



SOUTHWEST RESEARCH INSTITUTE®

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Institute Calibration Laboratory
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Certificate #

0972-01

Certificate of Calibration

Submitted By: DIV20

Address: B57

Contact: DON BANNON

Manufacturer Model: FLUKE 87 III

Description: MULTIMETER

Serial No: 73980497

Asset No: 007646

Procedure: MULTIMETERS, JAN/03

Work Order: 303067331

Date Issued: Jan 6, 2006

Calibration Date: Jan 6, 2006

***Calibration Due:** Jan 5, 2007

Calibration Location: Bldg. 64

Environment: Temp. 72.0°F Hum. 38 %RH

****Data Type:** FOUND-LEFT

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, ANSI/NC SL 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. **Found/Left = adjustment and/or repair was not required, As Left = adjusted and/or repaired was required. The client has sole responsibility for determination of in-/out-of-tolerance or compliance/noncompliance. See Remarks or attached Measurement Report with the same Work Order number for data.

Reported uncertainty calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM) and represents an expanded uncertainty with a coverage factor of k=2 to approximate a 95% confidence level.

Remarks: None

Standards Used

| Asset No. | Serial No. | Manufacturer | Model | Description | Cal Due |
|-----------|------------|--------------|--------------|--------------------------|------------|
| 006413 | 7085202 | FLUKE | 5520A/SC1100 | MULTI-PRODUCT CALIBRATOR | Mar 08, 06 |

Reviewed by: blt () jrg () pwc () wgh ()
Metrology Technician

Measurements by: Mike Young
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Measurement Report

| | | | | | |
|-------------|-----------|-------|------------|------------|----------|
| Work Order: | 303067331 | Mfr. | FLUKE | Technician | MSY |
| Asset No. | 007646 | Model | 87 III | Cal Date. | 6-Jan-06 |
| Serial No. | 73980497 | Type. | MULTIMETER | | |
| Remarks: | | | | | |

| Function/Range | Test Point | TI Reading | Difference | +/-Limit | +/-Uncertainty | Found/Left |
|------------------|------------|------------|------------|----------|----------------|------------|
| Switch Test | Display | Display | Display | Display | N/A | Result |
| ACV | 0 | 0 | 0.00 | 12 | N/A | Pass |
| DCV | -32 | -32 | 0.00 | 12 | N/A | Pass |
| Mv/DC | -64 | -64 | 0.00 | 12 | N/A | Pass |
| OHMS | -96 | -96 | 0.00 | 12 | N/A | Pass |
| DIODE | -128 | -128 | 0.00 | 12 | N/A | Pass |
| mA/A | -160 | -160 | 0.00 | 12 | N/A | Pass |
| uA | -192 | -192 | 0.00 | 12 | N/A | Pass |
| ACV 400mVolts | mVolts | mVolts | mVolts | mVolts | mVolts | |
| 60 Hz | 350.0 | 348.5 | -1.5 | 2.9 | 0.14 | Pass |
| 1 kHz | 350.0 | 349.0 | -1.0 | 3.9 | 0.14 | Pass |
| 5 kHz | 350.0 | 347.9 | -2.1 | 7.4 | 0.14 | Pass |
| 20 kHz | 350.0 | 351.9 | 1.9 | 9.0 | 0.17 | Pass |
| AC Volts | Volts | Volts | Volts | Volts | Volts | |
| 4 V at 60 Hz | 3.500 | 3.489 | -0.011 | 0.027 | 0.0014 | Pass |
| 1 kHz | 3.500 | 3.488 | -0.012 | 0.039 | 0.0014 | Pass |
| 5 kHz | 3.500 | 3.477 | -0.023 | 0.074 | 0.0014 | Pass |
| 20 kHz | 3.500 | 3.480 | -0.020 | 0.090 | 0.0022 | Pass |
| 40 V at 60 Hz | 35.00 | 34.88 | -0.12 | 0.27 | 0.019 | Pass |
| 1 kHz | 35.00 | 34.98 | -0.02 | 0.39 | 0.019 | Pass |
| 5 kHz | 35.00 | 35.07 | 0.07 | 0.74 | 0.019 | Pass |
| 20 kHz | 35.00 | 35.00 | 0.00 | 0.90 | 0.11 | Pass |
| 400 V at 60 Hz | 350.0 | 348.8 | -1.2 | 2.7 | 0.16 | Pass |
| 1 kHz | 350.0 | 349.5 | -0.5 | 3.9 | 0.16 | Pass |
| 2.5 kHz | 350.0 | 349.4 | -0.6 | 7.4 | 0.16 | Pass |
| 20 kHz | 100.0 | 99.5 | -0.5 | 4.0 | 0.88 | Pass |
| 4000 V at 60 Hz | 900 | 902 | 2 | 8 | 1.2 | Pass |
| 1 kHz | 900 | 903 | 3 | 13 | 1.2 | Pass |
| Frequency | kHz | kHz | kHz | kHz | kHz | |
| 150 mVolt | 19.000 | 18.999 | -0.001 | 0.002 | 0.0012 | Pass |
| | 190.00 | 189.99 | -0.01 | 0.02 | 0.012 | Pass |
| Sensitivity | Hz | Hz | Hz | Hz | Hz | |
| 4 VAC with 300mV | 1000.0 | 999.9 | -0.1 | 0.2 | 0.12 | Pass |
| 4 VDC with 1.7V | 1000.0 | 999.9 | -0.1 | 0.2 | 0.12 | Pass |
| 4 VDC with 1 V | 0.0 | 0.0 | 0.0 | 0.2 | 0.12 | Pass |
| 40 VDC with 6 V | 1000.0 | 999.9 | -0.1 | 0.2 | 0.12 | Pass |
| 40 VDC with 2 V | 0.0 | 0.0 | 0.0 | 0.2 | 0.12 | Pass |

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Measurement Report

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| Asset No. | 007646 | Model | 87 III | Cal Date. | 6-Jan-06 |
| Serial No. | 73980497 | Type. | MULTIMETER | | |

| Function/Range | Test Point | TI Reading | Difference | +/-Limit | +/-Uncertainty | Found/Left |
|----------------|------------|------------|------------|----------|----------------|------------|
| DC Volts | Volts | Volts | Volts | Volts | Volts | Result |
| 4 Volts | 3.500 | 3.499 | -0.001 | 0.003 | 0.0012 | Pass |
| 40 Volts | 35.00 | 34.99 | -0.01 | 0.03 | 0.012 | Pass |
| | -35.00 | -34.99 | 0.01 | 0.03 | 0.012 | Pass |
| 400 Volt | 350.0 | 349.9 | -0.1 | 0.3 | 0.12 | Pass |
| 4000 Volt | 1000 | 1000 | 0 | 2 | 1.2 | Pass |
| IMS Min-Max | Volts | Volts | Volts | Volts | Volts | |
| | 2.828 | 2.828 | 0.000 | 0.123 | 0.0012 | Pass |
| | -2.828 | -2.828 | 0.028 | 0.123 | 0.0012 | Pass |
| DC mV | mVolts | mVolts | mVolts | mVolts | mVolts | |
| | 350.0 | 349.9 | -0.1 | 0.5 | 0.12 | Pass |
| Ohm | Ohms | Ohms | Ohms | Ohms | Ohms | |
| 190 | 190.00 | 190.10 | 0.10 | 0.6 | 0.12 | Pass |
| | kOhms | kOhms | kOhms | kOhms | kOhms | |
| 19.00k | 19.00 | 19.00 | 0.00 | 0.05 | 0.012 | Pass |
| | MOhms | MOhms | MOhms | MOhms | MOhms | |
| 1.9M | 1.900 | 1.900 | 0.000 | 0.012 | 0.0012 | Pass |
| 19M | 19.00 | 19.00 | 0.00 | 0.22 | 0.014 | Pass |
| | nS | nS | nS | nS | nS | |
| 100M | 10.00 | 9.98 | -0.02 | 0.20 | 0.062 | Pass |
| Capacitance | uF | uF | uF | uF | uF | |
| | 1.00 | 0.98 | -0.02 | 0.05 | 0.012 | Pass |
| | 0.470 | 0.4680 | -0.002 | 0.008 | 0.0016 | Pass |
| | 0.0470 | 0.0471 | 0.0001 | 0.0008 | 0.00012 | Pass |
| | nF | nF | nF | nF | nF | |
| | 4.70 | 4.62 | -0.08 | 0.08 | 0.032 | Pass |
| Diode | Volts | Volts | Volts | Volts | Volts | |
| | 3.000 | 2.979 | -0.021 | 0.061 | 0.0012 | Pass |
| DC mAmps | mAmps | mAmps | mAmps | mAmps | mAmps | |
| | 35.00 | 35.00 | 0.00 | 0.09 | 0.013 | Pass |
| | 350.0 | 349.8 | -0.2 | 0.9 | 0.12 | Pass |
| AC Amps | mAmps | mAmps | mAmps | mAmps | mAmps | |
| 60 Hz | 35.00 | 34.88 | -0.12 | 0.37 | 0.041 | Pass |
| 1 kHz | 35.00 | 34.97 | -0.03 | 0.37 | 0.041 | Pass |
| 60 Hz | 350.0 | 349.2 | -0.8 | 3.7 | 0.34 | Pass |
| 1 kHz | 350.0 | 349.8 | -0.2 | 3.7 | 0.34 | Pass |

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| Asset No. | 007646 | Model | 87 III | Cal Date. | 6-Jan-06 |
| Serial No. | 73980497 | Type. | MULTIMETER | | |

| Function/Range | Test Point | TI Reading | Difference | +/-Limit | +/-Uncertainty | Found/Left |
|----------------|------------|------------|------------|----------|----------------|------------|
| DC uAmp | uAmp | uAmp | uAmp | uAmp | uAmp | Result |
| | 350.0 | 350.3 | 0.3 | 0.9 | 0.14 | Pass |
| | 3500 | 3500 | 0 | 9 | 1.3 | Pass |
| AC uAmp | uAmp | uAmp | uAmp | uAmp | uAmp | |
| 60 Hz | 350.0 | 349.2 | -0.8 | 3.7 | 1.0 | Pass |
| 1 kHz | 350.0 | 349.9 | -0.1 | 3.7 | 1.0 | Pass |
| 60 Hz | 3500 | 3494 | -6 | 37 | 2.7 | Pass |
| 1 kHz | 3500 | 3499 | -1 | 37 | 2.7 | Pass |
| DC Amps | mAmps | mAmps | mAmps | mAmps | mAmps | |
| | 3500 | 3498 | -2 | 11 | 2.7 | Pass |
| | Amps | Amps | Amps | Amps | Amps | |
| | 10.00 | 9.99 | -0.01 | 0.04 | 0.013 | Pass |
| AC Amp | mAmps | mAmp | mAmp | mAmp | mAmp | |
| 60 Hz | 3500 | 3487 | -13 | 37 | 4.2 | Pass |
| 1 kHz | 3500 | 3498 | -2 | 37 | 4.2 | Pass |
| AC Amp | Amp | Amp | Amp | Amp | Amp | |
| 60 Hz | 10.00 | 10.02 | 0.02 | 0.12 | 0.017 | Pass |
| 1 kHz | 10.00 | 10.05 | 0.05 | 0.12 | 0.017 | Pass |

END OF REPORT