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DUAL DISPLAY DIGITAL MULTIMETER

MODEL: GDM-8246

User Manual

Good Will Instrument Co., Ltd.

GW Part No. 82DM-82460MA

Printed in Taiwan October 2002

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Good Will Instrument Co., Ltd.
No. 95-11, Pao-Chung Road, Hsin-Tien City, Taipei Hsien, Taiwan

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Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.
No. 95-11, Pao-Chung Rd., Hsin-Tien City, Taipei Hsien, Taiwan
GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.
No.69 Lushan Road, Suzhou New District Jiangsu, China.

declares that the below mentioned products

GDM-8246

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Equipment Directive (73/23/EEC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Equipment Directive, the following standards were applied:

◎ EMC

EN 61326-1: Electrical equipment for measurement, control and laboratory use — EMC requirements **(1997+A1: 1998)**	
Conducted and Radiated Emissions EN 55011: 1998	Electrostatic Discharge EN 61000-4-2: 1995+A1:1998
Current Harmonic EN 61000-3-2: 1995+A1: 1998+A2: 1998 +A14: 2000	Radiated Immunity EN 61000-4-3: 1996+A1 :1998
Voltage Fluctuation EN 61000-3-3: 1995	Electrical Fast Transients EN 61000-4-4: 1995
----------	Surge Immunity EN 61000-4-5: 1995
----------	Conducted Susceptibility EN 61000-4-6: 1996
----------	Voltage Dips/ Interrupts EN 61000-4-11: 1994

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC
EN 61010-1 : 2001 IEC 61010-1: 2001

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1. SAFETY SUMMARY

Measuring Circuit

Measuring circuits are subjected to working voltage and transient stresses from the circuit to which they are connected during measurement or test. The circuits are divided into the following measurement categories:

Measurement category I is for measurements performed on circuits not directly connected to MAINS.

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation.

Measurement category III is for measurements performed in the building installation.

Measurement category IV is for measurements performed at the source of the low-voltage installation.

Please refer to the installation category indicated on the font panel to select adequate measurement category.



The equipment marked with measurement category I shall not be used for measurements within measurement II, III and IV.

Safety terms and symbols

Please take a moment to review these safety terms and symbols which may appear in this manual or on Equipment to prevent damage to the instrument.



WARNING. Warning statements identify condition or practices that could result in injury or loss of life.



CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.



DANGER High Voltage



ATTENTION refer to Manual



Protective Conductor Terminal



(ground) Earth Terminal



Frame or Chassis Terminal

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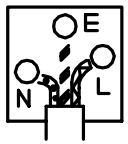
FOR UNITED KINGDOM ONLY

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow: Earth
Blue: Neutral
Brown: Live(Phase)



As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.

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The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.
This cable/appliance should be protected by a suitably rated and approved HBC mains fuse : refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm² should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

2. INTRODUCTION

This is a portable, bench-type dual display digital multimeter with a good-performance 50000 counts designed for general purpose application. The dual display allows you to display two functions of the input signal being measured.

Features

- 50000 counts DMM
- Multi-function ACV, DCV, ACA, DCA, R, C , Hz, Continuity Beeper, Diode Test, MAX/MIN, REL, dBm, HOLD, Autohold, Compare.
- Dual display Indicate ACV and Hz, DCV (ACV) and dBm or DCV and ACV ripple.
- Manual or Autoranging
- 0.02% DCV accuracy
- 20A high current range
- 1200V high voltage range
- AC True RMS or AC+DC True RMS.
- ACV frequency response 100kHz.
- The reference impedance selectable in the dBm modifier.
- Auto-recall the setting upon power on.
- Interface RS232 (Standard) and GPIB (option).

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3. SPECIFICATIONS

The specifications are operated under the essential conditions as follows:

- A 1-year calibration cycle.
- An operating temperature of 18 to 28℃ (64.4 to 82.4℉).
- Relative humidity not exceeding 90%.
- Accuracy is expressed as ±(percentage of reading + digits).
- The AC specification is based on the 50% of duty cycle.

1. DC VOLTAGE OR DCV OF RIPPLE FUNCTION		
RANGE	RESOLUTION	ACCURACY
500mV	10μV	0.02%+4
5V	100μV	
50V	1mV	
500V	10mV	
1200V	100mV	
DCV Input Impedance	10MΩ in parallel with <100pF, all ranges.	
DCV of Ripple Function	5V~500V 3 ranges.	
DCV of Ripple Input Impedance	10MΩ //10MΩ in parallel with <100pF.	
Normal Mode Rejection Ratio	>60dB at 60Hz or 50Hz.	
Common Mode Rejection Ratio	>90dB at 60Hz or 50Hz.	
Common Mode Voltage (Maximum)	500V dc or peak ac.	
Maximum Input	450V dc or peak ac continuous on 500mV range and ripple function. 1200V dc or peak ac continuous on other range.	
When the input exceeds the full scale of the selected range, the display will appear "—OL—" of over-range indication.		

2. TRUE RMS AC, AC+DC VOLTAGE						
Accuracy	between 2% of range and full range.					
RANGE	20Hz-50Hz	50Hz-2kHz	2kHz-10kHz	10kHz-20kHz	20kHz-50kHz	50kHz-100kHz
500mV	1%+10	0.3%+30	0.4%+50	0.5%+50	2%+20	5%+50
5V						
50V						
500V					--------	--------
1000V				--------	--------	--------
Input Impedance	10MΩ in parallel with < 100pF,all ranges.					
Maximum Input	450V dc or peak ac continuous on 500mV range. 1000Vrms on other range.					
Crest Factor Range	3.0 at full scale.					
AC+DC all ranges	±(percentage of reading + 50 counts).					
When the input exceeds the full scale of the selected range, the display will appear "—OL—" of over-range indication.						
3. ACV OF RIPPLE FUNCTION						
RANGE	20Hz-50Hz	50Hz-2kHz	2kHz-10kHz	10kHz-20kHz	20kHz-50kHz	50kHz-100kHz
500mV	1%+10	0.3%+30	0.4%+50	0.5%+50	2%+20	5%+50
Input Impedance	10MΩ //10MΩ in parallel with < 100pF.					
Maximum Input	450V dc or peak ac continuous.					
Crest Factor Range	3.0 at full scale.					
When the input exceeds the full scale of the selected range, the display will appear "—OL—" of over-range indication.						

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4. FREQUENCY MEASUREMENT AT ACV RANGE

RANGE	FREQUENCY	INPUT LEVEL (SINE WAVE)	ACCURACY
500mV	10Hz ~ 50kHz	≧120mV	0.05%+1
	50kHz ~ 150kHz	≧200mV	
5V	10Hz ~ 200kHz	≧1.2V	
50V	20Hz ~ 200kHz		
500V	20Hz ~ 20kHz	≧12V	

AC+DC measurement does not support AC+Hz function.

Maximum Input	450V peak ac continuous on 500mV range. 500V peak ac continuous on the other range.

5. DC Current

RANGE	RESOLUTION	ACCURACY	BURDEN VOLTAGE
500 μA	0.01 μA	0.05% +3	0.7Vmax.
5mA	0.1 μA		
50mA	1 μA		
500mA	10 μA		0.8Vmax.
2A	100 μA	0.2% +5	
20A	1mA		0.9Vmax.

Protection	Fuse protection for 500 μA,5mA,50mA,500mA,2A and 20A ranges, 20A range input for 15 seconds max.

When the input exceeds the full scale of the selected range, the display will appear "—OL—" of over-range indication.

6. TRUE RMS AC OR AC+DC CURRENT

Accuracy	Between 2% of range and full range.

RANGE	20Hz-45Hz	45Hz-2kHz	2kHz-10kHz	10kHz-20kHz
500 μA	1%+15	0.5%+15	1%+15	2%+15
5mA				
50mA				
500mA				
2A			————————	
20A			————————	

Protection	Fuse protection 500 μA,5mA,50mA,500mA,2A and 20A ranges, 20A range input for 15 seconds max.
Crest Factor Range	3.0 at full scale.

The burden voltage is the same as the DC current.

When the input exceeds the full scale of the selected range, the display will appear "—OL—" of over-range indication.

7. FREQUENCY MEASUREMENT AT ACA RANGE

RANGE	FREQUENCY	INPUT LEVEL (SINE WAVE)	ACCURACY
500 μA	10Hz ~ 20kHz	≧90 μA	0.05%+1
5mA	10Hz ~ 20kHz	≧0.9mA	
50mA	10Hz ~ 20kHz	≧9mA	
500mA	10Hz ~ 20kHz	≧90mA	
2A	10Hz ~ 2kHz	≧1A	
20A	10Hz ~ 2kHz	≧9A	

AC+DC measurement does not support AC+Hz function.

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8. RESISTANCE		
RANGE	RESOLUTION	ACCURACY
500Ω	0.01Ω	0.1%+4
5kΩ	0.1Ω	0.1%+2
50kΩ	1Ω	
500kΩ	10Ω	
5MΩ	100Ω	0.2%+2
20MΩ	1kΩ	0.3%+2
Open-circuit Voltage	3.2 volts maximum on 500Ω, 5kΩ 1.3 volts maximum on all other ranges.	
Protection	450V dc or peak ac continuous.	
9. CAPACITANCE		
RANGE:	RESOLUTION	ACCURACY
5n *	0.001n	≧1nF: 2%+10 <1nF & ≧0.5nF: 2%+20
50n	0.01n	≧10nF: 2%+10 <10nF & ≧5nF: 2%+30
500n	0.1n	2%+4
5μ	1n	
50μ	10n	
*5n range tends to be interfered by the test lead's impedance and position. For the accuracy, please measure the range on the input terminal directly.		
Protection	450V dc or peak ac continuous.	
10. DIODE CHECK		
Description	Display read forward voltage of diode.	
Open Voltage	3.1V approx.	
Maximum Forward Voltage	1.5V	
Protection	450V dc or peak ac continuous.	

11. CONTINUITY BEEPER	
Description	Built in buzzer sounds when conductance is less than 5 ohm.
Open Voltage	3 volts maximum.
Protection	450V dc or peak ac continuous.
12. ENVIRONMENTAL	
Operation Environment	Indoor use, altitude up to 2000m. Ambient Temperature 0℃ to 50℃. Relative Humidity 80% (Maximum). Installation category II Pollution Degree 2
Storage temperature	-10℃ to 70℃.
Relative Humidity	Up to 90%, 0℃ to 35℃, Up to 50%, 35℃ to 50℃, except the ranges of 2MΩ and 20MΩ which are up to 80% , 0℃ to 35℃.
13. GENERAL	
Maximum Common Mode Voltage	500V dc or peak ac (low terminal potential with respect to power line ground).
Warm Up	0.5 hours to achieve rated accuracy.
Power source	AC 100V/120V/220V/230V±10%, 50/60Hz, 12.5VA, 10.5W.
Accessories	Test Lead × 1 Instruction manual × 1, Interface manual × 1
Dimension	251(W)×91(H)×291(D) m/m
Weigh	Approx. 2.6 kg

WARNING : To avoid electrical shock, the power cord protective grounding conductor must be connected to ground.

CAUTION : To avoid damaging the instrument, do not use it

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in a place where ambient temperature exceeds 50℃.

4. OPERATION INSTRUCTIONS

4-1. Front panel and rear panel

The front panel, shown in Figure4-1, contains three main elements: the input terminals, the primary and secondary displays, and the push buttons. The rear panel, shown in Figure 4-2, contains the AC power-line connector, and fuse & line voltage selector, input fuse holder, and interface terminal.

4-2. The [SHIFT] key and function keys

[SHIFT] button is used to enable the secondary function of certain function keys that with blue symbols printed above. The SHIFT LED will be on after pressed the [SHIFT] button. At this time, only the buttons with blue symbols are workable. To release SHIFT function, press [SHIFT] again. For example, to select DCmV function, press [SHIFT], then press [DCV] ([DCmV]).

4-3. Set mode

Press [SHIFT] [SET] in sequence into SET mode, then proceed further setting by pressing the white characters with blue background [HI], [LO], [REF Ω], [RS232], [GPIB], [ENTER] sequentially.

4-4. Warm up

The instrument requires half-an-hour warm up to achieve rated accuracy.

4-5. Over-range indication

An input is over-range if it exceeds the full scale of the selected range. GDM-8246 indicates an input is over-range by lighting the "—OL—" pattern on display.

4-6. No specification indication

On AC+Hz measured mode, when an input is less sensitivity, the secondary display show "————". When the frequency of an input exceeds 110kHz, the primary display will show "————".

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4-7. Interface Operation

This instrument equips RS-232 as standard device with a D-SUB 9 PIN SHELL on the rear panel. Besides, the instrument also provides a GPIB option device with a 24 PIN SHELL in blue. The configuration is compliance with IEE488.

For further detailed operation, please refer to the Interface manual.

4-8. Input overload protection

The maximum allowable input is shown as table 4-1. Please proceed the measurement accordingly.

Table 4-1:

FUNCTION	RANGE	MAXIMUN INPUT
DCV	5V~1200V	1200Vdc or peak ac
ACV (AC+DC)	5V~1000V	1000V rms continuous & 10^7 V•Hz maximum
DCA,ACA(AC+DC)	500 μ A~2A	fuse protected: T2A 250V 1.5kA breaking capacity
DC,AC20A(AC+DC)	20A	fuse protected: F20A 600V 100kA breaking capacity
DC,ACmV (AC+DC)	500mV	450V dc or ac peak
OHM	all ranges	450V dc or ac peak
CAPACITANCE	all ranges	450V dc or ac peak
RIPPLE	all ranges	450V dc or ac peak



WARNING: To avoid shock hazard and/or instrument damage, do not apply input potentials that exceed the input overload limits shown in table 4-1.

4-9. Input connections to common



WARNING: To avoid shock hazard and/or instrument damage, do not connect the common input terminal to any source of more than 500 volts DC or peak AC above earth ground.

- **Figure 4-1 Front Panel**

- **Figure 4-2 Rear Panel**

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5. MEASUREMENT TUTORIAL

5-1. Voltage measurements (DCV, ACV, DCmV, ACmV)

1).Press the button to select desired function.

2).Press [▲]or[▼]to the desired range (if you have no idea about the value of input, we suggest you always start at the highest range). Press [AUTO/MAN] button for manual or auto-ranging selection.

3).Connect the test lead to the V and COM input terminals of the instrument.

4).Connect the test lead to the measuring points and read the displayed value.

NOTE: After measuring high voltage to 1000V dc, errors may occur when the 100μV is measured. Allow up to one minute prior to making low-level measurements

5-2. Current measurements (DCA, DC 20A, ACA, AC 20A)

1).Press the button to select function.

2).Press [▲]or[▼]to the desired range (if you have no idea about the value of input. we suggest you always start at the highest range).Press [AUTO/MAN] button to change manual or auto-ranging.

3).Connect the test lead to the 2A or 20A and COM input terminals of the instrument.

4).Connect the test lead to the measuring points and read the displayed value.

5-3. Resistance, capacitance, continuity beeper measurements

1). Press the button to select function.

2). Press [▲]or[▼]to the desired range. Press [AUTO/MAN] button to change manual or auto-ranging.

3). Connect the test lead to the Ω, ⊣← and COM input terminals of the instrument.

4). Connect the test lead to the measuring points and read the displayed value.

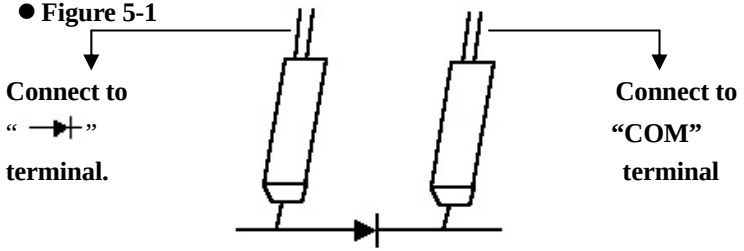
5-4. Diode test measurements

1). Press the button to select function.

2). Connect the test lead to the ⊣▶| and COM input terminals of the instrument.

3). Connect the test lead to the semiconductor junction (diode or transistor) as shown in Figure 5-1,and read the displayed value.

● **Figure 5-1**



5-5. dBm measurements

This function converts a voltage measurement into dBm. The function can be selected only when a voltage function (volts ac, volts dc, or volts ac+dc) is selected. Press [dBm] button, the secondary display shows the dBm value that reposed on the voltage value showed in the primary display.

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For example, if [dBm] is pressed when measuring voltage in the max mode, the maximum value is converted to dBm. To release the dBm function, press [dBm] again. The dBm mode, AC+Hz mode and Compare are not selected concurrently.

The reference impedance can be set to any of 21 reference impedances listed in the Table 5-1 according to the steps as follows:

1) Press [SHIFT] [SET] in sequence into SET mode.
2) Press [REF Ω] to reference impedance selection . The value displayed on the primary display is the current setting value.
3) Select the required impedance by using [▼] and [▲], then press [ENTER] to save the data, or press [SHIFT] to cancel the setting.

Table 5-1

8000	300	93
1200	250	75
1000	150	50
900	135	16
800	125	8
600	124	4
500	110	2

5-6. AC+Hz measurements

The function can be selected only when ac range is selected. Press [SHIFT], then press [AC+Hz], the secondary display shows the frequency of the input signal that is higher than the sensitivity. The frequency measurement does not depend on the max/min, rel, or hold mode. In this mode, the reading rate of the DMM may be slower than the normal state.

To release the AC+Hz function, press [AC+Hz] again. The dBm mode and AC+Hz mode and Compare are not selected concurrently.

5-7. AC+DC measurements

The function can be selected only when voltage or current function is selected. Press [AC+DC] button, the primary display shows the true rms value of the input signal including the ac component and dc component. In this mode, the reading rate of the DMM is slower than the normal state.

To release the AC+DC function, press other function (voltage ac or dc, current ac or dc, R,C, Continuity Beeper, Diode Test) key.

5-8. MAX/MIN measurements

The MAX/MIN mode causes the DMM to hold the lowest and highest readings. Press [MAX/MIN] button to the MAX mode. The highest will be displayed in continuous input. In the MAX mode, press [MAX/MIN] button to the MIN mode. The lowest will be displayed in continuous input. In the MIN mode, press [MAX/MIN] button to release the MAX/MIN mode.

5-9. REL measurements

When the [REL] button is pressed, the meter stores the present reading and displays subsequent measurements as the difference between the measured value and the stored reading.

In the MAX/MIN mode, set [REL] button to the REL mode. The maximum or minimum reading will become the relative base.

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5-10. HOLD and AUTO HOLD measurements

The HOLD mode can keep the measured value on the primary display. Press [HOLD] button, the last reading is held on the display in all function. To release the HOLD function, just press [HOLD] again.

The AUTOHOLD mode allows you to keep your eyes fixing on the probes when taking measurements in difficult or hazardous circumstances, then read the display when it is convenient and safe. Press [SHIFT][AUTOHOLD] in sequence into AUTOHOLD mode, every time when the value is more than the 8% of full scale, and with 200 counts of different value compared with the previous AUTOHOLD value, the data on the primary display will be updated. In the AUTO range mode, when the value is less than 10% full scale and more than 0.8% full scale, it will change range downward automatically. If want to release AUTOHOLD function, press [SHIFT] [AUTOHOLD] in sequence.

5-11. COMPARE MEASUREMENT

In Compare mode, can set the maximum and minimum value to compare with the current measured value. The secondary display will show “Hi” when the measured value is more than the maximum value, will show “Lo” when the measured value is less than minimum value, and will show “Pass” in other status. The functions of DCV(DCmV), ACV(ACmV, AC+DC), DCA(DC20A), ACA(AC20A), OHM, and Capacitance have their own maximum and minimum value setting separately according to the procedure as follows:

1) Select the required function and range, set maximum or minimum value by pressing [SHIFT][SET] and [HI] or [LO] in sequence. Now the panel is displaying the current setting value, if the setting value is more than 50000 counts, the panel will display 60000.
2) The flickering digits can be adjusted by pressing [▲] to set the value, and pressing [▼] to move the adjusted position. Also can adjust the plus and minus sign through [▲] and [▼].
3) When the setting is completed, press [ENTER] to save the setting, or press [SHIFT] to cancel the setting.

5-12. RIPPLE MEASUREMENT

The RIPPLE mode can monitor DC level and AC ripple of power supply. In DCV voltage function, set to RIPPLE mode by pressing [SHIFT][RIPPLE] in sequence, the primary display will show DCV value with the ranges of 5V, 50V, and 500V, the secondary display will show AC component of signal with the range of 500mVac, 100kHz frequency response. The function is easy to detect DC and AC components of signal simultaneously.

If want to leave the RIPPLE mode, just switch to other main function.

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6. MEASUREMENT TECHNIQUES

6-1. dBm measurement technique

dBm is defined as above or below a 1mW reference. A voltage measurement is converted to dBm using the following formula:

dBm=10*log $_{10}$(1000*voltage value^2/reference impedance.)

The reference impedance can be set.

For example, the reference impedance of 600Ω, 0.7746V will be convert to 0 dBm.

6-2. True rms measurement

The true rms (root-mean-square) value of a waveform is equivalent to dc value that causes the same amount of heat to be dissipated in a resistor.

Since average-responding meters have been in use for so long, you may have accumulated test or reference data based on them. Figure 6-1 illustrates the relationship between ac and dc components for common waveforms, and compares readings for true rms meters and average-responding meters. Figure 6-1 will help you convert between the two measurement methods.

- **Figure 6-1: Voltage Conversion**

AC-COUPLED INPUT WAVEFORM	PEAK VOLTAGES		METERED VOLTAGE			DC AND AC TOTAL RMS
			AC COMPONENT ONLY		DC COMPONENT ONLY	
	PK-PK	0-PK	*RMS CAL	AC TRUE RMS		**TRUE RMS= $\sqrt{ac^2 + dc^2}$
SINE	2.828	1.414	1.000	1.000	0.000	1.000
RECTIFIED SINE (FULL WAVE)	1.414	1.414	0.421	0.435	0.900	1.000
RECTIFIED SINE (HALF WAVE)	2.000	2.000	0.764	0.771	0.636	1.000
SQUARE	2.000	1.000	1.110	1.000	0.000	1.000
RECTIFIED SQUARE	1.414	1.414	0.785	0.707	0.707	1.000
RECTANGULAR PULSE D = X/Y $K = \sqrt{D \cdot D^2}$	2.000	2.000	2.22K	2K	2D	$2\sqrt{D}$
TRIANGLE SAWTOOTH	3.464	1.732	0.960	1.000	0.000	1.000

* RMS CAL IS THE DISPLAYED VALUE FOR AVERAGE RESPONDING METERS THAT ARE CALIBRATED TO DISPLAY RMS FOR SINE WAVES.
** Your Digital Multimeter.

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6-3. AC+DC measurement

A signal includes an ac component and a dc level. The relationship between the total rms value of the signal and the ac component and the dc component is:

$$\text{rms total} = \sqrt{(\text{ac component rms})^2 + (\text{dc component})^2}$$

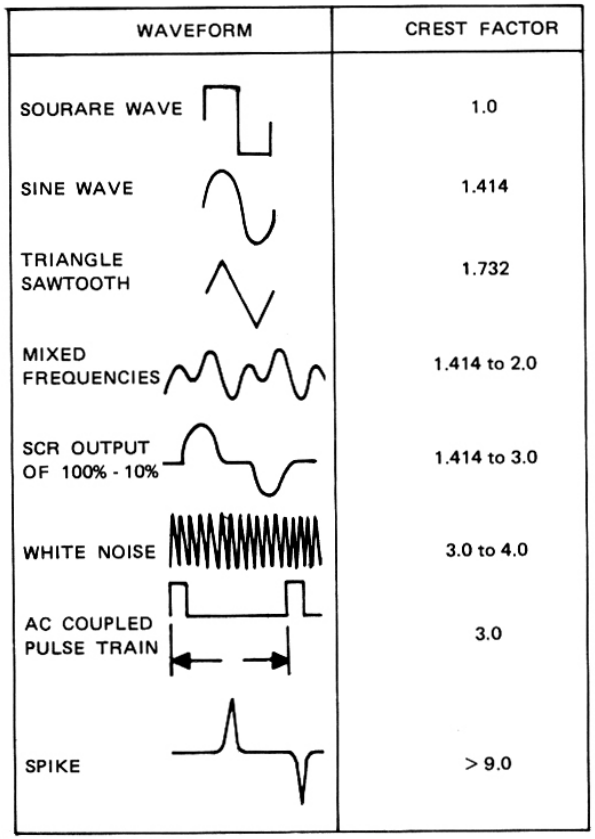
6-4. Crest factor

Crest factor is often overlooked in determining the accuracy of an ac measurement. Crest factor is defined as the ratio of the peak signal amplitude to the rms value of the signal.

If an input signal has a crest factor of 3.0 or less, voltage measurements will not be in error due to dynamic range limitations at full-scale.

The waveforms in Figure 6-2 show signals with increasing value of crest factor. As you can see from the series of waveforms, a signal with a crest factor above 3.0 is unusual.

- **Figure 6-2: Crest Factor**



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7. MAINTENANCE

The following instructions are executed by qualified personnel only. To avoid electrical shock, do not perform any servicing other than the operating instructions unless you are qualified to do so.

7-1. Line fuse replacement

If the fuse blows, the DMM would not work. Try to determine and correct the cause of the blown fuse, then replace the fuse with correct rating and type shown as below:

FUSE RATING AND TYPE	
100/120V	T0.16A 250V
220/230V	T0.08A 250V
F101 on PCB	T0.5A 250V

7-2. Current fuse replacement

The current fuse protects the 500μA~ 2A range from an input current greater 2A.To replace the current fuse, perform the following steps:

1). Turn off the power, disconnect the power line and remove the test leads.

2). Place the end of a flat blade screwdriver into the slot of the fuse holder on the front panel. Push and carefully rotate the fuse carrier turn counterclockwise till remove the fuse and the fuse carrier off the front panel.

3). Remove the defective fuse and replace the correct fuse (T2A 250V, 1.5kA breaking capacity).

Remark: There is a F20A fuse built inside the case located on F301, if any damage occurred on this fuse, please return to the manufacturer for repair.

7-3. Line voltage conversion

The primary winding of the power transformer is tapped to permit operation from 100/120V, or 220/230V AC 50/60Hz line voltage. Conversion from one line voltage to another is done by changing the line voltage selector switch as shown in Figure 4-2. The rear panel identifies the line voltage to which the unit was factory set. To convert to a different line voltage, perform the following procedure:

1). Make sure the power cord is unplugged.

2). Adjust the line voltage selector switch to the desired line voltage position.

3). A change in line voltage may also require a corresponding change of fuse value. Install the correct fuse value as listed on rear panel.

7-4. Cleaning

To keep the instrument clean, wipe the case with a damp cloth and detergent. Do not use abrasives or solvents.

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