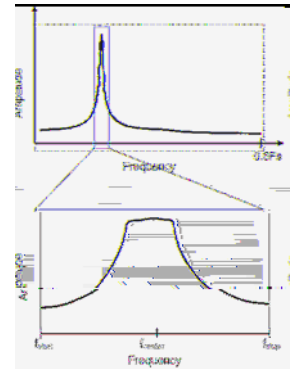


One Oscilloscope ,Two Domains

MDO-2000E series is multi-functional mixed domain oscilloscope. The series includes two feature combinations : MDO-2000EG and MDO-2000EX. MDO-2000EG models have a built-in spectrum analyzer and a dual channel 25MHz arbitrary waveform generator and MDO-2000EX models feature a built-in a spectrum analyzer, arbitrary waveform generator, a 5,000 count DMM, and a 5V/1A power supply. The first of its kind, MDO-2000EX is the only oscilloscope to equip with a DMM and a power supply in the T&M industry.

While entering the spectrum mode, MDO-2000E series will display a full screen of frequency domain. Users can input Center frequency, Span, Start frequency, and Stop frequency based upon test requirements so as to rapidly and intuitively observe required frequency range that allows users to experience the user interface of a real spectrum analyzer. While observing frequency domain display, engineers can observe waveform characteristics, which are not easily to be seen from time domain waveforms, for instance, the harmonic composition of a waveform and the frequency characteristics of a modulation signal. Compared with oscilloscope' FFT, MDO-2000E series allows engineers to effectively conduct signal measurements on frequency domain.

Conventional DSO's FFT always calculates the entire signal bandwidth up to half the sampling rate (F_s). However, the insufficient calculation capability can't conduct FFT calculation with more points. Users can't have the signal's detailed frequency information due to the insufficient frequency resolution from the calculation result. Whereas MDO-2000E series analyzes signal spectrum of interest. Compared with oscilloscope' FFT, MDO-2000E series allows engineers to effectively conduct signal measurements on frequency domain. Right illustration shown the conventional DSO's FFT (above figure) VS. MDO-2000E's Spectrum analyzer (below figure).



MDO-2000E series frequency domain also includes Spectrum Trace Type settings (Normal, Max-hold, Min-hold, and Average)(Figure 1). Users can freely select various Spectrum Traces for simultaneous display. Detection method (Sample, +Peak, -Peak, and Average)(Figure 2) can be individually set for each Trace. Additionally, users, via Cursor, can manually mark the corresponding positions to reflect Frequency and Amplitude. The Search function can also be applied to log spectrum's Peak Table. Amplitude is displayed with dB and Marker can obtain measurement data. Users can use the Search function to search and mark the amplitude and frequency of spectrum signal. Search methods include Max. peak and threshold. Measurement results can be displayed and saved.(Figure 3)

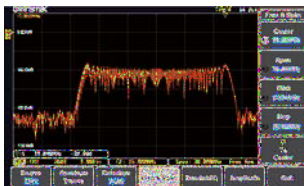


Figure 1

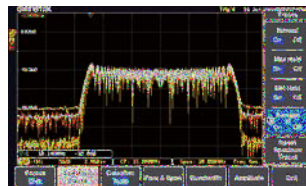


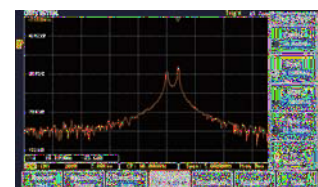
Figure 2



Figure 3

Compared with the general spectrum analyzer, the spectrum function of MDO-2000E series can test below~9kHz signals, which is applicable to the frequency domain analysis of audio frequency and vibration. MDO-2000E series can also test the frequency domain signal with DC component without damaging the instrument. With respect to frequency domain waveform display, MDO-2000E series, featuring the same capability of a real-time spectrum analyzer, is faster than the general spectrum analyzer. Why? It is because MDO-2000E series utilizes digital circuit and software to calculate FFT. The general spectrum analyzer can only process the signal of a narrow frequency bandwidth at a time by frequency sweeping. Each sweeping will take several ms to dozens of ms. Hundreds and thousands of frequency sweepings are gathered to form a spectrum. Therefore, the displayed spectrum is not obtained at the same time. MDO-2000E series obtains spectrum display at the same time by utilizing digital circuit and software to calculate FFT that is faster than the frequency sweeping method. The FFT settings of oscilloscopes are based upon horizontal scale (sample rate) setting, which is totally different from the frequency range setting of MDO-2000E series. Most instruments will have insufficient frequency resolution due to insufficient FFT points while conducting spectrum measurement by FFT. Compared with the FFT of oscilloscopes, MDO-2000E series satisfies users with signal measurement requirements under 9kHz; a better setting interface, measurement resolution and measurements speed.

Three screen displays on the right show the spectrum results of MDO-2000E's spectrum analyzer and the FFT of two different branded oscilloscopes after testing the same FSK signal. The parameters of FSK signal: 500mVpp sine wave, fmax: 10.2MHz, fmin: 10.0MHz, bit rate: 10.0kHz. The upper right screen display is the spectrum of MDO-2000E's spectrum analyzer. Users can directly input Center and Span Frequency by an intuitive and swift setting. Fmax and fmin can be clearly identified from the screen display.



The right screen display is an often seen spectrum from a general oscilloscope's FFT. The left boundary started from DC (low frequency signal) and the maximum frequency on the right is half of the sample rate (can be extended to the right or even out of the boundary). The Span setting for spectrum can only be switched by fixed 1-2-5 multiplying factors. Therefore, users can't set Span according to their requirements that is extremely inconvenient for the operation. In fact, switching multiplying factor is to conduct Zoom In/Out calculation on the original FFT spectrum and the sample rate remains the same during the calculation process. Users can easily encounter the upper and lower boundary limits that is totally different from the general spectrum analyzer in terms of operational experience. Most importantly, no matter how setting is changed the important fmax and fmin of spectrum can't be identified.

The right screen display is the FFT spectrum from a well-known oscilloscope manufacturer. It also provides Span setting (adjustable 1-2-5 multiplying factor) but the result is the same as the previous case, which only conducts Zoom In/Out calculation on FFT spectrum and FFT calculation points have not increased. This method is absolutely unhelpful on increasing frequency resolution. Therefore, its fmax and fmin can't be identified as well.

Users will see fmax and fmin appearing on the screen alternatively if the conventional swept tuned spectrum analyzer is used to conduct the measurement on the previous signal. The reason is that each frequency component is not obtained at the same time frame and it will take a longer time to process.

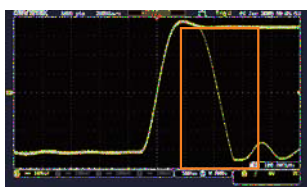
economical and multi-function mixed domain oscilloscope.

FRA of RC high-pass filter

Cursor measurement for the determination at 3dB cut-off frequency of the high-pass filter.

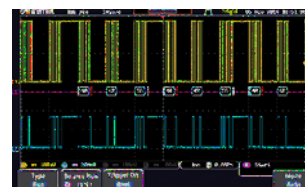
Other than the new functionalities, the hardware characteristics of MDO-2000EG and MDO-2000EX are identical to those of GDS-2000E Series. MDO-2000EG and MDO-2000EX are equipped with 8-inch display and feature bandwidth selections of 200MHz, 100MHz, and 70MHz. Models with two analog channels provide 1GSa/s real-time sampling rate per channel; models with four analog channels provide 1GSa/s maximum real-time sampling rate. The waveform update rate of 120,000 wfms/s and the minimum 1mV/div vertical range allow MDO-2000E series MDO-2000EX to measure complex feeble signals and clearly display measurement results. With respect to the memory depth, MDO-2000E series provide 10M long memory for users to completely retrieve and analyze waveforms. Users, based upon the application requirements, can select 1k, 10k, 100k, 1M or 10M memory depth. The segmented memory can be divided the maximum into 29,000 sections for users to bypass any unimportant waveforms so as to swiftly search all required waveforms. With the function, more meaningful waveforms can be saved and target waveforms can be displayed rapidly. With the waveform search function, users can rapidly search desired waveforms according to the required trigger conditions. MDO-2000E series also provides 1M FFT display that allows users to correctly and efficiently acquire measurement results of the frequency domain. MDO-2000E series, enhancing by the high waveform update rate of 120,000wfms/sec, Window Zoom and Peak Search, becomes the optimal choice of the economical and multi-function mixed domain oscilloscope.

A. 120,000wfms/s WAVEFORM UPDATE RATE AND VPO WAVEFORM DISPLAY TECHNOLOGY



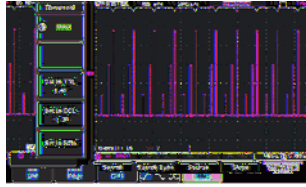
The MDO-2000E series oscilloscope allows users to easily and completely observe inrush signals and rare transient waveforms to increase waveform debugging efficiency by using features, including advanced VPO (Visual Persistence Oscilloscope) signal processing technology, waveform update rate as high as 120,000 wfms/s, and multi-layered afterglow display to enhance waveform display efficiency. Oscilloscope with VPO technology displays signals with three dimensional waveforms constructed by amplitude, time and signal strength to show each waveform point. 256 color gradients yield clear waveform changes. Comparing with the conventional digital storage oscilloscope, the MDO-2000E series provides more natural and more genuine signal display effect which is very close to the original analog signal.

B. SUPPORT I²C, SPI, UART, CAN, LIN BUS TRIGGER AND DECODING FUNCTIONS



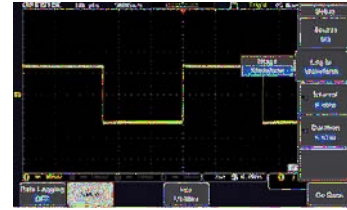
The serial bus technology has been widely applied in the present embedded application design. The IoT devices connecting sensors and the peripheral components are using serial bus such as UART, I²C, and SPI. To rapidly and correctly trigger and analyze serial bus data has posed a difficult challenge to engineers. The MDO-2000E series provides serial bus analysis function with 10M long memory depth. Users can trigger, decode, and analyze frequently used I²C, SPI and UART serial bus and CAN/LIN bus, which is often used by automotive communications.

C. WAVEFORM SEARCH FUNCTION



Users can rapidly search desired waveforms according to the trigger condition. After activating the search function, hollow inverted triangles will show the location met the trigger condition. The upper left hand corner Overall will show the total number of waveforms met the trigger condition. Users can set waveform search by the trigger condition such as Edge, pulse width, Runt, Rise/Fall, and Bus. When the trigger condition is met, hollow inverted triangles will appear. Users can save all marks to compare with the next input signal. The front panel of the MDO-2000E series controls waveform zoom-out and play/pause function to swiftly identify each desired event. The function allows users to conveniently complete waveform search and save marks for rapid comparison and analysis.

D. DATA LOG FUNCTION



Users, via the data log function, can observe waveform changes in long periods of time to ensure product reliability or measure sporadically appeared signals. The data log function, based on the requirements, can set record time and interval. Record time can be selected from 5 minutes to 1000 hours, and record interval is 5 seconds, the minimum. Waveform type for record data and CSV file format for each channel can also be selected. Data can be stored in USB drive, the MDO-2000E series or the remote computer via LAN.

E. SEGMENTED MEMORY FUNCTION



Users Can Select "Analyze Segments" to Conveniently Obtain The Analysis Results.

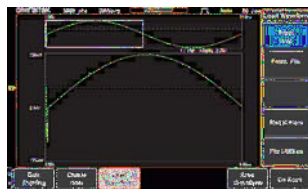
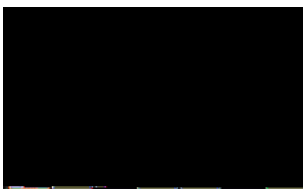
To achieve the most ideal application for memory depth, the MDO-2000E series has the built-in segmented memory function. The segmented memory function allows users to select the desired important signals for observation. Hence, insignificant signals can be neglected and serial bus decoding; pulse or inrush signals can be identified when retrieving signals. The segmented memory function of the MDO-2000E series allows users to select the number of sections. The maximum sections can be selected are 29,000. After activating the function, users can select and observe waveform for each segment by turning the Variable knob. The ultimate application of memory depth, therefore, is completely realized.

F. MASK FUNCTION



The MDO-2000E series provides the Mask function, which allows users to apply Auto Mask and user-defined Mask to determine whether the quality of the product meets the regulation. Via user-defined mask, users can set up to 8 areas and each area is up to 10 points to meet test requirements. Users can also refer to the examples from user manual to edit Mask by the PC to satisfy all test needs. By setting Save On, users can log and monitor signals, which violate test conditions.

G. 25MHz DUAL CHANNEL ARBITRARY WAVEFORM GENERATOR

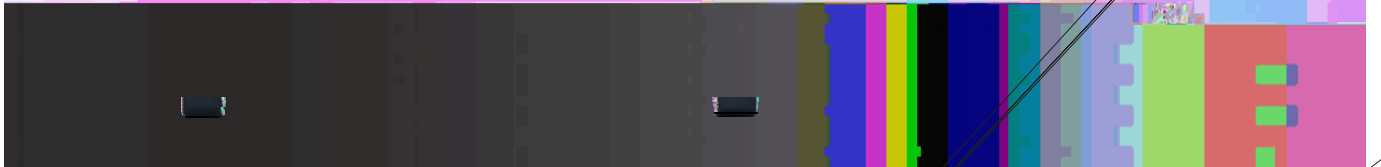
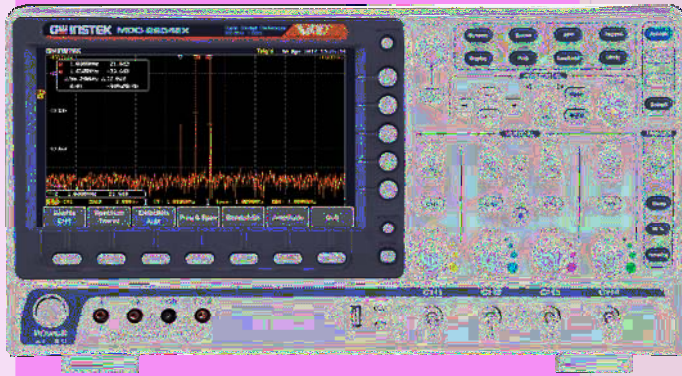


With respect to signal source, MDO-2000E features a built-in dual channel 25MHz arbitrary waveform generator with modulation capability and also provides 14 bits vertical resolution; sample rate of 200MSa/s; 13 output waveforms (Sine, Square, Pulse, Ramp, DC, Noise, Sinc, Gaussian, Lorentz, Exponential Rise, Exponential Fall, Haversine, Cardiac); and AM/FM/FSK modulation and sweep function. The friendly user interface is the ideal choice for education and applications such as circuit simulation tests. Arbitrary waveform generator provides users with 16k memory length. Users can upload basic waveforms, including Sine, Square, Pulse, Ramp, and Noise to edit arbitrary waveforms. Normal and Function Edit can edit waveforms. The edited waveforms can be saved as UAW file for data access.

H. POWER SUPPLY AND DMM FUNCTIONS (MDO-2000EX only)



MDO-2000EX has expanded its capabilities by incorporating a 5,000 count DMM and a 5V/1A power supply. DMM provides tests for ACV, DCV, ACA, DCA resistance, diode and temperature. The highly accurate DMM can strengthen DSO's capabilities of voltage and current measurement accuracy. Power supply provides 5V/1A; 0.1V incremental adjustment which can supply power for the development board and IoT (Internet of Things) module of the often used 8051/Arduino/ESP8266/MSP430 in Microprocessors and Micro controllers experiment courses. For education and digital circuit tests, it can satisfy the voltage input requirements of 5V or 3.3V. Each increment is 0.1V and over load protection is available.



SELECTION GUIDE Ethernet High Speed 671011121314151613425891

Model	MDO-2204E(G/X)	MDO-2202E(G/X)	MDO-2104E(G/X)	MDO-2102E(G/X)	MDO-2074E(G/X)	MDO-2072E(G/X)
Bandwidth	200MHz	200MHz	100MHz	100MHz	70MHz	70MHz
Channels	4	2	4	2	4	2
Record Length	10M / ch	10M / ch	10M / ch	10M / ch	10M / ch	10M / ch
Real-time Sampling Rate	Max. 1 GSa/s	Per channel 1 GSa/s	Max. 1 GSa/s	Per channel 1 GSa/s	Max. 1 GSa/s	Per channel 1 GSa/s
Built-in	MDO-2000EG : Spectrum Analyzer ; Dual Channel 25MHz Arbitrary Waveform Generator MDO-2000EX : Spectrum Analyzer ; Dual Channel 25MHz Arbitrary Waveform Generator ; Power Supply and DMM					

5. Math, Reference & Bus Keys

6. Calibration Output

7. USB Host Port

SPECIFICATIONS		
X-Y MODE	X-Axis Input Y-Axis Input Phase Shift	Channel 1 ; Channel 3* (* : four channel models only) Channel 2 ; Channel 4* (* : four channel models only) ±3° at 100kHz
CURSORS AND MEASUREMENT	Cursors Automatic Measurement	Amplitude, Time, Gating Available; Unit : Seconds(S), Hz(1/S), Phase (Degrees), Ratio(%) 38 sets : Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPRESshoot, FPREShoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges, %Flicker, Flicker Idx., FRR, FRF, FFR, FFF, LRR, LRF, LFF, Phase
CONTROL PANEL FUNCTION	Auto Counter Autoset Save Setup Save Waveform	6 digits, range from 2Hz minimum to the rated bandwidth Single-button, automatic setup of all channels for vertical, horizontal and trigger systems, with undo Autoset 20 sets 24 sets
DISPLAY SYSTEM	TFT LCD Type Display Resolution Interpolation Waveform Display Waveform Update Rate Display mode Display Graticule	8" TFT LCD WVGA color display 800 horizontal x 480 vertical pixels (WVGA) Sin(x)/x Dots, Vectors, Variable persistence(16ms-4s), Infinite persistence 120,000 waveforms per second, maximum YT; XY 8 x 10 divisions
INTERFACE	USB Port Ethernet Port (LAN) Go/NoGo BNC Kensington Style Lock	USB 2.0 High-speed host port x 1, USB 2.0 High-speed device port x 1 RJ-45 connector, 10/100Mbps with HP Auto-MDIX 5V Max/10mA TTL open collector output Rear-panel security slot connects to standard Kensington-style lock
SPECTRUM ANALYZER SPECIFICATIONS	Frequency Range Span Resolution Bandwidth Reference Level Vertical Units Vertical Position Vertical Scale Display Average Noise Level Spurious Response Frequency Domain Trace Types Detection Methods FFT Windows	DC-500MHz(Max.) (Max. bandwidth -500MHz uncalibrated) 1kHz - 500MHz(Max.) 1Hz - 500kHz(Max.) -50 dBm to +40dBm in steps of 5dBm dBV RMS; Linear RMS; dBm -12divs to +12divs 1dB/div to 20dB/div in a 1-2-5 Sequence 1V/div < -50dBm, Avg : 16 ; 100mV/div < -70dBm, Avg : 16 ; 10mV/div < -90dBm, Avg : 16 2nd harmonic distortion < 40dBc ; 3rd harmonic distortion < 45dBc Normal ; Max Hold ; Min Hold ; Average (2 - 256) Sample ; +Peak ; -Peak ; Average FFT Factor : Hanning 1.44 ; Rectangular 0.89 ; Hamming 1.30 ; Blackman 1.68
AWG SPECIFICATIONS	Channels Sample Rate Vertical Resolution Max. Frequency Waveforms Output Range Output Resolution Output Accuracy Offset Range Offset Resolution Sine Square/Pulse Ramp	2 200 Msa/s 14 bits 25 MHz Sine, Square, Pulse, Ramp, DC, Noise, Sinc, Gaston, Lorentz, Exponential Rise, Exponential Fall, Haversine, Cardiac 20 mVpp to 5 Vpp, HighZ; 10 mVpp to 2.5 Vpp, 50 Ω 1mV 2% (1 kHz) ±2.5 V, HighZ; ±1.25 V, 50 Ω 1mV Frequency Range: 100mHz-25MHz ; Flatness: ±0.5 dB (relative to 1kHz) ; Harmonic Distortion: <40 dBc ; Stray (Non-harmonic): <40 dBc ; Total Harmonic Distortion: 1% ; S/N Ratio: 40 dB Frequency Range: 100mHz-15MHz ; Rise/Fall time: <15ns ; Overshoot: <3% ; Duty cycle Square: 50% & Pulse: 0.4%-99.6% ; Min. Pulse Width: 30 ns ; Jitter: 500 ps Frequency Range: 100mHz-1MHz ; Linearity: 1% ; Symmetry: 0-100%
FREQUENCY RESPONSE ANALYSIS	Dynamic Range Input and Output Sources Frequency Range Number of Test Points Test Amplitude Test Results Manual Measurements Plot Scaling	> 80 dB (typical) Channel 1 or 2 (3 or 4 for four channel model) 20 Hz to 25 MHz 10 to 90 points per decade 20 mVpp to 5 Vpp into High-Z Fixed amplitude across entire sweep Logarithmic overlaid gain and phase plot Two pairs of tracking gain and phase markers Auto-scaled during test
DMM SPECIFICATIONS (MDO-2000EX only)	Digit Level DC Voltage Accuracy Input Impedance DC Current Accuracy AC Voltage Accuracy AC Current Accuracy Resistance Accuracy	5,000 counts ; CAT II 600Vrms, CAT III 300Vrms 50mV, 500mV, 5V, 50V, 500V, 1000V 6 ranges 50mV, 500mV, 5V, 50V, 500V, 1000V ±(0.1% reading + 5 digits) 10MΩ 50mA, 500mA, 10A 3 ranges 50mA-500mA (0.5% reading+0.05mA), 10A ±(0.5% reading + 50mA) 50mV, 500mV, 5V, 50V, 700V 5 ranges 50mV, 500mV, 5V, 50V, 700V ±(1.5% reading + 15 digits) at 50Hz-1kHz * Amplitude greater than 0.2% of the full scale reading. 50mA, 500mA, 10A 3 ranges 50mA, 500mA, ±(1.5% reading + 0.05mA) at 50Hz-1kHz ; 10A ±(3% reading + 50mA) at 50Hz-1kHz * Measure range: >10mA 500Ω, 5kΩ, 50kΩ, 500kΩ, 5MΩ, 5 ranges 500Ω, 5kΩ, 50kΩ, 500kΩ ±(0.3% reading + 3 digits); 5MΩ ±(0.5% reading + 5 digits)
POWER SUPPLY SPECIFICATIONS (MDO-2000EX only)	Output Channel Output Voltage Range Output Current (Max.) Voltage Step Output Voltage Accuracy Ripple and Noise	CH1 & CH2 1.0V-5.0V 1A 0.1V Continuously Adjustable ±3% 50mVrms
POWER SOURCE MISCELLANEOUS	Line Voltage Range Multi-Language Menu On-Line Help Time Clock Operation Environment	AC 100V ~ 240V, 48Hz ~ 63Hz, auto selection Available Available Time and date, provide the date/time for saved data Temperature: 0°C to 50°C. Relative Humidity: ≤80% at 40°C or below; ≤45%, 41°C ~ 50°C
DIMENSIONS & WEIGHT	384(W) X 208(H) X 127.3(D)mm, Approx. 3 kg	

Note : Three-year warranty, excluding probes & LCD display panel.

Specifications subject to change without notice.

MDO2000GD21BH

ORDERING INFORMATION

MDO-2204E(G/X) 200MHz, 4Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
MDO-2202E(G/X) 200MHz, 2Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
MDO-2104E(G/X) 100MHz, 4Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
MDO-2102E(G/X) 100MHz, 2Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
MDO-2074E(G/X) 70MHz, 4Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
MDO-2072E(G/X) 70MHz, 2Channel, Digital Storage Oscilloscope, Spectrum analyzer, dual channel 25MHz AWG
*(X) built in 5,000 counts DMM and power supply

ACCESSORIES

Quick start guide, User manual CD x 1, Power cord x 1, GTL-110 BNC-BNC cable x 2, GTL-105A Alligator Clip test lead (only on MDO-2000EX), GTL-207 Banana plug test lead (only on MDO-2000EX)
GTP-070B-4 : 70MHz(10:1/1:1) Switchable passive probe for MDO-2072E(X)/2074E(X) (one per channel)
GTP-100B-4 : 100MHz(10:1/1:1) Switchable passive probe for MDO-2102E(X)/2104E(X) (one per channel)
GTP-200B-4 : 200MHz(10:1/1:1) Switchable passive probe for MDO-2202E(X)/2204E(X) (one per channel)

OPTIONAL ACCESSORIES

GRA-426 Rack Adapter Panel	GCP-100 Current Probe, DC-100kHz, 100A, Current Probe
GAK-003 50Ω Impedance Adapter	GCP-1030 Current Probe, DC-100MHz, 30Arms, Current Probe
CSC-008 Soft Carrying Case	GCP-206P Current Probe - Power Supply, 2 Channel Power Supply for GCP-530/1030
GTL-246 USB Cable, USB 2.0, A-B Type, 1200mm	GCP-425P Oscilloscope Education & Training Kit Supply for GCP-530/1030
GDB-03 Oscilloscope Education & Training Kit	GCP-530 Current Probe - Power Supply, 4 Channel Power Supply for GCP-530/1030
GCP-020 Current Probe, 40Hz-40kHz, 240A, Current Probe	GDP-530 Current Probe, DC-50MHz, 30Arms, Current Probe
GTP-033A Oscilloscope Probe, 35MHz 1:1 Passive Probe	GDP-025 Differential Probe, 25M High Voltage Differential Probe
	GDP-050 Differential Probe, 50M High Voltage Differential Probe

FREE DOWNLOAD

PC Software	OpenWave software	Driver	USB driver ; LabView driver
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