

# 5080A Calibrator

Service Manual

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# OPERATOR SAFETY SUMMARY

## WARNING



is used in the operation of this equipment

## LETHAL VOLTAGE

may be present on the terminals, observe all safety precautions!

To avoid electrical shock hazard, the operator should not electrically contact the output HI or sense HI terminals or circuits connected to these terminals. During operation, lethal voltages of up to 1020 V ac or dc may be present on these terminals.

Whenever the nature of the operation permits, keep one hand away from equipment to reduce the hazard of current flowing through vital organs of the body.

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#### 5080A

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#### Introduction

#### **∧ M** Warning

If the 5080A Calibrator is used in a manner not specified by this manual or other documentation provided by Fluke Calibration, the protection provided by the Calibrator may be impaired.

The 5080A Calibrator (the Product or the Calibrator) is a fully programmable precision source of:

- DC voltage from 0 V to ±1020 V.
- AC voltage from 1 mV to 1020 V, with output from 45 Hz to 1 kHz.
- AC current from 29 μA to 20.5 A, with variable frequency limits.
- DC current from 0 A to ±20.5 A.
- Discrete resistance values from a short circuit to 190 M $\Omega$ .

#### Features of the Product include:

- Automatic meter error calculation.
- x 10 and -10 keys that change the output value to pre-determined cardinal values for various functions.
- Programmable entry limits that prevent entering invalid amounts.
- Simultaneous output of voltage and current, up to an equivalent of 20.9 kVA.
- Simultaneous output of two voltages.
- Variable phase signal output.
- EIA Standard RS-232 serial data interface to print, show, or transfer internally stored calibration constants, and for remote control of the Product.

### **Safety Information**

This Product complies with:

- ANSI/ISA-61010-1 (82.02.01)
- CAN/CSA C22.2 No. 61010-1-04
- ANSI/UL 61010-1
- EN 61010-1

Symbols used on the Product and in this manual are explained in Table 1.

Table 1. Symbols

| Symbol | Description  | Symbol   | Description  |
|--------|--|----------|--|
| ~      | AC (Alternating Current)   | Ť        | Earth  |
| Δ      | WARNING - RISK OF DANGER. Consult user documentation.  | A        | WARNING. HAZARDOUS VOLTAGE. Risk of electric shock.  |
| CE     | (2 № ∞   |          | Certified by CSA Group to North American safety standards.   |
| CATI   | Measurement Category I is applicable to test measurements not directly connected to mains. Maximum transient Overvoltage is as specified by terminal markings. | <u>X</u> | This product complies with the WEEE Directive marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. |

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

#### **∧** Marning

To prevent possible electrical shock, fire, or personal injury:

- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Do not apply more than 264 V ac rms between the supply conductors or between either supply conductor and ground.
- Use caution when working with voltages above 30 V ac rms,
   42 V peak, or 60 V dc. These voltages pose a shock hazard.
- Make sure the ground conductor in the mains power cord is connected to a protective earth ground. Disruption of the protective earth could put voltage on the chassis that could cause death.
- Replace a blown fuse with exact replacement only for continued protection against arc flash.
- Do not put the Product where access to the mains power cord is blocked.
- Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.
- Do not use the Product around explosive gas, vapor, or in damp or wet environments.
- Verify the voltage applied to the unit under test (UUT) does not exceed the insulation rating of the UUT and the interconnecting cables.
- Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.
- Do not use the Product if it is damaged.
- Disable the Product if it is damaged.

#### 

To avoid damage to the Product, do not apply voltage in excess of the marked rating to any terminal.

#### **Product Manuals**

The Product manuals give complete data for operators and service or maintenance technicians. The set includes:

- Operators Manual
- Service Manual
- Product Manual CD

The Operators and Service manuals are shipped with the Product. To order replacements, see *How to Contact Fluke Calibration*.

#### **Operators Manual**

The *Operators Manual* includes installation and operation instructions of the Product from the front-panel keys and in remote configurations. This manual also has a glossary of calibration, specifications, and error code information. Operator Manual topics are:

- Installation
- Operating controls and features, including front-panel operation
- Remote operation (Ethernet or serial port remote control)
- Serial port operation (printing, displaying, or transferring data, and setting up for serial port remote control)
- Operator maintenance, including verification procedures and calibration approach for the Product
- Accessories and options

#### Service Manual

This Service Manual includes:

- Specifications
- General Maintenance covers how to handle and clean the Product as well as fuse replacement
- Theory of Operation
- Performance Tests to verify Product performance to specifications
- Calibration or adjustments to keep Product operation within the specifications
- List of Replaceable Parts

#### How to Contact Fluke Calibration

To contact Fluke Calibration, call one of the telephone numbers shown below.

Technical Support USA: 1-877-355-3225

Calibration/Repair USA: 1-877-355-3225

Canada: 1-800-36-FLUKE (1-800-363-5853)

Europe: +31-40-2675-200 Japan: +81-3-6714-3114 Singapore: +65-6799-5566

China: +86-400-810-3435 Brazil: +55-11-3759-7600

Anywhere in the world: +1-425-446-6110

To see product information and download the latest manual supplements, visit Fluke Calibration's website at www.flukecal.com.

To register your product, visit http://flukecal.com/register-product.

#### **Specifications**

The Product is verified and calibrated at the factory prior to shipment to ensure it meets the accuracy standards necessary for all certified calibration laboratories. By calibrating to the specifications in this section, the high-performance level can be maintained throughout the life of the Product.

#### General Specifications

All specifications are valid after a warm-up period of 30 minutes, or twice the time since last warmed up, to a maximum of 30 minutes. For example, if the 5080A has been turned off for 5 minutes, the warm-up period is 10 minutes.

All specifications apply for the temperature and time period indicated. For temperatures outside of tcal  $\pm 5$  °C (tcal is the ambient temperature when the 5080A was calibrated), the temperature coefficient as stated in the General Specifications must be applied.

The specifications also assume the 5080A is zeroed every seven days or whenever the ambient temperature changes by more than 5 °C.

| Warmup Time             | Twice the time since last warmed up, to a maximum of 30 minutes.   |  |  |
|-------------------------|--|--|--|
| Settling Time           | Less than 7 seconds for all functions and ranges except as noted.  |  |  |
| Standard Interfaces     | RS-232 and Ethernet  |  |  |
| Temperature             |  |  |  |
| Operating               | 0 °C to 50 °C  |  |  |
| Calibration (tcal)      | 15 °C to 35 °C   |  |  |
| Storage                 | 20 °C to +70 °C  |  |  |
| Temperature Coefficient | Temperature coefficient for temperatures outside tcal $\pm 5$ °C is 10 % of the stated specification per °C for temperatures in the range of 0 °C to 35 °C. Above 35 °C, the temperature coefficient is 20 % of the stated specification per °C. |  |  |
| Relative Humidity       |  |  |  |
| On a mating of          | 100 0/ 1- 00 00 -70 0/ 1- 40 00 -440 0/ 1- 50 00   |  |  |

Operating .......<80 % to 30 °C, <70 % to 40 °C, <40 % to 50 °C.

Storage ......<95 %, non-condensing

Altitude

Safety ...... IEC 61010-1: Overvoltage category II, Pollution Degree 2

Analog Low Isolation......20 V

Electromagnetic Compatibility (EMC)

International ......IEC 61326-1: Basic Electromagnetic Environment

CISPR 11: Group 1, Class A

Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.

Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.

Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.

Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.

clause 15.103.

Line Power

Line Frequency .......47 to 63 Hz

Line Voltage Variation......±10 % about line voltage setting

Power Consumption......600 VA

Dimensions

Depth ...... 53.8 cm (21.2 in)

the total specification for the temperature range indicated.

#### **Detailed Specifications**

#### DC Voltage

| Panga                                    | Specificatio<br>±(% of ou | n, tcal ±5 °C<br>tput + μV) | Stability                              | Desclution (v.V) | Max Burden <sup>[1]</sup> |
|--|---------------------------|-----------------------------|--|------------------|---------------------------|
| Range                                    | 90 days                   | 1 year                      | 24 hours, ±1 °C<br>±(% of output + μV) | Resolution (μV)  | wax Burden                |
| 0 to 329.999 mV                          | 0.011 % + 10              | 0.013 % + 10                | 0.0035 % + 6                           | 1                | 60 Ω                      |
| 0 to 3.29999 V                           | 0.008 % + 15              | 0.010 % + 15                | 0.0025 % + 10                          | 10               | 300 mA                    |
| 0 to 32.9999 V                           | 0.008 % + 150             | 0.010 % + 150               | 0.0025 % + 100                         | 100              | 600 mA                    |
| 10 to 101.999 V                          | 0.010 % + 1500            | 0.012 % + 1500              | 0.003 % + 1000                         | 1000             | 300 mA                    |
| 30 to 329.999 V                          | 0.010 % + 1500            | 0.012 % + 1500              | 0.003 % + 1000                         | 1000             | 120 mA                    |
| 100 to 1020.00 V                         | 0.010 % + 5500            | 0.012 % + 5500              | 0.003 % + 5000                         | 10000            | 40 mA                     |
| Auxiliary Output (dual output mode only) |                           |                             |  |                  |                           |
| 0 to 329.99 mV                           | 0.10 % + 1000             | 0.12 % + 1000               | 0.03 % + 300                           | 10               | 5 mA                      |
| 0.33 to 3.2999 V                         | 0.10 % + 1000             | 0.12 % + 1000               | 0.03 % + 300                           | 100              | 5 mA                      |
| 3.3 to 7.000 V                           | 0.10 % + 1000             | 0.12 % + 1000               | 0.03 % + 300                           | 1000             | 5 mA                      |

<sup>[1]</sup> Remote sensing is not provided. Output resistance is 60 Ω for outputs <330 mV. Output resistance is <5 mΩ for outputs ≥0.33 V. The AUX output has an output resistance of <1 Ω.

|                  | Noise  |   |  |  |
|------------------|--|---|--|--|
| Range            | Bandwidth 0.1 Hz to 10 Hz, p-p<br>±(ppm of output + floor) | Bandwidth 10 Hz to 10 kHz, rms<br>±( floor) |  |  |
| 0 to 329.999 mV  | 0 + 3 μV   | 20 μV                                       |  |  |
| 0 to 3.29999 V   | 0 + 30 μV  | 200 μV                                      |  |  |
| 0 to 32.9999 V   | 0 + 300 μV   | 2 mV  |  |  |
| 10 to 101.999 V  | 30 + 5 mV  | 60 mV                                       |  |  |
| 30 to 329.999 V  | 30 + 5 mV  | 60 mV                                       |  |  |
| 100 to 1020.00 V | 30 + 20 mV   | 100 mV                                      |  |  |
|                  | Auxiliary Output (dual output mode only                    | 7)  |  |  |
| 0 to 329.99 mV   | 0 + 20 μV  | 60 μV                                       |  |  |
| 0.33 to 3.2999 V | 0 + 200 μV   | 600 μV                                      |  |  |
| 3.3 to 7.000 V   | 0 + 2 mV   | 3 mV  |  |  |

#### **DC** Current

| Range                            | Specificatio<br>±(% of ou | n, tcal ±5 °C<br>tput + μA) | Resolution | Max. Compliance<br>Voltage (V) [2] | Max. Inductive<br>Load |
|----------------------------------|---------------------------|-----------------------------|------------|------------------------------------|------------------------|
|                                  | 90 days                   | 1 year                      |            | voitage (v)                        | Loau                   |
| 0 to 329.99 μA                   | 0.07 % + 0.1              | 0.075 % + 0.1               | 10 nA      | 9                                  |                        |
| 0 to 3.2999 mA                   | 0.06 % + 0.25             | 0.065 % + 0.25              | 0.1 μΑ     | 9                                  |                        |
| 0 to 32.999 mA                   | 0.048 % + 1.25            | 0.05 % + 1.25               | 1 μΑ       | 50                                 |                        |
| 0 to 329.99 mA                   | 0.048 % + 16.5            | 0.05 % + 16.5               | 10 μΑ      | 35                                 |                        |
| 0 to1.0999 A<br>(in 3 A range)   | 0.14 % + 220              | 0.15 % + 220                | 100 μΑ     | 6                                  | 2.5 H                  |
| 1.1 to 2.9999 A                  | 0.18 % + 220              | 0.19 % + 220                | 100 μΑ     | 6                                  |                        |
| 0 to 10.999 A<br>(in 20 A range) | 0.23 % + 2500             | 0.25 % + 2500               | 1 mA       | 4                                  |                        |
| 11 to 20.500 A <sup>[1]</sup>    | 0.48 % + 3750             | 0.5 % + 3750                | 1 mA       | 4                                  |                        |

<sup>[1]</sup> Duty Cycle: Currents <11 A may be provided continuously. For currents >11 A, the current may be provided 60-T-I minutes in any 60 minute period where T is the temperature in °C (room temperature is about 23 °C) and I is the output current in Amps. For example, 17 A at 23 °C could be provided for 60-17-23 = 20 minutes each hour. When the 5080A is outputting currents between 5 and 11 amps for long periods, the internal self-heating reduces the duty cycle. Under those conditions, the allowable "on" time indicated by the formula is achieved only after the 5080A is outputting currents <5 A for the "off" period first.

<sup>[2]</sup> Maximum resistive load for all DC current ranges is 30 K $\Omega$ .

| Pango          | Noise                          |                                |  |  |
|----------------|--------------------------------|--------------------------------|--|--|
| Range          | Bandwidth 0.1 Hz to 10 Hz, p-p | Bandwidth 10 Hz to 10 kHz, rms |  |  |
| 0 to 329.99 μA | 20 nA                          | 60 nA                          |  |  |
| 0 to 3.2999 mA | 200 nA                         | 600 nA                         |  |  |
| 0 to 32.999 mA | 2 μΑ                           | 6 μΑ                           |  |  |
| 0 to 329.99 mA | 20 μΑ                          | 60 μΑ                          |  |  |
| 0 to 2.9999 mA | 200 μΑ                         | 3 mA                           |  |  |
| 0 to 20.500 A  | 2 mA                           | 30 mA                          |  |  |

#### Resistance

| Nominal Value | Value, to | f Characterized cal $\pm 5$ °C, ue or $\Omega$ ) [1] | Max. Difference<br>of<br>Characterized<br>Value to | 2-Wire        | Full Spec. Load<br>Range, I <sub>min</sub> to I <sub>max</sub> [4][5] | Max. Peak<br>Current <sup>[5]</sup> |
|---------------|-----------|--|--|---------------|---|-------------------------------------|
|               | 90 days   | 1 year   | Nominal Value,<br>± (%) [2]                        | Adder, ±(\$2) | Range, I <sub>min</sub> to I <sub>max</sub>                           | Current                             |
| 0 Ω           | 0.01 Ω    | 0.01 Ω   | -  | 0.001 Ω       | 8 to 210 mA   | 220 mA                              |
| 1 Ω           | 0.99 %    | 1.0 %  | 1.75 %   | 0.001 Ω       | 8 to 210 mA   | 220 mA                              |
| 1.9 Ω         | 0.49 %    | 0.5 %  | 0.85 %   | 0.001 Ω       | 8 to 210 mA   | 220 mA                              |
| 10 Ω          | 0.14 %    | 0.15 %   | 0.23 %   | 0.001 Ω       | 5 to 90 mA  | 220 mA                              |
| 19 Ω          | 0.09 %    | 0.1 %  | 0.18 %   | 0.001 Ω       | 4 to 65 mA  | 160 mA                              |
| 100 Ω         | 0.035 %   | 0.04 %   | 0.05 %   | 0.001 Ω       | 2 to 15 mA  | 70 mA                               |
| 190 Ω         | 0.035 %   | 0.04 %   | 0.05 %   | 0.001 Ω       | 1 to 11 mA  | 50 mA                               |
| 1000 Ω        | 0.022 %   | 0.025 %  | 0.045 %  | 0.01 Ω        | 0.5 to 4.5 mA   | 22 mA                               |
| 1.9 kΩ        | 0.022 %   | 0.025 %  | 0.045 %  | 0.01 Ω        | 0.2 to 3.3 mA   | 16 mA                               |
| 10 kΩ         | 0.022 %   | 0.025 %  | 0.045 %  | 0.1 Ω         | 0.1 to 1.5 mA   | 3 mA                                |
| 19 kΩ         | 0.026 %   | 0.029 %  | 0.045 %  | 0.2 Ω         | 0.05 to 1 mA  | 1.6 mA                              |
| 100 kΩ        | 0.035 %   | 0.038 %  | 0.045 %  | 2 Ω           | 10 to 280 μA  | 0.3 mA                              |
| 190 kΩ        | 0.039 %   | 0.042 %  | 0.045 %  | 8 Ω           | 5 to 150 μA   | 0.16 mA                             |
| 1 ΜΩ          | 0.035 %   | 0.04 %   | 0.055 %  | -             | 1 to 28 μA  | 30 μΑ                               |
| 1.9 ΜΩ        | 0.035 %   | 0.04 %   | 0.055 %  | -             | 0.5 to 15 μA  | 16 μΑ                               |
| 10 MΩ         | 0.09 %    | 0.1 %  | 0.18 %   | -             | 0.1 to 2.8 μA   | 3 μΑ                                |
| 19 ΜΩ         | 0.14 %    | 0.15 %   | 0.23 %   | -             | 0.05 to 1.5 μA  | 1.6 μΑ                              |
| 100 MΩ        | 0.49 %    | 0.5 %  | 1.45 %   | -             | 10 to 280 nA  | 300 nA                              |
| 190 MΩ        | 0.99 %    | 1.0 %  | 1.5 %  | -             | 5 to 150 nA   | 160 nA                              |

<sup>[1]</sup> Specifications apply to the displayed value, using 4-wire connections up to 190 k $\Omega$ .

<sup>[2]</sup> For 21 to 25  $^{\circ}$ C, <70  $^{\circ}$ RH.

<sup>[3]</sup> For all except 4-wire (COMP 4 wire) mode, 2-wire internal (COMP off) and external (COMP 2-wire) compensation is available up to 190 k $\Omega$ .

<sup>[4]</sup> For currents less than the specified load range, where  $I_{mi}$  is the minimum load current in the table and  $I_{actual}$  is the actual load current: Specification = Table specification X ( $I_{min} / I_{actual}$ ).

<sup>[5]</sup> Imax and Max Peak Current are limited to 150 mA for the 0 to 19  $\Omega$  resistors in COMP 2-wire mode.

#### AC Voltage (Sine Wave)

| Range                    | Frequency      | Specificatio<br>±(% of ou | ,                 | Resolution   | Max.       | Max. Distortion & Noise<br>10 Hz to 100 kHz        |
|--------------------------|----------------|---------------------------|-------------------|--------------|------------|--|
| Range                    | rrequency      | 90 days                   | 1 year            | Resolution   | Burden [1] | Bandwidth <sup>[2]</sup><br>±(% of output + floor) |
| 1.00 to                  | 45 to 65 Hz    | 0.31 % + 60               | 0.33 % + 60       | 10 μV        | 60 Ω       | 0.1 % + 300 μV                                     |
| 32.99 mV                 | 65 Hz to 1 kHz | 0.32 % + 60               | 0.34 % + 60       | 10 μν        | 00 22      | 0.1 % + 300 μν                                     |
| 33 to                    | 45 to 65 Hz    | 0.13 % + 60               | 0.15 % + 60       | 10\/         | 60 Ω       | 0.4.9/ 1.200\/                                     |
| 329.99 mV <sup>[3]</sup> | 65 Hz To 1 KHz | 0.14 % + 60               | 0.16 % + 60       | 10 μV        | 60 22      | 0.1 % + 300 μV                                     |
| 0.33 to                  | 45 to 65 Hz    | 0.09 % + 180              | 0.10 % + 180      | 100\/        | 300 mA     | 0.2 % + 600 μV                                     |
| 3.2999 V <sup>[3]</sup>  | 65 Hz to 1 kHz | 0.10 % + 180              | 0.11 % + 180      | 100 μV       | 300 IIIA   | 0.2 % + 600 μν                                     |
| 3.3 to                   | 45 to 65 Hz    | 0.09 % + 1800             | 0.10 % + 1800     | 1 mV         | 800 mA     | 0.5 % + 6 mV                                       |
| 32.999 V                 | 65 Hz to 1 kHz | 0.11 % + 1800             | 0.12 % + 1800     | 1 1111       | 000 IIIA   | 0.5 /0 + 0 1114                                    |
| 33 to 101.99 V           | 45 to 65 Hz    | 0.12 % + 18000            | 0.14 % + 18000    | 10 mV        | 400 mA     | 0.5 % + 30 mV                                      |
| 33 to 101.99 V           | 65 Hz to 1 kHz | 0.13 % + 18000            | 0.15 % + 18000    | 10 1110      | 400 IIIA   | 0.5 % + 30 IIIV                                    |
| 102 to                   | 45 to 65 Hz    | 0.12 % + 18000            | 0.14 % + 18000    | 10 mV        | 120 mA     | 0.5 % + 30 mV                                      |
| 329.99 V                 | 65 Hz to 1 kHz | 0.13 % + 18000            | 0.15 % + 18000    | 101110       | 120 1117   | 0.5 /0 + 50 1110                                   |
| 330 to                   | 45 to 65 Hz    | 0.12 % + 180000           | 0.14 % + 180000   | 100 mV       | 40 mA      | 0.5 % + 100 mV                                     |
| 1020.0 V                 | 65 Hz to 1 kHz | 0.13 % + 180000           | 0.15 % + 180000   | 100 1110     | 40 11174   | 0.5 /0 1 100 1114                                  |
|                          |                | Auxiliary C               | output (dual outp | ut mode only | )          |  |
| 10 to                    | 45 to 65 Hz    | 0.18 % + 1000             | 0.20 % + 1000     | 10 μV        | 5 mA       | 0.2 % + 600 μV                                     |
| 329.99 mV                | 65 Hz to 1 kHz | 0.20 % + 1000             | 0.22 % + 1000     | 10 μν        | 3 IIIA     | 0.2 /0 1 000 μν                                    |
| 0.33 to                  | 45 to 65 Hz    | 0.18 % + 1000             | 0.20 % + 1000     | 100 μV       | 5 mA       | 0.2 % + 600 μV                                     |
| 3.2999 V                 | 65 Hz to 1 kHz | 0.20 % + 1000             | 0.22 % + 1000     | 100 μν       | JIIIA      | 0.2 /0 ± 000 μV                                    |
| 3.3 to 5.000 V           | 45 to 65 Hz    | 0.18 % + 1000             | 0.20 % + 1000     | 1 mV         | 5 mA       | 0.2 % + 600 μV                                     |
| 3.3 to 3.000 V           | 65 Hz to 1 kHz | 0.20 % + 1000             | 0.22 % + 1000     | I IIIV       | 5 MA       | 0.2 % + 600 μV                                     |

Remote sensing is not provided. Output resistance is 60  $\Omega$  for outputs <330 mV. Output resistance is <5 m $\Omega$  for outputs ≥0.33 V. The AUX output resistance is <1  $\Omega$ . The maximum load capacitance is 500 pF.

<sup>[2]</sup> For a resistive load. Bandwidth of 10 Hz to 10 kHz for Auxiliary Output.

<sup>[3]</sup> In dual output mode with output currents >0.33 A, the floor specification is 3X for specified outputs.

#### AC Current (Sine Wave)

| Range                            | Frequency      |                | n, tcal ±5 °C<br>tput + μA) | Compliance<br>Adder [2] | Max. Distortion & Noise 10 Hz to 10 kHz | Max.<br>Inductive    |
|----------------------------------|----------------|----------------|-----------------------------|-------------------------|---|----------------------|
|                                  |                | 90 days        | 1 year                      | (μ <b>A</b> /V)         | Bandwidth ±(% of output + floor)        | Load (μH)            |
|                                  |                |                | LCOMP OFF                   |                         |   |                      |
| 29.0 to                          | 45 to 65 Hz    | 0.24 % + 0.75  | 0.25 % + 0.75               | 0.05                    | 0.2 % + 3 μA                            | 200                  |
| 329.9 μΑ                         | 65 Hz to 1 kHz | 0.25 % + 0.75  | 0.26 % + 0.75               | 0.15                    | 0.2 % + 3 μΑ                            | 200                  |
| 0.33 to                          | 45 to 65 Hz    | 0.21 % + 0.9   | 0.22 % + 0.9                | 0.05                    | 0.2 % + 5 μA                            | 200                  |
| 3.2999 mA                        | 65 Hz to 1 kHz | 0.22 % + 0.9   | 0.23 % + 0.9                | 0.15                    | 0.2 % + 5 μΑ                            | 200                  |
| 3.3 to                           | 45 to 65 Hz    | 0.09 % + 12    | 0.10 % + 12                 | 0.05                    | 0.2 % + 15 μA                           | 50                   |
| 32.999 mA                        | 65 Hz to 1 kHz | 0.18 % + 12    | 0.19 % + 12                 | 0.15                    | 0.2 % + 15 μΑ                           | 50                   |
| 33 to                            | 45 to 65 Hz    | 0.09 % + 120   | 0.10 % +120                 | 0.1                     | 0.2 % + 150 μA                          | 50                   |
| 329.99 mA                        | 65 Hz to 1 kHz | 0.18 % + 120   | 0.19 % +120                 | 0.2                     | 0.2 % + 150 μΑ                          | 50                   |
| 0.33 to                          | 45 to 65 Hz    | 0.09 % + 1200  | 0.10 % + 1200               | 10                      | 0.35 % + 1.5 mA                         | 2.5                  |
| 1.0999 A                         | 65 Hz to 1 kHz | 0.22 % + 1200  | 0.24 % + 1200               | 125                     | 0.35 % + 1.5 IIIA                       | 2.5                  |
| 1.1 to                           | 45 to 65 Hz    | 0.09 % + 1500  | 0.10 % + 1500               | 10                      | 0.35 % + 1.5 mA                         | 2.5                  |
| 2.9999 A                         | 65 Hz to 1 kHz | 0.26 % + 1500  | 0.28 % + 1500               | 125                     | 0.35 % + 1.5 IIIA                       | 2.0                  |
| 3.0 to                           | 45 to 65 Hz    | 0.24 % + 6000  | 0.25 % + 6000               | 10                      | 0.6 % + 15 mA                           | 1                    |
| 10.999 A                         | 65 Hz to 1 kHz | 0.38 % + 6000  | 0.40 % + 6000               | 125                     | 0.0 % + 15 IIIA                         | <u>'</u>             |
| 11 to                            | 45 to 65 Hz    | 0.48 % + 15000 | 0.50 % + 15000              | 10                      | 0.00/ + 45 4                            | 4                    |
| 20.500 A <sup>[1]</sup>          | 65 Hz to 1 kHz | 0.50 % + 15000 | 0.52 % + 15000              | 125                     | 0.6 % + 15 mA                           | 1                    |
|                                  |                |                | LCOMP ON                    |                         |   |                      |
| 29.0 to<br>329.9 μA              |                | 0.24 % + 0.75  | 0.25 % + 0.75               | 0.05                    | 0.3 % + 3 μΑ                            |                      |
| 0.33 to<br>3.2999 mA             |                | 0.21 % + 0.9   | 0.22 % + 0.9                | 0.05                    | 0.5 % + 5 μΑ                            |                      |
| 3.3 to<br>32.999 mA              |                | 0.19 % + 9     | 0.20 % + 9                  | 0.05                    | 0.5 % + 15 μΑ                           |                      |
| 33 to<br>329.99 mA               | 45 45 05 11-   | 0.19 % + 90    | 0.20 % + 90                 | 0.1                     | 0.5 % + 150 μΑ                          | [3]                  |
| 0.33 to<br>1.0999 A              | 45 to 65 Hz    | 0.20 % + 900   | 0.21 % + 900                | 10                      | 0.6 % + 1.5 mA                          | 2.5 H <sup>[3]</sup> |
| 1.1 to<br>2.9999 A               |                | 0.22 % + 900   | 0.23 % + 900                | 10                      | 0.6 % + 1.5 mA                          |                      |
| 3.0 to<br>10.999 A               |                | 0.24 % + 6000  | 0.25 % + 6000               | 10                      | 0.6 % + 1.5 mA                          |                      |
| 11 to<br>20.500 A <sup>[1]</sup> |                | 0.48 % + 15000 | 0.50 % + 15000              | 10                      | 0.6 % + 1.5 mA                          |                      |

<sup>[1]</sup> Duty Cycle: Currents <11 A may be provided continuously. For currents >11 A, the current may be provided 60 T-I minutes in any 60 minute period where T is the temperature in °C (room temperature is about 23 °C) and I is the output current in amps. For example, 17 A at 23 °C could be provided for 60-17-23 = 20 minutes each hour. When the 5080A is outputting currents between 5 and 11 amps for long periods, the internal self-heating reduces the duty cycle. Under those conditions, the allowable "on" time indicated by the formula is achieved only after the 5080A is outputting currents <5 A for the "off" period first.

<sup>[3]</sup> Subject to compliance voltage limits.

| Range                               | Resolution (μA) | Max. Compliance Voltage,<br>LCOMP Off, V rms | Max. Compliance Voltage,<br>LCOMP On, V rms |  |  |
|-------------------------------------|-----------------|--|---|--|--|
| 29.0 to 329.9 μA                    | 0.1             | 3.3 <sup>[1]</sup>                           | 3.3 <sup>[1]</sup>                          |  |  |
| 0.33 to 3.2999 mA                   | 0.1             | 6.5  | 6.5   |  |  |
| 3.3 to 32.999 mA                    | 1               | 6.5  | 44  |  |  |
| 33 to 329.99 mA                     | 10              | 6  | 25  |  |  |
| 0.33 to 2.9999 A                    | 100             | 4  | 4   |  |  |
| 3 to 20.500 A                       | 1000            | 3  | 3   |  |  |
| [1] Load impedance <10 k $\Omega$ . |                 |  |   |  |  |

<sup>[2]</sup> To be applied for compliance voltages >1 V rms.

#### **DC Power Summary**

|         |                 |   | Curr             | ents             |             |
|---------|-----------------|---|------------------|------------------|-------------|
| Time    | Voltage         | 0.33 to 3.2999 mA                                   | 3.3 to 329.99 mA | 0.33 to 2.9999 A | 3 to 20.5 A |
|         |                 | Specification, tcal ±5 °C, ±(% of watts output) [1] |                  |                  |             |
| 90 days | 33 mV to 1020 V | 0.14  | 0.11             | 0.21             | 0.52        |
| 1 year  | 33 mV to 1020 V | 0.15  | 0.11             | 0.22             | 0.54        |

To determine the actual dc power specification, see the individual "DC Voltage Specifications", "DC Current Specifications", and "Calculating Power Specifications" sections. The actual specification at the operating point will usually be significantly better than the table value, since the specifications state the minimum performance for the voltages and currents listed.

#### AC Power Summary

|         |                  |                  | Curr                  | ents               |                 |
|---------|------------------|------------------|-----------------------|--------------------|-----------------|
| Time    | Voltages         | 3.3 to 8.9999 mA | 9 to 32.999 mA        | 33 to 89.99 mA     | 90 to 329.99 mA |
|         |                  | Specification    | , tcal ±5 °C, 45 to 6 | Hz, PF = 1, ±(% of | watts output)   |
| 90 days | 33 to 329.999 mV | 0.56             | 0.43                  | 0.56               | 0.43            |
| 90 days | 330 mV to 1020 V | 0.50             | 0.34                  | 0.50               | 0.34            |
| 1 year  | 33 to 329.999 mV | 0.58             | 0.45                  | 0.58               | 0.45            |
| i yeai  | 330 mV to 1020 V | 0.51             | 0.36                  | 0.51               | 0.36            |
|         |                  | Currents         |                       |                    |                 |
|         |                  | 0.33 to 0.8999 A | 0.9 to 2.1999 A       | 2.2 to 4.499 A     | 4.5 to 20.5 A   |
|         |                  | Specification    | , tcal ±5 °C, 45 to 6 | Hz, PF = 1, ±(% of | watts output)   |
| 00 days | 33 to 329.999 mV | 0.57             | 0.43                  | 0.54               | 0.69            |
| 90 days | 330 mV to 1020 V | 0.51             | 0.35                  | 0.47               | 0.64            |
| 1 year  | 33 to 329.999 mV | 0.59             | 0.46                  | 0.56               | 0.72            |
| 1 year  | 330 mV to 1020 V | 0.52             | 0.37                  | 0.49               | 0.67            |

#### Notes

To determine the actual ac power specification, see the individual "AC Voltage Specifications", "AC Current Specifications", "Phase Specifications", and "Calculating Power Specifications" sections. The actual specification at the operating point will usually be significantly better than the table value, since the specifications state the minimum performance for the voltages and currents listed.

#### Power and Dual Output Limits

| Frequency       | Voltages (NORMAL) | Currents          | Voltages (AUX) | Power Factor (PF) |
|-----------------|-------------------|-------------------|----------------|-------------------|
| DC              | 0 to ±1020 V      | 0 to ±20.5 A      | 0 to ±7 V      | -                 |
| 45 to 65 Hz     | 33 mV to 1000 V   | 3.3 mA to 20.5 A  | 100 mV to 5 V  | 0 to 1            |
| 65 to 500 Hz    | 330 mV to 1000 V  | 33 mA to 2.9999 A | 100 mV to 5 V  | 0 to 1            |
| 05 to 500 HZ    | 3.3 V to 1000 V   | 33 mA to 20.5 A   | 100 mV to 5 V  | 0 to 1            |
| 500 Hz to 1 kHz | 330 mV to 1000 V  | 33 mA to 20.5 A   | 100 mV to 5 V  | 1                 |

#### Notes

The range of voltages and currents shown in "DC Voltage Specifications", "DC Current Specifications", "AC Voltage Specifications", and "AC Current Specifications" are available in the power and dual output modes, except that the minimum current for AC power is 0.33 mA However, only the voltages and currents shown in this table are specified. See "Calculating Power Specifications" to determine the specification at any points within this table.

The phase adjustment range for dual AC outputs is 0  $^{\circ}$  to  $\pm 179.9$   $^{\circ}$ . The phase resolution for dual AC outputs is 0.1 degree. Power and dual output amplitude settling times are typically <9 seconds.

#### Phase

| Specification, 1 year, tcal ±5 °C, ±(ΔΦ) [1][2] |              |                 |  |  |
|---|--------------|-----------------|--|--|
| 45 TO 65 Hz                                     | 65 to 500 Hz | 500 Hz to 1 kHz |  |  |
| 0.25 °  | 1.5 °        | 5.0 °           |  |  |
|   |              |                 |  |  |

- [1] See Power and Dual Output Limit specifications for applicable outputs.
- [2] Phase settling times are typically <18 seconds additional.

| Dhace (A) Wette | Dhace (A) VADe | PF    | Power Facto | r Adder due to Pha | se Error, ±(%)  |
|-----------------|----------------|-------|-------------|--------------------|-----------------|
| Phase (Φ) Watts | Phase (Φ) VARs |       | 45 to 65 Hz | 65 to 500 Hz       | 500 Hz to 1 kHz |
| 0 °             | 90 °           | 1.000 | 0.00 %      | 0.03 %             | 0.38 %          |
| 10 °            | 80 °           | 0.985 | 0.08 %      | 0.50 %             | -               |
| 20 °            | 70 °           | 0.940 | 0.16 %      | 0.99 %             | -               |
| 30 °            | 60 °           | 0.866 | 0.25 %      | 1.55 %             | -               |
| 40 °            | 50 °           | 0.766 | 0.37 %      | 2.23 %             | -               |
| 50 °            | 40 °           | 0.643 | 0.52 %      | 3.15 %             | -               |
| 60 °            | 30 °           | 0.500 | 0.76 %      | 4.57 %             | -               |
| 70 °            | 20 °           | 0.342 | 1.20 %      | 7.23 %             | -               |
| 80 °            | 10 °           | 0.174 | 2.48 %      | 14.88 %            | -               |
| 90 °            | 0 °            | 0.000 | -           | -                  | -               |

#### Notes

To calculate exact ac watts power factor adders due to phase error for values not shown, use the following formula:

$$Adder(\%) = 100(1 - \frac{Cos(\Phi + \Delta\Phi)}{Cos(\Phi)})$$

For example, for a PF of 0.9205 ( $\Phi$  = 23) and a phase specification of  $\Delta\Phi$  = 0.15, the ac watts power factor adder is:

$$Adder(\%) = 100(1 - \frac{Cos(23 + .15)}{Cos(23)}) = 0.11\%$$

#### Calculating Power Specifications

The Overall specification for power output in watts (or VARs) is based on the root sum square (rss) of the individual specifications in percent for the selected voltage, current, and power factor or VARs parameters:

Watts specification 
$$Spec_{power} = \sqrt{Spec^2_{voltage} + Spec^2_{current} + Spec^2_{pFadder}}$$
  
VARs specification  $Spec_{vARs} = \sqrt{Spec^2_{voltage} + Spec^2_{current} + Spec^2_{vARsadder}}$ 

Because there are a tremendous number of combinations, you should calculate the actual power specification for your selected voltages and currents. The method of calculation is best shown in the following examples (using 1-year specifications):

**Example 1** Output: 100 V, 1 A, 60 Hz, Power Factor = 1.0 ( $\Phi$ =0), 1-year specifications

Voltage Specification Specification for 100 V at 60 Hz is 0.14 % + 18 mV, totaling:

100 V x 0.0014 = 140 mV added to 18 mV = 158 mV. Expressed in percent: 158 mV/100 V x 100 = 0.158 % (see "AC Voltage Specifications").

Current Specification Specification for 1 A at 60 Hz is 0.10 % + 1200  $\mu$ A, totaling:

1 A x 0.001 = 1000  $\mu$ A added to 1200  $\mu$ A = 2.2 mA. Expressed in percent:

2.2 mA/1 A x 100 = 0.22 % (see "AC Current Specifications").

**PF Adder** Watts Adder for PF = 1 ( $\Phi$ =0) at 60 Hz is 0 % (see "Phase Specifications").

Total Watts Output Specification = 
$$Spec_{power} = \sqrt{0.158^2 + 0.22^2 + 0^2} = 0.27\%$$

**Example 2** Output: 100 V, 1 A, 50 Hz, Power Factor = 0.5 ( $\Phi$ =60), 1-year specifications

**Voltage Specification** Specification for 100 V at 50 Hz is, 0.14 % + 18 mV, totaling: 100 V x 0.0014 = 140 mV added to 18 mV = 158 mV. Expressed in percent:

158 mV/100 V x 100 = 0.158 % (see "AC Voltage Specifications").

Current Specification Specification for 1 A is 0.10 % + 1200  $\mu$ A, totaling:

1 A x  $0.001 = 1000 \,\mu\text{A}$  added to  $1200 \,\mu\text{A} = 2.2 \,\text{mA}$ . Expressed in percent:

 $2.2 \text{ mA/1 A} \times 100 = 0.22 \%$  (see "AC Current Specifications").

**PF Adder** Watts Adder for PF = 0.5 ( $\Phi$ =60) at 50 Hz is 0.76 % (see "Phase Specifications").

Total Watts Output Specification = 
$$Spec_{power} = \sqrt{0.158^2 + 0.22^2 + 0.76^2} = 0.81\%$$

VARs When the Power Factor approaches 0.0, the watts output specification becomes unrealistic because the dominant characteristic is the VARs (volts-amps-reactive) output. In these cases, calculate the Total VARs Output Specification, as shown in example 3:

**Example 3** Output: 100 V, 1 A, 400 Hz, Power Factor = 0.174 ( $\Phi$ =80), 1-year specifications

**Voltage Specification** Specification for 100 V at 400 Hz is, 0.15 % + 18 mV, totaling:  $100 \text{ V} \times 0.0015 = 150 \text{ mV}$  added to 18 mV = 168 mV. Expressed in percent:  $168 \text{ mV}/100 \text{ V} \times 100 = 0.168 \%$  (see "AC Voltage Specifications").

**Current Specification** Specification for 1 A at 400 Hz is 0.24 % + 1200  $\mu$ A, totaling: 1 A x 0.0024 = 2400  $\mu$ A added to 1200  $\mu$ A = 3.6 mA. Expressed in percent: 3.6 mA/1 A x 100 = 0.36 % (see "AC Current Specifications").

**VARs Adder** VARs Adder for  $\Phi$  = 80 at 400 Hz is 0.50 % (see "Phase Specifications").

Total VARS Output Specification = 
$$Spec_{VARs} = \sqrt{0.168^2 + 0.36^2 + 0.5^2} = 0.64\%$$

#### Frequency

| Frequency Range    | Resolution | Specification,<br>1 year, tcal ±5 °C | Jitter |
|--------------------|------------|--------------------------------------|--------|
| 45.00 to 119.99 Hz | 0.01 Hz    | 0.0050 % ±2 mHz                      | 4.00   |
| 120.0 to 1000.0 Hz | 0.1 Hz     | 0.0050 % ±2 IIIH2                    | 4 μs   |

#### Theory of Operation

This section gives a description of the analog and digital sections of the Product at a block diagram level. Figure 1 shows the assemblies loaded into the Product.

The Product outputs:

- DC voltage from 0 V to ±1020 V.
- AC voltage from 1 mV to 1020 V, with output from 45 Hz to 1 kHz.
- AC current from 29 μA to 20.5 A, with variable frequency limits.
- DC current from 0 to ±20.5 A.
- Discrete resistance values from a short circuit to 190 M $\Omega$ .
- Simultaneous voltage and current, up to an equivalent of 20.9 kVA.
- Two simultaneous voltages
- Variable phase signal

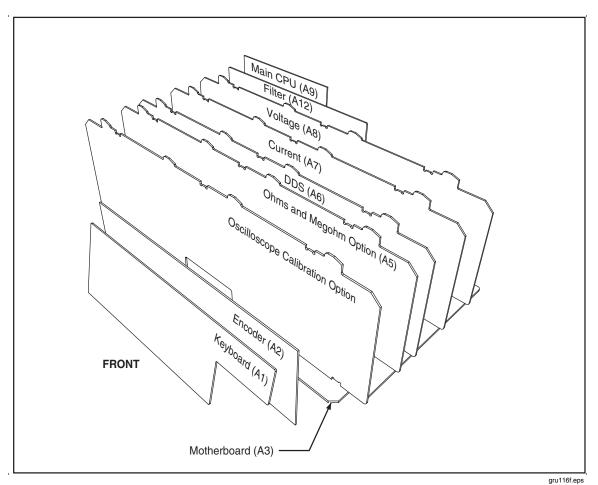


Figure 1. Internal Layout

#### Functional Block Diagram

Figures 2 and 3 show the block diagram of the Product.

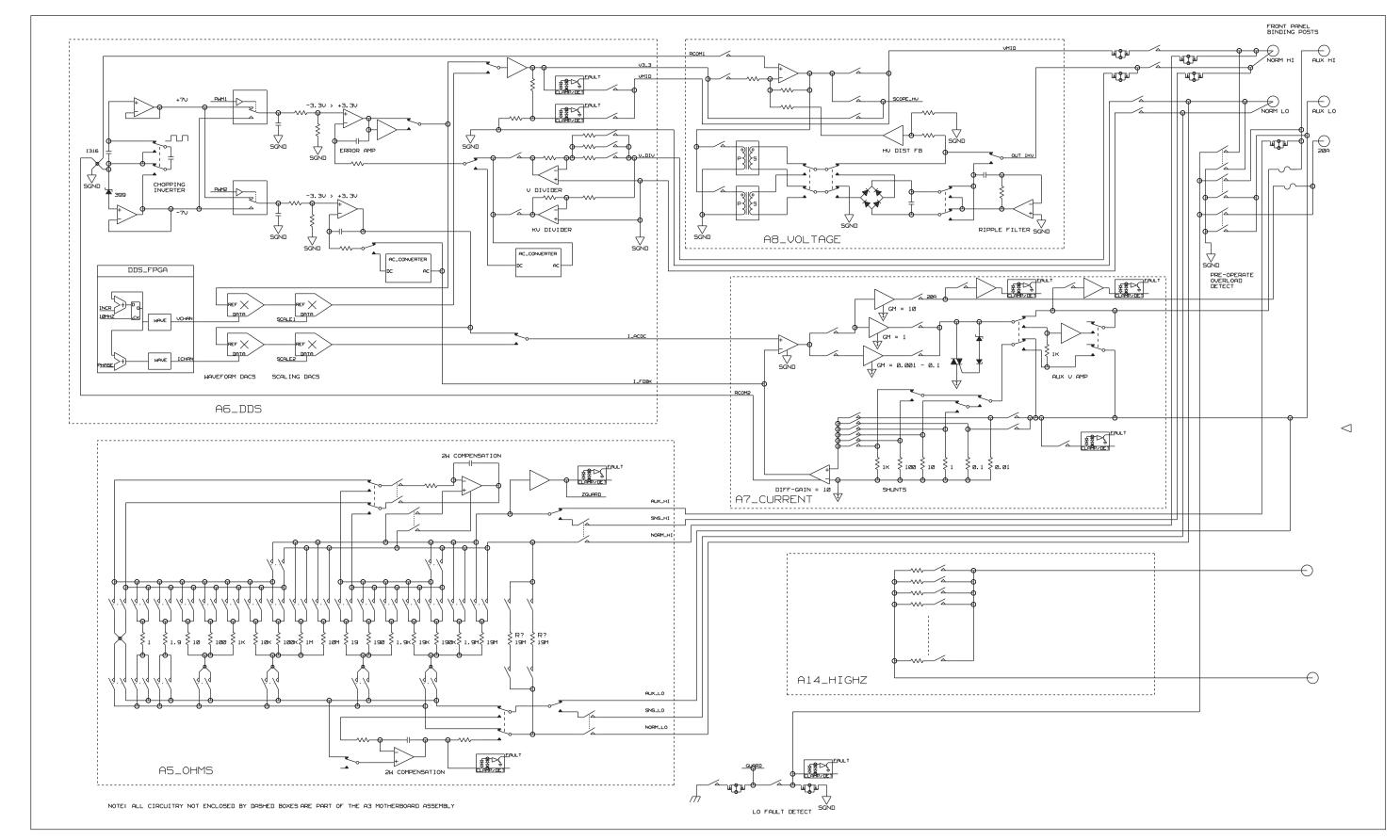


Figure 2. Block Diagram, Part 1

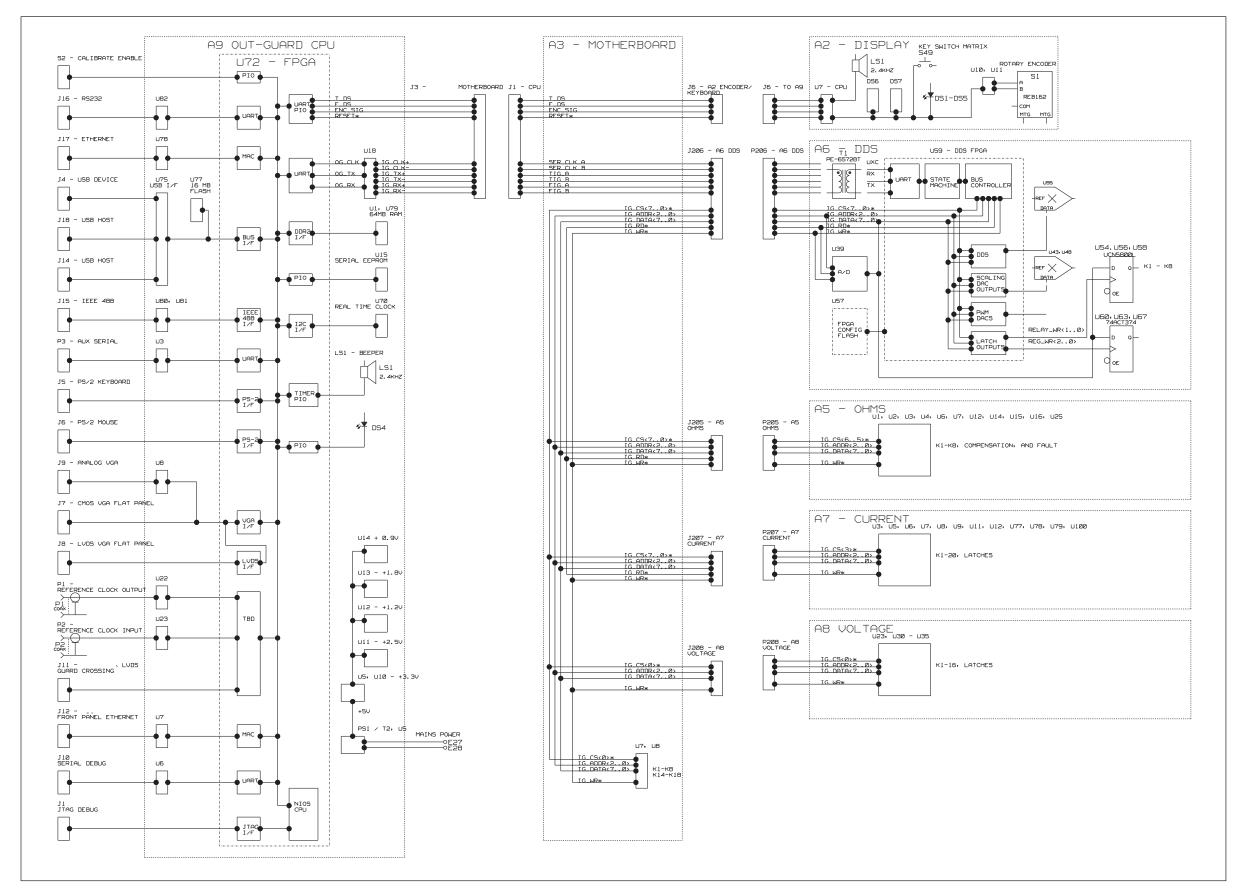


Figure 3. Block Diagram, Part 2

#### Encoder PCA (A2)

The Encoder PCA (A2) controls the front panel keyboard, knob, and displays. It has its own microprocessor and communicates with the Main CPU PCA (A9) on the Rear Panel through a serial link. Memory for the Encoder PCA is contained in EPROM. The Encoder PCA is the interface to the Keyboard PCA (A1).

#### Ohms PCA (A5)

The Ohms PCA (A5) sources 1x and 1.9x fixed value resistances, provides compensation, and generates an active guard. The board can source ohms in one of several ways: two-wire, two-wire with compensation, and 4-wire ohms.

Proprietary resistor networks are used in the ohms board. The values are not exact, but the resistors have excellent stability and low temperature coefficients. The resistors are made for 4-wire operation but may be used as 2-wire devices with degraded specifications. In four-wire mode, the resistors are connected to the NORM\_HI, NORM\_LO, AUX\_HI, and AUX\_LO terminals without additional active circuitry.

The relay switch matrix is used to switch in the resistors, compensation, and other circuits that provide all of the A5 Ohms functionality.

Besides 4-wire ohms and uncompensated 2-wire ohms, the user can also select to have two-wire compensated ohms where circuitry is used to negate most of the effects of path loss to a two terminal resistance measurement instrument.

Compensation circuits are protected by clamping diodes. However, the resistors have maximum peak currents that cannot be exceeded. See Figure 4.

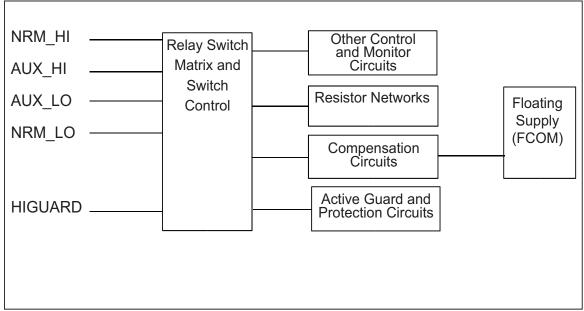


Figure 4. Ohms Function

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#### DDS PCA (A6)

The DDS (Direct Digital Synthesis) PCA (A6) has these functional blocks:

- References for all voltage and current functions
- Gain elements for voltage functions and thermocouple measurement and sources
- An A/D (Analog-to-Digital) measurement system to monitor all functions
- Self-calibration circuitry
- Zero calibration circuitry
- Precision voltage channel DAC (VDAC)
- Precision current channel DAC (IDAC)
- Dual-channel DDS (Direct Digital Synthesizer)

These functional blocks, when used with the Voltage (A8) and/or Current (A7) assemblies, supply:

- Single or dual channel ac and dc volts, amps, and watts
- Offsettable waveforms
- Internal calibration and diagnostics
- Digital control of all the analog assemblies

DACS are used to control the level of dc signals and to control the amplitude of ac signals.

#### **Current PCA (A7)**

The Current PCA outputs six current ranges (330  $\mu$ A, 3.3 mA, 33 mA, 330 mA, 3 A, and 20 A) and three voltage ranges (330 mV, 3.3 V, and 5 V) to the AUX outputs. The 20 A outputs are sourced through the 20 A AUX binding posts.

The Current PCA connects to the DDS PCA (A6). The Filter PCA (A12) supplies the high current power supplies.

The Current PCA (A7) has these functional blocks:

- Transconductance amplifier.
- Precision current shunts and amplifier. (These are the elements that set accuracy.)
- AUX voltage function.

Power for the Current PCA is provided by the Filter PCA (A12).

Figure 5 is a block diagram of the current function. Note that the DDS PCA works together with the Current PCA to supply current outputs.

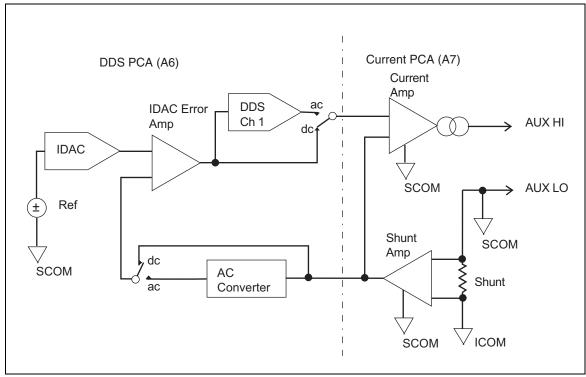


Figure 5. Current Function (AUX Out Ranges)

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#### Voltage PCA (A8)

The Voltage PCA (A8) supplies dc and ac voltage outputs in the range 3.3 V and above. It includes transformers and HV rectification for 330V and 1kV ACV and DCV ranges. It also supplies all the inguard supplies referenced to SCOM. See the "Power Supplies" section.

Figure 6 is a block diagram of the voltage function and shows the signal paths for dc and ac voltage outputs. The DAC shown in the figure is VDAC, which resides on the DDS PCA. Note that the voltage amplifier for outputs ≥3.3 V resides on the Voltage PCA, but the amplifier for voltage outputs <3.3 V is on the DDS PCA.

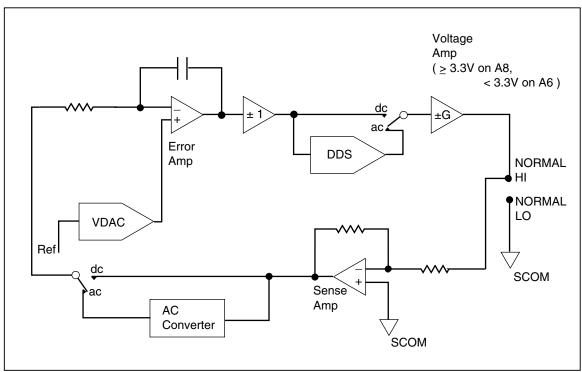


Figure 6. Voltage Function

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#### Main CPU PCA (A9)

The Main CPU PCA (A9) attached to the rear-panel assembly communicates with:

- Inguard CPU on the DDS PCA (A6)
- Display assembly CPU
- Serial interfaces

The main CPU memory is Flash ROM. There is a real-time clock with a battery backup.

The CPU PCA communicates with each of the analog PCAs via a digital bus. Each analog assembly has the same bus structure:

- One or more Chip Select lines
- Common data bus that connects to the motherboard, latched in by latches
- A fault line that sets all modules to a safe condition if a malfunction is found

The routing of signals to the front panel jacks are controlled by output relays on the motherboard.

#### **Power Supplies**

AC line voltage is applied through a line filter to a power module in the rear panel. The module switches to accommodate four line voltages. The outputs of the power module are attached directly to the primaries of the mains transformer. The safety ground wire is attached from the power module to the rear panel.

Major internal grounds are SCOM, which is attached to OUTPUT LO and the guard shell, ICOM, which is the internal ground for the current function, and GCOM, which is the outguard common and is attached to earth ground.

#### **Outquard Supplies**

All the transformer connections for the outguard supplies come through one bundle of wires connected to the motherboard with P1. A row of test points in front of the fan lets you to connect to the raw and regulated supplies. The outguard supplies are used only by the CPU PCA (A9) and Encoder PCA (A2).

#### Inguard Supplies

The inguard power supplies are provided by the Voltage PCA (A8) via the motherboard (A3). The motherboard is connected to the mains transformer and includes current protection devices. Filter capacitors for the high-current supply for the Current PCA (A7) are located on the Filter PCA (A12).

The inguard SCOM referenced supplies are +15 V, -15 V, +5 V, -5 V, and +5 RLH. The +5 V and +5 RLH supplies share the same raw supply. The +5 RLH supply is used exclusively as a relay driver and is nominally approximately 6.3 V. Test points for these supplies are put in a row across the top of the Voltage PCA. The 65 V supplies are rectified and filtered on the motherboard but regulated on the Voltage PCA (A8).

### **Accessories and Options**

Table 2 lists accessories and options available for the Product.

**Table 2. Accessories and Options** 

| Accessory/Option   | Part Number                     |
|--|---------------------------------|
| Operators Manual   | 4770797                         |
| Service Manual   | 4770785                         |
| Documentation CD   | 4770772                         |
| Oscilloscope Calibration Option [1]  | 5080A-SC                        |
| MegOhm Meter Calibration Option [1]  | 5080A-MEG                       |
| Transit Case with Wheels   | 5080A/CASE                      |
| Double Banana Plug Adapter   | 105825                          |
| 5 A/250 V Time Delay Fuse (mains fuse for 100 V/120 V line voltage)  | 109215                          |
| 2.5 A/250 V Time Delay Fuse (mains fuse for 200 V/240 V line voltage)  | 851931                          |
| 4 A/500 V Fuse (AUX current output fuse)   | 3674001                         |
| 25 A/250 V Fuse (20 A current output fuse)   | 3470596                         |
| RS-232 Interface Cable   | RS43                            |
| Ethernet Internet Cable  | 884X-ETH                        |
| Calibration Software for Automated Calibration with 5080A  | 5080/CAL                        |
| MET/CAL w/MET/TEAM Software  | MET/CAL/TEAM                    |
| MET/CAL with MET/TEAM Express Software   | MET/CAL/TEAMXP                  |
| Additional MET/CAL License (for MET/TEAM or Express)   | MET/CAL-TL                      |
| Additional MET/TEAM License  | MET/TEAM-L                      |
| Additional MET/TEAM Express License  | MET/TEAMXP-L                    |
| [1] Options can be ordered factory installed with a new Product or added later at a Fluke Canditional installation and calibration charge. | alibration service center for a |

#### Performance Tests

The Performance Tests section contains the procedures used to make sure the Product performs to specifications.

#### Required Test Equipment

Table 3 is a list of the test equipment necessary to perform Verification and Calibration of the main Product functions.

**Table 3. Test Equipment for Verification and Calibration** 

| Test Equipment  | Recommended Model   |
|---|---|
| Reference Multimeter                                      | Fluke 8508A   |
|   | Fluke 5790A, Fluke 5790B, or equivalent.  |
| AC Measurement Standard                                   | Note The 5790A and 5790B have identical connections. This manual shows the 5790A in all of the illustrations but also apply to the 5790B. |
| Current shunts (10 mA, 50 mA, 20 A, 1 A, 2 A, and 200 mA) | Fluke A40B  |
| Shunt, 0.01 $\Omega$                                      | Guildline 9230  |
| Resistance Standard, 1 k $\Omega$                         | Fluke 742A-1k   |
| Resistance Standard, 100 $\Omega$                         | Fluke 742A-100  |
| Resistance Standard, 10 $\Omega$                          | Fluke 742A-10   |
| Resistance Standard, 1 $\Omega$                           | Fluke 742A-1  |
| Type-N Dual Banana Adapter                                | Fluke Part Number 900394  |
| A40 Current Shunt   | Fluke 792-7004  |
| Distortion Analyzer                                       | Krohn-Hite 6900B  |
| Phasemeter  | Clarke-Hess 6000  |
| Timer/Counter   | Fluke PM6680B   |

#### Verify the Main Calibrator

Use Tables 4 through 14 to make sure the Product operates to its specifications. The tables are for approved metrology personnel who have access to a standards laboratory that has equipment that can test calibration equipment of this level of accuracy. The tables show the recommended test points and the upper and lower limits for each point. The limits calculation is the 90-day specification added to or subtract from the output value. There is no built-in factor for measurement uncertainty.

Table 4. Verification Tests for DC Voltage (Normal)

| Range      | Output      | Lower Limit  | Upper Limit  |
|------------|-------------|--------------|--------------|
| 329.999 mV | 0.000 mV    | -0.0100 mV   | 0.0100 mV    |
| 329.999 mV | 329.000 mV  | 328.9538 mV  | 329.0462 mV  |
| 329.999 mV | -329.000 mV | -329.0462 mV | -328.9538 mV |
| 3.29999 V  | 0.000000 V  | -0.000015 V  | 0.000015 V   |
| 3.29999 V  | 1.00000 V   | 0. 999905 V  | 1.000095 V   |
| 3.29999 V  | -1.00000 V  | -1.000095 V  | 0.999905 V   |
| 3.29999 V  | 3.29000 V   | 3.289722 V   | 3.290278 V   |
| 3.29999 V  | -3.29000 V  | -3.290278 V  | -3.289722 V  |
| 32.9999 V  | 0.00000 V   | -0.00015 V   | 0.00015 V    |
| 32.9999 V  | 10.0000 V   | 9.99905 V    | 10.00095 V   |
| 32.9999 V  | -10.0000 V  | -10.00095 V  | -9.99905 V   |
| 32.9999 V  | 32.9000 V   | 32.89722 V   | 32.90278 V   |
| 32.9999 V  | -32.9000 V  | -32.90278 V  | -32.89722 V  |
| 100.000 V  | 100.000 V   | 99.9885 V    | 100.0115 V   |
| 100.000 V  | -100.000 V  | -100.0115 V  | -99.9885 V   |
| 329.999 V  | 329.000 V   | 328.9656 V   | 329.0344 V   |
| 329.999 V  | -329.000 V  | -329.0344 V  | -328.9656 V  |
| 1000.00 V  | 330.000 V   | 329.962 V    | 328.9656 V   |
| 1000.00 V  | -330.000 V  | -330.039 V   | -329.962 V   |
| 1000.00 V  | 1020.00 V   | 1019.893 V   | 1020.108 V   |
| 1000.00 V  | -1020.00 V  | -1020.108 V  | -1019.893 V  |

Table 5. Verification Tests for DC Voltage (AUX)

| Range      | Output     | Lower Limit | Upper Limit |
|------------|------------|-------------|-------------|
| 329.999 mV | 0.00 mV    | -1.000 mV   | 1.000 mV    |
| 329.999 mV | 329.00 mV  | 327.671 mV  | 330.329 mV  |
| 329.999 mV | -329.00 mV | -330.329 mV | -327.671 mV |
| 3.29999 V  | 3.2900 V   | 3.28571 V   | 3.29429 V   |
| 3.29999 V  | -3.2900 V  | -3.29429 V  | -3.28571 V  |
| 7.0000 V   | 7.000 V    | 6.9920 V    | 7.0080 V    |
| 7.0000 V   | -7.000 V   | -7.0080 V   | -6.9920 V   |

**Table 6. Verification Tests for DC Current** 

| Range  | Output      | Lower Limit  | Upper Limit |
|--------|-------------|--------------|-------------|
| 330 μΑ | 0.00 μΑ     | -0.100 μΑ    | 0.100 μΑ    |
| 330 μΑ | 329.00 μΑ   | 328.670 μΑ   | 329.330 μΑ  |
| 330 μΑ | -329.00 μΑ  | -329.330 μΑ  | -328.670 μΑ |
| 3.3 mA | 0.00000 mA  | -0.000250 mA | 0.000250 mA |
| 3.3 mA | 3.2900 mA   | 3.28778 mA   | 3.29222 mA  |
| 3.3 mA | -3.00000 mA | -3.29222 mA  | -3.28778 mA |
| 33 mA  | 0.00000 mA  | -0.001250 mA | 0.001250 mA |
| 33 mA  | 32.900 mA   | 32.8830 mA   | 32.9170 mA  |
| 33 mA  | -32.900 mA  | -32.9170 mA  | -32.8830 mA |
| 330 mA | 0.00000 mA  | -0.016500 mA | 0.016500 mA |
| 330 mA | 329.00 mA   | 328.826 mA   | 329.174 mA  |
| 330 mA | -329.00 mA  | -329.174 mA  | -328.826 mA |
| 1.1 A  | 0.00000 A   | -0.000220 A  | 0.000220 A  |
| 1.1 A  | 1.0000 A    | 0.99838 A    | 1.00162 A   |
| 1.1 A  | -1.0000 A   | -1.00162 A   | -0.99838 A  |
| 3 A    | 0.00000 A   | -0.000220 A  | 0.000220 A  |
| 3 A    | 2.9900 A    | 2.98440 A    | 2.99560 A   |
| 3 A    | -2.9900 A   | -2.99560 A   | -2.98440 A  |
| 11 A   | 0.00000 A   | -0.002500 A  | 0.002500 A  |
| 11 A   | 10.900 A    | 10.8724 A    | 10.9276 A   |
| 11 A   | -10.900 A   | -10.9276 A   | -10.8724 A  |
| 20.5 A | 0.00000 A   | -0.003750    | 0.003750 A  |
| 20.5 A | 19.9900 A   | 19.8007 A    | 19.9993 A   |
| 20.5 A | -19.9900 A  | -19.9993 A   | -19.8007 A  |

**Table 7. Verification Tests for 4-Wire Resistance** 

| Range      | Output     | Tolerance    |
|------------|------------|--------------|
| 0.0000 Ω   | 0.0000 Ω   | ±0.01000 Ω   |
| 1.0000 Ω   | 1.0000 Ω   | ±0.00989 Ω   |
| 1.9000 Ω   | 1.9000 Ω   | ±0.00931 Ω   |
| 10.000 Ω   | 10.000 Ω   | ±0.014 Ω     |
| 19.000 Ω   | 19.000 Ω   | ±0.0171 Ω    |
| 100.000 Ω  | 100.000 Ω  | ±0.035 Ω     |
| 190.000 Ω  | 190.000 Ω  | ±0.0665 Ω    |
| 1.00000 kΩ | 1.00000 kΩ | ±0.00022 kΩ  |
| 1.90000 kΩ | 1.90000 kΩ | ±0.000418 kΩ |
| 10.0000 kΩ | 10.0000 kΩ | ±0.0022 kΩ   |
| 19.0000 kΩ | 19.0000 kΩ | ±0.00494 kΩ  |
| 100.000 kΩ | 100.000 kΩ | ±0.035 kΩ    |
| 190.000 kΩ | 190.000 kΩ | ±0.0741 kΩ   |
| 1.00000 ΜΩ | 1.00000 MΩ | ±0.00035 MΩ  |
| 1.90000 MΩ | 1.90000 ΜΩ | ±0.000665 MΩ |
| 10.000 MΩ  | 10.000 ΜΩ  | ±0.0092 MΩ   |
| 19.000 ΜΩ  | 19.000 ΜΩ  | ±0.0266 MΩ   |
| 100.00 MΩ  | 100.00 ΜΩ  | ±0.049 MΩ    |
| 190.00 ΜΩ  | 190.00 ΜΩ  | ±1.876 MΩ    |

Table 8. Verification Tests for AC Voltage (Normal)

| Range  | Output    | Frequency | Lower Limit | Upper Limit |
|--------|-----------|-----------|-------------|-------------|
| 33 mV  | 10.00 mV  | 45 Hz     | 9.909 mV    | 10.091 mV   |
| 33 mV  | 10.00 mV  | 100 Hz    | 9.908 mV    | 10.092 mV   |
| 33 mV  | 10.00 mV  | 1 kHz     | 9.908 mV    | 10.092 mV   |
| 33 mV  | 32.90 mV  | 45 Hz     | 32.738 V    | 30.062 V    |
| 33 mV  | 32.90 mV  | 100 Hz    | 32.735 V    | 33.065 V    |
| 33 mV  | 32.90 mV  | 1 kHz     | 32.735 V    | 33.065 V    |
| 330 mV | 329.00 mV | 45 Hz     | 328.512 V   | 329.488 V   |
| 330 mV | 329.00 mV | 100 Hz    | 328.479 V   | 329.521 V   |
| 330 mV | 329.00 mV | 1 kHz     | 328.479 V   | 329.521 V   |
| 3.3 V  | 3.2900 V  | 45 Hz     | 3.28686 V   | 3.29314V    |
| 3.3 V  | 3.2900 V  | 100 Hz    | 3.28653 V   | 3.29347 V   |

Table 8. Verification Tests for AC Voltage (Normal) (cont.)

| Range  | Output   | Frequency | Lower Limit | Upper Limit |
|--------|----------|-----------|-------------|-------------|
| 3.3 V  | 3.2900 V | 1 kHz     | 3.28653 V   | 3.29347 V   |
| 33 V   | 32.900 V | 45 Hz     | 32.8686V    | 32.9314V    |
| 33 V   | 32.900 V | 100 Hz    | 32.8620 V   | 32.9380 V   |
| 33 V   | 32.900 V | 1 kHz     | 32.8620 V   | 32.9380 V   |
| 330 V  | 100.00 V | 45 Hz     | 99.862 V    | 100.138 V   |
| 330 V  | 100.00 V | 100 Hz    | 99.852 V    | 100.148 V   |
| 330 V  | 100.00 V | 1 kHz     | 99.862V     | 100.138V    |
| 1000 V | 1020.0 V | 45 Hz     | 1018.60 V   | 1021.40 V   |
| 1000 V | 1020.0 V | 100 Hz    | 1018.49 V   | 1021.51 V   |
| 1000 V | 1020.0 V | 1 kHz     | 1018.49 V   | 1021.51 V   |

Table 9. Verification Tests for AC Voltage (AUX)

| Range  | Output, AUX | Frequency | Lower Limit | Upper Limit |
|--------|-------------|-----------|-------------|-------------|
| 330 mV | 10.00 mV    | 45 Hz     | 8.982 mV    | 11.018 mV   |
| 330 mV | 10.00 mV    | 100 Hz    | 8.980 mV    | 11.020 mV   |
| 330 mV | 10.00 mV    | 1 kHz     | 8.980 mV    | 11.020 mV   |
| 330 mV | 329.00 mV   | 45 Hz     | 327.408 mV  | 330.592 mV  |
| 330 mV | 329.00 mV   | 100 Hz    | 327.342 mV  | 330.658 mV  |
| 330 mV | 329.00 mV   | 1 kHz     | 327.342 mV  | 330.658 mV  |
| 3.3 V  | 3.29000 V   | 45 Hz     | 3.283078 V  | 3.296922 V  |
| 3.3 V  | 3.29000 V   | 100 Hz    | 3.282420 V  | 3.297580 V  |
| 3.3 V  | 3.29000 V   | 1 kHz     | 3.282420 V  | 3.297580 V  |
| 5 V    | 5.00000 V   | 45 Hz     | 4.990000 V  | 5.010000 V  |
| 5 V    | 5.00000 V   | 100 Hz    | 4.989000 V  | 5.011000 V  |
| 5 V    | 5.00000 V   | 1 kHz     | 4.989000 V  | 5.011000 V  |

**Table 10. Verification Tests for AC Current** 

| Range  | Output   | Frequency | Lower Limit | Upper Limit |
|--------|----------|-----------|-------------|-------------|
| 330 μΑ | 29.0 μΑ  | 45 Hz     | 28.18 μΑ    | 29.82 μΑ    |
| 330 μΑ | 29.0 μΑ  | 100 Hz    | 28.18 μΑ    | 29.82 μΑ    |
| 330 μΑ | 29.0 μΑ  | 1 kHz     | 28.18 μΑ    | 29.82 μΑ    |
| 330 μΑ | 329.0 μΑ | 45 Hz     | 327.46 μΑ   | 330.54 μΑ   |
| 330 μΑ | 329.0 μΑ | 100 Hz    | 327.43 μΑ   | 330.57 μΑ   |
| 330 μΑ | 329.0 μΑ | 1 kHz     | 327.43 μΑ   | 330.57 μΑ   |

Table 10. Verification Tests for AC Current (cont.)

| Range  | Output    | Frequency | Lower Limit | Upper Limit |
|--------|-----------|-----------|-------------|-------------|
| 3.3 mA | 3.2900 mA | 45 Hz     | 3.28219 mA  | 3.29781 mA  |
| 3.3 mA | 3.2900 mA | 100 Hz    | 3.28186 mA  | 3.29814 mA  |
| 3.3 mA | 3.2900 mA | 1 kHz     | 3.28186 mA  | 3.29814 mA  |
| 33 mA  | 19.900 mA | 45 Hz     | 19.8701 mA  | 19.9299 mA  |
| 33 mA  | 19.900 mA | 100 Hz    | 19.8701 mA  | 19.9299 mA  |
| 33 mA  | 32.900 mA | 1 kHz     | 32.8288 mA  | 32.9712 mA  |
| 330 mA | 199.00 mA | 45 Hz     | 198.701 mA  | 199.299 mA  |
| 330 mA | 199.00 mA | 100 Hz    | 198.701 mA  | 199.299 mA  |
| 330 mA | 329.00 mA | 1 kHz     | 328.288 mA  | 329.712 mA  |
| 1.1 A  | 1.0000 A  | 45 Hz     | 0.99790 A   | 1.00210 A   |
| 1.1 A  | 1.0000 A  | 100 Hz    | 0.99790 A   | 1.00210 A   |
| 1.1 A  | 1.0000 A  | 1 kHz     | 0.99660 A   | 1.00340 A   |
| 3 A    | 1.9900 A  | 45 Hz     | 1.98671 A   | 1.99329 A   |
| 3 A    | 1.9900 A  | 100 Hz    | 1.98671 A   | 1.99329 A   |
| 3 A    | 2.9900 A  | 1 kHz     | 2.98073 A   | 2.99927 A   |
| 11 A   | 10.000 A  | 45 Hz     | 9.9700 A    | 10.0300 A   |
| 11 A   | 10.000 A  | 100 Hz    | 9.9700 A    | 10.0300 A   |
| 11 A   | 10.000 A  | 1 kHz     | 9.9560 A    | 10.0440 A   |
| 20.5 A | 19.900 A  | 45 Hz     | 19.7895 A   | 20.0105 A   |
| 20.5 A | 19.900 A  | 100 Hz    | 19.7855 A   | 20.0145 A   |
| 20.5 A | 19.900 A  | 1 kHz     | 19.7855 A   | 20.0145 A   |

Table 11. Verification Tests for Phase (Normal Voltage vs. AUX Current)

| Range,<br>Normal<br>Output | Output,<br>Normal V | Frequency | Range, AUX<br>Output<br>Current | Output<br>AUX | Phase | Lower<br>Limit | Upper<br>Limit |
|----------------------------|---------------------|-----------|---------------------------------|---------------|-------|----------------|----------------|
| 3.3 V                      | 3.00000 V           | 45 Hz     | 3.3 mA                          | 300.00 mA     | 0 °   | -0.25 °        | 0.25 °         |
| 3.3 V                      | 3.00000 V           | 500 Hz    | 3.3 mA                          | 300.00 mA     | 0 °   | -1.5 °         | 1.5 °          |
| 3.3 V                      | 3.00000 V           | 1 kHz     | 3.3 mA                          | 300.00 mA     | 0 °   | -5 °           | 5 °            |
| 3.3 V                      | 3.00000 V           | 65 Hz     | 2.5 A                           | 2.00000 A     | 0 °   | -0.25 °        | 0.25 °         |
| 3.3 V                      | 3.00000 V           | 65 Hz     | 2.5 A                           | 5.0000 A      | 0 °   | -0.25 °        | 0.25 °         |

Table 12. Verification Tests for Phase (Normal Voltage vs. Aux Voltage)

| Range | Output | Frequency | Range, AUX<br>Output<br>Voltage | Output<br>AUX | Phase | Lower<br>Limit | Upper<br>Limit |
|-------|--------|-----------|---------------------------------|---------------|-------|----------------|----------------|
| 3.3 V | 329 mV | 65 Hz     | 3.29999 V                       | 329 mV        | 0 °   | -0.25 °        | 0.25 °         |
| 3.3 V | 329 mV | 65 Hz     | 3.29999 V                       | 329 mV        | 60 °  | -0.25 °        | 0.25 °         |
| 3.3 V | 329 mV | 65 Hz     | 3.29999 V                       | 329 mV        | 90 °  | -0.25 °        | 0.25 °         |
| 3.3 V | 100 mV | 500 Hz    | 3.29999 V                       | 100 mV        | 0 °   | -1.5 °         | 1.5 °          |
| 3.3 V | 330 mV | 1 kHz     | 3.29999 V                       | 330 mV        | 0 °   | -5.00 °        | 5.00 °         |

**Table 13. Verification Tests for Distortion** 

| Range, Normal Output   | Output | Lower Limit | Upper Limit |
|------------------------|--------|-------------|-------------|
| 0.000 % @ 3 V 45 Hz    | 0.00 % | 0.00 %      | 0.22 %      |
| 0.000 % @ 3 V 100 Hz   | 0.00 % | 0.00 %      | 0.22 %      |
| 0.000 % @ 30 V 45 Hz   | 0.00 % | 0.00 %      | 0.52 %      |
| 0.000 % @ 30 V 1 kHz   | 0.00 % | 0.00 %      | 0.52 %      |
| 0.000 % @ 100 V 100 Hz | 0.00 % | 0.00 %      | 0.53 %      |
| 0.000 % @ 100 V 1 kHz  | 0.00 % | 0.00 %      | 0.53 %      |

**Table 14. Verification Tests for Frequency** 

| Range     | Output    | Nominal     | Lower Limit | Upper Limit |
|-----------|-----------|-------------|-------------|-------------|
| 3.29999 V | 1.00000 V | 100.0000 Hz | 99.993 Hz   | 100.007 Hz  |

# **MEGOHM Option Verification Tests**

The verification test points in Tables 15 through 17 are to be used as a guide when you re-verify the Calibrator. There is no built-in factor for measurement uncertainty. The tables are for approved metrology personnel who have access to a standards laboratory that has equipment that can test calibration equipment of this level of accuracy.

# Low Resistance Source (LVR) Verification

To verify the Low Resistance Source function:

1. Connect the low resistance source output to a standard multimeter as shown in Figure 7. Use a 4-wire connection and setup the multimeter for a 4-wire ohms measurement.

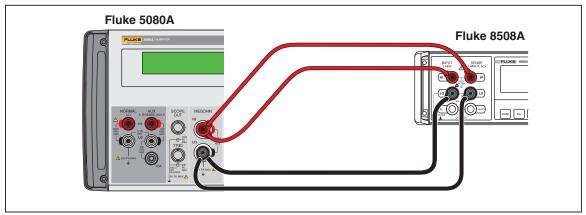


Figure 7. Low Resistance Verifications Connections

gru001.eps

- 2. Push 📠 on the Product.
- 3. Push the softkey labeled **MODE** until **Ivr** shows above the right-most Product softkey.
- 4. Set the multimeter for true ohms and auto range.
- 5. Measure the Low Resistance calibration performance at each resistance point in Table 15. Deviations must not be larger than the specified limits.

Table 15. Megohm Option LVR Verification Points

| Range     | Output    | Tolerance           |
|-----------|-----------|---------------------|
| 1.0000 Ω  | 1.0000 Ω  | ±0.0109 Ω           |
| 1.8000 Ω  | 1.8000 Ω  | $\pm 0.0139~\Omega$ |
| 3.7000 Ω  | 3.7000 Ω  | ±0.0208 Ω           |
| 5.9000 Ω  | 5.9000 Ω  | ±0.0288 Ω           |
| 10.000 Ω  | 10.000 Ω  | $\pm 0.045~\Omega$  |
| 18.000 Ω  | 18.000 Ω  | $\pm 0.075~\Omega$  |
| 37.000 Ω  | 37.000 Ω  | ±0.154 Ω            |
| 59.000 Ω  | 59.000 Ω  | ±0.281 Ω            |
| 100.00 Ω  | 100.00 Ω  | ±0.45 Ω             |
| 180.00 Ω  | 180.00 Ω  | ±0.75 Ω             |
| 370.00 Ω  | 370.00 Ω  | ±1.5 Ω              |
| 590.00 Ω  | 590.00 Ω  | ±2.0 Ω              |
| 1.0000 kΩ | 1.0000 kΩ | ±0.003 kΩ           |
| 1.8000 kΩ | 1.8000 kΩ | ±0.004 kΩ           |
| 3.7000 kΩ | 3.7000 kΩ | ±0.005 kΩ           |
| 5.9000 kΩ | 5.9000 kΩ | ±0.006 kΩ           |

# High Resistance Source (HVR) Verification

To verify the High Resistance Source function:

1. Connect the high resistance source output to the input terminals of a standard multimeter in 2-wire configuration as shown in Figure 8.

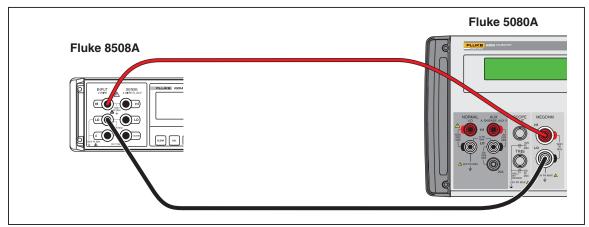


Figure 8. High Resistance Source Calibration Connections

gru002.eps

- 3. Push the softkey labeled **MODE** until **hvr** shows above the right-most Product softkey.
- 4. Set the multimeter for 2-wire ohms measurement and auto range.
- 5. Measure the High Resistance calibration performance at each resistance point shown in Table 16. Deviations should not be greater than the specified limits.

**Table 16. Megohm Option HVR Verification Points** 

| Range                     | Output    | Tolerance   |
|---------------------------|-----------|-------------|
| 10.000 kΩ                 | 10.000 kΩ | ±0.0200 kΩ  |
| 11.550 kΩ                 | 11.550 kΩ | ±0.0231 kΩ  |
| 21.000 kΩ                 | 21.000 kΩ | ±0.042 kΩ   |
| 42.000 kΩ                 | 42.000 kΩ | ±0.0840 kΩ  |
| 80.850 kΩ                 | 80.850 kΩ | ±0.1617 kΩ  |
| 100.00 kΩ                 | 100.00 kΩ | ±0.0200 kΩ  |
| 150.20 kΩ                 | 150.20 kΩ | ±0.0300 kΩ  |
| 288.20 kΩ                 | 288.20 kΩ | ±0.576 kΩ   |
| 500.00 kΩ                 | 500.00 kΩ | ±1.000 kΩ   |
| 535.50 kΩ                 | 535.50 kΩ | ±1.071 kΩ   |
| 1.0000 ΜΩ                 | 1.0000 MΩ | ±0.00300 MΩ |
| 1.0290 MΩ                 | 1.0290 MΩ | ±0.00309 MΩ |
| 1.9200 MΩ                 | 1.9200 MΩ | ±0.00576 MΩ |
| $3.6600~\mathrm{M}\Omega$ | 3.6600 MΩ | ±0.01098 MΩ |

| Range     | Output    | Tolerance   |
|-----------|-----------|-------------|
| 6.9800 MΩ | 6.9800 MΩ | ±0.02094 MΩ |
| 10.000 ΜΩ | 10.000 MΩ | ±0.0500 MΩ  |
| 10.240 MΩ | 10.240 MΩ | ±0.0512 MΩ  |
| 20.980 ΜΩ | 20.980 MΩ | ±0.1049 MΩ  |
| 39.190 MΩ | 39.190 MΩ | ±0.196 MΩ   |
| 76.550 MΩ | 76.550 MΩ | ±0.3827 MΩ  |
| 100.00 MΩ | 100.00 MΩ | ±0.500 MΩ   |
| 138.60 MΩ | 138.60 MΩ | ±0.693 MΩ   |
| 148.90 MΩ | 148.90 MΩ | ±0.744 MΩ   |
| 289.60 MΩ | 289.60 MΩ | ±1.448 MΩ   |
| 559.60 MΩ | 559.60 MΩ | ±2.798 MΩ   |

Table 16. Megohm Option HVR Verification Point (cont.)

6. Connect the Product directly to the megohmmeter as shown in Figure 9. Make sure you reverse the polarity.

### Note

When you use the 100 G $\Omega$  value on the Product for some megohmmeters, the leads must be swapped between the HI and LO ohms resistance output on the Product. The ground must be turned on (Gnd On) when you swap HI and LO leads positions in the high ohms resistance function. For example, to make a correct measurement with the Quadtech 1865 Megohmmeter, connect the HI terminal on the megohmmeter to the LO terminal on the Product and connect the LO terminal on the megohmmeter to the HI terminal on the Product. Turn the ground on and make the measurement.

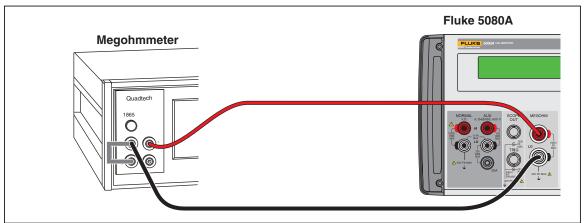


Figure 9. High Resistance Verification for 1 G  $\Omega$  and higher

aru003.eps

7. Setup the Quadtech 1865 as follows:

Voltage = 500 Charge Time = 5 Dwell time = 5 Measure time = 20 Discharge time = 5 Mode = Auto Number of average = 400

8. Verify the high resistance performance of the Product at the test points in Table 17. Deviations should not exceed the specified limits. For 18.24 G $\Omega$ , push the **MODE** softkey until 18G shows in the display.

**Table 17. High Resistance Verification** 

| Range     | Output    | Tolerance |
|-----------|-----------|-----------|
| 1.000 GΩ  | 1.000 GΩ  | ±0.010 GΩ |
| 1.060 GΩ  | 1.060 GΩ  | ±0.011 GΩ |
| 2.000 GΩ  | 2.000 GΩ  | ±0.020 GΩ |
| 3.920 GΩ  | 3.920 GΩ  | ±0.039 GΩ |
| 5.000 GΩ  | 5.000 GΩ  | ±0.050 GΩ |
| 5.370 GΩ  | 5.370 GΩ  | ±0.054 GΩ |
| 7.000 GΩ  | 7.000 GΩ  | ±0.070 GΩ |
| 7.210 GΩ  | 7.210 GΩ  | ±0.072 GΩ |
| 10.000 GΩ | 10.000 GΩ | ±0.100 GΩ |
| 18.24 GΩ  | 18.24 GΩ  | ±0.55 GΩ  |

# Scope Option Verification Tables

Before the 5080A/SC Option leaves the Fluke factory, it is verified to meet its specifications at the test points shown in Tables 18 through 28. The verification test points are provided here as a guide when re-verification is desired. Table 42 is a list of test equipment necessary for SC200 Scope option calibration.

Table 18. Voltage Function Verification: AC Voltage into a 1  $M\Omega$  Load

| Nominal Value (p-p) | Frequency | Measured Value<br>(p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|-------------------------|----------------|----------------------|
| 5.0 mV              | 10 Hz     |                         |                | 0.11                 |
| 5.0 mV              | 100 Hz    |                         |                | 0.11                 |
| 5.0 mV              | 1 kHz     |                         |                | 0.11                 |
| 5.0 mV              | 5 kHz     |                         |                | 0.11                 |
| 5.0 mV              | 10 kHz    |                         |                | 0.11                 |
| 10.0 mV             | 10 kHz    |                         |                | 0.12                 |
| 20.0 mV             | 100 Hz    |                         |                | 0.15                 |
| 20.0 mV             | 1 kHz     |                         |                | 0.15                 |

Table 18. Voltage Function Verification: AC Voltage into a 1  $\text{M}\Omega$  Load (cont.)

| Nominal Value (p-p) | Frequency | Measured Value<br>(p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|-------------------------|----------------|----------------------|
| 20.0 mV             | 10 kHz    |                         |                | 0.15                 |
| 50.0 mV             | 10 kHz    |                         |                | 0.23                 |
| 89.0 mV             | 10 Hz     |                         |                | 0.32                 |
| 89.0 mV             | 10 kHz    |                         |                | 0.32                 |
| 100.0 mV            | 10 kHz    |                         |                | 0.55                 |
| 200.0 mV            | 100 Hz    |                         |                | 0.60                 |
| 200.0 mV            | 1 kHz     |                         |                | 0.60                 |
| 500.0 mV            | 10 kHz    |                         |                | 1.35                 |
| 890.0 mV            | 10 Hz     |                         |                | 2.32                 |
| 890.0 mV            | 10 kHz    |                         |                | 2.32                 |
| 1.0 V               | 100 Hz    |                         |                | 2.60                 |
| 1.0 V               | 1 kHz     |                         |                | 2.60                 |
| 1.0 V               | 10 kHz    |                         |                | 2.60                 |
| 2.0 V               | 10 kHz    |                         |                | 5.10                 |
| 5.0 V               | 10 Hz     |                         |                | 12.60                |
| 5.0 V               | 10 kHz    |                         |                | 12.60                |
| 10.0 V              | 10 kHz    |                         |                | 25.10                |
| 20.0 V              | 10 kHz    |                         |                | 50.10                |
| 50.0 V              | 10 Hz     |                         |                | 125.10               |
| 50.0 V              | 100 Hz    |                         |                | 125.10               |
| 50.0 V              | 1 kHz     |                         |                | 125.10               |
| 50.0 V              | 10 kHz    |                         |                | 125.10               |
| 105.0 V             | 100 Hz    |                         |                | 262.60               |
| 105.0 V             | 1 kHz     |                         |                | 262.60               |

Table 19. Voltage Function Verification: AC Voltage into a 50  $\Omega$  Load

| Nominal Value (p-p) | Frequency | Measured Value<br>(p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|-------------------------|----------------|----------------------|
| 5.0 mV              | 10 Hz     |                         |                | 0.11                 |
| 5.0 mV              | 100 Hz    |                         |                | 0.11                 |
| 5.0 mV              | 1 kHz     |                         |                | 0.11                 |
| 5.0 mV              | 5 kHz     |                         |                | 0.11                 |
| 5.0 mV              | 10 kHz    |                         |                | 0.11                 |

Table 19. Voltage Function Verification: AC Voltage into a 50  $\Omega$  Load (cont.)

| Nominal Value (p-p) | Frequency | Measured Value<br>(p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|-------------------------|----------------|----------------------|
| 10.0 mV             | 100 Hz    |                         |                | 0.12                 |
| 10.0 mV             | 1 kHz     |                         |                | 0.12                 |
| 10.0 mV             | 10 kHz    |                         |                | 0.12                 |
| 20.0 mV             | 10 kHz    |                         |                | 0.15                 |
| 44.9 mV             | 10 Hz     |                         |                | 0.15                 |
| 44.9 mV             | 10 kHz    |                         |                | 0.21                 |
| 50.0 mV             | 10 kHz    |                         |                | 0.23                 |
| 100.0 mV            | 100 Hz    |                         |                | 0.35                 |
| 100.0 mV            | 1 kHz     |                         |                | 0.35                 |
| 100.0 mV            | 10 kHz    |                         |                | 0.35                 |
| 200.0 mV            | 10 kHz    |                         |                | 0.60                 |
| 449.0 mV            | 10 Hz     |                         |                | 1.22                 |
| 449.0 mV            | 10 kHz    |                         |                | 1.22                 |
| 500.0 mV            | 10 kHz    |                         |                | 1.35                 |
| 1.0 V               | 100 Hz    |                         |                | 2.60                 |
| 1.0 V               | 1 kHz     |                         |                | 2.60                 |
| 1.0 V               | 10 kHz    |                         |                | 2.60                 |
| 2.0 V               | 10 Hz     |                         |                | 5.10                 |
| 2.0 V               | 100 Hz    |                         |                | 5.10                 |
| 2.0 V               | 1 kHz     |                         |                | 5.10                 |
| 2.0 V               | 5 kHz     |                         |                | 5.10                 |
| 2.0 V               | 10 kHz    |                         |                | 5.10                 |

Table 20. Voltage Function Verification: DC Voltage into a 50  $\Omega$  Load

| Nominal Value (dc) | Measured Value (dc) | Deviation (mV) | 1-Year Spec. (mV) |
|--------------------|---------------------|----------------|-------------------|
| 0.0 mV             |                     |                | 0.10              |
| 5.0 mV             |                     |                | 0.11              |
| -5.0 mV            |                     |                | 0.11              |
| 10.0 mV            |                     |                | 0.12              |
| -10.0 mV           |                     |                | 0.12              |
| 22.0 mV            |                     |                | 0.15              |
| -22.0 mV           |                     |                | 0.15              |
| 25.0 mV            |                     |                | 0.16              |

Table 20. Voltage Function Verification: DC Voltage into a 50  $\Omega$  Load (cont.)

| Nominal Value (dc) | Measured Value (dc) | Deviation (mV) | 1-Year Spec. (mV) |
|--------------------|---------------------|----------------|-------------------|
| -25.0 mV           |                     |                | 0.16              |
| 55.0 mV            |                     |                | 0.24              |
| -55.0 mV           |                     |                | 0.24              |
| 100.0 mV           |                     |                | 0.35              |
| -100.0 mV          |                     |                | 0.35              |
| 220.0 mV           |                     |                | 0.65              |
| -220.0 mV          |                     |                | 0.65              |
| 250.0 mV           |                     |                | 0.72              |
| -250.0 mV          |                     |                | 0.72              |
| 550.0 mV           |                     |                | 1.47              |
| -550.0 mV          |                     |                | 1.47              |
| 700.0 mV           |                     |                | 1.85              |
| -700.0 mV          |                     |                | 1.85              |
| 2.2 V              |                     |                | 5.60              |
| -2.2 V             |                     |                | 5.60              |

Table 21. Voltage Function Verification: DC Voltage into a 1  $\text{M}\Omega$  Load

| Nominal Value (dc) | Measured Value (dc) | Deviation (mV) | 1-Year Spec. (mV) |
|--------------------|---------------------|----------------|-------------------|
| 0.0 mV             |                     |                | 0.10              |
| 5.0 mV             |                     |                | 0.11              |
| -5.0 mV            |                     |                | 0.11              |
| 22.0 mV            |                     |                | 0.15              |
| -22.0 mV           |                     |                | 0.15              |
| 25.0 mV            |                     |                | 0.16              |
| -25.0 mV           |                     |                | 0.16              |
| 45.0 mV            |                     |                | 0.21              |
| -45.0 mV           |                     |                | 0.21              |
| 50.0 mV            |                     |                | 0.23              |
| -50.0 mV           |                     |                | 0.23              |
| 220.0 mV           |                     |                | 0.65              |
| -220.0 mV          |                     |                | 0.65              |
| 250.0 mV           |                     |                | 0.72              |
| -250.0 mV          |                     |                | 0.72              |
| 450.0 mV           |                     |                | 1.22              |

Table 21. Voltage Function Verification: DC Voltage into a 1  $M\Omega$  Load (cont.)

| Nominal Value (dc) | Measured Value (dc) | Deviation (mV) | 1-Year Spec. (mV) |
|--------------------|---------------------|----------------|-------------------|
| -450.0 mV          |                     |                | 1.22              |
| 500.0 mV           |                     |                | 1.35              |
| -500.0 mV          |                     |                | 1.35              |
| 3.3 V              |                     |                | 8.35              |
| -3.3 V             |                     |                | 8.35              |
| 4.0 V              |                     |                | 10.10             |
| -4.0 V             |                     |                | 10.10             |
| 33.0 V             |                     |                | 82.60             |
| -33.0 V            |                     |                | 82.60             |

Table 22. Edge Function Verification

| Nominal Value (p-p) | Frequency | Pulse Response Time (nS) | 1-Year Spec. (ps) |
|---------------------|-----------|--------------------------|-------------------|
| 25.0 mV             | 1 MHz     |                          | 400               |
| 250.0 mV            | 1 MHz     |                          | 400               |
| 250.0 mV            | 10 kHz    |                          | 400               |
| 250.0 mV            | 100 kHz   |                          | 400               |
| 250.0 mV            | 1 MHz     |                          | 400               |
| 2.5 V               | 1 MHz     |                          | 400               |

Table 23. Wave Generator Function Verification: 1  $M\Omega$  Load

| Waveform | Nominal<br>Value (p-p) | Frequency | Measured<br>Value (p-p) | Deviation<br>(mV) | 1-Year Spec. |
|----------|------------------------|-----------|-------------------------|-------------------|--------------|
| Square   | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Square   | 20.0 mV                | 10 kHz    |                         |                   | 0.70 mV      |
| Square   | 89.0 mV                | 10 kHz    |                         |                   | 2.77 mV      |
| Square   | 219.0 mV               | 10 kHz    |                         |                   | 6.67 mV      |
| Square   | 890.0 mV               | 10 kHz    |                         |                   | 26.80 mV     |
| Square   | 6.5 V                  | 10 kHz    |                         |                   | 195.10 mV    |
| Square   | 55.0 V                 | 10 kHz    |                         |                   | 1.65 V       |
| Sine     | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Sine     | 20.0 mV                | 10 kHz    |                         |                   | 0.70 mV      |
| Sine     | 89.0 mV                | 10 kHz    |                         |                   | 2.77 mV      |
| Sine     | 219.0 mV               | 10 kHz    |                         |                   | 6.67 mV      |
| Sine     | 890.0 mV               | 10 kHz    |                         |                   | 26.80 mV     |

Table 23. Wave Generator Function Verification: 1  $M\Omega$  Load (cont.)

| Waveform | Nominal<br>Value (p-p) | Frequency | Measured<br>Value (p-p) | Deviation<br>(mV) | 1-Year Spec. |
|----------|------------------------|-----------|-------------------------|-------------------|--------------|
| Sine     | 6.5 V                  | 10 kHz    |                         |                   | 195.10 mV    |
| Sine     | 55.0 V                 | 10 kHz    |                         |                   | 1.65 V       |
| Triangle | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Triangle | 20.0 mV                | 10 kHz    |                         |                   | 0.70 mV      |
| Triangle | 89.0 mV                | 10 kHz    |                         |                   | 2.77 mV      |
| Triangle | 219.0 mV               | 10 kHz    |                         |                   | 6.67 mV      |
| Triangle | 890.0 mV               | 10 kHz    |                         |                   | 26.80 mV     |
| Triangle | 6.5 V                  | 10 kHz    |                         |                   | 195.10 mV    |

Table 24. Wave Generator Function Verification: 50  $\Omega$  Load

| Waveform | Nominal<br>Value (p-p) | Frequency | Measured<br>Value (p-p) | Deviation<br>(mV) | 1-Year Spec. |
|----------|------------------------|-----------|-------------------------|-------------------|--------------|
| Square   | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Square   | 10.9 mV                | 10 kHz    |                         |                   | 0.43 mV      |
| Square   | 44.9 mV                | 10 kHz    |                         |                   | 1.45 mV      |
| Square   | 109.0 mV               | 10 kHz    |                         |                   | 3.37 mV      |
| Square   | 449.0 mV               | 10 kHz    |                         |                   | 13.57 mV     |
| Square   | 1.1 V                  | 10 kHz    |                         |                   | 32.50 mV     |
| Square   | 2.2 V                  | 10 kHz    |                         |                   | 66.10 V      |
| Sine     | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Sine     | 10.9 mV                | 10 kHz    |                         |                   | 0.43 mV      |
| Sine     | 44.9 mV                | 10 kHz    |                         |                   | 1.45 mV      |
| Sine     | 109.0 mV               | 10 kHz    |                         |                   | 3.37 mV      |
| Sine     | 449.0 mV               | 10 kHz    |                         |                   | 13.57 mV     |
| Sine     | 1.1 V                  | 10 kHz    |                         |                   | 32.50 mV     |
| Sine     | 2.2 V                  | 10 kHz    |                         |                   | 66.10 V      |
| Triangle | 5.0 mV                 | 10 kHz    |                         |                   | 0.25 mV      |
| Triangle | 10.9 mV                | 10 kHz    |                         |                   | 0.43 mV      |
| Triangle | 44.9 mV                | 10 kHz    |                         |                   | 1.45 mV      |
| Triangle | 109.0 mV               | 10 kHz    |                         |                   | 3.37 mV      |
| Triangle | 449.0 mV               | 10 kHz    |                         |                   | 13.57 mV     |
| Triangle | 1.1 V                  | 10 kHz    |                         |                   | 32.50 mV     |
| Triangle | 2.2 V                  | 10 kHz    |                         |                   | 66.10 V      |

Table 25. Leveled Sine Wave Function Verification: Amplitude

| Nominal Value<br>(p-p) | Frequency | Measured Value (p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|------------------------|-----------|----------------------|----------------|----------------------|
| 5.0 mV                 | 50 kHz    |                      |                | 0.300                |
| 10.0 mV                | 50 kHz    |                      |                | 0.400                |
| 20.0 mV                | 50 kHz    |                      |                | 0.600                |
| 40.0 mV                | 50 kHz    |                      |                | 1.000                |
| 50.0 mV                | 50 kHz    |                      |                | 1.200                |
| 100.0 mV               | 50 kHz    |                      |                | 2.200                |
| 200.0 mV               | 50 kHz    |                      |                | 4.200                |
| 400.0 mV               | 50 kHz    |                      |                | 8.200                |
| 500.0 mV               | 50 kHz    |                      |                | 10.200               |
| 1.3 V                  | 50 kHz    |                      |                | 26.200               |
| 2.0 V                  | 50 kHz    |                      |                | 40.200               |
| 5.5 V                  | 50 kHz    |                      |                | 110.200              |

Table 26. Leveled Sine Wave Function Verification: Flatness

| Nominal Value<br>(p-p) | Frequency | Measured Value (p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|------------------------|-----------|----------------------|----------------|----------------------|
| 5.0 mV                 | 500 kHz   |                      |                | 0.17                 |
| 5.0 mV                 | 1 MHz     |                      |                | 0.17                 |
| 5.0 mV                 | 1 MHz     |                      |                | 0.17                 |
| 5.0 mV                 | 2 MHz     |                      |                | 0.17                 |
| 5.0 mV                 | 5 MHz     |                      |                | 0.17                 |
| 5.0 mV                 | 10 MHz    |                      |                | 0.17                 |
| 5.0 mV                 | 20 MHz    |                      |                | 0.17                 |
| 5.0 mV                 | 50 MHz    |                      |                | 0.17                 |
| 5.0 mV                 | 100 MHz   |                      |                | 0.17                 |
| 5.0 mV                 | 125 MHz   |                      |                | 0.20                 |
| 5.0 mV                 | 160 MHz   |                      |                | 0.20                 |
| 5.0 mV                 | 200 MHz   |                      |                | 0.20                 |
| 10.0 mV                | 500 kHz   |                      |                | 0.25                 |
| 10.0 mV                | 1 MHz     |                      |                | 0.25                 |
| 10.0 mV                | 1 MHz     |                      |                | 0.25                 |
| 10.0 mV                | 2 MHz     |                      |                | 0.25                 |
| 10.0 mV                | 5 MHz     |                      |                | 0.25                 |

Table 26. Leveled Sine Wave Function Verification: Flatness (cont.)

| Nominal Value (p-p) | Frequency | Measured Value (p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|----------------------|----------------|----------------------|
| 10.0 mV             | 10 MHz    |                      |                | 0.25                 |
| 10.0 mV             | 20 MHz    |                      |                | 0.25                 |
| 10.0 mV             | 50 MHz    |                      |                | 0.25                 |
| 10.0 mV             | 100 MHz   |                      |                | 0.25                 |
| 10.0 mV             | 125 MHz   |                      |                | 0.30                 |
| 10.0 mV             | 160 MHz   |                      |                | 0.30                 |
| 10.0 mV             | 200 MHz   |                      |                | 0.30                 |
| 40.0 mV             | 500 kHz   |                      |                | 0.70                 |
| 40.0 mV             | 1 MHz     |                      |                | 0.70                 |
| 40.0 mV             | 1 MHz     |                      |                | 0.70                 |
| 40.0 mV             | 2 MHz     |                      |                | 0.70                 |
| 40.0 mV             | 5 MHz     |                      |                | 0.70                 |
| 40.0 mV             | 10 MHz    |                      |                | 0.70                 |
| 40.0 mV             | 20 MHz    |                      |                | 0.70                 |
| 40.0 mV             | 50 MHz    |                      |                | 0.70                 |
| 40.0 mV             | 100 MHz   |                      |                | 0.70                 |
| 40.0 mV             | 125 MHz   |                      |                | 0.90                 |
| 40.0 mV             | 160 MHz   |                      |                | 0.90                 |
| 40.0 mV             | 200 MHz   |                      |                | 0.90                 |
| 100.0 mV            | 500 kHz   |                      |                | 1.60                 |
| 100.0 mV            | 1 MHz     |                      |                | 1.60                 |
| 100.0 mV            | 1 MHz     |                      |                | 1.60                 |
| 100.0 mV            | 2 MHz     |                      |                | 1.60                 |
| 100.0 mV            | 5 MHz     |                      |                | 1.60                 |
| 100.0 mV            | 10 MHz    |                      |                | 1.60                 |
| 100.0 mV            | 20 MHz    |                      |                | 1.60                 |
| 100.0 mV            | 50 MHz    |                      |                | 1.60                 |
| 100.0 mV            | 100 MHz   |                      |                | 1.60                 |
| 100.0 mV            | 125 MHz   |                      |                | 2.10                 |
| 100.0 mV            | 160 MHz   |                      |                | 2.10                 |
| 100.0 mV            | 200 MHz   |                      |                | 2.10                 |
| 400.0 mV            | 500 kHz   |                      |                | 6.10                 |

Table 26. Leveled Sine Wave Function Verification: Flatness (cont.)

| Nominal Value (p-p) | Frequency | Measured Value (p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|---------------------|-----------|----------------------|----------------|----------------------|
| 400.0 mV            | 1 MHz     |                      |                | 6.10                 |
| 400.0 mV            | 1 MHz     |                      |                | 6.10                 |
| 400.0 mV            | 2 MHz     |                      |                | 6.10                 |
| 400.0 mV            | 5 MHz     |                      |                | 6.10                 |
| 400.0 mV            | 10 MHz    |                      |                | 6.10                 |
| 400.0 mV            | 20 MHz    |                      |                | 6.10                 |
| 400.0 mV            | 50 MHz    |                      |                | 6.10                 |
| 400.0 mV            | 100 MHz   |                      |                | 6.10                 |
| 400.0 mV            | 125 MHz   |                      |                | 8.10                 |
| 400.0 mV            | 160 MHz   |                      |                | 8.10                 |
| 400.0 mV            | 200 MHz   |                      |                | 8.10                 |
| 1.3 V               | 500 kHz   |                      |                | 19.60                |
| 1.3 V               | 1 MHz     |                      |                | 19.60                |
| 1.3 V               | 1 MHz     |                      |                | 19.60                |
| 1.3 V               | 2 MHz     |                      |                | 19.60                |
| 1.3 V               | 5 MHz     |                      |                | 19.60                |
| 1.3 V               | 10 MHz    |                      |                | 19.60                |
| 1.3 V               | 20 MHz    |                      |                | 19.60                |
| 1.3 V               | 50 MHz    |                      |                | 19.60                |
| 1.3 V               | 100 MHz   |                      |                | 19.60                |
| 1.3 V               | 125 MHz   |                      |                | 26.10                |
| 1.3 V               | 160 MHz   |                      |                | 26.10                |
| 1.3 V               | 200 MHz   |                      |                | 26.10                |
| 5.5 V               | 500 kHz   |                      |                | 82.5                 |
| 5.5 V               | 1 MHz     |                      |                | 82.5                 |
| 5.5 V               | 1 MHz     |                      |                | 82.5                 |
| 5.5 V               | 2 MHz     |                      |                | 82.5                 |
| 5.5 V               | 5 MHz     |                      |                | 82.5                 |
| 5.5 V               | 10 MHz    |                      |                | 82.5                 |
| 5.5 V               | 20 MHz    |                      |                | 82.5                 |
| 5.5 V               | 50 MHz    |                      |                | 82.5                 |
| 5.5 V               | 100 MHz   |                      |                | 82.5                 |
|                     |           |                      |                |                      |

Table 26. Leveled Sine Wave Function Verification: Flatness (cont.)

| Nominal Value<br>(p-p) | Frequency | Measured Value (p-p) | Deviation (mV) | 1-Year Spec.<br>(mV) |
|------------------------|-----------|----------------------|----------------|----------------------|
| 5.5 V                  | 125 MHz   |                      |                | 110.00               |
| 5.5 V                  | 160 MHz   |                      |                | 110.00               |
| 5.5 V                  | 200 MHz   |                      |                | 110.00               |

Table 27. Leveled Sine Wave Function Verification: Frequency

| Nominal Value<br>(p-p) | Frequency | Measured Frequency | Deviation | 1-Year Spec.<br>(mV) |
|------------------------|-----------|--------------------|-----------|----------------------|
| 1.3 V                  | 50 kHz    |                    |           | 0.0013 kHz           |
| 1.3 V                  | 10 MHz    |                    |           | 0.0003 MHz           |
| 1.3 V                  | 200 MHz   |                    |           | 0.0063 MHz           |

**Table 28. Marker Generator Function Verification** 

| Nominal Interval | Measured Interval | Deviation | 1-Year Spec. |
|------------------|-------------------|-----------|--------------|
| 4.98 s           |                   |           | 25.12 ms     |
| 2.00 s           |                   |           | 4.05 ms      |
| 1 s              |                   |           | 1.03 ms      |
| 500.00 ms        |                   |           | 262.50 ms    |
| 200.00 ms        |                   |           | 45.00 ms     |
| 100.00 ms        |                   |           | 12.50 ms     |
| 50.00 ms         |                   |           | 3.75 ms      |
| 20.00 ms         |                   |           | 900.000 ns   |
| 10.00 ms         |                   |           | 350.00 ns    |
| 5.00 ms          |                   |           | 150.00 ns    |
| 2.00 ms          |                   |           | 54.00 ns     |
| 1.00 ms          |                   |           | 26.00 ns     |
| 500.00 μs        |                   |           | 12.750 ns    |
| 200.00 μs        |                   |           | 5.040 ns     |
| 100.00 μs        |                   |           | 2.510 ns     |
| 50.00 μs         |                   |           | 1.287 ns     |
| 20.00 μs         |                   |           | 0.506 ns     |
| 10.00 μs         |                   |           | 0.252 ns     |
| 5.00 μs          |                   |           | 0.125 ns     |
| 2.00 μs          |                   |           | 0.050 ns     |
| 1.00 μs          |                   |           | 0.025 ns     |

0.050 ps

| Nominal Interval | Measured Interval | Deviation | 1-Year Spec. |
|------------------|-------------------|-----------|--------------|
| 500.000 ns       |                   |           | 0.013 ns     |
| 200.000 ns       |                   |           | 5.000 ps     |
| 100.000 ns       |                   |           | 2.500 ps     |
| 50.000 ns        |                   |           | 1.250 ps     |
| 20.000 ns        |                   |           | 0.500 ps     |
| 10.000 ns        |                   |           | 0.250 ps     |
| 5.000 ns         |                   |           | 0.125 ps     |
|                  |                   |           |              |

**Table 28. Marker Generator Function Verification (cont.)** 

# Mainframe Calibration

2.000 ns

The standard Product has no internal hardware adjustments. Oscilloscope Options have hardware adjustments. The Control Display prompts you through the complete calibration procedure. Calibration occurs in the major steps below:

- 1. The Product sources specified output values and you measure the outputs with traceable measurement instruments of higher accuracy. The Product automatically programs the outputs and prompts you to make external connections to applicable measurement instruments.
- 2. At each measure and enter step, you can push the **OPTIONS**, and **BACK UP STEP** softkeys to redo a step, or **SKIP STEP** to skip over a step.
- 3. Enter the measured results manually through the front panel keyboard or through the remote interface with an external terminal or computer.

#### Note

Mixed in with the "output and measure" procedures are internal calibration procedures that are done without operator aid.

- 4. The Product computes a software correction factor and stores it in volatile memory.
- 5. When the calibration steps are complete, you are prompted to store all the correction factors in nonvolatile memory or discard them and start over.

For usual calibration, all steps but frequency and phase are necessary. All the usual calibration steps are available from the front panel interface as well as the remote interface (IEEE-488 or serial). Frequency and phase calibration are recommended after instrument repair, and are available only through the remote interface (IEEE-488 or serial). Remote commands for calibration are given later.

### Required Calibration Test Equipment

Table 29 shows the test equipment necessary.

Table 29. Test Equipment Required for Calibration

| Quantity | Manufacturer | Model          | Equipment  |
|----------|--------------|----------------|--|
| 1        | Fluke        | 8508A          | Reference Multimeter                                       |
| 1        | Fluke        | 5790A or 5790B | AC Measurement Standard                                    |
| 1        | Fluke        | A40B           | 10 mA, 50 mA, 20 A, 2 A, 1 A, and<br>200 mA current shunts |
| 1        | Fluke        | 742A-1k        | Resistance Standard, 1 k $\Omega$                          |
| 1        | Fluke        | 742A-100       | Resistance Standard, 100 $\Omega$                          |
| 1        | Fluke        | 742A-10        | Resistance Standard, 10 $\Omega$                           |
| 1        | Fluke        | 742A-1         | Resistance Standard, 1 $\Omega$                            |
| 1        | Guildline    | 9230           | 0.01 $\Omega$ shunt  |
| 1        | Fluke        | PN 900394      | Type N Dual Banana Adapter                                 |
| 1        | Fluke        | 792-7004       | A40 Current Shunt, Adapter                                 |
| 1        | Fluke        | 742A-1M        | Resistance Standard, 1 M $\Omega$                          |
| 1        | Fluke        | 742A-10M       | Resistance Standard, 10 M $\Omega$                         |
| 1        | Guildline    | 9334/100M      | Resistance Standard, 100 M $\Omega$                        |

### Start Calibration

To start a calibration:

- 1. Push SETUP.
- 2. Push the CAL softkey twice.
- 3. Push the 5080A CAL softkey.

### Note

The CALIBRATION SWITCH on the Product rear panel can be in either position when you begin calibration. It must be set to ENABLE to store the correction factors into nonvolatile memory.

After you push the **5080A CAL** softkey, the procedure works as follows:

- 1. The Product automatically programs the outputs and prompts you to make external connections to applicable measurement instruments.
- 2. The Product then goes into Operate mode, or prompts you to place it into Operate mode.
- 3. You are then prompted to type in the value read on the measurement instrument.

### Note

To redo a step, push the **OPTIONS**, and **BACK UP STEP** softkey, or skip over a step by pressing the **SKIP STEP** softkey

# **DC Volts Calibration (NORMAL Output)**

The equipment shown in Table 30 is necessary for calibration of the dc volts function. (The equipment is also listed in the consolidated table, Table 29.)

Table 30. Test Equipment Required for DC Volts Calibration

| Quantity | Manufacturer | Model | Equipment            |
|----------|--------------|-------|----------------------|
| 1        | Fluke        | 8508A | Reference Multimeter |

To calibrate the dc voltage function:

- 1. Make sure that the UUT is in Standby.
- 2. Start calibration as instructed in the *Start Calibration* section.
- 3. Perform an internal DC Zeros Calibration as prompted.
- 4. Connect the test equipment as shown in Figure 10.
- 5. Measure and enter the values from the UUT in Table 31 as prompted by the Product. Disconnect and reconnect the DMM as prompted during these steps.

DC Voltage adjust completed.

Table 31. Calibration Steps for DC Volts

| Step | 5080A Output (NORMAL) |
|------|-----------------------|
| 1    | 1.000000 V            |
| 2    | 3.000000 V            |
| 3    | -1.000000 V           |
| 4    | -3.000000 V           |
| 5    | 0.0000 mV             |
| 6    | 300.0000 mV           |
| 7    | 30.00000 V            |
| 8    | 300.0000 V            |
| 9    | 1000.000 V            |

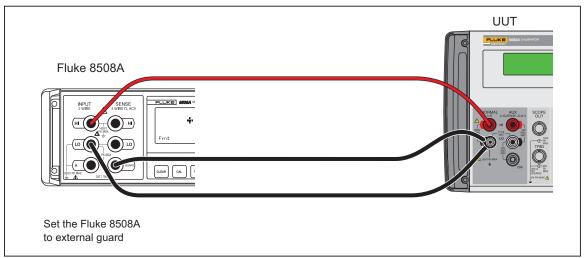


Figure 10. DC Voltage Adjustment Setup

gru005.eps

# AC Volts Calibration (NORMAL Output)

The equipment shown in Table 32 is necessary for calibration of the ac volts function. (The equipment is also listed in the consolidated table, Table 29.)

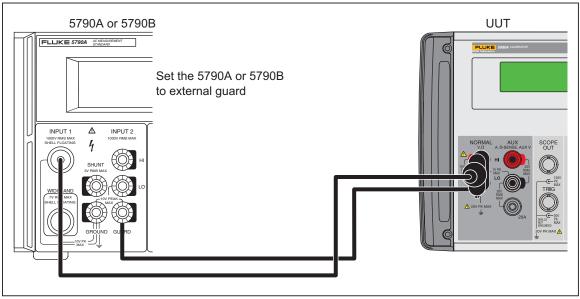
Table 32. Test Equipment Required for AC Volts Calibration

| Quantity | Manufacturer | Model        | Equipment                     |
|----------|--------------|--------------|-------------------------------|
| 1        | Fluke        | PN 900394    | Type N to dual banana adapter |
| 1        | Fluke        | 5790A, 5790B | AC Measurement Standard       |

To calibrate the ac voltage function:

- Measure the Product output through Input 1 of a Fluke 5790A or 5790B AC Measurement Standard. Use a Type N to dual banana adapter as shown in Figure 11..
- 2. Type in the measured values into the Product for each step in Table 33 as prompted.

AC Voltage adjust completed.



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Figure 11. AC Voltage Adjustment Setup

Table 33. Calibration Steps for AC Volts

| Steps | Output (NORMAL) |           |
|-------|-----------------|-----------|
|       | Amplitude       | Frequency |
| 1     | 3.2999 V        | 100.00 Hz |
| 2     | 0.3300 V        | 100.00 Hz |
| 3     | 30.000 mV       | 100.00 Hz |
| 4     | 300.000 mV      | 100.00 Hz |
| 5     | 30.0000 V       | 100.00 Hz |
| 6     | 300.000 V       | 100.00 Hz |
| 7     | 1000.00 V       | 100.00 Hz |

### **DC Current Calibration**

The equipment shown in Table 34 is necessary for calibration of the dc current function. (The equipment is also listed in the consolidated table, Table 29.)

You must use the calibrated dc current function of the Product later to prepare for ac calibration. Because of this, you must save the dc current constants after dc current calibration and exit calibration, then resume calibration. The dc current calibration procedure shows how to save, exit, and resume calibration.

| Quantity | Manufacturer | Model    | Equipment                         |
|----------|--------------|----------|-----------------------------------|
| 1        | Fluke        | 8508A    | DMM                               |
| 1        | Fluke        | 742A-1k  | Resistance Standard, 1 kΩ         |
| 1        | Fluke        | 742A-100 | Resistance Standard, 100 $\Omega$ |
| 1        | Fluke        | 742A-10  | Resistance Standard, 10 $\Omega$  |
| 1        | Fluke        | 742A-1   | Resistance Standard, 1 Ω          |
| 1        | Guildline    | 9230     | 0.01 Ω shunt                      |

Table 34. Test Equipment Required for DC Current Calibration

To calibrate the dc current function:

- 1. Make sure to zero each range before each DMM measurement.
- 2. Make sure the UUT is in standby.
- 3. Set the DMM to the dc voltage function.
- 4. Connect the DMM and 742A-1k Resistance Standard to the UUT as shown in Figure 12.
- 5. On the first dc current calibration point in Table 35, wait for the output to settle, record the DMM voltage measurement, and compute the UUT current output with the certified resistance value of the 742A.
- 6. Type in the computed value into the UUT.
- 7. Go to the subsequent calibration point, make sure that the UUT is in standby, and disconnect the 742A.
- 8. Redo steps 3 through 6 above with the resistance standard or current shunt specified for each calibration point in Table 35.
- 9. Exit calibration and save the calibration constants changed so far through the front panel menus or the CAL\_STORE remote command.

| Step | 5080A Output (AUX, HI, LO) | Shunt to Use                                    |
|------|----------------------------|---|
| 1    | 300.000 μΑ                 | Fluke 742A-1k 1 kΩ Resistance Standard          |
| 2    | 3.00000 mA                 | Fluke 742A-100 100 $\Omega$ Resistance Standard |
| 3    | 30.000 mA                  | Fluke 742A-10 10 $\Omega$ Resistance Standard   |
| 4    | 300.000 mA                 | Fluke 742A-1 1 Ω Resistance Standard            |
| 5    | 1.9000 A                   | Guildline 9230 0.01 $\Omega$ shunt              |

Table 35. Calibration Steps for DC Current

Table 35. Calibration Steps for DC Current (cont.)

| Step 5080A Output (AUX HI, LO) |           | Shunt to Use                       |
|--------------------------------|-----------|------------------------------------|
|                                | 20A, LO   |                                    |
| 6                              | 10.0000 A | Guildline 9230 0.01 $\Omega$ shunt |

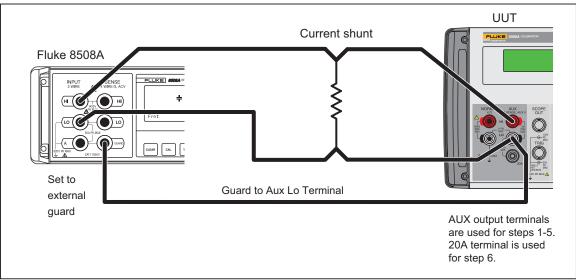


Figure 12. DC Current Adjustment Setup

gru006.eps

#### **AC Current Calibration**

#### Note

DC Current must be calibrated before you continue with the accurrent calibration.

The ac current calibration uses a number of current shunts that are necessary for dc characterization before they can be used. DC characterization can be done with the Product, if you do the full dc current calibration first. When you do a dc characterization, data is obtained for each of the ac current levels needed by the ac current calibration procedure. For example, if a shunt is used for 0.33 mA ac and 3.3 mA ac calibrations, data must be obtained at 0.33 mA dc and 3.3 mA dc.

### To characterize the shunt:

1. Connect the test equipment as shown in Figure 13.

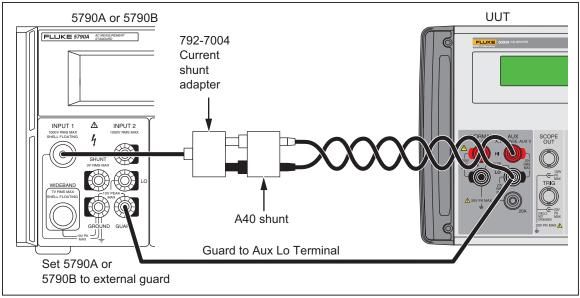


Figure 13. Connections for Calibrating AC Current with a Fluke A40 Shunt

gru007.eps

- 2. For each amplitude shown in Table 36, apply the equivalent +(positive) and (negative) dc current from the Product.
- 3. Calculate the actual dc characterization value with this formula:

The time between the dc characterization of a current shunt and the start calibration should be kept to a minimum. To decrease this time, each shunt is characterized as it is needed. As the ac current calibration procedure is done, it must be temporarily aborted each time a new shunt value is necessary. After the necessary shunt is characterized, the calibration procedure is continued at the previous point with the newly characterized shunt.

The example that follows demonstrates this procedure:

- 1. Do the dc current calibration procedure.
- 2. Select the first current shunt (A40-10 mA) shown in Table 36.
- 3. Do a dc characterization of the shunt at the amplitude specified in the table (as demonstrated above).

- 4. Start the ac current calibration procedure and push the softkey labeled SKIP **STEP** to go to the step(s) that use the newly characterized shunt.
- 5. Put the Product in OPERATE and measure the ac voltage across the shunt.
- 6. Calculate the ac current from the data derived from the dc characterization and the ac correction factors supplied by the shunt manufacturer.
- 7. Type in the ac current value in the Product.
- 8. Continue the calibration until Table 36 is complete.

There are important remote commands used in this procedure.

- CAL START MAIN, AI Start the ac current calibration procedure.
- CAL SKIP Skip to the applicable calibration step.
- CAL ABORT Used to exit calibration between steps.
- Do the subsequent calibration step. CAL NEXT
- CAL STORE Store the new calibration constants

Because of the complexity of this procedure, it is recommended that the calibration steps be automated. See Figure 14 for a MET/CAL code fragment that demonstrates how the code can be written. Figure 14 is an example only to be used for a demonstration.

The equipment shown in Table 36 is necessary to do the calibration steps in Table 37 for the ac current function.

Table 36. Test Equipment Required for AC Current Calibration

Manufacturer Model

| Qualitity | Manufacturer | Wiodei         | Equipment                     |
|-----------|--------------|----------------|-------------------------------|
| 1         | Fluke        | PN 900394      | Type N to dual banana adapter |
| 1         | Fluke        | 5790A or 5790B | AC Measurement Standard       |
| 1         | Fluke        | A40-10 mA      | Current Shunt, 10 mA          |
| 1         | Fluke        | A40-200 mA     | Current Shunt, 200 mA         |
| 1         | Fluke        | A40-2A         | Current Shunt, 2 A            |
| 1         | Fluke        | A40A-20A       | Current Shunt, 20 A           |
| 1         | Fluke        | 792-7004       | A40 Current Shunt, Adapter    |

Table 37. Calibration Steps for AC Current

| Stone | Output (AUX HI, LO) |           |                  |
|-------|---------------------|-----------|------------------|
| Steps | Amplitude           | Frequency | Shunt to Use     |
| 1     | 3.2999 mA           | 55.00 Hz  | Fluke A40 10 mA  |
| 2     | 0.3300 mA           | 55.00 Hz  | Fluke A40 10 mA  |
| 3     | 3.0000 mA           | 55.00Hz   | Fluke A40 10 mA  |
| 4     | 3.00000 mA          | 1.000 kHz | Fluke A40 10 mA  |
| 5     | 300.0uA             | 55.00 Hz  | Fluke A40 10 mA  |
| 6     | 300.0uA             | 1.000 kHz | Fluke A40 10 mA  |
| 7     | 30.000 mA           | 55.00 Hz  | Fluke A40 200 mA |
| 8     | 30.000 mA           | 1.000 kHz | Fluke A40 200 mA |
| 9     | 300.000 mA          | 55.00 Hz  | Fluke A40 2 A    |
| 12    | 300.000 mA          | 1.000 kHz | Fluke A40 2 A    |
| 13    | 1.9000 A            | 55.00 Hz  | Fluke A40 2 A    |
| 15    | 1.9000 A            | 1.000 kHz | Fluke A40 2 A    |
|       | AUX 20A, LO         |           |                  |
| 16    | 10.0000 A           | 55.00 Hz  | Fluke A40A 20 A  |
| 17    | 10.0000 A           | 1.000 kHz | Fluke A40A 20 A  |

```
Fluke Calibration Corporation - Worldwide Support Center MET/CAL Procedure
______
INSTRUMENT: Sub Fluke 5080A ACI ADJ
DATE:
                   03-Oct-2011
AUTHOR:
REVISION:
                    0.6
ADJUSTMENT THRESHOLD: 70%
NUMBER OF TESTS:
                    1
NUMBER OF LINES:
                    487
CONFIGURATION:
                   Fluke 5790A
_____
STEP FSC RANGE NOMINAL TOLERANCE MOD1 MOD2 3 4 CON
# 10 Sep 98 changed Cal Info? commands to Out? and checked for 10A -
# needs cal next to get past display; check for 0 out when ACI is done.
 1.001 ASK- R Q N
                                          C
                                     TT
                                                                  W
                  AC CURRENT ADJUSTMENT
 1.002 HEAD
# Set M[10] to 3mA initially
                 M[10] = 0.003
 1.003 MATH
# Reset UUT - get it out of calibration mode.
 1.004 IEEE
                   *CLS; *RST; *OPC?[I]
 1.005 IEEE
                  ERR?[I$][GTL]
 1.006 MATH
                  MEM1 = FLD(MEM2,1,",")
 1.007 JMPT
 1.008 IEEE
                  CAL SW?[I][GTL]
 1.009 MEME
 1.010 JMPZ
                   1.012
 1.011 JMP
                   1.015
 1.012 HEAD
                   WARNING! CALIBRATION SWITCH IS NOT ENABLED.
                   The UUT CALIBRATION switch is in NORMAL.
 1.013 DISP
 1.013 DISP
 1.013 DISP
                  The switch MUST be in ENABLE to store the
 1.013 DISP
                 new calibration constants.
 1.013 DISP
 1.013 DISP
                  Select ENABLE, then press "Advance" to
 1.013 DISP
                   continue with the calibration process.
 1.014 JMP
                   1.008
# Reset 5790A standard.
 1.015 ACMS
 1.016 5790
 1.017 HEAD
                  DCI References
 1.018 PIC
                  552A410m
 1.019 IEEE
1.020 IEEE
                  OUT 3.2999mA, OHZ; OPER; *OPC?[I][GTL]
                   [D30000] [GTL]
 1.021 ACMS
                                                          G
 1.022 5790
                                                          SH
                                                               N 2W
 1.023 MATH
                  M[17] = MEM
# Apply nominal -DC Current to A40
 1.024 IEEE
                  OUT -3.2999mA, OHZ; OPER; *OPC?[I][GTL]
 1.025 IEEE
                   [D5000] [GTL]
 1.026 ACMS
1.027 5790
                                                          G
                                                          SH
                                                               N 2W
 1.028 MATH
                  M[17] = (ABS(MEM) + M[17]) / 2
 1.029 IEEE
                   OUT .33mA, OHZ; OPER; *OPC?[I][GTL]
 1.030 IEEE
                   [D15000] [GTL]
 1.031 ACMS
 1.032 5790
                                                          SH
                                                               N 2W
 1.033
       MATH
                   M[18] = MEM
```

Figure 14. Sample MET/CAL Program

```
# Apply nominal -DC Current to A40
 1.034 IEEE OUT -.33mA, OHZ; OPER; *OPC?[I][GTL]
 1.035 IEEE
                    [D5000] [GTL]
 1.036 ACMS
                                                               G
 1.037 5790
                   M[18] = (ABS(MEM) + M[18]) / 2
 1.038 MATH
                    OUT 3mA, OHZ; OPER; *OPC?[I][GTL]
        IEEE
 1.040 IEEE
                    [D15000] [GTL]
 1.041 ACMS
                                                               G
 1.042 5790
                                                               SH
                                                                     N 2W
 1.043 MATH
                   M[19] = MEM
# Apply nominal -DC Current to A40
 1.044 IEEE OUT -3mA, OHZ; OPER; *OPC?[I][GTL]
 1.045 IEEE
                    [D5000] [GTL]
 1.046 ACMS
 1.047 5790
                    Α
                                                               SH
                                                                     N 2W
                    M[19] = (ABS(MEM) + M[19]) / 2
 1.048 MATH
                    CAL START MAIN, AI; *OPC?[I][GTL]
 1.049 IEEE
 1.050 IEEE
                    CAL NEXT; *OPC?[I][GTL]
 1.051 HEAD
                    Calibrating 3.2999mA @ 100Hz
# cal next is required for initial start.
# after sending AIG330U if you send cal next 5520A tries to
# start the cal at that time.
# 3.2999mA @ 100Hz
                    *CLS;OPER; *OPC?[I][GTL]
 1.052 IEEE
 1.053
        IEEE
                     [D5000] [GTL]
 1.054 ACMS
                                                               G
 1.055 5790
                                                                     N 2W
# Calculate difference between the average value of both polarities of DC
# Current and the applied AC Current.
                    M[21] = 0.0032999 - (.0032999 * (1 - (MEM / M[17])))
 1.056 MATH
# Determine measurement frequency to retrieve correct AC-DC difference value.
 1.057 IEEE OUT?[I$][GTL]
 1.058 MATH
                    M[2] = FLD(MEM2, 5, ", ")
# Retrieve AC-DC difference from data file named "A40-10mA"
              get_acdc A40-10mA
 1.059 DOS
 1.060 JMPT
                    1.064
 1.061 OPBR
                    An error occurred during get acdc
                   Press YES to try again or NO to terminate.
 1.061 OPBR
 1.062 JMPT
                    1.059
 1.063 JMP
                    1.231
# Correct the calculated value of AC Current by adding the AC-DC difference
# of the A40-series shunt used at the frequency under test
 1.064 MATH
                MEM = (M[21] * MEM) + M[21]
# Store corrected value into the UUT
                    CAL NEXT [MEM]; *OPC?[I][GTL]
 1.065 IEEE
 1.066 IEEE
                    ERR? [I$] [GTL]
 1.067 MATH
                   MEM1 = FLD(MEM2, 1, ", ")
 1.068 JMPT
                    1.231
# 'Ask' UUT for next value to calibrate
 1.069 IEEE
                    CAL REF?[I][GTL]
```

Figure . Sample MET/CAL Program (cont)

# DC Volts Calibration (AUX Output)

To calibrate the auxiliary dc voltage function, use the same procedure as shown for the normal dc voltage output, but use the AUX HI and LO terminals on the UUT. Table 38 shows the calibration steps for AUX dc volts.

Table 38. Calibration Steps for AUX DC Current

| Steps | Output (Aux) |
|-------|--------------|
| 1     | 300.00 mV    |
| 2     | 3.0000 V     |
| 3     | 7.000 V      |

# AC Volts Calibration (AUX Output)

To calibrate the auxiliary ac voltage function, use the same procedure as shown for the normal ac voltage output, but use the AUX HI and LO terminals instead on the UUT. Table 39 shows the calibration steps for AUX ac volts.

Table 39. Calibration Steps for AUX AC Volts

| Steps | Output (AUX) |           |  |
|-------|--------------|-----------|--|
|       | Amplitude    | Frequency |  |
| 1     | 300.00 mV    | 55 Hz     |  |
| 2     | 300.00 mV    | 1 kHz     |  |
| 3     | 3.0000 V     | 55 Hz     |  |
| 4     | 3.0000 V     | 1 kHz     |  |
| 5     | 5.0000 V     | 55 Hz     |  |
| 6     | 5.000 V      | 1 kHz     |  |

#### Resistance Calibration

The equipment shown in Table 40 is necessary for calibration of the resistance function.

Table 40. Test Equipment Required for Resistance Calibration

| Quantity | Manufacturer | Model | Equipment |
|----------|--------------|-------|-----------|
| 1        | Fluke        | 8508A | DMM       |

To calibrate the resistance function:

- 1. Use the Fluke 8508A DMM for each measurement.
- 2. Make sure the UUT is in Standby.
- 3. Follow the prompt on the Control Display to connect the DMM to the UUT for 4-wire ohms measurement as shown in Figure 15.
- 4. Push the **GO ON** softkey and wait for the internal calibration steps to complete.
- 5. When the internal calibration steps are done, measure and type in the values into the UUT for calibration steps 1 through 12 in Table 41 as prompted.
- 6. Connect the UUT to the DMM in a 2-wire ohms configuration as shown in Figure 16.
- 7. Measure and type in the values into the UUT for calibration steps 13 through 18 in Table 41 as prompted.
- 8. Make sure the UUT is in Standby and disconnect the test equipment.

**Table 41. Calibration Steps for Resistance** 

| Step | Output (4-Wire Ohms, NORMAL and AUX) |  |  |
|------|--------------------------------------|--|--|
| 1    | 1.0000 Ω                             |  |  |
| 2    | 1.9000 Ω                             |  |  |
| 3    | 10.000 Ω                             |  |  |
| 4    | 19.000 Ω                             |  |  |
| 5    | 100.000 Ω                            |  |  |
| 6    | 190.000 Ω                            |  |  |
| 7    | 1.00000 kΩ                           |  |  |
| 8    | 1.90000 kΩ                           |  |  |
| 9    | 10.0000 kΩ                           |  |  |
| 10   | 19.0000 kΩ                           |  |  |
| 11   | 100.000 kΩ                           |  |  |
| 12   | 190.000 kΩ                           |  |  |
|      | 2-Wire Ohms, NORMAL                  |  |  |
| 13   | 1.00000 MΩ                           |  |  |
| 14   | 1.90000 MΩ                           |  |  |
| 15   | 10.0000 MΩ                           |  |  |
| 16   | 19.000 MΩ                            |  |  |
| 17   | 100.00 MΩ                            |  |  |
| 18   | 190.00 ΜΩ                            |  |  |

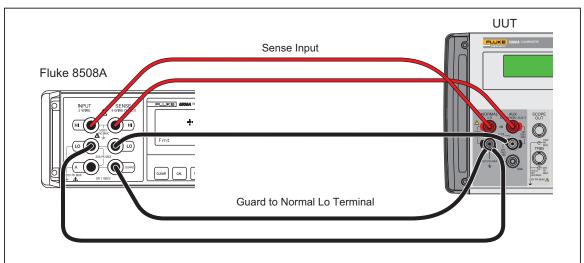


Figure 15. Connections for Calibrating 4-Wire Resistance

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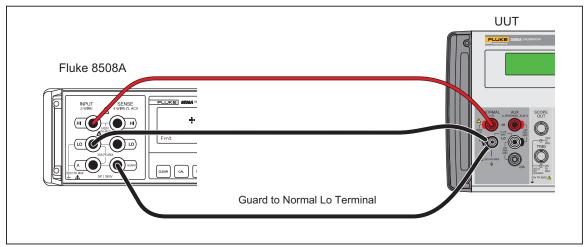


Figure 16. Connections for Calibrating 2-Wire Resistance

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# **SC200 Calibration**

The SC200 is an oscilloscope calibration option for the 5080A. The sections that follow explain how to calibrate the SC200 Oscilloscope Option.

### Note

Although this procedure will calibrate the SC200 option in the field, it is recommended the Product be sent to Fluke Calibration for calibration and verification.

Fluke Calibration recommends that you review all of the procedures in this section to make sure you have the resources to complete the calibration before you start.

# Required Test Equipment

**BNC Cable** 

All test equipment used to calibrate the SC200 option must be calibrated and in their specified environment. To keep traceability, all equipment must be certified traceable. Refer to the operators manual of each piece of test equipment for operation instructions.

Table 42 shows the test equipment required to verify and calibrate the SC200 option.

| Tuble 42. Required Took Equipment for Gozoo Guibration              |                       |   |   |
|---|-----------------------|---|---|
| Test Equipment  | Recommended Model     | Mii   | nimum Specifications                        |
| Wave Generator, Edge Amplitude Calibration, AC Voltage Verification |                       |   |   |
| Digital Multimeter  | Hewlett Packard 3458A | Voltage   | 1.8 mv to ±105 V p-p<br>uncertainty: 0.06 % |
|   |                       | Edge  | 4.5 mV to 2.75 V p-p uncertainty: 0.06 %    |
| Adapter   | Pomona #1269          | BNC(f) to Double Banana Plug  |   |
| Termination   |                       | Feedthrough 50 $\Omega$ , +1 % (used with Edge Amplitude Calibration and AC Voltage Verification) |   |
|   |                       | 1   |   |

(supplied with SC200)

Table 42. Required Test Equipment for SC200 Calibration

| Table 42. Required Test Equipment for SC200 Calibration (cont.) |  |   |                        |  |  |
|---|--|---|------------------------|--|--|
| Test Equipment  | Equipment Recommended Model Minimum Specifications                   |   |                        |  |  |
| Edge Rise Time and Aberrations Verification                     |  |   |                        |  |  |
| High Frequency  | Tektronix 11801 with SC-   | Frequency                               | 2 GHz                  |  |  |
| Digital Storage<br>Oscilloscope                                 | 22/26 sampling head, or<br>Tektronix TDX 820 with<br>8 GHz bandwidth | Resolution                              | 4.5 mV to 2.75 V       |  |  |
| Attenuator  | Weinschel 9-10 (SMA) or<br>Weinschel 18W-10 or<br>equivalent         | 10 dB, 3.5 mm(m/f)                      |                        |  |  |
| Adapter   |  | BNC(f) to 3.                            | 5 mm(m)                |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |
| Leve  | led Sine Wave Amplitude C  | alibration an                           | d Verification         |  |  |
| AC Measurement  | Fluir 5700A  | Range                                   | 5 mV p-p to 5.5 V p-p  |  |  |
| Standard  | Fluke 5790A  | Frequency                               | 50 kHz                 |  |  |
| Adapter   | Pomona #1269   | BNC(f) to Do                            | ouble Banana Plug      |  |  |
| Termination   |  | Feedthrough                             | h 50 Ω, +1 %           |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |
| DC and AC   | Voltage Calibration and Ve   | rification, DC                          | Voltage Verification   |  |  |
| Digital Multimeter  | Hewlett Packard 3458A  |   |                        |  |  |
| Adapter   | Pomona #1269   | BNC(f) to Double Banana Plug            |                        |  |  |
| Termination   |  | Feedthrough 50 Ω, +1 %                  |                        |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |
|   | Leveled Sine Wave Freq   | uency Verific                           | cation                 |  |  |
| Frequency Counter   | PM 6680 with Option (PM 9621, PM 9624, or PM 9625) and (PM 9678)     | 50 kHz to 350 MHz, <1.6 ppm uncertainty |                        |  |  |
| Adapter   | Pomona #3288   | BNC(f) to Ty                            | ype N(m)               |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |
| Leveled Sine  | Wave Flatness (Low Frequ   | iency) Calibra                          | ation and Verification |  |  |
| AC Measurement  | Fluke 5790A with 03  | Range                                   | 5 mV p-p to 5.5 V p-p  |  |  |
| Standard  | option   | Frequency                               | 50 kHz to 10 MHz       |  |  |
| Adapter   | Pomona #3288   | BNC(f) to Type N(m)                     |                        |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |
|   | Leveled Sine Wave Harn   | nonics Verific                          | cation                 |  |  |
| Spectrum Analyzer   | Hewlett Packard 8590A  |   |                        |  |  |
| Adapter   | Pomona #3288   | BNC(f) to Type N(m)                     |                        |  |  |
| BNC Cable   | (supplied with SC200)  |   |                        |  |  |

Table 42. Required Test Equipment for SC200 Calibration (cont.)

| Test Equipment   | Recommended Model  | Minimum Specifications                                    |                        |  |  |  |  |  |
|--|--|---|------------------------|--|--|--|--|--|
| Edge Frequency, AC Voltage Frequency Verification                        |  |   |                        |  |  |  |  |  |
| Frequency Counter  | PM 6680 with PM 9678 option                                      | 20 ms to 150 ns, 10 Hz to 10 MHz:<br><1.6 ppm uncertainty |                        |  |  |  |  |  |
| BNC Cable  | (supplied with SC200)  |   |                        |  |  |  |  |  |
| Edge Duty Cycle  |  |   |                        |  |  |  |  |  |
| Frequency Counter  | PM 6680  |   |                        |  |  |  |  |  |
| BNC Cable  | (supplied with SC200)  |   |                        |  |  |  |  |  |
| Leveled Sine Wave Flatness (High Frequency) Calibration and Verification |  |   |                        |  |  |  |  |  |
| Power Meter  |  | Range   | -42 dBm to +5.6 dBm    |  |  |  |  |  |
|  | Hewlett Packard 437B   | Frequency   | 10 MHz – 300 MHz       |  |  |  |  |  |
| Power Sensor   | Hewlett Packard 8482A  | Range   | -20 dBm to +19 dBm     |  |  |  |  |  |
|  |  | Frequency   | 10 MHz – 300 MHz       |  |  |  |  |  |
| Power Sensor   | Howlett Dookord 9491A  | Range   | -42 dBm to -20 dBm     |  |  |  |  |  |
| Power Sensor   | Hewlett Packard 8481A  | Frequency   | 10 MHz – 300 MHz       |  |  |  |  |  |
| 30 dB Reference  | Hewlett Packard 11708A<br>(supplied with HP 8481D)               | Range   | 30 dB                  |  |  |  |  |  |
| Attenuator   |  | Frequency   | 50 MHz                 |  |  |  |  |  |
| Adapter  | Hewlett Packard<br>PN 1250-1474                                  | BNC(f) to Type N(f)                                       |                        |  |  |  |  |  |
| BNC Cable  | (supplied with SC200)  |   |                        |  |  |  |  |  |
| Lev  | eled Sine Wave Frequency,  | Time Marker   | Verification           |  |  |  |  |  |
| Frequency Counter  | PM 6680 with Option (PM 9621, PM 9624, or PM 9625) and (PM 9678) | 2 ns to 5 s, 50 kHz to 500 MHz: <1.6 ppm uncertainty      |                        |  |  |  |  |  |
| Adapter  | Pomona #3288   | BNC(f) to Type N(m)                                       |                        |  |  |  |  |  |
| BNC Cable  | (supplied with SC200)  |   |                        |  |  |  |  |  |
| Wave Generator Verification  |  |   |                        |  |  |  |  |  |
| AC Measurement   | Fluke 5790A or 5790B<br>with 03 option                           | Range   | 1.8 mV p-p to 55 V p-p |  |  |  |  |  |
| Standard   |  | Frequency   | 10 Hz to 100 kHz       |  |  |  |  |  |
| Adapter  | Pomona #1269   | BNC(f) to Double Banana Plug                              |                        |  |  |  |  |  |
| Termination  |  | Feedthrough 50 $\Omega$ , +1 %                            |                        |  |  |  |  |  |
| BNC Cable  | (supplied with SC200)  |   |                        |  |  |  |  |  |

# **Calibration Steps**

#### Note

The Product mainframe must be calibrated before you start to calibrate the SC200 option.

Adjustments can be necessary after repair of the SC200. Hardware adjustments must be done before calibration. You must calibrate the option after hardware adjustments. See the Hardware Adjustment section.

#### Note

The Product mainframe must complete its warm-up period and the SC200 must be turned on (SCOPE button green LED on) for a minimum of five minutes before you start the calibration. The mainframe warm-up period must be a minimum of two times the Product off time or a maximum of 30 minutes.

To calibrate the SC200 through the front panel:

- 1. Push SETUP.
- 2. Push the CAL softkey.
- 3. Push the SCOPE CAL softkey.

#### Note

If you start the SCOPE CAL mode before the five minutes after you push , an error message will show in the display.

The Product first prompts to calibrate the dc voltage function. Push the **OPTIONS** and **NEXT SECTION** softkeys until the function to calibrate shows in the display.

### Calibration and Verification of the Square Wave Functions

The SC200 ac voltage and edge functions have square wave voltages that must be calibrated and made sure they equal specifications.

The Hewlett Packard 3458A is setup as a digitizer to measure the peak-to-peak value of the signal. Set the meter to the dcv function and the different analog-to-digital integration times and trigger commands to measure the topline and baseline of the square wave signal.

### Note

You can set the different meter set ups into the HP3458A user defined keys to quickly change the meter setup. For example, to make topline measurements at 1 kHz, you can set the meter to NPLC .01, LEVEL 1, DELAY<SL> .0002, TRIG LEVEL. To find the average of multiple measurements, you can program one of the user keys to MATH OFF, MATH STAT<SL> and then use the RMATH MEAN function to recall the average or mean value of the readings.

Table 43 is a list of parameters you set in to the HP3458A for the square wave and edge calibration and verification.

| Table 43. AC | Square Wave | · Voltage and | Edge Setting | s for HP3458A |
|--------------|-------------|---------------|--------------|---------------|
|              |             |               |              |               |

| Voltage Input<br>Frequency | HP 3458A Settings |                 |                  |  |
|----------------------------|-------------------|-----------------|------------------|--|
|                            | NPLC              | Delay (topline) | DELAY (baseline) |  |
| 10 Hz                      | 1                 | 0.02 s          | 0.07 s           |  |
| 100 Hz                     | 0.1               | 0.002 s         | 0.007 s          |  |
| 1 kHz                      | 0.01              | 0.0002 s        | 0.0007 s         |  |
| 5 kHz                      | 0.002             | 0.00004 s       | 0.00014 s        |  |
| 10 kHz                     | 0.001             | 0.00002 s       | 0.00007 s        |  |

#### Note

When you measure a signal that is >1 kHz, lock the HP3458A to the 1 V range. The meter can have 0.05 % to 0.1 % peaking on the 100 mV range.

# DC Voltage Calibration

Connect the Product to the HP3458A as shown in Figure 17.

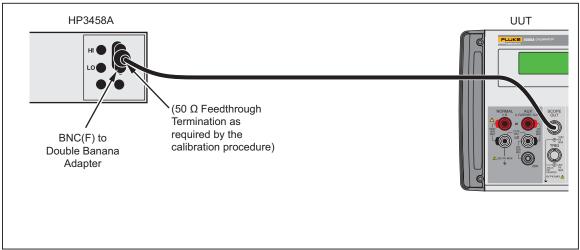


Figure 17. Connections for AC Square Wave Voltage and Edge Calibration

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- 1. Set the Product mainframe in Scope Cal mode, dc voltage section.
- 2. Set the HP3458A to DCV, AutoRange, NPLC=10, FIXEDZ=on.
- 3. Push the **GO ON** softkey.
- 4. Make sure the HP3458A measurement is 0.0 Vdc + 100 LiV.
- 5. Push the **GO ON** softkey.

### Note

The Product output goes to standby when the output is more than 33 volts. Push 👼 to turn on the output.

6. After the HP3458A measurement becomes stable, type the measurement into the Product and push ENTER.

#### Note

The Product shows a warning message if the typed in measurement is out of limit. Look at the measurement again and re-enter the value carefully, with the correct multiplier (m, k, n, p, etc.). If the warning continues to show in the display, Product repair can be necessary.

- 7. Do steps 6 and 7 again until **The next steps calibrate SC200ACV** shows in the display.
- 8. Push the **OPTIONS**, then **STORE CONSTS** softkeys to keep the calibration constants.

### AC Square Wave Voltage Calibration

The equipment and setup is the same for ac voltage calibration as the dc voltage calibration. There are different parameters for the HP3458A multimeter.

If "The next steps calibrates SC200 ACV" is not already shown in the Product display, push the **OPTIONS** and then **NEXT SECTION** softkeys until it does show.

- 1. Push the **GO ON** softkey.
- 2. Connect the Product to the HP3458A as shown in Figure 17.
- 3. Set the HP3458A to DCV, NPLC=.01, LEVEL 1, TRIG LEVEL, and the DELAY to .0002 to measure the top part of the waveform (topline). Change the DELAY to .0007 to measure the lower part of the waveform (baseline). Set the meter range to a range that shows the maximum resolution for the topline measurements. Use this same range for the related baseline measurements at each step.
- 4. At each calibration step, read measurements for a minimum of two seconds, with the HP 3458A MATH function to get the average or mean value.

The "true amplitude" of the waveform is the difference between the topline and baseline measurements, with a correction for the load resistance error. To make this correction, multiply the measurements by (0.5 \* (50 + Rload)/Rload), where Rload = actual feedthrough termination resistance.

#### Note

The Calibration mainframe will warn when the typed in value is out of limits. If this warning occurs, inspect the setup and carefully type in the measurement again with the correct multiplier (m, u, n, p, etc.). If the warning continue to show in the display, repair can be necessary.

Do step 4 again until the Product mainframe display shows WAVEGEN CAL
as the subsequent step. Push the OPTIONS, then the STORE CONSTS
softkeys to keep the new calibration constants.

## **Edge Amplitude Calibration**

To do an Edge Amplitude calibration:

- 1. Push the **OPTIONS** and **NEXT SECTION** softkeys until the display shows **Set up to measure fast edge amplitude**.
- 2. Use the BNC cable and BNC to double-banana adapter to connect the scope out connector of the Product to the HP 3458A as shown in Figure 18.
- 3. Set the HP 3485A to DCV, NPLC = .01, LEVEL 1, TRIG LEVEL, and the DELAY to 0.0002 to measure the top part (topline) of the waveform. Set the DELAY to 0.0007 to measure the lower part (baseline) of the waveform. Set the meter range to a range that shows the maximum resolution for the topline measurements. Use this same range for the related baseline measurements at each step.

#### Note

The topline is near 0 V, and the baseline is a negative voltage in the EDGE function.

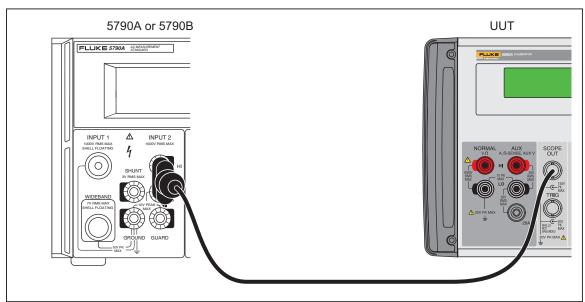
4. At each calibration step, read measurements for a minimum of two seconds, with the HP 3458A MATH function to get the average or mean value.

The "true amplitude" of the waveform is the difference between the topline and baseline measurements, with a correction for the load resistance error. To make this correction, multiply the measurements by (0.5 \* (50 + Rload)/Rload), where Rload = actual feedthrough termination resistance.

#### Leveled Sine Wave Amplitude Calibration

To do a leveled sine wave amplitude calibration:

- 1. Push the **OPTIONS** and **NEXT SECTION** softkeys until the display shows **Set up to measure leveled sine amplitude**.
- 2. Use the BNC cable, double-banana adapter, and the 50  $\Omega$  feed-through termination to connect the scope out connector of the Product to the 5790A or 5790B as shown in Figure 18.



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Figure 18. Product Mainframe to 5790A AC Measurement Standard Connections

- 3. Set the 5790A or 5790B to autorange, digital filter mode to fast, restart fine, and Hi Res on.
- 4. Push the **GO ON** softkey.
- 5. Push OPR.
- 6. When you see stable measurements on the 5790A or 5790B, multiply the measurement by (0.5 \* (50 + Rload)/Rload), to correct for the resistance error. Rload is the actual feed-through resistance. Type in the calculated rms measurement through the Product keypad.
- 7. Push ENTER.

#### Note

The Calibration mainframe warns you when the typed in value is out of limits. If this warning occurs, inspect the setup and carefully type in the measurement again with the correct multiplier (m, u, n, p, etc.). If the warning continue to show in the display, repair can be necessary.

Do steps 6 and 7 again until the Product mainframe display shows
 CALIBRATE LEVELED SINE FLATNESS as the subsequent step. Push the
 OPTIONS, then the STORE CONSTS softkeys to keep the new calibration
 constants.

#### Leveled Sine Wave Flatness Calibration

Leveled sine wave flatness calibration is divided into two frequency bands. 50 kHz to 10 MHz (low frequency) and >10 MHz to 200 MHz (high frequency). Test equipment setup is different for each frequency band. Flatness of the low frequency band is made relative to 50 kHz. The high frequency band is relative to 10 MHz.

Leveled sine wave flatness is calibrated at multiple amplitudes. Low and high frequency bands are calibrated at each amplitude. Calibration starts with the low frequency bands, then the high frequency band for the first amplitude, followed by the low frequency band, then the high frequency band for the second amplitude, and so on, until the flatness calibration is complete.

To start the leveled sine wave flatness calibration:

1. Push the **OPTIONS** and **NEXT SECTION** softkeys until **Set up to measure** leveled sine flatness shows in the display.

For the low frequency band:

- 2. Connect the Product SCOPE connector to the 5790A Wideband input.
- 3. Push the **GO ON** softkey.
- 4. When you see a stable 5790 measurement, push the **Set Ref** softkey on the 5790A to set the 50 kHz reference. If necessary, push the **Clear Ref** softkey on the 5790A before you set a new reference.
- 5. Push the **GO ON** softkey.
- 6. Use the knob on the Product to change the amplitude until the 5790A reference deviation is less than 1000 ppm of the 50 kHz reference.
- 7. Do steps 3 to 6 until the Product display shows a reference frequency of 10 MHz.

To continue with the high frequency band:

- 8. Connect the Product SCOPE connector to a power meter and power sensor.
- 9. Push the **GO ON** softkey.
- 10. Push the **SHIFT** key on the power meter, then the **FREQ** key, and use the arrow keys to set the cal factor of the power sensor for the frequency shown on the Product display. Make sure the cal factor is correct.
- 11. Push the **ENTER** key on the power meter.
- 12. Use the knob on the Product to change the amplitude until the power sensor measurement is less than 0.1 % of the 10 MHz reference.
- 13. Do steps 9 to 12 until the Product display shows a reference frequency of 50 kHz or the subsequent step is **calibrate pulse width**.
- 14. Do the low frequency calibration procedure again unless the Product shows the subsequent step is **calibrate pulse width**.
- 15. Push the **OPTIONS**, then the **STORE CONSTS** softkeys to keep the new calibration constants.

#### **SC200 Hardware Adjustments**

You must make hardware adjustments to the leveled sine and edge functions each time the SC200 is repaired. This section contains a list of equipment and recommended models necessary for these procedures. You can use equivalent

models if necessary.

## **Equipment Required**

Table 44 is a list of the equipment necessary to make hardware adjustments to the Product.

Table 44. Test Equipment for Hardware Adjustments

| Test Equipment                 | Recommended Model   |  |
|--------------------------------|---|--|
| Extender card                  | Fluke PN 661865 (5800A-7006K Extender kit)                              |  |
| Oscilloscope and Sampling head | Tektronix 11801 with SD-22/26 or Tektronix TDS 820 with 8 GHz bandwidth |  |
| 10 dB Attenuator               | Weinschel 9-10 (SMA) or Weinschel 18W-10                                |  |
| Spectrum Analyzer              | HP 8590A  |  |
| Cable supplied with SC200      | Fluke   |  |

You will also need a standard adjustment tool for adjusting the pots and trimmer capacitors.

## How to Adjust the Leveled Sine Wave Function

This is one adjustment procedure for the leveled sine wave function that adjusts the harmonics. To adjust the level sine wave function:

- 1. Set the Product into leveled sine wave mode.
- 2. Set the Product output to 5.5 V p-p at 50 MHz.
- 3. Push opr.
- 4. Connect the Product to the Spectrum Analyzer.
- 5. Set the spectrum analyzer so it shows one peak across the horizontal centerline. The far right of the peak is fixed at the far right of the centerline, as shown in Figure 19.
- 6. Set the spectrum analyzer to the parameters in Table 45.

**Table 45. Spectrum Analyzer Parameters** 

| Parameter            | Value   |  |
|----------------------|---------|--|
| Start Frequency      | 50 MHz  |  |
| Stop Frequency       | 500 MHz |  |
| Resolution Bandwidth | 3 MHz   |  |
| Video Bandwidth      | 3 kHz   |  |
| Reference Level      | 20 dBm  |  |

7. Use the search function on the spectrum analyzer to find the reference signal. The spectrum analyzer display will show the fundamental with the second and third harmonics. This adjustment will set the second harmonic to -34 dBc. The third harmonic can be at -39 dBc or more as shown in Figure 19.

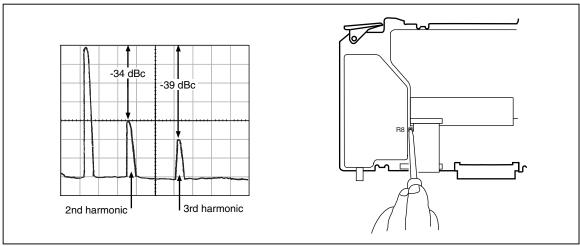


Figure 19. Leveled Sine Wave Harmonics Adjustment

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8. If the second and third harmonics are not at the correct dB level, adjust R8 until they are. You can find that you can have the second harmonic at - 34 dBc but the third harmonic is less than -39 dBc. Continue to adjust R8 until the third harmonic is at -39 dBc and the second harmonic is ≥ -34 dBc. The second harmonic will change, but there is a point at which both harmonics will be at the correct decibel level.

## How to Adjust the Aberrations for the Edge Function

You must adjust the edge aberrations after you repair the edge function.

- 1. Set the Product into edge mode.
- 2. Set the Product output to 1 V p-p at 1 MHz.
- 3. Push opr.
- 4. Connect the Product to the oscilloscope.
- 5. Set the oscilloscope to 1 mV/div vertical scale and 1 ns/div horizontal scale.
- 6. Set the oscilloscope to show the 90 % point of the edge signal. See Figure 20. Record this voltage (or set to the center of the display) as it will be used as a reference for future adjustments.
- 7. Set the oscilloscope to show the first 10 ns of the edge signal with the rising edge at the left edge of the oscilloscope display.

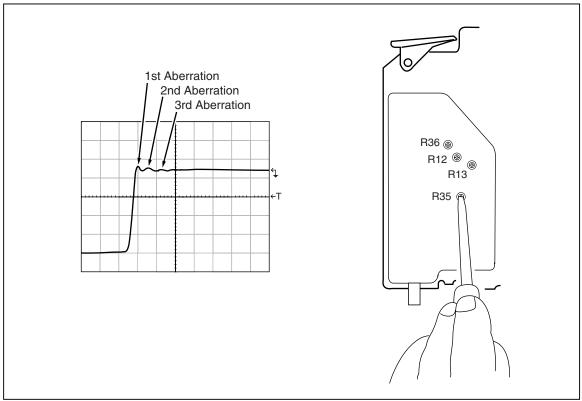


Figure 20. Edge Aberrations Adjustment

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- 8. Adjust R13 to set the edge signal at the 10 ns point to the reference level.
- 9. Adjust R12 for a flat edge signal. If necessary, adjust R13 again to keep the edge signal at the reference level.
- 10. Adjust R35 so the first overshoot is the same amplitude as the second aberration.
- 11. Adjust R36 to center the first two aberrations about the reference level.
- 12. If necessary, adjust R13 again to keep the edge signal at 10 ns to be at the reference level.
- 13. Adjust R36, R35, or R12 again to set the same amplitude of the aberrations

shown in the display in the first 10 ns to be equally above and below the reference level. Compare the aberrations with the specifications. You can slow the rise time (R35) to decrease the amplitude of the aberrations if necessary.

- 14. Set the Product output to 2.5 V and the oscilloscope to 2 mV/div vertical scale and examine the aberrations.
- 15. Remove the 20 dB attenuator from the oscilloscope input. Connect the Product to the oscilloscope input and set the Product to output 250 mV.
- 16. Set the oscilloscope to 5 mV/div vertical scale and examine the aberrations.
- 17. Examine the rise time and make sure it is <950 ps  $\pm$ 250 ps at 250 mV, 1 V, and 2.5 V outputs.

# **MEGOHM Option Calibration**

The sections that follow explain how to calibrate the MEGOHM Option.

#### Note

Although this procedure will calibrate the SC200 option in the field, it is recommended the Product be sent to Fluke Calibration for calibration and verification.

It is recommended that you review all of the procedures in this section to make sure you have the resources to complete the calibration before you start.

## Required Test Equipment

All test equipment used to calibrate the SC200 option must be calibrated and in their specified environment. To keep traceability, all equipment must be certified traceable. Refer to the Operators Manual of each piece of test equipment for operation instructions.

Table 46 shows the test equipment required to calibrate the MEGOHM option.

| Test Equipment      | Recommended Model                |  |
|---------------------|----------------------------------|--|
| Standard Multimeter | Fluke 8508A                      |  |
| Megohmmeter         | QuadTech 1865                    |  |
| Calibrator          | Fluke 5500A/5520A or 5502A/5522A |  |

Table 46. Test Equipment for MEGOHM Option Calibration

#### **Calibration Steps**

You can do all the calibration steps or only the steps to some of the functions. For a complete calibration, you must do all the calibration steps in the sequence set in the calibration menu. When you calibrate a function, it is not necessary to calibrate all the ranges specified by the calibration algorithm for each item in the calibration menu. If new calibration of all ranges is not possible (the required standard is not available for example), the calibration data that is in the Product can be used again.

#### Note

You can stop the calibration in the middle of the procedure, but this calibration procedure influences parameters of the Product. Accuracy of the Product is only guaranteed when you do a full calibration.

#### Low Resistance Source Calibration

You can calibrate the Low Resistance Source through the front-panel controls. This Calibration does a 4-wire DC resistance measurement on each resistor in the Low Resistance Source function.

#### Note

Fluke recommends you do a calibration of all resistors to make sure the low resistance source function operates to the specified accuracy.

To calibrate the Low Resistance function:

1. Connect the Fluke 8508A multimeter to the output terminals of the Product, as shown in Figure 21.

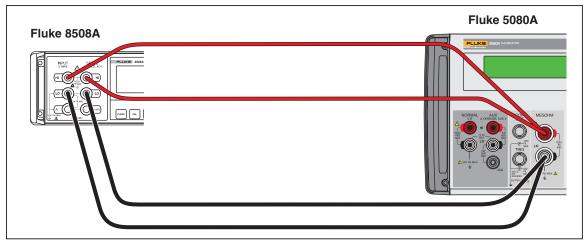


Figure 21. MEGOHM Low Resistance Calibration Connections

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- 2. Select the 4-wire TRUE ohms function on the multimeter.
- 3. Set the cal enable switch on the rear of the 5080A to the enable position.
- 4. Push [SETUP], then Cal, Cal, Option Cal, and Megohm Cal.
- 5. Do the instructions on Product display and cal points in Table 47. Type in the measured values through the Product keypad.

**Table 47. MEGOHM Calibration Adjustment Points** 

| Step | MEGOHM Output |
|------|---------------|
| 1    | 1.0000 Ω      |
| 2    | 1.8000 Ω      |
| 3    | 3.7000 Ω      |
| 4    | 5.9000 Ω      |
| 5    | 10.000 Ω      |
| 6    | 18.000 Ω      |
| 7    | 37.000 Ω      |
| 8    | 59.000 Ω      |
| 9    | 100.00 Ω      |
| 10   | 180.00 Ω      |
| 11   | 370.00 Ω      |
| 12   | 590.00 Ω      |
| 13   | 1.0000 kΩ     |
| 14   | 1.8000 kΩ     |
| 15   | 3.7000 kΩ     |
| 16   | 5.9000 kΩ     |
| 17   | 35.00 Ω       |

Table 47. MEGOHM Calibration Adjustment Points (cont.)

| Step | MEGOHM Output |
|------|---------------|
| 18   | 1.620 kΩ      |
| 19   | 6.810 kΩ      |
| 20   | 11.00 kΩ      |
| 21   | 20.00 kΩ      |
| 22   | 40.00 kΩ      |
| 23   | 77.00 kΩ      |
| 24   | 143.0 kΩ      |
| 25   | 274.5 kΩ      |
| 26   | 510.0 kΩ      |
| 27   | 980.0 kΩ      |
| 28   | 1.825 MΩ      |
| 29   | 3.490 MΩ      |
| 30   | 6.650 MΩ      |
| 31   | 9.760 MΩ      |
| 32   | 20.000 ΜΩ     |
| 33   | 37.40 MΩ      |
| 34   | 73.20 MΩ      |
| 35   | 133.0 ΜΩ      |
| 36   | 143.0 MΩ      |
| 37   | 280.0 ΜΩ      |
| 38   | 549.0 MΩ      |

- 6. Disconnect all connections from the Product and the multimeter.
- 7. Connect the Product to the Quadtech 1865 Megohmeter as shown in Figure 22. Make sure that you REVERSE POLARITY on this setup.

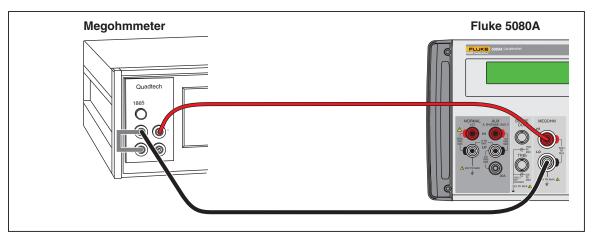


Figure 22. MEGOHM High Resistance Calibration Connections

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8. Set the parameters of the QuadTech 1865 to the values shown in Table 48 and then do the adjustment steps in Table 49.

Table 48. QuadTech 1865 Parameter Values

| Parameter         | Value |
|-------------------|-------|
| Voltage           | 500   |
| Charge Time       | 5     |
| Dwell Time        | 5     |
| Measure Time      | 20    |
| Discharge Time    | 5     |
| Mode              | Auto  |
| Number to Average | 400   |

**Table 49. MEGOHM Calibration Adjustments** 

| Steps | MEGOHM Output |
|-------|---------------|
| 1     | 1.070 GΩ      |
| 2     | 2.1 GΩ        |
| 3     | 3.9 GΩ        |
| 4     | 7.1 GΩ        |
| 5     | 11.02 GΩ      |
| 6     | 18.24 GΩ      |

9. Connect the 5500A/5520A to the MEGOHM terminals and follow the instructions on the Product display until the calibration is completed.

# Calibrate Through the Remote Interface

To access the standard calibration steps through the remote interface, send the command:

CAL START MAIN

To jump to a specified calibration step, add a comma followed by a modifier to specify an entry point. Table 50 shows the applicable entry points and the modifier to use for each point.

Table 50. Jumping to a Specific Calibration Step in Remote

| Entry points for CAL_START MAIN    | Modifier |
|------------------------------------|----------|
| AC Volts                           | AV       |
| Thermocouple Measuring             | TEMPX    |
| DC Current                         | ICAL     |
| AC Current                         | AI       |
| AUX DC Volts                       | V2       |
| AUX AC Volts                       | AVS      |
| Resistance                         | R        |
| Capacitance                        | С        |
| Entry Points for CAL_START FACTORY | Modifier |
| NORMAL Volts and AUX Volts Phase   | PHASE    |
| Volts and Current Phase            | IPHASE   |

For example, to jump directly to ac volts calibration, send the command:

CAL\_START MAIN, AV

To go directly to Resistance calibration, send the command:

These calibration commands can be sent through the IEEE-488 or serial interface. To type in commands through the serial interface:

- 1. Use a Fluke PM8914 cable to connect the applicable COM port on a PC to the 5080A Serial 1 connector.
- 2. In Microsoft Windows, start the Terminal program. Set the communications parameters to agree with that of the Product.
- 3. Push ENTER. At the prompt, type the calibration command, for example CAL START MAIN.

#### Remote Commands

The IEEE-488/RS-232 remote calibration commands for the Product are shown in this section alphabetically. This list ignores the \* character that is used as the first character in the common commands. The remote commands duplicate works that can be done from the front panel in local operation.

#### Note

For remote commands pertaining to normal operation of the Product, see the Operators Manual.

**IEEE-488 (GPIB)** and **RS-232 Applicability** Each command title shown in this section shares the same remote interface applicability, IEEE-488 (general purpose interface bus, or GPIB) and RS-232 remote operations, and command group: Sequential, Overlapped, and Coupled.

**Sequential Commands** – Commands executed immediately as they are found in the data stream are sequential commands. All commands that is not overlapped or coupled are sequential.

**Overlapped Commands** – Commands that take added time to execute are overlapped commands. The execution time of these commands can overlap the subsequent command.

**Coupled Commands** – Commands that "couple" in a compound command sequence are coupled commands. Some examples are CUR\_POST and OUT. You must take precautions to be sure one command does not disable a second command and cause a fault.

## CAL\_ABORT

**Description** Instructs the Product to abort a calibration procedure after current step.

Examples CAL ABORT

#### CAL BACKUP

**Description** Skip to a previous entry point in the current calibration procedure.

Examples CAL BACKUP

#### CAL DATE?

**Description** Returns a calibration date related to stored calibration constants.

The date is returned with the same format as the CLOCK command.

**Parameters** MAIN Returns the call date of the main unit calibration.

ZERO Returns the cal date of the ZERO calibration.

OHMSZERO Returns the cal date of the Ohms zero calibration.

SCOPE Returns the cal date of the scope option calibration.

Example CAL\_DATE? MAIN

**Response** The date.

## CAL DAYS?

**Description** Gets the number of days and hours since the last calibration constant. The data output for date is in the same format as the

CLOCK command.

**Parameters** MAIN Returns the days since the main unit calibration.

ZERO Returns the days since the ZERO calibration.
OHMSZERO Returns the days since the Ohms zero calibration.
SCOPE Returns the days since the scope option calibration.

Example CAL DAYS? ZERO

Response (Integer) Days.

(Integer) Hours.

## CAL\_FACT

**Description** Set the procedure "fault action" flag. Procedures refer to calibration

and diagnostic procedures. This command is more useful for

diagnostics that calibration.

**Parameters** CONT To continue on faults.

ABORT To abort on faults.

Example CAL FACT ABORT

## CAL FACT?

**Description** Get the procedure "fault action" flag.

**Example** CAL\_FACT?

Response ABORT.

#### CAL FAULT?

**Description** Get information about calibration error, if one occurred).

**Example** CAL FAULT?

**Response** 1. Error number (use EXPLAIN? command to interpret).

2. Name of step where error occured.

#### CAL INFO?

**Description** Return message or instructions related to the running step.

Example CAL INFO?

**Response** (String) the message string.

## CAL\_NEXT

**Description** Continue a calibration procedure if it is waiting for a CAL\_NEXT

command.

Parameters (Optional) reference value (used if it's waiting for a reference). If the

reference value has no unit, the unit is assumed to be that returned

by the CAL\_REF? command.

Example CAL NEXT

#### CAL REF?

**Description** Return normal value expected for reference entry.

**Response** 1. The nominal value.

2. The accepted or implied unit.

Example 3.000000e+00, V

## CAL SKIP

**Description** Skip to subsequent entry point in calibration procedure.

Examples CAL SKIP

#### CAL SECT

**Description** Skip to next section of the calibration procedure.

Example CAL SECT

## CAL\_START

**Description** Start a calibration procedure.

**Parameters** MAIN Procedure for the 5080A minus the scope cal option.

ZERO Internal procedure to touch up zero offsets.

OHMSZERO Internal procedure to touch up resistance offsets.

SCOPE Procedure for the 5080A-SC200 scope cal option.

DIAG Diagnostic pseudo-cal procedure.

NOT Aborts a procedure after the step underway.

A second optional parameter that shows the name of the step at which to start can be used. If this parameter is not supplied,

calibration starts at the first calibration step.

**Examples** CAL\_START MAIN Start the MAIN calibration

procedure.

CAL START MAIN, DVG3 3 Start the MAIN calibration procedure

at DVG3\_3 point.

#### CAL STATE?

**Description** Gets the state of calibration.

**Response** RUN A calibration step is in progress.

REF Waiting for a CAL\_NEXT with reference (measurement)

value.

INS Instruction available, waiting for a CAL\_NEXT.

NOT Not in a calibration procedure (or at end of one)

#### CAL STEP?

**Description** Gets the name of the calibration step in progress.

**Response** (Char) the step name.

Examples IDAC RATIO (running IDAC ratio calibration)

NOT (not running a calibration procedure now)

## CAL\_STORE

**Description** Store new calibration constants (CAL switch must be ENABLED).

Example CAL STORE

## CAL\_STORE?

**Description** Gets if a CAL\_STORE is necessary.

Response 1 Yes.

0 **No** 

**Example** CAL STORE?

## CAL SW?

**Description** Gets the position of the calibration switch.

Response 1 Enabled.

0 Normal

Example CAL SW?

#### **EOFSTR**

**Description** Sets the End-Of-File character string used for calibration reports.

The maximum length is two characters. The EOF parameter is kept in populatile memory

in nonvolatile memory.

Parameters The EOF string (two characters maximum).

#### EOFSTR?

**Description** Gets the End-Of-File character string used for calibration reports.

Parameters None

**Response** (String) The End-Of-File character string.

## PR\_RPT

**Description** Prints a self-calibration report out the selected serial port.

Parameters 1. Type of report to print: STORED, ACTIVE, or CONSTS

- 2. Format of report: PRINT (designed to be read) SPREAD (designed to be loaded into a spreadsheet)
- 3. Calibration interval to be used for instrument specifications in the report: I90D (90 day specifications) or I1Y (1 year specifications)
- 4. Serial port out which to print report: HOST or UUT

Example PR RPT STORED, PRINT, 190D, HOST

#### RPT?

**Description** Gets a self-calibration report.

Parameters 1. Type of report to print: STORED, ACTIVE, or CONSTS

- 2. Format of report: PRINT (designed to be read) SPREAD (designed to be loaded into a spreadsheet)
- 3. Calibration interval to be used for instrument specifications in the report: I90D (90 day specifications) or I1Y (1 year specifications)

Example PR RPT? STORED, PRINT, 190D

## RPT PLEN

**Description** Sets the page length used for calibration reports. This parameter is kept in nonvolatile memory.

Parameters Page length.

## RPT PLEN?

**Description** Gets the page length used for calibration reports.

Parameters None.

**Response** (Integer) Page length.

## RPT\_STR

**Description** Sets the user report string used for calibration reports. The string is stored in nonvolatile memory. The CALIBRATION switch must be set to ENABLE.

**Parameters** String of up to 40 characters.

## RPT STR?

**Description** Returns the user report string used for calibration reports.

Parameters None.

Response (String) Up to 40 characters.

## STOP PR

**Description** Terminates printing a calibration report if one was being printed.

Parameters None.

#### **UNCERT?**

**Description** Returns specified uncertainties for the present output. If there is no specification for an output, the uncertainty returned is zero.

**Parameters** 1. (Optional) The preferred unit in which to express the primary output uncertainty (default is PCT).

2. (Optional) The preferred unit in which to express the secondary output uncertainty (default is same as primary unit)

#### Response

- 1. (Float) 90 day specified uncertainty of primary output.
- 2. (Float) 1 year specified uncertainty of primary output.
- 3. (Character) unit of primary output uncertainty.
- 4. (Float) 90 day specified uncertainty of secondary output.
- 5. (Float) 1 year specified uncertainty of primary output.
- 6. (Character) unit of secondary output uncertainty.

### **Example** UNCERT?

**Returns** 2.00E-02,2.10E-02,PCT,4.60E-02,6.00E-02,PCT

## Generating a Calibration Report

Three different calibration reports are available from the Product: stored, active, or consts. Each report can be formatted for printing or comma-separated for importation into a different application. Push the **REPORT SETUP** softkey under **CAL** menu to set lines per page, calibration interval, type of report, format, and the serial port to output through. The specification shown in these reports is dependent on the interval selected in the **REPORT SETUP** menu.

The three types of report are:

- "stored," shows output shifts as a result of the most recent stored calibration constants.
- "active," shows output shifts as a result of a calibration just performed but whose calibration constants are not yet stored.
- "consts," which is a listing of the active set of raw calibration constant values.

## General Maintenance

This section explains how to do routine maintenance on the Product.

#### Clean Outside Surfaces

To clean the outside surfaces, wipe the case, front-panel keys, and lens using a soft cloth slightly dampened with water or a non-abrasive mild cleaning solution that does not harm plastics.

## 

To prevent damage to the plastic materials used in the Product, do not use aromatic hydrocarbons or chlorinated solvents when you clean the Product.

#### Replace the Line Fuse

#### **∧** Caution

To prevent possible damage to the Product, verify the correct fuse is installed for the selected line voltage setting 100 V and 120 V, use 5.0 A/250 V time delay (slow blow); 220 V and 240 V, use 2.5 A/250 V time delay (slow blow).

Access the line power fuse on the rear panel. The fuse rating is 5 A/250 V slow blow fuse for 100 V/120 V line voltage; 2.5 A/250 V slow blow fuse for 220 V/240 V line voltage.

To examine or replace the fuse, refer to Figure 23 and continue as follows:

- 1. Disconnect line power.
- 2. Put a screwdriver blade in the tab at the left side of fuse holder and pry until it can be removed with the fingers.
- 3. Remove the fuse from the compartment for replacement or verification. Be sure the correct fuse is installed.
- 4. Install the fuse compartment and push it into the compartment until the tab locks.

Table 51. Replacement Fuses

| Line Voltage Setting | Fuse Description                            | Part Number |
|----------------------|---|-------------|
| 100 V or 120 V       | 5.0A, 250V, Slow Blow, 0.25 x 1.25 <b>⚠</b> | 109215      |
| 220 V or 240 V       | 2.5A, 250V, Slow Blow, 0.25 x 1.25 <b>⚠</b> | 851931      |

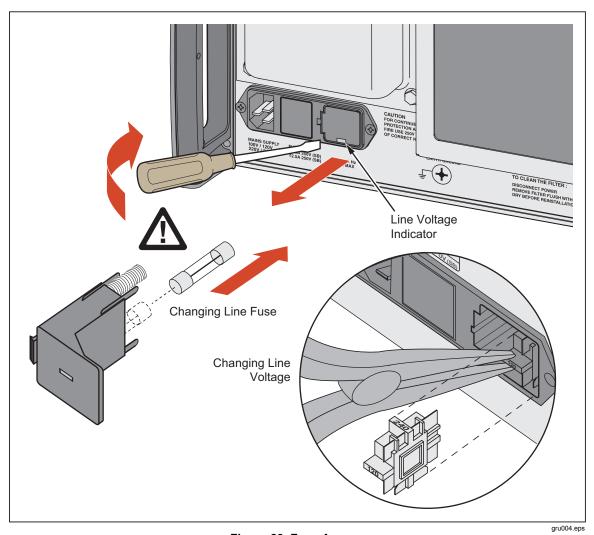


Figure 23. Fuse Access

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## Replace the Current Fuses

The two Product current outputs have fuse protection. If the Product cannot source current, one or both of the current fuses can be blown.

# ∧ Marning

To prevent possible electrical shock, fire, or personal injury, turn the Product off and remove the mains power cord. Stop for two minutes to let the power assemblies discharge before you open the fuse door.

To replace the current output fuses:

- 1. Turn the Product off and remove the mains power cord. Stop for two minutes to let the power assemblies discharge.
- 2. Turn the Product over.
- 3. Remove the two screws that hold the fuse compartment cover in place and remove the cover as shown in Figure 24.
- 4. Remove and examine the fuses as necessary. Table 52 shows the part number and rating of each fuse.

**Table 52. Current Fuses** 

| Current Output | Current Output Fuse Description Part Number |         |
|----------------|---|---------|
| AUX            | 4A/500V Ultra-Fast Blow (F3)                | 3674001 |
| 20A            | 25A/250V Fast Blow (F4)                     | 3470596 |

- 5. Replace fuses as required.
- 6. Replace the fuse compartment door and attach the fuse compartment cover with the screws removed in step 3.

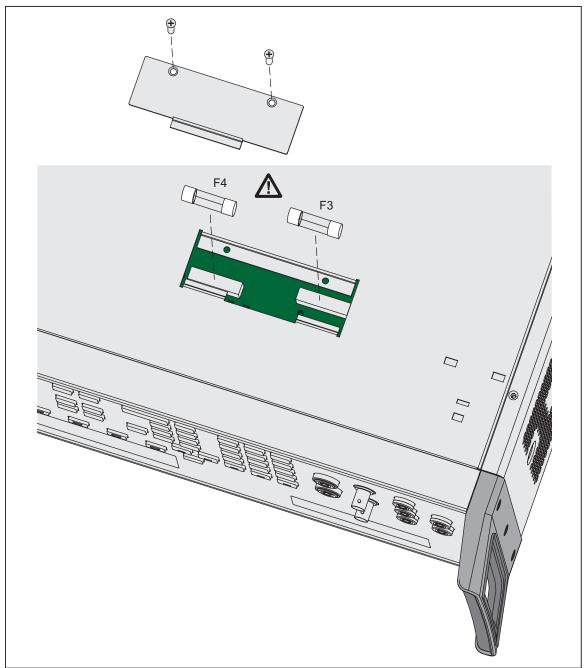


Figure 24. Current Fuse Compartment

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#### Clean the Air Filter

## Marning

To prevent risk of injury, do not operate or power the Product without the fan filter in place.

## **∧** Caution

Damage can occur when the Product becomes too hot if the area around the fan is restricted, the intake air is too warm, or the filter becomes clogged.

The air filter must be removed and cleaned at 30 day intervals or more frequently if the Product is operated in a dusty environment. Access the air filter from the rear panel of the Product.

To clean the air filter, refer to Figure 25 and continue as follows:

- 1. Turn the power off and let the fan come to a stop.
- 2. Disconnect the ac line cord.
- 3. Remove the filter element.
  - a. Hold the top and bottom of the air filter frame.
  - b. Squeeze the edges of the frame towards each other to disengage the filter tabs from the slots in the Product.
  - c. Pull the filter frame straight out from the Product.
- 4. Clean the filter element,
  - a. Clean the filter element in soapy water.
  - b. Flush the filter element.
  - c. Shake out the water and let the filter element dry before you install it.
- 5. Do the filter removal steps in reverse order to install the filter element.

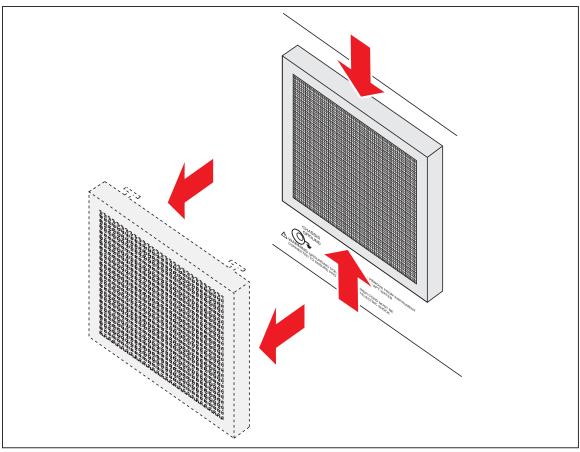


Figure 25. Accessing the Air Filter

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# **Static Awareness**





Semiconductors and integrated circuits can be damaged by electrostatic discharge during handling. This notice explains how to minimize damage to these components.

- 1. Understand the problem.
- 2. Learn the guidelines for proper handling.
- 3. Use the proper procedures, packaging, and bench techniques.

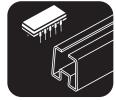
Follow these practices to minimize damage to static sensitive parts.

## Marning

To prevent electric shock or personal injury. Deenergize the product and all active circuits before opening a product enclosure, touching or handling any PCBs or components.



- Minimize handling.
- Handle static-sensitive parts by non-conductive edges.
- Do not slide staticsensitive components over any surface.
- When removing plug-in assemblies, handle only by non-conductive edges.
- Never touch open-edge connectors except at a static-free work station.



- Keep parts in the original containers until ready for use.
- Use static shielding containers for handling and transport.
- Avoid plastic, vinyl, and Styrofoam<sup>®</sup> in the work area.



- Handle static-sensitive parts only at a staticfree work station.
- Put shorting strips on the edge of the connector to help protect installed staticsensitive parts.
- Use anti-static type solder extraction tools only.
- Use grounded-tip soldering irons only.

## **Access Procedure**

The access procedures supplied here are for those who must replace a defective module only. Fluke Calibration does not recommend that the user repair the boards to the component level.

## **∧** Caution

To avoid damage to the Product, do not touch the circuit boards. Subtle long-term stability problems can result.

Use the procedures in this section to remove:

- Analog modules: Voltage (A8), Current (A7), DDS (A6), and Synthesized Impedance (A5)
- Rear-panel module (main CPU (A9), transformer and ac line input components)
- Filter PCA (A12)
- Encoder/Display (A2)
- Keypad

## **Analog Modules**

To remove the Voltage (A8), Current (A7), DDS (A6), or Synthesized Impedance (A5) modules, see Figure 26:

- 1. Remove the Phillips screws from the top cover including two from rear, four from sides, and six from bottom.
- 2. Remove the top cover.
- 3. Remove the eight Phillips screws from the guard box cover. The locations of the analog modules are printed on the guard box cover.
- 4. Use the finger pull on the left-rear of the cover to lift off the guard box cover.
- 5. For the Impedance (A5) module, remove the bottom cover. See steps 3-4 of the *Rear-Panel Assemblies* section. With the bottom side up, unclasp the cable clamp and detach the red and black wire connectors.
- 6. For the Voltage (A8) module, with top side up, disconnect the three multi-wire connectors at top of the board and remove the wires from the plastic wire guide.
- 7. With the top side up, release the board edge locks on the analog module to be removed.
- 8. Lift the board out of its socket in the Motherboard. Put the board shield side down.
- 9. To remove the shield, remove the Phillips screw at the center of the shield and then pull the sides of the shield away from the board.
- 10. To install the shield, first align one set of tabs and then push the other side into position.

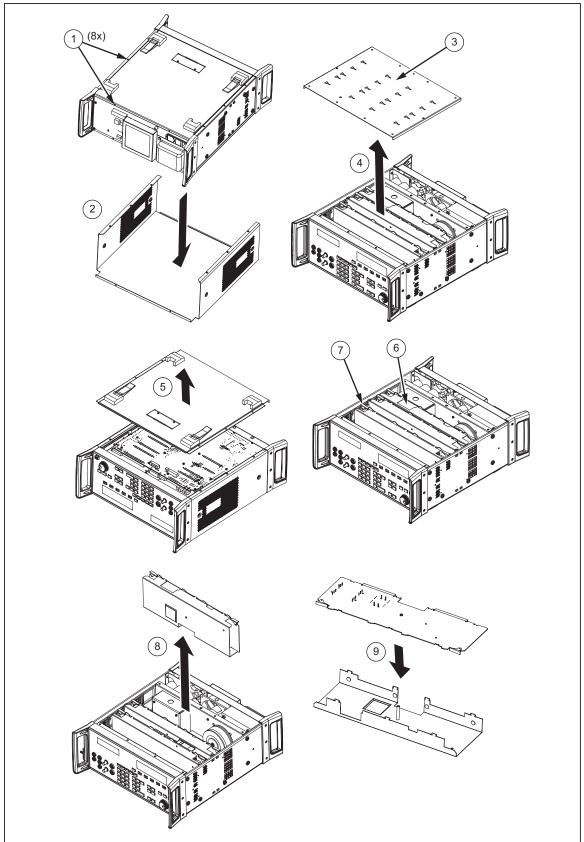


Figure 26. Remove Analog Modules

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#### Rear-Panel Assemblies

To remove the Main CPU PCA (A9), the transformer, and the ac line input filter, see Figure 27:

- 1. Remove the top cover. See steps 1-2 in the *Analog Modules* section.
- 2. Remove the six 3 mm Allen screws from the rear handles.
- 3. Remove the two Phillips screws from the back edge of the bottom cover.
- 4. Remove the bottom cover.
- 5. Remove the four Phillips screws that are accessible through holes in the bottom flange.
- 6. Remove the power switch pushrod.
- 7. Remove the rear panel. There are two cable bundles, plus one ribbon cable for the Main CPU PCA (A9).

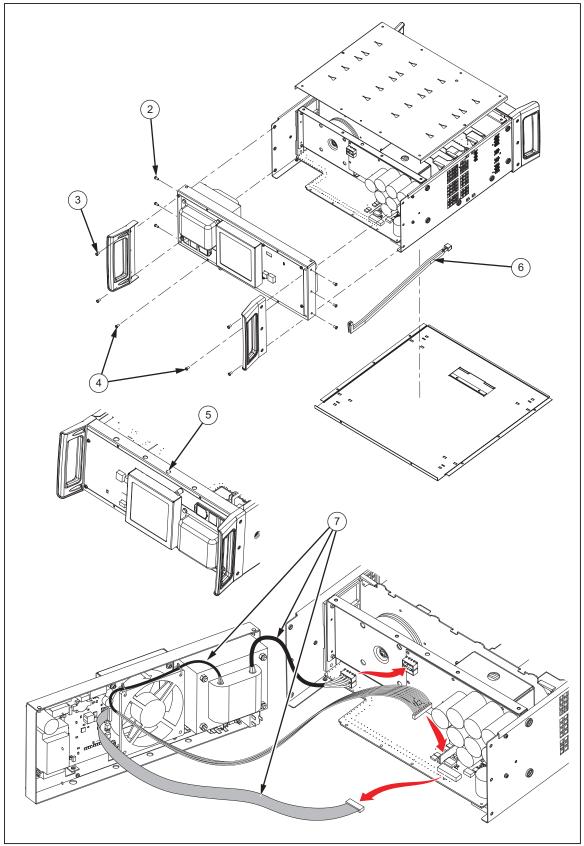


Figure 27. Remove Rear Panel Assemblies

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# Main CPU (A9)

To remove the Main CPU PCA, see Figure 28:

- 1. Remove the rear-panel assembly. See the Rear-Panel Assemblies section.
- 2. Remove the 3/16 inch jack screws and washers from the RS-232 connector.
- 3. Remove four Phillips screws from the right side of the rear panel.
- 4. Disconnect the two transformer wires from the Main CPU PCA (A9). These cables are attached by a cable tie that must be cut, and then replaced with a new one when you assemble the Product.
- 5. Lift out the Main CPU PCA (A9).

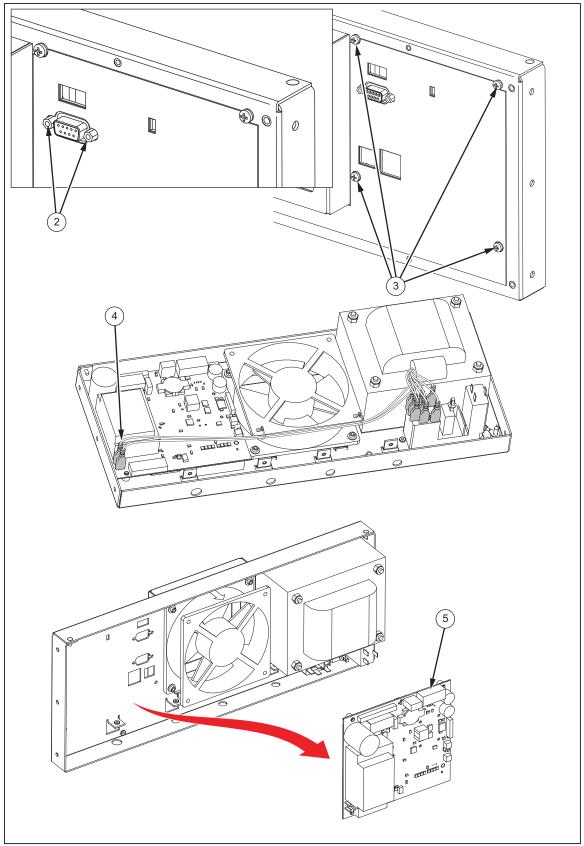


Figure 28. Remove the Main CPU PCA (A9)

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# Filter PCA (A12)

To remove the Filter PCA (A12):

- 1. Remove the top cover, guard-box cover, and all the analog modules. See the *Analog Modules* section and Figure 29.
- 2. Remove the two Phillips screws from the front side of the rear guard box wall.
- 3. Remove the three Phillips screws from the transformer cover on the front side of the rear guard box wall.
- 4. Remove the three standoffs under the transformer cover.
- 5. Lift out the Filter PCA (A12).

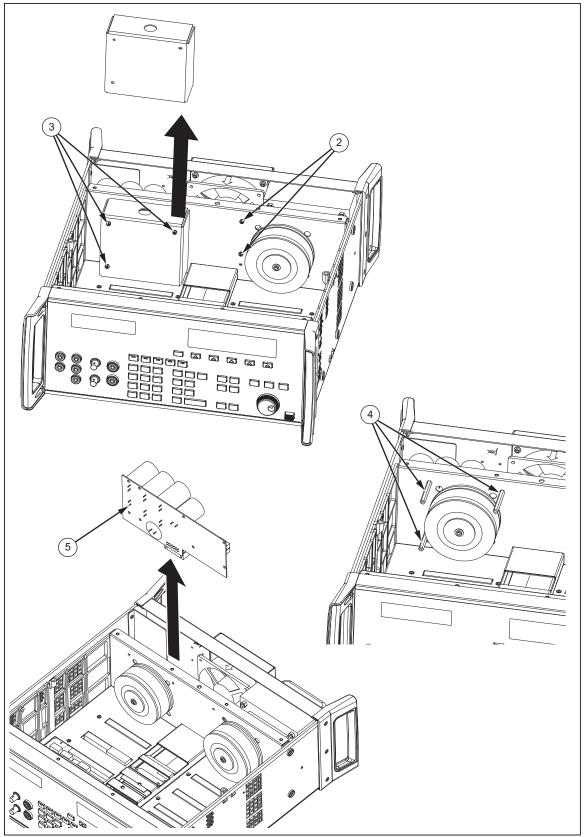


Figure 29. Remove Filter PCA (A12)

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## Encoder/Display PCA (A2)

To remove the Encoder/Display PCA (A2) PCA and Keypad, see Figure 30:

- 1. Remove top and bottom covers. See steps 1-4 in the *Rear Panel Assemblies* section.
- 2. With the bottom side up, disconnect all of the cables that go to the front panel.
- 3. Remove the six Allen screws from the front handles.
- 4. Remove the front panel.
- 5. Remove the Encoder knob and nut from the front side of the front panel.
- 6. Remove fifteen Phillips screws on the Encoder/Display PCA (A2)
- 7. Lift out the Encoder/Display PCA (A2). Access the keypad from under A2.

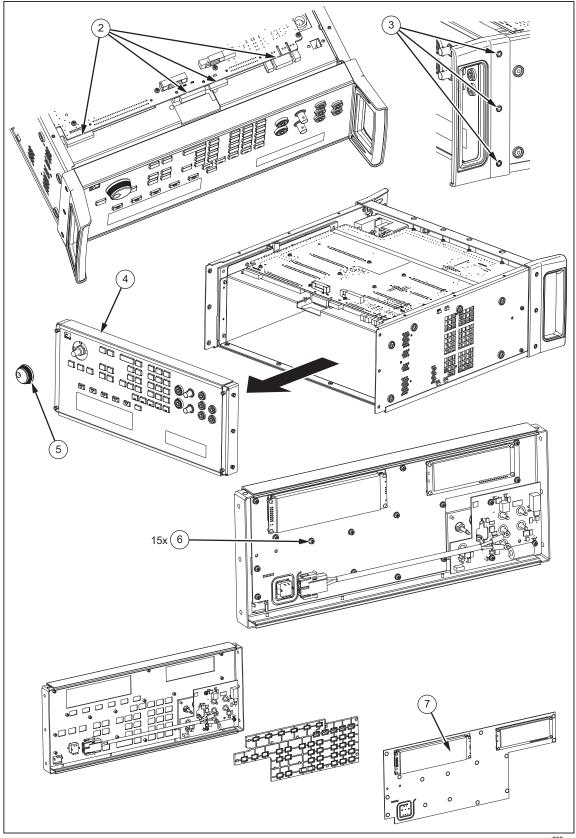


Figure 30. Remove Encoder/Display PCA (A2)

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# **Output Block PCA (A16)**

To remove the Output Block PCA (A16), see Figure 31:

- 1. Remove the three Phillips screws on the Output Block PCA (A16).
- 2. Remove the output cables, nuts, and washers from the terminal posts on the output block.
- 3. Lift out the Output Block PCA (A16).

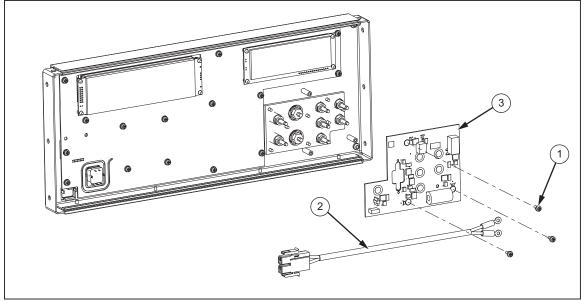


Figure 31. Remove Output Block (A16)

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# Replaceable Parts

This section contains an illustrated list of replaceable parts for the Product. Parts are in the list by assembly and alphabetized by reference designator. Each assembly is accompanied by an illustration that shows the location of each part and its reference designator. The replaceable parts list shows:

- Reference designator
- An indication if the part is subject to static discharge damage
- Description
- Fluke Calibration Part Number
- Total quantity
- Special notes (for example, factory-selected part)

#### How to Obtain Parts

Part prices are available from the Fluke Calibration or its representatives. See the *How To Contact Fluke Calibration* section to get parts.

If a part is replaced by a new or better part, the replacement will be accompanied by an explanatory note and if necessary, installation instructions.

To make sure you get the correct part, you must include:

- Instrument model and serial number
- Part number and revision level of the pca containing the part.
- Reference designator
- Fluke Calibration part number
- Description (as given under the Description column)
- Quantity

## **Parts**

Table 53 shows the replaceable parts for the Product. Figure 32 shows the parts within the Product.

Table 53. Replaceable Parts

| Reference<br>Designator | Description   | Part<br>Number | Qty |
|-------------------------|---|----------------|-----|
| A3                      | 5080A-7603, MOTHER BOARD, A3 - TESTED   | 4018029        | 1   |
| A5                      | 5080A-7605, OHMS, A5 - TESTED   | 4018034        | 1   |
| A6                      | 5080A-7606, INGUARD/CPU, DDS, A6 - TESTED   | 4018041        | 1   |
| A7                      | 5080A-7607, CURRENT, A7 - TESTED  | 4018052        | 1   |
| A8                      | 5080A-7608, VOLTAGE, A8 - TESTED  | 4018065        | 1   |
| A9                      | 5080A-7609, OUT-GUARD, CPU, A9 - TESTED   | 4018076        | 1   |
| A12                     | 5080A-7612, POWER SUPPLY, A12 - TESTED  | 4018083        | 1   |
| F1                      | FUSE, FUSE, .25X1.25,5A,250V,SLOW   | 109215         | 1   |
| H1-16                   | HEX NUT, M3-0.5,2.4MM THICK,DIN 934,STEEL,Z<br>CL8,COARSE THREAD FINISHED         | 3472020        | 16  |
| H17-H37                 | SCREW, HK M4-0.7X8MM,STEEL,PLAIN,LOW HEAD SOCKET CAP SCREW,W/SELF LOCKING PATCH   | 3472154        | 20  |
| H38-H60                 | SCREW,M3X0.5,6MM,PAN HEAD,PHILLIPS,STEEL,ZINC-CHROMATE,S-L NYLON PATCH            | 3783203        | 22  |
| H61-H77                 | WASHER,M3,6MM OD,3.38MM ID,0.4MM THK,DIN<br>6797,STEEL,ZINC,EXT TOOTH LOCK WASHER | 3472012        | 16  |
| H78,H79                 | WASHER, WASHER, FLAT, SS, .378, .563, .016  | 245811         | 2   |
| H80-H83                 | INSULATOR,BNC BULKHEAD,POLYCARBONATE  | 3533990        | 4   |
| H84,H85                 | WASHER,3 WAVE,SPRING,0.39 ID,0.50 OD,0.007 THICK                                  | 3591326        | 2   |
| H86-H89                 | LOCK NUT,NYLON INSERT,M5-0.8,5MM THICK,DIN 985,STEEL,ZINC PLATED                  | 3472047        | 4   |
| H90-H93                 | SCREW,M5-0.8X80MM,8.8 DIN 931,COARSE PARTIAL THD,STEEL,ZINC,HEX CAP SCREW         | 3471961        | 4   |
| H94-H97                 | WASHER, FLAT,.219 ID,.506 OD,.061 THK,STEEL,ZINC-CHROMATE                         | 2565513        | 4   |
| H98-H101                | WASHER, WASHER,FLAT,STL,.160,.281,.010  | 111005         | 4   |
| H102,H103               | CONNECTOR ACCESSORY,D-SUB JACK SCREW,4-40,.250 L,W/FLAT WASHER                    | 1777348        | 2   |
| H104,H105               | SCREW,M3X0.5,6MM,FLAT,PHILLIPS,STEEL,ZINC-CLEAR                                   | 2064911        | 2   |
| H106                    | WASHER, WASHER, LOCK, INTRNL, STL, .267ID   | 110817         | 1   |
| H107                    | NUT, NUT, HEX, BR, 1/4-28   | 110619         | 1   |

| Reference<br>Designator | Description   | Part<br>Number | Qty |
|-------------------------|---|----------------|-----|
| H108                    | SCREW,M3-0.5X18MM,PHILLIPS PAN HEAD,STEEL,ZINC,MACHINE SCREW W/SELF LOCK PATCH      | 3472243        | 4   |
| H109,H110               | 250400030,NUT #M4 X 0.7 HEX STEEL S   | 3168025        | 2   |
| H111-H120               | SCREW,M4-0.7X8MM,PHILLIPS,PAN HEAD,STEEL,ZINC<br>PLATED,W/SELF LOCKING NYLON PATCH  | 3566379        | 10  |
| H121-131                | SCREW,M3-0.5 X 8MM,PHILLIPS FLAT HEAD,DIN<br>965,STEEL,ZINC PL,W/SELF LOCKING PATCH | 3472058        | 11  |
| H132-H168               | 140102,SCREW,M3X0.5,8MM,PAN,PHILLIP,STEEL,ZN-CHROMATE                               | 2803610        | 36  |
| J1-J6                   | CABLE ACCESSORY ,CABLE ACCESS,TIE,4.00L,.10W,.75 DIA                                | 172080         | 6   |
| J7,J8                   | CONNECTOR ,CONN,COAX,BNC(F),CABLE   | 412858         | 2   |
| J9                      | 5080A-4403,CABLE, FRONT PANEL TO MOTHER BOARD                                       | 3474794        | 1   |
| J10                     | 5080A-4402,CABLE, 20AMP OUTPUT  | 3473928        | 1   |
| J11                     | 5800A-4409 ,WIRE, 6 GROUND"   | 626116         | 1   |
| J12                     | CABLE TIE RETAINER,CABLE TIE,FLAT<br>RETAINER,ADHESIVE BACK                         | 564625         | 1   |
| J13                     | CABLE,ADAPTER,USB STANDARD A TO RS232 DB-9<br>FEMALE,1.65M LENGTH,W/USB DRIVER CD   | 3525836        | 1   |
| MP1                     | 5080A-2001,FRONT PANEL SHEET METAL  | 3387819        | 1   |
| MP2                     | 5080A-8002,DECAL FRONT PANEL 5080A  | 3391354        | 1   |
| MP3                     | 5080A-2002,FRONT PANEL ALUMINUM TRIM EXTRUSION (PAINTED)                            | 3391331        | 2   |
| MP4                     | 5080A-2010,FRONT TRIM FIXING STRIP  | 3435237        | 2   |
| MP5                     | 5080A-8006,HANDLE, 4U   | 3468705        | 4   |
| MP6                     | 5080A-8001,KEYPAD RUBBER 5080A  | 3391346        | 1   |
| MP7                     | 5080A-4002,PCA, KEYPAD / ENCODER A1 / A2  | 3439674        | 1   |
| MP8                     | CONTRACT MFG ITEM, JACK BAN SAFE BLK  | 2079863        | 3   |
| MP9                     | CONTRACT MFG ITEM, JACK BAN SAFE RED  | 2079874        | 4   |
| MP10                    | 5080A-2019,HIGH VOLTAGE TERMINAL BLOCK  | 3564380        | 1   |
| MP11                    | 5080A-4016,PCA, ESD CLAMP, A16  | 3541713        | 1   |
| MP12                    | 5080A-8004,KNOB ENCODER GREY#3 6MM SHAFT  | 3441850        | 1   |
| MP13                    | 5080A-2007,REAR PANEL   | 3409081        | 1   |
| MP14                    | 5080A-8003,REAR PANEL DECAL   | 3409096        | 1   |
|                         |   | _              | _   |

Table 53. Replaceable Parts (cont.)

| Reference<br>Designator | Description   | Part<br>Number | Qty |
|-------------------------|---|----------------|-----|
| MP15                    | 5520A-2026 ,TRANSFORMER COVER, PAINTED  | 647138         | 1   |
| MP16                    | FILTER ,FILTER,LINE,250VAC,4A,W/ENTRY MODULE  | 944269         | 1   |
| MP17                    | FILTER PART ,FILTER,LINE,PART,VOLTAGE SELECTOR                                      | 944272         | 1   |
| MP18                    | FILTER PART ,FILTER,LINE,PART,FUSE DRWR W/SHRT BAR                                  | 944277         | 1   |
| MP19                    | 5440A-8197-01 ,BINDING HEAD, PLATED   | 102889         | 1   |
| MP20                    | FAN,TUBEAXIAL,110CFM,115VAC,15W,BALL<br>BRG,37DBA,0.28 IN H2O,120X120X38MM,BULK     | 3473622        | 1   |
| MP21                    | LABEL ,LABEL,MYLAR,GROUND SYMBOL  | 911388         | 1   |
| MP22                    | TAPE ,TAPE,FOAM,POLYUR,W/LINER,.3125,.250   | 603134         | 1   |
| MP23                    | 5080A-2008,CHASSIS RIVETED  | 3409118        | 1   |
| MP24                    | INSULATOR,NYLON,MOLDED,5/16 (M8),0.093 IN. LONG,BULK                                | 3533983        | 10  |
| MP25                    | CABLE TIE,50LB,14.2 IN. LIGHT GREEN HIGH-TEMP<br>NYLON WITH S-S LOCKING DEVICE,BULK | 3534000        | 8   |
| MP26                    | 5080A-8007,MAINS SWITCH PUSH ROD 5080A  | 3525824        | 1   |
| MP27                    | 5700A-2046 ,POWER BUTTON, ON/OFF  | 775338         | 1   |
| MP28                    | 5500A-8011 ,AIR FILTER  | 945287         | 1   |
| MP29                    | 5500A-2012 ,HOUSING, AIR FILTER   | 937107         | 1   |
| MP30                    | 5080A-2017,SHIELD OHMS  | 3474905        | 1   |
| MP31                    | 5080A-2018,SHIELD ANALOG FRONT DDS PANGU  | 3474910        | 1   |
| MP32                    | 5080A-2014,SHIELD COVER A7  | 3439961        | 1   |
| MP33                    | 5080A-2004,ANALOG TOP COVER   | 3409055        | 1   |
| MP34                    | WT-630564, TILT STAND   | 2650711        | 2   |
| MP35                    | 5700A-2043-01 ,BOTTOM FOOT, MOLDED, GRAY #7   | 868786         | 4   |
| MP36                    | 5080A-2005,BOTTOM INSTRUMENT COVER  | 3409062        | 1   |
| MP37                    | 5080A-2006,TOP INSTRUMENT COVER   | 3409070        | 1   |
| MP38                    | 5080A-2016,FUSE ACCESS PLATE  | 3473610        | 1   |
| MP39                    | 6070A-2063 ,AIDE,PCB PULL   | 541730         | 1   |
| MP40                    | 5080A-2015,SHIELD COVER A8  | 3449027        | 1   |
| MP41                    | FTCL-8001-01 ,LABEL,CALIB, CERTIFICATION SEAL                                       | 802306         | 2   |
| MP42                    | TAPE ,TAPE,FOAM,VINYL,.500,.125   | 330449         | 1   |
| MP43                    | TEST LEAD SET ,TEST LEAD SET,SI,STACKING,100CM,4 PC                                 | 601721         | 1   |

Table 53. Replaceable Parts (cont.)

| Reference<br>Designator | Description  | Part<br>Number | Qty |
|-------------------------|--|----------------|-----|
| MP44                    | GUIDE,GETTING STARTED GUIDE, 5080A   | 3502941        | 1   |
| MP45                    | SHIPPING BOX,REGULAR SLOTTED<br>CARTON,KRAFT,48LB B-C FLUTE,28.375,25.00,13.25 | 3753014        | 1   |
| MP46                    | DVD,GNU LESSER GENERAL PUBLIC LICENSE - 5080A                                  | 3779181        | 1   |
| MP47                    | LABEL,SERVICE ONLY LABEL- 5080A  | 3779509        | 1   |
| MP48                    | 5080A-2020,SHIELD, A9  | 3669601        | 1   |
| MP49                    | 5440A-8198-01 ,BINDING POST, STUD, PLATED                                      | 102707         | 1   |
| T1                      | TRANSFORMER,POWER,100/120/220/240V,50/60HZ,7:1:8: 2:1:2,PANGU,286VA,EI175      | 3471249        | 1   |
| T2                      | TRANSFORMER,POWER,45V,50-<br>400HZ,1:3,PANGU,TOROIDAL,105X35MM,BULK            | 3451576        | 1   |
| Т3                      | TRANSFORMER,POWER,45V,50-<br>400HZ,1:10:10:10,PANGU,TOROIDAL,105X35MM,BULK     | 3451583        | 1   |

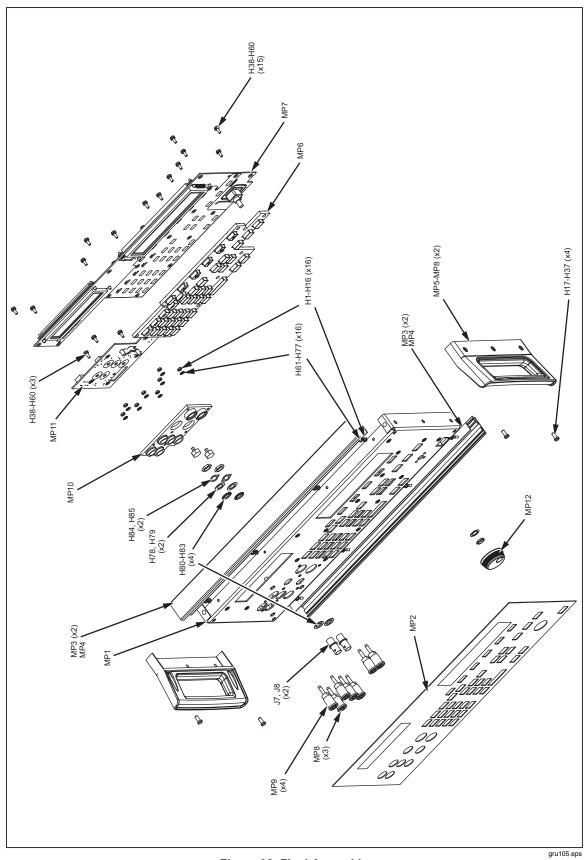


Figure 32. Final Assembly

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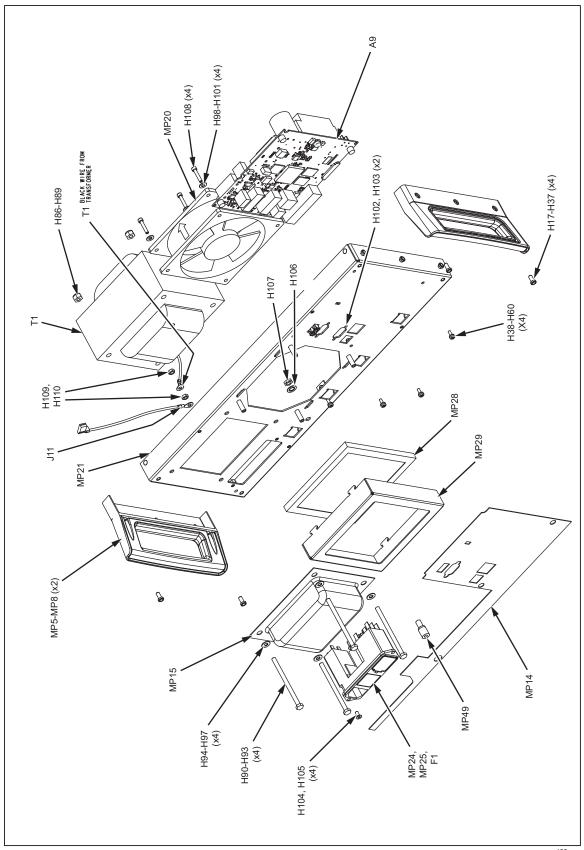


Figure 32. Final Assembly (cont.)

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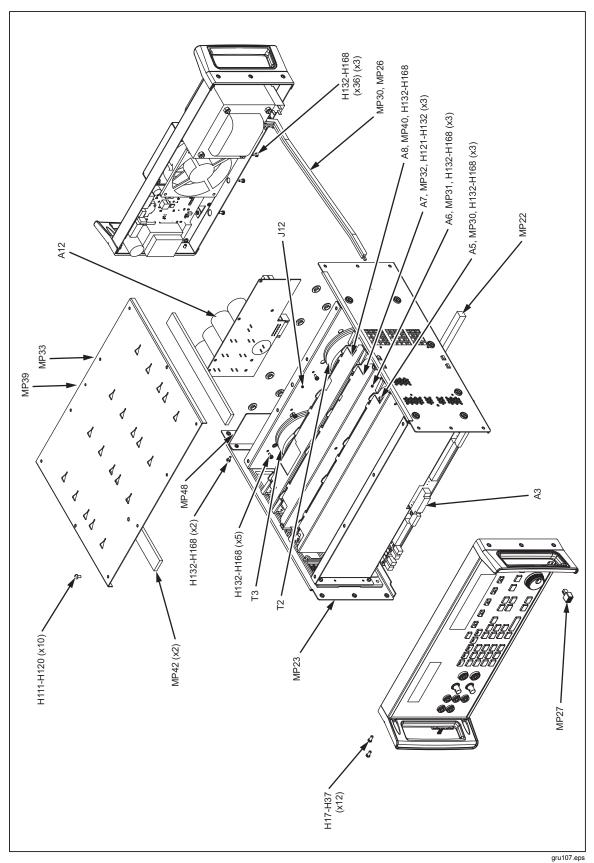


Figure 32. Final Assembly (cont.)

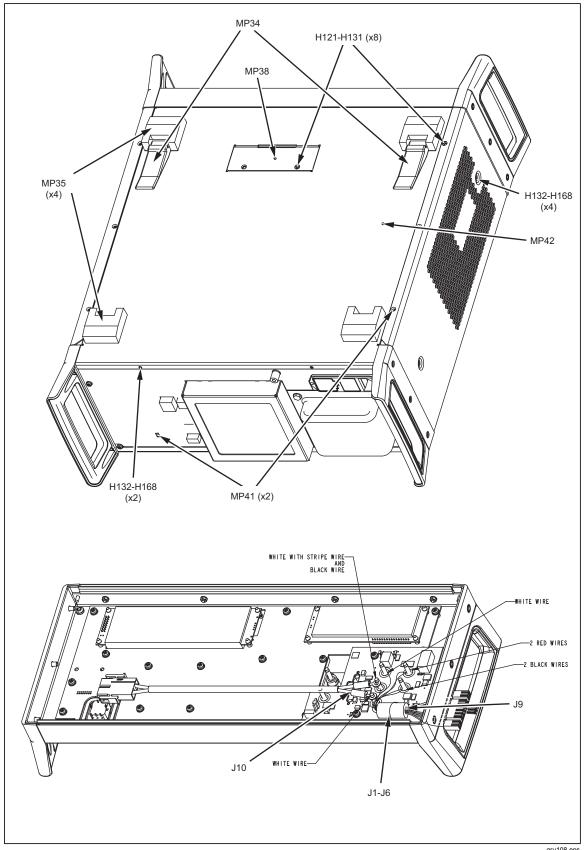


Figure 32. Final Assembly (cont.)

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