

Explanation of Measurement Report Results

“When statements of compliance (Pass/Fail) are made, the uncertainty of measurement shall be taken into account”. Reference ISO/IEC 17025:2005, 5.10.4.2

This explanation is provided to you because the instrument submitted for calibration has one or more of the following results.

Result

Pass – measured value or test is within the \pm limit, in tolerance, with a confidence level of 95 percent.

_____ Pass? – measured value is *within* the \pm limit, but by a margin less than half of the uncertainty interval and has a confidence level of less than 95 percent of being in tolerance. Adjustment is made and the measurement is repeated. If adjustment or repair is not possible or fails to improve the results, then the customer must determine in or out of tolerance.

_____ Fail? – measured value is *outside* the \pm limit, but by a margin less than half of the uncertainty interval and is reported as out of tolerance but it is not possible to state this with a 95 percent confidence level. Adjustment is made and the measurement is repeated. If adjustment or repair is not possible or fails to improve the results, then the customer must determine if out of tolerance action is necessary.

_____ Fail – measured value is *outside* the \pm limits with a 95 percent confidence level. Adjustment is made and the measurement is repeated for As-left data. If adjustment or repair is not possible or fails to improve the results, then the customer must determine if the measured value is in compliance for the intended use.

%Limit

✓ Adjustment is made, if possible, when the As-found measured value is equal to or greater than 70 percent of the \pm limit. If adjustment is not possible or did not lower the As-left reading below 70 percent, the customer shall determine if the instrument is suitable for their requirements.

Type Data

Found-left All measurements were in tolerance and no adjustments or repairs were performed.

As-found One or more measurements were other than Pass or exceeded 70 percent of the \pm limit and adjustment or repairs were performed.

As-left Results of measurements after adjustment or repair.

Uncertainty

Best estimate of the dispersion of the measured value that could be contributed by the; standard, environment, repeatability of the measurement process, characterizes of the instrument being calibrated (i.e. resolution) etc.

Please call extension 5215 for questions or additional information.

Southwest Research Institute
Calibration Laboratory
Measurement Report

Work Order:	303091644	Mfr:	KEITHLEY	Technician:	CER
Asset No:	003400	Model:	617	Type Data:	As-found
Serial No:	0579628	Type:	ELECTROMETER	Cal Date:	30-Dec-09
Remarks: Coulombs, 2 pA, 20 pA and 200 pA not calibrated.					

Function/Range	Test Point	TI Reading	Difference	± Test Limits	± Uncertainty	Result	%Limit
DC Amps	mA	mA	mA	mA	mA		
20 mA	19.000	19.008	0.008	0.030	0.0017	Pass	27%
2 mA	1.9000	1.9010	0.0010	0.0033	0.00014	Pass	30%
	µA	µA	µA	µA	µA		
200 µA	190.00	190.07	0.07	0.30	0.019	Pass	23%
20 µA	19.000	19.007	0.007	0.030	0.0015	Pass	23%
2 µA	1.9000	1.9007	0.0007	0.0033	0.00015	Pass	21%
	nA	nA	nA	nA	nA		
200 nA	190.00	190.00	0.00	0.49	0.023	Pass	0%
20 nA	19.000	19.000	0.000	0.049	0.0023	Pass	0%
2 nA	1.9000	1.8999	-0.0001	0.0053	0.00024	Pass	2%
DCV	mV	mV	mV	mV	mV		
200 mVolt	190.00	190.12	0.12	0.14	0.013	Pass	86%
	V	V	V	V	V		
2 Volt	1.9000	1.9007	0.0007	0.0011	0.00013	Pass	64%
20 Volt	19.000	19.006	0.006	0.011	0.0013	Pass	55%
200 Volt	190.00	190.07	0.07	0.14	0.013	Pass	50%
Resistance	GΩ	GΩ	GΩ	GΩ	GΩ		
20 GOhm	9.995	9.987	-0.008	0.150	0.058	Pass	5%
2 GOhm	0.9993	1.0047	0.0054	0.0150	0.0058	Pass	36%
	MΩ	MΩ	MΩ	MΩ	MΩ		
200 MOhm	99.99	100.03	0.04	0.31	0.018	Pass	14%
20 MOhm	9.999	10.001	0.002	0.026	0.0012	Pass	8%
2 MOhm	0.9999	1.0001	0.0002	0.0026	0.00055	Pass	8%
	kΩ	kΩ	kΩ	kΩ	kΩ		
200 kOhm	99.99	100.02	0.03	0.26	0.013	Pass	10%
20 kOhm	9.999	10.002	0.003	0.016	0.0013	Pass	17%
2 kOhm	0.9999	1.0011	0.0012	0.0021	0.00013	Pass	55%
Voltage Source	V	V	V	V	V		
	0.000	0.016	0.016	0.050	0.00019	Pass	32%
	1.000	1.015	0.015	0.052	0.00019	Pass	30%
	10.000	10.020	0.020	0.070	0.00010	Pass	28%
	25.000	25.023	0.023	0.100	0.00096	Pass	23%
	50.000	50.029	0.029	0.150	0.00096	Pass	19%
	100.000	100.034	0.034	0.250	0.00096	Pass	14%

END OF REPORT



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Calibration Laboratory
Certificate #0972-01

Certificate of Calibration

Cost Center / Customer: DIV20 / DON BANNON

Mail Stop: B51

Manufacturer/Model: KEITHLEY / 617

Description: ELECTROMETER

Serial Number: 0579628

Asset Number: 003400

Procedure: KEITHLEY 617 - 14 SEP 06

Work Order: 303091644

Date Issued: 30-Dec-2009

Date Calibrated: 30-Dec-2009

*** Date Due :** 30-Dec-2010

**** Results:** AS-LEFT

Temperature: 71.0 °F

Humidity: 41 %RH

Barometer: N/A

This certificate documents traceability to the National Institute of Standards and Technology (NIST) and the International System of Units (SI). The Laboratory quality system conforms to ISO/IEC 17025, 2005, ANSI/NCSL Z540-1-1994 and relevant requirements of the ISO 9000-2000 standard. This certificate shall not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. This certificate shall not be used to claim product endorsement by Southwest Research Institute, American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government. Results of this calibration relate only to the instrument described above at the time of calibration and does not imply any long term stability of the instrument.

*Determined by the customer, does not imply the instrument will remain within tolerance as any number of factors may cause an out-of-tolerance condition before this date. **Data type found in this certificate or attached measurement report must be interpreted as: Found-left - adjustment and/or repair was not performed, As-found - data is before unit is adjusted and/or repaired, As-left - data is after adjusted and/or repaired was performed. The customer has sole responsibility for determination of in-/out-of-tolerance or compliance/noncompliance.

Measurement uncertainty calculated in accordance with the method described in the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM), for a confidence level of approximately 95 percent using a coverage factor of $k=2$.

Remarks: Coulombs, 2 pA, 20 pA and 200 pA not calibrated

Standards Used

<u>Asset #</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Description</u>	<u>Cal Date</u>	<u>Due Date</u>
000101	BIDDLE	72-6346-1	DECADE RESISTOR	24-Aug-2009	24-Aug-2010
000182	FLUKE	5700A/EP	CALIBRATOR	2-Nov-2009	2-Feb-2010
001505	HEWLETT-PACKARD	3458A/OPT 002	MULTIMETER	29-Jan-2009	29-Jan-2010
009779	ESI	SR1050-1M	RESISTANCE TRANSFER STANDARD	13-May-2009	13-May-2010
009829	ESI	SR1050-10M	RESISTANCE TRANSFER STANDARD	14-May-2009	14-May-2010
010748	ESI	SR1030 10 KOHM/STEP	STANDARD RESISTOR	30-Jul-2009	30-Jul-2010
010749	ESI	SR1030 100 KOHM/STEP	STANDARD RESISTOR	30-Jul-2009	30-Jul-2010

Walt Hill

Laboratory Manager

Clint Rowe

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

Work Order:	303091644	Mfr:	KEITHLEY	Technician:	CER
Asset No:	003400	Model:	617	Type Data:	As-left
Serial No:	0579628	Type:	ELECTROMETER	Cal Date:	30-Dec-09

Remarks: Coulombs, 2 pA, 20 pA and 200 pA not calibrated.

Function/Range	Test Point	TI Reading	Difference	± Test Limits	± Uncertainty	Result	%Limit
DC Amps	mA	mA	mA	mA	mA		
20 mA	19.000	19.000	0.000	0.030	0.0017	Pass	0%
2 mA	1.9000	1.8996	-0.0004	0.0033	0.00014	Pass	12%
	µA	µA	µA	µA	µA		
200 µA	190.00	190.00	0.00	0.30	0.019	Pass	0%
20 µA	19.000	19.000	0.000	0.030	0.0015	Pass	0%
2 µA	1.9000	1.8994	-0.0006	0.0033	0.00015	Pass	18%
	nA	nA	nA	nA	nA		
200 nA	190.00	190.01	0.01	0.49	0.023	Pass	2%
20 nA	19.000	19.000	0.000	0.049	0.0023	Pass	0%
2 nA	1.9000	1.9004	0.0004	0.0053	0.00024	Pass	8%
DCV	mV	mV	mV	mV	mV		
200 mVolt	190.00	189.99	-0.01	0.14	0.013	Pass	7%
	V	V	V	V	V		
2 Volt	1.9000	1.8999	-0.0001	0.0011	0.00013	Pass	9%
20 Volt	19.000	19.001	0.001	0.011	0.0013	Pass	9%
200 Volt	190.00	190.00	0.00	0.14	0.013	Pass	0%
Resistance	GΩ	GΩ	GΩ	GΩ	GΩ		
20 GOhm	9.995	9.945	-0.050	0.150	0.058	Pass	33%
2 GOhm	0.9993	0.9995	0.0002	0.0150	0.0058	Pass	1%
	MΩ	MΩ	MΩ	MΩ	MΩ		
200 MOhm	99.99	99.99	0.00	0.31	0.018	Pass	1%
20 MOhm	9.999	9.997	-0.002	0.026	0.0012	Pass	7%
2 MOhm	0.9999	0.9998	-0.0001	0.0026	0.00055	Pass	3%
	kΩ	kΩ	kΩ	kΩ	kΩ		
200 kOhm	99.99	100.00	0.01	0.26	0.013	Pass	2%
20 kOhm	9.999	9.999	0.000	0.016	0.0013	Pass	2%
2 kOhm	0.9999	1.0007	0.0008	0.0021	0.00013	Pass	36%
Voltage Source	V	V	V	V	V		
	0.000	0.016	0.016	0.050	0.00019	Pass	32%
	1.000	1.015	0.015	0.052	0.00019	Pass	29%
	10.000	10.018	0.018	0.070	0.00010	Pass	26%
	25.000	25.018	0.018	0.100	0.00096	Pass	18%
	50.000	50.019	0.019	0.150	0.00096	Pass	12%
	100.000	100.014	0.014	0.250	0.00096	Pass	6%

END OF REPORT