5700A/5720A Series II

Multi-Function Calibrator

Service Manual

November 2007

LIMITED WARRANTY & LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

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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 5700A/5720A Series II Calibrator 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.

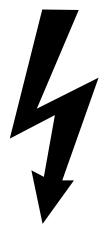
Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daβ Fluke Models 5700A/5720A Series II Calibrator in Übereinstimung mit den Bestimmungen der BMPT-AmtsblVfg 243/1991 funk-entstört ist. 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 Telekcommunikation wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Seire auf Einhaltung der Bestimmungen eingeräumt.

Fluke Corporation

OPERATOR SAFETY SUMMARY

WARNING



HIGH VOLTAGE

is used in the operation of this equipment

LETHAL VOLTAGE

may be present on the terminals, observe all safety precautions!

To avoid electrical shock hazard, the operator should not electrically contact the output hi or sense hi binding posts. During operation, lethal voltages of up to 1100V ac or dc may be present on these terminals.

Whenever the nature of the operation permits, keep one hand away from equipment to reduce the hazard of current flowing thought vital organs of the body.

Terms in this Manual

This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the instrument in safe condition.

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 the equipment or other property.

Symbols Marked on Equipment

⚡	DANGER — High Voltage
⏚	Protective ground (earth) terminal
⚠	Attention — refer to the manual. This symbol indicates that information about the usage of a feature is contained in the manual.

Power Source

The 5700A/5720A Series II is intended to operate from a 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 essential for safe operation.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified on the line voltage selection switch label, and which is identical in type voltage rating, and current rating.

Grounding the 5700A/5720A Series II

The 5700A/5720A Series II is Safety Class I (grounded enclosure) instruments as defined in IEC 348. The enclosure is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired earth grounded receptacle before connecting anything to any of the 5700A/5720A Series II terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Use the Proper Power Cord

Always use the power (line) cord and connector appropriate for the voltage and outlet of the country or location in which you are working.

Always match the line cord to the instrument.

- Use the AC line cord supplied with this instrument with this instrument only.
- Do not use this line cord with any other instruments.
- Do not use any other line cords with this instrument.

Use only the power cord and connector appropriate for proper operation of a 5700A/5720A Series II in your country.

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate the 5700A/5720A Series II in an atmosphere of explosive gas.

Do Not Remove Cover

To avoid personal injury or death, do not remove the 5700A/5720A Series II cover. Do not operate the 5700A/5720A Series II without the cover properly installed. There are no user-serviceable parts inside the 5700A/5720A Series II, so there is no need for the operator to ever remove the cover.

Do Not Attempt to Operate if Protection May be Impaired

If the 5700A/5720A Series II appears damaged or operates abnormally, protection may be impaired. Do not attempt to operate it. When in doubt, have the instrument serviced.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Also refer to the preceding Operator Safety Summary

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltage exist at many points inside this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Whenever the nature of the operation permits, keep one hand away from equipment to reduce the hazard of current flowing through vital organs of the body.

Do not wear a grounded wrist strap while working on this product. A grounded wrist strap increase the risk of current flowing through the body.

Disconnect power before removing protective panels, soldering, or replacing components.

High voltage may still be present even after disconnecting power.

FIRST AID FOR ELECTRIC SHOCK

Free the Victim From the Live Conductor

Shut off high voltage at once and ground the circuit. If high voltage cannot be turned off quickly, ground the circuit.

If the circuit cannot be broken or grounded, use a board, dry clothing, or other nonconductor to free the victim.

Get Help!

Yell for help. Call an emergency number. Request medical assistance.

Never Accept Ordinary and General Tests for Death

Symptoms of electric shock may include unconsciousness, failure to breathe, absence of pulse, pallor, and stiffness, and severe burns.

Treat the Victim

If the victim is not breathing, begin CPR or mouth-to-mouth resuscitation if you are certified.

Chapter 1
Introduction and Specifications

Title		Page

1-1. Introduction

The Fluke Model 5700A/5720A Series II calibrators are precise instruments that calibrate a wide variety of electrical measuring instruments. These calibrators maintain high accuracy over a wide ambient temperature range, allowing them to test instruments in any environment, eliminating the restrictions to calibrate only in a temperature-controlled standards laboratory. With a 5700A/5720A Series II, you can calibrate precision multimeters that measure ac or dc voltage, ac or dc current, and resistance. The 5720A Series II operates in a similar manner to the 5700A Series II, the difference is that the 5720A Series II has a considerably higher specified accuracy. Option 5700A-03 Wideband AC Voltage, which is available for both the 5700A Series II and the 5720A Series II, extends this workload to include rf voltmeters.

Specifications are provided at the end of this chapter. The calibrator is a fully-programmable precision source of the following:

- DC voltage to 1100V
- AC voltage to 1100V, with output available from 10 Hz to 1.2 MHz.
- AC and DC current to 2.2A, with output available from 10 Hz to 10 kHz
- Resistance in values of $1x10^n$ and $1.9x10^n$ from 1Ω to 100 MΩ, plus a short.
- Optional wideband ac voltage from 300 μV to 3.5V into 50Ω (-57 dBm to +24 dBm), 10 Hz to 30 MHz.

Features of the calibrator include the following:

- Internal environmentally-controlled references allowing the calibrator to maintain full performance over a wide ambient temperature range.
- Automatic meter error calculation obtained through using a simple output adjust knob; the display shows linearity, offset, and scale errors.
- Keys that multiply and divide the output value by 10 to simplify work on meters with calibration points at decade multiples of a fraction of full-scale.
- Programmable entry limits used for restricting the levels that can be keyed into the calibrator, preventing access to levels that may be harmful to equipment or personnel.
- A [SPEC] key that provides the capability of displaying the instrument's specification at the selected operating point, calibration interval, and specification confidence level.
- An auxiliary current binding post that allows you to calibrate meters with separate current inputs without moving cables.
- Real-time clock and calendar for date stamping reports.
- Offset and scaling modes that simplify linearity testing of multimeters.
- Variable phase reference signal output and phase-lock input.
- Interface for the Fluke 5725 Amplifier.
- Standard IEEE-488 (GPIB) interface, complying with ANSI/IEEE Standards 488.1-1987 and 488.2-1987.
- Selectable normal remote mode or emulation of the Fluke 5100B and 5200A Series calibrators in functions and response to system controller software
- EIA Standard RS-232C serial data interface for printing, displaying, or transferring internally-stored calibration constants, and for remote control of the calibrator.
- Extensive internal self testing and diagnostics of analog and digital functions.

- A traceable calibration procedure for all modes and ranges that requires only 10V, 1Ω, and 10 kΩ external standards, with only occasional independent verification.
- Fast, simple, automated calibration check providing added confidence between calibration recalls, and data that can be used to document and characterize the calibrator's performance between calibration recalls.

1-2. Contacting Fluke

To order accessories, receive operating assistance, or get the location of the nearest Fluke distributor or Service Center, call:

USA: 1-888-44-FLUKE (1-888-443-5853)
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**.

1-3. About this Manual

This manual provides complete information for installing the calibrator and operating it from the front panel keys and in remote. It also provides a glossary of calibration-related terms as well as general items such as specifications and error code information. The following topics are covered in this manual:

- Installation
- Operating controls and features
- 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 how to calibrate the 5700A/5720A Series II
- Options and accessories

1-4. How to Use this Manual

Use the following list to find the location of specific information.

- Quick setup procedure: *5700A/5720A Series II Operators Reference Guide*
- Unpacking and setup: Chapter 2.
- Installation and rack mounting: Chapter 2; also the rack mount kit instruction sheet
- AC line power and interface cabling: Chapter 2
- Controls, indicators, and displays: Chapter 3
- Front panel operation: Chapter 4
- Cabling to a UUT (Unit Under Test): Chapter 4
- Using auxiliary amplifiers: Chapter 4
- Self calibration: Chapters 1 and 7

- Remote operation (IEEE-488 or serial): Chapter 5
- Options and accessories: Chapters 2 and 8
- Instrument specifications: The end of this Chapter
- Theory of operation: Chapter 2 of the *5700A/5720A Series II Service Manual*

1-5. Wideband AC Voltage Module (Option 5700A-03)

The Wideband AC Voltage Module (Option 5700A-03) can be installed in both the 5700A and 5720A Series II Calibrators. The module is a high-accuracy, low-noise, extremely flat ac voltage source for calibrating rf voltmeters, with a frequency range of 10 Hz to 30 MHz. Output is in seven ranges from 300 μV (-57 dBm) to 3.5 V (+24 dBm) through a Type-N coaxial connector into a 50 Ω load. The output level is selected in volts or dBm through either the front panel controls or under remote control.

The wideband module also functions with the calibrator's output adjust controls that let display the error of a wideband meter in either percentage of output or in decibels.

Included with the wideband module is a Type-N output cable and a 50 Ω terminator. The wideband module is calibrated to the end of its standard-equipment output cable.

1-6. Auxiliary Amplifiers

The Fluke Model 5725A Amplifier is available to extend the high voltage performance and current range of the calibrator:

Interface connectors on the calibrator's rear panel accept cables to directly operate a 5725A. Three amplifiers can be connected to the calibrator at the same time, but only one output can be active at a time. Once you have connected the amplifiers and configured the calibrator in a setup menu, amplifier operation is controlled by the calibrator.

Chapter 4 provides instructions for operating the 5725A. The general specifications at the end of this chapter include specifications for operating the calibrator with the 5725A. For other amplifier specifications, refer to their instruction manuals. Table 1-1 summarizes the extended capabilities offered by the 5725A. Brief descriptions of the extended capabilities follow.

Table 1-1. Auxiliary Amplifier Data

Model	Mode	Range
5725A Amplifier	AC V	220 to 1100V rms up to 70 mA, 40 Hz to 30 kHz (50 mA < 5 kHz)
		220 to 750V rms up to 70 mA, 30 kHz to 100 kHz
	DC Amps	0 to ±11A
	AC Amps	1 to 11A rms, 40 Hz to 10 kHz

1-7. 5725A Amplifier

The Fluke 5725A Amplifier is an external unit operating under calibrator control to extend ac voltage drive capabilities and both ac and dc current output range. The amplifier adds the following capabilities to the calibrator's 1100V ac range with no compromise in accuracy:

- Frequency limits at higher voltage increase to 100 kHz at 750V, 30 kHz at 1100V.
- Load limit increases to 70 mA for frequencies above 5 kHz.
- Capacitive drive increases to 1000 pF, subject to the maximum output current.

Extended-performance voltage is available at the calibrator's front or rear binding posts, eliminating the need to change cables during a procedure.

A separate set of binding posts on the front panel of the 5725A supplies extended-range ac and dc current outputs. Since most meters have a separate input terminal for the high current ranges, this eliminates the need to change cables during a procedure. The 5725A can also be configured to source all current (both standard calibrator-generated current and its own current) through the 5725A binding posts.

1-8. Support Equipment and Services

Fluke supports your calibration needs with precision, high-quality equipment and a wide range of services. Depending on your needs, location, and capabilities, you may decide to support your 5700A/5720A Series II calibrator independently or use Fluke services for part, or all, of your support needs. The following paragraphs describe the support equipment and services offered by Fluke for the calibrator. For specifications and ordering instructions for this support equipment and other Fluke instruments, refer to the Fluke catalog, or contact a representative at a Fluke Sales and Service Center.

1-9. 732B Direct Voltage Reference Standard

The Fluke 732B is a rugged, easily transported solid state direct voltage reference standard with a highly predictable 10V output. This predictability allows the Fluke Standards Laboratory, as well as many Fluke customers, to completely eliminate fragile, saturated standard cells. Laboratories still maintain standard cells using the 732A and 732B as a transportable voltage standard, eliminating the need to transport their standard cells. The 732B can be short-circuited, even for extended periods of time, without damage or loss of stability. It maintains full specified stability over a temperature span of 18 to 28 °C.

The calibrator uses a 10V reference standard such as the Fluke 732B in its semi-automated calibration procedure to establish external voltage traceability. Chapter 7 describes this procedure.

1-10. 732B-200 Direct Volt Maintenance Program (U.S.A. Only)

The Fluke 732B-200 Direct Volt Maintenance Program provides your laboratory with NIST-traceable 10V calibration uncertainty as low as 0.6 parts per million.

The program maintains the 732B that you keep in your laboratory. To accomplish this, the following occurs:

1. Fluke sends you a calibrated Fluke-owned 732B standard, together with all necessary connecting cables and instructions for comparison with your 10V reference standard.
2. You take a series of readings over a five-day period, and return the results to the Fluke Standards Laboratory.
3. The Fluke Standards Laboratory assigns a value to your 10V standard relative to the NIST legal volt and sends you a report of calibration.

1-11. 742A Series Resistance Standards

The calibrator uses 1Ω and 10 kΩ resistor standards such as the 742A Series in its semi-automated calibration procedure to establish external traceability of resistance and current. Chapter 7 describes this procedure.

The 742A Resistance Standards, which are constructed of arrays of Fluke wirewound precision resistors, are ideally suited as support standards for the calibrator. Stability of the resistance transfer standards and their temperature coefficients make them ideal for easy transport to and operation in the calibrator's working environment.

1-12. Wideband AC Module (Option 5700A-03) Calibration Support

The Wideband AC Module (Option 5700A-03) requires two kinds of calibration: gain and flatness. Gain constants are checked and recalibrated as a part of the normal calibrator semi-automated calibration process.

Since frequency flatness is determined by such stable parameters as circuit geometry and dielectric constants, flatness of the Wideband AC module has excellent long-term stability. This stability gives the Wideband AC Module a two-year calibration cycle for flatness calibration. Flatness calibration is required only infrequently, and can be done when the calibrator is returned to a standards laboratory for periodic verification. The *5700A/5720A Series II Service Manual* contains the wideband flatness calibration procedure. Chapter 7 of this manual contains the wideband gain calibration procedure.

1-13. Service Centers

A worldwide network of Fluke service centers supports Fluke instruments and assists customers in many ways. Most service centers have standards and calibration laboratories certified by local national standards organizations. The following is a partial list of the services provided by most service centers:

- Repair and certified traceable calibration of all Fluke products.
- Certified traceable calibration of many non-Fluke standards and calibrators.
- Worldwide exchange of calibrator internal modules. Delivery inside the U.S.A. is typically within 48 hours.
- Service agreements with the flexibility to suit your needs. These can be a simple warranty extension or an agreement that includes on-site support. Calibration service agreements are also available in many areas.
- Training programs and seminars, including laboratory metrology, system applications, and product maintenance.
- Application help and consulting, including system design, hardware selection, custom software, site evaluation and installation.
- Replacement parts inventory, including recommended spare parts and module kits.
- Visit **www.fluke.com** for locations and phone numbers of authorized Fluke service centers.

1-14. The Components of the 5700A/5720A Series II Calibrator

The calibrator is configured internally as an automated calibration system, with process controls and consistent procedures. Internal microprocessors control all functions and monitor performance, using a switching matrix to route signals between modules. Complete automatic internal diagnostics, both analog and digital, confirm operational integrity.

Reference amplifiers maintain dc accuracy and stability. Of all technologies available, reference amplifiers have the lowest noise and best stability. Reference amplifiers in the calibrator go through special selection processes including long-term aging to ensure high reliability and performance well within specifications.

The calibrator achieves its exceptional ac voltage accuracy by using a patented Fluke rms sensor to make real-time ac/dc comparison measurements. The Fluke rms sensor is similar in principle to the traditional thermal voltage converter, but has a shorter time constant, virtually no reversal error, higher signal-to-noise ratio, and better frequency response. In the calibrator, one Fluke rms sensor serves as an ac/dc transfer standard to develop gain and flatness correction constants during calibration. The second Fluke rms sensor continuously monitors and corrects output voltage during operation.

A patented 26-bit digital-to-analog converter (dac) provides the calibrator with the ability to precisely vary its output. This is a pulse-width modulated dac with linearity typically better than 0.2 ppm of full scale. As with the other internal functions, the linearity of the dac is automatically checked during calibration and analog diagnostics.

1-15. Calibrating the 5700A/5720A Series II Calibrator

The traditional practice of returning a calibrator to a standards laboratory at regular intervals for a full calibration is time consuming, expensive, and disruptive to the task to which the calibrator is being applied. Moreover, it leaves gaps in confidence. You must rely on manufacturer's specifications to determine if a calibrator will perform acceptably in an operating environment outside the lab. Also, you must assume that drift is predictable enough so that performance is within limits between recalls.

The 5700A/5720A Series II Calibrator makes use of Fluke design breakthroughs in the use of internal check standards and measurement systems. As a result, it can be completely calibrated in place to full specifications using a small number of convenient, portable, environmentally tolerant standards available from Fluke. As you will see below, this procedure is traceable to military standard requirements.

When manufactured, each calibrator is calibrated and thoroughly verified with process metrology and calibration standards traceable to the U.S. National Bureau of Standards. A certificate of calibration is included.

A calibration verification procedure described in the *5700A/5720A Series II Service Manual* is recommended every two years, or as required by your established policies. This procedure involves no adjustments. It simply ensures internal processes are in control, and establishes parallel external traceability paths for internal functions such as ac transfers that are never adjusted or corrected.

Figure 1-1 illustrates the time and money that can be saved by using the 5700A/5720A Series II calibration support plan recommended by Fluke. Depending on your policies, you may initially decide to perform calibration verification more often. The calibrator makes this unnecessary and offers you a practical way to collect data unavailable with a traditional calibrator design about performance between calibrations.

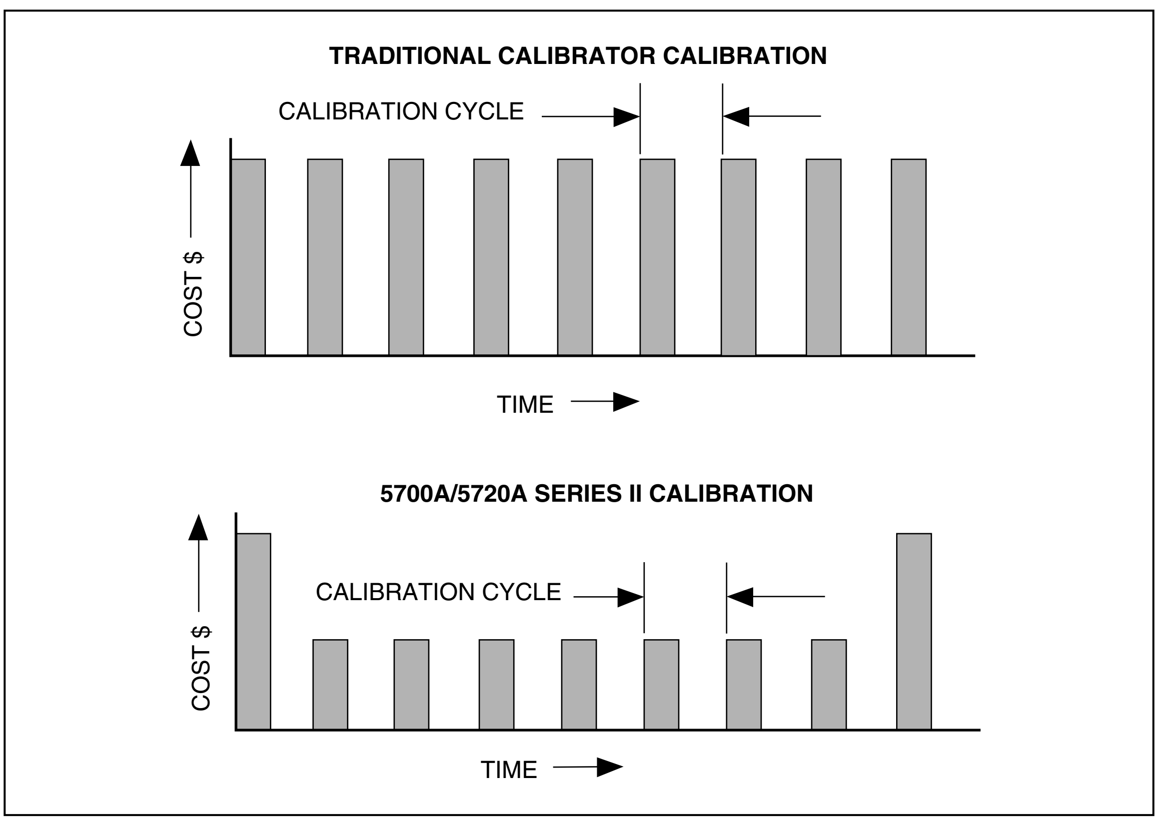


Figure 1-1. Time and Costs: Calibrator Calibration

1-16. The Calibration Process

Calibration requires only three external standards: 10V, 1Ω, and 10 kΩ. Environmentally-controlled internal check standards provide the primary reference points. A stored table of calibration constants defines additional reference points for controlling the output. Traceable calibration and adjustment to the specified level of performance is accomplished in a semi-automated process that revises this table.

When you finish calibration, but before you save the new constants, the calibrator presents you with the proposed adjustments as +/- ppm of range and percentage change in specification for each range and function. You can print a list of changes through the serial (RS-232C) port, or send them to a computer through either the serial port or the IEEE-488 port. Also on completion of calibration, the calibrator displays the largest proposed change.

Calibration can be completed as far as deriving and printing the proposed adjustments without changing the setting of the rear panel CALIBRATION switch; however, the switch must be set to ENABLE to store the changes in nonvolatile memory and make them effective. The switch is recessed to allow the metrologist to cover it with a calibration sticker to guarantee calibrator integrity.

1-17. Establishing Traceability

Traceability to national standards is established as follows:

- Except for the internal ac/dc transfer standard, the internal check standards are directly calibrated by traceable external standards every time the 5700A/5720A Series II is calibrated.
- The internal ac/dc transfer standard is never adjusted, so its traceability is not disturbed by calibration. Infrequent verification is done in the traditional way, by comparing selected ac voltage outputs with an external dc voltage standard through an external ac/dc transfer standard. Fluke recommends this be done every two years, or as determined by the policy of your organization.
- Infrequent independent verification is also performed on stable parameters, such as frequency flatness, determined more by circuit geometry and dielectric constants than time.

1-18. Calibration Reports

The calibrator stores two sets of calibration constants: the set currently in use and the old set from the previous calibration. This gives the calibrator the ability at any time to produce a calibration report of the differences between the present settings and the settings that were in effect before the last calibration. The report shows changes for each range and function in +/- ppm of range and in percentage of specification limit. You can print the report or send it to a host computer through either the RS-232-C or IEEE-488 interface.

If you request a calibration report after doing calibration but before saving the new constants, the report shows proposed changes to the calibration constants relative to the previously stored settings.

1-19. Calibration Check

Checking the calibration takes about an hour, and provides you with a means of documenting the calibrator's performance of a between calibrations. Calibration checking is similar to calibration, except internal check standards are used as primary references (no external standards are needed), and changes cannot be stored. The process produces a report similar to normal calibration, showing drift relative to internal check standards. Because cal check does not change stored calibration constants, there is no need to enable the rear panel CALIBRATION switch. Therefore, an external computer can do the procedure unattended.

1-20. Developing a Performance History

A Fluke specification is a set of performance limits that all products must meet. To maintain consistent quality, Fluke calibrators are specified with enough margin to include temperature, line, and load extremes, plus additional margin for production. This means that a typical 5700A/5720A Series II calibrator in a typical environment operates inside 50% of specification limits. For some exacting applications, it can be helpful to know just how accurately a particular calibrator operates. The proper way to do this is to accumulate a performance history by calibrating regularly and recording results on a control chart.

Calibrating regularly and recording the results on a control chart is tedious and requires a large array of equipment. The calibrator's calibration check feature is an alternative with some distinct advantages:

- Calibrated check standards are already programmed into the unit. You do not have to use external standards.
- The process is consistent and automatic: it does not require an operator's assistance.

Each calibration check produces a new set of data points for accumulating a historical record. When this process is externally automated, significant history can be accumulated much faster than with a manual calibration.

1-21. Range Calibration

After calibration, you can make further fine adjustments to each range. Range adjustments are optional; they are not necessary to meet total uncertainty specifications. However, they do allow you to align your calibrator closer to your standards.

Before you do range calibration, you must first use the calibrator's semi-automated calibration procedure. This is to calibrate the ranges that will not be adjusted. It also performs an initial adjustment for each range, and supplies flatness corrections for ac functions.

1-22. DC Zeros Calibration

To ensure the validity of the specifications, a dc zeros calibration must be performed at least every 30 days. If more than 30 days elapse without a dc zeros calibraiton a warning message appears. This procedure does not require any external equipment or connections and takes approximately 2.5 minutes to complete.

1-23. Specifications

The 5700A/5720A Series II calibrators are verified and calibrated at the factory prior to shipment to ensure they meet the accuracy standards required for all certified calibration laboratories. By calibrating to the specifications in this chapter, you can maintain the high performance level throughout the life of your calibrator.

Specifications are valid after a warm-up period of twice the time the calibrator has been turned off, up to a maximum of 30 minutes. For example, if the calibrator has been turned off for five minutes, the warm-up period is ten minutes.

1-24. Specification Confidence Levels

You calibrator's performance level is ensured by regular calibration to the primary performance specifications, which are provided at both the 99% and 95% confidence levels. The 95% confidence level will provide an accuracy that surpasses the accuracy requirements for meeting Tag 4 standards, or a coverage factor of 2. Calibration at the 99% confidence level is also available for those applications that require a confidence factor for the specifications that is higher than 95%. For information on selecting the confidence level, refer to Chapter 4.

The tables in this chapter provide specifications at both the 95% and 99% confidence levels for the 5700A/5720A Series II calibrators. Included with these tables are operating specifications for using the calibrator with the Wideband AC Module (Option 5700A-03) and the 5725A Amplifier.

1-25. Using Absolute and Relative Uncertainty Specifications

To evaluate the 5700A/5720A Series II coverage of your calibration workload, use the Absolute Uncertainty specifications. Absolute uncertainty includes stability, temperature coefficient, linearity, line and load regulation, and the traceability to external standards. You do not need to add anything to absolute uncertainty to determine the ratios between the calibrator's uncertainties and the uncertainties of your calibration workload.

Relative uncertainty specifications are provided for enhanced accuracy applications. These specifications apply when range constants are adjusted (see "Range Calibration"). To calculate absolute uncertainty, you must combine the uncertainties of your external standards and techniques with relative uncertainty.

1-26. Using Secondary Performance Specifications

Secondary performance specifications and operating characteristics are included in uncertainty specifications. They are provided for special calibration requirements such as stability or linearity testing.

1-27. General Specifications

Standard Interfaces .... IEEE-488, RS-232, 5725A, 5205A or 5215A, 5220A, phase lock in (BNC), phase reference out (BNC).

Temperature Performance

Operating .... 0 °C to 50 °C

Calibration .... 15 °C to 35 °C

Storage .... -40 °C to 75 °C

Relative Humidity

Operating .... <80 % to 30 °C, <70 % to 40 °C, <40 % to 50 °C

Storage .... <95 %, non-condensing. A power stabilization period of four days may be required after extended storage at high temperature and humidity.

Safety .... Designed to comply with UL3111; EN61010; CSA C22.2 No. 1010; ANSI/ISA S82.01-1994

Guard Isolation .... 20 V

EMI/RFI .... Designed to comply with FCC Rules Part 15, Subpart B, Class B; EN50081-1, EN50082-1

ElectroStatic Discharge .... This instrument meets criteria C for ESD requirements per EN61326

Line Power

Line Frequency .... 47 to 63 Hz; ±10 % 100 V, 110 V, 115 V, 120 V, 200 V, 220 V, 230 V, 240 V

Maximum Power

5700A/5720A .... 300 VA

5725A .... 750 VA

Weight

5700A/5720A .... 27 kg (62 lb)

5725A .... 32 kg (70 lb)

Size

5700A/5720A

Height .... 17.8 cm (7 in), standard rack increment, plus 1.5 cm (0.6 in) for feet

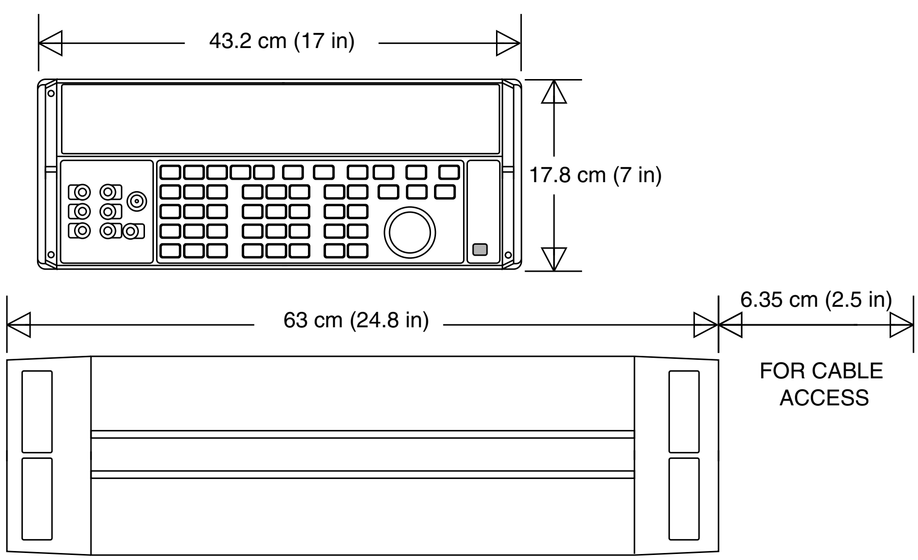
Width .... 43.2 cm (17 in), standard rack width

Depth .... 63.0 cm (24.8 in), overall; 57.8 cm (22.7 in), rack depth

5725A

Height .... 13.3 cm (5.25 in)

Width and Depth .... Same as 5700A/5720A. Both units project 5.1 cm (2 in) from rack front.



1-28. Electrical Specifications

Note

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

1-29. DC Voltage Specifications

5720A Series II DC Voltage Specifications

Range	Resolution	Absolute Uncertainty ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
		24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
		± (ppm output + µV)					
99 % Confidence Level							
220 mV	10 nV	5 + 0.5	7 + 0.5	8 + 0.5	9 + 0.5	2 + 0.4	2.5 + 0.4
2.2 V	100 nV	3.5 + 0.8	4 + 0.8	4.5 + 0.8	6 + 0.8	2 + 0.8	2.5 + 0.8
11 V	1 µV	2.5 + 3	3 + 3	3.5 + 3	4 + 3	1 + 3	1.5 + 3
22 V	1 µV	2.5 + 5	3 + 5	3.5 + 5	4 + 5	1 + 5	1.5 + 5
220 V	10 µV	3.5 + 50	4 + 50	5 + 50	6 + 50	2 + 50	2.5 + 50
1100 V	100 µV	5 + 500	6 + 500	7 + 500	8 + 500	2.5 + 400	3 + 400
95 % Confidence Level							
220 mV	10 nV	4 + 0.4	6 + 0.4	6.5 + 0.4	7.5 + 0.4	1.6 + 0.4	2 + 0.4
2.2 V	100 nV	3 + 0.7	3.5 + 0.7	4 + 0.7	5 + 0.7	1.6 + 0.7	2 + 0.7
11 V	1 µV	2 + 2.5	2.5 + 2.5	3 + 2.5	3.5 + 2.5	0.8 + 2.5	1.2 + 2.5
22 V	1 µV	2 + 4	2.5 + 4	3 + 4	3.5 + 4	0.8 + 4	1.2 + 4
220 V	10 µV	3 + 40	3.5 + 40	4 + 40	5 + 40	1.6 + 40	2 + 40
1100 V	100 µV	4 + 400	4.5 + 400	6 + 400	6.5 + 400	2 + 400	2.4 + 400

Notes:

DC Zeros calibration required every 30 days.

1. For fields strengths >1 V/m but ≤3 V/m, add 0.01 % of range.

5700A Series II DC Voltage Specifications

Range	Resolution	Absolute Uncertainty ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
		24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
		± (ppm output + µV)					
99 % Confidence Level							
220 mV	10 nV	6.5 + .75	7 + .75	8 + .75	9 + .8	2.5 + .5	4 + .5
2.2 V	100 nV	3.5 + 1.2	6 + 1.2	7 + 1.2	8 + 1.2	2.5 + 1.2	4 + 1.2
11 V	1 µV	3.5 + 3	5 + 4	7 + 4	8 + 4	1.5 + 3	3.5 + 4
22 V	1 µV	3.5 + 6	5 + 8	7 + 8	8 + 8	1.5 + 6	3.5 + 8
220 V	10 µV	5 + 100	6 + 100	8 + 100	9 + 100	2.5 + 100	4 + 100
1100 V	100 µV	7 + 600	8 + 600	10 + 600	11 + 600	3 + 600	4.5 + 600
95 % Confidence Level							
220 mV	10 nV	5.5 + 0.6	6 + 0.6	7 + 0.6	8 + 0.6	2 + 0.4	3.5 + 0.4
2.2 V	100 nV	3.5 + 1	5 + 1	6 + 1	7 + 1	2 + 1	3.5 + 1
11 V	1 µV	3 + 3.5	4 + 3.5	6 + 3.5	7 + 3.5	1.2 + 3	3 + 3.5
22 V	1 µV	3 + 6.5	4 + 6.5	6 + 6.5	7 + 6.5	1.2 + 6	3 + 7
220 V	10 µV	4 + 80	5 + 80	7 + 80	8 + 80	2 + 80	3.5 + 80
1100 V	100 µV	6 + 500	7 + 500	8 + 500	9 + 500	2.4 + 500	4 + 500

Notes:

DC Zeros calibration required every 30 days.

1. For fields strengths >1 V/m but ≤ 3 V/m, add 0.01 % of range.

DC Voltage Secondary Performance Specifications and Operating Characteristics

Range	Stability [1] ± 1 °C 24 Hours	Temperature Coefficient Adder [2]		Linearity ± 1 °C	Noise	
		10 - 40 °C	0 - 10 °C and 40 - 50 °C		Bandwidth 0.1-10 Hz pk-pk	Bandwidth 10 Hz-10 kHz RMS
	± (ppm output + µV)	± (ppm output + µV) / °C		± (ppm output + µV)		µV
220 mV	0.3 + 0.3	0.4 + 0.1	1.5 + 0.5	1 + 0.2	0.15 + 0.1	5
2.2 V	0.3 + 1	0.3 + 0.1	1.5 + 2	1 + 0.6	0.15 + 0.4	15
11 V	0.3 + 2.5	0.15 + 0.2	1 + 1.5	0.3 + 2	0.15 + 2	50
22 V	0.4 + 5	0.2 + 0.4	1.5 + 3	0.3 + 4	0.15 + 4	50
220 V	0.5 + 40	0.3 + 5	1.5 + 40	1 + 40	0.15 + 60	150
1100 V	0.5 + 200	0.5 + 10	3 + 200	1 + 200	0.15 + 300	500

Notes:

1. Stability specifications are included in the Absolute Uncertainty values in the primary specification tables.
2. Temperature coefficient is an adder to uncertainty specifications that does *not* apply unless operating more than ±5 °C from calibration temperature.

Minimum Output .... 0 V for all ranges, except 100 V for 1100 V range

Maximum Load .... 50 mA for 2.2 V through 220 V ranges; 20 mA for 1100 V range; 50 Ω output impedance on 220 mV range; all ranges <1000 pF, >25 Ω

Load Regulation .... <(0.2 ppm of output + 0.1 ppm of range), full load to no load

Line Regulation .... <0.1 ppm change, ± 10 % of selected nominal line

Settling Time .... 3 seconds to full accuracy; + 1 second for range or polarity change; + 1 second for 1100 V range

Overshoot .... <5 %

Common Mode Rejection .... 140 dB, DC to 400 Hz

Remote Sensing .... Available 0 V to ±1100 V, on 2.2 V through 1100 V ranges

1-30. AC Voltage Specifications

5720A Series II AC Voltage Specifications: 99% Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + µV)					
2.2 mV	1 nV	10 - 20	250 + 5	270 + 5	290 + 5	300 + 5	250 + 5	270 + 5
		20 - 40	100 + 5	105 + 5	110 + 5	115 + 5	100 + 5	105 + 5
		40 - 20 k	85 + 5	90 + 5	95 + 5	100 + 5	60 + 5	65 + 5
		20 k - 50 k	220 + 5	230 + 5	240 + 5	250 + 5	85 + 5	95 + 5
		50 k - 100 k	500 + 6	540 + 6	570 + 6	600 + 6	200 + 6	220 + 6
		100 k - 300 k	1000 + 12	1200 + 12	1250 + 12	1300 + 12	350 + 12	400 + 12
		300 k - 500 k	1400 + 25	1500 + 25	1600 + 25	1700 + 25	800 + 25	1000 + 25
		500 k - 1 M	2900 + 25	3100 + 25	3250 + 25	3400 + 25	2700 + 25	3000 + 25
22 mV	10 nV	10 - 20	250 + 5	270 + 5	290 + 5	300 + 5	250 + 5	270 + 5
		20 - 40	100 + 5	105 + 5	110 + 5	115 + 5	100 + 5	105 + 5
		40 - 20 k	85 + 5	90 + 5	95 + 5	100 + 5	60 + 5	65 + 5
		20 k - 50 k	220 + 5	230 + 5	240 + 5	250 + 5	85 + 5	95 + 5
		50 k - 100 k	500 + 6	540 + 6	570 + 6	600 + 6	200 + 6	220 + 6
		100 k - 300 k	1000 + 12	1200 + 12	1250 + 12	1300 + 12	350 + 12	400 + 12
		300 k - 500 k	1400 + 25	1500 + 25	1600 + 25	1700 + 25	800 + 25	1000 + 25
		500 k - 1 M	2900 + 25	3100 + 25	3250 + 25	3400 + 25	2700 + 25	3000 + 25
220 mV	100 nV	10 - 20	250 + 15	270 + 15	290 + 15	300 + 15	250 + 15	270 + 15
		20 - 40	100 + 8	105 + 8	110 + 8	115 + 8	100 + 8	105 + 8
		40 - 20 k	85 + 8	90 + 8	95 + 8	100 + 8	60 + 8	65 + 8
		20 k - 50 k	220 + 8	230 + 8	240 + 8	250 + 8	85 + 8	95 + 8
		50 k - 100 k	500 + 20	540 + 20	570 + 20	600 + 20	200 + 20	220 + 20
		100 k - 300 k	850 + 25	900 + 25	1000 + 25	1100 + 25	350 + 25	400 + 25
		300 k - 500 k	1400 + 30	1500 + 30	1600 + 30	1700 + 30	800 + 30	1000 + 30
		500 k - 1 M	2700 + 60	2900 + 60	3100 + 60	3300 + 60	2600 + 60	2800 + 60
2.2 V	1 µV	10 - 20	250 + 50	270 + 50	290 + 50	300 + 50	250 + 50	270 + 50
		20 - 40	95 + 20	100 + 20	105 + 20	110 + 20	95 + 20	100 + 20
		40 - 20 k	45 + 10	47 + 10	50 + 10	52 + 10	30 + 10	40 + 10
		20 k - 50 k	80 + 12	85 + 12	87 + 12	90 + 12	70 + 12	75 + 12
		50 k - 100 k	120 + 40	125 + 40	127 + 40	130 + 40	100 + 40	105 + 40
		100 k - 300 k	380 + 100	420 + 100	460 + 100	500 + 100	270 + 100	290 + 100
		300 k - 500 k	1000 + 250	1100 + 250	1150 + 250	1200 + 250	900 + 250	1000 + 250
		500 k - 1 M	1600 + 400	1800 + 600	1900 + 400	2000 + 400	1200 + 400	1300 + 400
22 V	10 µV	10 - 20	250 + 500	270 + 500	290 + 500	300 + 500	250 + 500	270 + 500
		20 - 40	95 + 200	100 + 200	105 + 200	110 + 200	95 + 200	100 + 200
		40 - 20 k	45 + 70	47 + 70	50 + 70	52 + 70	30 + 70	40 + 70
		20 k - 50 k	80 + 120	85 + 120	87 + 120	90 + 120	70 + 120	75 + 120
		50 k - 100 k	110 + 250	115 + 250	117 + 250	120 + 250	100 + 250	105 + 250
		100 k - 300 k	300 + 800	310 + 800	320 + 800	325 + 800	270 + 800	290 + 800
		300 k - 500 k	1000 + 2500	1100 + 2500	1150 + 2500	1200 + 2500	900 + 2500	1000 + 2500
		500 k - 1 M	1500 + 4000	1600 + 4000	1700 + 4000	1800 + 4000	1300 + 4000	1400 + 4000
			± (ppm output + mV)					
220 V [2]	100 µV	10 - 20	250 + 5	270 + 5	290 + 5	300 + 5	250 + 5	270 + 5
		20 - 40	95 + 2	100 + 2	105 + 2	110 + 2	95 + 2	100 + 2
		40 - 20 k	57 + 0.7	60 + 0.7	62 + 0.7	65 + 0.7	45 + 0.7	50 + 0.7
		20 k - 50 k	90 + 1.2	95 + 1.2	97 + 1.2	100 + 1.2	75 + 1.2	80 + 1.2
		50 k - 100 k	160 + 3	170 + 3	175 + 3	180 + 3	140 + 3	150 + 3
		100 k - 300 k	900 + 20	1000 + 20	1050 + 20	1100 + 20	600 + 20	700 + 20
		300 k - 500 k	5000 + 50	5200 + 50	5300 + 50	5400 + 50	4500 + 50	4700 + 50
		500 k - 1 M	8000 + 100	9000 + 100	9500 + 100	10,000 + 100	8000 + 100	8500 + 100
1100 V[1]	1 mV	15 - 50	300 + 20	320 + 20	340 + 20	360 + 20	300 + 20	320 + 20

		50 - 1 k	70 + 4	75 + 4	80 + 4	85 + 4	50 + 4	55 + 4
5725A Amplifier:								
1100 V	1 mV	40 - 1 k	75 + 4	80 + 4	85 + 4	90 + 4	50 + 4	55 + 4
		1 k - 20 k	105 + 6	125 + 6	135 + 6	165 + 6	85 + 6	105 + 6
		20 k - 30 k	230 + 11	360 + 11	440 + 11	600 + 11	160 + 11	320 + 11
750 V		30 k - 50 k	230 + 11	360 + 11	440 + 11	600 + 11	160 + 11	320 + 11
		50 k - 100k	600 + 45	1300 + 45	1600 + 45	2300 + 45	380 + 45	1200 + 45

Notes:

1. Maximum output 250 V from 15-50 Hz.
2. See Volt-Hertz capability in Figure A.

5720A Series II AC Voltage Specifications: 95 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + µV)					
2.2 mV	1 nV	10 - 20	200 + 4	220 + 4	230 + 4	240 + 4	200 + 4	220 + 4
		20 - 40	80 + 4	85 + 4	87 + 4	90 + 4	80 + 4	85 + 4
		40 - 20 k	70 + 4	75 + 4	77 + 4	80 + 4	50 + 4	55 + 4
		20 k - 50 k	170 + 4	180 + 4	190 + 4	200 + 4	70 + 4	80 + 4
		50 k - 100 k	400 + 5	460 + 5	480 + 5	500 + 5	160 + 5	180 + 5
		100 k - 300 k	300 + 10	900 + 10	1000 + 10	1050 + 10	280 + 10	320 + 10
		300 k - 500 k	1100 + 20	1200 + 20	1300 + 20	1400 + 20	650 + 20	800 + 20
		500 k - 1 M	2400 + 20	2500 + 20	2600 + 20	2700 + 20	2100 + 20	2400 + 20
22 mV	10 nV	10 - 20	200 + 4	220 + 4	230 + 4	240 + 4	200 + 4	220 + 4
		20 - 40	80 + 4	85 + 4	87 + 4	90 + 4	80 + 4	85 + 4
		40 - 20 k	70 + 4	75 + 4	77 + 4	80 + 4	50 + 4	55 + 4
		20 k - 50 k	170 + 4	180 + 4	190 + 4	200 + 4	70 + 4	80 + 4
		50 k - 100 k	400 + 5	460 + 5	480 + 5	500 + 5	160 + 5	180 + 5
		100 k - 300 k	300 + 10	900 + 10	1000 + 10	1050 + 10	280 + 10	320 + 10
		300 k - 500 k	1100 + 20	1200 + 20	1300 + 20	1400 + 20	650 + 20	800 + 20
		500 k - 1 M	2400 + 20	2500 + 20	2600 + 20	2700 + 20	2100 + 20	2400 + 20
220 mV	100 nV	10 - 20	200 + 12	220 + 12	230 + 12	240 + 12	200 + 12	220 + 12
		20 - 40	80 + 7	85 + 7	87 + 7	90 + 7	80 + 7	85 + 7
		40 - 20 k	70 + 7	75 + 7	77 + 7	80 + 7	50 + 7	55 + 7
		20 k - 50 k	170 + 7	180 + 7	190 + 7	200 + 7	70 + 7	80 + 7
		50 k - 100 k	400 + 17	420 + 17	440 + 17	460 + 17	160 + 17	180 + 17
		100 k - 300 k	700 + 20	750 + 20	800 + 20	900 + 20	280 + 20	320 + 20
		300 k - 500 k	1100 + 25	1200 +25	1300 + 25	1400 + 25	650 + 25	800 + 25
		500 k - 1 M	2400 + 45	2500 + 45	2600 + 45	2700 + 45	2100 + 45	2400 + 45
2.2 V	1 mV	10 - 20	200 + 40	220 + 40	230 + 40	240 + 40	200 + 40	220 + 40
		20 - 40	75 + 15	80 + 15	85 + 15	90 + 15	75 + 15	80 + 15
		40 - 20 k	37 + 8	40 + 8	42 + 8	45 + 8	25 + 8	35 + 8
		20 k - 50 k	65 + 10	70 + 10	73 + 10	75 + 10	55 + 10	60 + 10
		50 k - 100 k	100 + 30	105 + 30	107 + 30	110 + 30	80 + 30	85 + 30
		100 k - 300 k	300 + 80	340 + 80	380 + 80	420 + 80	230 + 80	250 + 80
		300 k - 500 k	800 + 200	900 + 200	950 + 200	1000 + 200	700 + 200	800 + 200
		500 k - 1 M	1300 + 300	1500 + 300	1600 + 300	1700 + 300	1000 + 300	1100 + 300
22 V	10 mV	10 - 20	200 + 400	220 + 400	230 + 400	240 + 400	200 + 400	220 + 400
		20 - 40	75 + 150	80 + 150	85 + 150	90 + 150	75 + 150	80 + 150
		40 - 20k	37 + 50	40 + 50	42 + 50	45 + 50	25 + 50	35 + 50
		20k - 50k	65 + 100	70 + 100	73 + 100	75 + 100	55 + 100	60 + 100
		50k - 100k	90 + 200	95 + 200	97 + 200	100 + 200	80 + 200	85 + 200
		100k - 300k	250 + 600	260 + 600	270 + 600	275 + 600	250 + 600	270 + 600
		300k - 500k	800 + 2000	900 + 2000	900 + 2000	1000 + 2000	700 + 2000	800 + 2000
		500k - 1M	1200 + 3200	1300 + 3200	1400 + 3200	1500 + 3200	1100 + 3200	1200 + 3200
			± (ppm output + mV)					
220 V [2]	100 mV	10 - 20	200 +4	220 + 4	230 + 4	240 + 4	200 + 4	220 + 4
		20 - 40	75 + 1.5	80 + 1.5	85 + 1.5	90 + 1.5	75 + 1.5	80 + 1.5
		40 - 20 k	45 + 0.6	47 + 0.6	50 + 0.6	52 + 0.6	35 + 0.6	40 + 0.6
		20 k - 50 k	70 + 1	75 + 1	77 + 1	80 + 1	60 + 1	65 + 1
		50 k - 100 k	120 + 2.5	130 + 2.5	140 + 2.5	150 + 2.5	110 + 2.5	120 + 2.5
		100 k - 300 k	700 + 16	800 + 16	850 + 16	900 + 16	500 + 16	600 + 16
		300 k - 500 k	4000 + 40	4200 + 40	4300 + 40	4400 + 40	3600 + 40	3800 + 40
		500 k - 1 M	6000 + 80	7000 + 80	7500 + 80	8000 + 80	6500 + 80	7000 + 80
1100 V [1]	1 mV	15 - 50	240 + 16	260 + 16	280 + 16	300 + 16	240 + 16	260 + 16
		50 - 1 k	55 + 3.5	60 + 3.5	65 + 3.5	70 + 3.5	40 + 3.5	45 + 3.5

5725A Amplifier:								
1100 V	1 mV	40 - 1 k 1 k - 20 k 20 k - 30 k	75 + 4 105 + 6 230 + 11	80 + 4 125 + 6 360 + 11	85 + 4 135 + 6 440 + 11	90 + 4 165 + 6 600 + 11	50 + 4 85 + 6 160 + 11	55 + 4 105 + 6 320 + 11
750 V		30 k - 50 k 50 k - 100 k	230 + 11 600 + 45	360 + 11 1300 + 45	440 + 11 1600 + 45	600 + 11 2300 + 45	160 + 11 380 + 45	320 + 11 1200 + 45

Notes:

1. Maximum output 250 V from 15-50 Hz.
2. See Volt-Hertz capability in Figure A.

5700A Series II AC Voltage Specifications: 99 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + μV)					
2.2 mV	1 nV	10 - 20	500 + 5	550 + 5	600 + 5	600 + 5	500 + 5	550 + 5
		20 - 40	200 + 5	220 + 5	230 + 5	240 + 5	200 + 5	220 + 5
		40 - 20 k	100 + 5	110 + 5	120 + 5	120 + 5	60 + 5	65 + 5
		20 k - 50 k	340 + 5	370 + 5	390 + 5	410 + 5	100 + 5	110 + 5
		50 k - 100 k	800 + 8	900 + 8	950 + 8	950 + 8	220 + 8	240 + 8
		100 k - 300 k	1100 + 15	1200 + 15	1300 + 15	1300 + 15	400 + 15	440 + 15
		300 k - 500 k	1500 + 30	1700 + 30	1700 + 30	1800 + 30	1000 + 30	1100 + 30
		500 k - 1 M	4000 + 40	4400 + 40	4700 + 40	4800 + 40	400 + 30	4400 + 30
22 mV	10 nV	10 - 20	500 + 6	550 + 6	600 + 6	600 + 6	500 + 6	550 + 6
		20 - 40	200 + 6	220 + 6	230 + 6	240 + 6	200 + 6	220 + 6
		40 - 20 k	100 + 6	110 + 6	120 + 6	120 + 6	60 + 6	65 + 6
		20 k - 50 k	340 + 6	370 + 6	390 + 6	410 + 6	100 + 6	110 + 6
		50 k - 100 k	800 + 8	900 + 8	950 + 8	950 + 8	220 + 8	240 + 8
		100 k - 300 k	1100 + 15	1200 + 15	1300 + 15	1300 + 15	400 + 15	440 + 15
		300 k - 500 k	1500 + 30	1700 + 30	1700 + 30	1800 + 30	1000 + 30	1100 + 30
		500 k - 1 M	4000 + 40	4400 + 40	4700 + 40	4800 + 40	4000 + 30	4400 + 30
220 mV	100 nV	10 - 20	500 + 16	550 + 16	600 + 16	600 + 16	500 + 16	550 + 16
		20 - 40	200 + 10	220 + 10	230 + 10	240 + 10	200 + 10	220 + 10
		40 - 20 k	95 + 10	100 + 10	110 + 10	110 + 10	60 + 10	65 + 10
		20 k - 50 k	300 + 10	330 + 10	350 + 10	360 + 10	100 + 10	110 + 10
		50 k - 100 k	750 + 30	800 + 30	850 + 30	900 + 30	220 + 30	240 + 30
		100 k - 300 k	940 + 30	1000 + 30	1100 + 30	1100 + 30	400 + 30	440 + 30
		300 k - 500 k	1500 + 40	1700 + 40	1700 + 40	1800 + 40	1000 + 40	1100 + 40
		500 k - 1 M	3000 + 100	3300 + 100	3500 + 100	3600 + 100	3000 + 100	3300 + 100
2.2 V	1 mV	10 - 20	500 + 100	550 + 100	600 + 100	600 + 100	500 + 100	550 + 100
		20 - 40	150 + 30	170 + 30	170 + 30	180 + 30	150 + 30	170 + 30
		40 - 20 k	70 + 7	75 + 7	80 + 7	85 + 7	40 + 7	45 + 7
		20 k - 50 k	120 + 20	130 + 20	140 + 20	140 + 20	100 + 20	110 + 20
		50 k - 100 k	230 + 80	250 + 80	270 + 80	280 + 80	200 + 80	220 + 80
		100 k - 300 k	400 + 150	440 + 150	470 + 150	480 + 150	400 + 150	440 + 150
		300 k - 500 k	1000 + 400	1100 + 400	1200 + 400	1200 + 400	1000 + 400	1100 + 400
		500 k - 1 M	2000 + 1000	2200 + 1000	2300 + 1000	2400 + 1000	2000 + 1000	2200 + 1000
22 V	10 mV	10 - 20	500 + 1000	550 + 1000	600 + 1000	600 + 1000	500 + 1000	550 + 1000
		20 - 40	150 + 300	170 + 300	170 + 300	180 + 300	150 + 300	170 + 300
		40 - 20 k	70 + 70	75 + 70	80 + 70	85 + 70	40 + 70	45 + 70
		20 k - 50 k	120 + 200	130 + 200	140 + 200	140 + 200	100 + 200	110 + 200
		50 k - 100 k	230 + 400	250 + 400	270 + 400	280 + 400	200 + 400	220 + 400
		100 k - 300 k	500 + 1700	550 + 1700	550 + 1700	600 + 1700	500 + 1700	550 + 1700
		300 k - 500 k	1200 + 5000	1300 + 5000	1300 + 5000	1400 + 5000	1200 + 5000	1300 + 5000
		500 k - 1 M	2600 + 9000	2800 + 9000	2900 + 9000	3000 + 9000	2600 + 9000	2800 + 9000
		± (ppm output + mV)						
220 V [2]	100 mV	10 - 20	500 + 10	550 + 10	600 + 10	600 + 10	500 + 10	550 + 10
		20 - 40	150 + 3	170 + 3	170 + 3	180 + 3	150 + 3	170 + 3
		40 - 20 k	75 + 1	80 + 1	85 + 1	90 + 1	45 + 1	50 + 1
		20 k - 50 k	200 + 4	220 + 4	240 + 4	250 + 4	100 + 1	110 + 1
		50 k - 100 k	500 + 10	550 + 10	600 + 10	600 + 10	300 + 10	330 + 10
		100 k - 300 k	1500 + 110	1500 + 110	1600 + 110	1600 + 110	1500 + 110	1500 + 100
		300 k - 500 k	5000 + 110	5200 + 110	5300 + 110	5400 + 110	5000 + 110	5200 + 110
		500 k - 1 M	12,000 + 220	12,500 + 220	12,500 + 220	13,000 + 220	12,000 + 220	12,000 + 220
1100 V [1]	1 mV	15 - 50	400 + 20	420 + 20	440 + 20	460 + 20	400 + 20	420 + 20
		50 - 1 k	75 + 4	80 + 4	85 + 4	90 + 4	50 + 4	55 + 4

5725A Amplifier:								
1100 V	1 mV	40 - 1 k 1 k - 20 k 20 k - 30 k	75 + 4 105 + 6 230 + 11	80 + 4 125 + 6 360 + 11	85 + 4 135 + 6 440 + 11	90 + 4 165 + 6 600 + 11	50 + 4 85 + 6 160 + 11	55 + 4 105 + 6 320 + 11
750 V		30 k - 50 k 50 k - 100 k	230 + 11 600 + 45	360 + 11 1300 + 45	440 + 11 1600 + 45	600 + 11 2300 + 45	160 + 11 380 + 45	320 + 11 1200 + 45

Notes:

1. Maximum output 250 V from 15-50 Hz.
2. See Volt-Hertz capability in Figure A.

5700A Series II AC Voltage Specifications: 95 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + μV)					
2.2 mV	1 nV	10 - 20	400 + 4.5	500 + 4.5	530 + 4.5	550 + 4.5	400 + 4.5	500 + 4.5
		20 - 40	170 + 4.5	190 + 4.5	200 + 4.5	210 + 4.5	170 + 4.5	190 + 4.5
		40 - 20 k	85 + 4.5	95 + 4.5	100 + 4.5	105 + 4.5	55 + 4.5	60 + 4.5
		20 k - 50 k	300 + 4.5	330 + 4.5	350 + 4.5	370 + 4.5	90 + 4.5	100 + 4.5
		50 k - 100 k	700 + 7	750 + 7	800 + 7	850 + 7	210 + 7	230 + 7
		100 k - 300 k	900 + 13	1000 + 13	1050 + 13	1100 + 13	380 + 13	420 + 13
		300 k - 500 k	1300 + 25	1500 + 25	1600 + 25	1700 + 25	900 + 25	1000 + 25
		500 k - 1 M	2800 + 25	3100 + 25	3300 + 25	3400 + 25	2900 + 25	3200 + 25
22 mV	10 nV	10 - 20	400 + 5	500 + 5	530 + 5	550 + 5	400 + 5	500 + 5
		20 - 40	170 + 5	190 + 5	200 + 5	210 + 5	170 + 5	190 + 5
		40 - 20 k	85 + 5	95 + 5	100 + 5	105 + 5	55 + 5	60 + 5
		20 k - 50 k	300 + 5	330 + 5	350 + 5	370 + 5	90 + 5	100 + 5
		50 k - 100 k	700 + 7	750 + 7	800 + 7	850 + 7	210 + 7	230 + 7
		100 k - 300 k	900 + 12	1000 + 12	1050 + 12	1100 + 12	380 + 12	420 + 12
		300 k - 500 k	1300 + 25	1500 + 25	1600 + 25	1700 + 25	900 + 25	1000 + 25
		500 k - 1 M	2800 + 25	3100 + 25	3300 + 25	3400 + 25	2900 + 25	3200 + 25
220 mV	100 nV	10 - 20	400 + 13	500 + 13	530 + 13	550 + 13	400 + 13	500 + 13
		20 - 40	170 + 8	190 + 8	200 + 8	210 + 8	170 + 8	190 + 8
		40 - 20 k	85 + 8	95 + 8	100 + 8	105 + 8	55 + 8	60 + 8
		20 k - 50 k	250 + 8	280 + 8	300 + 8	320 + 8	90 + 8	100 + 8
		50 k - 100 k	700 + 25	750 + 25	800 + 25	850 + 25	210 + 25	230 + 25
		100 k - 300 k	900 + 25	1000 + 25	1050 + 25	1100 + 25	380 + 25	420 + 25
		300 k - 500 k	1300 + 35	1500 + 35	1600 + 35	1700 + 35	900 + 35	1000 + 35
		500 k - 1 M	2800 + 80	3100 + 80	3300 + 80	3400 + 80	2900 + 80	3200 + 80
2.2 V	1 mV	10 - 20	400 + 80	450 + 80	480 + 80	500 + 80	400 + 80	450 + 80
		20 - 40	130 + 25	140 + 25	150 + 25	160 + 25	130 + 25	140 + 25
		40 - 20 k	60 + 6	65 + 6	70 + 6	75 + 6	35 + 6	40 + 6
		20 k - 50 k	105 + 16	110 + 16	115 + 16	120 + 16	85 + 16	95 + 16
		50 k - 100 k	190 + 70	210 + 70	230 + 70	250 + 70	170 + 70	190 + 70
		100 k - 300 k	350 + 130	390 + 130	420 + 130	430 + 130	340 + 130	380 + 130
		300 k - 500 k	850 + 350	950 + 350	1000 + 350	1050 + 350	850 + 350	950 + 350
		500 k - 1 M	1700 + 850	1900 + 850	2100 + 850	2200 + 850	1700 + 850	1900 + 850
22 V	10 mV	10 - 20	400 + 800	450 + 800	480 + 800	500 + 800	400 + 800	450 + 800
		20 - 40	130 + 250	140 + 250	150 + 250	160 + 250	130 + 250	140 + 250
		40 - 20 k	60 + 60	65 + 60	70 + 60	75 + 60	35 + 60	40 + 60
		20 k - 50 k	105 + 160	110 + 160	115 + 160	120 + 160	85 + 160	95 + 160
		50 k - 100 k	190 + 350	210 + 350	230 + 350	250 + 350	170 + 350	190 + 350
		100 k - 300 k	400 + 1500	450 + 1500	470 + 1500	500 + 1500	400 + 1500	450 + 1500
		300 k - 500 k	1050 + 4300	1150 + 4300	1200 + 4300	1250 + 4300	1000 + 4300	1100 + 4300
		500 k - 1 M	2300 + 8500	2500 + 8500	2600 + 8500	2700 + 8500	2200 + 8500	2400 + 8500
			± (ppm output + mV)					
220 V [2]	100 mV	10 - 20	400 + 8	450 + 8	480 + 8	500 + 8	400 + 8	450 + 8
		20 - 40	130 + 2.5	140 + 2.5	150 + 2.5	160 + 2.5	130 + 2.5	140 + 2.5
		40 - 20 k	65 + 0.8	70 + 0.8	75 + 0.8	80 + 0.8	40 + 0.8	45 + 0.8
		20 k - 50 k	170 + 3.5	190 + 3.5	210 + 3.5	220 + 3.5	85 + 3.5	95 + 3.5
		50 k - 100 k	400 + 8	450 + 8	480 + 8	500 + 8	270 + 8	300 + 8
		100 k - 300 k	1300 + 90	1400 + 90	1450 + 90	1500 + 90	1200 + 90	1300 + 90
		300 k - 500 k	4300 + 90	4500 + 90	4600 + 90	4700 + 90	4200 + 90	4500 + 90
		500 k - 1 M	10,500 + 190	11,000 + 190	11,300 + 190	11,500 + 190	10,500 + 190	11,000 + 190
1100 V [1]	1 mV	15 - 50	340 + 16	360 + 16	380 + 16	400 + 16	340 + 16	360 + 16
		50 - 1 k	65 + 3.5	70 + 3.5	75 + 3.5	80 + 3.5	45 + 3.5	50 + 3.5

5725A Amplifier:								
1100 V	1 mV	40 - 1 k 1 k - 20 k 20 k - 30 k	75 + 4 105 + 6 230 + 11	80 + 4 125 + 6 360 + 11	85 + 4 135 + 6 440 + 11	90 + 4 165 + 6 600 + 11	50 + 4 85 + 6 160 + 11	55 + 4 105 + 6 320 + 11
750 V		30 k - 50 k 50 k - 100 k	230 + 11 600 + 45	360 + 11 1300 + 45	440 + 11 1600 + 45	600 + 11 2300 + 45	160 + 11 380 + 45	320 + 11 1200 + 45

Notes:

1. Maximum output 250 V from 15-50 Hz.
2. See Volt-Hertz capability in Figure A.

AC Voltage Secondary Performance Specifications and Operating Characteristics

Range	Frequency (Hz)	Stability ± 1 °C [1] 24 Hours	Temperature Coefficient 10 - 40 °C	Temperature Coefficient 0 - 10 °C and 40 - 50 °C	Output Impedance (Ω)	Maximum Distortion Bandwidth 10 Hz-10 MHz
		± μV	±μV / °C			± (% output + μV)
2.2 mV	10 - 20	5	0.05	0.05	50	0.05 + 10
	20 - 40	5	0.05	0.05		0.035 + 10
	40 - 20 k	2	0.05	0.05		0.035 + 10
	20 k - 50 k	2	0.1	0.1		0.035 + 10
	50 k - 100 k	3	0.2	0.2		0.035 + 30
	100 k - 300 k	3	0.3	0.3		0.3 + 30
	300 k - 500 k	5	0.4	0.4		0.3 + 30
	500 k - 1 M	5	0.5	0.5		2 + 50
22 mV	10 - 20	5	0.2	0.3	50	0.05 + 11
	20 - 40	5	0.2	0.3		0.035 + 11
	40 - 20 k	2	0.2	0.3		0.035 + 11
	20 k - 50 k	2	0.4	0.5		0.035 + 11
	50 k - 100 k	3	0.5	0.5		0.035 + 30
	100 k - 300 k	5	0.6	0.6		0.3 + 30
	300 k - 500 k	10	1	1		0.3 + 30
	500 k - 1 M	15	1	1		2 + 30
		± (ppm output + μV)	± (ppm output μV) / °C			
220 mV	10 - 20	150 + 20	2 + 1	2 + 1	50	0.05 + 16
	20 - 40	80 + 15	2 + 1	2 + 1		0.035 + 16
	40 - 20 k	12 + 2	2 + 1	2 + 1		0.035 + 16
	20 k - 50 k	10 + 2	15 + 2	15 + 2		0.035 + 16
	50 k - 100 k	10 + 2	15 + 4	15 + 4		0.035 + 30
	100 k - 300 k	20 + 4	80 + 5	80 + 5		0.3 + 30
	300 k - 500 k	100 + 10	80 + 5	80 + 5		0.3 + 30
	500 k - 1 M	200 + 20	80 + 5	80 + 5		1 + 30
					Load Regulation ±(ppm output+ μV)	
2.2 V	10 - 20	150 + 20	50 + 10	50 + 10	10 + 2	0.05 + 80
	20 - 40	80 + 15	15 + 5	15 + 5	10 + 2	0.035 + 80
	40 - 20 k	12 + 4	2 + 1	5 + 2	10 + 4	0.035 + 80
	20 k - 50 k	15 + 5	10 + 2	15 + 4	30 + 10	0.035 + 80
	50 k - 100 k	15 + 5	10 + 4	20 + 4	120 + 16	0.035 + 110
	100 k - 300 k	30 + 10	80 + 15	80 + 15	300 ppm	0.3 + 110
	300 k - 500 k	70 + 20	80 + 40	80 + 40	600 ppm	0.5 + 110
	500 k - 1 M	150 + 50	80 + 100	80 + 100	1200 ppm	1 + 110
22 V	10 - 20	150 + 20	50 + 100	50 + 100	10 + 20	0.05 + 700
	20 - 40	80 + 15	15 + 30	15 + 40	10 + 20	0.035 + 700
	40 - 20 k	12 + 8	2 + 10	4 + 15	10 + 30	0.035 + 700
	20 k - 50 k	15 + 10	10 + 20	20 + 20	30 + 50	0.035 + 700
	50 k - 100 k	15 + 10	10 + 40	20 + 40	80 + 80	0.05 + 800
	100 k - 300 k	30 + 15	80 + 150	80 + 150	100 + 700	0.3 + 800
	300 k - 500 k	70 + 100	80 + 300	80 + 300	200 + 1100	0.3 + 800
	500 k - 1 M	150 + 100	80 + 500	80 + 500	600 + 3000	2 + 800
220 V	10 - 20	150 + 200	50 + 1000	50 + 1000	10 + 200	0.05 + 10,000
	20 - 40	80 + 150	15 + 300	15 + 300	10 + 200	0.05 + 10,000
	40 - 20 k	12 + 80	2 + 80	4 + 80	10 + 300	0.05 + 10,000
	20 k - 50 k	15 + 100	10 + 100	20 + 100	30 + .600	0.05 + 10,000
	50 k - 100 k	15 + 100	10 + 500	20 + 500	80 + 3,000	0.2 + 50,000
	100 k - 300 k	30 + 400	80 + 600	80 + 600	250 + 25,000	1.5 + 50,000
	300 k - 500 k	100 + 10,000	80 + 800	80 + 800	500 + 50,000	1.5 + 50,000
	500 k - 1 M	200 + 20,000	80 + 1000	80 + 1000	1000 + 110,000	3.5 + 100,000
		±(ppm output + mV)	±(ppm output) / °C		±(ppm output + mV)	±(% output)
1100 V	15 - 50	150 + 0.5	50	50	10 + 2	0.15
	50 - 1 k	20 + 0.5	2	5	10 + 1	0.07

5725A Amplifier:							
Range	Frequency (Hz)	Stability ± 1 °C [1] 24 Hours	Temperature Coefficient Adder		Load Regulation [2]	Distortion Bandwidth 10 Hz -10 MHz ±(% output)	
			10 - 40 °C	0 - 10 °C and 40 - 50 °C			
		±(ppm output + mV)	±(ppm output) / °C		±(ppm output + mV)	150 pF	1000 pF
1100 V	40 - 1 k	10 + .5	5	5	10 + 1	0.10	0.10
	1 k - 20 k	15 + 2	5	5	90 + 6	0.10	0.15
	20 k - 50 k	40 + 2	10	10	275 + 11	0.30	0.30
	50 k - 100 k	130 + 2	30	30	500 + 30	0.40	0.40

Notes:

1. Stability specifications are included in Absolute Uncertainty values for the primary specifications.
2. The 5725A will drive up to 1000 pF of load capacitance. Uncertainty specifications include loads to 300 pF and 150 pF as shown under "Load Limits." For capacitances up to the maximum of 1000 pF, add "Load Regulation."

Voltage Range	Maximum Current Limits		Load Limits
2.2 V [2] 22 V 220 V	50 mA, 0 °C-40 °C 20 mA, 40 °C-50 °C		>50 Ω, 1000 pF
1100 V	6 mA		600 pF
5725A Amplifier:			
1100 V	40 Hz-5 kHz	50 mA	1000 pF [1]
	5 kHz-30 kHz	70 mA	300 pF
	30 kHz-100 kHz	70 mA[3]	150 pF

Notes:

1. The 5725A will drive up to 1000 pF of load capacitance. Uncertainty specifications include loads to 300 pF and 150 pF as shown under "Load Limits." For capacitances up to the maximum of 1000 pF, add "Load Regulation."
2. 2.2 V Range, 100 kHz-1.2 MHz only: uncertainty specifications cover loads to 10 mA or 1000 pF. For higher loads, load regulation is added.
3. Applies from 0 °C to 40 °C.

Output Display Formats .... Voltage or dBm, dBm reference 600 Ω.

Minimum Output .... 10 % on each range

External Sense .... Selectable for 2.2 V, 22 V, 220 V, and 1100 V ranges; 5700A/5720A <100 kHz, 5725A <30 kHz

Settling Time to Full Accuracy

Frequency (Hz)	Settling Time (seconds)
<20	7
120-120 k	5
>120 k	2

Notes:

Plus 1 second for amplitude or frequency range change

Plus 2 seconds for 5700A/5720A 1100 V range

Plus 4 seconds for 5725A 1100 V range

Overshoot .... <10 %

Common Mode Rejection .... 140 dB, DC to 400 Hz

Frequency

Ranges (Hz) .... 10.000 - 119.99
0.1200 k - 1.1999 k
1.200 k - 11.999 k
12.00 k - 119.99 k
120.0 k - 1.1999 M

Uncertainty .... ±0.01 %

Resolution .... 11.999 counts

Phase Lock (Selectable Rear Panel BNC Input)

Phase Uncertainty (except 1100 V range) .... >30 Hz: ±1 ° + 0.05 °/kHz), <30 Hz: ±3 °

Input Voltage .... 1 V to 10 V rms sine wave (do not exceed 1 V for mV ranges)

Frequency Range .... 10 Hz to 1.1999 MHz

Lock Range .... ±2 % of frequency

Lock-In Time .... Larger of 10/frequency or 10 msec

Phase Reference (Selectable Rear Panel BNC Output)

Range .... ±180 °

Phase Uncertainty (except 1100 V range) .... ±1 ° at quadrature points (0 °, ±90 °, ±180 °) elsewhere ±2 °

Stability .... ±0.1 °

Resolution .... 1 °

Output Level .... 2.5 V rms ±0.2 V

Frequency Range .... 50 kHz to 1 kHz, usable 10 Hz to 1.1999 MHz

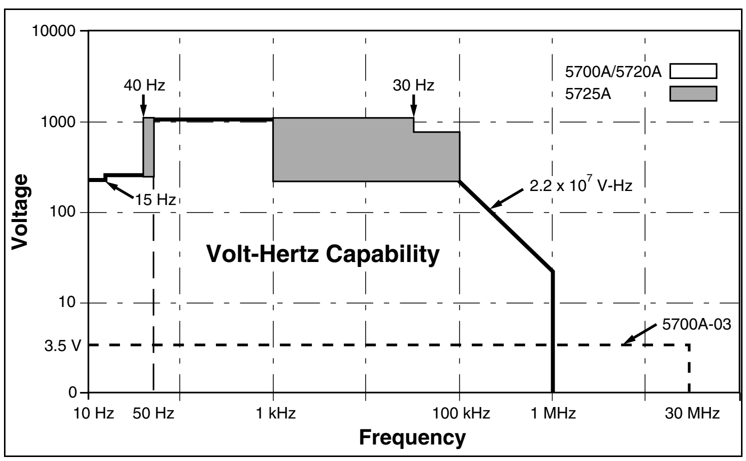


Figure A.

1-31. Resistance Specifications

5720A Series II Resistance Specifications

Nominal Value (Ω)	Absolute Uncertainty of Characterized Value ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
	24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
	±ppm					
99 % Confidence Level						
0	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ
1	85	95	100	110	32	40
1.9	85	95	100	110	25	33
10	23	25	26	27	5	8
19	23	25	26	27	4	7
100	10	11	11.5	12	2	4
190	10	11	11.5	12	2	4
1 k	8	9	9.5	10	2	3
1.9 k	8	9	9.5	10	2	3
10 k	8	9	9.5	10	2	3
19 k	9	9	9.5	10	2	3
100 k	9	11	12	13	2	3
190 k	9	11	12	13	2	3
1 M	16	18	20	23	2.5	5
1.9 M	17	19	21	24	3	6
10 M	33	37	40	46	10	14
19 M	43	47	50	55	20	24
100 M	100	110	115	120	50	60
95 % Confidence Level						
0	40 μΩ	40 μΩ	40 μΩ	40 μΩ	40 μΩ	40 μΩ
1	70	80	85	95	27	35
1.9	70	80	85	95	20	26
10	20	21	22	23	4	7
19	20	21	22	23	3.5	6
100	8	9	9.5	10	1.6	3.5
190	8	9	9.5	10	1.6	3.5
1 k	6.5	7.5	8	8.5	1.6	2.5
1.9 k	6.5	7.5	8	8.5	1.6	2.5
10 k	6.5	7.5	8	8.5	1.6	2.5
19 k	7.5	7.5	8	8.5	1.6	2.5
100 k	7.5	9	10	11	1.6	2.5
190 k	7.5	9	10	11	1.6	2.5
1 M	13	15	17	20	2	4
1.9 M	14	16	18	21	2.5	4
10 M	27	31	34	40	8	12
19 M	35	39	42	47	16	20
100 M	85	95	100	100	40	50

Note:

1. Specifications apply to displayed value. 4-wire connections, except 100 MΩ.

5700A Series II Resistance Specifications

Nominal Value (Ω)	Absolute Uncertainty of Characterized Value ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
	24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
	±ppm					
99 % Confidence Level						
0	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ
1	85	95	100	110	32	40
1.9	85	95	100	110	25	33
10	26	28	30	33	5	8
19	24	26	28	31	4	7
100	15	17	18	20	2	4
190	15	17	18	20	2	4
1 k	11	12	13	15	2	3.5
1.9 k	11	12	13	15	2	3.5
10 k	9	11	12	14	2	3.5
19 k	9	11	12	14	2	3.5
100 k	11	13	14	16	2	3.5
190 k	11	13	14	16	2	3.5
1 M	16	18	20	23	2.5	5
1.9 M	17	19	21	24	3.5	6
10 M	33	37	40	46	10	14
19 M	43	47	50	55	20	24
100 M	110	120	125	130	50	60
95 % Confidence Level						
0	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ	50 μΩ
1	70	80	85	95	32	40
1.9	70	80	85	95	25	33
10	21	23	27	28	5	8
19	20	22	24	27	4	7
100	13	14	15	17	2	4
190	13	14	15	17	2	4
1 k	9	10	11	13	2	3.5
1.9 k	9	10	11	13	2	3.5
10 k	7.5	9.5	10.5	12	2	3.5
19 k	7.5	9.5	10.5	12	2	3.5
100 k	9	11	12	14	2	3.5
190 k	9	11	12	14	2	3.5
1 M	13	15	17	20	2.5	5
1.9 M	14	16	18	21	3	6
10 M	27	31	34	40	10	14
19 M	35	39	42	47	20	24
100 M	90	100	105	110	50	60

Note:

1. Specifications apply to displayed value. 4-wire connections, except 100 MΩ.

Resistance Secondary Performance Specifications and Operating Characteristics

Nominal Value (Ω)	Stability ± 1 °C [1] 24 Hours	Temperature Coefficient Adder [2]		Full Spec Load Range [3] I_L - I_U (mA)	Maximum Peak Current I_{MAX} (mA)	Maximum Difference of Characterized to Nominal Value	Two-Wire Adder Active Compensation [4]	
		10 - 40 °C	0 - 10 °C and 40 - 50 °C				Lead Resistance	
							0.1 Ω	1 Ω
	±ppm	±ppm/°C				±ppm	±mΩ	
0	—	—	—	8 - 500	500	—	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
1	32	4	5	8 - 100	700	500	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
1.9	25	6	7	8 - 100	500	500	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
10	5	2	3	8 - 11	220	300	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
19	4	2	3	8 - 11	160	300	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
100	2	2	3	8 - 11	70	150	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
190	2	2	3	8 - 11	50	150	$2 + \frac{4\mu V}{I_m}$	$4 + \frac{4\mu V}{I_m}$
1 k	2	2	3	1 - 2	22	150	10	15
1.9 k	2	2	3	1 - 1.5	16	150	10	15
10 k	2	2	3	100 - 500 µA	7	150	50	60
19 k	2	2	3	50 - 250 µA	5	150	100	120
100 k	2	2	3	10 - 100 µA	1	150	I_m= Current produced by Ohmmeter (A)	
190 k	2	2	3	5 - 50 µA	500 µA	150		
1 M	2.5	2.5	6	5 - 20 µA	100 µA	200		
1.9 M	3.5	3	10	2.5 - 10 µA	50 µA	200		
10 M	10	5	20	0.5 - 2 µA	10 µA	300		
19 M	20	8	40	0.25 - 1 µA	5 µA	300		
100 M	50	12	100	50 - 200 nA	1 µA	500		

Notes:

1. Stability specifications are included in the Absolute Uncertainty values in the primary specification tables.
2. Temperature coefficient is an adder to uncertainty specifications that does not apply unless operated more than 5 °C from calibration temperature, or calibrated outside the range 19 °C to 24 °C. Two examples:

   - Calibrate at 20 °C: Temperature coefficient adder is not required unless operated below 15 °C or above 25 °C.

   - Calibrate at 26 °C: Add 2 °C temperature coefficient adder. Additional temperature coefficient adder is not required unless operated below 21 °C or above 31 °C.
3. Refer to current derating factors table for loads outside of this range.
4. Active two-wire compensation may be selected for values less than 100 kΩ, with either the front panel or the meter input terminals as reference plane. Active compensation is limited to 11 mA load, and to 2 V burden. Two-wire compensation can be used only with Ω-meters that source continuous (not pulsed) dc current.

Current Derating Factors

Nominal Value (Ω)	Value of Derating Factor K for Over or Under Current		
	Two-Wire Comp $I < I_L$ [1]	Four-Wire $I < I_L$ [1]	Four-Wire $I_U < I < I_{MAX}$ [2]
SHORT	4.4	0.3	—
1	4.4	300	4×10^{-5}
1.9	4.4	160	1.5×10^{-4}
10	4.4	30	1.6×10^{-3}
19	4.4	16	3×10^{-3}
100	4.4	3.5	1×10^{-2}
190	4.4	2.5	1.9×10^{-2}
1 k	4.4	0.4	0.1
1.9 k	4.4	0.4	0.19
10 k	5000	50	2.0
19 k	5000	50	3.8
100 k	—	7.5	2×10^{-5}
190 k	—	4.0	3.8×10^{-5}
1 M	—	1.0	1.5×10^{-4}
1.9 M	—	0.53	2.9×10^{-4}
10 M	—	0.2	1×10^{-3}
19 M	—	0.53	1.9×10^{-3}
100 M		0.1	—

Notes:

1. For $I < I_L$, errors occur due to thermally generated voltages within the 5720A. Use the following equation to determine the error, and add this error to the corresponding uncertainty or stability specification.

   Error = $K(I_L - I)/(I_L \times I)$

   Where: Error is in mΩ for all two-wire comp values and four-wire short, and in ppm for the remaining four-wire values.

   K is the constant from the above table;
   I and I_L are expressed in mA for short to 1.9 kΩ;
   I and I_L are expressed in µA for 10 kΩ to 100 MΩ

2. For $I_U < I < I_{MAX}$ errors occur due to self-heating of the resistors in the calibrator. Use the following equation to determine the error in ppm and add this error to the corresponding uncertainty or stability specification.

   Error in ppm = $K(I^2 - I_U^2)$

   Where: K is the constant from the above table;
   I and I_U are expressed in mA for short to 19 kΩ;
   I and I_U are expressed in µA for 100 kΩ to 100 MΩ

1-32. DC Current Specifications

5720A Series II DC Current Specifications

Range	Resolution	Absolute Uncertainty ± 5 °C from calibration temperature [2]				Relative Uncertainty ± 1 °C	
		24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
	nA	± (ppm output + nA)					
99 % Confidence Level							
220 µA	0.1	40 + 7	42 + 7	45 + 7	50 + 7	24 + 2	26 + 2
2.2 mA	1	30 + 8	35 + 8	37 + 8	40 + 8	24 + 5	26 + 5
22 mA	10	30 + 50	35 + 50	37 + 50	40 + 50	24 + 50	26 + 50
	µA	± (ppm output + µA)					
220 mA [1]	0.1	40 + 0.8	45 + 0.8	47 + 0.8	50 + 0.8	26 + 0.3	30 + 0.3
2.2 A [1]	1	60 + 15	70 + 15	80 + 15	90 + 15	40 + 7	45 + 7
5725A Amplifier:							
11 A	10	330 + 470	340 + 480	350 + 480	360 + 480	100 + 130	110 + 130
95 % Confidence Level							
	nA	± (ppm output + nA)					
220 µA	0.1	32 + 6	35 + 6	37 + 6	40 + 6	20 + 1.6	22 + 1.6
2.2 mA	1	25 + 7	30 + 7	33 + 7	35 + 7	20 + 4	22 + 4
22 mA	10	25 + 40	30 + 40	33 + 40	35 + 40	20 + 40	22 + 40
	µA	± (ppm output + µA)					
220 mA [1]	0.1	35 + 0.7	40 + 0.7	42 + 0.7	45 + 0.7	22 + 0.25	25 + 0.25
2.2 A [1]	1	50 + 12	60 + 12	70 + 12	80 + 12	32 + 6	40 + 6
5725A Amplifier:							
11 A	10	330 + 470	340 + 480	350 + 480	360 + 480	100 + 130	110 + 130

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 mA and 2.2 mA ranges are increased by a factor of 1.3 when supplied through 5725A terminals.

Specifications are otherwise identical for all output locations.

1. Add to uncertainty specifications:

   ±200 x I^2 ppm for >100 mA on 220 mA range
   ±10 x I^2 ppm for >1 A on 2.2 A range

2. For fields strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

5700A Series II DC Current Specifications

Range	Resolution	Absolute Uncertainty ± 5 °C from calibration temperature [2]				Relative Uncertainty ± 1 °C	
		24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
	nA	± (ppm output + nA)					
99 % Confidence Level							
220 µA	0.1	45 + 10	50 + 10	55 + 10	60 + 10	24 + 2	26 + 2
2.2 mA	1	45 + 10	50 + 10	55 + 10	60 + 10	24 + 5	26 + 5
22 mA	10	45 + 100	50 + 100	55 + 100	60 + 100	24 + 50	26 + 50
	µA	± (ppm output + µA)					
220 mA [1]	0.1	55 + 1	60 + 1	65 + 1	70 + 1	26 + 0.3	30 + 0.3
2.2 A [1]	1	75 + 30	80 + 30	90 + 30	95 + 30	40 + 7	45 + 7
5725A Amplifier:							
11 A	10	330 + 470	340 + 480	350 + 480	360 + 480	100 + 130	110 + 130
95 % Confidence Level							
	nA	± (ppm output + nA)					
220 µA	0.1	35 + 8	40 + 8	45 + 8	50 + 8	20 + 1.6	22 + 1.6
2.2 mA	1	35 + 8	40 + 8	45 + 8	50 + 8	20 + 4	22 + 4
22 mA	10	35 + 80	40 + 80	45 + 80	50 + 80	20 + 40	22 + 40
	µA	± (ppm output + µA)					
220 mA [1]	0.1	45 + 0.8	50 + 0.8	55 + 0.8	60 + 0.8	22 + 0.25	25 + 0.25
2.2 A [1]	1	60 + 25	65 + 25	75 + 25	80 + 25	35 + 6	40 + 6
5725A Amplifier:							
11 A	10	330 + 470	340 + 480	350 + 480	360 + 480	100 + 130	110 + 130

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 mA and 2.2 mA ranges are increased by a factor of 1.3 when supplied through 5725A terminals.

Specifications are otherwise identical for all output locations.

1. Add to uncertainty specifications:

   ±200 x I^2 ppm for >100 mA on 220 mA range
   ±10 x I^2 ppm for >1 A on 2.2 A range

2. For fields strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

DC Current Secondary Performance Specifications and Operating Characteristics

Range	Stability ± 1 °C [1] 24 Hours	Temperature Coefficient [2]		Compliance Limits	Burden Voltage Adder [3] (±nA/V)	Maximum Load for Full Accuracy [4] (Ω)	Noise	
		10 - 40 °C	0 - 10 °C and 40 - 50 °C				Bandwidth 0.1-10 Hz pk-pk	Bandwidth 10 Hz-10 kHz RMS
	± (ppm output + nA)	± (ppm output + nA) / °C					ppm output + nA	nA
220 µA	5 + 1	1 + 0.40	3 + 1	10	0.2	20k	6 + .9	10
2.2 mA	5 + 5	1 + 2	3 + 10	10	0.2	2k	6 + 5	10
22 mA	5 + 50	1 + 20	3 + 100	10	10	200	6 + 50	50
220 mA	8 + 300	1 + 200	3 + 1 µA	10	100	20	9 + 300	500
2.2 A	9 + 7 µA	1 + 2.5 µA	3 + 10 µA	3 [5]	2 µA	2	12 + 1.5 µA	20 µA
5725A	± (ppm output + µA)	± (ppm output + µA) / °C					ppm output + µA	µA
11 A	25 + 100	20 + 75	30 + 120	4	0	4	15 + 70	175

Notes:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 mA and 2.2 mA ranges are increased by a factor of 1.3 when supplied through 5725A terminals.

1. Stability specifications are included in the Absolute Uncertainty values for the primary specifications.
2. Temperature coefficient is an adder to uncertainty specifications. It does not apply unless operating more than ±5 °C from calibration temperature.
3. Burden voltage adder is an adder to uncertainty specifications that does not apply unless burden voltage is greater than 0.5 V.
4. For higher loads, multiply uncertainty specification by: $1 + \frac{0.1 \times \text{actual load}}{\text{maximum load for full accuracy}}$
5. The calibrator's compliance limit is 2 V for outputs from 1 A to 2.2 A. 5725A Amplifier may be used in range-lock mode down to 0 A.

Minimum Output: .... 0 for all ranges, including 5725A.

Settling Time: .... 1 second for mA and mA ranges; 3 seconds for 2.2 A range; 6 seconds for 11 range; + 1 second for range or polarity change

Overshoot: .... <5 %

1-33. AC Current Specifications

5720A Series II AC Current Specifications: 99 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + nA)					
220 µA	1 nA	10 - 20	260 + 20	280 + 20	290 + 20	300 + 20	260 + 20	280 + 20
		20 - 40	170 + 12	180 + 12	190 + 12	200 + 12	130 + 12	150 + 12
		40 - 1 k	120 + 10	130 + 10	135 + 10	140 + 10	100 + 10	110 + 10
		1k - 5 k	300 + 15	320 + 15	340 + 15	350 + 15	250 + 15	280 + 15
		5k - 10 k	1000 + 80	1100 + 80	1200 + 80	1300 + 80	900 + 80	1000 + 80
2.2 mA	10 nA	10 - 20	260 + 50	280 + 50	290 + 50	300 + 50	260 + 50	280 + 50
		20 - 40	170 + 40	180 + 40	190 + 40	200 + 40	130 + 40	150 + 40
		40 - 1 k	120 + 40	130 + 40	135 + 40	140 + 40	100 + 40	110 + 40
		1k - 5 k	210 + 130	220 + 130	230 + 130	240 + 130	250 + 130	280 + 130
		5k - 10 k	1000 + 800	1100 + 800	1200 + 800	1300 + 800	900 + 800	1000 + 800
22 mA	100 nA	10 - 20	260 + 500	280 + 500	290 + 500	300 + 500	260 + 500	280 + 500
		20 - 40	170 + 400	180 + 400	190 + 400	200 + 400	130 + 400	150 + 400
		40 - 1 k	120 + 400	130 + 400	135 + 400	140 + 400	100 + 400	110 + 400
		1k - 5 k	210 + 700	220 + 700	230 + 700	240 + 700	250 + 700	280 + 700
		5k - 10 k	1000 + 6000	1100 + 6000	1200 + 6000	1300 + 6000	900 + 6000	1000 + 6000
			± (ppm output + µA)					
220 mA	1 µA	10 - 20	260 + 5	280 + 5	290 + 5	300 + 5	260 + 5	280 + 5
		20 - 40	170 + 4	180 + 4	190 + 4	200 + 4	130 + 4	150 + 4
		40 - 1 k	120 + 3	130 + 3	135 + 3	140 + 3	100 + 3	110 + 3
		1k - 5 k	210 + 4	220 + 4	230 + 4	240 + 4	250 + 4	280 + 4
		5k - 10 k	1000 + 12	1100 + 12	1200 + 12	1300 + 12	900 + 12	1000 + 12
2.2 A	10 µA	20 - 1 k	290 + 40	300 + 40	310 + 40	320 + 40	300 + 40	350 + 40
		1 k - 5 k	440 + 100	460 + 100	480 + 100	500 + 100	500 + 100	520 + 100
		5 k - 10 k	6000 + 200	7000 + 200	7500 + 200	8000 + 200	6000 + 200	7000 + 200
5725A Amplifier:								
11 A	100 µA	40 - 1 k	370 + 170	400 + 170	440 + 170	460 + 170	300 + 170	330 + 170
		1 k - 5 k	800 + 380	850 + 380	900 + 380	950 + 380	700 + 380	800 + 380
		5 k - 10 k	3000 + 750	3300 + 750	3500 + 750	3600 + 750	2800 + 750	3200 + 750

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 µA and 2.2 mA ranges are increased by a factor of 1.3 plus 2 µA when supplied through 5725A terminals. For the 5720A 220 µA range, 1 kHz through 5 kHz and 5 kHz through 10 kHz, when the output is coming from the AUX current terminal, use the 5700A Absolute Uncertainty Specifications. Specifications are otherwise identical for all output locations.

1. For fields strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

5720A Series II AC Current Specifications: 95% Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + nA)					
220 µA	1 nA	10 - 20	210 + 16	230 + 16	240 + 16	250 + 16	210 + 16	230 + 16
		20 - 40	130 + 10	140 + 10	150 + 10	160 + 10	110 + 10	130 + 10
		40 - 1 k	100 + 8	110 + 8	115 + 8	120 + 8	80 + 8	90 + 8
		1k - 5 k	240 + 12	250 + 12	270 + 12	280 + 12	200 + 12	230 + 12
		5k - 10 k	800 + 65	900 + 65	1000 + 65	1100 + 65	700 + 65	800 + 65
2.2 mA	10 nA	10 - 20	210 + 40	230 + 40	240 + 40	250 + 40	210 + 40	230 + 40
		20 - 40	140 + 35	140 + 35	150 + 35	160 + 35	110 + 35	130 + 35
		40 - 1 k	100 + 35	110 + 35	115 + 35	120 + 35	80 + 35	90 + 35
		1k - 5 k	170 + 110	180 + 110	190 + 110	200 + 110	200 + 110	230 + 110
		5k - 10 k	800 + 650	900 + 650	1000 + 650	1100 + 650	700 + 650	800 + 650
22 mA	100 nA	10 - 20	210 + 400	230 + 400	240 + 400	250 + 400	210 + 400	230 + 400
		20 - 40	130 + 350	140 + 350	150 + 350	160 + 350	110 + 350	130 + 350
		40 - 1 k	100 + 350	110 + 350	115 + 350	120 + 350	80 + 350	90 + 350
		1k - 5 k	170 + 550	180 + 550	190 + 550	200 + 550	200 + 550	230 + 550
		5k - 10 k	800 + 5000	900 + 5000	1000 + 5000	1100 + 5000	700 + 5000	800 + 5000
			± (ppm output + µA)					
220 mA	1 µA	10 - 20	210 + 4	230 + 4	240 + 4	250 + 4	210 + 4	230 + 4
		20 - 40	130 + 3.5	140 + 3.5	150 + 3.5	160 + 3.5	110 + 3.5	130 + 3.5
		40 - 1 k	100 + 2.5	110 + 2.5	115 + 2.5	120 + 2.5	80 + 2.5	90 + 2.5
		1k - 5 k	170 + 3.5	180 + 3.5	190 + 3.5	200 + 3.5	200 + 3.5	230 + 3.5
		5k - 10 k	800 + 10	900 + 10	1000 + 10	1100 + 10	700 + 10	800 + 10
2.2 A	10 µA	20 - 1 k	230 + 35	240 + 35	250 + 35	260 + 35	250 + 35	300 + 35
		1 k - 5 k	350 + 80	390 + 80	420 + 80	450 + 80	400 + 80	440 + 80
		5 k - 10 k	5000 + 160	6000 + 160	6500 + 160	7000 + 160	5000 + 160	6000 + 160
5725A Amplifier:								
11 A	100 µA	40 - 1 k	370 + 170	400 + 170	440 + 170	460 + 170	300 + 170	330 + 170
		1 k - 5 k	800 + 380	850 + 380	900 + 380	950 + 380	700 + 380	800 + 38
		5 k - 10 k	3000 + 750	3300 + 750	3500 + 750	3600 + 750	2800 + 750	3200 + 750

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 µA and 2.2 mA ranges are increased by 1.3 plus 2 µA when supplied through 5725A terminals. For the 5720A 220 µA range, 1 kHz through 5 kHz and 5 kHz through 10 kHz, when the output is coming from the AUX current terminal, use the 5700A Absolute Uncertainty Specifications. Specifications are otherwise identical for all output locations.

1. For fields strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

5700A Series II AC Current Specifications: 99 % Confidence Level

Range	Resolution	Frequency(Hz)	Absolute Uncertainty ± 5 °C from calibration temperature[1]				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + nA)					
220 µA	1 nA	10 - 20	650 + 30	700 + 30	750 + 30	800 + 30	450 + 30	500 + 30
		20 - 40	350 + 25	380 + 25	410 + 25	420 + 25	270 + 25	300 + 25
		40 - 1 k	120 + 20	140 + 20	150 + 20	160 + 20	110 + 20	120 + 20
		1k - 5 k	500 + 50	600 + 50	650 + 50	700 + 50	450 + 50	500 + 50
		5k - 10 k	1500 + 100	1600 + 100	1700 + 100	1800 + 100	1400 + 100	1500 + 100
2.2 mA	10 nA	10 - 20	650 + 50	700 + 50	750 + 50	800 + 50	450 + 50	500 + 50
		20 - 40	350 + 40	380 + 40	410 + 40	420 + 40	270 + 40	300 + 40
		40 - 1 k	120 + 40	140 + 40	150 + 40	160 + 40	110 + 40	120 + 40
		1k - 5 k	500 + 500	600 + 500	650 + 500	700 + 500	450 + 500	500 + 500
		5k - 10 k	1500 + 1000	1600 + 1000	1700 + 1000	1800 + 1000	1400 + 1000	1500 + 1000
22 mA	100 nA	10 - 20	650 + 500	700 + 500	750 + 500	800 + 500	450 + 500	500 + 500
		20 - 40	350 + 400	380 + 400	410 + 400	420 + 400	270 + 400	300 + 400
		40 - 1 k	120 + 400	140 + 400	150 + 400	160 + 400	110 + 400	120 + 400
		1k - 5 k	500 + 5000	600 + 5000	650 + 5000	700 + 5000	450 + 5000	500 + 5000
		5k - 10 k	1500 + 10,000	1600 + 10,000	1700 + 10,000	1800 + 10,000	1400 + 10,000	1500 + 10,000
			± (ppm output + µA)					
220 mA	1 µA	10 - 20	650 + 5	700 + 5	750 + 5	800 + 5	450 + 5	500 + 5
		20 - 40	350 + 4	380 + 4	410 + 4	420 + 4	280 + 4	300 + 4
		40 - 1 k	120 + 4	150 + 4	170 + 4	180 + 4	110 + 4	130 + 4
		1k - 5 k	500 + 50	600 + 50	650 + 50	700 + 50	450 + 50	500 + 50
		5k - 10 k	1500 + 100	1600 + 100	1700 + 100	1800 + 100	1400 + 100	1500 + 100
2.2 A	10 µA	20 - 1 k	600 + 40	650 + 40	700 + 40	750 + 40	600 + 40	650 + 40
		1 k - 5 k	700 + 100	750 + 100	800 + 100	850 + 100	650 + 100	750 + 100
		5 k - 10 k	8000 + 200	9000 + 200	9500 + 200	10,000 + 200	7500 + 200	8500 + 200
5725A Amplifier:								
11 A	100 µA	40 - 1 k	370 + 170	400 + 170	440 + 170	460 + 170	300 + 170	330 + 170
		1 k - 5 k	800 + 380	850 + 380	900 + 380	950 + 380	700 + 380	800 + 380
		5 k - 10 k	3000 + 750	3300 + 750	3500 + 750	3600 + 750	2800 + 750	3200 + 750

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 µA and 2.2 mA ranges are increased by a factor of 1.3 plus 2 µA when supplied through 5725A terminals. Specifications are otherwise identical for all output locations.

1. For field strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

5700A Series II AC Current Specifications: 95 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute Uncertainty ± 5 °C from calibration temperature [1]				Relative Uncertainty ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			± (ppm output + nA)					
220 µA	1 nA	10 - 20	550 + 25	600 + 25	650 + 25	700 + 25	375 + 25	400 + 25
		20 - 40	280 + 20	310 + 20	330 + 20	350 + 20	220 + 20	250 + 20
		40 - 1 k	100 + 16	120 + 16	130 + 16	140 + 16	90 + 16	100 + 16
		1k - 5 k	400 + 40	500 + 40	550 + 40	600 + 40	375 + 40	400 + 40
		5k - 10 k	1300 + 80	1400 + 80	1500 + 80	1600 + 80	1200 + 80	1200 +80
2.2 mA	10 nA	10 - 20	550 + 40	600 + 40	650 + 40	700 + 40	375 + 40	400 + 40
		20 - 40	280 + 35	310 + 35	330 + 35	350 + 35	220 + 35	250 + 35
		40 - 1 k	100 + 35	120 + 35	130 + 35	140 + 35	090 + 35	100 + 35
		1k - 5 k	400 + 400	500 + 400	550 + 400	600 + 400	375 + 400	400 + 400
		5k - 10 k	1300 + 800	1400 + 800	1500 + 800	1600 + 800	1200 + 800	1200 + 800
22 mA	100 nA	10 - 20	550 + 400	600 + 400	650 + 400	700 + 400	375 + 400	400 + 400
		20 - 40	280 + 350	310 + 350	330 + 350	350 + 350	220 + 350	250 + 350
		40 - 1 k	100 + 350	120 + 350	130 + 350	140 + 350	090 + 350	100 + 350
		1k - 5 k	400 + 4000	500 + 4000	550 + 4000	600 + 4000	375 + 4000	400 + 4000
		5k - 10 k	1300 + 8000	1400 + 8000	1500 + 8000	1600 + 8000	1200 + 8000	1200 + 8000
			± (ppm output + µA)					
220 mA	1 µA	10 - 20	550 + 4	600 + 4	650 + 4	700 + 4	375 + 4	400 + 4
		20 - 40	280 + 3.5	310 + 3.5	330 + 3.5	350 + 3.5	220 + 3.5	250 + 3.5
		40 - 1 k	100 + 3.5	120 + 3.5	130 + 3.5	140 + 3.5	90 + 3.5	100 + 3.5
		1k - 5 k	400 + 40	500 + 40	550 + 40	600 + 40	375 + 40	400 + 40
		5k - 10 k	1300 + 80	1400 + 80	1500 + 80	1600 + 80	1200 + 80	1200 + 80
2.2 A	10 µA	20 - 1 k	500 + 35	550 + 35	600 + 35	650 + 35	500 + 35	550 + 35
		1 k - 5 k	600 + 80	650 + 80	700 + 80	750 + 80	550 + 80	650 + 80
		5 k - 10 k	6500 + 160	7500 + 160	8000 + 1600	8500 + 160	6000 + 160	7000 + 160
5725A Amplifier:								
11 A	100 µA	40 - 1 k	370 + 170	400 + 170	440 + 170	460 + 170	300 + 170	330 + 170
		1 k - 5 k	800 + 380	850 + 380	900 + 380	950 + 380	700 + 380	800 + 380
		5 k - 10 k	3000 + 750	3300 + 750	3500 + 750	3600 + 750	2800 + 750	3200 + 750

Note:

Maximum output from the calibrator's terminals is 2.2 A. Uncertainty specifications for 220 A and 2.2 mA ranges are increased by a factor of 1.3 plus 2 µA when supplied through 5725A terminals. Specifications are otherwise identical for all output locations.

1. For fields strengths >0.4 V/m but ≤3 V/m, add 1 % of range.

AC Current Secondary Performance Specifications and Operating Characteristics

Range	Frequency (Hz)	Stability ± 1 °C [1] 24 Hours	Temperature Coefficient [2]		Compliance Limits (V rms)	Maximum Resistive Load For Full Accuracy [3] (Ω)	Noise and Distortion (Bandwidth 10 Hz - 50 kHz <0.5V Burden)
			10 - 40 °C	0 - 10 °C and 40 - 50 °C			
		± (ppm output + nA)	± (ppm output + nA)/°C				± (% output + μA)
220 μA	10 - 20	150 + 5	50 + 5	50 + 5	7	2 k [6]	0.05 + 0.1
	20 - 40	80 + 5	20 + 5	20 + 5			0.05 + 0.1
	40 - 1 k	30 + 3	4 + 0.5	10 + 0.5			0.05 + 0.1
	1 k - 5 k	50 + 20	10 + 1	20 + 1			0.25 + 0.5
	5 k - 10 k	400 + 100	20 + 100	20 + 100			00.5 + 1
2.2 mA	10 - 20	150 + 5	50 + 5	50 + 5	7	500	0.05 + 0.1
	20 - 40	80 + 5	20 + 4	20 + 4			0.05 + 0.1
	40 - 1 k	30 + 3	4 + 1	10 + 2			0.05 + 0.1
	1 k - 5 k	50 + 20	10 + 100	20 + 100			0.25 + 0.5
	5 k - 10 k	400 + 100	50 + 400	50 + 400			00.5 + 1
22 mA	10 - 20	150 + 50	50 + 10	50 + 10	7	150	0.05 + 0.1
	20 - 40	80 + 50	20 + 10	20 + 10			0.05 + 0.1
	40 - 1 k	30 + 30	4 + 10	10 + 20			0.05 + 0.1
	1 k - 5 k	50 + 500	10 + 500	20 + 400			0.25 + 0.5
	5 k - 10 k	400 + 1000	50 + 1000	50 + 1000			00.5 + 1
	Hz	± (ppm output + μA)	± (ppm output + μA) / °C				
220 mA	10 - 20	150 + 0.5	50 + 0.05	50 + 0.05	7	15	0.05 + 10
	20 - 40	80 + 0.5	20 + 0.05	20 + 0.05			0.05 + 10
	40 - 1 k	30 + 0.3	4 + 0.1	10 + 0.1			0.05 + 10
	1 k - 5 k	50 + 3	10 + 2	20 + 2			0.25 + 50
	5 k - 10 k	400 + 5	50 + 5	50 + 5			00.5 + 100
2.2 A	20 - 1 k	50 + 5	4 + 1	10 + 1	1.4 [4]	0.5	0.5 + 100
	1 k - 5 k	80 + 20	10 + 5	20 + 5			0.3 + 500
	5 k - 10 k	800 + 50	50 + 10	50 + 10			0 1 + 1 mA
5725A Amplifier:							± (% output)
11 A	40 - 1 k	75 + 100	20 + 75	30 + 75	3	3	0.05 [5]
	1 k - 5 k	100 + 150	40 + 75	50 + 75			0.12 [5]
	5 k - 10 k	200 + 300	100 + 75	100 + 75			0.5 [5]

Notes:

Maximum output from 5720A terminals is 2.2 A. Uncertainty specifications for 220 μA and 2.2 mA ranges are increased by a factor of 1.3, plus 2 μA when supplied through 5725A terminals. Specifications are otherwise identical for all output locations.

1. Stability specifications are included in the Absolute Uncertainty values for the primary specifications.
2. Temperature coefficient is an adder to uncertainty specifications that does not apply unless operating more than ±5 °C from calibration temperature.
3. For larger resistive loads multiply uncertainty specifications by: $\left(\frac{\text{actual load}}{\text{maximum load for full accuracy}}\right)^2$
4. 1.5 V compliance limit above 1 A. 5725A Amplifier may be used in range-lock mode down to 1 A.
5. For resistive loads within rated compliance voltage limits.
6. For outputs from the Aux Current terminals, the maximum resistive load for full accuracy is 1 kΩ. For larger resistive loads, multiply the uncertainty as described in Note 3.

Minimum Output..9 μA for 220 μA range, 10 % on all other ranges. 1 A minimum for 5725A.

Inductive Load Limits..400 μH (5700A/5720A, or 5725A). 20 μH for 5700A/5720A output >1 A.

Power Factors..5700A/5720A, 0.9 to 1; 5725A, 0.1 to 1. Subject to compliance voltage limits.

Frequency:

Range (Hz)..10.000 - 11.999, 12.00 - 119.99, 120.0 - 1199.9, 1.200 k - 10.000 k

Uncertainty ....±0.01 %

Resolution ....11,999 counts

Settling Time..5 seconds for 5700A/5720A ranges; 6 seconds for 5725A 11 A range; +1 second for amplitude or frequency range change.

Overshoot...<10 %

1-34. Wideband AC Voltage (Option 5700-03) Specifications

Specifications apply to the end of the cable and 50 Ω termination used for calibration.

Range		Resolution	Absolute Uncertainty ± 5 °C from calibration temperature 30 Hz - 500 kHz			
Volts	dBm		24 Hours	90 Days	180 Days	1 Year
			± (% output + µV)			
1.1 mV	–46	10 nV	0.4 + 0.4	0.5 + 0.4	0.6 + 0.4	0.8 + 2
3 mV	–37	10 nV	0.4 + 1	0.45 + 1	0.5 + 1	0.7 + 3
11 mV	–26	100 nV	0.2 + 4	0.35 + 4	0.5 + 4	0.7 + 8
33 mV	–17	100 nV	0.2 + 10	0.3 + 10	0.45 + 10	0.6 + 16
110 mV	–6.2	1 µV	0.2 + 40	0.3 + 40	0.45 + 40	0.6 + 40
330 mV	+3.4	1 µV	0.2 + 100	0.25 + 100	0.35 + 100	0.5 + 100
1.1 V	+14	10 µV	0.2 + 400	0.25 + 400	0.35 + 400	0.5 + 400
3.5 V	+24	10 µV	0.15 + 500	0.2 + 500	0.3 + 500	0.4 + 500

Frequency (Hz)	Frequency Resolution (Hz)	Amplitude Flatness, 1 kHz Reference Voltage Range			Temperature Coefficient ± ppm/°C	Settling Time To Full Accuracy (Seconds)	Harmonic Distortion (dB)
		1.1 mV	3 mV	> 3 mV			
		± (% output + floor indicated)					
10 - 30	0.01	0.3	0.3	0.3	100	7	-40
30 - 120	0.01	0.1	0.1	0.1	100	7	-40
120 - 1.2 k	0.1	0.1	0.1	0.1	100	5	-40
1.2 k - 12 k	1	0.1	0.1	0.1	100	5	-40
12 k - 120 k	10	0.1	0.1	0.1	100	5	-40
120 k - 1.2 M	100	0.2 + 3 µV	0.1 + 3 µV	0.1 + 3 µV	100	5	-40
1.2 M - 2 M [1]	100 k	0.2 + 3 µV	0.1 + 3 µV	0.1 + 3 µV	100	0.5	-40
2 M - 10 M	100 k	0.4 + 3 µV	0.3 + 3 µV	0.2 + 3 µV	100	0.5	-40
10 M - 20 M	1 M	0.6 + 3 µV	0.5 + 3 µV	0.4 + 3 µV	150	0.5	-34
20 M - 30 M	1 M	1.5 + 15 µV	1.5 + 3 µV	1 + 3 µV	300	0.5	-34

Note:

[1] For output voltages < 50 % of full range in the 33 mV, 110 mV, 330 mV, 1.1 V , and 3.5 V ranges, add 0.1 % to the amplitude flatness specification.

Additional Operating Information:

dBm reference = 50 Ω

Range boundaries are at voltage points, dBm levels are approximate.

$\text{dBm} = 10 \log \left(\frac{\text{Power}}{1\text{mW}} \right)$; 0.22361 V across 50 Ω = 1 mW or 0 dBm

Minimum Output .... 300 µV (–57 dBm)

Frequency Uncertainty .... ± 0.01 %

Frequency Resolution .... 11,999 counts to 1.1999 MHz, 119 counts to 30 MHz

Overload Protection .... A short circuit on the wideband output will not result in damage. After settling time, normal operation is restored upon removal.

1-35. Auxiliary Amplifier Specifications

For complete specifications, see the 5205A and 5220A Operators Manuals.

5205A (220V - 1100 V ac, 0 V - 1100 V dc)

Overshoot: < 10 %

Distortion (bandwidth 10 Hz - 1 MHz):

10 Hz - 20 kHz .... 0.07 %

20 kHz - 50 kHz .... 0.2 %

50 kHz - 100 kHz .... 0.25 %

Frequency (Hz)	90 Day Accuracy at 23 ± 5 °C ± (% output + % range)	Temperature Coefficient for 0 - 18 °C and 28 - 50 °C ± (ppm output + ppm range) / °C
0 dc	0.05 + 0.005	15 + 3
10 - 40	0.15 + 0.005	45 + 3
40 - 20 k	0.04 + 0.004	15 + 3
20 k - 50 k	0.08 + 0.006	50 + 10
50 k - 100 k	0.1 + 0.01	70 + 20

5220A (AC Current, 180-day specifications):

Accuracy:

20 Hz - 1 kHz .... 0.07 % + 1 mA

1 kHz - 5 kHz .... (0.07 % + 1mA) x frequency in kHz

Temperature Coefficient (0 - 18 °C and 28 - 50 °C):

(0.003 % + 100A) / °C

Distortion (bandwidth 300 kHz):

20 Hz - 1 kHz .... 0.1% + 1 mA

1 kHz - 5 kHz .... (0.1% + 1 mA) x frequency in kHz

Note: 5700A/5720A combined with 5220A is not specified for inductive loads.

Chapter 2
Theory of Operation

2-1. Introduction

This section provides a block diagram discussion of the calibrator's analog and digital sections.

2-2. Calibrator Overview

Figures 2-1, 2-2, and 2-3 comprise the block diagram of the Calibrator. These figures are presented further on in the Analog Section Overview and the Digital Section Overview.

The Calibrator is configured internally as an automated calibration system with process controls and consistent procedures. Internal microprocessors control all functions and monitor performance, using a switching matrix to route signals between modules. Complete automatic internal diagnostics, both analog and digital, confirm operational integrity.

The heart of the measurement system is a 5 1/2-digit adc (analog-to-digital converter), which is used in a differential mode with the Calibrator dac. (The dac is described next under "Internal References.")

2-3. Internal References

The major references that form the basis of the Calibrator's accuracy are the hybrid reference amplifiers, patented Fluke solid-state thermal rms sensors, an extremely linear dac, and two internal precision resistors.

2-4. Hybrid Reference Amplifiers

A precision source can only be as accurate as its internal references, so the dc voltage reference for the Calibrator was chosen with extreme care. Years of data collection have proven the ovenized reference amplifier to be the best reference device available for modern, ultra-stable voltage standards.

In a microprocessor-controlled precision instrument such as the 5700A/5720A Series II, the important characteristics of its dc voltage references are not the accuracy of the value of the references, but rather their freedom from drift and hysteresis. (Hysteresis is the condition of stabilizing at a different value after being turned off then on again.) The 5700A/5720A Series II hybrid reference amplifiers excel in both freedom from drift and absence of hysteresis.

2-5. Fluke Thermal Sensor (FTS).

Thermal rms sensors, or ac converters, convert ac voltage to dc voltage with great accuracy. These devices sense true rms voltage by measuring the heat generated by a voltage through a known resistance.

Conventional thermal voltage converters suffer from two main sources of error. First, they exhibit frequency response errors caused by component reactance. Second, they have a poor signal-to-noise ratio because they operate at the millivolt level. The FTS has a full-scale input and output of 2V and a flat frequency response.

After initial functional verification of the Fluke Thermal Sensors, their characteristics only change by less than 1/10th of the allowed ac/dc error per year. External calibration of the ac voltage function of the Calibrator consists of verifying that the Calibrator meets its specifications.

2-6. Digital-to-Analog Converter (DAC).

A patented 26-bit dac is used in the calibrator as a programmable voltage divider. The dac is a pulse-width modulated (pwm) type with linearity better than 1 ppm (part-per-million) from 1/10th scale to full scale.

2-7. Digital Section Overview

The unguarded Digital Section contains the CPU assembly (A20), Digital Power Supply assembly (A19), Front Panel assembly (A2), Keyboard assembly (A1), and the unguarded portion of the Rear Panel assembly (A21). Figure 2-1 is a block diagram of the digital section of the Calibrator.

Power for the digital assemblies and the cooling fans is supplied by the Digital Power Supply assembly.

The CPU (central processing unit) assembly is a single-board computer based on the 68HC000 microprocessor. It controls local and remote interfaces, as well as serial communications over a fiber-optic link to the crossing portion of the Regulator/Guard Crossing assembly (A17). The guard crossing controls the guarded analog circuitry.

A Keyboard assembly provides the user with front-panel control of the Calibrator. It contains four LED's, a rotary edit knob, and a forty-five key keypad. It connects to the Front Panel assembly via a cable.

The Front Panel assembly provides information to the user on an Output Display and a Control Display. The Front Panel also contains circuitry that scans the keyboard and encodes key data for the CPU.

The Rear Panel assembly includes digital interfaces for the following:

- IEEE-488 bus connection
- RS-232-C DTE serial port
- Auxiliary amplifier: the 5725A

2-8. Analog Section Overview

The guarded analog section contains the following assemblies:

- Wideband Output (A5) (Part of Option -03)
- Wideband Oscillator (A6) (Part of Option -03)
- Current/Hi-Res (A7)
- Switch Matrix (A8)
- Ohms Cal (A9)
- Ohms (A10)
- DAC (A11)
- Oscillator Control (A12)
- Oscillator Output (A13)
- High Voltage Control (A14)
- High Voltage/High Current (A15)
- Power Amplifier (A16)
- Regulator/Guard Crossing (A17)
- Filter/PA Supply (A18)

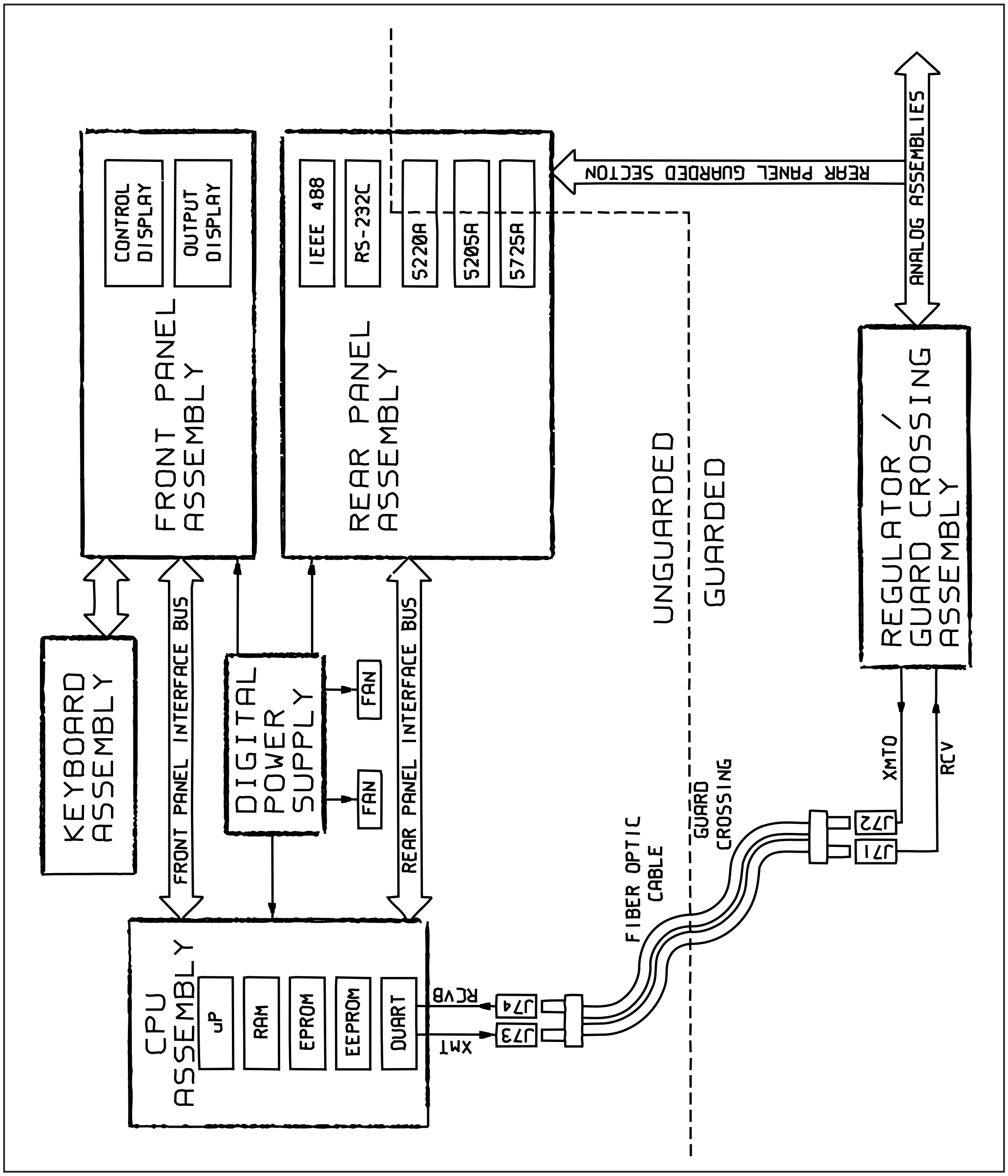


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Figure 2-1. Digital Section Block Diagram

These analog assemblies are interfaced to the Analog Motherboard assembly (A3). The guarded digital bus generated by the guard crossing portion of the Regulator/Guard Crossing assembly controls all analog assemblies except the Filter/PA Supply. The Guard Crossing interfaces with the unguarded CPU assembly via a fiber-optic link. The Transformer assembly, along with the filter portion of the Filter/PA Supply assembly and the regulator portion of the Regulator/Guard Crossing assembly, create the system power supply for all the analog assemblies. The Power Amplifier Supply portion of the Filter/PA Supply assembly provides the high voltage power supplies required by the Power Amplifier assembly. The amplitudes of these high voltage supplies are controlled by circuitry contained on the Power Amplifier assembly.

Figures 2-2 and 2-3 are block diagrams for the analog section of the Calibrator.

2-9. Functional Description Presented by Output Function

This part of the theory section presents Calibrator operation from the perspective of each output function. It describes which assemblies come into play, and how they interact. It does not provide a detailed circuit description.

2-10. DC Voltage Functional Description

The DAC assembly (A11) provides a stable dc voltage and is the basic building block of the Calibrator. DC voltages are generated in six ranges:

- 220 mV
- 2.2V
- 11V
- 22V
- 220V
- 1100V

The 11V and 22V ranges are generated by the DAC assembly, with its output, DAC OUT HI and DAC SENSE HI routed to the Switch Matrix assembly, where relays connect it to INT OUT HI and INT SENSE HI. Lines INT OUT HI and INT SENSE HI connect to the Calibrator binding posts by relays on the Analog Motherboard assembly (A3).

The 2.2V range is created on the Switch Matrix assembly by resistively dividing by five the 11V range from the DAC assembly. Relays on the Switch Matrix and Analog Motherboard route the 2.2V range output to the Calibrator binding posts.

The 220 mV range is an extension of the 2.2V range. The Switch Matrix assembly resistively divides by ten the 2.2V range to create the 220 mV range. Relays on the Switch Matrix and Analog Motherboard route the 220 mV range output to the front panel binding posts.

The 220V range is generated by the DAC and Power Amplifier assemblies. The Power Amplifier amplifies the 11V range of the DAC assembly by a gain of -20 to create the 220V range. The output of the Power Amplifier is routed to the High Voltage Control assembly (A14), where a relay connects it to PA OUT DC. Line PA OUT DC is routed to the binding posts via relays on the Switch Matrix and Analog Motherboard.

Figure 2-2. Analog Section Block Diagram, Part 1
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Figure 2-3. Analog Section Block Diagram, Part 2
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The 1100V range is generated by the High Voltage/High Current assembly (A15) operating in conjunction with the Power Amplifier assembly and the High Voltage Control assembly. The 11V range of the DAC assembly is routed to the High Voltage/High Current assembly which amplifies by a gain of -100 to create the 1100V range. Basically the high voltage output is obtained by rectifying and filtering a high voltage ac signal generated by the High Voltage Control assembly operating in conjunction with the Power Amplifier assembly.

2-11. AC Voltage Functional Description

The Oscillator Output assembly (A13) is the ac signal source for the Calibrator. The Oscillator Control assembly (A12), controls the amplitude of this ac signal by comparing it with the accurate dc voltage from the DAC assembly and making amplitude corrections via the OSC CONT line. The frequency of oscillation is phase locked to either the high resolution oscillator on the Current/Hi-Res (A7) assembly or an external signal connected to the PHASE LOCK IN connector on the rear panel. AC voltages are generated in the following ranges:

- 2.2 mV
- 22 mV
- 220 mV
- 2.2V
- 11V
- 22V
- 220V
- 1100V

The 2.2V and 22V ranges are generated by the Oscillator Output assembly and routed to the Calibrator binding posts via relays on the Switch Matrix (A8) and Analog Motherboard assemblies.

The 220 mV range is generated on the Switch Matrix assembly, which resistively divides by ten the 2.2V range of the Oscillator Output assembly. Relays on the Switch Matrix and Analog Motherboard route the 220 mV range to the Calibrator binding posts.

The 2.2 mV and 22 mV ranges are generated on the Switch Matrix assembly. In this mode, the Switch Matrix resistively divides the 2.2V range or the 22V range by 1000 to create the 2.2 mV and 22 mV ranges respectively. Relays on the Switch Matrix and Analog Motherboard route these ranges to the Calibrator binding posts.

The 220V range is generated on the Power Amplifier assembly. In this mode, the Power Amplifier is set for a nominal gain of -10 to amplify the 22V range from the Oscillator Output to the 220V range. The 220V ac range from the Power Amplifier is routed to the Calibrator binding posts by relays on the High Voltage Control assembly and the Analog Motherboard.

The 1100V range is generated by the High Voltage Control assembly operating in conjunction with the Power Amplifier assembly. In this mode, the 22V range from the Oscillator Output is amplified by the Power Amplifier and High Voltage Control assemblies, which create an amplifier with a nominal gain of -100. Relays on the High Voltage Control and Analog Motherboard assemblies route the 1100V ac range to the Calibrator binding posts.

2-12. Wideband AC V Functional Description (Option -03)

The Wideband AC Voltage module (Option -03) consists of the Wideband Oscillator assembly (A6) and the Wideband Output assembly (A5). There are two wideband frequency ranges:

- 10 Hz to 1.1 MHz
- 1.2 MHz to 30 MHz

During operation between 10 Hz and 1.1 MHz, output from the Oscillator Output assembly is routed to the Wideband Output assembly where it is amplified and attenuated to achieve the specified amplitude range. The output is connected to the Calibrator front panel WIDEBAND connector. Operation between 1.2 MHz and 30 MHz works the same way, except the input to the Wideband Output assembly is the ac signal from the Wideband Oscillator assembly.

2-13. DC Current Functional Description

DC current is generated in five ranges:

- 20 µA - 220 µA
- 220 µA - 2.2 mA
- 2.2 mA - 22 mA
- 22 mA - 220 mA
- 2.2A

All current ranges except 2.2A are generated by the current portion of the Current/Hi-Res assembly. These currents are created by connecting the output of the DAC assembly, set to the 22V range, to the input of the Current assembly. The Current assembly uses this dc voltage to create the output current. The current output can be connected to the AUX CURRENT OUTPUT binding post by relays on the Current assembly, to the OUTPUT HI binding post by relays on the Current, Switch Matrix, and Analog Motherboard assemblies, or to the 5725A via the B-CUR line by relays on the Analog Motherboard assembly and Rear Panel assembly.

The 2.2A range is an extension of the 22 mA range. The 22 mA range output from the Current assembly is amplified by a gain of 100 by the High Voltage/High Current assembly operating in conjunction with the Power Amp assembly and the High Voltage Control assembly. The 2.2A current range is routed back to the Current assembly where it is connected to either the AUX CURRENT OUTPUT binding post, the OUTPUT HI binding post, or the 5725A in the same manner as the lower current ranges.

2-14. AC Current Functional Description

AC current is created in the same manner as dc current, except the input to the Current assembly is the ac voltage from the Oscillator Output assembly set to the 22V range. The switching between ac and dc is carried out on the Switch Matrix, Oscillator Control, Oscillator Output, and DAC assemblies.

2-15. Ohms Functional Description

Two assemblies function as one to supply the fixed values of resistance:

- Ohms Main assembly (A10)
- Ohms Cal assembly (A9)

All of the resistance values except the 1Ω, 1.9Ω, and short are physically located on the Ohms Main assembly. The 1Ω, 1.9Ω, and short are physically located on the Ohms Cal assembly. The desired resistance is selected by relays on these Ohms assemblies and is connected to the Calibrator binding posts by relays on the Analog Motherboard. The Ohms Cal assembly also contains the appropriate circuitry to enable the Calibrator to perform resistance calibration. Once calibrated, the Calibrator output display shows the true value of the resistance selected, not the nominal (e.g., 10.00031 kΩ, not 10 kΩ).

Four ohms measurement modes are available. For the two-wire configuration, measurement with or without lead-drop compensation sensed at the binding posts of the UUT (using the SENSE binding posts and another set of leads), or at the ends of its test leads is available for 19 kΩ and below. Four-wire configuration is available for all but the 100 MΩ value.

Chapter 3
Calibration and Verification

Title		Page

3-1. Introduction

This chapter gives procedures for 5700A/5720A Series II calibration, verification, acceptance testing, and performance testing. Information here applies to testing the performance of and calibrating a normally operating 5700A/5720A Series II. In case of malfunction, refer to Chapter 5, Troubleshooting, which explains how to use self diagnostic tests to identify a faulty module. Calibration and Performance Testing is presented in the following three parts:

- Calibration, which is to be done at the beginning of every calibration cycle. This is the same procedure as in Chapter 7 of the *5700A/5720A Series II Operator Manual*. It uses three external standards; 1Ω, 10 kΩ, and 10V dc. The procedure is repeated here for convenience. Also included in this part are procedures for doing Calibration Check and Range Calibration.
- Full Performance Verification, which is the full verification procedure, recommended every two years. Part of this procedure is Wideband AC Module (Option 5700A-03) flatness calibration, also recommended only every two years.

Optional Tests, which are recommended following repair or for use in acceptance testing. These tests include such checks as load regulation, noise, and distortion. These tests are not required on a routine basis. They are not necessary after a Calibrator passes Full Performance Verification.

3-2. Calibration

This chapter provides procedures for calibrating the 5700A/5720A Series II to external standards, adjusting the range if necessary, and for performing a calibration check.

Your calibrator is calibrated at the factory with constants that are traceable to NIST. In order to maintain traceability, you only need to met the following requirements.

- Calibration to external standards must be completed at the beginning of the calibration cycle
- Performance verification must be completed every two years.
- Zero Calibration must be performed every 30 days (refer to the *5700A/5720A Series II Operators Manual*).

Calibration check and range calibration are optional procedures that are provided for enhancing the accuracy if needed for special requirements.

3-3. Calibrating the 5700A/5720A Series II to External Standards

You must calibrate to external standards at the beginning of the calibration cycle. The length of the cycle (24 hours, 90 days, 180 days, or one year) is selected in a setup menu described in Chapter 4 of the *5700A/5720A Operators Manual*.

To calibrate the 5700A/5720A Series II, you apply three portable standards to the output binding posts: a 10V dc voltage standard, a 1Ω resistance standard, and a 10 kΩ resistance standard. The following standards are recommended:

- Model 732B DC Reference Standard
- Model 742A-1 1Ω Resistance Standard
- Model 742A-10k 10Ω Resistance Standard

Use the following Low Thermal Leads for all connections:

- When calibrating the 5700A, use either the connector set 5440A-7002 (banana plugs) or the set 5440A-7003 (spade lugs).
- When calibrating the 5720A, use the set 5440A-7003 (spade lugs).

⚠⚠Warning

Operator accessible LETHAL VOLTAGES may be present on the lugs at the end of these cables when used with instrumentation capable of producing such voltages. These cables should be used only when thermal emf performance is required. For other applications, cables with operator protection form contact with high voltages should be used.

3-4. Calibration Requirements

Both the calibrator and the recommended external standards have the ability to internally control (or compensate for) ambient temperature variations. Therefore it is unnecessary to keep the calibrator in tightly controlled temperatures during calibration. During the calibration procedure, the calibrator prompts you to enter the ambient temperature, and includes this information in specification readouts and output shift reports.

3-5. When to Adjust the Calibrator's Uncertainty Specifications

Table 3-1 lists each external standard's uncertainty limit, and the 5700A/5720A Series II uncertainty specifications that must adjusted accordingly if that limit is exceeded.

As long as the external standards have the uncertainties listed in Table 3-1, you do not need to adjust the calibrator's absolute uncertainty specifications in Chapter 1. However, if your standard's uncertainty exceeds the value in the table you must adjust some of the calibrator's absolute uncertainty specifications by the algebraic difference between your standard's uncertainty and the uncertainty limit listed in the Table 3-1. For example, if the dc voltage standard has an uncertainty of ±2.5 ppm, then the 5700A and the 5720A absolute uncertainty specifications listed in Table 3-1 for the traceable quantity of voltage must all be increased by ±1 ppm.

Table 3-1. Standards for Calibrating 5700A/5720A Series II

Fluke Standard	Traceable Quantity	Nominal Value	Uncertainty Limit	5700A/5720A Series II Specifications susceptible to Uncertainty Limit
732B	Voltage	10V	±1.5 ppm	dc volts, ac volts, dc current, ac current
742A-1	Resistance	1Ω	±10 ppm	1Ω, 1.9Ω
742A-10k	Resistance	10 kΩ	±4 ppm	ac current, dc current 10Ω to 100 MΩ

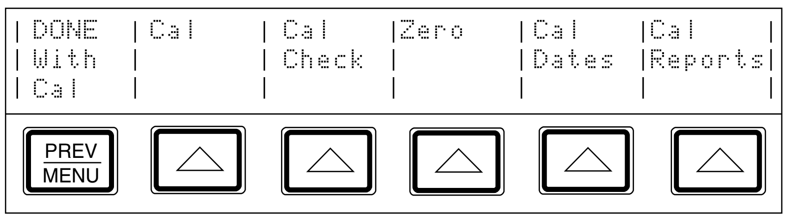
3-6. Calibration Procedure

Before you being this procedure make sure the calibrator is powered on and has completed the appropriate warm-up period.

After you have finished calibration, but before you save the new constants, the calibrator presents the new changes as ± ppm, and as a percentage of specifications for each range and function. A list of changes can be sent to a computer through either the serial or instrument control (IEEE-488) port, or printed through the serial port. The largest proposed change will be displayed on the calibrator's front panel.

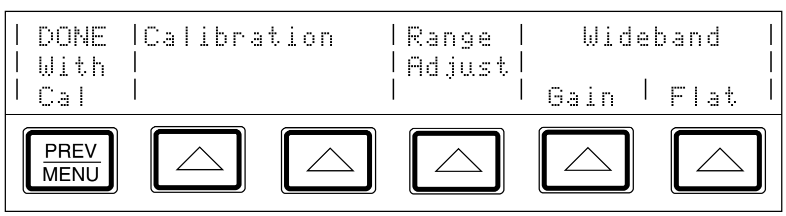
Follow this procedure to calibrate the main output functions.

1. Press the "Setup Menus" softkey; then press the "Cal" softkey. The calibration menu appears as shown below:

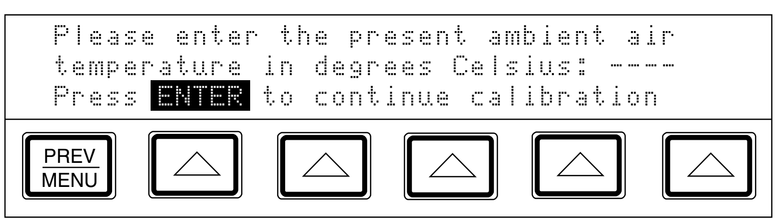


IF3-1.EPS

2. Press the "Cal" softkey. The display shows the following.

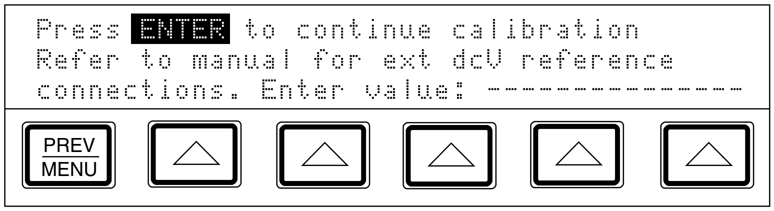


3. To calibrate the main output functions, press one of the softkeys under "Calibration." The display shows the following:



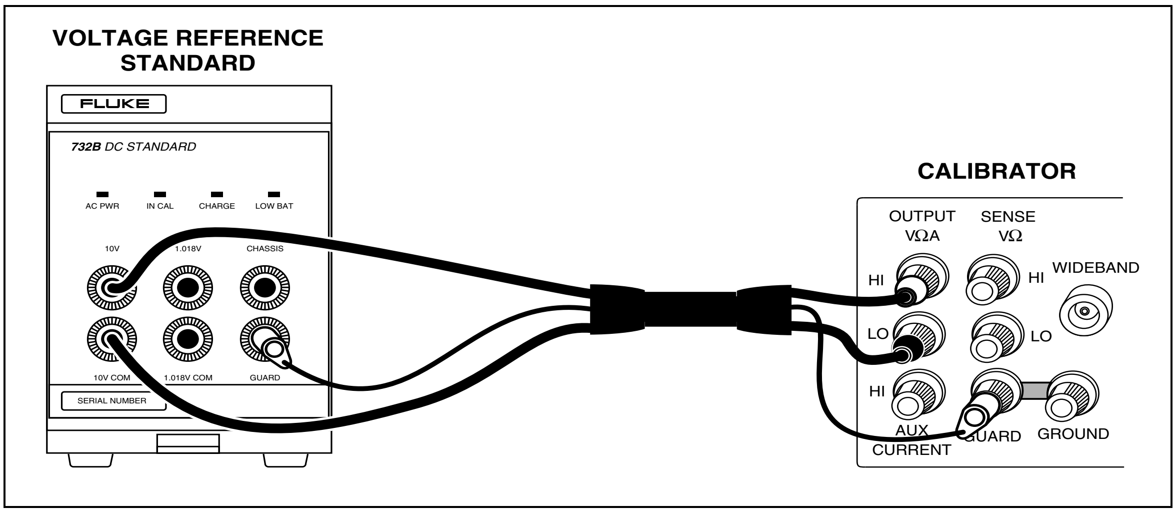
IF3-3.EPS

4. Enter the ambient temperature; then press ENTER. The display shows:



IF3-4.EPS

5. Connect the 732B to the calibrator as shown in Figure 3-1.



F7-3.EPS

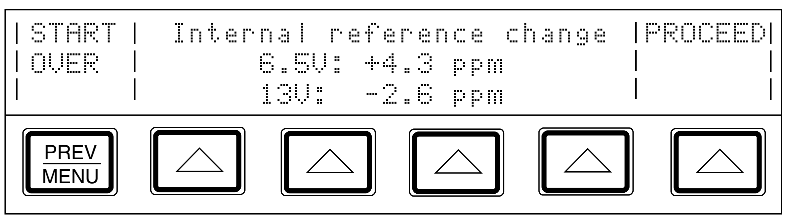
Figure 3-1. 732B External Calibration Connections.

6. Enter the true value of the 732B 10V output. The true value is the value printed on the calibration sticker, plus or minus, as well as drift that has occurred since calibration. That drift can be estimated provided control charts have been maintained for the 732B.

   If the entered value is not between 9V and 11V, and error message appears, which lets you start over from this point with a calibrated 732B. Press ENTER, and the display shows the following:

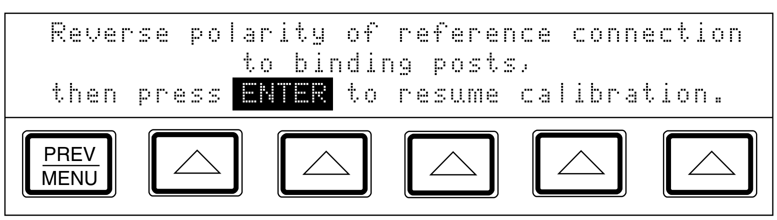
IF3-5.EPS

   When the calibrator's 6.5V and 13V references have been characterized, the display shows the following message, which lets you accept or reject the changes that are about to be made to the calibration constants.



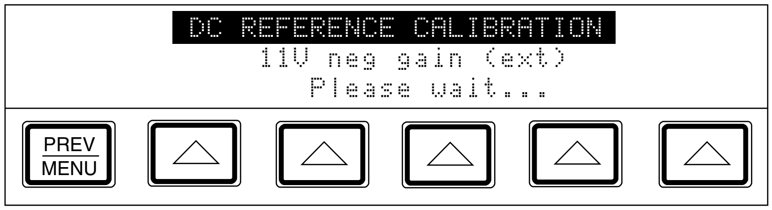
IF3-6.EPS

7. To reject the changes, return to the calibration menu shown in step 2 by pressing PREV MENU. Otherwise, press the softkey under "Proceed" to accept and save the changes, and to open the display shown below, letting you continue with calibration.



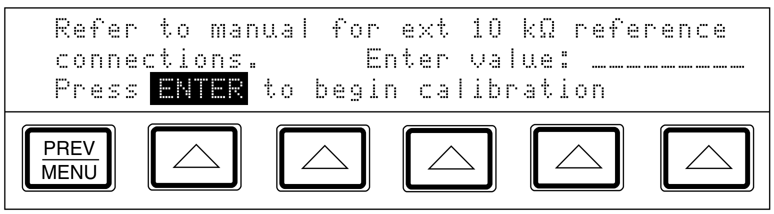
IF3-7.EPS

8. Reverse the HI and LO connections at the 732B terminals, and press ENTER. The following displays appear, asking you to wait before proceeding with the 10 kΩ standard.



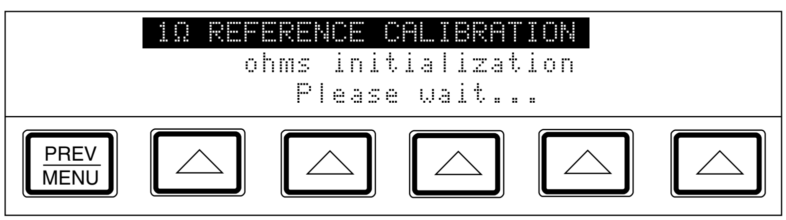
IF3-8.EPS

After a few seconds, the following display appears:



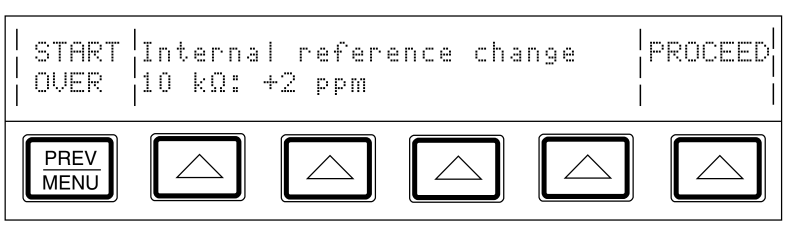
IF3-9.EPS

9. Connect the calibrator to the 10 kΩ standard as shown in Figure 3-2 and enter the true value of the standard. If the standard is not between 9 kΩ and 11 kΩ, an error message appears, which allows you to start over from this point with a different standard. Press ENTER again to open the following display:

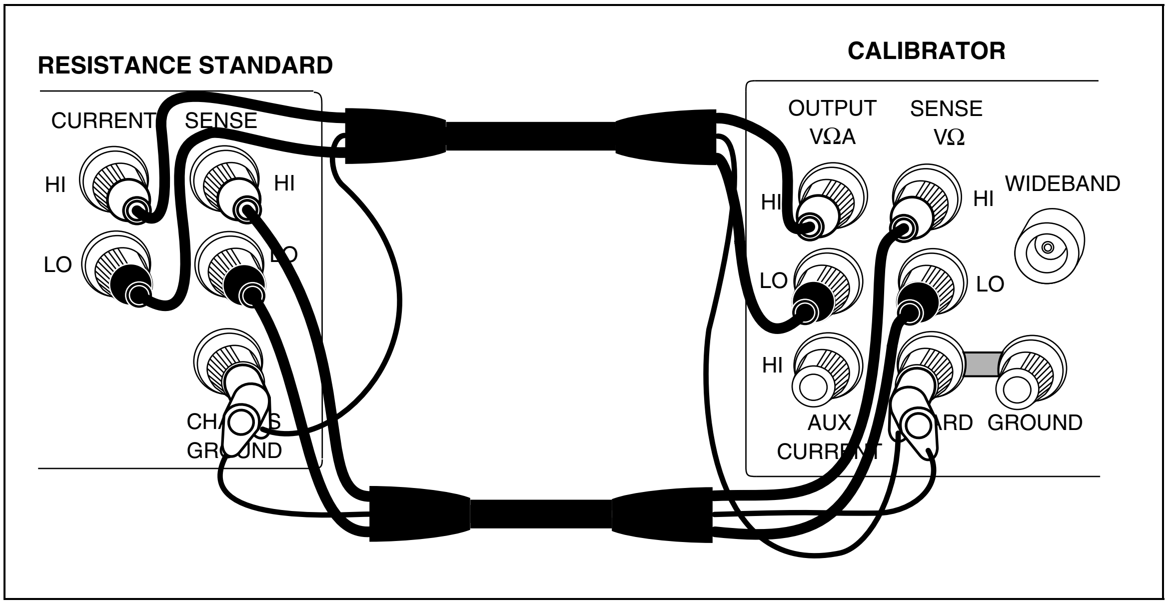


IF3-10.EPS

When the internal 10 kΩ reference has been characterized, the following message appears, which lets you accept or reject the changes that are about to be made to the calibration constant:



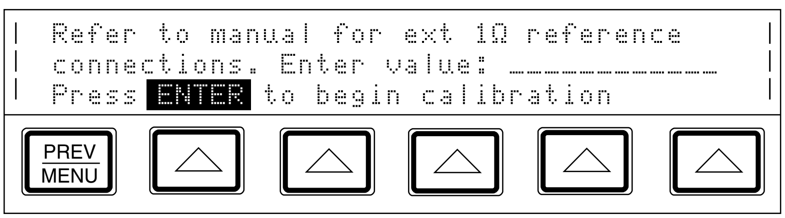
IF3-11.EPS



F7-4.EPS

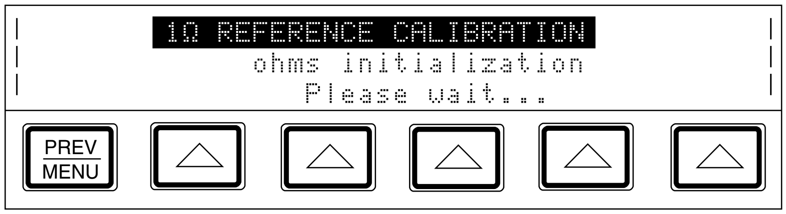
Figure 3-2. 742A-1 and 742A-10k External Calibration Connections

10. To reject the changes, return to the calibration menu shown in step 2 by pressing PREV MENU. Otherwise, press the softkey under "Proceed" to accept and save the changes, and to open the display shown below, letting you continue with calibration.



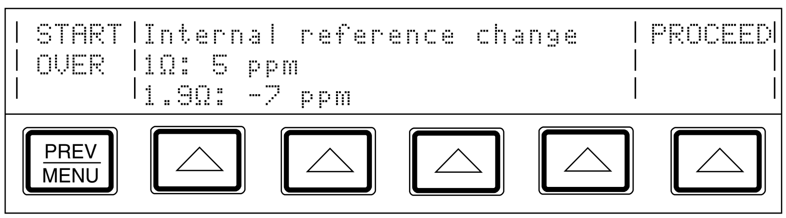
IF3-12.EPS

11. Disconnect the 10 kΩ standard, and connect the calibrator to the 1Ω standard; then enter the true value of the 1Ω standard. If the standard is not between 0.9Ω and 1.1Ω, an error message appears, which lets you start over from this point with another standard. Press ENTER to bring up the following display:



IF3-13.EPS

When the internal 1Ω reference has been characterized, the following message appears, which lets you accept or reject the changes that re about to be made to the calibration constant:



IF3-14.EPS

12. To reject the changes, return to the calibration menu shown in step 2 by pressing PREV MENU. Otherwise, press the softkey under "Proceed" to accept and save the changes, and let the calibrator complete the internal calibration steps.
13. The calibration is not effective until you store the newly calibrated constants in memory. To store the constants, set the rear panel CALIBRATION switch to ENABLE, the press the "Store Values" softkey.

Note

To review the proposed output shifts before you store the new constants, print a listing of the proposed shifts by pressing the softkey under "Print Output Shifts."

14. After you store the constants, press the softkey under "DONE with Cal" to exit calibration and resume normal operation.
15. If you press this softkey before you store the constants, the new constants will be used temporarily for normal operation until the calibrator is powered down or reset. (This is only true for software versions G and lower. For versions H and higher, the process is aborted without updating existing constants.)
16. Set the rear panel CALIBRATION switch to NORMAL.

3-7. Range Calibration

Once calibration is complete, you may find you need to make further adjustments to the range. Calibrating the range is accomplished by adjusting a range constant, which is an additional gain multiplier. Although range calibration is not needed in order to meet total uncertainty specifications, it is useful for tuning the calibrator so that its values are closer to your own standards.

Use your own laboratory standard to adjust the range constants. The following procedure for adjusting the range constants is designed for laboratory standard values that are between 45% and 95% of the range's full-scale value.

Once you adjust the range constant, the new constant remains active until the next calibration, at which time all range constant multipliers are rest to 1. You can also erase all range adjustments by calling up the format EEPROM menu and selecting Range Constants (refer to Chapter 4 of the *5700A/5720A Operators Manual*).

Before you begin the following procedure, make sure you have the equipment you need on hand including your own laboratory standards where required.

The following example procedure adjusts the 220V dc range constant using the following equipment:

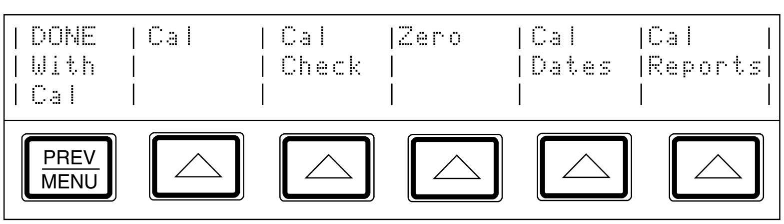
- 732B DC reference standard
- 752A Reference Divider
- 845AB/845AR Null Detector
- Low Thermal Test Leads: 5440A-7002 (banana plugs) or 5440A-7003 (spade lugs)

⚠⚠Warning

Operator accessible LETHAL VOLTAGES may be present on the lugs at the end of the 5440A-7003 cables when used with instrumentation capable of producing such voltages. These cables should be used only when thermal emf performance is required. For other applications, cables with operator protection form contact with high voltages should be used.

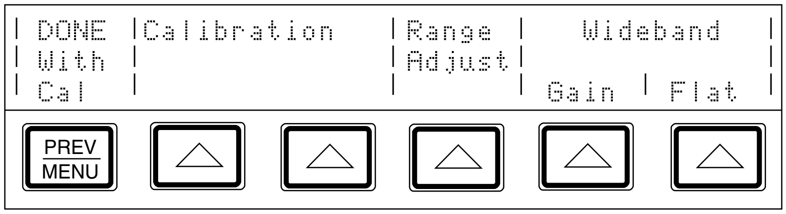
Proceed as follows to adjust the 220V dc range constant. You must have completed calibration to external standards before you follow this procedure.

1. Press the "Setup Menus" softkey; the press the "Cal" softkey. The following menu appears:



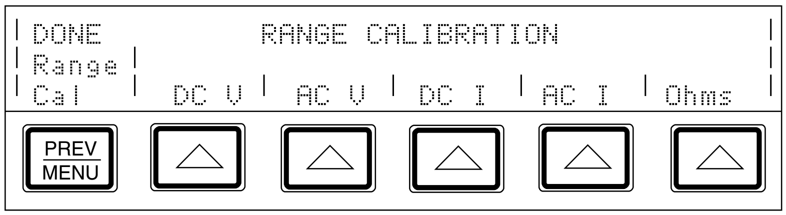
IF3-1.EPS

2. Press the "Cal" softkey to bring up the next menu shown below:



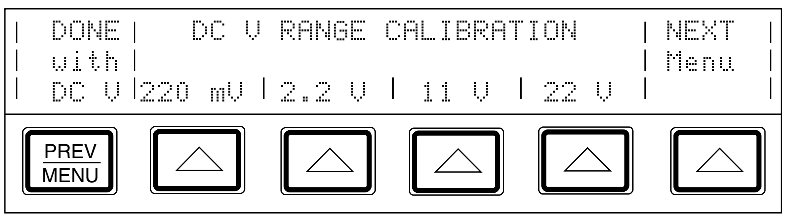
IF3-2.EPS

3. Press the “Range Adjust” softkey to bring up the next menu shown below:



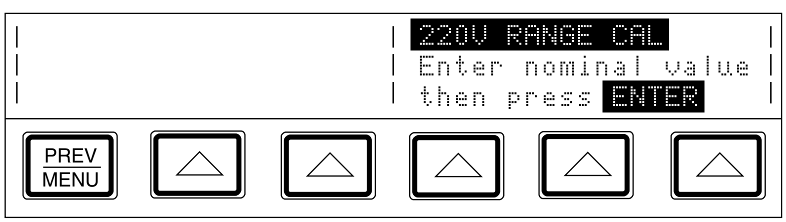
IF3-18.EPS

4. Press the “DC V” softkey to bring up the next menu shown below:



IF3-19.EPS

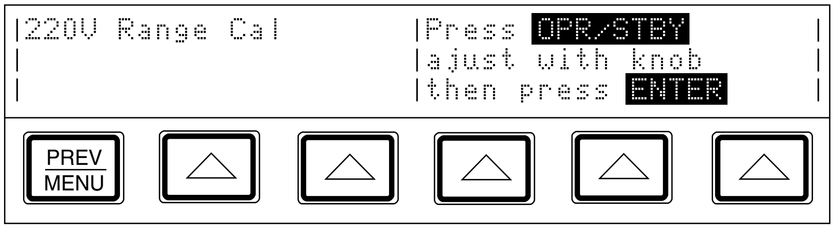
5. Press the “NEXT Menu” softkey, which scrolls through all the available dc voltage ranges, until 220V appears. Then press that selection’s softkey to open a display similar to the following:



IF3-20.EPS

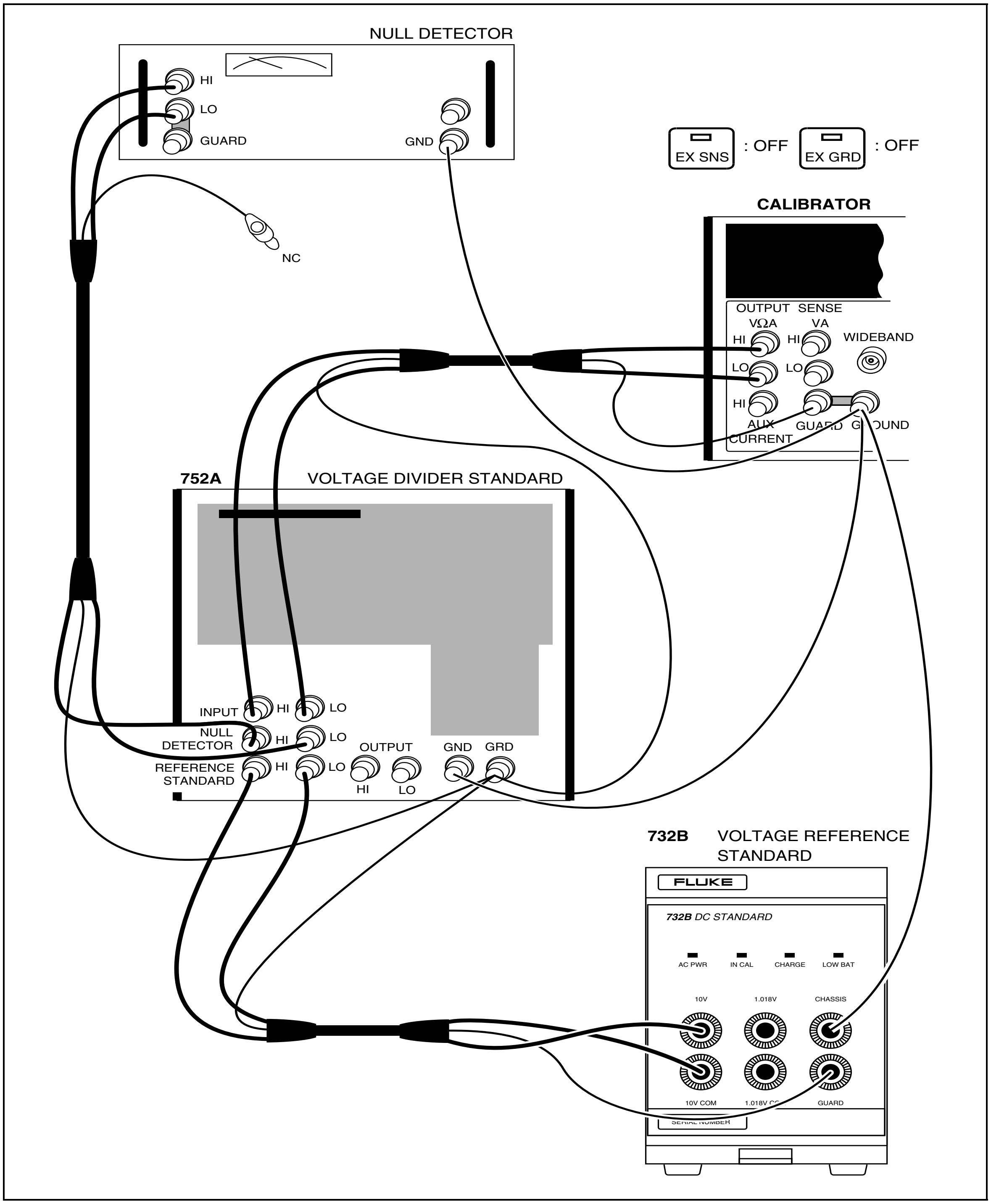
6. Connect the 732B, null detector, and 752A in a 10:1 configuration, as shown in Figure 3-3.

7. Multiply the 732B’s value by 10, and enter this new value. (This value is the output of the 752A, to which you will null the calibrator’s output.) Then press ENTER to bring up the following display.



IF057.EPS

8. Press OPR/STBY to activate the calibrator output. Then turn the output adjustment knob on the calibrator until you achieve a null on the null detector.
9. Se the rear panel CALIBRATION switch to ENABLE. Press ENTER on the front panel. The calibrator will now calculate a new range constant multiplier for the 220V dc range, and will store it in non-volatile memory.
10. The range calibration is now complete. Set the rear panel CALIBRATION switch to the NORMAL position, disconnect the external standards, and press RESET to reset the calibrator to its newly calibrated ranges.



F7-6.EPS

Figure 3-3. 220V DC Range Calibration Connections

3-8. Calibrating the Wideband AC Module (Option 5700A-03)

The Wideband AC Module (Option 5700A-03) can be installed in either the 5720A or 5700A Series II calibrator. The module needs to be calibrated for both gain and flatness. The gain should be calibrated when the 5700A-03 main output functions undergo their routine calibration.

Since frequency flatness is determined by stable parameters (i.e. circuit geometry and dielectric constants), the flatness of the Wideband AC Module has excellent long-term stability. Consequently, a two-year calibration cycle is adequate for flatness calibration, and can be scheduled to coincide with the calibrator's shipment to a standards laboratory for periodic verification.

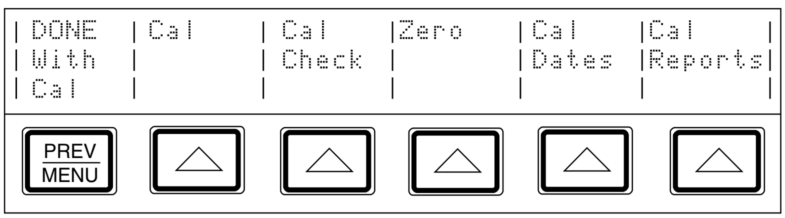
The following procedure describes how to perform the wideband gain calibration.

Note

To perform this procedure you will need, in addition to the standard equipment supplied with the wideband option, a Type "N" female to double banana plug adapter (e.g., Pomona 1740).

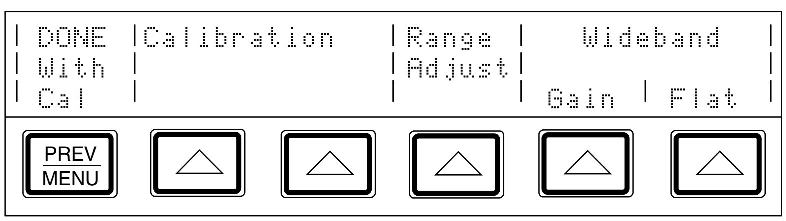
Before you start this procedure, make sure the calibrator is powered on and has completed an appropriate warm-up period. Then proceed with this procedure to calibrate the wideband gain.

1. Press the "Setup Menus" softkey; then press the "Cal" softkey to being up the menu shown below:



IF3-1.EPS

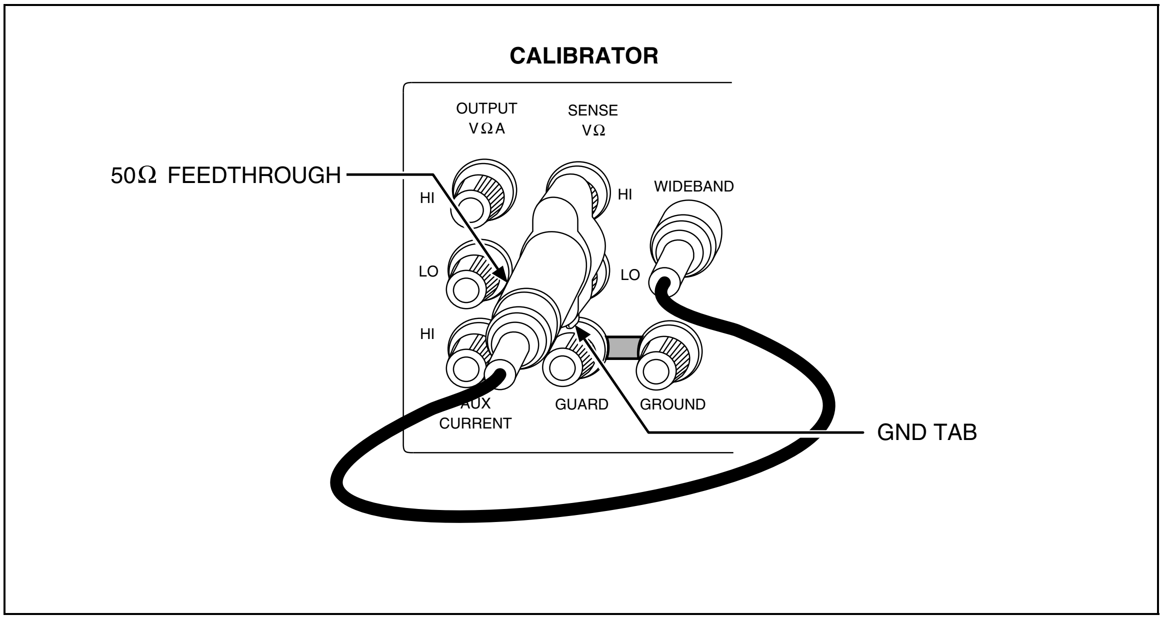
2. Press the "Cal " softkey to bring up the following menu:



IF3-2.EPS

3. Connect the wideband output cable between the WIDEBAND connector and the SENSE binding post.

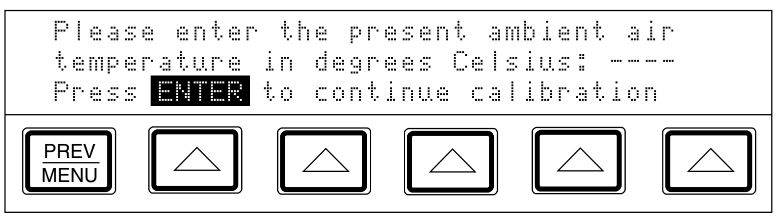
   The center conductor of the 50Ω feedthrough should go to SENSE HI and shown in Figure 3-4. The GND tab on the adapter should be on the LO side.



F7-5.EPS

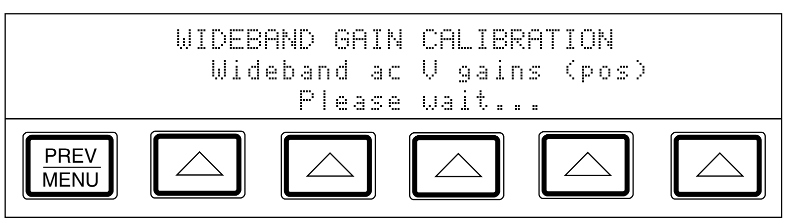
Figure 3-4. Wideband Module Calibration Connection

4. Press the "Gain" softkey to bring up the following display:



IF3-3.EPS

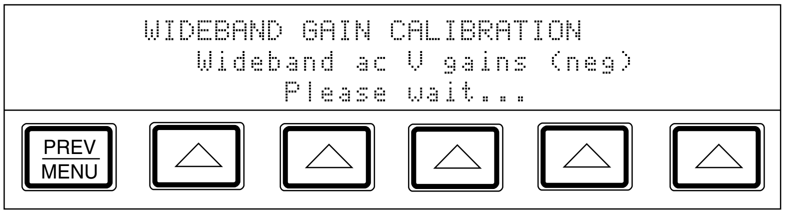
5. Enter the ambient temperature; the press ENTER. The display shows the following:



IF3-15.EPS

As the wideband calibration proceeds, messages appear on the display identifying all processes as they are encountered. When positive gains calibration is complete, a message appears telling you to refer to the manual for negative gains connections.

6. Reverse the dual-banana connector so that the center connector is connected to LO; then press ENTER. The display shows the following:



IF3-16.EPS

After a short time, a message appears indicating that the wideband calibration is complete.

7. To store the new constants, set the CALIBRATION switch to ENABLE and press "Store Values." To discard the constants, press "DONE with Cal" and answer "YES" when the display asks for verification.
8. You have now completed the wideband gain calibration. Set the CALIBRATION switch to NORMAL, disconnect the wideband cable, and press RESET.

3-9. Performing a Calibration Check

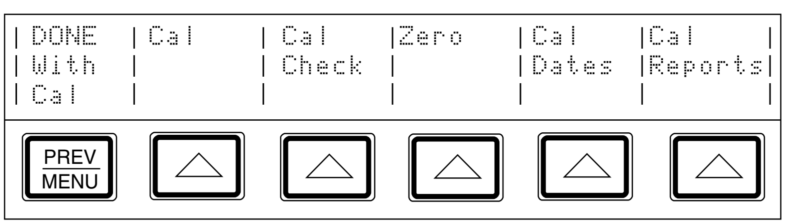
A calibration check is similar to the calibration, with the primary difference being that no changes are made to the stored constants, and the internal check standards are used as the reference points. A calibration check produces a report similar to the normal calibration report, and shows any proposed changes.

This procedure can be performed from an external computer, and can be set to run automatically, with no assistance (there is no need to enable the CALIBRATION switch, since no constants are changed).

You can use the calibration check at any time to confirm the integrity of the calibrator without connecting external standards. The calibration check is also useful for collecting a performance history.

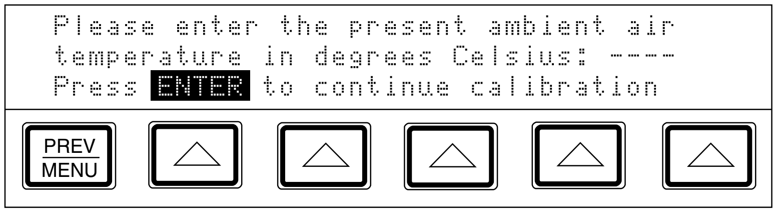
Before you begin this procedure, make sure the calibrator is powered on and has completed the appropriate warm-up period. Then follow this procedure to check the calibration.

1. Press the "Setup Menu" softkey; then press the "Cal" softkey to bring up the following menu:



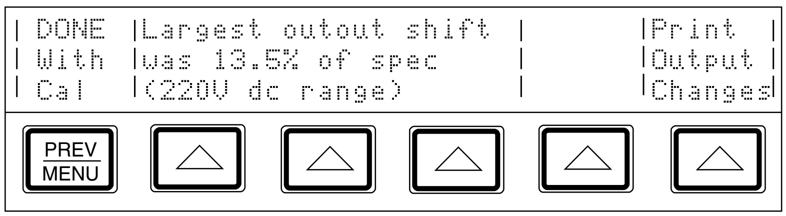
IF3-1.EPS

2. Press the "Cal Check" softkey to bring up the following display:



IF3-3.EPS

3. Enter the ambient temperature; then press ENTER. As the calibration check proceeds, the display indicates the current process of the calibration check. When the check is complete, the largest shift that is detected appears on the display.



IF3-17.EPS

4. You can now print a list of the proposed shifts, or quit without creating a list.

   To print the report, connect a printer and set up the serial interface as described in Chapter 6 of the *5700A/5720A Operators Manual*. Press the softkey under “Print Output Changes.” To return to normal operation without printing, press the softkey under “DONE with check.”

   Press PREV MENU to exit the calibration menus.

3-10. Full Verification

An independent external verification is recommended every two years, following normal periodic calibration or repair of the calibrator. Verification establishes and maintains parallel external traceability paths for the internal functions that are not adjusted or corrected during calibration. An example is the internal ac/dc transfer standard. Verification also serves as a check that internal calibration processes are in control.

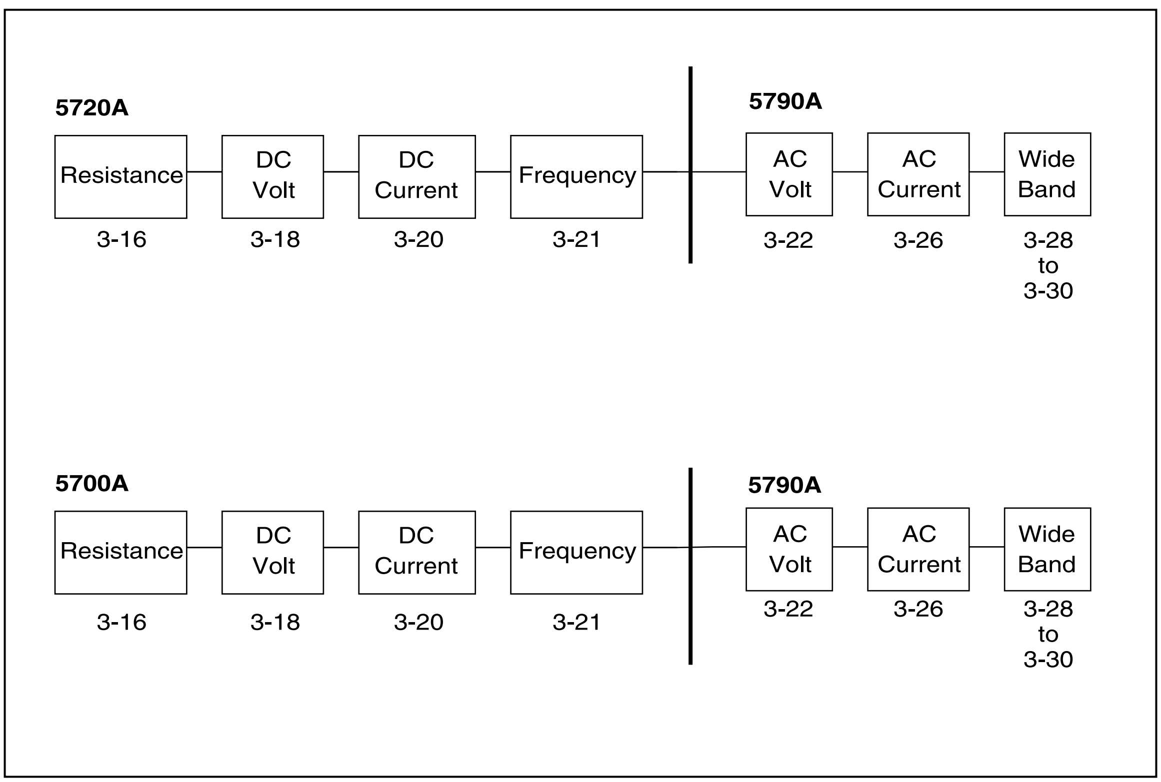
Note

All performance limits specified in the test records apply to 90-day specifications for the Calibrator. If limits to other specifications are desired, the test records must be modified. A description of how to determine a guardband test limits is included in this section.

Note

Equivalent equipment and methods, either manual or automated, may be substituted for the following verification tests as long as the same points are tested, and equipment and standards used are at least as accurate as those specified. If standards are less accurate than specified, appropriate tolerance limit and/or accuracy reductions must be made to achieve equivalent results.

Not all of the procedures contained in this chapter need to be performed to verify your calibrator. This chapter contains the verification procedures for the 5720A and the 5700A Series II Calibrators. In addition, procedures are provided to verify the ac functions of the calibrator with a 5790A. The following roadmap provides a high-level overview of the verification tests discussed in this chapter.



F0-0.EPS

Figure 3-5. Overview of Verification Tests

In Figure 3-5, the location of each test is identified by the paragraph numbers.

3-11. Required Equipment for All Tests

An abbreviated summary of required equipment for all the verification and optional tests is given in Table 3-2. Individual lists of required equipment are included at the beginning of each test. For substitution information, refer to Table 3-15, Minimum Use Requirements, located near the end of this section.

3-12. Warm-up Procedure for All Verification Tests

Before performing verification, do the following preliminary steps:

1. Verify that the Calibrator has warmed up for at least thirty minutes.

   Note

   If the Calibrator has been powered off in an environment outside of operating environment specifications, particularly with humidity above 70%, allow a minimum of two hours warm-up. Extended storage at high temperatures and humidity may require up to four days of power-on stabilization.

2. If you are doing a regularly scheduled full verification as recommended by Fluke, calibrate the 5700A/5720A Series II as previously described before continuing with verification.
3. Ensure that each piece of external test equipment has satisfied its specified warm-up requirements.
4. Ensure that the Calibrator is in standby (STANDBY annunciation lit).

Table 3-2. List of Required Equipment for Main Output

Equipment	Description	Application
AC Measurement Standard or	Fluke 5790A	ACV, ACI
Resistance Standards	Fluke 742A Series	Cal, Ohms, DCI
Reference Divider	Fluke 752A	DC V
Null Detector	EM Electronics N11 (Fluke 845A)	DC V
Shunt Adapter	Fluke 792A-7004	AC I
Calibrator	Fluke 55X0A	Ohms
Frequency Counter	Philips PM6669	Frequency
Shunts	Fluke A40 Series	AC I
High Current Shunt	Fluke Y5020	DC I
Resistance Standard	L&N 0.1Ω 4221B	DC I
DMM	Wavetek 1281 or HP 3458A	Ohms, DCI, ACI, AC V
Low Thermal Cables	Fluke 5440A-7002 (5700A) or 5440A-7003 (5720A or 5700A)	Various
Equipment Required for Wideband Ac Module (Option 5700-03) Verification		
Equipment	**Description**	**Application**
AC Measurement Standard	Fluke 5790A with Wideband Option -03	Wideband
Wideband Cable (supplied with 5700A-03)	Fluke Cable	Wideband
50Ω Termination (supplied with 5700A-03)	Fluke Termination	Wideband
Adapter (supplied with 5700A-03)	Pomona 1269 BNC(F) to dual banana plug	Wideband
Adapter	Kings KN-99-46 N(F) to BNC(M)	Wideband
Equipment Required for Optional Tests		
Equipment	**Description**	**Application**
Oscilloscope Mainframe	Tektronix 7000 Series	HF Noise
Differential Amplifier	Tektronix 7A22	HF Noise
Distortion Analyzer	Krohn-Hite 6900B	AC V, ACI, Distortion
Spectrum Analyzer	HP 8590A	AC V, Wideband Distortion
Kelvin Varley Divider	Fluke 720A	DC V Linearity

3-13. Resistance Verification Test

The following test requires testing at the high, low and intermediate values only. This is because the 5700A/5720A Series II creates the other values of resistance from these values. Use Tables 3-16 (5720A) and 3-17 (5700A) for test records. For the convenience of anyone wishing to test the intermediate values, the tolerance limits are included. Testing these values could be done using a Hamon-type ratio device and a very stable, high-resolution bridge or DMM, or a combination of the two. Table 3-3 lists equipment required for this test. See Table 3-15, Minimum Use Requirements, for substitution information.

Table 3-3. Equipment Required for Resistance Testing

Equipment	Decsription
Resistance Standards	Fluke 742A Series in the following values: 1Ω, 1.9Ω, 10Ω, 10 kΩ, 19 kΩ, 10 MΩ, and 19 MΩ
Current Source	Fluke 5500A or 5520A
DMM	Wavetek 1281 or HP 3458A

1. Connect the equipment as shown in Figure 3-6.
2. Set the Calibrator output to 1Ω with external sensing (EX SENS indicator lit) and set the dc DMM to read dc V. Record the 1Ω resistance standard value on the test record as the 1Ω STD RES VALUE.
3. Multiply the certified value of the 1Ω resistance standard by 0.1 and record the result on the test record as the 1Ω STD VOLTAGE.
4. Connect the DMM across the sense terminals of the 1Ω resistance standard.
5. Set the direct current source for a nominal 100 mA output. Vary the source until the DMM reading is as close as possible to the 1Ω Standard Voltage recorded in the previous step. Record the DMM voltage reading on the test record as the MEASURED 1Ω STD VOLTAGE.

Note

If the current source used has the resolution to achieve a voltage reading to within ±5 ppm of the value in step 3, it is not necessary to calculate the cal current in take next step. In this case, when you come to step 9 you will simply multiply the voltage reading from step 9 by a factor of 10, which is the same as dividing by 100 mA (0.1A).

6. Calculate the exact current by dividing the MEASURED 1Ω STD VOLTAGE by the 1Ω STD RES VALUE; record the result on the test record as the CAL CURRENT.
7. Enter the Calibrator displayed 1Ω value on the test record as the UUT 1Ω DISPLAYED VALUE.
8. Transfer the dc DMM leads to the Calibrator sense terminals.
9. Enter the DMM voltage reading on the test record as the UUT 1Ω VOLTAGE.
10. Calculate the UUT true 1Ω resistance by dividing the UUT 1Ω VOLTAGE by the CAL CURRENT.
11. Adjust the output adjustment knob for a UUT Control Display reading equal to the true 1Ω resistance value calculated in the previous step. The error from the displayed value is also shown on the Control Display. Enter the value of the error on the test record as the UUT DEVIATION FROM DISPLAYED VALUE.

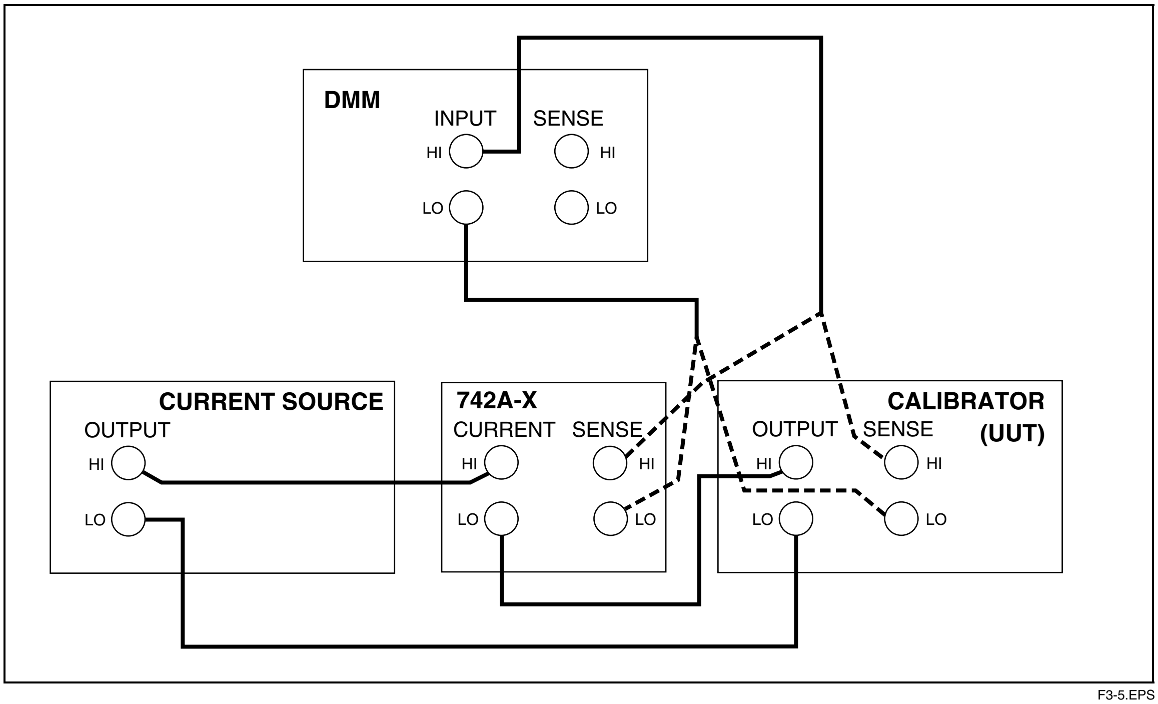


Figure 3-6. 1 Ohm and 10 Ohm Resistor Verification

Note

There is no need to do the cal current calculation of step 6 if the current source has a settability of ±3 ppm.

12. Repeat steps 3 through 11 for the 1.9Ω and 10Ω resistance values using the 1.9Ω and 10Ω resistance standards. At the 10 ohm check, use 10 mA of current and a multiplier for step 3 of 0.01.
13. The low-value (1Ω, 1.9Ω, and 10Ω) tests are summarized in Table 3-4.

Table 3-4. Low Value Resistance Calibration Using a Current Source

5720A (UUT) Resistance	Apply Current	5720A Deviation From Displayed Value (90-day)	5720A Displayed Value
1Ω	100 mA	±95 ppm	0.9995 to 1.0005
1.9Ω	100 mA	±95 ppm	1.89905 to 1.90095
10Ω	10 mA	±25.0 ppm	9.997 to 10.003
5700A (UUT) Resistance	**Apply Current**	**5700A Deviation From Displayed Value (90-day)**	**5700A Displayed Value**
1Ω	100 mA	±95 ppm	0.9995 to 1.0005
1.9Ω	100 mA	±95 ppm	1.89905 to 1.90095
10Ω	10 mA	±28.0 ppm	9.997 to 10.003

14. For the remaining tests, no current source is required. Verify that each true UUT value is within the limits shown in Table 3-16 for 5700A and Table 3-17 for 5720A.
    a. Connect the DMM, set for 4-wire resistance, first to the Resistance Standard equal to the UUT nominal output and then to the UUT itself. In each case, record the resistance standard DMM reading and the resistance standard certified value.
    b. Calculate the DMM correction by subtracting the DMM reading from the certified value; enter this calculated value on the test record as DMM ERROR.
    c. Move the DMM to the UUT terminals; enter the DMM reading on the test record as DMM UUT RES RDG.
    d. Algebraically add the DMM ERROR and the DMM UUT RES RDG; enter the sum on the test record as UUT TRUE RES VALUE.
    e. Adjust the output adjustment knob for a UUT Control Display reading equal to the true resistance value previously calculated. The error from the displayed value is also shown on the Control Display. Enter this error (with polarity reversed) on the test record as the UUT DEVIATION FROM DISPLAYED VALUE.

3-14. Two-Wire Compensation Verification

Use the following steps to verify that two-wire compensation operates correctly:

1. Connect the UUT (output set to 100Ω, with external sensing) to the DMM (set for 4-wire resistance measurement). Note the DMM reading.
2. Connect two shorts: DMM SOURCE HI to SENSE HI and DMM SOURCE LO to SENSE LO.
3. Activate UUT 2-wire compensation.
4. Check that the DMM reading returns to within 4 miliohms of the reading noted in step 1.

3-15. DC Voltage Verification Test

The following test checks every dc voltage range by testing the output accuracy at decade values of voltage from 100 mV to 1000V. Use Table 3-18 (5720A) or Table 3-19 (5700) for the test record. Table 3-5 lists equipment required for this test as well as the Linearity Test that follows. See Table 3-15, Minimum Use Requirements, for equipment substitution information.

Table 3-5. Equipment Required for DC Voltage Testing

Equipment	Model
DC Reference Standard	Fluke 732B
Reference Divider	Fluke 752A
Null Detector	EM Electronics 11 (Fluke 845A)
Low Thermal Cables	5440A-7002
	5440A-7003

Note

The 5440A-7002 or 5440A-7003 is for the 5700A; the 5720A uses only the 5440A-7003.

Proceed as follows to perform the dc voltage verification test:

1. Self-calibrate the reference divider in accordance with its instruction manual prior to proceeding.
2. Connect the equipment as shown in Figure 3-3.
3. Set the reference divider to 0.1V. Set the Calibrator to the certified value of the dc reference standard divided by 100. For example, if the certified value of the dc reference standard is 10.000007V, set the Calibrator to 100.00007 mV.
4. Press OPR/STBY. After the reading has settled, verify that the null detector reads 0V ±1.20 μV (5720A 90-day specification) or 0V ±1.45 μV (5700A 90-day specification). Set the Calibrator to standby.
5. Repeat the above process to test each dc voltage range output listed in Tables 3-23 or 3-24. (0.1V is in the table for completeness; you do not need to repeat it.) After the null detector reading stabilizes, ensure that any observed meter rattle (over and above the null detector rattle in the "zero" position) over a ten-second period does not exceed the amount shown in the last column. In each case, set the 5720A to standby before changing to the next voltage settings and go back to operate before reading the null detector.
6. Reverse the connections of the dc reference standard at the reference divider and repeat the previous measurement process for the -0.1V, -1V and -10V outputs.

3-16. DC Voltage One-Tenth Scale Linearity Test

Note

If the result of the previous test at 1V on the 11V range was less than 2.5 μV it is not necessary to perform this test.

This test uses the same equipment as the previous test. Proceed as follows to perform the DC Voltage One-Tenth Scale Linearity Test:

1. Set the reference divider range to 10V. On the voltage reference standard, remove the lead from the 10V high terminal and connect it under the binding post of the low terminal along with the low lead to provide a 0V reference input to the reference divider. Set the Calibrator output for 10V, then activate range lock for the 11V range. Now set the Calibrator to 0V OPERATE.
2. Note the reading on the null detector. Press OFFSET on the Calibrator. Return the lead on the voltage reference to the high output terminal.
3. Set the Calibrator to 10V. Use the Calibrator output adjustment knob to obtain the reading previously noted on the null detector. Press SCALE on the Calibrator.
4. Set the Calibrator to 1V dc. Set the reference divider to the 1V range, and verify that the null detector indicates less than 2.5 μV from the noted reading.
5. Press RESET on the Calibrator. This completes the DC Voltage Calibration Verification testing.

3-17. Direct Current Accuracy Verification Test

Equipment required for the Direct Current Accuracy Verification Test is listed in Table 3-6. Proceed as follows to test accuracy of the dc current function:

Table 3-6. Equipment Required for Direct Current Test

Equipment	Model
DC DMM, 6-1/2 digit	Wavetek 1281 or HP 3458A
High-Current Shunt	Fluke Y5020 (for 5725A only)
Resistance Standards	L&N 4221B (0.1Ω at 2A)
	Fluke 742A-1 (1Ω at 200 mA)
	Fluke 742A-10 (10Ω at 20 mA)
	Fluke 742A-1k (1 kΩ at 2 mA)
	Fluke 742A-10k (10 kΩ at 200 μA)

Use Table 3-20 (5720A) and Table 3-21 (5700A) for the test records.

1. Connect the dc DMM to the Calibrator output and set the Calibrator for outputs of 200 mV, -200 mV, 2V, and -2V, and record the dc DMM reading at each voltage in Table 3-20 or 3-21.

2. Refer to the resistance standard test report and enter the corrections for all the certified values in ± ppm in column A on the test record.

Note

The STD RES CORRECTION is the difference between the nominal standard resistor value and the certified or true resistor value. For example, if the nominal value is 0.1Ω and the certified value is 0.0999963Ω, the difference equals 0.0000037Ω, or +37 ppm.

3. Connect the equipment as shown in Figure 3-8 using the L&N 0.1Ω resistor.

4. Set the Calibrator for a 2A dc output, and adjust the Calibrator using the output adjustment knob to obtain the characterized voltage reading on the dc DMM. Wait 3 seconds, and record the Calibrator error display reading in ± ppm (Column B).

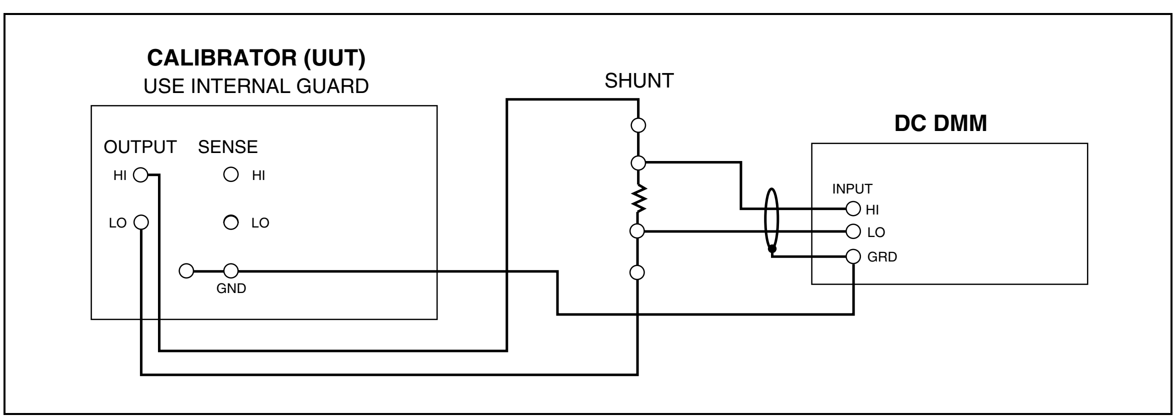


Figure 3-7. Direct Current Accuracy Test Setup

5. Algebraically add column B to column A. Enter the result on the test record. Verify that it is within the test limits shown.
6. Repeat steps 2 through 5 using the Fluke 742A Resistance Standards and Calibrator output currents shown in Tables 3-25 or 3-26.
7. If the Calibrator is attached to a 5725A Amplifier, connect the Y5020 high-current shunt to the 5725A output terminals. Connect the dc DMM to the Y5020 high-current shunt voltage output connector.
8. Set the Calibrator to 10A, -10A, 5A, 3A and -3A and record the dc DMM readings on the 5725A Amplifier dc current test record. Divide these readings by the certified value of the Y5020 high current shunt, record the resultant current and verify that it is within the test limit shown.

3-18. AC Voltage Frequency Accuracy Test

This test requires the use of a frequency counter. Philips model PM6669 is recommended. Use Table 3-22 for the test record. When using Philips Model PM 6666, it is recommended to use a 1 MHz Low Pass Filter as shown in Figure 3-10. Refer to Table 3-15, Minimum Use Requirements, for substitution information.

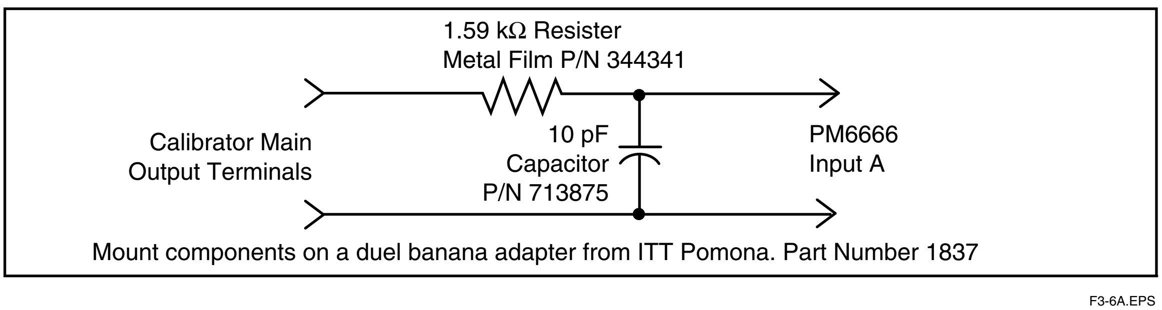


Figure 3-8. 1 MHz Low Pass Filter

To check the Calibrator frequency accuracy, proceed as follows:

1. Connect the frequency counter to the output terminals of the Calibrator.
2. Set the Calibrator to 1V at the output frequencies listed in Table 3-22. Verify that the counter reads within the limits shown on the test record.
3. Disconnect the counter from the Calibrator.

3-19. Output Level Tests For AC V Ranges

This test requires the use of equipment listed in Table 3-7.

Table 3-7. Equipment Required for AC V Output Level Tests

Equipment	Model
AC Measurement Standard	Fluke 5790A
BNC(F) to Dual-Banana Plug Adapter (2 required)	Pomona 1269
Coax Cable - RG-58A/U or RG-58C/U with BNC(M) Connectors, 12 ± 1 inch Long	

Use Table 3-23 (5720A) or Table 3-24 (5700A) for the test records.

1. Place the 5790A on top of the Calibrator and connect the equipment as shown in Figure 3-9.

Note

The point of measurement is at the end of the cable and adapter that connects to the 5790A. Other cable lengths and adapters will yield different results at high frequencies.

2. On the 5790A push UTIL MENUS button and then the MEAS CONTROL softkey. Set the digital filter mode to FAST and the restart to MEDIUM. Push the DONE soft key twice to return to the measurement display.
3. Set the 5790A to 2 mV at 1 kHz. Adjust the Calibrator using the output adjustment knob for a reading of 2.0000 mV ±1 count on the 5790A. Record the Calibrator error display reading in the 90 Day column in Table 3-23 (5720A) or 3-24 (5700A) as appropriate for the verification interval.
4. Verify that the result is within the test limits.
5. Repeat the previous steps for the 2 mV output on all remaining frequencies on the test record.
6. Proceed to the remaining output levels and frequencies list in Table 3-23 or 3-24 and repeat steps 3 through 5 using the appropriate output level in each step, and the adjustment tolerance in Table 3-8.

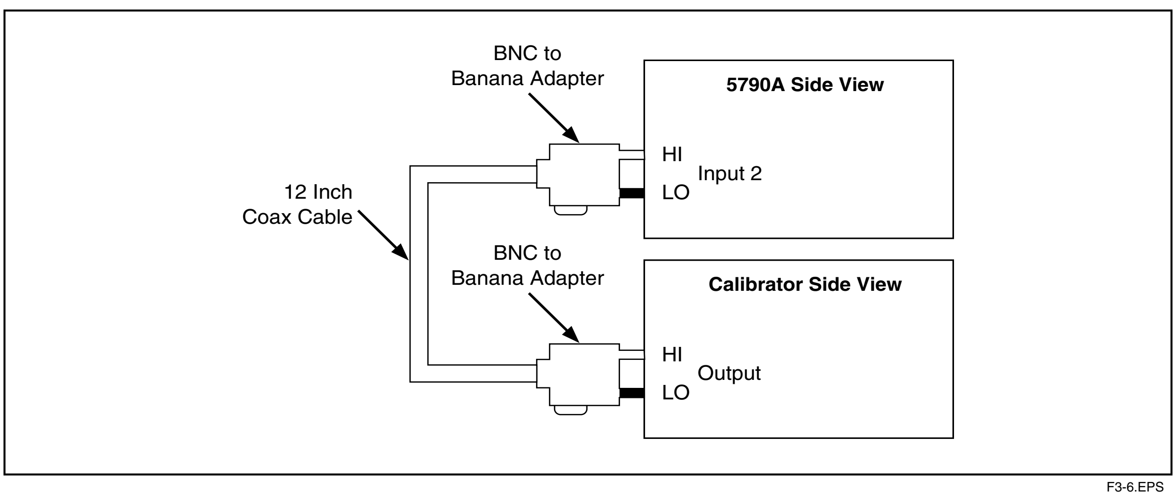


Figure 3-9. AC Voltage Test Setup

Table 3-8. 5790A Adjustment Counts

5700A/5720A Series II Output Level	5790A Display	5790A Adjustment Counts*
2 mV	2.0000	±1
20 mV	20.0000	±1
200 mV	200.0000	±4
2V	2.000000	±4
2.3V	2.30000	±1
20V	20.00000	±4
200V	200.0000	±4
300V	300.000	±1
600V	600.000	±2
1000V	1000.000	±2
*Adjustment counts of 3 times the listed value is allowed at 1 MHz		

3-20. AC Current Test, 22 mA to 11A Ranges

This test requires the use of equipment listed in Table 3-9, when using the 5790A Input 1. Use Tables 3-33 (5720A) or 3-34 (5700A) for a test record.

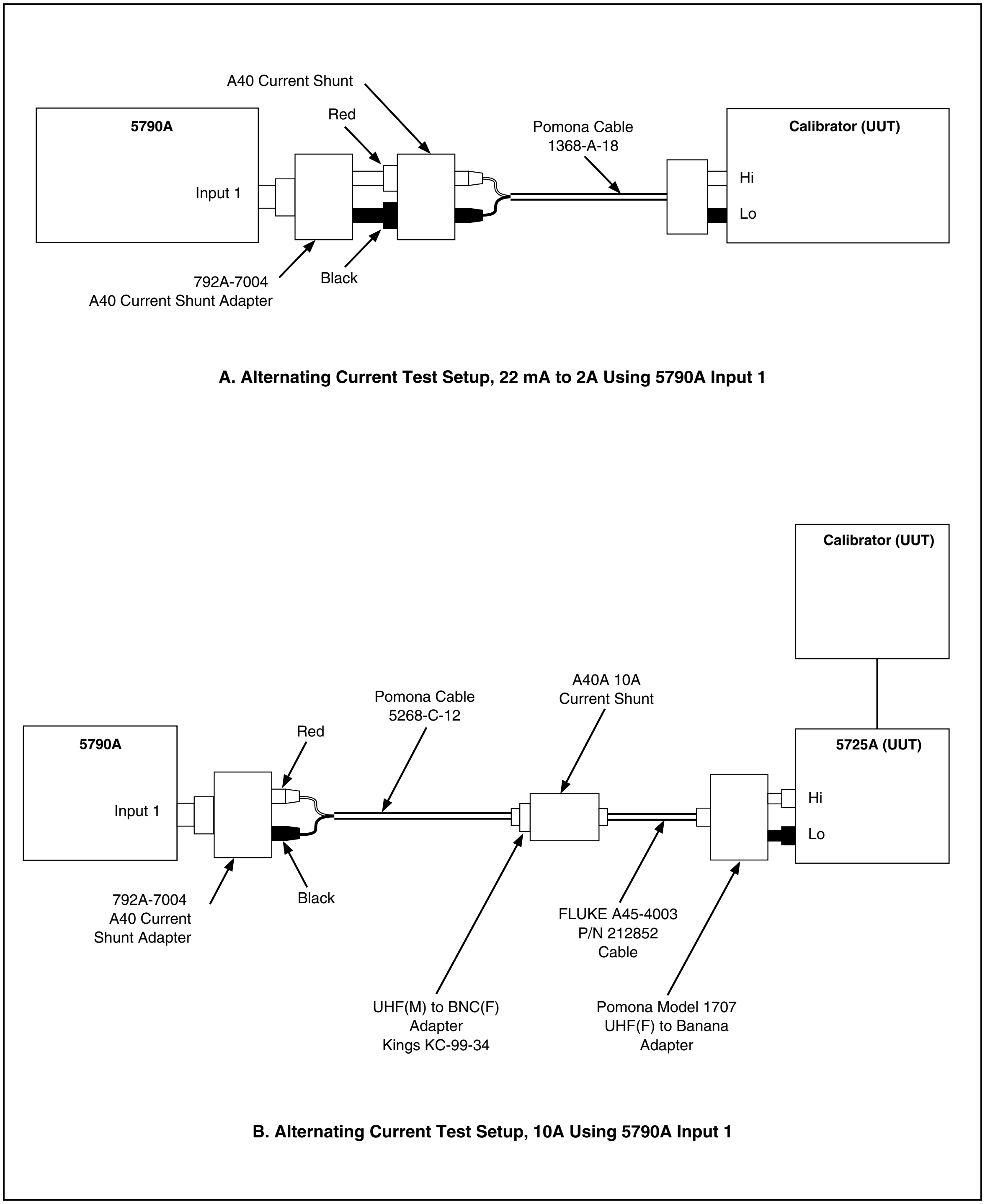
Table 3-9. Equipment Required for 22 mA to 11A Alternating Current Test Using the 5790A Input 1

Equipment	Model or Description
AC Measurement standard	Fluke 5790A
Current Shunts	Fluke A40 Series: 20 mA, 200 mA, 2A, and A40A Series: 10A (if verifying a 5725A) , with AC-DC difference corrections.
Current Shunt Adapter	Fluke 792A-7004 A40 current shunt adapter
Cable	Pomona 1368-A-18. Double banana to single banana plugs.
Cable (For 10A Setup)	Pomona 5268-C-12. BNC(M) to single banana plugs.
Cable (For 10A Setup)	Fluke A45-4003 (PN 212853) UHF(M) to UHF(M) with RG8A/U cable
Adapter (For 10A Setup)	Pomona Model 1707. UHF(F) to banana adapter.
Adapter (For 10A Setup)	Kings KC-99-34 UHF(M) to BNC(F)
Adapter (For 10A Setup)	Pomona Model 1707. UHF(F) to banana adapter.

1. Connect the equipment as shown in Figure 3-10(A) use the 2A shunt.
2. Enter the ac to dc difference corrections for each shunt at each frequency in the appropriate column of the test record (Table 3-26 or 3-27).
3. Set the Calibrator for a +2A dc output. Adjust the output so that the error display is equal to the UUT actual error for a +2A output, as shown on the dc current test record in Table 3-20 (5720A) or Table 3-21 (5700A).
4. Push the INPUT 1 button on the 5790A if you are using the INPUT 1 setup, or the SHUNT button if you are using the SHUNT set up. Let the 5790A settle on a reading.
5. Push the SET REF soft key on the 5790A.
6. Set the Calibrator for a -2A dc output. Adjust the output so that the error display is equal to the UUT actual error for a -2A output, as shown in Table 3-20 (5720A) or Table 3-21 (5700A).
7. Press the AVG REF soft key on the 5790A after the 5790A reading settles.
8. Set the Calibrator to 2A at 40 Hz and OPERATE.
9. Record the error displayed on the 5790A in Table 3-26 or 3-27.
10. Return to the error corrected +2A DC output that was set in step 3 and verify that the 5790A display returns to a zero reading ±10 PPM. If necessary, repeat steps 3 through 9 until the required results are obtained.
11. Algebraically add the 5790A error display reading to the A40 Shunt ac to dc difference, and verify that the result is within the specifications of the test limits. Record the results on Table 3-26 (5720A) or Table 3-27 (5700A).
12. Change the Calibrator frequency to 1 kHz, 5 kHz and 10 kHz. At each frequency record the 5790A error display. Verify the results as was done in steps 8 and 9.
13. Repeat steps 3 through 12 at currents of 200 mA and 20 mA using the appropriate A40 current shunt at the frequencies shown on the test record (Table 3-26 or 3-27).
14. For units with a 5725A Amplifier attached, use the test set up shown in Figure 3-10(B) using the 10A shunt at the frequencies listed on the test record.

Note

When verifying the 5725A Amplifier at the 10A level, allow sufficient time for the A40A-10 shunt to reach thermal stability after initially applying the current.



F3-8A.EPS

Figure 3-10. Alternating Current Test Setup

3-21. AC Current Test, 2 mA and 200 µA Ranges

The equipment required for the alternating current accuracy verification test for the 2 mA and 200 µA ranges is listed in Table 3-10. Use Table 3-28 (5720A) or 3-29 (5700A0 for the test record.

Table 3-10. Equipment Required for Alternating Current Accuracy Test for the 2 mA and 200 µA Ranges

Equipment	Model or Description
AC Measurement Standard	Fluke 5790A
Metal Film Resistor	200Ω, 1/8w, ±1%, T9 (P/N 309724) mounted on a dual banana plug.
Metal Film Resistor	2 kΩ, 1/8w, ±1%, T9 (PN 335422) mounted on a dual banana plug
Cable	Pomona 1368-A-18. Double banana to single banana plugs.

1. Connect the equipment as shown in Figure 3-11.

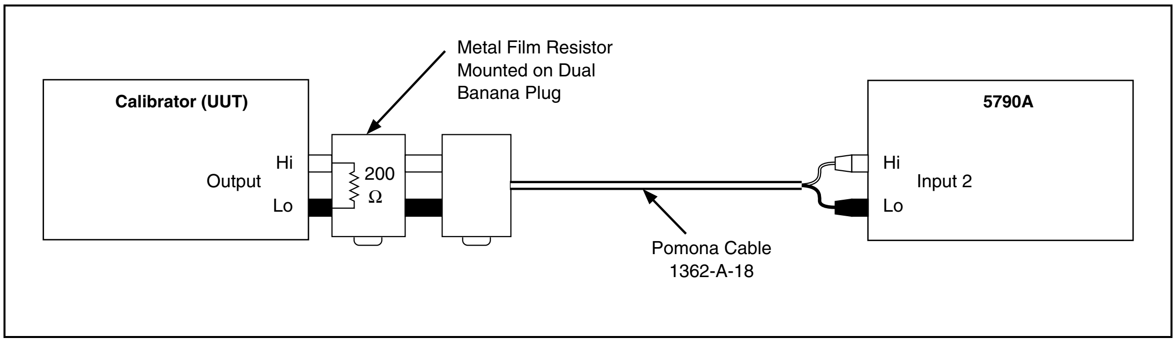


Figure 3-11. Alternating Current Test Setup 2 mA and 200 µA

Note

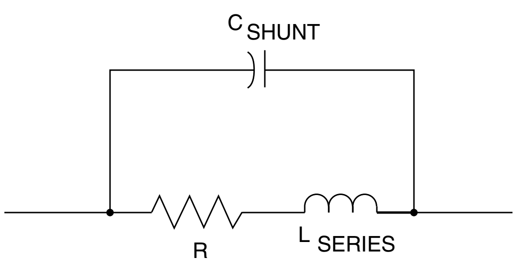
An explanation of the rationale for using metal film resistors to measure ac current follows this procedure.

2. Set the Calibrator for precisely +2 mA dc using the correction from previously recorded data, i.e. set the Calibrator error display to the value recorded for +2 mA dc (Table 3-9 or 3-11).
3. When the 5790A settles on a reading, push the SET REF soft key on the 5790A.
4. Set the Calibrator for precisely -2 mA dc output using the correction from previously recorded data, i.e., set the Calibrator error display to the value recorded for -2 mA dc, in Table 3-10.
5. Press the AVG REF soft key on the 5790A after the 5790A reading settles.
6. Set the Calibrator to 2 mA at 10 Hz and OPERATE.
7. Record the error displayed on the 5790A in Table 3-28 or 3-29, and verify results are within spec.
8. Return to the error corrected +2 mA DC output that was set in step 2. Verify that the 5790A display returns to a zero reading ±10 PPM. If necessary, repeat steps 2 through 6 until the required results are obtained.

9. Change the Calibrator frequency to 20 Hz, 40 Hz, 1 kHz, 5 kHz and 10 kHz. At each frequency record the error display on the 5790A in Table 3-28 or 3-29. Verify that the results are within limits shown.
10. Repeat steps 2 through 9, but replace the 200Ω metal film resistor with the 2 kΩ resistor, and use 200 µA instead of 2 mA.

3-22. Rationale for Using Metal-Film Resistors to Measure AC Current

To be able to measure alternating current, a system comprised of a suitable ac shunt and ac detector is required. First let us consider the ac shunt. For this example we will use a 2 kΩ metal film resistor. At frequencies up to 10 kHz, the equivalent circuit of the resistor can be illustrated as in Figure 3-12. Values typical for shunt capacitance and series inductance are 2 pF (Cs) and 0.01 µH (Ls). For comparison, wire has approximately 0.02 µH/inch. At 10 kHz, the reactance of Cshunt is 8 MΩ, and the reactance of Lseries is 0.6 mΩ. The formulae to use are:



F3-10.EPS

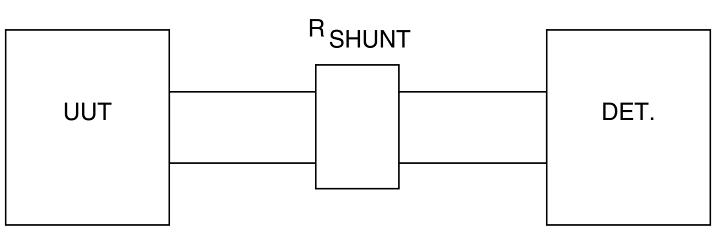
Figure 3-12. Metal Film Resistor Equivalent Circuit

$$(1/Z)^2 = (1/R)^2 + (1/XC)^2 \quad (1)$$
$$(Z)^2 = (R)^2 + (XL)^2 \quad (2)$$

```
Where R = resistance  Xc = Capacitive Reactance
Z = network impedance XL = Inductive Reactance
```

We can see that these effects can be ignored, because their contribution to errors in the measurement process is less than 1 ppm. That is, the metal film resistor's self reactance is totally dwarfed by the reactance of the measuring circuit, which is overwhelmingly capacitive.

If a detector as shown in Figure 3-13 has an input impedance of 10 MΩ shunted by 123 pF, then the effects of Xc must be accounted for. We can ignore the net resistance change introduced by the 10 MΩ detector resistance.



F3-11.EPS

Figure 3-13. Metal Film Resistor in Test Circuit

Note

The input impedance at INPUT 2 of the 5790A on the millivolt ranges is 10 MΩ shunted by 83 pF and the cable used to connect the shunt resistor to the 5790A has 40 pF capacitance, for a total of 123 pF.

The reactance of 123 pF at 10 kHz is 129 kΩ, and using formula (1), in the case where R=2 kΩ, the network impedance Z = 1.999760 kΩ. This produces an error of 120 PPM. The allowable error at 10 kHz is reduced to account for this error.

Using formula (2) we get a result of Xc = 88 kΩ, and a network impedance of Z = 1.9995 kΩ. This produces an error of approximately 250 ppm, or 0.025%. However, if we are making a measurement of 0.21% uncertainty (as in the present case), the ratio of measurement uncertainty is about 10:1 and is not of concern. It is easy to improve measurement uncertainty if desired, though, by measuring the actual input capacitance of the detector and any stray capacitance from input leads, etc. and making corrections. In this discussion, the UUT is assumed to be a high-impedance current source (like the 5700A), which can easily be verified by the manufacturer's specifications, i.e., a specified voltage adder for current outputs above a given burden voltage.

3-23. Wideband Frequency Accuracy Test

Use Table 3-30 for the test record. Proceed as follows to test the Wideband module frequency accuracy:

1. Connect the Philips PM 6669 to the Calibrator wideband output and measure the output frequency at the frequencies listed in Table 3-30.
2. Verify that the frequency counter indicates frequencies within the 0.01% limits shown.

3-24. Wideband AC Voltage Module Output Verification

The wideband tests are for units with the Option 5700A-03 Wideband AC Module only. The verification test for the wideband module works as follows:

- Accuracy at 1 kHz: Output at 1 kHz is tested by comparing the wideband output at the end of the cable and termination supplied with the instrument to the 5790A at INPUT 2.
- Attenuator flatness: The attenuator flatness is tested using the 5790A wideband input and using reduced spec limits when the TUR (Test Uncertainty Ratio) is less than 4:1.

Table 3-11 lists the equipment required for testing and calibrating the Wideband module.

Table 3-11. Equipment Required for Testing and Calibrating the Wideband Option

Equipment	Model or Description
AC Measurement Standard	Fluke 5790A with Wideband Option -03
Wideband cable	Supplied with 5700A-03
50Ω Termination	Supplied with 5700A-03
Adapter	Pomona 1269 BNC(F) to dual banana plug.
Adapter	Kings KN-99-46 N(F) to BNC(M)

3-25. Wideband Output Accuracy at 1 kHz Test

This test verifies the Wideband output level at 1 kHz by direct measurement with the 5790A at INPUT 2. Use Table 3-31 for a test record.

Proceed as follows to characterize the rms wideband voltmeter at 1 kHz:

1. Connect the equipment as shown in Figure 3-14.

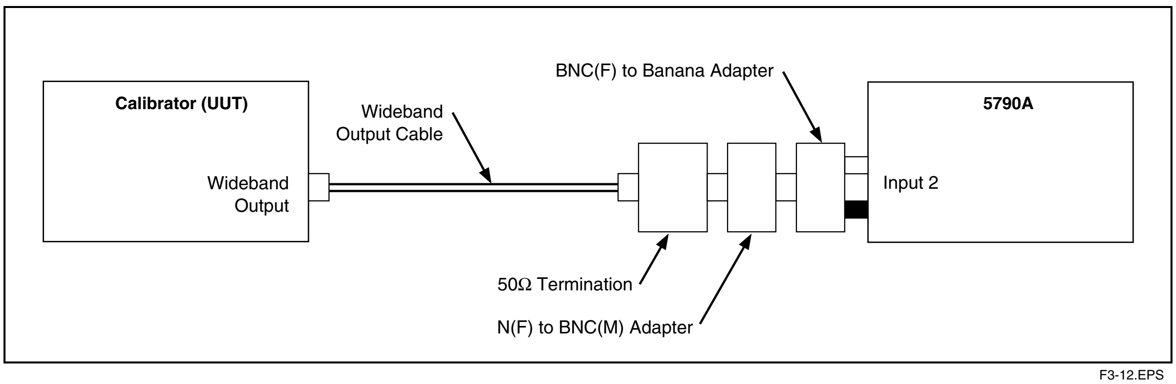


Figure 3-14. Wideband Accuracy at 1 kHz Test Setup

2. Set the Calibrator wideband output to 2.1V at 1 kHz and the 5790A to read INPUT 2.
3. Push the 2.2V RANGE button on the 5790A to lock it on the 2.2V range.
4. On the 5790A push UTIL MENUS button and then MEAS CONTROL soft key. Set the digital filter mode to FAST and the restart to MEDIUM. Push the DONE soft key twice to return to the measurement display.
5. Use the Calibrator output adjustment knob to obtain a reading on the 5790A measurement display of 2.100000 ±20 counts.
6. Read the error on the Calibrator display and record it in Table 3-32 for the 2.1V level for the appropriate verification internal. Verify that it is within spec limits shown.
7. Push the soft key under the RANGE display on the 5790A to return to AUTO RANGE.
8. Proceed to the remaining levels shown in Table 3-32 and repeat steps 5 through 7 with the appropriate output levels set in each step, using the adjustment tolerance in Table 3-12 in step 5.

Table 3-12. Wideband Adjustment Tolerance

5700A/5720A Series II Wideband Output	5790A Adjustment Counts ± ppm
2.10000V	20
1.00000V	10
300.000 mV	3
100.000 mV	10
30.0000 mV	3
10.0000 mV	1
3.00000 mV	1
1000.00 µV	1

3-26. Wideband Output Flatness Test

Use Table 3-32 as a test record. To perform wideband output flatness test, proceed as follows:

1. Connect the equipment as shown in Figure 3-15. Note that the Calibrator wideband cable is connected to the 5790A directly, the termination is not used.

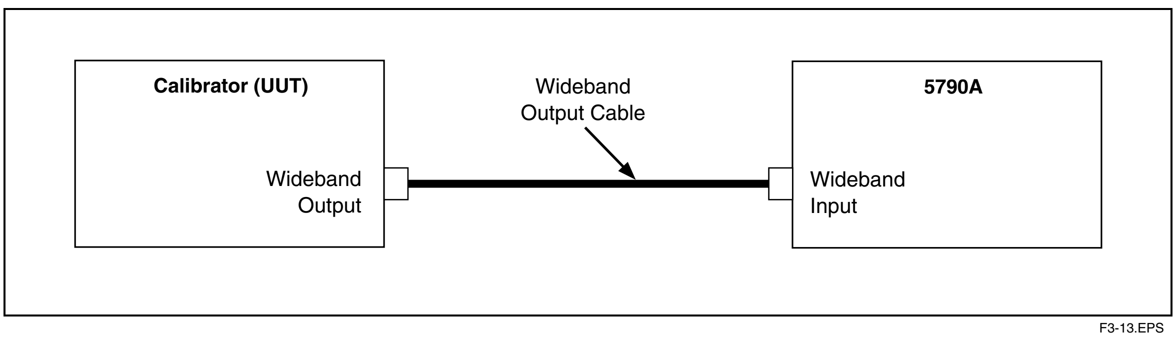


Figure 3-15. Wideband Flatness Test Setup

2. Set the wideband output to 3V at 1 kHz.
3. Push the WBND button on the 5790A, when the reading has settled, push the SET REF soft key.
4. Set the Calibrator to frequencies shown in Table 3-32 for the 3V output and record the errors on the 5790A error display at each frequency in Table 3-32.
5. Verify that the error readings are within spec limits or reduced spec limits shown on the test record. Reduced spec limits are used when the TUR (Test Uncertainty Ratio) is less than 4:1.
6. Repeat steps 4 and 5 for the remaining output levels shown in Table 3-32 using the appropriate voltage in step 4.
7. Record the 1 kHz absolute errors at each output level from Table 3-32 into the appropriate column in Table 3-33. Record the flatness errors from Table 3-32 for each output level and frequency into the appropriate column in Table 3-33. Add the errors and verify that they are within spec for the appropriate time internal.

3-27. Wideband Flatness Calibration Procedure

This procedure is the only part of full verification that stores calibration constants in the Calibrator. This is not a verification test, it is a calibration procedure. Because this part of calibration is recommended to be done only every two years, the same interval as full verification, it is included here and not under Calibration earlier in this chapter and in Chapter 7 of the *5700A/5720A Series II Operator Manual*.

Proceed as follows to perform wideband flatness calibration:

1. Connect the equipment as shown in Figure 3-10 and set the rear panel CALIBRATION switch to the ENABLE position.
2. Push the WBND button on the 5790A.
3. Call up the wideband flatness calibration routine on the Calibrator front panel, by pressing the softkey sequence SETUP MENUS, CAL, CALIBRATION and WIDEBAND FLAT.
4. Enter the present ambient air temperature as prompted and press ENTER.
5. Place the Calibrator in OPERATE. Wideband flatness calibration starts with a 3V output at 1 kHz.
6. Push the SET REF soft key on the 5790A when the 5790A settles to a reading. This is the 3V reference value from which all other frequencies will be compared.
7. Push the ENTER button on the Calibrator, and, the frequency will advance to the next value.
8. Adjust the Calibrator output adjustment knob to bring the 5790A error display to 0 and press ENTER on the Calibrator. Repeat this step for each frequency through 30 MHz.
9. Push the CLEAR REF WBND soft key on the 5790A. The Calibrator wideband output changes to 1V at 1 kHz.
10. Push the SET REF soft key on the 5790A when the 5790A settles to a reading,. This is the 1V reference value from which all other frequencies will be compared.
11. Repeat steps 7 and 8 above for each frequency through 30 MHz.
12. Push the CLEAR REF WBND soft key on the 5790A. The Calibrator Wideband output changes to 300 mV at 1 kHz.
13. Push the SET REF soft key on the 5790A when the 5790A settles to a reading. This is the 300 mV reference value from which all other frequencies will be compared.
14. Repeat steps 7 and 8 above for each frequency through 30 MHz.
15. Push the CLEAR REF WBND soft key on the 5790A. The 5790A wideband output changes to 100 mV at 1 kHz.
16. Push the SET REF soft key on the 5790A when the 5790A settles to a reading. This is the 100 mV reference value from which all other frequencies will be compared.
17. Repeat steps 7 and 8 above for each frequency through 30 MHz. Only the 10 MHz, 20 MHz and 30 MHz points are adjusted.
18. Push the CLEAR REF WBND soft key on the 5790A. The 5790A wideband output changes to 30 mV at 1 kHz.
19. Push the SET REF soft key on the 5790A when the 5790A settles to a reading. This is the 30 mV reference value from which all other frequencies will be compared.
20. Repeat steps 7 and 8 above for each frequency through 30 MHz.

21. Push the CLEAR REF WBND soft key on the 5790A. The 5790A wideband output changes to 10 mV at 1 kHz.
22. Push the SET REF soft key on the 5790A when the 5790A settles to a reading. This is the 10 mV reference value from which all other frequencies will be compared.
23. Repeat steps 7 and 8 above for each frequency through 30 MHz. Only the 10 MHz, 20 MHz and 30 MHz points are adjusted.
24. Make sure the rear panel CALIBRATION switch is in the ENABLE position. Store the cal constants by pushing the STORE VALUES softkey. When the display returns to normal, set the rear panel CALIBRATION switch to NORMAL. The Calibrator wideband flatness calibration is now complete.

3-28. Optional Tests

These tests may be used in acceptance testing or following repair likely to affect the characteristics tested here. They are not recommended to be done routinely. If the Calibrator passes Calibration Performance Verification, you do not need to perform these tests; verification either exercises these functions or is subject to their effects. The Optional Tests include such checks as load regulation, noise, and distortion. Equipment required for the optional tests is listed in Table 3-13.

Table 3-13. Equipment Required For DC V Optional Tests

Equipment	Model
DMM	Wavetek 1281 or HP 3458A
RMS Differential Voltmeter	Fluke 5790A
Power Decade Resistor	Clarostat 240C
Differential Amplifier Plug-In	Tektronix 7A22
Oscilloscope Mainframe	Tektronix 7000 Series
DC Voltage Reference Standard	Fluke 732B
Reference Divider	Fluke 752A
Null Detector	EM Electronics N11(Fluke 845A)
Kelvin-Varley Divider	Fluke 720A

3-29. DC Voltage Load Regulation Test

Use Table 3-34 for a test record. Proceed as follows to test the dc voltage load regulation:

1. Ensure the Calibrator is in standby. With the test setup of Figure 3-5, connect the power decade resistor across the Calibrator OUTPUT terminals. Connect two shorting links between the Calibrator SENSE and OUTPUT terminals and select external sense (EX SNS indicator lit).
2. Set the reference divider to 10V. Set the Calibrator output to 10V dc. Set the power decade resistor to 199Ω. Set the Calibrator to operate. Adjust the Calibrator as necessary to obtain a null on the null detector. Rotate the most significant dial on the power decade resistor to 9. Verify that the null detector indication changes less than ±2 µV. Set the Calibrator to standby.

3. Repeat load regulation testing at the remaining Calibrator outputs shown in Table 3-47.

4. Set the Calibrator to standby and disconnect all equipment from the Calibrator.

3-30. DC Voltage Linearity Test

Use Table 3-35 for a test record. Proceed as follows to test the dc voltage linearity:

1. Self calibrate the Kelvin-Varley (KV) divider as called for in its service manual.
2. Connect the equipment as shown in Figure 3-16.

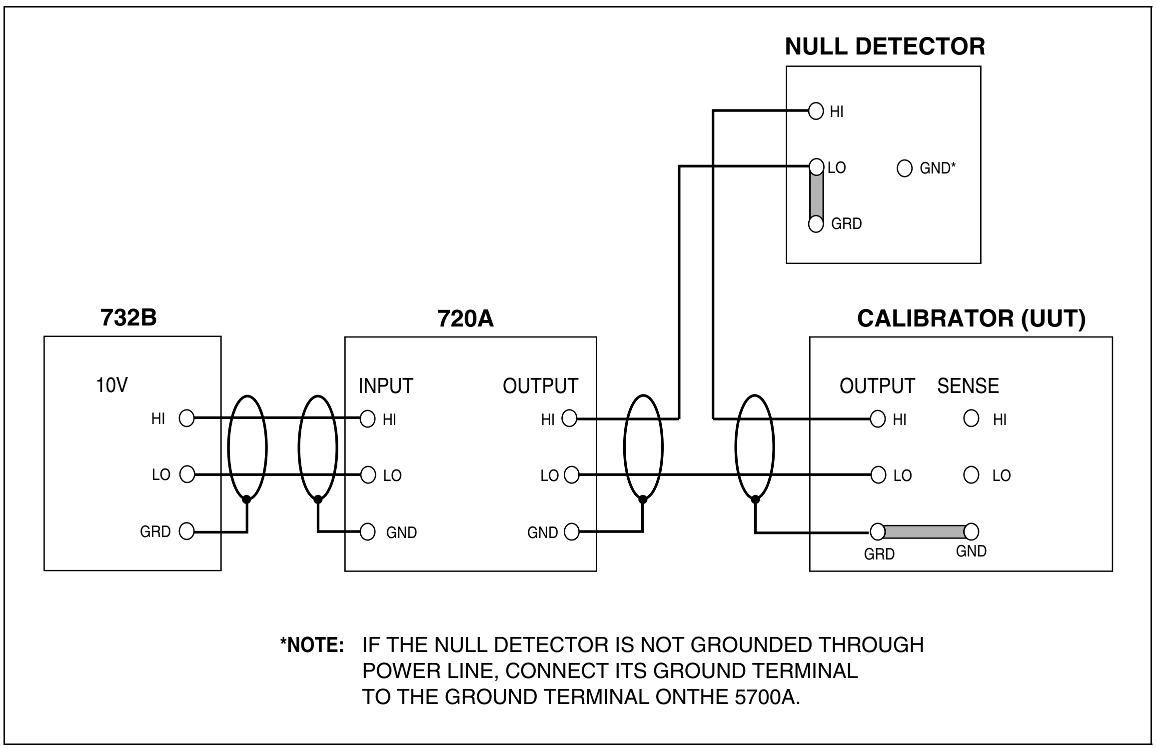


Figure 3-16. DC Voltage Linearity Test

3. Set the KV dials to zero by using the RANGE LOCK. Set the Calibrator to 0V on the 11V range operate. Note the null detector reading. Press OFFSET on the Calibrator.
4. Set KV dials to 0.999999X and Calibrator for a 10V output.
5. Use the Calibrator output adjustment to obtain a null detector reading equal to the reading noted in step 3. Press SCALE on the Calibrator.
6. For each of the KV settings tabulated in Table 3-36, make the required Kelvin Varley setting, and verify that the null detector reads within the limits shown.

3-31. DC Voltage Output Noise (10 Hz to 10 kHz) Test

Use Table 3-36 for a test record. Proceed as follows to test the dc voltage output noise that falls in the range 10 Hz to 10 kHz:

1. Connect the equipment as shown in Figure 3-17.

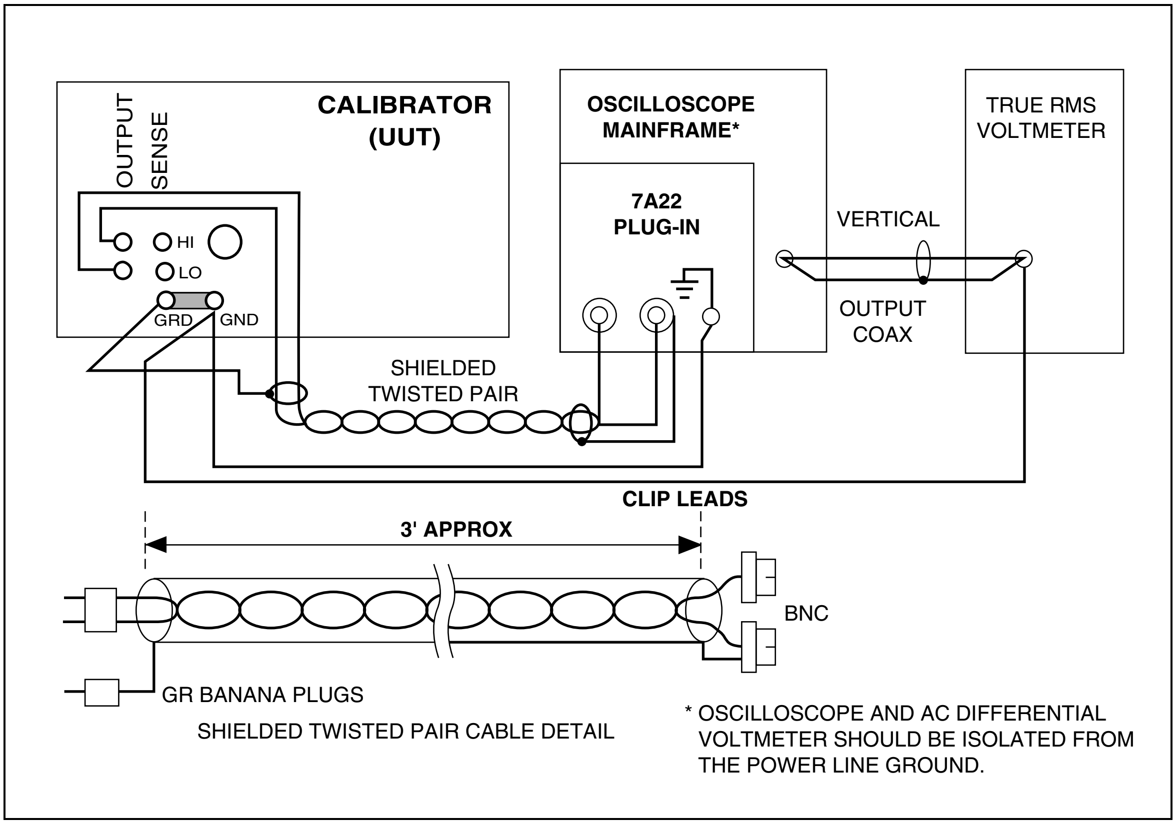


Figure 3-17. DC Voltage Output Noise Test Setup

2. Set the Oscilloscope Differential Amplifier controls as shown below.

Low Frequency -3 dB	10 Hz
High Frequency -3 dB	10 kHz
Input Coupling	AC (both inputs)
Volts/Div	50 µV (Var. to Cal.)

3. Set the Oscilloscope Time/Div for 2 ms.
4. Set the rms voltmeter range to 1V.
5. Set the Calibrator to 2.2V dc, operate. Verify that the reading on the rms voltmeter is less than 150 mV.

NOTE

This test assumes that the amplifier plug-in and scope have a gain equal to 0.5V divided by the input/div. setting, which in the above case is $1x10^4$.

6. Repeat the above process for the remaining tabulated settings shown in Table 3-49; verify that the rms meter indicates less than the amount shown for each required output level.

7. Press RESET on the Calibrator and disconnect the test configuration.

3-32. DC Voltage Output Noise (0.1 to 10 Hz) Test

Proceed as follows to test for dc voltage output noise in the range 0.1 to 10 Hz:

1. Place the 8520A DMM into Math Program 8 with the Display Option Register set to register 8.3 (Standard Deviation Computed Variable)as follows:
   a. Press SHIFT, 8, and PROGRAM SELECTION. Then press SHIFT, 0, ., 1, PROGRAM SELECTION, 8, ., 3, PROGRAM DATA.
   b. Set the DMM to 200 mV DC Range, 20 Samples/Second, and 1000 ms Filter.
   c. Set PROGRAMS IN USE to the ON position.
2. Lock the Calibrator in the 22V range and set it to 100 mV dc. Place the Calibrator in operate.
3. Connect the DMM to the Calibrator OUTPUT binding posts and press the DMM reset button once. Verify that after 10 seconds the DMM reads less than 0.0010E-3.
4. Lock the Calibrator in the 220V range and set it to 100 mV dc. Place the Calibrator in operate.
5. Press the DMM reset button once. Verify that after 10 seconds the DMM reads less than 0.0100E-3.
6. Set the Calibrator to standby.

3-33. AC Voltage Distortion Test

Equipment required for these tests is listed in Table 3-14. Proceed as follows to test for distortion in the ac voltage function. Use Table 3-37 for test record.

Table 3-14. Equipment Required for Distortion Test

Equipment	Model
DMM	Wavetek 1281 or HP 3458A
Distortion Analyzer	Krohn-Hite 6900B
Spectrum Analyzer (only for 5700A-03)	HP 8590A
Non-wirewound load resistors	Any (see *Table 3-50 for values)

1. Connect the Calibrator output terminals to the distortion analyzer.
2. Measure the Calibrator distortion at the output voltages and frequencies tabulated in Table 3-37. Verify that the distortion measured is within the limits shown.

⚠⚠Warning

A non-reactive voltage divider may be necessary to scale the test voltages to match the distortion analyzer characteristics.

3-34. Wideband Distortion Testing

Proceed as follows to test for distortion in the wideband output function (for units with the Option 5700A-03 Wideband AC Module only).

1. Connect the Wideband output terminated in 50Ω to the spectrum analyzer input.

Note

If the spectrum analyzer input impedance is 50Ω, do not use a separate termination.

2. With 0 dBm output programmed from the Calibrator wideband output, select frequencies over the band of 1 MHz to 30 MHz and verify that use the spectrum analyzer to verify that any harmonics are below -40 dBm for fundamentals up to 10 MHz and below -34 dBm for fundamentals of 10 MHz and above.
3. Disconnect the equipment from the Calibrator.

3-35. AC Voltage Overshoot Test

Proceed as follows to test for ac voltage overshoot:

1. Connect the Calibrator output to a properly compensated 10:1 probe.
2. AC couple the oscilloscope and set the sweeptime to a fairly low sweeptime (approximately 1 sec/div).
3. Set the Calibrator to 7.07V at 1 kHz, and press OPR/STBY.
4. Set the scope vertical sensitivity for 0.05V/div. Offset the trace vertically until you can see the top of the waveform at the approximate center of the display (must be at least 2-3 divisions down from the top of the scope graticule).
5. Set the Calibrator to standby and then back to operate. Verify that any overshoot visible on the oscilloscope display is less than 1.5 divisions (approximately 10% of the peak value).
6. Repeat the test at 100 Hz and 100 kHz. This completes the Optional Tests.

3-36. Minimum Use Requirements

Table 3-15 defines specifications for test equipment needed for tests in this section of the manual. If the specific test equipment called for in these tests is not available, you can substitute equipment that meets these specifications.

Table 3-15. Minimum Use Requirements

Item No.	Description	Minimum Use Specifications	Recommended Equipment
Calibration Equipment			
1.	Voltage Reference	10V nominal, true value certified to within ±1.5 ppm	Fluke 732B
2.	Resistance Standards	1Ω nominal, true value certified to within 10 ppm, 10 kΩ nominal, true value certified to within 4 ppm	Fluke 742A Series, 1Ω and 10 kΩ
Calibration Verification Equipment			
3.	Reference Voltage Divider	Range uncertainty 100:1, 1 kV input, ±0.5 ppm 10:1 100V input ±0.2 ppm	Fluke 752A
4.	Null Detector	Leakage resistance to case: 10^{12}Ω min. Resolution: 3 µV full scale	EM Electronics N11 (Fluke 845A)
5.	Low Thermal EMF Cables	Plug-in. Copper or gold-flashed copper (two cables per set, two sets required).	Fluke 5440A-7002
		Spade lug. Copper or gold-flashed copper (two cables per set, two sets required).	Fluke 5440A-7003
6.	Digital Multimeter	DC Voltage Range: 0.1 to 10V Resolution and short-term stability: ±2 ppm Resistance range: 1Ω to 10 MΩ Resolution and short-term stability :±20 uΩ at 1Ω, 1.9Ω ±5 ppm at 10Ω, 19Ω ±2 ppm at 100Ω to 1.9 MΩ ±4 ppm at 10 MΩ, 19 MΩ	Fluke 8508A
7.	Current Source	Range: 10 mA and 100 mA Typical short-term stability ±15 ppm for 5 minutes	Fluke 55X0A, 5700A/5720A Series II,
8.	AC Measurement Standard	Ranges: 2.2 mV through 1000V AC Frequency: 10 Hz to 1 MHz 24 to 7500 ppm, depending on amplitude and frequency (see Table 3-9.) Wideband Ranges: 2.2 mV through 7V Frequency: 10 Hz to 30 MHz Uncertainty: 0.03% to 0.9%, depending on amplitude and frequency (see Table 3-18.)	Fluke 5790A (Option -03 required for Wideband Flatness Verification)

Table 3-15. Minimum Use Requirements (cont)

Item No.	Description	Minimum Use Specifications	Recommended Equipment
9.	Current Shunt Adapter	Used in conjunction with 5790A and A40-series shunts to facilitate AC Current measurements	Fluke 792A-7004
10.	Frequency Counter	10 Hz to 30 MHz ±0.002%	Philips PM 6669
11.	Standard Resistors (1)	0.1Ω nominal, true value certified to within 20 ppm, rated for 2A DC; 1Ω nominal, true value certified to within 6 ppm; 1.9Ω nominal, true value certified to within 6 ppm; 10Ω nominal, true value certified to within 6 ppm; 1 kΩ nominal, true value certified to within 5.5 ppm; 10 kΩ nominal, true value certified to within 3.5 ppm; 19 kΩ nominal, true value certified to within 4 ppm; 10 MΩ nominal, true value certified to within 15 ppm; 19 MΩ nominal, true value certified to within 28 ppm	Fluke 742A-1 Fluke 742A-1.9 Fluke 742A-10 Fluke 742A-1k Fluke 742A-10k Fluke 742A-19k Fluke 742A-10M Fluke 742A-19M L&N 4221B (0.1Ω)
12.	DC Current Shunt (2)	Range: 10A Uncertainty: ±0.008%	Fluke Y5020
13.	AC/DC Current Shunt	Ranges: 20 mA, 200 mA, 2A and 10A Frequency: 10 Hz to 10 kHz Uncertainty: ±310 ppm at 10 Hz; ±100 ppm at 20 Hz; ±50 ppm at 40 Hz, 1 kHz; ±100 ppm at 5 kHz, 10 kHz	Fluke A40-20 mA Fluke A40-200 mA Fluke A40-2A Fluke A40A-10A (2)
14.	Metal Film Resistors	Values: 200Ω, 2 kΩ, and 1 MΩ Temperature C°: T9 or better Power Rating: 1/4 Watt Tolerance: ±1%	Stock Items
15.	Differential Amplifier	Sensitivity: 5 µV rms Bandwidth selectable to 10 kHz	Tektronix 7A22 w/7000-Series Mainframe
16.	Distortion Analyzer	Range: 2V to 300V Frequency: 10 Hz to 600 kHz	Krohn-Hite 6900B
17.	Kelvin-Varley Voltage Divider	Ratio uncertainty: ±0.1 ppm of input	Fluke 720A
18.	HF Spectrum Analyzer (used in optional test for wideband distortion)	Freq. Range: 2 MHz to 120 MHz Input Level: 3V (+20 dBm to -60 dBm)	HP 8590A

1: A DMM may be used for all but the 1Ω and 1.9Ω values. For those values using the DMM, a test method using an external current source is used for low-value resistance.
2: Needed only for 5725A Amplifier testing.

3-37. Determining Test Limits for Other Calibration Intervals

The verification procedures in this chapter test to the 90 day 99% confidence specification limits. For other calibration intervals it is necessary to calculate new specification limits and, if necessary, new test limits.

The following examples show how the 90 day limits were calculated. These examples illustrate how you can calculate the specifications and test limits, if necessary, for other calibration intervals.

Example 1 shows you how to calculate a specification limit for a specific test level from a specification listed as a percentage (or parts per million) of reading plus a floor error in microvolts, millivolts, miroamps, or nanoamps.

The 99% confidence specification for a 5720A at 2 mA, 1 kHz is 130 ppm + 40 nA. We can convert the floor uncertainty of 40 nA to ppm of output by dividing 40 nA by 2 mA and multiplying by a million:

(130 + 1000000*0.000000040/0.002)=130 ppm + 20 ppm = 150 ppm

This test limit is shown in Table 3-28.

If we wanted to test to the 1 year specification of 140 ppm + 40 nA, the test limit would be the specification of 140 ppm + 40 nA = 140 ppm + 40 ppm = 180 ppm.

Example 2 shows you how to calculate a specification limit and a tighter test limit. For instrumentation that have the precision of the 5720A/5700A Series II calibrators, it is difficult obtain standards which are many times more accurate than the calibrator specifications. Therefore, for cases when the test uncertainty ratio (TUR) of the standards is less than 4:1, guardbanding is used to set test limits which are tighter than the specification limits. These limits provide the same risk of accepting out of tolerance instruments as a TUR of 4:1. The statistical analysis of the guardbanding techniques used are described in a series of technical papers referenced at the end of this chapter.

Guardbanding is used to set the test limits different than the specification limits for a 5720A at 2V, 1 kHz. The 90 day specification is 47 ppm + 10 uV. When you calculate the specification in ppm at the 2V level in the same way as in Example 1, the specification limit is:

(47 + 1000000*0.000010/2)=47 ppm + 5 ppm = 52 ppm.

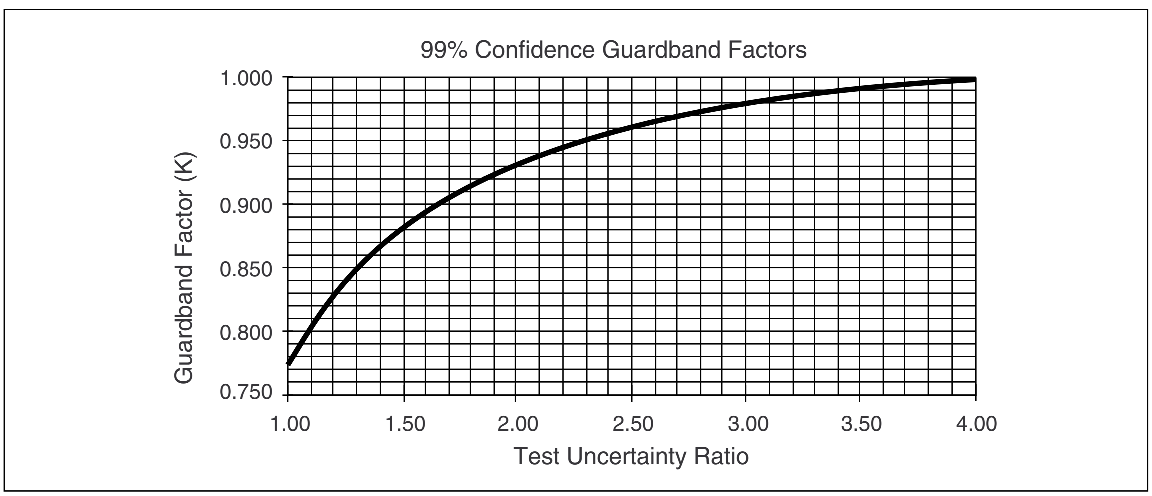


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Figure 3-18. Determining Other Test Limits

Table 3-16. 5720A Resistance Test Record

1Ω Std Res Value	1Ω Std Voltage	Measured 1Ω Std Voltage	Cal Current	UUT 1Ω Displayed Value	UUT 1Ω Voltage	UUT True Res	UUT Dev.	Uncert Std	Spec (±ppm)	TUR	GB Factor	Test Limit (±ppm)	Max Difference of Charactized to Nominal Value
								5.9	95	16.06	1.000	95	0.9995 to 1.0005
1.9Ω Std Res Value	**1.9Ω Std Voltage**	**Measured 1.9Ω Std Voltage**	**Cal Current**	**UUT 1.9Ω Displayed Value**	**UUT 1.9Ω Voltage**	**UUT True Res**	**UUT Dev.**		**Spec (±ppm)**				**Max Difference of Characterized to Nominal Value**
								5.9	95	16.06	1.000	95	1.89905 to 1.90095
10Ω Std Res Value	**10Ω Std Voltage**	**Measured 10Ω Std Voltage**	**Cal Current**	**UUT 10Ω Displayed Value**	**UUT 10Ω Voltage**	**UUT True Res**	**UUT Dev.**		**Spec (±ppm)**				**Max Difference of Characterized to Nominal Value**
								5.9	25	4.23	1.000	25	9.997 to 10.004

Resistance Accuracy Verification (19Ω And Above)

	Std Res Value	DMM Std Res Rdg	DMM Error	DMM UUT Res Value	UUT True Res Value	UUT Dev.	Uncert Std	Spec (±ppm)	TUR	GB Factor	Test Limit (±ppm)	Max Difference of Characterized to Nominal Value
19Ω (1)								25				18.9943 to 19.0057
100Ω (1)							5.1	11	2.16	0.970	10.7	99.985 to 100.015
190Ω (1)								11				189.9715 to 190.0285
1 kΩ (1)							4.7	9	1.91	0.926	8.3	999.85 to 1000.15
1.9 kΩ (1)								9				1.899715k to 1.900285k
10 kΩ							3.1	9	2.92	0.978	8.8	9.9985k to 10.0015k
19 kΩ							3.5	9	2.55	0.963	8.7	18.99715k to 19.00285k
100 kΩ(1)							5.1	11	2.15	0.942	10.4	99.985k to 100.015k
190 kΩ (1)								11				189.9715k to 190.0285k
1 MΩ (1)							8.1	18	2.23	0.948	17.1	0.9998M to 1.0002M

Table 3-16. 5720A Resistance Test Record (cont)

	Std Res Value	DMM Std Res Rdg	DMM Error	DMM UUT Res Value	UUT True Res Value	UUT Dev.	Uncert Std	Spec (ppm)	TUR	GB Factor	Test Limit (±ppm)	Max Difference of Characterized to Nominal Value
1.9 MΩ (1)								19				1.89962M to 1.90038M
10 MΩ)							12.0	37	3.07	0.982	36.3	9.997M to 10.003M
19 MΩ							21.9	47	2.15	0.942	44.3	18.9943M to 19.0057M
100 MΩ (2)								110				99.95M to 100.05M

1: Not necessary to test due to 5720A Series II internal calibration process. Uncertainties and test limits are shown for other available 742A Standard Resistors.

2: Due to extremely slow settling time (approximately 5 minutes to 0.005% and sensitivity to any nearby movement, use of the DMM to test 100 megohms to the specified 0.01% uncertainty is not practical and therefore is not recommended. For those who wish to test it, a suitable way is to use an ESI SR 1050 10M/step Hamon-type Resistance Transfer Standard and use it in conjunction with an ESI 242-series bridge to effect the measurement to the required uncertainty.

Table 3-17. 5700A Resistance Test Record

1Ω Std Res Value	1Ω Std Voltage	Measured 1Ω Std Voltage	Cal Current	UUT 1Ω Displayed Value	UUT 1Ω Voltage	UUT True Res	UUT Dev.	Uncert Std	Spec (ppm)	TUR	GB Factor	Test Limit (ppm)	Max Difference of Characterized to Nominal Value
								5.9	95	16.06	1.000	95	0.9995 to 1.0005
1.9Ω Std Res Value	**1.9Ω Std Voltage**	**Measured 1.9Ω Std Voltage**	**Cal Current**	**UUT 1.9Ω Displayed Value**	**UUT 1.9Ω Voltage**	**UUT True Res**	**UUT Dev.**		**Spec (ppm)**	**TUR**	**GB Factor**	**Test Limit (ppm)**	**Max Difference of Characterized to Nominal Value**
								5.9	95	16.06	1.000	95	1.89905 to 1.90095
10Ω Std Res Value	**10Ω Std Voltage**	**Measured 10Ω Std Voltage**	**Cal Current**	**UUT 10Ω Displayed Value**	**UUT 10Ω Voltage**	**UUT True Res**	**UUT Dev.**		**Spec (ppm)**	**TUR**	**GB Factor**	**Test Limit (ppm)**	**Max Difference of Characterized to Nominal Value**
								5.9	28	4.73	1.000	28	9.997 to 10.004

Resistance Accuracy Verification (19Ω And Above)

	Std Res Value	DMM Std Res Rdg	DMM Error	DMM UUT Res Value	UUT True Res Value	UUT Dev.	Uncert. std	Spec (±ppm)	TUR	GB Factor	Test Limit (±ppm)	Max Difference of Characterized to Nominal Value
19Ω (1)												18.9943 to 19.0057
100Ω (1)							5.1	17	3.33	0.990	16.8	99.985 to 100.015
190Ω (1)								11				189.9715 to 190.0285
1 kΩ (1)							4.7	12	2.54	0.963	11.6	999.85 to 1000.15
1.9 kΩ (1)								9				1.899715k to 1.900285k
10 kΩ							3.1	11	3.57	0.994	10.9	9.9985k to 10.0015k
19 kΩ							3.5	11	3.11	0.984	10.8	18.99715k to 19.00285k
100 kΩ(1)							5.1	13	2.54	0.963	12.5	99.985k to 100.015k
190 kΩ (1)								11				189.9715k to 190.0285k
1 MΩ (1)							8.1	18	2.23	0.948	17.1	0.9998M to 1.0002M

Table 3-17. 5700A Resistance Test Record (cont)

	Std Res Value	DMM Std Res Rdg	DMM Error	DMM UUT Res Value	UUT True Res Value	UUT Dev.	Uncert. std	Spec (±ppm)	TUR	GB Factor	Test Limit (±ppm)	Max Difference of Characterized to Nominal Value
1.9 MΩ (1)								±19				1.89962M to 1.90038M
10 MΩ							12.0	±37	3.07	0.982	36.3	9.997M to 10.003M
19 MΩ)							21.9	±47	2.15	0.942	44.3	18.9943M to 19.0057M
100 MΩ (2)								±110				99.95M to 100.05M

1: Not necessary to test due to 5720A Series II internal calibration process. Uncertainties and test limits are shown for other available 742A Standard Resistors.

2: Due to extremely slow settling time (approximately 5 minutes to 0.005% and sensitivity to any nearby movement, use of the DMM to test 100 megohms to the specified 0.01% uncertainty is not practical and therefore is not recommended. For those who wish to test it, a suitable way is to use an ESI SR 1050 10M/step Hamon-type Resistance Transfer Standard and use it in conjunction with an ESI 242-series bridge to effect the measurement to the required uncertainty.

Table 3-18. DC Voltage Test Record for 5720A

Divider Setting	5720A Range	5720A Output (1)	Null Detector Reading(μV) (2)	Null Det Limit (μV)	Meter Limit Rattle (μV)
0.1V	0.22V	0.1V		±1.20 (2)	NA
1V	2.2V	1V		±4.8 μV (2)	0.55
1V	11V	1V (3)		±6 (2)	2.2
10V	11V	10V (4)		±33	3.5
10V	22V	10V (3)		±35	5.5
100V	220V	100V		±45	7.5
1000V	1100V	1000V		±65	4.5
0.1V	0.22V	-0.1V		±1.20 (2)	NA
1V	2.2V	-1V		±4.8 (2)	0.55
10V	11V	-10V		±6.0 (2)	2.2

1: Mathematically, the true 5700A/5720A Series II output programmed is the certified value of the reference standard divided by the reference standard nominal value, multiplied by the required 5700A/5720A Series II nominal output. In other words, the 5700A/5720A Series II output is always programmed for the nominal output adjusted up or down by the same percentage as the certified value of the reference standard.

2: On the 752A 0.1 and 1V ranges, the null detector polarity is reversed. A low input (5700A/5720A Series II output) causes a positive null detector reading.

3: Use Range Lock to obtain 1V on 11V and 10V on 22V range. Deactivate Range Lock before setting the next voltage output.

4: Line regulation can be verified at this time by adjusting the autotransformer for a ±10% change in line voltage. The null detector reading must remain constant within ±1 μV.

Table 3-19. DC Voltage Test Record for 5700A

Divider Setting	5700A Range	5700A Output (1)	Null Detector Reading(μV) (2)	Null Det Limit (μV)	Meter Limit Rattle (μV)
0.1V	0.22V	0.1V		±1.45 (2)	NA
1V	2.2V	1V		±7.2 (2)	0.55
1V	11V	1V (3)		±9 (2)	2.2
10V	11V	10V (4)		±54	3.5
10V	22V	10V (3)		±58	5.5
100V	220V	100V		±70	7.5
1000V	1100V	1000V		±86	4.5
0.1V	0.22V	-0.1V		±1.45 (2)	NA
1V	2.2V	-1V		±7.2 (2)	0.55
10V	11V	-10V		±54	3.5

1: Mathematically, the true 5700A/5720A Series II output programmed is the certified value of the reference standard divided by the reference standard nominal value, multiplied by the required 5700A/5720A Series II nominal output. In other words, the 5700A/5720A Series II output is always programmed for the nominal output adjusted up or down by the same percentage as the certified value of the reference standard.

2: On the 752A 0.1 and 1V ranges, the null detector polarity is reversed. A low input (5700A/5720A Series II output) causes a positive null detector reading.

3: Use Range Lock to obtain 1V on 11V and 10V on 22V range. Deactivate Range Lock before setting the next voltage output.

4: Line regulation can be verified at this time by adjusting the autotransformer for a ±10% change in line voltage. The null detector reading must remain constant within ±1 μV.

Table 3-20. Direct Current Accuracy Test Record (5720A)

Characterizing dc DMM @ ±200 mV and ±2.0V							
Output Current	**Std Res Value**	**DC DMM Setting**	**Rdg.**	**Column A Std Res Correction (ppm)**	**Column B UUT Error Reading (ppm)**	**UUT Actual Error (A+B) (ppm)**	**Test Limit, 90-day (±ppm)**
+2A	0.1Ω	(200 mV)					118
-2A	0.1Ω	(200 mV)					118
+200 mA	1.0Ω	(200 mV)					57
-200 mA	1.0Ω	(200 mV)					57
+20 mA	10Ω	(200 mV)					38
-20 mA	10Ω	(200 mV)					38
+2 mA	1 kΩ	(2V)					39
-2 mA	1 kΩ	(2V)					39
+200 µA	10 kΩ	(2V)					49
-200 µA	10 kΩ	(2V)					49

Table 3-21. Direct Current Accuracy Test Record (5700A)

Characterizing dc DMM @ ±200 mV and ±2.0V							
Output Current	Std Res Value	DC DMM Setting	Rdg	Column A Std Res Correction (ppm)	Column B UUT Error Reading (ppm)	UUT Actual Error (A+B) (ppm)	Test Limit, 90-day (ppm)
+2A	0.1Ω	(200 mV)					135
-2A	0.1Ω	(200 mV)					135
+200 mA	1.0Ω	(200 mV)					73
-200 mA	1.0Ω	(200 mV)					73
+20 mA	10Ω	(200 mV)					55
-20 mA	10Ω	(200 mV)					55
+2 mA	1 kΩ	(2V)					55
-2 mA	1 kΩ	(2V)					55
+200 µA	10 kΩ	(2V)					100
-200 µA	10 kΩ	(2V)					100

5725A Amplifier DC Current Test				
Output Current	DC DMM Reading	Certified Shunt Value	Cal Actual Current	Test Limits, 90-day (±ppm)
+10A				388 ppm
-10A				388 ppm
+5A				436 ppm
+3A				500 ppm
-3A				500 ppm

Table 3-22. AC Voltage Frequency Accuracy Test Record

Frequency	Tolerance	Actual
10 Hz 15 Hz	99.99 ms - 100.01 ms 66.673 ms - 66.66 ms	
100 Hz 200 Hz 500 Hz	9.999 ms - 10.001 ms 199.98 Hz - 200.02 Hz 499.95 Hz - 500.05 Hz	
1 kHz 5 kHz	999.9 Hz - 1000.1 Hz 4999.5 Hz - 5000.5 Hz	
10 kHz	9.999 kHz - 10.001 kHz	
140 kHz 200 kHz 500 kHz	139.986 kHz - 140.014 kHz 199.98 kHz - 200.02 kHz 499.95 kHz - 500.05 kHz	
1 MHz	0.9999 MHz - 1.0001 MHz	

Table 3-23. 5720A AC Voltage Output Test Record

Output Level	Frequency	Error Display Reading	Spec (± ppm)	5790A 1-Year Spec (± ppm)	TUR	GB Factor	Test Limit (4) (± ppm)
90-Day Test Record							
2 mV	1 kHz		2590	1070	2.42	0.958	2480
2 mV	20 kHz		2590	1070	2.42	0958	2480
2 mV	50 kHz		2730	1810	1.51	0.882	2408
2 mV	100 kHz		3540	2450	1.44	0.874	3093
2 mV	300 kHz		7200	4300	1.67	0.903	6498
2 mV	500 kHz		14000	6400	2.19	0.945	13223
2 mV	1 MHz		15600	7500	2.08	0.938	14637
2 mV	40 Hz		2950	1070	2.42	0.958	2480
2 mV	20 Hz		2605	1390	1.87	0.923	2403
2 mV	10 Hz		2770	2350	1.18	0.823	2280
20 mV	1 kHz		340	175	1.94	0.928	316
20 mV	20 kHz		340	175	1.94	0.928	316
20 mV	50 kHz		480	310	1.55	0.887	426
20 mV	100 kHz		840	435	1.93	0.928	779
20 mV	300 kHz		1800	1010	1.78	0.914	1646
20 mV	500 kHz		2750	1290	2.13	0.942	2789
20 mV	1 MHz		4350	2100	2.07	0.938	4079
20 mV	40 Hz		340	175	1.94	0.928	316
20 mV	20 Hz		355	255	1.94	0.866	307
20 mV	10 Hz		520	355	1.46	0.877	456
200 mV	1 kHz		130	45	2.89	0.977	127
200 mV	20 kHz		130	45	2.89	0.977	127
200 mV	50 kHz		270	79	3.42	0.990	267
200 mV	100 kHz		640	172	3.72	0.996	638
200 mV	300 kHz		1025	270	3.80	0.997	1022
200 mV	500 kHz		1650	420	3.93	0.999	1648
200 mV	1 MHz		3200	1040	3.08	0.982	3143
200 mV	40 Hz		130	45	2.89	0.977	127
200 mV	20 Hz		245	92	1.58	0.891	129
200 mV	10 Hz		345	217	1.59	0.892	308
2V	1 kHz		52	24	2.17	0.943	49
2V	20 kHz		52	24	2.17	0.943	49
2V	50 kHz		91	46	1.98	0.931	85
2V	100 kHz		145	71	2.04	0.936	136
2V	300 kHz		470	160	2.94	0.978	460
2V	500 kHz		1225	260	4.70	1.000	—
2V	1 MHz		2100	900	2.23	0.953	2001
2V	40 Hz		52	24	2.17	0.943	49
2V	20 Hz		110	66	1.67	0.901	99
2V	10 Hz		295	200	1.48	0.878	259
2.3V(1)	1 kHz		81	24	3.37	0.989	80
20V	1 kHz		52	27	1.87	0.923	47
20V	20 kHz		52	27	1.87	0.923	47
20V	50 kHz		91	48	1.90	0.924	84
20V	100 kHz		128	81	1.57	0.891	114
20V	300 kHz		350	190	1.84	0.920	322
20V	500 kHz		1225	400	3.06	0.982	1203
20V	1 MHz		1800	1200	1.50	0.881	1585
20V(2)	40 Hz		52	27	1.87	0.923	47
20V	20 Hz		110	67	1.64	0.899	99
20V	10 Hz		295	200	1.48	0.878	259

Table 3-23. 5720A AC Voltage Test Record (cont)

Output Level	Frequency	Error Display Reading	Spec (± ppm)	5790A 1-Year Spec (± ppm)	TUR	GB Factor	Test Limit (4) (± ppm)
200V	1 kHz		64	31	2.05	0.936	59
200V	20 kHz		64	31	2.05	0.936	59
200V	50 kHz		101	69	1.46	0.875	88
200V	100 kHz		185	98	1.89	0.923	171
200V(2)	40 Hz		64	31	2.05	0.936	59
200V	20 Hz		110	68	1.62	0.896	99
200V	10 Hz		295	200	1.48	0.878	259
300V(3)	20 kHz		145	41	3.54	.993	144
600V(3)	50 kHz		378	130	2.91	.977	369
600V(3)	100 kHz		1375	500	2.21	.945	1299
1 kV	1 kHz		79	38	2.08	0.938	74
1 kV	50 Hz		79	38	2.08	0.938	74
1 kV	300 Hz		79	38	2.08	0.938	74
1 kV(3)	20 kHz		131	38	3.45	.991	130
1 kV(3)	30 kHz		371	130	2.85	.975	362
1 kV(3)	40 Hz		84	38	2.21	.945	79

1: This is a test of the bottom of the 20V range .
2: Observe the Calibrator output for 10 minutes and verify that it remains stable within ±7.5 ppm.
3: Perform only for units that are used with a 5725A Amplifier.
4: When the TUR (Test Uncertainty Ratio) is less than 4:1, the spec is reduced to give the same Consumer Risk as a 4:1 TUR as described later in this chapter.

Table 3-24. 5700A AC Voltage Output Test Record

Output Level	Frequency	Error Display Reading	Spec (± ppm)	5790A 1-Year Spec (± ppm)	TUR	GB Factor	Test Limit (4) (± ppm)
90-Day Test Record							
2 mV	1 kHz		2610	1070	2.44	0.958	2500
2 mV	20 kHz		2610	1070	2.44	0.958	2500
2 mV	50 kHz		2870	1810	1.59	0.892	2561
2 mV	100 kHz		4900	2450	2.00	0.932	4568
2 mV	300 kHz		8700	4300	2.02	0.932	8128
2 mV	500 kHz		16700	6400	2.61	0.966	16132
2 mV	1 MHz		24400	7500	3.25	0.987	24078
2 mV	40 Hz		2610	1070	2.44	0.958	2500
2 mV	20 Hz		2720	1390	1.96	0.928	2524
2 mV	10 Hz		3050	2350	1.30	0.848	2586
20 mV	1 kHz		410	175	2.34	0.953	391
20 mV	20 kHz		410	175	2.34	0.953	391
20 mV	50 kHz		670	310	2.16	0.943	632
20 mV	100 kHz		1300	435	2.99	0.980	1274
20 mV	300 kHz		1950	1010	1.93	0.927	1808
20 mV	500 kHz		3200	1290	2.48	0.960	3072
20 mV	1 MHz		6400	2100	3.05	0.982	6280
20 mV	40 Hz		410	175	2.34	0.950	390
20 mV	20 Hz		520	255	2.04	0.935	486
20 mV	10 Hz		850	355	2.39	0.956	813
200 mV	1 kHz		150	45	3.33	0.988	148
200 mV	20 kHz		150	45	3.33	0.988	148
200 mV	50 kHz		380	79	4.81	1.000	—
200 mV	100 kHz		950	172	5.52	1.000	—
200 mV	300 kHz		1150	270	4.26	1.000	—
200 mV	500 kHz		1900	420	4.52	1.000	—
200 mV	1 MHz		3800	1040	3.65	0.995	3781
200 mV	40 Hz		150	45	3.33	0.988	148
200 mV	20 Hz		270	92	2.93	0.978	264
200 mV	10 Hz		630	217	2.90	0.977	616
2V	1 kHz		78	24	3.25	0.987	77
2V	20 kHz		78	24	3.25	0.987	77
2V	50 kHz		140	46	3.04	0.980	137
2V	100 kHz		290	71	4.08	1.000	—
2V	300 kHz		515	160	3.22	0.986	508
2V	500 kHz		1300	260	5.00	1.000	—
2V	1 MHz		2700	900	3.00	0.980	2646
2V	40 Hz		78	24	3.25	0.987	77
2V	20 Hz		185	66	2.80	0.974	180
2V	10 Hz		600	200	3.00	0.980	588
2.3V(1)	1 kHz		105	24	4.38	1.000	—
20V	1 kHz		78	27	2.89	0.977	77
20V	20 kHz		78	27	2.89	0.977	77
20V	50 kHz		140	48	2.92	0.978	137
20V	100 kHz		270	81	3.33	0.988	267
20V	300 kHz		635	190	3.34	0.988	627
20V	500 kHz		1550	400	3.88	0.998	1547
20V	1 MHz		3250	1200	2.71	0.970	3153
20V(2)	40 Hz		78	27	2.89	0.977	77
20V	20 Hz		185	67	2.76	0.972	180
20V	10 Hz		600	200	3.00	0.980	588

Table 3-24. 5700A AC Voltage Output Test Record (cont)

Output Level	Frequency	Error Display Reading	Spec (± ppm)	5790A 1-Year Spec (± ppm)	TUR	GB Factor	Test Limit (4) (± ppm)
200V	1 kHz		85	31	2.74	0.971	83
200V	20 kHz		85	31	2.74	0.971	83
200V	50 kHz		240	69	3.48	0.991	238
200V	100 kHz		600	98	6.12	1.00	—
200V(2)	40 Hz		85	31	2.74	0.972	83
200V	20 Hz		185	68	2.72	0.970	179
200V	10 Hz		600	200	3.00	0.980	588
300V(3)	20 kHz		145	41	3.54	0.993	144
600V(3)	50 kHz		378	130	2.91	0.977	369
600V(3)	100 kHz		1375	500	2.21	0.945	1299
1 kV	1 kHz		84	38	2.21	0.945	79
1 kV	50 Hz		84	38	2.21	0.945	79
1 kV	300 Hz		84	38	2.21	0.945	79
1 kV(3)	20 kHz		131	38	3.45	0.991	130
1 kV(3)	30 kHz		371	130	2.85	0.975	362
1 kV(3)	40 Hz		84	38	2.21	0.945	79

1: This is a test of the bottom of the 20V range .
2: Observe the Calibrator output for 10 minutes and verify that it remains stable within ±7.5 ppm.
3: Perform only for units that are used with a 5725A Amplifier.
4: When the TUR (Test Uncertainty Ratio) is less than 4:1, the spec is reduced to give the same Consumer Risk as a 4:1 TUR as described later in this chapter.

Table 3-25. AC Voltage 2 mV Range Test Record

Characterized 1.9 mV Reading	Error Display Reading	Limits
		±0.26%

Table 3-26. 5720A AC Current 20 mA to 10A Accuracy Test Record

2A, 200 mA, 20 mA and 10A Test Record					
Output Current	**Freq**	**A40 Shunt AC-DC Diff**	**UUT Error Display**	**Calculated Error**	**Spec ± ppm**
2A	40 Hz				320
2A	1 kHz				320
2A	5 kHz				510
2A	10 kHz				7100
200 mA	10 Hz				305
200 mA	20 Hz				200
200 mA	40 Hz				145
200 mA	1 kHz				145
200 mA	5 kHz				240
200 mA	10 kHz				1160
20 mA	10 Hz				305
20 mA	20 Hz				200
20 mA	40 Hz				150
20 mA	1 kHz				150
20 mA	5 kHz				255
20 mA	10 kHz				1400
10A (1)	40 Hz				417
10A (1)	1 kHz				417
10A (1)	5 kHz				888
10A (1)	10 kHz				3375
1: If a 5725A is attached.					

Table 3-27. 5700A AC Current 20 mA to 10A Accuracy Test Record

2A, 200 mA, 20 mA and 10A Test Record (10A Only for 5725A)					
Output Current	**Freq**	**A40 Shunt AC-DC Diff**	**UUT Error Display**	**Calculated Error**	**Specs ±ppm**
2A	40 Hz				670
2A	1 kHz				670
2A	5 kHz				800
2A	10 kHz				9100
200 mA	10 Hz				725
200 mA	20 Hz				400
200 mA	40 Hz				170
200 mA	1 kHz				170
200 mA	5 kHz				850
200 mA	10 kHz				2100
20 mA	10 Hz				725
20 mA	20 Hz				400
20 mA	40 Hz				160
20 mA	1 kHz				60
20 mA	5 kHz				850
20 mA	10 kHz				2100
10A (1)	40 Hz				417
10A (1)	1 kHz				417
10A (1)	5 kHz				888
10A (1)	10 kHz				3375
1: If a 5725 is attached.					

Table 3-28. 5720A AC Current 2 mA and 200 μA Accuracy Test Record

Output Current	Frequency	Error	Spec. ± ppm (90-day)	5790A Transfer Spec ± ppm	TUR	GB Factor	Test Limits ± ppm
2 mA	10 Hz		305	210	1.45	0.874	267
2 mA	20 Hz		200	73	2.74	0.971	194
2 mA	40 Hz		150	27	5.56	1.000	150
2 mA	1 kHz		150	27	5.56	1.000	150
2 mA	5 kHz		285	27	10.56	1.000	285
2 mA	10 kHz		1500	27	55.56	1.000	1500
200 μA	10 Hz		380	210	1.81	0.916	348
200 μA	20 Hz		240	73	3.29	0.988	237
200 μA	40 Hz		180	27	6.67	1.000	180
200 μA	1 kHz		180	27	6.67	1.000	180
200 μA	5 kHz		395	27	14.63	1.000	+365/-425 (1)
200 μA	10 kHz		1500	27	55.56	1.000	+1380/-1620 (1)

1: The spec is modified because of the capacitive loading of the 2K resistor by the cable and input of the 5790A.

Table 3-29. 5700A AC Current 2 mA and 200 μA Accuracy Test Record

Output Current	Frequency	Error	Spec ± ppm (90-day)	5790A Transfer Spec ± ppm	TUR	GB Factor	Test Limits ± ppm
2 mA	10 Hz		725	210	3.45	0.991	718
2 mA	20 Hz		400	73	5.48	1.000	400
2 mA	40 Hz		160	27	5.93	1.000	160
2 mA	1 kHz		160	27	5.93	1.000	160
2 mA	5 kHz		850	27	31.48	1.000	850
2 mA	10 kHz		2100	27	77.8	1.000	2100
200 μA	10 Hz		850	210	4.05	1.000	850
200 μA	20 Hz		505	73	6.92	1.000	505
200 μA	40 Hz		240	27	8.89	1.000	240
200 μA	1 kHz		240	27	8.89	1.000	240
200 μA	5 kHz		850	27	31.48	1.000	+820/-880 (1)
200 μA	10 kHz		2100	27	77.8	1.000	+1980/-2220 (1)

1: The spec is modified because of the capacitive loading of the 2K resistor by the cable and input of the 5790A.

Table 3-30. Wideband Frequency Accuracy Test Record

Frequency (Hz)	Frequency Measured	Tolerance Limits
10 Hz		99.99 ms to 100.01 ms
100 Hz		9.999 ms to 10.001 ms
300 Hz		299.97 Hz to 300.03 Hz
500 Hz		499.95 Hz to 500.05 Hz
800 Hz		799.92 Hz to 800.08 Hz
900 Hz		899.91 Hz to 900.09 Hz
1 kHz		999.0 Hz to 1.0001 kHz
1.19 kHz		1.189881 kHz to 1.190119 kHz
2.2 MHz		2.19978 MHz to 2.20022 MHz
3.5 MHz		3.49965 MHz to 3.50035 MHz
3.8 MHz		3.79962 MHz to 3.80038 MHz
10 MHz		9.990 MHz to 10.001 MHz
20 MHz		19.998 MHz to 20.002 MHz
30 MHz		29.997 MHz to 30.003 MHz

Table 3-31. Wideband Accuracy at 1 kHz Test Record

Output Level	Measured Error	Spec ± ppm (90-day)	5790A 1-Year Spec ± ppm	TUR	GB Factor	Test Limit
2.1V		2238	24	93	1.000	2238
1.0V		2900	24	121	1.000	2900
0.3V		2833	38	74.5	1.000	2833
0.1V		3400	53	64.1	1.000	3400
30 mV		3333	115	29.0	1.000	3333
10 mV		3900	240	16.2	1.000	3900
3 mV		4833	643	7.5	1.000	4833
1 mV		5400	1720	3.14	0.980	5292

Table 3-32. Wideband Flatness Test Record

Output Level	Frequency	Measured Flatness Error	Spec ± ppm (90-day)	5790A 1-Year Spec	TUR	GB Factor	Test Limit ± ppm
3V	10 Hz		3000	1000	3.00	0.980	2940
	30 Hz		1000	300	3.33	0.988	988
	10 kHz		1000	300	3.33	0.988	988
	120 kHz		1000	300	3.33	0.988	988
	500 kHz		1000	300	3.33	0.988	988
	2 MHz		1000	500	2.00	0.932	932
	5 MHz		2000	1000	2.00	0.932	1864
	10 MHz		2000	1000	2.00	0.932	1864
	20 MHz		4000	1500	2.67	0.968	3872
	30 MHz		10000	3500	2.86	0.975	9750
1V	10 kHz		1000	300	3.33	0.988	988
	120 kHz		1000	300	3.33	0.988	988
	500 kHz		1000	300	3.33	0.988	988
	2 MHz		1000	500	2.00	0.932	932
	5 MHz		2000	1000	2.00	0.932	1864
	10 MHz		2000	1000	2.00	0.932	1864
	20 MHz		4000	1500	2.67	0.968	3872
	30 MHz		10000	3500	2.86	0.975	9750
300 mV	10 kHz		1000	300	3.33	0.988	988
	120 kHz		1000	300	3.33	0.988	988
	500 kHz		1000	300	3.33	0.988	988
	2 MHz		1000	500	2.00	0.932	932
	5 MHz		2000	1000	2.00	0.932	1864
	10 MHz		2000	1000	2.00	0.932	1864
	20 MHz		4000	1500	2.67	0.968	3872
	30 MHz		10000	3500	2.86	0.975	9750
100 mV	10 kHz		1000	400	2.50	0.961	961
	120 kHz		1000	400	2.50	0.961	961
	500 kHz		1030	400	2.58	0.964	993
	2 MHz		1030	500	2.06	0.936	964
	5 MHz		2030	1000	2.03	0.933	1894
	10 MHz		2030	1000	2.03	0.933	1894
	20 MHz		4030	1500	2.69	0.970	3909
	30 MHz		10030	3500	2.87	0.976	9789

Table 3-32. Wideband Flatness Test Record (cont)

Output Level	Frequency	Measured Flatness Error	Spec ± ppm (90-day)	5790A 1-Year Spec	TUR	GB Factor	Test Limit ± ppm
30 mV	10 kHz		1000	500	2.00	0.932	932
	120 kHz		1000	500	2.00	0.932	932
	500 kHz		1100	500	2.20	0.945	1040
	2 MHz		1100	500	2.20	0.945	1040
	5 MHz		2100	1000	2.10	0.939	1972
	10 MHz		2100	1000	2.10	0.939	1972
	20 MHz		4100	1500	2.73	0.972	3985
	30 MHz		10100	3500	2.89	0.977	9868
10 mV	10 kHz		1000	500	2.00	0.932	932
	120 kHz		1000	500	2.00	0.932	932
	500 kHz		1300	700	1.86	0.920	1196
	2 MHz		1300	700	1.86	0.920	1196
	5 MHz		2300	1000	2.30	0.950	2185
	10 MHz		2300	1000	2.30	0.950	2185
	20 MHz		4300	1700	2.53	0.962	4137
	30 MHz		10300	3700	2.78	0.972	10012
3 mV	10 kHz		1000	500	2.00	0.932	932
	120 kHz		1000	500	2.00	0.932	932
	500 kHz		2000	1033	1.94	0.928	1856
	2 MHz		2000	1033	1.94	0.928	1856
	5 MHz		4000	1333	3.00	0.980	3920
	10 MHZ		4000	1333	3.00	0.980	3920
	20 MHz		6000	2033	2.95	0.978	5868
	30 MHz		16000	4033	3.97	0.999	15984
1 mV	10 kHz		1000	500	2.00	0.932	932
	120 kHz		1000	500	2.00	0.932	932
	500 kHz		5000	1700	2.94	0.978	4890
	2 MHz		5000	1700	2.94	0.978	4890
	5 MHZ		7000	2700	2.59	0.965	6755
	10 MHz		7000	2700	2.59	0.965	6755
	20 MHz		9000	4000	2.25	0.948	8532
	30 MHz		30000	9000	3.33	0.988	29640

Table 3-33. Wideband Absolute Error 10 Hz to 500 kHz

Output Level	Frequency	1 kHz Absolute Error ppm	Flatness Error ppm	Error Sum ppm	90-Day Spec Limit (±ppm)
2.1V	10 Hz				5238
	30 Hz				2238
	10 kHz				2238
	120 kHz				2238
	500 kHz				2238
1V	10 kHz				2900
	120 kHz				2900
	500 kHz				2900
300 mV	10 kHz				2833
	120 kHz				2833
	500 kHz				2833
100 mV	10 kHz				3400
	120 kHz				3400
	500 kHz				3400
30 mV	10 kHz				3333
	120 kHz				3333
	500 kHz				3333
10 mV	10 kHz				3900
	120 kHz				3900
	500 kHz				3900
3 mV	10 kHz				4833
	120 kHz				4833
	500 kHz				4833
1 mV	10 kHz				5400
	120 kHz				5400
	500 kHz				5400

Table 3-34. Load Regulation Test Record

Div. Setting	5700A/5720A Series II Range	5700A/5720A Series II Out/Full Load	Change In Null Measured	Change In Null Limit
10V	11V	10V/199Ω		±3.1 µV
100V	220V	100V/1999Ω		±42 µV
1000V	1100V	1000V/49.99 kΩ		±310 µV

Table 3-35. DC Voltage Linearity Test Record

Kelvin-Varley Setting	5700A/5720A Series II Output	Null Detector Reading	Null Detector Reading limit
0.1	1V		±2.3 µV
0.2	2V		±2.6 µV
0.3	3V		±2.9 µV
0.4	4V		±3.2 µV
0.5	5V		±3.5 µV
0.6	6V		±3.8 µV
0.7	7V		±4.1 µV
0.8	8V		±4.4 µV
0.9	9V		±4.7 µV

Table 3-36. DC Voltage Output Noise Test

Differential Amplifier Sensitivity	Calibrator (UUT)	Rms Meter Reading	Maximum rms Meter Reading
50 µV/division	2.2V		150 mV
50 µV/division	10V		500 mV
50 µV/division	20V		500 mV
100 µV/division	200V		750 mV
500 µV/division	1000V		500 mV

Table 3-37. AC V Distortion Test Summary

5700A/5720A Series II Output	Load Resistors	Frequency	Measured Distortion	Max. Distortion
2V	100Ω, 1/8W	10 Hz, 20 Hz		0.054%
		1 kHz, 20 kHz, 50 kHz,		0.044%
		100 kHz, 200 kHz, 500 kHz		0.355%
20V	1 kΩ, 1/2W	10 Hz, 20 Hz		0.0535%
		20 kHz, 100 kHz		0.0385%
		200 kHz, 500 kHz		0.304%
200V	10 kΩ, 5W	10 Hz, 20 Hz		0.055%
		50 kHz, 100 kHz		0.1065%
300V(1)	15 kΩ, 5W	40 Hz		0.1%
300V(1)	15 kΩ, 5W	50 kHz		0.3%
300V(1)	15 kΩ, 5W	70 kHz		0.4%

(1) The 5700A/5720A Series II maximum volt-Hertz product is (2.2 x 10^7) The 300V level assumes that a Fluke 5725A Amplifier is attached.

Table 3-38. Test Record for Flatness Check of the AC 2 mV Range

Frequency	UUT Error Display Reading	Limits
10 Hz		
20 Hz		±0.26%
40 Hz		
1 kHz		±0.26%
20 kHz		±0.29%
50 kHz		±0.49%
100 kHz		±0.87%
300 kHz		
500 kHz		±1.83%
1 MHz		

Chapter 4
Maintenance

Title	Page

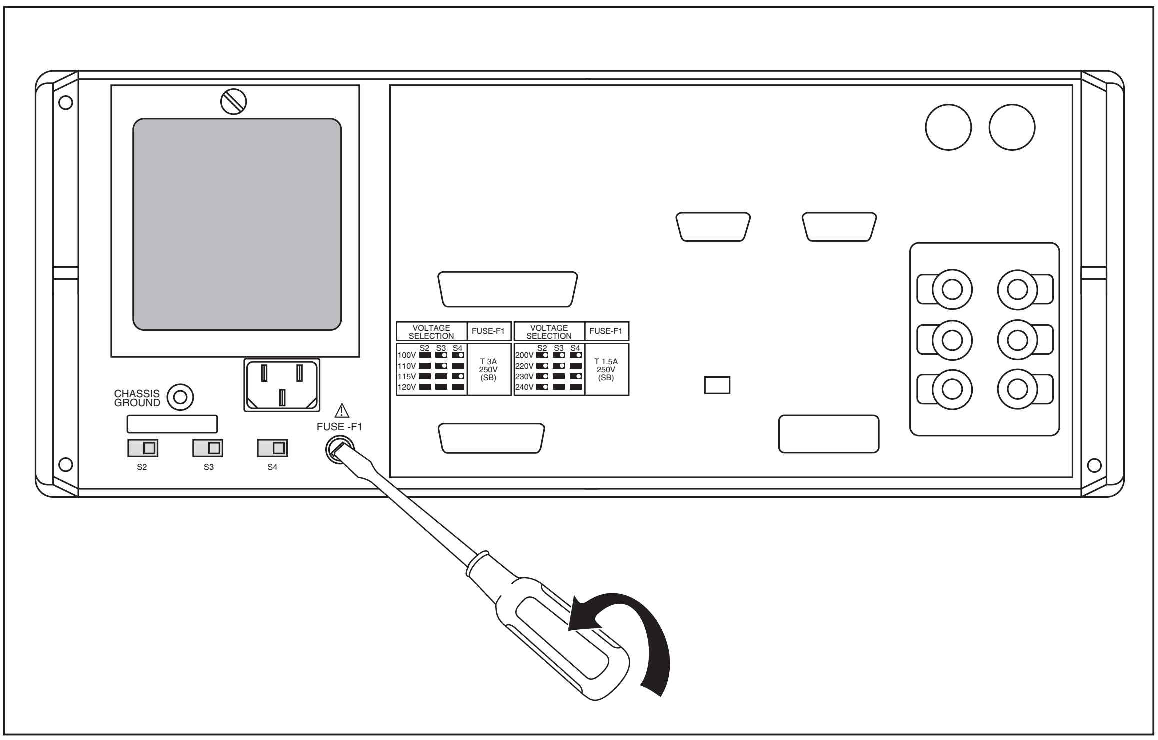
4-1. Introduction

Because this is a high performance instrument, it is not recommended that the user service the boards to the component level. In many different ways it is easy to introduce a subtle long-term stability problem by handling the boards. Access procedures are provided for those who want to replace a faulty module.

4-2. Accessing the Fuse

The fuse is accessible from the rear panel. The fuse rating label to the right of the fuse holder shows the correct replacement fuse ratings for each operating voltage. To access the fuse, refer to Figure 4-1 and proceed as follows:

1. Disconnect line power.
2. Using a standard screwdriver, turn the fuse holder counterclockwise until the cap and fuse are disengaged.



f7-1.eps

Figure 4-1. Accessing the Fuse

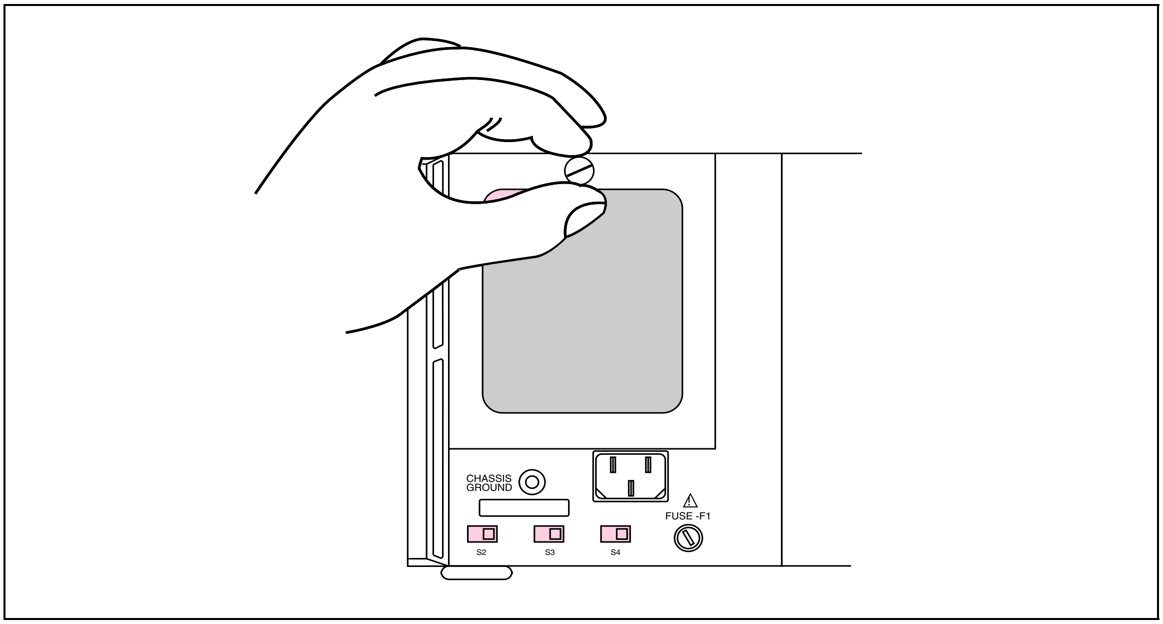
4-3. Cleaning the Air Filter

⚠Caution

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

The air filter must be removed and cleaned every 30 days or more frequently if the calibrator is operated in a dusty environment. The air filter is accessible from the rear panel of the calibrator.

To clean the air filter, refer to Figure 4-2 and proceed as follows:



F4-1.EPS

Figure 4-2. Air Filter

1. Disconnect line power.
2. Remove the filter element.
    a. Unscrew the knurled screw at the top of the air filter (counterclockwise).
    b. Pull the air filter retainer downward; it hinges at the bottom.
    c. Remove the filter element.
3. Clean the filter element.
    a. Wash the filter element in soapy water.
    b. Rinse the filter element in fresh running water.
    c. Shake out the excess water, then allow the filter element to dry thoroughly before reinstalling it.
4. Reinstall the filter element, its retainer, and the knurled screw.

4-4. General Cleaning

To keep the Calibrator looking like new, clean the case, front panel keys, and lens using a soft cloth slightly dampened with water or a non-abrasive mild cleaning solution that does not harm plastics.

⚠Caution

Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. They can damage the plastic materials used in the calibrator.

4-5. Cleaning PCA's

Printed circuit assemblies only need cleaning after repair work. After soldering on a pca, remove flux residue using isopropyl alcohol and a cotton swab.

4-6. Access Procedures

⚠⚠Warning

Servicing described in this section is to be performed by qualified service personnel only. To avoid electrical shock, do not perform any servicing unless qualified to do so.

4-7. Top and Bottom Covers

Check that power is not connected to the Calibrator; the power control must be off, and the line power cord must be disconnected. Top and bottom covers are each secured with eight Phillips head screws (four front, four rear).

4-8. Digital Section Cover

The Digital Section is accessed through one top cover that is secured by six Phillips head screws.

4-9. Analog Section Covers

The Analog Section is enclosed with separate covers on top and bottom. The top cover is secured with seven Phillips head screws. The bottom Analog Section cover is secured with eight Phillips head screws (three short, five longer).

4-10. Rear Panel Removal and Installation

Detach the Rear Panel by removing the six hex head screws (three on each rear handle side) and the two Phillips head screws found along the side of the Fan Assembly. Refer to Figure 4-3 for screw locations.

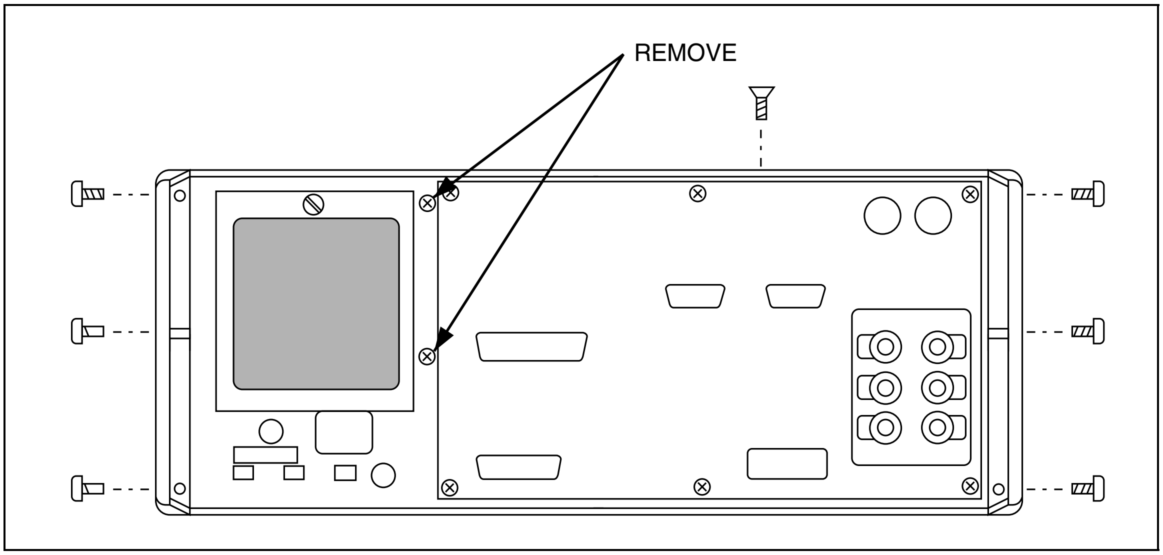


Figure 4-3. Rear Panel Removal

4-11. Rear Panel Assembly Access

Refer to Figure 4-4 during the following procedure:

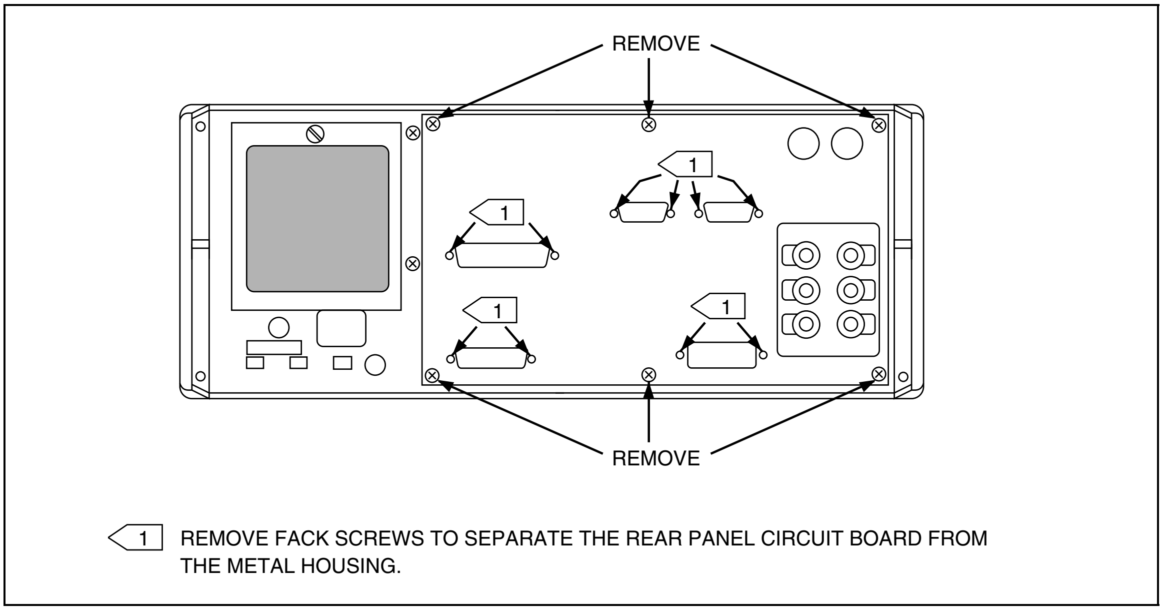


Figure 4-4. Rear Panel Assembly Access

1. Remove the six securing screws for the Rear Panel assembly housing.
2. Gently pull the rear panel housing from the Rear Panel.
3. Allow the rear panel housing to lay flat on the work surface by removing the two ribbon cables from the Rear Panel board.
4. Remove the two nuts at TB1 and TB2 on the paddle board; separate the associated wires from the paddle board.
5. Remove P11 from J11. Then remove the two paddle board mounting screws and separate the paddle board from the Rear Panel assembly.
6. Remove the jack screws for each connection on the rear panel housing, then gently lift the Rear Panel assembly out from the housing.
7. Reverse this procedure to install the Rear Panel assembly.

4-12. Front Panel Removal and Installation

Refer to Figure 4-5 during the following procedure:

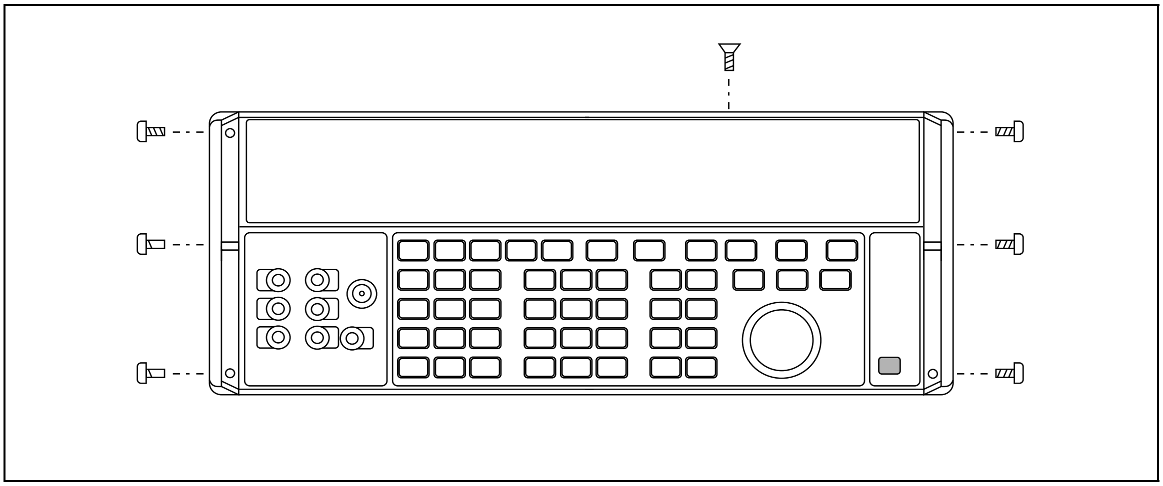


Figure 4-5. Front Panel Removal

1. Remove the Calibrator top and bottom covers.
2. Remove the single screw at the top of the Front Panel and the six hex screws on the front handle sides. Then grasp both handles and gently tilt the Front Panel down and away from the mainframe, disengaging the green power button. Position the Front Panel on its handles, in front of the instrument.
3. If you need to completely detach the Front Panel from the Calibrator, one, or possibly two, cables must be disconnected. The output cable must be detached in all configurations. If the Wideband Option is installed, you must also detach the related connector from the Front Panel.

Reverse this procedure to install the Front Panel.

4-13. Display Assembly Removal and Installation

Once the Front Panel has been removed, use the following procedure to access the Display assembly.

1. Remove the ribbon cable connecting the Display assembly to the Motherboard.
2. Remove the six screws securing the Front Panel Display assembly cover shield. Three of these screws are accessed from the inside, and the other three are accessed along the top of the front panel.
3. Remove the seven screws securing the Front Panel Display assembly to the Front Panel. Gently lift the Front Panel Display assembly up, and remove the keyboard ribbon cable. Now remove the Front Panel Display assembly.

Reverse this procedure to install the Front Panel Display assembly.

4-14. Keyboard Assembly Removal and Installation

The following procedure assumes that the Display Assembly Removal procedure has already been completed.

1. Remove all output cable connections (including GROUND-to-metal) from the front panel binding posts. Save all removed hardware.
2. Remove the two hex screws at the front of each handle. Then remove the front handles.
3. Gently release the eight plastic hook catches, and separate the front panel plastic from the sheet metal.

4. Remove the output adjustment knob flywheel by taking out its center screw. Hold the wheel in place by inserting a pencil in one of the flywheel holes and pressing on one of the plastic standoffs.
5. Remove the nine self-tapping screws connecting the Keyboard assembly to the front panel plastic.
6. Remove the Keyboard assembly by gently releasing the seven plastic hook catches. Work from one side of the board to the other. Start at either side by simultaneously releasing a catch and lifting on the board.

Reverse this procedure to install the Keyboard assembly. When reconnecting the wires to the binding posts, be sure to include a washer on each side of the ring terminals. Refer to the nearby decal or see sheet 4 of the Analog Motherboard schematic in Section 8 of this manual for proper connection of the output cable to the front binding posts.

⚠Caution

Do not tighten the nuts that hold the wires to the binding posts more than 7 in-lb. Force exceeding 7 in-lb can destroy the binding posts.

4-15. Analog Assembly Removal and Installation

The analog assemblies are installed in the sequence shown in Figure 4-6. Note that each module cannot be positioned in any other slot and that identifying information on the tab for each module faces forward. In most cases, the component side of each module also faces forward. The component side faces to the rear for three modules: Current/High Resolution Oscillator (A7), Ohms Cal (A9), and High Voltage Control (A14). All modules except the High Voltage Control pull straight up to disengage from the Digital Motherboard. For the High Voltage Control module, two Phillips head captive screws at the outer corners of the High Voltage Transformer must be removed before the module can be removed.

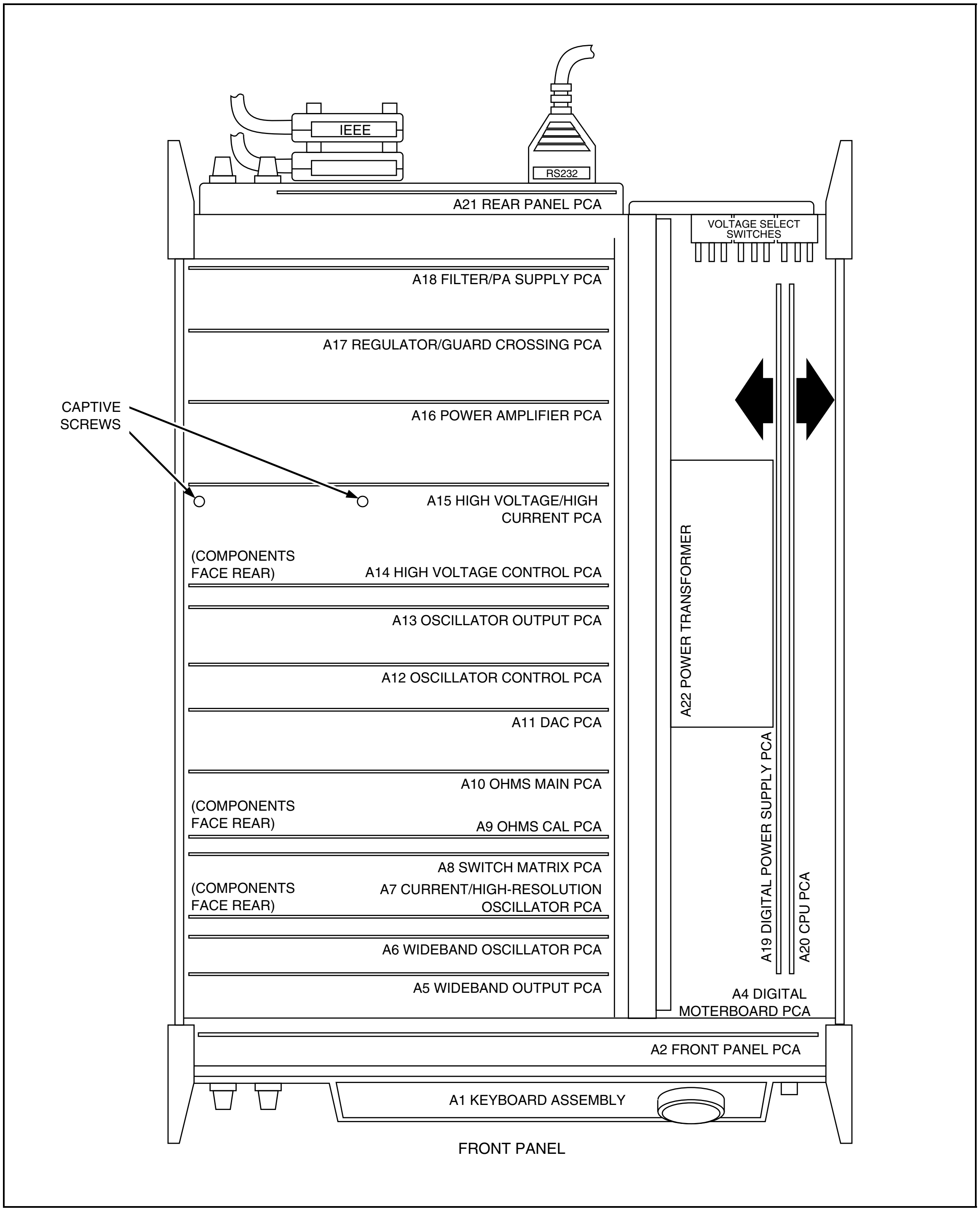


Figure 4-6. Analog and Digital Assemblies

⚠Caution

Do not touch any circuit area on an analog assembly. Contamination from skin oil can produce high resistance paths, with resulting leakage currents and possible erroneous readings. Always grasp an analog assembly by its upper corner ears.

4-16. Digital Assembly Removal and Installation

Remove the CPU Assembly or the Digital Power Supply Assembly by pulling straight up at the top corners of the assembly. In relation to the chassis side, the CPU Assembly components face toward, and the Digital Power Supply Assembly components face away. See Figure 4-6.

4-17. Power Transformer Removal and Installation

Use the following procedure to remove the Power Transformer assembly:

1. Remove the Calibrator Front and Rear Panels.
2. Remove the Digital Power Supply (A19) and CPU (A20) assemblies.
3. Detach the five connectors leading from the Power Transformer assembly to the Digital Motherboard. The three connectors at the rear of the assembly may not be accessible without first removing the rear fan. With the two digital assemblies (A19 and A20) removed, the four Phillips head screws securing this fan can be accessed through holes in the chassis side.

   Note that no two Power Transformer connectors are the same size and that each connector is keyed; re-connection only involves matching appropriate connectors.
4. Working from the bottom of the instrument, remove the Digital Motherboard (A4) assembly.
5. Remove the eleven screws securing the Power Transformer assembly, as follows:
   - Rear Panel: two screws, which were removed along with the Rear Panel.
   - Front Panel: two screws.
   - Top Edge: four screws.
   - Bottom Edge: three screws.
6. Remove the Power Transformer assembly.

To install the Power Transformer assembly, reverse the preceding six steps.

4-18. Hybrid Cover Removal

When removing the plastic covers from the hybrid assemblies, push the ends of the cover retainer pins through from the back of the circuit board. The retainer pins can be damaged by attempting to pull the covers off.

4-19. Front/Rear Binding Post Reconfiguration

An internal cable can be configured for output connections at either the front or rear binding posts. The front binding posts are usually connected at the factory. If the rear binding posts are connected at the factory, a decal describing this arrangement is attached to the front binding posts. The procedure that follows can be used to swap an existing binding post configuration; it is to be done only at Service Centers. The following procedure can be used to change front-to-rear or rear-to-front.

Reverse this procedure when changing from rear to front output operation.

1. Remove instrument top and bottom covers and remove bottom analog guard cover.
2. Remove the instrument front panel by removing the three hex screws on each front handle side and a single screw on the top of the front panel. See Figure 4-5 for screw locations. By grasping the handles gently pull the front panel away from the frame and lay it on its handles in front of the instrument.
3. Remove all the wires connecting the ring terminals of the output cable to the front panel binding posts. Save all hardware removed during this step.
4. Remove the two screws and restraining board attaching the toroid to the Front Panel. Save these items.
5. Position the output cable and toroid along the bottom left side of the instrument. In a later step, the output cable will be positioned between the Analog Motherboard and the left side panel.
6. Install the Front Panel.
7. Detach the Rear Panel by removing six hex screws (three on each rear handle side) and two screws near the the fan filter on the Rear Panel. See Figure 4-3 for screw locations. Then grasp the handles and gently pull the Rear Panel away from the frame.
8. Orient the instrument so that it is resting on its right side panel, with its bottom facing you.
9. Route the output cable between the left side panel and the Analog Motherboard, ending at the Rear Panel.
10. Using the items obtained during toroid removal, attach the toroid to the two rear panel standoffs.
11. Attach the color-coded output leads to the rear output binding posts. Use one washer on each side of each connecting ring. Verify connections by checking the decal mounted nearby or by matching lead color to the color on the front of the binding post. (Of the eleven wires, four are clear-insulated shield wires. If necessary, refer to page 4 of the Analog Motherboard schematic in Section 8 to determine these connections.)

   ⚠Caution

   Do not over tighten hardware on the binding posts. Torque in excess of seven inch-pounds can damage a binding post.

   Note that the I GUARD terminal is not connected at the front binding posts; cut away the I GUARD thermal fit covering to connect this terminal at the rear binding posts. Also, the AUX CURRENT ring terminal is not connected at the rear binding posts; this terminal must be insulated and tied off.

12. Replace the rear panel back, the bottom guard cover, and top and bottom covers to complete this procedure.

4-20. Installing a Wideband AC Module (Option -03)

⚠Caution

The Wideband option circuit board assemblies contain static-sensitive components. Use caution to avoid static discharge when handling the modules.

The procedure that follows can be used to install a 5700A-03 Wideband AC Voltage module in a Calibrator. The option consists of two circuit board assemblies. This procedure is to be done only at Service Centers.

1. Remove the top and bottom covers and analog section cover. (See ACCESS PROCEDURES this section)
2. Referring to Figure 4-6, locate the slots for the Wideband Output Module (A5) and the Wideband Oscillator Module (A6).
3. Make sure the cable supplied with the Wideband option is connected between the Wideband Output and Wideband Oscillator assemblies.
4. Uncoil the internal wideband output cable one turn from the Calibrator chassis and connect it to the coaxial connector on the Wideband Output Module. Make sure the cable is routed in such a way as to avoid shorting to ground when the board is installed in the chassis.
5. Install the Wideband Output and Wideband Oscillator Modules and lock the nylon ears.
6. Run the Wideband Gains Calibration procedure as described in Section 3.
7. Perform the Wideband Flatness Calibration procedure as described in Section 3. The Wideband option is now installed and ready for use.

4-21. Clearing Ghost Images from the Control Display

After prolonged periods of displaying the same message on the Control Display, you may notice a non-uniform brightness of pixels across the display. This phenomenon can be cleared up by lighting up the whole display and leaving it on overnight (or at least several hours). Proceed as follows to burn in the Control Display:

1. Turn on the Calibrator and press the "Setup Menus" softkey.
2. Press the "Self Test & Diags" softkey.
3. Press the "5700 Self Diags" softkey.
4. Press the "Front Panel Tests" softkey.
5. Under the "Display" label, press the "Control" softkey.
6. Press the "All On" softkey. This causes all Control Display pixels to light. Press the RESET key or press PREV MENU six times to return to normal operation after an overnight or equivalent burn in period.

4-22. Replacing the Clock/Calendar Backup Battery

To replace the lithium button-type battery on the CPU Assembly (A20), proceed as follows:

1. Make sure the power is off and the line power cord disconnected.

2. Follow the access procedures to remove the digital side cover.
3. Remove the CPU Assembly (A20).
4. Desolder and remove battery BT1.
5. Solder a replacement battery in place (refer to the parts list for replacement information if necessary.)
6. Replace the CPU Assembly. After replacing the battery, the setting of the time and date the elapsed time counter (read by the remote query ETIME? and set by ETIME) will need to be reprogrammed.

4-23. Using Remote Commands Reserved for Servicing

This information documents remote commands not described in the 5700A/5720A Series II Operator Manual, Section 5. The commands described here are useful for servicing the instrument.

4-24. Using the ETIME Command

The ETIME remote command is the companion to ETIME?, the elapsed time query, which is documented in the Operator Manual. The ETIME? query tells you how many minutes the Calibrator has been in the power on state since the instrument was built. If you replace the CPU Assembly (A20), the clock/calendar battery (BT1), or the clock/calendar IC (U33), you will lose the setting of ETIME. The ETIME command gives you a way to set this counter to where it was before servicing the instrument. (If possible, read the counter first using ETIME?.) The syntax for this remote command is as follows:

ETIME

Description:

Sets the elapsed time counter to any number of minutes from 0 to 2,147,483,647. The setting of this counter is read by the ETIME? query, described in the 5700A/5720A Series II Operator Manual. (Sequential command.)

Parameter:

1. SET_TO
2. Integer, number of minutes

Example:

ETIME SET_TO, 4628000

Using The Fatality? and Fatalclr Commands

The FATALITY? query recovers fault codes that were logged when a fatal problem occurred. These faults are logged into a separate fault queue. Once the faults are read from the queue, you can clear the queue by sending the FATALCLR command. The syntax for these remote commands are as follows:

FATALITY?

Description:

Returns the list of the fatal faults logged since the list was last cleared by the FATALCLR command. (Sequential command.)

Parameter:

None

Response:

(String) The list of faults, one per line in the following format:

<date> <time> <fault code> <fault description string> <EOL>

Example:

"8/30/88	6:33:49 Fault
8/30/88	6:34:05 Fault
8/30/88	6:34:12 Fault
8/30/88	6:34:13 Fault
8/30/88	6:34:14 Fault
8/30/88	6:34:15 Fault
8/30/88	6:34:16 Fault

FATLCLR?

Description:

Clears the list of the fatal faults logged since the list was last cleared by the FATALCLR command. The list is read by the FATALITY? query. (Sequential command.)

Parameter:

None

4-25. Fault Codes

100-Level Faults: Air Flow Monitoring Subsystem	
100	Low Air Flow
200-Level Faults: 5725 Boost System	
200	5725 No Error
201	5725 Self-Test ROM Failure
202	5725 Self-Test RAM Failure
203	5725 Self-Test EEPROM Failure
204	5725 Self-Test Data Bus Failure
205	5725 Self-Test CLAMPS Circuit Failure
206	5725 Self-Test HVCLR Circuit Failure
207	5725 Self-Test DAC Failure
208	5725 Self-Test Watchdog Timer Failure
209	5725 Current Heatsink Too Hot
210	Output Tripped To Standby
211	5725 Current Compliance Voltage Too High
212	5725 Current Compliance Voltage Too High
213	5725 +400V Supply Did Not Shut Off
214	5725 -400V Supply Did Not Shut Off
215	5725 Voltage Heatsink Too Hot
216	5725 Voltage Heatsink Too Hot
217	5725 +400V Supply Too Small
218	5725 +400V Supply Too Large
219	5725 -400V Supply Too Large
220	5725 -400V Supply Too Small
221	5725 +400V Supply Current Too High
222	Output Tripped To Standby
223	5725 -400V Supply Current Too High
224	Output Tripped To Standby
225	5725 Fan Not Working
226	5725 CLAMPS Fault
227	Output Tripped To Standby
228	5725 Software TRAP
229	5725 Cable Was Off

230	5725 RESET (power-up or watchdog timer)
231	5725 Guard-Crossing Timeout
232	5725 Illegal/Unexecutable Command
233	5725 Non-Maskable Interrupt Occurred
234	5725 HVCLEAR Circuit Activated
235	Output Tripped To Standby
400-Level Faults: Calibration Constant Subsystem	
400	Bad Cal Constant ID
500-Level Faults: Configuration Finder Subsystem	
500	Bad Mode To CNFmodeRanges
501	Configuration Table Overflow
502	Bad Amplifier Type Selection
503	Bad Flat Constant Type Selection
504	Bad Flat Constant Type In Table
505	5725 Guard Crossing Wouldn't Start
600-Level Faults: Dot Matrix Display Driver Subsystem	
600	Bad Row Selector
601	Bad Column Argument
602	Bad Character
800-Level Faults: Executive Subsystem	
800	Wideband Module Needed
801	Amplifier Not Selected Or Connected
802	Amplifier Must Remain On For This Output
803	Over Limits Of Locked Range
804	Under Limits Of Locked Range
806	Invalid Date
807	Invalid Time
808	DC dBm Not Allowed
809	Ext Ref Value Out Of Range
810	Bad Edit Digit Movement
811	Not Wideband Units
812	Cannot Set Frequency With Ohms
813	Bad Units
814	Wrong Polarity For Limit

815	Outside Entry Limits
816	Magnitude Too Large For Calibrator
817	Magnitude Too Small For Calibrator
818	Frequency Too Large For Calibrator
819	Frequency Too Small For Calibrator
820	Calibrator Cannot Source That Value
821	V Limit Outside Calibrator Ability
822	I Limit Outside Calibrator Ability
823	Cannot Adjust Frequency To <<= 0 Hz
824	Offset Not Allowed Now
825	Scale Not Allowed Now
826	Ohms Reading Set Too High
827	Ohms Reading Set Too Low
828	Cannot Use External Sense Now
829	Cannot Use Phase Shift Now
830	Cannot Use Phase Lock Now
831	Cannot Use 2-ire Comp Now
832	Could not Do Default Wideband Output
833	Bad Selector For Set/Get Item
834	Cannot Boost This Output Mode
835	Cannot Use Ext Sense On Selected Range
836	Cannot Use 2 Wire Comp On Selected Range
837	Cannot Lock This Range
838	Cannot Set Clock, Rear Switch In NORMAL
839	Cannot Fmt EEPROM, Rear Switch In NORMAL
840	Illegal Output Post For Current
841	No 5725 Available For Selected Output
842	Not A Valid Wideband Flatness Point
843	Wideband Flatness Cal Is Not Active
844	Report String Too Long
845	Cannot Store, Rear Switch In NORMAL
846	Range Calibration Is Not Active
847	Magnitude Too High For Range Cal
848	Magnitude Too Low For Range Cal

849	Invalid Calibrator Setup Block
850	Cannot Format, 5725 Switch In NORMAL
851	Cannot Store, 5725 Switch In NORMAL
852	Calibration Steps Out Of Order
853	Cannot Use External Guard Now
854	Cannot Use Ext Guard On Selected Range
855	Cannot Set String, Rear Switch in NORMAL
856	Present Output Exceeds Selected Limit
857	Bad Selector For Reference Calibration
858	Cannot Change Range Now
859	Hardware Not Installed For This Range
860	Cannot Use Amplifier For This Output
861	5725 Cannot Ext Sense At That Frequency
900-Level Faults: Keyboard Driver Subsystem	
900	Keyboard Output Queue Full
1000-Level Faults: 5725 Communication Receive Subsystem	
1000	Could not ACK Packet From 5725
1001	Illegal 5725 Receive Task State
1002	Bad Receive Packet Number From 5725
1003	Bad Control Byte From 5725
1100-Level Faults: 5725 Communication Transmit Subsystem	
1100	Multiple Timeouts Sending To 5725
1101	5725 Request Reset Loop
1102	Unexpected NSA From 5725
1103	Bad Packet Number In ACK From 5725
1104	Bad Control Byte From 5725 Receive Task
1105	Illegal 5725 Transmit Task State
1106	5725 Indefinite ACKWAIT Holdoff
1200-Level Faults: 5725 Communication Utility Subsystem	
1200	Serial Write Failure To 5725
1201	Packet Too Large For 5725
1300-Level Faults: Output Monitor Subsystem	
1300	Undefined Signal
1301	Output Tripped To Standby

1302	Output Tripped To Standby

1303	DC Zero Calibration is Needed (Every 30 Days)
1400-Level Faults: Software Timer Subsystem	
1400	Cannot Install MTtick()
1401	Bad Timer Selector
1500-Level Faults: Guard Crossing Receive Subsystem	
1500	Could not ACK Packet From Inguard
1501	Illegal Inguard Receive Task State
1502	Bad Receive Packet Number From Inguard
1503	Bad Control Byte From Inguard
1600-Level Faults: Guard Crossing Transmit Subsystem	
1600	Multiple Timeouts Sending To Inguard
1601	Inguard Request Reset Loop
1602	Unexpected NSA From Inguard
1603	Bad Packet Number In ACK From Inguard
1604	Bad Control Byte From Inguard Rcv Task
1605	Illegal Inguard Transmit Task State
1606	Inguard Indefinite ACKWAIT Holdoff
1700-Level Faults: Guard Crossing Utility Subsystem	
1700	Serial Write Failure To Inguard
1701	Packet Too Large For Inguard
1800-Level Faults: Normal Output Operations Subsystem	
1800	DORMANT To OPERATE
1801	Bad Transition Type
1802	Bad Boolean Selector
1803	NRMrngStby Encountered Error
1804	DCV Called For Non-DCV Range
1805	ACV Called For Non-ACV Range
1806	Bad ACV Frequency Range
1807	Hi Res Frequency Too High
1808	ACV Amplitude Correction Failure
1809	Cannot Phase Lock To Signal
1810	Bad Phase Quadrant
1811	Current Called for Non-Current Range

1812	Ohms Called for Non-Ohms Range
1813	Cannot Phase Lock, Output Not AC
1814	Cannot Phase Shift, Output Not AC
1815	Bad Wide Band Range
1816	Freq. Too High Even For Wide Band
1817	Illegal Current Output Location
1818	Output Current Out Of Tolerance
1819	Current Compliance Voltage Exceeded
1820	2-Wire Compensation Current Exceeded
1821	NRMbstcur Passed Bad Range
1822	5220 No Longer Connected
1823	5220 Detected Fault And Shut Off
1824	5205 No Longer Connected
1825	5205 Detected Fault And Shut Off
1826	5725 No Longer Connected
1827	14 Bit DAC Scaling Found Zero Output
1900-Level Faults: Non-Volatile Subsystem	
1900	Could not Write Byte To EEPROM
1901	Checksum Error Reading EEPROM
1902	EEPROM Is Full
1903	Unknown Nonvolatile Constant Selector
1904	EEPROM Partition Is Full
1905	Could not Write Byte To 5725 EEPROM
1906	Checksum Error Reading 5725 EEPROM

2000-Level Faults: Analog Operations Manager Subsystem	
2000	Bad Command Code
2001	Bad Signal
2002	Long Term Command In Progress
2003	Guard Crossing Protocol Failed To Start
2004	Fatal Fault, Output Tripped
2005	Tripped While Calibrating or Diagnosing
2100-Level Faults: Output Display Driver Subsystem	
2100	Bad Display Selector
2101	Bad Character
2102	Bad Annunciator Selector
2200-Level Faults: Remote Interface Subsystem	
2200	Unknown Command
2201	Invalid Number Of Parameters
2202	Invalid Cal Constant Name
2203	Invalid Keyword
2204	Invalid Range
2205	Invalid Parameter Type
2206	Invalid Parameter Unit
2207	Invalid Parameter Value
2208	IEEE488.2 I/O DEADLOCK
2209	Spare
2210	IEEE488.2 INTERRUPTED Query
2211	Not Allowed From GPIB Interface
2212	Not Allowed From Serial Interface
2213	Remote Only
2214	Invalid Syntax
2215	IEEE488.2 UNTERMINATED Command
2216	Symbol Table Overflow
2217	Command Reserved For Service
2218	Invalid Binary Number
2219	Invalid Binary Block
2220	Invalid Character

2221	Invalid Decimal Number
2222	Invlaid Hexadecimal Block
2223	Invalid Hexadecimal Number
2224	Too Many Parameters
2225	Invalid Octal Number
2226	Too Many Characters
2227	Invalid String
2228	Invalid Register Address
2229	Invalid Cal Constant Name
2230	Remote Serial Port Dead
2231	IEEE488.2 Query After Indef Response
2300-Level Faults: Executive Subsystem	
2300	Unknown Report Requested
2301	Unknown Report Device Requested
2302	Serial Port Timeout
2400-Level Faults: Real Time Clock Subsystem	
2400	Cannot Install Interrupt Handler
2401	Unknown Interrupt Selector
2402	Bad Date & Cannot Be Set
2500-Level and 2600-Level Faults: Self Calibration Subsystem	
2500	Invalid Cal Procedure Number
2501	Could not Ext Cal Gain
2502	Could not Ext Cal Ref
2503	Could not Ext Cal Neg
2504	Could not Cal Ratio
2505	Could not Cal Pos 11V or 22V DC Zero
2506	Could not Cal Neg 11V or 22V DC Zero
2507	Could not Cal Pos 11V or 22V DC Gain
2508	Could not Cal 6.5V or 13V Buf Ref
2509	Could not Cal 2.2V Zero
2510	Could not Cal 220 mV Gain S1
2511	Could not Cal 220 mV Gain S2
2512	Could not Cal 220 mV Gain S3

2513	Could not Cal 220 mV Gain S4
2514	Could not Cal 220V DC Offset
2515	Could not Cal 220V DC Rnet
2516	Could not Cal 220V DC Gain
2517	Could not Cal ACV Gain
2518	Flatness Cal: Main Sensor Fail?
2519	Flatness Cal: AC Cal Sensor Fail?
2520	Could not Cal Fine Tune (14 bit) DAC
2521	Could not Cal Fine Tune 15th bit Down
2522	Could not Cal Fine Tune 15th bit Up
2523	Could not Cal 2.2 mV/22 mV step 1
2524	Could not Cal 2.2 mV/22 mV step 2
2525	Could not Cal 220V AC Offset
2526	Could not Cal 220V AC Gain
2527	Could not Cal 220 mV Offset
2528	Could not Cal 1100V AC/DC Offset
2529	Could not Cal 1100V AC/DC Gain
2530	Could not Cal 220 µA DC Zero
2531	Could not Cal 2.2 mA DC Zero
2532	Could not Cal 22 mA DC Zero
2533	Could not Cal 220 mA DC Zero
2534	Could not Cal 2.2A DC Zero
2535	Could not Cal 220 µA DCI (Meas 1)
2536	Could not Cal 220 µA DCI (Meas 2)
2537	Could not Cal 2.2 mA DCI (Meas 1)
2538	Could not Cal 2.2 mA DCI (Meas 2)
2539	Could not Cal 22 mA DCI (Meas 1)
2540	Could not Cal 22 mA DCI (Meas 2)
2541	Could not Cal 220 mA DCI (Meas 1)
2542	Could not Cal 220 mA DCI (Meas 2)
2543	Could not Cal 2.2A DCI (Meas 1)
2544	Could not Cal 2.2A DCI (Meas 2)
2545	Could not Ext Cal 10K Ohm Std (Meas 1)

2546	Could not Ext Cal 10K Ohm Std (Meas 2)
2547	Could not Ext Cal 10K Ohm Std (Meas 3)
2548	Could not Cal 10K Ohm (Meas 1)
2549	Could not Cal 10K Ohm (Meas 2)
2550	Could not Cal 10K Ohm (Meas 3)
2551	Could not Cal 19K Ohm (Meas 1)
2552	Could not Cal 19K Ohm (Meas 2)
2553	Could not Cal 19K Ohm (Meas 3)
2554	Could not Cal 100K Ohm (Meas 1)
2555	Could not Cal 100K Ohm (Meas 2)
2556	Could not Cal 190K Ohm (Meas 1)
2557	Could not Cal 190K Ohm (Meas 2)
2558	Could not Cal 1M Ohm (Meas 1)
2559	Could not Cal 1M Ohm (Meas 2)
2560	Could not Cal 1.9M Ohm (Meas 1)
2561	Could not Cal 1.9M Ohm (Meas 2)
2562	Could not Cal 10M Ohm (Meas 1)
2563	Could not Cal 10M Ohm (Meas 2)
2564	Could not Cal 19M Ohm (Meas 1)
2565	Could not Cal 19M Ohm (Meas 2)
2566	Could not Cal 100M Ohm (Meas 1)
2567	Could not Cal 1K Ohm (Meas 1)
2568	Could not Cal 1K Ohm (Meas 2)
2569	Could not Cal 1.9K Ohm (Meas 1)
2570	Could not Cal 1.9K Ohm (Meas 2)
2571	Could not Cal 100 Ohm (Meas 1)
2572	Could not Cal 100 Ohm (Meas 2)
2573	Could not Cal 190 Ohm (Meas 1)
2574	Could not Cal 190 Ohm (Meas 2)
2575	Could not Cal Ohms Divider (Meas 1)
2576	Could not Cal Ohms Divider (Meas 2)
2577	Could not Cal 10 Ohm (Meas 1)
2578	Could not Cal 10 Ohm (Meas 2)

2579	Could not Cal 19 Ohm (Meas 1)
2580	Could not Cal 19 Ohm (Meas 2)
2581	Could not Ext Cal 1 Ohm (0.26V CM Meas)
2582	Could not Ext Cal 1 Ohm (Ext Meas)
2583	Could not Ext Cal 1 Ohm (0.13V CM Meas)
2584	Could not Ext Cal 1 Ohm (Int Meas)
2585	Could not Ext Cal 1.9 Ohm (0.18V CM Meas)
2586	Could not Ext Cal 1.9 Ohm (0.12V CM Meas)
2587	Could not Ext Cal 1.9 Ohm (Int Meas)
2588	Could not Cal Wideband Gain
2589	Bad Cal Step Selector
2590	A/D Appears To Have Failed
2591	User Range Gain Adjustment Is 0
2592	Stored User Range Gain Adjust Is 0
2593	220 μA AC Flatness Calibration Failed
2594	2.2 mA AC Flatness Calibration Failed
2595	22 mA AC Flatness Calibration Failed
2596	220 mA AC Flatness Calibration Failed
2597	Bad Range Number For IAC Flatness Cal
2598	No Data For DCI Calibration
2599	2.2V AC Flat Early Fail
2600	2.2V AC Flat Bad AC Cal Sensor?
2601	2.2V AC Flat Diverge
2602	22V AC Flat Early Fail
2603	22V AC Flat Bad AC Cal Sensor?
2604	22V AC Flat Diverge
2605	220V AC Flat Early Fail
2606	220V AC Flat Bad AC Cal Sensor?
2607	220V AC Flat Diverge
2608	1100V AC Flat Early Fail
2609	1100V AC Flat Bad AC Cal Sensor?
2610	1100V AC Flat Diverge
2611	220 μA IAC Flat Early Fail

2612	220 μA IAC Flat Bad AC Cal Sensor?
2613	220 μA IAC Flat Diverge
2614	2.2 mA IAC Flat Early Fail
2615	2.2 mA IAC Flat Bad AC Cal Sensor?
2616	2.2 mA IAC Flat Diverge
2617	22 mA IAC Flat Early Fail
2618	22 mA IAC Flat Bad AC Cal Sensor?
2619	22 mA IAC Flat Diverge
2620	220 mA IAC Flat Early Fail
2621	220 mA IAC Flat Bad AC Cal Sensor?
2622	220 mA IAC Flat Diverge
2623	2.2A IAC Flat Early Fail
2624	2.2A IAC Flat Bad AC Cal Sensor?
2625	2.2A IAC Flat Diverge
2626	Illegal Ohms Null Function State
2627	Unknown Source Divider Identifier
2628	No Data For Ohms Calibration
2629	Illegal Ohms Calibration Config
2630	Illegal Number Of Ohms Cal Points
2631	5725 Shunt 0A Meas Fail
2632	5725 Shunt 1.3A Meas Fail
2633	5725 Current Amplifier Zero Meas Fail
2634	5725 Current Amplifier Gain Meas Fail
2635	Wideband Thermal Sensor Cal Diverge
2636	Wideband Sensor Amp Offset Too Big
2637	Wideband Ext Cal Point Bad Const ID
2638	5725 ACV Sense Amp Offset Diverge
2639	5725 ACV Sense Amp Gain Diverge
2640	5725 ACV Flatness Ref Freq Failure
2641	5725 ACV Flatness Cal Freq Failure
2642	External V Reference Value Out Of Range
2643	5725 Diagnostic DAC Cal Didn't Converge
2644	Spare

2645	Spare
2646	DAC Appears To Not Meet Linearity Spec
2647	ACV Buffer Offset Too Large
2648	5725 ACV Flat Test Cap Too Large
2649	5725 ACV Flat Test Cap Too Large
2650	Could not Cal 100M Ohm (Meas 2)
2700-Level Faults: Self Diagnostics Subsystem (Current)	
2700	A7: 8255 Control Word
2701	A7: 8255 Port A Fault
2702	A7: 8255 Port B Fault
2703	A7: 8255 Port C Fault
2705	A7: Oven Regulation Fault
2706	A7: Current Compliance Fault
2707	A7: Hardware Initialization Fault
2709	A7: Current Magnitude Fault
2710	A7: Dummy Load Current Fault
2711	Assembly A7 Is Not Responding
2712	A7: Hi-Res Clock Fault
2713	A7: Hi-Res Loop Fault In 100HZ Range
2714	A7: Hi-Res Loop Fault In 1KHZ Range
2715	A7: Hi-Res Loop Fault In 10KHZ Range
2716	A7: Hi-Res Loop Fault In 100KHZ Range
2717	A7: Hi-Res Loop Fault In 1MHZ Range
2718	Fault In Setting Up AC For Diagnostics
2719	A7: 8255 Was Reset
2800-Level Faults: Self Diagnostics Subsystem (DAC)	
2800	A11: 8255 Control Word
2801	A11: 8255 Port A Wires
2802	A11: 8255 Port B Data Bus
2803	A11: 82C54 Status Words
2804	A11: DAC Heaters Not Regulated
2805	5700 Not Warmed Up
2806	A11: ADC Amp Output Noise

2807	A11: ADC Amp Output Offset
2808	A11: ADC Amp Gain Error
2809	A11: DAC Monitoring Fault
2810	A11: +11V DC Range Fault
2811	A11: -11V DC Range Fault
2812	A11: +22V DC Range Fault
2813	A11: -22V DC Range Fault
2814	A11: 6.5V Buffered Reference Fault
2815	A11: 6.5V Reference Fault
2816	A11: 13V Buffered Reference Fault
2817	A11: 13V Reference Fault
2818	Assembly A11 Missing
2819	A11: 8255 Was Reset
2820	A11: Fine Adjust Channel Fault
2821	A8/A11: +11/22V DC Zero Estimate Fault
2822	A8/A11: -11/22V DC Zero Estimate Fault
2823	A11: Could not Estimate +11V Or 22V Gain
2824	A11: Could not Estimate 6.5V Or 13V Ref
2825	A11: Could not Estimate 6.5V Or 13V Buf Ref
2826	A11: A/D Overload Fault
3100-Level Faults: Self Diagnostics Subsystem (High Voltage)	
3100	A14: 8255 Control Word
3101	A14: 8255 Port A Fault
3102	A14: 8255 Port B Fault
3103	A14: 8255 Port C Fault
3104	A15: HV Oven Regulation Fault
3105	A15: HV I Oven Regulation Fault
3106	A15: DC HV Amp Noise Fault
3107	A15: DC HV Amp Offset Fault
3108	A15: DC HV Amp Gain Fault
3109	A15: HV +DC Preamplifier Fault
3110	A15: HV +DC Series Pass & Current Fault
3111	A15: HV +DC High Voltage Output Fault

3112	A15: HV +DC Ref/Error Amplitude Fault
3113	A15: HV -DC Preamplifier Fault
3114	A15: HV -DC Series Pass & Current Fault
3115	A15: HV -DC High Voltage output Fault
3116	A15: HV -DC Reference/Error Amp Fault
3117	A14/A15: HV +DC Current Error Amp Fault
3118	A14/A15: HV -DC Current Error Amp Fault
3119	A14/A15: HV +DC Current Abs. Value
3120	A14/A15: HV -DC Current Abs. Value
3122	A14/A15: HV AC 1KHZ, Preamp Fault (lo)
3123	A14/A15: HV AC 1KHZ, Preamp Fault (mid)
3124	A14/A15: HV AC 1KHZ, Preamp Fault (hi)
3125	A14/A15: HV AC 100HZ, Preamp Fault (lo)
3126	A14/A15: HV AC 100HZ, Preamp Fault
3127	A14/A15: HV AC 100HZ, Preamp Fault (hi)
3128	A14/A15: HV AC 1KHZ, Output Fault (lo)
3129	A14/A15: HV AC 1KHZ, Output Fault (mid)
3130	A14/A15: HV AC 1KHZ, Output Fault (hi)
3131	A14/A15: HV AC 100HZ, Output Fault (lo)
3132	A14/A15: HV AC 100HZ, Output Fault (mid)
3133	A14/A15: HV AC 100HZ, Output Fault (hi)
3135	Assembly A14 Not Responding
3136	A14: 8255 Was Reset
3137	A14/A15/A16: 2.2A AC Range Mag. Fault
3138	A14/A15/A16: 2.2A AC Range Compliance
3139	A14/A15/A16: 2.2A AC Range Amplitude
3140	A14/A15/A16: 2.2A AC Range Abs. Value
3141	A14/A15/A16: 2.2A DC Range Dummy Load
3142	A14/A15/A16: 2.2A DC Range Compliance
3143	A14/A15/A16: 2.2A DC Range Magnitude

3200-Level Faults: Self Diagnostics Subsystem (misc)	
3200	Assemblies Missing
3201	Unknown Diagnostic Test
3202	5725 ACV Sense Amp Fault
3203	5725 ACV Standby 5725 Fault
3204	5725 ACV Operate 5725 Fault
3205	5725 ACV Cal Sensor Test Died
3206	5725 ACV Cal Sensor Fault
3207	5725 ACV VLF (100 Hz) Won't Converge
3208	5725 ACV LF (1 kHz) Won't Converge
3209	5725 ACV MF (10 kHz) Won't Converge
3210	5725 ACV HF (100 kHz) Won't Converge
3211	5725 Current Path To Shunt Open
3212	5725 Shunt Sense Open
3213	5725 Shunt Measurement Out Of Tolerance
3214	5725 Current Amplifier Offset Too Large
3215	5725 Current Drive Path Open
3216	5725 Current Error Amplifier Failure
3217	5725 Amplifer Not Connected
3300-Level Faults: Self Diagnostics Subsystem (Ohms)	
3300	A9: 8255 Control Word
3301	A9: 8255 Port A Fault
3302	A9: 8255 Port B Fault
3303	A9: 8255 Port C Fault
3304	A9: 10V Source Fault
3305	A9: 5V Source Fault
3306	A9: 2V Source Fault
3308	A9: Diff Amp Offset Fault
3309	A9: Diff Amp Gain Fault
3310	A9: Diff Amp Noise Fault
3311	A9/A10: Ohms 10:1 Divider Fault
3312	A9/A10: Ohms 1:1 Divider Fault

3313	A9/A10: 10K Ohm Diagnostic Fault
3314	A9/A10: 19K Ohm Cal Diag Fault
3315	A9/A10: 10 Ohm Cal Diag Fault
3316	A9/A10: 19 Ohm Cal Diag Fault
3317	A9/A10: 100K Ohm Ratio Fault
3318	A9/A10: 190K Ohm Ratio Fault
3319	A9/A10: 1M Ohm Ratio Fault
3320	A9/A10: 1.9M Ohm Ratio Fault
3321	A9/A10: 10M Ohm Ratio Fault
3322	A9/A10: 19M Ohm Ratio Fault 1
3323	A9/A10: 19M Ohm Ratio Fault 2
3324	A9/A10: 100M Ohm Ratio Fault
3325	A9/A10: 10K Ohm Check Fault
3326	A9/A10: 19K Ohm Check Fault
3327	A9/A10: 1K Ohm Check Fault
3328	A9/A10: 1.9K Ohm Check Fault
3329	A9/A10: 100 Ohm Check Fault
3330	A9/A10: 190 Ohm Check Fault
3331	A9/A10: 10 Ohm Check Fault
3332	A9/A10: 19 Ohm Check Fault
3333	A9/A10: 1 Ohm Check Fault
3334	A9/A10: 1.9 Ohm Check Fault
3335	A9/A10: Ohms Short Check Fault
3336	A9/A10: 2 Wire Compensation Fault
3337	A9/A10: Ohms Correction Factor Fault
3338	Assembly A9 Not Responding
3339	A9: 8255 Was Reset
3340	A9/A10: 100 Ohm Cal Diag Fault
3341	A9/A10: 190 Ohm Cal Diag Fault

3400-Level Faults: Self Diagnostics Subsystem (Oscillator)	
3400	A12: 8255 Control Word
3401	A12: 8255 Port A
3402	A12: 8255 Port B
3403	A12: 8255 Port C
3404	A13: 8255 Control Word
3405	A13: 8255 Port A
3406	A13: 8255 Port B
3407	A13: 8255 Port C
3408	A13: Fixed Ampl. Osc Fault
3409	A13: Phase Lock Loop Fault
3410	A12/A13: 22V Amp Bias Adj Error
3411	A12/A13: 22V Amp Nonfunctional
3412	A12 To A13 Interface Fault
3413	A12/A13: 14 bit DAC Nonfunctional
3414	A12/A13: Nonlinear Control Loop 2Vrng
3415	A12/A13: nonlinear Control Loop 20Vrng
3416	A12/A13: DAC 15th Bit Fault
3417	A12: DC Sensor Buffer Fault
3418	A12: Sensor Loop/Sq. Root Amp Fault
3419	A12: AC Sensor Buff (2V Range)
3420	A12: AC Sensor Buff (20V Range)
3421	A12: AC Cal Sensor (2V Range)
3422	A12: AC Cal Sensor (20V Range)
3423	Assembly A12 Missing
3424	Assembly A13 Missing
3425	Assembly A12 Or A13 Not Responding
3426	A12: 8255 Was Reset
3427	A13: 8255 Was Reset

3500-Level Faults: Self Diagnostics Subsystem (Power Amp)	
3500	A16: 8255 Control Word
3501	A16: 8255 Port A
3502	A16: 8255 Port B
3503	A16: 8255 Port C
3507	A16: PA Supplies Are Off
3508	A16/A14: 220V AC Range Output Fault
3509	A16: Amplifier Loop Not Regulated
3510	A16: 220V Amp Fault
3511	A16: Incorrect PA Input
3520	A16: PA Oven Regulation Fault
3521	Assembly A16 Is Not Responding
3524	A16: Power Amp Is Too Hot
3525	220V DC Initialization Fault
3526	220V AC Initialization Fault
3527	A16: Power Amp DC Cal Network Zero Fault
3528	A16: Power Amp DC Cal Network Gain Fault
3529	A16: Pwr Amp 220V Range Attenuator Fault
3530	A16: 8255 Was Reset
3600-Level Faults: Self Diagnostics Subsystem (Power Supplies)	
3600	+17S Supply Fault
3601	-17S Supply Fault
3602	+15S Supply Fault
3603	-15S Supply Fault
3604	+42S Supply Fault
3605	-42S Supply Fault
3606	LH COM Ground Fault
3607	-5LH Supply Fault
3608	5RLH Supply Fault
3609	8RLH Supply Fault
3610	+PASupply Fault
3611	-PASupply Fault
3612	+15 OSC Supply Fault

3613	-15 OSC Supply Fault
3614	OSC COM Ground Fault
3615	S COM Ground Fault
3700-Level Faults: Self Diagnostics Subsystem (Rear I/O)	
3700	A21: 8255 Control Word
3701	A21: 8255 Port A Fault
3702	A21: 8255 Port B Fault
3703	A21: 8255 Port C Fault
3704	Assembly A21 Not Responding
3705	A21: Rear Panel Data Bus Fault
3708	A21: 8255 Was Reset
3800-Level Faults: Self Diagnostics Subsystem (Switch Matrix)	
3800	A8: 8255 Control Word
3801	A8: 8255 Port A Fault
3802	A8: 8255 Port B Fault
3803	A8: 8255 Port C Fault
3804	A8: Zero Amp Lo Noise Fault
3805	A8: Zero Amp Lo Offset
3806	A8: Zero Amp Lo Gain Fault
3807	A8: Zero Amp Hi Noise Fault
3808	A8: Zero Amp Hi Offset
3809	A8: Zero Amp Hi Gain Fault
3810	A8: 2.2V Amp Noise Fault
3811	A8: Zero Amp Offset
3812	A8: 2.2V Gain Fault
3813	A8: 220mV Offset Fault
3814	A8: 220mV Divider Fault
3815	A8: 22mV Divider Fault
3818	A8: Out Lo To Sense Lo Continuity Fault
3819	A8: Relay Fault
3824	A8: Oven Regulation Fault
3825	Assembly A8 Not Responding

3826	A8: 8255 Was Reset
3827	Assembly A8 Too Hot
3900-Level Faults: Self Diagnostics Subsystem (Wideband)	
3900	A5: 8255 Control Word
3901	A5: 8255 Port A Fault
3902	A5: 8255 Port B Fault
3903	A5: 8255 Port C Fault
3904	Optional Assemblies A5/A6 Are Missing
3905	A6: Phase Lock Loop Fault
3906	A6: Phase Lock Loop Fault At 30Mhz
3907	A5: RMS Sensor Fault
3908	A5: RMS Sensor Fault At 30Mhz
3909	A5: RMS Sensor Fault At 6.5V DC in
3910	A5/A6: Ampl. Control Fault
3911	A5/A6: Ampl. Control Fault At 30Mhz
3912	A5/A6: Output Offset Fault
3913	A5/A6: Output Offset Fault At 30Mhz
3914	A5: 0DB Output Attenuation Fault
3915	A5: 10DB Output Attenuation Fault
3916	A5: 20DB Output Attenuation Fault
3917	A5: 30DB Output Attenuation Fault
3918	A5: 40DB Output Attenuation Fault
3922	A5/A6: Wideband Initialization Fault
3923	A5: 8255 Was Reset
4000-Level Faults: Analog Sequencing Subsystem	
4000	Bad Sequence ID
4001	Over Nested Subsequences
4002	Bad Sequence Command Code
4003	Bad Reply Size From Inguard
4004	Reply From Inguard Too Small
4005	False MSG Semaphore from Inguard
4006	Inguard CPU POP

4007	Inguard CPU Reset
4008	Inguard CPU A/D Timeout
4009	Inguard CPU Timed Out On Main CPU
4010	Inguard CPU Detected A Command Error
4011	Bad Y5000 Get/Set Selector
4012	Sequencer Timed Out Waiting For Inguard
4013	Illegal Analog State Command For 5725
4014	Sequencer Timed Out Waiting for 5725
4015	Could not Queue Command To 5725 BX
4016	Reply From 5725 Was Garbled
4100-Level Faults: Serial Interface Driver Subsystem	
4100	Bad Virtual channel
4101	Framing
4102	Input Queue Overflow
4103	Overrun
4104	Parity
4105	Uart Failed Self Test
4106	Serial Port 0
4107	Serial Port 1
4108	Guard Crossing UART
4109	Serial Port 3
4110	Remote Interface UART
4111	Boost Crossing UART
4200-Level Faults: Instrument State Manager Subsystem	
4200	Bad Boolean Value Selector
4201	Meaningless Target State Value
4202	Meaningless Actual State Value
4203	Mystery Target/Actual State Difference

4300-Level Faults: Self Test Subsystem	
4301	ROM Checksum
4302	RAM
4303	Real Time Clock
4304	Keyboard
4305	Output Display
4306	Control Display
4307	IEEE488
4308	Rear Panel DUART
4309	Guard Crossing DUART
4310	Interrupt Hardware
4311	Inguard CPU ROM Fault
4312	Inguard CPU RAM Fault
4313	Front Panel Refresh Fault
4400-Level Faults: General Purpose Utility Subsystem	
4400	Invalid Command
4500-Level Faults: Analog Value Finder Subsystem	
4500	VFdcDac Value Out Of DAC Range
4501	Bad Range Selector
4502	Non-Vfinder Range
4503	Bad DAC ICALL
4504	User Range Adjust of 0 (I used 1)
4505	Divide By 0 In (VF)correct
4600-Level Faults: Watch Dog Monitoring Subsystem	
4600	Watchdog Timed Out
4700-Level Faults: Operating Kernel Subsystem	
4700	Kstart Returned
4701	Task Termination
4702	No Signal Handler
4703	Ksuspend( ) When Not RUNNING
4704	Ksleep( ) When Not RUNNING
4705	Kevwait( ) When Not RUNNING

Chapter 5
List of Replaceable Parts

5-1. Introduction

This section contains an illustrated list of replaceable parts for the 5700A/5720A Series II. Where applicable, parts differences are indicated between the 5700A and 5720A. For example, Table 5-1 indicates MP36 (nameplate) is PN 600723 for a 5700A or PN 600759 for a 5720A. Parts are listed by assembly; alphabetized by reference designator. Each assembly is accompanied by an illustration showing the location of each part and its reference designator. The parts lists give the following information:

- Reference designator
- An indication if the part is subject to damage by static discharge
- Description
- Fluke stock number
- Total quantity
- Any special notes (i.e., factory-selected part)

⚠Caution

A * symbol indicates a device that may be damaged by static discharge.

5-2. How to Obtain Parts

Electrical components may be ordered directly from the manufacturer by using the manufacturer's part number, or from Fluke Corporation and its authorized representatives by using the part number under the heading FLUKE STOCK NO. Parts price information is available from the Fluke Corporation or its representatives. Prices are also available in a Fluke Replacement Parts Catalog which is available on request.

In the event that the part ordered has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

To ensure prompt delivery of the correct part, include the following information when you place an order:

- Instrument model and serial number
- Part number and revision level of the pca containing the part
- Reference designator
- Fluke stock number
- Description (as given under the DESCRIPTION heading)
- Quantity

Refer to Contacting Fluke earlier in this manual for more information.

5-3. Service Centers

To locate a service center, use the information located in Contacting Fluke earlier in this manual.

5-4. Parts List

The following pages contain the module-level parts lists for the 5700A/5720A Series II Calibrators.

Table 5-1. Front Panel Final Assembly

Reference Designator	Description	Fluke Stock No	Tot Qty	Notes
A1	* KEYBOARD PCA	761049	1	
A2	* FRONT PANEL PCA	761031	1	
A3	* ANALOG MOTHERBOARD PCA	761023	1	
A4	* DIGITAL MOTHERBOARD PCA	760942	1	
A7	* CURRENT/HIGHT RESOLUTION OSCILLTOR. PCA	764613	1	
A8	* SWITCH MATRIX PCA	761106	1	
A9	* OHMS,CAL PCA	775395	1	
A10	* OHMS,MAIN PCA	761114	1	
A11	* DAC PCA	761122	1	
A12	* OSCILLATOR CONTROL PCA	761130	1	
A13	* OSCILLATOR OUTPUT, PCA	761148	1	
A14	* HIGH VOLTAGE CONTROL PCA	775429	1	
A15	* HIGH VOLTAGE/HIGH CURRENT PCA	761155	1	
A16	* POWER AMPLIFIER PCA	761163	1	
A17	* REGULATOR./GUARD CROSSING PCA	761171	1	
A18	* FILTER/PA PCA	761189	1	
A19	* DIGITAL POWER SUPPLY PCA	761056	1	
A20	* CPU PCA (5700 Series I)	1591070	1	
A20	* CPU PCA (5700 Series II)	1639013	1	
A20	* CPU PCA (5720A)	1626228	1	
A21	* REAR PANEL PCA	761221	1	
A22	TRANSFORMER/MODULE ASSEMBLY	813527	1	
CP1	ADAPTER,COAX,SMA(F),N(F)	516963	1	
E1	JUMPER LINK,BINDING POST	190728	1	
E2	GROUND STRIP,COPPER,1.00,.375,.030	854836	1	
H5	SCREW,PH,P,THD FORM,STL,5-20,..312	494641	9	
H20	SCREW,PH,P,LOCK,STL,4-40,.187	129882	4	
H25	SCREW,CAP,SCKT,SS,8-32,.375	837575	4	
H29	SCREW,FHU,P,LOCK,SS,6-32,.250	769893	3	
H32	SCREW,PH,P,LOCK,STL,6-32,.250	152140	11	
H43	SCREW,PH,P,LOCK,SS,6-32,.375	334458	1	
MP1	PANEL, FRONT, SHEET METAL	761437	1	
MP2	SHIELD, DISPLAY PWB	764514	1	
MP3	LENS, SHIELD	760843	1	
MP4	DECAL, FRONT OUTPUT CABLE DIAGRAM	802967	1	
MP6	GROMMET,EXTRUDED,POLYETHYLENE,.085	854351	1	
MP14	BINDING POST-RED	886382	3	
MP17	BINDING POST-BLACK	886379	2	
MP19	BINDING POST-GREEN	886374	1	
MP20	BINDING POST-BLUE	886366	1	
MP21	ENCODER WHEEL	764548	1	
MP22	FRONT PANEL, MOLDED	886325	1	
MP23	KNOB, ENCODER, GREY	868794	1	
MP24	KEYPAD,ELASTOMERIC	1586631	1	
MP25	DECAL, POWER ON/OFF	886312	1	
MP26	DECAL, KEYPAD	886304	1	
MP27	DECAL, FRONT OUTPUT	886309	1	
MP28	NUT, #8 LOW THERMAL	850334	8	
MP35	LENS, DISPLAY	600756	1	
MP36	NAMEPLATE SET, ELECTROFORM (MODEL 5700A)	600723	1	
MP36	NAMEPLATE SET, ELECTROFORM (MODEL 5720A)	600759	1	
MP37	HANDLE,INSTRUMENT	886333	2	
TM1	5700A/5720 OPERATOR MANUAL	601622	1	
TM2	5700A/5720A SERVICE MANUAL	601630	1	
TM3	5700A/5720A SERIES GUIDE SET	601960	1	

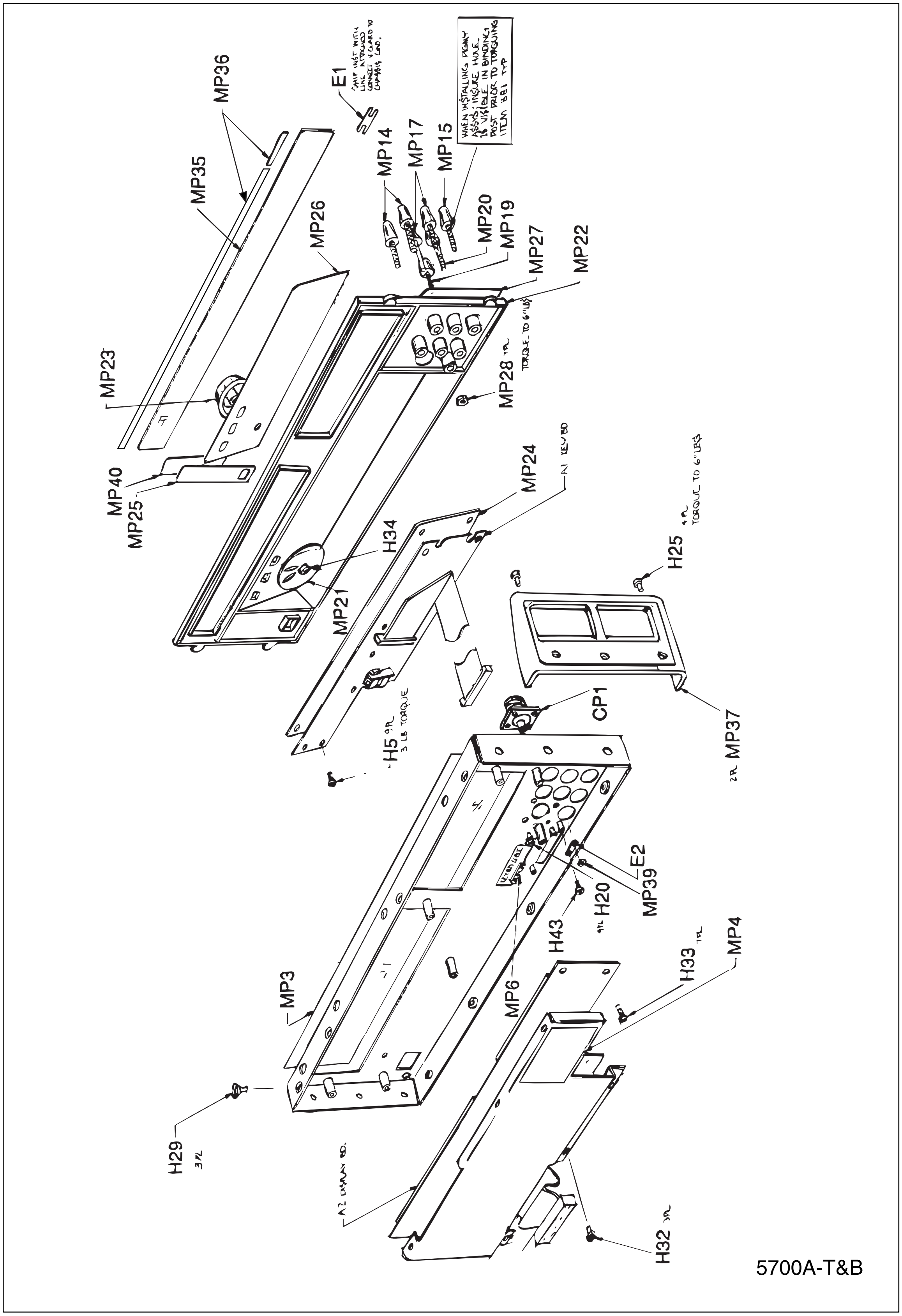


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Figure 5-1. Front Panel Final Assembly

Table 5-1. Chassis Final Assembly

Reference Designator	Description	Fluke Stock No	Tot Qty	Notes
A22	TRANSFORMER/MODULE ASSEMBLY	813527	1	1
B1,B2	FAN/CONNECTOR ASSEMBLY	761213	2	
E1	BINDING HEAD, PLATED	102889	1	
⚠F1	FUSE,.25X1.25,1.25A,250V,SLOW	109231	1	
H1	INSULATOR, ANALOG BOTTOM	775361	1	
H2	SCREW,PH,P,LOCK,SS,6-32,.500	320051	9	
H14	SCREW,PH,P,LOCK,STL,6-32,.750	114223	14	
H21	SCREW,PH,P,LOCK,STL,6-32,.250	152140	27	
H43	SCREW,PH,P,LOCK,STL,6-32,.375	152165	2	
H45	SCREW,CAP,SCKT,SS,8-32,.375	295105	12	
H57	SCREW,FHU,P,LOCK,SS,6-32,.250	769893	17	
H74	SCREW,PH,P,LOCK,STL,6-32,1.250	159756	8	
H85	WASHER,FLAT,STL,.149,.375,.031	110270	4	
H97	WASHER,FLAT,STL,.160,.281,.010	111005	10	
H105	SCREW,TH,P,LOCK,STL,8-32,.250	853622	4	
MP1	COVER, DIGITAL	775635	1	
MP2	BOTTOM COVER, ANALOG BOX	874912	1	
MP3	TOP COVER, ANALOG BOX	764522	1	
MP4	RELAY BRACKET	761015	1	
MP5	TOP COVER, INSTRUMENT	660941	1	
MP6	BOTTOM COVER, INSTRUMENT	660944	1	
MP7	SHROUD, CPU CABLE	813519	1	
MP8	NUT, #8 LOW THERMAL	850334	8	
MP11	POWER BUTTON, ON/OFF	775338	1	
MP12	BOTTOM FOOT, MOLDED, GRAY #7	868786	4	
MP18	SIDE EXTRUSION	886288	2	
MP20	ADHESIVE SIDE TRIM	698316	2	
MP22	DECAL, CAUTION 240V	760926	2	
MP23	DECAL, CAUTION 900V	760934	1	
MP31	WASHER, LOW THERMAL #8	859939	16	
MP45	INSERT EXTRUSION	886283	2	
MP47	INSULATOR, DIGITAL MOTHERBOARD	761247	1	
MP54	AIDE,PCB PULL	541730	2	
MP108	FOOT,RUBBER,ADHES,GRY,.44 DIA,.20 THK	1601870	3	
MP114	GROMMET,SLOT,RUBBER,.438,.062	853291	1	
W1	CABLE, WIDEBAND TO FRONT PANEL	802785	1	

1. Non-repairable part.
⚠ Fuse part number 109231 in all units.

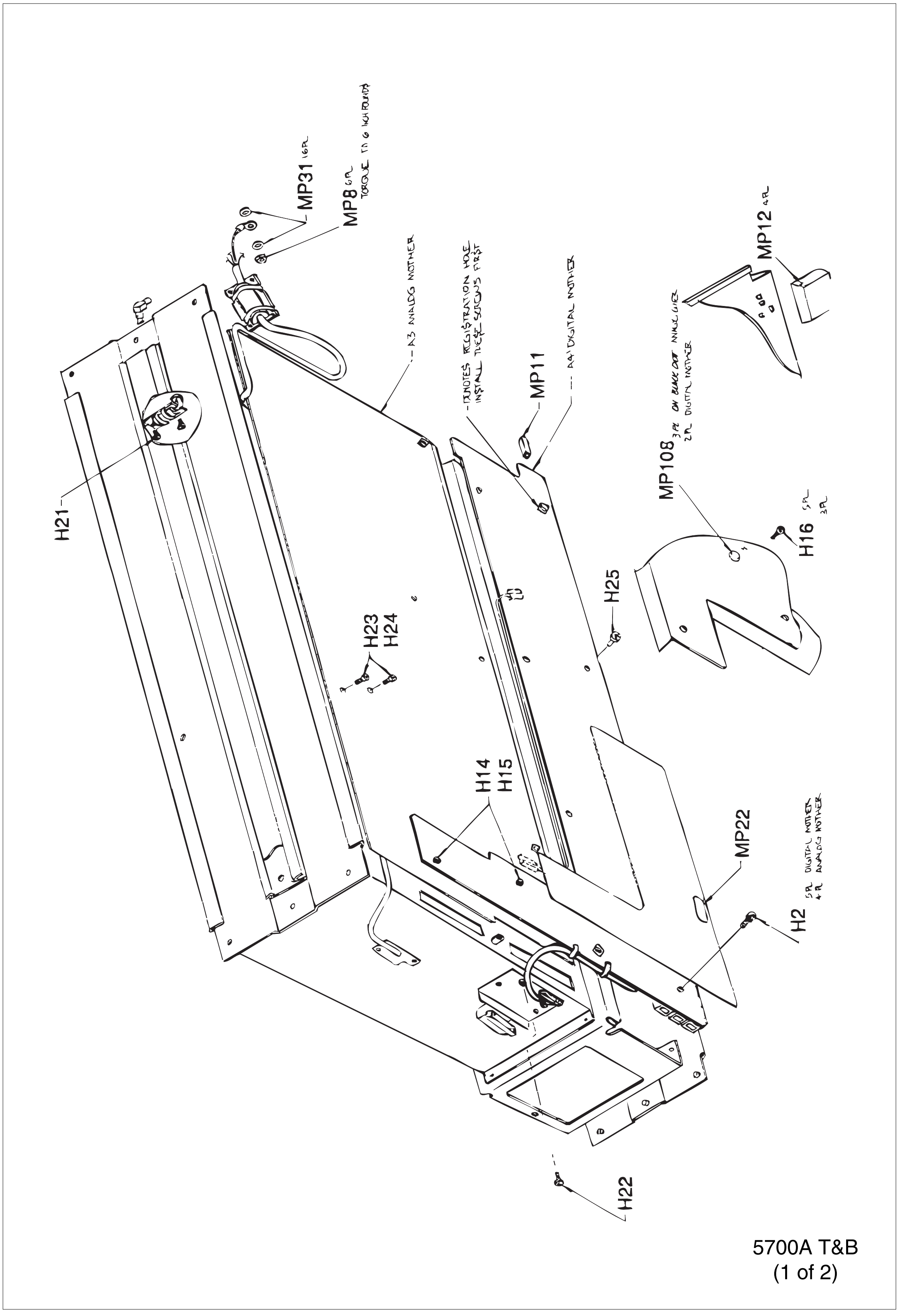

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Figure 5-2. Chassis Final Assembly

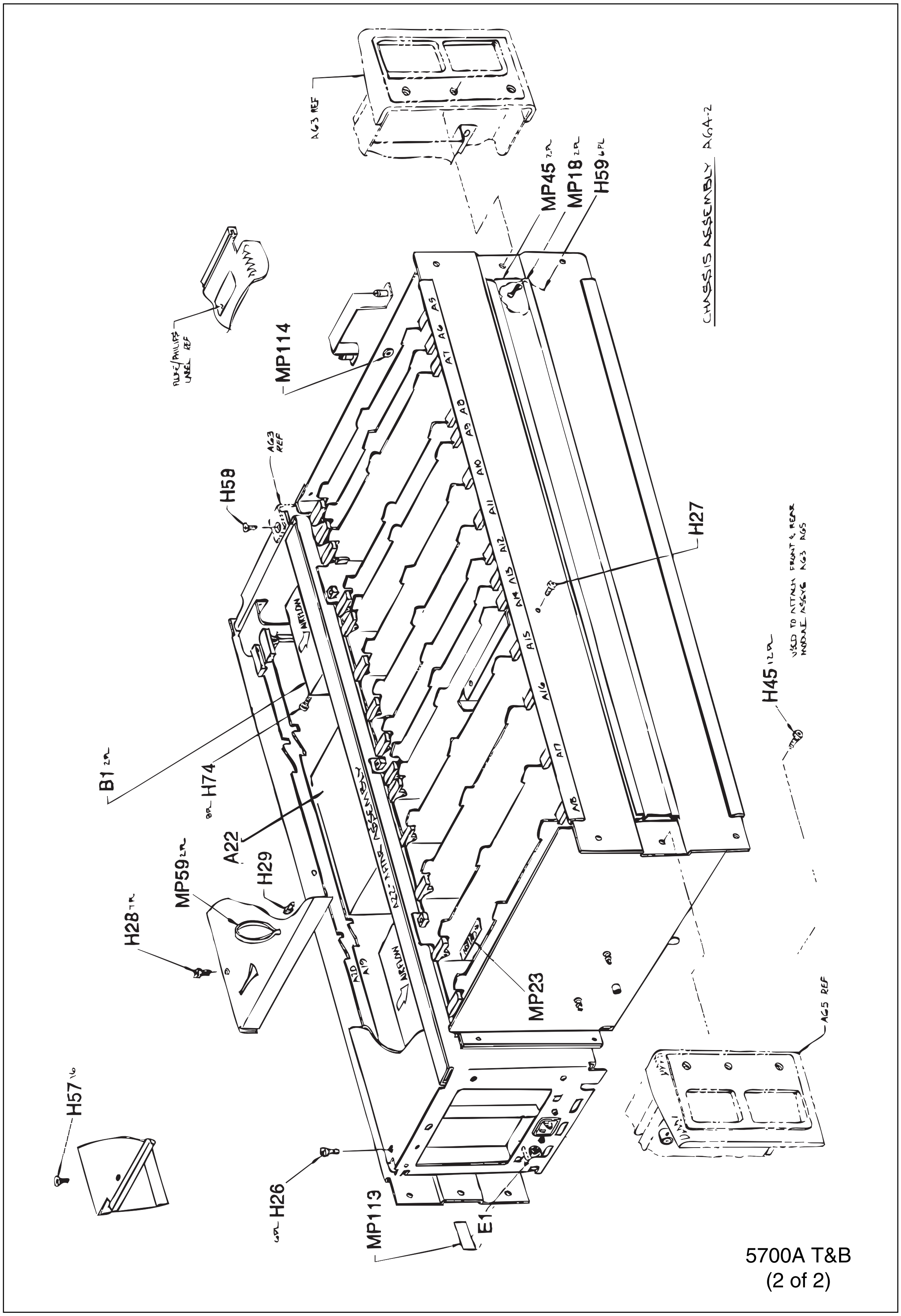

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Figure 5-2. Chassis Final Assembly (cont)

Table 5-1. Rear Panel Final Assembly

Reference Designator	Description	Fluke Stock No	Tot Qty	Notes
F1	FUSE,.25X1.25,1.25A,250V,SLOW	851936	1	
H1	FILTER, AIR	813493	1	
H3	SCREW,CAP,SCKT,SS,8-32,.375	837575	4	
H7	SCREW,PH,P,LOCK,STL,6-32,.750	114223	6	
H13	SCREW,PH,P,LOCK,STL,6-32,.250	152140	1	
MP1	REAR PANEL	886387	1	
MP2	GROMMET,EXTRUDED,POLYETHYLENE,.085	854351	1	
MP3	DECAL, REAR OUTPUT CABLE DIAGRRAM	886291	1	
MP5	GROMMET,NYLON,NAT,.056X.150X.100X.155	285254	1	
MP11	CONN ACC,MICRO-RIBBON,JACK SCREW	681940	2	
MP13	CONN ACC,D-SUB,JACK SCREW,4-40	448092	8	
MP21	ALUMINUM REAR OUTPUT HOUSING	885462	1	
MP22	MOLDED HOUSING, REAR OUTPUT	886358	1	
MP23	DECAL, REAR OUTPUT	886296	1	
MP24	FILTER FRAME	886390	1	
MP25	NUT, #8 LOW THERMAL	850334	6	
MP31	HANDLE,INSTRUMENT	886333	2	
MP33	BINDING POST-RED	886382	2	
MP35	BINDING POST-BLACK	886379	2	
MP37	BINDING POST-BLUE	886366	1	
MP38	BINDING POST-PURPLE	886361	1	
MP43	WASHER,FLAT,SS,.119,.187,.010	853296	8	
MP51	WASHER, LOW THERMAL	760892	4	
MP55	NUT, LOW THERMAL	760876	2	
MP106	WASHER,FLAT,STL,.191,.289,.010	111047	2	
MP125	WASHER,FLAT,STL,.160,.281,.010	111005	6	
W1	CORD,LINE,5-15/IEC,3-18AWG,SVT,7.5 FT06	284174	1	
W2	AC LINE FILTER ASSY	775445	1	

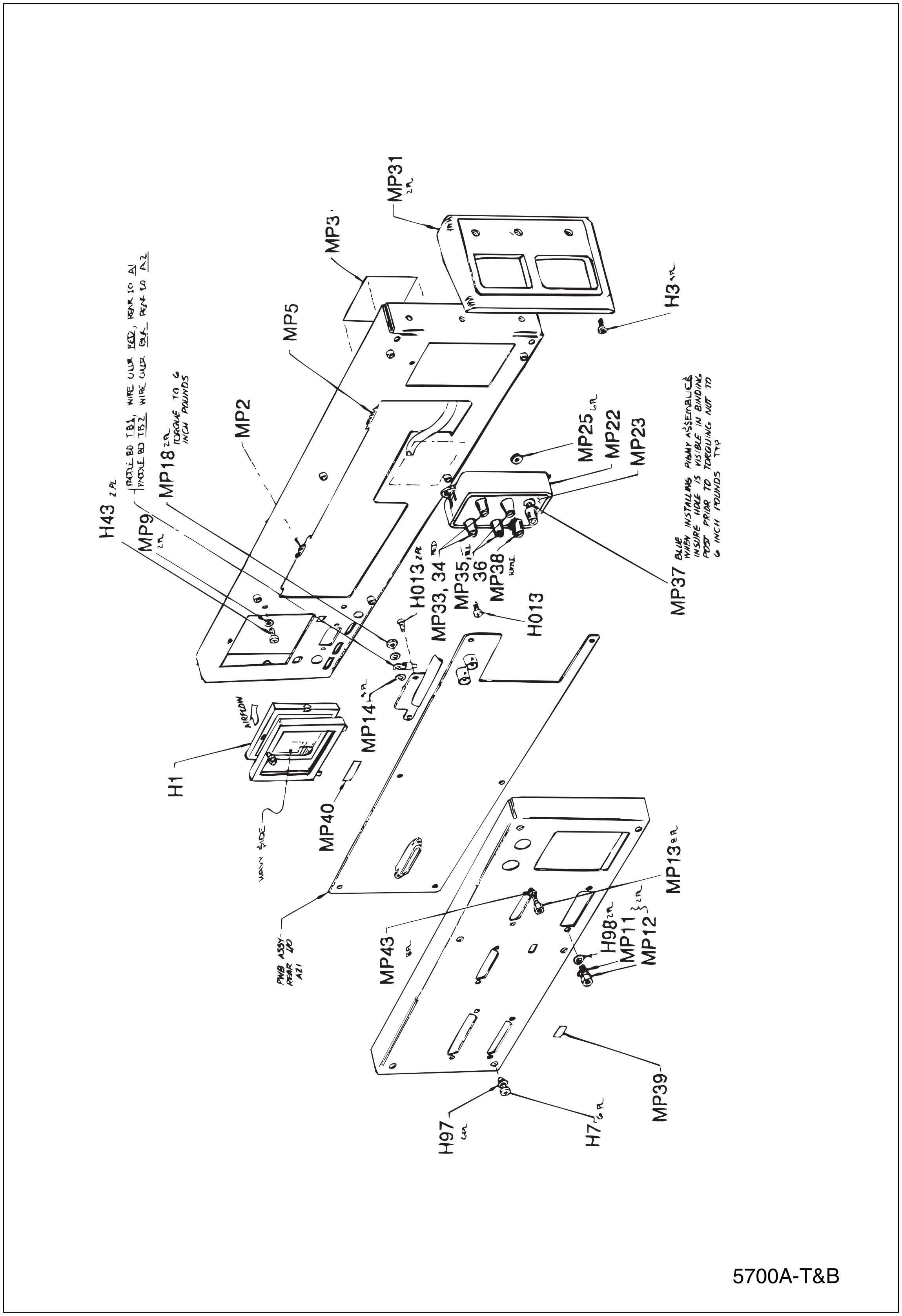

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Figure 5-3. Rear Panel Final Assembly