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Fluke Calibration Certificates

Application Note

A guide to understanding different types of calibration certificates and certificate terminology

Fluke Corporation is a supplier of a variety of electronic testing and measurement instruments. Fluke is also a provider of precision measurement instrumentation used as calibrators and standards in various areas of metrology. Additionally, Fluke provides repair and calibration services for many different test instruments. In each of these roles, providing calibration certificates plays a part which is very important, but sometimes different.

Also, Fluke is a company with a presence throughout the world. Original manufacturing is done from a series of worldwide factories. Additionally, the calibration and repair services are done at different authorized service centers throughout the counties from which Fluke serves its customers. Out of this manufacturing and service network there can be seen variations in the calibration certificates that Fluke provides.

While these variations are very reasonable and acceptable, the differences do raise questions from users of the test instruments. Fluke frequently is asked questions about what different types of calibration and testing reports are available with our products and services, what the different reports are, what reports and certificates accompany new instruments and what are available optionally. The most important issue is to determine what type of report will best meet the needs of the customer.

This guide answers frequently asked questions and provides general information about the calibration and test reports available from Fluke. It should be noted that reports of calibration evolve over time and Fluke has the right to change some aspects of these reports, as needed, and at any time.

What report types are available with Fluke's instrumentation and what are the purposes of these documents?

Reports on instrument performance supplied with Fluke's instruments can range from simple documents that certify that a general testing philosophy was applied to a particular instrument, to very detailed calibration reports that outline specific testing details intended to satisfy formal guidelines or requirements. Performance reports available from Fluke include:

1) **Statement of calibration practices**

A statement of calibration practices is not a formal calibration certificate. This document commonly accompanies most newly purchased test instruments that are of a general purpose nature. It attests that the quality control, testing, and calibration of this particular instrument were done according to Fluke's quality standards, and the instrument will meet its published specifications. The tests were conducted using instrumentation and systems with calibrations traceable to national and international standards. However, because such testing and calibration is done in a high volume production environment, no specific calibration certificate is available and no details of the testing can be provided. If a calibration certificate is required, a separate calibration must be done following production–usually at an extra charge. An example of this documentary statement is included in Figure 1.

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ISO 9001

Fluke Corporation Statement of Calibration Practices

Fluke Corporation hereby certifies that this product was calibrated in accordance with applicable Fluke calibration procedures during the manufacturing process. These procedures are ISO-9001 controlled and are designed to assure that the instrument will meet its published specification.

Fluke Corporation further certifies that the measurement standards and instruments used during the calibration of this product are traceable to the United States National Institute of Standards and Technology (NIST). At planned intervals, Fluke's measurement standards are calibrated by comparison to or measurement against the standards at NIST. This document is not a certificate of calibration or traceability.

To obtain a certificate of calibration, contact your nearest Fluke Service Center to process an order to have your unit sent in for calibration. A nominal fee is charged for calibration service.

Quality Assurance Manager
Fluke Corporation

P/N 1554590 Rev. 2 12/2003

Figure 1. Statement of calibration practices.

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2) **Certificate of traceable calibration (without data)**

This document certifies that a specific instrument, identified by model and serial number, was tested using Fluke's applicable procedures, in accordance with Fluke's quality standards, and the instrument met published specifications. "Without data" means that the report contains general information, such as instrument details and specific testing dates, but does not include test point measurement details. With this type of calibration, the procedure does perform the required test operations and evaluates the instrument for proper performance, but none of the test data is retained for future reference. This type of certificate is usually available only upon request from a service center. New instruments typically do not come with this certificate type. An example of this document is included in Figure 2.

3) **Certificate of traceable calibration with data**

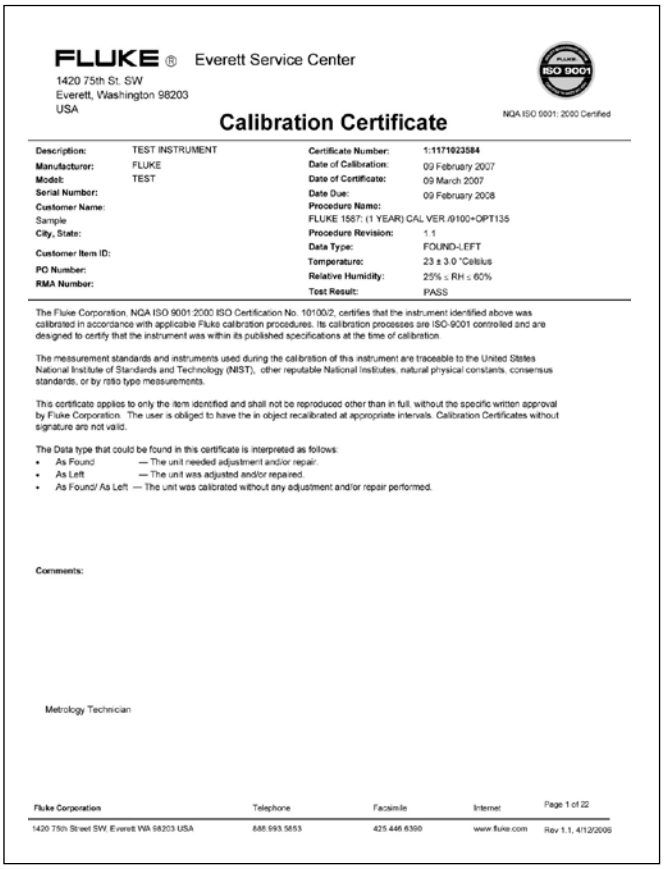
This document certifies that a specific instrument, identified by model and serial number, was tested using Fluke's applicable procedures, in accordance with Fluke's quality standards. The calibration was done with calibrating standards traceable to national and international standards. Specific testing dates and specific testing instrumentation details are provided. Details of the individual tests are also provided, with a variety of supporting information. These details are intended for future reference when evaluating instrument performance or assisting with corrective actions. Details may include some or all of these parameters: specific test points, appropriate specification limits, measured values, test ratio information, measurement uncertainty. Other parameters may be included as well, depending upon various quality and metrology requirements.

Within this category, there are different classes of certificates. They range from supplying details that generally satisfy commonly needed reporting requirements, to others that specifically satisfy various formal requirements for calibration certificates.

This type of certificate includes, but is not limited to these common certificates:

- **Traceable calibration certificates with data**
- **Z540 calibration certificates**
- **Accredited report of calibration**

Descriptions and general details of these are provided on the next page.



FLUKE® Everett Service Center
1420 75th St. SW
Everett, Washington 98203
USA

NQA ISO 9001: 2000 Certified

Calibration Certificate

Description:	TEST INSTRUMENT	**Certificate Number:**	**1:1171023584**
Manufacturer:	FLUKE	**Date of Calibration:**	09 February 2007
Model:	TEST	**Date of Certificate:**	09 March 2007
Serial Number:		**Date Due:**	09 February 2008
Customer Name:		**Procedure Name:**	
Sample		FLUKE 1587: (1 YEAR) CAL VER./9100+OPT135	
City, State:		**Procedure Revision:**	1.1
Customer Item ID:		**Data Type:**	FOUND-LEFT
PO Number:		**Temperature:**	23 ± 3.0 °Celsius
RMA Number:		**Relative Humidity:**	25% ≤ RH ≤ 60%
		Test Result:	PASS

The Fluke Corporation, NQA ISO 9001:2000 ISO Certification No. 10100/2, certifies that the instrument identified above was calibrated in accordance with applicable Fluke calibration procedures. Its calibration processes are ISO-9001 controlled and are designed to certify that the instrument was within its published specifications at the time of calibration.

The measurement standards and instruments used during the calibration of this instrument are traceable to the United States National Institute of Standards and Technology (NIST), other reputable National Institutes, natural physical constants, consensus standards, or by ratio type measurements.

This certificate applies to only the item identified and shall not be reproduced other than in full, without the specific written approval by Fluke Corporation. The user is obliged to have the in object recalibrated at appropriate intervals. Calibration Certificates without signature are not valid.

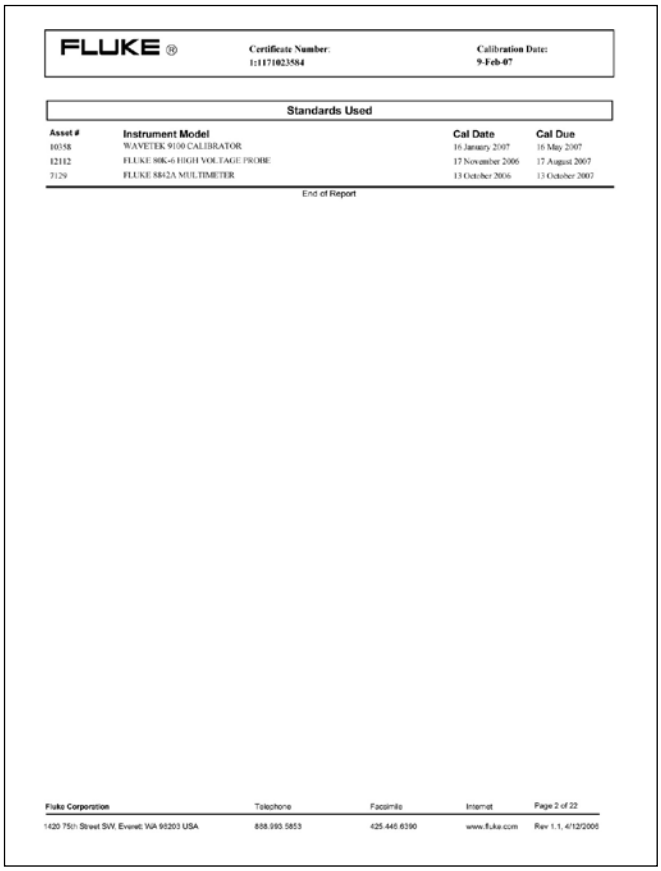
The Data type that could be found in this certificate is interpreted as follows:

- As Found — The unit needed adjustment and/or repair.
- As Left — The unit was adjusted and/or repaired.
- As Found/ As Left — The unit was calibrated without any adjustment and/or repair performed.

Comments:

Metrology Technician

Fluke Corporation	Telephone	Facsimile	Internet	Page 1 of 22
1420 75th Street SW, Everett WA 98203 USA	888.993.5853	425.446.6390	www.fluke.com	Rev 1.1, 4/12/2006



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Certificate Number:	**Calibration Date:**
1:1171023584	**9-Feb-07**

Standards Used

Asset #	Instrument Model	Cal Date	Cal Due
10358	WAVETEK 9100 CALIBRATOR	16 January 2007	16 May 2007
12112	FLUKE 80K-6 HIGH VOLTAGE PROBE	17 November 2006	17 August 2007
7129	FLUKE 8842A MULTIMETER	13 October 2006	13 October 2007

End of Report

Fluke Corporation	Telephone	Facsimile	Internet	Page 2 of 22
1420 75th Street SW, Everett WA 98203 USA	888.993.5853	425.446.6390	www.fluke.com	Rev 1.1, 4/12/2006

Figure 2. Certificate of traceable calibration.

Traceable calibration certificate with data

This calibration certificate documents that a specific instrument, identified by model and serial number, was tested using Fluke's applicable procedures. The processes ensure testing with traceability to national and international standards, but do not necessarily fulfill all requirements of various formal standards, such as Z540.1 or 17025. Hence it is considered "generic," simply a Traceable Calibration Certificate that includes test data. Details of the individual tests are provided with an appropriate set of supporting information. An example of this document is included in Figure 3.

CERTIFICATE OF CALIBRATION

ISSUED BY

FLUKE

Fluke Precision Measurement Ltd
Hurricane Way, Norwich
Norfolk NR6 6JB, United Kingdom
Tel: +44(0)1603 256600 Fax: +44(0)1603 483670

Certificate No: F14983
Issue Date: 22 Jan 2007
Page: Page 1 of 14
Signature:
Approved Signatory: R. A. Bull

Measurement Date:	14 January 2007
Date of Receipt:	14 January 2007
Model Type Number:	8508A
Description:	Reference Multimeter
Instrument Serial No:	932654019
Manufacturer:	Fluke
Job/Order No:	529336

This Certificate indicates the data recorded after adjustment of the instrument.

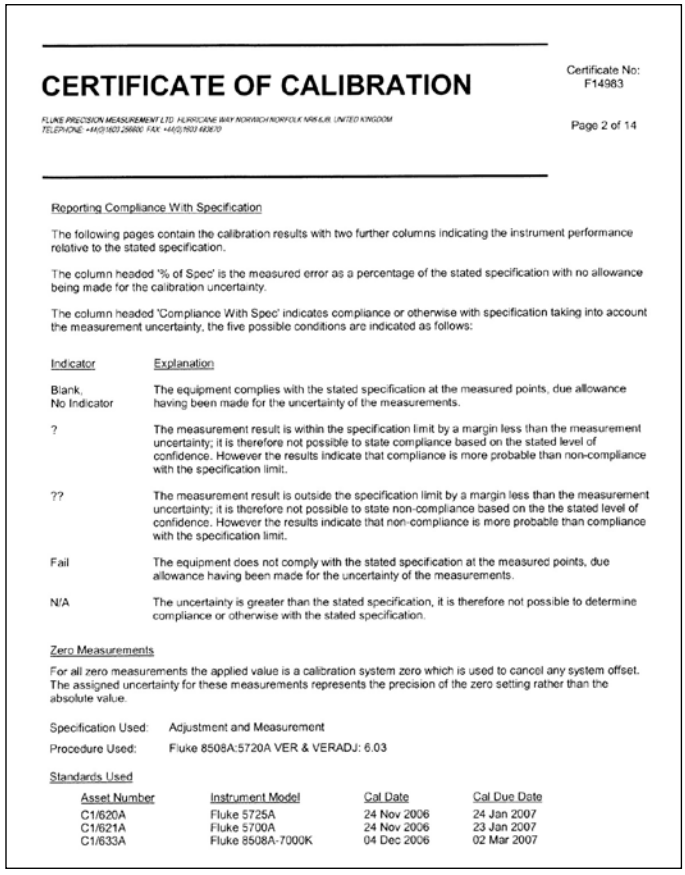
The instrument has been calibrated in accordance with the manufacturer's Instrument User's Handbook using standards that are directly traceable to National Standards maintained at the National Physical Laboratory, Teddington. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS M3003 and the ISO Guide to the Expression of Uncertainty in Measurement and is inclusive of the unit under test. The uncertainties relate only to the measured values and do not carry any implication regarding the long term stability of the instrument.

The measurements were made at a room temperature of 23.0 ± 1.0 °C and a relative humidity of 40% ± 10%.

Certificate rev: 1.02

This provides traceability of measurement to recognised national standards, and to the units of measurement realised at the National Physical Laboratory or other recognised national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Figure 3. Traceable Calibration Certificate with Data



CERTIFICATE OF CALIBRATION

Certificate No: F14983

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Reporting Compliance With Specification

The following pages contain the calibration results with two further columns indicating the instrument performance relative to the stated specification.

The column headed '% of Spec' is the measured error as a percentage of the stated specification with no allowance being made for the calibration uncertainty.

The column headed 'Compliance With Spec' indicates compliance or otherwise with specification taking into account the measurement uncertainty, the five possible conditions are indicated as follows:

Indicator	Explanation
Blank, No Indicator	The equipment complies with the stated specification at the measured points, due allowance having been made for the uncertainty of the measurements.
?	The measurement result is within the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the stated level of confidence. However the results indicate that compliance is more probable than non-compliance with the specification limit.
??	The measurement result is outside the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state non-compliance based on the the stated level of confidence. However the results indicate that non-compliance is more probable than compliance with the specification limit.
Fail	The equipment does not comply with the stated specification at the measured points, due allowance having been made for the uncertainty of the measurements.
N/A	The uncertainty is greater than the stated specification, it is therefore not possible to determine compliance or otherwise with the stated specification.

Zero Measurements

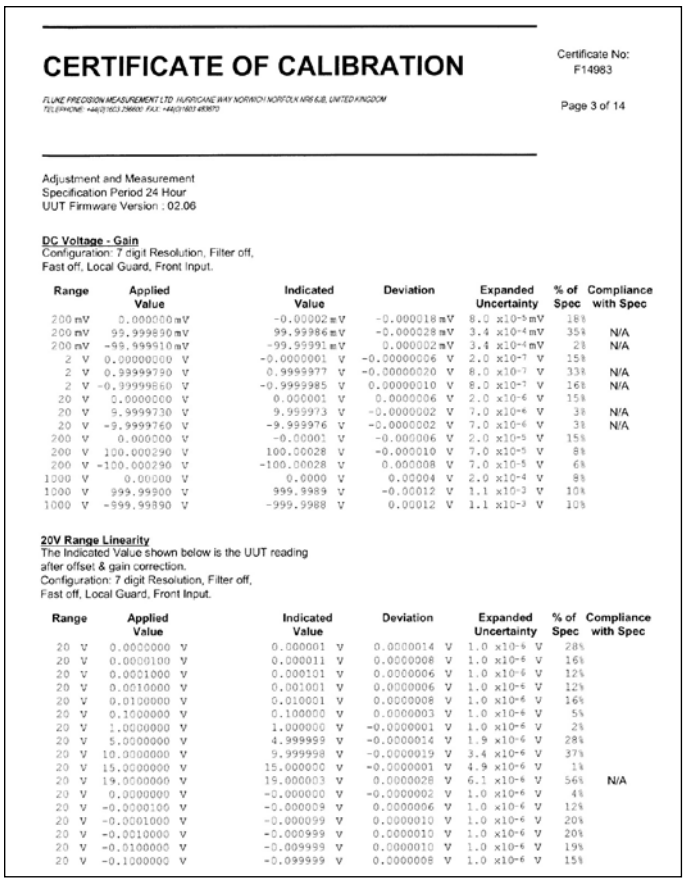
For all zero measurements the applied value is a calibration system zero which is used to cancel any system offset. The assigned uncertainty for these measurements represents the precision of the zero setting rather than the absolute value.

Specification Used: Adjustment and Measurement

Procedure Used: Fluke 8508A:5720A VER & VERADJ: 6.03

Standards Used

Asset Number	Instrument Model	Cal Date	Cal Due Date
C1/620A	Fluke 5725A	24 Nov 2006	24 Jan 2007
C1/621A	Fluke 5700A	24 Nov 2006	23 Jan 2007
C1/633A	Fluke 8508A-7000K	04 Dec 2006	02 Mar 2007



CERTIFICATE OF CALIBRATION

Certificate No: F14983

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Adjustment and Measurement
Specification Period 24 Hour
UUT Firmware Version : 02.06

DC Voltage - Gain
Configuration: 7 digit Resolution, Filter off,
Fast off, Local Guard, Front Input.

Range	Applied Value	Indicated Value	Deviation	Expanded Uncertainty	% of Spec	Compliance with Spec
200 mV	0.000000 mV	-0.00002 mV	-0.000018 mV	8.0 x10-5 mV	18%	
200 mV	99.999890 mV	99.99986 mV	-0.000028 mV	3.4 x10-4 mV	35%	N/A
200 mV	-99.999910 mV	-99.99991 mV	0.000002 mV	3.4 x10-4 mV	2%	N/A
2 V	0.00000000 V	-0.0000001 V	-0.00000006 V	2.0 x10-7 V	15%	
2 V	0.99999790 V	0.9999977 V	-0.00000020 V	8.0 x10-7 V	33%	N/A
2 V	-0.99999860 V	-0.9999985 V	0.00000010 V	8.0 x10-7 V	16%	N/A
20 V	0.0000000 V	0.000001 V	0.0000006 V	2.0 x10-6 V	15%	
20 V	9.9999730 V	9.999973 V	-0.0000002 V	7.0 x10-6 V	3%	N/A
20 V	-9.9999760 V	-9.999976 V	-0.0000002 V	7.0 x10-6 V	3%	N/A
200 V	0.000000 V	-0.00001 V	-0.000006 V	2.0 x10-5 V	15%	
200 V	100.000290 V	100.00028 V	-0.000010 V	7.0 x10-5 V	8%	
200 V	-100.000290 V	-100.00028 V	0.000008 V	7.0 x10-5 V	6%	
1000 V	0.00000 V	0.0000 V	0.00004 V	2.0 x10-4 V	9%	
1000 V	999.99900 V	999.9989 V	-0.00012 V	1.1 x10-3 V	10%	
1000 V	-999.99890 V	-999.9988 V	0.00012 V	1.1 x10-3 V	10%	

20V Range Linearity
The Indicated Value shown below is the UUT reading after offset & gain correction.
Configuration: 7 digit Resolution, Filter off,
Fast off, Local Guard, Front Input.

Range	Applied Value	Indicated Value	Deviation	Expanded Uncertainty	% of Spec	Compliance with Spec
20 V	0.0000000 V	0.000001 V	0.0000014 V	1.0 x10-6 V	28%	
20 V	0.0000100 V	0.000011 V	0.0000008 V	1.0 x10-6 V	16%	
20 V	0.0001000 V	0.000101 V	0.0000006 V	1.0 x10-6 V	12%	
20 V	0.0010000 V	0.001001 V	0.0000006 V	1.0 x10-6 V	12%	
20 V	0.0100000 V	0.010001 V	0.0000008 V	1.0 x10-6 V	16%	
20 V	0.1000000 V	0.100000 V	0.0000003 V	1.0 x10-6 V	5%	
20 V	1.0000000 V	1.000000 V	-0.0000001 V	1.0 x10-6 V	2%	
20 V	5.0000000 V	4.999999 V	-0.0000014 V	1.9 x10-6 V	28%	
20 V	10.0000000 V	9.999998 V	-0.0000019 V	3.4 x10-6 V	37%	
20 V	15.0000000 V	15.000000 V	-0.0000001 V	4.9 x10-6 V	1%	
20 V	19.0000000 V	19.000003 V	0.0000028 V	6.1 x10-6 V	56%	N/A
20 V	0.0000000 V	-0.000000 V	-0.0000002 V	1.0 x10-6 V	4%	
20 V	-0.0000100 V	-0.000009 V	0.0000006 V	1.0 x10-6 V	12%	
20 V	-0.0001000 V	-0.000099 V	0.0000010 V	1.0 x10-6 V	20%	
20 V	-0.0010000 V	-0.000999 V	0.0000010 V	1.0 x10-6 V	20%	
20 V	-0.0100000 V	-0.009999 V	0.0000010 V	1.0 x10-6 V	19%	
20 V	-0.1000000 V	-0.099999 V	0.0000008 V	1.0 x10-6 V	15%	

Z540 calibration certificate

Commonly referred to as a Z540 certificate, this is more properly termed a Z540.1 calibration certificate. It documents that a specific instrument, identified by model and serial number, was tested using Fluke's applicable procedures, traceable to national and international standards, in accordance with formal American Standard named Z540.1. (More specifically, its present version is named ANSI/NCSL Z540.1–1994 (R2002) Part I.) With this certificate, details of the individual tests are provided with a variety of supporting information. These details may include some or all of, but are not limited to, the specific test points, the appropriate specification limits, measured values, etc. It doesn't usually include specific measurement uncertainty information, but rather does enumerate test cases where accuracy ratios between the test tolerances and the associated standard are less than four to one. Also included are specific testing dates, specific testing instrumentation details and traceability information. An example of this document is included in Figure 4.

Z540.1 **Complies with the requirements of ANSI/NCSL Z540A.1-1994 (R2002)**

FLUKE ®
Fluke Corporation
Everett, Washington 98206
USA

Factory Annex of the Primary Standards Laboratory

ISO 9001

Calibration Certificate

Descripton:	Multi-Product Calibrator	**Certificate Number:**	Sample
Manufacturer:	Fluke	**Date of Calibration:**	14-Apr-2006
Model:	5520A	**Date of Certificate:**	20-Nov-2006
Serial number:	Sample Only	**Temperature:**	23 ± 3°C
Customer Name:	Fluke Corporation	**Relative Humidity:**	Less than 70% RH
City, State:	Everett, WA		
Procedure Name:	5520A-500		

Measurement uncertainties at the time of test are calculated in accordance with the method described in NIST TN1297, for a confidence level of 95% using a coverage factor of approximately k=2.

In the attached measurement results deviation may be expressed with units, Measured Value (MV) – Nominal Value (NV) or as a proportion of the nominal value ((NV-NV)/NV), expressed as percent.

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approval by Fluke Corporation. The user is obliged to have the object recalibrated at appropriate intervals. Calibration certificates without signatures are not valid.

Fluke's calibration system complies with the requirements of ANSI/NCSL Z540A.1-1994 (R2002).

Kim Bailey
Technician

Nicholas Mason
Factory Annex Deputy

Fluke Corporation 425.446.6378 Fax 425.446.5649 www.fluke.com

Figure 4. Z540 calibration certificate

Traceability Information

DC Voltage
This calibration was conducted using an unbroken chain of standards to the Fluke Volt, which is traceable to the U.S. representation of the volt, through the internationally accepted value of the Josephson constant Kj=483597.9 GHz/V and a 10 Volt Josephson Array Voltage Standard.

Frequency
This calibration was conducted using an unbroken chain of standards to a GPS disciplined oscillator frequency standard, traceable to the United States Naval Observatory (USNO), which is traceable to the National Institute of Standards and Technology (NIST).

AC Voltage (1 MHz and below), Resistance, DC Current, AC Current (10 mA and above), Capacitance, Inductance and Phase
This calibration was conducted using an unbroken chain of standards which are traceable to NIST.

AC Voltage (> 1 MHz) and RF Power
This calibration was conducted using an unbroken chain of standards which are traceable to NIST or the National Research Council Canada (NRC).

AC Current (< 10 mA)
This calibration was conducted using an unbroken chain of standards which are traceable to Physikalisch Technische Bundesanstalt (PTB) (German National Metrology Institute).

Temperature
This calibration was conducted using an unbroken chain of standards to the Hart Scientific Metrology Laboratory, which is traceable to NIST and/or to Hart maintained intrinsic standards.

Humidity
This calibration was conducted using an unbroken chain of standards traceable to the Fluke Everett Service Center, whose traceability is based on the physical phenomena in which the equilibrium relative humidity values associated with certain saturated salt solutions are known.

Standards Used
PM02

DC Voltage

Output/Range	Measurement	Deviation	TUR	90 Day Spec
0 V, 330 mV	231.169 nV	0.231 uV	1.7	1.000 µV
329 mV, 330 mV	329.000 mV	0.000 %		0.002 %
-329 mV, 330 mV	-328.998 mV	0.000 %		0.002 %
0 V, 3.30 V	66.681 nV	0.067 uV	3.0	2.000 µV
1 V, 3.30 V	999.998 mV	0.000 %	3.8	0.001 %
-1 V, 3.30 V	-999.995 mV	-0.001 %		0.001 %
3.29 V, 3.30 V	3.290 V	0.000 %	3.8	0.001 %
-3.29 V, 3.30 V	-3.290 V	0.000 %	3.7	0.001 %
0 V, 33 V	-3.027 µV	-3.027 µV		20.000 µV
10 V, 33 V	10.000 V	0.000 %		0.001 %
-10 V, 33 V	-10.000 V	0.000 %		0.001 %
32.9 V, 33 V	32.900 V	0.000 %		0.001 %
-32.9 V, 33 V	-32.900 V	0.000 %	3.6	0.001 %
50 V, 330 V	50.000 V	0.001 %		0.002 %
329 V, 330 V	329.000 V	0.000 %	3.4	0.002 %
-50 V, 330 V	-50.000 V	0.000 %		0.002 %
-329 V, 330 V	-328.999 V	0.000 %	3.4	0.002 %
334 V, 1 kV	334.002 V	0.001 %		0.002 %
900 V, 1 kV	900.005 V	0.001 %	3.7	0.002 %
1.020 kV, 1 kV	1.020 kV	0.001 %	3.7	0.002 %
-334 V, 1 kV	-334.002 V	0.000 %		0.002 %
-900 V, 1 kV	-900.004 V	0.000 %	3.7	0.002 %
-1.020 kV, 1 kV	-1.02000 kV	0.00045 %	3.7	0.00165 %
Aux Out/Range				
0 mV, 300 mV	-13.684 µV	-0.014 mV		0.350 mV
329 mV, 300 mV	329.008 mV	0.002 %		0.136 %
-329 mV, 300 mV	-329.032 mV	0.010 %		0.136 %
330 mV, 3 V	329.990 mV	-0.003 %		0.136 %
3.29 V, 3 V	3.290 V	0.001 %		0.041 %
-3.29 V, 3 V	-3.290 V	0.001 %		0.041 %
7 V, 7 V	6.999 V	-0.008 %		0.035 %
-7 V, 7 V	-6.999 V	-0.008 %		0.035 %
DC Current				
Output/Range	**Measurement**	**Deviation**	**TUR**	**90 Day Spec**
0 A, 300 µA	206.661 pA	0.207 nA		20.000 nA
190 µA, 300 µA	189.996 µA	-0.002 %		0.023 %
-190 µA, 300 µA	-189.995 µA	-0.002 %		0.023 %
329 µA, 300 µA	328.994 µA	-0.002 %		0.018 %
-329 µA, 300 µA	-328.993 µA	-0.002 %		0.018 %
0 A, 3 mA	1.417 nA	1.417 nA		50.000 nA
1.90 mA, 3 mA	1.900 mA	0.000 %		0.011 %
-1.90 mA, 3 mA	-1.900 mA	-0.001 %		0.011 %
3.29 mA, 3 mA	3.290 mA	0.000 %		0.010 %
-3.29 mA, 3 mA	-3.290 mA	0.000 %		0.010 %
0 A, 30 mA	26.477 nA	0.026 uA	2.2	0.250 uA
19 mA, 30 mA	19.000 mA	0.001 %	3.6	0.009 %
-19 mA, 30 mA	-19.000 mA	0.000 %	3.6	0.009 %
32.9 mA, 30 mA	32.900 mA	0.001 %	3.6	0.009 %
-32.9 mA, 30 mA	-32.900 mA	0.000 %	3.5	0.009 %
0 A, 300 mA	99.708 nA	0.100 uA		2.500 µA
190 mA, 300 mA	189.996 mA	-0.002 %	2.7	0.009 %
-190 mA, 300 mA	-189.994 mA	-0.003 %	2.7	0.009 %
329 mA, 300 mA	328.994 mA	-0.002 %	2.6	0.009 %
-329 mA, 300 mA	-328.992 mA	-0.002 %	2.6	0.009 %
0 A, 2.90 A	-14.165 µA	-14.165 µA	2.7	40.000 µA
1.09 A, 2.90 A	1.090 A	-0.001 %		0.020 %
-1.09 A, 2.90 A	-1.090 A	-0.001 %		0.020 %
2.99 A, 2.90 A	2.990 A	-0.004 %		0.031 %
-2.99 A, 2.90 A	-2.990 A	-0.005 %		0.031 %
0 A, 20 A	-70.623 µA	-0.071 mA		0.500 mA
11 A, 20 A	11.000 A	0.000 %		0.043 %
-11 A, 20 A	-11.000 A	0.002 %		0.043 %
20 A, 20 A	19.999 A	-0.006 %		0.084 %
-20 A, 20 A	-20.001 A	0.007 %		0.084 %

FLUKE®

Accredited report of calibration

This calibration certificate documents that a specific instrument was calibrated in a manner traceable to national and international standards, in accordance with the practices defined in the international standard ISO/IEC 17025. (Specifically, its present version is ISO/IEC 17025:2005). The report identifies the instrument tested by model and serial number. The testing used Fluke's applicable procedures. Details of the individual tests are provided with a variety of supporting information. These details may include some or all of, but are not limited to, the specific test points, measured values, the appropriate specification limits, measurement uncertainty, etc. Also included are specific testing dates, specific testing instrumentation details, traceability information, and refers to the 17025 accreditation body with accreditation details. An example of this document is included in Figure 5.

NVLAP

Accredited by the National Voluntary Laboratory Accreditation Program
for the specific Scope of accreditation under Lab Code 105016-0.

FLUKE ®
Fluke Corporation
Everett, Washington 98206
USA

Factory Annex of the Primary Standards Laboratory

ISO 9001

Calibration Certificate

Description:	Multi-Function Calibrator	**Certificate Number:**	Sample
Manufacturer:	Fluke	**Date of Calibration:**	23-Feb-2007
Model:	5720A	**Date of Certificate:**	05-Mar-2007
Serial number:	XXXXXXX	**Temperature:**	23 ± 3°C
Customer Name:	Fluke Corporation	**Relative Humidity:**	Less than 70% RH
City, State:	Everett, WA		
Procedure Name:	5720A-150		

This calibration certificate may contain data that is not covered by the NVLAP Scope of Accreditation. The unaccredited material, where applicable, is indicated by an asterisk (*) or confined to clearly marked sections.

Measurement uncertainties at the time of test are calculated in accordance with the method described in NIST TN1297, for a confidence level of 95% using a coverage factor of approximately k=2.

In the attached measurement results deviation may be expressed with units, Measured Value (MV) – Nominal Value (NV) or as a proportion of the nominal value ((NV-NV)/NV), expressed as percent.

This calibration certificate applies only to the item identified and shall not be reproduced other than in full, without specific written approval by Fluke Corporation. The user is obliged to have the object recalibrated at appropriate intervals. This certificate shall not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. Calibration certificates without signatures are not valid.

Fluke's calibration system complies with the requirements of ANSI/NCSL Z540A.1-1994 (R2002) and ISO/IEC 17025:2005.

Technician

Factory Annex Deputy

Traceability Information

DC Voltage
This calibration was conducted using an unbroken chain of standards to the Fluke Volt, which is traceable to the U.S. representation of the volt, through the internationally accepted value of the Josephson constant Kj=483597.9 GHz/V and a 10 Volt Josephson Array Voltage Standard.

Frequency
This calibration was conducted using an unbroken chain of standards to a GPS disciplined oscillator frequency standard, traceable to the United States Naval Observatory (USNO), which is traceable to the National Institute of Standards and Technology (NIST).

AC Voltage (1 MHz and below), Resistance, DC Current, AC Current (10 mA and above), Capacitance, Inductance and Phase
This calibration was conducted using an unbroken chain of standards which are traceable to NIST.

AC Voltage (> 1 MHz) and RF Power
This calibration was conducted using an unbroken chain of standards which are traceable to NIST or the National Research Council Canada (NRC).

AC Current (< 10 mA)
This calibration was conducted using an unbroken chain of standards which are traceable to Physikalisch Technische Bundesanstalt (PTB) (German National Metrology Institute).

Temperature
This calibration was conducted using an unbroken chain of standards to the Hart Scientific Metrology Laboratory, which is traceable to NIST and/or to Hart maintained intrinsic standards.

Humidity
This calibration was conducted using an unbroken chain of standards traceable to the Fluke Everett Service Center, whose traceability is based on the physical phenomena in which the equilibrium relative humidity values associated with certain saturated salt solutions are known.

Standards Used
DN46
DN47

DC Voltage

Output/Range	Measurement	Deviation	Uncertainty 24 Hour	Spec
0 V, 220 mV	-0.30 uV	-0.30 uV	0.21 uV	0.50 uV
0 V, 2.2 V	-0.11 uV	-0.11 uV	0.16 uV	0.80 uV
0 V, 11 V	-0.9 uV	-0.9 uV	0.6 uV	3.0 uV
0 V, 22 V	-0.6 uV	-0.6 uV	1.0 uV	5.0 uV
0 V, 220 V	-21 uV	-21 uV	16 uV	50 uV
100 mV, 220 mV	99.9996 mV	-0.0004 %	0.0005 %	0.0010 %
-100 mV, 220 mV	-99.9998 mV	-0.0002 %	0.0007 %	0.0010 %
1 V, 2.2 V	0.9999994 V	-0.0000636 %	0.0001207 %	0.0004300 %
-1 V, 2.2 V	-1.0000005 V	0.0000473 %	0.0001200 %	0.0004300 %
10 V, 11 V	9.999998 V	-0.000023 %	0.000070 %	0.000280 %
-10 V, 11 V	-9.999997 V	-0.000030 %	0.000070 %	0.000280 %
10 V, 22 V	10.000001 V	0.000013 %	0.000070 %	0.000300 %
-10 V, 22 V	-10.000000 V	0.000005 %	0.000070 %	0.000300 %
100 V, 220 V	99.99999 V	-0.00001 %	0.00010 %	0.00040 %
-100 V, 220 V	-100.00001 V	0.00001 %	0.00010 %	0.00040 %
1 kV, 1.1 kV	1.0000010 kV	0.0000997 %	0.0001400 %	0.0005500 %
-1 kV, 1.1 kV	-1.0000008 kV	0.0000842 %	0.0001400 %	0.0005500 %

Resistance

Output	Measurement	Deviation	Uncertainty 24 Hour	Spec
0 Ω	-8 µΩ	-8 µΩ	10 µΩ	50 µΩ
999.890 mΩ	999.874 mΩ	-0.002 %	0.002 %	0.009 %
1.89981 Ω	1.89983 Ω	0.00109 %	0.00202 %	0.00850 %
9.99963 Ω	9.99957 Ω	-0.00059 %	0.00100 %	0.00230 %
18.99974 Ω	18.99963 Ω	-0.00058 %	0.00085 %	0.00230 %
100.0003 Ω	100.0005 Ω	0.0001 %	0.0003 %	0.0010 %
190.0010 Ω	190.0009 Ω	-0.0001 %	0.0003 %	0.0010 %
1.0000400 kΩ	1.0000404 kΩ	0.0000427 %	0.0003132 %	0.0008000 %
1.900061 kΩ	1.900065 kΩ	0.000231 %	0.000418 %	0.000800 %
9.999987 kΩ	9.999985 kΩ	-0.000020 %	0.000208 %	0.000800 %
19.00080 kΩ	19.00080 kΩ	0.00003 %	0.00025 %	0.00090 %
99.99946 kΩ	99.99955 kΩ	0.00009 %	0.00035 %	0.00090 %
189.9923 kΩ	189.9925 kΩ	0.0001 %	0.0003 %	0.0009 %
999.985 kΩ	999.987 kΩ	0.000 %	0.000 %	0.002 %
1.899927 MΩ	1.899927 MΩ	0.000013 %	0.000477 %	0.001700 %
9.99904 MΩ	9.99904 MΩ	0.000005 %	0.00102 %	0.00330 %
18.99941 MΩ	18.99925 MΩ	-0.00082 %	0.00105 %	0.00430 %
100.010 MΩ	100.009 MΩ	-0.001 %	0.006 %	0.010 %

AC Voltage

Output/Frequency	Measurement	Deviation	Uncertainty 24 Hour	Spec
1.9 mV, 1 kHz	1.8993 mV	-0.0367 %	0.0964 %	0.2716 %
1.9 mV, 20 kHz	1.8998 mV	-0.0091 %	0.1230 %	0.2716 %
19 mV, 40 Hz	18.9972 mV	-0.0149 %	0.0090 %	0.0348 %
19 mV, 1 kHz	18.9974 mV	-0.0139 %	0.0090 %	0.0348 %
19 mV, 20 kHz	18.9990 mV	-0.0051 %	0.0090 %	0.0348 %
19 mV, 100 kHz	18.999 mV	-0.005 %	0.028 %	0.082 %
19 mV, 300 kHz	18.996 mV	-0.020 %	0.042 %	0.163 %
19 mV, 1 MHz	18.954 mV	-0.244 %	0.110 %	0.422 %
190 mV, 40 Hz	190.003 mV	0.002 %	0.003 %	0.013 %
190 mV, 1 kHz	189.999 mV	-0.001 %	0.006 %	0.013 %
190 mV, 20 kHz	190.000 mV	0.000 %	0.008 %	0.013 %
190 mV, 100 kHz	190.00 mV	0.00 %	0.01 %	0.06 %
190 mV, 300 kHz	190.00 mV	0.00 %	0.02 %	0.10 %
190 mV, 1 MHz	189.97 mV	-0.02 %	0.07 %	0.30 %
600 mV, 40 Hz	599.995 mV	-0.001 %	0.003 %	0.006 %
600 mV, 1 kHz	599.994 mV	-0.001 %	0.002 %	0.006 %
600 mV, 20 kHz	600.002 mV	0.000 %	0.002 %	0.006 %
600 mV, 100 kHz	600.03 mV	0.01 %	0.01 %	0.02 %
600 mV, 300 kHz	599.95 mV	-0.01 %	0.01 %	0.05 %
600 mV, 1 MHz	599.4 mV	-0.1 %	0.1 %	0.2 %
1 V, 40 Hz	1.00001 V	0.00057 %	0.00200 %	0.00550 %

Figure 5. Accredited report of calibration

Common questions

What are the documentary standards that reference the standard practices and requirements of calibration?

There are a number of formal documents that influence calibration practices and calibration certificates. A partial list of the more common of these is shown below, with a simple description.

- **ISO/IEC 17025**
  This refers to the international standard for General Requirements for the Competence of Testing and Calibration Laboratories. Originally published in 1999, the present version was revised in 2005. Its requirements are the basis for which present day calibration and testing laboratories are measured.
- **ANS/NCSL Z540.1**
  This refers to the American National Standard for Calibration Laboratories and Measuring and Test Equipment–General Requirements. It is based on the ISO/IEC Guide 25 as well as on MIL-STD 45662A, which was included to meet U.S. Department of Defense requirements. Originally published in 1994, it is scheduled to expire in 2007.
- **ISO 9000**
  This refers to the international standard for quality management systems. It covers a wide range of topics. Included are specific directions requiring the consideration of both the management and the calibration of the testing equipment which are involved in the quality processes of an organization. With respect to calibration, ISO 9000 is a philosophical standard rather than a technical one. Specific calibration certificate requirements are determined by the individual organization and its quality systems. To satisfy any technical and operational requirements for calibration, it is best to refer to other standards, such as those also mentioned in this section.
- **ISO Guide 25**
  This refers to the international guide for general requirements for the competence of calibration and testing laboratories. This is guide is now obsolete and has been replaced by ISO/IEC 17025.
- **MIL-STD 45662A**
  This refers to a military standard on calibration system requirements. This MIL-STD was originally intended to meet U.S. Department of Defense requirements. This standard is obsolete. Its requirements are still met through Z540.1 Part 2, and somewhat by ISO 10012-1, Quality Assurance Requirements for Measuring Equipment.

Why do there seem to be different types of 17025 Accredited Calibration Certificates or Reports?

Any calibration lab or testing organization providing such a calibration must be audited, approved, and certified to conform to the 17025 standard. This auditing is performed by any of a number of different organizations which are authorized to audit whether or not calibration laboratories meet the 17025 requirements. These auditing organizations reside in various countries who participate in the Mutual Recognition Agreement. These organizations and their accreditation assessments are internationally recognized outside of their country of origin through international agreements.

Once a lab has been certified, the specific accrediting organization's approval is referenced in the calibration certificate. Hence, the name of the accrediting organization will often be identified with the calibration certificate. This means there are several types of certificates, but all are considered equal as they conform to the requirements of the same international standard.

Examples of 17025 accredited calibration certificates include:

- **NVLAP accredited calibration certificate.** This certificate confirms the testing was done in a manner approved by the USA's calibration accrediting body named the National Voluntary Laboratory Accreditation Program.
- **UKAS accredited calibration certificate.** This certificate confirms the testing was done in a manner approved by the UK's calibration accrediting body named the United Kingdom Accreditation Service.
- **A2LA accredited calibration certificate.** This certificate confirms the testing was done in a manner approved by the USA's calibration accrediting body named the American Association for Laboratory Accreditation.

There are many other accreditation bodies authorized to accredit laboratories for 17025, represented in nearly all developed countries throughout the world. The names and acronyms for some of these bodies include:

- **CLAS.** Canadian Lab Accreditation System (Canada)
- **DKD.** Deutscher Kalibrierdienst, German Laboratory Association (Germany)
- **IAJapan JCSS.** International Accreditation Japan, Japan Calibration Service System (Japan)
- **NATA.** National Association of Testing Authorities (Australia)
- **RvA.** Raad voor Accreditatie, Dutch Accreditation Council (Netherlands)
- **SAC-SINGLAS.** Singapore Accreditation Council – Singapore Laboratory Accreditation Scheme (Singapore)

Common questions

What certificates come standard with a newly purchased instrument?

Generally, all Fluke instruments come with either a formal calibration certificate or a statement of calibration practices. General purpose test instruments commonly come with a statement of calibration practices. A formal calibration certificate is optional. On the other hand, calibration instruments commonly include some type of a traceable calibration certificate with data. When other certificates are required, then other specific calibrations with specific types of certificates may be performed as an option.

Do all new instruments need a calibration certificate?

It is highly recommended that an instrument be calibrated and have evidence of such through an appropriate certificate. The quality management system standard ISO 9000 states that prior to its use, an instrument should be calibrated using traceable standards to insure its proper performance. Depending upon the instrument user's requirements, the specific type of calibration and the associated certificate can be determined.

What about a calibration certificate for an existing instrument?

It is important to routinely calibrate existing test instruments during their useful life. The performance of all instruments changes with time, and certificates valid at the time they are new must replaced with valid certificates on a regular basis during the lifetime of an instrument. (Typically this is yearly, or alternatively at an interval that is set to be at an acceptable level risk against undetected instrument failures.) It is also a requirement for calibration after an instrument is repaired. When an instrument is returned for routine calibration or repair and recalibration, it is important to specify the appropriate type of calibration certificate required.

What is traceability?

The term traceability refers to an unbroken chain of measurements relating an instrument's measurements to a known standard. These measurements are realized through an unbroken chain of comparisons from the measurement being made, back to a recognized national and legal standard. Traceability insures that all measured parameters eventually trace back to an appropriate fundamental international system unit of measurement (the SI unit). In practice, the instrument is being calibrated with a calibration standard that can be proven as traceable is to a national standard. This national standard in turn is traceable to an international standard. This traceability chain is used to certify an instrument's accuracy relative to a known and accepted standard. The calibration certificate is documentary proof of traceability for a particular instrument.

Will a calibration certificate originating in another country, and possibly accredited by a foreign organization, be acceptable as traceable in my country?

Simply speaking, calibrations which are properly accredited as meeting ISO/IEC 17025 will satisfy the requirements to be internationally acceptable. There should be no need to recertify or recalibrate an instrument with such a calibration certificate to satisfy local authorities of proper traceability to international standards.

Specifically, an international agreement has been signed between the National Metrology Institutes (NMIs) of most developed countries worldwide. This Mutual Recognition Arrangement (MRA) provides for acceptance of the national measurement standards and for calibration and measurement certificates issued by NMIs. This acceptance is further expanded to the test and calibration certificates made by other laboratories traceable to NMIs, provided these laboratories have been accredited through the processes defined as acceptable under international agreement.

On the other hand, calibration certificates that are not accredited to meet ISO/IEC 17025 may or may not be found acceptable as traceable to national and international standards. No formal agreements of acceptance for such certificates exist. It is up to instrument owner and the local authorities to decide on the acceptability of such calibration reports.

Common questions

How can I ensure I get a particular type of calibration for my instrument?

When you either (1) purchase a new instrument or return it for (2) recalibration or (3) repair and recalibration, you should inquire about what type of documented calibrations are available from that servicing laboratory. Make sure the laboratory is capable and has the authority to provide the calibration your organization requires. Also, it is often necessary to have a report of the instrument's performance as measured when it arrives at a laboratory (commonly termed "As Found" data), and also supplied with performance data as measured when it leaves the laboratory (commonly termed "As Left" data). With this full set of data you can ensure that any present or future performance deemed marginal or faulty is properly identified for appropriate corrective actions.

What are "as found" data and "as left" data?

Several different measurement test data types can be found on certificates. They can be interpreted as:

- As found. Calibration data collected before the unit is adjusted and/or repaired.
- As left. Calibration data collected after the unit is adjusted and/or repaired.
- As found/as left. Calibration data collected without any adjustment and/or repair performed.

It is important for instruments that are being routinely recertified, or certified following a repair, to have the as found data documented as well the as left data documented. In this way, the complete performance profile of the calibrated instrument is known, and any future corrective actions can be more easily taken. Both as found/as left data are provided with 17025 certificates, but it is not necessarily included in Z540 certificates unless requested.

Are the procedures identical for producing 17025 and Z540.1 calibration certificates for a specific instrument?

In concept, both procedures should be identical or nearly identical. However differences can and do exist. These could be based on differences in the lab's equipment or metrology processes for one procedure vs. the other. Also, the measurement uncertainty calculation processes required in 17025 calibrations might cause the measurement process to be different than the process used in Z540 calibrations. For example, the number of measurements taken and analyzed at each test point could be different between the two types of calibration procedures.

However, both procedures will be appropriate and adequate to provide a proper calibration report per their individual requirements.

What calibration certificate does Fluke recommend?

As a general practice, Fluke does not recommend one certificate over another. It is up to the user of the instrument to determine what is appropriate for the quality and metrology processes which support their product or service. It is important to be consistent. For example, a laboratory which supplies 17025 accredited calibrations to their customers should obtain similar 17025 accredited calibrations for their instruments.

If there is some doubt on what type of calibration report is needed, it is good practice to obtain the more formal 17025 calibration certificate over less stringent calibration certificate alternatives. This ensures the highest quality and best situation to minimize an organization's risk against providing unreliable test results, services and/or products for their end customer's expectations.

Fluke. *Keeping your world up and running.*®

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