CHANNEL CALIBRATION PROCEDURE FOR THE NEES@UCSB WILDLIFE LIQUEFACTION ARRAY (WLA) AND 5210 SITE

CUSTOMER	University Of California Santa Barbara Crustal Studies Department
SYSTEM LOCATION	WLA
SYSTEM S/N	207
DATE OF TEST	2/18/2012
PERFORMED BY (Print)	Robin Gee and Dan Radulescu
SIGNATURE	Robin Gee

CHANNEL CALIBRATION PROCEDURE
FOR THE WLA and 5210 SURFACE ARRAY

1.0 PURPOSE

The purpose of this procedure is the determination of the calibration factors for the entire system as described in the proposal No: DCR2006-001. The main components of the system will be checked for functionality and when needed a calibration factor will be determined. The sensors and the entire system shall be tested such that they respond within a specified range and accuracy to an input traceable to the National Bureau of Standards or an acceptable physical constant, (e.g., tilt testing of an accelerometer within the earth's gravitational field). This calibration will require temporary removal of the sensors from their normal location.

2.0 REFERENCES

- Kinemetrics Episensor (Model FBA ES-T) Guide
- WLA Instrumentation Guide (nees.ucsb/edu/facilities/wla)

It is recommended that this calibration be performed every 12 months

3.0 SYSTEM PERFORMANCE NOTES

- Because this procedure is intended to be used by a qualified person, step-by-step instructions are not given
- Test sequence may be changed as needed for safety and /or efficiency.
- Items for which quantitative measurements cannot or need not to be made shall be reported in a qualitative mode (e.g. Yes/No).
- Any activities performed outside the normal scope of this procedure shall be documented.

- When a deficiency is observed, the technician may undertake additional testing and install factory authorized and/or factory calibrated replacement parts to restore the proper operation of the instrument.

- Calibration readings are equally valid using either the internal batteries (>11.5 VDC under load) or using an external power supply (between 12.0 and 13.0 VDC.

4.0 TEST EQUIPMENT

Instrument Type	Manufacturer	Model	Range
Digital Voltmeter	FLUKE	189	2V dc & 20Vdc
Bubble Level	PRO Products	PRO-inclinometer	0° ÷ 180°
Tilt Table	Radu Project	TT-1	± 180°

Note: inclinometer accuracy to ±½° (used to level tilt table)

5.0 PRE-TEST CONDITIONS

- Notify the End user that the system will be taken out of normal operation conditions

(Initials) RG

- Check the overall system functionality and appearance. Document any observed anomaly. If a subassembly is not functional, document the findings, perform the repair first (if possible), and continue with the calibration

(Initials) RG

NOTES: System functional
Sensor power supply functional

(Initials) RG

6.0 SYSTEM TEST

6.1 UNINTERRUPTIBLE POWER SUPPLY

a) Check the battery charging Indicator.
Mark FULL or indicate in % _____ (Initials)_____

b) Disconnect the AC power cord and wait 10 minutes.
The intermittent Battery operation sound should be present.
The battery charging indicator shall stay on the same range.

(Initials)_____

c) Reconnect the AC (Initials)_____

d) Document when the battery has been installed (dd/mm/yy) _____

NOTES: Used 12V dc power supply

6.2 SENSOR CALIBRATION

WLA SURFACE ACCELEROMETERS

LOCATION CODE #	SENSOR MODEL	SENSOR S/N	CALIBRATION [V/g]	
			AS FOUND	AS LEFT
00	Triaxial Accelerometer X-axis	1457	9.96	9.96
00	Triaxial Accelerometer Y-axis	1457	9.95	9.95
00	Triaxial Accelerometer Z-axis	1457	9.88	9.88
10	Triaxial Accelerometer X-axis	1456	9.97	9.97
10	Triaxial Accelerometer Y-axis	1456	9.96	9.96
10	Triaxial Accelerometer Z-axis	1456	9.61	9.61
11	Triaxial Accelerometer X-axis	1458	9.97	9.97
11	Triaxial Accelerometer Y-axis	1458	9.96	9.96
11	Triaxial Accelerometer Z-axis	1458	9.84	9.84

NOTES:

5210 SURFACE ACCELEROMETERS

LOCATION CODE #	SENSOR MODEL	SENSOR S/N	CALIBRATION [V/g]	
			AS FOUND	AS LEFT
00	Triaxial Accelerometer X-axis	2075	9.98	9.98
00	Triaxial Accelerometer Y-axis	2075	9.96	9.96
00	Triaxial Accelerometer Z-axis	2075	9.98	9.98

NOTES:

7.0 FINAL STEPS

- Change the batteries from the UPS and SENSOR POWER SUPPLY if they are three (3) years old or more. If the batteries are not purchased, make a note and change them at the first maintenance visit.

  (Initials) RL

- Return the system to functional state (Initials) RL
- Attach Final record to this document (Initials) RL
- List all test equipment (Initials) RL
- Inform the end user that the system is functional (Initials) RL
- Prepare the site (close the hat and the equipment) (Initials) RL

NOTES: System functional

8.0 SUMMARY (Comments, Parts replaced, Deficiencies, etc.)

System left functional

9.0 CERTIFICATION

All items included in this procedure have been performed unless noted above and were found or have been adjusted to be within the range required by this procedure.

Yes
(yes/no)

Robin Gee
(Signature)

Robin Gee
(Print)

10.0 ACTION REQUIRED (IF ANY)

APPENDIX A

Correspondence between the channel number and sensor type

Table A1: WLA SURFACE ARRAY INSTRUMENTS

Location Code #	Sensor Type	Model / Manufacturer
00	Triaxial Accelerometer X,Y,Z-axis	Kinemetrics FBA ES-T
10	Triaxial Accelerometer X,Y,Z-axis	Kinemetrics FBA ES-T
11	Triaxial Accelerometer X,Y,Z-axis	Kinemetrics FBA ES-T

Table A2: 5210 SURFACE ARRAY INSTRUMENTS

Location Code #	Sensor Type	Model / Manufacturer
00	Triaxial Accelerometer X,Y,Z-axis	Kinemetrics FBA ES-T

NOTE:

- Connected to the A/D Input through a Signal Conditioning board Model 163MK manufactured by CALEX

APPENDIX B

Recommended Calibration Methods

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA SØØ SN 1457

The following readings shall be taken in the indicated order: X-Axis

1. Horizontal -0.242 [V]
2. tilt to +30 degrees -5.19 [V]
3. tilt to +90 degrees -10.10 [V]
4. tilt back to horizontal -0.239 [V]
5. tilt to -30 degrees 4.75 [V]
6. tilt to -90 degrees 9.83 [V]
7. tilt back to horizontal -0.240 [V]

CALIBRATION FACTOR 9.96 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA SØØ SN 1457

The following readings shall be taken in the indicated order: Z-Axis

1. Horizontal 0.079 [V]
2. tilt to +60 degrees -4.81 [V]
3. tilt to +90 degrees -9.80 [V]
4. Continue to Horizontal -19.86 [V]

CALIBRATION FACTOR 9.88 [V/g]
|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA SØØ SN 1457

Y-AXIS

The following readings shall be taken in the indicated order:

1. Horizontal -0.104 [V]
2. tilt to +30 degrees -4.89 [V]
3. tilt to +90 degrees -10.07 [V]
4. tilt back to horizontal 0.102 [V]
5. tilt to -30 degrees 5.05 [V]
6. tilt to -90 degrees 9.82 [V]
7. tilt back to horizontal 0.098 [V]

CALIBRATION FACTOR 9.95 [V/g]

{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER _____

The following readings shall be taken in the indicated order:

1. Horizontal _____ [V]
2. tilt to +60 degrees _____ [V]
3. tilt to +90 degrees _____ [V]
4. Continue to Horizontal _____ [V]

CALIBRATION FACTOR _____ [V/g]

|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA 10 SN 1456

The following readings shall be taken in the indicated order: X-AXIS

1. Horizontal -0.139 [V]
2. tilt to +30 degrees -5.13 [V]
3. tilt to +90 degrees -10.22 [V]
4. tilt back to horizontal -0,138 [V]
5. tilt to -30 degrees 4.84 [V]
6. tilt to -90 degrees 9.73 [V]
7. tilt back to horizontal -0.138 [V]

CALIBRATION FACTOR 9.97 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA 10 SN 1456

The following readings shall be taken in the indicated order: Z-AXIS

1. Horizontal -0.726 [V]
2. tilt to +60 degrees -5.69 [V]
3. tilt to +90 degrees -10.34 [V]
4. Continue to Horizontal -20.68 [V]

CALIBRATION FACTOR 9.61 [V/g]
|Read 3 – Read 1|

v *ACCELEROMETERS*

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA 10 SN 1456

The following readings shall be taken in the indicated order: Y-Axis

1. Horizontal -0.009 [V]
2. tilt to +30 degrees -4.99 [V]
3. tilt to +90 degrees -10.02 [V]
4. tilt back to horizontal -0.012 [V]
5. tilt to -30 degrees 4.96 [V]
6. tilt to -90 degrees 9.90 [V]
7. tilt back to horizontal 0.013 [V]

CALIBRATION FACTOR 9.96 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER _____

The following readings shall be taken in the indicated order:

1. Horizontal _____ [V]
2. tilt to +60 degrees _____ [V]
3. tilt to +90 degrees _____ [V]
4. Continue to Horizontal _____ [V]

CALIBRATION FACTOR _____ [V/g]
|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA II SN 1458

The following readings shall be taken in the indicated order: X-Axis

1. Horizontal -0.305 [V]
2. tilt to +30 degrees -5.27 [V]
3. tilt to +90 degrees -10.19 [V]
4. tilt back to horizontal -0.326 [V]
5. tilt to -30 degrees 4.67 [V]
6. tilt to -90 degrees 9.73 [V]
7. tilt back to horizontal 0.327 [V]

CALIBRATION FACTOR 9.97 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA II SN 1458

The following readings shall be taken in the indicated order: Z-Axis

1. Horizontal -0.281 [V]
2. tilt to +60 degrees -5.36 [V]
3. tilt to +90 degrees -10.12 [V]
4. Continue to Horizontal -20.24 [V]

CALIBRATION FACTOR 9.84 [V/g]
|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER WLA II SN 1458

The following readings shall be taken in the indicated order: Y-AXIS

1. Horizontal -0.291 [V]
2. tilt to +30 degrees -5.28 [V]
3. tilt to +90 degrees -10.29 [V]
4. tilt back to horizontal -0.324 [V]
5. tilt to -30 degrees 4.63 [V]
6. tilt to -90 degrees 9.59 [V]
7. tilt back to horizontal -0.329 [V]

CALIBRATION FACTOR 9.96 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER _____

The following readings shall be taken in the indicated order:

1. Horizontal _____ [V]
2. tilt to +60 degrees _____ [V]
3. tilt to +90 degrees _____ [V]
4. Continue to Horizontal _____ [V]

CALIBRATION FACTOR _____ [V/g]
|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER 5210 S00 SN 2075

The following readings shall be taken in the indicated order: X - AXIS

1. Horizontal -0.128 [V]
2. tilt to +30 degrees -5.21 [V]
3. tilt to +90 degrees -10.25 [V]
4. tilt back to horizontal -0.129 [V]
5. tilt to -30 degrees 4.84 [V]
6. tilt to -90 degrees 9.71 [V]
7. tilt back to horizontal 0.137 [V]

CALIBRATION FACTOR 9.98 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER 5210 S00 SN 2075

The following readings shall be taken in the indicated order: Z-AXIS

1. Horizontal -0.035 [V]
2. tilt to +60 degrees -4.96 [V]
3. tilt to +90 degrees -10.01 [V]
4. Continue to Horizontal -20.02 [V]

CALIBRATION FACTOR 9.98 [V/g]
|Read 3 – Read 1|

ACCELEROMETERS

Each unit (uniaxial or triaxial that can be removed temporarily for calibration will be calibrated using a tilt table).

For the horizontal axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER 5210 SDP SN 2075

The following readings shall be taken in the indicated order: Y-AXIS

1. Horizontal -0.306 [V]
2. tilt to +30 degrees -5.29 [V]
3. tilt to +90 degrees -10.33 [V]
4. tilt back to horizontal -0.303 [V]
5. tilt to -30 degrees 4.65 [V]
6. tilt to -90 degrees 9.59 [V]
7. tilt back to horizontal -0.311 [V]

CALIBRATION FACTOR 9.96 [V/g]
{(|Read3 – Read1|) + (|Read6 – Read4|)} / 2

For the vertical axis:

The unit shall be placed on a tilt table which has been leveled and checked with a mechanical angular device.

MODEL / SERIAL NUMBER _____

The following readings shall be taken in the indicated order:

1. Horizontal _____ [V]
2. tilt to +60 degrees _____ [V]
3. tilt to +90 degrees _____ [V]
4. Continue to Horizontal _____ [V]

CALIBRATION FACTOR _____ [V/g]
|Read 3 – Read 1|

MICRO PRECISION CALIBRATION INC.
9080 ACTIVITY RD, STE C
SAN DIEGO
(858) 547-0217

Certificate of Calibration

Date: 6/17/2011

Certificate #: 1404392

Customer:
ENGLEKIRK STRUCTURAL ENGINEERING CENTER
10201 POMERADO RD
SAN DIEGO, CA, 92131

Work Order: 120733

MPC Control #:	BL8539	Serial Number:	172
Asset ID:	N/A	Department:	N/A
Gage Type:	TILT TABLE	Performed By:	PETER SINKS
Manufacturer:	KINEMETRICS	Received Condition:	IN TOLERANCE
Model Number:	F100200-XX-PL	Returned Condition:	IN TOLERANCE
Size:	N/A	Cal Date:	June 17, 2011
Temp./RH:	21 °C / 55 %	Cal. Interval:	12 MONTHS
		Cal. Due Date:	June 17, 2012

Found conditions meet or exceed manufacturer specifications.

***Calibration Notes:**

Test Points

Description	Standard	Tolerance -	Tolerance +	As Found	As Left	UOM	Result
TILT DEVIATION	-30.00	-31.00	-29.00	-29.95	-29.95	Deg	Pass
	-60.00	-61.00	-59.00	-60.00	-60.00	Deg	Pass
	-90.00	-91.00	-89.00	-89.95	-89.95	Deg	Pass
	30.00	29.00	31.00	30.05	30.05	Deg	Pass
	60.00	59.00	61.00	60.05	60.05	Deg	Pass
	90.00	89.00	91.00	90.00	90.00	Deg	Pass

Standards Used To Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
B3864	PROTRACTOR	N/A	N/A	HELIOS	4/30/2012	1327219
T9186	HEIGHT GAGE	0 - 12 IN	1886	VERDICT	6/30/2011	1005841

Calibrating Technician: Peter Sinks
PETER SINKS

QC Approval:
MAURICE HEATH

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-3, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacturer's service instructions and are warranted for no less than thirty (30) days.

MICRO PRECISION CALIBRATION INC.
9080 ACTIVITY RD, STE C
SAN DIEGO
(858) 547-0217

Certificate of Calibration

Date: 6/17/2011

Certificate #: 1404392

Procedures Used In This Event:

Procedure Name	Description
ANGLE PLATE	ANGLE PLATES - PROC# CP002O6

Calibrating Technician: Peter Sinks

PETER SINKS

QC Approval:

MAURICE HEATH

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-3, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacturer's service instructions and are warranted for no less than thirty (30) days.

MICRO PRECISION CALIBRATION INC.
9080 ACTIVITY RD, STE C
SAN DIEGO
(858) 547-0217

Certificate of Calibration

ACCREDITED
Lab # 935.10

Date: 12/19/2011

Certificate #: 1620009

Customer:
ENGLEKIRK STRUCTURAL ENGINEERING CENTER
10201 POMERADO RD
SAN DIEGO, CA, 92131

Work Order: 134240

MPC Control #:	BL3668
Asset ID:	N/A
Gage Type:	DIGITAL MULTIMETER
Manufacturer:	FLUKE
Model Number:	85 III
Size:	N/A
Temp./RH:	19.4 °C / 47 %

Serial Number:	46450375
Department:	N/A
Performed By:	FRANCISCO OLIVEROS
Received Condition:	IN TOLERANCE
Returned Condition:	IN TOLERANCE
Cal Date:	December 12, 2011
Cal. Interval:	12 MONTHS
Cal. Due Date:	December 12, 2012

Found conditions meet or exceed manufacturer specifications.

***Calibration Notes:**
Data and uncert. attached.

Standards Used To Calibrate Equipment

I.D.	Description	Model	Serial	Manufacturer	Cal. Due Date	Traceability #
BC3293	METER CALIBRATOR	5700A	5990310	FLUKE	8/31/2012	1254320
T9825	UNIVERSAL CALIBRATOR	9100	40144	WAVETEK	4/30/2012	1342582

Procedures Used In This Event:

Procedure Name	Description
MULTIMETER (FLUKE) GENE	MULTIMETER, DIG 33K8-4-14-1 (FLUKE)

Calibrating Technician: FRANCISCO OLIVEROS

QC Approval: Ricardo Morris

Unless Otherwise Noted, Uncertainty Estimated at >= 4 to 1. Uncertainties have been estimated at a 95 percent confidence level (k=2). Services rendered comply with ISO 17025:2005, ISO 9001:2008, ANSI/NCSL Z540-3, MPC Quality Manual, MPC CSD and with customer purchase order instructions.

Calibration cycles and resulting due dates were submitted/approved by the customer. Any number of factors may cause an instrument to drift out of tolerance before the next scheduled calibration. Recalibration cycles should be based on frequency of use, environmental conditions and customer's established systematic accuracy. The information on this report, pertains only to the instrument identified.

All standards are traceable to the National Institute of Standards and Technology (NIST). Services rendered include proper manufacturer's service instructions and are warranted for no less than thirty (30) days

(CERT. Rev 2)

MICRO PRECISION CALIBRATION INC.

CUSTOMER	ENGLEKIRK	MFR	FLUKE
TECH #	FRANCISCO O.	MODEL #	85III
DATE	12/12/2011	MCP #	BL3668
ASSET #	N/A	WORK #	134240
SERIAL #	46450375		

STEP	FUNCTION TESTED	NOMINAL VALUE	VALUE AS RECEIVED	RETURNED VALUE	OUT -OF- TOL	TOLERANCE BAND
4.1	DC Volts					
	400 mV Range	350.0 mV	349.1	349.1		349.5 to 350.5 mV
	4.0 V Range	3.500 V	3.498	3.498		3.495 to 3.505 V
	40.0 V Range	35.00 V	34.98	34.98		34.95 to 35.05 V
	40.0 V Range	-35.00 V	-34.98	-34.98		-35.05 to -34.95 V
	400.0 V Range	350.0 V	349.8	349.8		349.5 to 350.5 V
	1000 V Range	1000 V	1000	1000		998 to 1002 V
4.2	AC Volts					
	400 mV Range @ 60 Hz	350.0 mV	349.1	349.1		347.8 to 352.2 mV
	400 mV Range @ 5 kHz	350.0 mV	350.0	350.0		346.1 to 353.9 mV
	400 mV Range @ 20 kHz	350.0 mV	350.1	350.1		342.6 to 357.4 mV
	4.0 V Range @ 60 Hz	3.500 V	3.497	3.497		3.480 to 3.520 V
	4.0 V Range @ 5 kHz	3.500 V	3.485	3.485		3.463 to 3.537 V
	4.0 V Range @ 20 kHz	3.500 V	3.497	3.497		3.356 to 3.644 V
	40 V Range @ 60 Hz	35.00 V	34.99	34.99		34.80 to 35.20 V
	40 V Range @ 5 kHz	35.00 V	34.98	34.98		34.63 to 35.37 V
	40 V Range @ 20 kHz	35.00 V	34.97	34.97		33.56 to 36.44 V
	400 V Range @ 60 Hz	350.0 V	349.7	349.7		348.0 to 352.0 V
	400 V Range @ 5 kHz	350.0 V	350.1	350.1		346.3 to 353.7 V
	400 V Range @ 20 kHz	100.0 V	98.9	98.9		95.6 to 104.4 V
	400 V Range @ 20 kHz	200.0 V	199.8	199.8		191.6 to 208.4 V
	400 V Range @ 20 kHz	300.0 V	300.2	300.2		287.6 to 312.4 V
	400 V Range @ 20 kHz	350.0 V	349.7	349.7		335.6 to 364.4 V
	1000 V Range @ 60 Hz	1000 V	999	999		993 to 1007 V
	1000 V Range @ 5 kHz	1000 V	998	998		978 to 1022 V
4.3	Ohms					
	400 Ω Range	190.0 Ω	190.3	190.3		189.5 to 190.5 Ω
	4.0 kΩ Range	1.900 kΩ	1.900	1.900		1.895 to 1.905 kΩ
	40 kΩ Range	19.00 kΩ	19.99	19.99		18.95 to 19.05 kΩ

MICRO PRECISION CALIBRATION INC.

CUSTOMER	ENGLEKIRK	MFR	FLUKE
TECH #	FRANCISCO O.	MODEL #	85III
DATE	12/12/2011	MCP #	BL3668
ASSET #	N/A	WORK #	134240
SERIAL #	46450375		

STEP	FUNCTION TESTED	NOMINAL VALUE	VALUE AS RECEIVED	RETURNED VALUE	OUT -OF- TOL	TOLERANCE BAND
4.3	Ohms	(Cont'd)				
	4 MΩ Range	1.900 MΩ	1.900	1.900		1.895 to 1.905 MΩ
	40 MΩ Range	10.00 MΩ	9.96	9.96		9.87 to 10.13 MΩ
	40 MΩ Range	19.00 MΩ	18.90	18.90		18.78 to 19.22 MΩ
	40 nS Range	10 nS (100.00 MΩ)	10.01	10.01		9.80 to 10.20 nS
4.4	Capacitance					
	5.0 µF Range	1.00 µF	.99	.99		0.97 to 1.03 µF
	0.5 µF Range	0.470 µF	0.470	0.470		0.463 to 0.477 µF
	0.05 µF Range	0.0470 µF	.0468	.0468		0.0463 to 0.0477 µF
	5 nF Range (Relative Mode)	4.70 nF	4.69	4.69		4.63 to 4.77 nF
4.5	mA (DC)					
	400 µA Range	350.0 µA	350.0	350.0		349.1 to 350.9 µA
	4000 µA Range	3500 µA	3498	3498		3491 to 3509 µA
	40 mA Range	35.00 mA	34.99	34.99		34.91 to 35.09 mA
	400 mA Range	350.0 mA	349.7	349.7		349.1 to 350.9 mA
	4000 mA Range	3500 mA	3501	3501		3491 to 3509 mA
	10 A Range	10.00 A	10.00	10.00		9.96 to 10.04 A
4.6	mA (AC)					
	400 µA Range @ 60 Hz	350.0 µA	349.6	349.6		347.7 to 352.3 µA
	400 µA Range @ 1kHz	350.0 µA	349.8	349.8		347.7 to 352.3 µA
	3500 µA Range @ 60 Hz	3500 µA	3506	3506		3477 to 3523 µA
	3500 µA Range @ 1kHz	3500 µA	3505	3505		3477 to 3523 µA
	40 mA Range @ 60 Hz	35.0 mA	34.97	34.97		34.77 to 35.23 mA
	40 mA Range @ 1kHz	35.0 mA	34.98	34.98		34.77 to 35.23 mA
	400 mA Range @ 60 Hz	350.0 mA	350.6	350.6		347.7 to 352.3 mA
	400 mA Range @ 1kHz	350.0 mA	350.4	350.4		347.7 to 352.3 mA
	4000 mA Range @ 60 Hz	3500 mA	3500	3500		3477 to 3523 mA

MICRO PRECISION CALIBRATION INC.

CUSTOMER	ENGLEKIRK	MFR	FLUKE
TECH #	FRANCISCO O.	MODEL #	85III
DATE	12/12/2011	MCP #	BL3668
ASSET #	N/A	WORK #	134240
SERIAL #	46450375		

STEP	FUNCTION TESTED	NOMINAL VALUE	VALUE AS RECEIVED	RETURNED VALUE	OUT -OF- TOL	TOLERANCE BAND
	4000 mA Range @ 1kHz	3500 mA	3498	3498		3477 to 3523 mA
4.6	mA (AC)	(Cont'd)				
	10 A Range @ 60 Hz	10.00 A	10.0	10.0		9.92 to 10.08 A
	10 A Range @ 1kHz	10.00 A	9.99	9.99		9.92 to 10.08 A
4.7	Diode Test					
		3.000 V	2.997	2.997		2.939 to 3.061 V
4.8	Frequency Test					
	@ 150 mV	19.000 kHz	19.000	19.000		18.998 to 19.002 kHz
	@ 150 mV	190.00 kHz	190.00	190.00		189.98 to 190.02 kHz

COMMENTS:

Uncertainty Analysis Report

12-Dec-11

Englekirk

Sumitted by: **Francisco Oliveros**
Approved By: **Ricardo Morris**
Asset: **BL3668**

Subject Unit: Multimeter
Manufacturer: Fluke Corp.
Model Number: 85 III

Uncertainty Results:

Parameter Name	Uncertainty	Units	Confidence Level
Resistance-Range			
<190K	+/- 6	mΩ	95.00
>190K	+/- .6	mΩ	95.00
DC Voltage-Ranges			
200 mV	+/- 6	µV	95.00
2V	+/- 600	µV	95.00
20 V	+/- 6	mV	95.00
200 V	+/- 40	mV	95.00
AC Voltage			
200 mV	+/- 6	µV	95.00
2V	+/- 60	µV	95.00
20 V	+/- 600	µV	95.00
200 V	+/- 6	mV	95.00
DC Current			
200 mA	+/- 6	µA	95.00
2 A	+/- 600	µA	95.00
AC Current			
200 mA	+/- 6	µA	95.00
2 A	+/- 6	mA	95.00

The expanded uncertainty presented in this report is consistent with the 1993 ISO Guide to the Expression of Uncertainty in Measurement.
The expanded Uncertainty is not to be confused with a tolerance limit for the user during application.