

KEITHLEY

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(216) 248-0400
Telefax: 248-6168

Certificate of Calibration


Model 614 Serial No. 0555368 Date 9-13-93

This notification serves to certify that the unit described above has been inspected and tested in accordance with specifications published by Keithley Instruments, Inc.

The accuracy and calibration of this instrument are traceable through reference standards that are compared, at planned intervals, to national standards maintained by the National Institute of Standards and Technology (NIST), by comparison to natural physical constants or self-calibrating ratio type measurements.

The measurement standards which support this calibration are calibrated on a schedule to maintain required accuracy level. Applicable NIST Test Report numbers are listed below:

DC Voltage: 250045
AC Voltage: 238764
Resistance: 247956
Temperature: 246568
Capacitance: 246592
Frequency: WWVB



Edward T. Kifer
Quality Assurance Manager

S O U T H W E S T R E S E A R C H I N S T I T U T E

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION

Issued to: DIV20 B57 NARASI SRIDHAR

Device No: 2792

Manufacturer: KEITHLEY

Model: 614

Nomenclature: ELECTROMETER

Serial Number: 0555368

SwRI No: NONE

Cal interval 6 Mo.

Remarks

Accuracy: MFGR

Procedure: MFGR

ENVIRONMENT

Temperature: 74 Humidity: 30 Location: ROTHE DEVELOPMENT, INC.

CONCLUSION

Tolerance/Remarks: Received into the system, introduced or reactivated

Calibrated by Rothe Development, Inc.
Rothe Certificate #32641

Calibration was in accord with requirements of MIL-STD-45662A. Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

Signed Umceat Monle for J.B.P.

Calibration Date: 11/11/93

Cal interval: 6 Months

Record Number: 00012631

Next Calibration Due: 05/11/94



Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

CHARGE # 107

CONTROL # 114 - 17876

WORK ORDER # 40630

RECEIVED FROM Southwest Research Institute

(5) DATE 10/28/93

ADDRESS 6220 Culebra, Bldg. 68/Division 5
San Antonio, TX 78284

PHONE# 684-5111 + 2702

CONTACT (NAME) Mr. Jim Patterson

FAX# 684-3133

PURCHASE ORDER # 03602/ST8226858/205704041

CUSTOMER COMMENTS N/T BEFORE & AFTER DATA OUT OF SPEC ITEM

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

ACCES.
RCVD.

Manual, Tri
Axial Cable

☒ REPAIR
☐ OPERATIONAL CHECK
☒ CALIBRATION

CALIBRATION DATE 11 Nov 93

CALIBRATION
INTERVAL

DATE DUE 11 May 94

☒ RECEIVED IN SPECS.
☐ RECEIVED INOPERATIVE
☐ RECEIVED OUT OF SPECS.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST	ROTHE TECH.	OUR P.O. #
R120	1	R2-305-10M	Res	N/C	PJS	
					REPAIR LABOR HRS.	SERVICE CODE
					N/C	F
					PARTS TOTAL	
					REPAIR LABOR	
					SHIPPING	
					TEAR DOWN CHARGE	
					CALIBRATION	92 50
					TAX	
					TOTAL	92 50

TR #'s 20, 13, 75, 235

COMMENTS

WORK PERFORMED:

All MR ranges were reading .2% high.
All NA ranges were reading .2% low.
Replaced range resistor R120 corrected
error. All readings were within specs before
repair but error was not normal for unit.
Part was supplied by Keithley at no cost.

TEMP. 74 °F

R.H. 30 %

SPECS: MFG RDI

PROCEDURE: MFG RDI OTHER

RDI 2002

SHIP VIA: DATE:

RECEIVED BY:



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

32641

CAL DATE: 11/11/93

DUE DATE: 05/11/94

ISSUED TO: Southwest Research Institute (5)
6220 Culebra, Bldg. 68/Division 5
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

CONTROL: 114 - 17876

TYPE Electrometer

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 40630

CUSTOMER PO #: 03602/ST#226858/205704041

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 74°F, Relative Humidity 30%

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfg	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	08/27/93	3	11/27/93
TR 13	8860A	FLUKE	3335024	DMM	07/27/93	6	01/27/94
TR 75	NMN	JRL	75	RESISTANCE BOX	05/28/93	12	05/28/94
TR 235	6500A	GUILDLINE	59660	TERAOhmmeter	07/01/93	12	07/01/94

----- Test Report Numbers -----
DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 250839
TEMP NIST TEST# 248798
Hz WWVB Transmission

INSPECTED BY
COMMENTS:

Janna Grauna

S O U T H W E S T R E S E A R C H I N S T I T U T E

Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION

Issued to: DIV20 B57 NARASI SRIDHAR

Device No: 2792

Manufacturer: KEITHLEY

Model: 614

Nomenclature: ELECTROMETER

Serial Number: 0555368

SwRI No: NONE

Cal interval 6 Mo.

Remarks

Accuracy: MFGR

Procedure: MFGR

ENVIRONMENT

Temperature: 72 Humidity: 37 Location: ROTHE DEVELOPMENT, INC.

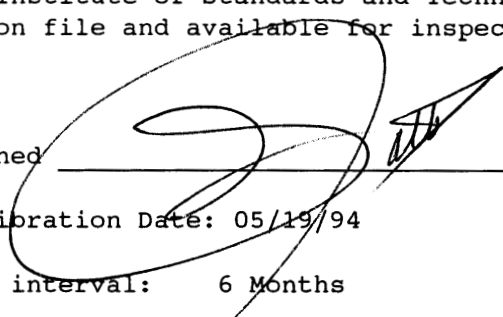
CONCLUSION

Tolerance/Remarks: Received in tolerance, minor adjustments/repairs made

Calibrated by Rothe Development.

Certificate #34871

Calibration was in accord with requirements of MIL-STD-45662A. Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

Signed 

Calibration Date: 05/19/94

Cal interval: 6 Months

Record Number: 00014076

Next Calibration Due: 11/19/94



Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

CHARGE # 107

CONTROL # 114 - 17876

WORK ORDER # 43380

RECEIVED FROM Southwest Research Institute

(5) DATE 05/16/94

ADDRESS 6220 Culebra, Bldg. 68/Division 5
San Antonio, TX 78284

PHONE# 684-5111 * 2702

CONTACT (NAME) Mr. Jim Patterson

FAX# 684-3133

PURCHASE ORDER # 03602/ST#236319 20-0760

CUSTOMER COMMENTS N/T BEFORE & AFTER DATA OUT OF SPEC ITEM

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

ACCES.
RCVD.

☐ REPAIR
☐ OPERATIONAL CHECK
☒ CALIBRATION

CALIBRATION DATE 19 May 94

CALIBRATION
INTERVAL

DATE DUE 19 Nov 94

6 mo.

☒ RECEIVED IN SPECS.
☐ RECEIVED INOPERATIVE
☐ RECEIVED OUT OF SPECS.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST	ROTHE TECH.	OUR P.O. #
					PJS	
					REPAIR LABOR HRS.	SERVICE CODE
						12
					PARTS TOTAL	
					REPAIR LABOR	
					SHIPPING	
					TEAR DOWN CHARGE	
					CALIBRATION	92.50
					TAX	
					TOTAL	92.50

TR #'s 20, 75, 255

COMMENTS

WORK PERFORMED:

Cal Data Taken - minor adjustment
made to improve readings.

CFL

TEMP. 72 °F

SPECS: MFG RDI

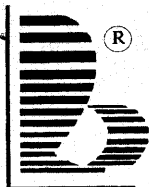
R.H. 37 %

PROCEDURE: MFG RDI OTHER

RDI 2002

SHIP VIA: _____ DATE: _____

RECEIVED BY: _____



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

34871

CAL DATE: 05/19/94

DUE DATE: 11/19/94

ISSUED TO: Southwest Research Institute
6220 Culebra, Blds. 68/Division 5
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

CONTROL: 114 - 17876

TYPE Electrometer

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 43380

CUSTOMER PO #: 03602/ST# /

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 72°F, Relative Humidity 37%.

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfg	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	02/25/94	3	05/25/94
TR 75	NMM	JRL	75	RESISTANCE BOX	05/03/94	12	05/03/95
TR 235	6500A	GUILDLINE	59660	TERAOhMETER	07/01/93	12	07/01/94

Test Report Numbers

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 250839
TEMP NIST TEST# 251316
Hz MMVB Transmission

INSPECTED BY
COMMENTS:

Jon A. Mendoza

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : KEITHLEY 614

CUSTOMER : SWRT
 WO NUMBER : 43380
 SERIAL : 055368

DATE : 19 May 94
 TECH : PJS
 INST NO : 17876

CAL DATA TAKEN

INCOMING
 OUTGOING ✓

CONDITION

IN TOLERANCE ✓
 OUT OF TOLERANCE

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 MV	-0.00002	<u>-0.06001</u>	+0.00002
	+190 MV	+1.8983	<u>.18999</u>	+1.9017
	-190 MV	-1.8983	<u>.19000</u>	-1.9017
2 V	+1.9 V	+1.8984	<u>1.9000</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8998</u>	-1.9016
20 V	+19 V	+18.984	<u>19.000</u>	+19.016
	-19 V	-18.984	<u>18.998</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 UA	+190 UA	+189.3	<u>190.0</u>	+190.7
200 NA	+190 NA	+189.0	<u>189.9</u>	+191.0
2000 PA	+1900 PA	+1871	<u>1900</u>	+1929

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 PA	NONE	-00.06	<u>+00.04</u>	+00.06

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>18.999</u>	± 11 C	<u>18.98</u>
200 K Ω		<u>189.99</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.001</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.975</u>	$\pm 2\%$	<u>9.97</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 NC	1.0 VDC INTO 1000 PFD	0.9500	<u>.9861</u>	1.0500

ROTHER DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : KEITHLEY 614

CUSTOMER : SWRI
 WO NUMBER : 43380
 SERIAL : 0555368

DATE : 19 May 94
 TECH : PJS
 INST NO : 17876

CAL DATA TAKEN

INCOMING ✓
 OUTGOING _____

CONDITION

IN TOLERANCE ✓
 OUT OF TOLERANCE _____

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 MV	-0.00002	<u>-0.00001</u>	+0.00002
	+190 MV	+1.8983	<u>.18998</u>	+1.9017
	-190 MV	-1.8983	<u>.18997</u>	-1.9017
2 V	+1.9 V	+1.8984	<u>1.8998</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8996</u>	-1.9016
20 V	+19 V	+18.984	<u>18.997</u>	+19.016
	-19 V	-18.984	<u>18.995</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 UA	+190 UA	+189.3	<u>190.0</u>	+190.7
200 NA	+190 NA	+189.0	<u>189.8</u>	+191.0
2000 PA	+1900 PA	+1871	<u>1899</u>	+1929

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 PA	NONE	-00.06	<u>+00.04</u>	+00.06

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>18.999</u>	± 11 C	<u>18.98</u>
200 K Ω		<u>189.99</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.001</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.975</u>	$\pm 2\%$	<u>9.98</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 NC	1.0 VDC INTO 1000 PFD	0.9500	<u>.9862</u>	1.0500

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
12/09/94

Issued to: NARASI SRIDHAR DIV20 ,B57
Manufacturer: KEITH
Nomenclature: ELECTROMETER
Serial Number: 0555368

Asset Number: 002792
Model Number: 614
SwRI Capital Number: NONE

ENVIRONMENTAL CONDITIONS

Temperature: 73.0F

Relative Humidity: 27 %

CALIBRATION INFORMATION

Location: ROTHE
Procedure Number: MFG SPEC.
Remarks: ROTHE CERT. #36963

Technician: 8216
Accuracy: MFGR SPECS
Received IN Tolerance

Calibration was in accordance with requirements of MIL-STD-45662A.
Measurements are traceable to the National Institute of Standards and Tech-
nology. Inspection and test data are on file and available for inspection.

STANDARDS USED FOR CERTIFICATION

Asset #	Serial #	Mfg	Model #	Nomenclature	Cal Date	Int. Cal Due
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VENDOR

Certified by :



Certificate#: 15790

Calibration Date: 11/30/94
Interval: 6 months
Next Calibration Due: 05/30/95



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

36963

CAL DATE: 11/30/94

DUE DATE: 05/30/95

ISSUED TO: Southwest Research Institute
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

CONTROL: 114 - 17876
TECHNICIAN #: 4
SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER #: 45897
CUSTOMER PO #: 03602/ST244883/

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 73°F, Relative Humidity 27%

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfg	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	11/25/94	3	02/25/95
TR 75	NMN	JRL	75	RESISTANCE BOX	05/03/94	12	05/03/95
TR 235	6500A	GUILDLINE	59660	TERAOhMETER	08/24/94	12	08/24/95

----- Test Report Numbers -----
DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 250839
TEMP NIST TEST# 251316
Hz MWB Transmission

INSPECTED BY
COMMENTS:

Jose A Mendez

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : KEITHLEY 614

CUSTOMER : SWRI
 WD NUMBER : 45897
 SERIAL : 0555368

DATE : 30 Nov 94
 TECH : PJS
 INST NO : 17876

CAL DATA TAKEN

INCOMING ✓
 OUTGOING ✓

CONDITION

IN TOLERANCE ✓
 OUT OF TOLERANCE

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 MV	-0.00002	<u>-.00001</u>	+0.00002
	+190 MV	+1.8983	<u>.18998</u>	+1.9017
	-190 MV	-1.8983	<u>.18998</u>	-1.9017
2 V	+1.9 V	+1.8984	<u>1.8999</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8998</u>	-1.9016
20 V	+19 V	+18.984	<u>18.999</u>	+19.016
	-19 V	-18.984	<u>18.997</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 UA	+190 UA	+189.3	<u>190.0</u>	+190.7
200 NA	+190 NA	+189.0	<u>189.9</u>	+191.0
2000 PA	+1900 PA	+1871	<u>1899</u>	+1929

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 PA	NONE	-00.06	<u>00.04</u>	+00.06

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>18.999 K</u>	± 11 C	<u>18.98</u>
200 K Ω		<u>189.99 K</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.001 M</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.979 G</u>	$\pm 2\%$	<u>9.95</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 NC	1.0 VDC INTO 1000 PFD	0.9500	<u>0.9872</u>	1.0500



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

39172

CAL DATE: 06/15/95*

DUE DATE: 12/15/95

ISSUED TO: Southwest Research Institute (30)
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

CONTROL: 114 - 17876

TECHNICIAN #: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 48544

CUSTOMER PO #: 03602/ST266168/20-5704-42

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 72°F, Relative Humidity 36%.

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfgr	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	05/22/95	3	08/22/95
TR 235	6500A	GUILDLINE	59660	TERAOhMETER	08/24/94	12	08/24/95

----- Test Report Numbers -----

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
DMM NIST TEST# 250839
TEMP NIST TEST# 251316
Hz WWVB Transmission

INSPECTED BY
COMMENTS:

Joe A. Mendez

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA : KEITHLEY 614

CUSTOMER : SURTI
 WO NUMBER : 48544
 SERIAL : 0555368

DATE : 15 Jun 95
 TECH : PJS
 INST NO : 17876

CAL DATA TAKEN

INCOMING ✓
 OUTGOING ✓

CONDITION

IN TOLERANCE ✓
 OUT OF TOLERANCE

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 MV	-.00002	<u>.00000</u>	+0.00002
	+190 MV	+.18983	<u>.18998</u>	+1.9017
	-190 MV	-.18983	<u>.18997</u>	-.19017
2 V	+1.9 V	+1.8984	<u>1.8999</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8997</u>	-1.9016
20 V	+19 V	+18.984	<u>18.998</u>	+19.016
	-19 V	-18.984	<u>18.996</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 UA	+190 UA	+189.3	<u>190.0</u>	+190.7
200 NA	+190 NA	+189.0	<u>189.9</u>	+191.0
2000 PA	+1900 PA	+1871	<u>1901</u>	+1929

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 PA	NONE	-00.06	<u>00.03</u>	+00.06

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 k</u>	± 11 C	<u>18.98</u>
200 K Ω		<u>190.0 k</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.98 G</u>	$\pm 2\%$	<u>9.98</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 NC	1.0 VDC INTO 1000 PFD	0.9500	<u>.9863</u>	1.0500

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
06/16/95

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer: KEITH
Nomenclature: ELECTROMETER
Serial Number: 0555368
Notes:

Asset Number: 002792
Model Number: 614
SwRI/Div. I.D. #: NONE

ENVIRONMENTAL CONDITIONS

Temperature: 72.0F

Relative Humidity: 36%

CALIBRATION INFORMATION

Procedure Number: MFG SPEC.
Remarks: CAL BY ROTHE DEV.
CERT # 39172

Accuracy: MFGR SPECS
Received IN Tolerance

Calibration was in accordance with requirements of MIL-STD-45662A.
Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

STANDARDS USED FOR CERTIFICATION

Asset #	Serial #	Mfg	Model #	Nomenclature	Cal Date	Int. Cal Due
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VENDOR

Certified by : _____

Calibration Date: 06/15/95
Interval: 6 months
Next Calibration Due: 12/15/95

Certificate#: 17610



Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

CHARGE # 107

CONTROL # 114 - 17876

WORK ORDER # 48544

CUSTOMER

RECEIVED FROM Southwest Research Institute (30) DATE 06/04/95
ADDRESS 6220 Culebra, Bldg. 64/Division 30 PHONE# 684-5111 * 2702
San Antonio, TX 78284
CONTACT (NAME) Mr. Jim Patterson FAX# 522-3692
PURCHASE ORDER # 03602/ST266168/20-5704-42
CUSTOMER COMMENTS N/T BEFORE & AFTER DATA OUT OF SPEC ITEM

MFG Keithley
MODEL 614
SERIAL # 0555368
TYPE Electrometer
ACCES. RCVD. Lead

☐ REPAIR
☐ OPERATIONAL CHECK
☒ CALIBRATION

CALIBRATION DATE 15 Jun 95
DATE DUE 15 Dec 95

CALIBRATION
INTERVAL 6 mo.

☒ RECEIVED IN SPECS.
☐ RECEIVED INOPERATIVE
☐ RECEIVED OUT OF SPECS.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST	ROTHE TECH.	OUR P.O. #
					PJS	
					REPAIR LABOR HRS.	SERVICE CODE
						J
					PARTS TOTAL	
					REPAIR LABOR	
					SHIPPING	
					TEAR DOWN CHARGE	
					CALIBRATION	97.50
					TAX	
					TOTAL	97.50

TR #'s 20, 235

COMMENTS

WORK PERFORMED:

Cal Date Taken -

CRAZ

JIM PATTERSON

TEMP. 72 °F

SPECS: MFG RDI

R.H. 36 %

PROCEDURE: MFG RDI OTHER

RDI 2002

SHIP VIA: DATE: RECEIVED BY:

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
02/28/96

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer/Model: KEITH/614
Nomenclature: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792
Notes:

ENVIRONMENTAL CONDITIONS

Temperature: 73.0F

Relative Humidity: 36%

CALIBRATION INFORMATION

Procedure Number: MFG SPEC.
Remarks: CAL BY ROTHE DEV., SAN ANTONIO, TX
CERT# 42342

Accuracy: MFGR SPECS
Received IN Tolerance

Calibration was in accordance with requirements of MIL-STD-45662A.
Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

STANDARDS USED FOR CERTIFICATION

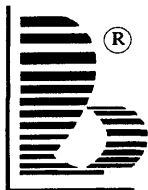
Asset #	Serial #	Mfg	Model #	Nomenclature	Cal Date	Int. Cal Due
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VENDOR

Certified by : _____

Calibration Date: 02/27/96
Interval: 6 months
Next Calibration Due: 08/27/96

Certificate#: 20183



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

42342

CAL DATE: 02/27/96

DUE DATE: 08/27/96

ISSUED TO: Southwest Research Institute (30)
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

CONTROL: 114 - 17876

TECHNICIAN #: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 52213

CUSTOMER PO #: 03602/ST278281/20-5708573

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 73°F, Relative Humidity 36%

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfg	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	12/04/95	3	03/04/96
TR 235	6500A	GUILDLINE	59660	TERAOhMETER	09/01/95	12	09/01/96
TR 75	NMN	JRL	75	RESISTANCE BOX	07/11/95	12	07/11/96

----- Test Report Numbers -----

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 255975
TEMP NIST TEST# 253806
Hz WWVB Transmission

INSPECTED BY Juan A Mendez
COMMENTS:

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER:	<u>SW RT</u>	DATE:	<u>26 Feb 96</u>
WO NUMBER:	<u>S2213</u>	TECH:	<u>PJS</u>
SERIAL:	<u>0555368</u>	INST NO:	<u>17876</u>
CUST ID:	<u></u>		

CALIBRATION DATA TAKEN

INCOMING ✓
OUTGOING

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
OUT OF TOLERANCE

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	+ <u>00.03</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	+.18983	<u>.18997</u>	+.19017
	-190 mV	-.18983	<u>.18996</u>	-.19017
2 V	+1.9 V	+1.8984	<u>1.8997</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8996</u>	-1.9016
20 V	+19 V	+18.984	<u>18.996</u>	+19.016
	-19 V	-18.984	<u>18.995</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	+190 uA	+189.3	<u>190.0</u>	+190.7
200 nA	+190 nA	+189.0	<u>189.9</u>	+191.0
2000 pA	+1900 pA	+1871	<u>1902</u>	+1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.97</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.6</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>9.99</u>
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>9.96</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9869</u>	1.0500

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 52213
 SERIAL: 0555368
 CUST ID: _____

DATE: 27 Feb 96
 TECH: PJS
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING _____
 OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
 OUT OF TOLERANCE _____

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.02</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	+.18983	<u>.19001</u>	+.19017
	-190 mV	-.18983	<u>.19000</u>	-.19017
2 V	+1.9 V	+1.8984	<u>1.9000</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8998</u>	-1.9016
20 V	+19 V	+18.984	<u>19.000</u>	+19.016
	-19 V	-18.984	<u>18.998</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	+190 uA	+189.3	<u>190.0</u>	+190.7
200 nA	+190 nA	+189.0	<u>189.9</u>	+191.0
2000 pA	+1900 pA	+1871	<u>1900</u>	+1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.97</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>9.99</u>
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>10.00</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9876</u>	1.0500

SOUTHWEST RESEARCH INSTITUTE
Department of Quality Assurance
Calibration Laboratory

CERTIFICATE OF CALIBRATION
02/28/96

Issued to: DARRELL DUNN DIV20 ,B57
Manufacturer/Model: KEITH/614
Nomenclature: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792
Notes:

ENVIRONMENTAL CONDITIONS

Temperature: 73.0F

Relative Humidity: 36%

CALIBRATION INFORMATION

Procedure Number: MFG SPEC.
Remarks: CAL BY ROTHE DEV., SAN ANTONIO, TX
CERT# 42342

Accuracy: MFGR SPECS
Received IN Tolerance

Calibration was in accordance with requirements of MIL-STD-45662A.
Measurements are traceable to the National Institute of Standards and Technology. Inspection and test data are on file and available for inspection.

STANDARDS USED FOR CERTIFICATION

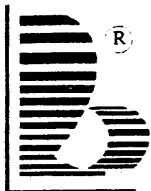
Asset #	Serial #	Mfg	Model #	Nomenclature	Cal Date	Int. Cal Due
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VENDOR

Certified by : _____

Calibration Date: 02/27/96
Interval: 6 months
Next Calibration Due: 08/27/96

Certificate#: 20183



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

42342

CAL DATE: 02/27/95

DUE DATE: 08/27/96

ISSUED TO: Southwest Research Institute (30)
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
654-5111 x 2702

MFG Keithley

MODEL 614

SERIAL # 0553368

TYPE Electrometer

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

CONTROL: 114 - 17876

TECHNICIAN #: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 52213

CUSTOMER PO #: 03602/ST278281/20-5703573

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 73°F, Relative Humidity 36%

Test Report Number and Calibration Standards Used

Ref #	Model #	Mfg	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	12/04/95	3	03/04/96
TR 105	6500A	QUILLLINE	59660	TERAOhmMETER	09/01/95	12	09/01/96
TR 75	NIM	JRL	75	RESISTANCE BOX	07/11/95	12	07/11/96

----- Test Report Numbers -----

ICV FLUKE CERT# DH70
ACV FLUKE CERT# DP00
JHM NIST TEST# 255975
TEAF NIST TEST# 253806
AC WWVB Transmission

INSPECTED BY
COMMENTS:

Jon A Mendez

ROTHER DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 52213
 SERIAL: 0555368
 CUST ID: _____

DATE: 26 Feb 96
 TECH: PJS
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING ✓
 OUTGOING _____

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
 OUT OF TOLERANCE _____

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	+ <u>00.03</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	+.18983	<u>.18997</u>	+.19017
	-190 mV	-.18983	<u>.18996</u>	-.19017
2 V	+1.9 V	+1.8984	<u>1.8997</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8996</u>	-1.9016
20 V	+19 V	+18.984	<u>18.996</u>	+19.016
	-19 V	-18.984	<u>18.995</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	+190 uA	+189.3	<u>190.0</u>	+190.7
200 nA	+190 nA	+189.0	<u>189.9</u>	+191.0
2000 pA	+1900 pA	+1871	<u>1902</u>	+1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.97</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.6</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>9.99</u>
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>9.96</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9869</u>	1.0500

ROTHER DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 52213
 SERIAL: 0555368
 CUST ID: _____

DATE: 27 Feb 96
 TECH: PJS
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING _____
 OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
 OUT OF TOLERANCE _____

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.02</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	+.18983	<u>.19001</u>	+.19017
	-190 mV	-.18983	<u>.19000</u>	-.19017
2 V	+1.9 V	+1.8984	<u>1.9000</u>	+1.9016
	-1.9 V	-1.8984	<u>1.8998</u>	-1.9016
20 V	+19 V	+18.984	<u>19.000</u>	+19.016
	-19 V	-18.984	<u>18.998</u>	-19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	+190 uA	+189.3	<u>190.0</u>	+190.7
200 nA	+190 nA	+189.0	<u>189.9</u>	+191.0
2000 pA	+1900 pA	+1871	<u>1900</u>	+1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.97</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.7</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>9.99</u>
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>10.00</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9876</u>	1.0500



Rothe Development, Inc.

4614 SINCLAIR RD. SAN ANTONIO, TEXAS 78222-2099

210-648-3131 FAX: 210-648-4091

METROLOGY SERVICES DIVISION
PRECISION MEASUREMENT EQUIPMENT LABORATORY
TRACEABLE TO NIST

CHARGE # 107

CONTROL # 114 - 17876

WORK ORDER # 52213

RECEIVED FROM Southwest Research Institute

(30) DATE 02/14/96

MFG Keithley

ADDRESS 6220 Culebra, Bldg. 64/Division 30

PHONE# 684-5111 * 2702

MODEL 614

San Antonio, TX 78264

CONTACT (NAME) Mr. Jim Patterson

FAX# 522-3692

SERIAL # 0555368

PURCHASE ORDER # 03602/ST278281/20-5708573

TYPE Electrometer

CUSTOMER COMMENTS N/T BEFORE & AFTER DATA OUT OF SPEC ITEM

ACCES. RCVD. Cable

- ☐ REPAIR
☐ OPERATIONAL CHECK
☒ CALIBRATION

CALIBRATION DATE 27 Feb 96

CALIBRATION INTERVAL

- ☒ RECEIVED IN SPECS.
☐ RECEIVED INOPERATIVE
☐ RECEIVED OUT OF SPECS.

DATE DUE 27 Feb 97

6 MO.

CKT REF #	QTY.	MFG PART #	DESCRIPTION	COST	ROTHE TECH.	OUR P.O. #
					PJS	
					REPAIR LABOR HRS.	SERVICE CODE
						1K
					PARTS TOTAL	
					REPAIR LABOR	
					SHIPPING	
					TEAR DOWN CHARGE	
					CALIBRATION	97.50
					TAX	
					TOTAL	97.50

R #'s 20, 235, 75

COMMENTS

WORK PERFORMED:

Cal Data Taken - minor adjustment made to improve readings

CAC

TEMP. 73 °F

SPECS: MFG RDI

H. 36 %

PROCEDURE: MFG RDI OTHER

RDI 2002

SHIP VIA: DATE:

RECEIVED BY:



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

4 September 1996

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITH 614
Description: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792

Environmental Conditions

Temperature: 73.0 Deg. F

Humidity: 38%

Calibration Information

Calibration was in accordance with requirements of MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Measurements are traceable to the National Institute of Standards and Technology (NIST). This report may not be reproduced except in full without written approval of the originator. Inspection and test data are on file and available for inspection.

Calibration Date: 30 Aug 96

Calibration Procedure: MFG

Interval: 6 months

Accuracy: MFGR SPECS

Next Calibration Due: 1 Mar 97

Received: In Tolerance

Remarks: CAL BY ROTHE DEVELOPMENT, SAN ANTONIO, TX.
CERT. #44749

Certificate # 22373

Signed: 

LAST PAGE OF REPORT
Total Pages Printed: 1



Rothe Development Inc.

Metrology Services Division

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 210-648-3131 FAX 210-648-4091

Certificate of Calibration

47239

CAL DATE: 03/13/97

DUE DATE: 09/13/97

ISSUED TO: Southwest Research Institute (30)
6220 Culebra, Bldg. 64/Division 30
San Antonio, TX 78284
684-5111 * 2702

MFG Keithley

MODEL 614

SERIAL # 0555368

TYPE Electrometer

CONTROL: 103 - 17876

TECHNICIAN #: 6

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER #: 58417

CUSTOMER PO #: 02127/ST297061/20-5708561

RECEIVED IN-SPECS ☒
OUT-OF-SPECS ☐

All Calibration measurements performed at ROTHE DEVELOPMENT INC. METROLOGY SERVICES meet the requirements of MIL-STD-45662A, and are traceable to the National Institute of Standards and Technology through Primary NIST Calibration or Secondary Calibration performed by other Metrological facilities. Ambient conditions: Temperature 74°F, Relative Humidity 34%

Test Report Number and Calibration Standards Used

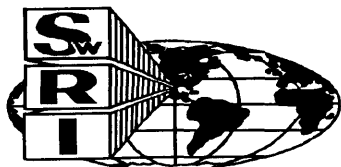
Ref #	Model #	Mfgr	Serial #	Description	Cal Date	Int	Cal Due
TR 20	5700A	FLUKE	4605002	CALIBRATOR	03/03/97	3	06/03/97
TR 75	NMN	JRL	75	RESISTANCE BOX	08/30/96	12	08/30/97
TR 235	6500A	GUILDLINE	59660	TERADHMETER	09/17/96	12	09/17/97

----- Test Report Numbers -----

DCV FLUKE CERT# DH70
ACV FLUKE CERT# DP30
OHM NIST TEST# 255975
TEMP NIST TEST# 8980
Hz WWVB Transmission

INSPECTED BY
COMMENTS:

NOTE: The collective uncertainty of the measurement standards does not exceed 25%
(\pm)=4:1 of the instrument specification tested unless noted in COMMENTS section.



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

14 March 1997

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 614
Description: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792

Environmental Conditions

Temperature: 74.0 Deg. F Humidity: 34%

Calibration Information

Calibration was in accordance with requirements of MIL-STD-45662A and ANSI/NC SL Z540-1-1994. Measurements are traceable to the National Institute of Standards and Technology (NIST). This report may not be reproduced except in full without written approval of the originator. Inspection and test data are on file and available for inspection.

Calibration Date: 13 Mar 97 Calibration Procedure: MFG

Interval: 6 months Accuracy: MFGR SPECS

Next Calibration Due: 13 Sep 97 Received: In Tolerance

Remarks: CALIBRATED BY ROTHE DEV., SAN ANTONIO, TX.
CERT. #47239.

Certificate # 24576

Signed: 

LAST PAGE OF REPORT
Total Pages Printed: 1



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

17 October 1997

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 614
Description: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792

Environmental Conditions

Temperature: 73.00 Deg. F Humidity: 34 % RH

Calibration Information

Calibration was in accordance with requirements of MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Measurements are traceable to the National Institute of Standards and Technology (NIST). This report may not be reproduced except in full without written approval of the originator. Inspection and test data are on file and available for inspection.

The uncertainty of the calibration was sufficient to determine that the instrument met the manufacturer's specifications.

Calibration Date: 16 Oct 97 Calibration Procedure: MFG
Interval: 12 months Uncertainty: MFG SPECS
Next Calibration Due: 16 Oct 98 Received: In Tolerance

Remarks: CALIBRATED BY ROTHE DEV., SAN ANTONIO, TX.
ROTHE CERT #49976. CAL INT EXT TO 12 MOS.

Standards Used

Asset	MFR	Model	Description	Serial No.	Due Cal
VENDOR					

Signed: _____

Title: _____

LAST PAGE OF REPORT
Total Pages Printed: 1

Certificate # 27164



Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238
(210) 522-5215
Department of Quality Assurance
Calibration Laboratory

Certificate of Calibration

9 November 1998

Issued to: DARRELL DUNN DIV20 B57
Manufacturer/Model: KEITHLEY 614
Description: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

Ambient Conditions: Temperature 72 Degrees Fahrenheit Humidity 32 % RH

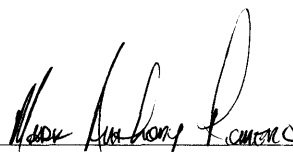
Calibration Date: 6 Nov 98 **Calibration Procedure** MFG

Condition as Received: IN TOLERANCE

Condition as Released: IN TOLERANCE

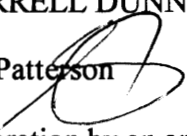
Remarks: CALIBRATED BY ROTHE DEV., SAN ANTONIO, TX.

Comments: ROTHE CERT. #55170.


Mark Romero / Clerk

**SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM**

December 27, 1999

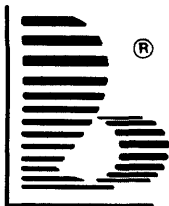
To: DARRELL DUNN DIV20 B57
From: Jim Patterson 
Subject: Calibration by an approved supplier

Manufacturer/Model: KEITHLEY 614
Description: ELECTROMETER
Serial Number: 0555368
Asset Number: 002792
Calibration Due: December 26, 2000
Remarks: ROTHE CERTIFICATE NO.: 17876:946195038.

Supplier: ROTHE DEVELOPMENT, INC., SAN ANTONIO, TX

The above item was sent to an approved supplier who is listed on the SwRI Approved Suppliers List (ASL). This supplier is qualified to supply a product or service in support of project activities that require the use of approved suppliers. Please notify Mark Romero, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 1



CERT. NUMBER:
17876:946195038

ROTHE DEVELOPMENT, INC.
METROLOGY SERVICES DIVISION

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

CERTIFICATE OF CALIBRATION

ISSUED TO: Southwest Research Institute MFG: Keithley
(30) MODEL: 614
6220 Culebra NOMEN: Electrometer
San Antonio, TX 78284 S/N: 0555368
CUST. ID: CAL DATE: 12/26/1999
DUE DATE: 12/26/2000

CONTROL NO.: 103 - 17876

TECHNICIAN: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER: 75610

CUSTOMER P.O.: 02127/ST359500/20.00760.

RECEIVED CONDITION: IN TOLERANCE

RETURNED CONDITION: IN TOLERANCE

CALIBRATION PERFORMED AT: RDMSD

CALIBRATION INTERVAL: 12Mo.

TEMPERATURE: 72.0 °F

RELATIVE HUMIDITY: 33 %

DATE RECEIVED: 11/22/1999

COMMENTS:

ATTACHMENTS:

All Calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI/NCSL Z540-1-1994, ISO/IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR_≥4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	3/23/2000
258	FLUKE	5725A	6585002	3/23/2000
235	GUILDLINE	6500A	59660	10/26/2000
186	GEN RAD	1689	7241583008	8/17/2000

APPROVED BY: *Actu J. Stemmer*

☒ CMS

☐ QCO

DATE:

12/27/1999


RDMSD 1001
08/97

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**SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM**

April 9, 2003

To: DARRELL DUNN DIV20 B57

From: Walt Hill, Metrology Group Leader
Institute Calibration Laboratory 

Subject: Status of Calibration Supplier

Manufacturer/Model: KEITHLEY 614

Description: ELECTROMETER

Serial Number: 0555368

Asset Number: 002792

Work Order Number: 444053037

Date Calibrated: April 8, 2003

Supplier: ROTHE DEVELOPMENT, SAN ANTONIO TX - AUDIT - 648-3131

Remarks: Rothe Cert # 1786:1049798301

☒ Supplier is on the Approved Suppliers List (ASL).

☐ Supplier is not on the Approved Suppliers List.

☐ Calibration is ISO 17025 accredited.

☒ Calibration is not ISO 17025 accredited.

☐ There is no known supplier to meet ISO 17025 accreditation at this time.

Please notify the Institute Calibration Laboratory, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 5



CERT. NUMBER:
17876:1049798301

ROTHE DEVELOPMENT, INC.
METROLOGY SERVICES DIVISION
4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

CERTIFICATE OF CALIBRATION

ISSUED TO: Southwest Research Institute MFG: Keithley
(30) MODEL: 614 CAL DATE: 4/8/2003
6220 Culebra NOMEN: PROG ELECTROMETER DUE DATE: 4/8/2004
San Antonio, TX 78284 S/N: 0555368
CUST. ID: 2792

CONTROL NO.: 103 - 17876
TECHNICIAN: 4
SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER: 002027768
CUSTOMER P.O.: 01571R/ST408333/1.20.007
RECEIVED CONDITION: OUT OF TOLERANCE
RETURNED CONDITION: IN TOLERANCE

CALIBRATION PERFORMED AT: RDMSD
CALIBRATION INTERVAL: 12Mo.
TEMPERATURE: 72.0 °F
RELATIVE HUMIDITY: 35 %

DATE RECEIVED: 3/31/2003

COMMENTS:

ATTACHMENTS: CALIBRATION DATA 4 SHEETS

All Calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI/NC SL Z540-1-1994, ISO/IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR \geq 4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	6/25/2003
258	FLUKE	5725A	6585002	6/25/2003
75	JRL	NMN	75	1/8/2004
235	GUILDLINE	6500A	59660	12/19/2003



REGISTERED TO ISO 9002
CERTIFICATE NO. A9428

APPROVED BY: Peter J. Stemann

☒ CMS

☐ QCO

DATE

4/8/2003

RDMSD 1001
03/01

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1 OF 1

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 002027768
 SERIAL: 0555368
 CUST ID: 2792

DATE: 8 Apr 03
 TECH: PJS
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING _____
 OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
 OUT OF TOLERANCE _____

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.03</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	.18983	<u>.19000</u>	.19017
	-190 mV	.18983	<u>.19000</u>	.19017
2 V	+1.9 V	1.8984	<u>1.9000</u>	1.9016
	-1.9 V	1.8984	<u>1.8999</u>	1.9016
20 V	+19 V	18.984	<u>19.001</u>	19.016
	-19 V	18.984	<u>19.000</u>	19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	190 uA	189.3	<u>190.0</u>	190.7
200 nA	190 nA	189.0	<u>189.9</u>	191.0
2000 pA	1900 pA	1871	<u>1900</u>	1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.99</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.8</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.986</u>	± 2 %	<u>9.98</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9909</u>	1.0500

INST NO: 17876

DOC. DATE: 2/22/2001

2 OF 2

✓ INCOMING
OUTGOING

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 002027768
 SERIAL: 0555368
 CUST ID: 2792

DATE: 2 Apr 03
 TECH: PJS
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING ✓
 OUTGOING

CONDITION OF EQUIPMENT

IN TOLERANCE
 OUT OF TOLERANCE ✓ *

* For Battery operation only
 Battery Mode - unit in op.

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.03</u>	+00.06

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00001</u>	+.00002
	+190 mV	.18983	<u>.18995</u>	.19017
	-190 mV	.18983	<u>.18994</u>	.19017
2 V	+1.9 V	1.8984	<u>1.8994</u>	1.9016
	-1.9 V	1.8984	<u>1.8992</u>	1.9016
20 V	+19 V	18.984	<u>18.993</u>	19.016
	-19 V	18.984	<u>18.992</u>	19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	190 uA	189.3	<u>189.9</u>	190.7
200 nA	190 nA	189.0	<u>189.9</u>	191.0
2000 pA	1900 pA	1871	<u>1898</u>	1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.96</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.5</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>9.98</u>
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>9.95</u>

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9873</u>	1.0500

INST NO: 17876

DOC. DATE: 2/22/2001

2 OF 2

✓ INCOMING
OUTGOING

**SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM**

September 19, 2003

To: DARRELL DUNN DIV20 B57

From: Walt Hill, Metrology Group Leader
Institute Calibration Laboratory

Subject: Status of Calibration Supplier

Manufacturer/Model: KEITHLEY 614

Description: ELECTROMETER

Serial Number: 0555368

Asset Number: 002792

Work Order Number: 444055338

Date Calibrated: September 17, 2003

Supplier: ROTHE DEVELOPMENT, SAN ANTONIO TX - AUDIT - 648-3131

Remarks: Rothe Cert # 1786:1063795408

☒ Supplier is on the Approved Suppliers List (ASL).

☐ Supplier is not on the Approved Suppliers List.

☐ Calibration is ISO 17025 accredited.

☒ Calibration is not ISO 17025 accredited.

☐ There is no known supplier to meet ISO 17025 accreditation at this time.

Please notify the Institute Calibration Laboratory, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 3

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

DATE: 17 Sep 03
TECH: Latip H. Himmeh
INST NO: 17876

INCOMING	✓
OUTGOING	✓

IN TOLERANCE _____
OUT OF TOLERANCE

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.03</u>	+00.06

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002
	+190 mV	.18983	<u>.19001</u>	.19017
	-190 mV	.18983	<u>.19000</u>	.19017
2 V	+1.9 V	1.8984	<u>1.9001</u>	1.9016
	-1.9 V	1.8984	<u>1.9000</u>	1.9016
20 V	+19 V	18.984	<u>19.001</u>	19.016
	-19 V	18.984	<u>19.000</u>	19.016

RANGE	INPUT	MIN	READING	MAX
200 uA	190 uA	189.3	<u>190.0</u>	190.7
200 nA	190 nA	189.0	<u>190.0</u>	191.0
2000 pA	1900 pA	1871	<u>1899</u>	1929

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING
20 K Ω	(19)	<u>19.00 K</u>	± 11 C	<u>18.99</u>
200 K Ω		<u>190.0 K</u>	± 11 C	<u>189.8</u>
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>10.00</u>
20 G Ω	(10)	<u>9.986</u>	± 2 %	<u>9.98</u>

CHARGE ACCURACY

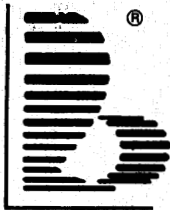
RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9875</u>	1.0500

INST NO: 17876

DOC. DATE: 2/22/2001

2 OF 2

☒ INCOMING
☒ OUTGOING



CERT. NUMBER:
17876:1063795408

ROTHE DEVELOPMENT, INC.
METROLOGY SERVICES DIVISION

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

CERTIFICATE OF CALIBRATION

ISSUED TO: Southwest Research Institute MFG: Keithley
(30) MODEL: 614 CAL DATE: 9/17/2003
6220 Culebra NOMEN: PROG ELECTROMETER DUE DATE:
San Antonio, TX 78284 S/N: 0555368
CUST. ID: 2792

CONTROL NO.: 103 - 17876
TECHNICIAN: 4
SPECIFICATIONS: MFG
PROCEDURE: MFG
WORK ORDER: 002032068
CUSTOMER P.O.: 01571R/ST417997/1.20.007
RECEIVED CONDITION: IN TOLERANCE
RETURNED CONDITION: IN TOLERANCE

CALIBRATION PERFORMED AT: RDMSD
CALIBRATION INTERVAL: 0
TEMPERATURE: 72.0 °F
RELATIVE HUMIDITY: 36 %

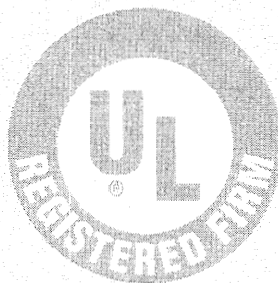
DATE RECEIVED: 9/15/2003

COMMENTS:

ATTACHMENTS: CALIBRATION DATA 2 SHEETS

All Calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI/NCSL Z540-1-1994, ISO/IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR≥4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	9/20/2003
258	FLUKE	5725A	6585002	9/20/2003
235	GUILDLINE	6500A	59660	12/19/2003



REGISTERED TO ISO 9002
CERTIFICATE NO. A9428

APPROVED BY:

Peter J. Stammen

☒ CMS

☐ QCO

DATE

9/18/2003

RDMSD 1001
03/01

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1 OF 1

**SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM**

March 22, 2004

To: DARRELL DUNN DIV20 B57

From: Walt Hill, Metrology Group Leader
Institute Calibration Laboratory

Subject: Status of Calibration Supplier

Manufacturer/Model: KEITHLEY 614

Description: ELECTROMETER

Serial Number: 0555368

Asset Number: 002792

Work Order Number: 444057986

Date Calibrated: March 19, 2004

Supplier: ROTHE DEVELOPMENT, SAN ANTONIO TX - AUDIT - 648-3131

Remarks: Rothe Cert # 17876:1079700217

☒ Supplier is on the Approved Suppliers List (ASL).

☐ Supplier is not on the Approved Suppliers List.

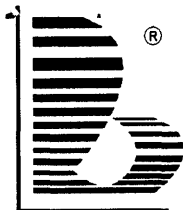
☐ Calibration is ISO 17025 accredited.

☒ Calibration is not ISO 17025 accredited.

☐ There is no known supplier to meet ISO 17025 accreditation at this time.

Please notify the Institute Calibration Laboratory, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 3



CERT. NUMBER: 17876:1079700217

Rothe Development, Inc.

METROLOGY SERVICES DIVISION

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

CERTIFICATE OF CALIBRATION

ISSUED TO: Southwest Research Institute (30)

6220 Culebra
San Antonio, TX 78284

MFG: Keithley

MODEL: 614

NOMEN: PROG ELECTROMETER

S/N: 0555368

CUST. ID: 2792

CAL DATE: 3/19/04

DUE DATE:

CONTROL NO: 103 - 17876

TECHNICIAN: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER: 002036148

CUSTOMER P.O.: 01571R/ST418541/1.20.00755.000

RECEIVED CONDITION: IN TOLERANCE

RETURNED CONDITION: IN TOLERANCE

COMMENTS:

ATTACHMENTS: CALIBRATION DATA 2 SHEETS

CALIBRATION PERFORMED AT: RDMSD

CALIBRATION INTERVAL: 0

TEMPERATURE: 72.0°F

RELATIVE HUMIDITY: 35%

DATE RECEIVED: 3/10/04

All calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI / NCSL Z540-1-1994, ANSI / ISO / IEC 17025, ISO / IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR ≥ 4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	4/12/2004
258	FLUKE	5725A	6585002	4/12/2004
75	JRL	NMN	75	3/1/2005
235	GUILDLINE	6500A	59660	1/22/2005

APPROVED BY:

Peter J. Stammen

☒ CMS

☐ QCO

DATE: 3/19/04

RDMSD 1001
11/03

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1 OF 1

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

DATE: 19 Mar 04
TECH: Electrochem
INST NO: 17876

INCOMING ✓
OUTGOING ✓

IN TOLERANCE _____
OUT OF TOLERANCE _____

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.03</u>	+00.06 pA

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+0.00002 V
	+190 mV	.18983	<u>.19001</u>	.19017
	-190 mV	.18983	<u>.19000</u>	.19017
2 V	+1.9 V	1.8984	<u>1.9000</u>	1.9016
	-1.9 V	1.8984	<u>1.9000</u>	1.9016
20 V	+19 V	18.984	<u>19.002</u>	19.016
	-19 V	18.984	<u>19.000</u>	19.016

RANGE	INPUT	MIN	READING	MAX
200 μ A	190 μ A	189.3	<u>190.0</u>	190.7 μ A
200 nA	190 nA	189.0	<u>190.0</u>	191.0 nA
2000 pA	1900 pA	1871	<u>1900</u>	1929 pA

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING	
20 k Ω	(19)	<u>19.00 k</u>	± 11 C	<u>18.99</u>	k Ω
200 k Ω		<u>190.0 k</u>	± 11 C	<u>189.8</u>	
20 M Ω	(10)	<u>10.00 M</u>	± 10 C	<u>10.00</u>	M Ω
20 G Ω	(10)	<u>9.98 G</u>	± 2 %	<u>9.99</u>	G Ω

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9915</u>	1.0500 nC

INST NO: 17876

DOC. DATE: 3/19/2004


2 OF 2

☒ INCOMING
☒ OUTGOING

**SOUTHWEST RESEARCH INSTITUTE
CALIBRATION LABORATORY
MEMORANDUM**

September 17, 2004

To: DARRELL DUNN DIV20 B57

From: Walt Hill, Metrology Group Leader
Institute Calibration Laboratory 

Subject: Status of Calibration Supplier

Manufacturer/Model: KEITHLEY 614

Description: ELECTROMETER

Serial Number: 0555368

Asset Number: 002792

Work Order Number: 444060611

Date Calibrated: September 13, 2004

Supplier: ROTHE DEVELOPMENT, SAN ANTONIO TX - AUDIT - 648-3131

Remarks: Rothe Cert. #17876:1095085180.

☒ Supplier is on the Approved Suppliers List (ASL).

☐ Supplier is not on the Approved Suppliers List.

☐ Calibration is ISO 17025 accredited.

☒ Calibration is not ISO 17025 accredited.

☐ There is no known supplier to meet ISO 17025 accreditation at this time.

Please notify the Institute Calibration Laboratory, extension 5215, of any discrepancies with the item or calibration documentation.

Attachment(s) 3



CERT. NUMBER: 17876:1095085180

Rothe Development, Inc.

METROLOGY SERVICES DIVISION

4614 SINCLAIR RD., SAN ANTONIO, TEXAS 78222 PH:210-648-3131

CERTIFICATE OF CALIBRATION

ISSUED TO: Southwest Research Institute (30)

6220 Culebra
San Antonio, TX 78284

MFG: Keithley

MODEL: 614

NOMEN: PROG ELECTROMETER

S/N: 0555368

CUST. ID: 2792

CAL DATE: 9/13/04

DUE DATE:

CONTROL NO: 103 - 17876

TECHNICIAN: 4

SPECIFICATIONS: MFG

PROCEDURE: MFG

WORK ORDER: 002040056

CUSTOMER P.O.: 01571R/ST418458/1.20.00755.000

RECEIVED CONDITION: IN TOLERANCE

RETURNED CONDITION: IN TOLERANCE

COMMENTS:

ATTACHMENTS: CALIBRATION DATA 2 SHEETS

CALIBRATION PERFORMED AT: RDMSD

CALIBRATION INTERVAL: 0

TEMPERATURE: 73.0°F

RELATIVE HUMIDITY: 35%

DATE RECEIVED: 9/3/04

All calibrations performed at Rothe Development, Inc. Metrology Services Division meet the requirements of ANSI / NCSL Z540-1-1994, ANSI / ISO / IEC 17025, ISO / IEC GUIDE 25, and ISO 10012-1, and are traceable to the National Institute of Standards and Technology. The collective uncertainty of the measurement(s) does not exceed 25% (TUR ≥ 4:1) of the instrument specification(s) unless noted in the COMMENTS section.

TR#	MFG	MODEL	SERIAL NO.	DUE DATE
20	FLUKE	5700A/EP	4605002	10/9/2004
258	FLUKE	5725A	6585002	10/9/2004
75	JRL	NMN	75	3/1/2005
235	GUILDLINE	6500A	59660	1/22/2005



REGISTERED TO ISO 9001

CERTIFICATE NO A9428

APPROVED BY:

Peter J. Stammer

☒ CMS

☐ QCO

DATE: 9/14/04

RDMSD 1001
11/03

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1 OF 1

ROTHE DEVELOPMENT METROLOGY SERVICES

CALIBRATION DATA: KEITHLEY 614 ELECTROMETER

CUSTOMER: SWRI
 WO NUMBER: 002040056
 SERIAL: 0555368
 CUST ID: 2792

DATE: 13 Sep 04
 TECH: Rutupflem
 INST NO: 17876

CALIBRATION DATA TAKEN

INCOMING ✓
 OUTGOING ✓

CONDITION OF EQUIPMENT

IN TOLERANCE ✓
 OUT OF TOLERANCE

INPUT CURRENT VERIFICATION

RANGE	INPUT	MIN	READING	MAX
20 pA	NONE	-00.06	<u>00.04</u>	+00.06 pA

DC VOLTMETER ACCURACY

RANGE	INPUT	MIN	READING	MAX
.2 V	0.0 mV	-.00002	<u>.00000</u>	+.00002 V
	+190 mV	.18983	<u>.19001</u>	.19017
	-190 mV	.18983	<u>.19000</u>	.19017
2 V	+1.9 V	1.8984	<u>1.9001</u>	1.9016
	-1.9 V	1.8984	<u>1.9000</u>	1.9016
20 V	+19 V	18.984	<u>19.002</u>	19.016
	-19 V	18.984	<u>19.000</u>	19.016

DC CURRENT ACCURACY

RANGE	INPUT	MIN	READING	MAX
200 uA	190 uA	189.3	<u>190.0</u>	190.7 uA
200 nA	190 nA	189.0	<u>190.0</u>	191.0 nA
2000 pA	1900 pA	1871	<u>1900</u>	1929 pA

RESISTANCE ACCURACY

RANGE		ACTUAL INPUT	TOLERANCE	READING	
20 k Ω	(19)	<u>19.00 kΩ</u>	± 11 C	<u>18.99</u>	k Ω
200 k Ω		<u>190.0 kΩ</u>	± 11 C	<u>189.8</u>	
20 M Ω	(10)	<u>10.00 MΩ</u>	± 10 C	<u>10.00</u>	M Ω
20 G Ω	(10)	<u>9.98 GΩ</u>	± 2 %	<u>9.98</u>	G Ω

CHARGE ACCURACY

RANGE	INPUT	MIN	READING	MAX
2 nC	1.0 VDC INTO 1000 pF	0.9500	<u>.9861</u>	1.0500 nC

INST NO: 17876

DOC. DATE: 3/19/2004

2 OF 2

☒ INCOMING
☒ OUTGOING



SOUTHWEST RESEARCH INSTITUTE™

6220 Culebra Road, P.O. Drawer 28510
Institute Quality Systems
Institute Calibration Laboratory
Phone: 210-522-5215 Fax 210-522-3692



Certificate of Calibration

0972-01

Submitted By: DIV20
Address: B57
Contact: DARRELL DUNN
Manufacturer Model: KEITHLEY 614
Description: ELECTROMETER
Serial No: 0555368
Asset No: 002792
Procedure: CL-741, APR/03

Work Order: 303063395
Date Issued: Apr 1, 2005
Calibration Date: Apr 1, 2005
****Calibration Due:** Sep 30, 2005
Calibration Location: Bldg. 64
Environment: Temp. 72.0°F Hum. 44 %RH
***As Found:** IN TOLERANCE
***As Left:** IN TOLERANCE

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, 1999 and ANSI/NCSL Z540-1-1994 which are equivalent to relevant requirements of the ISO 9000-1994 series of standards. This certificate may not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. The results of this calibration relate only to the individual instrument described above. This certificate shall not be used to claim product endorsement by the American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government.

Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of $k=2$ to approximate a 95% confidence level. See Remarks or attached Calibration Report with the same Work Order number for calibration data.

*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

**Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

Remarks: None

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009709	GUILDLINE	9211A	CURRENT SHUNT	Nov 18, 05
009753	GEN RAD	1422-CB	CAPACITOR STANDARD	Oct 26, 05
000182	FLUKE	5700A/EP	CALIBRATOR	Jun 23, 05
000185	GENERAL RADIO	1433G	DECADE RESISTOR	Mar 01, 07

Approved by: Walt Hill
Metrology Group Leader

m:\a2la1.rpt Rev date 11, May 04

Measurements by: Curtis Laurence
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

Work Order:	303063395	Mfr.	KEITHLEY	Technician	WCL
Asset No.	002792	Model	614		
Serial No.	0555368	Type.	Electrometer	Cal Date.	01-Apr-05
Remarks:					

Function/Range	Test Point	TI Reading	Difference	+/-Test Limits	+/-Uncertainty	Found/Left
Zero	mVolts 0.00000	mVolts 0.00000	mVolts 0.00000	mVolts 0.00001	mVolts 0.0000012	Results Pass
DCV	Volts	Volts	Volts	Volts	Volts	
0.2 V	0.19000	0.19015	0.00015	0.00017	0.000022	Pass
0.1 V	0.10000	0.10008	0.00008	0.00010	0.000022	Pass
2 Volt	1.9000	1.9001	0.0001	0.0016	0.00012	Pass
	1.0000	1.0002	0.0002	0.0009	0.00012	Pass
20 Volt	19.000	19.001	0.001	0.016	0.0012	Pass
	10.000	10.002	0.002	0.009	0.0012	Pass
DC Amps	uAmps	uAmps	uAmps	uAmps	uAmps	
20 uAmp	19.00	19.01	0.01	0.08	0.014	Pass
	nAmps	nAmps	nAmps	nAmps	nAmps	
200 nAmp	190.0	190.0	0.0	1.1	0.12	Pass
	pAmps	pAmps	pAmps	pAmps	pAmps	
2000 pAmp	1900	1905	5	29	0.12	Pass
Resistance	kOhm	kOhm	kOhm	kOhm	kOhm	
20 kOhm	19.00	18.99	-0.01	0.11	0.012	Pass
200 kOhm	190.0	189.7	-0.3	1.1	0.12	Pass
	MOhm	MOhm	MOhm	MOhm	MOhm	
20 MOhm	10.00	10.01	0.01	0.10	0.012	Pass
	GOhm	GOhm	GOhm	GOhm	GOhm	
20 GOhm	10.00	10.00	0.00	0.02	0.014	Pass
Charge Calibration	nC	nC	nC	nC	nC	
2 n Coulomb	1.0000	1.0045	0.0045	0.0500	0.00012	Pass
END OF REPORT						