FLUKE®

8508A
Reference Multimeter

Getting Started Manual

September 2004

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Reference Multimeter

Introduction

The Fluke 8508A Reference Multimeter (hereafter "the Multimeter") is designed for the most demanding measurement applications and provides extremely high measurement precision in both stand-alone and systems applications.

This Getting Started Manual provides an overview of Chapters 1, 2, 3, and 5 from the Users Manual and includes enough information to begin operating you 8508A safely. For more detailed information, refer to the 8508AUsers Manual on the 8508A CD-ROM. A description of the material contained in the Users Manual follows:

Chapter 1 *Introduction and Safety Information* provides unpacking, storage and shipping instructions, line voltage and fuse selection, and safety information.

Chapter 2 *Getting Acquainted with the Basics* provides an introduction to the front panel keys operation and rear panel connector details.

Chapter 3 *Making Measurements* provides detailed access information to the full range of multimeter facilities, with suggestions for measurement techniques.

Chapter 4 *Remote Operations Using the IEEE 488 Interface* provides detailed information for remote control access via the IEEE 488 interface.

Chapter 5 *Specifications* provides specification details for the multimeter.

Chapter 6 *Calibration and Verification* provides detailed information for access to calibration menus, suggested calibration methods and verification procedures for the multimeter.

⚠⚠ Warning

To avoid electric shock, personal injury, or death, carefully read the information under *Safety Considerations* before attempting to install, use, or service the Multimeter.

Contacting Fluke

To contact Fluke for product information, operating assistance, service, or to get the location of the nearest Fluke distributor or Service Center, call:

1-888-99FLUKE (1-888-993-5853) in U.S.A.

1-800-36-FLUKE (1-800-363-5853) in Canada

+31-402-675-200 in Europe

+81-3-3434-0181 Japan

+65-738-5655 Singapore

+1-425-446-5500 from other countries

Visit Fluke's web site at: www.fluke.com.

To register your product, visit register.fluke.com

Unpacking and Inspection

Every care is taken in the choice of packing material to ensure that your equipment will reach you in perfect condition.

Carefully unpack the equipment and check for external damage. If the instrument is damaged notify the carrier and your sales representative immediately.

For orders of the model 8508A/01 check that the instrument has the six terminals on the rear panel for connection of signals.

In addition to the Multimeter the shipping container should include the following:

Item Description	Quantity
Power cable suitable for you location	1
CD-ROM containing detailed user information in a variety of languages	1
General Purpose CAT 11 Probe Kit and Wallet	1
Users Manual	1

Line Voltage and Line Fuse

The instrument is packed ready for use with a line voltage determined at the time of ordering. The fuse that corresponds to the set line-voltage is installed in the Multimeter. See Figure 1.

For 200 V to 240 V supplies, `230` is shown in the voltage selector window on the rear panel, and the fuse is rated at 630 mA.

For 100 V to 120 V supplies, `115` is shown in the window and the fuse rating is 1.25 A.

Refer to the 8508A Users Manual for details about changing supply voltage and about changing or replacing line fuses.

⚠Caution

To avoid fire hazard, use only the fuse arrangements that appear in the fuse specifications given in the Users Manual.

Additionally, the supply network must be fused at a maximum of 16 A, and if the power cable plug is internally fused, a 5 A fuse must be fitted in the power cable plug.

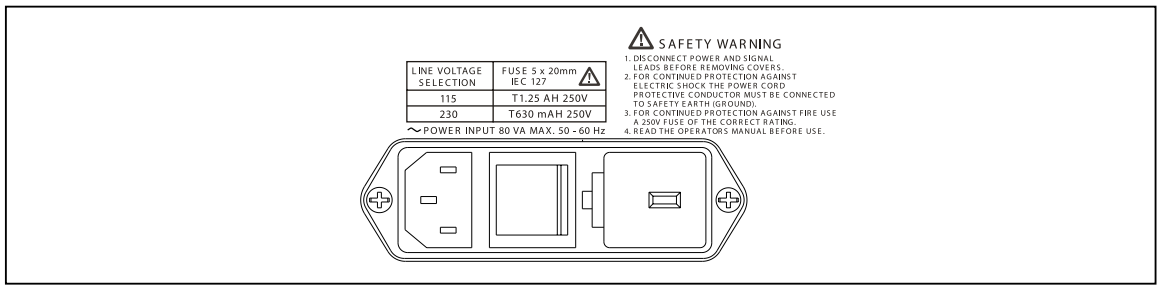

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Figure 1. Rear Panel – Line Power Cable, On/Off Switch, and Line Power Fuse Locations

Safety Considerations and Symbols

This sections addresses safety considerations and describes symbols that appear on the Multimeter.

A ⚠ **Warning** statement identifies conditions or practices that could result in injury or death.

A ⚠ **Caution** statement identifies conditions or practices that could result in damage to the Multimeter or equipment to which it is connected.

⚠⚠Warning

This instrument can deliver a lethal electric shock.

To avoid electric shock, personal injury, or death, carefully read the information under *Safety Considerations* before attempting to install, use, or service the Multimeter.

General Safety Summary

This instrument has been designed and tested in accordance with the European standard publication EN61010-1: 2001 and U.S. / Canadian standard publications UL 61010-1A1 and CAN/CSA-C22.2 No.61010.1. The instrument has been supplied in a safe condition.

This manual contains information and warnings that must be observed to keep the instrument in a safe condition and ensure safe operation.

Using or servicing this Multimeter in conditions other than as specified in the Users Manual could compromise your safety.

To use the Multimeter correctly and safely, read and adhere to the precautions on the *Safety Page* and follow all the safety instructions or warnings given throughout this manual and the Users Manual that relate to specific measurement functions. In addition, follow all generally accepted safety practices and procedures required when working with and around electricity.

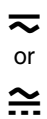
⚠⚠ Safety Page

Warning: To avoid possible electric shock, personal injury, or death, read the following before using the Multimeter:

- ⇒ **Use the Multimeter only as specified in this manual, or the protection provided by the Multimeter might be impaired.**
- ⇒ **Do not use the Multimeter in wet environments.**
- ⇒ **The Multimer can output lethal voltages. Use it only as described in this manual.**
- ⇒ **Inspect the Multimeter before using it. Do not use the Multimeter if it appears damaged. Pay particular attention to the insulation around the connectors.**
- ⇒ **Inspect the test leads before use. Do not use them if insulation is damaged or metal is exposed. Check the test leads for continuity. Replace damaged test leads before using the Multimeter.**
- ⇒ **Verify the Multimeter's operation by measuring a known voltage before and after using it. Do not use the Multimeter if it operates abnormally. Protection may be impaired. If in doubt, have the Multimeter serviced.**
- ⇒ **Whenever it is likely that safety protection has been impaired, make the Multimeter inoperative and secure it against any unintended operation.**
- ⇒ **Have the Multimeter serviced only by qualified service personnel.**
- ⇒ **Do not apply more than the rated voltage, as marked on the Multimeter, between the terminals or between any terminal and earth ground.**
- ⇒ **Always use the power cord and connector appropriate for the voltage and outlet of the country or location in which you are working.**
- ⇒ **Remove test leads from the Multimeter before opening the case.**
- ⇒ **Never remove the cover or open the case of an instrument without first removing the power source.**
- ⇒ **Never operate the Multimeter with the cover removed or the case open.**
- ⇒ **Use caution when working with voltages above 30 V ac rms, 42 V ac peak, or 42 V dc. These voltages pose a shock hazard.**
- ⇒ **Use only the replacement fuse(s) specified by the manual.**
- ⇒ **Use the proper terminals, function, and range for your measurements.**
- ⇒ **Do not operate the Multimeter around explosive gas, vapor, or dust.**
- ⇒ **When using probes, keep your fingers behind the finger guards.**
- ⇒ **When making electrical connections, connect the common test lead before connecting the live test lead; when disconnecting, disconnect the live test lead before disconnecting the common test lead.**
- ⇒ **Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity, diodes, or capacitance.**
- ⇒ **Before measuring current, check the Multimeter's fuses and turn OFF power to the circuit before connecting the Multimeter to the circuit.**
- ⇒ **When servicing the Multimeter, use only specified replacement parts.**

Symbols

The following safety and electrical symbols may be used on the Multimeter, in this Getting Started Manual, or in the Users Manual.

	Risk of danger. Important information. See manual.		Power ON / OFF
	Hazardous voltage. Voltage > 30 V dc or ac peak might be present		Earth ground.
	AC (Alternating Current).		Capacitance.
	DC (Direct Current).		Diode.
	AC or DC (Alternating or Direct Current)		Laser caution.
			Warning. Laser.
	Continuity test or continuity beeper tone.		Fuse.
	Digital signal.		Warning. Hot or burn hazard.
	Potentially hazardous voltage.	**CAT**	IEC 61010 Overvoltage (installation or measurement) Category .
	Brightness / contrast adjustment		Display backlight
	Double insulated.		Recycle.
	Static awareness. Static discharge can damage part(s).		Do not mix with solid waste stream. Dispose using a qualified recycler or hazardous material handler.
	Do not connect to public network (e.g., telephone system.)		Maintenance or Service.
	Battery or battery compartment. Low battery when shown on display.		Tone or beep.

Protection Class I

Protective Earth/Ground

The Multimeter **must** be operated with a Protective Earth/Ground connected via the power cable's protective earth/ground conductor. The Protective Earth/Ground connects to the instrument before the line & neutral connections when the supply plug is inserted into the power socket on the back of the instrument.

⚠⚠ Warning

To avoid possible electric shock, personal injury, or death:

- **Ensure that no interruption of the protective ground conductor inside or outside the instrument has occurred. Any interruption of the protective ground is likely to make the instrument dangerous.**
- **Make signal connections to the instrument after making the protective ground connection.**
- **Remove signal connections before removing the protective ground connection, i.e. the power cable must be connected whenever signal leads are connected.**

Do Not Operate Without Covers

⚠⚠ Warning

To avoid possible electric shock, personal injury, or death, do not operate the instrument with its covers removed.

The covers protect users from live parts, and unless otherwise stated, must only be removed by qualified service personnel for maintenance and repair purposes.

Removing the covers may expose voltages in excess of 1.5 kV peak.

Safe Operating Conditions

⚠⚠ Warning

To avoid electric shock or fire hazard, do not apply to or subject the Multimeter to any condition that is outside specified range. See Chapter 5 of the Users Manual for detailed instrument specifications and operating conditions.

Only operate the Multimeter within the manufacturer's specified operating conditions. Examples of operating conditions that must be considered include:

- Ambient temperature
- Ambient humidity
- Power supply voltage & frequency
- Maximum terminal voltages or currents
- Altitude
- Ambient pollution level
- Exposure to shock and vibration

⚠Caution

To avoid possible damage to the Multimeter, consider direct sunlight, radiators and other heat sources when assessing ambient temperature.

Before connecting the Multimeter to the supply, make sure that the ac supply voltage connector on the rear panel is set to the correct voltage and that the correct fuses are installed. Refer to the Users Manual for fuse details.

The Power Cable and Power Supply Disconnection

The intended power supply disconnect device is the ON/OFF switch that is located on the Multimeter's rear panel. See Figure 1.

The ON/OFF switch **must** be readily accessible while the instrument is operating. If this operating condition cannot be met, the power-cable plug or other power-disconnecting device **must** be readily accessible to the operator.

⚠⚠ Warning

To avoid electric shock and fire hazard, make sure that the power cable is not damaged, and that it is adequately rated against power supply network fusing.

If the power cable plug is to be the accessible disconnect device, the power cable must not be longer than 3 meters.

Terminal Connections

Make sure that the instrument is correctly grounded (earth ground) via the power cable before and while any other connection is made.

Installation/Measurement Category I

Measurement and/or guard terminals are designed for connection at Installation or Measurement Category I.

⚠⚠ Warning

To avoid electric shock and fire hazard, do not connect the Multimeter terminals directly to the ac line power, to an ac line power current transformer, or to any other voltage or current source that may (even temporarily) exceed the instrument's peak ratings.

⚠⚠ Warning

To avoid injury or death, do not connect or disconnect signal leads while they are connected to a hazardous voltage or current source.

Make sure that signal leads are in a safe condition before you handle them.

This instrument can deliver a lethal electric shock. Never touch any lead or terminal unless you are absolutely certain that no dangerous voltage is present.

Maintenance and Repair

⚠ Warning

For protection against injury and fire hazard, use only manufacturer supplied parts that are relevant to safety. Perform Safety tests after replacing any part that is relevant to safety.

Observe all applicable local and/or national safety regulations and rules while performing any work.

First disconnect the instrument from all signal sources, then from the ac line supply before removing any cover.

Only the manufacturer's authorized service personnel should perform adjustment, parts replacement, maintenance, or repair on the Multimeter.

Front and Rear Panel Features

This chapter contains descriptions the front and rear panel features of the 8508A Reference Multimeter (hereafter, referred to as the Multimeter). Figure 2 shows the Multimeter's front panel controls, indicators, and connectors.

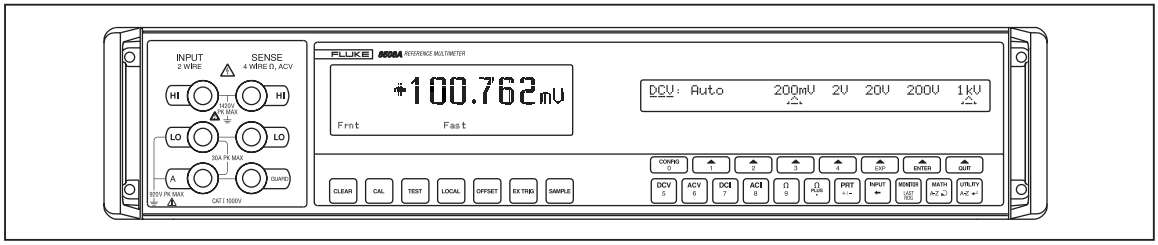


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Figure 2. Front Panel Displays

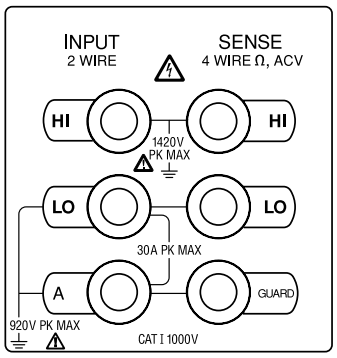
Input Terminals

⚠⚠ Warning

to avoid electric shock, personal injury, or death, never touch any lead or terminal on the Multimeter unless you are absolutely certain that no dangerous voltage is present.

The 8508A Multimeter has only front terminals. The 8508A/01 includes both front and rear panel input terminals (Figures 3). Select either front or rear, or Scan both using the Input menu or via IEEE-488 remote control.

For maximum input limits, see the *Specifications* section later in this manual.



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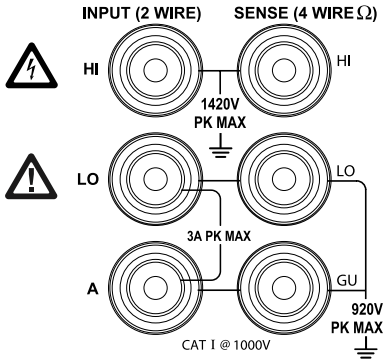

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Figure 3. Front and Rear Input Terminals

Three pairs of 4 mm ëbananaí terminals are fitted on the left of the front panel and, as an option, on the right of the rear panel . Their functions are as follows:

INPUT 2 wire		**SENSE** 4WIRE Ω, ACV	
HI	Voltage High Ohms High (2 – wire)	**HI**	Voltage High (4-wire *front only*) Ohms High (4-wire)
LO	Voltage Low Current Low Ohms Low (2-wire)	**LO**	Voltage Low (4-wire *front only*) Ohms Low (4wire)
A	Current High *(only 2A max on rear)*	**GUARD**	

The Front Panel Displays

The front panel (Figure 2) has two displays:

- The display on the left, the main display, is used to show all measurement readings, with status legends on the bottom line, and measurement qualifiers on the line above. Figure 4 shows details of the main display, including annunciators.
- The display on the right is used to display menus for the softkeys situated below. It is also used for error messages and status information when in remote.

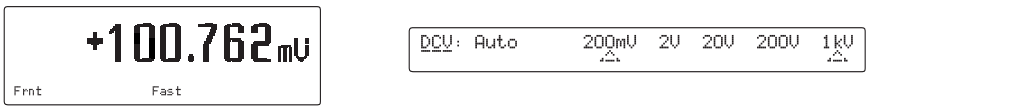

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Figure 4. Sample of the Main Display

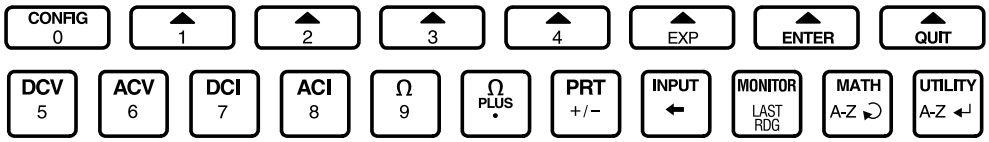
Front Panel Keys

There are four types of keys on the front panel:

- The major measurement function keys: DCV 5 | ACV 6 | DCI 7 | ACI 8 | Ω 9 | Ω PLUS . | PRT +/−
- The mode keys: CAL | TEST | INPUT ← | MONITOR LAST READ | MATH A-Z | UTILITY A-Z ↵ | CLEAR
- Direct action keys that immediately initiate an action or set a state: LOCAL | OFFSET | EX TRIG | SAMPLE
- The "soft-keys" point to a menu label on the display above, indicating the operation and setting of the Multimeter: 1 | 2 | 3 | 4 | EXP | ENTER | QUIT

System messages may appear to clarify settings or operations.

Numeric Keyboard



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Numeric Keyboard

The operation of the numeric keys is enabled for appropriate menus. The active keys are:

CONFIG 0 | 1 | 2 | 3 | 4 | DCV 5 | ACV 6 | DCI 7 | ACI 8 | Ω 9 numerals 0 to 9.

Ω PLUS • decimal point

PRT +/− polarity

EXP for exponent

INPUT ← for backspace

MONITOR LAST RDG to enter the last reading taken

ENTER to confirm the numeric entry

QUIT to abort the numeric entry.

When the numeric keyboard is active other keys are locked out.

For some operations the two alpha selection keys are enabled along with the numeric keys.

MATH A-Z selects the alpha characters (upper case only) and cylces A through Z.

UTILITY A-Z enters the selected character and moves the entry point one character to the right.

Exiting a Menu

You can generally exit from any menu by pressing a measurement function key or a mode key.

For those menus where the numeric or alpha numeric keyboard is active, exit by pressing either Enter or Quit. For some menus, a special soft key permits exit by a single keystroke.

Major Function Keys

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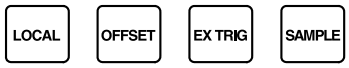
Each measurement function has a CONFIG (Configuration) menu, from which you can select function-dependent parameters such as resolution and filter settings.

Once set, the instrument remembers the function dependant parameters until you change it or turn the Multimeter off.

Direct Action Keys



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Direct Action Keys

EX TRIG — Press to disable internal triggers and enable all external trigger sources. The Ext annunciator on the main display is lit.

SAMPLE — Press to trigger a single-shot measurement if the Multimeter is in Ext'trig mode. All measurements triggered using the Sample key are subject to the standard internal time delays before A-D conversion.

LOCAL — Press to return the Multimeter to the control of the front panel when operating on the IEEE-488 bus.

OFFSET — Press to store the displayed value in memory. This temporary value will be subsequently subtracted from the next measured value. The Offset annunciator on the main display is lit. To cancel this subtraction press the Offset key.

Mode Keys

CAL — Press to access to the calibration mode.

TEST — Press to gain access to test operations.

INPUT — Press to gain access to guarding, input zero operation, selection of alternate inputs, and scanning operations.

MONITOR (LAST HUG) — Provides additional monitoring operations on measurements e.g. frequency (in AC), and recorded measurements of maximum, minimum, and peak to peak

MATH (A-Z) — Provides additional mathematical operations on measurements

UTILITY (A-Z) — Press to gain access to bus address, display adjustments, line frequency selection, and information on cal due date, serial number and spot frequency.

CLEAR — Press to gain access to the menu for removing Input zero for the range selected or all the ranges in the selected function and for resetting the Multimeter to the power up state.

Rear Panel

The rear panel of the Multimeter (Figure 5) and a description of it features follows:

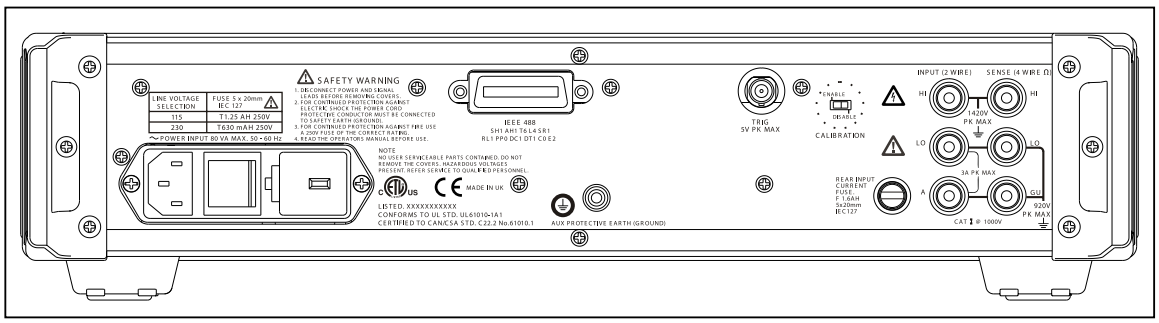

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Figure 5. 8508A Rear Panel Detail

Labels

Attached to the rear panel are the identification label for the instrument and a modification strike label.

Fuses

⚠ **Power Fuse:** Located in the fuse drawer which is part of the integrated module for power input and voltage selection.

⚠ **Rear Input Current Fuse:** Protects the current measuring circuitry when using the rear terminals for signal input.

⚠⚠Warning

To avoid damage to the Multimeter, or shock, injury, or death, use ONLY fuses with the amperage, interrupt, voltage, and speed ratings specified in the Users Manual.

Voltage Selector

The power line voltage selector block is located behind the fuse block drawer, and adapts the instrument to either 115V or 230V line inputs.

Power Input and Power Switch

The power input socket and power ON/OFF switch are part of the integrated module for power input and voltage selection. Power on default configuration is listed later in this chapter.

Calibration Switch

Access to calibration mode is enabled (or restricted) by the rear panel calibration switch. Setting the switch to ENABLE will allow access to the calibration mode via the front panel CAL key and the CALIBRATION menu, and will also enable the remote IEEE-488 interface calibration commands.

Always be set the calibration switch to DISABLE on completion of any calibration operation. Applying an integrity seal or calibration sticker to cover the rear panel Calibration switch is a convenient way to ensure the security of calibration and to prevent unauthorized access to the switch.

Rear Panel Connectors and Pin Designations

⚠⚠ Warning

This instrument can deliver a lethal electric shock.

To avoid electric shock, personal injury, or death, never touch any lead or terminal unless you are absolutely certain that no dangerous voltage is present.

Rear Inputs

For details of rear input terminals see Figure 5.

External Trigger Input

This co-axial BNC socket can be used to trigger a measurement when external triggers are enabled.

The single pin is pulled up internally to +5V, and requires a negative-going TTL edge to initiate the reading.

IEEE 488 Input/Output

The IEEE 488 input/output is a 24-way Amphenol connector which is directly compatible with the IEEE 488 interface and the IEC 625 Bus.

Note that the Bus Address is set from the front panel. See Chapter 4 in the Users Manual for detailed information about the IEEE 488 connector and remote operations.

Power-On Configuration

To turn the Multimeter on, use the Power Switch on the rear panel. The Multimeter powers on in the following configuration:

Function	DCV
Range	1 kV
Resolution	7-1/2 digits
Input	Front
Filter	Off
Fast	On
External Guard	Off
Scan	Off
Monitor	Off
Math	Off

Making Measurements

⚠⚠Warning

This instrument can deliver a lethal electric shock.

To avoid electric shock, personal injury, or death, carefully read the information under *Safety Considerations* (earlier in this manual) before attempting to install, use, or service the Multimeter.

A "⚠⚠ Warning" statement identifies conditions or practices that could result in injury or death.

A "⚠⚠ Caution" statement identifies conditions or practices that could result in damage to the Multimeter or equipment to which it is connected.

The following information is organized to provide an overview of the following Multimeter functions and modes.

Functions

DC Voltage AC Voltage Resistance DC Current AC Current Temperature

Modes

Input Control Monitoring Math Utility Clear Test

Before proceeding make sure that the Multimeter has been properly installed and prepared for operation as described earlier in this manual.

⚠⚠ Warning

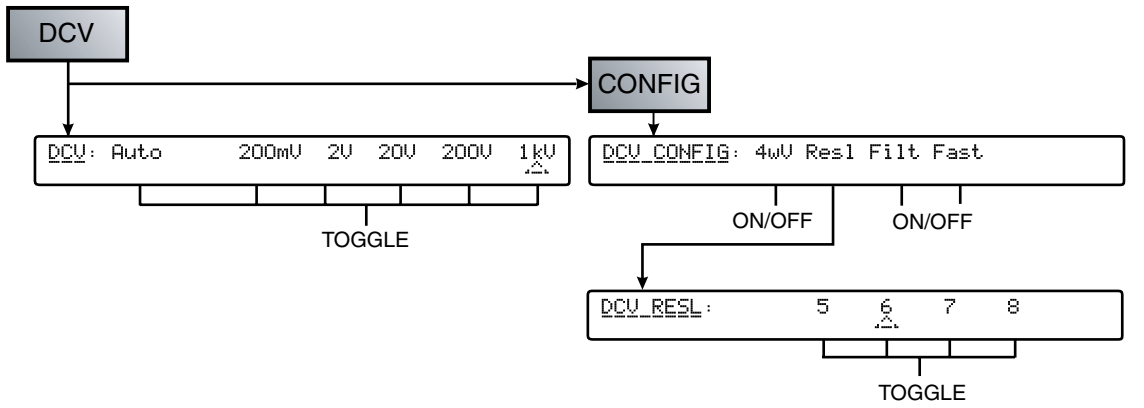
Using this instrument can deliver a lethal electric shock. To avoid possible electric shock, personal injury, or death:

- **Ensure that no interruption of the protective ground conductor inside or outside the instrument has occurred. Any interruption of the protective ground is likely to make the instrument dangerous.**
- **Never touch any lead or terminal unless you are absolutely certain that no dangerous voltage is present.**

Using the Measurement Functions

The following descriptions include an overview of the menus associated with the available measurement functions. These menus are adequate to explore the Multimeterís various functions, ranges, and features. They are also useful as a quick reference to the available functions. To ensure proper use of these menus and measurement functions refer to the 8508A Users Manual for complete details.

DC Voltage



DC Voltage Menu Tree

For the majority of applications the simple lead connection without external guard will be adequate. See Figure 6.The disadvantage of this simple arrangement is that the connecting leads can form a loop. If a stray alternating magnetic field (e.g., from the line transformer of a neighboring instrument) passes through the loop, it will behave as a single-turn secondary winding inducing unwanted AC voltages into the measuring circuit. Refer to the 8508A Users Manual for descriptions of more complex lead descriptions.

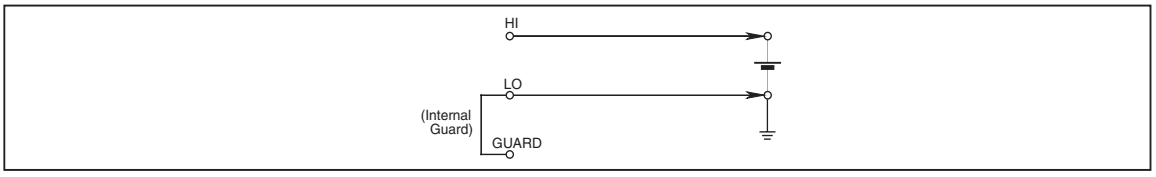


Figure 6. Simple Lead Connections

AC Voltage

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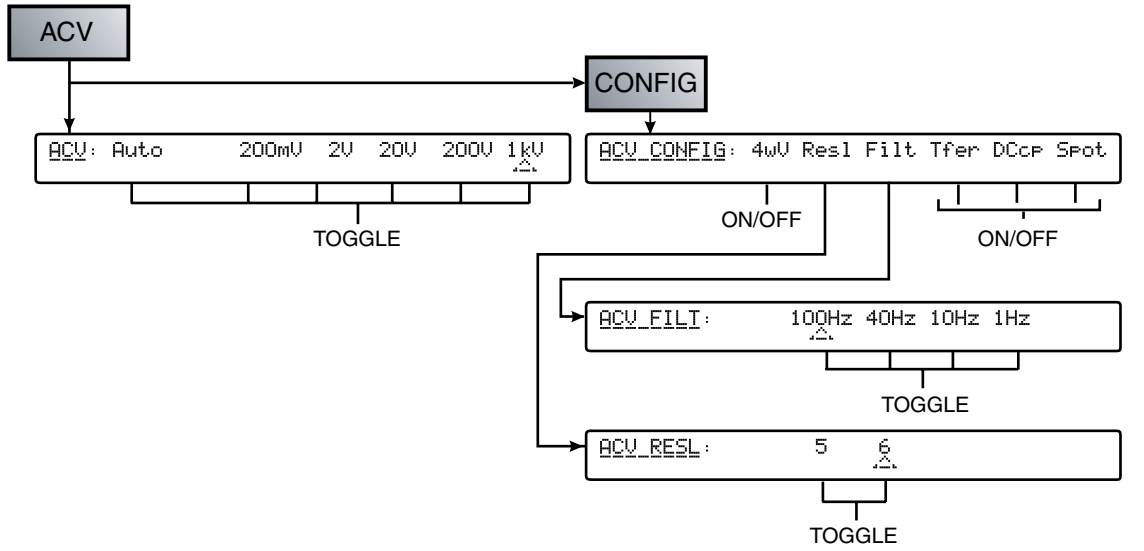

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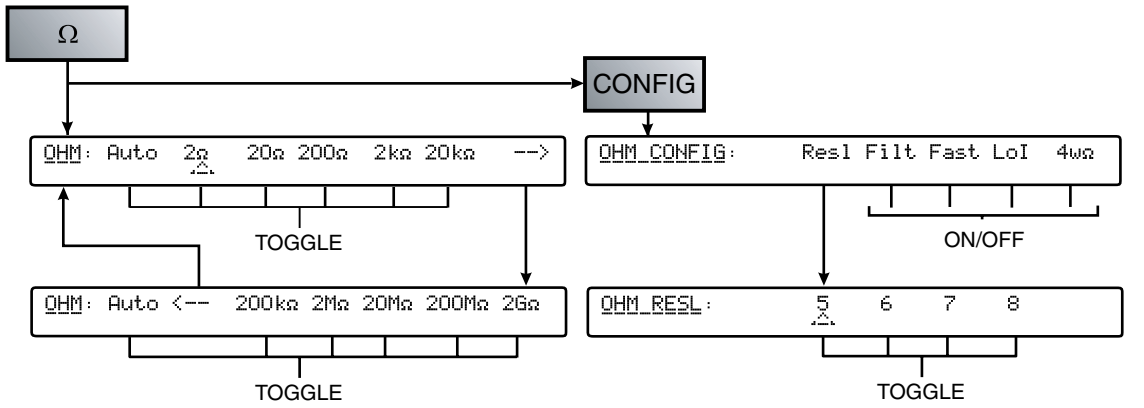
AC Voltage Menu Tree

Resistance



adj076f.eps

Resistance Menu Tree

High Voltage Ohms

The High Voltage Ohms function provides both 2-wire and 4-wire measurements of resistance, in decade ranges from 20MΩ to 20GΩ. The measurement is performed at High Voltage using a current source with high compliance. The resulting increase in current through the unknown resistor is valuable to the reduction of leakage and bias current uncertainties. The function may also be used alongside the normal Ohms function to determine the voltage coefficient in the unknown resistor.

The MAXIMUM voltage that could appear across the measured resistor is 240 V. No autoranging is provided in this function.

⚠⚠ WARNING

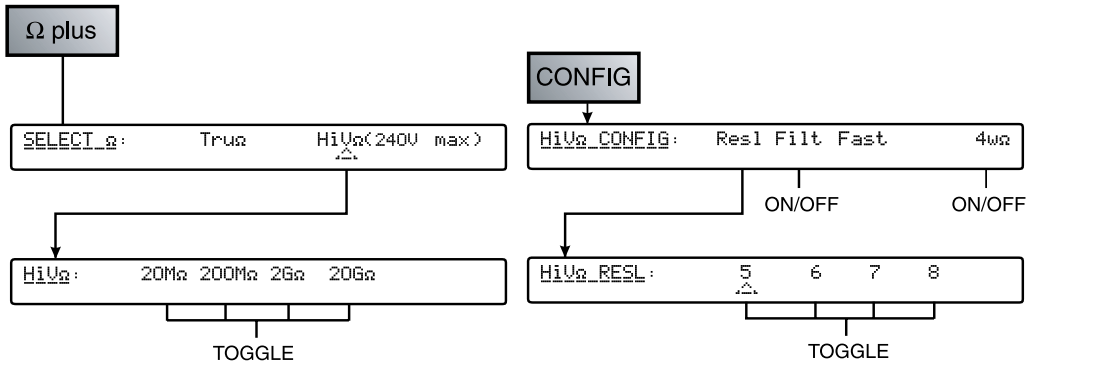
DANGER OF LETHAL ELECTRIC SHOCK

To avoid LETHAL electrical shock DO NOT CONNECT EXTERNAL CAPACITANCE greater than 50 nF to the Multimeter terminals.

The maximum voltage across the measured resistor or open Multimeter terminals while using the HiVΩ function is 240 V. The maximum current that the Multimeter will source while using HiVΩ is 10 µA (Lo to Hi), or 2.0 mA (Guard to Hi if Ext Guard is selected). These characteristics are not considered "Hazardous Live" within the Safety standards applied to this instrument. However, capacitors (>50 nF) external to the Multimeter could accumulate LETHAL charge while making a HiVΩ measurement. DO NOT TOUCH the Multimeter terminals or circuitry under test unless you are sure it is safe to do so.

⚠⚠CAUTION – HIGH VOLTAGE

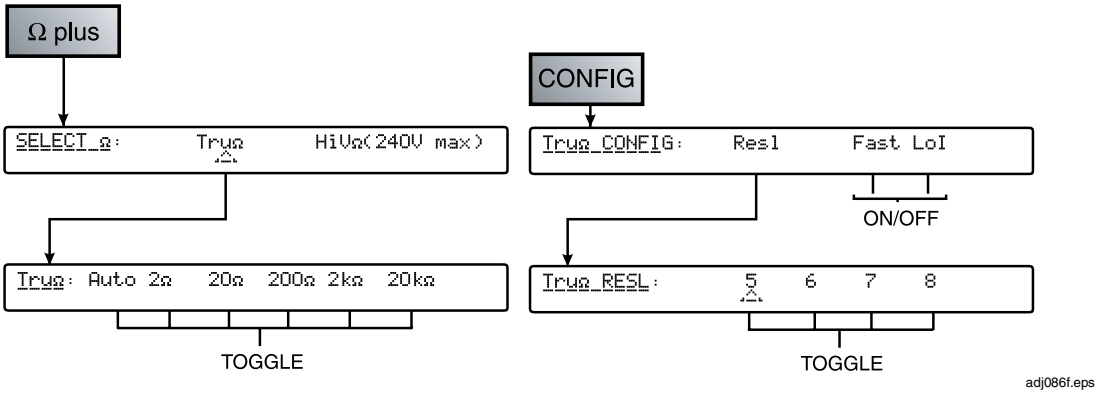
To avoid equipment damage when using the HiVΩ function make sure that circuits or components connected to the Multimeter can withstand at least 240 V dc.



HiVΩ Menu Tree

True Ohms

The TruΩ mode takes two measurements per reading. The second measurement is made with the current reversed relative to the first measurement. The two measurements are combined to eliminate the effects of any external EMFs that may be present.

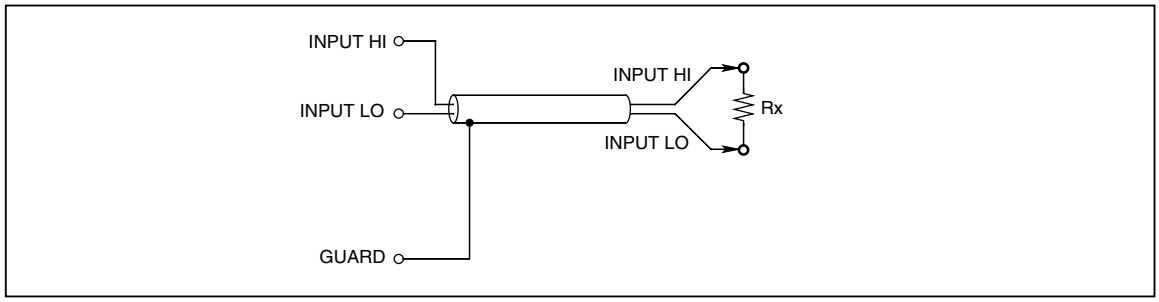


TRUΩ Movement Between Menu

Measuring Resistance

2-Wire Measurements

For many applications the simple 2-wire arrangement will be adequate. See Figure 7. However, the value displayed will include the resistance of the connecting leads.

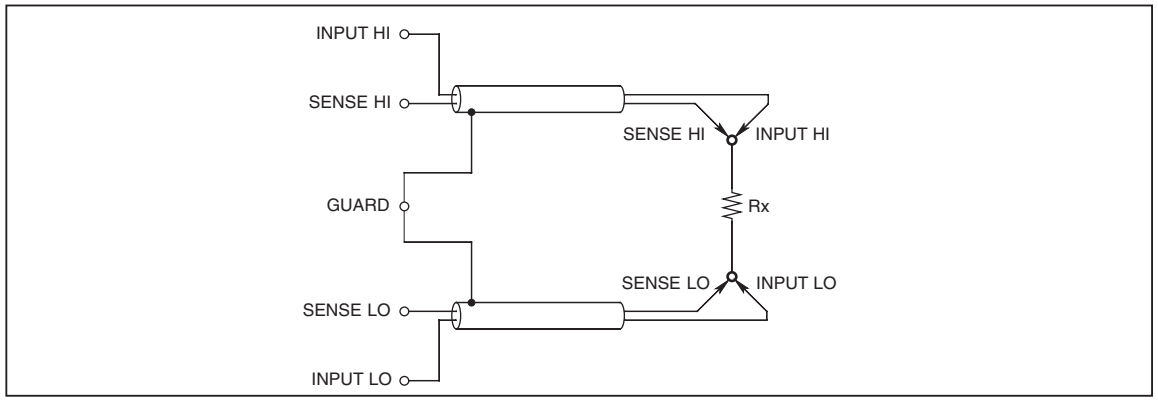


adj091f.eps

Figure 7. 2-Wire Measurements

4-wire Measurements

With a 4-wire connection the lead resistances have negligible effect and only the value of Rx is displayed. See figure 8.



adj092f.eps

Figure 8. 4-Wire Measurements

DC Current

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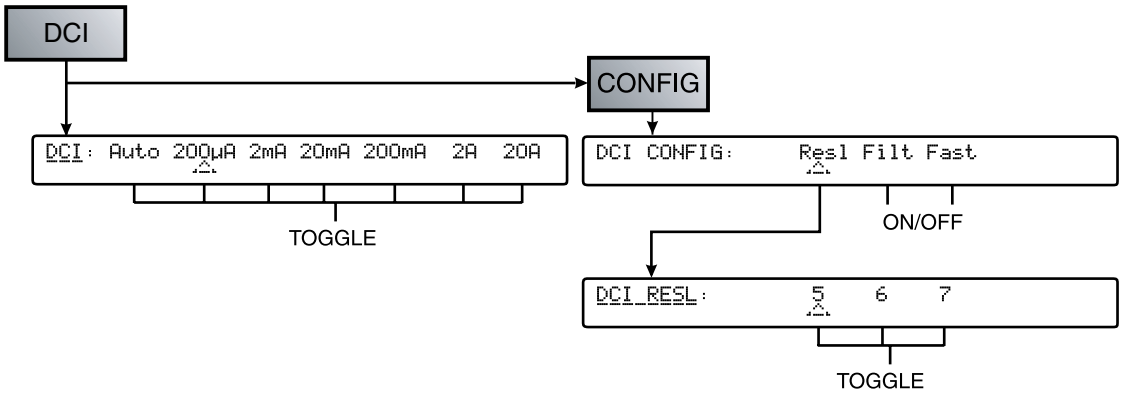


adj100f.eps

DCI Movement Between Menu

Measuring DC Current

Similar connection considerations are required for DC current measurement as for DC voltage measurement. Refer to the 8508A Users Manual for a complete description of lead connections.

⚠⚠ WARNING – HIGH CURRENT FLOW

To avoid fire hazard make sure that conductors of adequate guage are used when making current measurement. High Current can cause excessive heating of underated conductors and may cause a fire.

Note

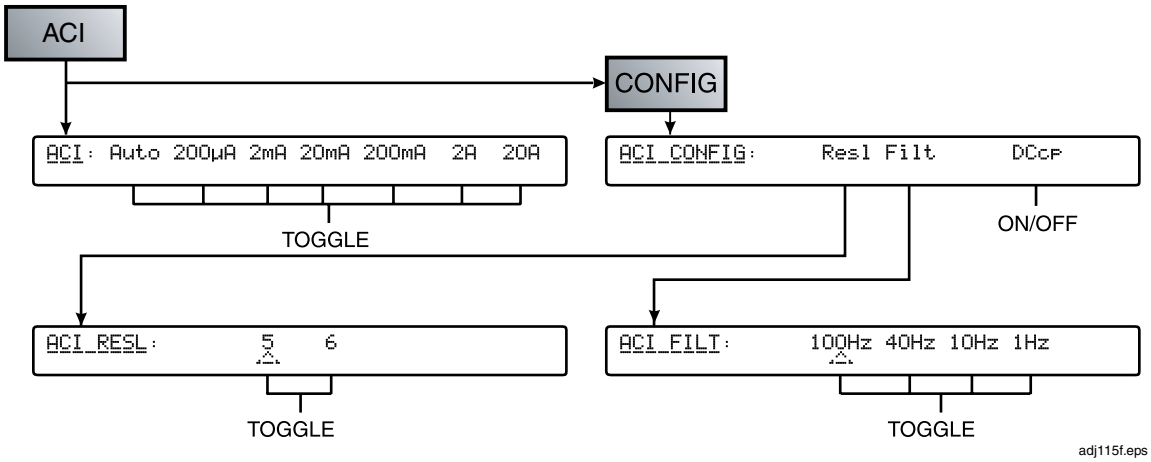
The Current path between DMM terminals is not made when the Current functions are not in use or when Front or Rear terminals are deselected.

Note

Maximum Input Current capability and protection *The front input terminals may be used to measure currents up to 20 A. The front input A terminal protection is automatic and self-resetting, and does not interrupt current flow. Damage is likely to occur if more than 20 A is applied.*

The Rear input terminals may be used to measure currents up to 2 A only. The rear input A terminal is protected by a fuse mounted on the rear panel.

AC Current



ACI Menu Tree

Measuring AC Current

Insert the Multimeter in the current path via its **A** and **Lo** terminals. Similar connection considerations are required for AC current measurement as for AC voltage measurement.

⚠⚠ WARNING – HIGH CURRENT FLOW

To avoid fire hazard make sure that conductors of adequate guage are used when making current measurement. High Current can cause excessive heating of underated conductors and may cause a fire.

Note

The Current path between DMM terminals is not made when the Current functions are not in use or when Front or Rear terminals are deselected.

Note

***Lead Impedance** - When making AC current measurements pay particular attention to the lead impedance, especially lead capacitance at high frequencies on the lower current ranges. (See "Measuring AC Voltage" earlier in this chapter.)*

Note

***Maximum Input Current capability and protection** - The front input terminals may be used to measure currents up to 20 A. The front input A terminal protection is automatic and self-resetting, and does not interrupt current flow. Damage is likely to occur if more than 20 A is applied.*

The Rear input terminals may be used to measure currents up to 2 A only. The rear input A terminal is protected by a fuse mounted on the rear panel.

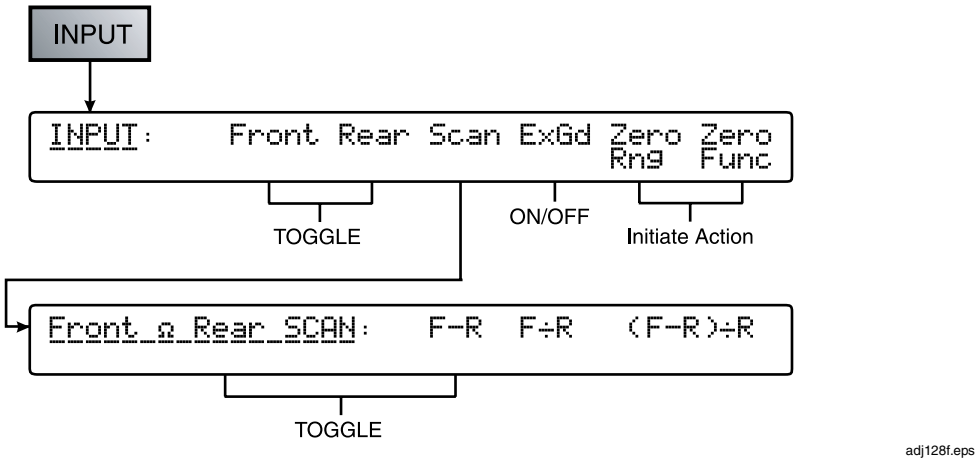
Temperature

The Multimeter provides a temperature readout by measuring the resistance of the connected PRT or SPRT probe, and converting the resitance value to temperature. The multimeter autoranges between the 200Ω LoIΩ range and the 2kΩ Normal Ω range depending on the resistance value obtained at the temperature being measured.

Refer to the 8508A Users Manual for additional details.

Multimeter Inputs

The Input key and its menu allow you to select either the Front or Rear panel terminals as the input to the Multimeter: The scan softkey gives access to dual-channel measurement and processing selection which produces a single result.



Input Menu Tree

In each of three Scan modes, measurements are taken alternately from the Front and Rear Terminals and are combined mathematically to produce a single result. Refer to the 8508A Users Manual for additional details and applications of the Scan mode.

Note

Scan of the Current functions *- Scan is not available in the ACI and DCI functions.*

Note

Scan of the Ohms functions *- In the Ohms and HiV Ohms functions the Scan Operation switches both current stimulus and potential difference measurement between the Front and Rear terminals. The Tru Ohms Ratio feature described below scans only the potential difference measurement between Front and Rear terminals, maintaining stimulus current through both Front and Rear terminals.*

⚠⚠ WARNING

DANGER OF LETHAL ELECTRIC SHOCK

To avoid LETHAL electrical shock DO NOT CONNECT EXTERNAL CAPACITANCE greater than 50 nF to the Multimeter terminals.

The maximum voltage across the measured resistor or open Multimeter terminals while using the HiVΩ function is 240 V. The maximum current that the Multimeter will source while using HiVΩ is 10 µA (Lo to Hi), or 2.0 mA (Guard to Hi if Ext Guard is selected). These characteristics are not considered "Hazardous Live" within the Safety standards applied to this instrument. However, capacitors (>50 nF) external to the Multimeter could accumulate LETHAL charge while making a HiVΩ measurement. DO NOT TOUCH the Multimeter terminals or circuitry under test unless you are sure it is safe to do so.

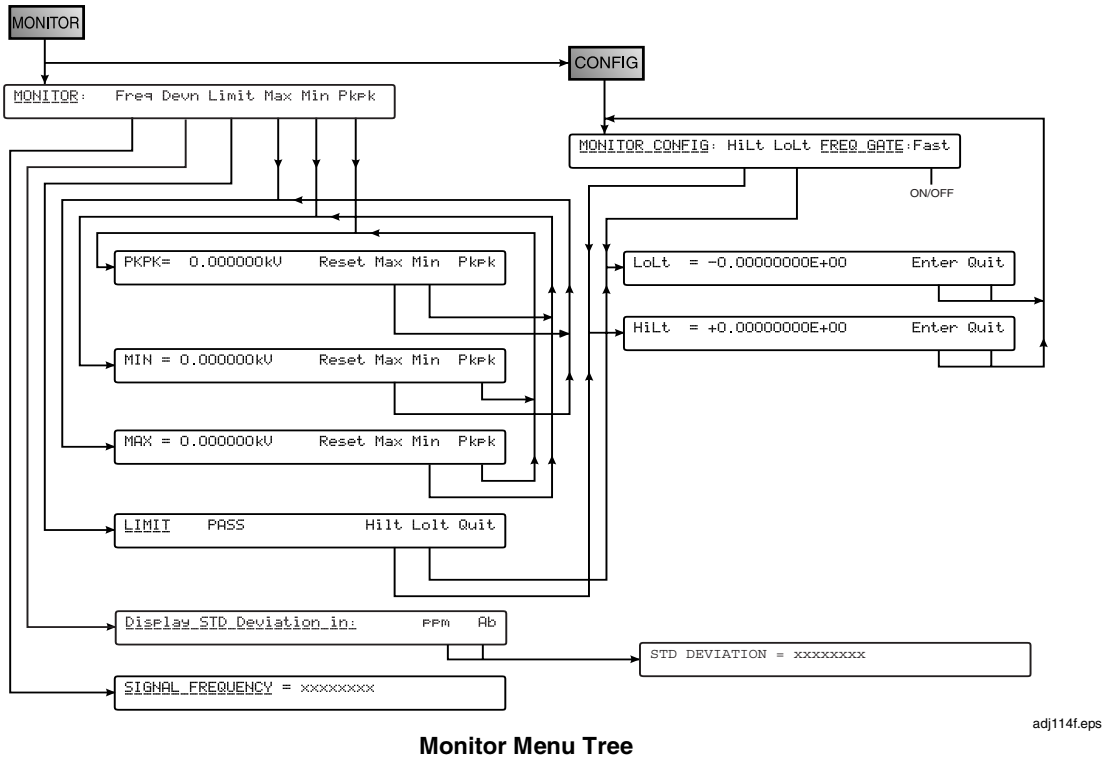
⚠⚠CAUTION – HIGH VOLTAGE

To avoid equipment damage when using the HiVΩ function make sure that circuits or components connected to the Multimeter can withstand at least 240 V dc.

Note

Scan of Temperature Measurement *- Scan Mode is not available in the PRT Function. Temperature Measurements from two PRTs (each with its own linearization coefficients) connected to the Front and Rear Terminals may however be compared under remote control of the DMM.*

Monitoring Modes

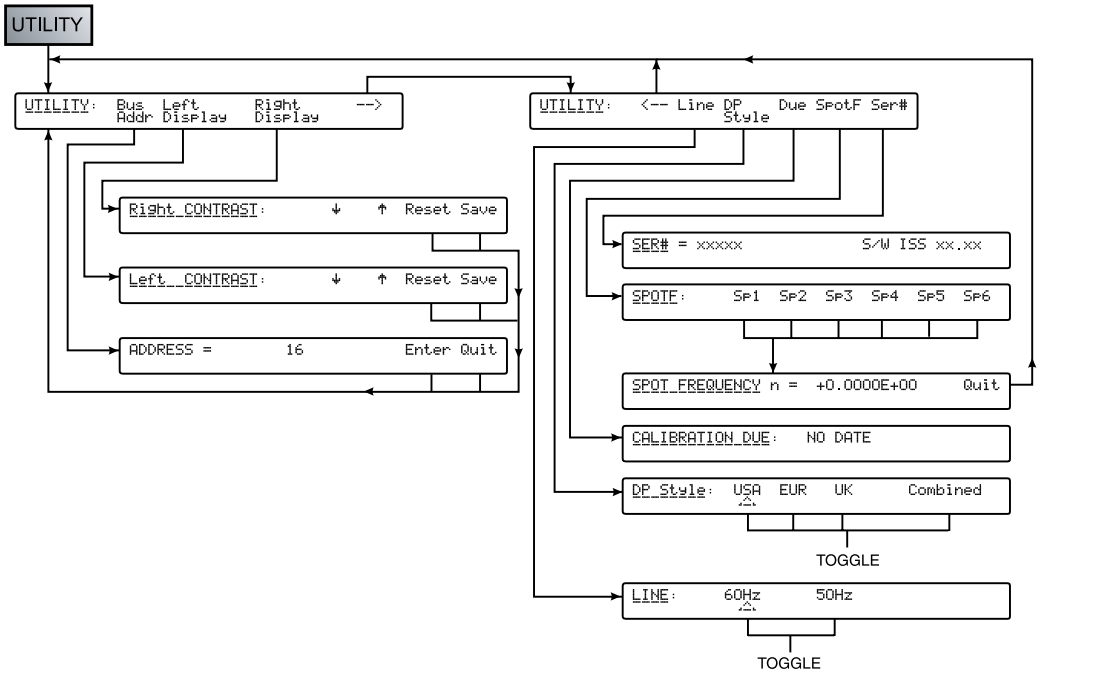


Monitor Menu Tree

Note

From any of these menus, pressing the Config *hard key will enter the* MONITOR CONFIG *menu; pressing the* Monitor *key reverts to the* MONITOR *menu.*

Utility

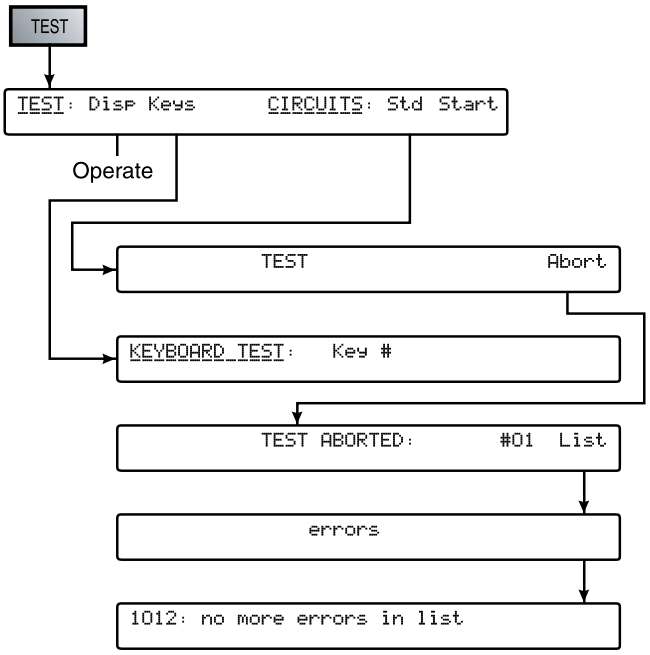


adj124.eps

Utility Menu Tree

Selftest

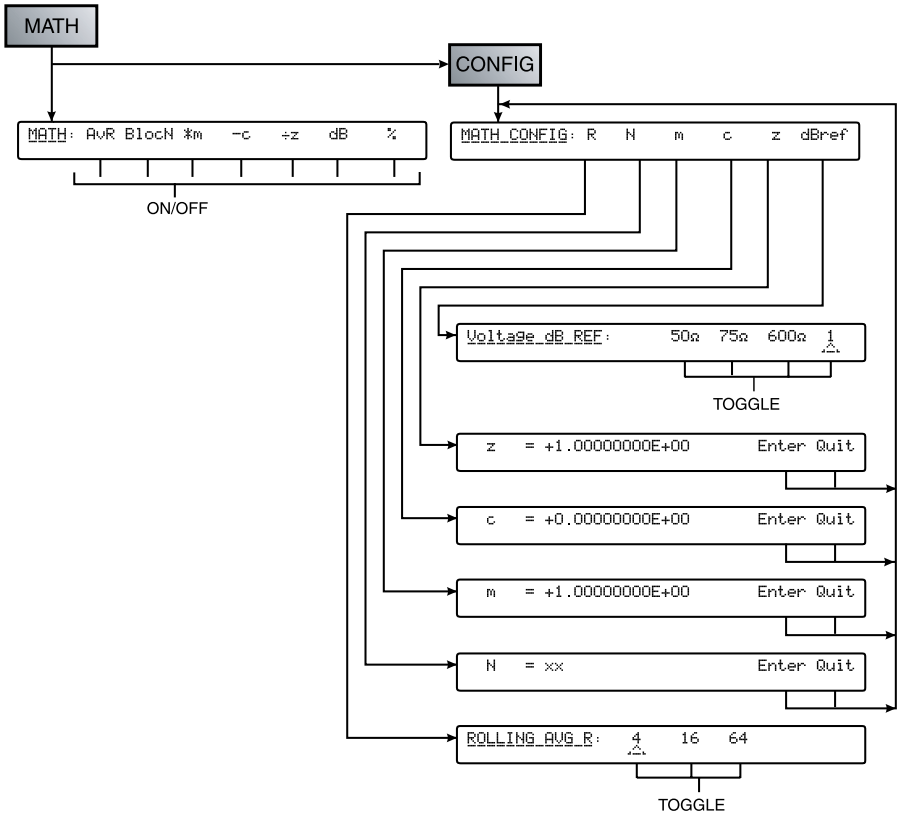
The Test mode provides a variety of selftest that may be run from the menu.



adj125.eps

Test Menu Tree

Math



adj127f.eps

Math Menu Tree

The MATH CONFIG menu has six menu keys.

R — Provides selection of the number of readings used in rolling average.

N — Provides a numeric entry menu for the value of N. The most recent N value is shown and the keyboard is activated. Press Enter to store the new value or Quit to leave the old value intact and return to the MATH CONFIG menu.

m — Provides a numeric entry menu for the value of the multiplier constant, m.

c — Provides a numeric entry menu for the value of the subtractor constant, c.

z — Provides a numeric entry menu for the value of the divisor constant, z.

dBref — Provides selection of the decibel reference constant, dBREF Only voltage functions can utilize all the settings. Other functions will utilize a unity reference.

- 50Ω — Selects a reference of 1 mW in 50 Ω.
- 75Ω — Selects a reference of 1 mW in 75 Ω.
- 600Ω — Selects a reference of 1 mW in 600 Ω
- 1 — Selects a unity reference value.

Clear

The ëinput zeroí corrections will remain active until power down, but the selections available in this menu allow the corrections to be cleared or restored to restored to their Power-up default.

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CLEAR Menu

8508A Specifications

General

Power

Voltage

115 V Setting ..... 100 V to 120 V rms ±10 %

230 V Setting ..... 200 V to 240 V rms ±10 %

Frequency ..... 47 Hz to 63 Hz

Consumption ..... < 80 VA

Dimensions

Height ..... 88 mm (3.5 inches)

Width ..... 427 mm (16.8 inches)

Depth ..... 487 mm (19.2 inches)

Weight ..... 11.5 kg (25.5 lbs)

Environment Temperature

Operating ..... 0 °C to 50 °C

Specified Operation ..... 5 °C to 40 °C

Calibration (TCal) ..... 20 °C to 25 °C

Factory Cal Temp ..... 23 °C

Storage ..... -20 °C to 70 °C

Warm Up ..... 4 hours to full uncertainty specification.

Relative Humidity (non condensing)

Operating, 5 °C to 40 °C ..... < 90 %

Storage, 0 °C to 70 °C ..... < 95 %

Altitude

Operating ..... < 2000 meters

Storage ..... < 12000 meters

Vibration and Shock ..... Complies with MIL-PRF-28800F Class 3.

Safety ..... Designed and tested to EN61010-1: 2001, UL 61010-1A1, CAN/CSA-C22.2 No.61010.1, CE and ETL marked. Pollution Degree 2. Installation Category II. Equipment Class I (single insulation / Earthed metal case). Protection against water ingress IP4X (general indoor conditions). Input circuitry and connections (creepage and clearances) designed to interface at Installation or Measurement Category 1.

EMC ..... EN50081-1 Class B, EN55011/22, EN61326-1:1998, EN50082-1, EN55011 1991 Class B, EN61000-6-1:2001, FCC Rules part 15 sub part J class B, CETL and CE marked.

Measurement Isolation

Guard to Safety Ground ..... < 3300 pF, > 10 GΩ.

Lo to Guard

In Remote Guard ..... < 2800 pF, > 10 GΩ (Not in Resistance function).

In Local Guard ..... Lo and Guard terminals are internally shorted (in Resistance < 2800 pF, > 10 GΩ).

Autorange

Range Up ..... 100 % of range.

Range Down ..... 9 % of range (18 % on 1000 V range).

Remote Interface ..... IEEE 488.2

Warranty ..... 1 YearMaximum Voltage and Current Inputs

Notes to maximum voltage and current input specifications

1. Maximum DC input equal to maximum rms input. Maximum peak input is rms x 1.414
2. Specifications apply equally to front and rear input terminals except where noted below.
3. Front to rear isolation allows opposing polarity of maximum terminal voltage on each input.
4. Digital I/O Ground (DigGnd) is internally connected to Safety Ground (Ground).

DC and AC Voltage

Maximum rms terminal voltages

			A	1000 V	1000 V	1000 V	1000 V
		Guard	1000 V	250 V	250 V	1000 V	1000 V
	DigGnd	650 V	650 V	650 V	650 V	1000 V	1000 V
Ground	0 V	650 V	650 V	650 V	650 V	1000 V	1000 V

Notes:

1. The A terminal is open circuit in these functions.
2. In 4wV mode Sense Hi is internally connected to Hi and Sense Lo is internally connected to Lo.

DC and AC Current

Maximum rms terminal voltages

							Sense Hi
						Hi	250 V
					Sense Lo	1000 V	1000 V
				Lo	250 V	1000 V	1000 V
			A	5 V	250 V	1000 V	1000 V
		Guard	250 V	250 V	250 V	1000 V	1000 V
	DigGnd	650 V	650 V	650 V	650 V	1000 V	1000 V
Ground	0 V	650 V	650 V	650 V	650 V	1000 V	1000 V

Maximum rms terminal currents

	Guard	A	Lo	Sense Lo	Hi	Sense Hi
Front Input	n.a	20 A	20 A	n.a	n.a	n.a
Rear input	n.a	2 A	2 A	n.a	n.a	n.a

Notes:

1. The Sense Lo, Sense Hi, and Hi Terminals are open circuit in these functions.
2. The front input A terminal protection is automatic and self-resetting, and does not interrupt current flow. Damage is likely to occur if more than 20 A is applied.
3. The rear input A terminal is protected by a fuse mounted on the rear panel.

Resistance and Temperature

Maximum rms terminal voltages

							Sense Hi
						Hi	250 V
					Sense Lo	250 V	250 V
				Lo	250 V	250 V	250 V
			A	250 V	250 V	250 V	250 V
		Guard	250 V	250 V	250 V	250 V	250 V
	DigGnd	650 V	650 V	650 V	650 V	1000 V	1000 V
Ground	0 V	650 V	650 V	650 V	650 V	1000 V	1000 V

Note: The A terminal is open circuit in these functions.

DC Voltage

DC Voltage [1] [2] [3]

Range	Full Scale	Uncertainty Relative to Cal Stds			Absolute Uncertainties	
		± (ppm Reading + ppm Range) [4]				
		24 hour TCal ±1 °C	90 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±5 °C
95 % Confidence Level						
200 mV	199.999 999	0.7 + 0.5	1.4 + 0.5	2.7 + 0.5	4.5 + 0.5	5.0 + 0.5
2 V	1.999 999 99	0.5 + 0.2	1.4 + 0.2	2.7 + 0.2	3.0 + 0.2	3.5 + 0.2
20 V	19.999 999 9	0.5 + 0.2	1.4 + 0.2	2.7 + 0.2	3.0 + 0.2	3.5 + 0.2
200 V	199.999 999	1.0 + 0.2	2.6 + 0.2	4.0 + 0.2	4.5 + 0.2	5.5 + 0.2
1000 V	1050.000 00	1.0 + 0.5	2.6 + 0.5	4.0 + 0.5	4.5 + 0.5	5.5 + 0.5
99 % Confidence Level						
200 mV	199.999 999	0.8 + 0.6	2.0 + 0.6	3.5 + 0.6	6.0 + 0.6	6.5 + 0.6
2 V	1.999 999 99	0.6 + 0.25	1.8 + 0.25	3.5 + 0.25	4.0 + 0.25	4.5 + 0.25
20 V	19.999 999 9	0.6 + 0.25	1.8 + 0.25	3.5 + 0.25	4.0 + 0.25	4.5 + 0.25
200 V	199.999 999	1.2 + 0.25	3.5 + 0.25	5.2 + 0.25	6.0 + 0.25	7.0 + 0.25
1000 V	1050.000 00	1.2 + 0.6	3.5 + 0.6	5.2 + 0.6	6.0 + 0.6	7.0 + 0.6

DC Voltage (Secondary Specifications) [1] [2] [3]

Range	Transfer Uncertainty 20 mins ±1 °C ± (ppm Reading+ ppm Range)	Temperature Coefficient	
		15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
		± ppm Reading/°C	
200 mV	0.4 + 0.3	0.4	0.6
2 V	0.12 + 0.1	0.3	0.5
20 V	0.12 + 0.1	0.3	0.5
200 V	0.4 + 0.1	0.7	1.0
1000 V	0.4 + 0.3	0.7	1.0

Type ..... Multi-slope, multi-cycle A-D Converter

CMRR (1 KΩ unbalance) [5] ..... 140 dB at DC and 1 - 60 Hz

NMRR[5]

Filter Out ..... 60 dB at 50/60 Hz ±0.09 %

Filter In ..... 110 dB at 50/60 Hz ±0.09 %

Protection (All ranges) ..... 1 kV rms

Input Impedance

200 mV to 20 V Ranges ..... > 10 GΩ

200 V & 1000 V Ranges ..... 10.1 MΩ ± 1 %

Max Input Current ..... 50 pA

Ratio Accuracy

Range to Range ..... ±(Net Front Input Accuracy + Net Rear Input Accuracy)

Within Range ..... Apply 24 hour or 20 minute Transfer Uncertainty specifications

Settling Time (to 10 ppm step size)

Filter Out ..... < 50 ms

Filter In ..... < 1 s

DC Current

DC Current [1] [2] [3]

Range	Full Scale	Uncertainty Relative to Cal Stds			Absolute Uncertainties	
		± (ppm Reading + ppm Range) [4]				
		24 hour TCal ±1 °C	90 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±5 °C
95 % Confidence Level						
200 µA	199.999 99	5.5 + 2.0	6.0 + 2.0	6.5 + 2.0	12 + 2.0	12 + 2.0
2 mA	1.999 999 9	5.5 + 2.0	6.0 + 2.0	6.5 + 2.0	12 + 2.0	12 + 2.0
20 mA	19.999 999	6.5 + 2.0	7.0 + 2.0	8.0 + 2.0	13 + 2.0	14 + 2.0
200 mA	199.999 99	28 + 4.0	30 + 4.0	33 + 4.0	36 + 4.0	48 + 4.0
2 A	1.999 999 9	80 + 8.0	125 + 8.0	170 + 8.0	170 + 8.0	185 + 8.0
20 A	19.999 999	200 + 20	290 + 20	380 + 20	380 + 20	400 + 20
99 % Confidence Level						
200 µA	199.999 99	7.0 + 2.0	7.5 + 2.0	8.0 + 2.0	15 + 2.0	16 + 2.0
2 mA	1.999 999 9	7.0 + 2.0	7.5 + 2.0	8.0 + 2.0	15 + 2.0	16 + 2.0
20 mA	19.999 999	8.0 + 2.0	9.0 + 2.0	10 + 2.0	16 + 2.0	18 + 2.0
200 mA	199.999 99	35 + 4.0	37 + 4.0	40 + 4.0	45 + 4.0	60 + 4.0
2 A	1.999 999 9	100 + 8.0	150 + 8.0	205 + 8.0	210 + 8.0	225 + 8.0
20 A	19.999 999	250 + 20	350 + 20	450 + 20	455 + 20	500 + 20

DC Current (Secondary Specifications) [1] [2] [3]

Range	Input Impedance (Ω)		Temperature Coefficient	
			15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
	Front	Rear	± ppm Reading/°C	
200 µA	150	150	0.4	0.6
2 mA	15.2	15.2	0.4	0.6
20 mA	1.8	1.9	1.2	1.8
200 mA	1.2	1.3	6. 0	9.0
2 A	0.3	0.4	8.0	12
20 A	0.04	-	8.0	12

Type.....Multi-slope, multi-cycle A-D Converter

Protection

Front Input .....20 A rms

Rear Input.....2 A rms, Rear Panel Fuse

Settling Time

200 µA to 200 mA Ranges, to 10 ppm step size.

Filter Out .....< 50 ms

Filter In.....< 1 s

2 A Range to 10 ppm step size.....< 1 s

20 A Range to 100 ppm step size.....< 30 s

AC Voltage

AC Voltage [1] [2] [6] [7]

Range	Full Scale	Frequency (Hz)	Uncertainty Relative to Cal Stds ± (ppm Reading + ppm Range) [4]			Absolute Uncertainties [9] ± (ppm Reading + ppm Range) [4]	
			24 hour TCal ±1 °C	90 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±5 °C
95% Confidence Level							
200 mV	199.999 9	1 - 10	80 + 70	120 + 70	120 + 70	160 + 70	165 + 70
		10 - 40	80 + 20	120 + 20	120 + 20	130 + 20	140 + 20
		40 - 100	60 + 20	100 + 20	100 + 20	110 + 20	115 + 20
		100 - 2k	40 + 10	100 + 10	100 + 10	105 + 10	110 + 10
		2k - 10k	60 + 20	100 + 20	100 + 20	105 + 20	135 + 20
		10k - 30k	250 + 30	300 + 40	300 + 40	305 + 40	340 + 40
		30k - 100k	400 + 100	700 + 100	700 + 100	705 + 100	765 + 100
2 V, 20 V & 200 V	1.999 999 19.999 99 199.999 9	1 - 10	70 + 60	100 + 60	100 + 60	140 + 60	150 + 60
		10 - 40	70 + 10	100 + 10	100 + 10	105 + 10	115 + 10
		40 - 100	50 + 10	80 + 10	80 + 10	85 + 10	90 + 10
		100 - 2k	30 + 10	60 + 10	60 + 10	65 + 10	75 + 10
		2k - 10k	50 + 10	80 + 10	80 + 10	85 + 10	110 + 10
		10k - 30k	100 + 20	200 + 20	200 + 20	205 + 20	220 + 20
		30k - 100k	250 + 100	500 +100	500 +100	505 + 100	570 + 100
		100k - 300k	0.15% + 0.1%	0.3% + 0.1%	0.3% + 0.1%	0.3% + 0.1%	0.3% + 0.1%
		300k - 1M	1% + 0.5%	1% + 1%	1% + 1%	1% + 1%	1% + 1%
1000 V [8]	1050.000	1 - 10	70 + 70	100 + 70	100 + 70	140 + 70	150 + 70
		10 - 40	70 + 20	100 + 20	100 + 20	110 + 20	120 + 20
		40 - 10k	50 + 20	80 + 20	80 + 20	95 + 20	115 + 20
		10k - 30k	100 + 40	200 + 40	200 + 40	205 + 40	225 + 40
		30k - 100k	250 + 200	500 + 200	500 + 200	510 + 200	580 + 200
99% Confidence Level							
200 mV	199.999 9	1 - 10	90 + 80	140 + 80	140 + 80	200 + 80	210 + 80
		10 - 40	90 + 25	140 + 25	140 + 25	145 + 25	160 + 25
		40 - 100	70 + 25	115 + 25	115 + 25	125 + 25	135 + 25
		100 - 2k	45 + 12	115 + 12	115 + 12	125 + 12	135 + 12
		2k - 10k	70 + 25	115 + 25	115 + 25	125 + 25	165 + 25
		10k - 30k	270 + 35	340 + 50	340 + 50	345 + 50	395 + 50
		30k - 100k	450 + 120	750 + 120	750 + 120	755 + 120	855 + 120
2 V, 20 V & 200 V	1.999 999 19.999 99 199.999 9	1 - 10	80 + 70	115 + 70	115 + 70	180 + 70	190 + 70
		10 - 40	80 + 12	115 + 12	115 + 12	120 + 12	135 + 12
		40 - 100	60 + 12	90 + 12	90 + 12	95 + 12	110 + 12
		100 - 2k	35 + 12	70 + 12	70 + 12	75 + 12	90 + 12
		2k - 10k	60 + 12	90 + 12	90 + 12	95 + 12	135 + 12
		10k - 30k	115 + 25	240 + 25	240 + 25	245 + 25	260 + 25
		30k - 100k	270 + 120	550 + 120	550 +120	555 + 120	650 + 120
		100k - 300k	0.15%+0.12%	0.3%+0.12%	0.3% + 0.12%	0.3% + 0.12%	0.3% + 0.12%
		300k - 1M	1% + 0.6%	1% + 1.2%	1% + 1.2%	1% + 1.2%	1% + 1.2%
1000 V [8]	1050.000	1 - 10	80 + 80	115 + 80	115 + 80	180 + 80	190 + 80
		10 - 40	80 + 25	115 + 25	115 + 25	135 + 25	145 + 25
		40 - 10k	60 + 25	90 + 25	90 + 25	110 + 25	140 + 25
		10k - 30k	115 + 50	240 + 50	240 + 50	250 + 50	265 + 50
		30k - 100k	270 + 250	600 + 250	600 + 250	615 + 250	700 + 250

AC Voltage (Secondary Specifications) [1] [2]

Range	Frequency (Hz)	Temperature Coefficient	
		15 °C - 30 °C	5 °C - 15 °C 30 °C – 40 °C
		± ppm Reading/°C	
200 mV	1 - 10	5	10
	10 - 40	5	10
	40 - 100	5	10
	100 - 2k	5	10
	2k - 10k	12	20
	10k - 30k	15	20
	30k - 100k	40	60
2 V 20 V 200 V	1 - 10	5	10
	10 - 40	5	10
	40 - 100	5	10
	100 - 2k	5	10
	2k - 10k	10	15
	10k - 30k	12	20
	30k - 100k	40	60
	100k - 300k	60	90
	300k - 1M	80	120
1000 V	1 - 10	5	10
	10 - 40	5	10
	40 - 10k	10	15
	10k - 30k	12	20
	30k - 100k	40	60

Type ..... True RMS, AC coupled measures AC component with up to 1000 V DC bias on any range. DC coupled gives $\sqrt{(ac^2 + dc^2)}$

CMRR (1 kΩ unbalance) [5] ..... > 90 dB DC - 60 Hz

Crest Factor

200 mV to 200 V ranges ..... 10:1 at 12% range, 5:1 at 50% range, 2.5:1 at full range

1000 V range ..... 10:1 at 25% range, 5:1 at full range

Protection (All ranges) ..... 1 kV rms

Input Impedance ..... 1 MΩ in parallel with 150 pF

DC Accuracy (DC Coupled) [15] ..... Add ±(50 ppm Reading + 50 ppm Range + 20 μV)

Ratio Accuracy

Range to Range ..... ±(Net Front Input Accuracy + Net Rear Input Accuracy)

Within Range ..... Apply 24 hour or 20 minute Transfer Uncertainty specifications

Settling Time (to 100 ppm step size)

100 Hz ..... < 0.5 s

40 Hz ..... < 1.25 s

10 Hz ..... < 5 s

1 Hz ..... < 50 s

Frequency Measurement

Signal Amplitude Range ..... 5 % of range to limit set by maximum V•Hz

Gate Mode	**Normal**	**Fast**
Resolution	6.5 digits	4.5 digits
Frequency Range	10 Hz - 1 MHz	200 Hz - 1 MHz
Accuracy (1 year, 13 °C - 33 °C)	± (10 ppm of Reading + 2 digits)	± 2 digits
Sample Interval	1 s	50 ms

AC Current

AC Current [1] [2] [6] [9]

Range	Full Scale	Frequency (Hz)	Uncertainty Relative to Cal Stds ± (ppm Reading + ppm Range) [4]			Absolute Uncertainties [9]	
			24 hour TCal ±1 °C	90 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±5 °C
95% Confidence Level							
200 µA, 2 mA & 20 mA	199.999 9	1 - 10	200 + 100	250 + 100	250 + 100	290 + 100	310 + 100
	1.999 999	10 - 10k	200 + 100	250 + 100	250 + 100	280 + 100	300 + 100
	19.999 99	10k - 30k	500+ 100	600 + 100	600 + 100	650 + 100	710 + 100
		30k - 100k	0.35% + 100	0.4% + 100	0.4% + 100	0.4% + 100	0.4% + 100
200 mA	199.999 9	1 - 10	200 + 100	250 + 100	250 + 100	290 + 100	310 + 100
		10 - 10k	200 + 100	250 + 100	250 + 100	250 + 100	290 + 100
		10k - 30k	500 + 100	600 + 100	600 + 100	600 + 100	625 + 100
2 A	1.999 999	10 - 2k	500 + 100	600 + 100	600 + 100	600 + 100	620 + 100
		2k - 10k	600 + 100	700 + 100	700 + 100	700 + 100	725 + 100
		10k - 30k	0.25% + 100	0.3% + 100	0.3% + 100	0.3% + 100	0.3% + 100
20 A	19.999 99	10 - 2k	700 + 100	800 + 100	800 + 100	800 + 100	820 + 100
		2k - 10k	0.2% + 100	0.25% + 100	0.25% + 100	0.25% + 100	0.25% + 100
99% Confidence Level							
200 µA, 2 mA & 20 mA	199.999 9	1 - 10	250 + 120	300 + 120	300 + 120	380 + 120	400 + 120
	1.999 999	10 - 10k	250 + 120	300 + 120	300 + 120	340 + 120	370 + 120
	19.999 99	10k - 30k	600+ 120	700 + 120	700 + 120	775 + 120	800 + 120
		30k - 100k	0.35% + 120	0.4% + 120	0.4% + 120	0.4% + 120	0.4% + 120
200 mA	199.999 9	1 - 10	250 + 120	300 + 120	300 + 120	380 + 120	400 + 120
		10 - 10k	250 + 120	300 + 120	300 + 120	305 + 120	360 + 120
		10k - 30k	600 + 120	700 + 120	700 + 120	700 + 120	740 + 120
2 A	1.999 999	10 - 2k	600 + 120	700 + 120	700 + 120	705 + 120	725 + 120
		2k - 10k	700 + 120	800 + 120	800 + 120	815 + 120	860 + 120
		10k - 30k	0.25% + 120	0.3% + 120	0.3% + 120	0.3% + 120	0.3% + 120
20 A	19.999 99	10 - 2k	800 + 120	900 + 120	900 + 120	900 + 120	920 + 120
		2k - 10k	0.2% + 120	0.25% + 120	0.25% + 120	0.25% + 120	0.25% + 120

AC Current (Secondary Specifications) [1] [2] [6] [9]

Range	Frequency (Hz)	Temperature Coefficient ± ppm Reading/°C		Input Impedance (Ω)		
		15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C	Range	Front	Rear
200 µA, 2 mA & 20 mA	1 - 10	10	15	200 µA	150	150
	10 - 10k	10	15	2 mA	15.2	15.2
	10k - 30k	12	20	20 mA	1.8	1.9
	30k - 100k	40	60			
200 mA	1 - 10	10	15		1.2	1.3
	10 - 10k	15	20			
	10k - 30k	15	20			
2 A	10 - 2k	10	15		0.3	0.4
	2k - 10k	15	20			
	10k - 30k	20	30			
20 A	10 - 2k	10	15		0.04	-
	2k - 10k	15	20			

Type..... True RMS, AC coupled. DC coupled gives $\sqrt{(ac^2 + dc^2)}$

Crest Factor..... 3:1 at 50% range, 1.5:1 at full range

Protection

Front Input ..... 20 A rms

Rear Input ..... 2 A rms, Rear Panel Fuse

Settling Time (to 100 ppm step size)	**200 µA to 2 A Ranges**	**20 A Range**
100 Hz	< 0.5 s	< 30 s
40 Hz	< 1.25 s	< 30 s
10 Hz	< 5 s	< 30 s
1 Hz	< 50 s	< 50 s

Resistance

Resistance [1] [2] [3] [9]

Range	Full Scale	Mode [10]	Uncertainty Relative to Cal Stds ± (ppm Reading + ppm Range) [4]			Absolute Uncertainties ± (ppm Reading + ppm Range) [4]	
			24 hour TCal ±1 °C	90 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±1 °C	365 day TCal ±5 °C
95% Confidence Level							
2 Ω	1.999 999 99	Normal	5.0 + 2.0	8.0 + 2.0	10 + 2.0	15 + 2.0	17 + 2.0
20 Ω	19.999 999 9	Normal	2.5 + 0.7	4.5 + 0.7	7.0 + 0.7	9.0 + 0.7	9.5 + 0.7
200 Ω	199.999 999	Normal	1.5 + 0.25	4.0 + 0.25	7.0 + 0.25	7.5 + 0.25	8.0 + 0.25
2 kΩ	1.999 999 99	Normal	1.0 + 0.25	3.5 + 0.25	7.0 + 0.25	7.5 + 0.25	8.0 + 0.25
20 kΩ	19.999 999 9	Normal	1.0 + 0.25	3.5 + 0.25	7.0 + 0.25	7.5 + 0.25	8.0 + 0.25
200 kΩ	199.999 999	Normal	1.0 + 0.25	3.5 + 0.25	7.0 + 0.25	7.5 + 0.25	8.0 + 0.25
2 MΩ	1.999 999 99	Normal	2.0 + 0.5	4.0 + 0.5	7.0 + 0.5	8.5 + 0.5	9.0 + 0.5
20 MΩ	19.999 999 9	Normal	3.5 + 5.0	6.0 + 5.0	9.0 + 5.0	15 + 5.0	20 + 5.0
200 MΩ	199.999 999	Normal	20 + 50	25 + 50	30 + 50	60 + 50	120 + 50
2 GΩ	1.999 999 99	Normal	250 + 500	350 + 500	500 + 500	525 + 500	1510 + 500
2 Ω	1.999 999 99	Lo Current	5.0 + 2.0	8.0 + 2.0	10 + 2.0	15 + 2.0	17 + 2.0
20 Ω	19.999 999 9	Lo Current	2.5 + 0.7	4.5 + 0.7	7.0 + 0.7	9.0 + 0.7	9.5 + 0.7
200 Ω	199.999 999	Lo Current	2.5 + 0.7	5.0 + 0.7	7.0 + 0.7	7.5 + 0.7	8.0 + 0.7
2 kΩ	1.999 999 99	Lo Current	2.5 + 0.7	5.0 + 0.7	7.0 + 0.7	7.5 + 0.7	8.0 + 0.7
20 kΩ	19.999 999 9	Lo Current	2.5 + 0.7	5.0 + 0.7	7.0 + 0.7	7.5 + 0.7	8.0 + 0.7
200 kΩ	199.999 999	Lo Current	5.0 + 0.5	6.5 + 0.5	7.0 + 0.5	7.5 + 0.5	8.0 + 0.5
2 MΩ	1.999 999 99	Lo Current	7.0 + 0.5	8.0 + 0.5	9.0 + 0.5	10 + 0.5	15 + 0.5
20 MΩ	19.999 999 9	Lo Current	20 + 5.0	20 + 5.0	25 + 5.0	35 + 5.0	90 + 5.0
200 MΩ	199.999 999	Lo Current	250 + 500	350 + 500	500 + 500	515 + 500	1505 + 500
2 GΩ	1.999 999 99	Lo Current	250 + 500	350 + 500	500 + 500	525 + 500	1510 + 500
20 MΩ	19.999 999 9	High Voltage	2.0 + 0.5	4.0 + 0.5	7.0 + 0.5	15 + 0.5	17 + 0.5
200 MΩ	199.999 999	High Voltage	3.5 + 5.0	6.0 + 5.0	9.0 + 5.0	60 + 5.0	65 + 5.0
2 GΩ	1.999 999 99	High Voltage	20 + 50	25 + 50	30 + 50	150 + 50	180 + 50
20 GΩ	19.999 999 9	High Voltage	250 + 500	350 + 500	500 + 500	525 + 500	1510 + 500
99% Confidence Level							
2 Ω	1.999 999 99	Normal	6.0 + 2.5	10 + 2.5	12 + 2.5	19 + 2.5	22 + 2.5
20 Ω	19.999 999 9	Normal	3.0 + 0.9	5.5 + 0.9	8.5 + 0.9	11.5 + 0.9	12.0 + 0.9
200 Ω	199.999 999	Normal	1.8 + 0.3	5.0 + 0.3	8.5 + 0.3	9.5 + 0.3	10.0 + 0.3
2 kΩ	1.999 999 99	Normal	1.2 + 0.3	4.5 + 0.3	8.5 + 0.3	9.5 + 0.3	10.0 + 0.3
20 kΩ	19.999 999 9	Normal	1.2 + 0.3	4.5 + 0.3	8.5 + 0.3	9.5 + 0.3	10.0 + 0.3
200 kΩ	199.999 999	Normal	1.2 + 0.3	4.5 + 0.3	8.5 + 0.3	9.5 + 0.3	10.0 + 0.3
2 MΩ	1.999 999 99	Normal	2.5 + 0.6	5.0 + 0.6	8.5 + 0.6	10.5 + 0.6	12.0 + 0.6
20 MΩ	19.999 999 9	Normal	4.5 + 6.0	7.5 + 6.0	12 + 6.0	20 + 6.0	25 + 6.0
200 MΩ	199.999 999	Normal	25 + 60	30 + 60	35 + 60	75 + 60	150 + 60
2 GΩ	1.999 999 99	Normal	325 + 600	450 + 600	650 + 600	675 + 600	1810 + 600
2 Ω	1.999 999 99	Lo Current	6.0 + 2.5	10 + 2.5	12 + 2.5	19 + 2.5	22 + 2.5
20 Ω	19.999 999 9	Lo Current	3.0 + 0.9	5.5 + 0.9	8.5 + 0.9	11.5 + 0.9	12.0 + 0.9
200 Ω	199.999 999	Lo Current	3.0 + 0.9	6.5 + 0.9	8.5 + 0.9	9.5 + 0.9	10.0 + 0.9
2 kΩ	1.999 999 99	Lo Current	3.0 + 0.9	6.5 + 0.9	8.5 + 0.9	9.5 + 0.9	10.0 + 0.9
20 kΩ	19.999 999 9	Lo Current	3.0 + 0.9	6.5 + 0.9	8.5 + 0.9	9.5 + 0.9	10.0 + 0.9
200 kΩ	199.999 999	Lo Current	6.0 + 0.6	8.0 + 0.6	9.0 + 0.6	9.5 + 0.6	10.0 + 0.6
2 MΩ	1.999 999 99	Lo Current	8.0 + 0.6	10.0 + 0.6	12.0 + 0.6	13.0 + 0.6	17.0 + 0.6
20 MΩ	19.999 999 9	Lo Current	25 + 6.0	25 + 6.0	30 + 6.0	45 + 6.0	110 + 6.0
200 MΩ	199.999 999	Lo Current	325 + 600	450 + 600	650 + 600	670 + 600	1810 + 600
2 GΩ	1.999 999 99	Lo Current	325 + 600	450 + 600	650 + 600	675 + 600	1810 + 600
20 MΩ	19.999 999 9	High Voltage	2.5 + 0.6	5.0 + 0.6	8.5 + 0.6	19 + 0.6	20 + 0.6
200 MΩ	199.999 999	High Voltage	4.5 + 6.0	7.5 + 6.0	12 + 6.0	75 + 6.0	80 + 6.0
2 GΩ	1.999 999 99	High Voltage	25 + 60	30 + 60	35 + 60	195 + 60	230 + 60
20 GΩ	19.999 999 9	High Voltage	325 + 600	450 + 600	650 + 600	675 + 600	1810 + 600

Resistance - Normal Mode (Secondary Specifications) [1] [2] [3] [10]

Range	Measurement Current	Transfer Uncertainty 20 mins ±1 °C ± (ppm Reading + ppm Range)	Temperature Coefficient	
			15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
			± ppm Reading/°C	
2 Ω	100 mA	2.0 + 2.0	1.5	2.5
20 Ω	10 mA	0.8 + 0.7	0.6	1.0
200 Ω	10 mA	0.2 + 0.15	0.5	0.8
2 kΩ	1 mA	0.2 + 0.15	0.5	0.8
20 kΩ	100 µA	0.2 + 0.15	0.5	0.8
200 kΩ	100 µA	0.2 + 0.15	0.5	0.8
2 MΩ	10 µA	0.5 + 0.5	0.6	1.0
20 MΩ	1 µA	2.5 + 5	2	3
200 MΩ	100 nA	15 + 50	20	30
2 GΩ	10 nA	200 + 500	200	300

Resistance - Lo Current Mode (Secondary Specifications) [1] [2] [3] [10]

Range	Measurement Current	Transfer Uncertainty 20 mins ±1 °C ± (ppm Reading + ppm Range)	Temperature Coefficient	
			15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
			± ppm Reading/°C	
2 Ω	100 mA	2.0 + 2.0	1.5	2.5
20 Ω	10 mA	0.8 + 0.7	0.6	1.0
200 Ω	1 mA	0.8 + 0.7	0.6	1.0
2 kΩ	100 µA	0.8 + 0.7	0.6	1.0
20 kΩ	10 µA	0.8 + 0.7	0.6	1.0
200 kΩ	10 µA	0.5 + 0.5	0.6	1.0
2 MΩ	1 µA	2.0 + 0.5	2	3
20 MΩ	100 nA	15 + 5	20	30
200 MΩ	10 nA	200 + 500	200	300
2 GΩ	10 nA	200 + 500	200	300

Resistance - High Voltage Mode (Secondary Specifications) [1] [2] [3]

Range [9]	Measurement Current	Transfer Uncertainty 20 mins ±1 °C ± (ppm Reading + ppm Range)	Temperature Coefficient	
			15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
			± ppm Reading/°C	
20 MΩ	10 µA	0.5 + 0.5	0.6	1.0
200 MΩ	1 µA	2.0 + 0.5	2.0	3
2 GΩ	100 nA	15 + 50	20	30
20 GΩ	10 nA	200 + 500	200	300

Type..... True 4-wire with Ohms guard. 2-wire selectable.

Max Lead Resistance..... 10 Ω in any or all leads, 1 Ω on 2 Ω range

Full Scale Measurement Voltage

Normal Mode ..... 200 mV/2 V/20 V

Lo Current Mode..... 200 mV/2 V

High Voltage Mode ..... 200 V

Protection (All ranges) ..... 250 V rms, 360 V pk

Ratio Accuracy

Range to Range..... ±(Net Front Input Accuracy + Net Rear Input Accuracy)

Within Range ..... Apply 24 hour or 20 minute Transfer Uncertainty specifications

Settling Time ..... Up to 200 kΩ range generally the same as DC Voltage Filter In but depends on external connections

Temperature

Temperature Readout [1] [2] [3]

Resistance Range	Absolute Resistance Measurement Uncertainty 365 day Tcal ±1 °C [4] ±(ppm Reading + mΩ)[11]	Typical Equivalent Temperature Measurement Uncertainty [12]			
		Probe Type	Nominal Temperature (°C)	Resistance (Ω)	Accuracy ± (°C)
95% Confidence Level					
0 - 199.999 999 Ω	7.5 + 0.14	25 Ω PRT/SPRT	-200	5	0.0085
		25 Ω PRT/SPRT	0	25	0.0035
		25 Ω PRT/SPRT	660	84	0.0025
		100 Ω PRT/SPRT	-200	20	0.0035
		100 Ω PRT/SPRT	0	100	0.0025
		100 Ω PRT/SPRT	232	185	0.0020
200 - 1999.999 99 Ω	7.5 + 0.5	100 Ω PRT/SPRT	400	250	0.0025
99% Confidence Level					
0 - 199.999 999 Ω	9.5 + 0.18	25 Ω PRT/SPRT	-200	5	0.0010
		25 Ω PRT/SPRT	0	25	0.0040
		25 Ω PRT/SPRT	660	84	0.0025
		100 Ω PRT/SPRT	-200	20	0.0040
		100 Ω PRT/SPRT	0	100	0.0025
		100 Ω PRT/SPRT	232	185	0.0020
200 - 1999.999 99 Ω	9.5 + 0.6	100 Ω PRT/SPRT	400	250	0.0025

Temperature Readout (Secondary Specifications) [1] [2] [3]

Resistance Range	Resistance Measurement Uncertainty				
	Transfer Uncertainty 20 Minute ±1 °C ±(ppm Reading + mΩ) [11]	2-Wire Adder (Ω)	3-Wire Adder (Ω)	Temp Coeff. ± ppm Reading/°C	
				15 °C - 30 °C	5 °C - 15 °C 30 °C - 40 °C
0 - 199.999 999 Ω	0.8 + 0.14	0.1	0.005	0.6	1.0
200 - 1999.999 99 Ω	0.2 + 0.5	0.1	0.005	0.5	0.8

Type ..... 4-wire current reversal resistance measurement with readout of equivalent temperature. 2-wire and 3-wire selectable without current reversal. Refer to Resistance specifications for additional details.

Temperature Range ..... -200 ∝C to 660 ∝C, readout also available in ∝F or K.

Linearization ..... ITS-90 or Callendar van Dusen. Entry and storage of coefficients and nominal resistance for up to 100 probes.

Current Source ..... 1 mA

Read Rate and Additional Uncertainty

Read Rate and Additional Uncertainty

Function	Resolution	Filter Frequency (Hz)	Read Rate (readings/second)		Additional Errors [13] ± (ppm Reading + ppm Range)	
			Normal	Fast	Normal	Fast
DCV, DCI & Ohms [10]	8		1/25	1/6	0 + 0	0 + 0.1
	7		1/6	1/2	0 + 0.1	0 + 0.5
	6		2	35	1.0 + 0.5	0 + 2.5
	5		35	150	0 + 5	0 + 25
ACV & ACI [6]	6	1	1/50		0 + 0	
		10	1/5		0 + 0	
		40	1/2		0 + 0	
		100	1		0 + 0	
	5	1	1/50		0 + 5	
		10	1/5		0 + 5	
		40	1/2		0 + 5	
		100	2		0 + 5	
ACV Transfer Off [6]		1	1/25		200 + 20	
		10	1/2.5		200 + 20	
		40	1		200 + 20	
		100	4		200 + 20	
PRT & Tru Ohms [14]	8	-	1/90	1/30	0 + 0	
	7	-	1/30	1/10	0 + 0.1	
	6	-	1/4	1/3	1.0 + 0.5	
	5	-	1/3	1/3	0 + 5	

Notes to Performance Specifications

Fluke guarantees 8508A performance verification using specifications stated to 99% confidence level.

[1] Specifications apply for max resolution in each function, normal mode

[2] Assumes 4 hour warm-up period

[3] Input zero or offset null required whenever the temperature moves more than ±1 °C from the temperature at which the previous null/zero was performed

[4] TCal = Ambient calibration temperature

[5] Integration time > 1 Power Line cycle

[6] Valid for signals > 1 % Full Scale, Transfer Mode On. Signals must be DC coupled < 40 Hz. Readings invalid with Transfer Mode On and 1Hz filter selected when using internal trigger mode

[7] Max Volt.Hertz 3×10^7

[8] >300 V, < 10 kHz add: $\pm 0.0004\ (R\text{-}300)^2$ ppm
> 300 V, 10 kHz - 30 kHz add: $\pm\ (0.0004 + (F - 10000) \times 10^{-7})(R\text{-}300)^2$ ppm
> 300 V, > 30 kHz add: $\pm 0.0024\ (R\text{-}300)^2$ ppm

[9] Typical below 10 Hz for ACV, below 10 Hz and above 10 kHz for ACI, and above 2 GΩ for Resistance

[10] Tru Ohms mode available on 2 Ω to 20 kΩ ranges. Read Rate reduced in Tru Ohms Mode. Specification for Tru Ohms same as corresponding Normal or Lo Current range

[11] Valid for 4-wire sensor

[12] Not including sensor uncertainty

[13] Assume Range and Full Scale = 2000 V when calculating for 1000V Range. For DCI, additional errors only apply in 5 digit resolution

[14] Fast mode not available in PRT

Applying the Specifications

Introduction

The Fluke 8508A has been designed specifically for metrologists. Not only does it provide the performance metrologists need, but it is specified in a way to allow users to really understand the uncertainties of the measurements, and easily make allowance for those uncertainty contributions when performing measurement uncertainty analyses and compiling uncertainty budgets. Contemporary metrology practices, including ISO17025 based laboratory accreditation schemes, require uncertainty analysis to be performed in accordance with the statistically based techniques described in the ISO Guide to the Expression of Uncertainty in Measurement (often referred to as the ëGUMí). For convenience, the 8508A specifications are quoted at a coverage factor of k=2, equivalent to a confidence level of approximately 95 %, as required by these methods. Specifications are also provided at a confidence level of 99 %.

Performance specifications for the 8508A consist of two elements, the first is a contribution expressed as parts-per-million of the Reading, and the second contribution is expressed as parts-per-million of the Range. These must be evaluated and combined for the relevant reading and range values applicable to the measurement being made, ensuring that both elements are evaluated on the same basis, such as parts per million of the measured value or in absolute terms (volts, amps, ohms, etc). The two elements are combined by adding algebraically. For example measuring 10 V on the 20VDC range and applying the 365 day ±1 °C specifications:

First, expressing the contributions in terms of parts-per-million of the measured value:

$$= \pm\left(3.0 + 0.2 \text{ x } \frac{20}{10}\right) = \pm(3.0 + 0.4) = \pm 3.4 \text{ ppm of } 10\text{V}$$

Second, expressing the contributions in volts:

$$= \pm\left(3.0 \text{ x } 10^{-6} \text{ x } 10 + 0.2 \text{ x } 10^{-6} \text{ x } 20\right) = \pm 3.4 \text{ x } 10^{-5} = \pm 34 \text{ µV}$$

The 8508 is designed to provide accuracy and stability without the need for internal auto or self calibration routines which may otherwise compromise the continuity and traceability of measurement performance history. To realise the full potential of the 8508A performance accepted metrology practices should be employed, such as performing a zeroing or null operation to remove any offsets present in the measurement setup when making DC measurements. The 8508A specifications assume that these methods are employed.

Absolute and Relative Specifications

The Relative to Calibration Standards specifications describe the performance of the 8508A itself for the time periods and temperature range listed excluding the uncertainty of the standards used to perform calibration of the 8508A during manufacture. The Absolute specifications include the uncertainty of the standards used to perform calibration of the 8508A at manufacture and may be used to determine the uncertainty of measurements made with the 8508A for periods up to 1 year and over a temperature range of ±5 °C from calibration. If the user has their 8508A calibrated with different uncertainties, the Relative specifications can be combined with the uncertainties applicable to that calibration to determine the effective absolute uncertainty following that calibration.

Applying User's Calibration Uncertainties

When the 8508A is calibrated by another laboratory the uncertainties of the calibration standards used may be applied by combining those uncertainties with the 8508Aís Relative to Standards specifications. The applicable calibration uncertainties and the 8508A relative specifications must both be expressed at the same confidence level, and be combined in a RSS (Root Sum Square) summation. Accepted metrology practice mandates that calibration uncertainties are stated at 95 %. Check the applicable calibration uncertainties are stated at 95 % and then combine them with the 8508A 95 % Relative specifications. For example, if the 8508A is calibrated at 10 V DC with an uncertainty of 1.5 ppm at 95 %: The absolute uncertainty at 10 V for a period of 90 days and ±1 °C from calibration is:

$$= \pm\sqrt{1.5^2 + \left(1.4 + 0.2 \times \frac{20}{10}\right)^2} = \pm 2.3 \text{ ppm of } 10\text{V}$$

Operating and Calibration Temperature Ranges

As a metrology tool, the 8508A will commonly be used in a calibration laboratory where the temperature would be controlled to ±1 °C, and the 8508A ±1 °C specifications are applicable to those situations. The majority of electrical calibration laboratories operate at a nominal temperature of 23 °C, the temperature at which the 8508A is calibrated by Fluke during manufacture and service. The 8508A is also capable of being calibrated at any temperature between 20 °C and 25 °C and the ±1 °C specifications will apply to operation within ±1 °C of that calibration temperature. In the 8508A specification tables the temperature of calibration is referred to as TCal. Specifications for ±5 °C are provided for situations where the 8508A is operated in environments with wider temperature variations up to ±5 °C. For applications where the knowledge of the effect of temperature on 8508A performance is important, temperature coefficients are listed in the 8508A specifications. If the operating temperature is within the range 15 °C to 30 °C the 15 °C to 30 °C temperature coefficient specifications are applicable otherwise use the 5 °C to 15 °C/30 °C to 40 °C figures, provided the temperature lies within that range. The 8508A may be operated at temperatures between 0 °C and 50 °C, but performance is not specified outside the range 5 °C to 40 °C.

Applying Temperature Coefficient Specifications

The 8508A specification tables include information for the typical operating conditions of ±1 °C for calibration laboratories with tight temperature control, and ±5 °C for calibration laboratories with looser temperature control or uncontrolled environments within that temperature range. For the majority of applications choosing the Absolute specifications for the most appropriate operating temperature range will be adequate. However performance at other temperatures may be determined by including an allowance for temperature coefficient over the additional temperature range. Care should be taken when making this calculation as an amount of temperature coefficient is already included in the 8508A specifications and those specifications are themselves based on combining contributions using techniques similar to those employed in uncertainty analysis. For example, consider operating at 33 °C, 10 °C from the 23 °C calibration temperature. The ±5 °C specifications already include a contribution for 5 °C of temperature difference, so this amount of temperature effect must be removed before the effect of the 10 °C difference is added. Consider 10 V on the 20VDC range: 365 day absolute specification (95 %) at 33 °C expressed in parts-per-million of 10 V is:

$$= \pm\sqrt{\left(3.5 + 0.2 \times \frac{20}{10}\right)^2 - (5 \text{ x } 0.3)^2 + (10 \text{ x } 0.5)^2} = \pm 6.16 \text{ ppm of } 10\text{V}$$

Ratio Measurements

The 8508A Ratio mode will automatically take measurements of inputs applied to the front and rear terminals and display the result as a ratio in the voltage and resistance functions. The measurements can be made on the same range or different ranges. When making measurements on different ranges the error in each measurement is evaluated by applying the relevant specification for each range and combining the two specifications in an RSS summation, expressing the contributions in parts-per-million of the measured values. For example, making measurements of the ratio of 100 mV on the 200mVDC range and 100 V on the 200VDC range, applying the 365 day ±1 °C Absolute specifications:

$$= \pm \sqrt{\left(4.5 + 0.5 \text{ x } \frac{200 \text{ x } 10^{-3}}{100 \text{ x } 10^{-3}}\right)^2 + \left(4.5 + 0.2 \text{ x } \frac{200}{100}\right)^2} = \pm 7.37 \text{ ppm of the ratio}$$

Making measurements on the same range will eliminate range to range errors, such as drift since the time of calibration, and improve the result. When making measurements on the same range these errors will affect both measurements and effectively cancel, leaving short term noise and linearity as the dominant errors. The 20 minute Transfer Uncertainty Specifications are provided to describe the performance obtained when making ratio measurements on the same range. The error in each measurement is evaluated by applying the relevant 20 minute Transfer Uncertainty Specification for each value and combining the two specifications in an RSS summation, expressing the contributions in parts-per-million of the measured values. If the measurements are made within the same range, but independently (not using the ratio mode) with an elapsed time greater than 20 minutes but less than 24 hours between the measurements, then the 24 hour specifications should be applied instead.

For example, making measurements of the ratio of 5 V and 10 V on the 20VDC range, applying the 20 minute Transfer Uncertainty specifications:

$$= \pm \sqrt{\left(0.12 + 0.1 \text{ x } \frac{20}{5}\right)^2 + \left(0.12 + 0.1 \text{ x } \frac{20}{10}\right)^2} = \pm 0.61 \text{ ppm of the ratio}$$

Additional Errors

The 8508A specifications are listed for the maximum resolution in each function, using the Normal reading mode. For measurements taken in other resolutions or the Fast read mode additional error contributions listed in the Read Rate and Additional Uncertainty table must be included. These additional contributions must be added algebraically to the relevant specifications. For example measuring 10 V on the 20VDC range at 5 digit resolution in Fast mode and applying the 365 day ±1 °C Absolute specifications:

$$= \pm \left((3.0 + 0) + (0.2 + 25) \text{ x } \frac{20}{10} \right) = \pm (3.0 + 50.4) = \pm 53.4 \text{ ppm of 10V}$$

Other additional contributions apply in certain situations and are also to be added algebraically to the relevant specifications. These additional contributions include the DC Accuracy specification to be applied when making DC measurements on the AC Voltage function when DC coupled, and the High Voltage Adder when making measurements above 300 V on the AC Voltage function.