Certificate of Calibration

ISO/IEC 17025:2005 and ANSI/NCSL Z540.1-1994

Certificate Number 1-5607144213-1

Model Number	34401A
Manufacturer	Keysight Technologies Inc
Description	Digital multimeter, 6.5 digit
Serial Number	MY41007563
Date of Calibration	26 May 2014
Procedure	STE-50111013-C.01.20
Temperature	(23±5) °C
Humidity	(50±30) %RH

Customer
Keysight Technologies Deutschland GmbH
Herrenberger Strasse 130
71034 BOEBLINGEN
Germany

Location of Calibration
Keysight Technologies Deutschland GmbH
Herrenberger Strasse 130, Geb 4
D-71034 Boeblingen
Germany

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2005 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2008.

As Received Conditions
The measured values of the equipment were observed IN SPECIFICATION at the points tested.

Action Taken
- No corrective actions were necessary.

As Completed Conditions
The measured values of the equipment were observed IN SPECIFICATION at the points tested.

Remarks or Special Requirements

This calibration certificate may reference instruments manufactured by HP, Agilent and Keysight as being manufactured by Keysight Technologies, Inc.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

Keysight Technologies
Deutschland GmbH
Herrenberger Strasse 130, Geb 4
D-71034 Boeblingen
Germany

Edgar Leckel - European Operations Manager

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Traceability Information

Technician ID Number 00126797

Measurements are traceable to the International System of Units (SI) via national metrology institutes (e.g., NIST, NPL, PTB, NMIJ, NRC, KRISS, SIRIM, etc.) that are signatories to the CIPM Mutual Recognition Arrangement.

Calibration Equipment Used

Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
33250A	Function/Arbitrary Waveform Generator	DE2574	11 Jul 2014	1-5268582535-1
5720A	Calibrator	DE2928	31 Dec 2014	1-5547708624-1
5725A	Amplifier	DE2929	31 Dec 2014	1-5547708624-2

Traceability Table

	Model	Model Description	Equipment ID	Certificate Number	Trace Value
W	33250A	FUNCTION/ARB WAVEFORM GENERATOR	DE2574	1-5268582535-1	
R	11050A	CONVERTER	DE535	1-4821576242-1-UKAS:C 0147	AC Voltage
R	3458A	Digital multimeter, 8.5 digit	DE1980	1-5079162138-1-UKAS:C 0147	DC Voltage
R	910R	GPS Controlled Frequency STD	UK15764	1-3663443973-1-UKAS:C 0147	Frequency
W,R	5720A	CALIBRATOR	DE2928	1-5547708624-1-UKAS:C 0147	AC Current AC Voltage DC Current DC Voltage Resistance
W,R	5725A	AMPLIFIER	DE2929	1-5547708624-2-UKAS:C 0147	AC Current AC Voltage DC Current

Legend

W - Working Standard The calibration equipment used for the calibration of the Model indicated on the first page of the Certificate of calibration.
R - Reference Standard The Reference Standard (Accredited or NMI-calibrated ETE) used to provide traceability to the SI-Units for the calibration parameter's listed.

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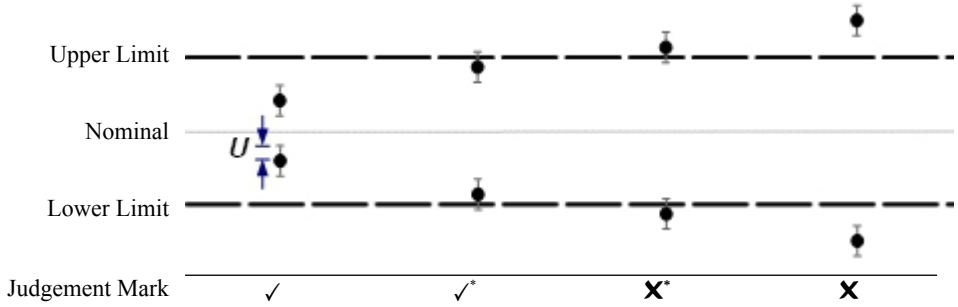
Compliance with Specification

In the assessment of compliance with specification, the uncertainty of measurement has been taken into account. If the uncertainty of measurement overlaps the specification limit (upper limit or lower limit), it is not possible to state compliance/non-compliance based on a 95% level of confidence. However, where a confidence level less than 95% is acceptable, a compliance/non-compliance statement may be possible.

The status of compliance with the acceptance criteria is reported as:

- ✓ - Compliant with specification.
- ✓* - Compliance with specification providing a lower level of confidence is acceptable.
- ✗* - Non-compliance with specification providing a lower level of confidence is acceptable.
- ✗ - Not compliant with specification.



The diagram above shows the typical compliance status for measured values as defined by this service. The vertical bar (*U*) above and below each measurement value represents the uncertainty of measurement.

As Received Conditions/As Completed Conditions
A compilation for all performed tests of the status as received (before any adjustment/repair) and the status as completed (after any adjustment/repair) is reported on the first page of this report. The compliance with typical (non-warranted) specifications will not affect the status as received or the status as completed reported on the first page.

The status summaries relate to the tested item only. A final decision about whether the item's performance actually satisfies requirements of the user can only be made by the user.

Uncertainty of Measurement
The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported expanded measurement uncertainty is the standard uncertainty multiplied by the coverage factor k=2 (for a normal distribution) or k=1.65 (for a uniform distribution), which corresponds to a coverage probability of approximately 95%. Where this is not the case, the distribution, coverage factor (k), effective degrees of freedom (veff) and coverage probability (p) are stated.

Any quoted measurement uncertainty applies only to the measured value and does not imply anything regarding the long-term stability of the equipment.

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Performance Test Results Summary

Test Name	As Received Status
ZERO OFFSET - FRONT TERMINALS	PASSED
ZERO OFFSET - REAR TERMINALS	PASSED
DC VOLTS	PASSED
AC VOLTS	PASSED
FREQUENCY	PASSED
OHMS	PASSED
DC CURRENT	PASSED
AC CURRENT	PASSED

ZERO OFFSET - FRONT TERMINALS PASSED

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Range (Front)	Input					
DC Volts Zero Offset						
100 mV	0 V	-3.5 uV	-0.6 uV	3.5 uV	1.1 uV	✓
1 V	0 V	-7 uV	-1 uV	7 uV	1.2 uV	✓
10 V	0 V	-0.05 mV	0.00 mV	0.05 mV	6.6 uV	✓
100 V	0 V	-0.6 mV	0.0 mV	0.6 mV	0.17 mV	✓
1000 V	0 V	-10 mV	0 mV	10 mV	0.74 mV	✓
Range (Front)	Input					
4-Wire Ohms Zero Offset						
100 Ohm	0 Ohm	-4.0 mOhm	0.6 mOhm	4.0 mOhm	1.2 mOhm	✓
1 kOhm	0 Ohm	-10 mOhm	0 mOhm	10 mOhm	1.2 mOhm	✓
10 kOhm	0 Ohm	-0.10 Ohm	0.01 Ohm	0.10 Ohm	0.014 Ohm	✓
100 kOhm	0 Ohm	-1.0 Ohm	0.0 Ohm	1.0 Ohm	0.13 Ohm	✓
1 MOhm	0 Ohm	-10 Ohm	0 Ohm	10 Ohm	0.68 Ohm	✓
10 MOhm	0 Ohm	-0.10 kOhm	0.00 kOhm	0.10 kOhm	0.011 kOhm	✓
100 MOhm	0 Ohm	-10.0 kOhm	0.0 kOhm	10.0 kOhm	0.058 kOhm	✓
Range (Front)	Input					
2-Wire Ohms Zero Offset						
100 Ohm	0 Ohm	-204.0 mOhm	6.8 mOhm	204.0 mOhm	3.0 mOhm	✓
1 kOhm	0 Ohm	-210 mOhm	7 mOhm	210 mOhm	3.3 mOhm	✓
10 kOhm	0 Ohm	-0.30 Ohm	0.00 Ohm	0.30 Ohm	8.4 mOhm	✓
100 kOhm	0 Ohm	-1.2 Ohm	0.0 Ohm	1.2 Ohm	0.068 Ohm	✓
1 MOhm	0 Ohm	-10 Ohm	0 Ohm	10 Ohm	1.3 Ohm	✓
10 MOhm	0 Ohm	-0.10 kOhm	0.00 kOhm	0.10 kOhm	7.8 Ohm	✓
100 MOhm	0 Ohm	-10.0 kOhm	0.0 kOhm	10.0 kOhm	0.058 kOhm	✓
Range (Front)	Input					
DC Current Zero Offset						
10 mA	0 A	-2.00 uA	0.02 uA	2.00 uA	0.16 uA	✓
100 mA	0 A	-5.0 uA	0.0 uA	5.0 uA	0.21 uA	✓
1 A	0 A	-100 uA	1 uA	100 uA	7.0 uA	✓
3 A	0 A	-600 uA	-1 uA	600 uA	11 uA	✓

ZERO OFFSET - REAR TERMINALS PASSED

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Range (Rear)	Input					
---	---					
DC Volts Zero Offset						
100 mV	0 V	-3.5 uV	-0.9 uV	3.5 uV	0.88 uV	✓
1 V	0 V	-7 uV	-1 uV	7 uV	0.91 uV	✓
10 V	0 V	-0.05 mV	0.00 mV	0.05 mV	6.1 uV	✓
100 V	0 V	-0.6 mV	0.0 mV	0.6 mV	0.074 mV	✓
1000 V	0 V	-10 mV	0 mV	10 mV	0.61 mV	✓
Range (Rear)	Input					
---	---					
4-Wire Ohms Zero Offset						
100 Ohm	0 Ohm	-4.0 mOhm	0.3 mOhm	4.0 mOhm	1.1 mOhm	✓
1 kOhm	0 Ohm	-10 mOhm	0 mOhm	10 mOhm	0.82 mOhm	✓
10 kOhm	0 Ohm	-0.10 Ohm	0.00 Ohm	0.10 Ohm	8.3 mOhm	✓
100 kOhm	0 Ohm	-1.0 Ohm	0.0 Ohm	1.0 Ohm	0.16 Ohm	✓
1 MOhm	0 Ohm	-10 Ohm	0 Ohm	10 Ohm	0.98 Ohm	✓
10 MOhm	0 Ohm	-0.10 kOhm	0.00 kOhm	0.10 kOhm	6.3 Ohm	✓
100 MOhm	0 Ohm	-10.0 kOhm	0.3 kOhm	10.0 kOhm	0.058 kOhm	✓
Range (Rear)	Input					
---	---					
2-Wire Ohms Zero Offset						
100 Ohm	0 Ohm	-204.0 mOhm	-3.6 mOhm	204.0 mOhm	6.1 mOhm	✓
1 kOhm	0 Ohm	-210 mOhm	-4 mOhm	210 mOhm	5.8 mOhm	✓
10 kOhm	0 Ohm	-0.30 Ohm	0.00 Ohm	0.30 Ohm	7.2 mOhm	✓
100 kOhm	0 Ohm	-1.2 Ohm	0.0 Ohm	1.2 Ohm	0.068 Ohm	✓
1 MOhm	0 Ohm	-10 Ohm	0 Ohm	10 Ohm	0.60 Ohm	✓
10 MOhm	0 Ohm	-0.10 kOhm	0.00 kOhm	0.10 kOhm	0.0097 kOhm	✓
100 MOhm	0 Ohm	-10.0 kOhm	0.1 kOhm	10.0 kOhm	0.058 kOhm	✓
Range (Rear)	Input					
---	---					
DC Current Zero Offset						
10 mA	0 A	-2.00 uA	0.01 uA	2.00 uA	5.8 nA	✓
100 mA	0 A	-5.0 uA	0.0 uA	5.0 uA	0.21 uA	✓
1 A	0 A	-100 uA	-1 uA	100 uA	4.7 uA	✓
3 A	0 A	-600 uA	0 uA	600 uA	8.7 uA	✓

DC VOLTS PASSED

TEST CONDITIONS		MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Range	Input(Front)					
100 mV	100 mV	99.9915 mV	99.9992 mV	100.0085 mV	0.0029 mV	✓
1 V	1 V	0.999953 V	1.000001 V	1.000047 V	0.0000070 V	✓

DC VOLTS (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
10 V 10 V	9.99960 V	10.00001 V	10.00040 V	0.000043 V	✓
10 V -10 V	-10.00040 V	-10.00002 V	-9.99960 V	0.000041 V	✓
100 V 100 V	99.9949 V	100.0002 V	100.0051 V	0.00058 V	✓
1000 V 1000 V	999.945 V	1000.000 V	1000.055 V	0.0084 V	✓

AC VOLTS PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Input Freq. (Front)					
------- -------					
100 mV Range					
10 mV 1 kHz	9.9540 mV	9.9938 mV	10.0460 mV	0.0056 mV	✓
100 mV 1 kHz	99.9000 mV	99.9716 mV	100.1000 mV	0.021 mV	✓
100 mV 50 kHz	99.8300 mV	99.9886 mV	100.1700 mV	0.035 mV	✓
Input Freq. (Front)					
------- -------					
1 V Range					
1 V 20 Hz	0.999100 V	0.999639 V	1.000900 V	0.00012 V	✓
1 V 1 kHz	0.999100 V	0.999899 V	1.000900 V	0.000063 V	✓
1 V 20 kHz	0.999100 V	0.999820 V	1.000900 V	0.000065 V	✓
1 V 50 kHz	0.998300 V	0.999558 V	1.001700 V	0.00016 V	✓
1 V 100 kHz	0.993200 V	0.999021 V	1.006800 V	0.00030 V	✓
1 V 300 kHz	0.955000 V	0.996175 V	1.045000 V	0.00063 V	✓
Input Freq. (Front)					
------- -------					
10 V Range					
100 mV 1 kHz	86.94 mV	100.64 mV	113.06 mV	0.20 mV	✓
1 V 1 kHz	0.99640 V	0.99956 V	1.00360 V	0.00019 V	✓
10 V 10 Hz	9.99100 V	9.99830 V	10.00900 V	0.0029 V	✓
10 V 1 kHz	9.99100 V	9.99823 V	10.00900 V	0.00059 V	✓
10 V 50 kHz	9.98300 V	9.99732 V	10.01700 V	0.0016 V	✓
Input Freq. (Front)					
------- -------					
100 V Range					
100 V 1 kHz	99.9100 V	99.9841 V	100.0900 V	0.0079 V	✓
100 V 50 kHz	99.8300 V	99.9656 V	100.1700 V	0.015 V	✓
Input Freq. (Front)					
------- -------					
750 V Range					
700 V 1 kHz	699.355 V	699.817 V	700.645 V	0.073 V	✓
700 V 50 kHz	698.785 V	700.223 V	701.215 V	0.45 V	✓
700 V 45 Hz	699.355 V	699.713 V	700.645 V	0.12 V	✓

FREQUENCY PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Input Freq. (Front)					
------- -------					
100 mV Range					
10 mV 100 Hz	99.9000 Hz	99.9989 Hz	100.1000 Hz	0.0048 Hz	✓
1 V Range					
1 V 100 kHz	99.9900 kHz	100.0000 kHz	100.0100 kHz	0.0013 kHz	✓

OHMS PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
4-Wire Ohms					
Range Input(Front)					
100 Ohm 100 Ohm	99.9860 Ohm	99.9995 Ohm	100.0140 Ohm	0.0028 Ohm	✓
1 kOhm 1 kOhm	0.999890 kOhm	1.000002 kOhm	1.000110 kOhm	0.000012 kOhm	✓
10 kOhm 10 kOhm	9.99890 kOhm	10.00003 kOhm	10.00110 kOhm	0.00011 kOhm	✓
100 kOhm 100 kOhm	99.9890 kOhm	100.0005 kOhm	100.0110 kOhm	0.0014 kOhm	✓
1 MOhm 1 MOhm	0.999890 MOhm	0.999996 MOhm	1.000110 MOhm	0.000022 MOhm	✓
10 MOhm 10 MOhm	9.99590 MOhm	9.99957 MOhm	10.00410 MOhm	0.00043 MOhm	✓
100 MOhm 100 MOhm	99.1900 MOhm	99.9538 MOhm	100.8100 MOhm	0.14 MOhm	✓

DC CURRENT PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Range Input(Front)					
10 mA 10 mA	9.99300 mA	9.99989 mA	10.00700 mA	0.00042 mA	✓
100 mA 100 mA	99.9450 mA	100.0011 mA	100.0550 mA	0.0054 mA	✓
1 A 1 A	0.998900 A	0.999987 A	1.001100 A	0.000097 A	✓
3 A 2 A	1.99700 A	1.99977 A	2.00300 A	0.00026 A	✓

AC CURRENT PASSED

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
Input Freq. (Front)					
-------- --------					
1 Amp Range					
10 mA 1 kHz	8.590 mA	9.955 mA	11.410 mA	0.032 mA	✓
1 A 1 kHz	0.998600 A	0.999565 A	1.001400 A	0.00033 A	✓

AC CURRENT (cont.)

TEST CONDITIONS	MINIMUM	MEASURED	MAXIMUM	UNCERT.	
3 Amp Range					
2 A 1 kHz	1.99520 A	1.99880 A	2.00480 A	0.00065 A	✓