# GPM-8310 Specifications

The specifications apply when warmed up for at least 30 minutes and operates under the slow rate & 18~28 °C.


(with optional D/A 4)

**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 | EX1: 2.5 V, 5 V, 10 V<br>EX2: 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 (EX1) | | Input resistance: approach 100 kΩ |
| | Input range 50mV ~ 2V (EX2) | | 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℃ |
| | 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 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. | |
| 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 (/EX1) | 1 mV/°C |
| | External current sensor input (/EX2) | 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 | |
| | ± {(0.1 + 0.15 × f) % of S } for up to 100 kHz as reference data | |
| | •f is frequency of input signal in kHz | |
| | when 0 < λ < 1 (Φ: phase angle of the Voltage and current) | |
| | (power reading ) × [(power reading error%) + (power range %) × (power range / indicated apparent power value) + {tanΦ × (influence when λ=o)%}] | |
| When the line filter is turned ON | 45 ~ 66 Hz | Add 0.3 % of reading |
| | < 45 Hz | Add 1 % of reading |
| Temperature coefficient | same as the temperature coefficient for voltage and current | |
| 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 of apparent power S | voltage accuracy + current accuracy | |
| Accuracy of reactive power Q | accuracy of apparent power + (√1.0004 - λ2) - (√1 - λ2) ×100 % | |
| Accuracy of power factor λ | ± [(λ-λ/1.0002)+｜ cosø-cos{ø+sin-1 (influence from the power factor when λ = 0%/100)}｜] ±1 digit when voltage and current are at the measurement range rated input | |
| Accuracy of phase difference Φ | ± [｜ ø-cos-1(λ/1.0002)｜+ sin-1 (influence from the power factor when λ = 0 % / 100)] ± 1 digit when voltage and current are at the measurement range rated input | |

| | |
|---|---|
| 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. |

**Voltage, Current and Active Power Measurements**

| Item | Specifications | |
|---|---|---|
| Measurement method | Digital sampling method | |
| Crest factor | 3 or 6 (6A) | |
| Wiring system | Single-phase, two-wire (1 P2 W) | |
| Range select | Select manual or auto ranging | |
| Auto range | Auto-range increase | |
| | The range is upped when any of the following conditions is met. | |
| | Crest factor 3 | Vrms or Irms exceeds 130% of the currently set measurement range.<br>Vpk, Ipk value of the input signal exceeds 300% of the currently set measurement range. |
| | Crest factor 6 | Vrms or Irms exceeds 130% of the currently set measurement range.<br>Vpk, Ipk value of the input signal exceeds 600% of the currently set measurement range. |
| | Crest factor 6A | Vrms or Irms exceeds 260% of the currently set measurement range.<br>Vpk, Ipk 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 | Vrms or Irms is less than or equal to 30% of the measurement range.<br>Vrms or Irms is less than or equal to 125% of the next lower measurement range.<br>Vpk, Ipk value of the input signal exceeds 300% of the currently set measurement range. |
| | Crest factor 6 or 6A | Vrms or Irms is less than or equal to 30% of the measurement range.<br>Vrms or Irms is less than or equal to 125% of the next lower measurement range.<br>Vpk, Ipk value of the input signal exceeds 600% of the currently set measurement range. |
| Display mode Switching | 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 | |
| Measurement synchronization source | Select voltage, current, or off | |
| | In the case of Auto Update Rate, select the voltage or current from the equipped element. | |
| Line filter | Select OFF or ON (cutoff frequency at 500 Hz). | |
| Peak measurement | Measures the peak (max, min) value of voltage, current or power from the instantaneous voltage, instantaneous current or instantaneous power that is sampled. | |
| Zero-level compensation | Removes the internal offset of the measure unit (After measurement range is changed) | |
| Measurement parameters | 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 |

**Frequency Measurement**

| Item | Specifications | |
|---|---|---|
| Measurement item | Voltage and current | |
| Measurement frequency range | Data update interval | Measurement Frequency Range |
| | 0.1 s | 20 Hz ≤ f ≤ 100 kHz |
| | 0.25 s | 10 Hz ≤ f ≤ 100 kHz |
| | 0.5 s | 5 Hz ≤ f ≤ 100 kHz |
| | 1 s | 2.0 Hz ≤ f ≤ 100 kHz |
| | 2 s | 1.0 Hz ≤ f ≤ 100 kHz |
| | 5 s | 0.5 Hz ≤ f ≤ 100 kHz |
| | 10 s | 0.2 Hz ≤ f ≤ 100 kHz |
| | 20 s | 0.1 Hz ≤ f ≤ 100 kHz |
| | Auto ( * ) | 0.1 Hz ≤ f ≤ 100 kHz |
| | ( * ) Limit of the measurement lower limit frequency by the Timeout setting | |
| | Timeout | lower limit frequency |
| | 1 s | 2.0 Hz |
| | 5 s | 0.5 Hz |
| | 10 s | 0.2 Hz |
| | 20 s | 0.1 Hz |
| Measurement range | Auto switching among six types: 100mHz, 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz. | |
| Frequency filter | Select OFF or ON (cut off frequency of 500 Hz) | |
| Accuracy | Requirements | When the input signal level is 30% or more of the measurement range If the crest factor is set to 3.<br>(60% or more if the crest factor is set to 6 or 6A)<br>• Frequency filter is ON when measuring voltage or current of 200 Hz or less. |
| | ± (0.06% of reading) | |

**Integration**

| Item | Specifications |
|---|---|
| Mode | Select manual integration mode, standard integration mode, or repetitive integration mode. |
| Timer | Automatically stop integration by setting a timer. |
| | Selectable range: 0 hours 00 minutes 00 seconds to 9999 hours 59 minutes 59 seconds |
| Accuracy | ±(Power accuracy (or current accuracy) + 0.1% of reading) (fixed range) |
| Range setting | Auto range or fixed range is available for Integration |
| Timer accuracy | ±0.02% |
| Remote control | Start, stop and reset operations are available using an external remote signal. (option) |

**Harmonic Measurement**

| Item | Specifications | | | |
|---|---|---|---|---|
| Measured item | Voltage, Current, Power | | | |
| Measured method | Zero-cross simultaneous calculation method | | | |
| Frequency range | 10 Hz to 1.2 kHz. | | | |
| FFT data length | 1024 | | | |
| | 4096 (Auto switch when both 50Hz/60Hz and update rate > 0.1s conditions are met) | | | |
| Sample rate, window width, and upper limit of Analysis orders* | Fundamental Frequency | Sample rate | Window Width | upper limit of Analysis orders |
| | 10 Hz to 44 Hz | f × 1024 | 1 | 50 |
| | 45 Hz to 55 Hz | f x 512 | 10 | 50 |
| | 54 Hz to 66Hz | f x 512 | 12 | 50 |
| | 67 Hz to 150 Hz | f × 512 | 2 | 32 |

| | | | | |
|---|---|---|---|---|
| | 150 Hz to 300 Hz | f × 256 | 4 | 16 |
| | 300 Hz to 600 Hz | f × 128 | 8 | 8 |
| | 600 Hz to 1200 Hz | f × 64 | 16 | 4 |
| Accuracy | Frequency | Voltage | Current | Power |
| | 10 Hz ≤ f < 45 Hz | 0.15% of reading | 0.15% of reading | 0.35% of reading |
| | | + 0.35% of range | + 0.35% of range | + 0.50% of range |
| | 45 Hz ≤ f < 440 Hz | 0.15% of reading | 0.15% of reading | 0.25% of reading |
| | | + 0.35% of range | + 0.35% of range | + 0.50% of range |
| | 440 Hz ≤ f < 1.2kHz | 0.20% of reading | 0.20% of reading | 0.40% of reading |
| | | + 0.35% of range | + 0.35% of range | + 0.50% of range |
| * 50Hz/60Hz Compliant IEC61000-4-7 | | | | |

### D/A Output (Options)

| Item | Specifications |
|---|---|
| Output voltage | ±5 V FS (approach ±7.5 V maximum) against each rated value. |
| Number of output channels | 4 |
| Output items | Set for each channel : V, I, P, VA, VAR, PF, DEG, VHZ, IHZ, Vpk, Ipk, WP, WP±, q, q±, Off |
| Accuracy | ±(accuracy of each measurement item + 0.2% of FS)(FS = 5 V) |
| D/A conversion resolution | 16 bits |
| Minimum load | 100 kΩ |
| Update Interval | Same as the data update interval. |
| | In the case of Auto Update Rate, update interval is equal to signal interval. More than 100ms. |
| Temperature coefficient | ±0.05%/°C of FS |

### Remote Control Input/Output Signal (Options)

| Item | Specifications |
|---|---|
| Remote control input signal | EXT HOLD, EXT TRIG, EXT START, EXT STOP, EXT RESET |
| Remote control output signal | INTEG BUSY |
| I/O level | TTL |
| I/O logic format | Negative logic, Falling edge |

### Digital IO Signal (Options)

| Item | Specifications |
|---|---|
| I/O control output signal | OUT1, OUT2, OUT3, OUT4 |
| I/O level | TTL |
| I/O sink current | Max 100mA (per/ch) |

* 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.
* "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).

### General

| | |
|---|---|
| Display | 5" TFT LCD |
| Interfaces | RS-232C, USB host/device, LAN, GPIB |
| Power Source | AC 100-240V, 50-60Hz |
| Power Consumption | 30VA max. |
| Dimensions & Weight | 268(W) x 107(H) x 379(D) mm (w/t bumpers), Approx. 2.9kg |