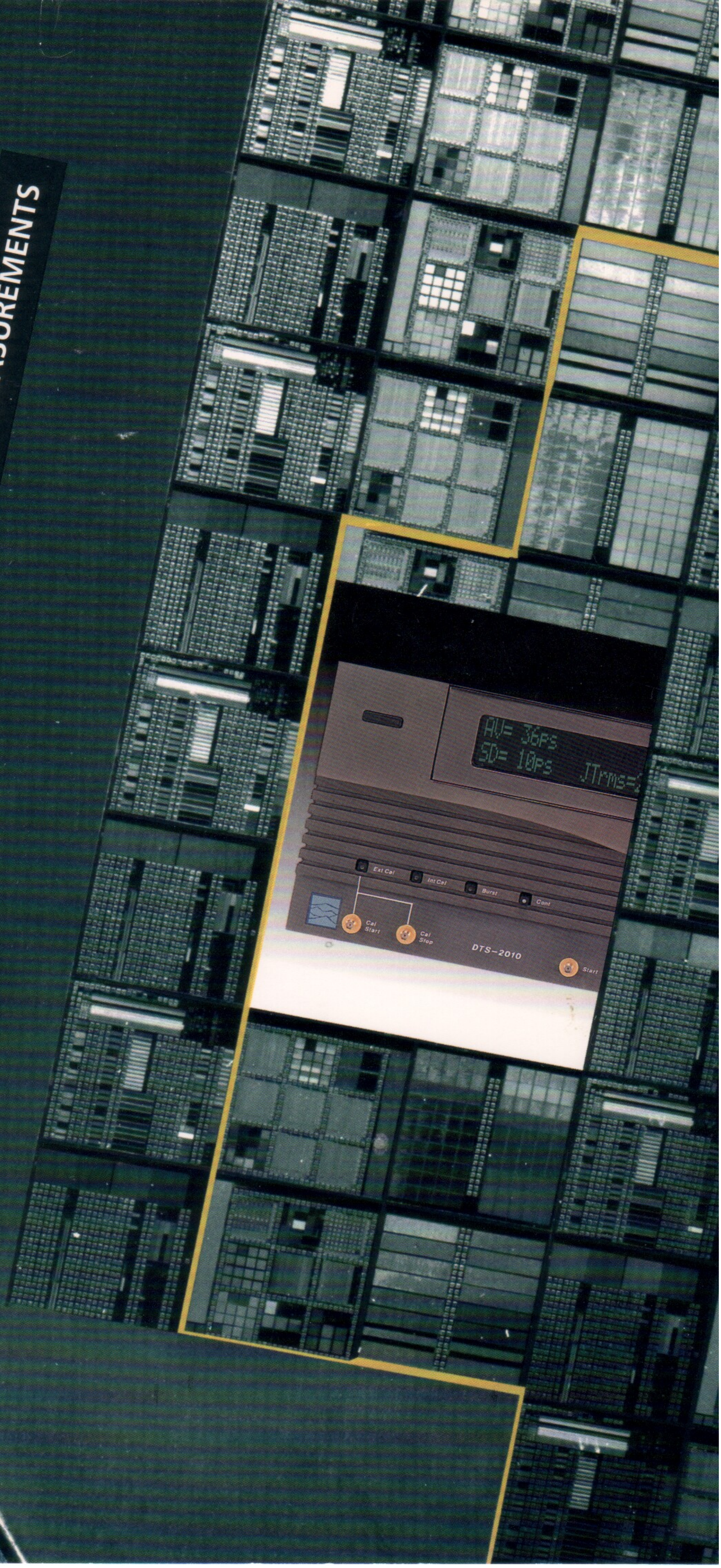
wave

PRECISION TIME DOMAIN MEASUREMENTS



DTS-2010

Speed, Accuracy, Resolution, Repeatability

A New Level of Timing Measurement Performance: ±50 Picosecond Single-shot Accura

The DTS-2010 Digital Time Scope provides automated measurements in multiple test environments where large numbers of fast, accurate time measurements are necessary and where repeatablility is critical.

It measures and displays rise time, fall time, pulse width, period and propogation delay; and when interfaced with a PC via LabWindows®, it provides histogram display of jitter, visual definition of rising and falling edges, as well as interpretive display of a wide range of statistical data.

It performs these operations with a degree of speed, accuracy, repeatability and resolution not possible with a conventional high-speed DSO.

Unlike the DSO, which relies on vertical sampling to provide a series of averages, with repeatability dependent on placing waveforms on a screen, the Wave DTS-2010 provides direct, single-shot measurement of real time events between voltage levels. This approach eliminates the errors inherent in sampling and the transformation of data while waiting for a waveform to be developed.

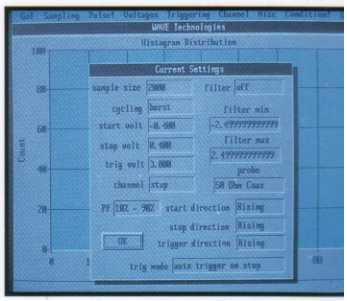
The DTS-2010 will reduce your test time, increase productivity and enhance end-product quality in any time domain measurement application where speed, accuracy and repeatability are prime considerations.

The Wave Technologies DTS-2010 Digital Time Scope represents a dramatic departure from the traditional Digital Storage Oscilloscope (DSO) approach to critical timing functions.

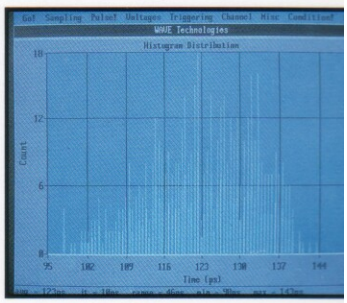
While the DSO measures the number of events within a time frame and arrives at a figure for average elapsed time between each event, the DTS-2010 uses a patented technique to measure one-shot events between any two edges in real time, without wasted samples.

This single-shot capability provides direct, real-time measurement, without ambiguity, as well as eliminating the delay created by loading multiple data points into a memory, analyzing them, then recreating them as a representation of what is actually happening.

The result of the Wave DTS-2010 approach is a combination of speed and accuracy impossible with time measurement instruments which use vertical sampling techniques.



Current setting display showi
status of rise time, jitter histogra
measurement 10% to 90%.



Typical DTS-2010 jitter histogram

The Timing Measurement Instrument from Wave

Femtosecond Resolution, ±2.5 Picosecond Repeatability

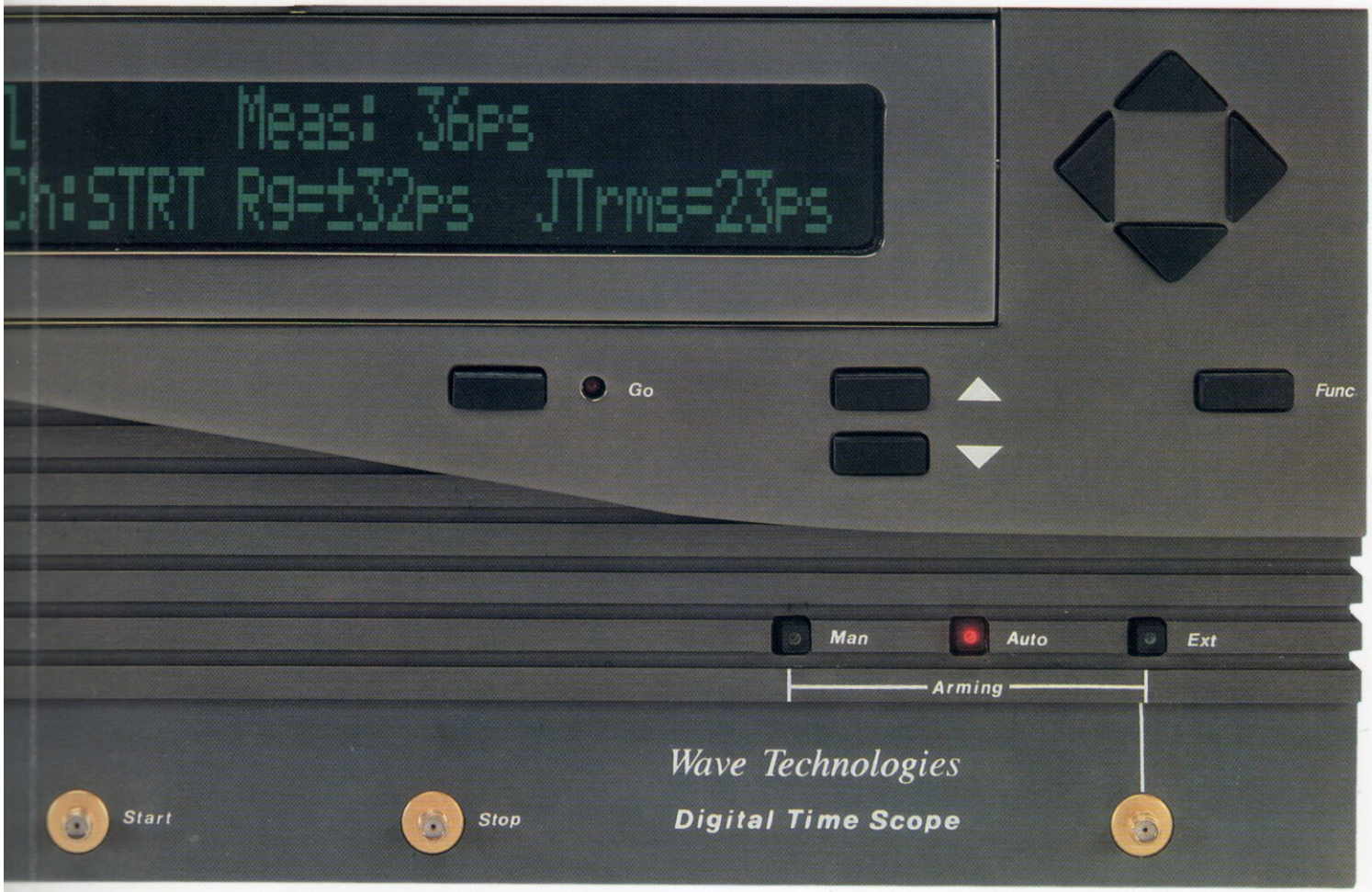
Features

- Complete statistical analysis and capability for standardized integration into OEM products via IEEE-488 interface.
- LabWindows support.
- Selectable rise time, fall time and pulse width measurements.
- 800 femtoseconds resolution without averaging; ±1pSec displayed.
- Internal calibration; automatically calibrates itself internally within 90 seconds to a NIST traceable 100 MHz ovenized crystal oscillator.
- External calibration; automatically measures cables connected to the system and stores the cable length measurements in memory for recall during operation.
- Trigger levels set independently on rising or falling edges.
- ±50 pSec single-shot accuracy.
- ±25 pSec accuracy with averaging.
- Independently programmable voltage thresholds on all imputs for start, stop and trigger.
- ±2.5 pSec repeatability.

1. **Display Window -** Two-line by 40-character LCD provides access to a variety of screens. With the menus, the user can scroll to the appropriate menu to store the information, view sampling information, or define program-specific measurement parameters as required by the application.
2. **External Calibrated -** Permits calibration of any external cable connected to the corresponding SMA commector. After all calibrations are completed, the results are stored in non-volatile RAM.
3. **Internal Calibrate -** Automatically calibrates the instrument internally to ±50 pSec single-shot accuracy or ±25 pSec with averaging. Calibration requires 90 seconds, and once the instrument is calibrated, results are stored in non-volatile RAM.
4. **Burst -** Activation begins measuremen of the selected (1 to 100,000) numbe of samples to be measured.
5. **Continuous -** Activation initiates mea surement of pulses corresponding to the sample size displayed. Once the number of the pulses measured equals the sample size, the new computed results are displayed and stored and a new measurement sequence begins.
6. **Go -** Used in conjunction with othe switches and selected menu items to start the selected measurement or dis play sequence.

Typical Applications

- ATE test head deskew and timing verification.
- Propogation, rise and fall time, period and pulse width measurements.
- Fast measurement of oscillator and phase lock loop jitter.
- Calibration of external fixtures and delay lines.
- Clock fan-out distribution deskew for computer systems.
- Clock tuning in computers
- Device thermal-vs.-time characteristi
- Fast, accurate coax cable delay measurements
- Other applications where fast and accurate time domain event measurement is critical.



7. **Start Connection** - SMA connection for the Start input pulse.

8. **Manual Trigger** - Activation illuminates the corresponding indicator light and allows the GO switch to arm the Digital Time Scope for measurement to the next pulse to be presented.

9. **Automatic Trigger** - Permits automatic sample collection based on the edges of the Start pulses. The instrument then collects the number of samples selected and computes the values.

10. **External Trigger** - Permits an external voltage source to arm the instrument and allows selection of voltage level. Once armed, the instrument measures the next pulse, with one measurement collected each time this switch is activated. When the number of measurements equal to the selected sample size is collected, computations are made and displayed.

11. **Stop** - SMA connection used for the Stop input pulse.

12. **Increment/Decrement Value Pushbuttons** - Permits selection and input of variable memory and user interface information within the field enters and stores the displayed value/data in memory. Frequently used setup information may be stored and recalled by depressing the increment button when the cursor is at the appropriate Save or Recall position.

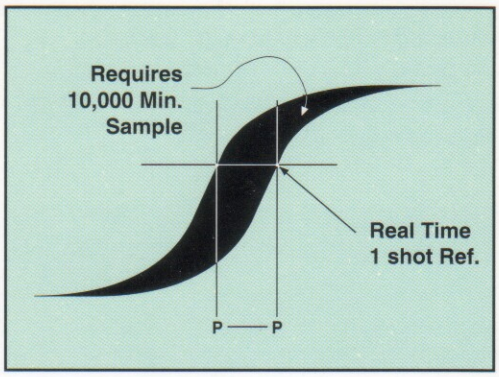
13. **Menu Scroll/Cursor Control** - The Up/Down buttons permit scrolling up or down to select the desired menu within th LCD Display window. The Left/Right buttons permit movement of the cursor left or right to the desired data entry within the menu screen.

15. **External Trigger Connect** - SMA con nection for input to the External Trigger.

14. **Function Pushbutton** - When activated with the MENU/UP pushbutton, this returns the instrument to the Data Observe menu. When depressed by itself in the Data Observe menu, unfiltered statistics will be displayed. When depressed by itself in the Voltage menu, it activates the pulse finder.

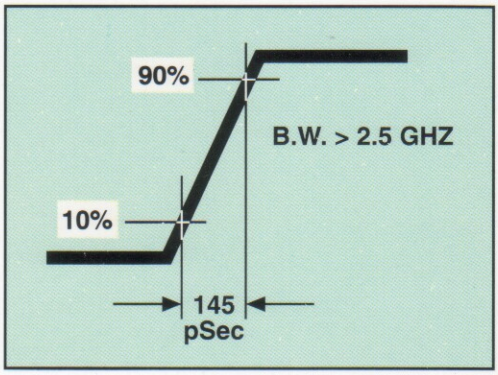
Real Time vs. Sampling

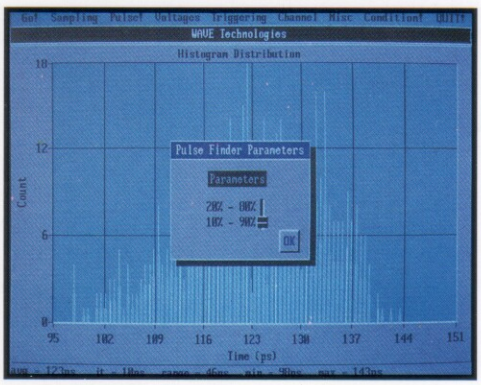
The most graphic illustration of the difference between the sampling technique of the conventional Digital Storage Oscilloscope and the direct, real-time measurement of the DTS-2010 may be seen in this example. The DSO requires millions of voltage samples to display the jitter of a pulse as pictured here. The representation on the DSO screen is a re-creation of the many samples taken during a tiny time frame, stored in memory, then displayed. The time it takes to acquire a waveform is usually the limiting factor when considering throughput, and that's why single-shot performance is so important.

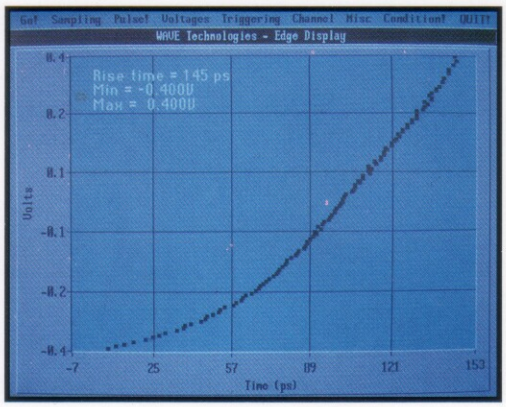


Histogram and Jitter

The histogram displayed by the Wave DTS-2010 Digital Time Scope presents a true picture of what is happening. The range of pulses from minimum to maximum is measured directly and actual real-time jitter is displayed in numeric form.







Key Specifications

- 800 Femtoseconds resolution (1 Picoseconds displayed)
- ±50 pSec single-shot accuracy; ±25 pSec with averaging.
- ±2.5 Picosecond repeatability
- Input frequency >500 MHz
- Input Bandwidth >2 GHz.
- 3000 Readings/Second.
- Programmable input trigger levels selectable from +6V to -4V
- Auto pulse finder. Resolution 1mV.
- Trigger levels set independently
- NIST traceable
- IEEE-488 Interface for complete statistical analysis.
- Impedance 50 Ohms
- Termination Programmable: -3V to +3

Timing Measurement Performance

Resolution:	800 femtoSec (internal) 1 pSec (displays)
Single Shot Accuracy:	~~±50~~ pSec ±1x10^{-7} of measured interval
Accuracy with Averaging:	~~±25~~ pSec ±1x10^{-7} of measured interval
Repeatability:	<2.5 pSec typical
Measurement Rate:	3000 readings/sec (max)

Input Signal Characteristics

Input Thresholds:	Programmable +6V to -4V
Resolution:	1 mV
Sensitivity:	<50 mV (peak-to-peak)
Impedance:	50 ohm
Input Frequency:	>500 MHz
Minimum Pulse Width:	1 nSec
Input Bandwidth:	>2 GHz
Termination:	Programmable -3V to +3V
Input Edges:	Independently programmable for rising or falling
Connectors:	SMA type

Trigger Functions

Automatic Trigger:	Auto trigger; starts and stops on incoming edges
Manual Trigger:	Arms input with GO pushbutton to accept next incoming edge

External Trigger:

Input Threshold:	Programmable +6V to -4V
Resolution:	3.3mV
Sensitivity:	>50 mV (peak-to-peak)
Impedance:	50 ohm
Termination:	0V or -2V
Connectors:	SMA type

Statistical Functions

Average:	The average of n readings
Jitter RMS:	Distribution of n readings
Standard Deviation:	Distribution of n readings

Maximum and Minimum:

Reading:	The extremes of n readings
Range:	The difference between minimum and maximum(shows input signal quality)

IEEE-488 Interface

All front panel functions can be programmed.

Functions:	AH1, T6, L4, SR1, RL2, SH1, DC1, DT1, C0, E1

Two Line LCD Display with Menu

Start:	Voltage threshold; rising/falling edge
Stop:	Voltage threshold, rising/falling edge
Pulse Finder:	Automatic Mode Set 50%/50%, 20%/80%; 80%/20%, 10%/90%, 90%/10%
Trigger:	Voltage threshold (rising edge only)
Force:	Start-before-stop
Filters:	Time window
Presets:	Four memories
Set number of samples:	1 to 100,000
IEEE-488:	Select address
Choice of Displays:	Auto, pSec, nSec, µSec, mSec, Sec
Cable Length Measurement:	Time delay

Operational Modes

Burst:	Perform n measurements, then halt; update display
Continuous:	Continuously make measurements, update display after each n reading

Calibration Modes

Internal:	Internal calibration to self-contained NIST traceable standard in <90 seconds
External:	Cancels measurement path skew

Timebase

High stability, low phase noise, ovenized, NIST Traceable crystal oscillator.

Aging/Day:	5 x 10^{-10}
Aging Short Term:	5 x 10^{-11}

Power Requirements

Voltage:	90 to 132; 216 to 264 VAC
Frequency:	47 to 63 Hz
Power:	<300 watts

Physical Dimensions

Length:	22" (55.88 cm)
Width:	19" (48.26 cm)
Height:	7.5" (19.05 cm)

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