MPO-2000 Series

μPy

Multi-function Programmable Oscilloscope

FEATURES

- MPO-2000P: 200 MHz; 4 CH/2 CH
  MPO-2000B: 100 MHz; 4 CH/2 CH
- Allow to Use Python Scripts to Control for Automation Purpose
- Dual Channel Spectrum Analyzer with Spectrogram
- I²C/SPI/UART/CAN/LIN Serial Bus Trigger and Decoding Function
- MPO-2000P: CAN-FD, USB 2.0 (Full Speed), FlexRay, USB-PD, I²S Digital Decoding
- MPO-2000B: CAN-FD, USB 2.0 (Full Speed) Digital Decoding
- MPO-2000P: Supports USB HID Protocol, Which Can be Used to Connect Keyboard, Mouse and Barcode Scanner Under Python Script Control
- MPO-2000P: Supports USB Host CDC-ACM Protocol, Which Controls Other GW Instek Instruments
- Equips with a Spectrum Analyzer; a Dual Channel 25 MHz AWG; DMM and Power Supply
- Power Supply: Dual Channel Output, 1 V to 20 V Continuously Adjustable (0.1 V step)

GW INSTEK

Simply Reliable

The MPO-2000 series is named after the abbreviation of Multi-function Programmable Oscilloscope. In addition to being an scilloscope, it also includes a spectrum analyzer, an arbitrary waveform generator, a digital multimeter and a DC power supply. In addition to the five-in-one multi-functional architecture, we innovatively introduced the Python script function into the MPO-2000, so that users can conduct program control of a small automated test system by setting up a single unit test or multi-unit test without a PC, hence, the name MPO.

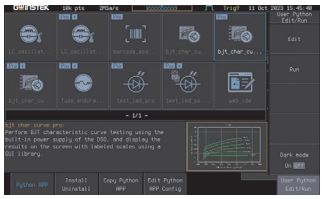
The MPO-2000 series provides Basic and Professional versions (model suffixes are represented by B and P).In terms of bandwidth, the Basic version is 100MHz and the Professional version is 200MHz and the main difference is that the Professional version provides larger program memory and more system resources to achieve the ability to process longer waveform data. The series provides USB CDC device control to meet the needs of multi-unit collaborative tests, and a Python GUI library is provided to allow users to modify the original built-in Python APP or write their own programs that present curve drawing and GUI operation menus to be packaged into Python programs developed by users. The Basic version features the provided demo programs that can be executed (including programs with USB device control and GUI) and Python programs provided by users. In addition, the Professional version provides more diverse bus decoding functions, including FlexRay, USB-PD and I^2S. Many bus decoding functions are included in the standard configuration, and users do not have to pay to have the functions, making MPO-2000 more competitive.

MPO-2000P is the only product of its class that has a built-in Python GUI library. Users can build their own test systems at a lower cost. A variety of executable Python APPs are built-in. An all-in-one instrument with affordable pricing is ideal for test and measurement automation teaching courses; small-scale automated test of production lines, component tolerance testing for quality assurance, and diversified test applications. It is hoped that the launch of MPO-2000 can solve users' product test needs for repeatability and diversity, and can improve users' demand for simple and repetitive work efficiency and single-unit program control or the requirement of ploading test results to the cloud. It is also hoped that with the launch of MPO-2000, new markets can be explored in the fiercely competitive oscilloscope market and the overall competition of oscilloscopes can be improved.

Why do we choose to import Python into the oscilloscope? In the survey of top programming languages on GitHub in 2022, Python is second only to JavaScript in web-related applications, ranking second in the most popular programming language. The number of users of Python continues to grow, and the entry threshold is low. For beginners, its syntax is relatively simple and easy to learn. Python has become an increasingly common programming language, so we chose Python to be imported into the oscilloscopes to expand its program control applications.

The Python APP currently installed on MPO-2000 includes the following categories: BJT output characteristic curve; LC oscillator circuit frequency and temperature characteristic curve; fuse endurance test; LED forward bias characteristic curve and barcode scanner measurement application.

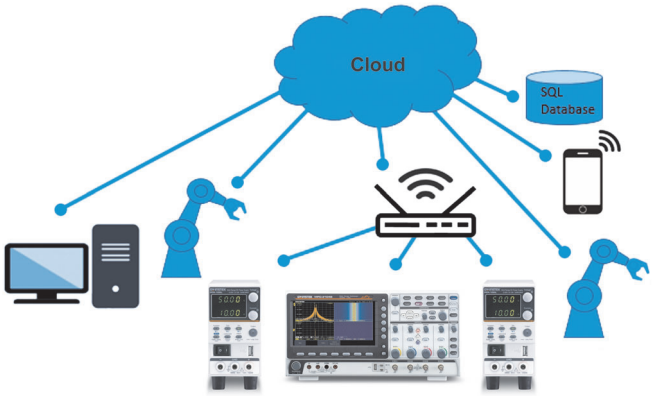
Python APP for MPO-2000



On the MPO-2000, if users want to modify or call the script of the drawing library, they must purchase the Pro version to modify the program by themselves to meet the testing of different DUTs. In addition, other manufacturers can use the built-in AWG function of the oscilloscope to achieve similar effects, but the voltage and power of this kind of AWG are too small, and their practicality is low. One single MPO-2000 unit can meet the IV test requirements of parts suitable for voltages below 20 V.

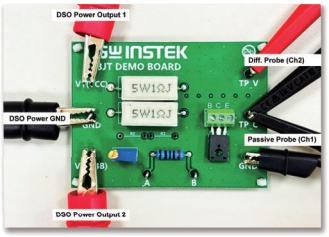
MPO-2000 is the only five-in-one instrument in the same class and provides seven innovative functions to extend diverse applications. The seven innovative functions include Python script execution, component tester I-V curve, MQTT protocol, serial bus decoding, spectrogram, Python GUI library* and USB CDC-ACM*; USB HID protocol*. (*: Professional version only).

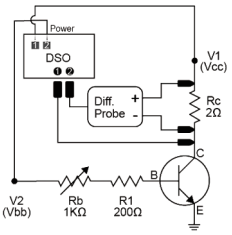
A. PYTHON SCRIPT EXECUTION

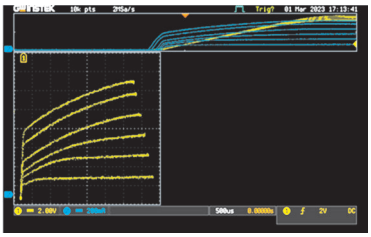


Maximum number of installable python APPs: 100 sets (including pre-installed Python APPs).Running Python source code (.py file) from internal disk or USB flash disk.

B. COMPONENT TESTER I-V CURVE

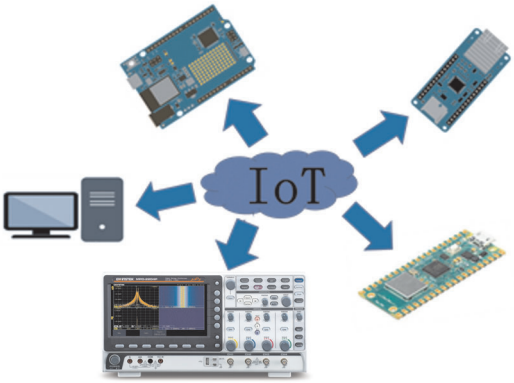






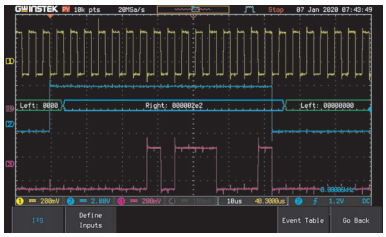
Providing I-V characteristic curve (Curve Tracer) with readout scale. The transistor characteristic curve is our first application after completing the Python software platform. We use MPO-2000 to implement the Curve Tracer function application. XY mode is used to have waveform accumulation (as shown in the figures below). Users can use the two built-in 20 V DC power outputs of MPO-2000. The Professional version can use an external DC power supply through USB CDC-ACM.

C. SUPPORT MQTT PROTOCOL



MPO-2000 also supports MQTT (Message Queuing Telemetry Transport) protocol. For publishers, measurement data can be transmitted to the cloud and for subscribers, remote control of an oscilloscope can be realized.

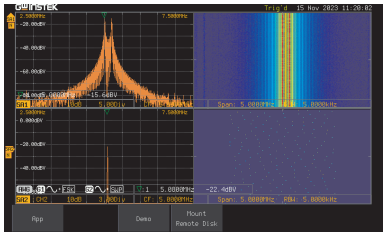
D. SERIAL BUS DECODING



Decoding Category	Application
CAN-FD	Automobile/electric vehicle control system signal transmission
USB 2.0 (Full Speed)	PC peripheral device/CPU embedded system development
FlexRay (Professional Version)	Automobile/electric vehicle control system signal transmission
I^2S (Professional Version)	Digital audio signal transmission
USB-PD (Professional Version)	USB Power Delivery for portable battery quick charging

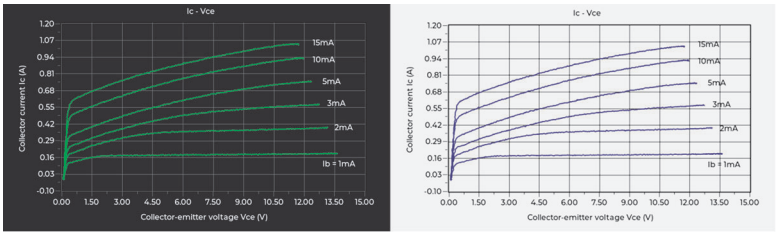
MPO-2000 provides CAN FD / USB 2.0 (FS) decoding in the Basic version and CAN FD / USB 2.0 (FS) / FlexRay / USB PD / I^2S decoding is provided in the Professional version. No additional options are required for decoding and analysis of new automotive, USB and audio protocols.

E. DUAL CHANNEL SPECTRUM ANALYZER WITH SPECTROGRAM



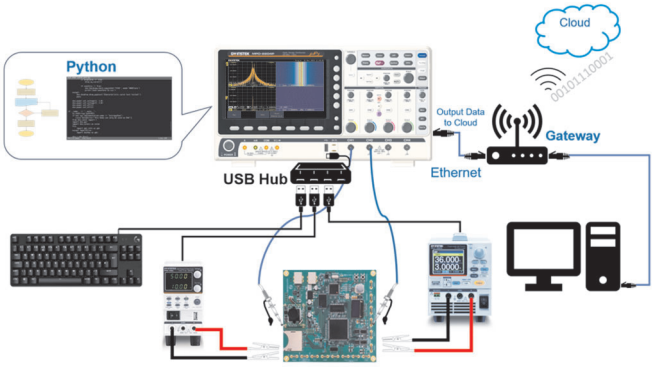
Other than signal measurement on time domain, MPO-2000 also provides the frequency domain measurement and operation, which are similar to a spectrum analyzer. The dual channel spectrum analyzer and spectrogram are equipped. Users can measure and analyze dual channel frequency domain signals at the same time. The spectrogram function, which allows users to easily observe the signal's strength distribution and the relationship of the spectrum distribution over time. For promotion selling point, dual Spectrum Analyzer and Spectrogram can test the frequency response of low frequency ~ VHF wireless communication; audio processing; vibration analysis (abnormal resonance of mechanical equipment), etc.

F. SUPPORT PYTHON GUI LIBRARY



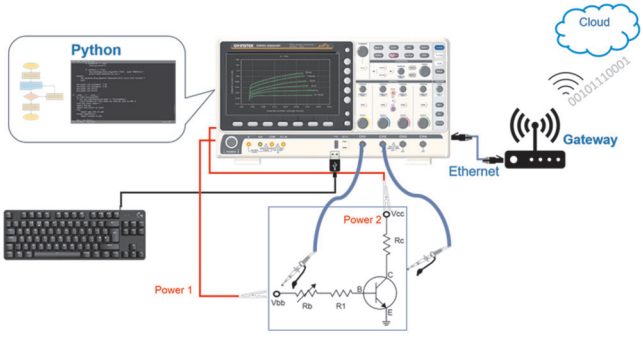
The Basic version can execute Python APP (with scale) with GUI drawing mode, and the parameters can be modified to accommodate the testing of different parts to be tested. If users wish to modify the script that is from the drawing library, users must purchase the Pro version to modify the program by themselves. The Python GUI library can be used to draw scaled charts. (As shown in the figures left, users can modify background color arbitrarily).

G. SUPPORT USB CDC-ACM TO ACHIEVE MULTI-UNIT COLLABORATIVE TEST



As Console: Control Other Instruments

The above two schematic diagrams are single-unit and multi-unit collaborative tests. No additional computer is required. Users only need to plug in a USB keyboard to program on a MPO-2000P model, and the measurement results can be presented in charts. It can also be saved as a CSV or image file, or uploaded to the cloud. It has the function of Python script execution to implement edge computing.



Standalone Auto-measurement

PANEL INTRODUCTION

CE | USB high Speed | PC Software | Labview Driver | Ethernet

1. Hardcopy Key
2. Autoset, Run/Stop, Single & Default Keys
3. Search and Zooming Controls
4. Trigger Controls
5. Math, Reference & Bus Keys
6. Python APP Key
7. Probe Calibration Output
8. USB Host Port
9. Option Key
10. Menu Off Key
11. USB Device Port
12. LAN Port
13. Go-NoGo Output
14. Calibration Output
15. Dual Channel Arbitrary Waveform Generator
16. Power Supply Output

SPECIFICATIONS

	MPO-2102B	MPO-2104B	MPO-2202P	MPO-2204P
Channels	2 ch+Ext	4 ch	2 ch+Ext	4 ch
Bandwidth	DC to 100 MHz	DC to 100 MHz	DC to 200 MHz	DC to 200 MHz
	(-3 dB)	(-3 dB)	(-3 dB)	(-3 dB)
Rise Time(calculated)	3.5 ns	3.5 ns	1.75 ns	1.75 ns
Bandwidth Limit	20 MHz	20 MHz	20M/100 MHz	20M/100 MHz
Python Script Execution (μPy)	Basic version	Basic version	Professional version	Professional version
VERTICAL SENSITIVITY				
Resolution	8 bit ; 1 mV to 10 V/div			
Input Coupling	AC, DC, GND			
Input Impedance	1 MΩ // 16 pF approx.			
DC Gain Accuracy	±(3 %)when 2 mV/div or greater is selected ; ±(5 %) when 1 mV/div is selected			
Polarity	Normal & Invert			
Maximum Input Voltage	300 Vrms, CAT I			
Offset Position Range	1 mV/div to 20 mV/div : ±0.5 V ; 50 mV/div to 200 mV/div : ±5 V ; 500 mV/div to 2 V/div : ±25 V ; 5V to 10 V/div : ±250 V			
Waveform Signal Process	+, -, ×, ÷, FFT, User Defined Expression. FFT: 1 Mpts ; FFT: Spectral magnitude. Set FFT Vertical Scale to Linear RMS or dBV RMS, and FFT Window to Rectangular, Hamming, Hanning or Blackman			
TRIGGER				
Source	CH1 ,CH2, CH3**, CH4**, Line, EXT* ; *dual channel models only ; **four channel models only			
Trigger Mode	Auto (supports Roll Mode for 100 ms/div and slower), Normal, Single			
Trigger Type	Edge, Pulse Width(Glitch), Video, Pulse Runt, Rise & Fall(Slope), Timeout, Alternate, Event-Delay(1 to 65535 events), Time-Delay (Duration, 4 ns to 10 s), Bus (UART, I^2C , SPI*, CAN, LIN) *This bus decoder is only available on 4 channel models			
Holdoff Range	4 ns to 10 s			
Coupling	AC, DC, LF rej. ,HF rej. ,Noise rej.			
Sensitivity	1 div			
EXTERNAL TRIGGER				
Range	±15 V			
Sensitivity	DC to 100 MHz Approx. 100 mV ; 100 MHz to 200 MHz Approx. 150 mV			
Input Impedance	1 MΩ±3 % to 16 pF			
HORIZONTAL				
Time Base Range	1 ns/div to 100 s/div (1-2-5 increments) ; ROLL: 100 ms/div to 100 s/div			
Pre-trigger	10 div maximum			
Post-trigger	2,000,000 div maximum			
Time Base Accuracy	±50 ppm over any ≥ 1 ms time interval			
Real Time Sample Rate	Max.:1 GSa/s (4 ch model); Per channel 1 GSa/s (2 ch model)			
Record Length	Per channel 10 M pts			
Acquisition Mode	Normal, Average, Peak Detect, Single			
Peak Detection	2 ns (typical)			
Average	selectable from 2 to 512			
X-Y MODE				
X-Axis Input	Channel 1; Channel 3 (four channel models only)			
Y-Axis Input	Channel 2; Channel 4 (four channel models only)			
Phase Shift	±3° at 100kHz			
CURSORS AND MEASUREMENT				
Cursors	Amplitude, Time, Gating available; Unit: Seconds(s), Hz(1/s) , Phase(degree) , Ration(%)			
Automatic Measurement	38 sets: Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPREShoot, FPREShoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges, %Flicker, Flicker Idx,FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase			
Auto Counter	6 digits, range from 2Hz minimum to the rated bandwidth			
CONTROL PANEL FUNCTION				
Autoset	Single-button, automatic setup of all channels for vertical, horizontal and trigger systems, with “Undo Autoset”; “Fit Screen”/ “AC Priority” mode, and “Fine Scale” functions			
Save Setup	20 sets			
AWG SPECIFICATIONS				
Channels	2			
Sample Rate	200 Msa/s			
Vertical Resolution	14 bits			
Max. Frequency	25 MHz			
Waveforms	Sine, Square, Pulse, Ramp, DC, Noise, Sinc, Gaussian, Lorentz, Exponential Rise, Exponential Fall, Haversine, Cardiac			
Output Range	20 mVpp to 5 Vpp, HighZ; 10 mVpp to 2.5 Vpp, 50 Ω			
Output Resolution	1 mV			
Output Accuracy	2 % (1 kHz)			
Offset Range	±2.5 V, HighZ; ±1.25 V, 50 Ω			
Offset Resolution	1 mV			
SINE				
Frequency Range	100 mHz to 25 MHz			
Flatness((relative to 1kHz)	±0.5 dB<15 MHz; ±1 dB 15 MHz to 25 MHz			
Harmonic Distortion	-40 dBc			
Stray (Non-harmonic)	-40 dBc			
Total Harmonic Distortion	1%			
S/N Ratio	40 dB			
SQUARE/PULSE				
Frequency Range	100 mHz to 15 MHz			
Rise/Fall Time	<15 ns			
Overshoot	<3 %			
Duty Cycle	Square: 50 %; Pulse: 0.4 % to 99.6 %			
Min. Pulse Width	30 ns			
Jitter	500 ps			
RAMP				
Frequency Range	100 mHz to 1 MHz			
Linearity	1%			
Symmetry	0 to 100 %			
SPECTRUM ANALYZER SPECIFICATIONS				
Frequency Range	DC to 500 MHz (Max. ,Max.bandwidth to 500 MHz uncalibrated)			
Span	1 kHz to 500 MHz (Max.)			
Resolution Bandwidth	1 Hz to 500 kHz (Max.)			
Reference Level	-50 dBm to +40 dBm in steps of 5 dBm			
Vertical Units	dBV RMS; Linear RMS; dBm			
Vertical Position	-12 divs to +12 divs			
Vertical Scale	1 dB/div to 20 dB/div in a 1-2-5 Sequence			
Display Average Noise Level	1 V/div < -50 dBm, Avg : 16100 mV/div < -70 dBm, Avg : 1610 mV/div < -90 dBm, Avg : 16			
Spurious Response	2 nd harmonic distortion < 40 dBc3rd harmonic distortion < 45 dBc			
Frequency Domain Trace Types	Normal ; Max Hold ; Min Hold ; Average (2 to 256)			
Detection Methods	Sample ; +Peak ; -Peak ; Average			
FFT Windows	FFT Factor : Hanning 1.44, Rectangular 0.89, Hamming 1.30, Blackman 1.68			

SPECIFICATIONS

	MPO-2102B	MPO-2104B	MPO-2202P	MPO-2204P
DMM SPECIFICATIONS				
Reading	5,000 counts			
Voltage Input	CAT II 600 Vrms, CAT III 300 Vrms			
	Below are the basic conditions required to operate the DMM within specifications: *Calibration: Yearly. *Operating Temperature Specification: 18˚C to 28˚C (64.4˚F to 82.4˚F). *Relative humidity: 80 %. (Non condensing) *AC measurement are based on a 50 % duty cycle.			
DC Voltage	50 mV, 500 mV, 5 V, 50 V, 500 V, 1000 V, 6 ranges			
Accuracy	50 mV, 500 mV, 5 V, 50 V, 500 V, 1000 V : ±(0.1 % reading + 5 digits)			
Input Impedance	10 MΩ			
DC Current	50 mA, 500 mA, 10 A, 3 ranges			
Accuracy	50 mA to 500 mA : ±(0.5 % reading + 0.05 mA) ; 10 A : ±(0.5 % reading + 50 mA)			
AC Voltage*	50 mV, 500 mV, 5 V, 50 V, 750 V, 5 range. * : AC voltage measurements above 700 V are not guaranteed to meet specifications.			
Accuracy	50 mV, 500 mV, 5 V, 50 V, 750 V : ±(1.5 % reading + 15 digits) at 50 Hz to 1 kHz			
AC Current	50 mA, 500 mA, 10 A, 3 ranges			
Accuracy*	50 mA, 500 mA: ±(1.5 % reading + 0.05 mA) at 50 Hz to 1 kHz 10 A: ±(3 % reading + 50 mA) at 50 Hz to 1 kHz ; * : Measure range: > 10 mA			
Resistance*	50 Ω, 500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 50 MΩ, 7 range. *: In resistance measurements, the 50 Ω and 50 MΩ ranges are not guaranteed to meet specifications.			
Accuracy	500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ: ±(0.3 % reading + 3 digits) 5 MΩ: ±(0.5 % reading + 3 digits)			
Diode Test	Maximum forward voltage 1.5 V, Open voltage 2.8 V			
Temperature (Thermocouple)*	Range: -50 °C to + 1000 °C; Resolution: 0.1 °C *: Specifications do not include probe accuracy.			
Continuity Beeper	15 Ω			
POWER SUPPLY SPECIFICATIONS				
Output Channel	CH1 & CH2			
Output Range	1 V to 5 V/1 A; 5 V to 10 V/0.5 A ; 10 V to 20 V/0.25 A ; Peak current: 1 A @250 ms			
Voltage Step	0.1V Continuously Adjustable			
Output Voltage Accuracy	±3 %			
Ripple and Noise	50 mVrms			
DISPLAY				
TFT LCD Type	8" TFT LCD WVGA color display			
Display Resolution	800 horizontal × 480 vertical pixels (WVGA)			
Interpolation	Sin(x)/x			
Waveform Display	Dots, vectors, variable persistence (16 ms to 4 s), infinite persistence			
Waveform Update Rate	120,000 waveforms per second, maximum			
Display Graticule	8 x 10 divisions			
Display Mode	YT ; XY			
INTERFACE				
USB 2.0 Hi-speed Host Port	One on the front panel. Supporting USB2.0 Mass Storage Class (FAT32 or NTFS formatted); Professional version (MPO-2000P series) also supports USB CDC ACM Class and USB HID Class			
USB 2.0 Hi-speed Device Port	One on the rear panel, USBTMC Class is supported			
Ethernet(LAN) Port	RJ-45 connector, 10/100 Mbps with HP Auto-MDIX which also supporting TCP sockets communication, the TCP socket communication is using the default 5025 port number			
Web Server	Supporting remote control and monitoring of the oscilloscope in web browser by using the LAN			
Go-NoGo BNC	5 V Max/10 mA TTL open collector output			
Kensington Style Lock	Rear-panel security slot connects to standard Kensington-style lock			
MISCELLANEOUS				
Multi-language Menu	Available			
Operation Environment	Temperature: 0 °C to 50 °C. Relative Humidity ≤ 80 % at 40 °C or below; ≤ 45 % at 41 °C to 50 °C			
Python Script Execution (μPy)	Maximum number of installable python apps: 100 sets (including the pre-installed Python apps); Note: There is no restriction on script files (*.py); APPs installation capacity limit: 20 M byte maximum; MQTT Protocol: "Message Queuing Telemetry Transport" is supported which including the "Publish" and "Subscribe" pattern. Basic version (MPO-2000B series): Supporting 1,000 points waveform data processing; Professional version (MPO-2000P series): Supporting USB CDC ACM Class, USB HID Class, Python GUI library, 100,000 points waveform data processing			
Component Tester	Providing I-V characteristic curve (tracer) with readout scale; Please refer to the application note for the details			
Time Clock	Time and Date , Provide the Date/Time for saved data			
Internal flash disk	100 M bytes Single-Level Cell flesh memory			
Installed APP	Go/NoGo, DVM, DataLog, Digital Filter, Frequency Response Analyzer, Mask, CAN-FD * , USB2.0 (full speed) * , FlexRay * + , I^2S * +, USB-PD * +, Mount Remote Disk, Demo. * : Available for bus decoder function ; + : For Professional version (MPO-2000P series) Note: The I^2S bus decoder is only available on 4 channel models.			
Dimensions & Weight	384(W) x 208(H) x 127.3(D) mm, Approx. 3 kg			

Specifications subject to change without notice. **MPO2000GD2BH**

ORDERING INFORMATION

MPO-2204P 200 MHz, 4-channel, Digital Storage Oscilloscope, Spectrum Analyzer, dual channel 25 MHz AWG, 5000 counts DMM and Power Supply

MPO-2202P 200 MHz, 2-channel, Digital Storage Oscilloscope, Spectrum Analyzer, dual channel 25 MHz AWG, 5000 counts DMM and Power Supply

MPO-2104B 100 MHz, 4-channel, Digital Storage Oscilloscope, Spectrum Analyzer, dual channel 25 MHz AWG, 5000 counts DMM and Power Supply

MPO-2102B 100 MHz, 2-channel, Digital Storage Oscilloscope, Spectrum Analyzer, dual channel 25 MHz AWG, 5000 counts DMM and Power Supply

ACCESSORIES

Power Cord, Certificate of Calibration, Passive probe (one probe per channel)
GTL-110 BNC-BNC cable x 2, GTL-105A Alligator Clip test lead,
GTL-207 Banana plug test lead

GTP-100B-4 100 MHz(10:1/1:1)Switchable passive probe for MPO-2102B/2104B(one per channel)

GTP-200B-4 200 MHz(10:1/1:1)Switchable passive probe for MPO-2202P/2204P(one per channel)

OPTIONAL ACCESSORIES

GRA-426	Rack Adapter Panel
GAK-003	50 Ω Impedance Adapter
GSC-008	Soft Carrying Case
GTL-246	USB Cable, USB 2.0, A-B Type, 1200 mm
GDP-025	Differential Probe, 25 M High Voltage Differntial Probe
GDP-050	Differential Probe, 50 M High Voltage Differntial Probe
GCP-300	300 kHz/200 A Current probe
GCP-530	50 MHz/30 A Current probe
GCP-500	500 kHz/150 A Current probe
GCP-1030	100 MHz/30 A Current probe
GCP-1000	1 MHz/70 A Current probe
GCP-206P	Power supply for current probe (2 input channel)
GCP-425P	Current Probe - Power Supply, 4 Channel Power Supply for GCP-530/1030
GCP-0275	2 MHz/750 A Current probe
GCP-0550	5 MHz/500 A Current probe
GCP-2525	25 MHz/250 A Current probe

OPTIONAL

MP2-PRO Basic version upgrade to professional version

FREE DOWNLOAD

PC Software OpenWave software **Driver** LabView driver

GOOD WILL INSTRUMENT CO., LTD.
No.7-1, Jhongsing Road, Tucheng Dist., New Taipei City 236, Taiwan
T +886-2-2268-0389 **F** +886-2-2268-0639
E-mail: marketing@goodwill.com.tw

Website Facebook LinkedIn

GW INSTEK
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