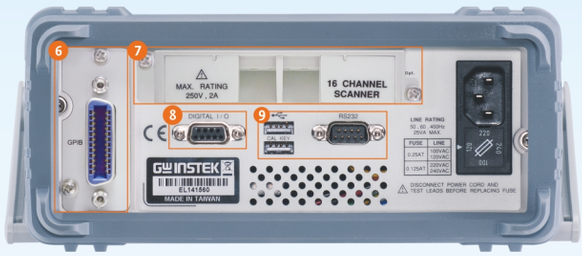
Digital Multi-meter



1. The 11 measurement functions can be selected at a button press; making operations easy and intuitive.
2. Dual VFD displays show the results of two different measurement functions simultaneously.
3. Both 2-Wire and 4-Wire resistance measurements are supported. The low current measurement and high current measurement are made through different inputs.
4. Two low DC current ranges (100 μ A and 1mA) are available for high resolution measurements down to 100pA detail.
5. A number of built-in math functions are included : MX+B, 1/X, % and statistics (max/min/average/standard deviation).
6. Either GPIB or LAN communication is supported as optional.
7. Flexible-sized screw terminals on scanner card to support a wide range of wire gauges for flexible compatibility.
8. The Digital I/O port sends out a signal of compare measurement result for external devices control. Additionally, the Digital I/O port can also be used as a power source for TTL & COMS logic.
9. USB and RS-232C communication ports facilitate the high speed communication.

A Basic Concept (What is digital multimeter?)

1. 1.A digital multimeter (DMM) is an epitomized device that combines the function alities of voltmeter, currentmeter and ohmmeter. It can perform parameters measurement such as voltage, current, resistance, frequency, temperature as well as capacitance. On the other hand, engineers can handle design, development and testing job for electronic circuits or products by just single equipment.
Some DMM also provides more functionality to support a test demand for instead an internal buffer with readings storage, a scanner card switch from point to point in a circuit or to several devices under test.

Waveform	Crest Factor (CF)	Effective Value (Vrms)	Average Value (Vavg)	Conversion (Vrms/Vavg)
	$\sqrt{2}$ ↓ ≈1.414	$\frac{1}{\sqrt{2}}$ A↓ ≈0.707	$\frac{2}{\pi}$ A↓ ≈0.637	≈1.11
	1.000	A	A	1
	$\sqrt{3}$ ↓ ≈1.732	$\frac{1}{\sqrt{3}}$ A↓ ≈0.577	0.5A	≈1.154

3. There are two methods commonly used in digital multi-meter (DMM) AC measurements, one is AC average rectified measurement and the other is True RMS measurement. True RMS is a consistent and standard way to measure and compare dynamic signals of all shapes and sizes. In other words, RMS measurement is equivalent to the heating potential of a dynamic waveform. The formulas below compare the calculations of an RMS meter compared to an average rectified measuring meter when measuring pure sinusoidal AC voltage.

$$V_{RMS} = \sqrt{\frac{1}{T}\int_0^T v^2(t)dt} = V_{pk}/\sqrt{2} = 0.707\ \text{Vpk}$$

$$V_{AVE} = \frac{1}{T}\int_0^T |v(t)|dt = 0.637\ \text{Vpk}$$

Therefore in non-true RMS meter reading, the value is calibrated by a form factor of 1.11, which is coming from 637.0707.0 = 1.11, but this is only accurate for a pure sinusoidal waveform.

"RMS" stands for root-mean-square. It comes from a mathematical formula that calculates the "effective" value (or heating value) of any ac wave shape. In electrical terms, the ac rms value is equivalent to the dc heating value of a particular waveform—voltage or current. For example, if a resistive heating element in an electric furnace is rated at 15 kW of heat at 240 V ac rms, then we would get the same amount of heat if we applied 240 V of dc instead of ac.

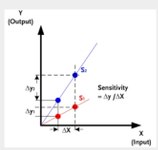
B Terminologies

1. Resolution :

the smallest portion of the signal that can actually be observed. It is determined by the analog-to-digital (A/D) converter of instrument. A commonly characterize resolution – bits, digits, counts etc. For example, 6 1/2 digits.

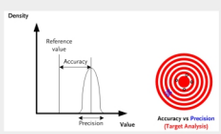
2. Sensitivity :

the smallest change in the measurement that can be detected in units of measured value. The sensitivity of an instrument is equal to its lowest range divided by the resolution.



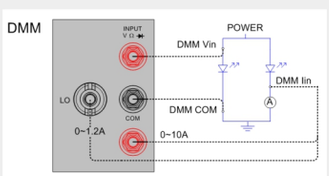
3. Accuracy :

the closeness of agreement between the result of a measurement and its true value. Normally an accuracy specification is expressed in two parts, one as a proportion of the value being measured, and the other as a proportion of the scale that the measurement is on, for example:
± (% reading + % range) or
± (% reading + offset error in digits)



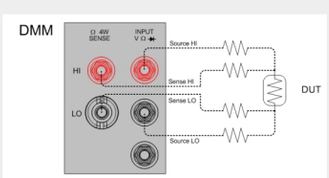
C Applications

1. Dual Measurement



Monitor the voltage and current present on a component in a circuit or the output voltage and current of a power supply.

2. Four Wires Resistance Measurement



Using four-wire measurements to measure the voltage drop across the resistor, instead of across the resistor and leads.

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