Digitizing Oscilloscopes

These Products are sold through distributors in the US only.

TDS 460A • TDS 420A • TDS 410A

Features

TDS 410A/TDS 420A/TDS 460A

- 200 and 400 MHz Bandwidths
- 100 MS/s Sampling Rate on 4 Channels
- 30 K Records Standard, 120 K Optional
- 3.5 inch DOS format floppy drive
- 1.5% Accuracy 1 – 10 V/div
- Proprietary Hi-Res Mode for up to 12-Bits of Single Shot Vertical Resolution
- Extended Waveform Math/FFT (Option)
- 10 ns Peak Detect Mode for Glitch Capture
- 25 Automatic Measurements
- Pass/Fail (Template) Waveform Testing
- Roll and Triggered Roll Modes
- RS-232 and Centronics Type Interfaces
- Tek Secure

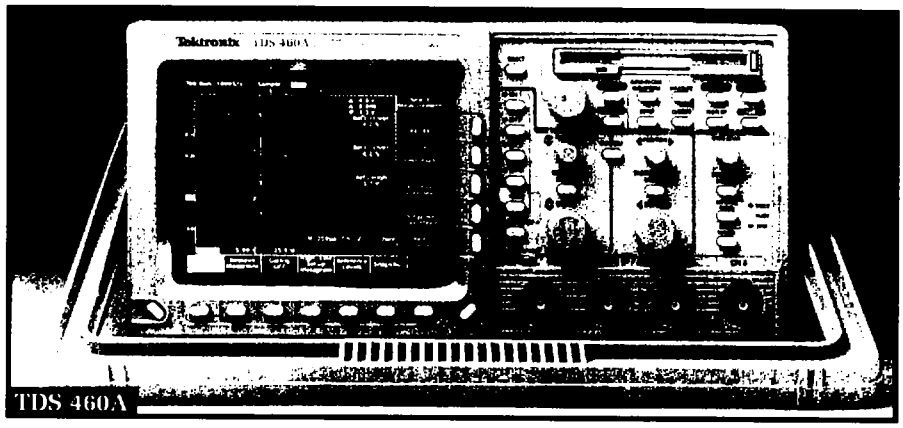
DIFFERENTIAL MEASUREMENTS

- ADA400A Analog Differential Amplifier (10 µV/div sensitivity)
- P5200/P5205 High Voltage Differential Probes (up to 1300 V) for Floating Measurements

(Please see pages 493 and 494 for details on ADA400A, P5200 and P5205)

Applications

- Biophysical Research
- Biomedical Research
- Electrophysical and Electromechanical System Design
- Audio System Measurement and Analysis
- Manufacturing Test and Quality Control
- Power Supply and Power-related Design
- Product Service and Maintenance



The TDS 460A 400 MHz, four channel, Personal Lab Scope.

TDS 400A Personal Lab Oscilloscopes

For professionals who demand high precision and fidelity from their measurements, the TDS 400A Personal Lab Scopes combine excellent performance and a broad feature set, all at affordable prices. A choice of 2 and 4 channel models ranging from 200 MHz to 400 MHz with 100 MS/s on all channels makes the TDS 400A Series a worthy fit for a variety of demanding applications.

Characteristics

SIGNAL ACQUISITION SYSTEM

Bandwidth – 200 MHz (TDS 410A, TDS 420A), 350 MHz (TDS 460A).

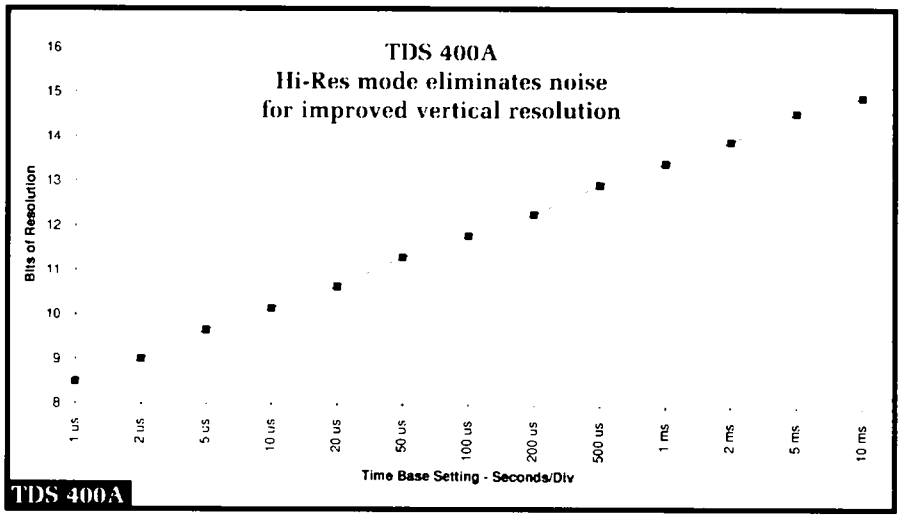
Channels – 4 (2 on TDS 410A).

Digitizers – 4 (2 on TDS 410A).

Sample Rate – 100 MS/s on all channels.

Sensitivity – 1 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 Divisions.



Theoretically achieveable resolution with TDS 400A Hi-Res Mode.

GPIB IEEE-488 *Product(s) complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.*

See Tektronix on the World Wide Web. http://www.tek.com

ISO 9001 *Tektronix Measurement products are manufactured in ISO registered facilities.*

Digitizing Oscilloscopes

TDS 460A • TDS 420A • TDS 410A

Offset Range – ±1 V from 1 to 99.5 ; ±10 V from 100 mV to 995 ; ±100 V from 1 to 10 V/div.

DC Gain Accuracy – ±1.5%.

Vertical Resolution – 8-Bits (256 levels over 10.24 vertical divisions).

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full.

Input Coupling – AC, DC or GND.

Input Impedance Selections – 1 MΩ in parallel with 15 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage – ±400 V (DC + peak AC). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz for any two channels.

AC Coupled Low Frequency Limit – ≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.

ACQUISITION MODES

Peak Detect – High frequency and random glitch capture. Captures glitches of 10 ns using acquisition hardware at all real-time sampling rates.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions, selectable from 2 to 2000, infinite.

Average – Waveform averages selectable from 2 to 10,000.

Hi-Res – Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 12-Bits at 10 ms/div and slower. Enhanced vertical resolution (>12-Bits) for noise reduction, on low frequency signals. Make precise low-level signal measurements (up to 5 µV) with differential amplifier (ADA400A).

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 1 ns to 20 s/div.

Time Base Accuracy – 0.005% over any interval >1 ms.

Record Length (real time and equivalent time) – Sample points per channel: 500 to 15,000. Opt. 1M offers 60,000 points.

Pre-Trigger Position – Selectable from 0 to 100% of record.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single Sequence.

Delayed Trigger – Delayed by time or events.

Time Delay Range – 0 ns to 20 s.

Events Delay Range – 2 to 10,000,000 events.

External Rear Input – >1.5 kΩ; Max input voltage is ±6 V (DC + AC peak).

Video Trigger Types – NTSC, PAL, SECAM, and Custom; TV Field, field 2 or both, Any line within a field. Line Rates –10 kHz to 64 kHz, interlaced, non-interlaced, composite.

Video Trigger Sensitivity – 0.6 divisions of composite SYNC will achieve a stable display.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Update Rate – 200 ea. 500 point waveforms per sec with infinite persistence mode selected.

Graticules – Full, grid, cross hair, frame.

Format – YT and XY.

VGA Out – Drives VGA display monitors.

ZOOM

The zoom feature allows waveforms to be expanded, compressed and positioned in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with Hi-Res or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

MEASUREMENT SYSTEM

Automatic waveform measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty cycle	– Duty cycle
+ Overshoot	– Overshoot
Propagation delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	

Continuous update of up to four measurements on any combination of waveforms.

Thresholds – Settable in percentage or voltage.

Gated – Any region of the record may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

Cursor Measurements – Absolute, Delta, Volts, Time, Frequency.

Cursor Types – Horizontal bars (volts); Vertical bars (time), paired; operated independently or in tracking mode.

WAVEFORM PROCESSING

Waveform Functions – Interpolate-selectable sin(x)/x or linear, Average, Envelope.

Advanced Waveform Functions – FT, Integration, Differentiation (optional).

Arithmetic Operators – Add, Subtract, Multiply, Invert.

Autosetup – Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing – Compares incoming waveform to a reference waveform's upper and lower limits.

COMPUTER INTERFACE

GPIB (IEEE 488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARDCOPY/DESKTOP PUBLISHING

Printer – HP ThinkJet, Epson, PostScript, Interleaf, DeskJet, LaserJet, TIFF, PCX, BMP (Microsoft Windows).

Plotter – HPGL.

Interface – GPIB standard.

Optional Hardcopy Interface – Centronics Type and RS-232.

Optional Printer Pack – 4 in. thermal printer and storage pouch.

STORAGE

Waveforms – 30,000 waveform points of non-volatile storage, 120,000 points optional.

Floppy Drive – 3.5 in. 1.44 MB or 720 KB DOS compatible (store waveforms, screen data, and setups)**

Setups – 10 front-panel setups.

CRT

Type – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P31 green phosphor.

Resolution – 640 horizontal by 480 vertical displayed pixels.

** *Waveforms can be stored to file in MathCAD and Spreadsheet (Excel, Lotus 1-2-3) formats for analysis.*

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POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 48 to 63 Hz.

Power Consumption – 240 W max.

*** Waveforms can be stored to file, in MathCAD and spreadsheet (Excel, Lotus 1-2-3) format for analysis.*

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0°C to +50°C. Nonoperating: –40°C to +75°C.

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41°C to +50°C.

Altitude – Operating: 15,000 ft., nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1, RE-02, Part 7; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart J, Class A.

Safety – Listed UL 1244, certified to CAN/CSA – C22.2 No. 231-M89; Tektronix self-certification to comply with IEC 348 recommendations.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	164	6.4
w/acc. pouch	177	7.5
Width	362	14.25
Depth		
w/front cover installed	491	19.25
w/handle extended	576	22.2
Weight	**kg**	**lb.**
Net	9.1	22.5
Shipping	12.5	32

ORDERING INFORMATION

TDS 410A
Two-Channel, 200 MHz Digitizing Oscilloscope.

TDS 420A
Four-Channel, 200 MHz Digitizing Oscilloscope.

TDS 460A
Four-Channel, 400 MHz Digitizing Oscilloscope.
All include: Probe (2 P6138A 10X Passive Probes); Reference Manual (070-8035-03); User Manual (070-8034-03); Programmer's Manual (070-8709-07); Performance Verification Document (070-8721-02); U.S. Power Cord (161-0230-01).

INSTRUMENT OPTIONS

Opt. 1K – K212 Cart.

Opt. 1M – 120,000 Point Record Length.

Opt. 1R – Rack Mount.

Opt. 02 – Front Cover and Accessories Pouch.

Opt. 1F – 3.5 in. DOS Floppy Drive.

Opt. 2A – Video Trigger and 120,000 Point Record Length.

Opt. 2F – Extended Waveform Math; FFT, Integration, Differentiation.

Opt. 3P – Printer Pack with Thermal Printer and RS-232C/Centronics Interfaces.

Opt. 05 – Video Trigger with Video Clamp Pod.

Opt. 13 – RS-232C and Centronics Hardcopy Interfaces.

Opt. 22 – Two Additional P6138A Probes.

Opt. 28 – ADA400A Analog Differential Amplifier.

Opt. 95 – NIST, MIL-STD-45662A and ISO 9000 Calibration Data Report.

Opt. 96 – Calibration Certificate.

Opt. J2 – 2 year Post Warranty Repair.

Opt. J5 – 5 year Calibration Services.

PROBES

Differential Probes –
100 MHz, –50 dB CMRR, 50X/100X. Order P5205.

High Voltage Probes –
2.5 kV, 25 MHz, 2.75 pF/10M, 100X. Order P5100.
20 kV, 75 MHz, 3pF/100M, 1000X, 3.1 m. Order P6015A.

High Voltage Differential Probe –
Up to 1300 V, 25 MHz. Order P5200.
Up to 1300 V, 100 MHz. Order P5205.

Passive Probe 1x – Order P6101B

Passive Probe – Order P6138A.

FET Probe – Order P6205.

SMT Probe – Order P6562A.

TTL Logic Probe – Order P6408

Optical Converters –
500nm to 950nm. Order P6711
1100 nm to 1700nm. Order P6713.

DC/AC Current Probe System – Order AM 503S.

RECOMMENDED ACCESSORIES

Analog Differential Amplifier –
10 µV sensitivity. Order ADA400A.

Current Measurement Capability –
Order TDS 400A and AM 503S.

Plotter – GPIB and Centronics Standard. Order HC100.

Scope Cart – Order K212.

Rackmount Kit – Order 016-1166-00.

Soft-sided Carrying Case – Order 016-1158-00.

Transit Case – Order 016-1157-00.

SOFTWARE SUPPORT

WaveStar™ – Data Management Software. Order WSTR31.

LabWindows® – Order S3FG910.

CABLES

GPIB – 1 meter. Order 012-0991-01.
2 meters. Order 012-0991-00.

Service Manual.

INTERNATIONAL POWER OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.

Opt. A2 – UK 240 V, 50 Hz.

Opt. A3 – Australian 240 V, 50 Hz.

Opt. A4 – North American 240 V, 60 Hz.

Opt. A5 – Switzerland 220 V, 50 Hz.

International power options required on instruments and selected accessories for operation outside U.S. For operation outside U.S., specify A1-A5 power options.

WARRANTY INFORMATION

Three years warranty, covering all labor and parts, including CRT, and excluding probes.

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