

# GPM-8310

## Digital Power Meter

### FEATURES

- 5" TFT LCD
- DC, 0.1Hz ~ 100kHz Voltage/Current Test Bandwidth
- Two Numerical Display Modes
  - General Mode: Displays 2 Main Test Items + 8 Secondary Test Items
  - Simple Mode: Displays the Test Values of 4 Main Test Items
- Waveform Display: V (voltage), I (current), P (power)
- The Current/Voltage can be Measured to a Deformed Wave with CF of 3, and the Half-range CF can Reach 6 or 6A
- Meeting the IEC 61000-4-7 Harmonics Measurement Requirements (50/60Hz)
- 50th Order of Harmonic Measurement and Analysis (value and bar graph)
- Integration Function Supports Automatic Level-changing
- External Current Sensor Input Terminals (EXT1/EXT2)
- Standard Interfaces: RS-232C, USB Device/Host, LAN, GPIB
- Optional Interface: Digital I/O (DA4) (must be installed before leaving the factory)
- Optional Accessory: GPM-001

**GW INSTEK**  
Simply Reliable

GW Instek GPM-8310 is a digital power meter for single-phase (1P/2W) AC power measurement. Features include DC, 0.1Hz~100kHz test bandwidth, 16bits A/D, and 300 kHz sampling rate. It adopts 5" TFT LCD screen with a five-digit measurement display and provides 25 power measurement related parameters, and has a high-precision measurement capability. It also features the ability to display waveform (voltage/current/power), the integration measurement function, harmonic measurement and analysis of each order (meeting the IEC 61000-4-7 harmonics measurement requirements at 50/60Hz), external sensor input terminals, and various communication interfaces, etc., to help users achieve clear, convenient and accurate power measurements. This power meter is a most cost-effective power meter with most complete functionalities among the products of the same category.

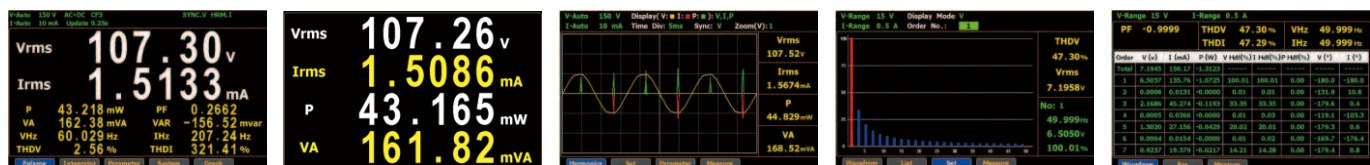
The rated direct input voltage of GPM-8310 is 600V and the input current is 20A. The minimum current level is 5mA (resolution up to 0.1uA) and the power measurement resolution is 0.1uW. The crest factor can reach 3 (half measurement range can reach 6 or 6A), and the voltage/current/power measurement capability can reach ( $\pm 0.05\%$  reading  $\pm 0.1\%$  level). Different measurement modes can be selected according to (AC+DC/ AC/ DC/ V-MEAN), providing up to 25 relevant parameters for power measurement, including voltage (Vrms/ Vac/ Vdc/ Vmn/ V+pk / V-pk), current (Irms/ Iac/ Idc/ I+pk/ I-pk), frequency (VHz/ IHz), power (P/ P+pk/ P-pk), crest factor (CFV/ CFI), apparent power (VA), reactive power (VAR), power factor (PF), phase angle (DEG), total harmonic distortion rate (THDV/THDI), maximum current ratio (MCR), and the MATH calculation function. Hence, for the measurement of low current/low power such as standby power consumption, or the measurement of power consumption of general products, this power meter provides the best range and accuracy support.

GPM-8310 also makes good use of the advantages of the TFT LCD to display the results of parameter measurement by using numerical and graphical methods. In terms of numerical values, the general mode and the simple mode are provided. The general mode can display 10 measurement parameters (2 main measurements + 8 monitoring measurements), and the simple mode can display four measurement parameters. These displayed parameters can be arbitrarily selected from 25 power parameters according to the needs of users. In terms of graphic display, a simple oscilloscope mode is provided to display waveforms for three parameters including voltage, current and power. In addition, the measurement and analysis of each harmonic order of the measurement signal can be completely displayed by numerical values or bar graphs. This power meter not only meets the needs of accuracy and legibility in process testing, but also meets the needs of diverse measurement applications in R&D design and quality verification.

In addition, the performance of GPM-8310 in auxiliary measurement mechanism/function is also comprehensive. For the application of measuring large voltage, the VT rate setting can be used with an external voltage Potential Transformer. For the measurement of large current, the type of current transformer ~ voltage output type or current output type will determine the applied method. If it is a current output type, it can be directly locked to the rear panel of the instrument and collocated with the CT rate setting to conduct measurement. If it is a voltage output type, measurement can be conducted through the external current sensor input terminals (EXT1/EXT2) provided by GPM-8310. Automatic level-changing can self-define the required level to save level-changing time. 10,000 lots of internal memories can be used to store measurement data according to the update rate set by GPM-8310 or a user-defined time interval for subsequent analysis.

In terms of data retrieval and storage, GPM-8310 provides a variety of communication interfaces including RS-232C/ USB device (virtual COM)/ LAN/ GPIB. Users can write programs to read the measurement results according to their habits or with existing system interfaces and there is no need to procure interfaces. USB host supports GPM-8310 screen capture, internal record data access, and firmware update. For the needs of external signal control or the use of data recorder to record data, GPM-8310 also provides an optional Digital I/O (DA4) interface (must be installed before leaving the factory), which can be connected to an external controller such as PLC or a data recorder to meet the application of automatic measurement or long recording.

## A. VARIOUS DISPLAY MODES



Numerical (General) Mode

Numerical (Simple) Mode

Waveform Mode

Harmonic (Bar Graph) Measurement

Harmonic (Table Column) Measurement

GPM-8310 provides the numerical value display mode and the waveform display mode, which help users to maximize the benefit of their measurement. Under the numerical mode, there are the general mode and the simple mode. The general mode has related measurement settings and can simultaneously display 10 measurement parameters (2 main measurements and 8 secondary measurements). The simple mode displays only 4 measurement parameter results. The parameters in each mode can be arranged and combined as required. Under the graphic mode, a simple oscilloscope function is provided to display the waveforms of three parameters including voltage, current and power. The horizontal

scale can be adjusted (from 25us/div ~ 1s/div according to the set data update rate), and 3 magnification rates for waveform observation are also provided for users to select. In the harmonic measurement, the measurement results of each order of harmonics can be displayed by bar graphs, and a specific observation order can be specified. The relevant values of each order of harmonics (voltage/current/power/voltage distortion ratio/current distortion ratio/power distortion ratio/voltage phase angle/current phase angle) can be completely recorded and displayed.

## B. RICH MEASUREMENT PARAMETERS

Measurement Items	Symbols
Voltage	Vrms, V+pk, V-pk, Vac*, Vdc*, Vmn*
Current	Irms, I+pk, I-pk, Iac*, Idc*
Power	P, P+pk, P-pk, VA, VAR
Power Factor	PF
Crest Factor	CFV, CFI
Phase Angle	DEG
Frequency	VHz, IHz
Total Harmonic Distortion	THDV, THDI
Maximum Current Ratio	MCR
Integration	WP, WP+, WP-, q, q+, q-, Vac, Iac

Note : "\*" Only applicable to specific measurement modes for selection



GPM-8310 provides a variety of measurement items and functions, including voltage, current, frequency, effective power, apparent power, reactive power, power factor, crest factor, total harmonic distortion, and can also measure the maximum current ratio. GPM-8310 is also equipped with the measurement function of power or current time integration for the DUT. Users set a period of time to perform instantaneous power

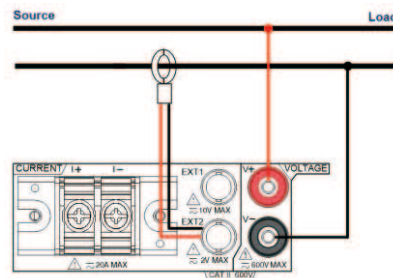
integration at the set time period, and then divide by the time to obtain the average power of the DUT. In addition, when performing integration measurement, GPM-8310 supports automatic level-changing function for the power change of the DUT at different times in order to obtain the most complete integration result within the set time.

## C. SUPERB MEASUREMENT ASSISTANCE



Ratio Configuration

With respect to the support of measurement assistance, the performance of GPM-8310 is outstanding. First of all, for the measurement of high voltage/high power, the setting of voltage ratio/power ratio is provided to restore the attenuated ratio to a true value. For the measurement of large current, other than the setting of current ratio, external current sensor terminals (EXT1/EXT2) can be utilized to connect with a voltage output type current transformer, making large current measurement more



External Current Sensor Input

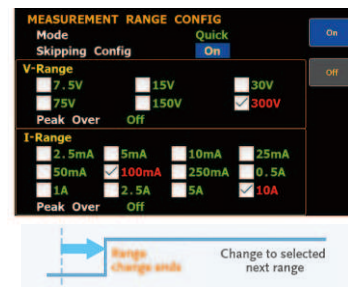
convenient. In addition, GPM-8310 provides 4 sets of panel settings for storage/recall and memory for storing 10,000 lots of measurement values. The measurement storage can log the measurement results based upon the update rate or a self-defined time interval to facilitate the subsequent analysis. The USB host on the front panel supports screen capture, measurement value storage, and GPM-8310 firmware update.

## D. FLEXIBLE LEVEL-CHANGING MECHANISM



Automatic level-changing under the integration function

GPM-8310 provides the measurement of the integration function under the automatic level-changing mode to allow users to fully calculate the total value of the power consumption of the DUT from the beginning to the end of the integration function. In addition, GPM-8310 also supports



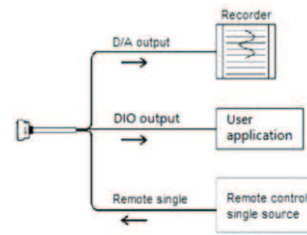
Self-defined automatic level-changing mechanism

self-defined setting mechanism for level-changing. Users can select the required level to be changed to save time on level-changing and expedite the test.

## E. CONVENIENT AND PRACTICAL INTERFACE



Practical Interface



DA4 Interface Mechanism

GPM-8310 provides comprehensive and diverse communications interfaces including RS-232 / USB / LAN / GPIB, which are suitable for customers to write computer software for remote control and the collection of measurement results through commands. The optional Digital I/O (DA4) interface provides 3 different modes: the external control mode, the DA4 output mode and the self-defined output mode based on user settings. When the setting is in the external control mode, it allows users to activate, stop, trigger or reset the integration measurement

function through external signals. When the setting is in the DA4 output mode, users can define 4 measurement parameter values from the 25 measurement parameters provided (even with the result of integration measurement) to produce outputs by a fixed level (full scale +5V) or a manual level (full scale  $\pm 5V$ ) and receive results by collocating with a data recorder. When the setting is in the self-defined output mode, a communications interface is required to control the action of each defined pin through commands.

## PANEL INTRODUCTION



CE

USB Host

USB Device

LAN

RS-232

GPIB

DA4



1. Hardcopy key & USB Host
2. 5" TFT LCD
3. Operation & Navigator Key
4. Current Input Terminal
5. External Current Sensor Input Terminal (EXT1/EXT2)
6. Voltage Input Terminal
7. Standard Interfaces : RS-232C, LAN, USB Device
8. Standard Interface : GPIB
9. Optional Interface : DA4



GTL-213 Test Lead



GTL-210 Test Lead



GPM-001 Test Fixture



GPM-001(EU) Test Fixture

## SPECIFICATIONS

### INPUT

Item	Specifications
Input Type	Voltage Floating input through resistive voltage divider Current Floating input through shunt
Measure Range	Voltage 15V, 30V, 60V, 150V, 300V, 600V Current Direct input 5mA, 10mA, 20mA, 50mA, 100mA, 200mA, 0.5A, 1A, 2A, 5A, 10A, 20A Sensor input EXT 1: 2.5 V, 5 V, 10 V EXT 2: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V
Input Impedance	Voltage Input resistance: approach 2 MΩ Current Direct input range 5mA ~ 200mA Input resistance: approach 505 mΩ Direct input range 0.5A ~ 20A Input resistance: approach 5 mΩ Sensor input Input range 2.5V ~ 10V (EXT1) Input resistance: approach 100 kΩ Input range 50mV ~ 2V (EXT2) Input resistance: approach 20 kΩ
Continuous Maximum Allowable Input	Voltage peak value of 1.5kV or RMS value of 1kV, whichever is less Current Direct input range 5mA ~ 200mA peak value of 30 A or RMS value of 20A, whichever is less Direct input range 0.5A ~ 20A peak value of 100A or RMS value of 30A, whichever is less Sensor input peak value less than or equal to 5 times of the rated range
Input Bandwidth	DC, 0.1 Hz ~ 100kHz
Continuous Maximum Common-mode Voltage	600 Vrms, CAT II
Line Filter	select OFF or ON (cut off frequency of 500 Hz)
Frequency Filter	select OFF or ON (cut off frequency of 500 Hz)
A/D Converter	Simultaneous conversion voltage and current inputs Resolution 16bits Maximum conversion rate Approx. 300kHz

### VOLTAGE AND CURRENT ACCURACY

Item	Specifications
Requirements	Temperature 23 ± 5°C Humidity 30~75% RH Input waveform Sine wave crest factor = 3 common-mode voltage 0 V Number of displayed digits 5 digits Frequency filter Turn on to measure voltage or current of 200 Hz or less After 30 minutes after warm-up time has passed After measurement range is changed (zero-level compensation) Update interval is 250 ms
Accuracy	DC ± (0.1% of reading + 0.2% of range) 0.1 Hz ≤ f < 45 Hz ± (0.1 % of reading + 0.2 % of range) 45 Hz ≤ f ≤ 66 Hz ± (0.1 % of reading + 0.05 % of range) 66 Hz < f ≤ 1 kHz ± (0.1 % of reading + 0.2 % of range) 1 kHz < f ≤ 10 kHz ± (0.07 *f) % of reading + 0.3% of range) 10 kHz < f ≤ 100 kHz ± (0.5 % of reading + 0.5 % of range) ± [{0.04x(f-10)}% of reading]
Temperature Coefficient	Add ±0.03% of reading/°C within the range 5 to 18°C or 28 to 40°C.
When the Line Filter is Turned ON	45 ~ 66 Hz Add 0.2 % of reading < 45 Hz Add 0.5 % of reading
Accuracy When the Crest Factor is Sset to 6 or 6A	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3
Accuracy Changes Caused by Data Update Interval	When the data update interval is 100 ms, and Auto, add 0.05% of reading to the 0.1 Hz to 1 kHz accuracy.
Influence of Temperature Changes After Zero-level Compensation or Range Change	Add 0.02% of range/°C to the DC voltage accuracy. Add the following value to the DC current accuracies. 5 mA/10 mA/20 mA/50 mA/100 mA/200 mA ranges 5 μA/°C 0.5 A/1 A/2 A/5 A/10 A/20 A ranges 500 μA/°C External current sensor input (/EXT1) 1 mV/°C External current sensor input (/EXT2) 50 μV/°C
Accuracy When the Crest Factor is Set to 6 or 6A	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3
Accuracy Changes Caused by Data Update Interval	When the data update interval is 100 ms, and Auto, add 0.05% of reading to the 0.1 Hz to 1 kHz accuracy.

### ACTIVE POWER ACCURACY

Item	Specifications
Requirements	same as the conditions for voltage and current. Power factor 1
Accuracy	DC (0.1 % of reading + 0.2 % of range) 0.1Hz ≤ f < 45 Hz ± (0.3 % of reading + 0.2 % of range) 45 Hz ≤ f ≤ 66 Hz ± (0.1 % of reading + 0.05 % of range) 66 Hz < f ≤ 1kHz ± (0.2 % of reading + 0.2 % of range) 1 kHz < f ≤ 10 kHz ± (0.1 % of reading + 0.3 % of range) ± [{0.067x(f-1)}% of reading] 10 kHz < f ≤ 100 kHz ± (0.5 % of reading + 0.5 % of range) ± [{0.09x(f-10)}% of reading]
Influence of Power Factor	when power factor (λ) = 0 (S: apparent power) ± 0.1 % of S for 45 Hz ≤ f ≤ 66 Hz

## SPECIFICATIONS

	$\pm \{ (0.1 + 0.15 \times f) \% \text{ of } S \}$ for up to 100 kHz as reference data • f is frequency of input signal in kHz when $0 < \lambda < 1$ ( $\Phi$ : phase angle of the Voltage and current) $(\text{power reading}) \times [(\text{power reading error}\%) + (\text{power range \%}) \times (\text{power range} / \text{indicated apparent power value}) + \{\tan\Phi \times (\text{influence when } \lambda=0)\}\%]$																												
<b>When The Line Filter is Turned ON</b>	45 ~ 66 Hz                      Add 0.3 % of reading < 45 Hz                              Add 1 % of reading																												
<b>Temperature Coefficient</b>	same as the temperature coefficient for voltage and current																												
<b>Accuracy When The Crest Factor is Set to 6 or 6A</b>	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3																												
<b>Accuracy of Apparent Power S</b>	voltage accuracy + current accuracy																												
<b>Accuracy of Reactive Power Q</b>	accuracy of apparent power + $(\sqrt{1.0004 - \lambda^2} - (\sqrt{1 - \lambda^2})) \times 100 \%$																												
<b>Accuracy of Power Factor <math>\Delta</math></b>	$\pm [   \lambda - \lambda / 1.0002   +   \lambda \cos\phi - \cos\{\phi + \sin^{-1}(\text{influence from the power factor when } \lambda = 0\% / 100)\}   ] \pm 1$ digit when voltage and current are at the measurement range rated input																												
<b>Accuracy of Phase Difference <math>\Phi</math></b>	$\pm [   \phi - \cos^{-1}(\lambda / 1.0002)   + \sin^{-1}(\text{influence from the power factor when } \lambda = 0\% / 100) ] \pm 1$ digit when voltage and current are at the measurement range rated input																												
<b>Accuracy When The Crest Factor is Set to 6 or 6A</b>	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3																												
<b>Accuracy Changes Caused by Data Update Interval</b>	When the data update interval is 100 ms, and Auto, add 0.05% of reading to the 0.1 Hz to 1 kHz accuracy.																												
<b>VOLTAGE, CURRENT AND ACTIVE POWER MEASUREMENTS</b>																													
<b>Item</b>	Specifications																												
<b>Measurement Method</b>	Digital sampling method																												
<b>Crest Factor</b>	3 or 6 (6A)																												
<b>Wiring System</b>	Single-phase, two-wire (1 P2 W)																												
<b>Range Select</b>	Select manual or auto ranging																												
<b>Auto Range</b>	Auto-range increase The range is upped when any of the following conditions is met. Crest factor 3      Urms or Irms exceeds 130% of the currently set measurement range. Upk, lpk value of the input signal exceeds 300% of the currently set measurement range. Crest factor 6      Urms or Irms exceeds 130% of the currently set measurement range. Upk, lpk value of the input signal exceeds 600% of the currently set measurement range. Crest factor 6A     Urms or Irms exceeds 260% of the currently set measurement range. Upk, lpk value of the input signal exceeds 600% of the currently set measurement range. Auto-range decline The range is downed when all of the following conditions are met. Crest factor 3      Urms or Irms is less than or equal to 30% of the measurement range. Urms or Irms is less than or equal to 125% of the next lower measurement range. Upk, lpk value of the input signal exceeds 300% of the currently set measurement range. Crest factor 6 or 6A     Urms or Irms is less than or equal to 30% of the measurement range. Urms or Irms is less than or equal to 125% of the next lower measurement range. Upk, lpk value of the input signal exceeds 600% of the currently set measurement range.																												
<b>Display Mode Switching</b>	Vrms (the true RMS value of voltage and current) VOLTAGE MEAN (the rectified mean value calibrated to the RMS value of the voltage and the true RMS value of the current) AC DC																												
<b>Measurement Synchronization Source</b>	Select voltage, current, or off In the case of Auto Update Rate, select the voltage or current from the equipped element.																												
<b>Line Filter</b>	Select OFF or ON (cutoff frequency at 500 Hz).																												
<b>Peak Measurement</b>	Measures the peak (max, min) value of voltage, current or power from the instantaneous voltage, instantaneous current or instantaneous power that is sampled.																												
<b>Zero-level Compensation</b>	Removes the internal offset of the measure unit (After measurement range is changed)																												
<b>Measurement Parameters</b>	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Voltage</td> <td>Vrms , Vmn, Vdc , Vac</td> </tr> <tr> <td>Current</td> <td>Irms , Idc , Iac</td> </tr> <tr> <td>Active Power</td> <td>P</td> </tr> <tr> <td>Apparent Power</td> <td>VA</td> </tr> <tr> <td>Reactive power</td> <td>VAR</td> </tr> <tr> <td>Power Factor</td> <td>PF</td> </tr> <tr> <td>Crest Factor</td> <td>CFI, CFV</td> </tr> <tr> <td>Phase Angle</td> <td>DEG</td> </tr> <tr> <td>Frequency</td> <td>IHz and VHz</td> </tr> <tr> <td>Voltage Peak</td> <td>V+pk and V-pk</td> </tr> <tr> <td>Current Peak</td> <td>I+pk and I-pk</td> </tr> <tr> <td>Active Power Peak</td> <td>P+pk and P-pk</td> </tr> <tr> <td>Total Harmonic Distortion</td> <td>THDI and THDV</td> </tr> <tr> <td>Maximum Current Ratio</td> <td>MCR</td> </tr> </table>	Voltage	Vrms , Vmn, Vdc , Vac	Current	Irms , Idc , Iac	Active Power	P	Apparent Power	VA	Reactive power	VAR	Power Factor	PF	Crest Factor	CFI, CFV	Phase Angle	DEG	Frequency	IHz and VHz	Voltage Peak	V+pk and V-pk	Current Peak	I+pk and I-pk	Active Power Peak	P+pk and P-pk	Total Harmonic Distortion	THDI and THDV	Maximum Current Ratio	MCR
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## SPECIFICATIONS

### DIGITAL IO SIGNAL (OPTIONS)

<b>Item</b>	Specifications
<b>I/O Control Output Signal</b>	OUT1, OUT2, OUT3, OUT4
<b>I/O Level</b>	TTL
<b>I/O Sink Current</b>	Max 100mA (per/ch)
<p>* Q (VAR), S (VA), λ (PF) and Φ (DEG) are originated from the measured values including voltage, current and active power which go through computation process. In respect to distorted signal input, accordingly, the value acquired from other instruments, which employ different methods, may differ from that acquired from GPM-8310 unit.</p> <p>* "Zero" will be shown for S or Q and "-.-" will be displayed for λ and Φ when either current or voltage is less than 0.5% of the rated range (less than or equivalent to 1% when crest factor is set 6).</p>	

### GENERAL

 <b>Note</b>	<p>The below are the basic conditions required to operate the GPM-8310 within specifications:</p> <ul style="list-style-type: none"> <li>• 1-year Calibration: Yearly</li> <li>• Operating Environment: 18~28 °C (64.4~82.4°F)</li> <li>• Humidity: &lt;80%RH,</li> <li>• Accuracy: ± (% of reading + % of range)</li> <li>• The specifications apply when it warmed up for at least 30 minutes and operates in the slow rate.</li> <li>• The power supply cable must be grounded to ensure accuracy.</li> <li>• Input voltage and current must be standard sine wave.</li> <li>• The power factor must be 1.</li> <li>• The crest factor must be 3.</li> <li>• The common-mode voltage must be zero.</li> </ul>
<b>Specification Condition</b>	<p>Temperature: 23°C±5°C Humidity: &lt;80%RH(non-condensing)</p>
<b>Operation Condition</b>	<p>Temperature 0°C ~ 40°C,  <ul style="list-style-type: none"> <li>• 30 ~ 40°C, Relative Humidity &lt; 70%RH (non-condensing)</li> <li>• &gt;40°C, Relative Humidity &lt; 50%RH (non-condensing)</li> </ul>                     Indoor use only                      Altitude: &lt; 2000 meters                      Pollution degree 2</p>
<b>Storage Condition</b>	<p>Temperature -40°C ~ 70°C Humidity: &lt; 90%RH (non-condensing)</p>
<b>Power Source</b>	AC 100-240V, 50-60Hz ; Consumption Max. 30VA
<b>Dimensions</b>	268(W) x 107(H) x 379(D) mm (w/t bumpers)
<b>Weight</b>	Approx. 2.9kg

PM-8213CD1BH Specifications subject to change without notice.

### ORDERING INFORMATION

<b>GPM-8310</b>	Digital Power Meter with RS-232C/USB device & host/LAN/GPIB
<b>GPM-8310 with DA4</b>	Digital Power Meter with RS-232C/USB device & host/LAN/GPIB and opt. DA4

### ACCESSORIES

Safety Instruction Sheet x 1, Power cord x 1  
 Test lead GTL-209 x 1, Test lead GTL-212 x 1  
 CD x 1 (including complete user manual and USB driver)  
 DA4 cable GTL-214 (available for GPM-8310 with DA4 only)

### OPTION

**Opt.01** DA4 Interface (including cable, GTL-214)

Note : Optional DA4 interface must be installed in factory.

### OPTION ACCESSORIES

<b>GPM-001</b>	Test Fixture (including GTL-210 x 2, GTL-213 x 1)
<b>GPM-001(EU)</b>	Test Fixture (including GTL-210 x 2, GTL-213 x 1)
<b>GTL-209</b>	Test Lead, Banana to Bare-wire, Approx. 1000mm
<b>GTL-210</b>	Test Lead, Banana to Banana, Approx. 1000mm
<b>GTL-212</b>	Test Lead, O-Type to Bare-wire, Approx. 1000mm
<b>GTL-213</b>	Test Lead, O-Type to Banana, Approx. 1000mm
<b>GTL-214</b>	DA4 Cable, Approx. 1000mm
<b>GTL-232</b>	RS-232C cable, 9-pin Female to 9-pin, null modem for computer, Approx. 2000mm
<b>GTL-246</b>	USB Cable, A-B type, Approx. 1200mm
<b>GTL-248</b>	GPIB Cable, Approx. 2000mm
<b>GRA-422</b>	Rack Mount Kit, 19" 2U size

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