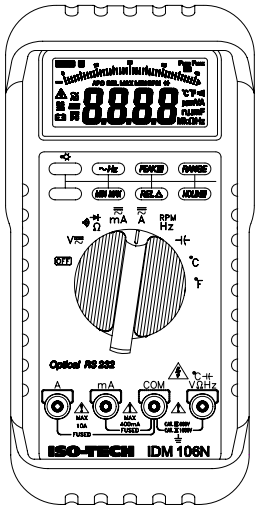
ISO-TECH

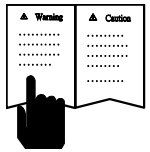
Instruction Manual
IDM 103N/105N/106N
Digital Multimeter

EN FR IT



ISO-TECH IDM 103N/105N/106N
DIGITAL MULTIMETER
INSTRUCTION MANUAL

Safety Alert Symbol : ⚠



READ and **UNDERSTAND** all ***safety alert symbols :*** ⚠ in this manual.
Failure to read and understand safety instructions can result in **INJURY** or **DEATH**

Limited Warranty

This meter is warranted to the original purchaser against defects in material and workmanship for 3 year from the date of purchase. During this warranty period RS Components will, at its option, replace or repair the defective unit, subject to verification of the defect or malfunction. This warranty does not cover fuses, disposable batteries, or damage from abuse, neglect, accident, unauthorized repair, alteration, contamination, or abnormal conditions of operation or handling.

Any implied warranties arising out of the sale of this product, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited to the above. RS Components shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses, or economic loss, or for any claim or claims for such damage, expense or economic loss. Some states or countries laws vary, so the above limitations or exclusions may not apply to you.

For full terms and conditions, refer to the current RS Catalogue.

Safety

"⚠Warning" and "⚠Caution" Alert Symbol Statement :

"⚠ Warning" Alert Symbol

A "**⚠Warning**" Statement identifies hazardous conditions and actions that could cause **BODILY HARM** or **DEATH.**

"⚠ Caution" Alert Symbol

A " **⚠Caution**" Statement: identifies conditions and actions that could **DAMAGE** the Meter or the equipment under test.

"⚠ Warnings" and "⚠ Cautions" :

⚠ Warnings

- When using test leads or probes, keep your fingers behind the finger guards.
- Remove test lead from Meter before opening the battery door or Meter case.

- Use the Meter only as specified in this manual or the protection by the Meter might be impaired.
- Always use proper terminals, switch position, and range for measurements.
- Never attempt a voltage measurement with the test lead inserted into the A input terminal.
- Verify the Meter's operation by measuring a known voltage. If in doubt, have the Meter serviced.
- Do not apply more than the rated voltage, as marked on Meter, between terminals or between any terminal and earth ground.
- Do not attempt a current measurement when the open voltage is above the fuse protection rating. Suspected open circuit voltage can be checked with voltage function.
- Only replace the blown fuse with the proper rating as specified in this manual.
- Use caution with voltages above 30 Vac rms, 42 Vac peak , or 60 Vdc. These voltages pose a shock hazard.
- To avoid false readings that can lead to electric shock and injury, replace battery as soon as low battery indicator ⊟ appears.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.
- Do not use Meter around explosive gas or vapor
- To reduce the risk of fire or electric shock do not expose this product to rain or moisture.

⚠ Cautions

- Disconnect the test leads from the test points before changing the position of the function rotary switch.
- Never connect a source of voltage with the function rotary switch in Ω/→+·))) /⎓ ~mA /⊣⊢/Hz position.
- Do not expose Meter to extremes in temperature or high humidity.
- Never set the meter in ⎓ ~mA function to measure the voltage of a power supply circuit in equipment that could result in damage the meter and the equipment under test.

Symbols as Marked on The Meter :

~ : AC (Alternating Current)

⎓ : DC (Direct Current)

⚠ : Caution, **Risk of Electric shock.** To alert you to the presence of a potentially hazardous voltage.

⚠ : Caution, **Risk of Danger.** Refer to ⚠Warnings and ⚠ Cautions in the manual.

⧈ : **Double Insulation** protection against electric shock.

CE : Conforms to **European** Union directives.

Symbols and Terms in The Manual

Symbols :

⚠ **: Caution, Risk of Danger.**
⚠ **Warning :** To identifies hazardous conditions and actions that could cause **BODILY HARM** or **DEATH**
⚠ **Caution :** To identifies conditions and actions that could **DAMAGE** the meter or equipment under test.

⏛ **:** Fuse.

Terms :

CAT Level **:** Over Voltage Category Level, indicates measurement can be performed at which measuring circuit level. The different level measuring circuit has different high transient stresses voltage.

PER IEC 1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY Ⅰ
Equipment of **OVERVOLTAGE CATEGORY Ⅰ** is equipment for connection to circuits in which measures are taken to limit the transient overvoltage to an appropriate low level. Note-examples include protected electronic circuits.

OVERVOLTAGE CATEGORY Ⅱ
Equipment of **OVERVOLTAGE CATEGORY Ⅱ** is energy consuming equipment to be supplied from this fixed installation.

OVERVOLTAGE CATEGORY Ⅲ
Equipment of **OVERVOLTAGE CATEGORY Ⅲ** is equipment in fixed installations. Note-Examples include switches in this fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY Ⅳ
Equipment of **OVERVOLTAGE CATRGORY Ⅳ** is for use at the origin of the installations Note-Examples include electricity meters and primary over-current protection equipment.

PER IEC1010 Pollution degree
POLLUTION
Addition of foreign matter, solid, liquid or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity.

POLLUTION degree
For the purpose of evaluating spacing of this product, the following degrees of POLLUTION in the microenvironment are defined.

POLLUTION DEGREE 1
No POLLUTION or only dry, non-conductive POLLUTION occurs. The POLLUTION has no influence.

POLLUTION DEGREE 2
Normally POLLUTION only non-conductive POLLUTION occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.

POLLUTION DEGREE 3
Conductive POLLUTION occurs, or dry, non-conductive POLLUTION occurs which becomes conductive due to condensation, which is expected.

NOTE : In such conditions equipment is *normally protected against exposure to direct sunlight, precipitation, and full wind pressure,* but neither temperature nor humidity is controlled.

Safety Compliance And Certification

Safety compliance

The Meter conform to CENELEC **LVD (Low-Voltage rective)** 73/23/EEC and EMC **(Electromagnetic Compatibility directive)** 89/336/EEC

The Meter meet the requirements to IEC 61010-1 (2001) , EN 61010-1 (2001), UL 3111-1 (Jan.1994)
CSA C22.2 NO.1010-1-92 +A2: Feb. 1997

Safety Certification : CE

Introduction

Unpacking and Inspection

Upon removing your new Digital Multimeter from its packing, you should have the following items.

1. Digital Multimeter.
2. Test lead set (one black, on red)
3. User Manual.
4. Protective holster.

Environmental Conditions

This product is safe at least under the following conditions**:**

1. Indoor Use.
2. Altitude up to 2000 Meter.
3. Operating Temperature and Relative Humidity **:**

   Non-condensing ≦10°C ,11°C ~ 30°C (≦80% R.H)

   31°C ~ 40°C (≦75% R.H), 41°C ~ 50°C (≦45% R.H),
4. Storage Temperature and Relative Humidity **:** -20°C ~ 60°C (0 ~ 80% R.H) when battery removed from Meter.
5. Pollution degree 2
6. Installation category **:**
   The standard 100 series models meet the requirements for double insulation to IEC 61010-(2001), EN61010 (2001), UL3111-1(6.1994), CSA C22.2 NO.1010-1-92 to terminals**:**

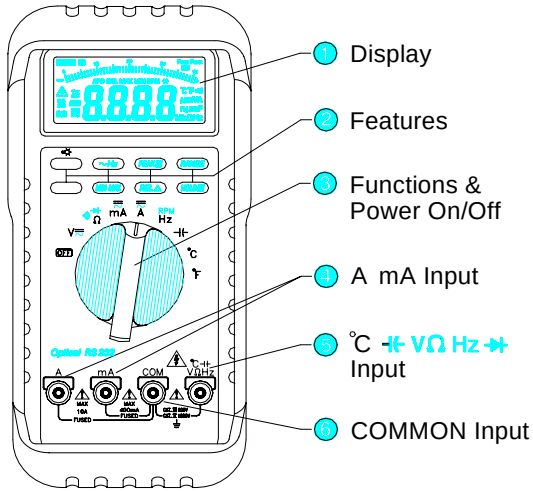
   V/Ω : Cat. Ⅱ 1000V, Cat. Ⅲ 600V

   mA /A : Cat. Ⅱ 600V, Cat. Ⅲ 300V

The Meter Description

Front Panel Illustration

1. 4000 counts LCD display.
2. Push-buttons for features.
3. Rotary switch to turn the Power On or Off and to select a function.
4. Input Terminal for A current function
5. Input Terminal for all functions EXCEPT current (A) functions
6. Common (Ground reference) Input Terminal for all functions.



Making Basic Measurements

Preparation and Caution Before Measurement

⚠ : **Observe the rules** of

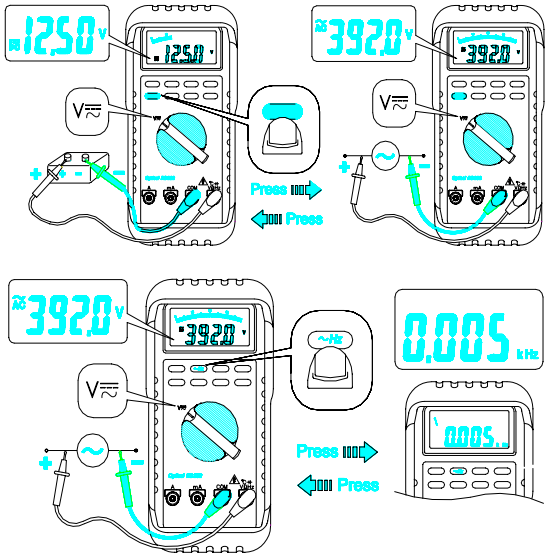
⚠ *Warnings* and ⚠ *Cautions*.

When connecting the test leads to the **DUT** (**D**evice **U**nder **T**est) ***connect the common (COM) test lead before connecting the live lead ; when removing the test leads removing the test live lead before removing the common test lead.***
The figures on the following pages show how to make basic measurements.

TEST EQUIPMENT RISK ASSESSMENT (UK RECOMMENDATION)

Users of this equipment and/or their employers are reminded that Health and Safety Legislation require them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as from inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 "Electrical Test Equipment for use by Electricians" should be used.

Measuring AC/DC Voltage And Frequency

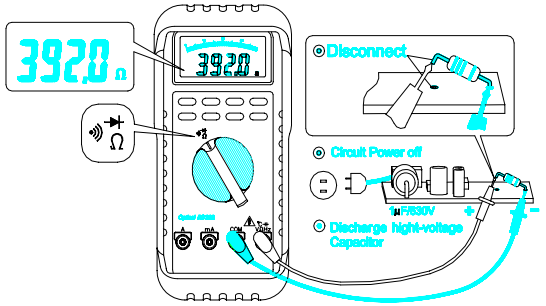


Note – When measuring voltage, the Meter acts like a 10MΩ impedance in parallel with the circuit under test. This loading effect of the 10MΩ of the Meter can cause measurement errors, ***loading efffect error***, Especially in high impedance circuits.
For example : A 1.1M impedance circuit will cause a –10% measuring error. The ***error percentage of the loading effect*** of the Meter is expressed as following :

$$100 \times \frac{-Z_{circuit}}{Z_{circuit} + 10M\Omega} \%$$

The non-zero display reading is normal when the meter test leads are open, which will not affect actural measurement accuracy. The Meter will show zero or close to reading when the test leads are shorted. In reading AC voltage or current, reading-settling time increases to several seconds at the low end of AC voltage and current ranges in rms models.

Measuring Resistance



Caution

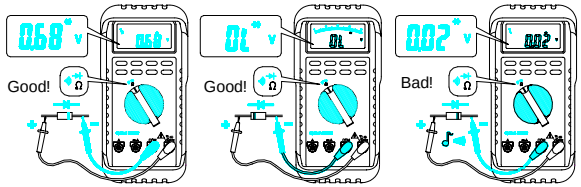
To avoid possible damage to the Meter or to the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before measuring resistance.

Note – The Meter provides a open voltage ≦–1.5V to the circuit under test that cause the diode, transistor junction to conduct so *it is batter to disconnect the resistance from the circuit to get a correct measurement.*

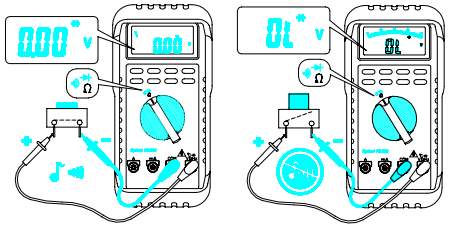
The resistance of test leads is about 0.1Ω ~ 0.2Ω. To test the leads resistance, touch the probe tips together. For accuracy measurement in low resistance use the relative features to zero the test leads resistance.

Testing for Diode and Continuity

Diode :



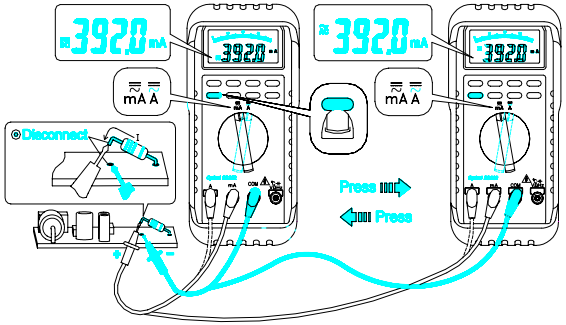
Continuity :



For in-circuit test, turns circuit power off and Discharge the high-voltage capacitors through an appropriate resistance load.

Note – Use the diode test to check the semiconductor junction is good or bad. The Meter sends a current through the semiconductor junction to measures the voltage drop across the junction. A good junction drops between 0.4 V to 0.9 V.

Measuring DC mA, AC mA, DC A, AC A Current And Frequency



Warning

Never attempt an in–circuit measurement where The open–circuit potential to earth potential is great than 500V, or example a 3-phase system measurement, you may damage the Meter or to be injured.

⚠ Caution

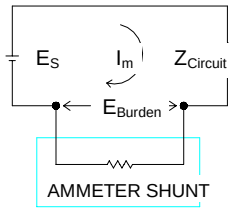
To avoid possible damage to the Meter or to the equipment under test, check the Meter's fuses before measuring current. *Use the proper terminals, function, and range for your measurement.*

Never place the probes across (in parallel with) any circuit or component when the leads are plugged into the current terminals.

When measuring current, the Meter acts like a impedance such as 5Ω at AC/DC mA (0.005Ω at DC / AC A) in series with the circuit.

This loading effect of the Meter can cause measurement errors, ***loading effect error***, especially in low impedance circuits.

For example : To measure a 5Ω impedance circuit at DC / AC mA range will cause a –50% measuring error. The ***error percentage of the loading effect*** of the Meter is expressed as following :

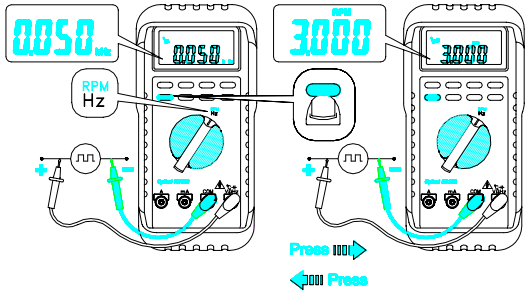


$$100 \times \frac{-5\Omega}{Zcircuit + 5\Omega} \%$$

or

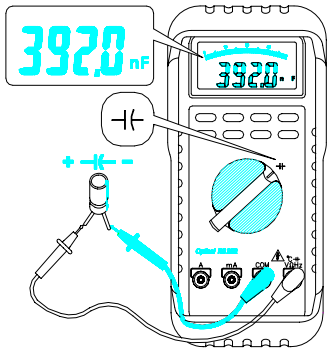
$$100 \times \frac{-E_{Burden}}{E_S} \%$$

Measuring Hz / RPM



Note – Connect the red test lead to the "⏚ VΩHz " terminal and the other (black) test lead to the "COM" terminal.
Set the rotary function selector to "Hz RPM" position to measure the frequency or RPM with the blue switch.
Connect the test leads to the circuit to be measured.

Measuring Capacitance



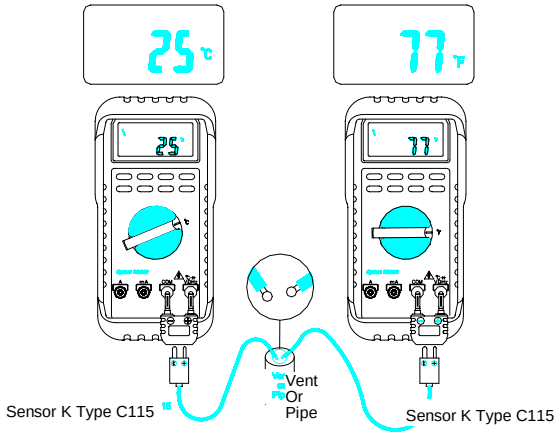
Caution

To avoid possible damage to the meter or to the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance. Use the DC voltage function to confirm that the capacitor discharged.

Note– To improve the measurement accuracy of small value capacitor, memory the reading with the test leads open than substracts the residual capacitance of the Meter and leads from measurement.

$$C_{UNKNOWN} = C_{MEASUREMENT} - C_{RESIDUAL}$$

Measuring Temperature (Model 106 only)



Caution

Do not Connect senor K Type C115 (Bead probe) to live Circuits.

Features

Feature Description

The Meter has Features :

Display Hold – To freezes the display.

Min Max Hold – To record the Max or Min reading of the display.

Peak H – To record the Max or Min reading of the display.

REL △ – Press the REL Key to zero the display, and store the displayed reading as a reference value.

∼ HZ – If "∼HZ" switch is pushed in voltage or current measurement mode, the meter enters frequency counter mode with automatic range selection. Therefore, pressing "RANGE" switch in ∼HZ mode does not change the frequency range. However, "RANGE" switch changes the sensitivity of frequency detection. If the input signal has a small amplitude, the user shall increase the sensitivity.

Range – To select the manual ranging mode. The default mode is Automatic Range.

RS232 – An optical isolated interface output for data communcation.

Backligh – LCD display backlight.

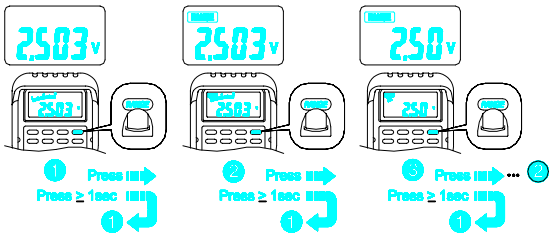
APO (Auto Power Off) (Battery Sever) –
The Meter automatically enters "Sleep Mode" and blanks the display if the Meter is not used for 30 minutes. Press any of the feature buttons and change the rotary switch position will reset the time of APO. When RS232 output is active the APO is disabled.

Features Available vs Functions

	ACV DCV	⊣◁))	Ω	DCmA ACmA	DCA ACA	⊣⊢	Hz	RPM	°C °F
Light Key	O	O	O	O	O	O	O	O	O
~ Hz	O	X	X	O	O	X	X	X	X
PEAK ⎓	O	X	X	O	O	X	X	X	X
RANGE	O	X	O	O	O	O	O	O	X
Blue Key	O	O	O	O	O	O	O	O	X
MIN Max	O	O	O	O	O	O	O	O	O
REL △	O	O	O	O	O	O	O	O	O
HOLD ⎓	O	O	O	O	O	O	O	O	O

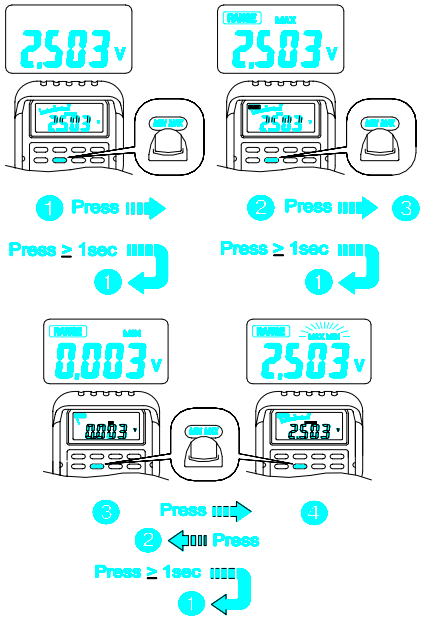
Using The Features

Manual Ranging and Auto Ranging



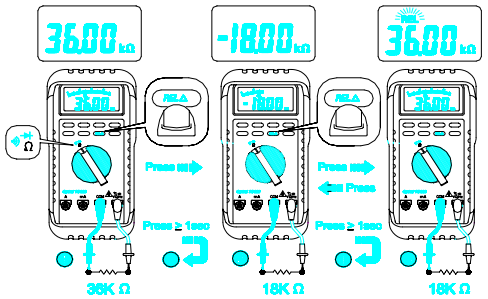
Note - The Range button is pressed to select manual ranging and to change ranges. When the Range button is pressed once, the RANGE indicator turns off. Press Range button to select the appropriate range for measurement you want to make. Press Range button and hold for 1 seconds to return to autorange.

MIN MAX Record

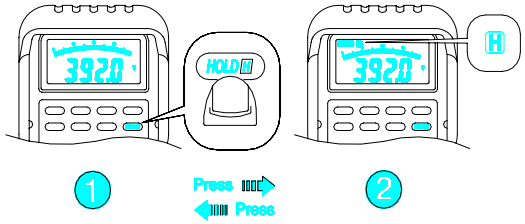


Note – Press ***HOLD*** button in ***MIN MAX*** mode makes the Meter stop updating the maximum and minimum value. When display ***Hold*** mode is nested in ***MIN MAX*** mode, to release ***MIN MAX*** mode is needed to release display hold first.

REL △

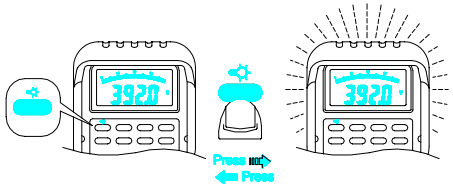


Display Hold



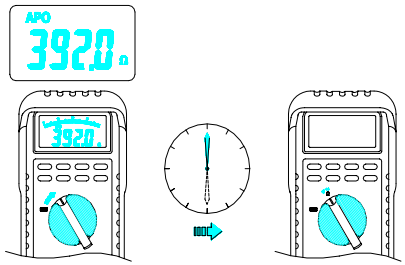
Note – Press the ***Hold*** button to toggle in and out of the display Hold mode. The ***MAX / MIN*** feature is unavailable when display Hold is active.

Backlight



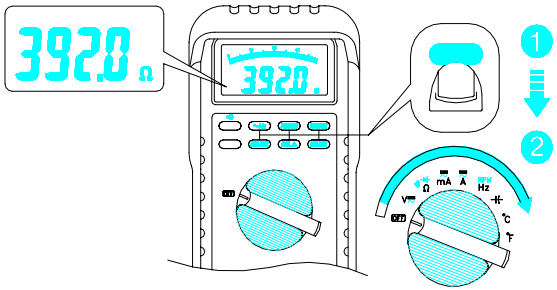
Note – Press the ***Backlight Button*** ☼ to toggle in and out the display backlight.

Auto Power Off (Battery Saver)



Note – If the Meter idles for more than 30 minutes, the Meter automatically turns the power off. When this happens, the LCD displaying-state of the Meter is saved, the Meter can be turns back on by pushing any buttons, the LCD display the saved state when auto power off itself, pushing ***Hold*** button to disable the hold state. Any button press or rotary change reset the time of Auto-Power-OFF.

Disable Auto Power Off



Maintenance

⚠ Caution

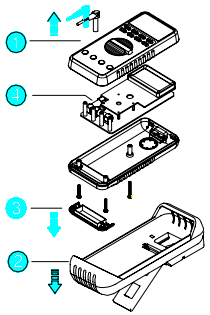
- ***Do not attempt to repair this meter. It contains no user-serviceable parts. Repair or servicing should only be performed by qualified personal.***
- ***Failure to observe this precaution can result in injury and can damage the meter.***

Cleaning and storage

Periodically wipe the housing with a damp cloth and mild detegent. Dirt or moisture in the terminals can effect readings. If the Meter doesn't be used for long period more than 60 days, ***remove the battery and store it separately.***

Fuse Replacement

Refer to Figure xx to replace fuse :

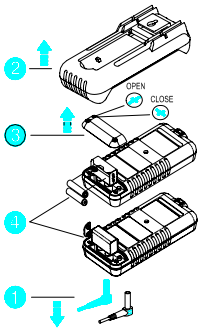


⚠ Caution

- Use Two fuses with the amperage, interrupt, voltage, and speed rating specified.
- Fuse rating : 1A, 600V, Fast.
  Fuse rating : 15A, 600V, Fast.

Battery Replacement

Refer to Figure xx to replace the battery :



⚠ Caution

- Replace the battery as soon as the low battery indicator "🔋" appears to avoid false reading.
- 103N/105 : Battery 1.5V x 2
  106 : Battery 9V

Trouble Shooting

Do not attempt to repair your Meter unless you are qualified to do so and have the relevant calibration, performance test and service information.

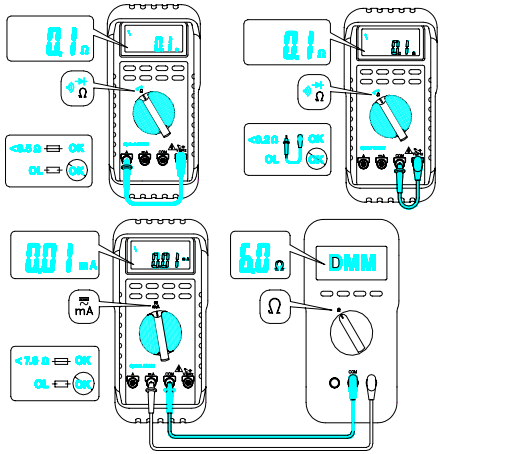
Basicc Trouble Shooting

If the Meter fails, fist check the battery, the loose of battery and battery snap, fuse, test leads, replace as necessary. Review this manual to make sure that you are operating the Meter correctly.

Testing the Fuse and Test Leads

Testing the current fuse and test leads as shown below.

Testing the Fuse ***Testing the Test Leads***



Specification

General Specifications

Display : The Liquid Crystal Display (LCD) with a maximum reading of 4000 and 82 segments bar graph.

Polarity Indication : Automatic, positive implied, negative indicated.

Overrange Indication : "OL" or "-OL"

Low Battery Indication : " " is displayed when the battery voltage drops below operating voltage.

Sampling : 2 times/sec for digit. 12 times/sec for analog bargraph.

Auto Power Off : Approx 30 minutes.

Operating Ambient :
Non-condensing ≦10°C,11°C ~ 30°C (≦80% R.H)
31°C ~ 40°C (≦75% R.H), 41°C ~ 50°C (≦45% R.H),

Storage Temperature : -20ºC to 60ºC , 0 to 80% R.H. when battery removed from Meter.

Temperature Coefficient :
0.15 x (Spec.Acc'y) / ºC , <18ºC or > 28ºC .

Power Requirements :
Alkaline 1.5V x 2 batteries (for 103N/105N)
Alkaline 9V battery (for 106)

Battery Life :
Alkaline 500 hours. (for 103N/105N)
Alkaline 300 hours. (for 106)

Dimensions (W x H x D) :
90mm x 200mm x 42mm , without holster.
100mm x 212mm x 55mm , with holster.

Accessories : Protective Holster, Battery (installed), Test leads and User manual.

Electrical Specifications

Accuracy is ± (% reading + number of digits) at 23ºC ± 5ºC , less than 80% R.H.

(1) DC Volts

Range	Accuracy	
	103N	105N/106
400.0mV	±(0.3% + 2dgt)	±(0.3% + 2dgt)
4.000V	±(0.4% + 2dgt)	±(0.1% + 2dgt)
40.00V	±(0.25% + 2dgt)	
400.0V		
1000V		

(2) AC Volts

Range	Accuracy	
	103N	105N/106
400.0mV	±(2.0% + 8dgt)*	±(2.0% + 8dgt)*
4.000V	±(1.3% + 5dgt)**	***
40.00V	±(1.5% + 5dgt) 40Hz to 60Hz ±(1.3% + 5dgt) 61Hz to 1KHz	±(1.5% + 5dgt) 40Hz to 60Hz ±(1.0% + 5dgt) 61Hz to 1KHz
400.0V		
750V		

Over voltage protection : 1000V rms

Input Impedance : 10MΩ // less than 100pF.

CMRR / NMRR : (Common Mode Rejection Ratio)
(Normal Mode Rejection Ratio)

V_{AC} : CMRR > 60dB at DC, 50Hz / 60Hz
V_{DC} : CMRR > 100dB at DC, 50Hz / 60Hz
NMRR > 50dB at DC, 50Hz / 60Hz

AC Conversion Type :
103N / 105N : Average sensing rms indication.
106 : AC conversions are ac-coupled, true rms responding, calibrated to the rms value sine wave input.
The specified accuracy is for since wave at full scale and non-sine wave at half scale below 500Hz with crest factor up to 2.
AC conversions are average sensing , calibrated to the rms value sine wave input.

*** Frequency Response :** 50Hz ~ 60Hz.
**** Frequency Response :** 40Hz ~ 300Hz.
***** Frequency Response :** 40Hz ~ 500Hz for 4V range.

(3) DC Current

Range	Accuracy		Voltage Burden
	103N	105N/106	
40.00mA	±(0.6% + 2dgt)	±(0.4% + 2dgt)	300mV max
400.0mA	±(0.7% + 2dgt)	±(0.5% + 2dgt)	3V max
10.00A	±(1.2% + 3dgt)	±(1.0% + 3dgt)	3V max

(4) AC Current

Range	Accuracy		Voltage Burden
	103N	105N/106	
40.00mA	±(1.5% + 5dgt)*	±(1.5% + 5dgt)*	300mV max
400.0mA			3V max
10.00A	±(2.5% + 5dgt)	±(2.0% + 5dgt)	3V max

Frequency Response : 40Hz ~ 1KHz.

AC Conversion Type :

103N / 105N : Average sensing rms indication.

106 : AC conversions are ac-coupled, true rms responding, calibrated to the rms value sine wave input.
The specified accuracy is for since wave at full scale and non-sine wave at half scale below 500Hz with crest factor up to 2.
AC conversions are average sensing, calibrated to the rms value sine wave input.

Overload Protection :

1A , 600V IR 10KA fuse (Bussmann BBS-1 or equivalent) for mA input. (Size 10.3mm x 34.9mm)
15A , 600V IR 100KA fuse (Bussman KTK 15 or equivalent) for A input. (Size 10.3mm x 38.1mm)

(5) Resistance

Range	Accuracy	
	103N	105N/106
400.0Ω	±(0.7% + 3dgt)	±(0.7% + 3dgt)
4.000KΩ	±(0.6% + 3dgt)	±(0.4% + 2dgt)
40.00KΩ		
400.0KΩ		
4.000MΩ	±(0.7% + 3dgt)	±(0.6% + 3dgt)
40.00MΩ	±(1.5% + 5dgt)	±(1.5% + 5dgt)

Open circuit Voltage : -1.3V approx.

(6) Diode Check and Continuity

Range	Resolution	Accuracy
⏩	1 mV	±(1.5% + 5 dgt)*

* For 0.4V ~ 0.8V

Max.Test Current : 1.5mA

Max. Open Circuit Voltage : 3V

Overload Protection : 600V rms.

Continuity : The internal sounder operates when resistance is less than 30Ω approximately.

(7) Frequency / RPM

Range	Sensitivity	Accuracy
4.000KHz / 40.00KRPM	150mV rms ≧ 20Hz 1.5V rms ≦ 20Hz	Frequency : ±(0.01% + 1dgt)
40.00KHz / 400.0KRPM		
400.0KHz / 4.000KRPM		
4.000MHz / 40.00MRPM	300mV rms	RPM : ±(0.01% + 10dgt)
40.00MHz / 400.0MRPM	1V rms	
400.0MHz / 4.000MRPM	**	

Overload Protection : 600V rms.

***** For 105N / 106 only.
** The spec is not guaranty.

(8) Capacitance

Range	Accuracy	Overload Protection
4.000nF	±(3.0% + 10 dgt)	600V rms
40.00nF	±(2.0% + 8 dgt)	
400.0nF		
4.000µF		
40.00µF		
400.0µF		
4.000mF *	±(5.0% + 20 dgt) **	
40.00mF *		

* In these two ranges the reading maybe rolling within specification.
** specify reading <half of full scale range.

(9) Temperature (ºC) for 106 only

Temperature	Accuracy	Overload Protection
-20°C ~ 0°C	±(2% + 4°C)	600V rms
1°C ~ 100°C	±(1% + 3°C)	
101°C ~ 500°C	±(2% + 3°C)	
501°C ~ 800°C	±(3% + 2°C)	

(10) Temperature (°F) for 106 only

Temperature	Accuracy	Overload Protection
-4°F ~ 32°F	±(2% + 8°F)	600V rms
33°F ~ 212°F	±(1% + 6°F)	
213°F ~ 932°F	±(2% + 6°F)	
933°F ~ 1472°F	±(3% + 4°F)	

(11) PEAK HOLD

Function	Range	Accuracy
DCV	400mV	Unspecified
	4V	±(1.5% + 300dgt) 2*
	40V	±(1.5% + 60dgt)
	400V	
	1000V	
ACV	400mV	Unspecified
	4V	±(1.5% + 300dgt) 2*
	40V	±(1.5% + 60dgt)
	400V	
	750V	
DCA / ACA	40mA 3*	±(3.0% + 60dgt)
	400mA 3*	
	10A 3*	±(1.5% + 60dgt)

Note : 1. With zero calibrated before measurement.
2* 4V range specifies readings above 10% of full scale of range.
3* Amp ranges specify reading <90% of full scale of range.
4. In the noise generating field, may affect intervals.

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