CALIBRATION PROCEDURE

NI 4065 6½-Digit Digital Multimeter

This document contains instructions for writing an external calibration procedure for the National Instruments PXI/PCI/PCIe/USB-4065 6½-digit digital multimeter (DMM). For more information on calibration, visit `ni.com/calibration`.

Contents

NATIONAL INSTRUMENTS™

Conventions

The following conventions are used in this document:

» The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **Options»Settings»General** directs you to pull down the **Options** menu, select the **Settings** item, and select **General** from the last dialog box.

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on a product, refer to the *Read Me First: Safety and Electromagnetic Compatibility* document included with the device for information about precautions to take.

bold Bold text denotes items you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic Italic text denotes variables, emphasis, a cross-reference, hardware labels, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value you must supply.

`monospace` Text in this font denotes text or characters you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

Software Requirements

NI-DMM supports a number of programming languages including LabVIEW, LabWindows™/CVI™, Microsoft Visual C++, and Microsoft Visual Basic. When you install NI-DMM, you need to install support for only the language you intend to use to write your calibration utility. The procedures in this document are described using LabVIEW VIs and C function calls.

Note NI-DMM version 2.7.1 or later supports NI PXI/PCI/PCIe-4065 calibration. NI-DMM version 2.8 or later supports NI USB-4065 calibration. You can download the latest version of NI-DMM from `ni.com/drivers`.

Documentation Requirements

In addition to this calibration document, you may find the following references helpful in writing your calibration utility. All of these documents are installed on your computer when you install NI-DMM. To locate them, select **Start»All Programs»National Instruments» NI-DMM»Documentation**.

- *NI Digital Multimeters Help*
- *NI Digital Multimeters Getting Started Guide*

NI recommends referring to the following document online at `ni.com/manuals` to ensure you are using the latest NI 4065 specifications:

- *NI 4065 Specifications*

Calibration Function Reference

For detailed information about the NI-DMM calibration VIs and functions in this procedure, refer to the *LabVIEW Reference* or the *C/CVI/VB Reference* sections of the *NI Digital Multimeters Help*, located at **Start» All Programs»National Instruments»NI-DMM»Documentation**. Refer to Figure 9 in this document for the procedural flow for verification. Refer to Figure 10 in this document for the procedural flow for adjustment.

Password

The password is required to open an external calibration session. If the password has not been changed since manufacturing, the password is `NI`.

Calibration Interval

The accuracy requirements of your measurement application determine how often you should calibrate the NI 4065. NI recommends performing a complete calibration at least once a year. NI does not guarantee the absolute accuracy of the NI 4065 beyond this one-year calibration interval. You can shorten the calibration interval based on the demands of your application. Refer to *Appendix A: Calibration Options* for more information.

Test Equipment

Table 1 lists the equipment required for calibrating the NI 4065. If you do not have the recommended instruments, use these specifications to select a substitute calibration standard.

Table 1. Required Test Equipment

Required Equipment	Recommended Models
Multifunction calibrator	Fluke 5700A (calibrated within the last 90 days) or Fluke 5720A (calibrated within the last year)
Two sets of low thermal electromotive force (EMF) copper cables	Fluke 5440 cables
A means of creating a short with low thermal EMF (≤150 nV) across the HI and LO input banana plug connectors on the NI 4065	Pomona 5145 insulated double banana plug shorting bar
Double banana plug with binding posts	Pomona 5405 Binding Post
Two insulated low thermal electromotive force (EMF) spade lugs	Pomona 2305 lugs
Chassis	NI PCI/PCIe-4065: PC with an available PCI slot or an available x1, x4, x8, or x16 PCI Express slot NI USB-4065: PC with an available USB port NI PXI-4065: National Instruments PXI chassis and controller

Test Conditions

Follow these guidelines to optimize the connections and the environment during calibration:

- Ensure that the PXI chassis fan speed is set to HI (if calibrating the NI PXI-4065) and the fan filters are clean.
- Use PXI/PCI filler panels in all vacant slots to allow proper cooling.
- Plug the PXI chassis or PC and the calibrator into the same power strip to avoid ground loops.
- Power on and warm up the calibrator for at least 60 minutes before beginning this calibration procedure.

- Power on and warm up the NI PXI/PCI/PCIe-4065 for at least 30 minutes and the NI USB-4065 for at least 50 minutes before beginning this calibration procedure.
- Maintain an ambient temperature of 23 ±1 °C.
- Maintain an ambient relative humidity of less than 60%.
- Allow the calibrator to settle fully before taking any measurements. Consult the Fluke 5700A/5720A user documentation for instructions.
- Allow the thermal EMF enough time to stabilize when you change connections to the calibrator or the NI 4065. The suggested time periods are stated where necessary throughout this document.
- Keep a shorting bar connected between the *V GUARD* and GROUND binding posts of the calibrator at all times.
- Clean any oxidation from the banana plugs on the Fluke 5440 cables before plugging them into the binding posts of the calibrator or the banana plug connectors of the NI 4065. Oxidation tarnishes the copper banana plugs so they appear dull rather than shiny. Oxidation leads to greater thermal EMF.
- Keep the blue banana plugs on the Fluke 5440 cables connected to the *V GUARD* binding post of the calibrator at all times.
- Prevent the cables from moving or vibrating by taping or strapping them to a nonvibrating surface. Movement or vibration causes triboelectric effects that can result in measurement errors.

Calibration Procedures

The calibration process includes the following steps:

1. *Initial Setup*—Set up the test equipment.
2. *Verification Procedures*—Verify the existing operation of the device. This step confirms whether the device is operating within its specified range prior to calibration. Figure 9 shows the procedural flow for verification.
3. *Adjustment Procedures*—Perform an external adjustment of the device that adjusts the calibration constants with respect to a known voltage source. Figure 10 shows the procedural flow for adjustment.
4. Reverification—Repeat the verification procedure to ensure the device is operating within its specifications after adjustment.

These steps are described in more detail in the following sections and in *Appendix A: Calibration Options*.

Note Throughout the procedure, refer to the C/C++ function call parameters for the LabVIEW input values.

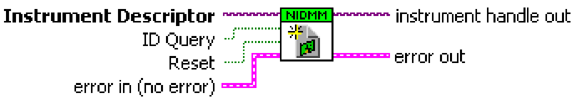
Initial Setup

To set up the test equipment, complete the following steps:

1. Remove all connections from the input banana plug connectors on the NI 4065.
2. Verify that the calibrator has been calibrated within the time limits specified in the *Test Equipment* section, and that DC zeros calibration has been performed within the last 30 days. Consult the Fluke 5700A/5720A user documentation for instructions on calibrating these devices.

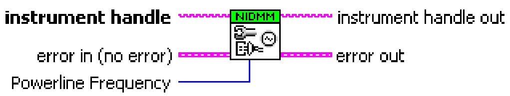
Note Warm up the calibrator for at least 60 minutes, the NI PXI/PCI/PCIe-4065 (installed in a powered-on chassis or PC) for at least 30 minutes, and the NI USB-4065 (plugged into a USB port on a powered-on PC) for at least 50 minutes before you begin this procedure.

3. Call the niDMM Initialize VI with the Instrument Descriptor of the device to create an instrument session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_init` with the following parameters: **Resource_Name**: The name of the device to calibrate. You can find this name under Devices and Interfaces in Measurement & Automation Explorer (MAX) **ID_Query**: `VI_FALSE` **Reset**: `VI_FALSE`

Note You will use this session in all subsequent VI and function calls throughout the verification procedures. For more information on using the niDMM Initialize VI or the `niDMM_init` function, refer to the *NI Digital Multimeters Help*.

4. Call the niDMM Configure Powerline Frequency VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_ConfigurePowerLineFrequency</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
PowerLine Frequency: Set this parameter to <code>50</code> or <code>60</code>, depending on the powerline frequency (in hertz) powering your instruments; select <code>50</code> for 400 Hz powerline frequencies</td></tr>
</table>

Verification Procedures

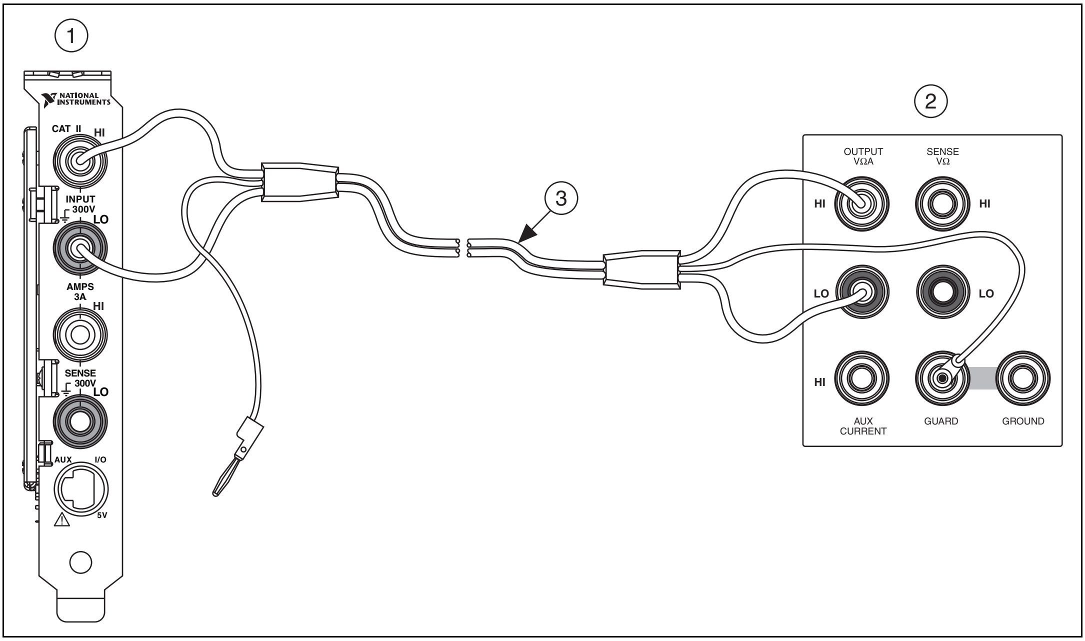
You can use the verification procedures described in this section for both pre-adjustment and post-adjustment verification. The steps of each verification procedure must be performed in the order listed; however, you can omit entire sections (for example, the entire *Verifying AC Current* section), if necessary. Refer to *Appendix A: Calibration Options* for more information.

The parameters **Range** and **Resolution in Digits** used in VI and function calls throughout this section have floating point values. For example, if **Range** = `1`, the floating point value is `1.0`. Refer to the *NI Digital Multimeters Help* for more information about parameter values.

Verifying DC Voltage

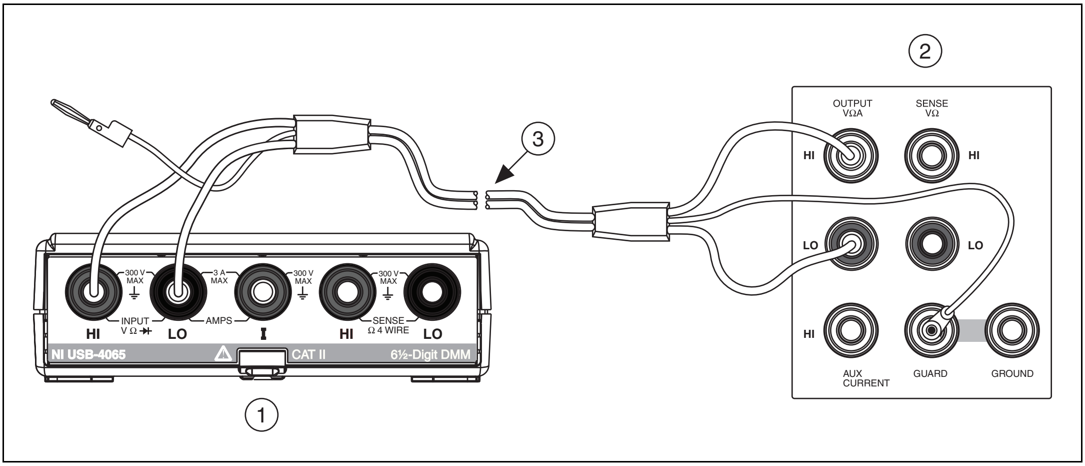
To verify DC voltage of the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using the Fluke 5440 cable, as shown in Figure 1 for NI PXI/PCI/PCIe-4065 and Figure 2 for NI USB-4065. Table 2 lists the cable connections.



1	NI PCI-4065	2	Fluke 5700A/5720A Calibrator	3	Fluke 5440 Cable

Figure 1. NI PXI/PCI/PCIe-4065 Cable Connections for Voltage and 2-Wire Resistance



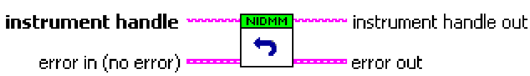
1	NI USB-4065	2	Fluke 5700A/5720A Calibrator	3	Fluke 5440 Cable

Figure 2. NI USB-4065 Cable Connections for Voltage and 2-Wire Resistance

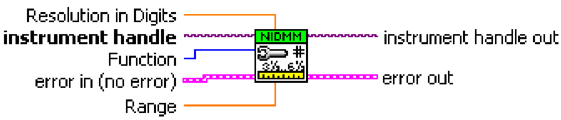
Table 2. Fluke 5440 Cable Connections

Banana Plug Connector (NI 4065)	Banana Plug Color (Fluke 5440 Cable)	Binding Post Label (Fluke 5700A/5720A Calibrator)
HI	Red	OUTPUT HI
LO	Black	OUTPUT LO
(No connection)	Blue	V GUARD

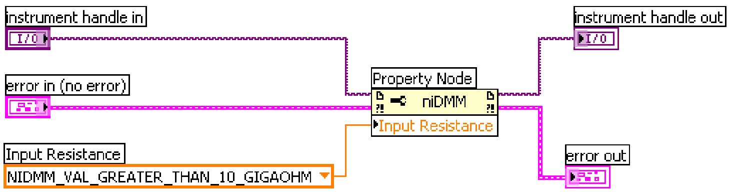
3. Wait two minutes for the thermal EMF to stabilize.
4. Generate 0 V on the calibrator. *Allow the calibrator output to settle before proceeding.*
5. Call the niDMM Reset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

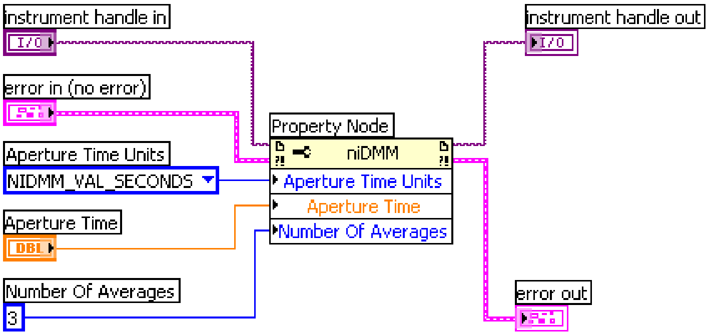
6. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_VOLTS` **Range**: `0.1`

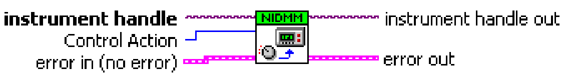
7. Set a writable niDMM property node to set the input resistance of the NI 4065 to >10 GΩ.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeVi Real64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT_ RESISTANCE` **Attribute_Value**: `NIDMM_VAL_GREATER _THAN_10_GIGAOHM`

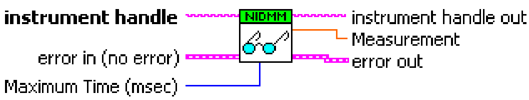
8. Set a writable niDMM property node to set the aperture time and number of averages for the NI 4065.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

9. Call the niDMM Control VI.

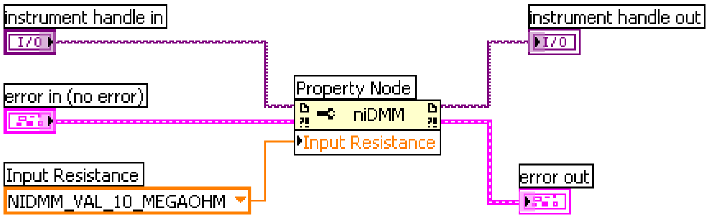
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

10. Call the niDMM Read VI.

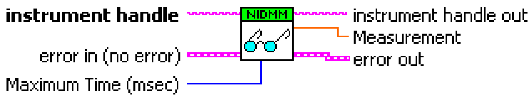
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 20 **Maximum_Time**: `–1`

a. Store the measurement as the 100 mV >10 GΩ mode offset.

11. Set a writable niDMM property node to set the input resistance of the NI 4065 to 10 MΩ.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT _RESISTANCE` **Attribute_Value**: `NIDMM_VAL_10_MEGAOHM`

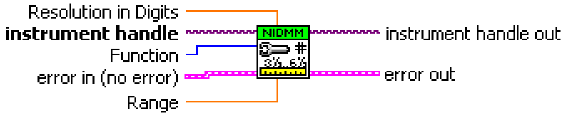
12. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 20 **Maximum_Time**: –1

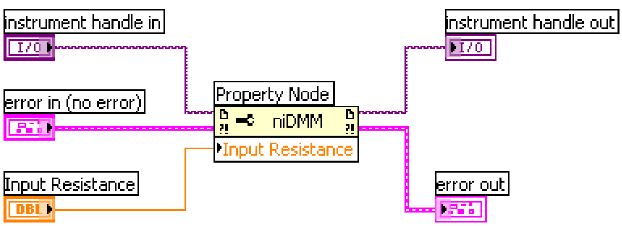
a. Store the measurement as the 100 mV 10 MΩ mode offset.

13. Refer to Table 3 for the appropriate parameter values as you complete the following steps:

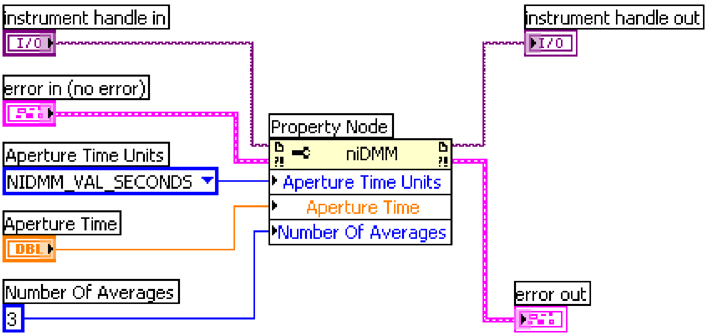
    a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_VOLTS` **Range**: The *Range* value listed in Table 3 for the current iteration

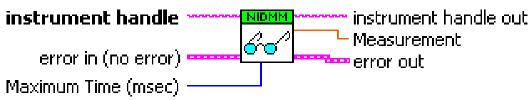
    b. Set a writable niDMM property node.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT _RESISTANCE` **Attribute_Value**: The *Input Resistance* value listed in Table 3 for the current iteration

c. Set a writable niDMM property node (for iterations 1, 3, 5, and 6 only).

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

d. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 20 **Maximum_Time**: `–1`

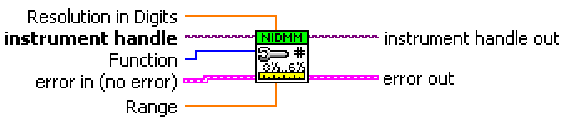
e. Verify that this measurement falls between the limits listed in Table 20.

14. Repeat step 13 for each of the remaining iterations shown in Table 3.

Table 3. DC Voltage Offset Settings

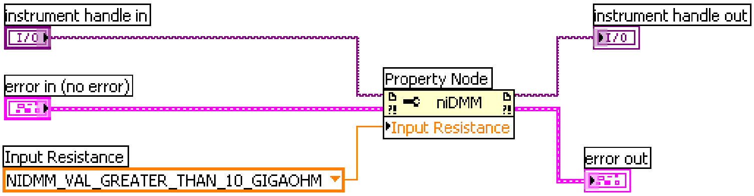
Iteration	niDMM Config Measurement Parameters	
	Range (V_{dc})	Input Resistance
1	1	NIDMM_VAL_GREATER_THAN_10_GIGAOHM
2	1	NIDMM_VAL_10_MEGAOHM
3	10	NIDMM_VAL_GREATER_THAN_10_GIGAOHM
4	10	NIDMM_VAL_10_MEGAOHM
5	100	NIDMM_VAL_10_MEGAOHM
6	300	NIDMM_VAL_10_MEGAOHM

15. Reset the calibrator.
16. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

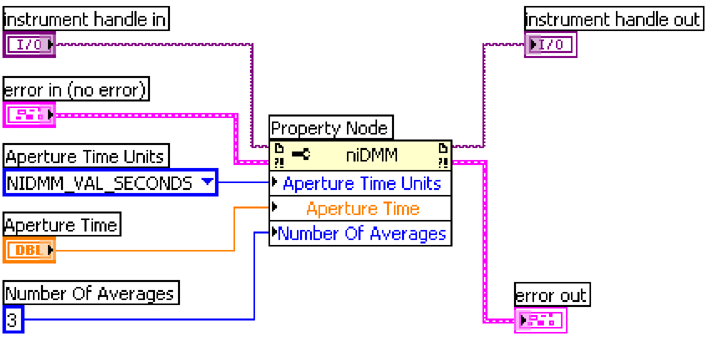
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call niDMM_ConfigureMeasurementDigits with the following parameters:

Instrument_Handle: The instrument handle from niDMM_init
Resolution_Digits: 6.5
Measurement_Function: NIDMM_VAL_DC_VOLTS
Range: 0.1</td></tr>
</table>

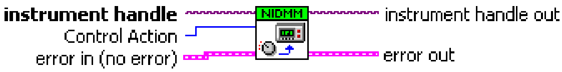
17. Set a writable niDMM property node to set the input resistance of the NI 4065 to >10 GΩ.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT_RESISTANCE` **Attribute_Value**: `NIDMM_VAL_GREATER_THAN_10_GIGAOHM`

18. Set a writable niDMM property node to set the aperture time and number of averages of the NI 4065.

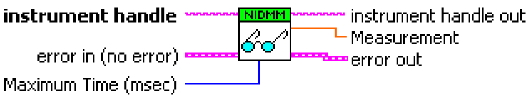
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

19. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

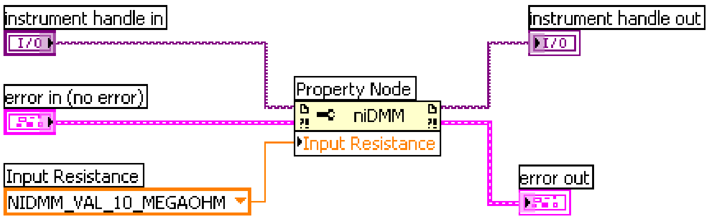
20. Output 100 mV on the calibrator with the range locked to 2.2 V. This range prevents a 50 Ω calibrator output resistance from creating a voltage divider with the internal resistance of the NI 4065. *Allow the calibrator output to settle before proceeding*.

21. Call the niDMM Read VI.

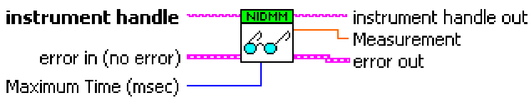
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that the result falls between the limits listed in Table 20 **Maximum_Time**: `–1`

a. Subtract the previously stored 100 mV >10 GΩ mode offset from this measurement, and verify that the result falls between the limits listed in Table 20.

22. Set a writable niDMM property node to set the input resistance of the NI 4065 to 10 MΩ.

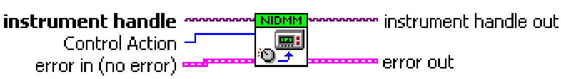
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT _RESISTANCE` **Attribute_Value**: `NIDMM_VAL_10_MEGAOHM`

23. Call the niDMM Read VI.

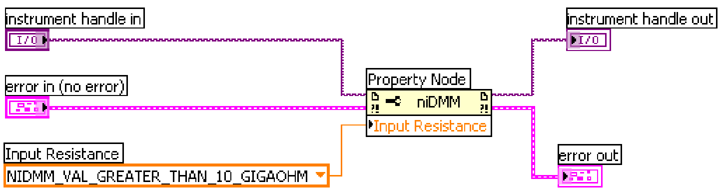
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that the result falls between the limits listed in Table 20 **Maximum_Time**: –1

a. Subtract the previously stored 100 mV 10 MΩ mode offset from this measurement, and verify that the result falls between the limits listed in Table 20.

24. Call the niDMM Control VI.

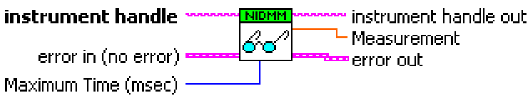
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

25. Set a writable niDMM property node to set the input resistance of the NI 4065 to >10 GΩ.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT_RESISTANCE` **Attribute_Value**: `NIDMM_VAL_GREATER_THAN_10_GIGAOHM`

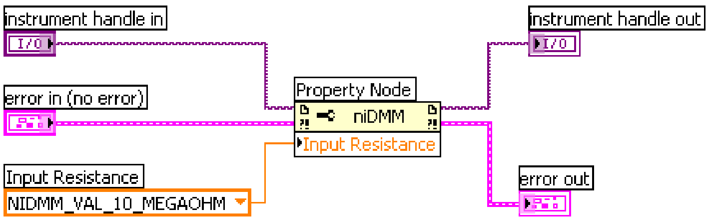
26. Output –100 mV on the calibrator with the range locked to 2.2 V. This range prevents a 50 Ω calibrator output resistance from creating a voltage divider with the internal resistance of the NI 4065. *Allow the calibrator output to settle before proceeding*.

27. Call the niDMM Read VI.

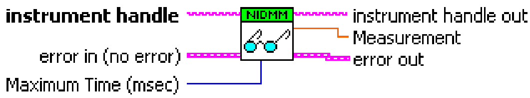
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that the result falls between the limits listed in Table 20 **Maximum_Time**: `–1`

a. Subtract the previously stored 100 mV >10 GΩ mode offset from this measurement, and verify that the result falls between the limits listed in Table 20.

28. Set a writable niDMM property node to set the input resistance of the NI 4065 to 10 MΩ.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT _RESISTANCE` **Attribute_Value**: `NIDMM_VAL_10_MEGAOHM`

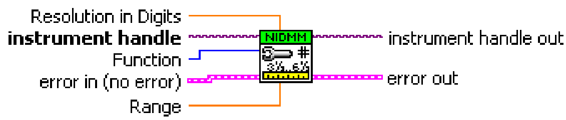
29. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that the result falls between the limits listed in Table 20 **Maximum_Time**: –1

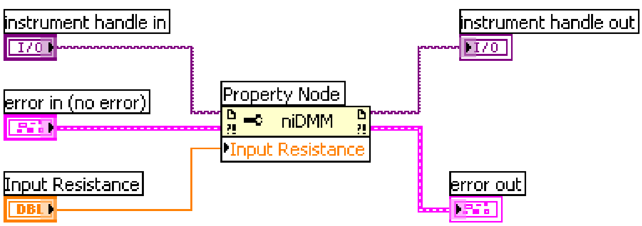
a. Subtract the previously stored 100 mV 10 MΩ mode offset from this measurement, and verify that the result falls between the limits listed in Table 20.

30. Refer to Table 4 for the appropriate calibrator outputs and parameter values as you complete the following steps:

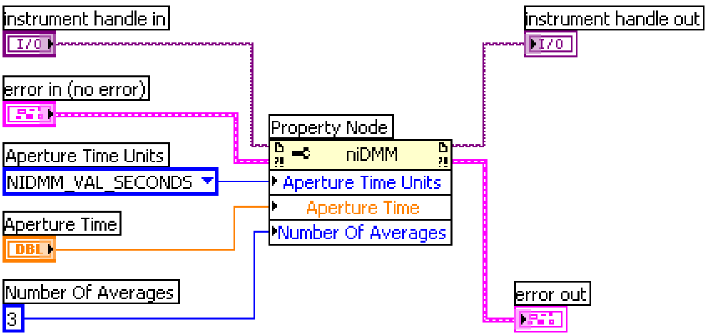
    a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_VOLTS` **Range**: The *Range* listed in Table 4 for the current iteration

    b. Set a writable niDMM property node.

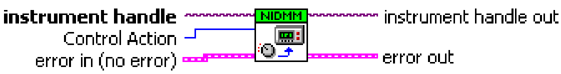
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_INPUT _RESISTANCE` **Attribute_Value**: The *Input Resistance* value listed in Table 4 for the current iteration

c. Set a writable niDMM property node (for iterations 1, 5, 9, and 11 only).

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM SetAttributeViReal64</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Attribute_ID: <code>NIDMM_ATTR_APERTURE_TIME</code>
Attribute_Value: <code>166.67 ms</code> (<code>200 ms</code> for 50 Hz PowerLine Frequency)
Attribute_ID: <code>NIDMM_ATTR_NUMBER_OF_AVERAGES</code>
Attribute_Value: <code>3</code></td></tr>
</table>

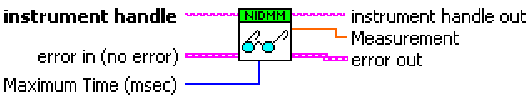
d. Call the niDMM Control VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_Control</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Control Action: <code>Commit</code></td></tr>
</table>

e. On the calibrator, output the value listed in the *Calibrator Output* column in Table 4 for the current iteration. *Allow the calibrator output to settle before proceeding*.

f. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 20 **Maximum_Time**: `–1`

g. Verify that this measurement falls between the limits listed in Table 20.

31. Repeat step 30 for each of the remaining iterations shown in Table 4.

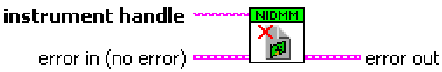
Table 4. DC Voltage Settings

Iteration	niDMM Config Measurement Parameters		Calibrator Output (V_{dc})
	Range (V_{dc})	Input Resistance	
1	1	NIDMM_VAL_GREATER_THAN_10_GIGAOHM	1
2	1	NIDMM_VAL_10_MEGAOHM	1
3	1	NIDMM_VAL_GREATER_THAN_10_GIGAOHM	–1
4	1	NIDMM_VAL_10_MEGAOHM	–1
5	10	NIDMM_VAL_GREATER_THAN_10_GIGAOHM	10
6	10	NIDMM_VAL_10_MEGAOHM	10
7	10	NIDMM_VAL_GREATER_THAN_10_GIGAOHM	–10
8	10	NIDMM_VAL_10_MEGAOHM	–10
9	100	NIDMM_VAL_10_MEGAOHM	100
10	100	NIDMM_VAL_10_MEGAOHM	–100
11	300	NIDMM_VAL_10_MEGAOHM	300
12	300	NIDMM_VAL_10_MEGAOHM	–300

32. Reset the calibrator for safety reasons.

You have completed verifying DC voltage for the NI 4065. Select one of the following options:

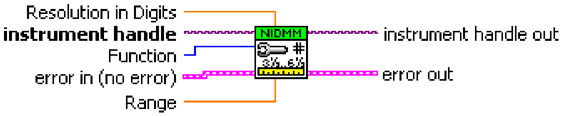
- If you want to continue verifying other modes, go to the *Verifying AC Voltage* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI or the `niDMM_close` function to close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init`

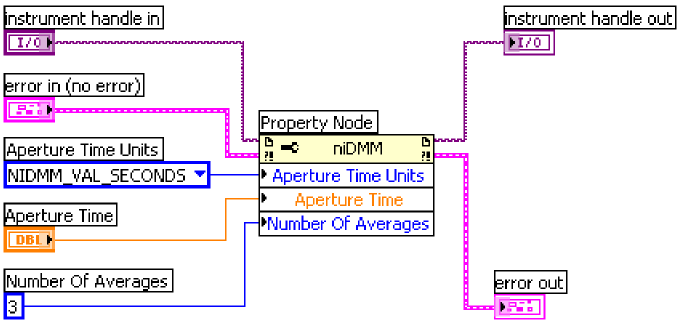
Verifying AC Voltage

To verify AC voltage for the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using the Fluke 5440 cable, as shown in Figure 1. Table 2 lists the cable connections.
3. Refer to Table 5 for the appropriate calibrator outputs and parameter values as you complete the following steps:
   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

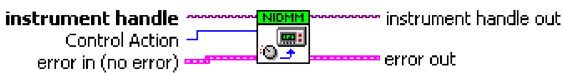
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_AC_VOLTS` **Range**: The Range as shown in Table 5 for the current iteration

b. Set a writable niDMM property node (for iterations 1, 4, 7, and 10 only).

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM SetAttributeViReal64</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Attribute_ID: <code>NIDMM_ATTR_APERTURE_TIME</code>
Attribute_Value: <code>166.67 ms</code> (<code>200 ms</code> for 50 Hz PowerLine Frequency)
Attribute_ID: <code>NIDMM_ATTR_NUMBER_OF_AVERAGES</code>
Attribute_Value: <code>3</code></td></tr>
</table>

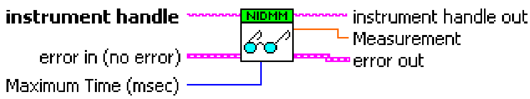
c. Call the niDMM Control VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_Control</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Control Action: <code>Commit</code></td></tr>
</table>

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 5 for the current iteration. *Allow the calibrator output to settle before proceeding*.

e. Call the niDMM Read VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_read</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Reading: Verify that this measurement falls between the limits listed in Table 21
Maximum_Time: <code>–1</code></td></tr>
</table>

f. Verify that this measurement falls between the limits listed in Table 21.

4. Repeat step 3 for each of the remaining iterations shown in Table 5.

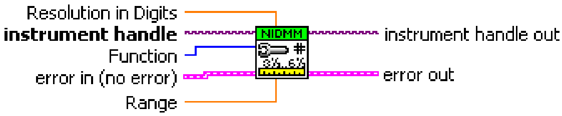
Table 5. AC Voltage Linearity Settings

Iteration	Range (V_{ac})	Calibrator Output	
		Amplitude (V_{ac})	Frequency (kHz)
1	`0.2`	0.004	1
2	`0.2`	0.02	1
3	`0.2`	0.2	1
4	`2`	0.04	1
5	`2`	0.2	1
6	`2`	2	1
7	`20`	0.4	1
8	`20`	2	1
9	`20`	20	1
10	`300`	6	1
11	`300`	30	1
12	`300`	300	1

5. Reset the calibrator.

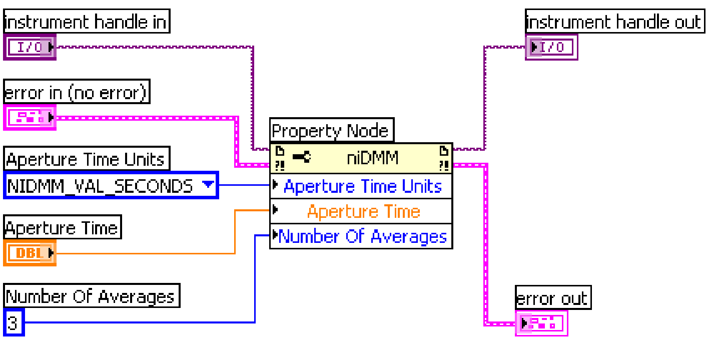
6. Refer to Table 6 for the appropriate calibrator outputs and parameter values as you complete the following steps:

   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_ConfigureMeasurement Digits</code> with the following parameters:

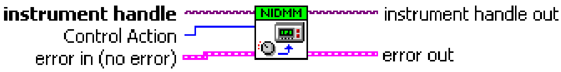
Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Resolution_Digits: <code>6.5</code>
Measurement_Function: <code>NIDMM_VAL_AC_VOLTS</code>
Range: The Range listed in Table 6 for the current iteration</td></tr>
</table>

   b. Set a writable niDMM property node (for iterations 1, 6, 11, and 16 only).

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM SetAttributeViReal64</code> with the following parameters:

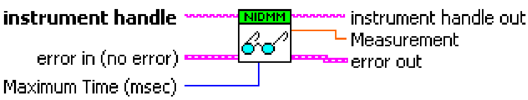
Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Attribute_ID: <code>NIDMM_ATTR_APERTURE_ TIME</code>
Attribute_Value: <code>166.67 ms</code> (<code>200 ms</code> for 50 Hz PowerLine Frequency)
Attribute_ID: <code>NIDMM_ATTR_NUMBER_OF _AVERAGES</code>
Attribute_Value: <code>3</code></td></tr>
</table>

c. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 6 for the current iteration. *Allow the calibrator output to settle before proceeding*.

e. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 21 **Maximum_Time**: `–1`

f. Verify that this measurement falls between the limits listed in Table 21.

7. Repeat step 6 for each iteration shown in Table 6.

Table 6. AC Voltage Flatness Settings

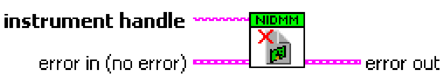
Iteration	Range (V_{ac})	Calibrator Output	
		Amplitude (V_{ac})	Frequency
1	`0.2`	0.2	10 Hz
2	`0.2`	0.2	40 Hz
3	`0.2`	0.2	20 kHz
4	`0.2`	0.2	50 kHz
5	`0.2`	0.2	100 kHz
6	`2`	2	10 kHz
7	`2`	2	40 Hz

Table 6. AC Voltage Flatness Settings (Continued)

Iteration	Range (V_{ac})	Calibrator Output	
		Amplitude (V_{ac})	Frequency
8	2	2	20 kHz
9	2	2	50 kHz
10	2	2	100 kHz
11	20	20	10 Hz
12	20	20	40 Hz
13	20	20	20 kHz
14	20	20	50 kHz
15	20	20	100 kHz
16	300	200	10 Hz
17	300	200	40 Hz
18	300	200	20 kHz
19	300	200	50 kHz
20	300	200	100 kHz

You have completed verifying AC voltage for the NI 4065. Select one of the following options:

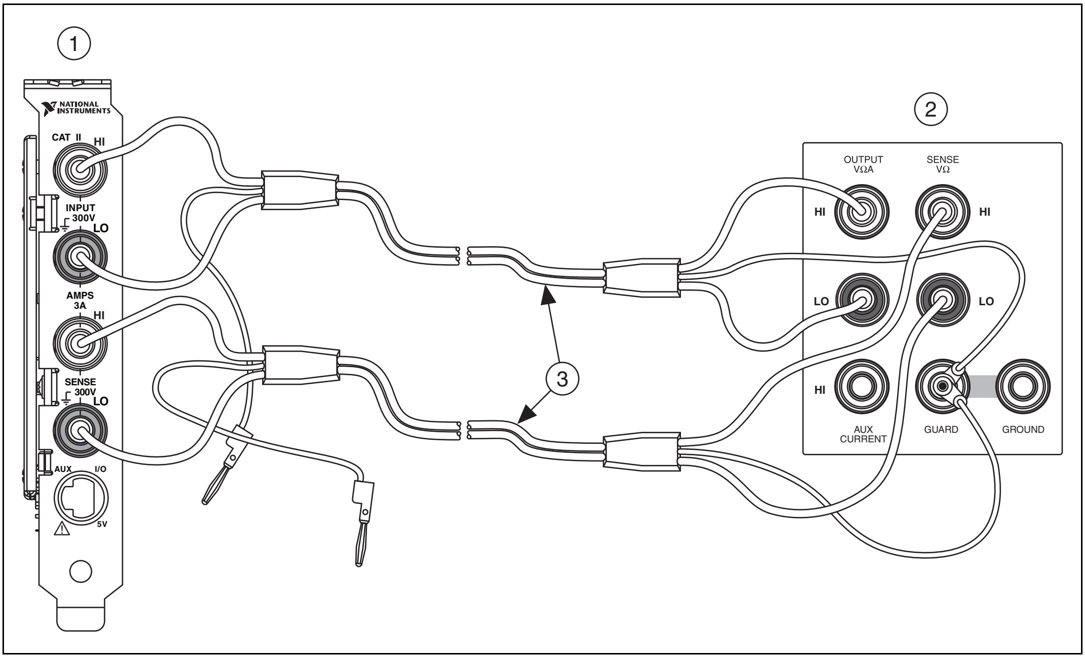
- If you want to continue verifying other modes, go to the *Verifying 4-Wire Resistance* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI or the `niDMM_close` function to close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

Verifying 4-Wire Resistance

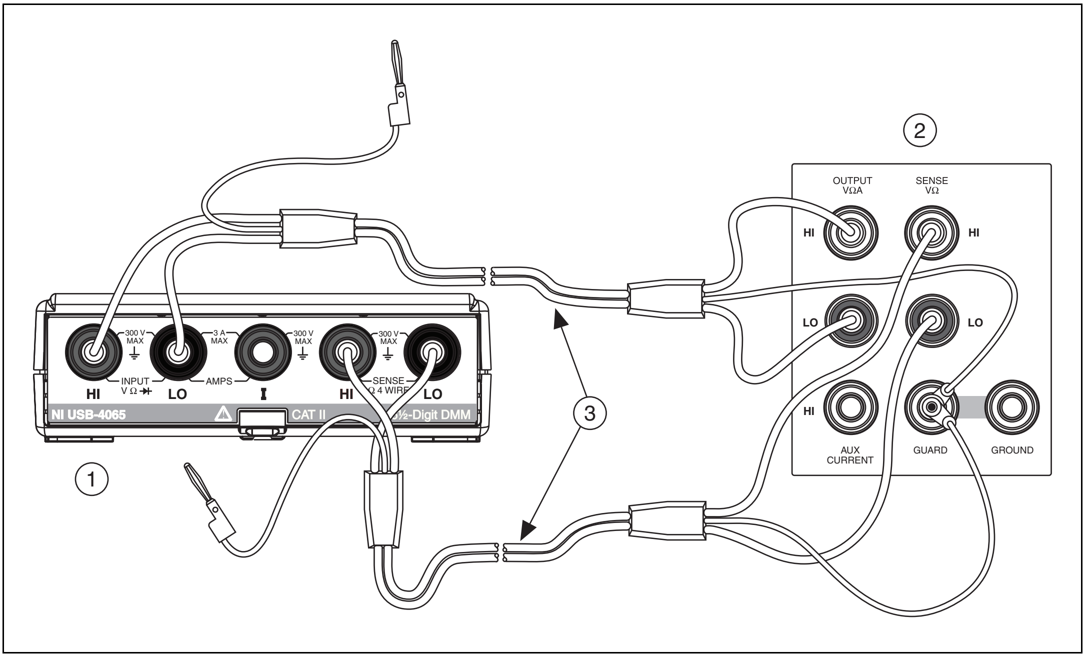
To verify the 4-wire resistance of the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using the Fluke 5440 cables, as shown in Figure 3 for the NI PXI/PCI/PCIe-4065 and Figure 4 for the NI USB-4065. Table 7 lists the cable connections.



1	NI PCI-4065	2	Fluke 5700A/5720A Calibrator	3	Fluke 5440 Cables

Figure 3. NI PXI/PCI/PCIe-4065 Cable Connections for 4-Wire Resistance



1 NI USB-4065	2 Fluke 5700A/5720A Calibrator	3 Fluke 5440 Cables

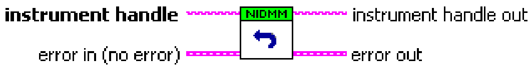
Figure 4. NI USB-4065 Cable Connections for 4-Wire Resistance

Table 7. Fluke 5440 Cable Connections

Fluke 5440 Cable Identification	Banana Plug Connector (NI 4065)	Banana Plug Color (Fluke 5440 Cable)	Binding Post (Fluke 5700A/5720A Calibrator)
First cable	HI	Red	OUTPUT HI
	LO	Black	OUTPUT LO
	(No connection)	Blue	V GUARD
Second cable	HI SENSE	Red	SENSE HI
	LO SENSE	Black	SENSE LO
	(No connection)	Blue	V GUARD

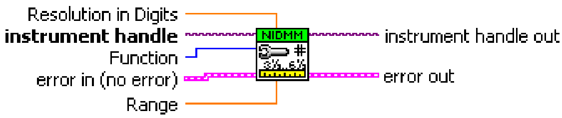
3. If the Fluke 5440 cables were not previously connected in this configuration, wait two minutes for the thermal EMF to stabilize.

4. Call the niDMM Reset VI.

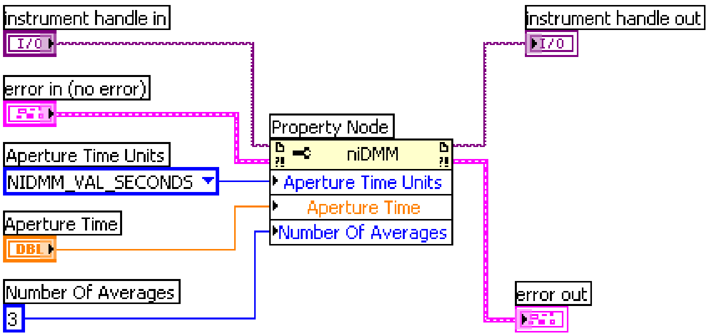
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

5. Refer to Table 8 for the appropriate calibrator output and function parameter values as you complete the following steps:

   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

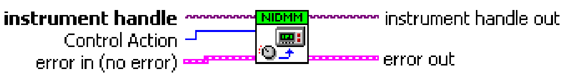
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_4_WIRE_RES` **Range**: The *Range* listed in Table 8 for the current iteration

b. Set a writable niDMM property node (for iterations 1, 4, 7, 10, and 13 only).

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM SetAttributeViReal64</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Attribute_ID: <code>NIDMM_ATTR_APERTURE_TIME</code>
Attribute_Value: <code>166.67 ms</code> (<code>200 ms</code> for 50 Hz PowerLine Frequency)
Attribute_ID: <code>NIDMM_ATTR_NUMBER_OF_AVERAGES</code>
Attribute_Value: <code>3</code></td></tr>
</table>

c. Call the niDMM Control VI.

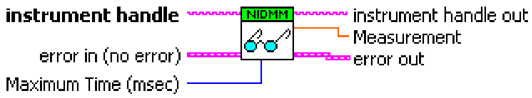
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_Control</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Control Action: <code>Commit</code></td></tr>
</table>

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 8 for the current iteration. Make sure external sense is turned on, but 2-wire compensation is turned off. *Allow the calibrator output to settle before proceeding*.

e. Wait for the specified time listed in the *Delay* column in Table 8 for the current iteration. This delay time is necessary to guarantee the calibrator signal has settled to within specifications.

f. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the tolerances listed in Table 22 **Maximum_Time**: `–1`

g. Verify that this measurement falls between the tolerances listed in Table 22. Tolerances are provided instead of absolute limits, because your calibrator will have different discrete resistance values.

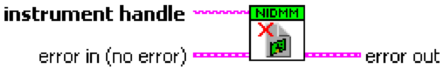
6. Repeat step 5 for each of the remaining iterations listed in Table 8.

Table 8. 4-Wire Resistance Settings

Iteration	Range (Ω)	Calibrator Output	Delay (seconds)
1	`100`	0 Ω	0.0
2		10 Ω	0.0
3		100 Ω	0.0
4	`1 k`	0 Ω	0.0
5		100 Ω	0.0
6		1 kΩ	0.0
7	`10 k`	0 Ω	0.0
8		1 kΩ	0.0
9		10 kΩ	0.1
10	`100 k`	0 Ω	0.0
11		10 kΩ	0.1
12		100 kΩ	0.25
13	`1 M`	0 Ω	0.0
14		100 kΩ	0.25
15		1 MΩ	1.0

You have completed verifying 4-wire resistance for the NI 4065. Select one of the following options:

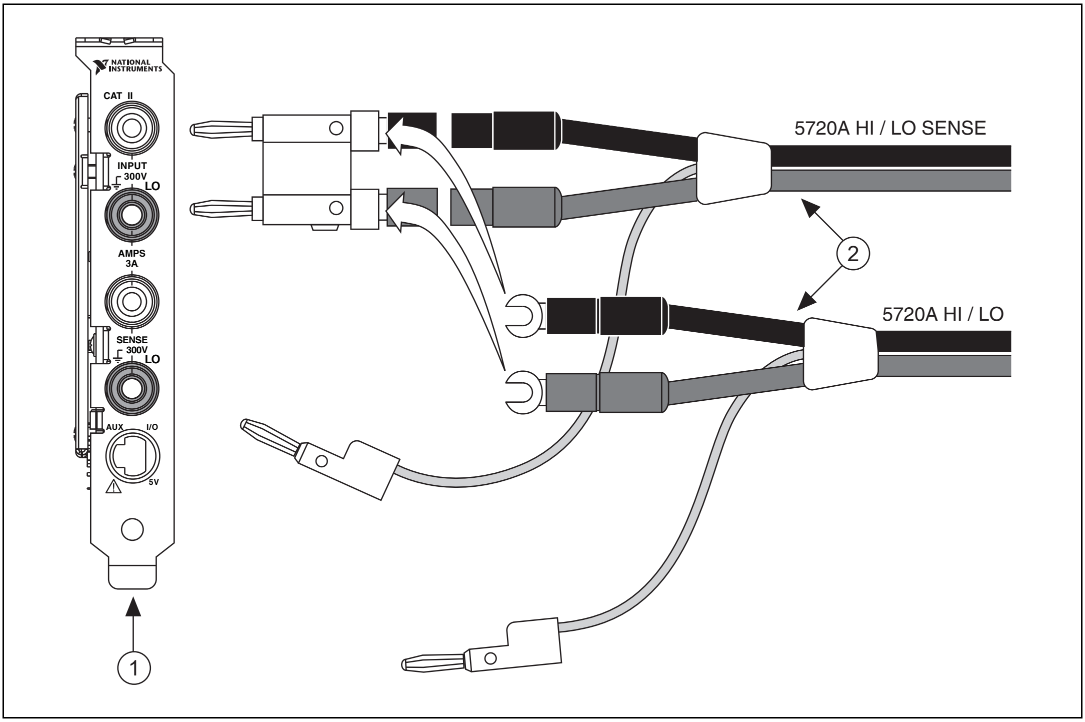
- If you want to continue verifying other modes, go to the *Verifying 2-Wire Resistance* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI or the `niDMM_close` function to close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

Verifying 2-Wire Resistance

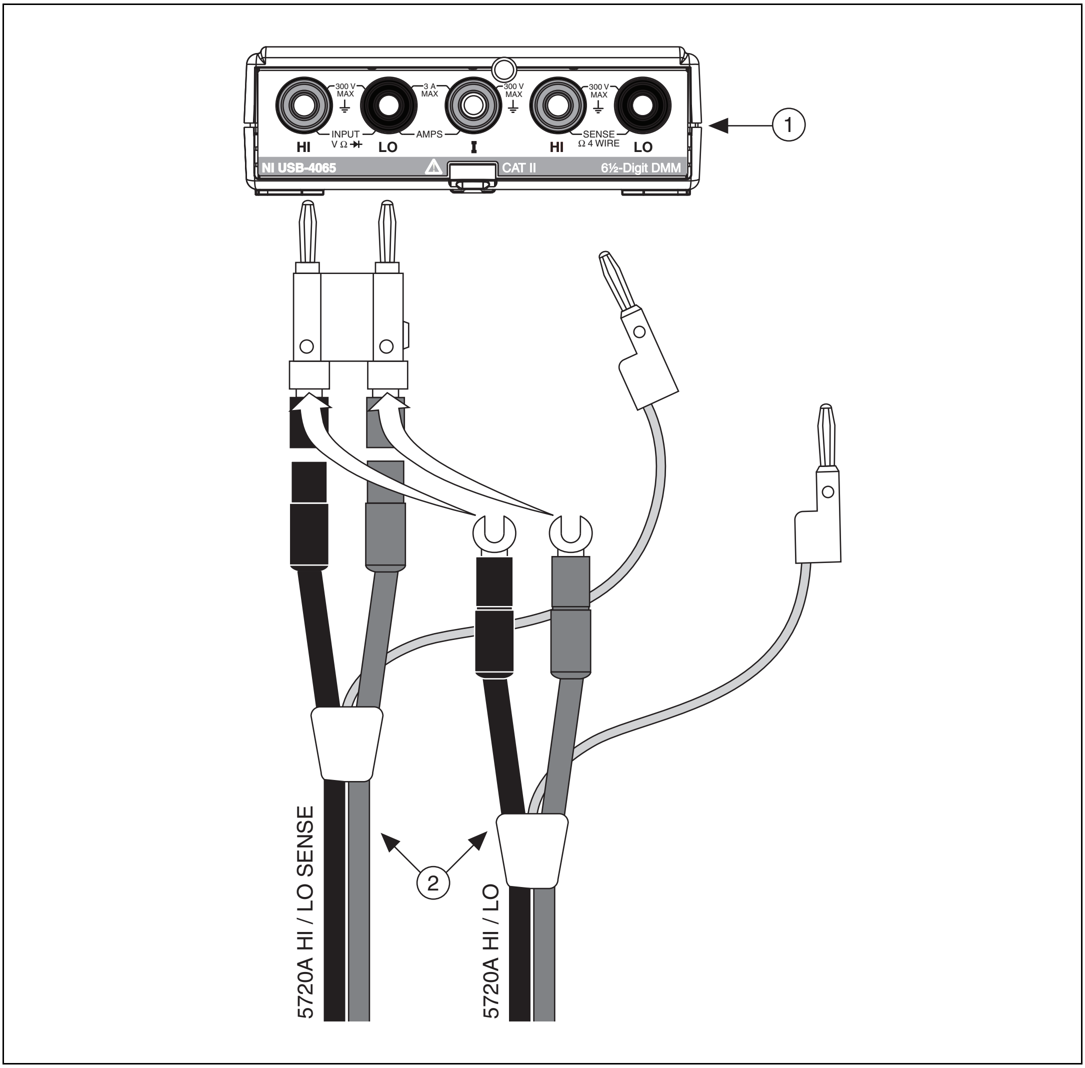
To verify 2-wire resistance for the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using two sets of Fluke 5440 cables, a double banana plug, and two insulated, low EMF spade lugs, as shown in Figure 5 for the NI PXI/PCI/PCIe-4065 and Figure 6 for the NI USB-4065. Table 9 lists the cable connections.



1 NI PCI-4065	2 Fluke 5440 Cables

Figure 5. NI PXI/PCI/PCIe-4065 Cable Connections for 2-Wire Resistance



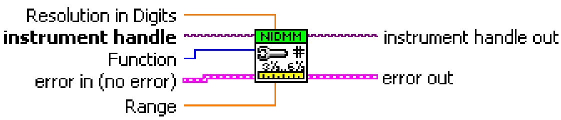
1 NI USB-4065	2 Fluke 5440 Cables

Figure 6. NI USB-4065 Cable Connections for 2-Wire Resistance

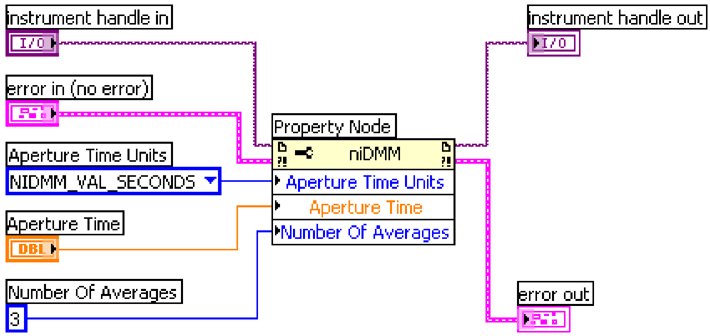
Table 9. Fluke 5440 Cable Connections

Banana Plug Connector (NI 4065)	Banana Plug Color (Fluke 5440 Cable)	Binding Post Label (Fluke 5720A Calibrator)
HI	Red	OUTPUT HI
LO	Black	OUTPUT LO
(No connection)	Blue	V GUARD
HI	Red	OUTPUT HI SENSE
LO	Black	OUTPUT LO SENSE
(No connection)	Blue	V GUARD

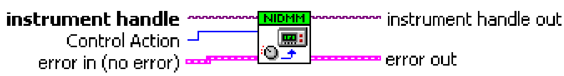
3. Wait two minutes for the thermal EMF to stabilize.
4. Refer to Table 10 for the appropriate calibrator output and function parameter values as you complete the following steps:
   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_2_WIRE_RES` **Range**: The Range as shown in Table 10 for the current iteration

b. Set a writable niDMM property node (for iterations 1, 4, 7, and 10 only).

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_ TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF _AVERAGES` **Attribute_Value**: `3`

c. Call the niDMM Control VI.

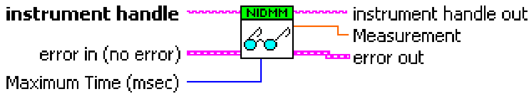
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 10 for the current iteration. Set external sense and 2-wire compensation as shown in Table 10 for the current iteration. *Allow the calibrator output to settle before proceeding*.

e. Wait for the specified time listed in the *Delay* column in Table 10 for the current iteration. This delay time is necessary to guarantee the calibrator signal has settled to within specifications.

f. Call the niDMM Read VI.

- For iterations containing the 0 Ω measurement of each range, store the result as the offset null for that range.
- For all other iterations, subtract the previously stored offset null for the corresponding range from the measurement taken.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_read</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Reading: Verify that this measurement falls between the tolerances listed in Table 23
Maximum_Time: <code>–1</code></td></tr>
</table>

g. Verify that this measurement falls between the tolerances listed in Table 23. Tolerances are provided instead of absolute limits because your calibrator will have different discrete resistance values.

5. Repeat step 4 for each of the remaining iterations shown in Table 10.

Table 10. 2-Wire Resistance Settings

Iteration	Range (Ω)	Calibrator Output			
		Resistance (Ω)	Delay (seconds)	2-Wire Compensation	External Sense
1	`100`	0	0.0	ON	`ON`
2		10	0.0	ON	`ON`
3		100	0.0	ON	`ON`
4	`1 k`	0	0.0	ON	`ON`
5		100	0.0	ON	`ON`
6		1 k	0.0	ON	`ON`
7	`10 k`	0	0.0	ON	`ON`
8		1 k	0.0	ON	`ON`
9		10 k	0.1	ON	`ON`

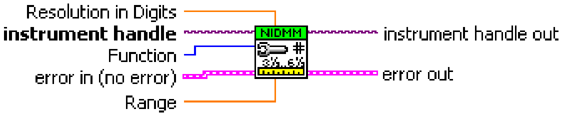
Table 10. 2-Wire Resistance Settings (Continued)

Iteration	Range (Ω)	Calibrator Output			
		Resistance (Ω)	Delay (seconds)	2-Wire Compensation	External Sense
10	`100 k`	0	0.0	OFF	`ON`
11		10 k	0.1	OFF	`ON`
12		100 k	0.25	OFF	`ON`
13	`1 M`	0	0.0	OFF	`ON`
14		100 k	0.25	OFF	`ON`
15		1 M	1	OFF	`ON`
16	`10 M`	0	0.0	OFF	`ON`
17		1 M	1	OFF	`ON`
18		10 M	4	OFF	`ON`
19	`100 M`	0	0.0	OFF	`OFF`
20		10 M	4	OFF	`OFF`
21		100 M	4	OFF	`OFF`

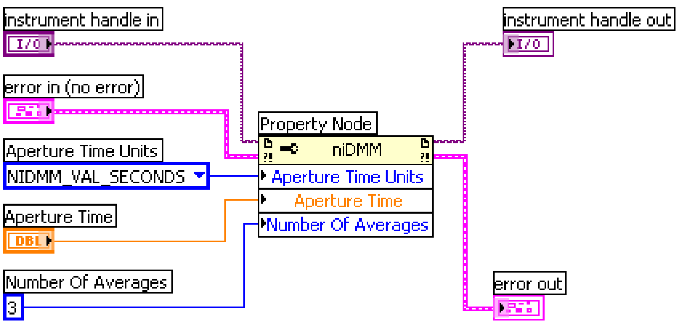
6. Remove the Fluke 5440 cables, double banana plug, and two insulated, low EMF spade lugs from the HI and LO banana plug connectors on the NI 4065.
7. Plug in the insulated banana plug shorting bar across the HI and LO banana plug connectors on the NI 4065.
8. Wait two minutes for the thermal EMF to stabilize.

9. Refer to Table 11 for the appropriate range values as you complete the following steps:

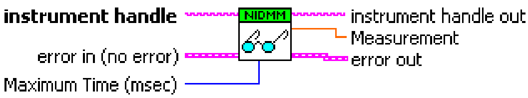
   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_2_WIRE_RES` **Range**: The Range as shown in Table 11 for the current iteration

   b. Set a writable niDMM property node.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

c. Call the niDMM Read VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_read</code> with the following parameters:

Instrument_Handle: The instrument handle from <code>niDMM_init</code>
Reading: Verify that the measurement for 0 Ω falls between the tolerances listed in Table 24
Maximum_Time: <code>–1</code></td></tr>
</table>

d. Verify that the measurement for 0 Ω falls between the tolerances listed in Table 24.

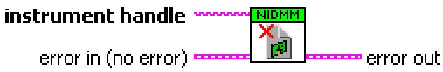
10. Repeat step 9 for each of the remaining iterations shown in Table 11.

Table 11. 2-Wire Resistance Settings

Iteration	Range
1	100 MΩ
2	10 MΩ
3	1 MΩ
4	100 kΩ
5	10 kΩ
6	1 kΩ
7	100 Ω

You have completed verifying 2-wire resistance for the NI 4065. Select one of the following options:

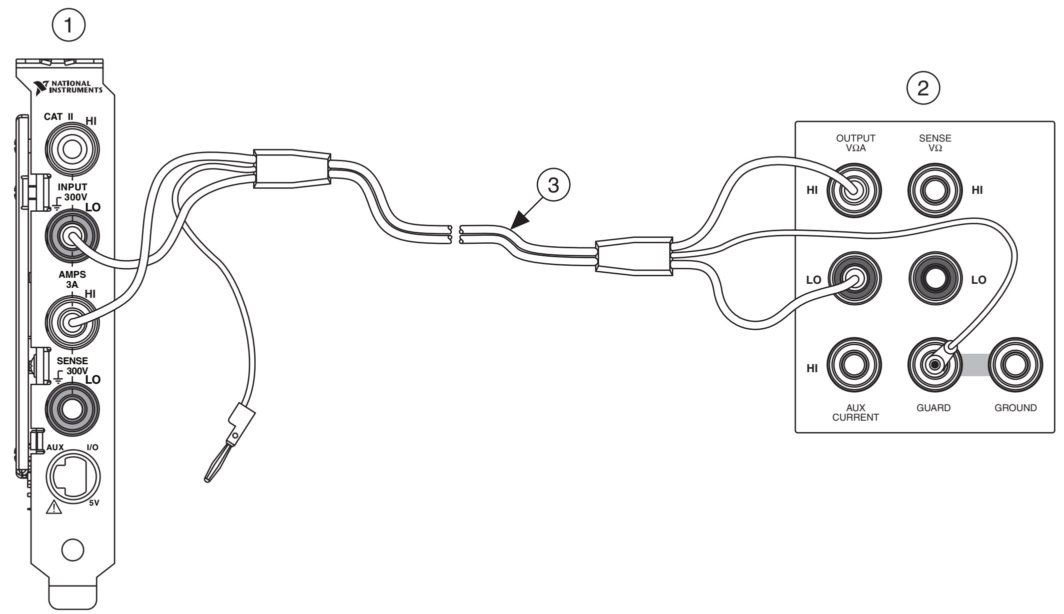
- If you want to continue verifying other modes, go to the *Verifying DC Current* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

Verifying DC Current

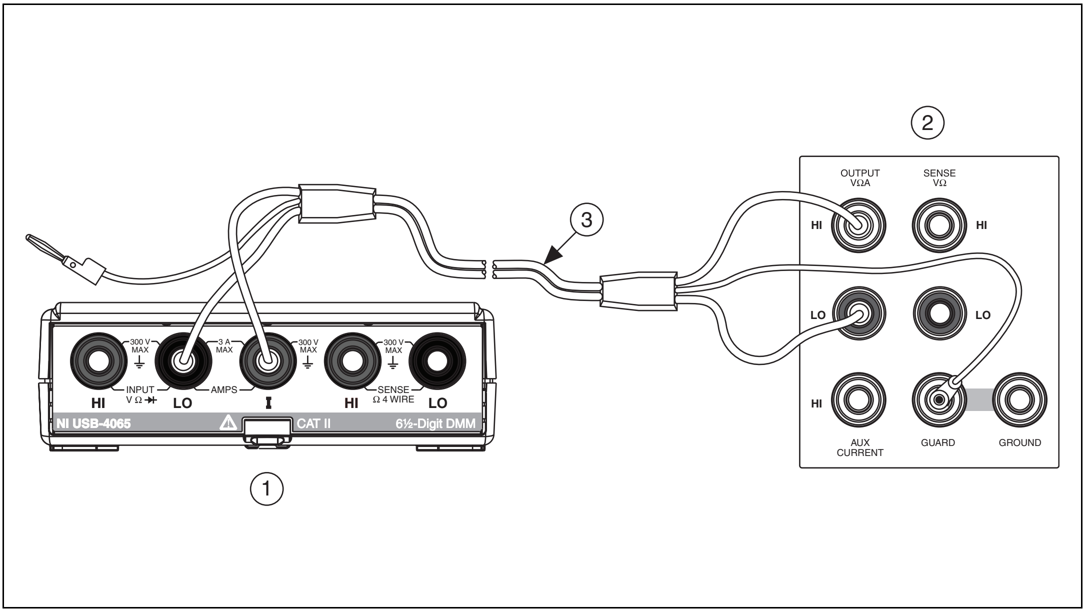
To verify DC current for the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using the Fluke 5440 cable, as shown in Figure 7 for the NI PXI/PCI/PCIe-4065 and Figure 8 for the NI USB-4065. Table 12 lists the cable connections.



1 NI PCI-4065	2 Fluke 5700A/5720A Calibrator	3 Fluke 5440 Cable

Figure 7. NI PXI/PCI/PCIe Cable Connections for Current



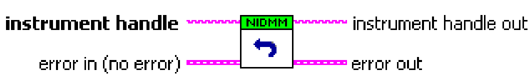
1 NI USB-4065	2 Fluke 5700A/5720A Calibrator	3 Fluke 5440 Cable

Figure 8. USB Cable Connections for Current

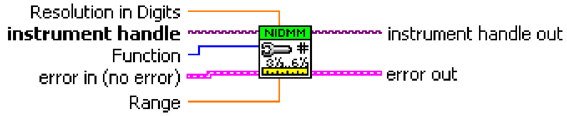
Table 12. Fluke 5440 Cable Connections

Banana Plug Connector (NI 4065)	Banana Plug Color (Fluke 5440 Cable)	Binding Post (Fluke 5700A/5720A Calibrator)
HI SENSE (NI PXI/PCI/PCIe-4065 only)	Red	OUTPUT HI
LO	Black	OUTPUT LO
I (NI USB-4065 only)	Red	OUTPUT HI
(No connection)	Blue	V GUARD

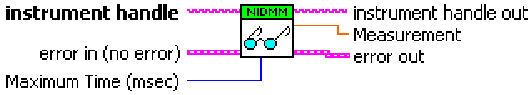
3. Wait two minutes for the thermal EMF to stabilize.
4. Call the niDMM Reset VI to reset the NI 4065 to a known state.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

5. Set the current output on the calibrator to `NORM` and output 0 A. Allow the calibrator to settle before proceeding.
6. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

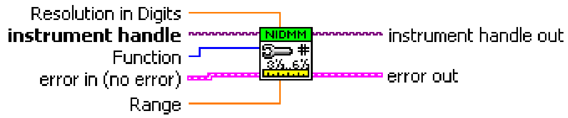
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_CURRENT` **Range**: `0.01`

7. Call the niDMM Read VI to configure the NI 4065 for a current mode before applying current.

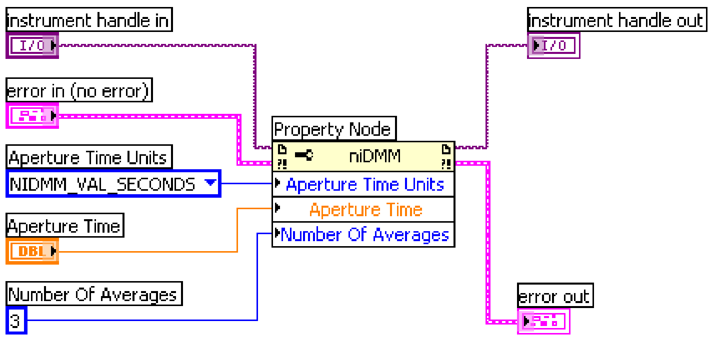
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

8. Refer to Table 13 for the appropriate calibrator outputs and parameter values as you complete the following steps:

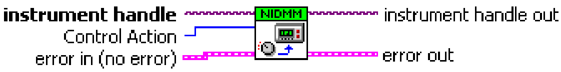
   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_CURRENT` **Range**: The Range as shown in Table 13 for the current iteration

   b. Set a writable niDMM property node (for iterations 1, 4, 7, and 10 only).

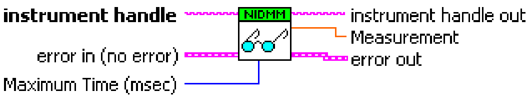
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

c. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 13 for the current iteration. *Allow the calibrator output to settle before proceeding*.

e. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 25 **Maximum_Time**: `–1`

f. Verify that this measurement falls between the limits listed in Table 25.

9. Repeat step 8 for each of the remaining iterations shown in Table 13.

Table 13. DC Current Settings

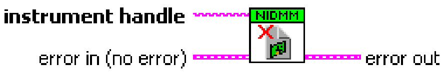
Iteration	Range (A)	Calibrator Output (A)
1	`0.01`	–10 m
2	`0.01`	0
3	`0.01`	10 m
4	`0.1`	–100 m
5	`0.1`	0
6	`0.1`	100 m
7	`1`	–1.0
8	`1`	0

Table 13. DC Current Settings (Continued)

Iteration	Range (A)	Calibrator Output (A)
9	1	1.0
10	3	–2.2
11	3	0
12	3	2.2

You have completed verifying DC current for the NI 4065. Select one of the following options:

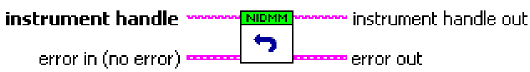
- If you want to continue verifying other modes, go to the *Verifying AC Current* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI or the `niDMM_close` function to close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameters **Instrument_Handle**: The instrument handle from `niDMM_init`

Verifying AC Current

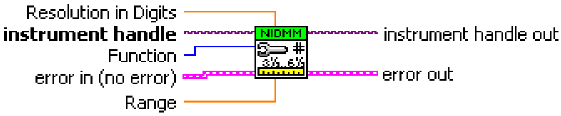
To verify AC current for the NI 4065, complete the following steps:

1. Reset the calibrator.
2. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using the Fluke 5440 cable, as shown in Figure 7. Table 12 lists the cable connections.
3. Call the niDMM Reset VI to reset the NI 4065 to a known state.

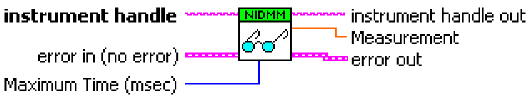
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

4. Set the current output on the calibrator to `NORM` and output 0 A. Allow the calibrator to settle before proceeding.

5. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

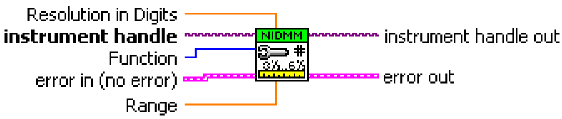
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_AC_CURRENT` **Range**: `0.01`

6. Call the niDMM Read VI to configure the NI 4065 for a current mode before applying current.

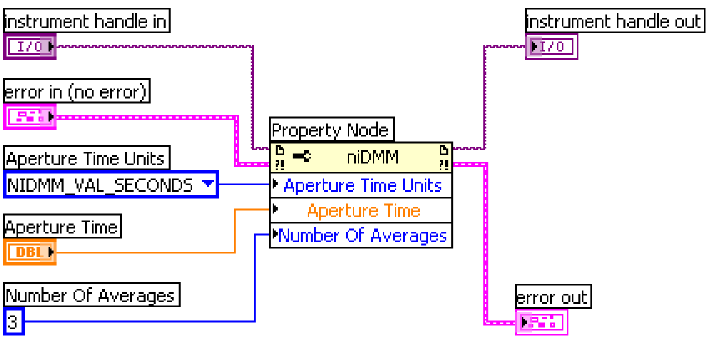
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Maximum_Time**: `–1`

7. Refer to Table 14 for the appropriate calibrator outputs and parameter values as you complete the following steps:

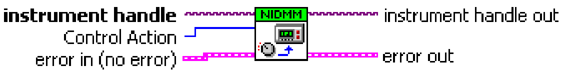
   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_AC_CURRENT` **Range**: The Range as shown in Table 14 for the current iteration

   b. Set a writable niDMM property node (for iterations 1, 4, 7, and 10 only).

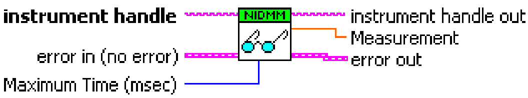
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM SetAttributeViReal64` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Attribute_ID**: `NIDMM_ATTR_APERTURE_TIME` **Attribute_Value**: `166.67 ms` (`200 ms` for 50 Hz PowerLine Frequency) **Attribute_ID**: `NIDMM_ATTR_NUMBER_OF_AVERAGES` **Attribute_Value**: `3`

c. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Control Action**: `Commit`

d. On the calibrator, output the value listed in the *Calibrator Output* column in Table 14 for the current iteration. *Allow the calibrator output to settle before proceeding*.

e. Call the niDMM Read VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_read` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **Reading**: Verify that this measurement falls between the limits listed in Table 26 **Maximum_Time**: `–1`

f. Verify that this measurement falls between the limits listed in Table 26.

8. Repeat step 7 for each of the remaining iterations shown in Table 14.

Table 14. AC Current Settings

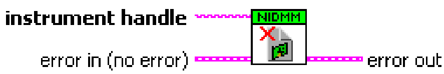
Iteration	Range (A_{ac})	Calibrator Output	
		Amplitude (A)	Frequency
1	`0.01`	200 µ	1 kHz
2	`0.01`	1 m	1 kHz
3	`0.01`	10 m	1 kHz
4	`0.1`	2 m	1 kHz
5	`0.1`	10 m	1 kHz
6	`0.1`	100 m	1 kHz
7	`0.5`	10 m	1 kHz

Table 14. AC Current Settings (Continued)

Iteration	Range (A_{ac})	Calibrator Output	
		Amplitude (A)	Frequency
8	`0.5`	50 m	1 kHz
9	`0.5`	500 m	1 kHz
10	`3`	60 m	1 kHz
11	`3`	300 m	1 kHz
12	`3`	2.2	1 kHz

You have completed verifying AC current for the NI 4065. Select one of the following options:

- If you do *not* want to verify other modes *and* you are performing a *post-adjustment* verification, go to the *Completing the Adjustment Procedures* section.
- If you do *not* want to verify any additional modes *and* you are performing a *pre-adjustment* verification, call the niDMM Close VI or the `niDMM_close` function to close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_close` with the following parameter: **Instrument_Handle**: The instrument handle from `niDMM_init`

Adjustment Procedures

This section explains how to adjust the NI 4065. You can choose to perform these adjustment procedures with or without performing the verification procedures first.

The parameters **Range**, **Resolution in Digits**, **Expected Measurement**, and **Frequency** used in VI and function calls in this section have floating point values. For example, if **Range** = `1`, the floating point value is `1.0`. Refer to the *NI Digital Multimeters Help* for more information about parameter values.

Note NI recommends repeating the verification procedures, using the 24-hour accuracy limits, after you perform these adjustment procedures. Reverification ensures the device you calibrated is operating within specifications after adjustment.

Caution If you skip any of the steps within a section of the adjustment procedures, the niDMM Close External Cal VI and the `niDMM_ExtCalClose` function do *not* allow you to store your new calibration coefficients. Instead, NI-DMM restores the original coefficients to the EEPROM.

Setting Up the Test Equipment

If you have not already set up the test equipment, complete the following steps:

1. Remove all connections from the input banana plug connectors on the NI 4065.
2. Verify that the calibrator has been calibrated within the time limits specified in the *Test Equipment* section, and that DC zeros calibration has been performed within the last 30 days. Consult the Fluke 5700A/5720A user documentation for instructions on calibrating these devices.

Note Ensure the calibrator is warmed up for at least 60 minutes before you begin this procedure.

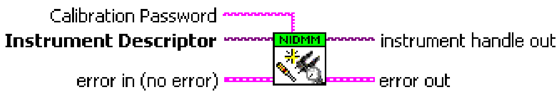
3. Reset the calibrator.
4. If you have not already done so, allow the NI PXI/PCI/PCIe-4065 to warm up for 30 minutes within a powered-on chassis or PC and the NI USB-4065 to warm up for 50 minutes after it is plugged into a USB port on a powered-on PC.

Adjustment Procedures Initial Setup for Calibration

To initially set up the NI 4065 for calibration, complete the following steps:

1. Fasten the connectors on one end of the Fluke 5440 cable to the NI 4065 HI and LO banana plug connectors. Fasten the connectors on the other end of the cable to the HI and LO calibrator binding posts, respectively. Figure 1 shows the correct connections for the NI PXI/PCI/PCIe-4065 and Figure 2 shows the correct connections for the NI USB-4065. Table 2 lists the cable connections.
2. If the cable was not previously connected in this configuration, wait two minutes for the thermal EMF to stabilize.

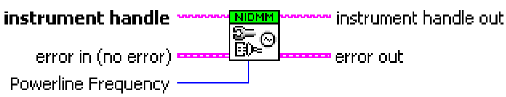
3. Call the niDMM Initialize External Cal VI with the **Instrument Descriptor** of the NI 4065 and your valid user password to output a calibration session (`Cal Session`) you can use to perform NI-DMM calibration or regular measurement functions.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_InitExtCal` with the following parameters: **Resource_Name**: The resource descriptor of the NI 4065 **Calibration_Password**: Your valid user password **Instrument_Handle**: `Cal Session`

Notes You will use `Cal Session` in all subsequent VI and function calls.

Use the niDMM Set Cal Password VI or the `niDMM_SetCalPassword` function to change the password.

4. Call the niDMM Configure Powerline Frequency VI.

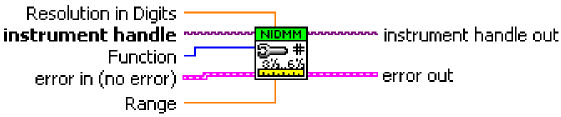
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigurePowerLineFrequency` with the following parameters: **Instrument_Handle**: The instrument handle from `niDMM_init` **PowerLine Frequency**: Set this parameter to `50` or `60`, depending on the powerline frequency (in hertz) powering your instruments; select `50` for 400 Hz powerline frequency

Adjusting Linearization

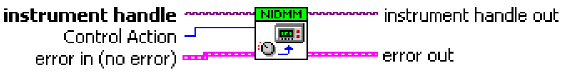
To adjust Linearization for the NI 4065, complete the following steps:

1. Output 1 V on the calibrator with the range locked to 2.2 V. This range prevents a 50 Ω calibrator output resistance from creating a voltage divider with the internal resistance of the NI 4065. *Allow the calibrator output to settle before proceeding.*

2. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_VOLTS` **Range**: `1.0`

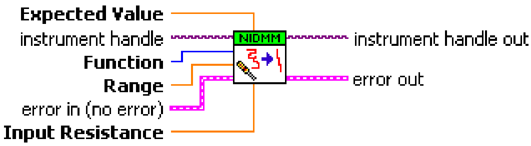
3. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

4. Refer to Table 15 for the appropriate calibrator output and parameter values as you complete the following steps:

   a. On the calibrator, output the value listed in the *Calibrator Output* column in Table 15 for the current iteration. *Allow the calibrator output to settle before proceeding*.

   b. Call the Cal Adjust Linearization VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustLinearization` with the following parameters: **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: Set as shown in Table 15 for the current iteration **Input_Resistance**: `NIDMM_VAL_GREATER_THAN_10_GIGAOHM` **Expected_Value**: Set as shown in Table 15 for the current iteration

5. Repeat step 4 for each of the remaining iterations listed in Table 15.

Table 15. Linearization Settings

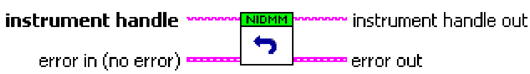
Iteration	Calibrator Output	niDMM Cal Adjust Linearization Parameters	
	Amplitude (V)	Range (V)	Expected Value
1	–1.0	`1`	`–1.0`
2	–0.8	`1`	`–0.8`
3	–0.6	`1`	`–0.6`
4	–0.4	`1`	`–0.4`
5	–0.2	`1`	`–0.2`
6	0.0	`1`	`0.0`
7	0.2	`1`	`0.2`
8	0.4	`1`	`0.4`
9	0.6	`1`	`0.6`
10	0.8	`1`	`0.8`
11	1.0	`1`	`1.0`

6. Reset the calibrator.

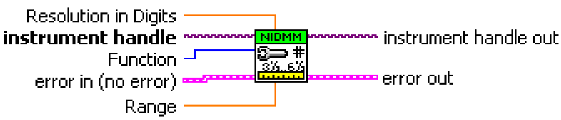
Adjusting DC Voltage

To adjust DC voltage for the NI 4065, complete the following steps:

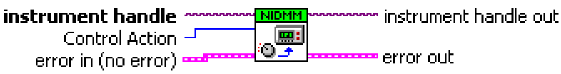
1. Call the niDMM Reset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: `Cal Session`

2. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_VOLTS` **Range**: `300.0`

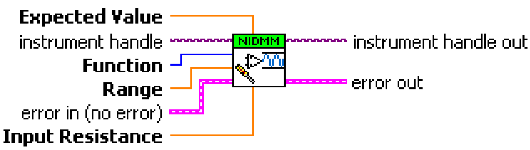
3. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

4. Refer to Table 16 for the appropriate calibrator output and parameter values as you complete the following steps:

   a. On the calibrator, output the value listed in the *Calibrator Output* column in Table 16 for the current iteration. *Allow the calibrator output to settle before proceeding*.

   b. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: Set as shown in Table 16 for the current iteration **Input_Resistance**: Set as shown in Table 16 for the current iteration **Expected_Value**: Set as shown in Table 16 for the current iteration

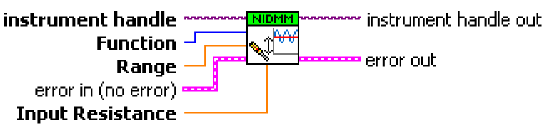
5. Repeat step 4 for each of the remaining iterations listed in Table 16.

Table 16. DC Voltage Settings

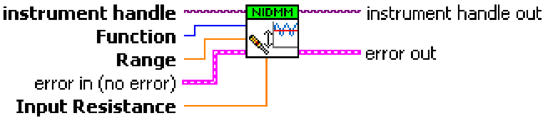
	Calibrator Output	niDMM Cal Adjust Gain Parameters		
Iteration	**Amplitude (V)**	**Range (V)**	**Expected Value**	**Input Resistance**
1	300	`300`	`300`	`NIDMM_VAL_10_MEGAOHM`
2	–300	`300`	`-300`	`NIDMM_VAL_10_MEGAOHM`
3	100	`100`	`100`	`NIDMM_VAL_10_MEGAOHM`
4	–100	`100`	`-100`	`NIDMM_VAL_10_MEGAOHM`
5	10	`10`	`10`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`
6	–10	`10`	`-10`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`
7	1	`1`	`1`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`
8	–1	`1`	`-1`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`
9	0.1	`0.1`	`0.1`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`
10	–0.1	`0.1`	`-0.1`	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`

6. Output 0 V on the calibrator. *Allow the calibrator output to settle before proceeding*.
7. Wait 2 seconds to allow maximum settling on the calibrator.
8. Call the niDMM Cal Adjust Offset VI.

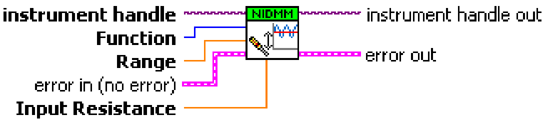
LabVIEW Block Diagram	C/C++ Function Call

	Call `niDMM_CalAdjustOffset` with the following parameters:
	Instrument_Handle:
	`Cal Session`**Mode**:
	`NIDMM_VAL_DC_VOLTS`
	Range: `0.1`
	Input_Resistance:
	`NIDMM_VAL_GREATER_THAN_10_GIGAOHM`

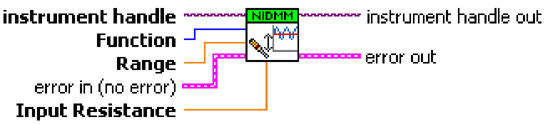
9. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: `1` **Input_Resistance**: `NIDMM_VAL_GREATER_THAN_10 _GIGAOHM`

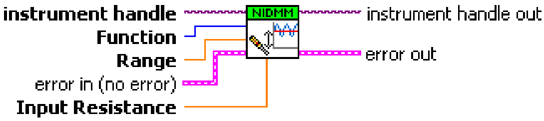
10. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: `10` **Input_Resistance**: `NIDMM_VAL_GREATER_THAN_10 _GIGAOHM`

11. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: `100` **Input_Resistance**: `NIDMM_VAL_10_MEGAOHM`

12. Call the niDMM Cal Adjust Offset VI.

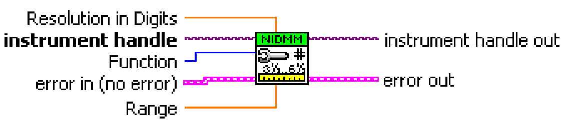
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_VOLTS` **Range**: `300` **Input_Resistance**: `NIDMM_VAL_10_MEGAOHM`

13. Reset the calibrator.

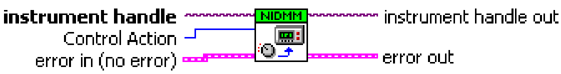
Adjusting 4-Wire Resistance

To adjust 4-wire resistance for the NI 4065, complete the following steps:

1. Fasten the connectors on one end of the Fluke 5440 cable to the NI 4065 *HI SENSE* and *LO SENSE* banana plug connectors. Fasten the connectors on the other end of the cable to the *HI SENSE* and *LO SENSE* calibrator binding posts, respectively. Figure 3 shows the correct connections for the NI PXI/PCI/PCIe-4065 and Figure 4 shows the correct connections for the NI USB-4065. Table 2 lists the cable connections.Table 7 lists the cable connections.
2. Wait two minutes for the thermal EMF to stabilize.
3. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_4_WIRE_RES` **Range**: `1 M`

4. Call the niDMM Control VI.

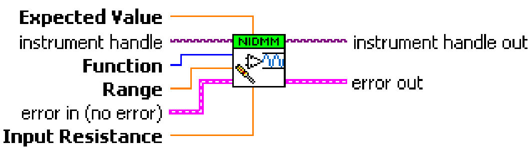
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

5. Refer to Table 17 for the appropriate calibrator output and parameter values as you complete the following steps:

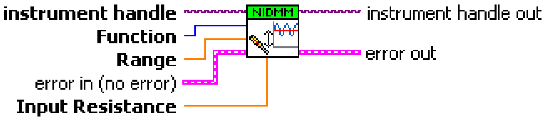
   a. On the calibrator, output the value listed in the *Calibrator Output* column in Table 17 for the current iteration. *Allow the calibrator output to settle before proceeding*.

Note For all 4-wire measurements, external sense on the calibrator is turned on.

   b. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_4_WIRE_RES` **Range**: Set as shown in Table 17 for the current iteration **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: Set as shown in Table 17 for the current iteration

c. Call the niDMM Cal Adjust Offset VI (for iterations 7, 8, 9, 10, and 11 only).

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_4_WIRE_RES` **Range**: Set as shown in Table 17 for the current iteration **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

6. Repeat step 5 for each of the remaining iterations listed in Table 17.

Table 17. 4-Wire Resistance Settings

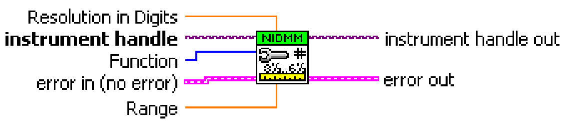
Iteration	Calibrator Output (Ω)	niDMM Cal Adjust Gain Parameters	
		Range (Ω)	**Expected Value**
1	1 M	`1 M`	*the display on the calibrator for 1 MΩ*
2	190 k	`1 M`	*the display on the calibrator for 190 kΩ*
3	100 k	`100 k`	*the display on the calibrator for 100 kΩ*
4	10 k	`10 k`	*the display on the calibrator for 10 kΩ*
5	1 k	`1 k`	*the display on the calibrator for 1 kΩ*
6	100	`100`	*the display on the calibrator for 100 Ω*
7	0	`1 M`	*the display on the calibrator for 0 Ω*
8	0	`100 k`	*the display on the calibrator for 0 Ω*
9	0	`10 k`	*the display on the calibrator for 0 Ω*
10	0	`1 k`	*the display on the calibrator for 0 Ω*
11	0	`100`	*the display on the calibrator for 0 Ω*

7. Reset the calibrator.

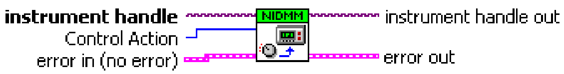
Adjusting 2-Wire Resistance

To adjust 2-wire resistance for the NI 4065, complete the following steps:

1. Connect the NI 4065 and the Fluke 5700A/5720A calibrator using two sets of Fluke 5440 cables, a double banana plug, and two insulated, low EMF spade lugs, as shown in Figure 5. Table 9 lists the cable connections.
2. Wait two minutes for the thermal EMF to stabilize.
3. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

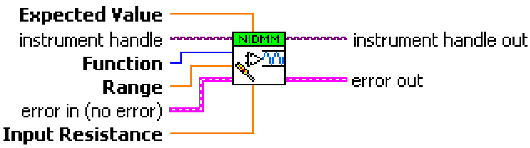
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 M`

4. Call the niDMM Control VI.

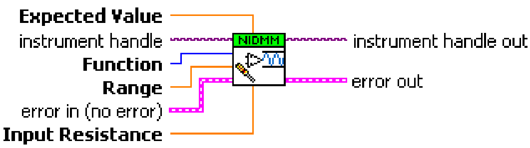
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

5. Output 100 MΩ from the calibrator with 2-wire compensation and external sense turned off. *Allow the calibrator output to settle before proceeding*.

6. Call the niDMM Cal Adjust Gain VI.

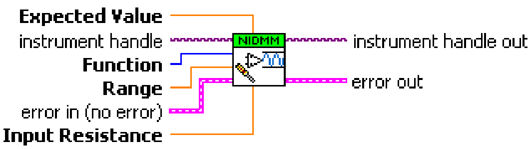
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 100 MΩ

7. Output 19 MΩ from the calibrator with 2-wire compensation and external sense turned off. *Allow the calibrator output to settle before proceeding*.
8. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 19 MΩ

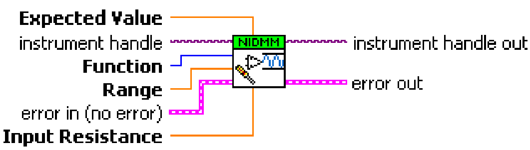
9. Output 10 MΩ from the calibrator with 2-wire compensation turned off, but with external sense turned on. *Allow the calibrator output to settle before proceeding*.

10. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 10 MΩ

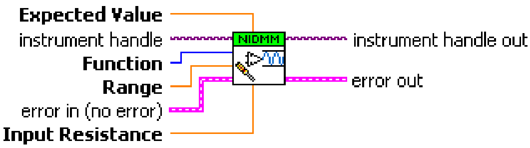
11. Output 1.9 MΩ from the calibrator with 2-wire compensation turned off, but with external sense turned on. *Allow the calibrator output to settle before proceeding*.

12. Call the niDMM Cal Adjust Gain VI.

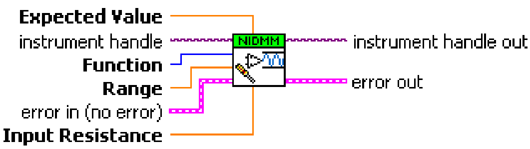
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 1.9 MΩ

13. Output 1 MΩ from the calibrator with 2-wire compensation turned off, but with external sense turned on. *Allow the calibrator output to settle before proceeding*.

14. Call the niDMM Cal Adjust Gain VI.

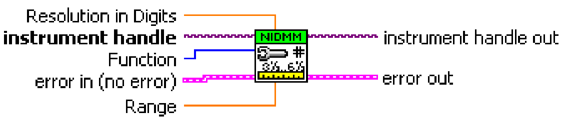
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `1 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 1 MΩ

15. Output 100 kΩ from the calibrator with 2-wire compensation turned off, but with external sense turned on. *Allow the calibrator output to settle before proceeding*.
16. Call the niDMM Cal Adjust Gain VI.

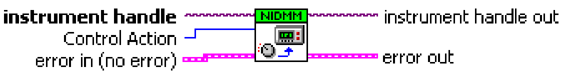
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 100 kΩ

17. Output 10 kΩ from the calibrator with 2-wire compensation and external sense turned on.

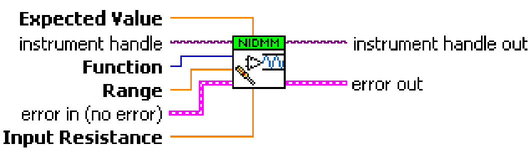
18. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurementDigits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 k`

19. Call the niDMM Control VI.

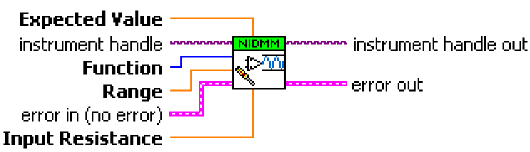
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

20. Wait 10 seconds to allow maximum settling on the calibrator after turning 2-wire compensation on.
21. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 10 kΩ

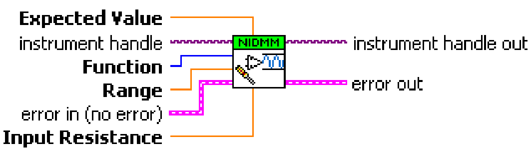
22. Output 1 kΩ from the calibrator with 2-wire compensation and external sense turned on. *Allow the calibrator output to settle before proceeding*.

23. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `1 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 1 kΩ

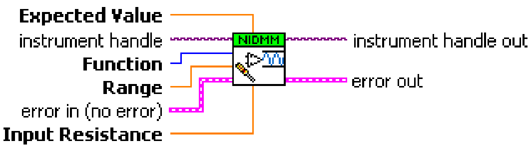
24. Output 100 Ω from the calibrator with 2-wire compensation and external sense turned on. *Allow the calibrator output to settle before proceeding*.

25. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 100 Ω

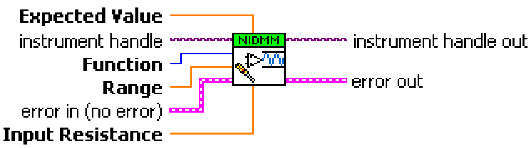
26. Output 0 Ω from the calibrator with 2-wire compensation turned off, but with external sense turned on. *Allow the calibrator output to settle before proceeding*.

27. Call the niDMM Cal Adjust Gain VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:

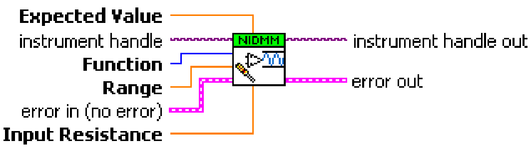
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>100 M</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: The display on the calibrator for 0 Ω</td></tr>
</table>

28. Call the niDMM Cal Adjust Gain VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:

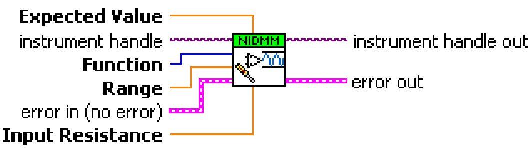
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>10 M</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: The display on the calibrator for 0 Ω</td></tr>
</table>

29. Call the niDMM Cal Adjust Gain VI.

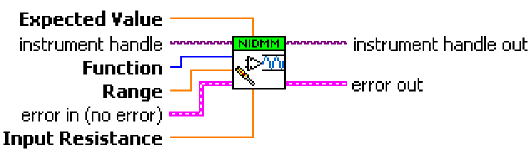
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:

Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>1 M</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: The display on the calibrator for 0 Ω</td></tr>
</table>

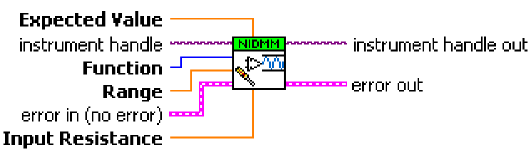
30. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 0 Ω

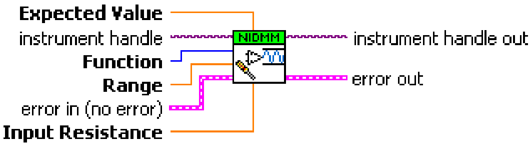
31. Output 0 Ω from the calibrator with 2-wire compensation and external sense turned on. *Allow the calibrator output to settle before proceeding*.
32. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 0 Ω

33. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `1 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: The display on the calibrator for 0 Ω

34. Call the niDMM Cal Adjust Gain VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:

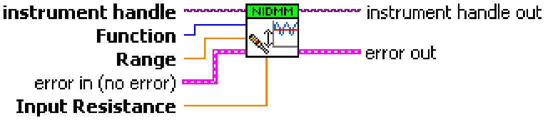
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>100</code>
Input_Resistance:
<code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: The display on the calibrator for 0 Ω</td></tr>
</table>

35. Reset the calibrator.

36. Plug in the insulated banana plug shorting bar across the HI and LO banana plug connectors on the NI 4065.

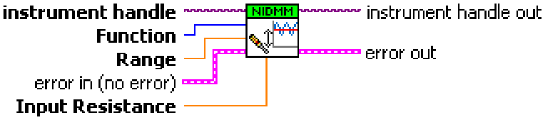
37. Wait two minutes for the thermal EMF to stabilize.

38. Call the niDMM Cal Adjust Offset VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustOffset</code> with the following parameters:

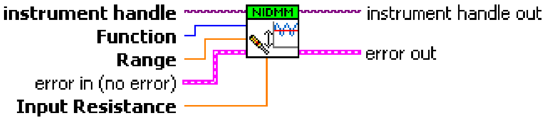
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>100 M</code>
Input_Resistance:
<code>NIDMM_VAL_RESISTANCE_NA</code></td></tr>
</table>

39. Call the niDMM Cal Adjust Offset VI.

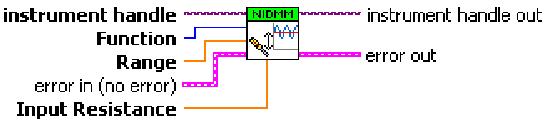
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustOffset</code> with the following parameters:

Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_2_WIRE_RES</code>
Range: <code>10 M</code>
Input_Resistance:
<code>NIDMM_VAL_RESISTANCE_NA</code></td></tr>
</table>

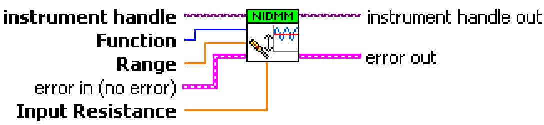
40. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `1 M` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

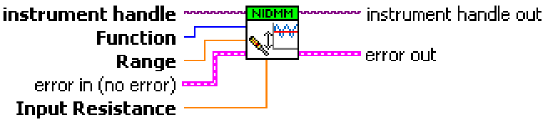
41. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

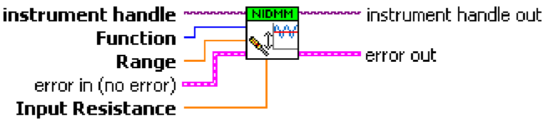
42. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `10 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

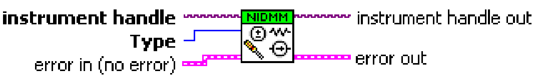
43. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `1 k` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

44. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_2_WIRE_RES` **Range**: `100` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

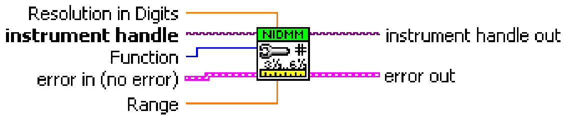
45. Call the niDMM Cal Adjust Miscellaneous VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustMisc` with the following parameters: **Instrument_Handle**: `Cal_Session` **Type**: `NIDMM_EXTCAL_MISCCAL_SECTION`

Adjusting AC Voltage

To adjust AC voltage for the NI 4065, complete the following steps:

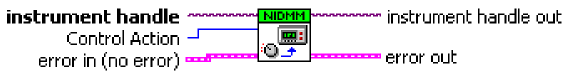
1. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>


</td><td>
Call <code>niDMM_ConfigureMeasurementDigits</code> with the following parameters:

Instrument_Handle: <code>Cal Session</code>
Resolution_Digits: <code>6.5</code>
Measurement_Function: <code>NIDMM_VAL_AC_VOLTS</code>
Range: <code>300</code>
</td></tr>
</table>

2. Call the niDMM Control VI.

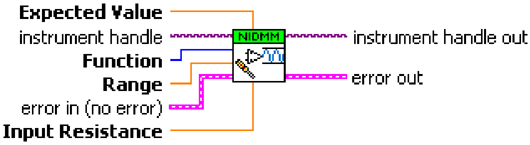
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>


</td><td>
Call <code>niDMM_Control</code> with the following parameters:

Instrument_Handle: <code>Cal Session</code>
Control Action: <code>Commit</code>
</td></tr>
</table>

3. Refer to Table 18 for the appropriate calibrator output and parameter values as you complete the following steps:
   a. On the calibrator, output the value listed in the *Calibrator Output* column in Table 18 for the current iteration. *Allow the calibrator output to settle before proceeding*.

b. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_AC_VOLTS` **Range**: Set as shown in Table 18 for the current iteration **Input_Resistance**: `NIDMM_VAL_10_MEGAOHM` **Expected_Value**: Set as shown in Table 18 for the current iteration

4. Repeat step 3 for each of the remaining iterations listed in Table 18.

Table 18. AC Voltage Settings

Iteration	Calibrator Output		niDMM Cal Adjust Gain Parameters	
	Amplitude (V)	f (kHz)	Range (V)	Expected Value
1	200	1	300	200
2	100	1	300	100
3	4	1	300	4
4	20	1	20	20
5	10	1	20	10
6	0.4	1	20	0.4
7	2	1	2	2
8	1	1	2	1
9	0.04	1	2	0.04
10	0.2	1	0.2	0.2
11	0.1	1	0.2	0.1
12	4 m	1	0.2	4 m

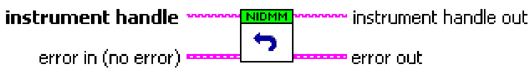
5. Reset the calibrator.

Adjusting DC Current

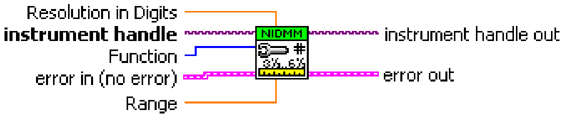
To adjust DC current for the NI 4065, complete the following steps:

1. If you are using an NI PXI/PCI/PCIe-4065, fasten the connectors on one end of the Fluke 5440 cable to the HI SENSE and LO banana plug connectors, and fasten the connectors on the other end of the cable to the HI and LO calibrator binding posts, respectively. Figure 7 shows the correct connections. Table 12 lists the cable connections.

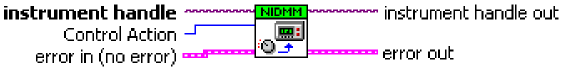
   If you are using an NI USB-4065, fasten the connectors on one end of the Fluke 5440 cable to the I and LO banana plug connectors, and fasten the connectors on the other end of the cable to the HI and LO calibrator binding posts, respectively. Figure 8 shows the correct connections. Table 12 lists the cable connections.
2. Wait two minutes for the thermal EMF to stabilize.
3. Call the niDMM Reset VI to reset the NI 4065 to a known state.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_reset` with the following parameter: **Instrument_Handle**: `Cal Session`

4. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

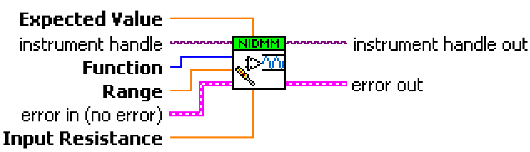
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_CURRENT` **Range**: `1.0`

5. Call the niDMM Control VI.

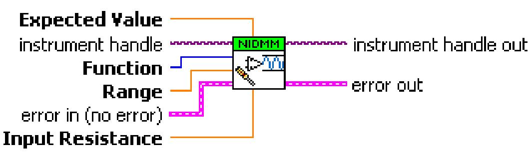
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

Note Configure the DMM for current mode before applying a current from the calibrator.

6. Set the current output on the calibrator to `NORM` and output 0.01 A. *Allow the calibrator output to settle before proceeding*.
7. Call the niDMM Cal Adjust Gain VI.

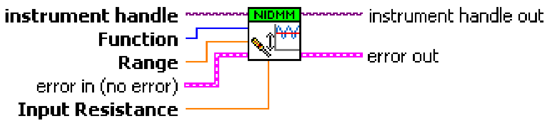
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `0.01` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `0.01`

8. Output –0.01 A on the calibrator. *Allow the calibrator output to settle before proceeding*.
9. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `0.01` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `–0.01`

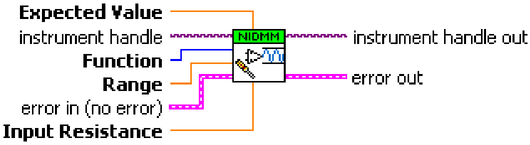
10. Output 0 A on the calibrator. *Allow the calibrator output to settle before proceeding*.

11. Call the niDMM Cal Adjust Offset VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustOffset</code> with the following parameters:
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_DC_CURRENT</code>
Range: <code>0.01</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code></td></tr>
</table>

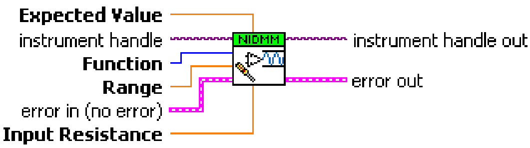
12. Output 0.1 A on the calibrator. *Allow the calibrator output to settle before proceeding.*

13. Call the niDMM Cal Adjust Gain VI.

<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_DC_CURRENT</code>
Range: <code>0.1</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: <code>0.1</code></td></tr>
</table>

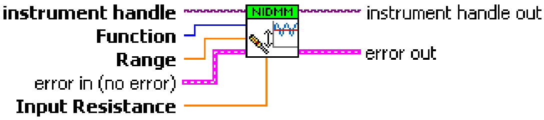
14. Output –0.1 A on the calibrator. *Allow the calibrator output to settle before proceeding.*

15. Call the niDMM Cal Adjust Gain VI.

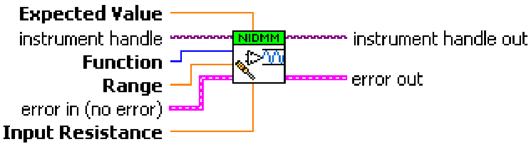
<table>
<tr><th>LabVIEW Block Diagram</th><th>C/C++ Function Call</th></tr>
<tr><td>
</td><td>Call <code>niDMM_CalAdjustGain</code> with the following parameters:
Instrument_Handle: <code>Cal Session</code>
Mode: <code>NIDMM_VAL_DC_CURRENT</code>
Range: <code>0.1</code>
Input_Resistance: <code>NIDMM_VAL_RESISTANCE_NA</code>
Expected_Value: <code>–0.1</code></td></tr>
</table>

16. Output 0 A on the calibrator. *Allow the calibrator output to settle before proceeding.*

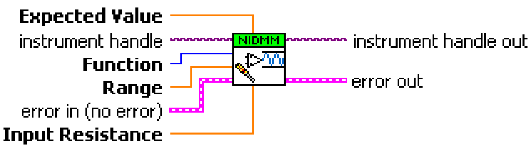
17. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `0.1` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

18. Output 2.2 A on the calibrator. *Allow the calibrator output to settle before proceeding*.
19. Call the niDMM Cal Adjust Gain VI.

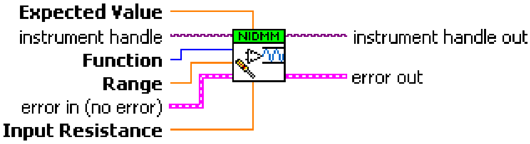
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `3` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `2.2`

20. Output –2.2 A on the calibrator. *Allow the calibrator output to settle before proceeding*.
21. Call the niDMM Cal Adjust Gain VI.

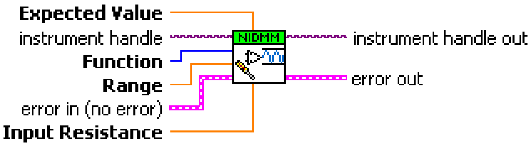
LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `3` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `–2.2`

22. Output 1 A on the calibrator. *Allow the calibrator output to settle before proceeding*.

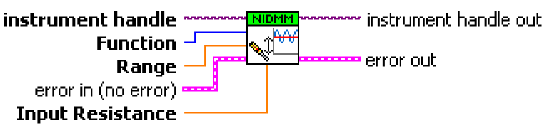
23. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `1` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `1`

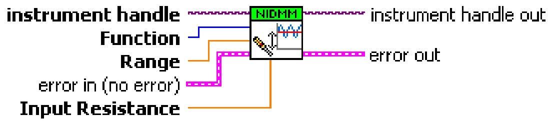
24. Output –1 A on the calibrator. *Allow the calibrator output to settle before proceeding.*
25. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `1` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: `–1`

26. Output 0 A on the calibrator.
27. Wait 5 seconds before making a measurement to allow thermal EMF to settle.
28. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `3` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

29. Call the niDMM Cal Adjust Offset VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustOffset` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_DC_CURRENT` **Range**: `1` **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA`

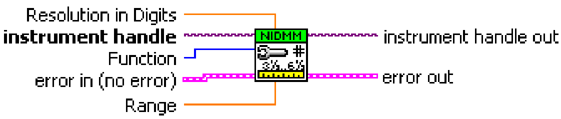
30. Reset the Calibrator.

Adjusting AC Current

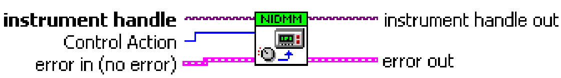
To adjust AC current for the NI 4065, complete the following steps:

1. Refer to Table 19 for the appropriate calibrator output and parameter values as you complete the following steps:

   a. Call the niDMM Config Measurement VI. The niDMM Config Measurement VI is polymorphic. To change the selected instance of this polymorphic VI, right-click the VI and choose **Select Type** followed by **Resolution in Digits**.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_ConfigureMeasurement Digits` with the following parameters: **Instrument_Handle**: `Cal Session` **Resolution_Digits**: `6.5` **Measurement_Function**: `NIDMM_VAL_DC_CURRENT` **Range**: `1.0`

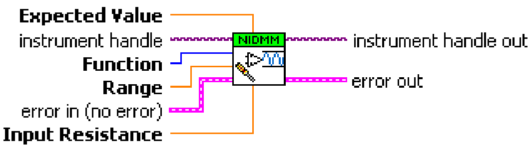
   b. Call the niDMM Control VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_Control` with the following parameters: **Instrument_Handle**: `Cal Session` **Control Action**: `Commit`

Note Configure the DMM for current mode before applying a current from the calibrator.

c. On the calibrator, output the value listed in the *Calibrator Output* column in Table 19 for the current iteration. *Allow the calibrator output to settle before proceeding*.

d. Call the niDMM Cal Adjust Gain VI.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CalAdjustGain` with the following parameters: **Instrument_Handle**: `Cal Session` **Mode**: `NIDMM_VAL_AC_CURRENT` **Range**: Set as shown in Table 19 for the current iteration **Input_Resistance**: `NIDMM_VAL_RESISTANCE_NA` **Expected_Value**: Set as shown in Table 19 for the current iteration

2. Repeat step 1 for each of the remaining iterations listed in Table 19.

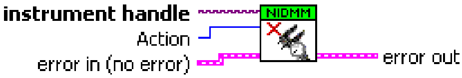
Table 19. AC Current Settings

Iteration	Calibrator Output		niDMM Cal Adjust Gain Parameters	
	Amplitude (A)	f (kHz)	Range (A)	Expected Value (A)
1	2.2	1	3	2.2
2	1.1	1	3	1.1
3	0.06	1	3	0.06
4	0.5	1	0.5	0.5
5	0.25	1	0.5	0.25
6	0.01	1	0.5	0.01
7	0.1	1	0.1	0.1
8	0.05	1	0.1	0.05
9	2 m	1	0.1	2 m
10	0.01	1	0.01	0.01
11	5 m	1	0.01	5 m
12	200 µ	1	0.01	200 m

3. Reset the calibrator.

Completing the Adjustment Procedures

Call the niDMM Close External Cal VI to complete the adjustment procedure for the NI 4065 and close the session.

LabVIEW Block Diagram	C/C++ Function Call
	Call `niDMM_CloseExtCal` with the following parameters: **Instrument_Handle**: `Cal Session` **Action**: `NIDMM_EXTCAL_ACTION_SAVE` if the results of the calibration are satisfactory, and you want to save the new calibration coefficients to the EEPROM. Otherwise, **Action**: `NIDMM_EXTCAL_ACTION_ABORT` if the results of the calibration are unsatisfactory, and you want to restore the original calibration coefficients to the EEPROM.

Verification Limits

This section includes the verification limits for DC voltage, AC voltage, 4-wire resistance, 2-wire resistance, DC current, and AC current for the NI 4065. Compare these limits to the results in the *Verification Procedures* section.

Note Use the values in the *24-Hour Limits* column for a post-adjustment verification *only*. Otherwise, use the values in the *1-Year Limits* column.

Limits in the following tables are based upon the August 2010 edition of the *NI 4065 Specifications*. Refer to the most recent NI 4065 Specifications online at `ni.com/manuals`. If a more recent edition of the specifications is available, recalculate the limits based upon the latest specifications.

DC Voltage

Table 20. DC Voltage Verification Limits

Calibrator Amplitude	Range (V)	Input Resistance	1-Year Limits		24-Hour Limits	
			Lower	Upper	Lower	Upper
0 V	1	>10 GΩ/10 MΩ	–12 µV	12 µV	–8 µV	8 µV
0 V	10	>10 GΩ/10 MΩ	–120 µV	120 µV	–70 µV	70 µV
0 V	100	10 MΩ	–1.2 mV	1.2 mV	–0.8 mV	0.8 mV
0 V	300	10 MΩ	–12 mV	12 mV	–7.2 mV	7.2 mV
100 mV	100 m	>10 GΩ/10 MΩ	0.0999875 V	0.1000125 V	0.099994 V	0.100006 V
–100 mV	100 m	>10 GΩ/10 MΩ	–0.1000125 V	–0.0999875 V	–0.100006 V	–0.099994 V
1 V	1	>10 GΩ/10 MΩ	0.999898 V	1.000102 V	0.999972 V	1.000028 V
–1 V	1	>10 GΩ/10 MΩ	–1.000102 V	–0.999898 V	–1.000028 V	–0.999972 V
10 V	10	>10 GΩ/10 MΩ	9.99898 V	10.00102 V	9.99978 V	10.00022 V
–10 V	10	>10 GΩ/10 MΩ	–10.00102 V	–9.99898 V	–10.00022 V	–9.99978 V
100 V	100	10 MΩ	99.9878 V	100.0122 V	99.9972 V	100.0028 V
–100 V	100	10 MΩ	–100.0122 V	–99.9878 V	–100.0028 V	–99.9972 V
300 V	300	10 MΩ	299.955 V	300.045 V	299.9868 V	300.0132 V
–300 V	300	10 MΩ	–300.045 V	–299.955 V	–300.0132 V	–299.9868 V

AC Voltage

Table 21. AC Voltage Verification Limits

Calibrator Output		Range (V)	1-Year Limits		24-Hour Limits	
Amplitude	Frequency		Lower	Upper	Lower	Upper
4 mV	1 kHz	200 m	3.892 mV	4.108 mV	3.912 mV	4.088 mV
20 mV	1 kHz	200 m	19.86 mV	20.14 mV	19.88 mV	20.12 mV
200 mV	1 kHz	200 m	199.5 mV	200.5 mV	199.52 mV	200.48 mV
40 mV	1 kHz	2	38.92 mV	41.08 mV	39.12 mV	40.88 mV
200 mV	1 kHz	2	198.6 mV	201.4 mV	198.8 mV	201.2 mV
2 V	1 kHz	2	1.995 V	2.005 V	1.9952 V	2.0048 V
400 mV	1 kHz	20	389.2 mV	410.8 mV	391.2 mV	408.8 mV
2 V	1 kHz	20	1.986 V	2.014 V	1.988 V	2.012 V

Table 21. AC Voltage Verification Limits (Continued)

Calibrator Output			1-Year Limits		24-Hour Limits	
Amplitude	**Frequency**	**Range (V)**	**Lower**	**Upper**	**Lower**	**Upper**
20 V	1 kHz	20	19.95 V	20.05 V	19.952 V	20.048 V
6 V	1 kHz	300	5.838 V	6.162 V	5.868 V	6.132 V
30 V	1 kHz	300	29.79 V	30.21 V	29.82 V	30.18 V
300 V	1 kHz	300	299.25 V	300.75 V	299.28 V	300.72 V
200 mV	10 Hz	200 m	195.9 mV	204.1 mV	196.92 mV	203.08 mV
200 mV	40 Hz	200 m	195.9 mV	204.1 mV	196.92 mV	203.08 mV
200 mV	20 kHz	200 m	199.5 mV	200.5 mV	199.52 mV	200.48 mV
200 mV	50 kHz	200 m	199.3 mV	200.7 mV	199.32 mV	200.68 mV
200 mV	100 kHz	200 m	196.84 mV	203.16 mV	196.84 mV	203.16 mV
2 V	10 Hz	2	1.959 V	2.041 V	1.9692 V	2.0308 V
2 V	40 Hz	2	1.959 V	2.041 V	1.9692 V	2.0308 V
2 V	20 kHz	2	1.995 V	2.005 V	1.9952 V	2.0048 V
2 V	50 kHz	2	1.993 V	2.007 V	1.9932 V	2.0068 V
2 V	100 kHz	2	1.9684 V	2.0316 V	1.9684 V	2.0316 V
20 V	10 Hz	20	19.59 V	20.41 V	19.692 V	20.308 V
20 V	40 Hz	20	19.59 V	20.41 V	19.692 V	20.308 V
20 V	20 kHz	20	19.95 V	20.05 V	19.952 V	20.048 V
20 V	50 kHz	20	19.93 V	20.07 V	19.932 V	20.068 V
20 V	100 kHz	20	19.684 V	20.316 V	19.684 V	20.316 V
200 V	10 Hz	300	195.85 V	204.15 V	196.88 V	203.12 V
200 V	40 Hz	300	195.85 V	204.15 V	196.88 V	203.12 V
200 V	20 kHz	300	199.45 V	200.55 V	199.48 V	200.52 V
200 V	50 kHz	300	199.25 V	200.75 V	199.28 V	200.72 V
200 V	100 kHz	300	196.76 V	203.24 V	196.76 V	203.24 V

4-Wire Resistance

Table 22. 4-Wire Resistance Verification Tolerances

Calibrator Resistance	Range (Ω)	Limits, 1-Year (±)		Limits, 24-hour (±)	
		ppm of Reading*	ppm of Range	ppm of Reading*	ppm of Range
0 Ω	100	110	40	30	30
10 Ω	100				
100 Ω	100				
0 Ω	1 k	110	20	20	8
100 Ω	1 k				
1 kΩ	1 k				
0 Ω	10 k	110	20	20	8
1 kΩ	10 k				
10 kΩ	10 k				
0 Ω	100 k	110	20	20	8
10 kΩ	100 k				
100 kΩ	100 k				
0 Ω	1 M	125	24	20	12
100 kΩ	1 M				
1 MΩ	1 M				

* ppm of Reading applied to displayed discrete resistance value of calibrator.

2-Wire Resistance

Table 23. 2-Wire Resistance Verification Tolerances

Calibrator Resistance	Range (Ω)	Limits, 1-Year (±)		Limits, 24-hour (±)	
		ppm of Reading*	ppm of Range	ppm of Reading*	ppm of Range
10 Ω	100	110	2040	30	2030
100 Ω	100				
100 Ω	1 k	110	220	20	208
1 kΩ	1 k				
1 kΩ	10 k	110	40	20	28
10 kΩ	10 k				

Table 23. 2-Wire Resistance Verification Tolerances (Continued)

Calibrator Resistance	Range (Ω)	Limits, 1-Year (±)		Limits, 24-hour (±)	
		ppm of Reading*	ppm of Range	ppm of Reading*	ppm of Range
10 kΩ	100 k	110	22	20	10
100 kΩ	100 k				
100 kΩ	1 M	125	24	20	12
1 MΩ	1 M				
1 MΩ	10 M	500	24	150	12
10 MΩ	10 M				
10 MΩ	100 M	8000	60	2000	24
100 MΩ	100 M				

* ppm of Reading applied to displayed discrete resistance value of calibrator.

Table 24. 2-Wire 0 Ω Resistance Verification Tolerances

Shorting Bar	Range (Ω)	Limits, 1-Year (±ppm)	Limits, 24-hour (±ppm)
0 Ω	100 M	60	24
0 Ω	10 M	24	12
0 Ω	1 M	24	12
0 Ω	100 k	22	10
0 Ω	10 k	40	28
0 Ω	1 k	220	208
0 Ω	100	2040	2030

DC Current

Table 25. DC Current Verification Limits

Calibrator Amplitude	Range (A)	1-Year Limits		24-Hour Limits	
		Lower	Upper	Lower	Upper
–10 mA	10 m	–10.007 mA	–9.993 mA	–10.0015 mA	–9.9985 mA
0 A	10 m	–2 µA	2 µA	–1 µA	1 µA
10 mA	10 m	9.993 mA	10.007 mA	9.9985 mA	10.0015 mA
–100 mA	100 m	–100.055 mA	–99.945 mA	–100.014 mA	–99.986 mA
0 A	100 m	–5 µA	5 µA	–4 µA	4 µA

Table 25. DC Current Verification Limits (Continued)

Calibrator Amplitude	Range (A)	1-Year Limits		24-Hour Limits	
		Lower	Upper	Lower	Upper
100 mA	100 m	99.945 mA	100.055 mA	99.986 mA	100.014 mA
–1 A	1	–1.0011 A	–0.9989 A	–1.00056 A	–0.99944 A
0 A	1	–100 µA	100 µA	–60 µA	60 µA
1 A	1	0.9989 A	1.0011 A	0.99944 A	1.00056 A
–2.2 A	3	–2.204241 A	–2.195759 A	–2.203801 A	–2.196199 A
0 A	3	–600 µA	600 µA	–600 µA	600 µA
2.2 A	3	2.195759 A	2.204241 A	2.196199 A	2.203801 A

AC Current

Table 26. AC Current Verification Limits

Calibrator Output		Range (A)	1-Year Limits		24-Hour Limits	
Amplitude	Frequency		Lower	Upper	Lower	Upper
200 µA	1 kHz	10 m	193.4 µA	206.6 µA	194.4 µA	205.6 µA
1 mA	1 kHz	10 m	0.991 mA	1.009 mA	0.992 mA	1.008 mA
10 mA	1 kHz	10 m	9.964 mA	10.036 mA	9.965 mA	10.035 mA
2 mA	1 kHz	100 m	1.934 mA	2.066 mA	1.944 mA	2.056 mA
10 mA	1 kHz	100 m	9.91 mA	10.09 mA	9.92 mA	10.08 mA
100 mA	1 kHz	100 m	99.64 mA	100.36 mA	99.65 mA	100.35 mA
10 mA	1 kHz	500 m	9.67 mA	10.33 mA	9.72 mA	10.28 mA
50 mA	1 kHz	500 m	49.55 mA	50.45 mA	49.6 mA	50.4 mA
500 mA	1 kHz	500 m	498.2 mA	501.8 mA	498.25 mA	501.75 mA
60 mA	1 kHz	3	58.02 mA	61.98 mA	58.32 mA	61.68 mA
300 mA	1 kHz	3	297.3 mA	302.7 mA	297.6 mA	302.4 mA
2.2 A	1 kHz	3	2.1916 A	2.2084 A	2.1919 A	2.2081 A

Appendix A: Calibration Options

The complete calibration process consists of verifying, adjusting, and reverifying a device. During verification, you compare the measured performance to an external standard of known measurement uncertainty to confirm the product meets or exceeds specifications. Figure 9 shows the procedural flow for verification. During adjustment, you correct the measurement error of the device by adjusting the calibration constants and storing the new calibration constants in the EEPROM. Figure 10 shows the procedural flow for adjustment.

The calibration sequence is as follows:

1. Verify the operation of the NI 4065 using the 1-year accuracy limits (or the 90-day accuracy limits if it has been calibrated within that time).
2. Adjust the NI 4065.
3. Reverify the NI 4065 using the 24-hour accuracy limits (or the 1-year accuracy limits when the 24-hour limits are not specified).

Note You must compare the verification limits provided in this procedure with the most recent specifications. Refer to the latest *NI 4065 Specifications* at `ni.com/manuals`.

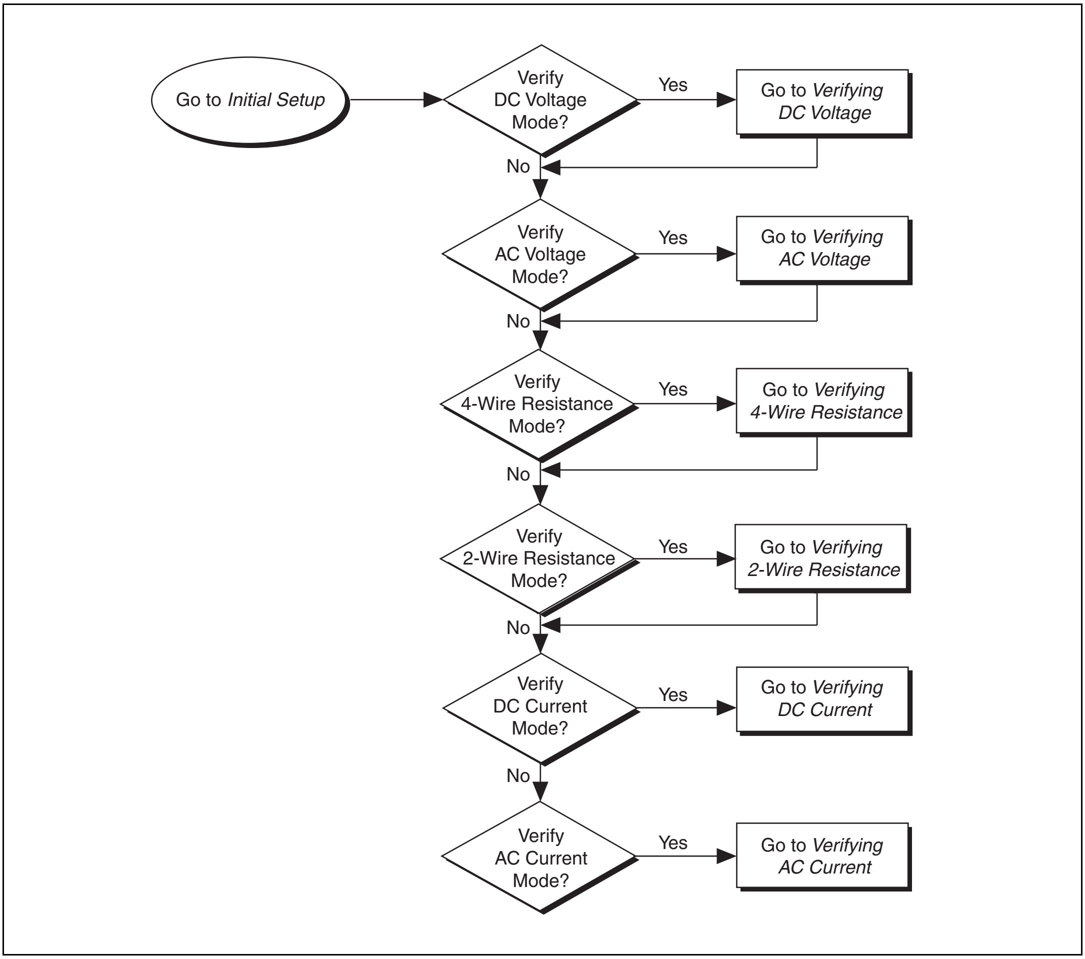


Figure 9. Verification Procedures Flowchart

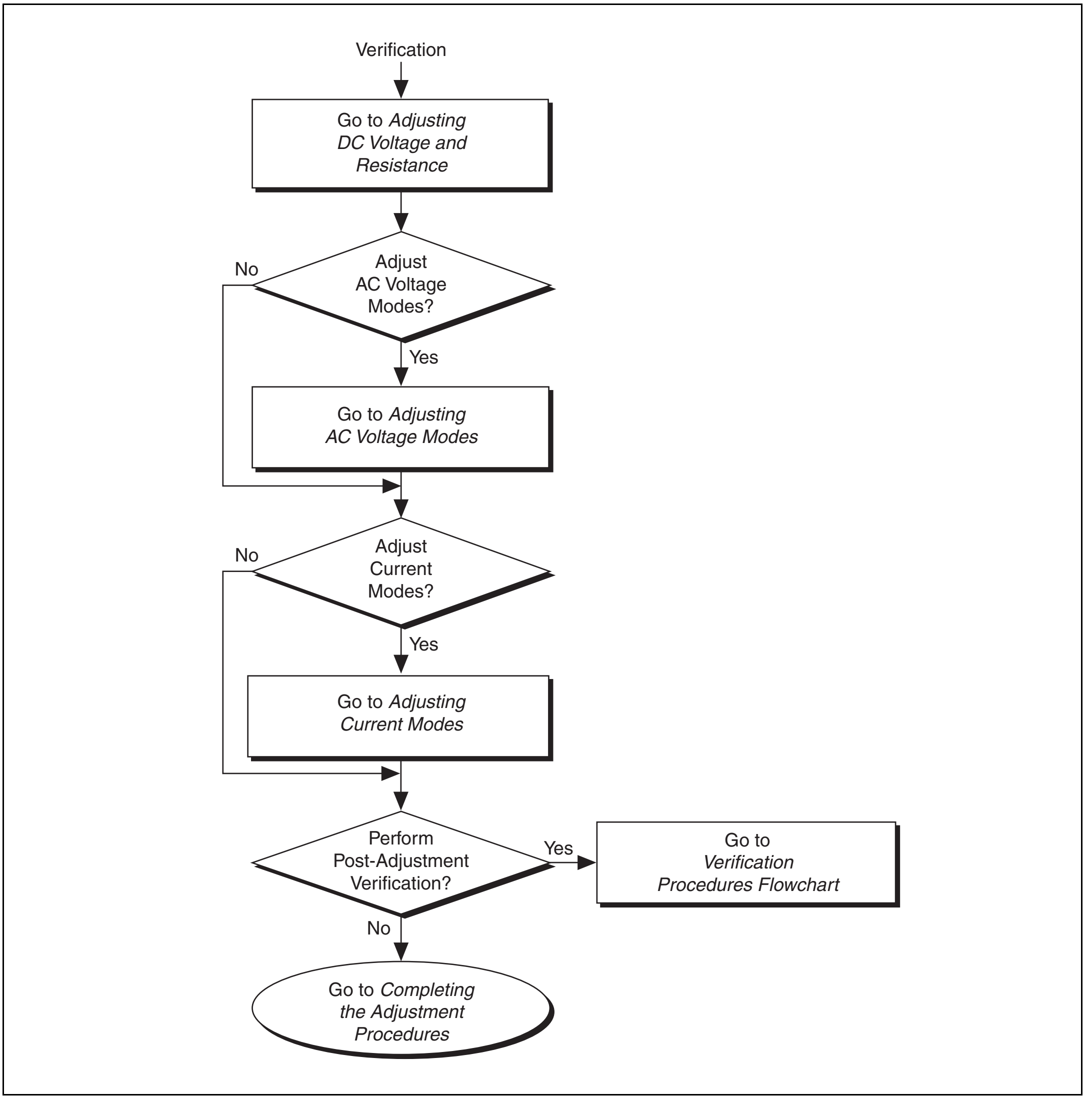


Figure 10. Adjustment Procedures Flowchart

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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