

UDS-2128 * UDS-2113 Series PC–Communication Analyzers



Features and Benefit

- Two electrical channels with 20 GHz (UDS-2128) and 12 GHz (UDS-2123) Electrical Bandwidth
- Integrated/calibrated optical channel with 8 GHz (UDS-2128) and 3 GHz (UDS-2123) unfiltered optical Bandwidth
- Up to three switchable Bessel-Thomson filters for compliance testing with standard data rates from 155 Mbps to 3.125 Gbps
- 750 nm to 1650 nm Wavelength range
- Single- or multi-mode fibers
- 14-Bit Vertical Resolution
- Dual Time Base 10 ps/div to 2 ms/div
- 100 fs Sampling Interval
- DC to 1 GHz Full-function Direct Trigger
- 12 GHz Prescaled Trigger
- 10 Mbps to 2.7 Gbps Continuous Rate Clock and Data Recovery
- 40 ps TDR/TDT
- Normal, Infinite, Variable Persistence and Color Graded Display Modes
- High Resolution Cursor and Automatic Waveform Measurements with Statistics
- Waveform Processing including FFT
- Statistical analysis with Time and Voltage Histograms
- Automated Eye-Diagram Measurements for NRZ and RZ signal types
- Automated Mask test with Predefine Standard, and Custom Masks
- Familiar Windows Intuitive Graphical User Interface
- Built-in information system
- USB 2.0 (FS) or IEEE1284 (ECP mode) UDS-2128 to PC Interface
- Win95/98/ME/NT4/2000/XP Compatibility

Applications

- High-speed Optical Communications Testing: Extinction Ratio, Optical Power, Jitter, Q-factor
- Eye-pattern and Pulse Shape Analysis

- Electronic Mask Drawing and Display
- Optical Signal Analysis
- Conformance Testing
- NRZ and RZ Pulse Characterization
- Electrical Standards Compliance Testing
- Semiconductor Characterization
- Telecom Service and Manufacturing, Wireless Carrier Analysis
- Timing Analysis
- Digital System Design and Characterization
- Automatic Pass/Fail Limit Testing
- Time Domain Reflectometry and Time Domain Transmission, Impedance and Cross-talk Characterization of Circuit Boards, IC Packages and Cables
- High Speed Serial Bus Pulse Response

Product Description

The UDS-2128 and UDS-2123, the world Faster PC-Communication Analyzers are a powerful instruments designed specifically to give you the highest accuracy, measurement speed, and ease-of-use for characterizing both optical and electrical telecommunications and data communications waveforms.

Both instruments are PC-Communication Analyzers, or analyzers for Personal Computer. They require just USB 2.0 (FS) or IEEE1284 (ECP mode) connector in your PC to give you the computing power of a stand-alone instrument within your PC.

Test engineers, production engineers, and systems integrators find that this type of analyzer enables them to quickly create high-throughput test systems (e.g. ATE systems) that are capable of measuring a wide variety of waveforms. For research and design or production test, the analyzers provide right and fast answers on complete characterization of waveforms with automated measurement, and mask testing. The analyzers use sequential equivalent-time sampling technology to achieve electrical bandwidth up to 20 GHz (12 GHz), while unfiltered optical bandwidth of up to 8 GHz (3 GHz). Data acquisition and measurement analysis are performed in parallel, enabling the instrument to achieve outstanding measurement throughput. The instruments provide fast acquisition, repeatable waveform performance analysis with automated direct or statistical measurements, Markers

and Histograms, Math or FFT analysis, high-resolution TDR/TDT, Color-Graded Display, Parametric Limit Testing, and Mask Template Testing. These measurements can be used independently or in concert.

Digital Communications Analysis

The UDS-2128 is designed for communications applications. They provide solutions for design and evaluation of datacomm/telecomm components, transceiver subassemblies, and transmission systems. The UDS-2128 generates measurement results, not just raw data, with time and voltage histograms, mask testing, and statistical pulse parameter measurements. It provides a communications-tailored measurement set that includes jitter, noise, duty cycle, overshoot, undershoot, extinction ratio and amplitude measurements.

The UDS-2128 provides the ideal measurement system for testing low powered SDH/SONET, Fibre Channel and Gigabit Ethernet signals as well as other high-speed telecommunications signals. The calibrated integrated optical receiver, with 8-GHz unfiltered optical bandwidth, allows for easy, precise measurements of optical signals. An average power meter is built-in.

For compliance testing up to three different hardware Bessel-Thomson filters can automatically be switched in to create a calibrated reference receiver. The switchable filter minimizes setup time while maximizing measurement repeatability. Filters have the following data rates – standard: 155.52 Mbps (OC-3/STM-1), 1.25 Gbps (GBE) and 2.488 Gbps (OC-48/STM-16); optional: 622.08 Mbps (OC-12/STM-4), 1063 Mbps (Fc1603), 2.125 Gbps (Fc2125), 2.500 Gbps (Infiniband2.5G), 3.125 Gbps (XAUI).

The diagram below is a block diagram of an optical receiver for the UDS-2128 and UDS2123.

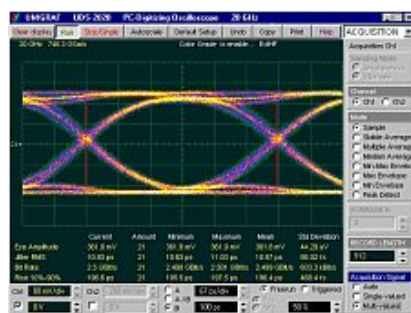
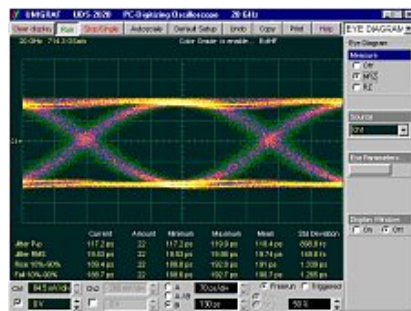


The Block Diagram of Optical Reference Receiver

With the addition of 50 Mbps to 2.7 Gbps internal or external continuous clock recovery trigger, or with the UDX-R01 (622 Mbps, OC12/STM4) and UDX-R02 (2.488 Gbps OC48/STM16) Clock Recovery Heads, reliable parametric testing becomes easy even when you do not have access to a clock signal trigger.



UDS-2128 and UDS-2123 Clock/Data Recovery Trigger System



Same 2.5 Gbps (OC-48/STM-16) signal triggered on a data signal with 20-ps RMS jitter (top), and the more accurate recovered clock signal with less than 11-ps RMS jitter (bottom)

Eye Diagram Measurements

Accurate eye-diagram analysis for NRZ and RZ signal types is essential for characterizing the quality of electrical and optical transmitters to beyond 10 Gb/s. The UDS-2128 was designed specifically for the complex task of analyzing digital communications waveforms. It quickly measures 38 fundamental parameters used to characterize NRZ signals, also 40 fundamental parameters used to characterize RZ signals. Up to four parameters can be measured simultaneously. Standard measurements include

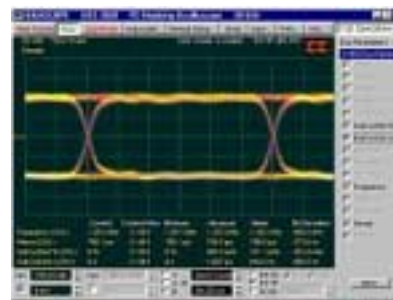
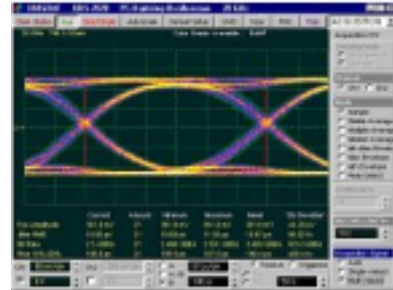
such parameters as Extinction Ratio, Mean rise and fall time, Jitter: p-p and RMS, Crossing %, Eye-width, Eye-height, Overshoot, Duty-cycle-distortion and many others. Very important extinction-ratio measurements are automated with a histogram-based algorithm.

SONET/SDH: STM-0, 1, 3, 4, 16, 64/OC-1, 3, 9, 12, 24, 48; and 192.
 Fibre Channel: 133, 266, 531, 1063, 2125, 4250, 10518.
 GB Ethernet: 1250 Mbps, 2.500 Gbps, 9.953 Gbps, 10.3125 Gbps, 12.5 Gbps.

Waveform analysis

In addition to extensive communications waveform analysis, the UDS-2128 and UDS-2123 also perform as a conventional high-speed sampling oscilloscopes, performing accurate Automatic Measurements. They make the measurement process fast and easy, while reducing human errors, particularly essential for repetitive test. All measurements conform to the IEEE standards. Measurements cover Voltage, Timing and FFT.

19 Amplitude Measurements are made on vertical parameters. They typically mean voltage. 15 Timing Measurements are made on horizontal parameters. They typically mean seconds or hertz. 5 FFT Measurements are made on both vertical and horizontal parameters. They typically mean volts and hertz. Such parameters as Maximum, Amplitude, RMS, Overshoot, Period, Frequency, Width, Rise Time, FFT Magnitude, FFT Frequency and many others can be provided.



Two examples of 9.5-Gbit (top) and 2.5 Gbps (bottom) eye diagram measurements

Compliance mask test

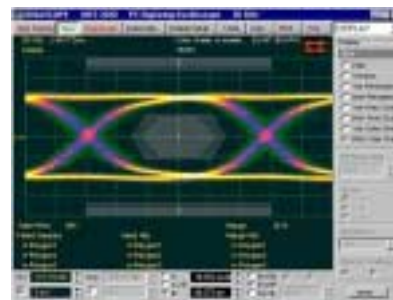
The UDS-2128 and UDS-2123 offer a full range of industry standard masks for automated compliance testing. The waveform instantly can be scaled and aligned to the mask. Exceptional measurement speed results in rapid compliance testing. This results in a significantly lower cost per test and gives you a big advantage in overall cost of ownership. Test conditions can be set according to the number of waveforms, number of samples, number of failed waveforms, or number of failed samples. For guard-band testing, margin masks are easily created.

Limit testing

Signals can be tested by up to four automatic parametric measurements and compared to user-defined test boundaries. Failure tolerances can be selected independently for each of the parametric tests.

Alternatively you can built a limit template from acquired waveforms or download a template from disk. Using a reference waveform method (Automask), masks are constructed by adding a DELTA X and DELTA Y tolerance around a reference waveform. Then the analyzers offer fully automatic pass-fail limit testing. This method is simple to use, though not as flexible as the polygon method.

Limit test can be set to run continuously for a user-selected number of waveforms, or a defined number of failures.

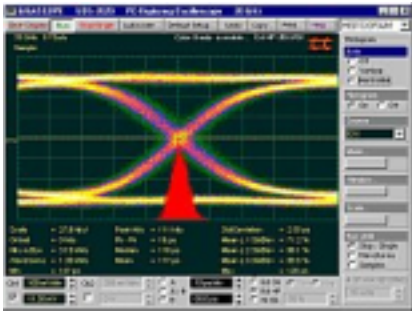
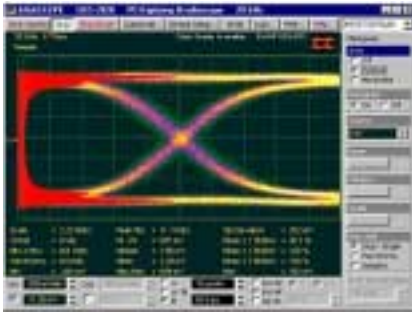


Mask Test and 20-% Margin Test performed for a standard 9.95 Gbps STM64/OC192 eye-diagram

Standard masks available:

Histograms

Time and voltage/power histograms may be taken with a user-specified number of samples or waveforms. Time or amplitude histograms are taken within a user-specified vertical and horizontal window. Automatic-histogram measurements include 12 parameters such as Pk - Pk, Median, Mean, Standard Deviation, Mean ± 1 std dev.



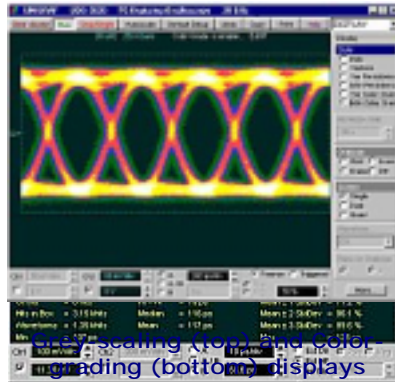
The pictures demonstrates of how quickly the UDS-2128 measures all parameters of vertical histogram (top) and horizontal histogram (bottom) for 12-Gbit Eye Diagram

Grey-scaling and Color-grading display

When you select Grey Scaling mode, is assigned a single color. As a persistence data map develops, different intensities of that color are assigned to the range between a minimum and a maximum population.

With Color Grading display style the accumulated points are color graded (shaded with different colors) to indicate the density of the points, and a color-graded database is built. You can use the color-graded database with histograms, mask testing, statistical measurements, and eye diagrams. You can also use color grading to provide more visual information about the waveforms.

Automatic-parametric measurements may be made on both displays allowing evaluation of multi-valued (i.e., eye-diagram) waveforms.



Waveform math functions

The analyzers support up to four simultaneous mathematical combinations and functional transformation of waveforms that is acquires. You can select any of the math functions as a math operator to act on the operand or operands. A waveform math operator is a math function that requires either one or two sources.

A variety of functions can also be performed on signals: Add, Subtract, Multiply, Divide, Invert, Absolute, Exponent (e), Exponent (10), Logarithm (e), Logarithm (10), Differentiate, Integrate, Inverse FFT, Linear Interpolation, Smoothing, Trend and Sin(x)/x Interpolation.

FFT

Up to two fast Fourier transforms can be run simultaneously. To compensate some of the limitations of FFT analysis you can use windowing. The window type defines the bandwidth and shape of the equivalent filter associated with the FFT processing. The analyzers support six types of windows: Rectangular FFT window, which does not taper the time domain data; five tapering FFT windows of different shapes -Hamming, Hanning, Flattop, Blackman-Harris and Kaiser-Bessel windows. Automatic measurements can be made on frequency, delta frequency, magnitude, delta magnitude and THD.

Specifications and Characteristics

Channel Configuration

Number of Channels – O/E Converter +Two Electrical Channels or One Optical Channel +One Electrical Channel.

Optical Channel

Unfiltered Optical Bandwidth - UDS-2128: 8 GHz; UDS-2123: 3 GHz
Fibre - Single-mode (SM) or Multi-mode (MM).
Wavelength range - 750 nm to 1650 nm.

Calibrated wavelengths - 850nm (MM), 1310nm (MM/SM), 1550nm (SM).

Optical sensitivity - (smallest average optical power required for mask test) - 13 dBm.

Transition time (10% to 90% calculated from $T_r = 0.48 / \text{optical BW}$) – UDS-2128: 60 ps; UDS-2113: 160 ps.

RMS noise (maximum) - 4.5 μW (1310 nm), 6 μW (850 nm).
Scale factor - 1 $\mu\text{W}/\text{div}$ to 400 $\mu\text{W}/\text{div}$.

Maximum input peak power - +7dBm (1310nm).

Fiber input connector - FC/PC. Input Return Loss – SM: -24dB (typ), MM: -16dB (typ), -14dB (max).

Filter Data Rates –

Standard: 155.52Mbps (OC-3/STM-1), 1.25Gbps (GBE) and 2.488Gbps (OC-48/STM-16).

Optional: 622.08Mbps (OC-12/STM-4), 1063Mbps (Fc1603), 2.125Gbps (Fc2125), 2.500Gbps (Infiniband2.5G), 3.125Gbps (XAUI)

Electrical Channels

Number of Channels – 2 (Simultaneous acquisition).

Bandwidth –

UDS-2128: 20 or 12 GHz, UDS-2113: 12 GHz.

Rise Time (10% to 90%, calculated from $T_r = 0.35 / \text{BW}$) –

UDS-2128: <17.2 ps or <29.2 ps
UDS-2113: <29.2 ps.

RMS Noise (maximum) –

UDS-2128: 2 mV @ 20 GHz, 1.5 mV @ 12 GHz,
UDS-2012: 1 mV @ 12 GHz.

TDR/TDT Channels -

UDS-2128: 40-ps Single-ended TDR/TDT with UDX-G01 Pulse Head,
UDS-2113: 45-ps Single-ended TDR/TDT with UDX-G01 Pulse Head.

Scale Factors (Sensitivity) – 1 mV/div to 255 mV/div (Full scale is 8 divisions). Adjustable from 1 mV/div to 255 mV/div in a 1-2-5-10 sequence. Also adjustable in fine increments 0.5 mV to 2 mV.

DC Difference Voltage Accuracy - $\pm 1.6\%$ of full vertical scale ± 2 mV.

DC Offset Range – Adjustable from -1 V to 1 V in a 25 mV increments (coarse). Also adjustable in fine increment 1 mV.

ADC - 14-Bits.

Vertical Resolution - 125 $\mu\text{V}/\text{LSB}$ without averaging. Up to 16 bit with averaging.

Maximum operating input voltage - 1.0 V p-p at ± 1 V range.

Maximum Safe Input Voltage – 16 dBm, or ± 2 V (dc + peak ac).

Nominal Input Impedance – (50 ± 1) Ohm.

Input Connectors – SMA (f). Deskew (The difference in delay between channels) - Can be nulled

out with 1-ps resolution to compensate for differences in input cables or probe length. Up to 100 ns of skew can be nulled out.
Attenuation - Attenuation factors may be entered to scale the oscilloscope for external attenuators connected to the channel inputs.
 Range: 0.00001:1 to 1,000,000:1.
 Units: Ratio or dB. Scale: Volt, Watt, Ampere, or Unknown.
Channel-to-channel isolation - > 40 dB.

Time Base (Horizontal)

Time Bases - Main, Intensified, two Delayed, Dual Delayed.

Scale Factors -

Main Time Base: 10 ps/div to 2 ms/div (Full scale is 10 divisions).

Delayed Time Bases: 10 ps/div to current Main Time Base setting. Adjustable in a 1-2-5-10 sequence. Also adjustable in fine increment 1 ps, or 0.1% and better.

Delta Time Interval Accuracy - ± 0.4% of reading ± 15 ps ± 100 ppm of delay setting (maximum); ± 0.4% of reading ± 10 ps ± 100 ppm of delay setting (typical).

Note: Measured at a temperature within ± 3°C of horizontal calibration temperature.

Typical Timing Accuracy - The time base uses a series of 2-ns blocks. Time base linearity and small discontinuities across these blocks contribute to the 10-ps accuracy specification.

Variable Delay (Time offset relative to trigger) - Up to 1000 screen diameters of Delayed Time Base or 19.98 ms, whichever is smaller.

Minimum Delay (Minimum time offset relative to trigger) - < 40 ns.

Display Units - Time or Bit Period.

Time Interval Resolution - Screen diameter / (record length) or 100 fs, whichever is larger.

Trigger

Trigger Sources - External (Direct Trigger), External HF with different trigger heads, Internal Clock trigger (internally connected to direct trigger).

Trigger Holdoff - Adjustable from 10 us to 30.72 ms in a 1-2-5-10 sequence, or in 2 ns increments.

Internal Clock Repetition Rate - 10 us to 2 ms in a 1-2-5-10 sequence, or in 125 ns increments.

Direct Trigger

Trigger Modes - Triggered: causes the scope to trigger synchronously to the trigger input signal. Freerun: causes the scope to generate its own triggers.

Slope - Positive: triggers on positive-slewing edge. Negative: triggers on negative-slewing edge.

Trigger Bandwidth and Sensitivity - 100 mV p-p DC to 100 MHz. Increasing linearly from 100 mV p-p at 100 MHz to 400 mV p-p at 1 GHz.

Pulse Width: 500 ps @ 400 mV p-p.
RMS Jitter-

2.5 ps + 50 ppm of delay setting (maximum);

2.0 ps + 30 ppm of delay setting (typical).

Note: Measured at 1 GHz with the triggering level adjusted for optimum trigger.

Trigger Level Range - -1 V to 1 V.

Trigger Level Resolution - 1 mV.

Trigger Hysteresis - Normal: the trigger hysteresis is set so the instrument meets the trigger sensitivity specification. High Sensitivity: hysteresis is turned off to allow a best sensitivity to high-frequency signals. This mode should not be used for noisy lower frequency signals that may miss-trigger without hysteresis.

Maximum Safe Trigger Input Voltage - ± 2 V (dc+peak ac) or 16 dBm.

Nominal Input Impedance - (50 ± 1) Ohm.

Trigger Coupling - DC coupled.

Trigger Input Connector - SMA (f).

External UHF Trigger

Several trigger heads enhance trigger possibilities of the UDS-2000 sampling oscilloscopes.

UDX-T01 - Countdown trigger up to 10 GHz.

UDX-PO1 - Prescaled trigger up to 12 GHz.

UDX-PO2 - Prescaled trigger up to 18 GHz.

UDX-PO3 - Low-Jitter Trigger less than 300 fs up to 12 GHz.

UDX-RO1 - Clock recovery trigger for fixed 622 Mbps data rate.

UDX-RO2 - Clock recovery trigger for fixed 2.488 Gbps data rate.

UDX-RO3 - Clock recovery trigger 10 Mbps to 2.7 Gbps continuous data rate.

See Data Sheet for details.

Internal Clock Recovery trigger from O/E Converter (optional)

Clock Recovery Range - 50 Mbps to 2.7 Gbps continuous rate.

Maximum RMS Jitter - 1.25% of Unit Interval.

Coupling - O/E Converter to Clock Recovery: AC.

Clock Recovery to Trigger: AC.

Clock Recovery to Clock Out: AC.

Clock Recovery to Data Out: AC.

Recovered Trigger Clock Output Frequency -

Clock Recovery to Trigger: Input Bit Rate.

Clock Recovery to Clock Out: Input Bit Rate/4.

Recovered Trigger Clock

Amplitude - 400 mV p-p.

Recovered Data Amplitude - 400 mV p-p.

Output Connectors - SMA (f)

Acquisition

Number of Acquisition Channels - 2 (Simultaneous acquisition).

ADC Resolution - 14 -Bits.

Digitizing Rate - DC to 100 kHz.

The signal is sampled and digitized at a rate dictated by the trigger repetition rate and the time base range. If data acquisition is not trigger rate limited, the maximum sample rate is 100 kHz.

Acquisition Modes - Sample (normal), Average, Envelope, or Peak Detect.

Average Modes - Stable, Multiple, or Median.

Number of averages - From 2 to 4096 in x2 sequence.

Envelope Modes - Min, Max or both Min-Max values acquired over one or more acquisitions.

Peak Detect Mode - High frequency and short repetitive glitch capture. Captures glitches of 20 ps using acquisition hardware at al horizontal scales.

Data Record Length - 32 to 4096 points maximum per channel in x2 sequence.

Display

Display Resolution - Full: 640 points horizontally x 480 points vertically, Data: 501 points horizontally x 257 points vertically.

Display Style - Dots; Vectors; Variable Persistence: time that each data point is retained on the display, persistence time can be varied from 100 ms to 20 s; Infinite Persistence;

Variable Gray Scaling: five color levels that are used are one color that is varied in saturation and luminosity levels (in other words, different shades of the same color),

refresh time an be varied from 1 s to 100 s; Infinite Gray Scaling; Variable Color Grading: with Color Grading selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms. Refresh time can be varied from 1 to 200 s, Infinite Color Grading.

Graticule - Full Grid, Axes with tic marks, Frame with tic marks, Off (no graticule).

Screen - Single: all waveforms are superimposed and are eight divisions high. Dual: with two graticules all waveforms can be displayed separately or are superimposed with four divisions high. Quad: with four graticules all waveforms can be

displayed separately or are superimposed with two divisions high. When you selected dual or quad screen display every waveform channels, memories, and functions can be placed on specified graticule. **Display Format** - YT, XY or both YT & XY.

Colors - You may choose a Default Color selection, or select your own Set Color. Different colors are used for display selected Item: background, channels, functions, waveform memories, FFTs, TDR/TDTs, and histograms.

Save/Recall

Management - Store and recall setups, waveforms, data base and screen images to both the hard drive and the floppy drive of the PC. Storage capacity is limited only by disk space.

File extensions for waveform files - The following file extensions for waveform and setup files are used: Waveforms - .wfm for binary format, .txt for text format, .wfm, and .txt for both formats. Data base files - .cgs. Setup files - .set.

Operating System - Microsoft Windows® 95/98/ME/NT4/2000/XP.

Waveform Save/Recall - Up to four waveforms may be stored into Waveform Memories (M1-M4), and then recalled on display.

Save/Recall to Disk - You can save or recall your acquired waveforms or data base to or from hard disk or floppy disk of PC. To save a waveform, use the traditional Windows "Save as" dialog box. From this dialog box you can create subdirectories, new waveform files, or overwrite existing waveform files. You can load file with a waveform or data base you have previously saved, into one of Waveform Memories, and then recall it on display.

Save/Recall Setups - The instrument may store into the memory and then recall complete setups.

Autoscale - Pressing the Autoscale key automatically adjusts the vertical of channels, the horizontal scale factors, and the trigger level for a display appropriate to the signals applied to the inputs. The Autoscale feature requires a repetitive signal with a frequency greater than 1 kHz, duty cycle greater than 1%, amplitudes greater than 50 mV p-p (vertical) and 200 mV p-p (trigger). Autoscale is operative only for relatively stable input signals.

Marker

Marker Type - X-Marker: vertical bars (measure time). Y-Marker: horizontal bars (measure volts). XY-

Markers: waveform markers (x and +).

Marker Measurements - Absolute, Delta, Volts, Time, Frequency, Slope (Volts/Time).

Marker Modes - Independent: both markers can be adjusted independently. Paired: both markers can be adjusted together.

Ratiometric measurements - Provide ratiometric measurements between measured and reference values. These measurements give results in such ratiometric units as %, dB, and Degrees.

Measure

Automated Measurements - Up to ten simultaneous measurements, or four statistics measurements can be supported at the same time.

Automatic Parametric - 39 automatic measurements available.

Amplitude Measurements - Maximum, Minimum, Peak-Peak, Top, Base, Amplitude, Middle, Mean, dc RMS, ac RMS, Area, Cycle Middle, Cycle Mean, Cycle dc RMS, Cycle ac RMS, Cycle Area, Pos. Overshoot, Neg. Overshoot.

Timing Measurements - Period, Frequency, Pos Width, Neg Width, Rise Time, Fall Time, Pos Duty Cycle, Neg Duty Cycle, Pos Crossing, Neg Crossing, Burst Width, Cycles, Time@Maximum, Time@Minimum.

Dual-Channel Measurements - Delay, Gain.

FFT Measurements - FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, FFT Delta Frequency.

Measurement Statistics - Display minimum, maximum, mean and standard deviation on any displayed waveform measurements.

Histicons - A miniature histograms of parameter measurements that appear in Measurement Area. These thumbnail histograms let you see at a glance the statistical distribution of each parameter.

Method of Top-Base Definition - Histogram, Min/Max, or User Defined (in absolute voltage).

Thresholds - Settable in percentage, voltage or divisions. Standard thresholds are 10-50-90 % or 20-50-80 %.

Margins - Any region of the waveform may be isolated for measurement using vertical bars.

Measurement Mode - Repetitive or Single-shot.

Limit Test

Limit Test - Signals can be tested by up to ten automatic parametric measurements and compared to user-defined test boundaries. Failure tolerances can be selected independently for each of the parametric tests. Limit test can be set to run continuously for a user-

selected number of waveforms, or for a defined number of failures. **On failure actions** - Beep, Save failed waveform to disk or Stop acquisition.

Mathematics

Waveform Math - Up to four math waveforms can be defined and displayed using math functions F1-F4.

Math Operators - Add, Subtract, Multiply, Divide, Invert, Absolute, Exponentiation (e), Exponentiation (10), Logarithm (e), Logarithm (10), Differentiate, Integrate, Inverse FFT, Linear Interpolation, Sin(x)/x Interpolation, Smoothing, Trend.

Operands - Any channel, waveform memory, math function, spectrum, or constant can be selected as a source for one of two operands.

FFT

FFT - Up to two fast Fourier transforms can be run simultaneously.

Frequency Span - Frequency Span = Sample Rate / 2 = Record Length / (2 x Time Base Range).

Frequency Resolution - Frequency Resolution = Sample Rate / Record Length.

FFT Windows - The built-in filters (Rectangular, Nicolson, Hanning, Flattop, Blackman- Harris and Kaiser-Bessel) allow optimization of frequency resolution, transients, and amplitude accuracy.

FFT Measurements - Marker measurements can be made on frequency, delta frequency, magnitude, and delta magnitude. Automated FFT Measurements include: FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, and FFT Delta Frequency.

Zoom

Zoom feature - The zoom feature allows waveforms (memories, functions, and spectrums) to be expanded and positioned in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions.

Complex Scale - You can select different Complex Scale: Magnitude, Phase, Magnitude + Phase, Real, Imaginary, and Real + Imaginary.

Vertical expanding and positioning - Zoom provides a vertical dynamic range of 10 mln. divisions or 1 mln. screens.

Horizontal expanding and positioning - Zoom provides a horizontal dynamic range of 640 divisions or 64 screens.

Histogram

Histogram Axis - Vertical, or Horizontal. Both vertical and horizontal histograms, with

periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.

Histogram Measurement Set - Scale, Offset, Hits in Box, Peak Hits, Pk-Pk, Median, Mean, Standard Deviation, Mean \pm 1 Std Dev, Mean \pm 2 Std Dev, Mean \pm 3 Std Dev.

Histogram Window - The histogram window determines which part of the database is used to plot the histogram. You can set the size of the histogram window to be any size that you want within the horizontal and vertical scaling limits of the scope.

Eye Diagram

Eye Diagram - The UDS-2000s has ability to automatically characterize NRZ and RZ eye pattern.

Measurements are based upon statistical analysis of the waveform.

NRZ Measurement Set - AC RMS, Area, Bit Rate, Bit Time, Crossing %, Crossing Level, Crossing Time, Cycle Area, Duty Cycle Distortion (%), Extinction Ratio (dB, %, ratio), Eye Amplitude, Eye High, Eye Width (%), Fall Time, Frequency, Jitter (P-p, RMS), Max, Mean, Mid, Min, Neg Overshoot, Noise P-p (One, Zero), Noise RMS, One Level, Peak-Peak, Pos. Overshoot, Period, Rise Time, RMS, Signal-to-Noise, Zero Level.

RZ Measurement Set - AC RMS, Area, Bit Rate, Bit Time, Contrast Ratio (dB, %, ratio), Cycle Area, Eye Amplitude, Eye High, Eye Opening Factor, Eye Width (%), Fall Time, Jitter (P-p, RMS), Max, Mean, Mid, Min, RMS, Rise, Fall, Neg Crossing, Noise P-p (One, Zero), Noise RMS, One Level, Peak-Peak, Pos. Crossing, Pos. Duty Cycle, Pulse Width, Rise Time, RMS, Signal-to-Noise, Zero Level.

Mask Test

Mask Test - Acquired signals are tested for fit outside areas defined by up to eight polygons. Any samples that fall within the polygon boundaries result in test failures.

Masks can be loaded from disk, or created automatically or manually.

Mask Creation - You can create the following Mask: Standard predefined Mask, Automask, Mask saved on disk, Create new mask, Edit any mask.

Standard Mask - Standard predefined optical or standard electrical masks can be created. SONET/SDH: OC1/STMO, OC3/STM1, OC9/STM3, OC12/STM4, OC18/STM6, OC48/STM16, FEC2666, OC192/STM64, FEC1066, FEC1071, FEC4266, FEC4302; Fiber Channel: FC133, FC266, FC531, FC1063, FC2125, FC4250, 10GFC; Ethernet: GB Ethernet, 2XGB Ethernet, 10GB Ethernet, 10GBE

Ethernet, 10XGB Ethernet; INFIBAND, XAUI; ITU G.703: DS1, DS2, 8 Mb, DS3, 140 Mb; ANSI T1/102: DS1, DS1C, DS2, DS3, STS1 Eye, STS1 Pulse, STS3.

Mask Margin - Available for industry standard mask testing.

Automask Creation - Masks are created automatically for single-valued voltage signals. Automask specifies both delta X and delta Y tolerances. The failure actions are identical to those of limit testing.

Data collected during test - Total number of waveforms examined, number of failed samples, number of hits within each polygon boundary.

UDX-G01 Pulse Head

The UDX-G01 Pulse Head is a fast tunnel-diode step generator designed for use with the UDS-2000 Series PC-Sampling Oscilloscopes for short-distance 40-ps TDR/TDT. See UDX-G01 Data Sheet for details.

Calibrators

Vertical Calibrator -

Modes: DC, Pseudo-meander, or Off. Adjustable Output Range: -1.0 V to +1.0 V terminated into 50 OHm. Output Voltage Accuracy: \pm 0.25 % of Output Voltage \pm 1 mV.

Horizontal Calibrator -

Waveform: Square-Wave. Polarity: Positive from ground. Adjustable Period: 80 ns to 2 ms. Period Accuracy: \pm 0.01 % of Period. Output Voltage: >700 mV terminated into 50 OHm.

DSO to PC Interface

Type - USB 2.0 (FS) or IEEE1284 (ECP mode)

Environmental Characteristics

Temperature - Operating: + 5°C to + 40°C. Non-operating: -40°C to + 50°C.

Humidity - Operating: up to 85 % relative humidity (non-condensing) at + 25°C.

Power Requirements

Voltage - 95 to 125 VAC or 190 to 250 VAC.

Frequency - 48 to 66 Hz single phase.

Power - 70 VA maximum.

Physical Characteristics

Dimensions - Width (with handle): 270 mm, Width (w/o handle): 240 mm, Height: 102 mm, Depth (with handle): 420 mm, Depth (w/o handle): 377 mm.

Weight - Net: 6.5 kg, Shipping: 12.0 kg.

Ordering Information

P/N 070794 -

UDS-2128 PC-Communication Analyzer, 20 GHz Dual Electrical Channel, 8 GHz Single Optical Channel.

Includes:

Installation CD with Online Help. USB 2.0 or Centronix cable (optional).

Power Cord (Universal Euro Power Plug 230 VAC, 50 Hz).

One year of return repair (sampling diodes replacement) and calibration service.

Option CDR:

50 Mbps to 2.7 Gbps Continuous Rate Clock Recovery Trigger

P/N 070795

UDS-2113 PC-Communication Analyzer, 12 GHz Dual Electrical Channel, 3 GHz Single Optical Channel.

Includes:

Installation CD with Online Help. USB 2.0 or Centronix cable (optional).

Power Cord (Universal Euro Power Plug 230 VAC, 50 Hz).

One year of return repair (sampling diodes replacement) and calibration service.

Options CDR:

50 Mbps to 2.7 Gbps Continuous Rate Clock Recovery Trigger.