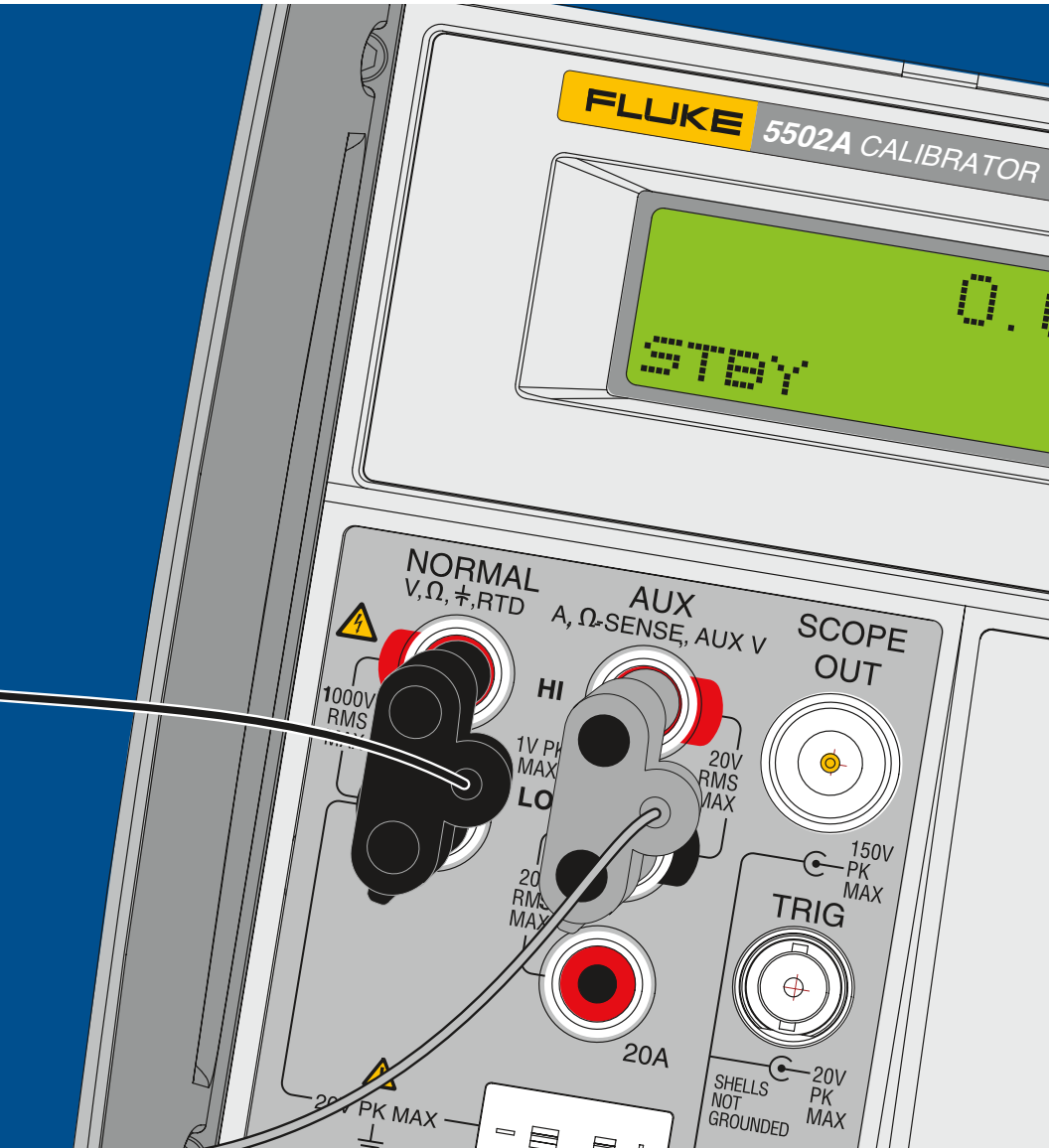
FLUKE®
Calibration

55XX Series Multi-Product Calibrator
15-minute demo guide



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Safety warning: The 55XX Series calibrators are capable of producing 1000 V ac and dc at the NORMAL output terminals. Do not touch any connectors until you confirm that the calibrator is set to 0 V and in STANDBY mode. Always keep one hand at your side when attaching cables to avoid electric shock through the body.

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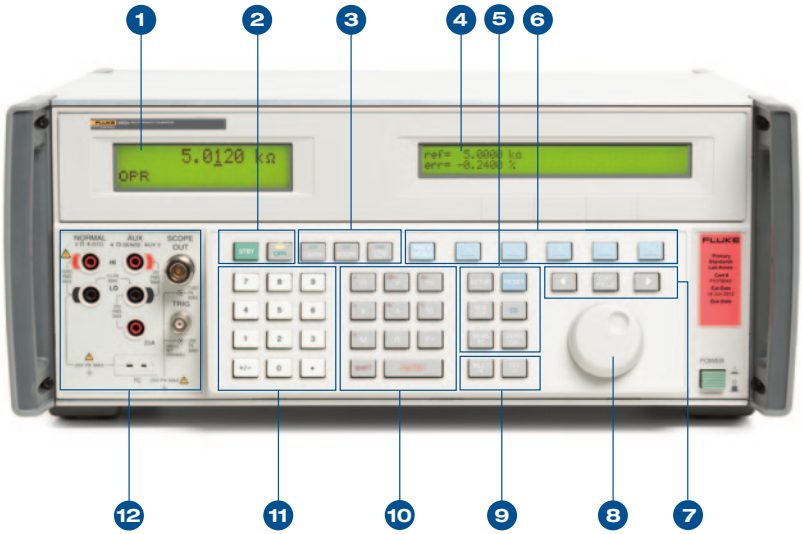
Introduction



1. Output Window displays main output information.
2. Separate STBY and OPR Keys control output.
3. SCOPE and Trig Out Keys enable the optional oscilloscope calibration functions; EARTH, when on, ties analog low to earth ground.
4. Control Window displays messages, softkey menus, status, auxiliary information.
5. SETUP activates setup softkey menus. RESET returns the instrument to its power-up state. NEW REF sets present output as the reference for calculating errors. CE clears the current entry. MEAS TC puts the 55XX calibrator in thermocouple measurement mode. TRIG OUT triggers the oscilloscope calibration option.
6. "Soft" keys allow access to the menus in the Control Window, letting you select parameters. PREV MENU lets you step backward through menus.
7. Arrow Keys select highlighted digits in the Output Window. EDIT FIELD toggles between two values if present in the Output Window.
8. Edit Knob, which has a detent for each digit increment, allows you to vary the output.
9. MULT[X] and DIV [÷] Keys step up/down in decade multiples of any output setting.
10. Unit selection and unit modifiers. The ENTER Key completes the entry, moving it from the Control Window to the Output Window.
11. Calculator-Style Keypad allows easy value entry.
12. Output Block with recessed safety terminals for voltage, ohms, RTDs, auxiliary voltage, current and ohms sensing; isothermal terminal for thermocouples, and BNC connectors for oscilloscope calibration and external trigger outputs.

Presenting the 55XX Series Multi-Product Calibrators—Each is eleven calibrators in one

Compared with more traditional calibrators designed to calibrate a certain type of instrument, the Fluke Calibration 55XX Series represents a whole new class of multi-product calibrator, offering an unprecedented range of dc and low-frequency electrical calibration workload coverage. The basic 55XX Series calibrator can calibrate digital and analog multimeters, thermometers (thermocouple and RTD), handheld wattmeters, data loggers, current clamps, strip chart recorders, oscillographic recorders, panel meters, process calibrators, power harmonics analyzers and many other similar measurement tools.

Try using a 55XX Series calibrator with actual units under test (UUTs)

This demonstration guide lets you see for yourself in about 15 minutes how the advanced features of the 55XX Calibrators make it easy to calibrate a wide variety of instruments. The following examples use Fluke products. In most cases, similar products from other vendors can be substituted. If you have any questions, contact your Fluke Calibration representative.

You'll discover that each 55XX Series' front panel is arranged to make it easy to use, even for the first time operator. Values are entered on the calculator-style keypad; units are selected from the keypad to the right of it. Operate, standby, scope and boost enable keys are arranged across the top edge of the panel along with five "softkeys," whose meaning changes depending on the display window above it.

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Section 1: Meter functions

What you'll need
In addition to a 55XX Series Multi-Product Calibrator, you'll need a Fluke 179 Digital Multimeter or equivalent and a set of compatible test leads.

Direct voltage

The 55XX Series calibrators can output direct voltage from 0 to ± 1020 V.

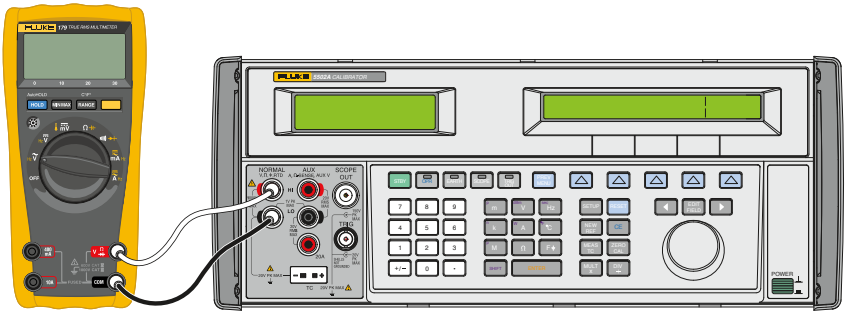
1. Connect the V and COM terminals of the dmm to the NORMAL outputs of the calibrator.
2. Set the meter to direct voltage mode: $\overline{\overline{V}}$
3. Select a 10 volt dc output from the 5500A by pressing:
   [1] [0] [dBm V] [ENTER] [OPR]
   10 V is indicated on the output window.
4. Turn the edit knob to vary the calibrator's output. Notice how the control window now displays error, showing the reference voltage and the difference between it and the current output.
5. Turn the edit knob to return the output to 10 V.
6. The [◀] [▶] cursor keys above the edit knob and on either side of the [EDIT FIELD] key allow you to select which decades on the output display to edit. Press the [◀] key until the cursor is under the most significant 0 on 10.00000 V:
   [◀] [◀] [◀] [◀] [◀]

Then turn the edit knob clockwise until the output display reads 33 V. Notice that the calibrator dropped into standby mode. This safety precaution protects the operator from inadvertently slewing the output to a potentially hazardous level.

7. Now press the [NEW REF] key, located in the keypad to the left of the edit knob. Notice that the error display disappeared from the control window. The indicated output is now set as the reference and errors can be calculated with respect to the new reference value. This simplifies certain kinds of troubleshooting or flatness tests.

8. Press the [RESET] key. This resets the output to 0.0000 mV and puts the calibrator in standby mode.

Alternating voltage



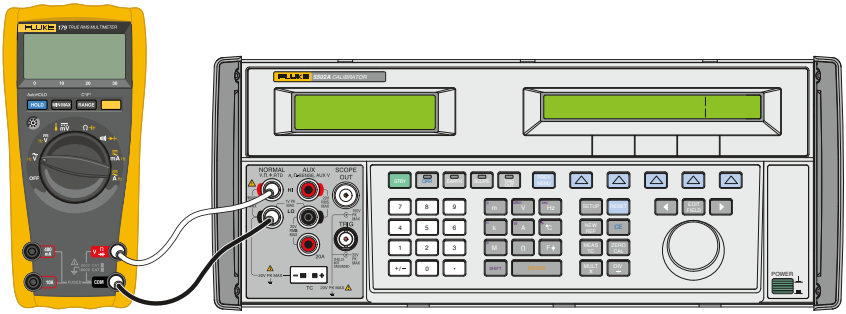
Alternating voltage is available from 1 mV to 1020 V over a frequency range of 0.01 Hz to 2 MHz. Operation is the same as with volts dc. Just enter the value and the units.

1. Put the dmm in ac voltage mode: $\tilde{V}$

2. Connect the V and COM terminals of the dmm to the NORMAL outputs of the 55XX Series. Then select a 10 volt 60 hertz output by pressing:
   [1] [0] [dBm V] [6] [0] [sec Hz] [ENTER] [OPR]
   Notice how the display in the control window has changed, providing you with the opportunity to change the waveform of the volts ac signal or to set a dc offset for duty cycle and sensitivity checks.

3. Press the ▲ under WAVE sine. Notice the menu changes to WAVE tri for triangle wave. Also notice the output display has changed from a conventional rms voltage reading to peak-to-peak.
4. Press the ▲ under WAVE tri and the display changes to WAVE square. Note you are now offered a softkey choice for setting duty cycle, making it easy to directly check the duty cycle display on the dmm.
5. Press the RESET key.

Resistance



Resistance values are available from 0 to 1100 MΩ.

The 55XX Series calibrators use a synthesis technique for simulating resistance values. So, rather than using discrete values, you may select values in ohms much the same way you would select a voltage. The 55XX Series' unique resistance synthesis technique results in wide dynamic range. Unlike synthesized resistance techniques used in other calibrators, the 55XX Series calibrators may be used with a wide range of UUTs, including handheld dmms; analog volt-ohm meters, which typically output relatively high current in low resistance ranges; and bench dmms, which typically output relatively high voltage to make high resistance measurements.

1. Connect the test leads to the Ω and COM inputs of the dmm and to the NORMAL terminals of the 55XX Series calibrator.
2. Put the dmm in ohms mode: **Ω**
3. On the 55XX Series, select a 10 ohms output by pressing:
   1 0 Ω ENTER OPR

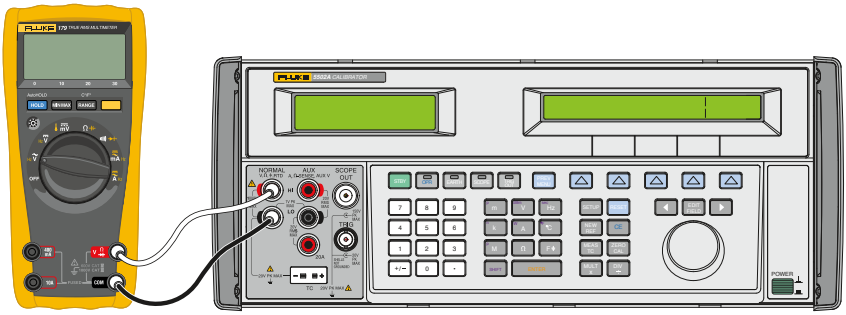
4. Notice that the control window displays a range of lead compensation choices. Simply press the [▲] under COMPoff to cycle through the choices—off, 2-wire and 4-wire. With compensation off, the 55XX Series does not compensate for external lead resistances. In 2-wire mode, the calibrator compensates for lead resistance at the terminals of the UUT. Four-wire mode permits the 55XX Series to be used with UUTs capable of making 4-wire measurements.

5. Notice to the left of the edit knob a group of eight function keys, dedicated to miscellaneous functions. The bottom two, [MULT x] and [DIV ÷], permit you to step the output up or down in even decades of the reference output displayed in the output window. Try it:
[MULT x] [MULT x]

6. Now the output reads 1 kΩ. Edit the output with the edit knob and keys to set the value to 1.42 kΩ and press the [NEW REF] key.

7. Try using the [DIV ÷] key by pressing it three times:
[DIV ÷] [DIV ÷] [DIV ÷]
Now the output display indicates 1.42 Ω.

8. Press the [RESET] key.



Capacitance

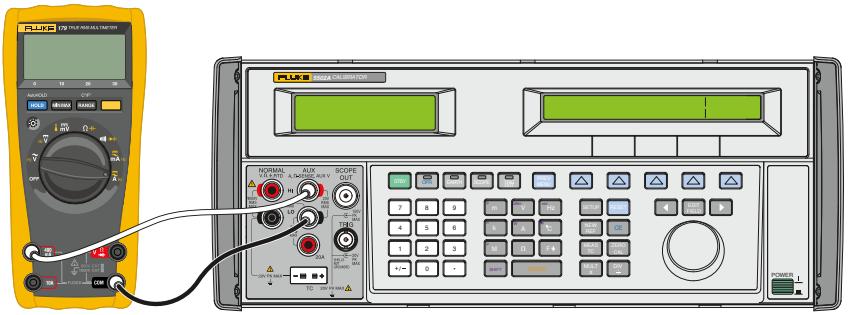
Capacitance is available from 220 pF to 110 mF.

The capacitance function operates in much the same way as the resistance function; that is, simply enter the desired capacitance

output. The design of the 55XX Series calibrators' synthesized capacitance circuit permits it to be used with meters that use both the dc charge/discharge method currently used on handheld dmms, as well as the ac technique used by RCL meters.

1. Connect the test leads to the Ω and COM inputs of the dmm and to the NORMAL terminals of the 5500A Series calibrator.
2. Put the dmm in capacitance mode (on the Fluke 179, select resistance mode **Ω** then press the yellow button for capacitance).
3. On the numeric units keypad, notice there are a number of units indicated in red. These units are entered by first pressing the [SHIFT] key. The 55XX Series keyboard will remain in a shifted state until another key is pressed. This eliminates the need to hold down the [SHIFT] key while entering the shifted value.
4. Microfarads are entered as shifted units. Give it a try. Enter 5 microfarads by pressing :
   [5] [SHIFT] [μ m] [F+] [ENTER] [OPR]
5. The same lead resistance compensation choices available in resistance mode are available in capacitance as well. You may also edit the output in the same way. Press the [DIV ÷] key twice to reduce the output in even decades to 50 nF:
   [DIV ÷] [DIV ÷]
6. Now, edit the output. Select the most significant digit on the output display by pressing the [◀] key three times:
   [◀] [◀] [◀]
   And edit the output by turning the edit knob. As with all the other calibration modes, the calibrator calculates the error and displays it in the control window.
7. Press the [RESET] key.

Direct current



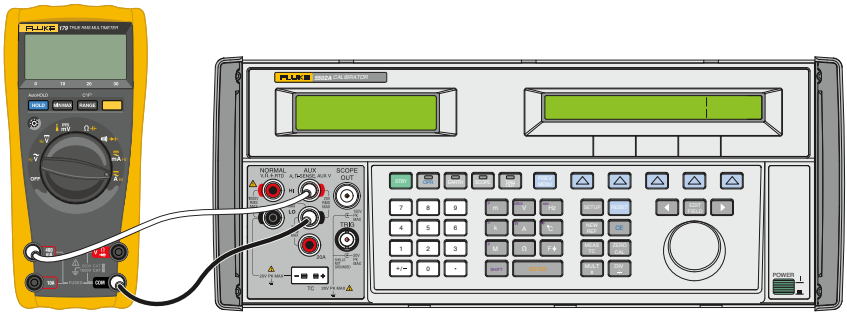
Direct current is available from 0 to ± 20.5 A.

Sourcing direct current is identical to sourcing direct voltage; however you have to change connections on the 55XX Series, and most likely also on the dmm. Current is available from the AUX terminals of the calibrator.

Be sure to connect a UUT to the calibrator, or the calibrator will go over-compliance and trip out.

1. Connect the 400 A and COM terminals of the dmm to the AUX HI and LO terminals of the 55XX Series.
2. Put the dmm in milliamps direct current mode by turning the dmm knob to direct current millamps position: ⎓ mA (On the Fluke 179, select milliamps then press the yellow button for direct current).
3. Select 100 mA by pressing:
   [1] [0] [0] [μ m] [W A] [ENTER] [OPR]
4. Then press the [MULT X] key once to change to 1 A:
   [MULT X]
5. Turn the edit knob to see the calibrator calculate the uncertainty.
6. Press the [RESET] key.

Alternating current



Alternating current is available from 29 µA to 20.5 A over frequencies from 0.01 Hz to 30 kHz.

Using a 55XX Series calibrator in alternating current mode is similar to using it in alternating voltage mode; however you must change connections on both the calibrator and the dmm. Current is available at the AUX terminals.

You also have to be sure to connect a UUT, or the calibrator will go over-compliance and trip out.

1. Connect the 400 mA and COM terminals of the dmm to the AUX HI and LO terminals of the 55XX Series calibrator.

2. Put the dmm in the milliamps alternating current mode by turning the dmm knob to the mA position: ≂ mA (On the Fluke 179 select milliamps, then press the yellow button for alternating current).

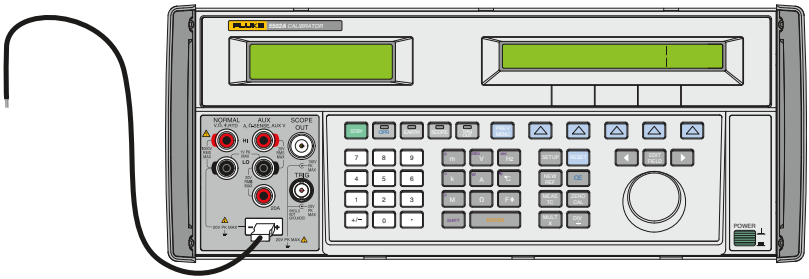
3. Select 100 mA 60 Hertz by pressing:
   [1] [0] [0] [µ m] [W A] [6] [0] [sec Hz] [ENTER] [OPR]
   Notice that the control window display shows that the output is on the auxiliary terminals. Also notice that you have the same choice of waveforms available in alternating voltage mode. Each is selected by pressing the softkey under the display. As with all other modes, the output can be edited by selecting a digit on the output display and slewing it up and down with the edit knob.

4. Press the [RESET] key.

Section 2: Temperature functions

What you'll need
In addition to a 55XX Series Multi-Product Calibrator, you'll need a Fluke 54II or equivalent thermocouple thermometer, a K-type thermocouple and a K-type thermocouple wire with male connectors on each end.

Temperature

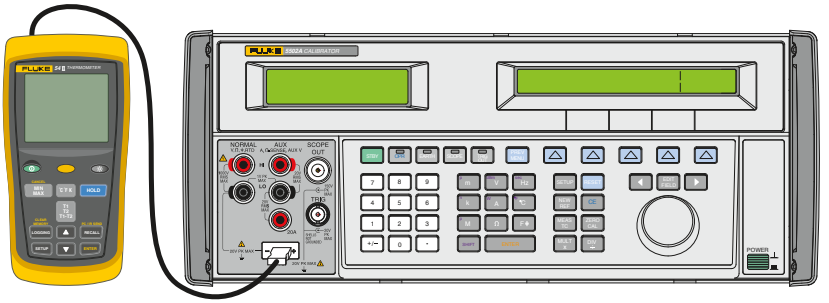


The 55XX Series calibrators have three temperature modes:

- They can simulate eleven types of thermocouples (B C E J K L N R S T U) for calibrating thermometers and other thermocouple indicators. There are also both a 10 µV/°C and a 1 mV/°C modes for creating custom temperature linearizations.
- The 55XX Series calibrators can also measure temperature with the eleven thermocouples indicated above. The thermocouples supported by the 55XX Series span the range of –250 °C to +2350 °C.
- Finally, the 55XX Series can simulate eight resistance temperature devices (RTDs), including six varieties of platinum RTDs ranging from 100 Ω to 1000 Ω, an Ni 120 RTD and a Cu427 10 Ω RTD. These RTDs cover temperatures from –250 °C to +850 °C.

In thermocouple measurement mode, the 55XX Series calibrators simply function as a thermocouple thermometer or can be used to calibrate thermocouple simulation instruments.

1. Connect a K-type thermocouple to the TC connector of the calibrator.
2. In the group of miscellaneous function keys to the left of the edit knob is the [MEAS TC] key. To put the 55XX Series into thermocouple measurement mode, simply press this key: [MEAS TC]
   The temperature is displayed in the output window. This is a convenient way to measure ambient air temperature before performing a calibration or to verify the temperature of ovens, oil or solder baths or related devices. Notice that the voltage level in mV is displayed in the control window. You can also display temperature in °F by pressing the [▲] under TC MENUS. When done, press the [RESET] key.

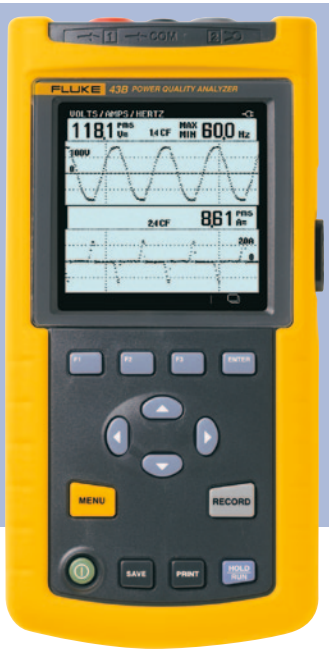


To simulate a thermocouple (source temperature) connect a thermocouple cable (a piece of thermocouple wire with a male connector at each end) to the input of the 54 II and TC output of the 55XX Series calibrator.

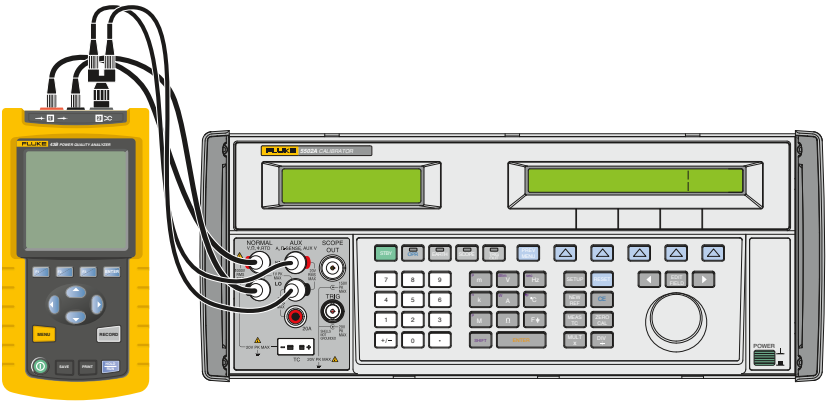
1. Turn on the 54 II.
2. Sourcing temperature is very similar to sourcing direct voltage. Enter 100 °C by pressing:
   [1] [0] [0] [°F °C] [ENTER] [OPR]
   The reference temperature is displayed in the output window. Two temperature-related softkey menus appear in the control window.
3. To enter temperature in °F, use the shift function. To enter 100 degrees Farenheit, press:
   [1] [0] [0] [SHIFT] [°F °C] [ENTER]
4. The temperature output can be slewed in the same way as voltage can be slewed. To see an example, turn the edit knob. When done, press the [PREV MENU] key.
5. The [▲] under TC MENUS selects the reference source (the internal source or an external reference, such as an ice bath) and thermocouple type menus. The [▲] under OUTPUT tc switches the 5500A to RTD simulation mode.
   Press the [▲] under OUTPUT tc.
6. The softkey menu has changed. On this new menu you can choose the type of RTD required and 2-wire compensation or 4-wire modes. Press the [▲] under OUTPUT rtd to return the calibrator to thermocouple mode.
   Press the [RESET] key.

Section 3: Power functions

What you'll need
In addition to a 55XX Series Multi-Product Calibrator, you'll need a Fluke 43B and a set of test leads. If you do not have access to a Fluke 43B, a general purpose watt meter with voltage and current inputs may be substituted. In the example below, where dual voltage outputs are indicated, use volts plus current.



Power



Direct power can be simulated into phantom loads from 0 to 20.9 kW. This is accomplished by sourcing voltage from one output and current from another. To simulate devices like current clamps, where current is converted to voltage, voltage can be sourced from both the NORMAL and AUX terminals simultaneously.

- Power can be entered in one of three ways.
- Voltage plus current.
- Voltage plus voltage
- Watts (enter voltage or current and watts)

Steps 1–5 are provided as examples in order to illustrate the use of the calibrator for different power measurement instruments. Instructions for an actual demonstration of this capability will follow.

1. Enter power as voltage plus current. To enter 10 volts 10 amps, press:

   [1] [0] [dBm V] [1] [0] [W A] [ENTER]

Notice that the 55XX Series calibrator has calculated the power level in watts and displayed it on the control window.

Alternating power works the same way, with the addition of a frequency term:

[1] [0] [dBm V] [1] [0] [W A] [6] [0] [sec Hz] [ENTER]

2. Either the voltage or current output can be slewed. Switch between them by pressing the [EDIT FIELD] key.

3. Entering voltage plus voltage is the same as entering voltage plus current, except that you substitute voltage for current. The voltage output on the AUX terminal is limited to 7 V (1.0 mV to 5 V in ac mode). If you were simulating a current clamp that outputs 1 mV per amp, this output would simulate 100 W (10 V + 10 A) ac at 60 Hz:
[1] [0] [dBm V] [1] [0] [μ m] [dBm V] [6] [0] [sec Hz] [ENTER]

4. The 55XX Series calibrator also allows you to select power in watts. To do this, you need to enter a voltage or current level and the desired power level in watts, and the calibrator will calculate the necessary voltage or current required. For example you can ask 100 watts based on 10 volts by pressing:
[1] [0] [dBm V] [1] [0] [0] [SHIFT] [W A] [ENTER]
The 55XX Series calibrator calculates that 10 A is required from the AUX output.

5. Before continuing, press the [RESET] key.

Now, we will use a Fluke 43B to demonstrate some of the power capabilities of the 55XX Series calibrators.

1. Connect a set of test leads between the COM and Input 1 terminals of the 43B and the NORMAL Hi and LO output terminals of the 55XX Series calibrator. Using appropriate adapters, connect the Input 2 terminals of the 43B to the AUX HI and LO output terminals of the calibrator.

2. Using the MENU button on the 43B, select Instrument Setup. followed by the PROBES selection. Then select the probe type on Input 1 to be TEST LEADS and the probe type on Input 2 to be 1mV/A. With the enter key, set the display on the 43B to show single phase power.

3. On the 55XX Series calibrator, enter 120 volts 100 mV 60 Hertz by pressing:
[1] [2] [0] [dBm V] [1] [0] [0] [μ m] [dBm V] [6] [0] [sec Hz] [ENTER] [OPR]
The calibrator is now outputting 12 kW. The 100 mV on the AUX terminals simulates the 100A being simulated by the 55XX Series at 1 mV per amp.

4. The Fluke 43B displays both the measured sine waves of the voltage and current outputs. It also displays other information such as the frequency, power and power factor.

6. Notice that in this mode, the 55XX Series calibrator's control window displays a WAVE MENUS. When you press the [▲] under this display, WAVE MENU provides a range of choices, including harmonics, current and voltage waveforms and phase. First, we'll demonstrate the waveform and phase control functions.
   Press the [▲] under WAVE MENU then the [▲] under ALTWAVE sine softkeys.
   Notice the Fluke 43B now displays current as a triangle wave. Continue to press the [▲] under ALTWAVE to view the four different waveforms: sine, triangle, square and truncated sine. When complete, return to sine mode.

7. The 55XX Series calibrators permit you to vary the phase relationship between current and voltage with 0.01 resolution. For instance, to enter a 45° phase offset, press the [▲] under PHASE. Then press these numbers on the numeric keypad:
   [4] [5] [ENTER]
   Notice the current waveform displayed on the 43B has shifted 45°.

8. On the right side of the control window is a softkey menu choice labeled SHOW PF. The 55XX Series calibrators permit you to control the phase relationship using both phase in degrees and power factor (sine only).
   To see how this functions, press the [▲] under SHOW PF.

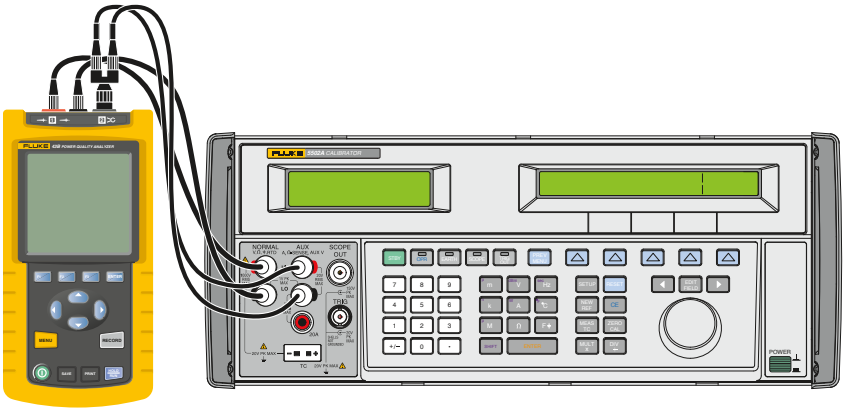
9. The present 45° phase shift is now displayed as a power factor of 0.707. You may select between lead or lag in power factor mode using a softkey.

10. To change the output of the 55XX Series calibrator back to unity power factor (0° phase) press these keys:
    [1] [ENTER]

11. Press the [▲] under SHOW PHASE and notice that the phase is now indicated at 0°.

12. To view other power mode features, press the [PREV MENU] key to return to the WAVES MENU.

Power harmonics



To cover harmonics analyzers like the Fluke 43B, the 55XX Series multi-product calibrators can source harmonics of the fundamental output frequency, up to the 50th harmonic. You access this capability by pressing the ▲ under HARMONIC MENUS when the 55XX Series is in ac power mode.

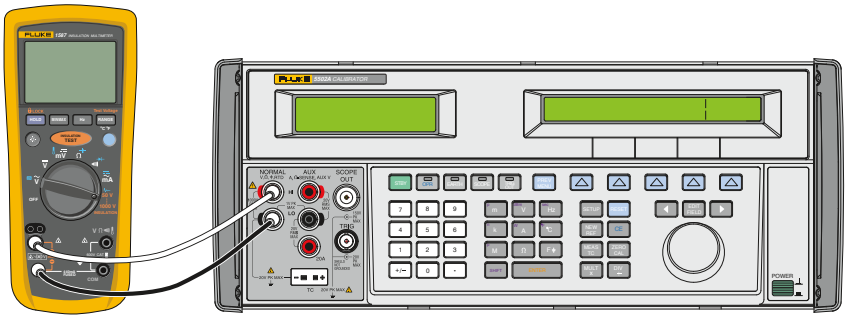
In HARMONIC MENUS mode, the control window displays the fundamental frequency, the selected harmonic and the source of the fundamental, either the NORMAL or AUX terminal of the calibrator.

1. To set the harmonic, press the ▲ under HARMONIC MENUS then the ▲ under HARMNIC.
2. To select the third harmonic, press the three on the numeric keypad:
   [3] [ENTER]
3. Now the calibrator is sourcing the fundamental frequency on the NORMAL output and the third harmonic (180 Hz) on the AUX terminal. To see this with the Calibration 43B, change the Fluke 43B to Amps view by pressing the Enter key on the 43B to select its harmonic display mode. Then push the F2 button to select the Amps harmonics view. Use the ▶ to select the third harmonic.
4. Press [RESET] and remove all cables.

Section 4: Overload Protection

What you'll need
In addition to a 55XX Series Multi-Product Calibrator, you'll need a Fluke 1587 Insulation Multimeter or equivalent.

Output protection



The 55XX Series calibrators incorporate overload protection, which provides reverse-power protection, immediate output disconnection, and/or fuse protection on the output terminals for all functions. This protection is for applied external voltages up to ±300 V peak.

To demonstrate the overload protection a 1587 Insulation Meter is used. This Insulation Meter provides in its Insulation Test Mode (low power) test voltages up to 1000 V. Setting the test voltage to a level between 100 V and 300 V allows for a useful demonstration of the 55XX overload protection, without damaging the 55XX calibrator.

1. Connect the test leads to the + and – inputs of the 1587 insulation meter and to the NORMAL terminals of the 55XX Series calibrator.
2. On the 55XX Series, select a 100 k Ω ohms output by pressing
   [1] [0] [0] [k] [Ω] [ENTER] [OPR]
3. Turn the 1587 rotary knob to the INSULATION position. A battery load check is initiated when the switch is moved to this position.
4. Press the 1587 “Range button” to select the test voltage. Set it to 100 V. The 1587 primary display shows – – – –
5. Press and hold the “INSULATION TEST” button on the 1587 Insulation Meter. The 1587 secondary display shows the test voltage applied to the calibrator’s resistance output terminals.
6. Observe the 55XXA trip to standby without any damage.

FLUKE®
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