at the time they were very popular and practical. They can still be used today without too much pain, provided you have a floppy drive on your modern computer (you can buy a USB one on Amazon, but I had to return two to find one that worked).

The DSAs can save **setups** and **waveforms** in various formats, including as images, but I could not understand why they only in grayscale formats.

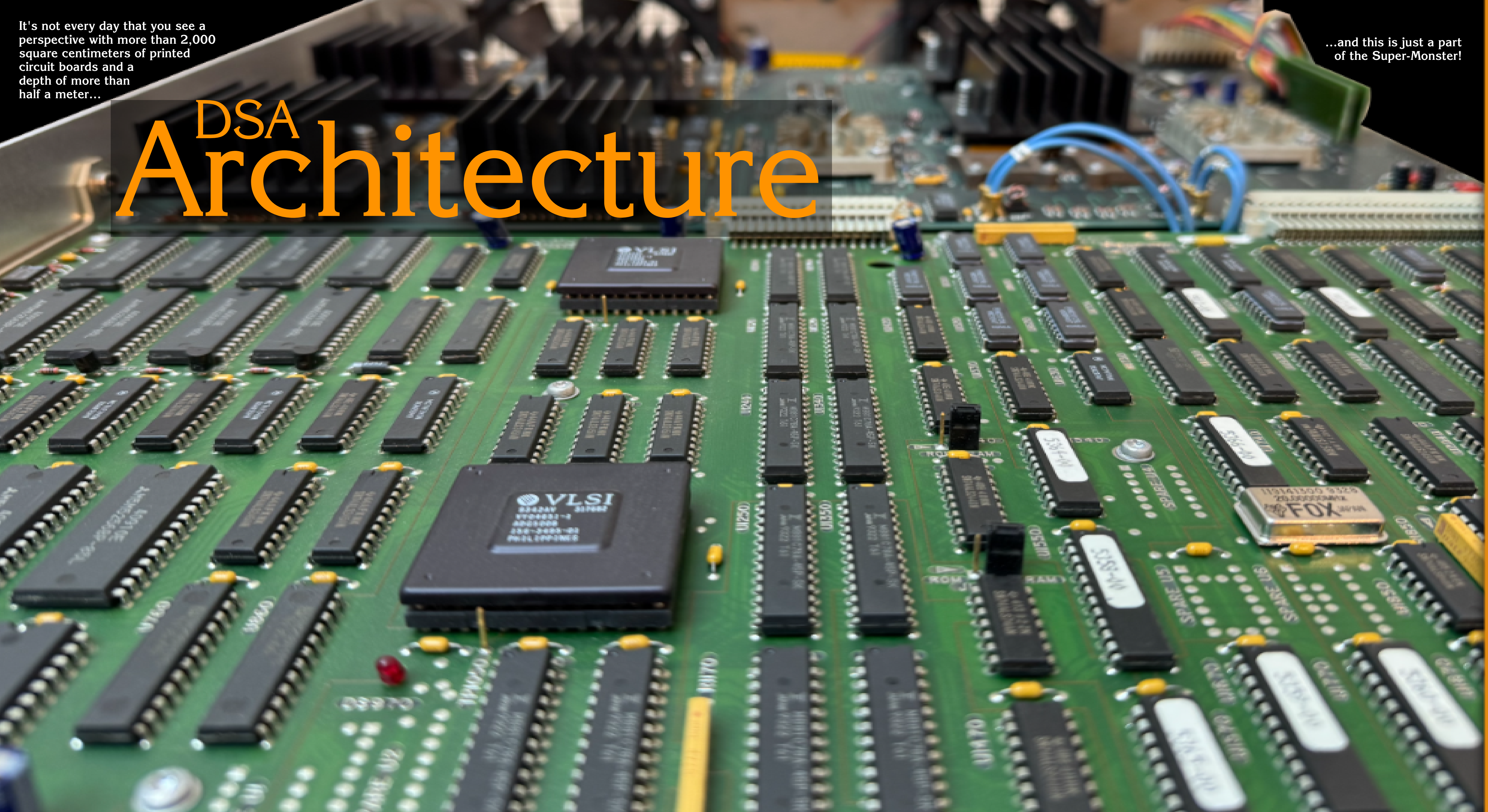
Although it is a bit cumbersome, you can do almost all typical disk operations with your oscilloscope.

You can also set the DSA to take a snapshot of the screen by simply pressing the HARDCOPY button; the file name is automatically created and incremented. The save operation is quite fast, and the resulting file is quite small; this way, many files can be saved without space problems, although a floppy is only 1.44 Mbytes (this is probably the reason why only the images are saved only in gray levels).

It's not every day that you see a perspective with more than 2,000 square centimeters of printed circuit boards and a depth of more than half a meter...

DSA Architecture

...and this is just a part of the Super-Monster!



Almost Totally New

On Top Of the 11400

In the Summer 1989 issue of Handshake, Tektronix compared the new DSA architecture (figure ❷) to that of the previous 11400 Series (figure ❶). According to these diagrams, in the DSAs they "simply" added a TriStar processor in a direct data transfer pipeline between the acquisition and display processors, with all communications handled by high-speed internal buses. This allowed complex measurements and functions to be applied to the acquired data prior to display, in real time.

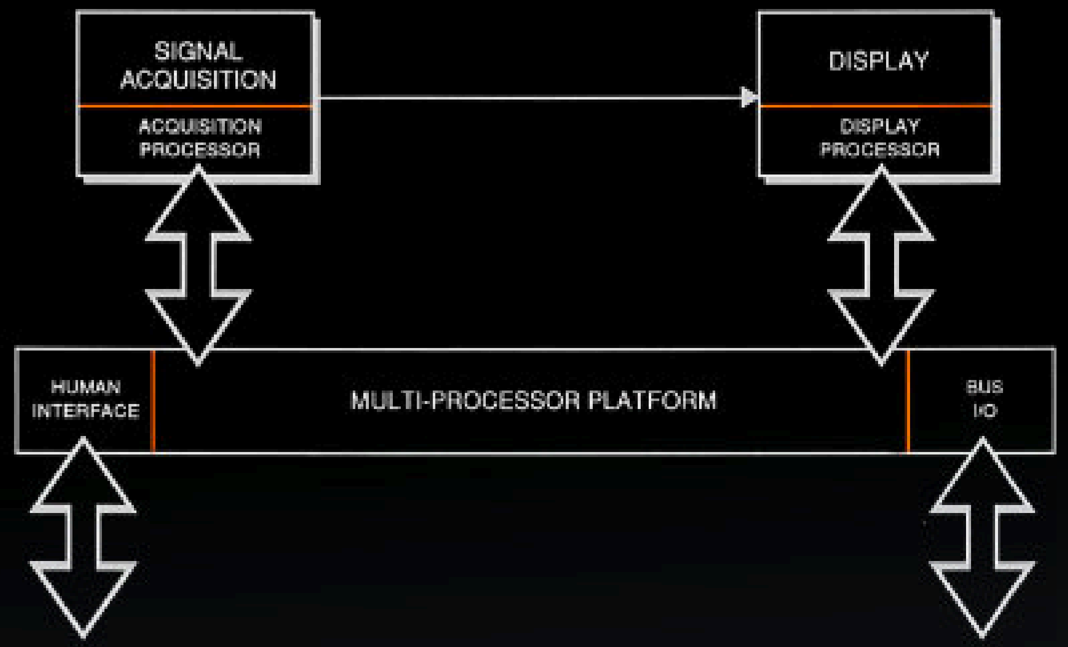
More Logical Than Practical

All that was certainly true from a logical point of view, and evidently Tektronix wanted to emphasize the similarity between the two implementations, but in practice things were different. In fact, we can observe this:

- the acquisition section was completely new;
- the DSP was not present in the 11000 scheme;
- the DSA has eight rack mounted logic boards while the 11403 has only four;
- of them, only the Battery Backup Memory Board, the MMU Board and the I/O Board were kept apparently almost unchanged;
- the Main Processor board was heavily modified (the one with the 80286 microprocessor);
- the Time Bases board is no longer present in the DSA but is embedded in the Digitizers.

In practice, the two series were anything but similar, if not completely different, but, if we neglect performance, they behaved very similarly, even if with several additions and improvements.

On the following pages you'll find the physical description of the DSA 602A, made up of drawings, photos of most of the boards and of construction details.



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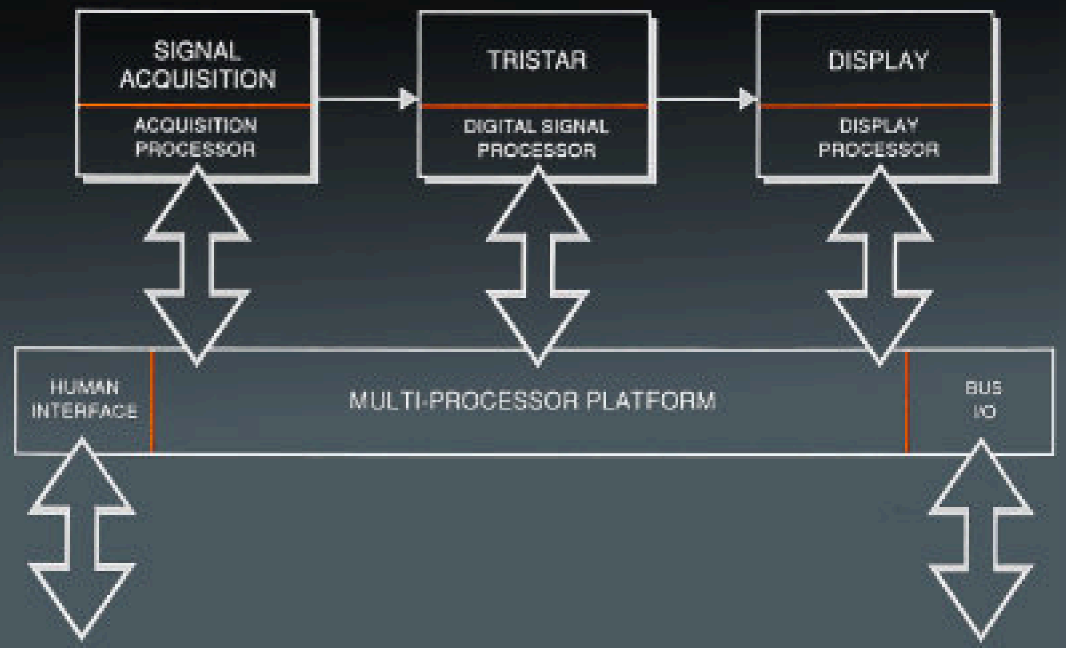


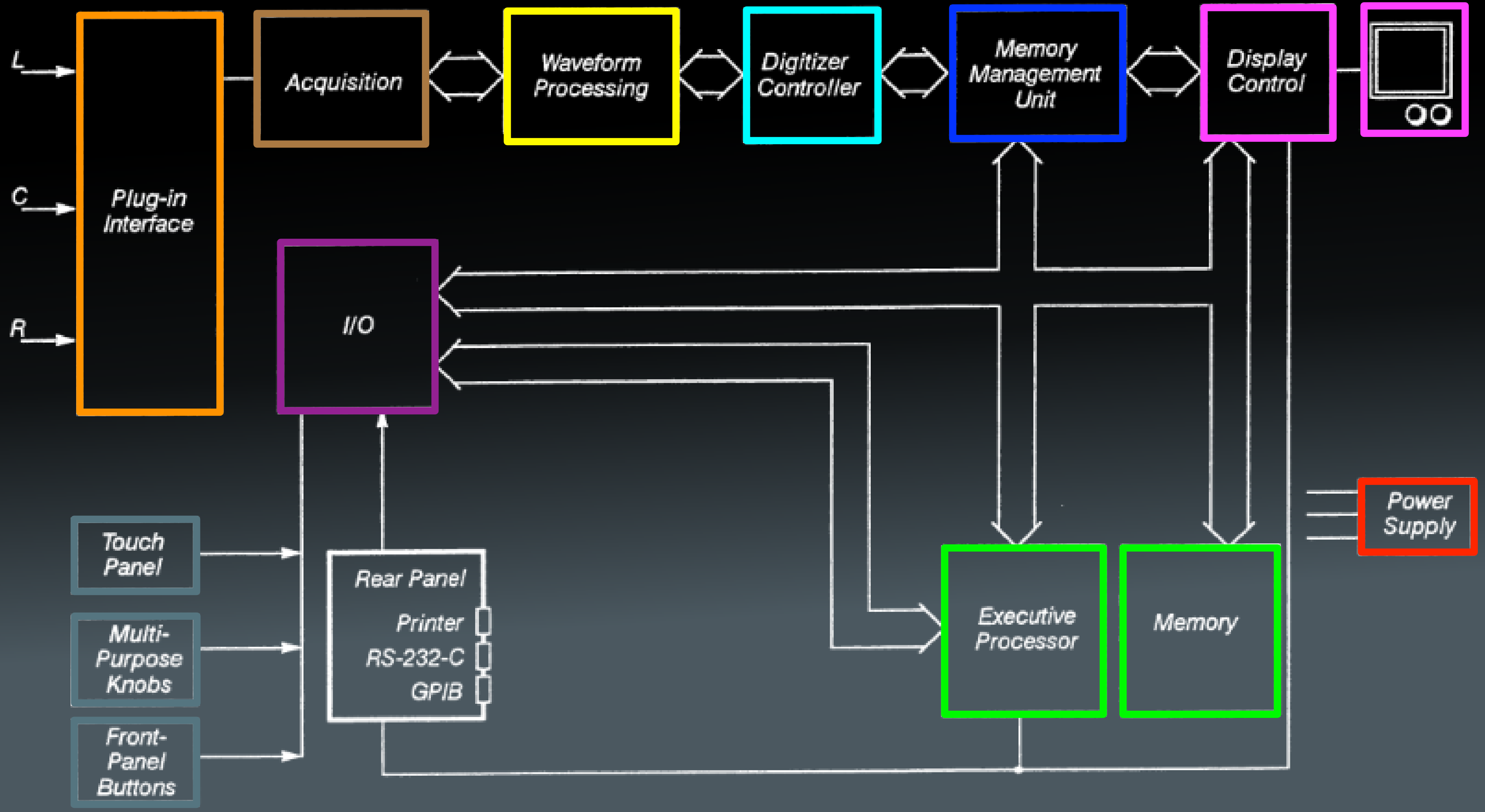
2

DSA 602A Functional Block Diagram

Plug-in Interface Block - The Plug-in Interface block provides a point of connection between the plug-in amplifiers and the Acquisition block of the DSA. This interface allows signal access to the digitizer, allows communication between the DSA mainframe and the plug-in amplifiers, and provides the plug-in amplifiers with power. The Plug-in Interface accommodates a left, center, and right plug-in compartment. Each of the three compartments can support a plug-in amplifier having up to four input channels for a total of twelve active input channels.

Acquisition Block - The Acquisition block digitizes and stores the input signals in high-speed RAM. The selected input signals are converted by a free-running digitizer that acquires signals continuously. Trigger signals for controlling the sweep are processed within this block. When a trigger signal is recognized, the trigger comparator gates a portion of the data through an appropriate channel for processing and display.

Waveform Processing Block - The Waveform Processing block reads the waveform data from the high-speed RAM on the Acquisition board at a rate slower than acquisition, then deposits the waveform data in local RAM for the Digitizer Controller. The Waveform Processing block may also process the data by summing, averaging, calculating an FFT, etc., before sending it to the Digitizer Controller.



Digitizer Controller Block - The Digitizer Controller block sets the parameters for waveform processing and acquisition using commands from the Executive Processor block. These commands are based on the user-selected settings (front panel buttons, control knobs, and touch panel) of the DSA. The Digitizer Controller also moves the data from the local RAM in the Waveform Processing block into waveform memory (part of the Memory block).

Memory Management Unit Block - The Memory Management Unit (MMU) coordinates requests for access to the Memory block from the following three DSA subsystems:

- Display;
- Digitizer;
- Executive.

This arbitration allows all three subsystems transparent access to the Memory block.

Display Control Block - The Display Control block of the DSA provides all of the visual output. Visual output includes data output (such as waveform traces, graticules, axes, and annotation) and displays supporting the human interface (menus, labeling for touch-panel input, and an interactive output to assist in operating the system). The DSA uses a custom vertical raster-scan display that provides excellent resolution for both waveform display and text. The Display Control block produces a display by:

- receiving waveform data from the MMU.
- compressing the waveform data into 512 horizontal pixels.
- converting the compressed waveform data into a format compatible with the vertical raster-scan display.

I/O Block - The I/O block provides an interface to the Rear Panel block, touch panel, multi-purpose knobs, and front-panel buttons.

Rear Panel Block - The Rear Panel block provides a GPIB port, an RS-232-C port, and a PRINTER port for interfacing various peripheral devices.

Executive Processor Block - After you request an operation (for example, using a front-panel control), a primary function of the Executive processor (EXP) is to direct the DSA to perform the requested operation. Another primary function of the EXP is to execute Self-Test diagnostics on the DSA when powering-on or upon your request. To control these operations, the EXP controls and monitors the other boards sharing the Executive system bus. Through the Executive bus boards, the EXP also indirectly controls all other DSA boards (and the floppy disk drive on "A" versions). The EXP generates

commands and status signals to control on-board devices and 1/0 devices (such as GPIB and RS-232-C interfaces) which process data and control the rest of the DSA.

Memory Block - The Memory block provides the EXP with RAM and EPROM for waveform storage, setting storage, and program instructions. The EXP initiates all accesses to RAM and ROM. Also, support circuitry for these memories, diagnostic circuitry for troubleshooting, and an option for non-volatile waveform storage is housed in the Memory block.

Front-Panel Controls - You control the DSA using:

- the front-panel (major-menu) buttons;
- the touch panel;
- the multi-purpose knobs.

The multi-purpose knobs control the function of the particular item that is selected. The major menu buttons are the top-level menu selections for the DSA. Touching an icon, menu item, or waveform selects that particular icon, menu item, or waveform, respectively.

Power Supply - The DSA operates from either a 110 V or 220 V nominal line voltage source at a line frequency between 48 and 72 Hz. The LINE VOLTAGE SELECTOR switch on the rear panel of the DSA allows selection of AC line inputs of 90 to 132 V RMS (110 V) or 180 to 250 V RMS (220 V).

It seems impossible, but the 1990s DSA architecture was still based on the ancient plug-in connectors defined for the glorious 1969 7000 Series.
You can find notes about their restoration in my Tektronix Oscilloscopes Restoration Guide, published by Elektor Books, on page 324.

Physical
Block Diagram

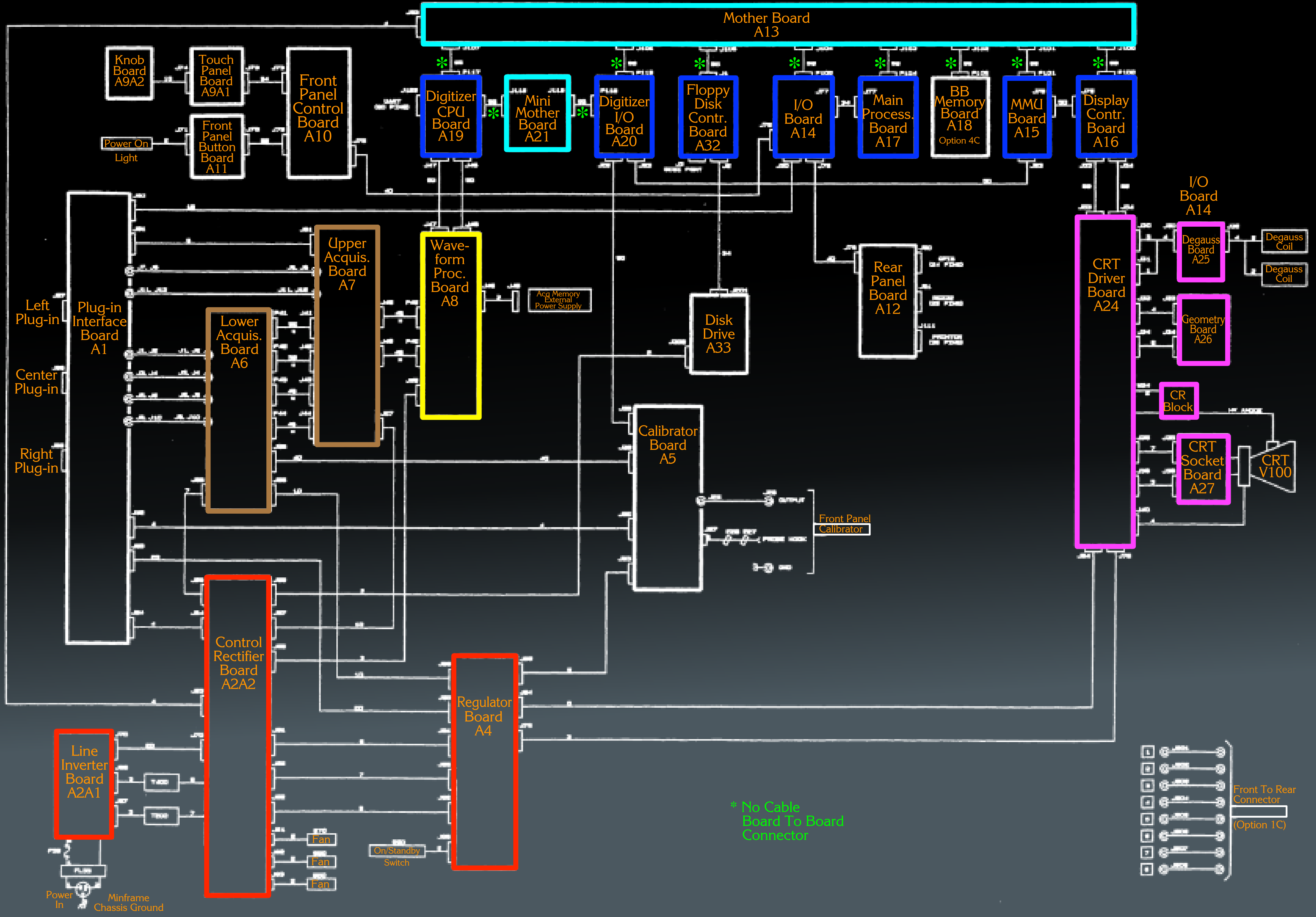
A Restored Version

I dedicated some time to restore this Physical Block Diagram excerpted from the 070-8184-00 Service Manual because it was almost unreadable, but its seems to me it were quite useful for us who deal with this instrument. Unfortunately, I could not restore it completely because many labels are unreadable.

What's Next?

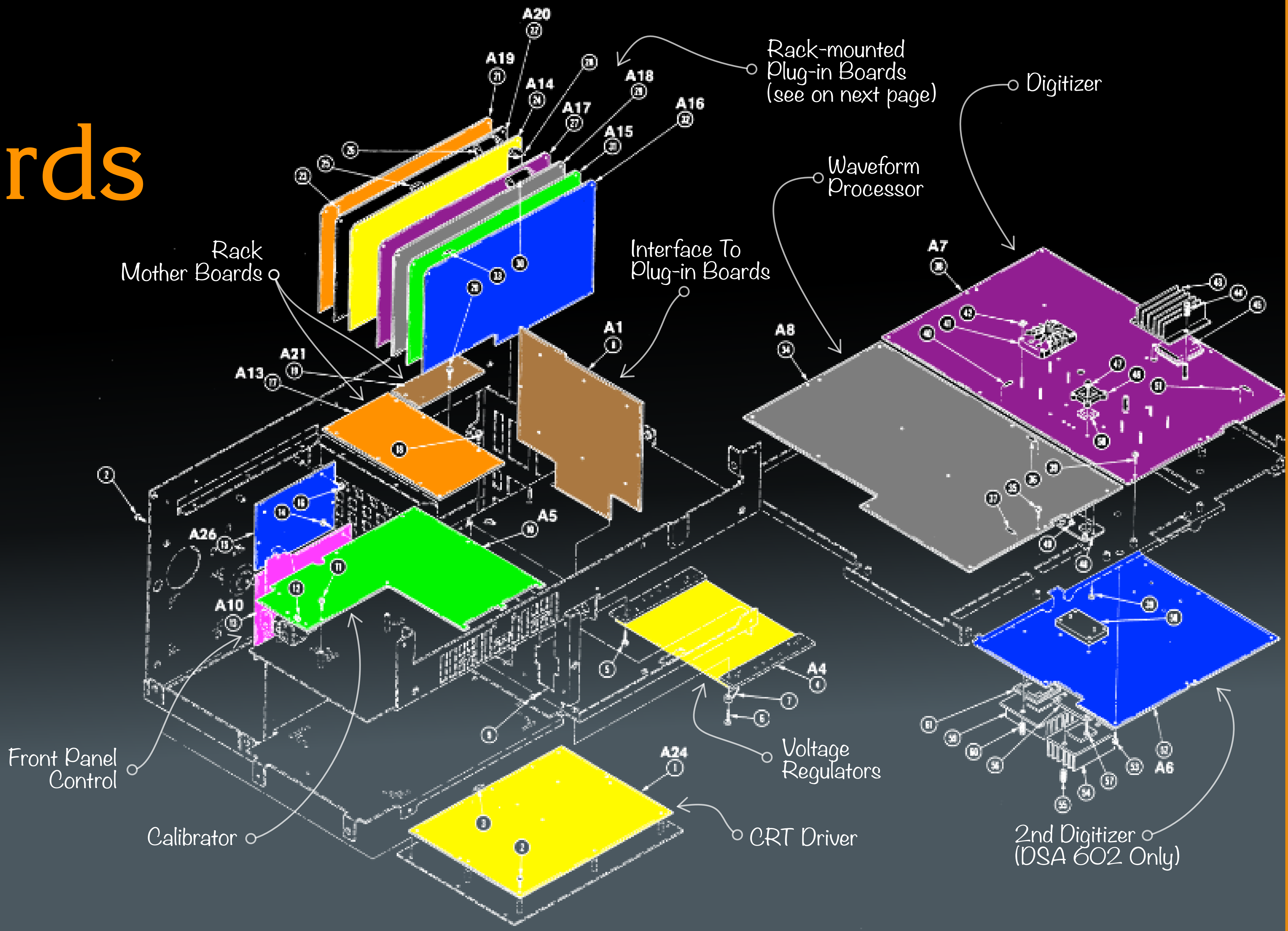
On the next pages, we are going to:

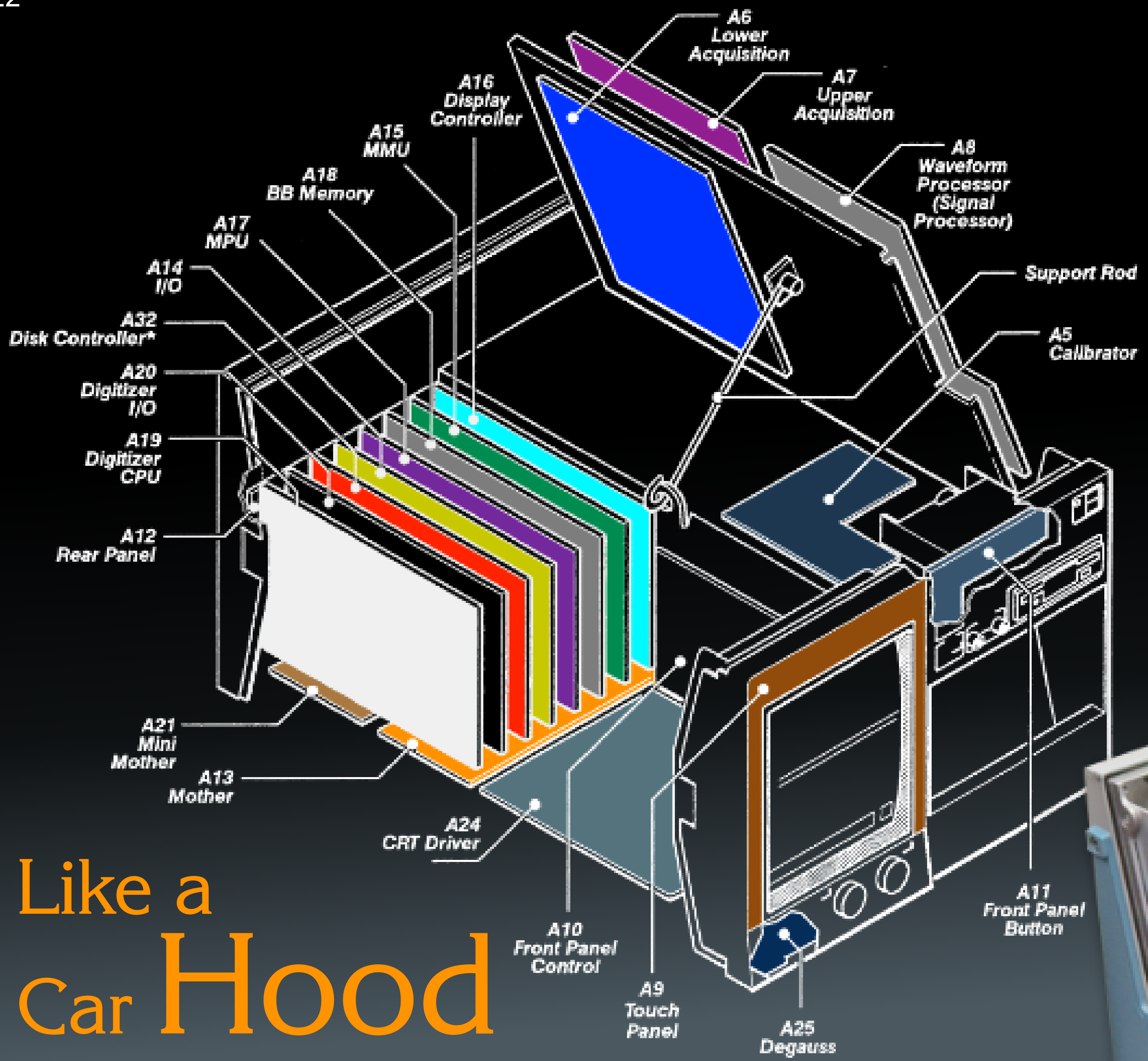
- list the boards that compose the DSA 602A;
- show you the physical board organization, very useful if you need to operate on that;
- report detailed photos of most of the boards;
- describe quite in detail the main modules, i.e., the Digitizers and the Waveform Processor, using the text from the service manual;
- give a short description for all the other boards.



DSA 602A
Boards

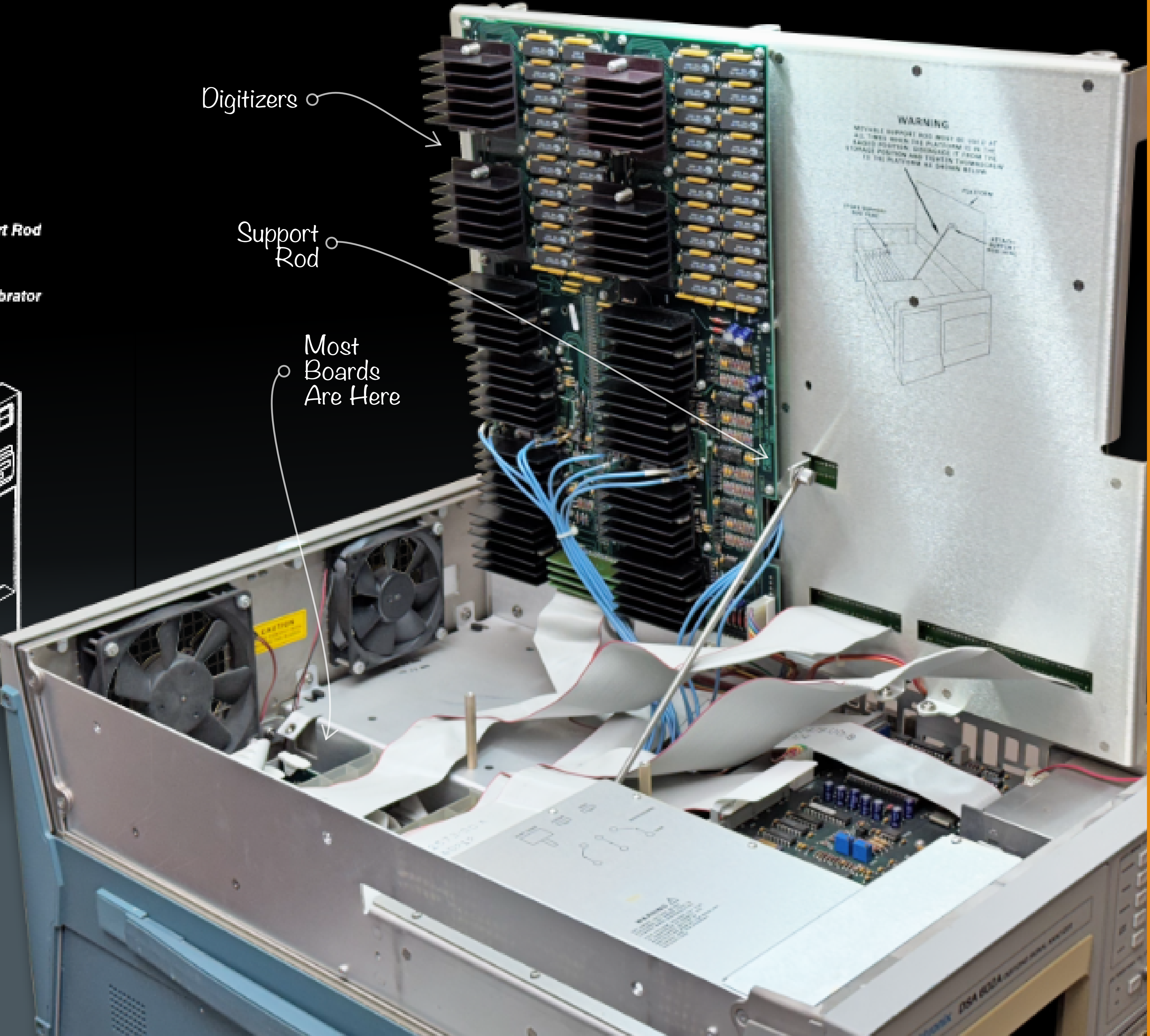
- A1 Plug-in Interface Board
- A4 Regulator Board
- A5 Calibrator Board
- A6 Lower Acquisition Board
- A7 Upper Acquisition Board
- A8 Waveform Processor or A8 Signal Processor Board
- A9 Touch Panel Assembly
- A10 Front Panel Control Board
- A11 Front Panel Button Board
- A12 Rear Panel Assembly
- A13 Mother Board
- A14 Input/Output (I/O) Board
- A15 Memory Manager Unit (MMU) Board
- A16 Display Controller Board
- A17 Main Processor Board
- A18 (Battery Back-up) BB Memory Board
- A19 Digitizer CPU Board
- A20 Digitizer (Input/Output) 1/0 Board
- A21 Mini Mother Board
- A24 CRT Driver Board
- A25 Degauss Board
- A26 Geometry Board
- A27 CRT Socket Board
- A32 Disk Controller Board
- A33 Disk Drive





Like a Car Hood

The DSA is very well designed and probably looks better on the inside than from the outside. To tilt the acquisition/waveform processor sections, simply remove three screws on each side and two screws in the center of the upper boards. A support rod is provided, very sturdy, safe and well designed.



The New (not-only) Digitizers

We have said that the digitizers are a major innovation of the DSA Series, and that is true. However, what we call the digitizer is much more than the digitizers themselves, and is probably the most important part of the oscilloscope; it consists of the A6 Lower Acquisition Board and the A7 Upper Acquisition Board.

The **A6 Lower Acquisition Board** consists of the following major blocks:

- programmable control voltages;
- flash ADCs (two on the DSA 601 and four on the DSA 602);
- utility (two on the DSA 601 and four on the DSA 602);
- demux (two);
- precision DC reference board and fast rise source.

The **A7 Upper Acquisition Board** consists of the following major blocks:

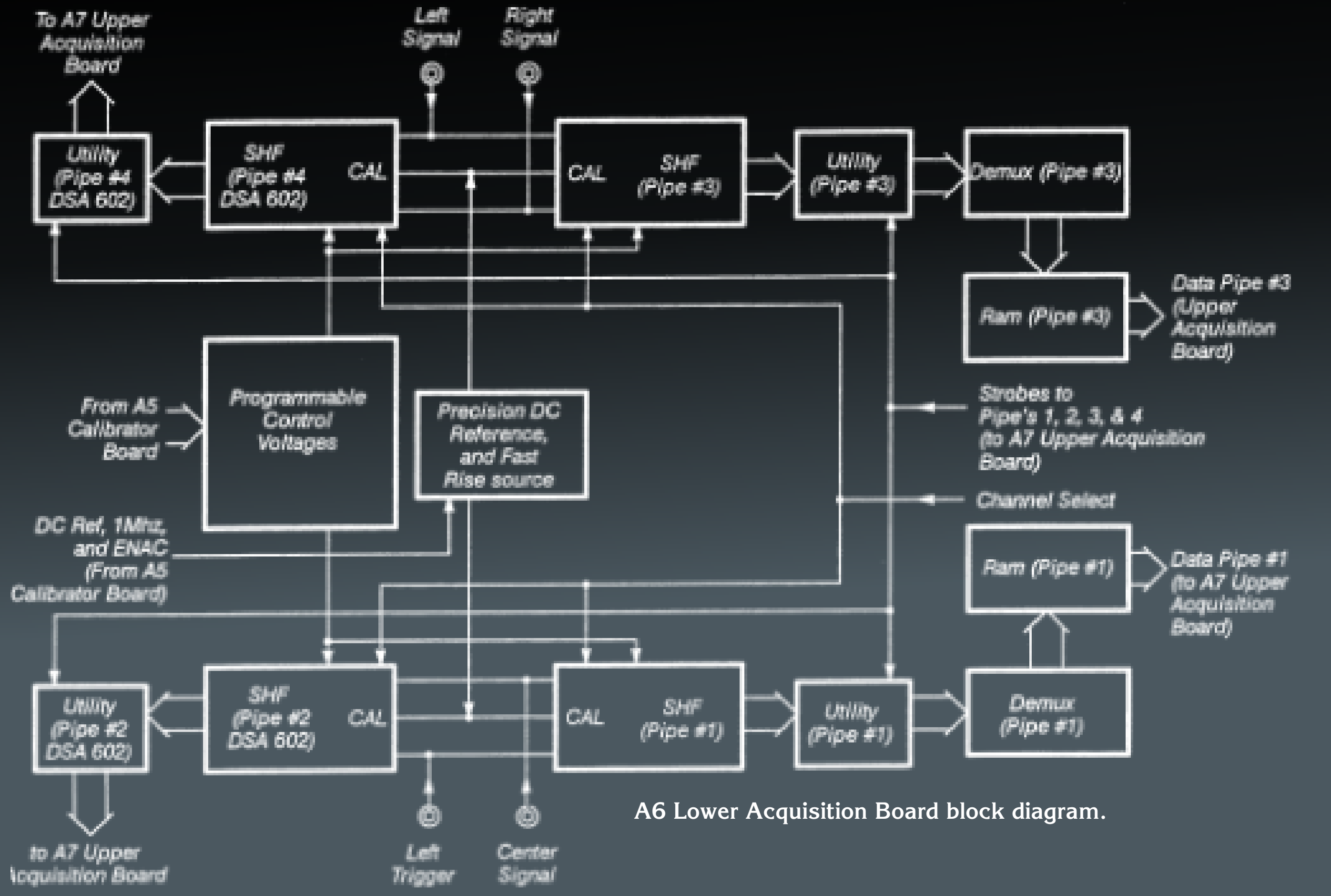
- triggers (one main and one window);
- time interpolators (one main and one window);
- programmable control voltage sources;
- clock driver circuitry;
- demux (two on the DSA 602);
- pseudo random voltage generator sweep controller.

Triggers - Like in other Tektronix models of the same period, the trigger is implemented as a hybrid IC; it receives and processes analog signals from the left, center, and right plug-in compartments, and the line trigger from the power supply. An internal channel switch provides a signal to one input of the trigger comparator (the trigger level you select is applied to the other input). The output of the trigger comparator is applied to the trigger gate latch, which the holdoff signal from the sweep controller resets and enables. The trigger gate latch outputs initialize the time interpolators. The trigger hybrid also provides conditioning of the signal you select (i.e., HF Reject, LF Reject, etc.).

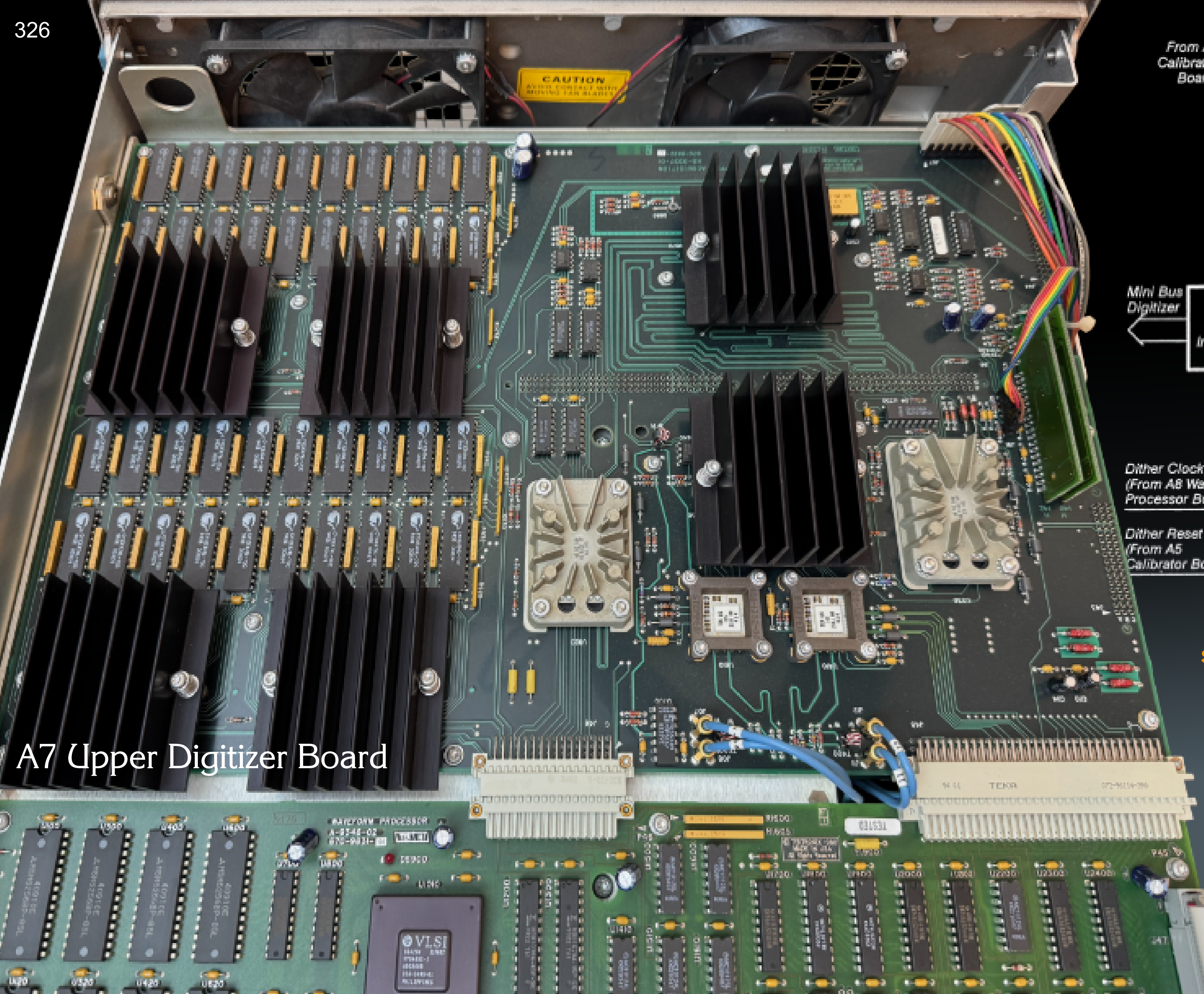
The Time Interpolator - It measures the time between the trigger gate and the sampling clock during each acquisition cycle. This time is then converted to a 10-bit data word which is sent to the sweep controller. This allows for the time placement of an acquisition into the correct location within the waveform record.

Programmable Control Voltages - They are required for the Enhanced Accuracy feature of the DSA. The circuitry that provides these control voltages utilizes the multiplexed analog voltages and the select and enable signals generated on the A5 Calibrator board. Various control voltages are then generated by sample/hold circuits, level shifters, gain and attenuator stages, and buffers.

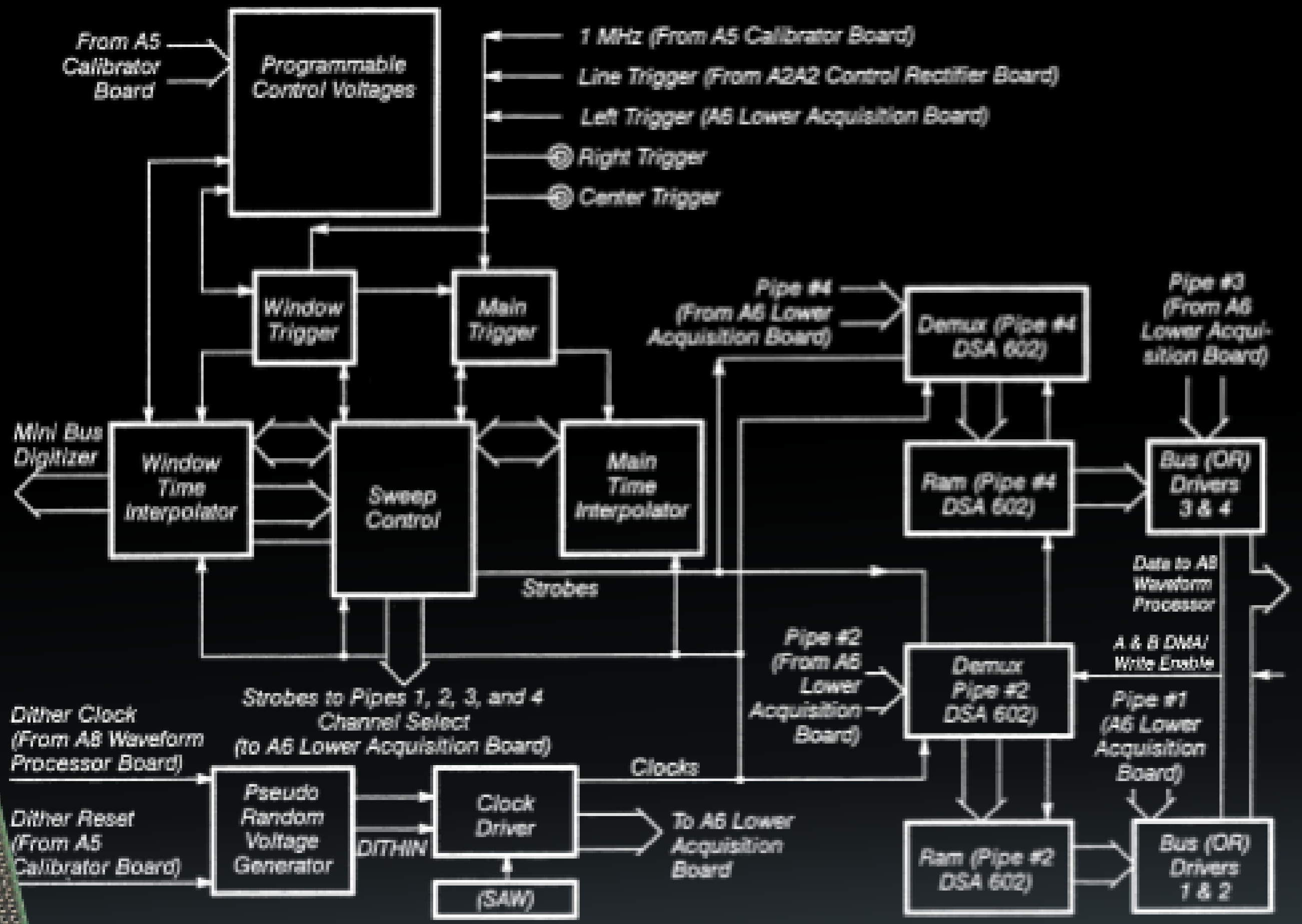
The Clock Driver Circuitry - It provides all of the system clocks for the SHF, utility, demux, time interpolator, and sweep controller. The clock driver also provides the phase adjustment of the appropriate clocks. This is necessary to obtain the gate interleave alignment of the various acquisition pipes (pipes 1 and 3 for the DSA 601, and pipes 1 through 4 for the DSA 602). DITHIN (an input which drives the pseudo-random voltage generator circuitry) changes the phase of the system clocks. This reduces the probability of your signal synchronizing with the system clock.



A6 Lower Acquisition Board block diagram.



A7 Upper Digitizer Board

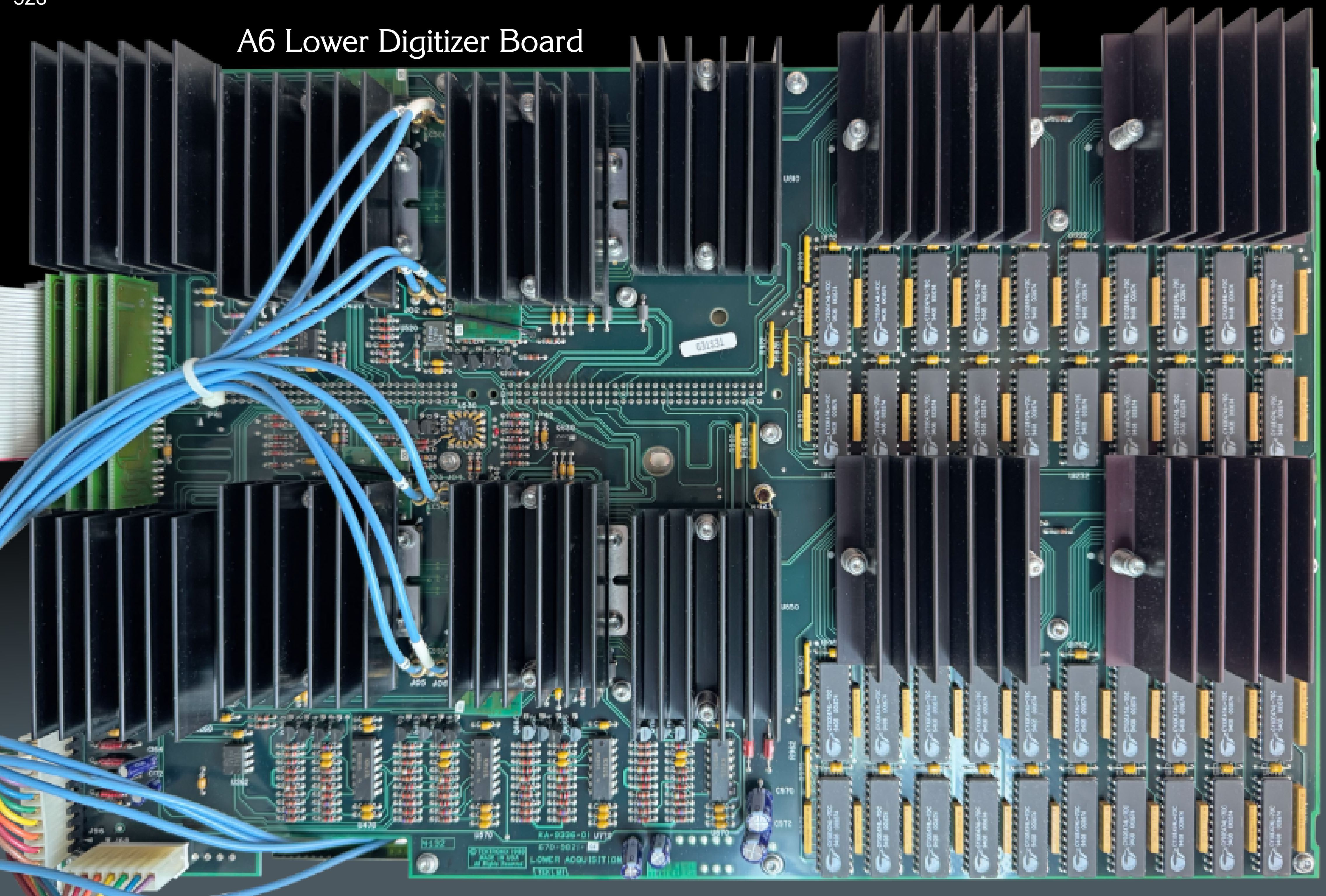


Sample/Hold and Flash IC (SHF) - It converts two samples of the selected signal to a pair of 8-bit digital values. Each byte of the pair represents data from one of two internal 250 MHz ADCs. A channel switch at the input selects one of three signals: the two signals from the plug-in compartments or the CAL input signal.

The selected signal is applied to a pair of track/hold circuits through a buffer. The polarity of one of the 250 MHz strobes driving the track/hold circuits is inverted; consequently shifting the phase of one converter by 180 degrees. When the samples of the pair of track/hold circuits are summed and interleaved, a sample rate of 500 MSa/s is obtained.

The Utility - It phase-aligns the two 8-bit digital signals from the flash ADC to the 500 MHz system clock, interleaving and outputting the pair of 250 Megabyte signals from the SHFs to the demux at a 500 Megabyte rate. The utility also limits the digital signal range of the input data.

A6 Lower Digitizer Board



The Demux - It sub-samples the 500 MHz data from the utility, and then demultiplexes it into high speed RAM. The demux sub-samples the data from the utility according to the sample strobes that supply the sweep controller. The demux buffers ten samples of the input data twice and writes those ten samples into the high speed RAM simultaneously. When data is transferred out of the high speed RAM into the signal processing memory, the demux acts as a slave to the controller, controlling address and select lines.

The pseudo-random voltage generator- generates a random DC voltage to the clock driver DITHIN input upon the completion of each acquisition cycle. The purpose of these voltages is to provide phase dithering. A PAL, which is configured as a circular shift register, generates 8-bit random data. This 8-bit data drives an ADC which level-shifts and buffers the output to provide the necessary DC levels.

The Precision DC Reference and Fast-Rise Source - It provides differential precision DC and step signals to the CAL inputs of the four acquisition flash ADCs. During the Enhanced Accuracy state of the DSA, these signals adjust the DC gains, DC offsets, and phase alignments of the acquisition pipes.

Sweep Controller - It performs two major functions: sub-sample strobe generation and trigger control. Sub-sample strobes are generated at a rate determined by the Digitizer processor, using an algorithm that takes into account such factors as the user-selected acquisition sample rate, the desired record lengths), and whether or not a window is enabled. The trigger control circuitry performs several functions: generation of hold-off for Main and Window trigger, holdoff by time, delay by events, two-channel Boolean triggering, and pulse-width triggering. The sweep controller operates under the control of the Digitizer processor.

Waveform Processor

The **A8 Waveform Processor Board** consists of two Tristar signal processors. These signal processors process data and control the operations of other ICs. Each signal processor is capable of accessing either data memory. The A8 Waveform Processor board consists of the following functional blocks:

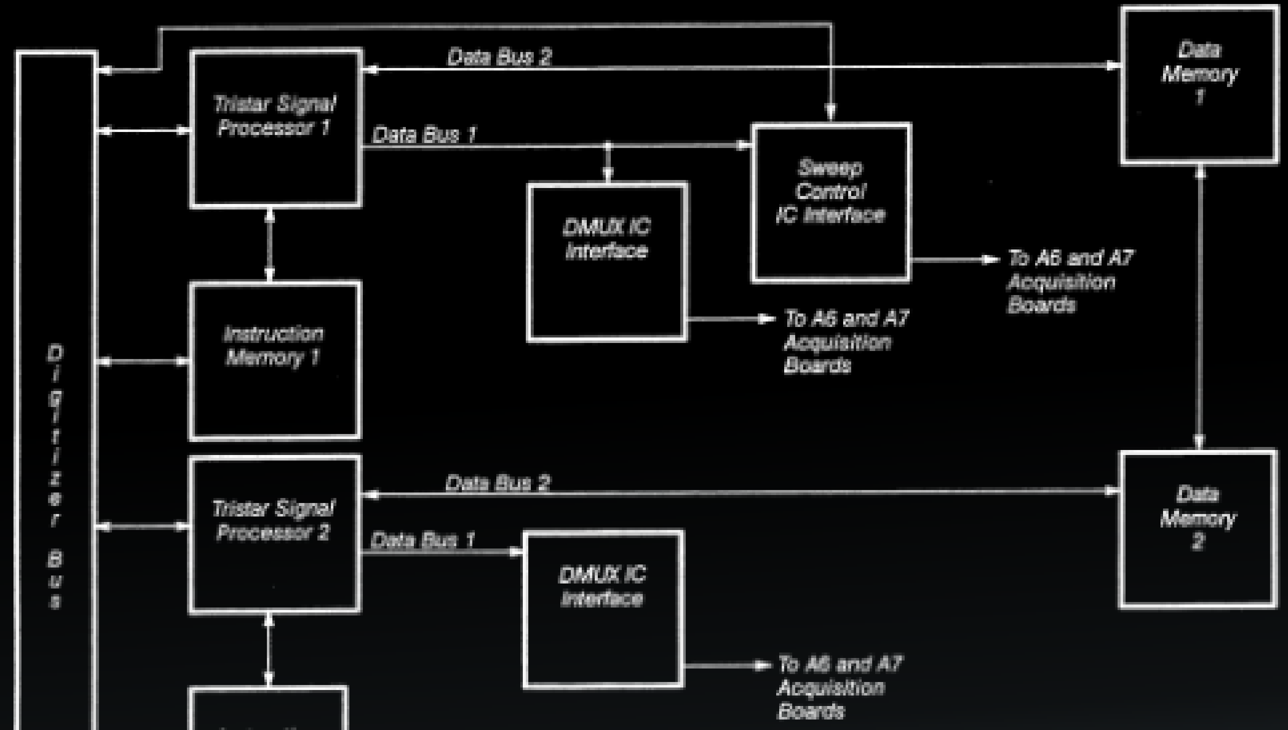
- signal processors (two)
- instruction memory (two)
- data memory (two)
- serial loop interface
- demux interface
- sweep controller interface
- trigger controller
- sample/hold control

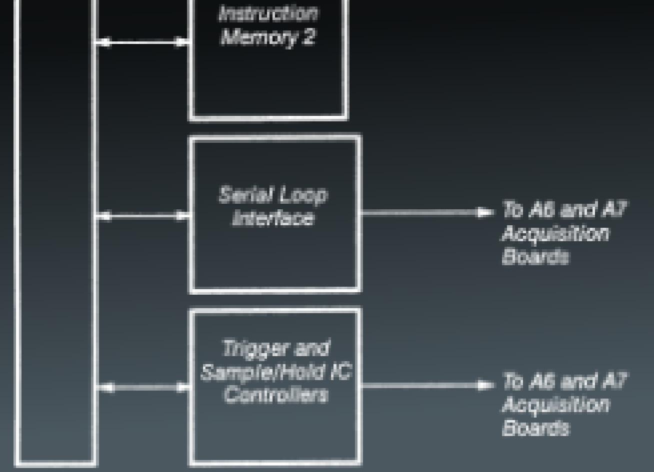
The signal processors - It alone can obtain the waveform points from the Acquisition system. After the signal processors complete the transfer of the waveform points to the data memories, the Digitizer processor can then transfer those waveform points to the A15 MMU board. The signal processors may perform processing operations on the waveform points before the Digitizer processor transfers them to the A15 MMU board. The signal processors, unlike many processors which have a single data bus for both data and instruction, have two independent data busses and an instruction data bus. The two data busses, data bus 1 and data bus 2, are data/address multiplexed. Control signals must latch the address from these data busses at the beginning of the cycle. Each data bus has a set of control signals to direct the flow of the data. The signal processors on this board appear as slaves to the Digitizer processor. Signal processor 1 has a priority over signal processor 2. Because the Digitizer processor is a master, it has a higher priority than either signal processor. This priority scheme determines which processor is allowed to access the bus during the bus request cycle.

Interrupts - Both signal processors have the capability to interrupt the Digitizer processor. The Digitizer processor is also capable of interrupting either signal processor.

Instruction Memories - It consist of six 8 K x 8 System RAMs (SRAMs). The six SRAMs are divided into two sets (or banks) of three SRAMs, allowing the signal processor to access 3 bytes of an instruction at a time. Instructions are 6-byte words, and the processor accesses the SRAMs twice on each processor cycle. The Digitizer processor has complete access to the instruction memories. At power-on, the Digitizer processor loads the signal processor instructions to the instruction memories.

Data Memory - It is also called the signal processor memory, and is divided into data memory 1 and data memory 2. Each Data Memory consists of four pair of RAMS. Signal processor 1, signal processor 2, and the Digitizer processor can access this memory. Each signal processor accesses Data Memory through its data bus 2. When the Digitizer processor accesses either Data Memory, the bus request signals are asserted to both sig-





nal processors. The Digitizer processor accesses data Memory when both signal processors acknowledge the requests.

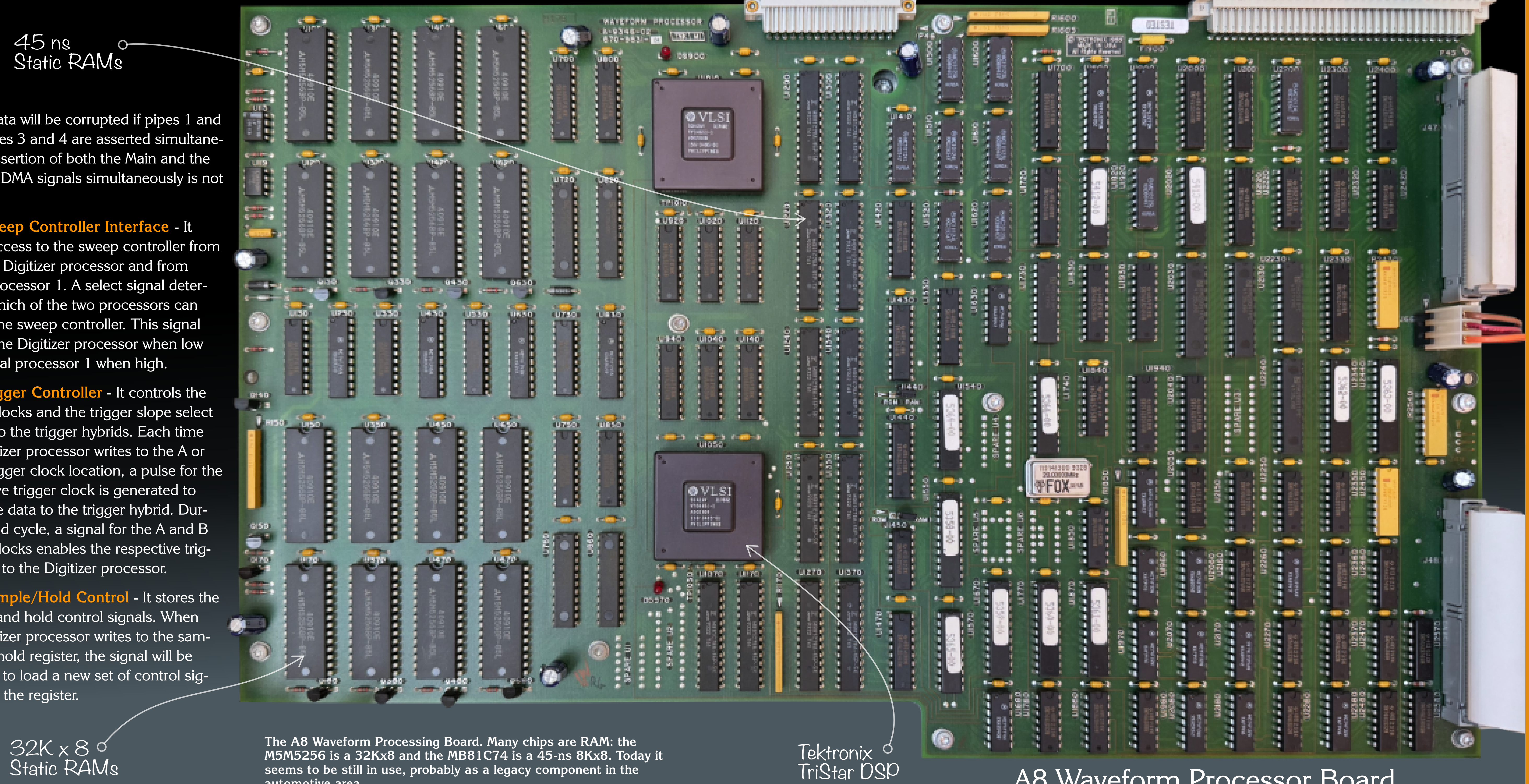
The Serial Loop Interface - to the demux, utility, and sweep controller, is directly controlled by the Digitizer processor. The interface is through a one-bit serial loop data line and a serial loop clock. During the processor write cycle to the serial loop, data is enabled into the serial loop data line and serial loop clock through a TTL to ECL converter. During the Digitizer processor read cycle to the serial loop, the processor reads the data from the ECL to TTL converter, but does not enable the serial loop clock.

The Demux Interface - links the demux of the Acquisition system to the signal processors. The signal processors read the acquisition data from the Acquisition system by generating DMA strobe(s) to the Demux. The DMA strobe(s) is (are) generated during the signal processor read cycle by decoding the appropriate addresses. Only one of the DMA strobes from each signal processor may be asserted at a time, except during a flush cycle. Data will be corrupted if pipes 1 and 2, or pipes 3 and 4 are asserted simultaneously. Assertion of both the Main and the Window DMA signals simultaneously is not valid.

The Sweep Controller Interface - It allows access to the sweep controller from both the Digitizer processor and from signal processor 1. A select signal determines which of the two processors can access the sweep controller. This signal selects the Digitizer processor when low and signal processor 1 when high.

The Trigger Controller - It controls the trigger clocks and the trigger slope select signals to the trigger hybrids. Each time the Digitizer processor writes to the A or the B trigger clock location, a pulse for the respective trigger clock is generated to clock the data to the trigger hybrid. During a read cycle, a signal for the A and B trigger clocks enables the respective trigger data to the Digitizer processor.

The Sample/Hold Control - It stores the sample and hold control signals. When the Digitizer processor writes to the sample and hold register, the signal will be asserted to load a new set of control signals into the register.



The A8 Waveform Processing Board. Many chips are RAM: the M5M5256 is a 32Kx8 and the MB81C74 is a 45-ns 8Kx8. Today it seems to be still in use, probably as a legacy component in the automotive area.

A8 Waveform Processor Board

Plug-in Boards Racks

In those years, architectures like the DSA, based on a rack with boards, were still very much in vogue, and I myself designed several modules in this logic, using the same DIN 41612 connectors, which were quite a step forward from the direct-insertion connectors obtained from gold-plated circuit board tracks.

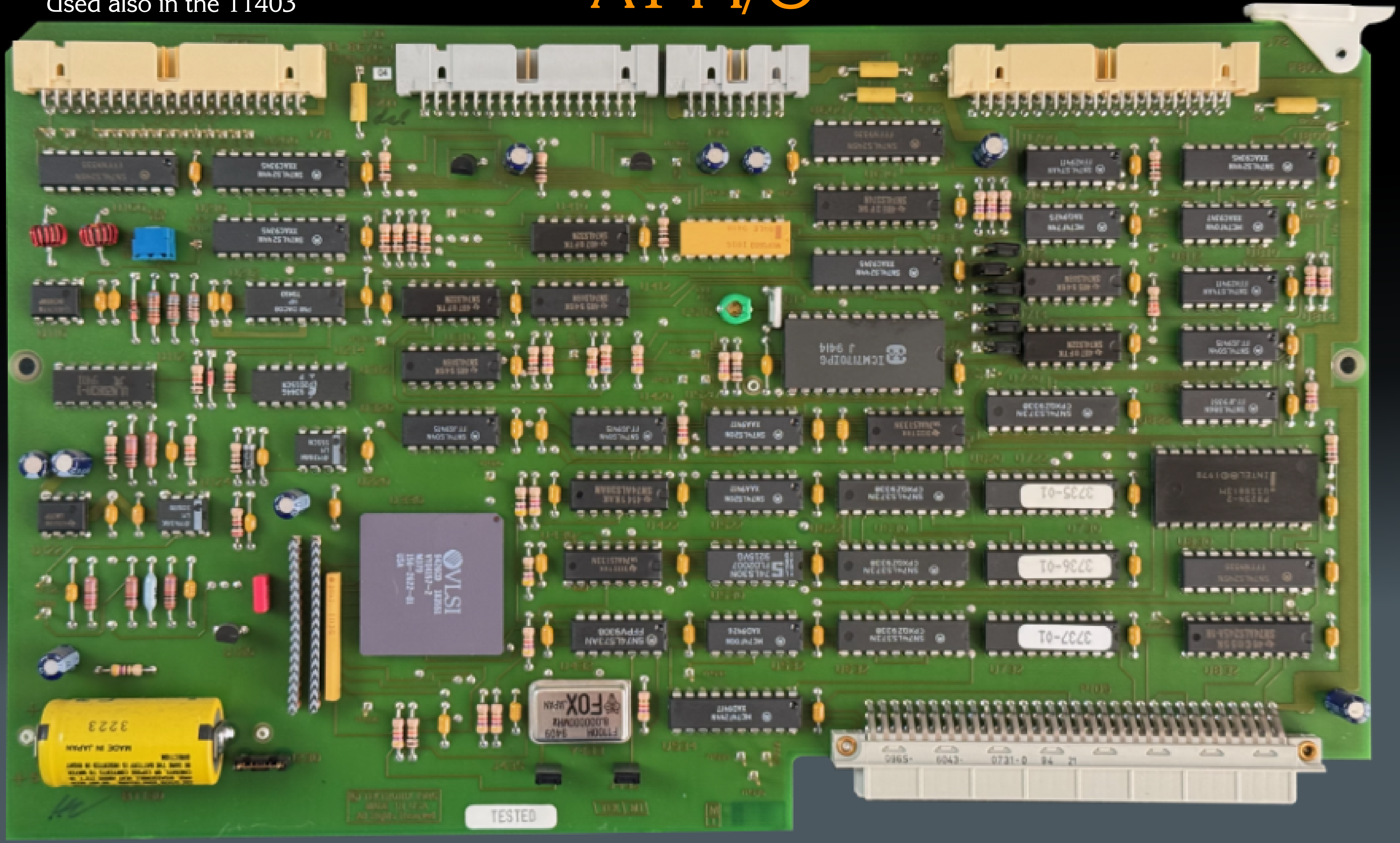
In this case, the connections offered by the underlying motherboard were not sufficient, and the DSA abuses the use of flat cables to supplement them somewhat. It has to be said, however, that when they are in place, they have well thought-out paths and do not intertwine too much. To remove a board, however, it may be necessary to disconnect several of them. As far as I have seen, it is not easy to make a mistake, which makes reassembly easier.

Much to my regret, there was no provision for field repair at the component level, so the board was the minimum replaceable item. I can understand the decision; this is an extremely complex item, and the poor service people would have gone crazy trying to fix any problems that might arise.

Fortunately, it seems possible to find replacement boards on eBay at prices that are not astronomical. Hopefully I will never need them, although these beautiful toys of ours are a bit like us humans, and after a certain age you never know how you will wake up the next morning...

A14 I/O

Used also in the 11403



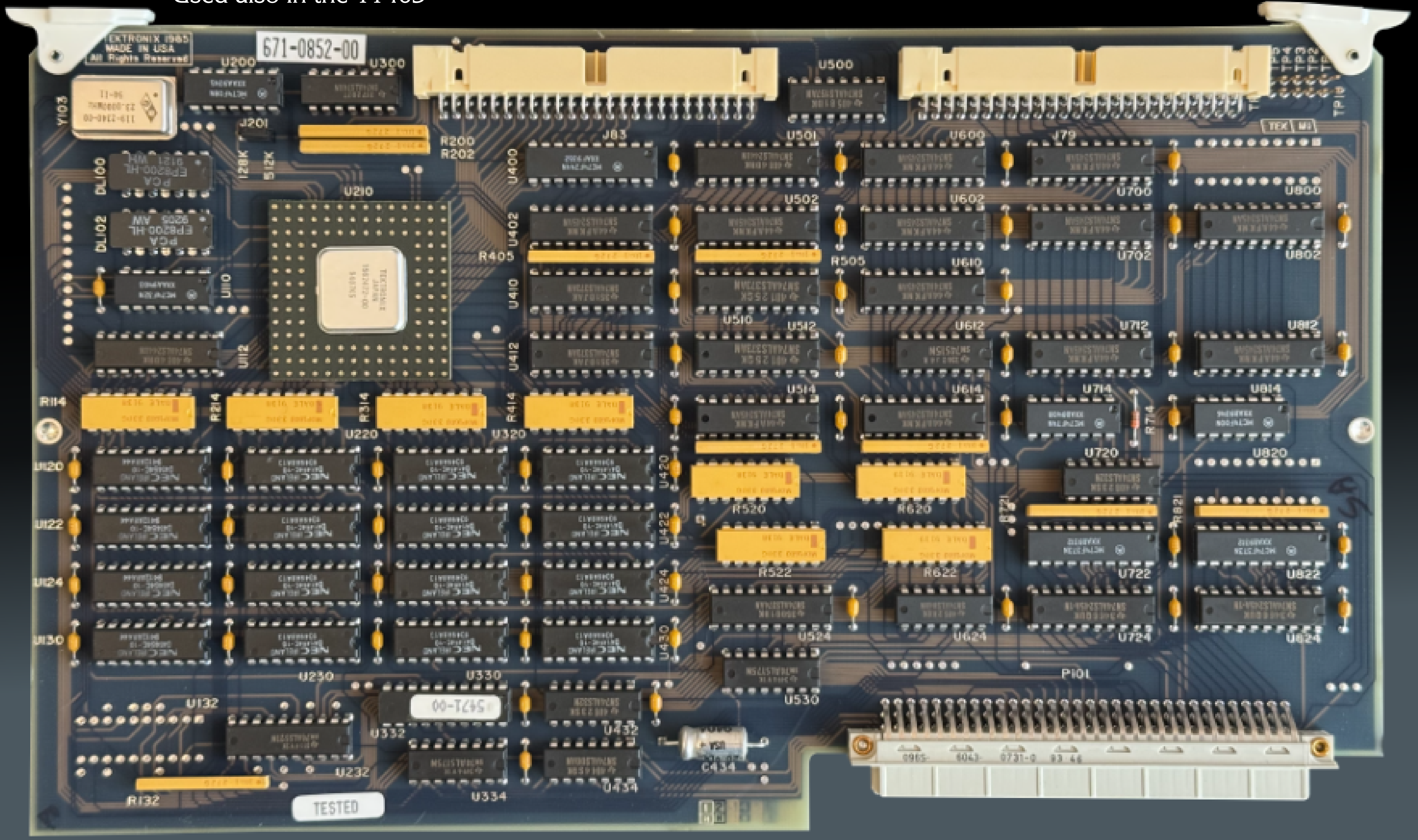
The **A14 I/O Board** consists of the following:

- data buffers;
- timer configuration circuitry;
- real time clock;
- serial data interface (SDI);
- temp/tone readback buffer;
- tone generator.

The A14 I/O board is an interface between the EXP and the communications ports (for example, RS-232-C), devices on the A9, A10, and A11 Front Panel circuit boards, the A12 Rear Panel assembly, and the plug-ins.

A15 MMU

Used also in the 11403



The **A15 MMU Board** consists of the following:

- MMU gate array;
- status and mode register (SMR);
- display interface;
- digitizer interface;
- executive processor interface.

The A15 MMU board coordinates communications among the following three DSA subsystems:

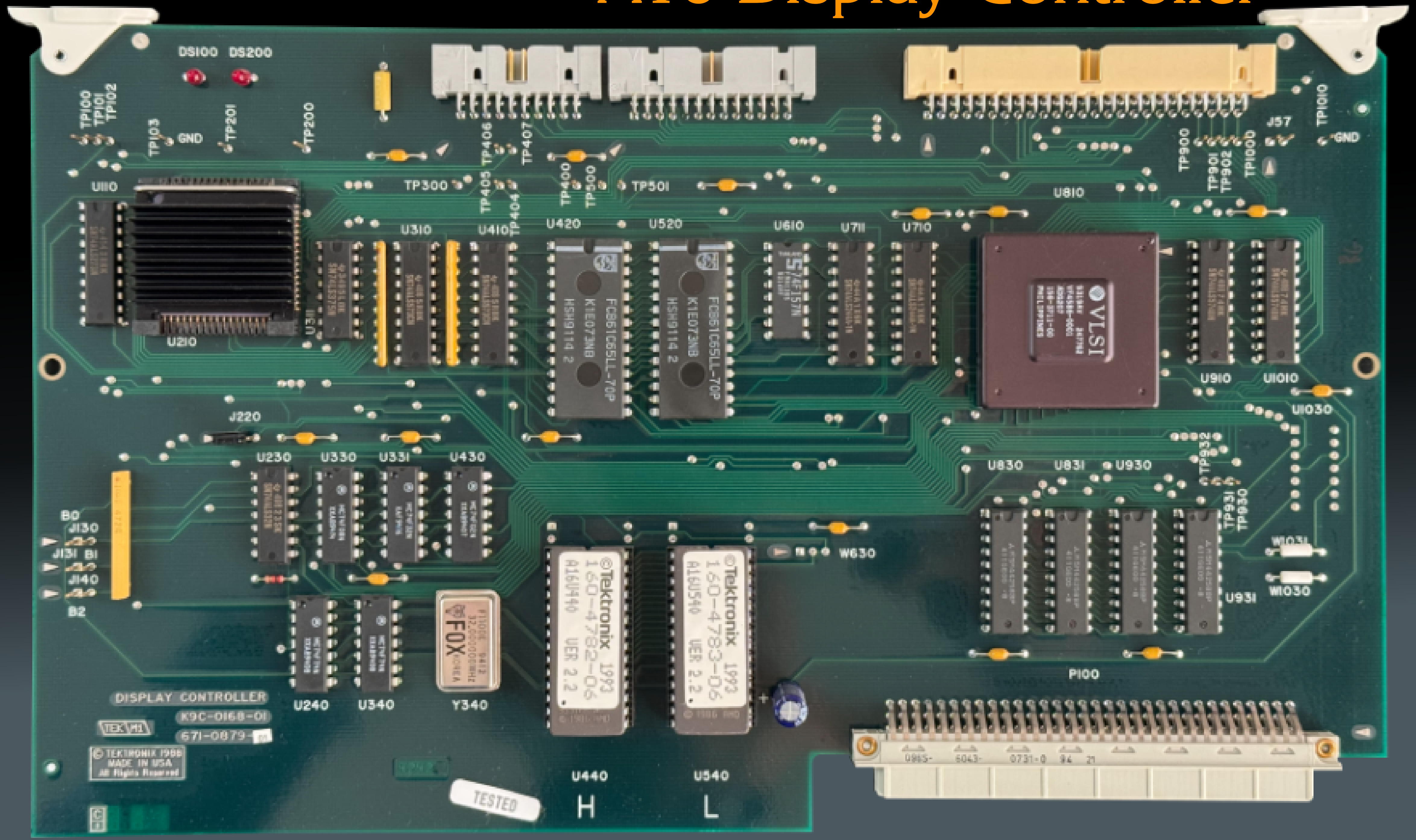
- Display;
- Digitizer;
- Executive.

A16 Display Controller

The **A16 Display Controller Board** is composed of hardware and firmware, which allow the Executive processor to present trace and other displays quickly and accurately. The hardware consists of the following:

- display IC microprocessor;
- bit map RAM;
- display RAM;

The Display RAM, whose description follows, is the only hardware that configures displays. The firmware places all display elements that are placed into the bit map.



Revision of the
1403 Executive Processor

A17 Main Processor

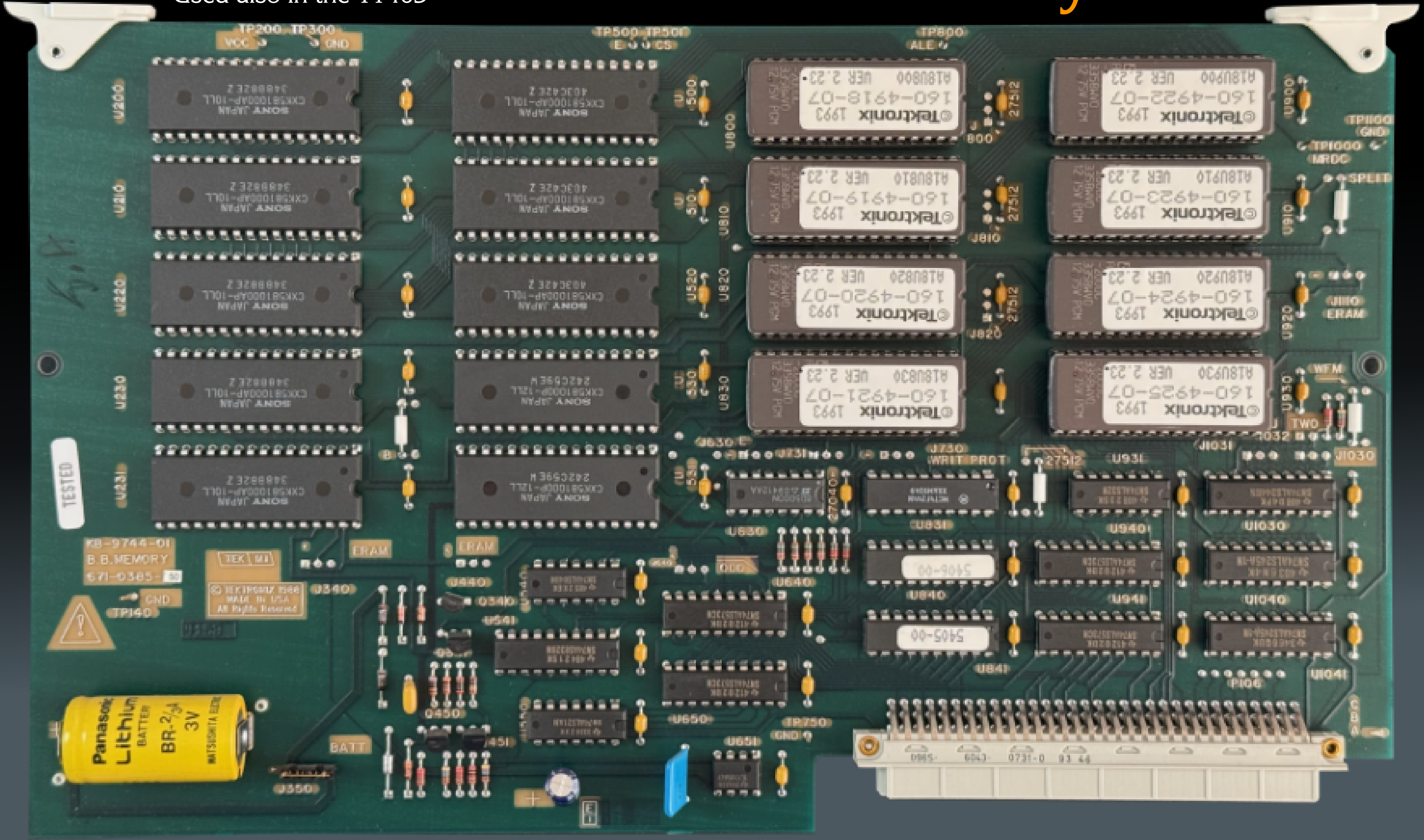
The **A17 Main Processor Board** consists of the:

- Executive processor (EXP);
- numeric co-processor circuitry;
- bus controller circuitry;
- reset circuitry;
- wait state circuitry;
- EPROMS;
- interrupt controllers;
- DMA.

The Executive processor (EXP) - executes firmware routines stored in EPROMS located on this board and the A18 BB Memory board to effectively control the operation of the DSA. When power is first applied to the DSA, the EXP executes local and system diagnostic tests, which are located in the EPROMs on the A18 BB Memory board.

A18 BB Memory

Used also in the 11403



The **A18 (Battery Back-up) BB Memory Board** provides the EXP with system RAM (SRAM) and EPROM for most operations. Support circuitry for the memories and diagnostic circuitry for troubleshooting are also located on-board. The A17 Main Processor board (specifically the Executive processor or the DMA controller) initiates all accesses to SRAM or EPROMs.

The A18 BB Memory board consists of the following:

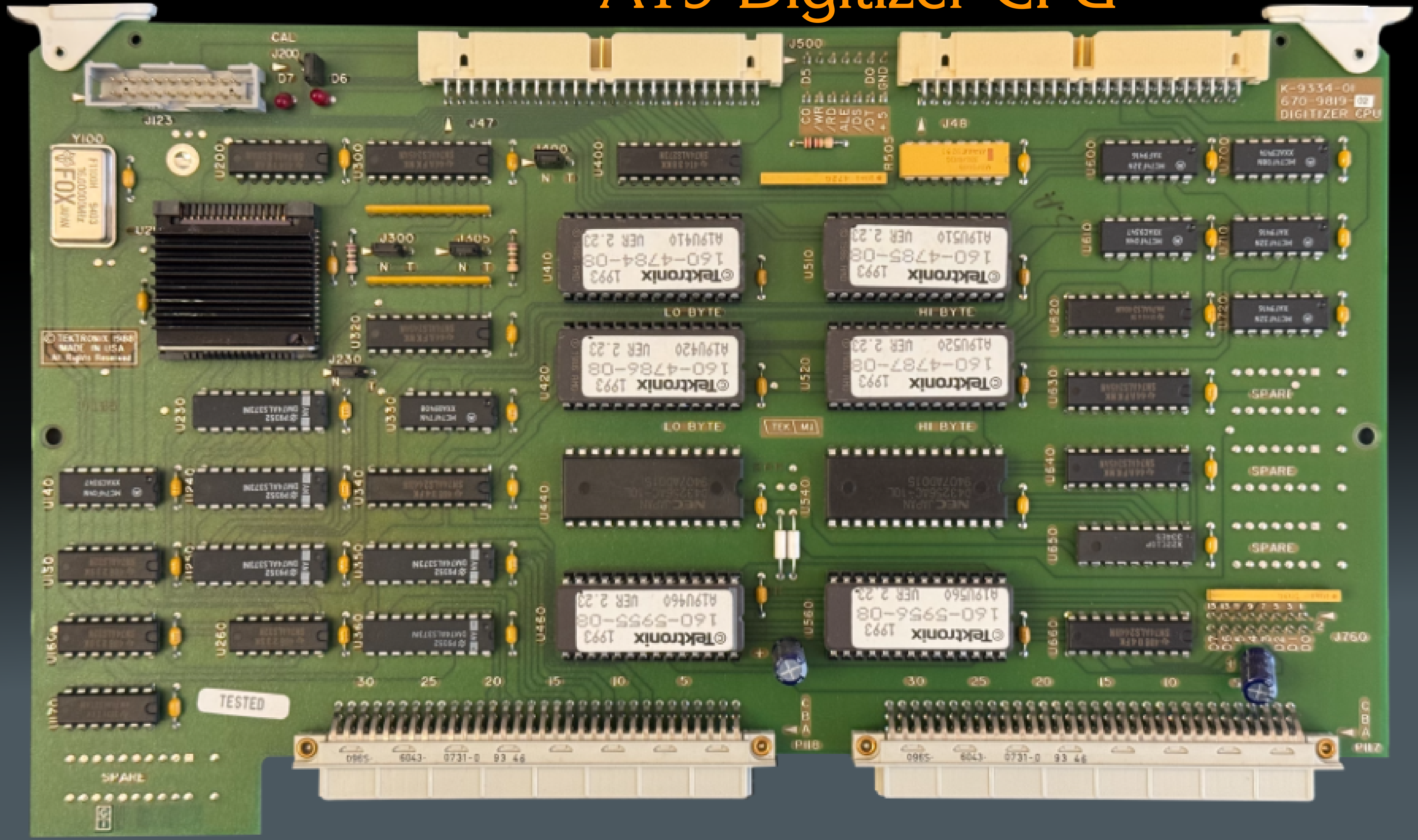
- address latches;
- address decode and memory select circuitry;
- EPROM and system ROM;
- memory data buffers;
- memory configuration readback;
- optional waveform storage RAM and battery backup.

A19 Digitizer CPU

The **A19 Digitizer (Central Processing Unit) CPU Board**, A20 Digitizer 1/0 board, and A8 Waveform Processor (Signal Processor) board form a system which manages the data acquisition hardware, communicates with the A17 Main Processor board, interprets the front panel settings, and executes diagnostic firmware.

The A19 Digitizer CPU board consists of the following:

- CPU;
- system ROM;
- system RAM;
- selectable RAM/ROM option;
- NVRAM;
- bus conversion circuitry;
- status/option readback.



A20 Digitizer I/O

The **A20 Digitizer I/O Board** links the Digitizer subsystem to the Executive subsystem. The arbitration between these two subsystems is accomplished through the A20 Digitizer I/0 board and the A15 MMU board.

The Digitizer I/O board consists of the following:

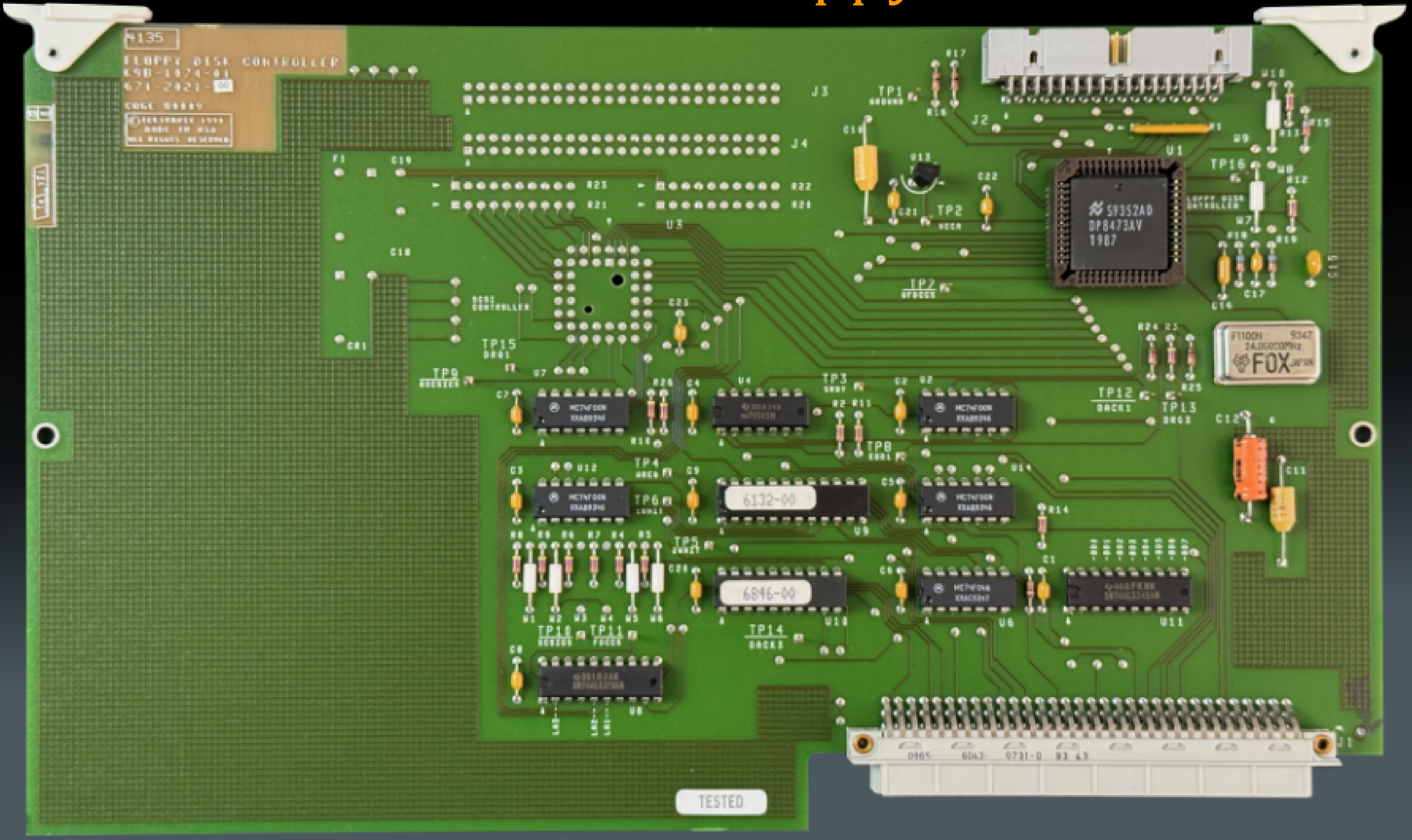
- Digitizer to MMU interface;
- MMU to Digitizer interface;
- MMU control.

A32 Floppy Disk Controller

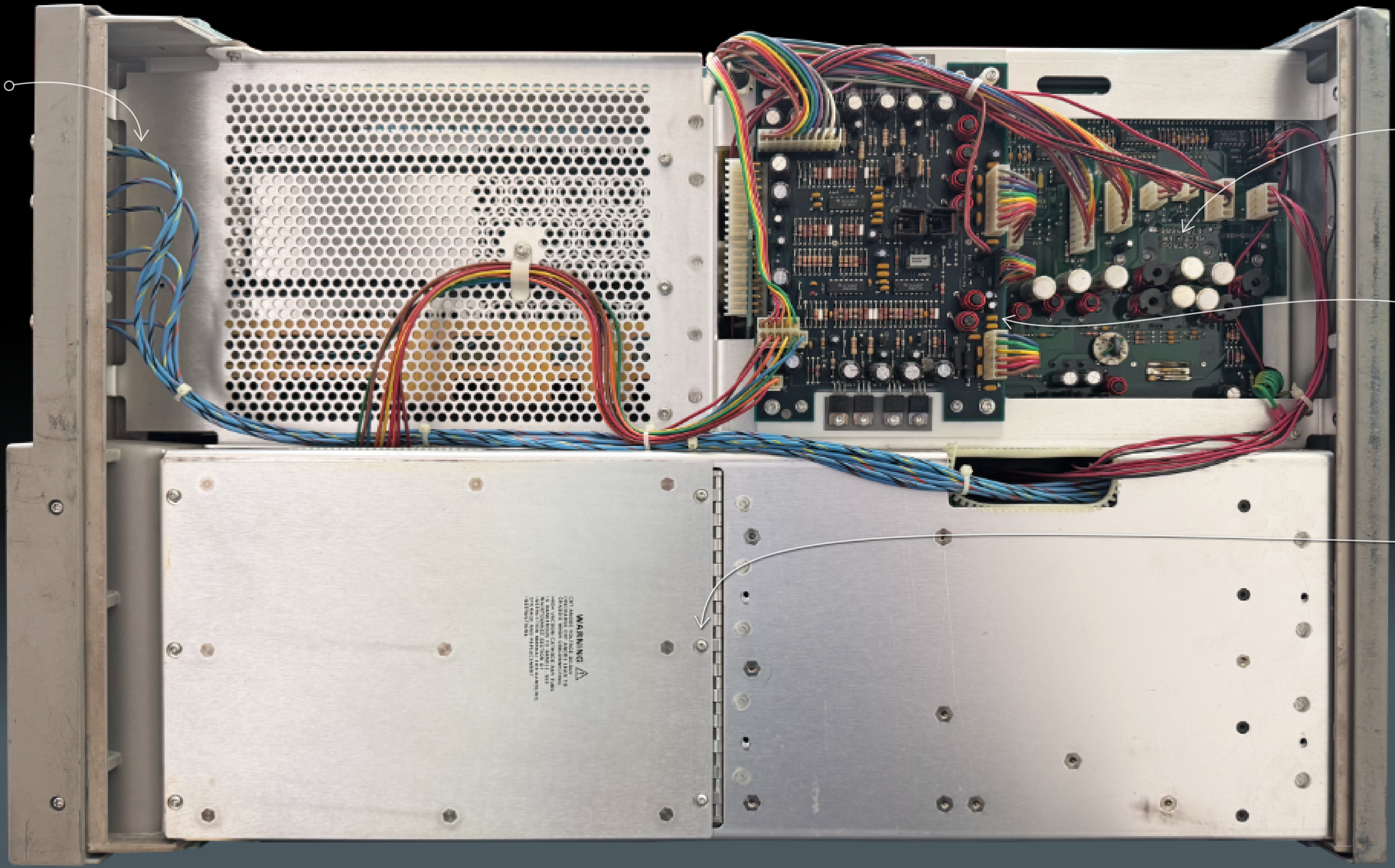
The **A32 Floppy Disk Controller Board** and the A33 Floppy Disk Drive form a floppy storage system under control of the Executive Processor (A17). Data transfers are done using Direct Memory Access (DMA).

The A32 Floppy Disk Controller Board consists of the following:

- floppy disk control IC;
- bus interface/buffers;
- wait state generation;
- DMA interface;
- interrupts.



Bottom View



Option 1C
Loop Through
BNC's

Power
Supply
Section

A4 Voltage
Regulator
Board

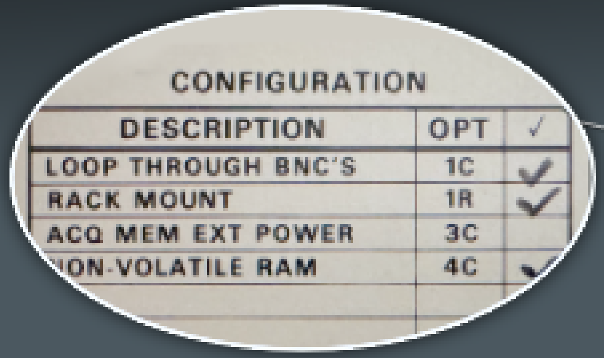
Warning!

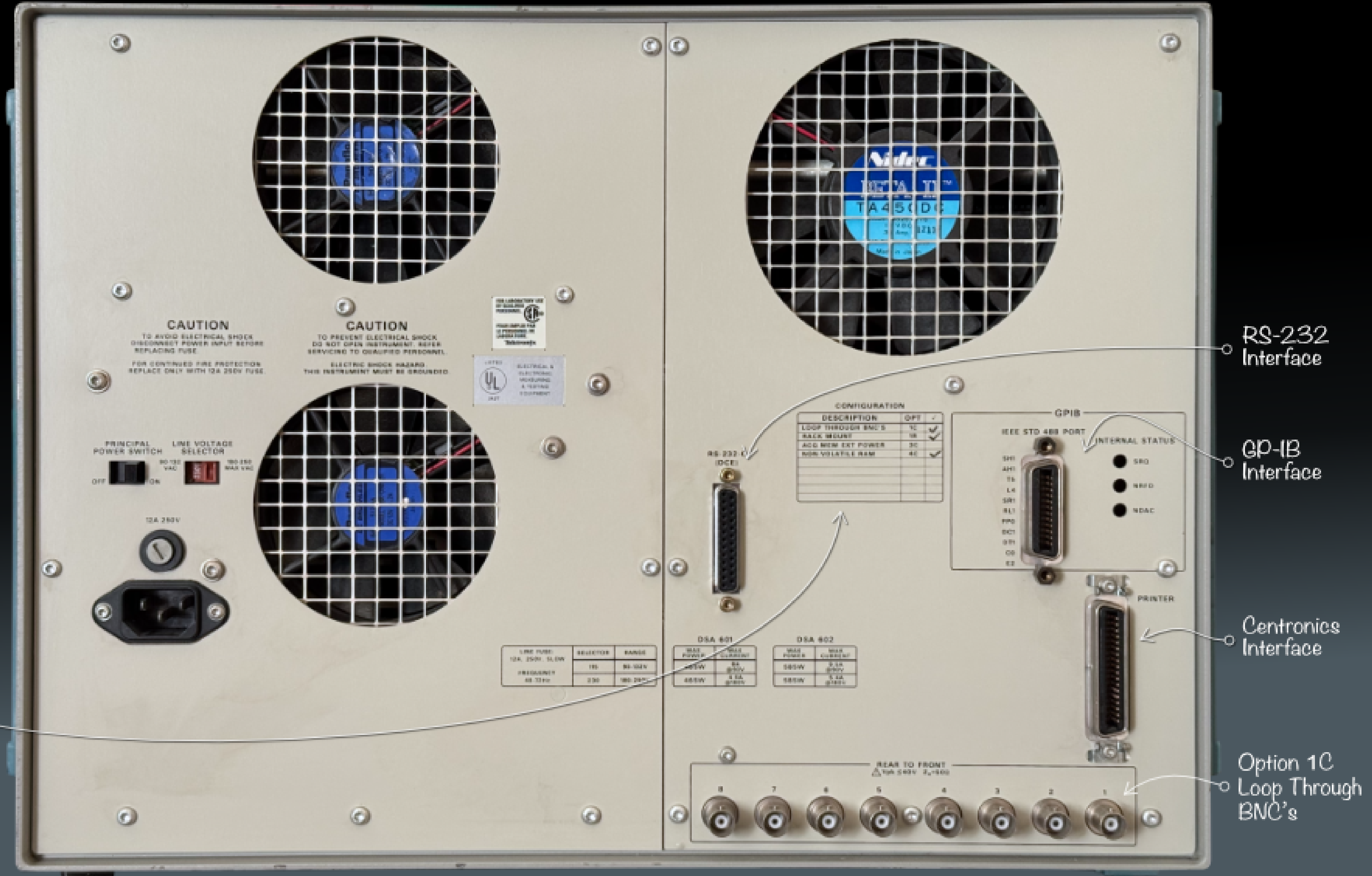
Don't be fooled by the hinge and don't remove these screws. Opening this window requires removing the CRT.

B-Side

Of course, the back of the DSA 602A is also mammoth. The three fans, though large, almost get lost in so much surface. On the other hand, compared with the 11300 and 11400 series, the fans do not imply a protrusion and the back surface is completely flat. This is an advantage, considering that the DSA is very deep, and what's more, at least 5 centimeters free must be maintained to ensure ventilation.

As with the 11000 series, in addition to the GP-IB there are RS-232 and Centronics interfaces, which were very popular on all PCs at the time, a notable improvement even today, especially the RS-232, which allows complete control of the instrument without resorting to the cumbersome GP-IB, which requires a special interface on the computer side and thick and terribly stiff cables.





As we noted earlier, DSA has way too many flat interconnect ribbons. Fortunately, when they are mounted, they are not as messy as in this photo.

Manuals and Other Documents

When writing my vintage equipment love books, I always tried to follow two guidelines:

- only describe equipment that I have actually owned/repaired/restored;
- only buy equipment that I could try to repair/restore, and thus those for which service manuals and schematics were available.

The DSA 602A is then outside those **Columns of Hercules** that I promised myself I would not cross, since there are **no schematics** that would allow it to be repaired in case of failure. In truth, even the 11300 series did not provide for component-level repair, but somehow its schematics did reach us.

Of course, with objects of this complexity, the possibilities of intervention by us mere amateurs are rather remote, and perhaps we did well to limit ourselves to the 500 and 7000 series, but it would still have been good to have at least the possibility.

Once again, we have to thank the great heroes of **TekWiki** if we still get to play with our beloved vintage Tektronix stuff. Without them, it would be impossible to keep our oscilloscopes alive, and in many cases they would just be scraps. Also in this case, even if no schematic diagram is available, as many as **eight** valuable documents are available, as listed in the table below.

P/N	601	602	601A	602A	Schem	Title	Latest
070-7252-01	●	●			No	Command Reference Manual	SEP 1989
070-????-00	●	●			No	Service Reference Manual	
070-8180-00			●	●	No	Tutorial Manual	MAY 1991
070-8181-00			●	●	No	User Reference Manual	FEB 1991
070-0182-00			●	●	No	Programmer Reference Manual	FEB 1991
070-0183-00			●	●	No	Quick Reference Manual	FEB 1991
070-8184-00			●	●	No	Service Reference Manual	APR 1993
						Handshake	SUM 1989

Comments and Silly Chatter

Somewhat Disappointing?

My first impressions of the DSA 602A were not very enthusiastic, and it was *antipatico* to me at first sight.

Despite the record numbers, or maybe because of them, I was not tempted for a moment to call this hypertrophic giant another **wonder of the world**, as I had so convincingly done with the **11302**.

I got the idea that the DSA 602 was simply the completion of the 11000 Series project; it was basically what the 11403 should have been from the beginning, but could not be realized because the technology (or Tektronix) was not ready when the 11400 series was designed, i.e. a fully digital scope with the proper sampling rate.

Idle Reflections

Without wanting to pass judgment on things I know so little about, and with all due respect to a company I hold in the highest regard, I wonder how reasonable this mega-project was. My impression is that Tektronix decided to put all their best efforts into the 11000/DSA Series, but that the project became a behemoth that consumed a lot of resources without a corresponding return; However, it had become a flagship for the company and, as is often the case in the industry, it had to be completed.

As if to confirm this doubt of mine, the DSAs were **discontinued** in 1995 and disappeared from the 1996 catalog, possibly now replaced by the TDS series, powerful, smaller and less expensive.

Not Striking

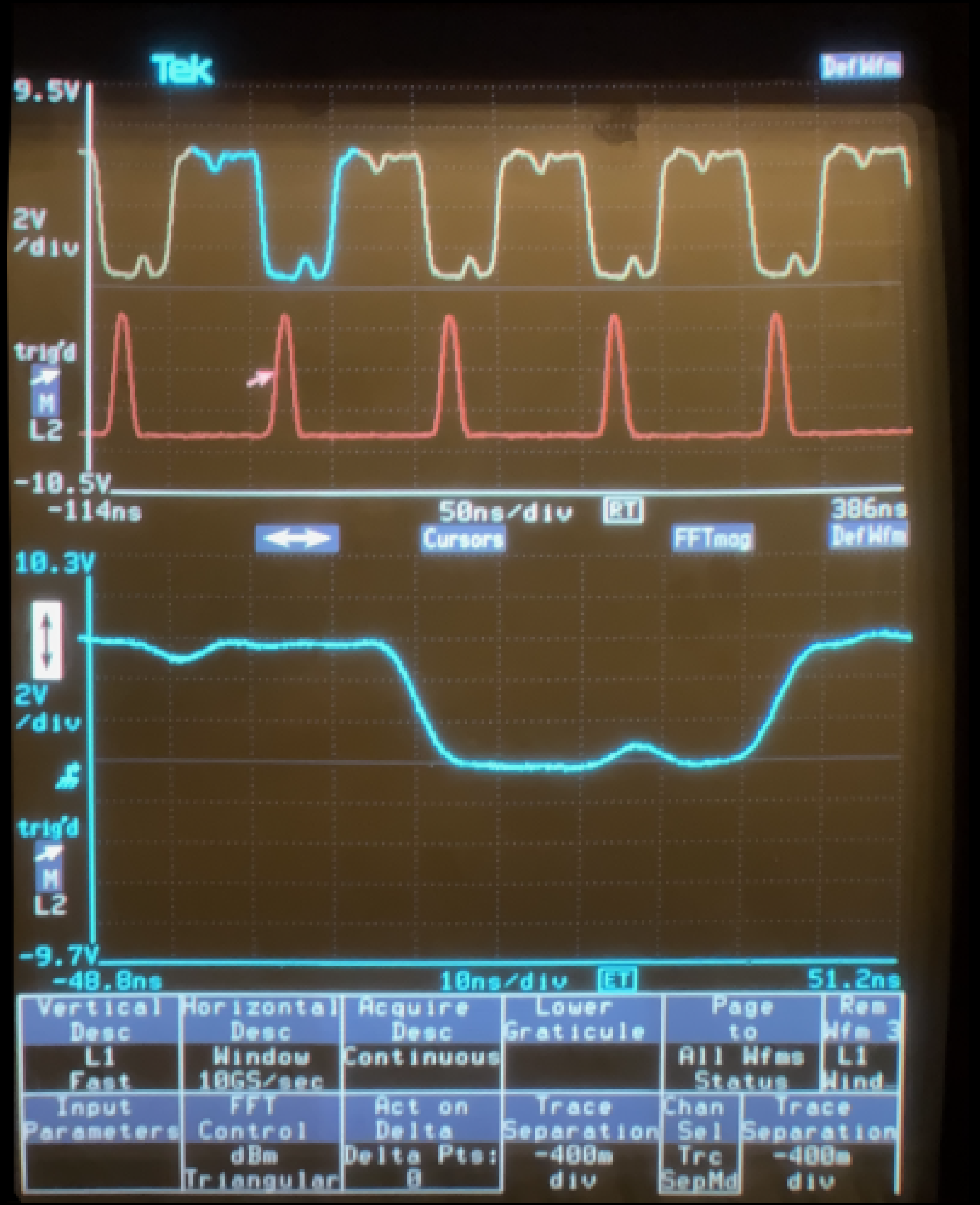
Furthermore, I have to say that despite the three years since the introduction of the 11000 Series, the firmware of the DSAs, except for the FFT, lacked major functional innovations, or at least they were not emphasized enough. Yes, there are many improvements, but they are the ones you would expect from the normal evolution of the instrument or from new plug-ins, not from this disruptive hardware-innovative Super-Monster.

The CRT Does Not Help

As with people, the "gaze" of an oscilloscope helps create a subliminal image of it in our minds. In this case, the image is a bit fuzzy due to the unexceptional quality of the magnetic deflection CRT. In fact, Tektronix chose a very good **Trinitron**, one of the best at the time, larger than the one used in the 11403 (10” vs. 8.5”) but with the same resolution of 552 x 704 pixels (in both cases, the scan is rotated by 90° so that the larger side is placed vertically instead of horizontally as usual).

Aging certainly played against it; for both the DSA 602A and the 11403, a UPTIME of almost 20,000 hours certainly did not improve their quality. But perhaps even more significant is the **change in our perception**, now accustomed to modern ultra-high quality flat displays. Our brain tends a bit to negatively classify that old-TV-set look given by the CRT's domed surface, with grainy low-resolution images and less than perfect linearity. Certainly the crisp CRT of the **11302**, even in its smaller size, conveys a far superior perception of professionalism and quality.

On top of that, the choice of **default colors** was really sad and gives the impression that your CRT is even worse than it really is (but you can change it from the Utility menu).



I wouldn't call the DSA 602A's display "attractive," perhaps because of its age, which has probably reduced its quality. Nevertheless, it is fast, responsive and, once you get used to it, even practical. A few extra keys, like on the 11302, would have helped a lot in terms of ergonomics.

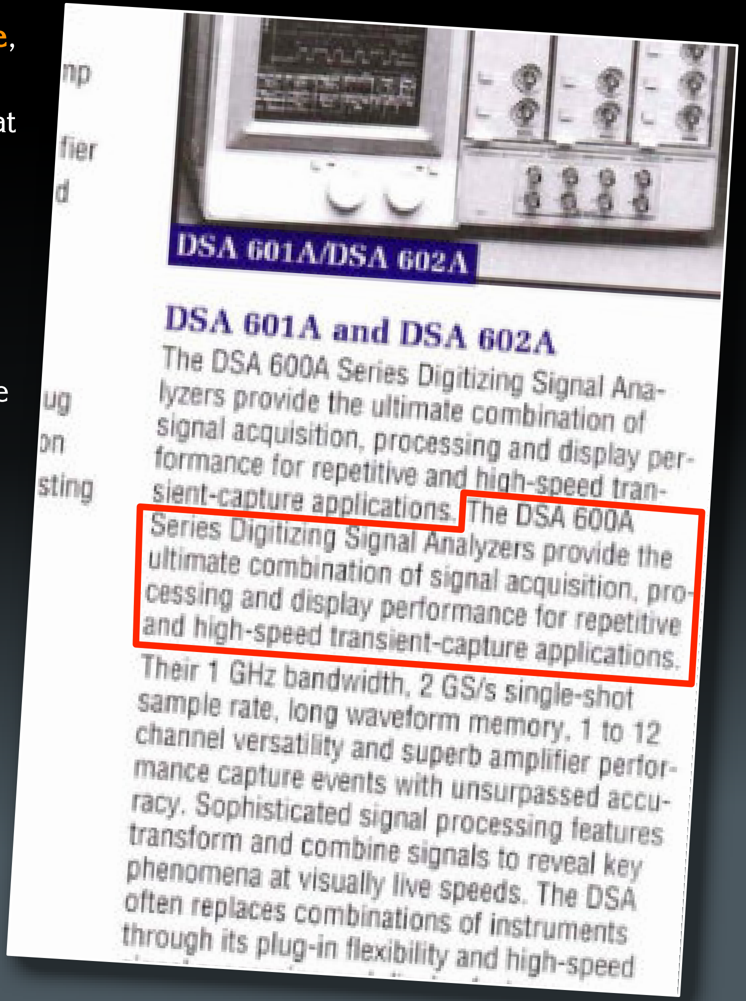
No Luxury Brochures For It

It seems that the DSA 602A was not a **son of love**, as I had the impression that the 11300 was, and finding material about it is not easy, except for what the generous TekWiki provides.

Even the 1993 general catalog confirms this impression of superficiality: as you can see in the fragment here on the right, the beginning of the DSA description is repeated twice, and the error is present again in the 1994 catalog (Howard, forgive them!).

Long gone are the days when the **Tekscopes** newsletter reported articles that we found as exciting as an adventure novel. The summer 1989 **Handshake** (which replaced Tekscopes) contained a presentation of the new DSA series, but it seems to have been written more out of duty than conviction, as if Tektronix itself did not believe too much in this elephantine design. They were probably more focused on other, more promising projects.

But perhaps this is only the feeling of a distant apprentice historian.



DSA 601A/DSA 602A

DSA 601A and DSA 602A

The DSA 600A Series Digitizing Signal Analyzers provide the ultimate combination of signal acquisition, processing and display performance for repetitive and high-speed transient-capture applications. The DSA 600A Series Digitizing Signal Analyzers provide the ultimate combination of signal acquisition, processing and display performance for repetitive and high-speed transient-capture applications.

Their 1 GHz bandwidth, 2 GS/s single-shot sample rate, long waveform memory, 1 to 12 channel versatility and superb amplifier performance capture events with unsurpassed accuracy. Sophisticated signal processing features transform and combine signals to reveal key phenomena at visually live speeds. The DSA often replaces combinations of instruments through its plug-in flexibility and high-speed

I could not find a beautiful brochure of the DSA as the one we saw for the 11300. I don't know if this is because it didn't arrive to us or if it really was never made.

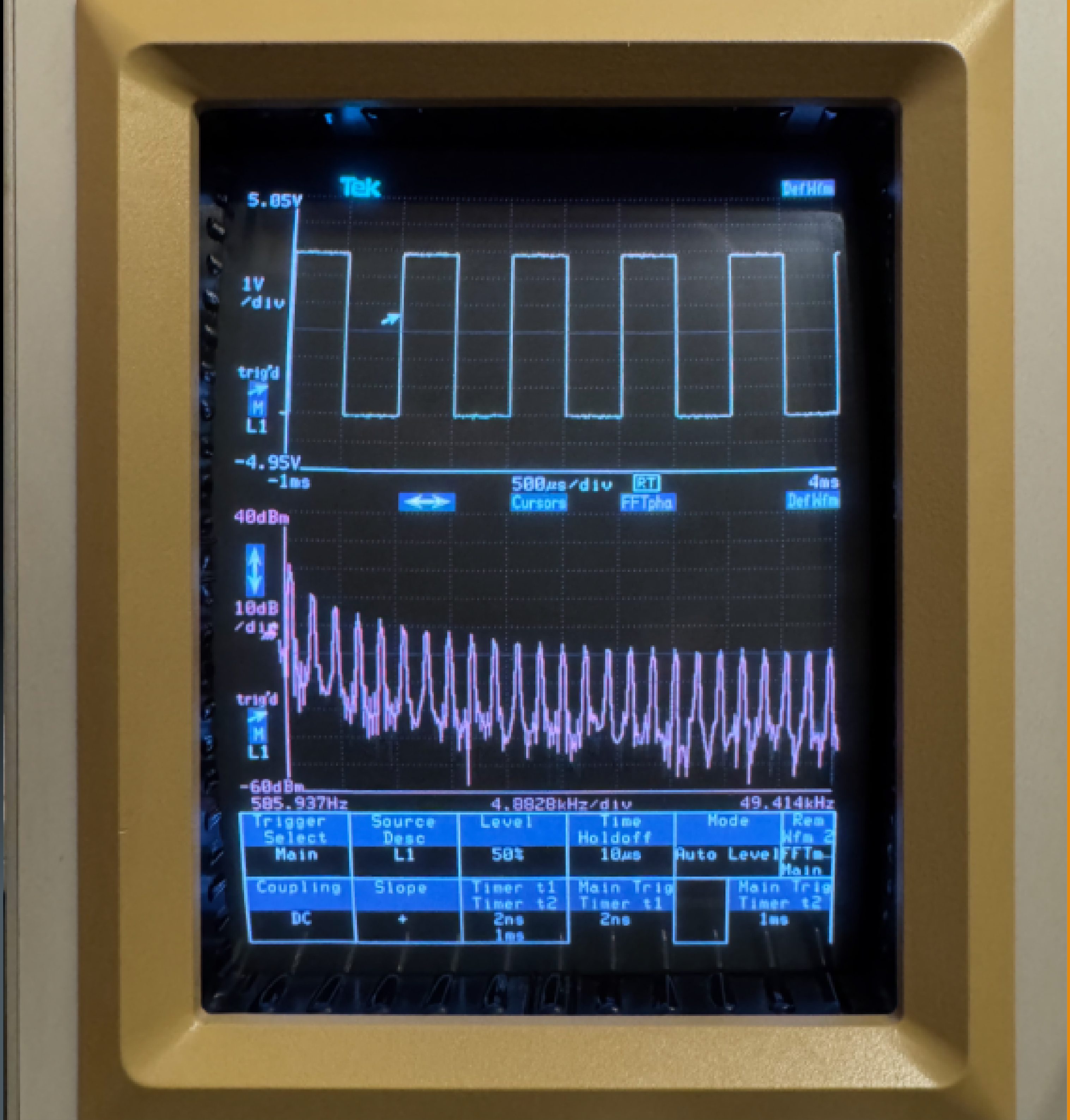
DSA 602A Estimators

Nevertheless, the DSAs have still today many estimators. I find interesting this very good analysis from a member of GroupsIO Tekscopes community:

I have DSA 602A scopes at home and enjoy using them. The flexibility of various channel voltage and frequency options is very useful along with their waveform definition entry, averaging/persistence acquisition options and extensive measurement and statistics capability within the scope.

Collectively the DSA 602s and plugins form a very capable general use scope including both real time and effective time sampling, depending upon what is being measured. At work, I use mostly TEK 5 Series MSO scopes with advanced ISO-Vu and differential probes. Even with these advanced recent TEK 5 Series scopes, I find that usually I transfer acquisition data to lab laptop and use TEK analysis software, python, excel or Matlab to analyze deep memory fast sampling rate data records. So, one significant difference is the extreme deep memory available with TEK 5 Series for longer acquisition time at very high sampling rates, far beyond what is possible with the DSA 602 scopes.

Still, one could argue even today that given the difference in price per performance and feature set, the DSA 602A scope still holds significant "value" as a general use scope if the size and weight is tolerable, park it on a cart and wheel the cart where needed. At work, I also keep the TEK 5 Series on cart and do the same thing, so not terribly different. The DSA 602A offers inexpensive 1GHz channel bandwidth with 11A71 and 11A72 plugins; at work, budgets dictated mostly 200 MHz bandwidth TEK 5 Series scopes, a practical difference in price vs performance. With modern TEK 5 Series, most measurements require using external differential probes for each channel and high performance differential probes are quite expensive and add significant total system cost. At home, I use 11A33 plugins and have 150MHz bandwidth with dual high impedance (up to 1 Gohm) inputs to nearly achieve the same thing for pennies on the dollar for many types of signal monitoring. Beyond that, for DSA 602A general purpose use the 11A32, 11A34 and 11A52 plugins provide more options geared toward specific testing needs and the three plugins slots can support plugins of mixed type. The DSA 602 is still useful today for most general purpose use. Advanced applications (i.e., double pulse testing on cutting edge GaN or SiC FET designs) probably warrants a modern scope, though even the DSA 602A supports integration and energy calculations so with enough effort it might be possible to get results.



The Good Giant

Conclusions

I started writing these notes with a rather critical attitude, then I gradually softened it, as I got to know the Super-Monster better; I must admit that, despite my initial coldness, it finished conquering my heart.

True, it is big and certainly not eco-friendly, but it is also a beautiful instrument; a dinosaur, and as such doomed to extinction.

My liking was further enhanced by the fact that this unit works perfectly: I have not found a single problem with it so far (this instrument was also purchased from **Radiosurplus Elettronica**, which, as you know, is one of my favorite suppliers), and the presence of the rare **11A34V** and **11T5H** made the cake even sweeter.

In the end I also solved the problem of where to put the whole thing. I bought 60 centimeters deep shelves, thinking they would be enough for everything, but the Super-Monster exceeds them also, and more if you want to leave at least five centimeters for air, as you must. But the resulting effect, as you can see in the photo, is not too bad, and so this Super-Monster also has its own kennel here… (I'll let you imagine the comments of the downstairs neighbors you see in the photo, who also felt cheated of their "monster" title...).