FLUKE®

110 PLUS and 115

True-rms Multimeters

Users Manual

PN 4750658
December 2015

LIMITED WARRANTY AND LIMITATION OF LIABILITY

This Fluke product will be free from defects in material and workmanship for three years from the date of purchase. This warranty does not cover fuses, disposable batteries, or damage from accident, neglect, misuse, alteration, contamination, or abnormal conditions of operation or handling. Resellers are not authorized to extend any other warranty on Fluke's behalf. To obtain service during the warranty period, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that Service Center with a description of the problem.

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Table of Contents

True-rms Multimeters

Introduction

The Fluke **110 PLUS** and **115** are battery-powered, true-rms multimeters (hereafter "the Meter" or the "Product") with a 6000-count display and a bar graph. This manual applies to all models. All figures show the 115.

Contacting Fluke

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Or, visit Fluke's website at www.fluke.com.

To register your product, visit http://register.fluke.com.

To view, print, or download the latest manual supplement, visit http://us.fluke.com/usen/support/manuals.

Unsafe Voltage

The hazardous voltage warning (ϟ) shows on the display when the Meter detects a voltage ≥30 V or a voltage overload (OL) condition. When making frequency measurements >1 kHz, the ϟ symbol is unspecified.

Test Lead Alert

⚠⚠ Warning

Personal injury or damage to the Meter can occur if you attempt to make a measurement with a lead in an incorrect terminal.

To remind you to check that the test leads are in the correct terminals, LEAd is briefly displayed and an audible beep sounds when you move the rotary switch to or from any **A** (Amps) position.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Read all safety information before you use the Product.**
- **Carefully read all instructions.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Use the correct terminals, function, and range for measurements.**
- **Do not touch voltages > 30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**

- **Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.**
- **Remove all probes, test leads, and accessories that are not necessary for the measurement.**
- **Do not use in CAT III or CAT IV environments without the protective cap installed on test probe. The protective cap decreases the exposed probe metal to <4 mm. This decreases the possibility of arc flash from short circuits.**
- **Do not work alone.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Replace the batteries when the low battery indicator shows to prevent incorrect measurements.**
- **Remove the batteries if the Product is not used for an extended period of time, or if stored in temperatures above 50 °C. If the batteries are not removed, battery leakage can damage the Product.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**
- **The battery door must be closed and locked before you operate the Product.**
- **Do not use the Product if it operates incorrectly.**
- **Disable the Product if it is damaged.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**

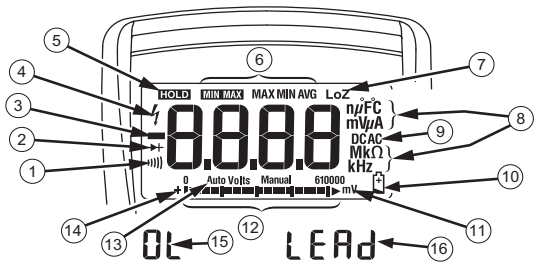
⚠ Caution

Do not use the Auto Volts function to measure voltages in circuits that could be damaged by this function's low input impedance (≈3 kΩ) (110 PLUS only).

Symbols

⚠	WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.	⚠	WARNING - RISK OF DANGER. Consult user documentation.
~	AC (Alternating Current)	⏤	Fuse
⎓	DC (Direct Current)	⧈	Double Insulated
🔋	Battery (Low battery when shown on the display.)	⏚	Earth
CE	Conforms to European Union directives.	≂	Both direct and alternating current
	Conforms to relevant South Korean EMC Standards.		
CAT II	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.		
CAT III	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
CAT IV	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		
	This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste.		

Display



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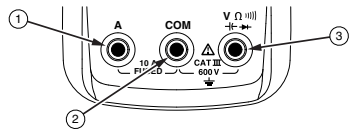
No.	Symbol	Meaning	Model
①		The Meter function is set to Continuity.	110 PLUS, 115
②		The Meter function is set to Diode Test	115
③		Input is a negative value.	110 PLUS, 115
④		⚠ Hazardous voltage. Measured input voltage ≥30 V, or voltage overload condition (OL).	110 PLUS, 115
⑤	HOLD	Display hold enabled. Display freezes present reading.	110 PLUS, 115

⑥	**MIN MAX** **MAX MIN AVG**	MIN MAX AVG mode enabled. Maximum, minimum, average or present reading displayed	110 PLUS, 115
⑦	**LoZ**	The Meter is measuring voltage or capacitance with a low input impedance.	110 PLUS, 115
⑧	**nµF mVµA** **MkΩ kHz**	Measurement units.	110 PLUS, 115
⑨	**DC AC**	Direct current or alternating current	115
⑩		Battery low warning.	110 PLUS, 115
⑪	**610000 mV**	Indicates the Meter's range selection.	110 PLUS, 115
⑫	**(Bar graph)**	Analog display.	110 PLUS, 115
⑬	**Auto Volts** **Auto** **Manual**	The Meter is in the Auto Volts function. Autoranging. The Meter selects the range for best resolution. Manual ranging. User sets the Meter's range.	110 PLUS 110 PLUS, 115 110 PLUS, 115
⑭	**+**	Bar graph polarity	110 PLUS, 115
⑮	**OL**	⚠ The input is too large for the selected range.	110 PLUS, 115
⑯	**LEAd**	⚠ Test lead alert. Briefly displayed whenever the Meter's function switch is rotated to or from any A position.	115

Terminals



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No.	Description	Model
①	Input terminal for measuring ac and dc current to 10 A.	115
②	Common (return) terminal for all measurements.	110 PLUS, 115
③	Input terminal for measuring voltage, continuity, resistance, capacitance, frequency and testing diodes.	110 PLUS, 115

Error Messages	
bAtt	Battery must be replaced before the Meter will operate.
CAL Err	Calibration required. Meter calibration is required before the Meter will operate.
EEPr Err	Internal error. The Meter must be repaired before it will operate.
F II- Err	Internal error. The Meter must be repaired before it will operate.

Rotary Switch Positions

Switch Position	Measurement Function	Model
AUTO-V LoZ	Automatically selects ac or dc volts based on the sensed input with a low impedance input.	110 PLUS
~ V Hz	AC voltage from 0.06 to 600 V.	110 PLUS, 115
Hz (button)	Frequency from 5 Hz to 50 kHz.	115
⎓ V	DC voltage from 0.001 V to 600 V.	110 PLUS, 115
~ mV ⎓	AC voltage from 6.0 to 600 mV, dc-coupled. DC voltage from 0.1 to 600 mV.	110 PLUS, 115
Ω	Ohms from 0.1 Ω to 40 MΩ.	110 PLUS, 115
)))	Continuity beeper turns on at <20 Ω and turns off at >250 Ω.	110 PLUS, 115
⏩	Diode Test. Displays OL above 2.0 V.	115
⊣⊢	Farads from 1 nF to 9999 µF.	115
~ A Hz **Hz (button)**	AC current from 0.1 A to 10 A (>10 to 20 A, 30 seconds on, 10 minutes off). >10.00 A display flashes. >20 A, **OL** is displayed. DC-coupled. Frequency from 45 Hz to 5 kHz.	115
⎓ A	DC current from 0.001 A to 10 A (>10 to 20 A, 30 seconds on, 10 minutes off). >10.00 A display flashes. >20 A, **OL** is displayed.	115
Note: All ac functions and Auto-V LoZ are true-rms. AC voltage is ac-coupled. Auto-V LoZ, AC mV and AC amps are dc-coupled.		

Battery Saver™ (Sleep Mode)

The Meter automatically enters "Sleep mode" and blanks the display if there is no function change, range change, or button press for 20 minutes. Pressing any button or turning the rotary switch awakens the Meter. To disable the Sleep mode, hold down the [ ] button while turning the Meter on. The Sleep mode is always disabled in the MIN MAX AVG mode.

MIN MAX AVG Recording Mode

The MIN MAX AVG recording mode captures the minimum and maximum input values (ignoring overloads), and calculates a running average of all readings. When a new high or low is detected, the Meter beeps.

- Put the Meter in the desired measurement function and range.
- Press [MIN MAX] to enter MIN MAX AVG mode.
- **MIN MAX** and MAX are displayed and the highest reading detected since entering MIN MAX AVG is displayed.
- Press [MIN MAX] to step through the low (MIN), average (AVG), and present readings.
- To pause MIN MAX AVG recording without erasing stored values, press [HOLD]. **HOLD** is displayed.
- To resume MIN MAX AVG recording, press [HOLD] again.
- To exit and erase stored readings, press [MIN MAX] for at least one second or turn the rotary switch.

Display HOLD

⚠⚠ Warning

To avoid electric shock, when Display HOLD is activated, be aware that the display will not change when you apply a different voltage.

In the Display HOLD mode, the Meter freezes the display.

1. Press [HOLD] to activate Display HOLD. (**HOLD** is displayed.)
2. To exit and return to normal operation, press [HOLD] or turn the rotary switch.

Backlight

Press ☼ to toggle the backlight on and off. The backlight automatically turns off after 40 seconds. To disable backlight auto-off, hold down ☼ while turning the Meter on.

Manual and Autoranging

The Meter has both Manual and Autorange modes.

- In the Autorange mode, the Meter selects the range with the best resolution.
- In the Manual Range mode, you override Autorange and select the range yourself.

When you turn the Meter on, it defaults to Autorange and **Auto** is displayed.

1. To enter the Manual Range mode, press RANGE . **Manual** is displayed.
2. In the Manual Range mode, press RANGE to increment the range. After the highest range, the Meter wraps to the lowest range.

   Note

   You cannot manually change the range in the MIN MAX AVG or Display HOLD modes.

   If you press RANGE while in MIN MAX AVG or Display Hold, the Meter beeps twice, indicating an invalid operation and the range does not change.
3. To exit Manual Range, press RANGE for at least 1 second or turn the rotary switch. The Meter returns to Autorange and **Auto** is displayed.

Power-Up Options

To select a Power-Up Option, hold down the button indicated in the following table while turning the Meter on. Power-Up Options are canceled when you turn the Meter off and when sleep mode is activated.

Button	Power-Up Options
HOLD	Turns on all display segments.
MIN MAX	Disables beeper. bEEP is displayed when enabled.
RANGE	Enables low impedance capacitance measurements. LCAP is displayed when enabled. See page 14.
▭	Disables automatic power-down ("Sleep mode"). PoFF is displayed when enabled.
☼	Disables auto backlight off. LoFF is displayed when enabled.

Making Basic Measurements

The figures on the following pages show how to make basic measurements.

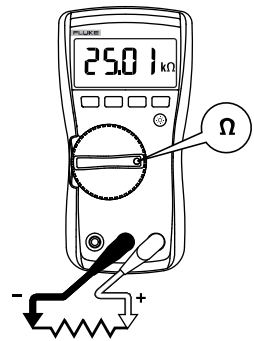
⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury:

- **Disconnect power and discharge all high-voltage capacitors before you measure resistance, continuity, capacitance, or a diode junction.**
- **Remove circuit power before you connect the Product in the circuit when you measure current. Connect the Product in series with the circuit.**
- **Do not use the HOLD function to measure unknown potentials. When HOLD is turned on, the display does not change when a different potential is measured.**

When connecting the test leads to the circuit or device, connect the common (**COM**) test lead before connecting the live lead; when removing the test leads, remove the live lead before removing the common test lead.

Measuring Resistance



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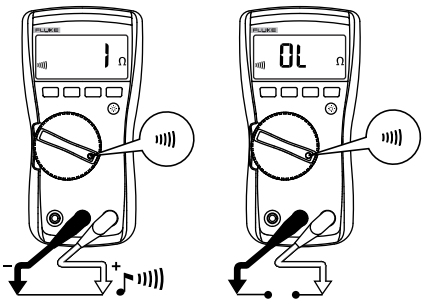
⚠⚠ Warning

To avoid electric shock, injury, or damage to the Meter, disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.

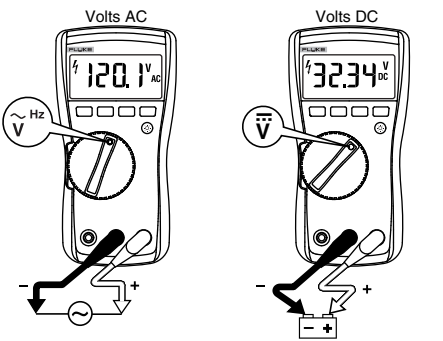
Testing for Continuity



Note

The continuity function works best as a fast, convenient method to check for opens and shorts. For maximum accuracy in making resistance measurements, use the Meter's resistance (**Ω**) *function.*

Measuring AC and DC Voltage

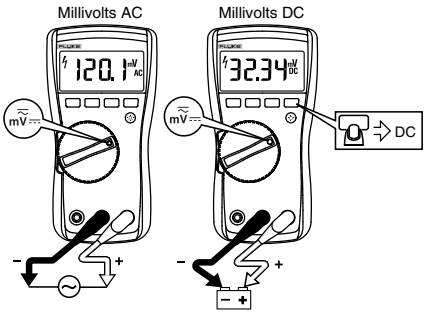


Using Auto Volts Selection (110 PLUS only)

With the function switch in the AUTO-V LoZ position, the Meter automatically selects a dc or ac voltage measurement based on the input applied between the **V** or **+** and **COM** jacks.

This function also sets the Meter's input impedance to approximately 3 kΩ to reduce the possibility of false readings due to ghost voltages.

Measuring AC and DC Millivolts



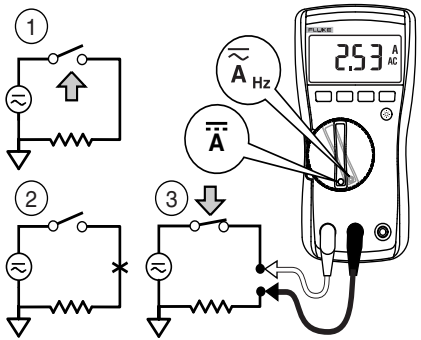
With the function switch in the mV position, the Meter measures ac plus dc millivolts. Press [ ] to switch the Meter to dc millivolts.

Measuring AC or DC Current (115 only)

⚠⚠ Warning

To avoid personal injury or damage to the Meter:

- **Never attempt to make an in-circuit current measurement when the open-circuit potential to earth is >600 V.**
- **Check the Meter's fuse before testing. (See "Testing the Fuse")**
- **Use the proper terminals, switch position, and range for your measurement.**
- **Never place the probes in parallel with a circuit or component when the leads are plugged into the A (Amps) terminals.**



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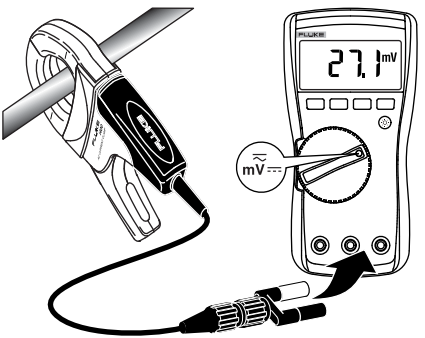
Turn circuit power off, break the circuit, insert the Meter in series with the circuit, and then turn circuit power on.

Measuring Current above 10 Amps

The millivolt and voltage function of the Meter can be used with an optional mV/A output Current Probe to measure currents that exceed the rating of the Meter. Make sure the Meter has the correct function selected, AC or DC, for your current probe. Refer to a Fluke catalog or contact your local Fluke representative for compatible current clamps.



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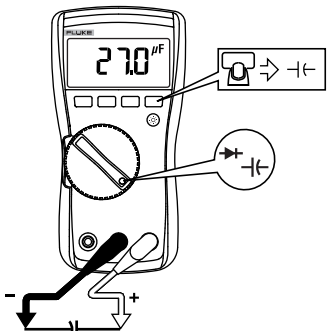
Measuring Capacitance (115 only)



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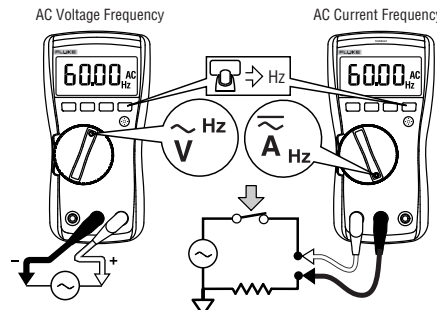
Measuring Frequency (115 only)

⚠⚠ Warning

To avoid electrical shock, disregard the bar graph for frequencies >1 kHz. If the frequency of the measured signal is >1 kHz, the bar graph and ϟ are unspecified.



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The Meter measures the frequency of a signal by counting the number of times the signal crosses a trigger level each second. The trigger level is 0 V, 0 A for all ranges.

Press [ ] to turn the frequency measurement function on and off. Frequency works with ac functions only.

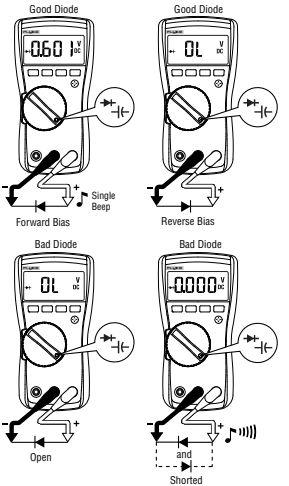
In frequency, the bar graph and range annunciator indicate the ac voltage or current present.

Select progressively lower ranges using manual ranging for a stable reading.

Low Impedance Capacitance Measurements (115 only)

For making capacitance measurements on cables with ghost voltage, hold RANGE while turning on the Meter to switch the Meter into LoZ, (low input impedance) Capacitance mode. In this mode, capacitance measurements will have a lower accuracy and lower dynamic range. This setting is not saved when the Meter is turned off or goes into sleep mode.

Testing Diodes (115 only)



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Using the Bargraph

The bar graph is like the needle on an analog meter. It has an overload indicator (▶) to the right and a polarity indicator (+) to the left.

Because the bar graph is much faster than the digital display, the bar graph is useful for making peak and null adjustments.

The bar graph is disabled when measuring capacitance. In frequency, the bar graph and range annunciator indicates the underlying voltage or current up to 1 kHz.

The number of segments indicates the measured value and is relative to the full-scale value of the selected range.

In the 60 V range, for example (see below), the major divisions on the scale represent 0, 15, 30, 45, and 60 V. An input of –30 V turns on the negative sign and the segments up to the middle of the scale.

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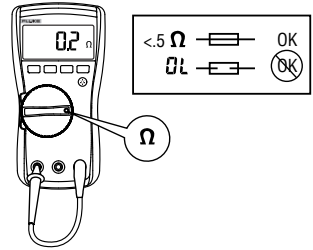
Testing the Fuse (115 only)

Test fuse as shown below.



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Maintenance

Maintenance of the Meter consists of battery and fuse replacement, as well as case cleaning.

Replacing the Battery and Fuse

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury and for safe operation and maintenance of the product:

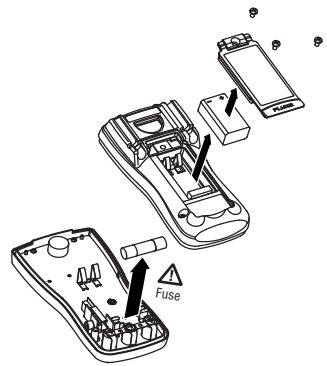
- **Repair the Product before use if the battery leaks.**
- **Have an approved technician repair the Product.**
- **Use ONLY a fuse with the amperage, voltage, speed, and interrupt rating specified.**

To remove the battery door for battery replacement:

1. Remove the test leads from the Meter
2. Remove the battery door screw.
3. Use the finger recess to lift the door slightly.
4. Lift the door straight up to separate it from the case.

The battery fits inside the battery door, which is then inserted into the case, bottom edge first, until it is fully seated. Do not attempt to install the battery directly into the case.

5. Install and tighten battery door screw.



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To open the case for fuse replacement:

1. Remove the test leads from the Meter.
2. Remove the Meter from its holster.
3. Remove two screws from the case bottom.
4. Separate the case bottom from the case top.
5. Remove the fuse from its holder and replace it with an 11 A, 1000 V, FAST fuse having a minimum interrupt rating of 17 000 A. Use only Fluke PN 803293.
6. To re-assemble the Meter, first attach the case bottom to the case top, then install the two screws. Finally, insert the Meter into its holster.

Cleaning

⚠ Caution

Do not use abrasives, isopropyl alcohol, or solvents to clean the case or lens/window.

Wipe the case with a damp cloth and mild detergent. Dirt or moisture in the terminals can affect readings.

General Specifications

Accuracy is specified for 1 year after calibration, at operating temperatures of 18 °C to 28 °C, with relative humidity at 0 % to 90 %.

Extended specifications are available at www.fluke.com.

Maximum voltage between any terminal and earth ground	600 V
⚠ **Fuse for A input (115 only)**	F 11 A, 1 000 V, Interrupt Rating: 17 kA (Fluke PN 803293)
Display	Digital: 6 000 counts, updates 4/sec Bar Graph: 33 segments, updates 32/sec
Temperature	Operating: -10 °C to + 50 °C Storage: -40 °C to + 60 °C (limited by battery specification)
Temperature Coefficient	0.1 x (specified accuracy)/°C (<18 °C or >28 °C)
Operating Altitude	2 000 meters
Battery	9 V Alkaline, NEDA 1604A / IEC 6LR61
Battery Life	Alkaline: 400 hours typical, without backlight
IP Rating (dust and water protection)	IP42 (non-operation)
Safety	IEC 61010-1: Pollution Degree 2 IEC 61010-2-033: CAT III 600 V

Electromagnetic Compatibility

International ..... IEC 61326-1: Portable Electromagnetic Environment; IEC 61326-2-2; CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.

Korea (KCC)..... Class A Equipment (Industrial Broadcasting & Communication Equipment)

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

USA (FCC)..... 47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Table 1. Accuracy Specifications

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])		Model
DC millivolts	600.0 mV	0.1 mV	0.5 % + 2		110 PLUS, 115
DC Volts	6.000 V 60.00 V 600.0 V	0.001 V 0.01 V 0.1 V	0.5 % + 2		110 PLUS, 115
			DC, 45 to 500 Hz	500 Hz to 1 kHz	
Auto-V LoZ[1] True-rms	600.0 V	0.1 V	2.0 % + 3	4.0 % + 3	110 PLUS
			45 to 500 Hz	500 Hz to 1 kHz	
AC millivolts[1] True-rms	600.0 mV	0.1 mV	1.0 % + 3	2.0 % + 3	110 PLUS, 115
AC Volts[1] True-rms	6.000 V 60.00 V 600.0 V	0.001 V 0.01 V 0.1 V	1.0 % + 3	2.0 % + 3	110 PLUS, 115

Table 1. Accuracy Specifications (cont.)

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])	Model
Continuity	600 Ω	1 Ω	Beeper on < 20 Ω, off > 250 Ω; detects opens or shorts of 500 µs or longer.	110 PLUS, 115
Ohms	600.0 Ω 6.000 kΩ 60.00 kΩ 600.0 kΩ 6.000 MΩ 40.00 MΩ	0.1 Ω 0.001 kΩ 0.01 kΩ 0.1 kΩ 0.001 MΩ 0.01 MΩ	0.9 % + 2 0.9 % + 1 0.9 % + 1 0.9 % + 1 0.9 % + 1 5 % + 2	110 PLUS, 115
Diode test	2.000 V	0.001 V	0.9 % + 2	115
Capacitance	1000 nF 10.00 µF 100.0 µF 9999 µF	1 nF 0.01 µF 0.1 µF 1 µF	1.9 % + 2 1.9 % + 2 1.9 % + 2 100 µF - 1000 µF: 1.9 % + 2 >1000 µF: 5 % + 20	115
Lo-Z Capacitance (Power-up option)	1 nF to 500 µF		10 % + 2 typical	115

Table 1. Accuracy Specifications (cont.)

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])	Model
AC Amps True-rms[1] (45 Hz to 500 Hz)	6.000 A 10.00 A[3] 20 A for 30 seconds max., 10 minutes rest min.	0.001 A 0.01 A	1.5 % + 3	115
DC Amps	6.000 A 10.00 A[3] 20 A for 30 seconds max., 10 minutes rest min.	0.001 A 0.01 A	1.0 % + 3	115

Table 1. Accuracy Specifications (cont.)

Function	Range	Resolution	Accuracy ± ([% of Reading] + [Counts])	Model
Hz (V or A input)[2]	99.99 Hz 999.9 Hz 9.999 kHz 50.00 kHz 99.99 kHz	0.01 Hz 0.1 Hz 0.001 kHz 0.01 kHz 0.01 kHz	0.1 % + 2	115

[1] All ac ranges except Auto-V LoZ are specified from 1 % to 100 % of range. Auto-V LoZ is specified from 0.0 V. Because inputs below 1 % of range are not specified, it is normal for this and other true-rms meters to display non-zero readings when the test leads are disconnected from a circuit or are shorted together. For volts, crest factor of ≤3 at 4000 counts, decreasing linearly to 1.5 at full scale. For amps, crest factor of ≤3. AC volts is ac-coupled. Auto-V LoZ, AC mV, and AC amps are dc-coupled.
[2] AC Volts Hz is ac-coupled and specified from 5 Hz to 99.99 kHz. Minimum input required >50.00 kHz typically is >1.1 vac sine. Minimum input typical and not specified. AC Amps Hz is dc-coupled and specified from 45 Hz to 5 kHz.
[3] >10 A unspecified.

Table 2. Input Characteristics

Function	Input Impedance (Nominal)	Common Mode Rejection Ratio (1 kΩ Unbalanced)		Normal Mode Rejection
Volts AC	>5 MΩ <100 pF	>60 dB at dc, 50 or 60 Hz		
Volts DC	>10 MΩ <100 pF	>100 dB at dc, 50 or 60 Hz		>60 dB at 50 or 60 Hz
Auto-V LoZ	~3 kΩ <500 pF	>60 dB at dc, 50 or 60 Hz		
	Open Circuit Test Voltage	**Full Scale Voltage**		**Short Circuit Current**
Ohms	<2.7 V dc	**To 6.0 MΩ**	**40 MΩ**	<350 µA
		<0.7 V dc	<0.9 V dc	
Diode Test	<2.7 V dc	2.000 V dc		<1.2 mA