FLUKE®

5500A
Multi-Product Calibrator

Getting Started

PN 945159
August 2001

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Pour avoir recours au service de la garantie, mettez-vous en rapport avec le centre de service Fluke le plus proche ou envoyez le produit, accompagné d'une description du problème, port et assurance payés (franco lieu de destination), au centre de service agréé par Fluke le plus proche. Fluke dégage toute responsabilité en cas de dégradations survenues au cours du transport. Après la réparation sous garantie, le produit sera retourné à l'acheteur, frais de port payés d'avance (franco lieu de destination). Si Fluke estime que le problème a été causé par un traitement abusif, une modification, un accident ou des conditions de fonctionnement ou de manipulation anormales, Fluke fournira un devis des frais de réparation et ne commencera la réparation qu'après en avoir reçu l'autorisation. Après la réparation, le produit sera retourné à l'acheteur, frais de port payés d'avance, et les frais de réparation et de transport lui seront facturés.

LA PRESENTE GARANTIE EST EXCLUSIVE ET TIENT LIEU DE TOUTES AUTRES GARANTIES, EXPLICITES OU IMPLICITES, Y COMPRIS, MAIS NON EXCLUSIVEMENT, TOUTE GARANTIE IMPLICITE QUANT A L'APTITUDE DU PRODUIT A ETRE COMMERCIALISE OU A ETRE APPLIQUE A UNE FIN OU A UN USAGE DETERMINE. FLUKE NE POURRA ETRE TENU RESPONSABLE D'AUCUN DOMMAGE PARTICULIER, INDIRECT, ACCIDENTEL OU CONSECUTIF, NI D'AUCUNS DEGATS OU PERTES DE DONNEES, QUE CE SOIT A LA SUITE D'UNE INFRACTION AUX OBLIGATIONS DE GARANTIE, SUR UNE BASE CONTRACTUELLE, EXTRA- CONTRACTUELLE OU AUTRE.

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Um die Garantieleistung in Anspruch zu nehmen, wenden Sie sich bitte an das nächstgelegene und von Fluke autorisierte Servicezentrum oder senden Sie das Produkt mit einer Beschreibung des Problems und unter Vorauszahlung von Fracht- und Versicherungskosten (FOB Bestimmungsort) an das nächstgelegene und von Fluke autorisierte Servicezentrum. Fluke übernimmt keinerlei Haftung für eventuelle Transportschäden. Im Anschluß an die Reparatur wird das Produkt unter Vorauszahlung von Frachtkosten (FOB Bestimmungsort) an den Erwerber zurückgesandt. Wenn Fluke jedoch feststellt, daß der Defekt auf unsachgemäße Handhabung, Veränderungen am Gerät, einen Unfall oder auf anormale Betriebsbedingungen oder unsachgemäße Handhabung zurückzuführen ist, wird Fluke dem Erwerber einen Voranschlag der Reparaturkosten zukommen lassen und erst die Zustimmung des Erwerbers einholen, bevor die Arbeiten in Angriff genommen werden. Nach der Reparatur wird das Produkt unter Vorauszahlung der Frachtkosten an den Erwerber zurückgeschickt und werden dem Erwerber die Reparaturkosten und die Versandkosten (FOB Versandort) in Rechnung gestellt.

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Para obtener servicio en garantía, póngase en contacto con el Servicio Oficial Fluke autorizado más próximo o envíe el producto, con una descripción del problema surgido, a portes y seguros pagados por anticipado (FOB en Destino), al Servicio Oficial Fluke autorizado más próximo. Fluke no asume ningún riesgo por los daños en tránsito. Tras la reparación en concepto de garantía, el producto será devuelto al Comprador, previo pago del transporte (FOB en Destino). Si Fluke decide que la avería ha sido causada por una mala utilización, alteración, accidente o manejo o manipulación anormales, Fluke hará una estimación de los costes de reparación y solicitará autorización antes de comenzar el trabajo. Tras la reparación, el producto será devuelto al Comprador, previo pago del transporte, y se facturarán al Comprador los gastos en concepto de reparación y de transporte para su devolución (FOB en el Punto de envío).

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CAUTION

This is an IEC safety Class 1 product. Before using, the ground wire in the line cord or rear panel binding post must be connected to an earth ground for safety.

Interference Information

This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation.

Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

There is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient the receiving antenna
- Relocate the equipment with respect to the receiver
- Move the equipment away from the receiver
- Plug the equipment into a different outlet so that the computer and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: How to Identify and Resolve Radio-TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 004-000-00345-4.

Declaration of the Manufacturer or Importer

We hereby certify that the Fluke Model 5500A is in compliance with BMPT Vfg 243/1991 and is RFI suppressed. The normal operation of some equipment (e.g. signal generators) may be subject to specific restrictions. Please observe the notices in the users manual. The marketing and sales of the equipment was reported to the Central Office for Telecommunication Permits (BZT). The right to retest this equipment to verify compliance with the regulation was given to the BZT.

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daβ die Fluke Model 5500A in Übereinstimmung mit den Bestimmungen der BMPT-AmtsblVfg 243/1991 funk-entstört sind. Der vorschriftsmäßige Betrieb mancher Geräte (z.B. Meßsender) kann allerdings gewissen Einschränkungen unterliegen. Beachten Sie deshalb die Hinweise in der Bedienungsanleitung. Dem Bundesamt für Zulassungen in der Telecommunikation wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Fluke Corporation

SAFETY TERMS IN THIS MANUAL

This instrument has been designed and tested in accordance with IEC publication 1010-1 (1992-1), Safety Requirements for Electrical Measuring, Control and Laboratory Equipment, and ANSI/ISA-582.01-1994, and CAN/CSA-C22.2 No. 1010.1-92. This User Manual contains information, warning, and cautions that must be followed to ensure safe operation and to maintain the instrument in a safe condition. Use of this equipment in a manner not specified herein may impair the protection provided by the equipment.

This instrument is designed for IEC 1010-1 Installation Category II use. It is not designed for connection to circuits rated over 4800 VA.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to equipment.

SYMBOLS MARKED ON EQUIPMENT

WARNING Risk of electric shock. Refer to the manual (see the Index for references).

GROUND Ground terminal to chassis (earth).

Attention Refer to the manual (see the Index for references). This symbol indicates that information about usage of a feature is contained in the manual. This symbol appears on the rear panel ground post and by the fuse compartment.

AC POWER SOURCE

The instrument is intended to operate from an ac power source that will not apply more than 264V ac rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is required for safe operation.

USE THE PROPER FUSE

To avoid fire hazard, for fuse replacement use only the specified unit: 110 or 120 V operation, 2.5 ampere/250 volt time delay; 220 or 240 V operation, 1.25 ampere/250 volt time delay.

GROUNDING THE INSTRUMENT

The instrument utilizes controlled overvoltage techniques that require the instrument to be grounded whenever normal mode or common mode ac voltages or transient voltages may occur. The enclosure must be grounded through the grounding conductor of the power cord, or through the rear panel ground binding post.

USE THE PROPER POWER CORD

Use only the power cord and connector appropriate for the voltage and plug configuration in your country.

Use only a power cord that is in good condition.

Refer power cord and connector changes to qualified service personnel.

DO NOT OPERATE IN EXPLOSIVE ATMOSPHERES

To avoid explosion, do not operate the instrument in an atmosphere of explosive gas.

DO NOT REMOVE COVER DURING OPERATION

To avoid personal injury or death, do not remove the instrument cover without first removing the power source connected to the rear panel. Do not operate the instrument without the cover properly installed. Normal calibration is accomplished with the cover closed. Access procedures and the warnings for such procedures are contained both in this manual and in the Service Manual. Service procedures are for qualified service personnel only.

DO NOT ATTEMPT TO OPERATE IF PROTECTION MAY BE IMPAIRED

If the instrument appears damaged or operates abnormally, protection may be impaired. Do not attempt to operate the instrument under these conditions. Refer all questions of proper instrument operation to qualified service personnel.

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Getting Started

Introduction

The Fluke Model 5500A Multi-Product Calibrator (Figure 1) is a precise instrument that calibrates a wide variety of electrical measuring instruments. With the 5500A Calibrator, you can calibrate precision multimeters that measure ac or dc voltage, ac or dc current, ac or dc power, resistance, capacitance, and temperature. With the Oscilloscope Calibration option, you can use the 5500A Calibrator to calibrate analog and digital oscilloscopes. Specifications are provided in this manual. Complete operating information is provided in the Operator Manual and complete service information is provided in the Service Manual. Both manuals are provided on the CD-ROM you received with your Calibrator.

⚠ Warning

If the 5500A Calibrator is operated in any way not specified by this manual or other documentation provided by Fluke, the protection provided by the Calibrator may be impaired.

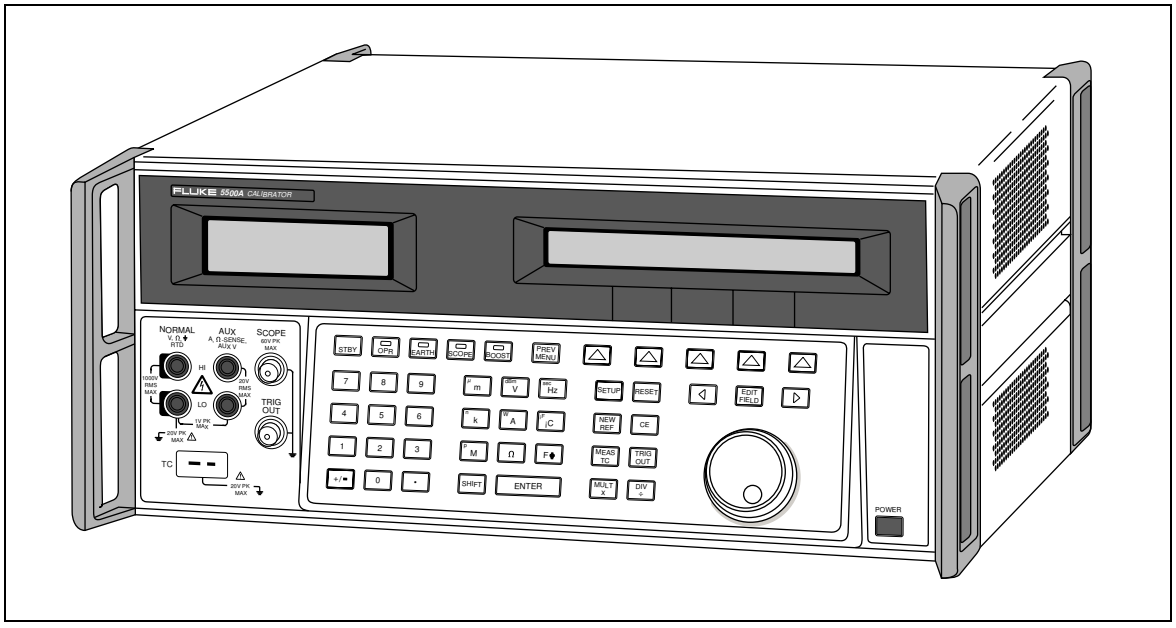

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Figure 1. 5500A Multi-Product Calibrator

The 5500A Calibrator is a fully programmable precision source of the following:

- DC voltage from 0 V to ±1020 V.
- AC voltage from 1 mV to 1020 V, with output from 10 Hz to 500 kHz.
- AC current from 0.01 µA to 11.0 A, with output from 10 Hz to 10 kHz.
- DC current from 0 to ±11.0 A.
- Resistance values from a short circuit to 330 MΩ.
- Capacitance values from 330 pF to 1100 µF.
- Simulated output for three types of Resistance Temperature Detectors (RTDs).
- Simulated output for nine types of thermocouples.

Features of the 5500A Calibrator include the following:

- Automatic meter error calculation.
- MULT X and DIV ÷ keys that change the output value to pre-determined cardinal values for various functions.
- Programmable entry limits that prevent invalid amounts from being entered.
- Simultaneous output of voltage and current, up to 11 kW.
- Simultaneous output of two voltages.
- Extended bandwidth mode outputs multiple waveforms down to 0.01 Hz, and sine waves to 2 MHz.
- Variable phase signal output.
- Standard IEEE-488 (GPIB) interface, complying with ANSI/IEEE Standards 488.1-1987 and 488.2-1987.
- EIA Standard RS-232-C serial data interface for printing, displaying, or transferring internally stored calibration constants, and for remote control of the 5500A.
- Pass-through RS-232-C serial data interface for communicating with the Unit Under Test (UUT).
- Extensive automatic internal self testing and diagnostics of analog and digital functions.

Instruction Manuals

The 5500A Manual Set provides complete information for operators and service or maintenance technicians. The set includes:

- *5500A Getting Started Manual* (PN 945159)
- *5500A Operator Reference Guide* (PN 945097)
- *5500A Remote Programming Reference Guide* (PN 105783)
- *5500A Operator Manual* (Provided on CD-ROM or printed copy available for purchase (PN 1628802) through the Fluke Service Department.)
- *5500A Service Manual* (PN 105798)

5500A Getting Started Manual

This *5500A Getting Started Manual* contains a brief introduction to the 5500A Manual Set, instructions on how to get your calibrator prepared for operation and a complete set of specifications.

5500A Operator Manual

The *5500A Operator Manual* provides complete information for installing the 5500A Calibrator and operating it from the front panel keys and in remote configurations. This manual also provides a glossary of calibration, specifications, and error code information. The Operator Manual includes the following topics:

- Installation
- Operating controls and features, including front panel operation
- Remote operation (IEEE-488 bus or serial port remote control)
- Serial port operation (printing, displaying, or transferring data, and setting up for serial port remote control)
- Operator maintenance, including verification procedures and calibration approach for the 5500A
- Oscilloscope Calibration Option
- Accessories

5500A Operator Reference Guide

The *5500A Operator Reference Guide* contains a summary of operating instructions, and a front panel and rear panel feature reference. This guide is included with this manual.

5500A Programmer Reference Guide

The *5500A Programmer Reference Guide* contains a summary of remote commands and reference information useful in determining system status using the status byte and related registers. This guide is included with this manual.

5500A Service Manual

The *5500A Service Manual* is available in PDF format on the CD-ROM provided with your instrument. It can also be ordered through your local Fluke Sales or Service representative. The 5500A Service Manual includes: theory of operation, performance testing, maintenance, calibration, troubleshooting, parts lists, and schematic diagrams.

Where to Go from Here

To locate specific information concerning the operation of the 5500A calibrator, refer to the following list:

- Controls, indicators, and displays: *Operator Manual* - Chapter 3, “Features”
- Front panel operation: *Operator Manual* - Chapter 4, “Front Panel Operation”
- Cabling to a UUT (Unit Under Test): *Operator Manual* - Chapter 4, “Front Panel Operation”
- Using the auxiliary amplifier: *Operator Manual* - Chapter 4, “Front Panel Operation”
- Remote operation (IEEE-488 or serial): *Operator Manual* - Chapter 5, “Remote Operation”
- Calibrating an Oscilloscope: *Operator Manual* - Chapter 8, “Oscilloscope Calibration Option”
- Accessories to the 5500A Calibrator: *Operator Manual* - Chapter 9, “Accessories”

Operation Overview

The 5500A Calibrator may be operated at the front panel in the local mode, or remotely using RS-232 or IEEE-488 ports. For remote operations, several software options are available to integrate 5500A operation into a wide variety of calibration requirements.

Local Operation

Typical local operations include front panel connections to the Unit Under Test (UUT), and then manual keystroke entries at the front panel to place the calibrator in the desired output mode. The front panel layout facilitates hand movements from left to right, and multiply and divide keys make it easy to step up or down at the press of a single key. You can also review 5500A Calibrator specifications at the push of a button [available, July, 1995]. The backlit liquid crystal display is easy to read from many different viewing angles and lighting conditions, and the large, easy-to-read keys are color-coded and provide tactile feedback when they are pressed.

Remote Operation (RS-232)

There are two rear-panel serial data RS-232 ports: SERIAL 1 FROM HOST, and SERIAL 2 TO UUT (Figure 2). Each port is dedicated to serial data communications for operating and controlling the 5500A during calibration procedures. For complete information on remote operations, see Chapter 5.

The SERIAL 1 FROM HOST serial data port connects a host terminal or personal computer to the 5500A. You have several choices for sending commands to the 5500A: you can enter commands from a terminal (for example, using the Terminal accessory from Windows using a PC), you can write your own programs using BASIC, or you can run optional Windows-based software such as 5500/CAL or MET/CAL. The 5500/CAL software includes more than 200 example procedures covering a wide range of test tools the 5500A can calibrate. (See Chapter 6 for a discussion of the RS-232 commands.)

The SERIAL 2 TO UUT serial data port connects a UUT to a PC or terminal via the 5500A (see Figure 2). This “pass-through” configuration eliminates the requirement for two COM ports at the PC or Terminal. A set of four commands control the operation of the SERIAL 2 TO UUT serial port. See Chapter 6 for a discussion of the UUT_* commands.

Remote Operation (IEEE-488)

The 5500A rear panel IEEE-488 port is a fully programmable parallel interface bus meeting standard IEEE-488.1 and supplemental standard IEEE-488.2. Under the remote control of an instrument controller, the 5500A Calibrator operates exclusively as a “talker/listener.” You can write your own programs using the IEEE-488 command set or run the optional Windows-based MET/CAL software. (See Chapter 6 in the Operator Manual for a discussion of the commands available for IEEE-488 operation.)

⚠ Warning

The 5500A Calibrator can supply lethal voltages. Read this section before operating the calibrator.

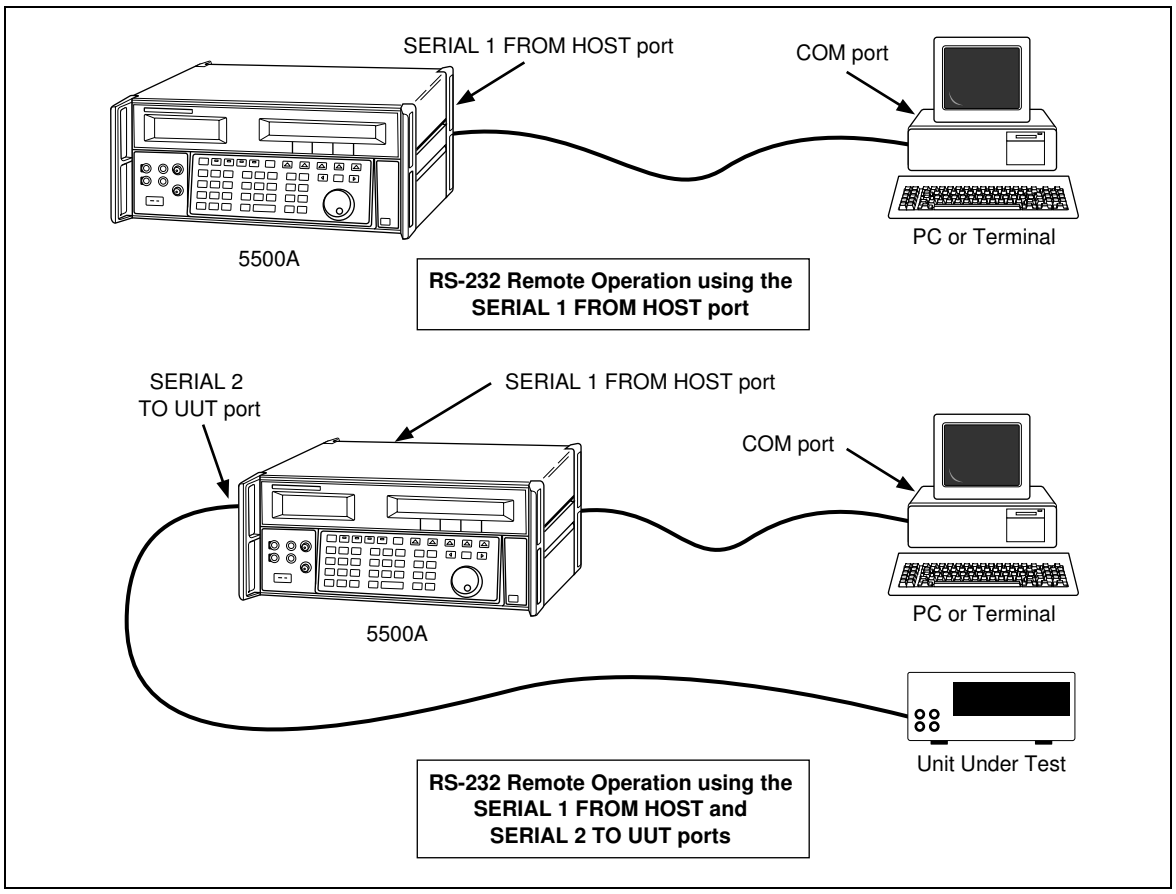


Figure 2. RS-232 Remote Connections

Preparing for Operation

The following paragraphs provide instructions for unpacking and installing the 5500A, selecting the line voltage, replacing the fuse, and connecting to line power. Instructions for cable connections other than line power can be found in the following chapters of the Operator Manual:

- UUT (Unit Under Test) connections: Chapter 4, “Front Panel Operation”
- IEEE-488 parallel interface connection: Chapter 5, “Remote Operation”
- RS-232C serial interface connection: Chapter 5, “Remote Operation”
- Auxiliary amplifier connections: Chapter 4, “Front Panel Operation”

Unpacking and Inspection

The calibrator is shipped in a container designed to prevent damage during shipping. Inspect the calibrator carefully for damage and immediately report any damage to the shipper. Instructions for inspection and claims are included in the shipping container.

When you unpack the calibrator, check for all the standard equipment listed in Table 1 and check the shipping order for any additional items ordered. Refer to the *5500A Operator Manual* Chapter 9, “Accessories” for more information. Report any shortage to the place of purchase or to the nearest Fluke Technical Service Center. A performance test is provided in the *5500A Operator Manual* Chapter 7, “Maintenance.”

If reshipping the calibrator, use the original container. If it is not available, you can order a new container from Fluke by indicating the calibrator's model and serial number.

Table 1. Standard Equipment

Item	Model or Part Number
Calibrator	5500A
Line Power Cord	See Table 2
5500A CD-ROM (contains Operator and Service Manual)	1627768
5500A Getting Started Manual	945159
5500A Operator Reference Guide	945097
5500A Remote Programming Reference Guide	105783
Certificate of Calibration	Form G749

Replacing the Fuse

CAUTION

To prevent possible damage to the instrument, verify the correct fuse is installed for the selected line voltage setting (100 V and 120 V, use 2.5 A/250 V time delay; 200 V and 240 V, use 1.25 A/250 V time delay).

The line power fuse is accessible on the rear panel. The fuse rating is 2.5 A/250 V time delay fuse for the 100 V/120 V line voltage setting; 1.25 A/250 V time delay fuse for the 220 V/240 V line voltage setting. Fuses that are not user replaceable are discussed in Chapter 7, "Maintenance."

To check or replace the fuse, refer to Figure 4 and proceed as follows:

1. Disconnect line power.
2. Open the fuse compartment by inserting a screwdriver blade in the tab located at the left side of the compartment and gently pry until it can be removed with the fingers.
3. Remove the fuse from the compartment for replacement or verification. Be sure the correct fuse is installed.
4. Reinstall the fuse compartment by pushing it back into place until the tab locks.

Selecting Line Voltage

The calibrator arrives from the factory configured for the line voltage normally appropriate for the country of purchase, or as specified at the time of your purchase order. You can operate the 5500A Calibrator from one of four line voltage settings: 100 V, 120 V, 200 V, and 240 V (47 to 63 Hz). To check the line voltage setting, note the voltage setting visible through the window in the power line fuse compartment cover (Figure 4). The allowed line voltage variation is 10% above or below the line voltage setting.

To change the line voltage setting, complete the following procedure:

1. Remove the fuse compartment by following the first two steps in "Replacing the Fuse" earlier in this manual.
2. Remove the line voltage selector assembly by gripping the line voltage indicator tab with pliers and pulling it straight out of its connector.
3. Rotate the line voltage selector assembly to the desired voltage and reinsert.
4. Verify the appropriate fuse for the selected line voltage (100 V/120 V, use 2.5 A/250 V time delay; 220 V/240 V, use 1.25 A/250 V time delay) and reinstall the fuse compartment by pushing it back into place until the tab locks.

Connecting to Line Power

⚠ Warning

To avoid shock hazard, connect the factory supplied three-conductor line power cord to a properly grounded power outlet. Do not use a two-conductor adapter or extension cord; this will break the protective ground connection.

Use the rear-panel ground terminal for a protective grounding wire if there is any question as to instrument earth grounding.

The calibrator is shipped with the appropriate line power plug for the country of purchase. If you need a different type, refer to Table 2 and Figure 3 for a list and illustration of the line power plug types available from Fluke.

After you verify that the line voltage selection is set correctly and that the correct fuse for that line voltage is installed, connect the calibrator to a properly grounded three-prong outlet.

Table 2. Line Power Cord Types Available from Fluke

Type	Voltage/Current	Fluke Option Number
North America	120 V/15 A	LC-1
North America	240 V/15 A	LC-2
Universal Euro	220 V/16 A	LC-3
United Kingdom	240 V/13 A	LC-4
Switzerland	220 V/10 A	LC-5
Australia	240 V/10 A	LC-6
South Africa	240 V/5 A	LC-7

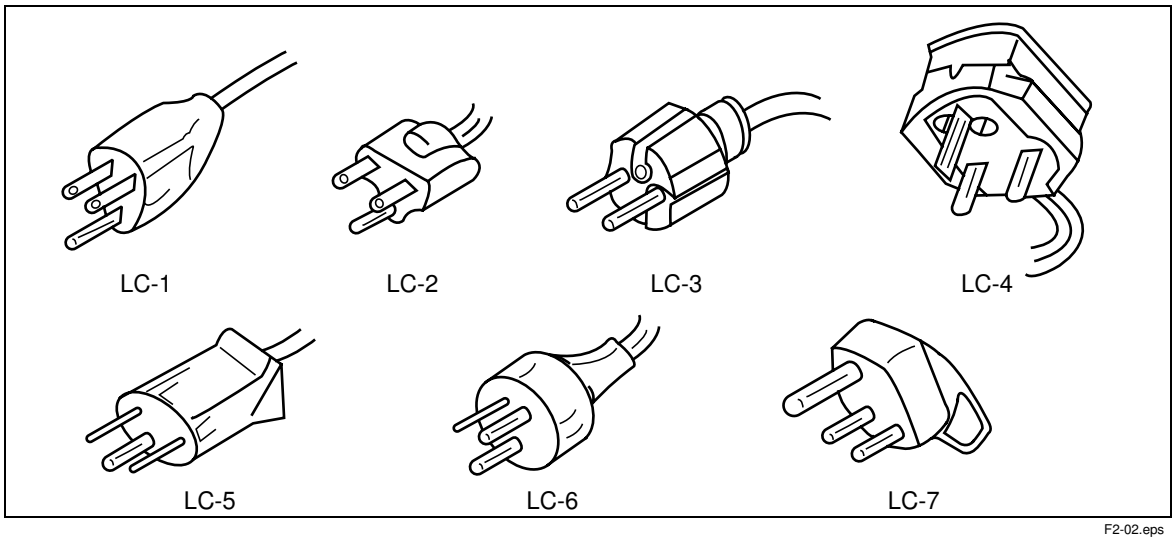


Figure 3. Line Power Cord Types Available from Fluke

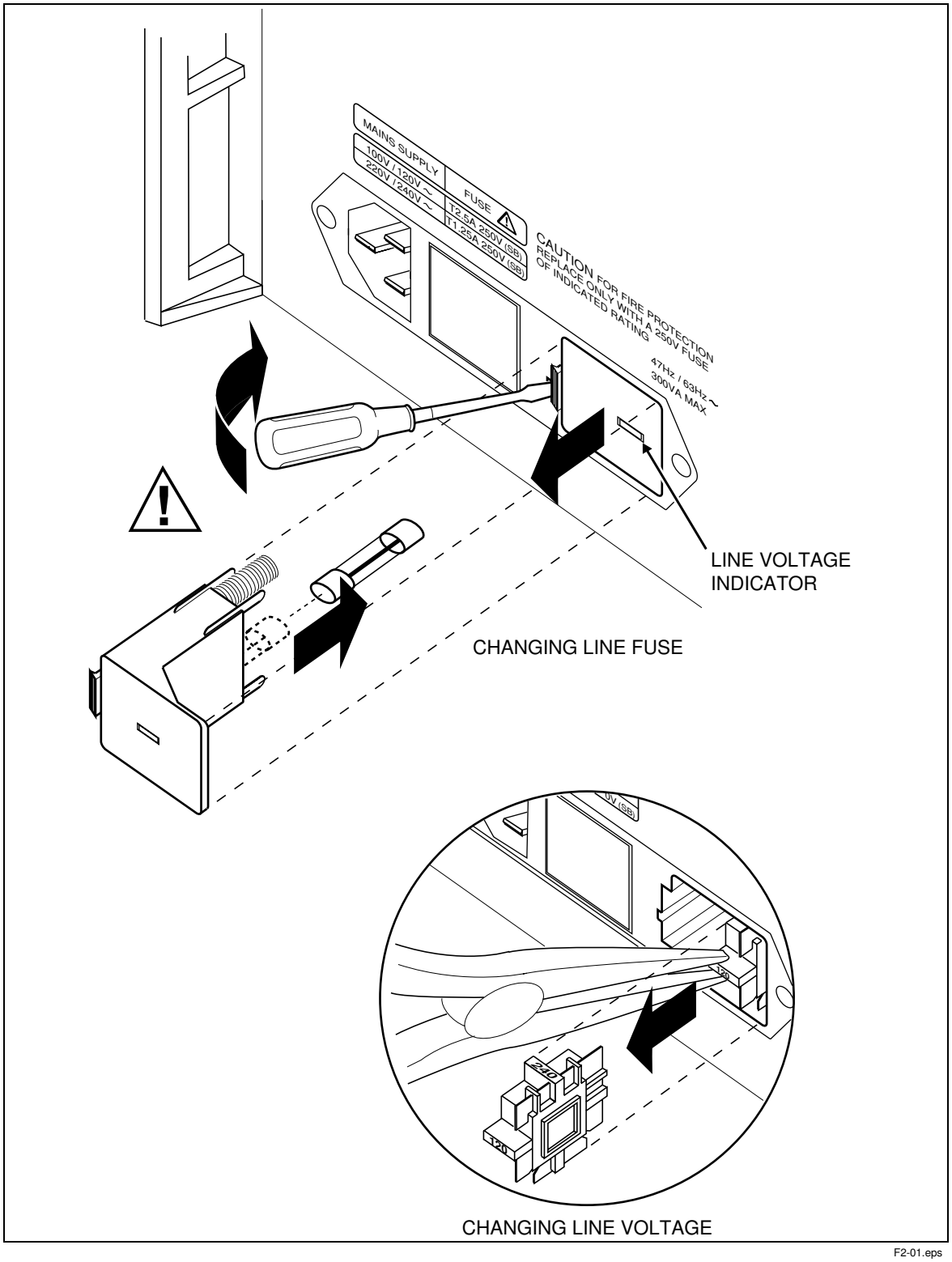


Figure 4. Accessing the Fuse and Selecting Line Voltage

Service Information

Each Model 5500A Calibrator is warranted to the original purchaser for a period of 1 year beginning on the date received. The warranty is located at the front of this manual.

To locate an authorized service center, call Fluke using any of the phone numbers listed below, or visit us on the World Wide Web: www.fluke.com

USA: 1-888-99-FLUKE (1-888-993-5853)
Canada: 1-800-36-FLUKE (1-800-363-5853)
Europe: +31 402-675-200
Japan: +81-3-3434-0181
Singapore: +65-738-5655
Anywhere in the world: +1-425-446-5500

Or, visit Fluke's Web site at www.fluke.com.
To register your product, visit register.fluke.com.

After-warranty service is available, but you may choose to repair the calibrator using the information in the Troubleshooting Chapter of the 5500A Service Manual and the Module Exchange Program. Refer to the Fluke catalog or contact a Technical Service Center representative for the module exchange procedure.

Placement and Rack Mounting

You may place the calibrator on a bench top or mount it in a standard-width, 24-inch (61-cm) deep equipment rack. For bench-top use, the calibrator is equipped with non-slipping, non-marring feet. To mount the calibrator in an equipment rack, use the 5500A Rack Mount Kit, Model Y5537. Instructions for rack mounting the calibrator are packed with the rack mount kit.

Cooling Considerations

⚠ Warning

To avoid risk of injury, never operate or power the 5500A Calibrator without the fan filter in place.

CAUTION

Damage caused by overheating may occur if the area around the air intake is restricted, the intake air is too warm, or the air filter becomes clogged.

Baffles direct cooling air from the fan throughout the chassis to internally dissipate heat during operation. The accuracy and dependability of all internal parts of the calibrator are enhanced by maintaining the coolest possible internal temperature. You can lengthen the life of the calibrator and enhance its performance by observing the following rules:

- The area around the air filter must be at least 3 inches from nearby walls or rack enclosures.
- The exhaust perforations on the sides of the calibrator must be clear of obstructions.
- The air entering the instrument must be at room temperature: make sure the exhaust air from another instrument is not directed into the fan inlet.
- Clean the air filter every 30 days or more frequently if the calibrator is operated in a dusty environment. (See the *5500A Operator Manual* Chapter 7, "Maintenance" for instructions on cleaning the air filter.)

5725A Amplifier

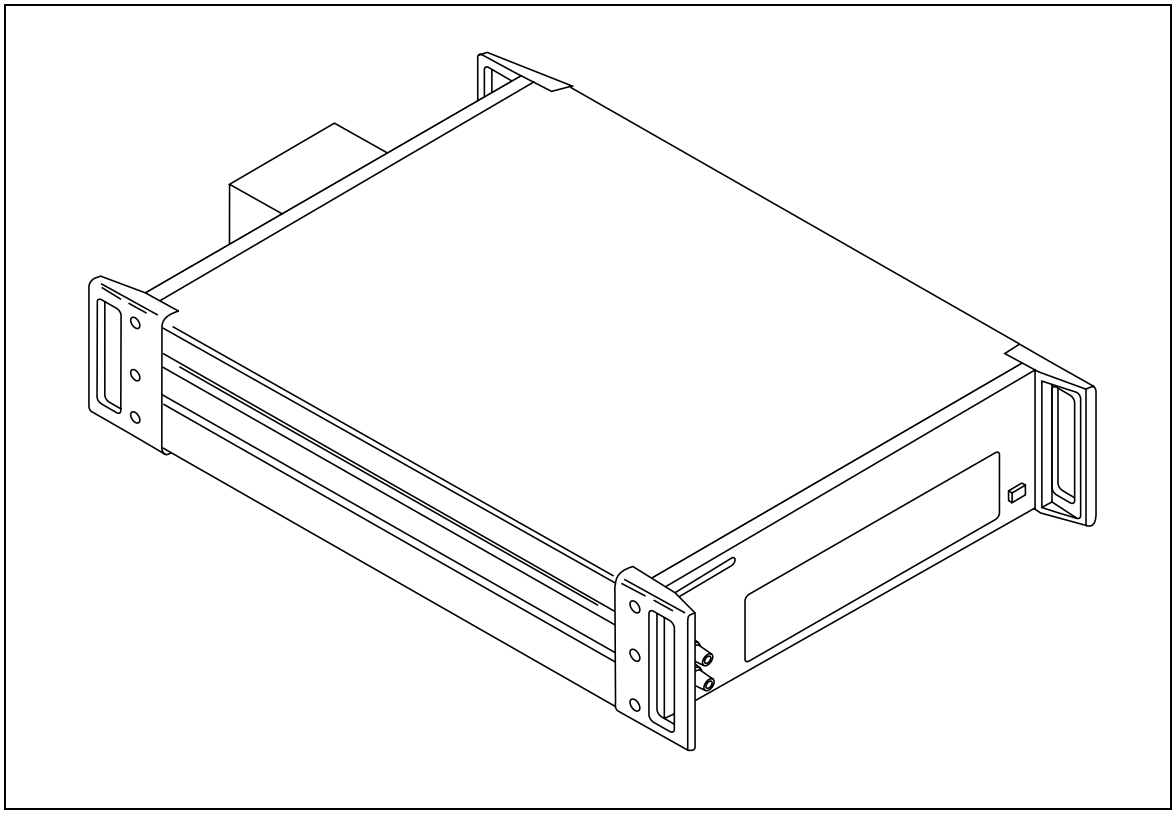
The Fluke 5725A Amplifier (Figure 5) is an external unit operating under 5500A control to extend the Volts x Hertz and voltage compliance of the calibrator. The amplifier adds the following capabilities with no compromise in accuracy:

Frequency Increase to 100 kHz at 750 V, 30 kHz at 1020 V.

AC Voltage Load limit extended to 70 mA for frequencies above 5 kHz, and to 50 mA for frequencies less than 5 kHz. Capacitive drive increases to 1020 pF, subject to the maximum output current, for volts ac.

AC Current 11 A load limit extended to 10 kHz, with a 3-volt drive compliance.

A separate set of binding posts on the front panel of the 5725A supplies extended capability. Since most meters have a separate input terminal for the high current ranges, this eliminates the need to change cables during a procedure.



F1-03.eps

Figure 5. 5725A Amplifier

Connecting the 5725A Amplifier

The 5500A provides an interface connection for the Fluke 5725A Amplifier. You designate whether the 5500A or 5725A is the preferred source of current and voltage in a calibrator setup menu (see *5500A Operator Manual* Chapter 4, “Front Panel Operation”). A single connection cable provides the complete link for analog and digital control signals. Refer to the *5725A Instruction Manual* for installation instructions (a copy is provided on the CD-ROM you received with your 5500A).

Specifications

The following paragraphs describe the details for the 5500A specifications. All specifications are valid after allowing a warm-up period of 30 minutes, or twice the time the 5500A has been turned off. (For example, if the 5500A has been turned off for 5 minutes, the warm-up period is 10 minutes.)

All specifications apply for the temperature and time period indicated. For temperatures outside of tcal $\pm$ 5°C (tcal is the ambient temperature when the 5500A was calibrated), the temperature coefficient is less than 0.1 times the 90-day specifications per °C (limited to 0°C - 50°C). These specifications also assume the 5500A Calibrator is zeroed every seven days or when the ambient temperature changes more than 5°C. (See "Zeroing the Calibrator" in Chapter 4 of the Operator Manual.)

Also see additional specifications later in this chapter for information on extended specifications for ac voltage and current. The dimensional outline for the 5500A Calibrator is shown in Figure 6.

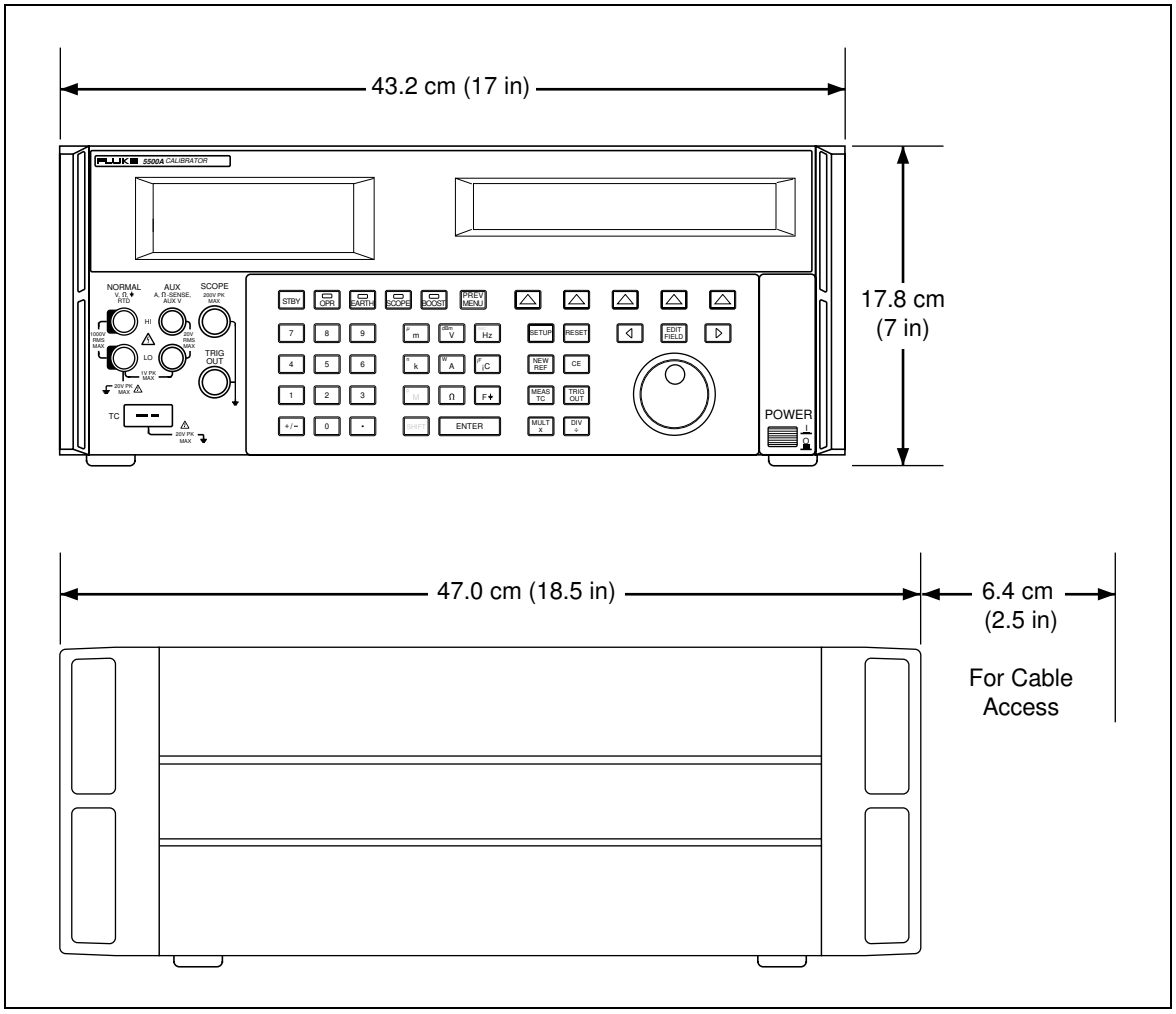


Figure 6. 5500A Calibrator Dimensional Outline

General Specifications

Warmup Time	Twice the time since last warmed up, to a maximum of 30 minutes
Settling Time	5 seconds typical for all functions and ranges
Internal Diagnostics	Comprehensive analog and digital self-tests on demand. Self-tests are valid after warm-up time.
Standard Interfaces	IEEE-488 (GPIB), RS-232, 5725A Amplifier
Temperature Performance	Operating: 0°C to 50°C
	Calibration (tcal): 15°C to 35°C
	Storage: -20°C to 70°C
Electromagnetic Compatibility	Designed to operate in Standard Laboratory environments where the Electromagnetic environment is highly controlled. If used in areas with Electromagnetic fields of 1 to 3 V/m, resistance outputs have a floor adder of 0.508 Ω. Performance not specified above 3 V/m.
Temperature Coefficient	Temperature Coefficient for temperatures outside tcal ±5°C is 0.1X/°C of the 90-day specification (or 1-year, as applicable).
Relative Humidity	Operating: <80% to 30°C, <70% to 40°C,<40% to 50°C
	Storage: <95%, noncondensing
Altitude	Operating: 3,050 m (10,000 ft) maximum Nonoperating: 12,200 m (40,000 ft) maximum
Safety	Designed to comply with IEC 1010-1 (1992-1); ANSI/ISA-S82.01-1994; CAN/CSA-C22.2 No. 1010.1-92
Analog Low Isolation	20V
EMI/RFI	Designed to comply with FCC Rules Part 15; VFG 243/1991
Line Power	Line Voltage (selectable): 100 V, 120 V, 220 V, 240 V
	Line Frequency: 47 to 63 Hz
	Line Voltage Variation: ±10% about line voltage setting
Power Consumption	5500A Calibrator, 300 VA; 5725A Amplifier, 750 VA
Dimensions	5500A Calibrator: Height, 17.8 cm (7 inches), standard rack increment, plus 1.5 cm (0.6 inch) for feet on bottom of unit; Width, 43.2 cm (17 inches), standard rack width Depth, 47.3 cm (18.6 inches) overall.
	5725A Amplifier: Height, 13.3 cm (5.25 inches) Width, 43.2 cm (17 inches), standard rack width Depth, 63.0 cm (24.8 inches) overall.
Weight	5500A Calibrator: 20 kg (44 pounds)
	5725A Amplifier: 32 kg (70 pounds)

DC Voltage Specifications

Ranges	Absolute Uncertainty, tcal ± 5°C ± (% of output + µV)				Stability 24 hours, ± 1°C ± (ppm output + µV)	Resolution	Maximum Burden [1]
	90 days		1 year				
0 to 329.9999 mV	0.005%	3 µV	0.006%	3 µV	5 ppm + 1 µV	0.1 µV	50 Ω
0 to 3.299999 V	0.004%	5 µV	0.005%	5 µV	4 ppm + 3 µV	1 µV	10 mA
0 to 32.99999 V	0.004%	50 µV	0.005%	50 µV	4 ppm + 30 µV	10 µV	10 mA
30 to 329.9999 V	0.0045%	500 µV	0.0055%	500 µV	4.5 ppm + 300 µV	100 µV	5 mA
100 to 1020.000 V	0.0045%	1500 µV	0.0055%	1500 µV	4.5 ppm + 900 µV	1000 µV	5 mA
Auxiliary Output (dual output mode only) [2]							
0 to 329.999 mV	0.03%	350 µV	0.04%	350 µV	30 ppm + 100 µV	1 µV	5 mA
0.33 to 3.3 V	0.03%	350 µV	0.04%	350 µV	30 ppm + 100 µV	10 µV	5 mA

[1] Remote sensing is not provided. Output resistance is < 5 mΩ for outputs ≥ 0.33 V. The AUX output has an output resistance of < 1Ω.

[2] Two channels of dc voltage output are provided.

Ranges	Noise	
	Bandwidth 0.1 to 10 Hz p-p ± (ppm output + µV)	Bandwidth 10 to 10 kHz rms µV
0 to 329.9999 mV	1 µV	4 µV
0 to 3.299999 V	10 µV	50 µV
0 to 32.99999 V	100 µV	600 µV
30 to 329.9999 V	10 ppm + 1 mV	20 mV
100 to 1020.000 V	10 ppm + 5 mV	20 mV
Auxiliary Output (dual output mode only) [1]		
0 to 329.999 mV	5 µV	20 µV
0.33 to 3.3 V	20 µV	200 µV

[1] Two channels of dc voltage output are provided.

DC Current Specifications

Ranges	Absolute Uncertainty, tcal ± 5°C ± (% of output + µA)				Resolution	Compliance Voltage	Maximum Inductive Load
	90 days		1 year				
0 to 3.29999 mA	0.010%	0.05 µA	0.013%	0.05 µA	0.01 µA	4.5 V	1 µH
0 to 32.9999 mA	0.008%	0.25 µA	0.01%	0.25 µA	0.1 µA	4.5 V	200 µH
0 to 329.999 mA	0.008%	3.3 µA	0.01%	3.3 µA	1 µA	4.5 to 3.0 V [1]	200 µH
0 to 2.19999 A	0.023%	44 µA	0.03%	44 µA	10 µA	4.5 to 3.4 V [2]	200 µH
0 to 11 A	0.038%	330 µA	0.06%	330 µA	100 µA	4.3 to 2.5 V [3]	200 µH
5725A Amplifier							
0 to 11 A	0.03%	330 µA	0.04%	330 µA	100 µA	4 V	400 µH

[1] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -5.05*I_o+4.67$. The highest compliance voltage is limited to 4.5 V.

[2] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -0.588*I_o+4.69$. The highest compliance voltage is limited to 4.5 V.

[3] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -0.204*I_o+4.75$. The highest compliance voltage is limited to 4.3 V.

Ranges	Noise	
	Bandwidth 0.1 to 10 Hz	Bandwidth 10 to 10 kHz
	p-p	rms
0 to 3.29999 mA	20 nA	200 nA
0 to 32.9999 mA	200 nA	2.0 µA
0 to 329.999 mA	2000 nA	20 µA
0 to 2.19999 A	20 µA	1 mA
0 to 11 A	200 µA	10 mA
5725A Amplifier		
0 to 11 A	± 25 ppm of output + 200 nA	2 mA

Resistance Specifications

Ranges [1]	Absolute Uncertainty, tcal ± 5°C ± (% of output + Ω) [2]				Resolution	Allowable Current [4]
	90 days		1 year			
0 to 10.99 Ω	0.009%	0.008 Ω [3]	0.012%	0.008Ω [3]	0.001 Ω	1 to 125 mA
11 to 32.999 Ω	0.009%	0.015 Ω [3]	0.012%	0.015 Ω [3]	0.001 Ω	1 to 125 mA
33 to 109.999 Ω	0.007%	0.015 Ω [3]	0.009%	0.015 Ω [3]	0.001 Ω	1 to 70 mA
110 to 329.999 Ω	0.007%	0.015 Ω [3]	0.009%	0.015 Ω [3]	0.001 Ω	1 to 40 mA
330Ω to 1.09999 kΩ	0.007%	0.06 Ω	0.009%	0.06Ω	0.01 Ω	250 µA to 18 mA
1.1 to 3.29999 kΩ	0.007%	0.06 Ω	0.009%	0.06 Ω	0.01 Ω	250 µA to 5 mA
3.3 to 10.9999 kΩ	0.007%	0.6 Ω	0.009%	0.6 Ω	0.1 Ω	25 µA to 1.8 mA
11 to 32.9999 kΩ	0.007%	0.6 Ω	0.009%	0.6 Ω	0.1 Ω	25 µA to 0.5 mA
33 to 109.999 kΩ	0.008%	6 Ω	0.011%	6 Ω	1 Ω	2.5 µA to 0.18 mA
110 to 329.999 kΩ	0.009%	6 Ω	0.012%	6 Ω	1 Ω	2.5 µA to 0.05 mA
330 k to 1.09999 MΩ	0.011%	55 Ω	0.015%	55 Ω	10 Ω	250 nA to 0.018 mA
1.1 to 3.29999 MΩ	0.011%	55 Ω	0.015%	55 Ω	10 Ω	250 nA to 5 µA
3.3 to 10.9999 MΩ	0.045%	550 Ω	0.06%	550 Ω	100 Ω	25 nA to 1.8 µA
11 to 32.9999 MΩ	0.075%	550 Ω	0.1%	550 Ω	100 Ω	25 nA to 0.5 µA
33 to 109.999 MΩ	0.4%	5.5 kΩ	0.5%	5.5 kΩ	1000 Ω	2.5 nA to 0.18 µA
110 to 330 MΩ	0.4%	16.5 kΩ	0.5%	16.5 kΩ	1000 Ω	2.5 nA to 0.06 µA

[1] Continuously variable from 0 to 330 MΩ.

[2] Applies for COMP OFF (to the 5500A Calibrator front panel NORMAL terminals) and 2-wire and 4-wire compensation.

[3] The floor adder is improved to 0.006 Ω (0 to 10.99 Ω range) and 0.010 Ω (11 to 329.999 Ω) if the 5500A Calibrator is zeroed (ohms zero or instrument zero) within 8 hours and temperature is ±1°C of zeroing ambient temperature.

[4] Do not exceed the largest current for each range. For currents lower than shown, the floor adder increases by $Floor_{(new)} = Floor_{(old)} \times I_{min}/I_{actual}$. For example, a 100 µA stimulus measuring 100 Ω has a floor uncertainty of 0.01 Ω x 1 mA/100 µA = 0.1 Ω.

Ranges	Maximum Voltage [1]	Maximum Lead Resistance [2]
0 to 10.99 Ω	1.37 V	<3.2 Ω
11 to 32.999 Ω	4.1 V	<3.2 Ω
33 to 109.999 Ω	7.7 V	<3.2 Ω
110 to 329.999 Ω	13.2 V	<3.2 Ω
330Ω to 1.09999 kΩ	19.8 V	<6 Ω
1.1 to 3.29999 kΩ	16.5 V	<6 Ω
3.3 to 10.9999 kΩ	19.8 V	<6 Ω
11 to 32.9999 kΩ	16.5 V	<6 Ω
33 to 109.999 kΩ	19.8 V	<6 Ω
110 to 329.999 kΩ	16.5 V	(n/a 110 kΩ and above)
330 kΩ to 1.09999 MΩ	19.8 V	(n/a 110 kΩ and above)
1.1 to 3.29999 MΩ	16.5 V	(n/a 110 kΩ and above)
3.3 to 10.9999 MΩ	19.8 V	(n/a 110 kΩ and above)
11 to 32.9999 MΩ	16.5 V	(n/a 110 kΩ and above)
33 to 109.999 MΩ	19.8 V	(n/a 110 kΩ and above)
110 to 330 MΩ	19.8 V	(n/a 110 kΩ and above)

[1] This is for the largest resistance for each range. The maximum voltage for other values is Imax (highest value of Allowable Current above) multiplied by Rout.

[2] Maximum lead resistance for no additional error in 2-wire COMP.

AC Voltage (Sinewave) Specifications

Ranges	Frequency	Absolute Uncertainty, tcal ± 5°C ± (% of output + μV)				Resolution	Maximum Burden
		90 days		1 year			[1]
1.0 to 32.999 mV	10 to 45 Hz	0.26%	20 μV	0.35%	20 μV	1 μV	50 Ω
	45 Hz to 10 kHz	0.11%	20 μV	0.15%	20 μV		
	10 to 20 kHz	0.15%	20 μV	0.2%	20 μV		
	20 to 50 kHz	0.19%	20 μV	0.25%	20 μV		
	50 to 100 kHz	0.26%	33 μV	0.35%	33 μV		
	100 to 500 kHz	0.75%	60 μV	1%	60 μV		
33 to 329.999 mV	10 to 45 Hz	0.19%	50 μV	0.25%	50 μV	1 μV	50 Ω
	45 Hz to 10 kHz	0.04%	20 μV	0.05%	20 μV		
	10 to 20 kHz	0.08%	20 μV	0.1%	20 μV		
	20 to 50 kHz	0.12%	40 μV	0.16%	40 μV		
	50 to 100 kHz	0.17%	170 μV	0.24%	170 μV		
	100 to 500 kHz	0.53%	330 μV	0.7%	330 μV		
0.33 to 3.29999 V	10 to 45 Hz	0.11%	250 μV	0.15%	250 μV	10 μV	10 mA
	45 Hz to 10 kHz	0.02%	60 μV	0.03%	60 μV		
	10 to 20 kHz	0.06%	60 μV	0.08%	60 μV		
	20 to 50 kHz	0.10%	300 μV	0.14%	300 μV		
	50 to 100 kHz	0.17%	1700 μV	0.24%	1700 μV		
	100 to 500 kHz	0.38%	3300 μV	0.5%	3300 μV		
3.3 to 32.9999 V	10 to 45 Hz	0.11%	2500 μV	0.15%	2500 μV	100 μV	10 mA
	45 Hz to 10 kHz	0.03%	600 μV	0.04%	600 μV		
	10 to 20 kHz	0.06%	2600 μV	0.08%	2600 μV		
	20 to 50 kHz	0.14%	5000 μV	0.19%	5000 μV		
	50 to 100 kHz	0.17%	17000 μV	0.24%	17000 μV		
33 to 329.999 V	45 Hz to 1 kHz	0.04%	6.6 mV	0.05%	6.6 mV	1 mV	5 mA, except
	1 to 10 kHz	0.06%	15 mV	0.08%	15 mV		20 mA for
	10 to 20 kHz	0.07%	33 mV	0.09%	33 mV		45 to 65 Hz
330 to 1020 V	45 Hz to 1 kHz	0.04%	80 mV	0.05%	80 mV	10 mV	2 mA, except
	1 to 5 kHz	0.15%	100 mV	0.20%	100 mV		6 mA for
	5 to 10 kHz	0.15%	500 mV	0.20%	500 mV		45 to 65 Hz
5725A Amplifier							
100 to 1020 V	45 Hz to 1 kHz	0.04	80 mV	0.05	80 mV	10 mV	50 mA
	1 to 20 kHz	0.06	100 mV	0.08	100 mV	10 mV	70 mA
	20 to 30 kHz	0.08	100 mV	0.10	100 mV	10 mV	70 mA
100 to 750 V	30 to 100 kHz	0.38	500 mV	0.5	500 mV	10 mV	70 mA
Auxiliary Output [dual output mode only] [2]							
10 to 329.999 mV	10 to 20 Hz	0.15	370 μV	0.2	370 μV	1 μV	5 mA
	20 to 45 Hz	0.08	370 μV	0.1	370 μV		
	45 Hz to 1 kHz	0.08	370 μV	0.1	370 μV		
	1 to 5 kHz	0.15	450 μV	0.2	450 μV		
	5 to 10 kHz	0.3	450 μV	0.4	450 μV		
0.33 to 3.29999 V	10 to 20 Hz	0.15	450 μV	0.2	450 μV	10 μV	5 mA
	20 to 45 Hz	0.08	450 μV	0.1	450 μV		
	45 Hz to 1 kHz	0.07	450 μV	0.09	450 μV		
	1 to 5 kHz	0.15	1400 μV	0.2	1400 μV		
	5 to 10 kHz	0.3	1400 μV	0.4	1400 μV		

[1] Remote sensing is not provided. Output resistance is < 5 mΩ for outputs ≥ 0.33 V. The AUX output resistance is < 1 Ω. The maximum load capacitance is 500 pF, subject to the maximum burden current limits.

[2] There are two channels of voltage output. The maximum frequency of the dual output is 10 kHz.

AC Voltage (Sinewave) Specifications (cont)

Ranges	Frequency	Maximum Distortion and Noise 10 Hz to 5 MHz Bandwidth
		± (% output + μV)
1.0 to 32.999 mV	10 to 45 Hz	0.15% + 90 μV
	45 Hz to 10 kHz	0.035% + 90 μV
	10 to 20 kHz	0.06% + 90 μV
	20 to 50 kHz	0.15% + 90 μV
	50 to 100 kHz	0.25% + 90 μV
	100 to 500 kHz	0.3% + 90 μV
33 to 329.999 mV	10 to 45 Hz	0.15% + 90 μV
	45 Hz to 10 kHz	0.035% + 90 μV
	10 to 20 kHz	0.06% + 90 μV
	20 to 50 kHz	0.15% + 90 μV
	50 to 100 kHz	0.20% + 90 μV
	100 to 500 kHz	0.20% + 90 μV
0.33 to 3.29999 V	10 to 45 Hz	0.15% + 200 μV
	45 Hz to 10 kHz	0.035% + 200 μV
	10 to 20 kHz	0.06% + 200 μV
	20 to 50 kHz	0.15% + 200 μV
	50 to 100 kHz	0.20% + 200 μV
	100 to 500 kHz	0.20% + 200 μV
3.3 to 32.9999 V	10 to 45 Hz	0.15% + 2 mV
	45 Hz to 10 kHz	0.035% + 2 mV
	10 to 20 kHz	0.08% + 2 mV
	20 to 50 kHz	0.2% + 2 mV
	50 to 100 kHz	0.5% + 2 mV
33 to 329.999 V	45 Hz to 1 kHz	0.15% + 10 mV
	1 to 10 kHz	0.05% + 10 mV
	10 to 20 kHz	0.6% + 10 mV
330 to 1020 V	45 Hz to 1 kHz	0.15% + 30 mV
	1 to 10 kHz	0.07% + 30 mV
5725A Amplifier		
100 to 1020 V	45 Hz to 1 kHz	0.07%
	1 to 20 kHz	0.15%
	20 to 30 kHz	0.3%
100 to 750 V	30 to 100 kHz	0.4%
Auxiliary Output [dual output mode only] 10 Hz to 100 kHz Bandwidth		
10 to 329.999 mV	10 to 20 Hz	0.2% + 200 μV
	20 to 45 Hz	0.06% + 200 μV
	45 Hz to 1 kHz	0.08% + 200 μV
	1 to 5 kHz	0.3% + 200 μV
	5 to 10 kHz	0.6% + 200 μV
0.33 to 3.29999 V	10 to 20 Hz	0.2% + 200 μV
	20 to 45 Hz	0.06% + 200 μV
	45 Hz to 1 kHz	0.08% + 200 μV
	1 to 5 kHz	0.3% + 200 μV
	5 to 10 kHz	0.6% + 200 μV

AC Current (Sinewave) Specifications

Ranges	Frequency	Absolute Uncertainty, tcal ± 5°C ± (% of output + μA)				Resolution	Compliance Voltage	Maximum Inductive Load
		90 days		1 year				
0.029 to 0.32999 mA	10 to 20 Hz	0.19%	0.15 μA	0.25%	0.15 μA	0.01 μA	3.0 V rms	1 μH
	20 to 45 Hz	0.09%	0.15 μA	0.125%	0.15 μA			
	45 Hz to 1 kHz	0.09%	0.25 μA	0.125%	0.25 μA			
	1 to 5 kHz	0.30%	0.15 μA	0.4%	0.15 μA			
	5 to 10 kHz	0.94%	0.15 μA	1.25%	0.15 μA			
0.33 to 3.2999 mA	10 to 20 Hz	0.15%	0.3 μA	0.2%	0.3 μA	0.01 μA	3.0 V rms	1 μH
	20 to 45 Hz	0.08%	0.3 μA	0.1%	0.3 μA			
	45 Hz to 1 kHz	0.08%	0.3 μA	0.1%	0.3 μA			
	1 to 5 kHz	0.15%	0.3 μA	0.2%	0.3 μA			
	5 to 10 kHz	0.45%	0.3 μA	0.6%	0.3 μA			
3.3 to 32.999 mA	10 to 20 Hz	0.15%	3 μA	0.2%	3 μA	0.1 μA	3.0 V rms	200 μH, 10 to 500 Hz
	20 to 45 Hz	0.08%	3 μA	0.1%	3 μA			
	45 Hz to 1 kHz	0.07%	3 μA	0.09%	3 μA			
	1 to 5 kHz	0.15%	3 μA	0.2%	3 μA			1 μH, 500 Hz to 10 kHz
	5 to 10 kHz	0.45%	3 μA	0.6%	3 μA			
33 to 329.99 mA	10 to 20 Hz	0.15%	30 μA	0.2%	30 μA	1 μA	3.0 to 2.0 V rms [1]	200 μH, 10 to 500 Hz
	20 to 45 Hz	0.08%	30 μA	0.1%	30 μA			
	45 Hz to 1 kHz	0.07%	30 μA	0.09%	30 μA			
	1 to 5 kHz	0.15%	30 μA	0.2%	30 μA			5 μH, 500 Hz to 10 kHz
	5 to 10 kHz	0.45%	30 μA	0.6%	30 μA			
0.33 to 2.19999 A	10 to 45 Hz	0.15%	300 μA	0.2%	300 μA	10 μA	3.0 to 2.0 V rms [2]	200 μH, 45 to 500 Hz
	45 Hz to 1 kHz	0.08%	300 μA	0.1%	300 μA			
	1 to 5 kHz	0.7%	300 μA	0.75%	300 μA			5 μH, 500 Hz to 5 kHz
2.2 to 11 A	45 to 65 Hz	0.05%	2000 μA	0.06%	2000 μA	100 μA	2.8 to 1.25 V rms [3]	200 μH, 45 to 65 Hz
	65 to 500 Hz	0.08%	2000 μA	0.10%	2000 μA			
	500 Hz to 1 kHz	0.25%	2000 μA	0.33%	2000 μA			1 μH, 65 Hz to 1 kHz
5725A Amplifier								
1.5 to 11 A	45 to 1 kHz	0.08%	100 μA	0.1%	100 μA	100 μA	3.0 V rms	400 μH
	1 to 5 kHz	0.19%	5000 μA	0.25%	5000 μA			
	5 to 10 kHz	0.75%	10000 μA	1%	10000 μA			

[1] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -3.37*I_o+3.11$. The highest compliance voltage is limited to 3.0 V.

[2] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -0.535*I_o+3.18$. The highest compliance voltage is limited to 3.0 V.

[3] The actual voltage compliance (V_c) is a function of current output (I_o), and is given by the formula $V_c = -0.176*I_o+3.19$. The highest compliance voltage is limited to 2.8 V.

Note

1. 0.30 mA - 2.19999 A can be sent from the 5500A Calibrator to the 5725A Amplifier front panel terminals. 0.30 mA - 32.999 mA is simultaneously available at the 5500A AUX terminals when sent from the 5500A Calibrator to the 5725A Amplifier front panel terminals.

AC Current (Sinewave) Specifications (cont)

Ranges	Frequency	Maximum Distortion and Noise 10 Hz to 100 kHz Bandwidth
		± (% output + μA)
0.02 to 0.32999 mA	10 to 20 Hz	0.15% + 1.0 μA
	20 to 45 Hz	0.1% + 1.0 μA
	45 Hz to 1 kHz	0.05% + 1.0 μA
	1 to 5 kHz	0.5% + 1.0 μA
	5 to 10 kHz	1.0% + 1.0 μA
0.33 to 3.2999 mA	10 to 20 Hz	0.15% + 1.5 μA
	20 to 45 Hz	0.06% + 1.5 μA
	45 Hz to 1 kHz	0.02% + 1.5 μA
	1 to 5 kHz	0.5% + 1.5 μA
	5 to 10 kHz	1.2% + 1.5 μA
3.3 to 32.999 mA	10 to 20 Hz	0.15% + 5 μA
	20 to 45 Hz	0.05% + 5 μA
	45 Hz to 1 kHz	0.07% + 5 μA
	1 to 5 kHz	0.3% + 5 μA
	5 to 10 kHz	0.7% + 5 μA
33 to 329.99 mA	10 to 20 Hz	0.15% + 50 μA
	20 to 45 Hz	0.05% + 50 μA
	45 Hz to 1 kHz	0.07% + 50 μA
	1 to 5 kHz	0.2% + 50 μA
	5 to 10 kHz	0.7% + 50 μA
0.33 to 2.19999 A	10 to 45 Hz	0.2% + 500 μA
	45 Hz to 1 kHz	0.1% + 500 μA
	1 to 5 kHz	1.4% + 500 μA
2.2 to 11 A	45 to 65 Hz	0.2% + 5 mA
	65 to 500 Hz	0.1% + 5 mA
	500 Hz to 1 kHz	0.4% + 5 mA
5725A Amplifier		
1.5 to 11 A	45 Hz to 1 kHz	0.05% + 1 m A
	1 to 5 kHz	0.12% + 1 mA
	5 to 10 kHz	0.5% + 1 mA

Capacitance Specifications

Ranges	Absolute Uncertainty, tcal ± 5°C ± (% of output + ηF)				Resolution	Allowed Frequency	Typical Frequency for <1% Error
	90 days		1 year				
0.33 to 0.4999 ηF	0.38%	0.01 ηF	0.5%	0.01 ηF	0.1 pF	50 to 1000 Hz	10 kHz
0.5 to 1.0999 ηF	0.38%	0.01 ηF	0.5%	0.01 ηF	0.1 pF	50 to 1000 Hz	10 kHz
1.1 to 3.2999 ηF	0.38%	0.01 ηF	0.5%	0.01 ηF	0.1 pF	50 to 1000 Hz	10 kHz
3.3 to 10.999 ηF	0.38%	0.01 ηF	0.5%	0.01 ηF	1 pF	50 to 1000 Hz	10 kHz
11 to 32.999 ηF	0.19%	0.1 ηF	0.25%	0.1 ηF	1 pF	50 to 1000 Hz	10 kHz
33 to 109.99 ηF	0.19%	0.1 ηF	0. 25%	0.1 ηF	10 pF	50 to 1000 Hz	10 kHz
110 to 329.99 ηF	0.19%	0.3 ηF	0.25%	0.3 ηF	10 pF	50 to 1000 Hz	10 kHz
0.33 to 1.0999 µF	0.19%	1 ηF	0.25%	1 ηF	100 pF	50 to 1000 Hz	5 kHz
1.1 to 3.2999 µF	0.26%	3 ηF	0.35%	3 ηF	100 pF	50 to 1000 Hz	2 kHz
3.3 to 10.999 µF	0.26%	10 ηF	0.35%	10 ηF	1 ηF	50 to 400 Hz	1.5 kHz
11 to 32.999 µF	0.30%	30 ηF	0.40%	30 ηF	1 ηF	50 to 400 Hz	800 Hz
33 to 109.99 µF	0.38%	100 ηF	0.50%	100 ηF	10 ηF	50 to 200 Hz	400 Hz
110 to 329.99 µF	0.50%	300 ηF	0.70%	300 ηF	10 ηF	50 to 100 Hz	200 Hz
330 to 1.1 mF	1%	300 ηF	1%	300 ηF	100 ηF	50 to 100 Hz	150 Hz

Notes

1. Specifications apply to both dc charge/discharge capacitance meters and ac RCL meters.
2. The output is continuously variable from 330 pF to 1.1 mF.
3. For all ranges, the maximum charge and discharge current is 150 mA peak or 30 mA rms. The peak voltage is 4 V, except the 330 µF - 1.1 mF range is limited to 1 V. The maximum lead resistance for no additional error in 2-wire COMP mode is 10 ohms.

Temperature Calibration (Thermocouple) Specifications

TC Type	Range (°C)		Absolute Uncertainty, tcal + 5°C, + (°C) [1]	
	Minimum	Maximum	Source/Measure	
			90 days	1 year
B	600°C	800°C	0.42°C	0.44°C
	800°C	1000°C	0.34°C	0.34°C
	1000°C	1550°C	0.30°C	0.30°C
	1550°C	1820°C	0.26°C	0.33°C
C	0°C	150°C	0.23°C	0.30°C
	150°C	650°C	0.19°C	0.26°C
	650°C	1000°C	0.23°C	0.31°C
	1000°C	1800°C	0.38°C	0.50°C
	1800°C	2316°C	0.63°C	0.84°C
E	-250°C	-100°C	0.38°C	0.50°C
	-100°C	-25°C	0.12°C	0.16°C
	-25°C	350°C	0.10°C	0.14°C
	350°C	650°C	0.12°C	0.16°C
	650°C	1000°C	0.16°C	0.21°C
J	-210°C	-100°C	0.20°C	0.27°C
	-100°C	-30°C	0.12°C	0.16°C
	-30°C	150°C	0.10°C	0.14°C
	150°C	760°C	0.13°C	0.17°C
	760°C	1200°C	0.18°C	0.23°C
K	-200°C	-100°C	0.25°C	0.33°C
	-100°C	-25°C	0.14°C	0.18°C
	-25°C	120°C	0.12°C	0.16°C
	120°C	1000°C	0.19°C	0.26°C
	1000°C	1372°C	0.30°C	0.40°C
L	-200°C	-100°C	0.37°C	0.37°C
	-100°C	800°C	0.26°C	0.26°C
	800°C	900°C	0.17°C	0.17°C
N	-200°C	-100°C	0.30°C	0.40°C
	-100°C	-25°C	0.17°C	0.22°C
	-25°C	120°C	0.15°C	0.19°C
	120°C	410°C	0.14°C	0.18°C
	410°C	1300°C	0.21°C	0.27°C
R	0°C	250°C	0.48°C	0.57°C
	250°C	400°C	0.28°C	0.35°C
	400°C	1000°C	0.26°C	0.33°C
	1000°C	1767°C	0.30°C	0.40°C
S	0°C	250°C	0.47°C	0.47°C
	250°C	1000°C	0.30°C	0.36°C
	1000°C	1400°C	0.28°C	0.37°C
	1400°C	1767°C	0.34°C	0.46°C
T	-250°C	-150°C	0.48°C	0.63°C
	-150°C	0°C	0.18°C	0.24°C
	0°C	120°C	0.12°C	0.16°C
	120°C	400°C	0.10°C	0.14°C
U	-200°C	0°C	0.56°C	0.56°C
	0°C	600°C	0.27°C	0.27°C

[1] Does not include thermocouple error.

Notes

1. Resolution is 0.01°C.
2. The 10 µV/°C linear output mode has the same uncertainty as the 300 mV dc range.
3. Applies to both simulated thermocouple output and thermocouple measurement.
4. Temperature standard ITS-90 or IPTS-68 is selectable.

Temperature Calibration (RTD) Specifications

RTD Type	Range (°C)		Absolute Uncertainty, tcal ± 5°C, ± (°C) [1]	
	Minimum	Maximum	90 days	1 year
Pt 385, 100 Ω	-200°C	-80°C	0.04°C	0.05°C
	-80°C	0°C	0.05°C	0.05°C
	0°C	100°C	0.07°C	0.07°C
	100°C	300°C	0.08°C	0.09°C
	300°C	400°C	0.09°C	0.10°C
	400°C	630°C	0.10°C	0.12°C
	630°C	800°C	0.21°C	0.23°C
Pt 3926, 100 Ω	-200°C	-80°C	0.04°C	0.05°C
	-80°C	0°C	0.05°C	0.05°C
	0°C	100°C	0.07°C	0.07°C
	100°C	300°C	0.08°C	0.09°C
	300°C	400°C	0.09°C	0.10°C
	400°C	630°C	0.10°C	0.12°C
Pt 3916, 100 Ω	-200°C	-190°C	0.25°C	0.25°C
	-190°C	-80°C	0.04°C	0.04°C
	-80°C	0°C	0.05°C	0.05°C
	0°C	100°C	0.06°C	0.06°C
	100°C	260°C	0.06°C	0.07°C
	260°C	300°C	0.07°C	0.08°C
	300°C	400°C	0.08°C	0.09°C
	400°C	600°C	0.08°C	0.10°C
	600°C	630°C	0.21°C	0.23°C
Pt 385, 200 Ω	-200°C	-80°C	0.03°C	0.04°C
	-80°C	0°C	0.03°C	0.04°C
	0°C	100°C	0.04°C	0.04°C
	100°C	260°C	0.04°C	0.05°C
	260°C	300°C	0.11°C	0.12°C
	300°C	400°C	0.12°C	0.13°C
	400°C	600°C	0.12°C	0.14°C
	600°C	630°C	0.14°C	0.16°C
Pt 385, 500 Ω	-200°C	-80°C	0.03°C	0.04°C
	-80°C	0°C	0.04°C	0.05°C
	0°C	100°C	0.05°C	0.05°C
	100°C	260°C	0.06°C	0.06°C
	260°C	300°C	0.07°C	0.08°C
	300°C	400°C	0.07°C	0.08°C
	400°C	600°C	0.08°C	0.09°C
	600°C	630°C	0.09°C	0.11°C

Temperature Calibration (RTD) Specifications (cont.)

RTD Type	Range (°C)		Absolute Uncertainty, tcal ± 5°C, ± (°C) [1]	
	Minimum	Maximum	90 days	1 year
Pt 385, 1000 Ω	-200°C	-80°C	0.03°C	0.03°C
	-80°C	0°C	0.03°C	0.03°C
	0°C	100°C	0.03°C	0.04°C
	100°C	260°C	0.04°C	0.05°C
	260°C	300°C	0.05°C	0.06°C
	300°C	400°C	0.05°C	0.07°C
	400°C	600°C	0.06°C	0.07°C
	600°C	630°C	0.22°C	0.23°C
PtNi 385, 120 Ω (Ni120)	-80°C	0°C	0.06°C	0.08°C
	0°C	100°C	0.07°C	0.08°C
	100°C	260°C	0.13°C	0.14°C
Cu 427, 10 Ω [2]	-100°C	260°C	0.3°C	0.3°C

[1] Applies for COMP OFF (to the 5500A Calibrator front panel NORMAL terminals) and 2-wire and 4-wire compensation.

[2] Based on MINCO Application Aid No. 18.

Note

1. Resolution is 0.003°C.

DC Power Specification Summary

	Voltage Range	5500A Calibrator Current Range			
		3.3 to 8.999 mA	**9 to 32.999 mA**	**33 to 89.99 mA**	**90 to 329.99 mA**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)			
90 days	33 mV to 1020 V	0.03%	0.02%	0.03%	0.02%
1 year	33 mV to 1020 V	0.04%	0.03%	0.04%	0.03%

	Voltage Range	5500A Calibrator Current Range			
		0.33 to 0.8999 A	**0.9 to 2.1999 A**	**2.2 to 4.4999 A**	**4.5 to 11 A**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)			
90 days	33 mV to 1020 V	0.07%	0.05%	0.08%	0.06%
1 year	33 mV to 1020 V	0.08%	0.06%	0.12%	0.09%

	Voltage Range	5725A Amplifier Current Range	
		1.5 to 4.4999 A	**4.5 to 11 A**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)	
90 days	33 mV to 1020 V	0.09%	0.07%
1 year	33 mV to 1020 V	0.10%	0.08%

Note

1. To determine dc power uncertainty with more precision, see the individual “DC Voltage Specifications” and “DC Current Specifications” and “Calculating Power Uncertainty.”

AC Power (45 Hz to 65 Hz) Specification Summary, PF=1

	Voltage Range	5500A Calibrator Current Range			
		3.3 to 8.999 mA	**9 to32.999 mA**	**33 to 89.99 mA**	**90 to 329.99 mA**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)			
5500A Calibrator					
90 days	33 to 329.999 mV	0.30%	0.20%	0.25%	0.20%
	330 mV to 1020 V	0.20%	0.12%	0.20%	0.12%
1 year	33 to 329.999 mV	0.40%	0.25%	0.35%	0.25%
	330 mV to 1020 V	0.25%	0.15%	0.25%	0.15%
5725A Amplifier					
90 days	100 to 1020 V	0.20%	0.12%	0.20%	0.12%
1 year	100 to 1020 V	0.25%	0.15%	0.25%	0.15%

	Voltage Range	5500A Calibrator Current Range			
		0.33 to 0.8999 A	**0.9 to 2.1999 A**	**2.2 to 4.4999 A**	**4.5 to 11 A**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)			
5500A Calibrator					
90 days	33 to 329.999 mV	0.25%	0.20%	0.25%	0.20%
	330 mV to 1020 V	0.20%	0.12%	0.18%	0.12%
1 year	33 to 329.999 mV	0.35%	0.25%	0.35%	0.25%
	330 mV to 1020 V	0.25%	0.15%	0.20%	0.15%
5725A Amplifier					
90 days	100 to 1020 V	0.20%	0.12%	0.18%	0.12%
1 year	100 to 1020 V	0.25%	0.15%	0.20%	0.15%

	Voltage Range	5725A Amplifier Current Range	
		1.5 to 4.4999 A	**4.5 to 11 A**
		Absolute Uncertainty, tcal ± 5°C, ± (% of watts output)	
5500A Calibrator			
90 days	33 to 329.999 mV	0.25%	0.20%
	330 mV to 1020 V	0.15%	0.12%
1 year	33 mV to 1020 V	0.35%	0.25%
	330 mV to 1020 V	0.20%	0.15%

Note

1. To determine uncertainty with more precision, see “Calculating Power Uncertainty.”

Power and Dual Output Limit Specifications

Frequency	Voltages (NORMAL)	Currents	Voltages (AUX)	Power Factor (PF)
DC	0 to ±1020 V	0 to ± 11 A	0 to ± 3.3 V	—
10 to 45 Hz	33 mV to 32.9999 V	3.3 mA to 2.19999 A	10 mV to 3.3 V	0 to 1
45 to 65 Hz	33 mV to 1020 V	3.3 mA to 11 A	10 mV to 3.3 V	0 to 1
65 to 500 Hz	330 mV to 1020 V	33 mA to 2.19999 A	100 mV to 3.3 V	0 to 1
65 to 500 Hz	3.3V to 1020 V	33 mA to 11 A	100 mV to 3.3 V	0 to 1
500 to 1 kHz	330 mV to 1020 V	33 mA to 11 A	100 mV to 3.3 V	1
1 to 5 kHz	3.3V to 1020 V [1]	33 mA to 2.19999 A	100 mV to 3.3 V [1]	1
5 to 10 kHz	3.3V to 1020 V [2]	33 to 329.99 mA	1 to 3.3 V [2]	1
[1] In dual volts, voltage is limited to 3.3 to 500 V in the NORMAL output. [2] In dual volts, voltage is limited to 3.3 to 250 V in the NORMAL output.				

Notes

1. The range of voltages and currents shown in “DC Voltage Specifications,” “DC Current Specifications,” “AC Voltage (Sinewaves) Specifications,” and “AC Current (Sinewave) Specifications” are available in the power and dual output modes (except minimum current for ac power is 0.33 mA). However, only those limits shown in this table are specified. See “Calculating Power Uncertainty” to determine the uncertainty at these points.
2. The phase adjustment range for dual ac outputs is 0 to ±179.99 degrees.
3. The phase resolution for dual ac outputs is 0.02 degree.

5500A Phase Specifications

1-Year Absolute Uncertainty, tcal ± 5 °C, (ΔΦdegrees)				
10 to 65 Hz **0.15° [1]**	**65 to 500 Hz** **0.9° [2]**	**500 to 1 kHz** **2.0° [3]**	**1k to 5 kHz** **6°**	**5k to 10 kHz** **10°**

Notes

1. For 33 to 1000 V output, burden current <6 mA. For 6 to 20 mA burden current (33 to 330 V), the phase uncertainty is 0.4°.
2. For 33 to 1000 V output, burden current <2 mA. For 2 to 5 mA burden current (33 to 330 V), the phase uncertainty is 1.5°.
3. For 33 to 1000 V output, burden current <2 mA. For 2 to 5 mA burden current (33 to 330 V), the phase uncertainty is 5°.

Phase (Φ) Watts	Phase (Φ) VARs	PF	Power Uncertainty Adder due to Phase Error				
			10 to 65 Hz	65 to 500 Hz	500 to 1 kHz	1 to 5 kHz	5 to 10 kHz
0°	90°	1.000	0.00%	0.01%	0.06%	0.55%	1.52%
5°	85°	0.996	0.02%	0.15%	—	—	—
10°	80°	0.985	0.05%	0.29%	—	—	—
15°	75°	0.966	0.07%	0.43%	—	—	—
20°	70°	0.940	0.10%	0.58%	—	—	—
25°	65°	0.906	0.12%	0.74%	—	—	—
30°	60°	0.866	0.15%	0.92%	—	—	—
35°	55°	0.819	0.18%	1.11%	—	—	—
40°	50°	0.766	0.22%	1.33%	—	—	—
45°	45°	0.707	0.26%	1.58%	—	—	—
50°	40°	0.643	0.31%	1.88%	—	—	—
55°	35°	0.574	0.37%	2.26%	—	—	—
60°	30°	0.500	0.45%	2.73%	—	—	—
65°	25°	0.423	0.56%	3.38%	—	—	—
70°	20°	0.342	0.72%	4.33%	—	—	—
75°	15°	0.259	0.98%	5.87%	—	—	—
80°	10°	0.174	1.49%	8.92%	—	—	—
85°	5°	0.087	2.99%	17.97%	—	—	—
90°	0°	0.000	—	—	—	—	—

Note

1. To calculate exact ac watts power adders due to phase uncertainty for values not shown, use the following formula: $Adder(\%) = 100(1 - \frac{Cos(\Phi + \Delta\Phi)}{Cos(\Phi)})$. For example:

   for a PF of .9205 (Φ = 23) and a phase uncertainty of ΔΦ = 0.15, the ac watts power adder is: $Adder(\%) = 100(1 - \frac{Cos(23+.15)}{Cos(23)}) = 0.11\%$

Calculating Power Uncertainty

Overall uncertainty for power output in watts (or VARs) is based on the root sum square (rss) of the individual uncertainties in percent for the selected voltage, current, and power factor parameters:

Watts uncertainty $U_{\text{power}} = \sqrt{U^2_{\text{voltage}} + U^2_{\text{current}} + U^2_{\text{PFadder}}}$

VARs uncertainty $U_{\text{VARs}} = \sqrt{U^2_{\text{voltage}} + U^2_{\text{current}} + U^2_{\text{VARsadder}}}$

Because there are an infinite number of combinations, you should calculate the actual ac power uncertainty for your selected parameters. The method of calculation is best shown in the following examples (using 90-day specifications):

Example 1 Output: 100 V, 1 A, 60 Hz, Power Factor = 1.0 (Φ=0)

Voltage Uncertainty Uncertainty for 100 V at 60 Hz is 0.04% + 6.6 mV, totaling:
100V x .0004 = 40 mV added to 6.6 mV = 46.6 mV. Expressed in percent:
46.6 mV/100 V x 100 = 0.047% (see "AC Voltage (Sinewave) Specifications").

Current Uncertainty Uncertainty for 1 A is 0.08% + 300 µA, totaling:
1 A x .0008 = 800 µA added to 300 µA = 1.1 mA. Expressed in percent:
1.1 mA/1A x 100 = 0.11% (see "AC Current (Sinewaves) Specifications").

PF Adder Watts Adder for PF = 1 (Φ=0) at 60 Hz is 0% (see "Phase Specifications").

Total Watts Output Uncertainty = $U_{\text{power}} = \sqrt{0.047^2 + 0.11^2 + 0^2} = 0.12\%$

Example 2 Output: 100 V, 1 A, 400 Hz, Power Factor = 0.5 (Φ=60)

Voltage Uncertainty Uncertainty for 100 V at 400 Hz is 0.04% + 6.6 mV, totaling:
100 V x .0004 = 40 mV added to 6.6 mV = 46.6 mV. Expressed in percent:
46.6 mV/100 V x 100 = 0.047% (see "AC Voltage (Sinewave) Specifications").

Current Uncertainty Uncertainty for 1 A is 0.08% + 300 µA, totaling:
1 A x .0008 = 800 µA added to 300 µA = 1.1 mA. Expressed in percent:
1.1 mA/1 A x 100 = 0.11% (see "AC Current (Sinewave) Specifications").

PF Adder Watts Adder for PF = 0.5 (Φ=60) at 400 Hz is 2.73% (see "Phase Specifications").

Total Watts Output Uncertainty = $U_{\text{power}} = \sqrt{0.047^2 + 0.11^2 + 2.73^2} = 2.73\%$

VARs When the Power Factor approaches 0.0, the watts output uncertainty becomes unrealistic because the dominant characteristic is the VARs (volts-amps-reactive) output. In these cases, calculate the Total VARs Output Uncertainty, as shown in example 3:

Example 3 Output: 100 V, 1 A, 60 Hz, Power Factor = 0.0872 (Φ=85)

Voltage Uncertainty Uncertainty for 100 V at 60 Hz is 0.04% + 6.6 mV, totaling:
100 V x .0004 = 40 mV added to 6.6 mV = 46.6 mV. Expressed in percent:
46.6 mV/100 V x 100 = 0.047% (see "AC Voltage (Sinewave) Specifications").

Current Uncertainty Uncertainty for 1 A is 0.08% + 300 µA, totaling:
1 A x .0008 = 800 µA added to 300 µA = 1.1 mA. Expressed in percent:
1.1 mA/1 A x 100 = 0.11% (see "AC Current (Sinewave) Specifications").

VARs Adder VARs Adder for Φ=85 at 60 Hz is 0.02% (see "Phase Specifications").

Total VARS Output Uncertainty = $U_{\text{VARs}} = \sqrt{0.047^2 + 0.11^2 + 0.02^2} = 0.12\%$

Additional Specifications

The following paragraphs provide additional specifications for the 5500A Calibrator ac voltage and ac current functions. These specifications are valid after allowing a warm-up period of 30 minutes, or twice the time the 5500A has been turned off. All extended range specifications are based on performing the internal zero-cal function at weekly intervals, or when the ambient temperature changes by more than 5°C. (See Chapter 4, "Front Panel Operations.")

Frequency Specifications

Frequency Range	Resolution	1-Year Absolute Uncertainty, tcal ± 5°C	Jitter
.01 to 119.99 Hz	.01 Hz	25 ppm, ± 1 mHz	2 µs
120.0 to 1199.9 Hz	0.1 Hz	25 ppm, ± 1 mHz	2 µs
1.200 to 11.999 kHz	1.0 Hz	25 ppm, ± 1 mHz [1]	2 µs
12.00 to 119.99 kHz	10 Hz	25 ppm, ± 15 mHz	140 ns
120.0 to 1199.9 kHz	100 Hz	25 ppm, ± 15 mHz	140 ns
1.200 to 2.000 MHz	1 kHz	25 ppm, ± 15 mHz	140 ns
[1] ± (25 ppm + 15 mHz) above 10 kHz			

Harmonics (2nd to 50th) Specifications

Fundamental Frequency [1]	Voltages NORMAL Terminals	Currents	Voltages AUX Terminals	Amplitude Uncertainty
10 to 45 Hz	33 mV to 32.9999 V	3.3 mA to 2.19999 A	10 mV to 3.3 V	Same % of output
45 to 65 Hz	33 mV to 1020 V	3.3 mA to 11 A	10 mV to 3.3 V	as the equivalent
65 to 500 Hz	33 mV to 1020 V	33 mA to 11 A	100 mV to 3.3 V	single output, but
500 to 1 kHz	330 mV to 1020 V	33 mA to 11 A	100 mV to 3.3 V	twice the floor
1 to 5 kHz	3.3 to 1020 V	33 mA to 2.19999 A	100 mV to 3.3 V	adder.

[1] The maximum frequency of the harmonic output is 10 kHz. For example, if the fundamental output is 5 kHz, the maximum selection is the 2nd harmonic (10 kHz). All harmonic frequencies (2nd to 50th) are available for fundamental outputs between 10 and 200 Hz.

Note

1. Phase uncertainty for harmonic outputs is 1 degree, or the phase uncertainty shown in “Phase Specifications” for the particular output, whichever is greater. For example, the phase uncertainty of a 400 Hz fundamental output and 10 kHz harmonic output is 10 degrees (from “Phase Specifications”). Another example, the phase uncertainty of a 60 Hz fundamental output and a 400 Hz harmonic output is 1 degree.

Example of determining Amplitude Uncertainty in a Dual Output Harmonic Mode

What are the amplitude uncertainties for the following dual outputs?

NORMAL (Fundamental) Output: 100 V, 100 Hz

From “AC Voltage (Sinewave) Specifications” the single output specification for 100 V, 100 Hz, is 0.04% + 6.6 mV. For the dual output in this example, the specification is 0.04% + 13.2 mV as the 0.04% is the same and the floor is twice the value (2 x 6.6 mV).

AUX (50th Harmonic) Output: 100 mV, 5 kHz

From “AC Voltage (Sinewave) Specifications” the auxiliary output specification for 100 mV, 5 kHz, is 0.15% + 450 mV. For the dual output in this example, the specification is 0.15% + 900 mV as the 0.15% is the same and the floor is twice the value (2 x 450 mV).

AC Voltage (Sinewave) Extended Bandwidth Specifications

Ranges	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C, ± (% of output + % of range)		Maximum Voltage Resolution
		%Output	%Range	
Normal Channel (Single Output Mode)				
1.0 to 33 mV	0.01 to 10 Hz	5.0%	0.5%	Two digits, e.g., 25 mV
34 to 330 mV				Three digits
0.4 to 3.3 V				Two digits
4 to 33 V				Two digits
	10 to 500 kHz	See “AC Voltage (Sinewaves) Specifications”		
0.3 to 3.3 V	500 to 1 MHz	-8 dB at 1 MHz, typical		Two digits
	1 to 2 MHz	-32 dB at 2 MHz, typical		
Auxiliary Output (Dual Output Mode)				
10 to 330 mV	0.01 to 10 Hz	5.0%	0.5%	Three digits
0.4 to 3.3 V				Two digits
	10 to 10 kHz	See “AC Voltage (Sinewaves) Specifications”		

AC Voltage (Non-Sinewave) Specifications

Trianglewave & Truncated Sine Ranges Peak-to-Peak [1]	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C, ± (% of output + % of range) [2]		Maximum Voltage Resolution
		%Output	%Range	
Normal Channel (Single Output Mode)				
2.9 to 92.999 mV	0.01 to 10 Hz	5.0%	0.5%	Two digits on each range
93 to 929.999 mV	10 to 45 Hz	0.25%	0.5%	Six digits on each range
0.93 to 9.29999 V	45 to 1 kHz	0.25%	0.25%	
9.3 to 92.9999 V	1 to 20 kHz	0.5%	0.25%	
	20 to 100 kHz	5.0%	0.5%	
Auxiliary Output (Dual Output Mode)				
93 to 929.999 mV	0.01 to 10 Hz	5.0%	0.5%	Two digits on each range
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
0.93 to 9.29999 V	45 to 1 kHz	0.25%	0.25%	
	1 to 10 kHz	5.0%	0.5%	

[1] To convert peak-to-peak to rms for trianglewave, multiply the peak-to-peak value by 0.2886751. To convert peak-to-peak to rms for truncated sinewave, multiply the peak-to-peak value by 0.2165063.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

Squarewave Ranges (p-p) [1]	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C ± (% of output + % of range) [2]		Maximum Voltage Resolution
		%Output	%Range	
Normal Channel (Single Output Mode)				
2.9 to 65.999 mV	0.01 to 10 Hz	5.0%	0.5%	Two digits on each range
66 to 659.999 mV	10 to 45 Hz	0.25%	0.5%	Six digits on each range
0.66 to 6.59999 V	45 to 1 kHz	0.25%	0.25%	
6.6 to 65.9999 V	1 to 20 kHz	0.5%	0.25%	
	20 to 100 kHz	5.0%	0.5%	
Auxiliary Output (Dual Output Mode)				
66 to 659.999 mV	0.01 to 10 Hz	5.0%	0.5%	Two digits on each range
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
0.66 to 6.59999 V	45 to 1 kHz	0.25%	0.25%	
	1 to 10 kHz	5.0%	0.5%	

[1] To convert peak-to-peak to rms for squarewave, multiply the peak-to-peak value by 0.5000000.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

AC Voltage, DC Offset Specifications

Range [1] (Normal Channel)	Offset Range [2]	Maximum Peak Signal	1-Year Absolute Offset Uncertainty, tcal ± 5°C [3]
			± (% Output (dc) + μV)
Sinewaves			
3.3m to 32.999 mV	0 to 50 mV	80 mV	0.1% + 33 μV
33m to 329.999 mV	0 to 500 mV	800 mV	0.1% + 330
0.33 to 3.29999 V	0 to 5 V	8 V	0.1% + 3300
3.3 to 32.9999 V	0 to 50 V	55 V	0.1% + 33 mV
Trianglewaves and Truncated Sinewaves			
9.3 to 92.999 mV p-p	0 to 50 mV	80 mV	0.1% + 93 μV
93 to 929.999 mV p -p	0 to 500 mV	800 mV	0.1% + 930
0.93 to 9.29999 V p-p	0 to 5 V	8 V	0.1% + 9300
9.3 to 92.9999 V p-p	0 to 50 V	55 V	0.1% + 93 mV
Squarewaves			
6.6 to 65.999 mV p-p	0 to 50 mV	80 mV	0.1% + 66 μV
66 to 659.999 mV p-p	0 to 500 mV	800 mV	0.1% + 660
0.66 to 6.59999 V p-p	0 to 5 V	8 V	0.1% + 6600
6.6 to 65.9999 V p-p	0 to 50 V	55 V	0.1% + 66 mV

[1] Offsets are not allowed on ranges above the highest range shown above.

[2] The maximum offset value is determined by the difference between the peak value of the selected voltage output and the allowable maximum peak signal. For example, a 10 V peak-to-peak square wave output has a peak value of 5 V, allowing a maximum offset up to ±50 V to not exceed the 55 V maximum peak signal. The maximum offset values shown above are for the minimum outputs in each range.

[3] For frequencies 0.01 to 10 Hz, and 500 kHz to 2 MHz, the offset uncertainty is 5% of output, ± 1% of the offset range.

AC Voltage, Squarewave Characteristics

Risetime @ 1 kHz Typical	Settling Time @ 1 kHz Typical	Overshoot @ 1 kHz Typical	Duty Cycle Range	Duty Cycle Uncertainty [1]
<1 μs	<10 μs to 1% of final value	<2%	1% to 99%, <3.3 V p-p, 0.01 Hz to 100 kHz	± (0.8% of period +140 ns) for frequencies >10 kHz; + (0.8% of period + 2 μs) for frequencies ≤10 kHz.

[1] For duty cycles of 10.00% to 90.00%.

AC Voltage, Triangle wave Characteristics (typical)

Linearity to 1 kHz	Aberrations
0.3% of p-p value, from 10% to 90% point	<1% of pk-to-pk value, with amplitude >50% of range

AC Current (Sinewave) Extended Bandwidth Specifications

Ranges	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C, ± (% of output + % of range) [2]		Maximum Current Resolution
		%Output	%Range	
All current ranges, <330 mA	0.01 - 10 Hz	5.0%	0.5%	2 digits each range
	10 - 10 kHz	See “AC Current (Sinewave) Specifications”		

AC Current (Non-Sinewave) Specifications

Trianglewave & Truncated Sinewave Ranges [1]	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C, ± (% of output + % of range) [2]		Maximum Current Resolution
		%Output	%Range	
2.9 to 92.999 mA	0.01 to 10 Hz	5.0%	0.5%	Two digits, e.g., 75 mA
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
	45 to 1 kHz	0.25%	0.25%	
	1 to 10 kHz	5.0%	0.5%	
93 to 929.999 mA	0.01 to 10 Hz	5.0%	0.5%	Two digits
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
	45 to 1 kHz	0.25%	0.5%	
	1 to 10kHz	5.0%	1.0%	
0.93 to 6.19999 A	10 to 45 Hz	5.0%	1.0%	Two digits
	45 to 1kHz	0.5%	0.5%	Six digits on each range
	1 to 5 kHz	5.0%	1.0%	
6.2 to 31 A	45 to 500 Hz	2.0%	0.5%	Two digits on each range
	500 to 1 kHz	5.0%	1.0%	Six digits on each range

[1] All waveforms are peak-to-peak output ranges.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

AC Current (Non-Sinewave) Specifications

Squarewave Ranges [1]	Frequency	1-Year Absolute Uncertainty, tcal ± 5°C, ± (% of output + % of range) [2]		Maximum Current Resolution
		%Output	%Range	
2.9 to 65.999 mA	0.01 to 10 Hz	5.0%	0.5%	Two digits, e.g., 50 mA
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
	45 to 1 kHz	0.25%	0.25%	
	1 to 10 kHz	5.0%	0.5%	
66 to 659.999 mA	0.01 to 10 Hz	5.0%	0.5%	Two digits
	10 to 45 Hz	0.25%	0.5%	Six digits on each range
	45 to 1 kHz	0.25%	0.5%	
	1 to 10 kHz	5.0%	1.0%	
0.66 to 4.39999 A	10 to 45 Hz	5.0%	1.0%	Two digits
	45 to 1 kHz	0.5%	0.5%	Six digits on each range
	1 to 5 kHz	5.0%	1.0%	
4.4 to 22 A	45 to 500 Hz	2.0%	0.5%	Two digits on each range
	500 to 1 kHz	5.0%	1.0%	Six digits on each range

[1] All waveforms are peak-to-peak output ranges.

[2] Uncertainty is stated in peak-to-peak. Amplitude is verified using an rms-responding DMM.

AC Current, Squarewave Characteristics (typical)

Range	Risetime	Settling Time	Overshoot
I<4.4 A @ 400 Hz	25 µs	40 µs to 1% of final value	<10% for loads <100 Ω

AC Current, Trianglewave Characteristics (typical)

Linearity to 400 Hz	Aberrations
0.3% of p-p value, from 10% to 90% point	<1% of p-p value, with amplitude >50% of range