

5730A

Multifunction Calibrator

Calibration Manual

August 2014

© 2014 Fluke Corporation. All rights reserved. Specifications are subject to change without notice.
All product names are trademarks of their respective companies.

LIMITED WARRANTY AND 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, contaminated, 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 only 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 to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). 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 failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, 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, ARISING FROM ANY CAUSE OR THEORY.

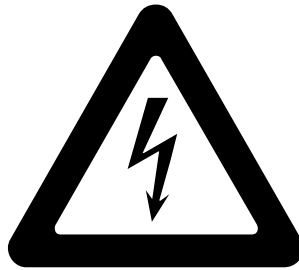
Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable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

Fluke Corporation
P.O. Box 9090
Everett, WA 98206-9090
U.S.A.

Fluke Europe B.V.
P.O. Box 1186
5602 BD Eindhoven
The Netherlands

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 prevent electrical shock hazard, the operator should not electrically contact the output HI or sense HI terminals or circuits connected to these terminals. During operation, lethal voltages of up to 1100 V ac or dc may be present on these terminals.

When 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

Table of Contents

Title	Page
Introduction.....	1
How to Contact Fluke Calibration.....	2
Safety Information	3
Symbols.....	4
Specifications	4
Specification Confidence Levels.....	4
Use of Absolute and Relative Specifications	5
Use of Secondary Performance Specifications	5
General Specifications	5
Electrical Specifications.....	7
AC Voltage Specifications	9
Resistance Specifications.....	15
DC Current Specifications	19
AC Current Specifications	21
Wideband AC Voltage (Option 5700-03) Specifications.....	24
52120A Specifications when Operated with the 5730A.....	25
52120A Electrical Performance Limits.....	25
Operated within 5730A Control Loop (all current ranges)	26
Coverage factor $k=2.58$ (99 % confidence level).....	26
Coverage factor $k=2.00$ (95 % confidence level).....	26
52120A/COIL 3 KA 25-Turn Coil	27
52120A/COIL 6 KA 50-Turn Coil	28
Product Calibration	29
The Artifact Calibration Process	29
Establish Traceability.....	30
Calibration Reports	30
Range Adjustment	30
DC Zero	31
Run DC Zeros.....	31
DC Zeros Reminder.....	31
Calibration Procedures	32
Calibration Security Passcode.....	32
Artifact Calibration	32
When to Adjust Product Uncertainty.....	33
Main Output Calibration Procedure	34
Range Adjustment.....	37

Calibrate the Wideband AC Module (Option 5700A-03).....	40
Wideband Flatness Calibration Procedure.....	42
Calibration Check.....	43
Develop a Performance History.....	44
Save Calibration Reports.....	45
Calibration Shift Results.....	45
Calibration Check Shift Results.....	46
Raw Data Results.....	46
Full Verification.....	47
Required Equipment for All Tests.....	47
Warmup Procedure for All Verification Tests.....	47
Determine Specification Limits for other Calibration Intervals.....	48
Applying Guardbands to Specification Limits.....	49
Resistance Verification Test.....	51
Verify 0 Ω , 1 Ω , and 1.9 Ω	52
Verify 10 Ω through 19 M Ω	53
Verify 100 M Ω	56
DC Voltage Verification Test.....	56
DC Zero Test.....	57
Self-Calibrate a Fluke 752A Divider with a Fluke 8508A as the Null Detector.....	58
DC Voltage Test at Decade Values.....	62
DC Voltage Test at 19 Volts.....	66
Direct Current Verification Test.....	68
AC Voltage Frequency Accuracy Test.....	71
AC Voltage Verification Test.....	72
Alternating Current Verification Test.....	76
2 mA to 2 A Ranges.....	77
200 μ A Range.....	78
Wideband Frequency Accuracy Test.....	82
Wideband AC Voltage Module Output Verification.....	82
Wideband Output Accuracy at 1 kHz Test.....	83
Wideband Output Flatness Test.....	84
General Maintenance.....	89
Clean the Exterior.....	89
Fuse Replacement.....	89
Clean the Air Filter.....	91
User-Replaceable Parts.....	92

List of Tables

Table	Title	Page
1.	Symbols.....	4
2.	Standards for Calibration.....	33
3.	List of Required Equipment for Main Output	48
4.	Required Test Equipment.....	51
5.	0 Ω , 1 Ω , 1.9 Ω Verification	52
6.	10 Ω through 19 M Ω Verification.....	55
7.	Required Equipment for DC Voltage Tests	56
8.	DC Zero Volt Verification.....	58
9.	DC Voltage Test at Decade Values Verification.....	63
10.	19 V DC Verification	66
11.	Required Equipment for Direct Current Test.....	68
12.	DC Current Accuracy Verification.....	70
13.	AC Voltage Frequency Accuracy Test Record.....	71
14.	Equipment Required for AC V Output Level Tests.....	72
15.	5790A Adjustment Counts.....	73
16.	Equipment Required for AC Current Test	76
17.	AC Current 2 mA to 2 A Verification.....	79
18.	AC Current 200 μ A Accuracy Test Record.....	81
19.	Equipment Required for Testing and Calibrating the Wideband Option....	82
20.	Wideband Adjustment Tolerance	84
21.	Wideband Frequency Accuracy Test Record	85
22.	Wideband Accuracy at 1 kHz Test Record.....	85
23.	Wideband Flatness Test Record	86
24.	Wideband Absolute Error 10 Hz to 500 kHz.....	88
25.	Replacement Fuses	90
26.	User-Replaceable Parts	92

List of Figures

Figure	Title	Page
1.	732B External Calibration Connections.....	34
2.	742A-1 and 742A-10 k External Calibration Connections	35
3.	220 V DC Range Calibration Connections	39
4.	Wideband Module Calibration Connection	40
5.	Wideband Flatness Calibration Connections	42
6.	Test Limits Established by Guardbanding.....	50
7.	0 Ω , 1 Ω , 1.9 Ω Resistance Verification.....	53
8.	10 Ω through 19 M Ω Resistance Verification	54
9.	Zero Null Detector Connection	61
10.	Zero Null Detector Connections s	64
11.	DC Voltage Calibration Connection.....	65
12.	19 V DC Verification Connections	67
13.	Direct Current Accuracy Test Connections	69
14.	1 MHz Low Pass Filter	71
15.	AC Voltage Test Setup.....	72
16.	2 mA to 2 A AC Current Verification Connections.....	77
17.	200 μ A Range Alternating Current Test Setup.....	78
18.	Wideband Accuracy at 1 kHz Test Setup.....	83
19.	Wideband Flatness Test Setup	84
20.	Access the Fuse.....	90
21.	Air Filter Access	91
22.	User-Replaceable Parts	93

Introduction

The Fluke Calibration 5730A Calibrator (the “Product” or the “Calibrator”) can calibrate a wide variety of electrical measurement instruments. The Product maintains a high accuracy over a wide ambient temperature range. This accuracy lets the Product test instruments in any environment, and eliminates the restrictions to calibrate only in a temperature-controlled standards laboratory. The Product can calibrate precision multimeters that measure ac or dc voltage, ac or dc current, and resistance. The Product also is available with a Wideband AC Voltage option which extends this workload to include RF voltmeters.

This manual contains specifications, calibration procedures, and verification procedures. The Product is a fully-programmable precision source of:

- DC voltage to 1100 V
- AC voltage to 1100 V, with output available from 10 Hz to 1.2 MHz
- AC and DC current to 2.2 A, with output available from 10 Hz to 10 kHz
- Resistance in values from a short ($0\ \Omega$) to 100 M Ω
- Optional wideband ac voltage from 300 μ V to 3.5 V into 50 Ω (-57 dBm to +24 dBm), 10 Hz to 30 MHz

Features of the Product include:

- Internal environmentally-controlled references that let the Product maintain full performance over a wide ambient temperature range.
- Automatic meter error calculation obtained through the use of a simple output adjust knob.
- Keys that multiply and divide the output value by 10. This simplifies work on meters with calibration points at decade multiples of a fraction of full-scale.
- Programmable entry limits used to restrict the levels that can be entered into the Product. This prevents access to levels that may be harmful to equipment or personnel.
- Continuous display of Product specifications at the selected operation point, calibration interval, and specification confidence level.
- An auxiliary current binding post to calibrate meters with separate current inputs without the need to move cables.
- Real-time clock and calendar for date stamping reports and reminders issued to perform the dc zeros calibration procedure within the required interval.
- Offset and scaling modes that simplify linearity tests of multimeters.

- Variable phase reference signal output and phase-lock input.
- Interface for the Fluke Calibration 5725A Amplifier.
- Interface for the Fluke Calibration 52120A Amplifier.
- Standard IEEE-488 (GPIB) interface, that complies with ANSI/IEEE Standards 488.1-1987 and 488.2-1987.
- EIA/TIA-574 Standard RS-232 serial data interface for remote control of the Product.
- Universal Serial Bus (USB) 2.0 high-speed interface device port for remote control of the Product.
- Integrated 10/100/1000BASE-T Ethernet port for network connection remote control of the Product.
- USB Host port to save calibration reports to a flash drive.
- Extensive internal self-testing and diagnostics of analog and digital functions
- Visual Connection Management output terminals illuminate to help show correct cable connection configurations.
- Soft Power - automatic selection of line voltage/frequency.
- LCD Color VGA display with touch panel overlay.
- A traceable calibration procedure for all modes and ranges that requires only 10 V, 1 Ω , and 10 k Ω external standards, with only occasional independent verification.
- Automated calibration check that provides added confidence between calibration recalls, and data that can be used to document and characterize Product performance between calibration recalls.

How to Contact Fluke Calibration

To contact Fluke Calibration, call one of the following telephone numbers:

- Technical Support USA: 1-877-355-3225
- Calibration/Repair USA: 1-877-355-3225
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31-40-2675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- China: +86-400-810-3435
- Brazil: +55-11-3759-7600
- Anywhere in the world: +1-425-446-6110

To see product information or download manuals and the latest manual supplements, visit Fluke Calibration's website at www.flukecal.com.

To register your product, visit <http://flukecal.com/register-product>.

Safety Information

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

⚠️⚠️ Warnings









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

- Read all safety information before you use the Product.
- Carefully read all instructions.
- Do not use the Product around explosive gas, vapor, or in damp or wet environments.
- Use this Product indoors only.
- Do not put the Product where access to the mains power cord is blocked.
- Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.
- Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.
- Make sure the ground conductor in the mains power cord is connected to a protective earth ground. Disruption of the protective earth could put voltage on the chassis that could cause death.
- Do not use an extension cord or adapter plug.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.
- Do not use the Product if it operates incorrectly.
- Do not connect to live output terminals. The Product can supply voltages that can cause death. Standby mode is not sufficient to prevent electrical shock.
- Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.
- Use only cables with correct voltage ratings.
- Do not touch exposed metal on banana plugs, they can have voltages that could cause death.
- Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.
- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Use only specified replacement fuses.
- Have an approved technician repair the Product.

Symbols

The symbols shown in Table 1 can be found in this manual or on the Product.

Table 1. Symbols

Symbol	Definition	Symbol	Definition
	Risk of Danger. Important information. See Manual.		Hazardous voltage. Risk of electric shock.
	This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.		Conforms to European Union directives
	Conforms to relevant North American Safety Standards.		Conforms to relevant Australian EMC standards
	Conforms to relevant Australian EMC standards		Conforms to relevant South Korean EMC Standards.

Specifications

The Product is calibrated and verified at the factory prior to shipment. By calibrating the Product using the processes in this manual, the high-performance level can be maintained throughout the life of the Product.

Specifications are valid after a warm-up period of twice the time the Product has been turned off, up to a maximum of 30 minutes. For example, if the Product has been turned off for five minutes, the warm-up period is 10 minutes.

Specification Confidence Levels

The Product performance level is ensured by regular calibration to the primary performance specifications. These specifications are provided at both the 99 % and 95 % confidence levels. Calibration at the 99 % confidence level is guaranteed by calibration at Fluke Calibration and Fluke Calibration Service Centers. For information on selecting the confidence level, refer to Chapter 4 of the Operators Manual.

The tables in this section provide Product specifications at both the 95 % and 99 % confidence levels. Included with these tables are operating specifications for use of the Product with the Wideband AC Module (Option 5700A-03) and the 5725A and 52120A Amplifiers.

Use of Absolute and Relative Specifications

To evaluate the Product coverage of the calibration workload, use the Absolute specifications. Absolute specifications includes stability, temperature coefficient, linearity, line and load regulation, and the traceability to external standards. It is not necessary to add anything to absolute specifications to determine the ratios between the Product specifications and the tolerance requirements of the calibration workload.

Relative specifications are provided for enhanced accuracy applications. These specifications apply when range constants are adjusted (see *Range Adjustment*). To calculate the absolute specification, combine the uncertainties of the external standards and techniques with relative specifications.

Use the specifications to determine the component of instrumental uncertainty for a particular measurement condition at time of use. When the Product is correctly calibrated, the specifications can be applied to subsequent uncertainty analyses as a Type B evaluation of measurement uncertainty. This is estimated as a normal distribution with a coverage factor of $K=2.58$. Instrumental measurement uncertainty is one of many contributors that must be considered in a thorough uncertainty analysis.

Use of Secondary Performance Specifications

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

General Specifications

Warm-Up Time	Twice the time since last warmed up, to a maximum of 30 minutes.
System Installation	Rack mount kits available.
Standard Interfaces	IEEE-488, RS-232, USB 2.0 device, Ethernet, 5725A, 52120A, 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 IEC 61010-1: Overvoltage Category II, Pollution Degree 2

Operating Altitude 2000 m maximum

Guard Isolation 20 V

Electromagnetic Compatibility (EMC)

IEC 61326-1 (Controlled EM environment)	IEC 61326-2-1; CISPR 11: Group 1, Class A Group 1 equipment has intentionally generated and/or use conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself. Class A equipment is equipment suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes. Emissions which exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object. The equipment may
---	---

not meet the immunity requirements of 61326-1 when test leads and/or test probes are connected.

- USA (FCC)..... 47 CFR 15 subpart B, this product is considered an exempt device per clause 15.103
- Korea (KCC) Class A Equipment (Industrial Broadcasting & Communication Equipment)
 This product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

Line Power

Line Voltage

- 5730A 100 V-120 V, 220 V- 240 V \pm 10 %
- 5725A 100 V, 110 V, 115 V, 120 V, 200 V, 220 V, 230 V, 240 V, \pm 10 %
- Line Frequency 47 Hz-63 Hz

Maximum Power

- 5730A 300 VA
- 5725A 750 VA

Weight

- 5730A 27 kg (62 lb)
- 5725A 32 kg (70 lb)

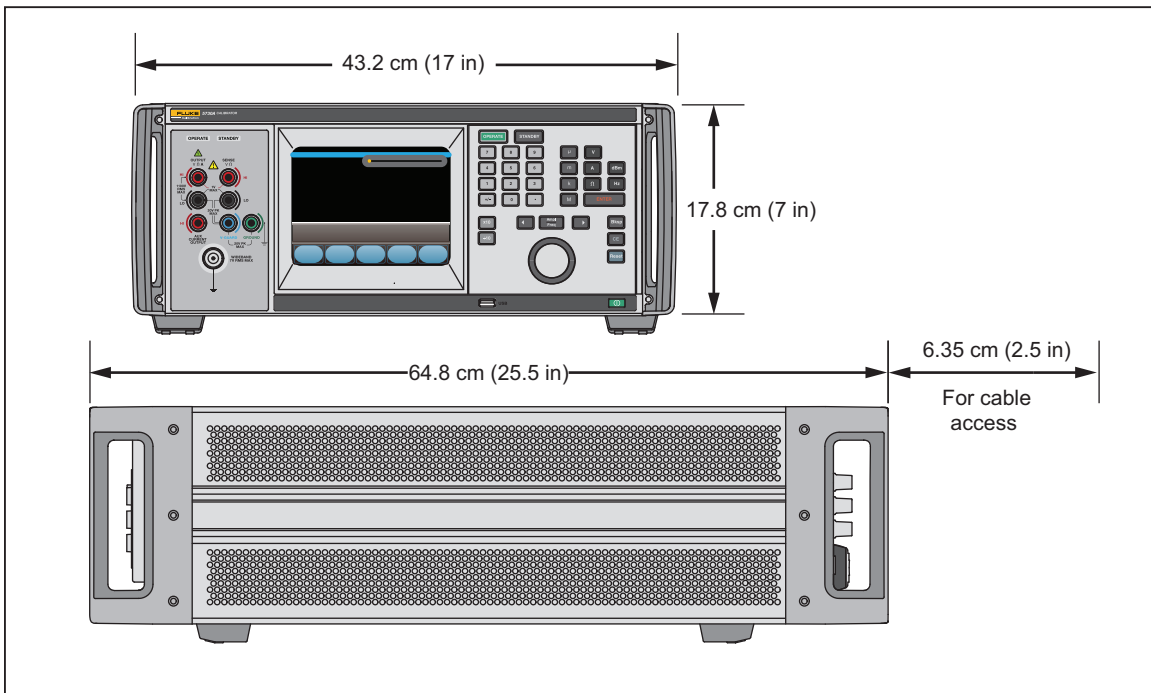
Size

5730A

- 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 64.8 cm (25.5 in), overall; 59.4 cm (23.4 in), rack depth

5725A

- Height 13.3 cm (5.25 in)
- Width and Depth Both units project 5.1 cm (2 in) from rack front.



hhp002.eps

Figure 1-1. Product Dimensions

Artifact Calibration Standards Requirements

The following external standards are necessary to calibrate the 5730A to the listed specification. Each external standard used must have an uncertainty equal to or less than the listed uncertainty limit.

Fluke Standard	Traceable Quantity	Nominal Value	Uncertainty Limit	5730A Specifications Susceptible to Uncertainty Limit
732B	Voltage	10 V	1.5 ppm	dc volts, ac volts, dc current, ac current
742A-1	Resistance	1 Ω	10 ppm	1 Ω, 1.9 Ω
742A-10k	Resistance	10 kΩ	2 ppm	ac current, dc current 10 Ω to 100 MΩ

Electrical Specifications

The product specifications describe the Absolute Instrumental Uncertainty of the Product. The product specifications include stability, temperature, and humidity; within specified limits, linearity, line and load regulation, and the reference standard measurement uncertainty. The product specifications are provided at a 99 %, k=2.58, normally distributed and a 95 %, k=2, normally distributed level of confidence. Fluke Calibration guarantees product performance to the 99 % level of confidence.

The relative specifications are provided for enhanced accuracy applications. The specifications apply when range constants are adjusted (see "Range Calibration"). To Calculate an enhanced absolute specification from the relative accuracy specification, it is necessary to combine the uncertainty of your external standards with the pertinent relative specifications.

Specifications are valid after allowing a warm-up period of 30 minutes, or twice the time the Product has been turned off.
DC Voltage Specifications

5730A DC Voltage Specifications

Range	Resolution	Absolute / ±5 °C from calibration temperature				Relative ±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.							

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 - 10 kHz RMS
	$\pm(\text{ppm output} + \mu\text{V})$	$\pm(\text{ppm output} + \mu\text{V}) / \text{°C}$	$\pm(\text{ppm output} + \mu\text{V})$	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:

- Stability specifications are included in the absolute specification values in the primary specification tables.
- Temperature coefficient is an adder to accuracy 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 specification; + 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

AC Voltage Specifications

5730A AC Voltage Specifications: 99 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute / $\pm 5^\circ\text{C}$ from calibration temperature				Relative $\pm 1^\circ\text{C}$	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			$\pm(\text{ppm output} + \mu\text{V})$					
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	65 + 8	66 + 8	67 + 8	70 + 8	60 + 8	65 + 8
		20 k - 50 k	135 + 8	140 + 8	145 + 8	150 + 8	85 + 8	95 + 8
		50 k - 100 k	370 + 20	380 + 20	390 + 20	400 + 20	200 + 20	220 + 20
		100 k - 300 k	650 + 25	700 + 25	750 + 25	800 + 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	46 + 10	47 + 10	48 + 10	30 + 10	40 + 10
		20 k - 50 k	75 + 12	77 + 12	78 + 12	80 + 12	70 + 12	75 + 12
		50 k - 100 k	95 + 40	97 + 40	98 + 40	100 + 40	100 + 40	105 + 40
		100 k - 300 k	350 + 100	370 + 100	380 + 100	400 + 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 + 400	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	46 + 70	47 + 70	48 + 70	30 + 70	40 + 70
		20 k - 50 k	75 + 120	77 + 120	78 + 120	80 + 120	70 + 120	75 + 120
		50 k - 100 k	95 + 250	97 + 250	98 + 250	100 + 250	100 + 250	105 + 250
		100 k - 300 k	285 + 800	290 + 800	295 + 800	300 + 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

			$\pm(\text{ppm output} + \text{mV})$					
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 - 100 k	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.								

5730A AC Voltage Specifications: 95 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute / ± 5 °C from calibration temperature				Accuracy ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			$\pm(\text{ppm output} + \mu\text{V})$					
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	800 + 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	800 + 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	54 + 7	55 + 7	56 + 7	57 + 7	50 + 7	55 + 7
		20 k - 50 k	105 + 7	110 + 7	115 + 7	120 + 7	70 + 7	80 + 7
		50 k - 100 k	296 + 17	298 + 17	303 + 17	310 + 17	160 + 17	180 + 17
		100 k - 300 k	535 + 20	583 + 20	600 + 20	655 + 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 μV	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	39 + 8	40 + 8	42 + 8	25 + 8	35 + 8
		20 k - 50 k	61 + 10	63 + 10	65 + 10	67 + 10	55 + 10	60 + 10
		50 k - 100 k	79 + 30	81 + 30	82 + 30	85 + 30	80 + 30	85 + 30
		100 k - 300 k	276 + 80	300 + 80	314 + 80	336 + 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 μV	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	39 + 50	40 + 50	42 + 50	25 + 50	35 + 50
		20k - 50k	61 + 100	63 + 100	65 + 100	67 + 100	55 + 100	60 + 100
		50k - 100k	78 + 200	80 + 200	81 + 200	83 + 200	80 + 200	85 + 200
		100k - 300k	238 + 600	243 + 600	249 + 600	254 + 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		

		$\pm(\text{ppm output} + \text{mV})$						
220 V ^[2]	100 μV	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	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 - 100 k	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.								

AC Voltage Secondary Performance Specifications and Operating Characteristics

Range	Frequency (Hz)	Stability $\pm 1^\circ\text{C}$ ^[1] 24 Hours	Temperature Coefficient		Output Impedance (Ω)	Maximum Distortion Bandwidth 10 Hz- 10 MHz
			10 - 40 $^\circ\text{C}$	0 - 10 $^\circ\text{C}$ and 40 - 50 $^\circ\text{C}$		$\pm(\% \text{ output} + \mu\text{V})$
		$\pm\mu\text{V}$	$\pm\mu\text{V} / ^\circ\text{C}$			
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		
		$\pm(\text{ppm output} + \mu\text{V})$	$\pm(\text{ppm output } \mu\text{V}) / ^\circ\text{C}$			
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 500 k - 1 M	70 + 20 150 + 50	80 + 40 80 + 100	80 + 40 80 + 100	600 ppm 1200 ppm	0.5 + 110 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 500 k - 1 M	70 + 100 150 + 100	80 + 300 80 + 500	80 + 300 80 + 500	200 + 1100 600 + 3000	0.3 + 800 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 500 k - 1 M	100 + 10,000 200 + 20,000	80 + 800 80 + 1000	80 + 800 80 + 1000	500 + 50,000 1000 + 110,000	1.5 + 50,000 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

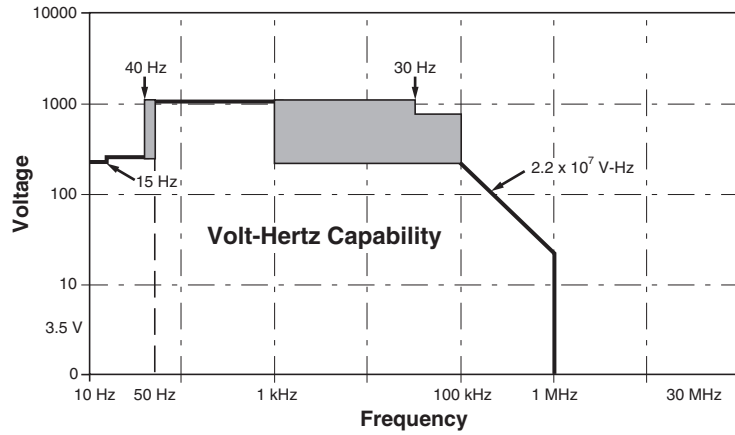


Figure A.

5725A Amplifier:							
Range	Frequency (Hz)	Stability ± 1 °C ^[1] 24 Hours	Temperature Coefficient Adder		Load Regulation ^[2]	Distortion Bandwidth 10 Hz -10 MHz \pm (% output)	
			10 - 40 °C	0 - 10 °C and 40 - 50 °C		150 pF	1000 pF
			\pm (ppm output) / °C				
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:

- Stability specifications are included in Absolute specification values for the primary specifications.
- The 5725A will drive up to 1000 pF of load capacitance. Absolute 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]	50 mA, 0 °C-40 °C		>50 Ω ,
22 V	20 mA, 40 °C-50 °C		1000 pF
220 V			
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:

- The 5725A will drive up to 1000 pF of load capacitance. Absolute 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 V Range, 100 kHz-1.2 MHz only: Absolute specifications cover loads to 10 mA or 1000 pF. For higher loads, load regulation is added.
- 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 Applicable for 2.2 V, 22 V, 220 V, and 1100 V ranges; 5730A <100 kHz, 5725A <30 kHz. Specifications are the same as internal sense.

Settling Time to Published Specifications

Frequency (Hz)	Settling Time (seconds)
10-120	7
>120	5

Notes:

- Plus 1 second for amplitude or frequency range change
- Plus 2 seconds for 5730A 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
Absolute Specification	±0.0025 %
Resolution	11.999 counts

Phase Lock (Selectable Rear Panel BNC Input)

Phase Specification (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 Absolute Specification	(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 Hz to 1 kHz, usable 10 Hz to 1.1999 MHz

Resistance Specifications

5730A Resistance Specifications

Nominal Value (Ω)	Absolute Specification of Characterized Value ±5 °C from calibration temperature ^[1]				Relative ±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	7	7.2	7.5	8	2	3
1.9 k	7	7.2	7.5	8	2	3
10 k	6	7	7.5	8	2	3
19 k	6	7	7.5	8	2	3
100 k	7	8	9	10	2	3
190 k	8	10	11	12	2	3
1 M	13	14	14.5	15	2.5	5
1.9 M	15	17	19	21	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						
	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$
0						
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	5.5	5.7	6	6.5	1.6	2.5
1.9 k	5.5	5.7	6	6.5	1.6	2.5
10 k	5	5.5	6	6.5	1.6	2.5
19 k	5	5.5	6	6.5	1.6	2.5
100 k	5.5	7.5	8	8.5	1.6	2.5
190 k	6	7	8	8.5	1.6	2.5
1 M	10	11	12	13	2	4
1.9 M	12	13.5	15	18	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 M Ω .

Resistance Secondary Performance Specifications and Operating Characteristics

Nominal Value (Ω)	Stability $\pm 1\text{ }^\circ\text{C}$ ^[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 $^\circ\text{C}$	0 - 10 $^\circ\text{C}$ and 40 - 50 $^\circ\text{C}$				Lead Resistance	
	$\pm\text{ppm}$	$\pm\text{ppm}/^\circ\text{C}$	$0.1\ \Omega$	$1\ \Omega$				
0	—	—	—	8 - 500	500	—	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
1	32	4	5	8 - 100	700	500	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
1.9	25	6	7	8 - 100	500	500	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
10	5	2	3	8 - 11	220	300	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
19	4	2	3	8 - 11	160	300	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
100	2	2	3	8 - 11	70	150	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
190	2	2	3	8 - 11	50	150	$2 + \frac{4\mu\text{V}}{I_m}$	$4 + \frac{4\mu\text{V}}{I_m}$
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 - 100 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 specification values in the primary specification tables.
2. Temperature coefficient is an adder to Absolute specifications that does not apply unless operated more than 5 $^\circ\text{C}$ from calibration temperature, or calibrated outside the range 19 $^\circ\text{C}$ to 24 $^\circ\text{C}$. Two examples:
 - Calibrate at 20 $^\circ\text{C}$: Temperature coefficient adder is not required unless operated below 15 $^\circ\text{C}$ or above 25 $^\circ\text{C}$.
 - Calibrate at 26 $^\circ\text{C}$: Add 2 $^\circ\text{C}$ temperature coefficient adder. Additional temperature coefficient adder is not required unless operated below 21 $^\circ\text{C}$ or above 31 $^\circ\text{C}$.
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 k Ω , 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:

- For $I < I_L$, errors occur due to thermally generated voltages within the 5730A. Use the following equation to determine the error, and add this error to the corresponding specifications.

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

Where: Error is in m Ω 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 k Ω ;
 I and I_L are expressed in μ A for 10 k Ω to 100 M Ω
- 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 specifications.

$$\text{Error in ppm} = K(I^2 - I_U^2)$$

Where: K is the constant from the above table;
 I and I_U are expressed in mA for short to 19 k Ω ;
 I and I_U are expressed in μ A for 100 k Ω to 100 M Ω

DC Current Specifications

5730A DC Current Specifications

Range	Resolution	Absolute / ± 5 °C from calibration temperature				Relative ± 1 °C	
		24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
	nA	$\pm(\text{ppm output} + \text{nA})$					
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	$\pm(\text{ppm output} + \mu\text{A})$					
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	$\pm(\text{ppm output} + \text{nA})$					
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	$\pm(\text{ppm output} + \mu\text{A})$					
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
<p>Note:</p> <p>Maximum output from the calibrator's terminals is 2.2 A. Specifications for 220 μA and 2.2 mA ranges are increased by a factor of 1.3 when supplied through 5725A terminals.</p> <p>Specifications are otherwise identical for all output locations.</p> <p>1. Add to specifications:</p> <ul style="list-style-type: none"> $\pm 200 \times I^2$ ppm for >100 mA on 220 mA range $\pm 10 \times I^2$ ppm for >1 A on 2.2 A 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] (\pm nA/V)	Maximum Load for Published Specification ^[4] (Ω)	Noise	
		10 - 40 °C	0 - 10 °C and 40 - 50 °C				Bandwidth 0.1-10 Hz	Bandwidth 10 Hz-10 kHz
	\pm (ppm output + nA)	\pm (ppm output + nA) / °C					pk-pk	RMS
220 μ A	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 μ A	10	100	20	9 + 300	500
2.2 A	9 + 7 μ A	1 + 2.5 μ A	3 + 10 μ A	3 ^[5]	2 μ A	2	12 + 1.5 μ A	20 μ A
5725A	\pm (ppm output + μ A)	\pm (ppm output + μ A) / °C					ppm output + μ A	μ A
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. Specifications for 220 μ A and 2.2 mA ranges are increased by a factor of 1.3 when supplied through 5725A terminals.

- Stability specifications are included in the Absolute specification values for the primary specifications.
- Temperature coefficient is an adder to Absolute specifications. It does not apply unless operating more than ± 5 °C from calibration temperature.
- Burden voltage adder is an adder to Absolute specifications that does not apply unless burden voltage is greater than 0.5 V.
- For higher loads, multiply Absolute specification by: $1 + \frac{0.1 \times \text{actual load}}{\text{maximum load for published specification}}$
- 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 μ A and mA ranges; 3 seconds for 2.2 A range; 6 seconds for 11 range; + 1 second for range or polarity change

Overshoot <5 %

AC Current Specifications

5730A AC Current Specifications: 99 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute / ± 5 °C from calibration temperature				Relative ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			\pm (ppm output + nA)					
220 μ A	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	115 + 10	117 + 10	118 + 10	120 + 10	100 + 10	110 + 10
		1 k - 5 k	300 + 15	320 + 15	340 + 15	350 + 15	250 + 15	280 + 15
		5 k - 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	115 + 40	117 + 40	118 + 40	120 + 40	100 + 40	110 + 40
		1 k - 5 k	210 + 130	220 + 130	230 + 130	240 + 130	190 + 130	220 + 130
		5 k - 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	115 + 400	117 + 400	118 + 400	120 + 400	100 + 400	110 + 400
		1 k - 5 k	210 + 700	220 + 700	230 + 700	240 + 700	190 + 700	220 + 700
		5 k - 10 k	1000 + 6000	1100 + 6000	1200 + 6000	1300 + 6000	900 + 6000	1000 + 6000
			\pm (ppm output + μ A)					
220 mA	1 μ A	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	115 + 3	117 + 3	118 + 3	120 + 3	100 + 3	110 + 3
		1 k - 5 k	210 + 4	220 + 4	230 + 4	240 + 4	190 + 4	220 + 4
		5 k - 10 k	1000 + 12	1100 + 12	1200 + 12	1300 + 12	900 + 12	1000 + 12
2.2 A	10 μ A	20 - 1 k	270 + 40	280 + 40	290 + 40	300 + 40	260 + 40	280 + 40
		1 k - 5 k	440 + 100	460 + 100	480 + 100	500 + 100	420 + 100	440 + 100
		5 k - 10 k	6000 + 200	7000 + 200	7500 + 200	8000 + 200	6000 + 200	7000 + 200
5725A Amplifier:								
11 A	100 μ A	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
<p>Note: Maximum output from the calibrator's terminals is 2.2 A. 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.</p>								

5730A AC Current Specifications: 95 % Confidence Level

Range	Resolution	Frequency (Hz)	Absolute / ± 5 °C from calibration temperature				Relative ± 1 °C	
			24 Hours	90 Days	180 Days	1 Year	24 Hours	90 Days
			$\pm(\text{ppm output} + \text{nA})$					
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	96 + 8	99 + 8	101 + 8	103 + 8	80 + 8	90 + 8
		1 k - 5 k	240 + 12	250 + 12	270 + 12	280 + 12	200 + 12	230 + 12
		5 k - 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	130 + 35	140 + 35	150 + 35	160 + 35	110 + 35	130 + 35
		40 - 1 k	96 + 35	99 + 35	101 + 35	103 + 35	80 + 35	90 + 35
		1 k - 5 k	170 + 110	180 + 110	190 + 110	200 + 110	160 + 110	170 + 110
		5 k - 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	96 + 350	99 + 350	101 + 350	103 + 350	80 + 350	90 + 350
		1 k - 5 k	170 + 550	180 + 550	190 + 550	200 + 550	160 + 550	170 + 550
		5 k - 10 k	800 + 5000	900 + 5000	1000 + 5000	1100 + 5000	700 + 5000	800 + 5000
$\pm(\text{ppm output} + \mu\text{A})$								
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	96 + 2.5	99 + 2.5	101 + 2.5	103 + 2.5	80 + 2.5	90 + 2.5
		1 k - 5 k	170 + 3.5	180 + 3.5	190 + 3.5	200 + 3.5	160 + 3.5	170 + 3.5
		5 k - 10 k	800 + 10	900 + 10	1000 + 10	1100 + 10	700 + 10	800 + 10
2.2 A	10 μA	20 - 1 k	214 + 35	224 + 35	234 + 35	244 + 35	200 + 35	230 + 35
		1 k - 5 k	350 + 80	390 + 80	420 + 80	450 + 80	300 + 80	350 + 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 + 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. Specifications for 220 μA and 2.2 mA ranges are increased by 1.3 plus 2 μA when supplied through 5725A terminals.								

AC Current Secondary Performance Specifications and Operating Characteristics

Range	Frequency (Hz)	Stability $\pm 1^\circ\text{C}$ ^[1] 24 Hours	Temperature Coefficient ^[2]		Compliance Limits (V rms)	Maximum Resistive Load For Published Specification ^[3] (Ω)	Noise and Distortion (Bandwidth 10 Hz - 50 kHz <0.5V Burden)
			10 - 40 $^\circ\text{C}$	0 - 10 $^\circ\text{C}$ and 40 - 50 $^\circ\text{C}$			
		$\pm(\text{ppm output} + \text{nA})$	$\pm(\text{ppm output} + \text{nA})/^\circ\text{C}$				
220 μA	10 - 20	150 + 5	50 + 5	50 + 5	7	2 k	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			0.05 + 1
2.2 mA	10 - 20	150 + 5	50 + 5	50 + 5	7	800	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			0.05 + 1
22 mA	10 - 20	150 + 50	50 + 10	50 + 10	7	80	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			0.05 + 1
	Hz	$\pm(\text{ppm output} + \mu\text{A})$	$\pm(\text{ppm output} + \mu\text{A})/^\circ\text{C}$				
220 mA	10 - 20	150 + 0.5	50 + 0.05	50 + 0.05	7	8	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			0.05 + 100
2.2 A	20 - 1 k	50 + 5	4 + 1	10 + 1	1.4 ^[4]	0.8	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			1 + 1 mA
5725A Amplifier:							$\pm(\% \text{ output})$
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 5730A terminals is 2.2 A. 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 values for the primary specifications.
2. Temperature coefficient is an adder to specifications that does not apply unless operating more than $\pm 5^\circ\text{C}$ from calibration temperature.

3. For larger resistive loads multiply accuracy specifications by: $\left(\frac{\text{actual load}^2}{\text{maximum load for published specification}} \right)$

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.

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

Inductive Load Limits 400 μH (5730A, or 5725A). 20 μH for 5730A output >1 A.

Power Factors 5730A, 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

Specification $\pm 0.01\%$ of output

Resolution 11,999 counts

Settling Time5 seconds for 5730A ranges; 6 seconds for 5725A 11 A range; +1 second for amplitude or frequency range change.
Overshoot<10 %

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 / ±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
3.3 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 Published Specification (Seconds)	Harmonic Distortion (dB)
		1.1 mV	3.3 mV	>3.3 mV			
±(% output + floor indicated)							
10 - 30	0.01	0.3	0.3	0.3	100	7	-40
30 - 119.99	0.01	0.1	0.1	0.1	100	7	-40
120 - 1.1999 k	0.1	0.1	0.1	0.1	100	5	-40
1.2 k - 11.999 k	1	0.1	0.1	0.1	100	5	-40
12 k - 119.99 k	10	0.1	0.1	0.1	100	5	-40
120 k - 1.1999 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 - 11.9 M	100 k	0.4 + 3 μV	0.3 + 3 μV	0.2 + 3 μV	100	0.5	-40
12 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.

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

Minimum Output 300 μV (-57 dBm)

Frequency Specification ±0.01 % of output

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.

52120A Specifications when Operated with the 5730A

Line Power

Voltage range	100 V to 240 V
Frequency	47 to 63 Hz
Voltage variations	±10 % about line voltage
Power consumption	<1500 VA
Transient overvoltage	Impulse withstand (overvoltage) Category II of IEC 60364-4-443

Dimensions (HxWxL)

With feet.....	192 mm x 432 mm x 645 mm (7.6 in x 17.0 in x 25.5 in)
Without feet.....	178 mm x 432 mm x 645 mm (7.0 in x 17.0 in x 25.5 in)

Weight 25 kg (54 lb)

Temperature

Operating	5 °C to 35 °C (41 °F to 95 °F)
Calibration (tcal).....	16 °C to 30 °C (61 °F to 86 °F)
Storage	0 °C to 50 °C (32 °F to 122 °F)
Transit.....	-20 °C to +60 °C (-4 °F to +140 °F) <100 hours

Warmup Time Twice the time since last warmed up, to a maximum of 1 hour.

Humidity (non-condensing)

Operating	<80 %, 5 °C to 31 °C (41 °F to 88 °F) ramping linearly down to 50 % at 35 °C (95 °F)
Storage	<95 %, 0 to 50 °C (32 °F to 122 °F)

Altitude

Operating	2,500 m (8,200 ft) maximum
Non-Operating	12,000 m (39,400 ft) maximum

Shock and Vibration MIL-PRF-28800F Class 3

Safety EN/IEC 61010-1, 300 V CAT II, Pollution Degree 2

Electromagnetic Environment IEC 61326-1, Industrial

Electromagnetic Compatibility FCC Rules part 15 sub part B

Applies to use in Korea only. Class A Equipment (Industrial Broadcasting & Communication Equipment) ^[1]

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

Indoor use only IP20

52120A Electrical Performance Limits

Voltage compliance developed across inductive loads may prevent range maximum current output being achieved at higher frequencies. The appropriate maximum frequency (*F_{max}*) for a given load inductance and current is given by:

$$F_{max} = \frac{4.5}{2 \cdot \pi \cdot I \cdot L} \quad \begin{array}{l} I = \text{Current} \\ L = \text{Total} \\ \text{inductance} \end{array}$$

The maximum frequency calculated with this equation is only approximate. Series resistance and parallel capacitance also affect the maximum achievable frequency.

Input Common Mode Rejection 80 dB @ DC decreasing linearly to 40 dB at 10 kHz

Input Impedance

Voltage input	>1 MΩ
Current input	10 Ω

Maximum Output Compliance Voltage 4.5 V rms (6.4 V pk), 6.4 V dc. 120 A range maximum compliance voltage decreases from 4.5 V at 1 kHz to about 3 V at 10 kHz

DC Offset Magnetic remanence that follows abrupt changes in output current level may cause small changes to DC current offset. It is good practice to correct for offsets in DC measurements and techniques such as DC reversal measurement will result in best accuracy.

Operated within 5730A Control Loop (all current ranges)

The current specification of the 52120A, when controlled by a single 5730A, applies to the parallel output of up to three 52120As connected as slaves.

Coverage factor $k=2.58$ (99 % confidence level)

Current Specification

Frequency	1-year, $t_{cal}^{[1]} \pm 5^\circ\text{C} \pm(\% \text{ of output} + \% \text{ of range})$	
	5730A	
	% of output	% of range
DC	0.015	0.010
10 Hz to 850 Hz	0.011	0.003
850 Hz to 6 kHz	0.052	0.005
6 kHz to 10 kHz	See Operated Stand Alone current specification table in the 52120A Users Manual.	
Notes:		
1. t_{cal} is the temperature at which calibration adjustment took place.		
Maximum inductance for stability LCOMP OFF is 100 μH . Maximum inductance for stability LCOMP ON is 400 μH for 2 A and 20 A ranges. 100 μH on the 120 A range.		
With LCOMP ON, the output is limited to 7.2e3 A-Hz. For example, a 100 A output is limited to 72 Hz.		

Coverage factor $k=2.00$ (95 % confidence level)

Current Specification

Frequency	1-year, $t_{cal}^{[1]} \pm 5^\circ\text{C} \pm(\% \text{ of output} + \% \text{ of range})$	
	5730A	
	% of output	% of range
DC	0.012	0.008
10 Hz to 850 Hz	0.009	0.002
850 Hz to 6 kHz	0.040	0.004
6 kHz to 10 kHz	See Operated Stand Alone current specification table in the 52120A Users Manual.	
Notes:		
1. t_{cal} is the temperature at which calibration adjustment took place.		
Maximum inductance for stability LCOMP OFF is 100 μH . Maximum inductance for stability LCOMP ON is 400 μH for 2 A and 20 A ranges. 100 μH on the 120 A range.		
With LCOMP ON, the output is limited to 7.2e3 A-Hz. For example, a 100 A output is limited to 72 Hz.		

Maximum Distortion and Noise

Frequency	Distortion ^[1]				Noise 16 Hz to 10 MHz
	LCOMP OFF		LCOMP ON		
	dBc	Current	dBc	Current	
2 Amp Range					
16 Hz to 850 Hz	-76	42 μ A	-70	83 μ A	-60 dB
850 Hz to 6 kHz	-52	662 μ A	-46	1.3 mA	-60 dB
6 kHz to 10 kHz ^[2]	-40	2.6 mA	-35	4.7 mA	-60 dB
20 Amp Range					
16 Hz to 850 Hz	-76	418 μ A	-60	2.6 mA	-70 dB
850 Hz to 6 kHz	-52	6.6 mA	-42	20.9 mA	-70 dB
6 kHz to 10 kHz ^[2]	-40	26.4 mA	-35	46.9 mA	-70 dB
120 Amp Range					
16 Hz to 850 Hz	-76	2.5 mA	-60	15.8 mA	-70 dB
850 Hz to 6 kHz	-52	39.7 mA	-42	125.7 mA	-70 dB
6 kHz to 10 kHz ^[2]	-40	158.2 ma	-35	281.3 mA	-70 dB
Notes:					
1. Use dB or Current. Whichever is larger.					
2. Interharmonics only above 6 kHz.					

52120A/COIL 3 KA 25-Turn Coil

- Number of Turns** 25
- Minimum internal jaw dimension to clear wires** 26 mm (width) x 36 mm (length)
- Maximum Input Current**..... 120 A continuous with built-in 12 V fan on
- Maximum Voltage** 4.5 V rms

Specification

Input Current ^[1]	Frequency	Effective Current Amp-turns	52120A + Coil Specification ^[2] \pm (% of Amp-turns + % of 52120A range)	
			% of Amp-turns	% of 52120A Range
0 A to 100 A	DC	0 to 2500	0.7 %	0.7 %
0 A to 120 A	10 Hz to 65 Hz	0 to 3000	0.7 %	0.7 %
0 A to 120 A	65 Hz to 300 Hz	0 to 3000	0.7 %	0.7 %
0 A to 40 A	300 Hz to 1 kHz	0 to 1000	0.7 %	0.7 %
0 A to 12 A	1 kHz to 3 kHz	0 to 300	0.8 %	1.0 %
0 A to 3 A	3 kHz to 6 kHz	0 to 75	1.5 %	1.0 %
0 A to 1 A	6 kHz to 10 kHz	0 to 25	5.0 %	1.0 %
Notes:				
1. The inductance and mutual inductance of the 25 turn coil and clamp that is measured causes a frequency dependent compliance voltage across the coil. The length and configuration of the cables that connect the current to the coil also have an effect. Maximum input current is 120 A input at approximately 100 Hz. Maximum current input decreases to approximately 0.8 A at 10 kHz.				
2. Includes coil/clamp interaction.				

52120A/COIL 6 KA 50-Turn Coil

Number of Turns	50
Minimum Flexible Probe Length.....	500 mm
Maximum Input Current.....	120 A continuous with built-in 12 V fan on
Maximum Voltage	4.5 V rms

Specification

Input Current ^[1]	Frequency	Effective Current Amp-turns	52120A + Coil Specification ^[2] ±(% of Amp-turns + % of 52120A range)	
			% of Amp-turns	% of 52120A Range
0 A to 100 A	DC	0 to 5000	0.7 %	0.7 %
0 A to 120 A	10 Hz to 65 Hz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	65 Hz to 300 Hz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	300 Hz to 1 kHz	0 to 6000	0.7 %	0.7 %
0 A to 120 A	1 kHz to 3 kHz	0 to 6000	0.8 %	1.0 %
0 A to 25 A	3 kHz to 6 kHz	0 to 1250	1.5 %	1.0 %
0 A to 13 A	6 kHz to 10 kHz	0 to 650	5.0 %	1.0 %

Notes:

- The inductance and mutual inductance of the 50 turn coil causes a frequency dependent compliance voltage across the coil. Maximum frequency for 120 A input current is approximately 600 Hz. Maximum current input decreases to approximately 13 A at 10 kHz.
- Includes coil/probe interaction.

Note

The specifications for these coils are at 99 % confidence level and are the combined specification of the coil and a 52120A. If the coils are used with other current sources the calibration specification of the coils alone is 0.65 % (99 % confidence level) from 0 Hz to 10 kHz.

Operating Limits

	Output Current Range		
	2 A	20 A	120 A
Current Output (Max.)	2 A rms	20 A rms	120 A rms
	Current Input		
Input Current (Max.)	200 mA rms	200 mA rms	120 mA rms
Current gain	10	100	1,000
	Voltage Input		
Input Voltage (Max.)	2 V rms	2 V rms	1.2 V rms
Transconductance	1 Siemen	10 Siemens	100 Siemens

120 A Range Current/Frequency Limits

Frequency	Maximum Output Current	Maximum Current Input	Maximum Voltage Input
DC	±100 A	±100 mA	±1.0 V
<10 Hz	100 A pk (70 A rms)	100 mA pk (70 mA rms)	1.0 V pk (0.7 V rms)
10 Hz to 10 kHz	170 A pk (120 A rms)	170 mA pk (120 mA rms)	1.7 V pk (1.2 V rms)

Note:
The 2 A and 20 A ranges operate at full output current from DC to 10 kHz.

Output Isolation

Frequency	Maximum Voltage Signal Applied to any Output Current Terminal with respect to Earth
DC to 850 Hz	600 V rms, 850 V pk, limited 2 A rms, no transient overvoltages
850 Hz to 3 kHz	100 V rms, 142 V pk, limited 2 A rms, no transient overvoltages
3 kHz to 10 kHz	33 V rms, 47 V pk, limited 2 A rms, no transient overvoltages

Product Calibration

The Product uses internal check standards and measurement systems. As a result, it can be completely calibrated in place to full specifications with a small number of convenient, portable, environmentally-tolerant standards available from Fluke Calibration. This procedure provides traceability for the ac and dc voltage, resistance, and ac and dc current functions.

When manufactured, each Product is calibrated and thoroughly verified with process metrology and calibration standards traceable to the International System of units (SI) through well-recognized national metrology institutes. A certificate of calibration that is accredited to ISO 17025 is included.

The calibration verification procedure is recommended every 2 years or as required by established policies. This procedure 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.

The Artifact Calibration Process

Artifact calibration is the historical name for a process which adjusts internal references to external standards, and then uses those internal references to calibrate all ranges and functions. Artifact calibration requires three external standards or artifacts: 10 V, 1 Ω , and 10 k Ω . Environmentally-controlled internal check standards provide the primary reference points. A stored table of calibration constants defines additional reference points for controlling the output. A semi-automated process that revises the stored table, makes traceable calibrations and adjustments to the specified level of performance.

When finished with artifact calibration, but before the new constants are saved, the Calibrator presents the proposed adjustments as \pm ppm of range and percentage change in specification for each range and function. A list of changes can be sent to a computer through the serial port, USB device port, Ethernet port, or the IEEE-488 port using the remote command: CAL_RPT? CHECK. Also on completion of calibration, the Product shows the largest proposed change.

Artifact calibration can be completed as far as deriving and printing the proposed adjustments without entering the calibration protection passcode. To save the changes in non-volatile memory to adjust future outputs from the Product, enter the passcode from the front panel or with a remote command. The passcode entry menu is shown on the display when necessary.

Establish Traceability

To establish traceability through external standards:

- Except for the internal ac/dc transfer standard, the internal check standards are directly calibrated by traceable external standards every time the Product is calibrated by Artifact Calibration.
- Traceability of the ac/dc transfer standards is done by external verification. These confirm the adjustments made during Artifact Calibrations. The internal ac/dc transfer standard is never adjusted, so its traceability is not disturbed by calibration. Infrequent verification is done by comparing selected ac voltage outputs with an external dc voltage standard through an external ac/dc transfer standard. Fluke Calibration recommends verification of this process every 2 years or according to the policy of your organization.
- Stable parameters, such as frequency flatness, determined more by circuit geometry and dielectric constants than time, addressed in the full verification procedures.

Calibration Reports

The Product stores two sets of calibration constants: the set currently in use and the old set from the previous calibration. This gives the Product 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 \pm ppm of range and in percentage of specification limit. Save the report to a USB drive or retrieve it from a host computer through either the RS-232, USB device port, Ethernet port, or IEEE-488 interface.

Range Adjustment

After artifact calibration, further fine adjustments can be made to each range. Range adjustments are optional and they are not necessary to meet published specifications. However, they can help to align the Product closer to in-house standards.

Before a range calibration, first do the Artifact Calibration as described later in this manual. This calibrates the ranges that will not be adjusted. It also makes an initial adjustment for each range, and supplies flatness corrections for ac functions.

DC Zero

DC Zeros is a quick, automatic process that corrects offset errors. Offset errors increase with time on several output ranges. If a 5725A Amplifier is attached, it also zeros the 11 A dc range. This process takes approximately 2 ½ minutes (plus an additional 30 seconds for the 5725A).

Run DC Zeros

To execute dc zeros, from the normal operation screen:

1. Touch **Setup Menu** to show the Setup Menu. See the *Setup Menu* section of Chapter 4 of the Operators Manual.
2. Touch the **Calibration** menu.
3. Touch **Run DC Zero** to start the dc zeros routine. The status of the dc zero calibration is shown as the Product progresses through a series of steps. When completed, the Product shows “Calibration complete”.

Note

If the Product is not warmed up, the display prompts to continue or cancel the DC Zeros function.

4. Touch **Close** to proceed with Product use.

DC Zeros Reminder

Specifications require that dc zeros be run at least every 30 days. If 30 days passes and dc zeros is not done, the display prompts to run the process.

To override the message and run dc zeros at a more convenient time, touch **Cancel**. To run dc zero at this time, touch **OK**.

Note

If this message shows after powering on the Product, let the Product warm up before running dc zeros. Otherwise an error message indicates that the Product is not warmed up. To ensure the best performance, complete the warmup.

Calibration Procedures

This manual provides procedures to calibrate the Product to external standards, adjust the range if necessary, and do a calibration check.

To maintain traceability, these requirements must be met:

- Complete calibration of the Product to external standards before the start of any calibration cycle.
- Performance verification must be completed every 2 years.

Calibration Check and range calibration are optional procedures that are provided to enhance the accuracy if needed for special requirements. See *Calibration Check*.

Calibration Security Passcode

The integrity of Product calibration is protected by a security passcode that must be entered before new calibration constants can be saved to non-volatile memory. This passcode replaces the hardware calibration switches found on older calibrators such as the Fluke 5720A. As with the 5720A, the passcode also protects the ability to set the date for the internal real-time clock.

If the passcode has not been entered, the Product is secured. Once the passcode is entered, the Product is unsecured. The Product secures itself when it is reset or when the setup menus are closed. The Product can be unsecured at any time over the remote interface with the CAL_SECURE command and by entering the passcode. The front panel prompts for the passcode to unsecure the Product before it can accept new values to be eventually stored.

The passcode contains 1 to 8 decimal digits. The Product is shipped with the passcode set to "5730". To change the passcode, touch **Setup Menu>Calibration>Change Calibration Passcode**. The Product prompts for the current passcode and then the new passcode. The passcode can also be changed over the remote interface with the CAL_PASSWD command.

If the passcode for a particular Product is lost, contact Fluke Customer Support. See *How to Contact Fluke Calibration*.

Artifact Calibration

The Product must be calibrated 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 Operators Manual.

To calibrate the Product, apply these portable standards to the output binding posts:

- 10 V dc voltage standard
- 1 Ω resistance standard
- 10 k Ω resistance standard

These standards are recommended:

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

Use 5730A-7003 (spade lugs) Low Thermal Leads for all connections:

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

Note

5440A-7002 and 5440A-7003 Low Thermal Lead sets include a third cable specifically designed for completing Artifact Calibration. The 5730A-7002 and 5730A-7003 Low Thermal Lead sets do not include the third cable for connection between reference standards.

When to Adjust Product Uncertainty

Table 2 lists each external uncertainty limit of the standards, and the Product specifications that must be adjusted accordingly if that limit is exceeded.

As long as the external standards have the uncertainties listed in Table 2, it is not necessary to adjust the Product absolute specifications. However, if uncertainty of the in-house standard exceeds the value in the table, some of the absolute specifications of the Product must be adjusted by the algebraic difference between the standard uncertainty and the uncertainty limit listed in the Table 2. For example, if the dc voltage standard has an uncertainty of 2.5 ppm, then the absolute specifications listed in the Electrical Specification tables above for dc volts, ac volts, dc current and ac current must all be increased by 1 ppm.

Table 2. Standards for Calibration

Fluke Standard	Traceable Quantity	Nominal Value	Uncertainty Limit	Specifications susceptible to Uncertainty Limit
732B	Voltage	10 V	1.5 ppm	dc volts, ac volts, dc current, ac current
742A-1	Resistance	1 Ω	10 ppm	1 Ω, 1.9 Ω
742A-10k	Resistance	10 kΩ	2 ppm	ac current, dc current 10 Ω to 100 MΩ

Main Output Calibration Procedure

Before this procedure is started, make sure the Product is powered on and has completed the appropriate warm-up period.

To calibrate the main output functions:

1. Touch **Setup Menu>Calibration**. The calibration menu is shown.
2. If necessary, touch **Temperature** and enter the correct temperature (in degrees Celsius) to update the ambient temperature. This is the air temperature in the local vicinity of the Product, which can be seen from laboratory environmental monitoring devices or from a temperature probe located closer to the exterior of the Product. Consider the ambient temperature of the Product if it is located in a rack which can have increased temperatures.
3. Touch **Run Artifact Cal** to begin the procedure. The Product prompts to refer to the manual for the correct connections.
4. Connect the 732B to the Product as shown in Figure 1.

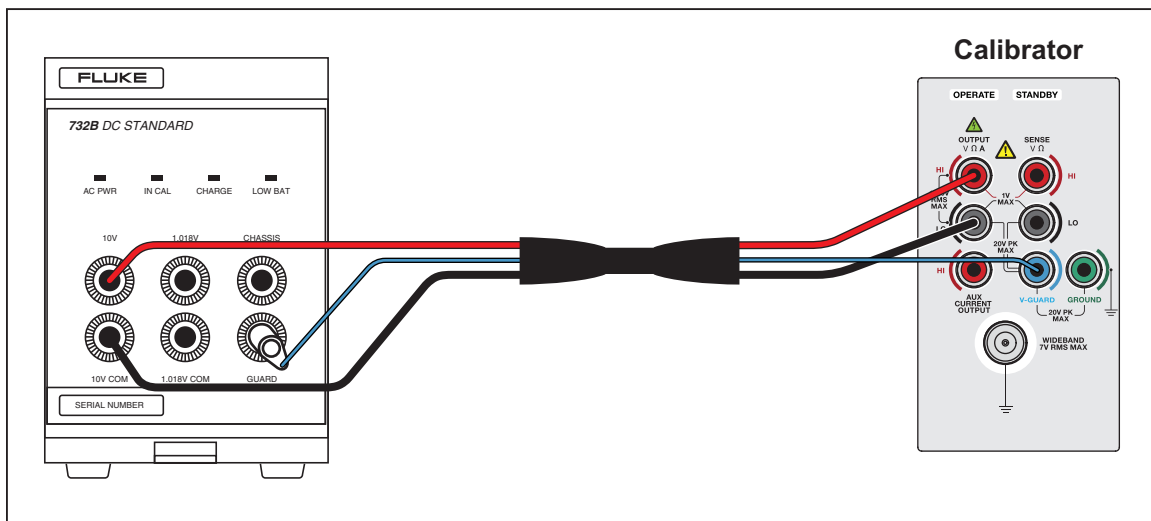


Figure 1. 732B External Calibration Connections

hhp027.eps

5. Enter the value of the 732B 10 V output. This should be obtained from the report of calibration for the 732B, and preferably, from control charts that use linear regression to predict the value of the 732B at the time of use. If the entered value is not between 9 V and 11 V, an error message is shown. Restart the process from this point with a calibrated 732B.
6. Push **ENTER** to start the calibration procedure. As the Product self-calibrates, it indicates what is happening on the display. When the 6.5 V and 13 V references have been characterized, the display prompts to accept or reject the changes that are about to be made to the calibration constants.
7. To reject the changes, touch **Cancel**. Otherwise, touch **Continue** to accept and save the changes, and to continue with calibration.

8. Reverse the HI and LO connections at the 732B terminals, and push **Continue** on the Product to continue the calibration process.
9. After this part of the calibration procedure is complete, the Product shows the reference shifts and prompts to continue. Touch **Continue**. The Product prompts to refer to the manual for the correct connections and enter the first calibration value.
10. Connect the Product to the 10 k Ω standard as shown in Figure 2 and enter the value of the standard using processes similar to those described for dc voltage. If the standard is not between 9 k Ω and 11 k Ω , an error message is shown. Start over from this point with a different 10 k Ω standard. Push **ENTER** on the Product again to continue.
11. When the internal 10 k Ω reference has been characterized, accept or reject the changes that are about to be made to the calibration constant. To reject the changes, touch **Cancel**. Otherwise, touch **Continue** to accept and save the changes. This lets the calibration process continue.

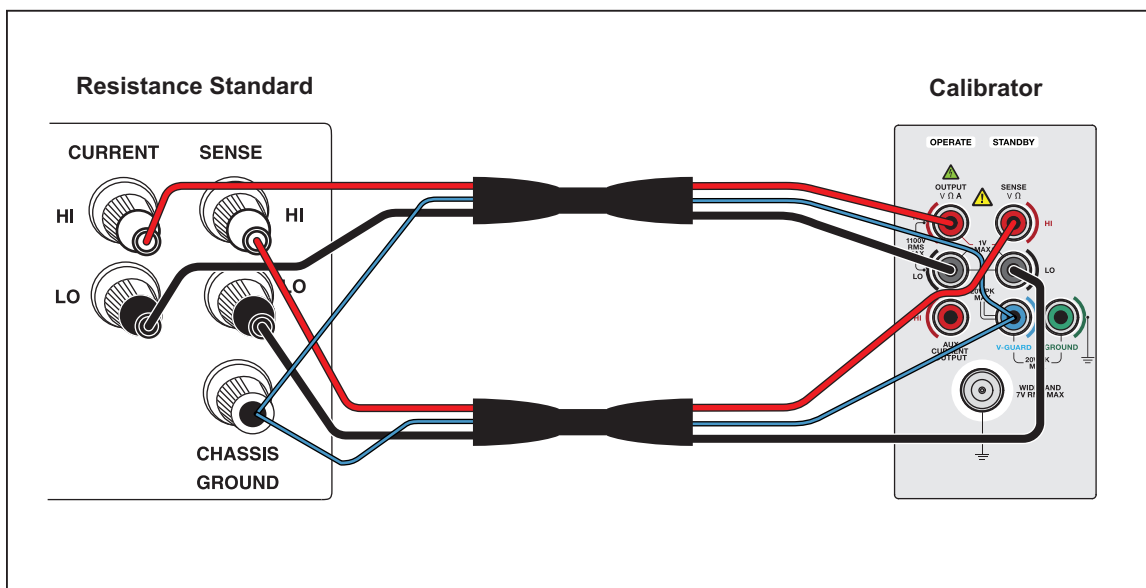


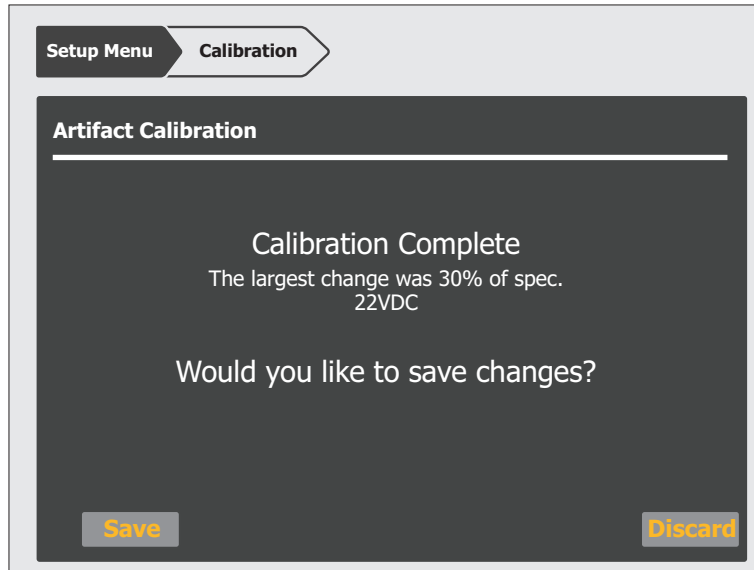
Figure 2. 742A-1 and 742A-10 k External Calibration Connections

hhp028.eps

12. Disconnect the 10 k Ω standard, and connect the Product to the 1 Ω standard. Enter the value of the 1 Ω standard using processes similarly described for the other standards. If the standard is not between 0.9 Ω and 1.1 Ω , an error message appears, and the user can start over from this point with another standard.
13. Push **Continue** to proceed with calibration.
14. When the internal 1 Ω reference has been characterized, accept or reject the changes that are about to be made to the calibration constant.

15. To reject the changes, touch **Cancel**. Otherwise, touch **Continue** to accept and save the changes, and to continue with calibration.

Once the internal steps are complete, a screen similar to this is shown:



hhp215.eps

16. Touch **Save** to store the results and adjust the Product. If the security passcode has not already been entered, the Product prompts to do so before the results are saved. Touch **Discard** to remove the results from the calibration.

Range Adjustment

Once artifact calibration is complete, it may be necessary to make further adjustments to the range. To make a range adjustment, adjust a range constant, which is an additional gain multiplier. Although range calibration is not needed in order to meet absolute specifications, they are useful for tuning the Product so that its values are closer to in-house standards.

Use an in-house laboratory standard to adjust the range constants. The subsequent 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 the range constant is adjusted, the new constant remains active until the next calibration, at which time all range constant multipliers are restored to 1. All range adjustments can be erased by selecting **Restore Factory Defaults** from the Calibration Menu.

Before the subsequent procedure is started, make sure the equipment necessary including in-house laboratory standards where necessary, are on hand.

The subsequent example procedure adjusts the 220 V dc range constant with the listed equipment:

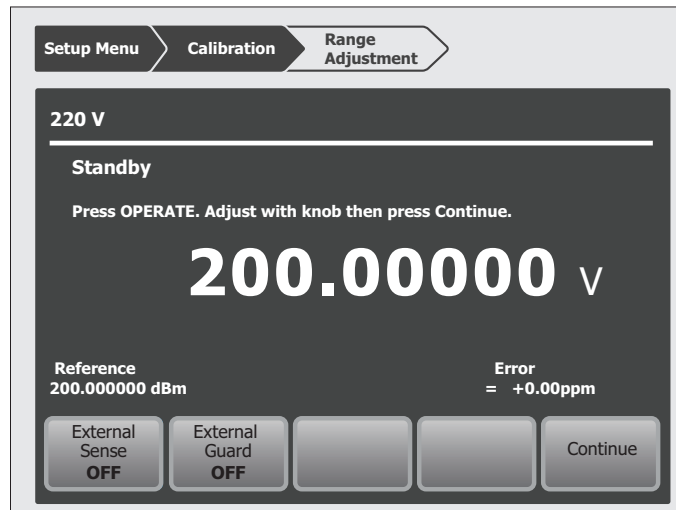
- 732B DC reference standard
- 752A Reference Divider
- 8508A
- Low Thermal Test Leads: 5730A-7003 (spade lugs)

Note

5440A-7002 and 5440A-7003 Low Thermal Lead sets include a third cable specifically designed calibrating a Fluke 5440 series instrument and is not specifically needed here. The 5730A-7002 and 5730A-7003 Low Thermal Lead sets do not include the third cable for connection between reference standards.

Proceed as follows to adjust the 220 V dc range constant (the procedure is similar for all ranges). Complete the calibration to external standards before the range adjustment procedure.

1. Touch **Setup Menu>Calibration>Range Adjustment >DCV** to show the Range Adjustment menu.
2. Touch **220 V** and enter the nominal value.
3. Connect the 732B, 8508A, and 752B in a 10:1 configuration, as shown in Figure 3.
4. Multiply the 732B value by 10, and enter this new value. The Product output will be nulled to this new value.
5. Push **ENTER** to show this display and confirm the values:



hhp217.eps

6. Push **OPERATE** to activate the Product output.
7. Turn the output adjustment knob on the Product until a null is achieved on the null detector, and then touch **Continue**.
8. Touch **Save** to store the results and adjust the Product. If the security passcode has not already been entered, the Product prompts to do so before the results are saved. Touch **Discard** to remove the results from the calibration.

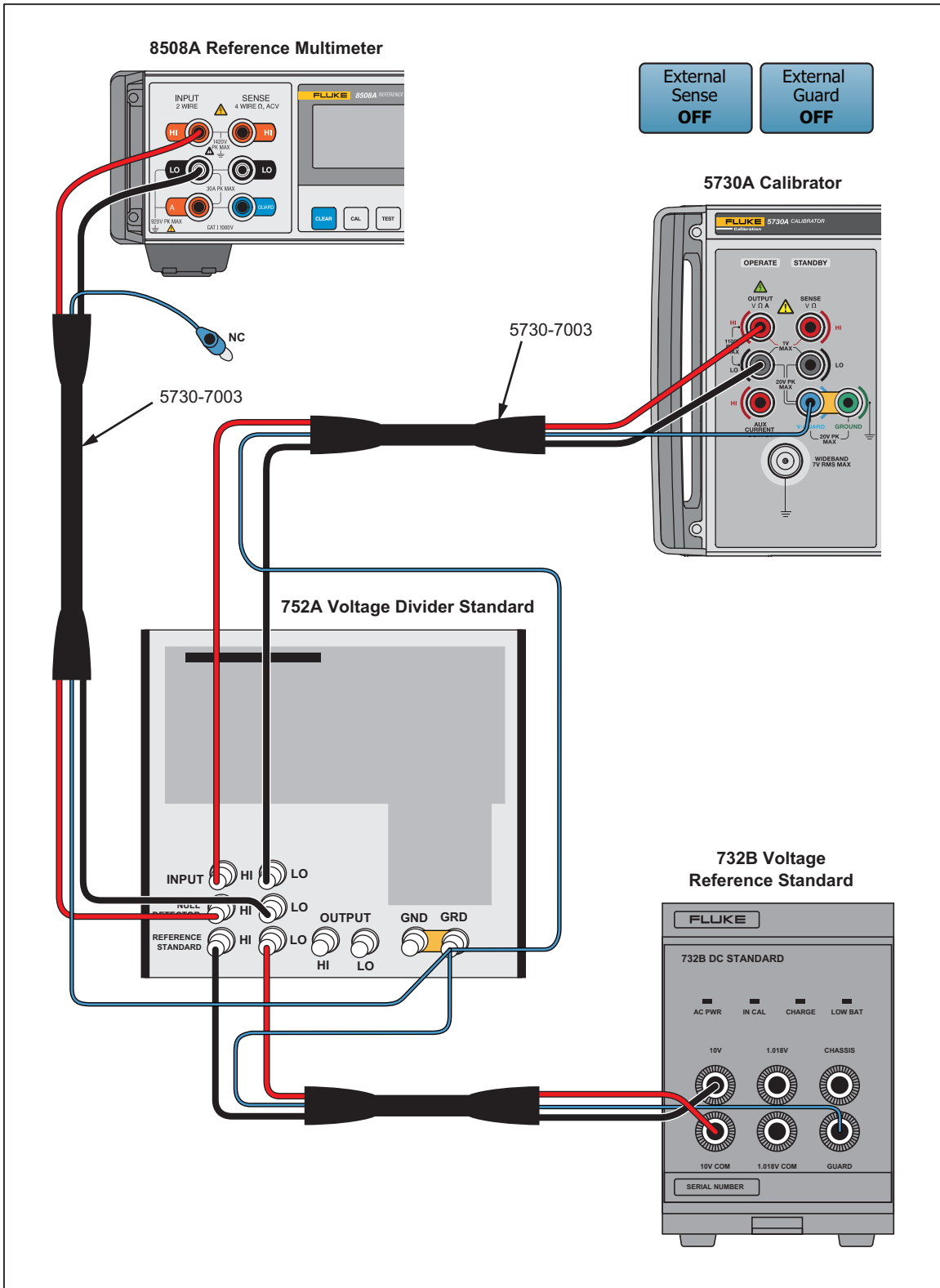


Figure 3. 220 V DC Range Calibration Connections

hhp302.eps

Calibrate the Wideband AC Module (Option 5700A-03)

The Wideband AC Module (Option 5700A-03) can be installed in the Product. The module needs to be calibrated for both gain and flatness. The gain should be calibrated when the 5730A main output functions undergo their routine calibration.

Since frequency flatness is determined by stable parameters (for example, 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 Product shipment to a standards laboratory for periodic verification.

The subsequent procedure describes the process for wideband gain calibration.

Note

To do this procedure, a Type “N” female to double banana plug adapter is necessary. This adapter comes with the Product.

Before this procedure is started, make sure the Product is powered on and has completed an appropriate warm-up period. To calibrate the wideband gain:

1. Touch **Setup Menu>Calibration** to show the Calibration menu.
2. Connect the wideband output cable between the WIDEBAND connector and the SENSE binding post.

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

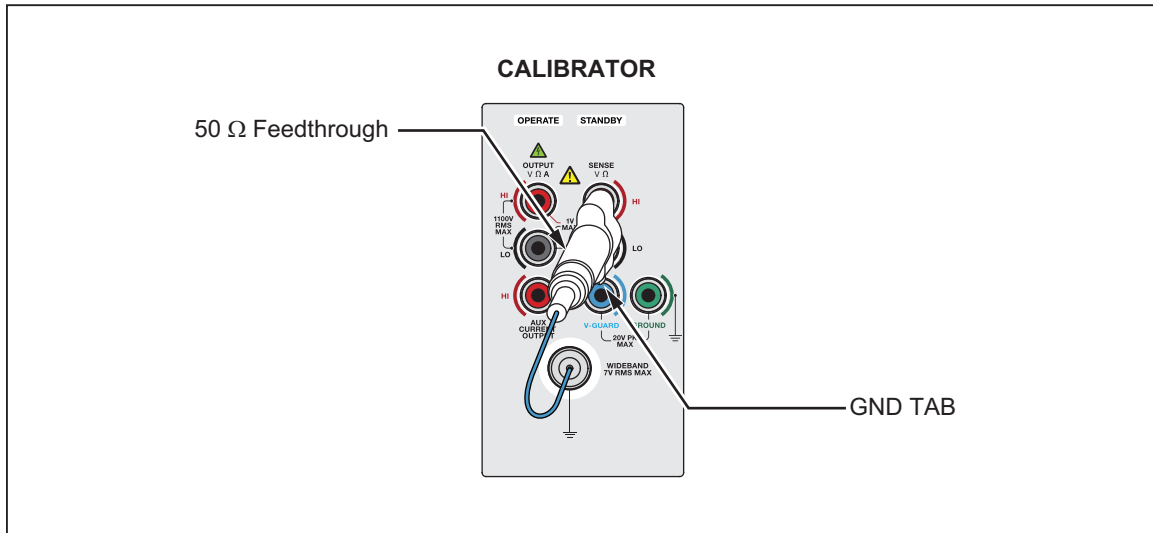


Figure 4. Wideband Module Calibration Connection

hhp030.eps

3. Touch **Run Wb Gain Cal** to begin calibration. The Product prompts to refer to the manual for the correct connections.

As the wideband calibration proceeds, messages are shown on the display that identify all processes as they are encountered. When positive gains calibration is complete, a message is shown to refer to the manual for negative gains connections.

4. Reverse the dual-banana connector so that the center connector is connected to LO.
5. Push **ENTER**. The display shows progress through the procedure in the same fashion as for artifact calibration. At the end of the procedure, the Product gives the option to save or discard the results.
6. Touch **Save** to store the results and adjust the Product. If the security passcode has not already been entered, the Product prompts to do so before the results are saved. Touch **Discard** to remove the results from the calibration.

Wideband Flatness Calibration Procedure

Do the calibration procedure and the full verification of the Product every 2 years.

For flatness calibration:

1. Touch **Setup Menu>Calibration**. If the ambient temperature has changed from the displayed value, update it.
2. Touch **Run Wb Flatness Cal**.
3. Connect the equipment as shown in Figure 5. Note that the wideband cable is connected to the 5790A directly, the termination is not used.
4. Touch **Continue**.
5. Push **OPERATE**. Wideband flatness calibration starts with a 3 V output at 1 kHz.
6. Push the **SET REF** softkey on the 5790A when the 5790A settles to a reading. This is the 3 V reference value from which all other frequencies will be compared.
7. Touch **Continue** and the frequency changes to the next value.
8. At this point and all subsequent points for this range, adjust the Product output adjustment knob to bring the 5790A error display to 0 and then touch **Continue** on the Product. Repeat this step for each frequency through 30 MHz.
9. The Product wideband output changes to 1 V at 1 kHz. When it has, push the **CLEAR REF WBND** softkey on the 5790A.
10. Repeat steps 6 to 9 for the 1 V, 300 mV, 100 mV, 30 mV, and 10 mV ranges.
11. Touch **Save** to store the results and adjust the Product. If the security passcode has not already been entered, the Product prompts to do so before the results are saved. Touch **Discard** to remove the results from the calibration.

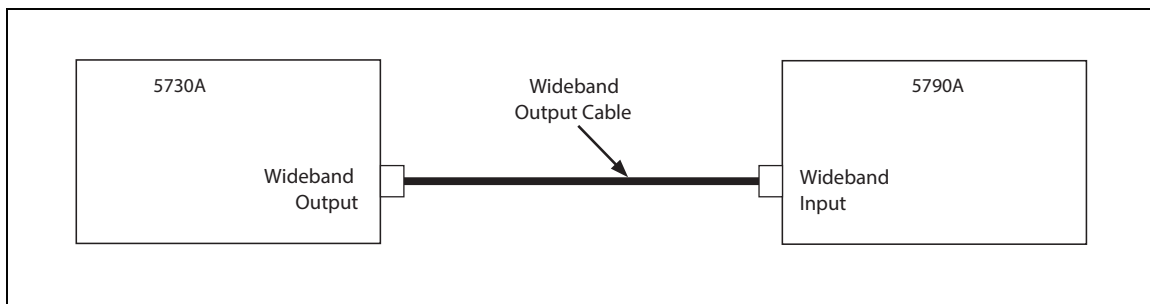


Figure 5. Wideband Flatness Calibration Connections

hhp313.eps

Calibration Check

Calibration check is similar to the artifact 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 artifact calibration report, and shows any proposed changes.

This procedure can be done from an external computer, and can be set to run automatically, with no assistance (there is no need to enter the security passcode, since no constants are changed).

Use calibration check at any time to confirm the integrity of the Product without connecting external standards. The calibration check is also useful to collect a performance history.

Before this procedure is started, make sure the Product is powered on and has completed the appropriate warm-up period.

To check the calibration:

1. Touch the **Setup Menu>Calibration** to show the Calibration menu.
2. Touch **Run Calibration Check** to begin the procedure.

As the calibration check proceeds, the display shows the current process of the calibration check. When the check is complete, the largest shift that is detected is shown on the display. The Product shows when calibration is complete.

3. Touch **Continue** to return to the Calibration menu. To save the calibration report, see *Save Calibration Reports*.

Develop a Performance History

A Fluke Calibration specification is a set of performance limits that all products must meet. To maintain consistent quality, the calibrators are specified with enough margin to include temperature, line, and load extremes, plus additional margin for production. This means that a typical Product in a typical environment operates well within specification limits. For some exacting applications, it can be helpful to know just how accurately a particular Product 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 Product calibration check feature is an alternative with some distinct advantages:

- Calibrated check standards are already programmed into the unit. External standards are not necessary.
- The process is consistent and automatic and it does not require operator 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.

Save Calibration Reports

Use the Product Calibration Report menu to create Calibration Reports and export the reports to a USB flash drive. The subsequent sections describe the reports.

To save a calibration report:

1. Connect a flash drive to the USB port on the front of the Product.
2. Go to **Setup Menu>Calibration>Generate Report**.
3. Select one of the three reports:
 - Save Calibration Shifts
 - Save Check Shifts
 - Save Raw Data

Once an item is selected, the report is saved to the USB flash drive. The report is in comma separated value (CSV) format.

4. Open or print the file from the PC.

Calibration Shift Results

The Calibration Shift report shows all adjustments made to stored zero-offset and gain constants, as a result of any drift detected at the most recent calibration. This report is available and valid at any time.

The report contains this information:

- Heading that shows the date and time the report was saved, the user report string, and the installed version of the Product software.
- Modules present (installed or attached) including any attached amplifiers
- Most recent calibration dates and temperatures
- Values of externally-calibrated internal references including the resistance reference, which is the average of the actual-to-nominal ratios of the 100 Ω , 190 Ω , 1 k Ω , 1.9 k Ω , 10 k Ω , 19 k Ω , 100 k Ω , and 190 k Ω resistors.
- DC voltage output shifts for each range
- AC voltage output shifts for each range. A gain shift for all frequencies is shown along with shifts at selected frequencies for each range.
- Current output shifts for each range (ac and dc)
- Resistance shifts for each value
- 5725A Amplifier output shifts (if attached)
- Wideband AC Module (Option 5700A-03) output shifts (if installed)

The shifts of references and outputs are given both as absolute shifts in V, A, ohms, and also (for non-zero magnitudes) as shifts relative to the previous value, in parts per million (ppm) or percent (%).

The specified accuracy for the output is also shown and the ratio of the shift to that accuracy in percent.

The Calibration Shift report file name is CSyymmdd.CSV, where yymmdd is the date today.

Calibration Check Shift Results

The Calibration Check report presents changes in the magnitude of self-correction generated by calibration check. Calibration check uses internal standards rather than external standards as the basis for comparison and does not make permanent changes to calibration constants. This report is available only after a calibration check has been done and until power has been reset to the Product.

The report contains this information:

- Heading that shows the date and time the report was saved and user report string
- Modules present (installed or attached)
- Most recent calibration dates and temperatures
- Values of externally-calibrated internal references
- DC voltage output shifts for each range
- AC voltage output shifts for each range
- AC and dc current output shifts for each range
- Resistance shifts for each value
- 5725A Boost Amplifier output shifts (if attached).

The calibration report file name is CKyymmdd.CSV, where yymmdd is the date today.

Raw Data Results

This report gives the values for the internally stored correction factors (calibration constants), and is useful primarily for Fluke Calibration service centers.

Full Verification

Verification is the process of evaluating the data taken during the process of calibration and evaluating whether the data is within the published specifications for the Product. An independent external verification is recommended every 2 years, before and after normal periodic adjustment or repair of the Product. Verification establishes and maintains parallel external traceability paths for the internal functions that are not adjusted or corrected during artifact calibration. An example is the internal ac/dc transfer standard. Verification also serves as a check that internal calibration processes are in control.

Notes

All performance limits specified in the test records apply to 90-day specifications for the Product at a 99% level of confidence. 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.

Equivalent equipment and methods, either manual or automated, may be substituted for the 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.

Required Equipment for All Tests

An abbreviated summary of required equipment for all the verification tests is given in Table 3. Individual lists of required equipment are included at the beginning of each test.

Warmup Procedure for All Verification Tests

Before verification:

1. Verify that the Product has warmed up for at least 30 minutes.

Note

If the Product has been powered off in an environment outside of operating environment specifications, particularly with humidity above 70 %, allow a minimum of 2 hours warm-up. Extended storage at high temperatures and humidity may require up to 4 days of power-on stabilization.

2. If a regularly scheduled full verification as recommended by Fluke Calibration is being done, calibrate the Product as described in the *Calibration Procedure* section before you continue with verification.
3. Ensure that each piece of external test equipment has satisfied its specified warm-up requirements.
4. Ensure that the Product is in standby (STANDBY annunciator lit).

Table 3. List of Required Equipment for Main Output

Equipment	Description	Application
AC Measurement Standard or Resistance Standards	Fluke 5790A	ACV, ACI
Reference Divider	Fluke 742A Series	Cal, Ohms, DCI
Null Detector	Fluke 752A	DCV
DC Reference Standard	Fluke 8508A	DCV
Frequency Counter	Fluke 732B	DCV
Shunts	Tektronix FCA3000	Frequency
Resistance Standard	Fluke A40B Series	ACI
Digital Multimeter	Guildline 9230 0.1 Ω and 0.01 Ω	DCI
Low Thermal Cables	Fluke 8508A	Ohms, DCI, ACV, and DCV
	5730A-7003	Various
Equipment Required for Wideband AC Module (Option 5700-03) Verification		
AC Measurement Standard	Fluke 5790A with Wideband Option -03	Wideband
Wideband Cable (supplied with 5730A-03)	Fluke Cable	Wideband
50 Ω Termination (supplied with 5730A-03)	Fluke Termination	Wideband
Adapter (supplied with 5730A-03)	Pomona 1269 BNC(F) to dual banana plug	Wideband
Adapter (supplied with 5730A-03)	Kings KN-99-46 N(F) to BNC(M)	Wideband

Determine Specification Limits for other Calibration Intervals

The verification procedures in this document test to the 90 day 99 % confidence specification limits. For other calibration intervals, it is necessary to calculate limits based upon the specification that was selected. The subsequent examples show how the 90 day specification limits were calculated. These examples illustrate how to calculate the specifications limits for other intervals or levels of confidence.

The next example shows how to calculate a specification limit for a particular test point from the combined specification which is listed as a percentage (or parts per million) of reading plus a floor error in microvolts, millivolts, microamps or nanoamps. The component of the specification in parts per million is referred to as a range specification. The floor specification has the same base units of measurement as the output value (volts, amps). It is not appropriate to add a range specification and floor specification together directly, because they are not in the same units of measurement. In order to add the two quantities, it is

necessary to convert one quantity so that they are both in the same units of measurement.

The 90 day 99 % confidence specification for the Product at 2 mA, 1 kHz is 117 ppm + 40 nA. Convert the range specification to the same units as the floor specification by multiplying the range specification by the output value:

$$(2 \text{ mA} \times 117 \text{ ppm} = [(2 \times 10^{-3}) \text{ A} \times (117 \times 10^{-6})] = 2.34 \times 10^{-7} \text{ A} = 234 \text{ nA}$$

Making the combined absolute specification $234 \text{ nA} + 40 \text{ nA} = 274 \text{ nA}$

The specification limits at 2 mA would be 1.999726 to 2.000274 mA

To test to the 1 year specification of 120 ppm + 40 nA, the specification limit would be $240 \text{ nA} + 40 \text{ nA} = 280 \text{ nA}$.

Applying Guardbands to Specification Limits

The expanded uncertainty of measurement must be determined by each laboratory that calibrates the Product. Even if the procedures for performance verification in this manual are followed completely, there are different sources of uncertainty due to traceability, environment, electrical cabling, electro-magnetic interference, uncertainty of the reference standards used, and operator influences that are unique to each calibration laboratory. These must be accounted for their individual situations, so it is not possible for Fluke Calibration to estimate uncertainty for all user calibrations.

Those doing the calibration of the Product can verify to 99 % confidence limits, 95 % confidence limits, 24 hour, 90 day or 1 year specifications. While the calibration procedure included in this manual is applicable to testing every test point, the uncertainty from the calibration process as compared to the specification limit varies and can require further consideration of measurement decision risk.

Some quality systems require adherence to particular rules for measurement decision risk when making claims of compliance with a specification. Examples of decision rules are:

1. The ratio of the specification tested to the specification of the accuracy of the standard used (often referred to as a Test Accuracy Ratio (TAR) or Test Specification Ratio (TSR)) must be greater than 4:1.
2. The ratio of the specification tested to the expanded uncertainty of measurement (often referred to as the Test Uncertainty Ratio) must be greater than 4:1.
3. The TUR or TAR must be greater than 3:1.
4. The probability of a false accept risk must be less than 2 %.
5. The Product cannot be determined as meeting specifications unless the measurement at the test point is less than the value of the specification minus the expanded uncertainty.

To comply with these decision rules, it can be necessary to establish a guardband for each test point. A guardband creates a zone that is less than the specification limits, and if the measured value obtained from the calibration is not in the guardband area, the level of measurement decision risk is sufficient. The inner edge of the guardband is the test limit for the calibration shown in Figure 6.

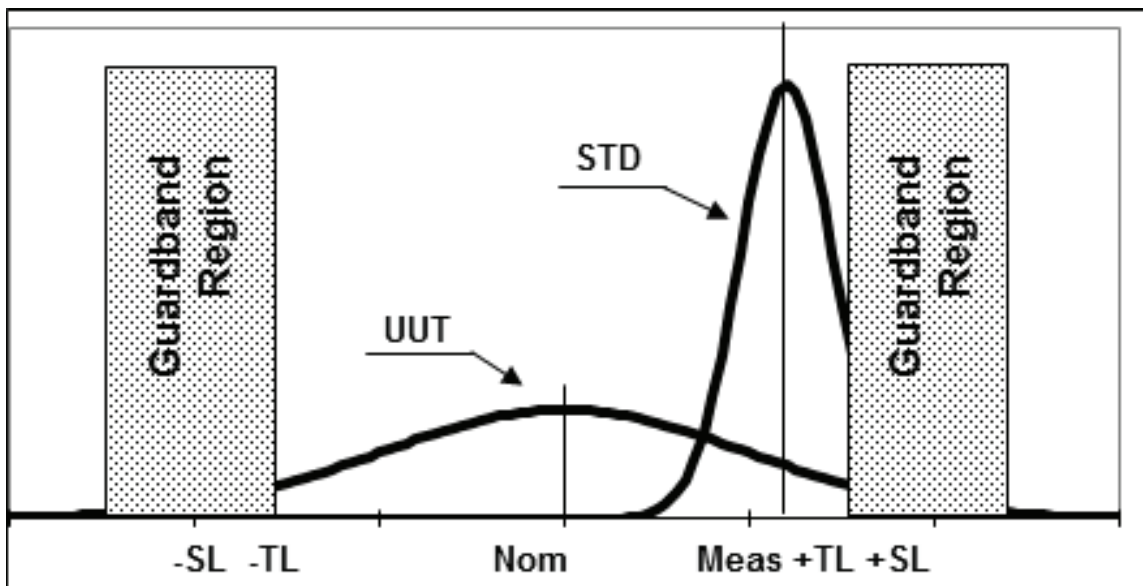


Figure 6. Test Limits Established by Guardbanding

hhp312.eps

There are many ways to develop test limits from decision rules. Two of these rules are shown as examples to develop test limits through guardbanding.

ILAC G8 (ISO 14253-1) Decision Rule

This guardband strategy addresses example 5 shown above. The test limit is determined by the subtracting the uncertainty of measurement from the specification.

Test Limit = Specification Limit – Expanded Uncertainty of Measurement

The specification limits can be obtained from the performance verification procedure or can be computed using information from *Determining Specification Limits for other Calibration Intervals* as guidance.

Once the calibration laboratory has determined the expanded uncertainty for a measurement, the test limits for this method may be computed as follows:

Using the example test point in the previous section, for the 90 day 99 % confidence specification for 2 mA at 1 kHz, the specification limits are ± 274 nA. If for example, the expanded uncertainty of measurement at this test point was 55 nA, the test limit would be:

$$\text{Test Limit} = 274 \text{ nA} - 55 \text{ nA} = 219 \text{ nA}$$

This creates upper and lower test limits of 1.999781 mA to 2.000219 mA. If the measured value obtained in the calibration were between these limits, by this decision rule the Product would be in tolerance or indicated as Pass.

If the measured value obtained was between 219 nA (the test limit) and 274 nA (the specification limit) this is known as an indeterminate measurement by ISO 14253-1. Some organizations elect to call this a conditional pass as it is more likely that the measurement indicates an in tolerance condition than not.

If the measured value is >274 nA, but <329 nA (the sum of the specification limit plus the uncertainty) ISO 14243-1 indicates that this is an indeterminate

measurement as well. Some organizations also elect to call this a conditional fail because there is still a possibility that the measurement is in tolerance. Most organizations consider this an out of tolerance result because although the value may exist anywhere with the interval of the measured value plus and minus the uncertainty, the best estimate of the value is the measured value.

RDS Method

Another guardbanding method that is the root difference of squares method. The test limit for this method is defined as:

$$\text{Test Limit} = \sqrt{(\text{Specification limit})^2 - (\text{Expanded Uncertainty of Measurement})^2}$$

This method makes a less aggressive guardband while still providing sufficient confidence in the measurement result for most quality standards. The determination of pass and conditional pass is generally used for this method in the same manner as the ILAC G8 method. The RDS method is used widely at Fluke Calibration and many other companies as a reasonable approach to ensuring confidence that the verified Product meets its published specifications.

This is not an all-inclusive list of guardbanding strategies. The method selected must meet the quality system requirements of the owner of the Product being calibrated. The best uncertainty attainable at some test points can be relatively large as compared to the specification. Fluke Calibration recommends that when making conformity assessment decisions of in or out of tolerance to published specifications during performance verification, the uncertainties of measurement should be evaluated and appropriate guardbanding rules should be applied to have sufficient confidence in the calibration results.

Resistance Verification Test

The subsequent tests check every resistance value from 0 Ω to 100 MΩ. For 0 Ω, 1 Ω, and 1.9 Ω an 8508A measures the resistance directly. For 10 Ω to 100 MΩ the 8508A is used in a transfer method where the Digital Multimeter (DMM) first measures a resistance standard and then measures the Product. The Product resistance value is then calculated. Use Tables 5 and 6 for the test record. Table 4 lists the required equipment.

Table 4. Required Test Equipment

Equipment	Model
Fluke Standard Resistors	742A-10, 742A-100, 742A-1k, 742A-10k, 742A-100k, 742A-1M, 742A-10M and a 100 MΩ Standard
Fluke DMM	Fluke 8508A
Low Thermal Cables	5730A-7003
Special Shielded Cable	See “Verify 100 M Ω” for details

Verify 0 Ω , 1 Ω , and 1.9 Ω

1. Connect the DMM to the Product as shown in Figure 7 using the 5730A-7003 cables.
2. Set the 8508A to Resistance, True Ohms, 2 Ω range, 6 digits, normal current, internal guard, 4 wire, and "Slow".
3. Set the Product to output 0 Ω , 4-wire sense on, and then push **OPERATE**.
4. Wait for the reading to settle and record the reading in the Table 5 DMM Measured Value column.
5. Set the Product to 1 Ω .
6. Wait for the reading to settle and then record the reading in the Table 5 DMM Measured Value column.
7. Set the Product to 1.9 Ω .
8. Wait for the reading to settle and then record the reading in the Table 5 DMM Measured Value column.
9. Push **STANDBY** to put the Product in standby.
10. Enter the value shown on the Product display for 1 Ω and 1.9 Ω into Table 5.
11. Enter the difference in the measured resistance and the resistance shown into the Table 5, Measured Minus Displayed Resistance column.
12. Verify the difference is within the test limits given.

Table 5. 0 Ω , 1 Ω , 1.9 Ω Verification

5730A Output	5730A Displayed Value	DMM Measured Value	Measured Minus Displayed Resistance	Limits
0 Ω	N/A		For 0 Ω use the measured value	$\pm 50 \mu\Omega$
1 Ω				$\pm 95 \mu\Omega$
1.9 Ω				$\pm 180.5 \mu\Omega$

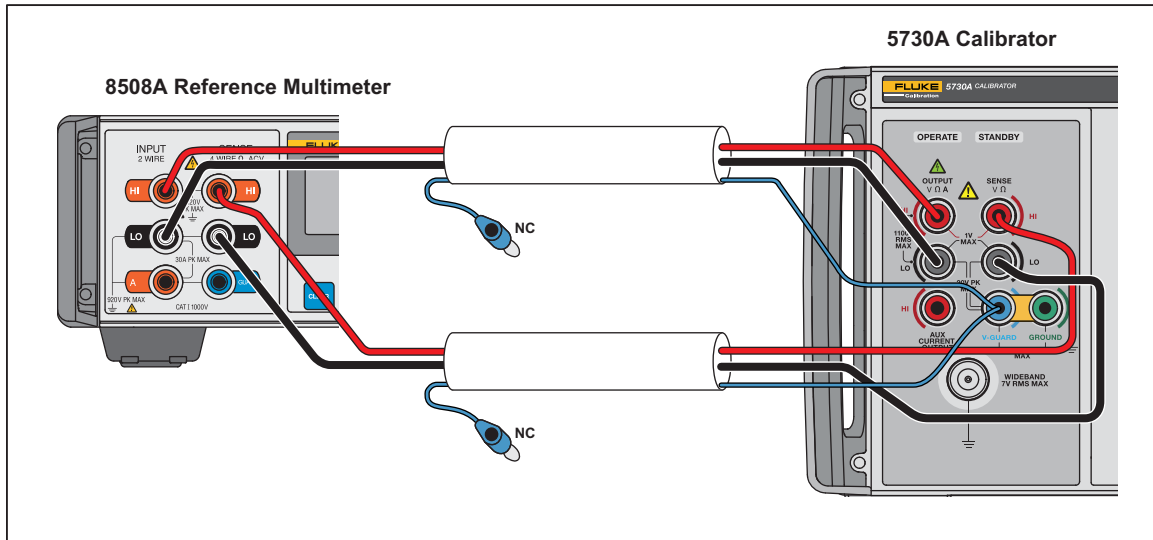


Figure 7. 0Ω , 1Ω , 1.9Ω Resistance Verification

hhp303.eps

Verify 10Ω through $19 M\Omega$

1. Set the 8508A to Resistance, 7 digits, and 4-wire sense on.
2. Connect a 4-wire short (8508A-7000K) to the 8508A input terminals.
3. Zero the meter on all ranges with the **ZERO FUNC** button.
4. Connect the DMM to the first or next resistance standard (742A) given in Table 6 using the 5730A-7003 cables as shown in Figure 8.
5. Enter the resistance value of the 742A Standard in Table 6 under the 742A STD Ohms Value. This value will be used with two measurements of the Product.
6. Set the 8508A to the range and 2W or 4W Ω as given in Table 6. For the 10Ω and 19Ω test, have the 8508A in the True-Ohms mode but for all resistance tests above that use the normal mode. For all measurements set the 8508A to 7 digits, Normal Current, Filter On, "Slow", and Internal Guard.

7. Wait for the reading to settle and then record it in Table 6 under 742A STD Ohm DMM Reading. This reading will be used with two measurements of the Product.
8. Connect the DMM to the Product as shown in Figure 7.
9. Set the Product to output the first resistance used with that standard as given in Table 6. Record the shown value in Table 6 under the Product Displayed Value. Set the Product to 4-wire Sense On for the measurements that have the DMM set to 4 wire and 4-wire Sense Off for the 2 wire measurements.
10. Push **OPERATE**.
11. Wait for the reading to settle and then record it in the Table 6 Product Ohms DMM Readings column.
12. Set the Product to the next resistance in Table 6 that uses the same resistance standard.
13. Record the shown value in Table 6 under Product Displayed Value.
14. Wait for the reading to settle and then record it in Table 6.
15. Calculate the Product values using Equation 1 in Table 6 and record it under the Calculated Value column.
16. Subtract the calculated value from the Product Display Value.
17. Confirm that the differences are within the limits given in the Table 6 Limits column.
18. Repeat the same process for the rest of the resistance measurements in Table 6.

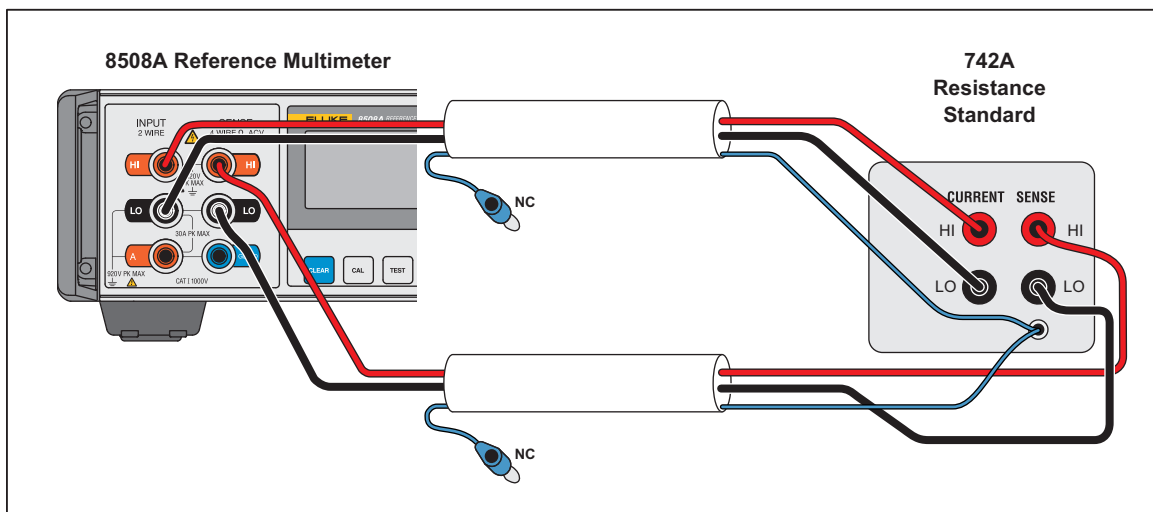


Figure 8. 10 Ω through 19 M Ω Resistance Verification

hhp306.eps

Table 6. 10 Ω through 19 MΩ Verification

Product Setting Ohms	DMM Range Ohms	2W/4W Connection	742A STD Used	742A STD Ohms Value (Rstd)	742A STD Ohms DMM Reading	Product Ohms DMM Reading	Calculated Value	Product Displayed Value	Calculated Value Minus Displayed Value	Limits Ω
10	20	4 Wire	10 Ω							±250 μ
19										±475 μ
100	200	4 Wire	100 Ω							±1.1 m
190										±2.09 m
1 K	2 k	4 Wire	1 kΩ							±7.2 m
1.9 K										±13.7 m
10 K	20 k	4 Wire	10 kΩ							±70 m
19 K										±133 m
100 K	200 k	4 Wire	100 kΩ							±800 m
190 K										±1.9
1 M	20 M	2 Wire	1 MΩ							±14
1.9 M										±32.3
10 M	20 M	2 Wire	10 MΩ							±370
19 M										±893
100 M	200 M	2 Wire	100 MΩ							±11 k

Equation 1: $R = R_{std} \frac{\text{Product Ohms DMM Reading}}{\text{742A STD Ohm DMM Reading}}$

Verify 100 M Ω

1. Verification of 100 M Ω requires a special cable be built that has banana plugs on both ends and is 100 % shielded, including over the banana plugs. Use a twisted pair, shielded cable made with Teflon insulation over the twisted wires. Build or purchase a metal shroud to go over the banana plugs so when they are plugged into the standard, Product, or the DMM, the plugs are covered all the way to the surface. Connect the twisted wires to the two banana plugs and the shield to the shroud.
2. With this special cable, do steps 2 through 11 and 15 through 17 from the last section.
3. For steps 7 and 11, while waiting for the reading to settle, hold very still and have no one moving within 10 feet or so of the test setup. Expect the readings to take several minutes to settle.

DC Voltage Verification Test

This test checks every dc voltage range, first at 0 V including "negative zero" points, then at decade voltages from 100 mV to 1000 V as well as a linearity check on the 22 V range. Use Tables 8 and 9 for the test record. See Table 7 for equipment used.

Table 7. Required Equipment for DC Voltage Tests

Equipment	Model
DC Reference Standard	Fluke 732B
Reference Divider	Fluke 752A
Reference Multimeter	Fluke 8508A
Low Thermal Cables	5730A-7003

DC Zero Test

1. Short one end of a 5730A-7003 cable. This can be done by connecting both spade lugs to a binding post but do not use the binding post on an instrument that is powered, such as the Product, but instead use the 752A or a 742A. Connect the other end to the Fluke 8508A Input HI and LO. Leave the shield connection open.
2. Set the 8508A to dc V, 200 mV range, 7 digits, internal guard, filter IN and "FAST" mode.
3. Wait for the reading to settle and then zero the meter using the **Zero Rng** button.
4. Remove the short from the end of the cable and connect it to the Product OUTPUT HI and LO and the shield to the guard terminal.
5. Connect the Product Guard and Ground together. Make sure the Product is set to internal guard
6. Set the Product to the first zero test on the appropriate range as given in Table 8.

Note

For each new range tested:

1. *Remove the range lock if set.*
2. *Set the Product to a near-full scale voltage on that range.*
3. *Set the range lock.*
4. *Set the zero voltage.*
7. Push **OPERATE** on the Product.
8. Wait for the reading to settle and record it in the Table 8 DMM Reading column.
9. Push **STANDBY** on the Product. Verify that the reading was within the limits given.
10. Repeat steps 6 through 9 for the rest of Table 8.

Table 8. DC Zero Volt Verification

Product Range	Product Setting	DMM Reading	Limits
220 mV	0 mV		$\pm 0.5 \mu\text{V}$
	$-0.010 \mu\text{V}$		$\pm 0.5 \mu\text{V}$
2.2 V	0 V		$\pm 0.8 \mu\text{V}$
	$-1 \mu\text{V}$		$\pm 0.8 \mu\text{V}$
11 V	0 V		$\pm 3 \mu\text{V}$
	$-1 \mu\text{V}$		$\pm 3 \mu\text{V}$
22 V	0 V		$\pm 5 \mu\text{V}$
	$-1 \mu\text{V}$		$\pm 5 \mu\text{V}$
220 V	0 V		$\pm 50 \mu\text{V}$
	$-10 \mu\text{V}$		$\pm 50 \mu\text{V}$

Self-Calibrate a Fluke 752A Divider with a Fluke 8508A as the Null Detector

1. Connect the Product, 752A, and 8508A as shown in Figure 9.
2. Set the 8508A to the 200 mV dc voltage range at 7 digits, filter “ON” and “FAST” and internal guard (external guard not selected). FAST mode updates the reading every 1.5 seconds. This lets the reading track the adjustments but the readings change frequently and it is somewhat noisy. FAST can be turned off so that the readings are updated every 5.3 seconds.
3. Set the 752A MODE switch to CAL and the CALIBRATE switch to 10:1 +.
4. Set the Product to output 0 mV on the 200 mV range and push **OPERATE**.
5. Wait for the reading to settle (this can take several minutes) and then zero the meter using the **Zero Rng** button.
6. Set the Product to output 20 V.
7. Wait for the reading to settle (this can take several minutes) and note the reading. Set the CALIBRATE switch to 10:1 – and note the reading.
8. If the readings in step 7 are not the same, then adjust the BALANCE control until they are the same. (see note 4 below)
9. Set the CALIBRATE switch to 10:1+. Adjust the 10:1 CALIBRATE adjustment until the reading is $0 \pm 0.5 \mu\text{V}$.
10. Set the Product to output 0 mV on the 200 mV range.
11. Set the 752A CALIBRATE switch to 100:1 +.
12. Wait for the reading to settle (this can take several minutes) and then push the **Zero Rng** button to zero the meter.
13. Set the Product to output 20 V.
14. Wait for the reading to settle (this can take several minutes) and note the reading. Set the CALIBRATE switch to 100:1- and note the reading.

15. If the readings in step 14 are not the same then adjust the BALANCE control until they are the same (see note 4 below).
16. Set the CALIBRATE switch to 100:1+. Adjust the 100:1 CALIBRATE adjustment until the reading is $0 \pm 0.5 \mu\text{V}$.
17. Push **STBY** on the Product.
18. Set the CALIBRATE switch to OPERATE and the MODE switch to the necessary position.
19. This completes the self-calibration of the 752A.

Notes

1. *The 10:1 adjustment must be done before the 100:1 adjustment can be done.*
2. *Following the "Self-Calibrate a Fluke 752A Divider with a Fluke 8508A as the Null Detector" procedure above adjusts the 752A to within 0.09 ppm or less of the nominal ratio for 10:1 and 0.18 ppm or less for 100:1.*
3. *Be sure the 752A is well stabilized in a constant temperature environment before calibration starts. The instrument stays calibrated as long as the temperature remains constant.*
4. *It can be difficult to adjust the BALANCE control for a difference of exactly $0 \mu\text{V}$ but it is not necessary to get it to exactly zero to get good results. Instead, adjust the BALANCE for as close to zero as is practical but a difference as large as $1 \mu\text{V}$ is still acceptable. Then adjust the 10:1 or 100:1 CALIBRATION adjustment for a reading that is the same for the switch in the 10:1+ position as the 10:1- position but opposite sign. For example, if the BALANCE difference is $1 \mu\text{V}$, then adjust the appropriate CALIBRATION adjustment until one switch position is say $+0.5 \mu\text{V}$ and the other position is $-0.5 \mu\text{V}$. These two readings do not have to be the same to meet the $\pm 0.5 \mu\text{V}$ requirement given in the procedure. To determine if the adjustment is close enough, use the following equation: Take the reading in the 10:1+ position and add it to the reading in the 10:1- position and then divide the result by two. For example, if the reading in the 10:1+ position is $+0.75 \mu\text{V}$ and in the 10:1- position is $-0.25 \mu\text{V}$ then: $(+0.75\mu\text{V}+(-0.25\mu\text{V}))/2 = +0.25\mu\text{V}$. This meets the requirement for an adjustment to within $\pm 0.5 \mu\text{V}$.*

5. *Using a DMM does take longer and more care to self-calibrate a 752A than using a Fluke 845 but it can still be done in a reasonable amount of time once the user gets use to the new technique. The user needs to determine which settings of the 8508A work best for them. Settings such as the number of digits, 7 or 8, using FAST or not or using the FILTER or not, can be tried until a combination is found that works best. It may be that one set of settings is found to be best for the initial adjustments and then a change in the settings for the final adjustment. For example, it may work best to set up the meter to respond quickly to a change in voltage to get the adjustments close then change to a setting that takes longer per reading but has less scatter for the final readings.*

DC Voltage Test at Decade Values

1. Self-Calibrate the reference divider according to the procedure for using the 8508A as the null detector in the "Self-Calibrate a Fluke 752A Divider with a Fluke 8508A as the Null Detector" section above.
2. Connect the reference divider and the 8508A as shown in Figure 10. The short on the INPUT and REFERENCE STANDARD inputs of the reference divider must be a low thermal EMF connection. A piece of copper wire is recommended for this.
3. Set the reference divider to 0.1 V and the mode switch to OPERATE.
4. Set the 8508A to dc V, 200 mV range, 7 digits, filter IN and "FAST" mode. Be sure the 8508A is on internal guard (external guard not selected).
5. Wait for the reading to settle and then push the **Zero Rng** button to zero the meter.
6. Remove the two shorts from the reference divider and connect the 732B 10 V Reference Standard and the Product as shown in Figure 11.
7. Enter the Reference Standard Voltage (V_{std}) into Table 9.
8. Set the Product to the first test voltage listed in Table 9, the reference divider to the setting given and the reference standard polarity given. To change the polarity of the reference standard, reverse the leads to the HI and LO output.
9. Push **OPERATE**.
10. Wait for the reading to settle, a least 1 minute, and record the reading in Table 9.
11. Calculate the Product measured voltage using the equation shown in Table 9 and ensure it is within the given limits.
12. Repeat steps 8 to 11 for the rest of the voltages given in Table 9. See the note in the *DC Zero Test* section about locking the range.

Table 9. DC Voltage Test at Decade Values Verification

10 V Std Polarity	Divider Setting	Product Range	Product Output	DMM Reading (Vdmm)	Equation	Calculated Measured Voltage	Limits
POS	0.1	220 mV	100 mV		$\frac{V_{std}}{100} - V_{dmm}$		±1.2 μV
NEG	0.1	220 mV	-100 mV		$\frac{-V_{std}}{100} - V_{dmm}$		±1.2 μV
POS	1	2.2 V	1 V		$\frac{V_{std}}{10} - V_{dmm}$		±4.8 μV
NEG	1	2.2 V	-1 V		$\frac{-V_{std}}{10} - V_{dmm}$		±4.8 μV
POS	10	11 V	10 V		$V_{std} + V_{dmm}$		±33 μV
NEG	10	11 V	-10 V		$-V_{std} + V_{dmm}$		±33 μV
POS	10	22 V	10 V		$V_{std} + V_{dmm}$		±35 μV
NEG	10	22 V	-10 V		$-V_{std} + V_{dmm}$		±35 μV
POS	100	220 V	100 V		$(V_{std} + V_{dmm}) * 10$		±450 μV
NEG	100	220 V	-100 V		$(-V_{std} + V_{dmm}) * 10$		±450 μV
POS	100	1100 V	100 V		$(V_{std} + V_{dmm}) * 10$		±1.1 mV
NEG	100	1100 V	-100 V		$(-V_{std} + V_{dmm}) * 10$		±1.1 mV
POS	1000	1100 V	1000 V		$(V_{std} + V_{dmm}) * 100$		±6.5 mV
NEG	1000	1100 V	-1000 V		$(-V_{std} + V_{dmm}) * 100$		±6.5 mV
Vstd=							

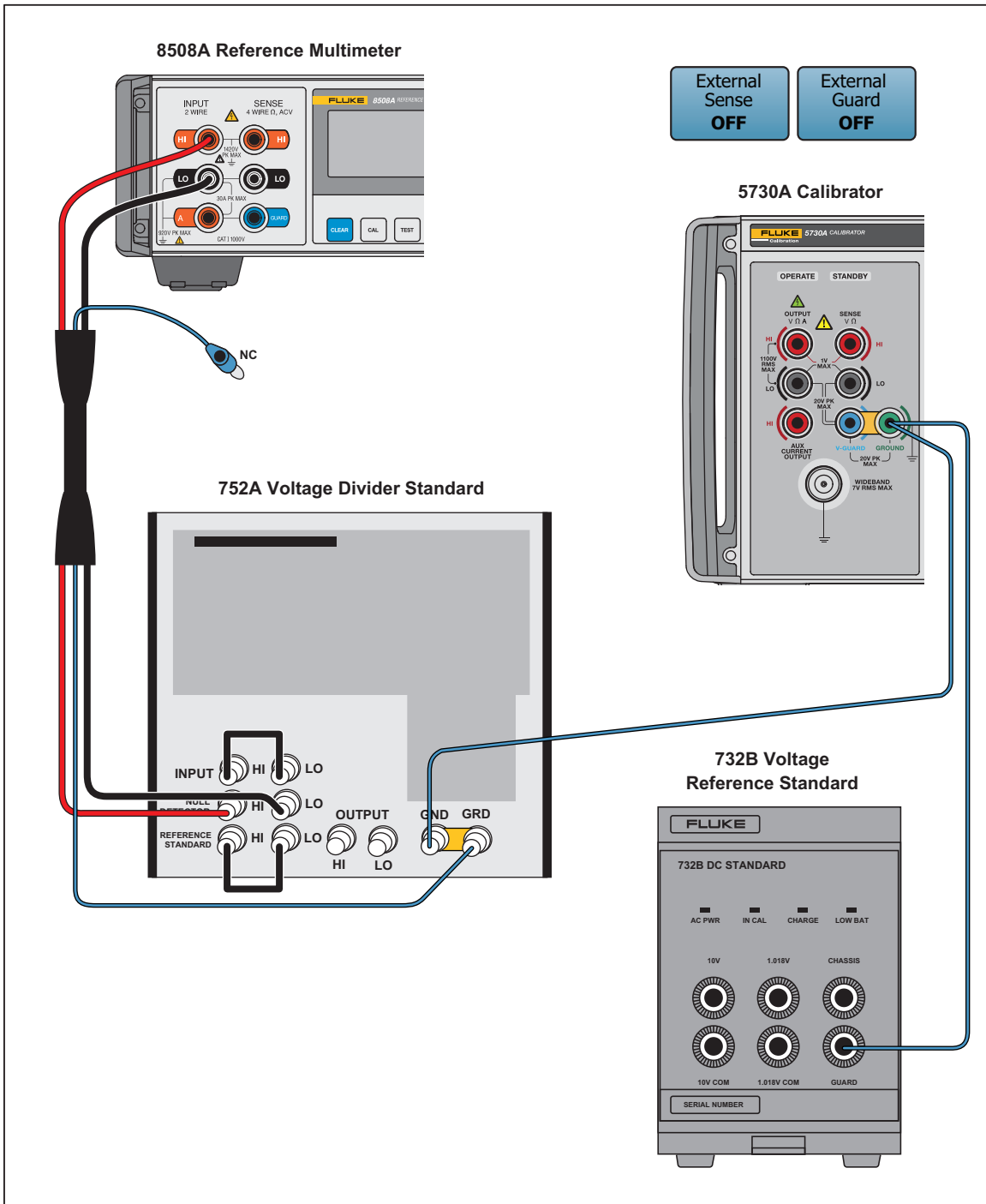


Figure 10. Zero Null Detector Connections

hhp301.eps

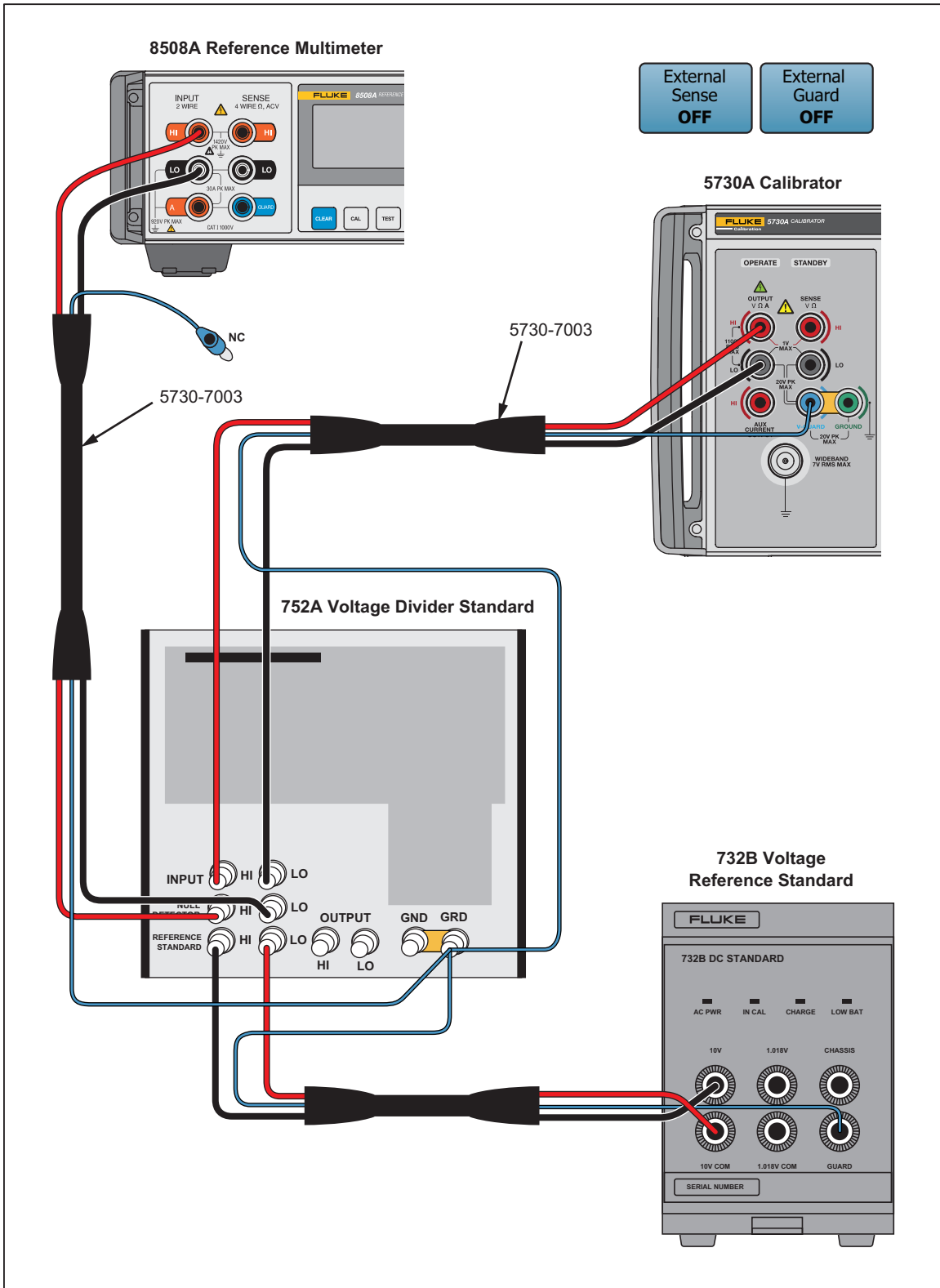


Figure 11. DC Voltage Calibration Connection

hhp302.eps

DC Voltage Test at 19 Volts

1. For this test, connect the 10 V standard to the 8508A as shown in Figure 12.
2. Record the value of the 10 V standard in Table 10. Record it as a negative voltage for the -19 V test.
3. Set the 8508A to dc V, 20 V range, 7 digits, filter "IN" and "FAST" mode. Be sure the 8508A is on internal guard (external guard not selected).
4. Wait for the reading to settle and record it in Table 10.
5. Connect the Product to the 8508A as shown in Figure 12.
6. Set the Product to output +19 V dc and push **OPERATE**.
7. Wait for the reading to settle and record it in Table 10. Push **STANDBY**.
8. Connect the 8508A to the 10 V standard but reverse the connection to the HI and LO so the 8508A reads -10 V.
9. Wait for the reading to settle and record it in Table 10.
10. Connect the Product to the 8508A as shown in Figure 12.
11. Set the Product to output -19 V and push **OPERATE**.
12. Wait for the reading to settle and record it in Table 10. Push **STANDBY**.
13. Calculate the measured voltage of the Product for each polarity and verify that it is within limits.

Table 10. 19 V DC Verification

Product Range	Product Output	10 V Standard Value (Vstd)	DMM Reading On 10 V Std (Vdmm at 10 V)	DMM Reading on Product (Vdmm at 19 V)	Calculated Product Output	Limits
22 V	+19 V					±62 µV
22 V	-19 V					±62 µV
Product=5730A DMM=8508A $\text{Calculated Product Output} = V_{\text{std}} \frac{V_{\text{dmm at 19 V}}}{V_{\text{dmm at 10 V}}}$						

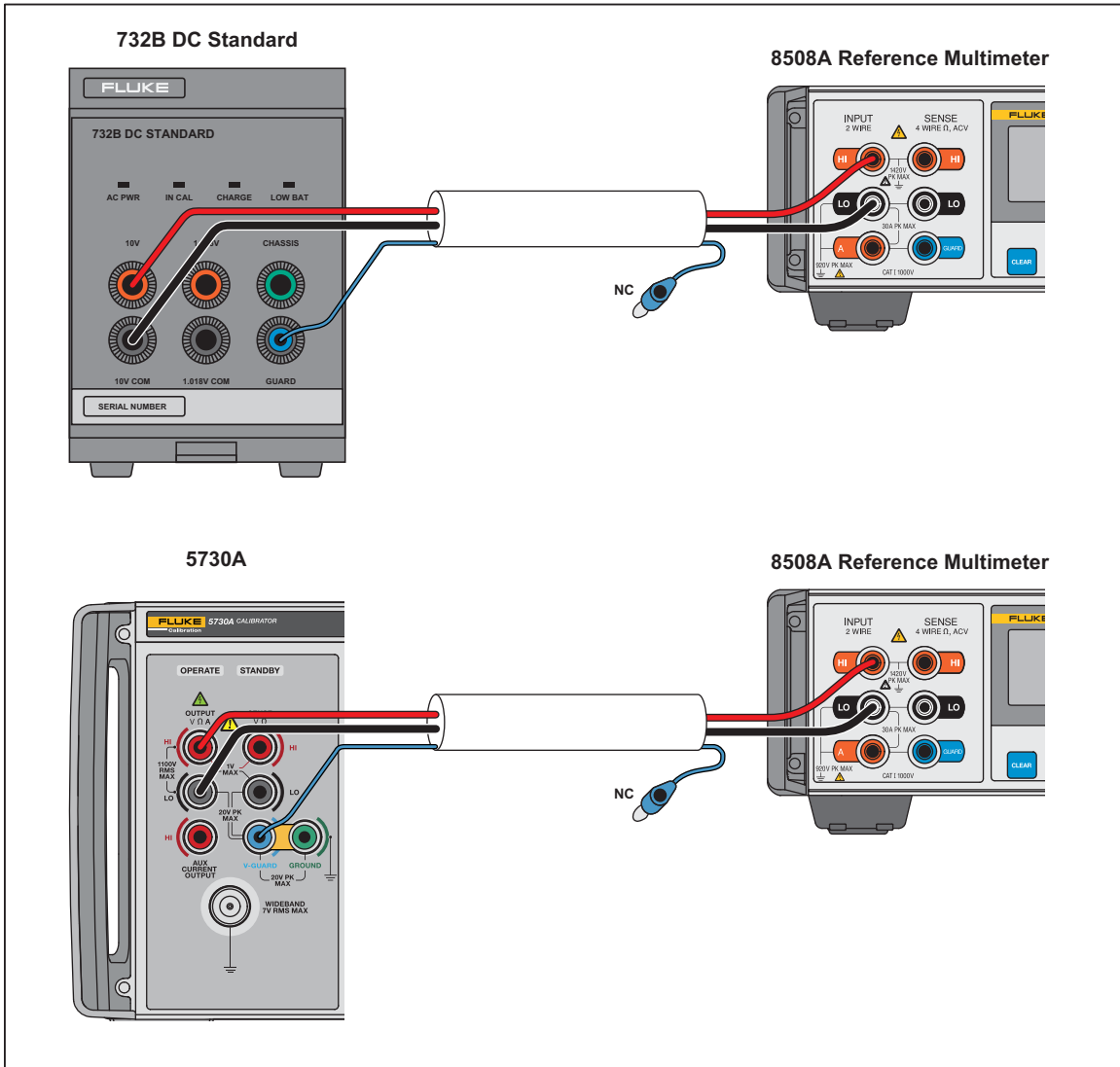


Figure 12. 19 V DC Verification Connections

hhp304.eps

Direct Current Verification Test

These tests check the Direct Current function by passing the current through a shunt and measuring the voltage drop with a DMM. Use Table 12 for the test record. Table 11 lists the required equipment.

Table 11. Required Equipment for Direct Current Test

Equipment	Model
DC DMM, 7 digits	Fluke 8508A
High-Current Shunt	Guildline 9230A-30 0.1 Ω Guildline 9230A100 0.01 Ω (5725A only)
Resistance Standards	Fluke 742A-1
	Fluke 742A-10
	Fluke 742A-100
	Fluke 742A-1k
	Fluke 742A-10k
Low Thermal EMF Cables	Fluke 5730A-7003

1. Connect the DMM and the Product to the shunt given in Table 12, as shown in Figure 13. When testing a 5725A, connect to the 5725A current output terminals instead of the Product output.
2. Enter the resistance of the shunt into the Table 12 Shunt Value column.
3. Set the DMM to DC Voltage and the range shown in Table 12. Set the DMM to 7 digits, filter ON, "Slow" and internal guard.
4. With the Product in standby wait for the reading to settle and push the **Zero Rng** button to zero the DMM.
5. Set the Product to the current level on the range given in Table 12. The Current Output is set to "NORMAL".
6. If the current in Table 12 is zero on a range above the 220 μ A range first set the Product to a current near full scale on the given range and then lock the range before setting the Product to zero current.
7. Push **OPERATE**.
8. Wait for the reading on the DMM to settle and record the reading in the Table 12 DMM Voltage Reading column.
9. Set the Product to standby.
10. Calculate the current with the equation shown in Table 12 and compare the results to the Limits given. Repeat steps 1 through 9 for all the tests in Table 12.

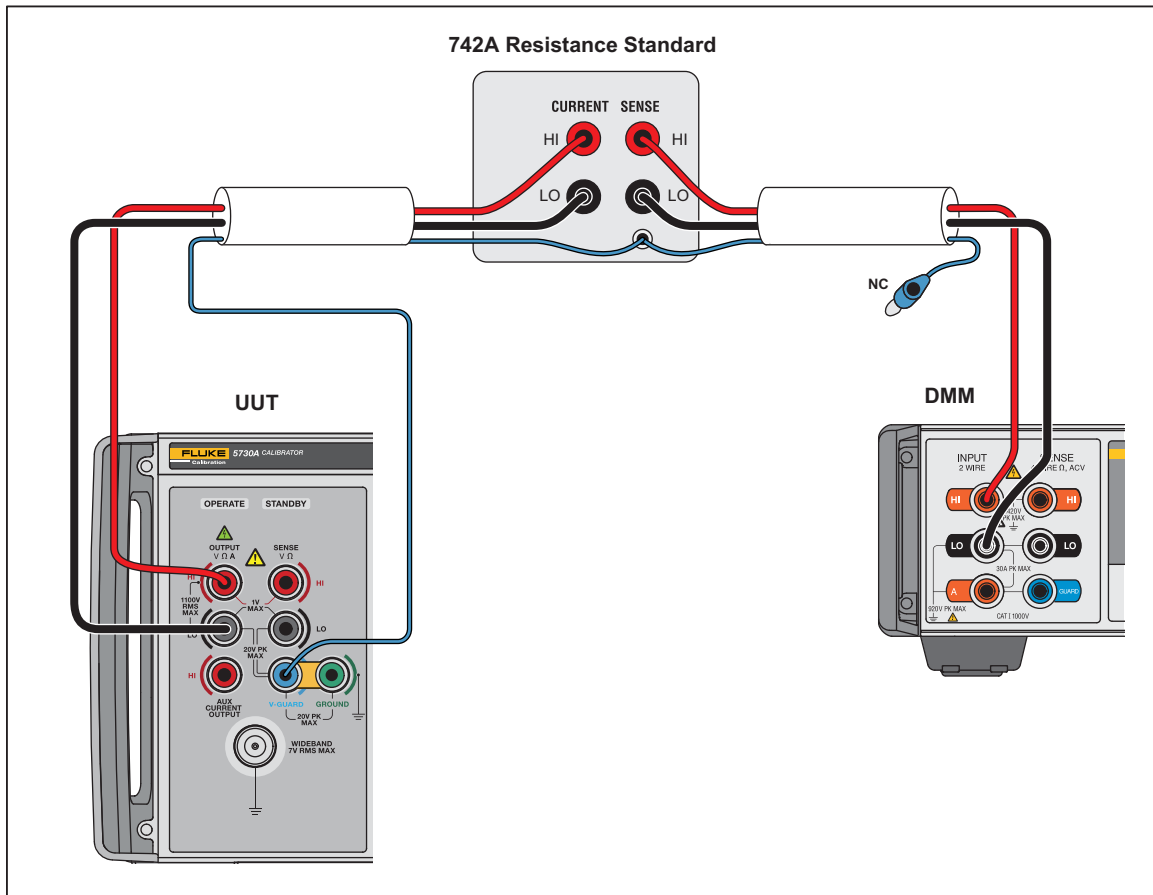


Figure 13. Direct Current Accuracy Test Connections

hhp307.eps

Table 12. DC Current Accuracy Verification

Product Output	Product Range	DMM Range	Shunt	Shunt Value (Ohms)	DMM Voltage Reading (Volts)	Calculated Current (Amps)	Limits
0 μ A	220 μ A	200 mV	10 k Ω				± 7 nA
10 μ A	220 μ A	200 mV	10 k Ω				± 7.4 nA
-10 μ A	220 μ A	200 mV	10 k Ω				± 7.4 nA
200 μ A	220 μ A	2 V	1 k Ω				± 15.4 nA
-200 μ A	220 μ A	2 V	1 k Ω				± 15.4 nA
0 mA	2.2 mA	200 mV	1 k Ω				± 8 nA
2 mA	2.2 mA	2 V	100 Ω				± 78 nA
-2 mA	2.2 mA	2 V	100 Ω				± 78 nA
0 mA	22 mA	200 mV	100 Ω				± 50 nA
20 mA	22 mA	2 V	10 Ω				± 75 μ A
-20 mA	22 mA	2 V	10 Ω				± 75 μ A
0 mA	220 mA	200 mV	10 Ω				± 0.8 μ A
100 mA	220 mA	200 mV	1 Ω				± 5.3 μ A
200 mA	220 mA	2 V	1 Ω				± 11.4 μ A
-200 mA	220 mA	2 V	1 Ω				± 11.4 μ A
0 A	2.2 A	200 mV	1 Ω				± 15 μ A
1 A	2.2 A	200 mV	0.1 Ω				± 85 μ A
2 A	2.2 A	2 V	0.1 Ω				± 235 μ A
-2 A	2.2 A	2 V	0.1 Ω				± 235 μ A
5725A Current Verification							
0 A	11 A	200 mV	10 Ω				± 480 μ A
3 A	11 A	2 V	0.1 Ω				± 1.5 mA
-3 A	11 A	2 V	0.1 Ω				± 1.5 mA
10 A	11 A	200 mV	0.01 Ω				± 3.9 mA
-10 A	11 A	200 mV	0.01 Ω				± 3.9 mA
200 μ A	11 A	2 V	1000 Ω				± 20 nA
-200 μ A	11 A	2 V	1000 Ω				± 20 nA
$\text{Current} = \frac{\text{DMM Voltage Reading}}{\text{Shunt Value}}$							

AC Voltage Frequency Accuracy Test

This test requires the use of a frequency counter. Tektronix model FCA3000 or equivalent is recommended. Use Table 13 for the test record. With some counters it may be necessary to use a 1 MHz low pass filter as shown in Figure 14.

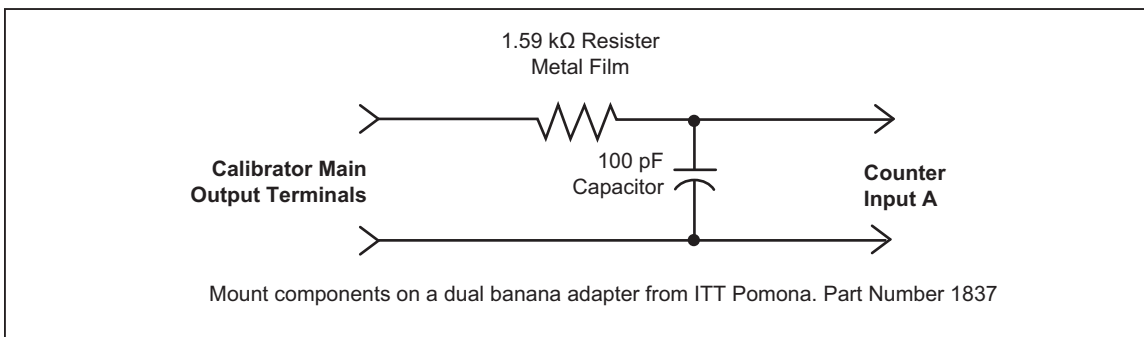


Figure 14. 1 MHz Low Pass Filter

hhp054.eps

To check the Product frequency accuracy:

1. Connect the frequency counter to the output terminals of the Product.
2. Set the Product to 2 V at the output frequencies listed in Table 13.
3. Record the reading in Table 13 Measured Value. Verify that the counter reads within the limits shown on the test record.
4. Disconnect the counter from the Product.

Table 13. AC Voltage Frequency Accuracy Test Record

Product Function/Range	Nominal Value	Measured Value	Limits
10.000 00 Hz @ 2 V	10.000 000		±0.25 mHz
119.900 00 Hz @ 2 V	119.900 00		±2.99 mHz
120.000 00 Hz @ 2 V	120.000 00		±3 mHz
400.000 0 Hz @ 2 V	400.000 0		±10 mHz
1199.000 0 Hz @ 2 V	1199.000 0		±29.9 mHz
1200.000 0 Hz @ 2 V	1200.000 0		±30 mHz
11990.000 Hz @ 2 V	11990.000		±299.7 mHz
12000.000 Hz @ 2 V	12000.000		±300 mHz
119900.0 Hz @ 2 V	11900.00		±2.997 Hz
120000.0 Hz @ 2 V	120000.00		±3 Hz
1000000.0 Hz @ 2 V	1000000.00		±25 Hz
1199900.0 Hz @ 2 V	1900000.00		±47.5 Hz

AC Voltage Verification Test

The equipment required for this test is listed in Table 14.

Table 14. 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 inch Long	

- Place the 5790A on top of the Product and connect the equipment as shown in Figure 15. Other placements of the equipment are fine as long as they can be connected with the 12 inch cable.

Note

The point of measurement is at the end of the cable and adapter that connects to the 5790A. It is essential that the cable not be longer than 12 inches, it can be shorter.

- Ensure the guard to ground strap on the Product is connected during the procedure. Also ensure the Product is set to internal Guard (External Guard OFF). Refresh the EX GRD button on the 5790A by pressing it off and on 3 times, and then leave it on. The green LED is lit when in the ON position. Set the range on the 5790A to AUTO and connect the Product guard to the 5790A guard using a short heavy lead.
- Refer to Table 15 and output .600000 mV @1 KHZ and record the reading under Measured Value.
- Test the remaining amplitudes and frequencies in Table 15.
- Verify that the measured values are within the limits given in the Table 15.

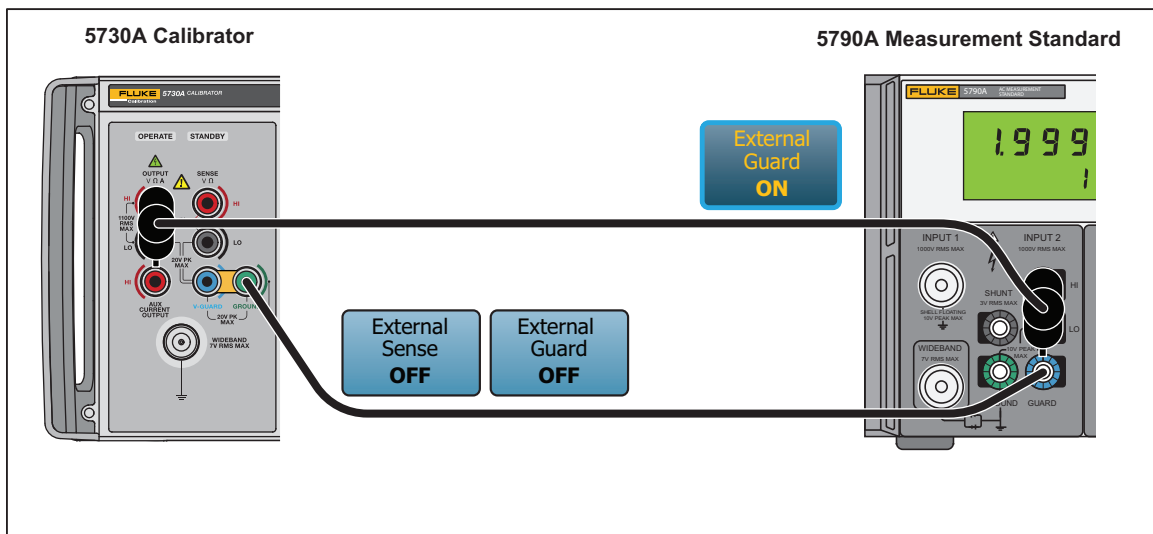


Figure 15. AC Voltage Test Setup

hhp310.eps

Table 15. 5790A Adjustment Counts

Product Range	Nominal Value	Measured Value	Limits
2.2 mV	.600 000 mV @ 1 kHz		±5.0 µV
2.2 mV	2.000 000 mV @ 10 Hz		±5.6 µV
2.2 mV	2.000 000 mV @ 20 Hz		±5.2 µV
2.2 mV	2.000 000 mV @ 40 Hz		±5.2 µV
2.2 mV	2.000 000 mV @ 1 kHz		±5.2 µV
2.2 mV	2.000 000 mV @ 20 kHz		±5.2 µV
2.2 mV	2.000 000 mV @ 50 kHz		±5.5 µV
2.2 mV	2.000 000 mV@100 kHz		±7.1 µV
2.2 mV	2.000 000 mV@300 kHz		±14.4 µV
2.2 mV	2.000 000 mV@500 kHz		±28 µV
2.2 mV	2.000 000 mV@1 MHz		±31.2 µV
22 mV	20.00 000 mV@10 Hz		±10.4 µV
22 mV	20.000 00 mV@20 Hz		±7.1 µV
22 mV	20.000 00 mV@40 Hz		+/- 6.8 µV
22 mV	20.000 00 mV@1 kHz		+/- 6.8 µV
22 mV	20.000 00 mV@20 kHz		±6.8 µV
22 mV	20.000 00 mV@50 kHz		±9.6 µV
22 mV	20.000 00 mV@100 kHz		±16.8 µV
22 mV	20.000 00 mV,300 kHz		±36.0 µV
22 mV	20.000 00 mV,500 kHz		±55.0 µV
22 mV	20.000 00 mV,1 MHz		± 87.0 µV
220 mV	200.000 0 mV,10 Hz		±69.0 µV
220 mV	200.000 0 mV, 20 Hz		±29.0 µV
220 mV	200.000 0 mV, 40 Hz		±21.2 µV
220 mV	200.000 0 mV, 1 kHz		±21.2 µV
220 mV	200.000 0 mV, 20 kHz		± 21.2 µV
220 mV	200.000 0 mV, 50 kHz		±36.0 µV
220 mV	200.000 0 mV, 100 kHz		±96.0 µV
220 mV	200.000 0 mV, 300 kHz		±165 µV
220 mV	200.000 0 mV, 500 kHz		±330 µV
220 mV	200.000 0 mV, 1 MHz		±640 µV

Table 15. 5790A Adjustment Counts (cont.)

Product Range	Nominal Value	Measured Value	Limits
2.2 V	.500 000 V, 40 Hz		±33 μV
2.2 V	.500 000 V, 1 kHz		±33 μV
2.2 V	.500 000 V, 20 kHz		±33 μV
2.2 V	.500 000 V, 100 kHz		±88.5 μV
2.2 V	.500 000 V, 300 kHz		±285 μV
2.2 V	.500 000 V, 1 MHz		±1.3 mV
2.2 V	1.000 000 V, 40 Hz		±56 μV
2.2 V	1.000 000 V, 1 kHz		±56 μV
2.2 V	1.000 000 V, 20 kHz		±56 μV
2.2 V	1.000 000 V, 100 kHz		±137 μV
2.2 V	1.000 000 V, 300 kHz		±470 μV
2.2 V	1.000 000 V, 1 MHz		±2.2 mV
2.2 V	2.000 000 V, 10 Hz		±590 μV
2.2 V	2.000 000 V, 20 Hz		±220 μV
2.2 V	2.000 000 V, 40 Hz		±102 μV
2.2 V	2.000 000 V, 1 kHz		±102 μV
2.2 V	2.000 000 V, 20 kHz		±102 μV
2.2 V	2.000 000 V, 50 kHz		±166 μV
2.2 V	2.000 000 V, 100 kHz		±234 μV
2.2 V	2.000 000 V, 300 kHz		±840 μV
2.2 V	2.000 000 V, 500 kHz		±2.5 mV
2.2 V	2.000 000 V, 1 MHz		±4.0 mV
22 V	20.000 00 V, 10 Hz		±5.9 mV
22 V	20.000 00 V, 20 Hz		±2.2 mV
22 V	20.000 00 V, 40 Hz		±990 μV
22 V	20.000 00 V, 1 kHz		±990 μV
22 V	20.000 00 V, 20 kHz		±990 μV
22 V	20.000 00 V, 50 kHz		±1.66 mV
22 V	20.000 00 V, 100 kHz		±2.19 mV
22 V	20.000 00 V, 300 kHz		±6.6 mV

Table 15. 5790A Adjustment Counts (cont.)

Product Range	Nominal Value	Measured Value	Limits
22 V	20.000 00 V, 500 kHz		±24.5 mV
22 V	20.000 00 V, 1 MHz		±36 mV
220 V	200.000 0 V, 10 Hz		±59 mV
220 V	200.000 0 V, 20 Hz		±22 mV
220 V	200.000 0 V, 40 Hz		±12.7 mV
220 V	200.000 0 V, 1 kHz		±12.7 mV
220 V	200.000 0 V, 20 kHz		±12.7 mV
220 V	200.000 0 V, 50 kHz		±20.2 mV
220 V	200.000 0 V, 100 kHz		±37 mV
220 V	50 V, 300 kHz		±70 mV
220 V	30 V, 500 kHz		±206 mV
220 V	22 V, 1 MHz		± 298 mV
1000 V	250 V, 15 Hz		±100 mV
1000 V	500 V, 50 Hz		±41.5 mV
1000 V	500 V, 1 kHz		±41.5 mV
1000 V	1000 V, 50 Hz		±79 mV
1000 V	1000 V, 1 kHz		±79 mV
5725A AC Voltage Verification			
1100 V	300 V, 40 Hz		±28 mV
1100 V	300 V, 1 kHz		±28 mV
1100 V	300 V, 20 kHz		±43.5 mV
1100 V	300 V, 50 kHz		±119 mV
1100 V	300 V, 100 kHz		±435 mV
1100 V	600 V, 40 Hz		±52 mV
1100 V	600 V, 1 kHz		±52 mV
1100 V	600 V, 20 kHz		±81 mV
1100 V	600 V, 50 kHz		±227 mV
1100 V	600 V, 100 kHz		±825 mV
1100 V	1000 V, 40 Hz		±84 mV
1100 V	1000 V, 1 kHz		±84 mV
1100 V	1000 V, 20 kHz		±131 mV
1100 V	1000 V, 30 kHz		±371 mV

Alternating Current Verification Test

This test checks the alternating current function by passing the current through a shunt and measuring the voltage drop with an ac voltmeter. Use Table 17 and Table 18 for the test record. Table 16 shows the required equipment.

Table 16. Equipment Required for AC Current Test

Equipment	Model or Description
AC Measurement standard	Fluke 5790A
Current Shunts	Fluke A40B 10 mA Shunt Fluke A40B 20 mA Shunt Fluke A40B 200 mA Shunt Fluke A40B 2 A Shunt Fluke A40B 5 A Shunt (5725A only) Fluke A40B 10 A Shunt (5725A only)
Coaxial Cable, Type N (M) connectors, both ends	Fluke A40B-LEAD/N
1000 Ω Shunt	See 200 μ A Range for description
Coaxial Cable, Type N (M) one end, dual banana plugs other end	Fluke A40B-LEAD/4mm
BNC(F) to Dual-Banana Plug Adapter (2 required) Coax Cable - RG-58A/U or RG-58C/U with BNC(M) Connectors, 12 \pm 1 inch long	Pomona 1269

2 mA to 2 A Ranges

Connect the equipment as shown in Figure 16.

1. Enter the ac resistance of each shunt at each test frequency into the Table 17 A40B AC Resistance column. See the A40B manual for instructions about how to determine the ac resistance.
2. Set the 5790A to Input 1 and the range given in Table 17. Set the 5790A to External Guard.
3. Set the Product to output the current level and frequency as given in Table 17 and then push **OPERATE**.
4. Wait for the 5790A reading to settle and record it in Table 17 under 5790A Reading Volts.
5. Calculate the measured current and record in the Table 17 Calculated Current column. This is found by dividing the 5790A reading in volts by the shunt ac resistance in ohms. See the equation in Table 17. Verify that the results are within the given limits.
6. Repeat steps 2 through 5 for all the test points.
7. Push **STANDBY** when the measurements are complete.

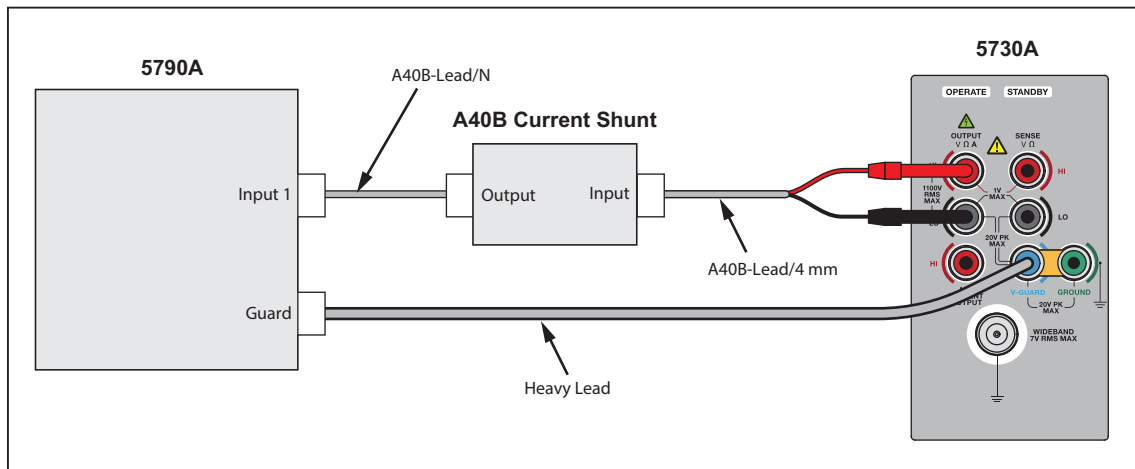


Figure 16. 2 mA to 2 A AC Current Verification Connections

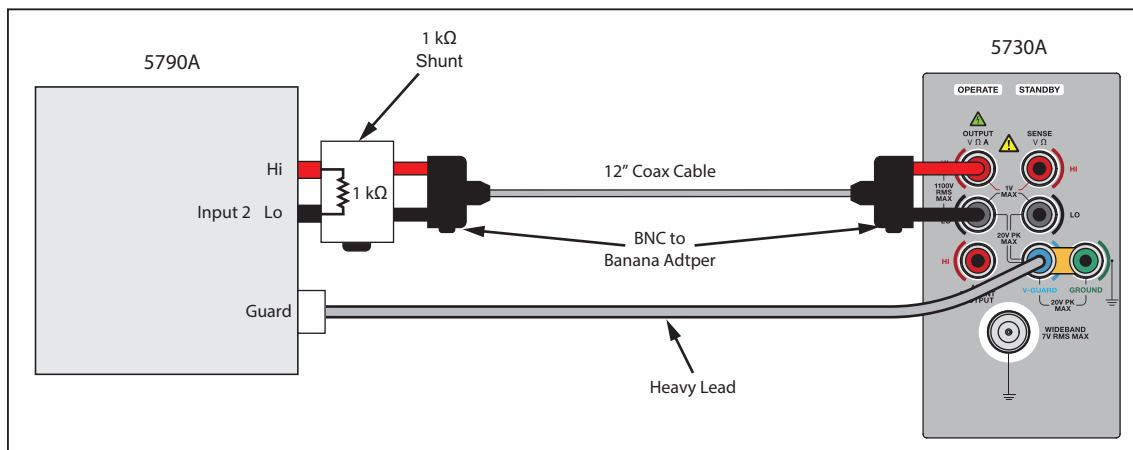
hhp308.eps

200 μ A Range

Note

This test requires a 1000 Ω shunt that has been calibrated with the 5790A. It will be used with the levels and frequencies given in Table 18. This shunt can be built from a non-inductive resistor such as a metal film resistor housed in a box with dual banana jacks on one end and banana plugs on the other end (Pomona 2259, 2098 or 2224). The resistor should be of sufficient precision that its variations in resistance with time, temperature, and humidity, plus the uncertainty of the calibration of the shunt with the 5790A, will lead to a satisfactory TUR for the time between calibrations. The box that contains the shunt should mount directly to the 5790A input 2.

1. Connect the equipment as shown in Figure 17.
2. Enter the Shunt ACI Corrections from the calibration certificate for the 5790A/Shunt combination into the Table 18 5790A Shunt ACI Correction (ppm) column.
3. Set the 5790A to Input 2, External Guard, and the range given in Table 18.
4. Set the Product to output the current level and frequency at the appropriate output terminals as given in Table 18 for the test point being done and then push **OPERATE**.
5. Wait for the 5790A reading to settle and record it in the Table 18 5790A Reading (Volts) column.
6. Calculate the measured current and record in Table 18 under Measured Current (Amps). See equation 2 in Table 18.
7. Verify that the results are within the given limits.
8. Repeat steps 3 through 7 for all tests.
9. Set the Product to STBY when the measurements are complete.



hhp309.eps

Figure 17. 200 μ A Range Alternating Current Test Setup

Table 17. AC Current 2 mA to 2 A Verification

Product Applied	Frequency	A40B Shunt	A40B AC Resistance (Ohms)	5790A Range	5790A Reading (Volts)	Calculated Current (Amps)	Limits
2 mA	10 Hz	10 mA		220 mV			610 nA
2 mA	20 Hz	10 mA		220 mV			400 nA
2 mA	40 Hz	10 mA		220 mV			274 nA
2 mA	1 kHz	10 mA		220 mV			274 nA
2 mA	5 kHz	10 mA		220 mV			570 nA
2 mA	10 kHz	10 mA		220 mV			3 µA
20 mA	10 Hz	20 mA		2.2 V			6.1 µA
20 mA	20 Hz	20 mA		2.2 V			4 µA
20 mA	40 Hz	20 mA		2.2 V			2.74 µA
20 mA	1 kHz	20 mA		2.2 V			2.74 µA
20 mA	5 kHz	20 mA		2.2 V			5.1 µA
20 mA	10 kHz	20 mA		2.2 V			28 µA
200 mA	10 Hz	200 mA		2.2 V			61 µA
200 mA	20 Hz	200 mA		2.2 V			40 µA
200 mA	40 Hz	200 mA		2.2 V			26.4 µA
200 mA	1 kHz	200 mA		2.2 V			26.4 µA
200 mA	5 kHz	200 mA		2.2 V			48 µA
200 mA	10 kHz	200 mA		2.2 V			232 µA
2 A	20 Hz	2 A		2.2 V			600 µA
2 A	1 kHz	2 A		2.2 V			600 µA
2 A	5 kHz	2 A		2.2 V			1.02 mA
2 A	10 kHz	2 A		2.2 V			14.2 mA

Table 17. AC Current 2 mA to 2 A Verification (cont.)

5725A							
3 A	40 Hz	3 A		700 mV			1.37 mA
3 A	1 kHz	3 A		700 mV			1.37 mA
3 A	5 kHz	3 A		700 mV			2.93 mA
3 A	10 kHz	3 A		700 mV			10.65 mA
10 A	40 Hz	10 A		2.2 V			4.17 mA
10 A	1 kHz	10 A		2.2 V			4.17 mA
10 A	5 kHz	10 A		2.2 V			8.88 mA
10 A	10 kHz	10 A		2.2 V			33.75 mA
Equation 1: Calculated Current = $\frac{5790A \text{ READING (V)}}{A40B \text{ AC RESISTANCE}}$							

Table 18. AC Current 200 µA Accuracy Test Record

Product Applied	Frequency	Output or AUX Current	5790A Range	5790A Shunt ACI Correction (ppm)	5790A Reading (Volts)	Measured Current (Amps)	Limits
20 µA	1 kHz	Output	22 mV				12.34 nA
20 µA	10 kHz	Output	22 mV				102 nA
200 µA	10 Hz	Output	220 mV				76 nA
200 µA	20 Hz	Output	220 mV				48 nA
200 µA	40 Hz	Output	220 mV				33.4 nA
200 µA	1 kHz	Output	220 mV				33.4 nA
200 µA	5 kHz	Output	220 mV				79 nA
200 µA	10 kHz	Output	220 mV				300 nA
20 µA	1 kHz	Aux Output	22 mV				2.0 µA
200 µA	5 kHz	Aux Output	220 mV				2.1 µA
200 µA	10 kHz	Aux Output	220 mV				2.4 µA
<p>Equation 2:</p> $\text{Measured Current} = \frac{5790A \text{ READING (V)}}{1000 \text{ Ohms}} \times (1 + (\text{ACI Correction}/1,000,000))$							

Wideband Frequency Accuracy Test

Use Table 21 for the test record. Proceed as follows to test the Wideband module frequency accuracy:

1. Connect the Frequency Counter, Tektronix Model FCA3000 or equivalent, to the Calibrator wideband output and measure the output frequency at the frequencies listed in Table 21.
2. Verify that the frequency counter indicates frequencies within the 0.01 % limits shown.

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.
- Output flatness: The output 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 19 lists the equipment required for testing and calibrating the Wideband module.

Table 19. 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
50 Ω Termination	Supplied with 5700A-03
Adapter	Pomona 1269 BNC(F) to dual banana plug.
Adapter	Kings KN-99-46 N(F) to BNC(M)

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 22 for a test record.

1. Connect the equipment as shown in Figure 18.

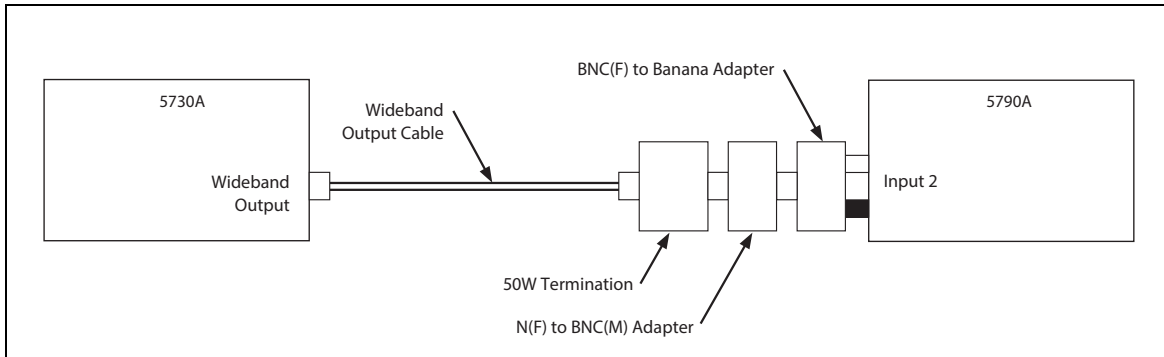


Figure 18. Wideband Accuracy at 1 kHz Test Setup

F3-12.EPS

2. Set the Product wideband output to 2.1 V at 1 kHz and the 5790A to read INPUT 2.
3. Push the 2.2 V RANGE button on the 5790A to lock it on the 2.2 V 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 Product output adjustment knob to obtain a reading on the 5790A measurement display of 2.100000 ± 20 counts.
6. Read the error on the Product display in ppm. If the error is shown in percent, convert it to ppm by multiplying it by 10,000 and record it in Table 22 for the 2.1 V level for the appropriate verification interval. Verify that it is within specification 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 22 and repeat steps 5 through 7 with the appropriate output levels set in each step, using the adjustment tolerance in Table 20 in step 5.

Table 20. Wideband Adjustment Tolerance

5730A Series II Wideband Output	5790A Adjustment Counts \pm ppm
2.10000 V	20
1.00000 V	10
300.000 mV	3
100.000 mV	10
30.0000 mV	3
10.0000 mV	1
3.00000 mV	1
1000.00 μ V	1

Wideband Output Flatness Test

Use Table 23 as a test record. To perform wideband output flatness test, proceed as follows:

1. Connect the equipment as shown in Figure 19. Note that the Calibrator wideband cable is connected to the 5790A directly, the termination is not used.

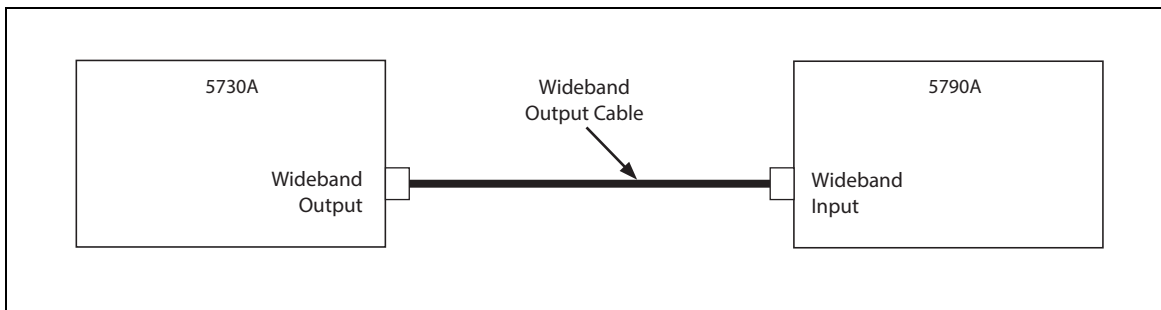


Figure 19. Wideband Flatness Test Setup

F3-13.EPS

2. Set the wideband output to 3 V 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 23 for the 3 V output and record the errors on the 5790A error display at each frequency in Table 23.
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 23 using the appropriate voltage in step 4.

7. Record the 1 kHz absolute errors at each output level from Table 22 into the appropriate column in Table 24. Record the flatness errors from Table 23 for each output level and frequency into the appropriate column in Table 24. Add the errors and verify that they are within spec for the appropriate time interval.

Table 21. 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 22. Wideband Accuracy at 1 kHz Test Record

Output Level	Measured Error ppm	Spec ± ppm (90-day)	5790A 1-Year Spec ± ppm	TUR	GB Factor	Test Limit
2.1 V		2238	24	93	1.000	2238
1.0 V		2900	24	121	1.000	2900
0.3 V		2833	38	74.5	1.000	2833
0.1 V		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 23. Wideband Flatness Test Record

Output Level	Frequency	Measured Flatness Error ± ppm	Spec ± ppm (90-day)	5790A 1-Year Spec ± ppm	TUR	GB Factor	Test Limit ± ppm
3 V	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
	30 MHz		10000	3500	2.86	0.975	9750
1 V	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
	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
	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
	30 MHz		10030	3500	2.87	0.976	9789

Table 23. 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 24. 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 (\pm 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

General Maintenance

The subsequent sections describe how to maintain the Product.

Clean the Exterior

Clean the case, front panel keys, and display with a soft cloth slightly dampened with either water or a non-abrasive mild cleaning solution that is not harmful to plastics.

⚠ Caution

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

Fuse Replacement

⚠⚠ Warning

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

- **Turn the Product off and remove the mains power cord. Stop for two minutes to let the power assemblies discharge before you open the fuse door.**
- **Use only specified replacement fuses.**

Access the fuse from the rear panel. The fuse rating label located under the fuse holder shows the correct replacement fuse ratings for each operating voltage. To access the fuse, refer to Figure 2020:

1. Disconnect line power.
2. With a standard screwdriver, release the fuse holder door.
3. Pull out the fuse holder.
4. Replace the fuse. Replacement fuses are listed in Table 25.
5. Reinsert the fuse holder.
6. Close the fuse holder door.

Table 25. Replacement Fuses

Line Voltage Setting	Fuse Description	Fluke Part Number
⚠ 100 V to 120 V	T 3 A 250 V	109280
⚠ 220 V to 240 V	T 1.5 A 250 V	109231

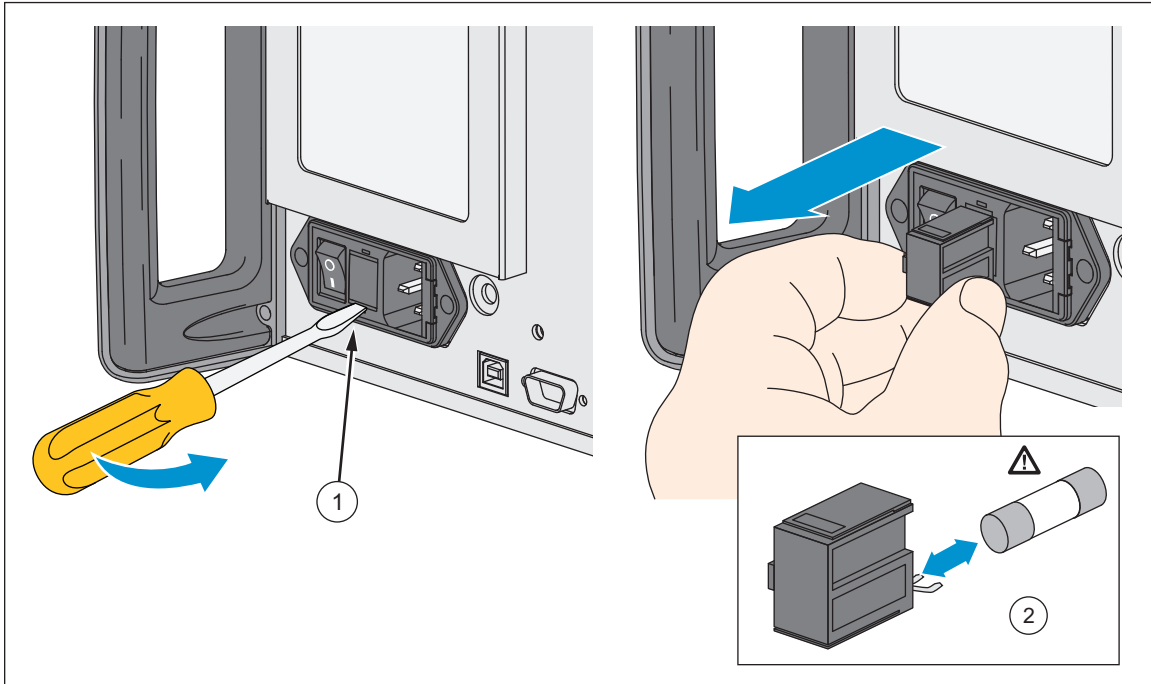


Figure 20. Access the Fuse

hhp003.eps

Clean the Air Filter

⚠ Caution

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

To prevent Product damage, make sure that the filter is completely dry before reinstallation.

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

To clean the air filter, refer to Figure 21:

1. Disconnect line power.
2. Unscrew the knurled screw at the top of the air filter and pull the filter retainer downwards (it is hinged at the bottom) to remove the filter.
3. To clean the filter, wash it in soapy water. Rinse and dry it thoroughly.
4. Reinstall the filter and the knurled screw.

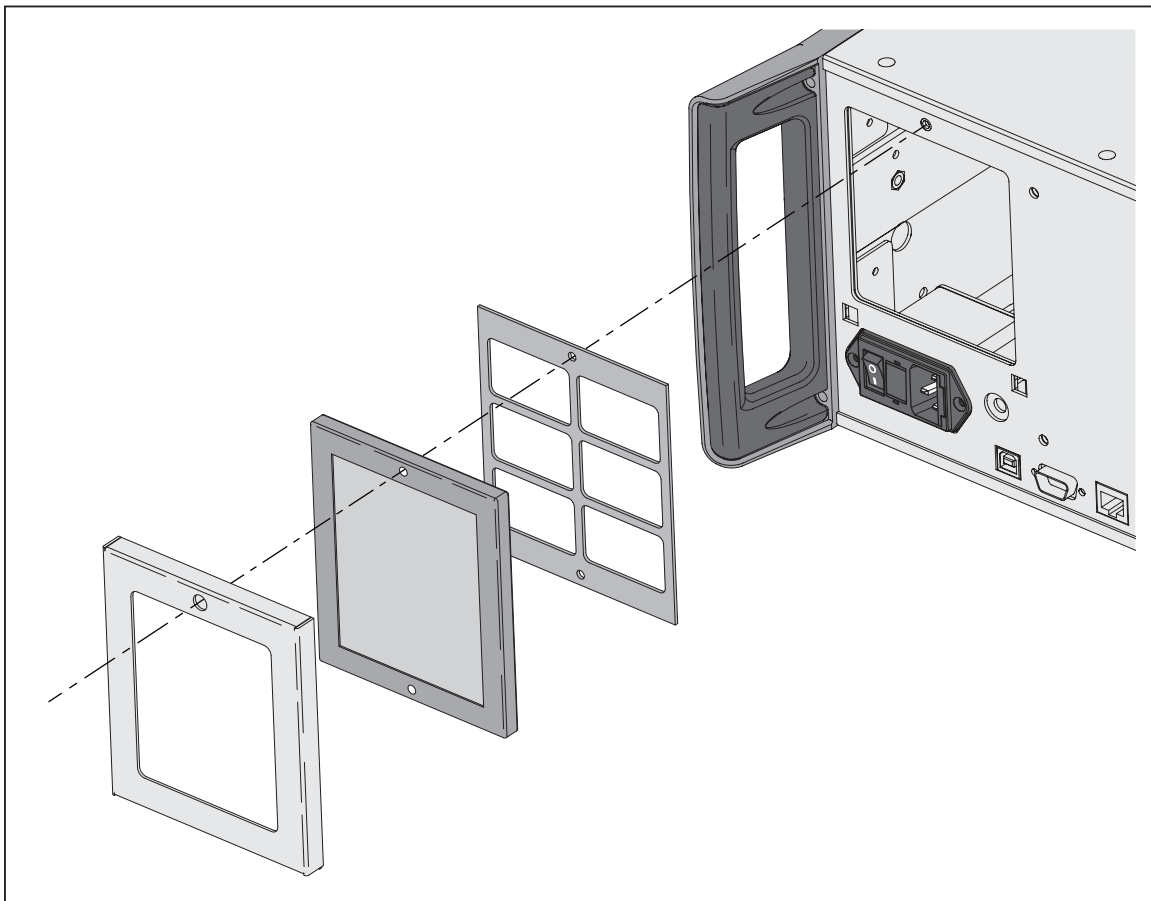


Figure 21. Air Filter Access

hhp026.eps

User-Replaceable Parts

Table 26 lists the part numbers of each user-replaceable part or accessory for the Product, see Figure 22.

Table 26. User-Replaceable Parts

Reference Designator	Description	Fluke Stock Number
①	TOP COVER	4104376
②	BOTTOM COVER	4104383
③	HANDLE	3468705
④	DECAL, INPUT	4104451
⑤	KNOB, ENCODER	4219600
⑥	DECAL, MODEL 5730A	4219569
⑦	DECAL, USB	4219557
⑧	BOTTOM FOOT	868786
⑨	FUSE, .25X1.25,3A,250V,SLOW (120V Model)	109280
	FUSE, .25X1.25,1.5A,250V,SLOW (230V Model)	109231
⑩	FILTER FRAME	886390
⑪	FILTER, AIR	813493
⑫	FILTER GUARD	674231
⑬	SIDE EXTRUSION	4222803
⑭	INSERT EXTRUSION	4233853
⑮	SCREW,8-32,.375,LO CAP (HANDLES)	295105
⑯	SCREW,6-32 X 0.25,FLAT HD (TOP/BOTTOM COVERS)	320093
Not shown	5730A Getting Started	4290571
Not shown	5730A Document CD (Contains Users Manual)	4290580

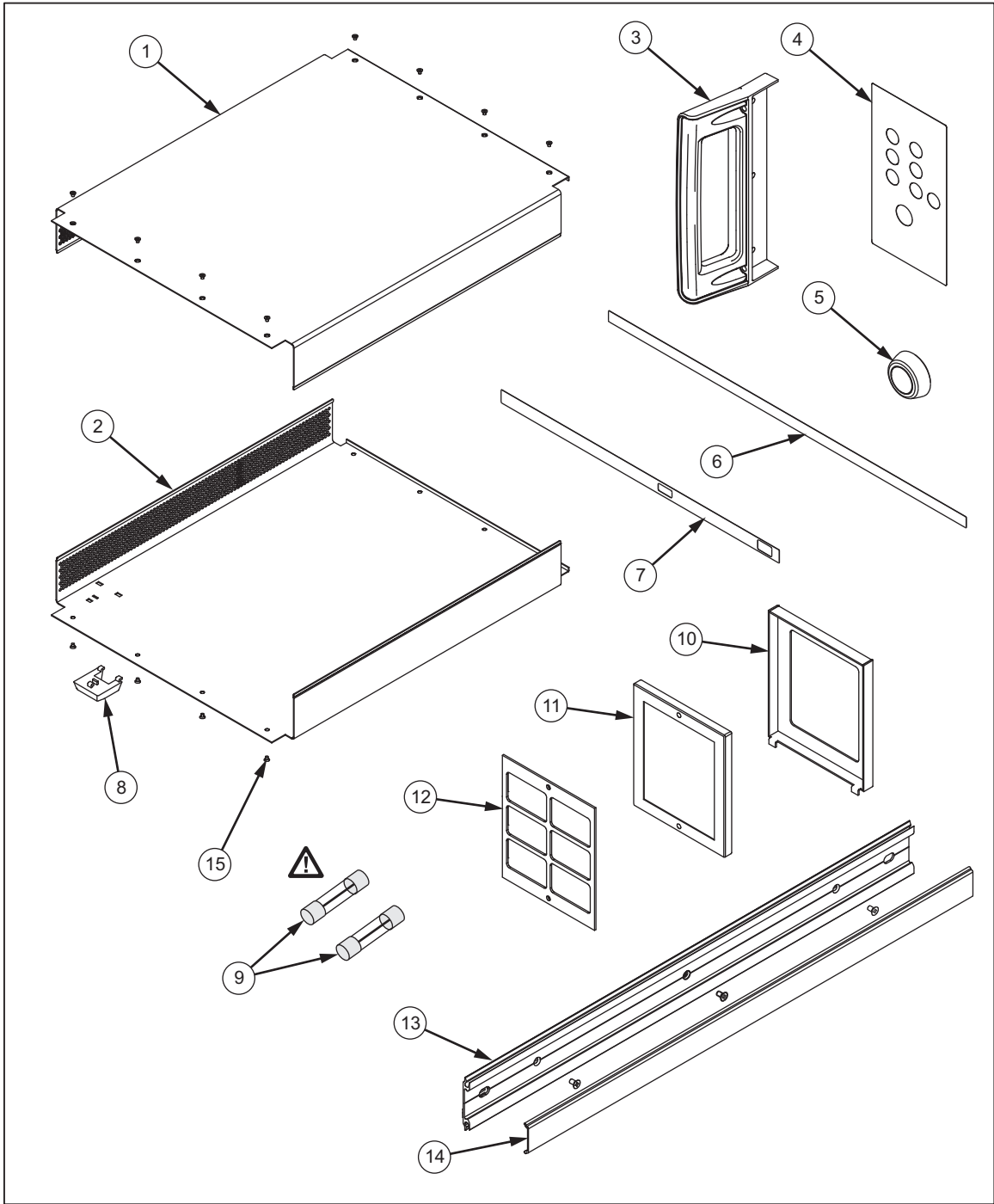


Figure 22. User-Replaceable Parts

hhp311.eps

