Metrics ICS Driver Manual

HP4284

Metrics ICS

Version 4.5

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The HP4284 Instrument Driver

Getting Started: Creating and Executing a Test Setup

This section will walk you through the steps required to create and execute a sample test setup. This sample test setup will measure input capacitance, C_{ibo}, of an NPN bipolar transistor as a function of voltage. This characteristic was measured with the HP4284A Precision LCR Meter and the HP16047A Test Fixture.

Step 1: Connect a Test Fixture or Cable Set to the Instrument

The capacitance example presented in this section was performed with the HP16047A Test Fixture. Connect either the HP16047A Test Fixture or a compatible four-terminal pair cable set to the instrument UNKNOWN terminals.

The cable length must be designated in the instrument configuration CABLE field in order to assure stable and accurate measurements. The CABLE field is located under the HP 4284 Configuration dialog box.

Set the CABLE field designation to "0m" if you are using the HP16047A or any other test fixture that connects directly to the instrument UNKNOWN terminals. If using standard length test cables, set the CABLE field designation to "1m", "2m", or "4m" as appropriate. Any other cable length will induce inaccuracies that must be accounted for. Refer to the HP4284A Operation Manual to review the cable length selection procedure.

Step 2: Connect the HP4284 Instrument Driver

The HP4284 Driver is connected to ICS in the Connect Instruments dialogue box. The Connect Instruments dialogue box is accessed by choosing the CONNECT INSTRUMENTS toolbar button or by selecting INSTRUMENTS/SELECT INSTRUMENT from the main menu bar.

How to Connect the HP4284 Driver:

1. Click the CONNECT INSTRUMENTS toolbar button or select INSTRUMENTS/SELECT INSTRUMENT from the measurement mode menu bar. This will open the Connect Instruments dialogue box.
2. Highlight the HP4284 Driver in the AVAILABLE field.
3. Click the CONNECT button.
4. Your choice will be displayed in the SELECTED field.
5. Clicking the OK button would close the Connect Instruments dialogue box and restore control to the ICS desktop. Keep the Connect Instruments dialogue box displayed for now, because the next step requires you to click the Connect Instruments CONFIG button.

Step 3: Designate the GPIB Address and Options Status

Connect the HP4284 to your computer using a standard IEEE-488 GPIB (General Purpose Interface Bus) as described in the HP4284A Operation Manual. The HP-IB hardware discussed in the Operation Manual is Hewlett-Packard's implementation of the IEEE-488 Standard Digital Interface for programmable instrumentation. Please refer to the HP4284A Operation Manual to review the HP-IB cable length limitations and connection restrictions recommended by Hewlett-Packard.

The HP4284 Configuration dialogue box is used to designate the instrument's GPIB address along with the installation of Options. The installation of Options must be designated in the HP4284 Configuration dialogue box in order to control the added capability from ICS.

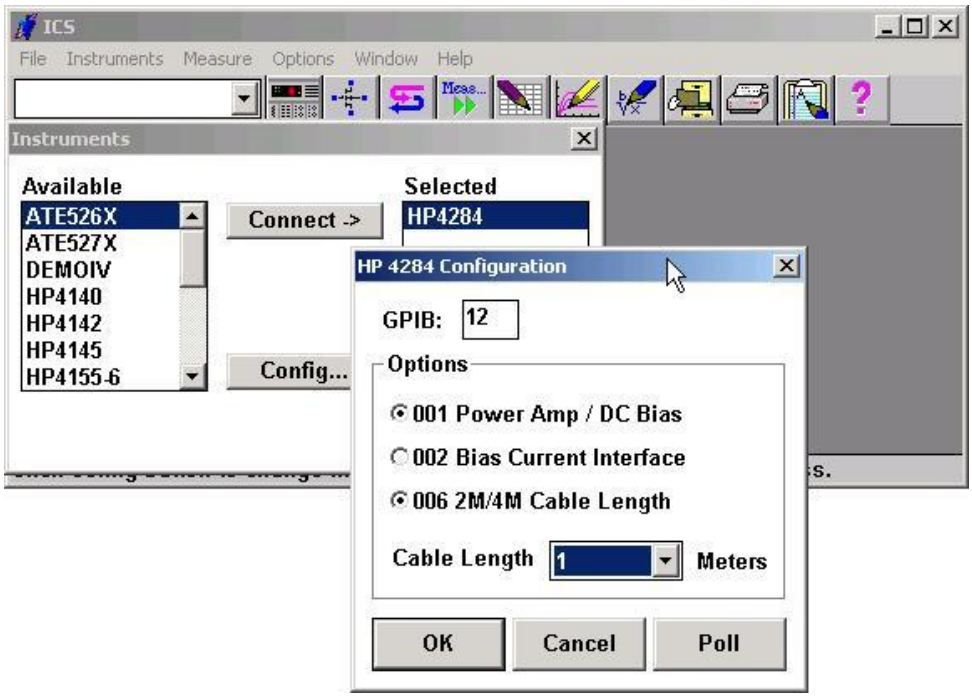


Figure 1: How to Define the HP4284 GPIB Address and Options

How to Designate the HP4284 GPIB Address and Options Status:

1. The Connect Instruments dialogue box should still be displayed from the last step. If it isn't, click the toolbar CONNECT INSTRUMENTS button or choose INSTRUMENTS/SELECT INSTRUMENT from the main menu bar. This will re-open the Connect Instruments dialogue box.
2. Open the HP4284 Configuration dialogue box by clicking the CONFIG button at the bottom of the Connect Instruments dialogue box.
3. Enter the HP4284 GPIB address in the GPIB field. The GPIB address is designated in the System Configuration page under the CATALOGUE/SYSTEM menu. If you wish to change the GPIB address, please refer to procedure outlined in the HP4284A Operation Manual.
4. Designate the installed Options of the HP4284 by selecting the corresponding switch.

Step 4: Calibrate the Instrument

The parasitic effects of the test fixture introduce device measurement inaccuracies. To eliminate this problem, the HP4284 includes an Open and Short Correction function that compensates for the LCR characteristics inherent to the test fixture. The correction functions are controlled from the Calibration dialogue box. Calibrate the instrument as described below.

How to Calibrate the HP4284:

1. Open the Calibrate dialogue box by clicking the Setup Editor OPTIONS button.
2. Make certain that no device is inserted in the test fixture. Select the Open switch and click the CALIBRATE button. The Calibrate dialogue box will remain displayed while the Open function is performed.
3. After completing the Open Correction function, short the test fixture HIGH and LOW terminals. Select the Short switch and click the CALIBRATE button. The Calibrate dialogue box will remain displayed while the Short function is performed.
4. The instrument is successfully calibrated. Remove the short between the test fixture HIGH and LOW terminals. Click the CLOSE button to restore control to the Setup Editor.

The procedure outlined above is a presentation of the minimal calibration requirements necessary for the C_{ibo} measurement specified in the example test setup. For a thorough discussion of the calibration functions, refer to *The HP4284 Calibration Dialogue Box* later in this chapter.

Step 5: Create the Test Setup

Test setups are created in the Setup Editor. Open the Setup Editor by selecting the SETUP EDITOR toolbar button. This example will demonstrate how to create a test setup that measures the input capacitance, C_{ibo}, of an NPN bipolar transistor as a function of voltage.

Click the corresponding toolbar button to display the Setup Editor.

Step 5A: Specify the Test Setup Name

When creating a new test setup, a test setup name must be specified before any other selections or conditions are designated.

How to Specify the Test Setup Name

1. Click the Setup Editor NEW button. This will open the New Setup dialogue box.
2. At the prompt, specify a test setup name. For this example, type "Cibo".
3. Click OK. This will close the New Setup dialogue box.
4. The test setup name will appear in the Setup Editor SETUP window.

Step 5B: Select a Device Schematic Corresponding to the DUT

A device schematic is located at the center of the Setup Editor. ICS provides a library of different device schematics. Select a schematic that is a representation of the DUT.

The device schematic does not have to match the pin layout of the Device Under Test. The device schematic is provided as a convenience for the user so that the user can document the terminal connections required for the corresponding test setup.

A MOSFET schematic will appear at the center of the Setup Editor when the Setup Editor is first opened. In this step the MOSFET schematic will be replaced with a BJT schematic. The MOSFET device is the default Setup Editor schematic. To change the default device schematic, refer to *Chapter 2: The Setup Editor*.

How to Select a Device Schematic:

1. Click the Setup Editor DEVICE button. This will open the Device dialogue box.
2. The Device Type window will display a list of available device schematics. Select "C". Notice the selected schematic is previewed in the small window to the right of the Device Type window.
3. Selecting the BJT schematic will display a set of polarity switches. Click the "NPN" designation.

4. Click OK. This will close the Device dialogue box and display the transistor schematic at the center of the Setup Editor.

Step 5C: Designate the Instrument/DUT Connections

The connections between the instrument UNKNOWN terminals and the device under test are designated in the Setup Editor. The Setup Editor display is provided as a tool to document the test fixture or test lead connections required for the corresponding device measurement. The connections designated in the Setup Editor must correspond to the orientation of the DUT in the test fixture or the connections between the DUT and the instrument test leads.

The Setup Editor should display a device schematic that is representative of the DUT (refer to the last step, if necessary). Connections are designated by first clicking either the "high" or "low" source listed in the Source Units dialogue box. After the source is selected, click the blue pad next to one of the device schematic pins. An instrument icon, along with the name of the connected source, will appear above the device schematic pin as a means of indicating the connection.

The instructions presented on the following page explain how to designate the connection between the HIGH terminals and the emitter, along with the connection between the LOW terminals and the base.

How to Designate the Instrument/DUT Connections:

1. Select the Setup Editor SOURCES button. This will open the Source Units dialogue box.
2. The Source Units dialogue box will display two sources. One of the sources is designated "high" and the other "low" (HP4284.CMH and HP4284.CML respectively).
3. Click on the "HP4284.CMH" designation.
4. Designate the intended orientation of the DUT in the HP16047A Test Fixture by clicking the blue pad next to the emitter.
5. Select the "HP4284.CML" designation and click the blue pad next to the base. An instrument icon will appear above both designated connections.
6. Close the Source Units dialogue box by double-clicking the "-" in the upper left-hand corner of the dialogue box.
7. If an incorrect DUT connection is mistakenly designated, undesignate the connection as described in *Chapter 2, Removing Instrument/DUT Connections.*

Step 5D: Specify the Setup Configuration of the Instrument

The measurement configuration of the HP4284 is controlled from the HP4284 Setup dialogue box. The HP4284 Setup dialogue box is opened by clicking the instrument icon next to the "CMH" connection.

In this example, the HP4284 will source a 0.25V 100kHz signal while applying a voltage sweep across the emitter-base junction of an NPN bipolar transistor. The voltage bias will sweep from -0.3V to 0.6V and consist of 91 data points. The voltage sweep will slightly forward bias the junction for the first few measurements and then reverse bias the junction for the remainder of the sweep. Capacitance (Cibo) and bias voltage (Vrb) will be returned as data.

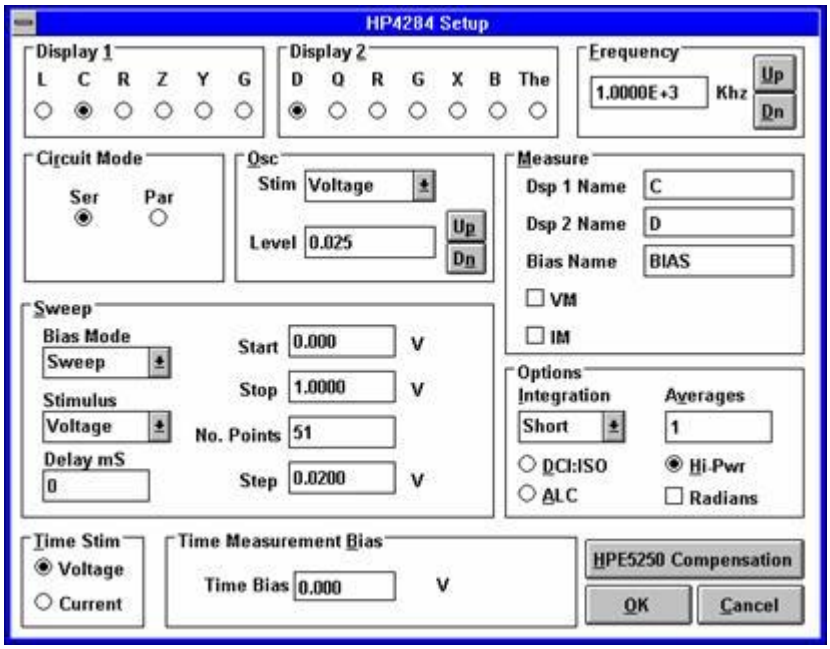


Figure 2: HP4284 Setup Configuration for the C_{ibo} Test Setup

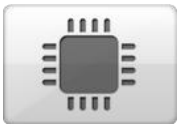
How to Specify the Instrument Setup Configuration:

1. Click once on the "CMH" instrument icon to open the HP4284 Setup dialogue box.
2. Configure the controls as shown in Figure 2. Use the mouse or TAB key to move between the different switches and fields.
3. Click OK to close the HP4284 Setup dialogue box.

Step 6: Insert the DUT into the Test Fixture

Insert the DUT into the test fixture sockets according to the DUT connections designated in the Setup Editor. For the C_{ibo} measurement described in this section, insert the emitter of an NPN bipolar transistor into the HP16047A HIGH socket. Insert the base into the LOW socket. Make certain the collector lead is open and not shorted to either of the test fixture connections.

Step 7: Execute the Measurement



Execute the test setup by clicking the toolbar MEASURE button and selecting desired measurement type from the measure remote control selections.

If the instrument has not been calibrated as described in Step 4, the HP4284 Calibrate dialogue box will be displayed in the center of the desktop. This is intended to remind the user that the instrument should be calibrated in order to compensate for the parasitic effects of the test fixture. If you choose not to calibrate the instrument, click the CLOSE button to continue with the measurement. If you wish to calibrate the instrument, follow the procedure presented earlier in *Step 4: Calibrating the Instrument.* After one or both of the calibration functions are performed, the Calibrate dialogue box will no longer be displayed each time the toolbar MEASURE button is selected.

Step 8: View the Results

Data is automatically written to the corresponding data window spreadsheet each time the measurement is executed. To display the numerical data, double-click on the white spreadsheet icon labeled Cibo at the bottom of the ICS desktop. The spreadsheet was created after the Cibo test setup name was specified in the Setup Editor, but it contained no data.

Data window spreadsheets are dynamically linked to the test setup. Each time the corresponding test setup is executed, the spreadsheet data is replaced with the most recently measured data. For this reason the data window spreadsheet is automatically named the same as the test setup.

Step 9: Create a Plot of the Results

A plot window is dynamically linked to a corresponding data window spreadsheet. This means that the plot is regenerated any time there is a change to the corresponding spreadsheet data. If the test setup is executed more than once, the plot window is regenerated after each measurement. If the data window spreadsheet is edited, the plot window is updated by clicking the REDRAW button at the top of the spreadsheet. Up to ten plots can be created from a single data window spreadsheet, and each plot can be independently formatted.

The steps below will show you how to create a plot of C_{ibo} with respect to the voltage sweep.

How to Create a Plot

1. If there is more than one defined test setup, designate the active test setup in one of two ways:
2. Click once on the appropriate data window spreadsheet icon. Clicking once on a data window spreadsheet icon will display a system menu. Ignore this display and proceed with Step 4.
3. Click the toolbar setup window arrow and select the desired setup from the displayed drop-down list.
4. Click the NEW PLOT toolbar button. This will open an empty plot window and the Plot Data dialogue box.
5. Designate the independent variable of the plot by double-clicking on the appropriate data vector listed in the Data window. Two quantities were measured in the C_{ibo} test setup: input capacitance and voltage. There should be two data vectors in the dialogue box Data window: "Cibo" and "Vrb" (according to the data vector labels specified in Figure 2). This example will create a plot of input capacitance with respect to the voltage sweep. Since voltage will be the independent variable, double-click on "Vrb". Notice that the X-button is now labeled with a "Vrb".
6. Designate a dependent variable by double-clicking the appropriate data vector in the dialogue box Data window. For this example, double-click on "Cibo". Notice that the Y1-button is now labeled with a "Cibo".
7. You could plot up to nine more data vectors with respect to the independent variable if more data vectors were measured. You can measure more than ten data vectors, but only ten data vectors can be plotted in a single plot window.
8. Click the dialogue box APPLY button. This will create the plot but will not close the Plot Data dialogue box.
9. Click the CLOSE button to close the Plot Data dialogue box.

Step 10: Save the Results into a Project File

A project file includes all of the information necessary to execute a test setup or group of test setups. A single project file includes: 1) the instrument driver selection, 2) any defined test setup(s), and 3) all of the data and plot windows associated with the test setup(s). For more information about project files, refer to *Chapter 1: How ICS Stores Information*.

The HP4284 Setup Dialogue Box

The HP4284 includes two sources: HIGH and LOW. These sources are designated as HP4284.CMH and HP4284.CML respectively in the Source Units dialogue box. HP4284.CMH is the source from which the HP4284 measurement configuration is specified. HP4284.CML is a ground reference.

The HP4284 measurement configuration is specified in the HP4284 Setup dialogue box. The HP4284 Setup dialogue box is opened by clicking the instrument icon displayed above the HP4284.CMH connection designated in the Setup Editor.

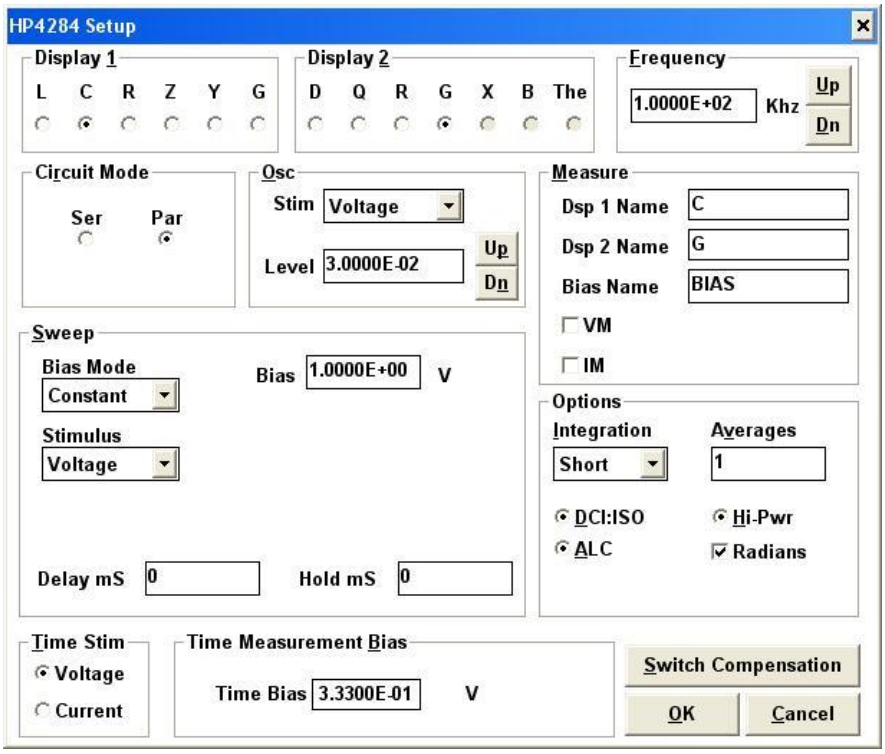


Figure 3: Layout of the HP4284 Setup Dialogue Box.

1. **Display A Controls:** The Display A controls are used to designate the primary component-parameter that will be measured by the instrument. The primary designation determines the availability of the secondary designations listed in Display B.

2. **Display B Controls:** The Display B controls are used to designate the secondary component-parameter that will be measured by the instrument. The availability of each secondary component-parameter is a function of both the primary designation and the circuit mode designation.

3. **Frequency Controls:** The Frequency controls are used to designate the frequency of the test signal.

4. **Circuit Mode Controls:** The Circuit Mode controls are used to select a series or parallel equivalent circuit.

5. **Oscillation Level Controls:** The Oscillation Level controls are used to specify stimulus type and the rms amplitude of the test signal.

6. **Measure Controls:** The Measure controls are used to designate the parameters, bias value, or bias value sweep that will be returned as data. The Measure controls also include the fields necessary to specify a label for each returned specification.

7. **Sweep Controls:** The Sweep controls are used to designate the configuration of the internal dc bias supply. ICS provides the capability to configure a constant bias or a staircase sweep bias. The staircase sweep configuration provided by ICS exceeds the functionality available with the HP4284 LIST SWEEP utility. ICS allows the user to define a dc bias sweep that consists of up to 2048 data points.

8. **Integration Field:** The Integration field is used to select among SHORT, MEDIUM, or LONG integration times. The integration time is the time required to perform the instrument's A-D conversion.

9. **Averaging Rate Field:** The Averaging Rate specifies the number of A-D conversions that will be averaged to obtain a single measurement. The Averaging Rate can be set from 1 to 256 in steps of 1.

10. **Automatic Level Control (ALC) Switch:** The ALC function implements a closed-loop feedback circuit that forces the test signal level at the DUT to the value designated with the oscillation controls.

11. **Bias Current Isolation (DCI:ISO) Switch:** The Bias Current Isolation function prevents the dc bias current from affecting the measurement input circuit. When the Bias Current Isolation switch is ON, the bias current through the device can be up to 100mA.

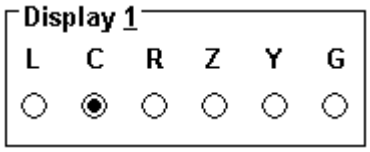
12. **Hi-Power Switch:** The Hi-Power switch allows you to turn ON or OFF Option 001. Option 001 is the Power Amplifier/DC Bias enhancement.

13. **Time Stimulus Switch:** The Time Stimulus Switch allows the user to select the type of stimulus to use during ICS Time measurements.

14. **Time Measurement Bias:** The Time Measurement Bias value indicates the source value to be used during ICS Time measurements.

15. **Switch Compensation:** The Switch Compensation button allows the user to setup C Compensation features through the HP E5250 or B220X switch matrix when measuring parallel C-G with the HP 4284.

Display A Controls

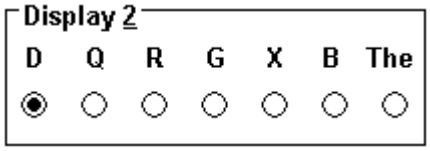


The Display A Controls are used to designate the primary component-parameter that will be measured by the instrument.

The parameter designated in Display A and the designated Circuit Mode option determine the availability of the secondary designations listed in Display B. The available combinations of primary, secondary, and circuit mode designations are described by the available HP4284 Measurement Functions. The HP4284 Measurement Function options are summarized in the HP4284 Operation Manual.

In an ICS environment, there is a distinction between measuring a designated parameter and returning the measured parameter as data. When a measured parameter is returned as data, the parameter measurement(s) will be written to a data window spreadsheet. When a parameter is selected in Display A or Display B, the instrument will be configured to measure the designated parameter only. To write the designated parameter to a data window spreadsheet, select the appropriate Measure switch.

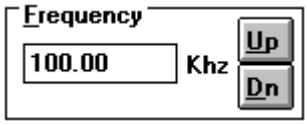
Display B Controls



The Display B controls are used to designate the secondary component-parameter that will be measured by the instrument. The availability of each secondary component-parameter is a function of the primary component-parameter designated in Display A as well as the designation selected in the Circuit Mode controls. To review the available combinations between primary, secondary, and circuit mode designations, refer to the HP4284A Operation Manual

In a ICS environment, there is a distinction between measuring a designated parameter and returning the measured parameter as data. When a measured parameter is returned as data, the parameter measurement(s) will be written to a data window spreadsheet. When a parameter is selected in Display A or Display B, the instrument will be configured to measure the designated parameter only. To write the designated parameter to a data window spreadsheet, select the appropriate Measure switch.

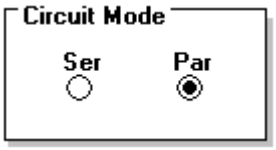
Frequency Controls



The Frequency controls are used to designate the frequency of the test signal. The HP4284 operates from 20Hz to 1MHz with 8610 frequency steps in between. To designate a frequency, click the DN and UP buttons as necessary.

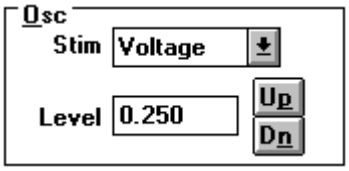
You can also specify a frequency by highlighting the present designation and entering a new value directly. When a frequency is specified this way, the instrument will select the available frequency that is nearest the designated value.

Circuit Mode Controls



The Circuit Mode controls are used to select a series or parallel equivalent circuit. The circuit mode designation, along with the designated primary component parameter, determines the availability of the secondary parameters listed in the Display B controls.

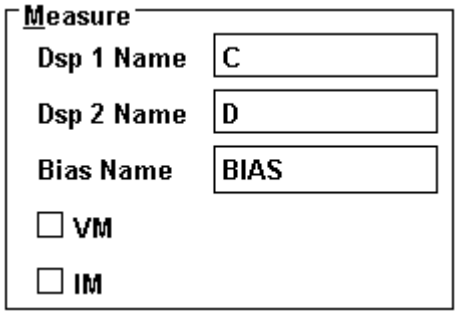
Oscillator Level Controls



The Oscillator Level controls are used to specify the stimulus type and rms amplitude of the test signal voltage.

Specify the amplitude using the UP and DN buttons. The amplitude can also be specified by highlighting the present designation and entering a new value directly. The available voltage ranges depend upon whether Option 001 is installed. The oscillator ranges and resolutions with and without Option 001 are presented in the HP4284 Operation Manual.

Measure Controls



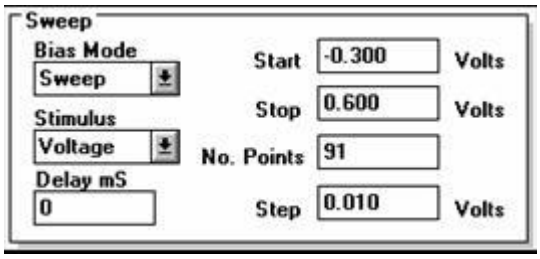
The Measure controls are used to designate the parameters that will be returned as data. The Measure controls also include the fields necessary to specify a label for each returned parameter.

In a ICS environment, there is a distinction between measuring a designated parameter and returning the measured parameter as data. When a measured parameter is returned as data, the parameter measurement(s) will be written to a data window spreadsheet. When a parameter is selected in Display A or Display B, the instrument will be configured to measure the designated parameter only. To write the designated parameter or bias value(s) to a data window spreadsheet, select the appropriate Measure switch.

Labeling Measured Data

All of the data that corresponds to a single curve or spot measurement is collectively referred to as a "data vector". Each data vector is identified by a "data vector label" that must be defined in the text field to the right of the DISPLAY A, DISPLAY B, or BIAS switch. A data vector label can be any alphanumeric string up to twelve characters in length.

Sweep Controls



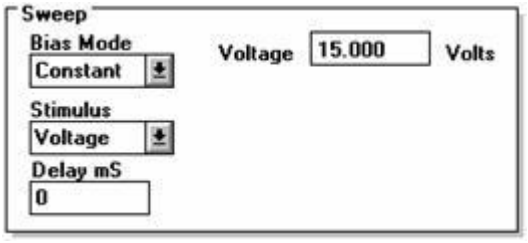
The Sweep controls are used to designate the configuration of the internal dc bias supply.

ICS provides the capability to generate characteristic curves in response to voltage or current bias sweeps. Under ICS control, the HP4284 can be configured to source a constant bias or a staircase sweep bias.

The staircase sweep enhancement provided by ICS exceeds the functionality available with the HP4284 LIST SWEEP utility. The LIST SWEEP utility allows the user to designate a 10-point sweep definition. Each test point must be manually specified by the user. ICS allows the user to define a bias sweep that consists of up to 2048 data points. A bias sweep is characterized by the START, STOP, NO. POINTS, and STEP size parameters. A bias sweep is fully defined when the user specifies three of the four sweep parameters.

Both voltage and current bias signals are supported. The frequency sweep capability and the capability to sweep the voltage/current oscillator-level are not presently supported by ICS.

Constant Mode

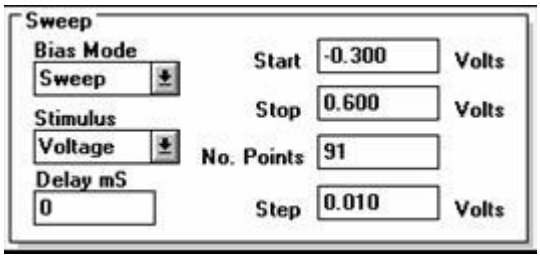


The Constant Mode sources a constant dc bias signal resulting in a single-point spot measurement.

How to Configure the HP4284 Bias Supply in Constant Mode

1. Select the "CONSTANT" option in the Bias Mode field. Click the scroll-arrow at the right end of the Bias Mode field to display the "CONSTANT" and "SWEEP" options. Click the "CONSTANT" designation.
2. Designate either a "VOLTAGE" or "CURRENT" bias stimulus. Click the scroll-arrow at the right end of the Stimulus field to display the two options. Click the appropriate designation.
3. Specify a bias signal amplitude in the amplitude field. Highlight the present value and specify a new value directly.
4. If desired, specify a trigger delay in the Delay field. The delay time can be set from 0s to 60s in 1ms steps. The value specified in the Delay field will be read as milliseconds.

Sweep Mode



The staircase sweep bias mode allows the user to generate parameter curves with the click of a single button. The staircase sweep enhancement provided by ICS exceeds the functionality available with the HP4284 LIST SWEEP utility.

The HP4284 LIST SWEEP utility is limited to a 10-point sweep definition and requires the user to specify each of the ten forcing values. Under ICS control, the HP4284 can be configured to source a staircase sweep bias signal consisting of up to 2048 data points. The sweep bias is fully defined by specifying three of the four sweep parameters: START, STOP, NO. POINTS, and STEP size.

How to Configure the HP4284 Bias Supply in Sweep Mode

1. Select the "SWEEP" option in the Bias Mode field. Click the scroll-arrow at the right end of the Bias Mode field to display the "CONSTANT" and "SWEEP" options. Click the "SWEEP" designation. Selecting the SWEEP designation will display a set of definition fields specific to the bias sweep mode.
2. Designate either a "VOLTAGE" or "CURRENT" bias stimulus. Click the scroll-arrow at the right end of the Stimulus field to display the two options. Click the appropriate designation.
3. Specify the starting value of the bias signal in the START field. Highlight the present value and specify a new value directly.
4. Press the TAB key once or use the mouse to advance to the STOP field. If desired, specify a stop value for the bias sweep. If the STEP size field is specified by the user, or if any other field is edited by the user after the bias sweep is fully defined, the STOP field will be updated automatically to accommodate the change.
5. Press the TAB key once or use the mouse to advance to the NO. POINTS field. Specify the number of data points that will comprise the bias sweep signal. The data point quantity is also the number of measurements the resultant parameter curve will consist of.

6. If necessary, hit the TAB key once or use the mouse to advance to the STEP size field. The STEP size designates the magnitude by which the bias signal will be incremented as it steps through the sweep. If the START, STOP, and NO. POINTS fields have been designated, the STEP size field will be calculated automatically.
7. If desired, specify a trigger delay in the Delay field. The delay time can be set from 0s to 60s in 1ms steps. The value specified in the Delay field will be read as milliseconds.

Delay

The Delay Time function allows you to designate a trigger delay. A trigger delay is the length of time the HP4284 will wait before executing a measurement after the instrument has been triggered from the ICS toolbar. The delay value must be specified in milliseconds and can range from 0s to 60s in 1ms steps. For more information about the HP4284 Delay Time function, refer to the HP4284 Operation Manual.

Integration Field

The Integration field is used to select among SHORT, MEDIUM, or LONG integration times. The HP4284 uses an integrating A-D converter to convert the analog signal to a digital signal. The integration time is the time required to perform the instrument's A-D conversion. Generally, a longer conversion time will provide more stable and accurate measurements. The integration time, averaging rate, and delay time determine the overall measurement time for the HP4284. For more information about integration time, refer to the HP4284 Operation Manual.

To designate an integration time, click the scroll arrow at the right end of the Integration field. This will display the "SHORT", "MEDIUM", and "LONG" options. Click the desired designation. As a default, the integration time will be configured in SHORT mode.

Averaging Rate Field

The averaging rate specifies the number of A-D conversions that will be averaged to obtain a single measurement. A higher averaging rate will result in a more accurate measurement but a longer measurement time. The averaging rate can be set from 1 to 256 in steps of 1. For more information about the averaging rate, refer to the HP4284 Operation Manual.

To designate an averaging rate, highlight the present designation and specify a new value. As a default, the averaging rate will be set to "1".

Automatic Level Control (ALC) Switch

The ALC function implements a closed-loop feedback circuit that forces the test signal level at the DUT to the level designated with the oscillation controls. This capability eliminates any unwanted test signal variations as seen by the DUT. The ALC function limits the range of the oscillator level. Refer to the HP4284 Operation Manual for a presentation of the oscillator level range available with the use of the ALC function.

Bias Current Isolation (DCI:ISO) Switch

The Bias Current Isolation function prevents the dc bias current from affecting the measurement input circuit. When the Bias Current Isolation switch is ON, the bias current through the device can be up to 100mA. When the Bias Current Isolation switch is OFF, the bias current through the device is limited to the values listed in the HP4284 Operation Manual. For more information about the Bias Current Isolation function refer to the same source.

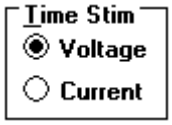
Hi-Power Switch

The Hi-Power switch allows you to turn ON or OFF Option 001. Option 001 is the Power Amplifier/DC Bias enhancement. If Option 001 is installed and the Hi-Power switch is ON, the test signal voltage amplitude can be varied from $5mV_{rms}$ to $20V_{rms}$, and the dc bias can be set up to 40V. Turning the Hi-Power switch OFF disables the added capability of Option 001. When the Hi-Power switch is OFF, the test signal voltage amplitude is limited to a range of $5mV_{rms}$ to $2V_{rms}$, and the dc bias is limited to 0V, 1.5V, or 2.0V.

Radians Switch

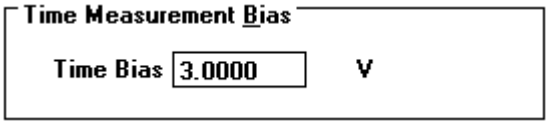
The Radians switch allows the user to switch between Theta being measured in radians when checked or in degrees when unchecked.

Time Stimulus Switch



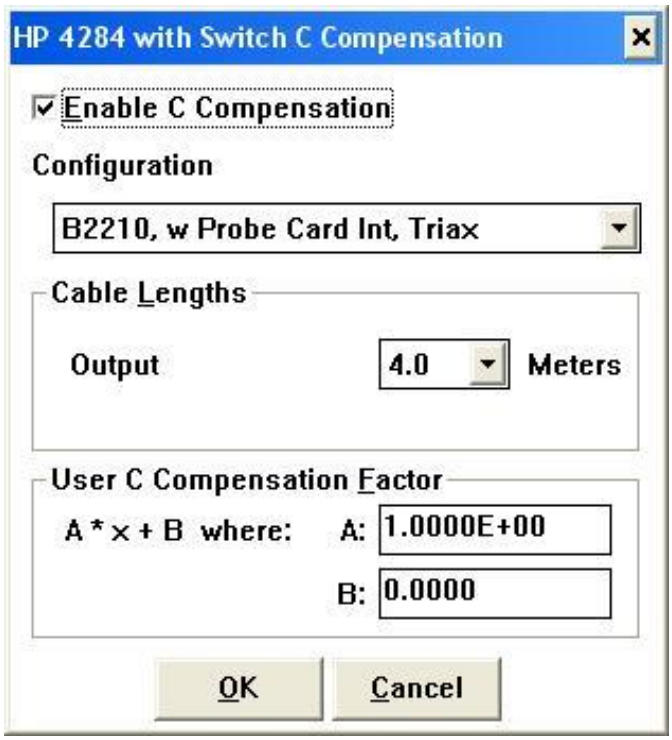
The Time Stimulus Switch allows the user to select the type of stimulus to use during ICS Time measurements.

Time Measurement Bias



The Time Measurement Bias value indicates the source value to be used during ICS Time measurements.

Switch Compensation



Turning the Switch Compensation on allows the user to setup C Compensation features through the HP E5250 or B220X switch matrix when measuring parallel C-G with the HP 4284. The Switch Compensation Model is only valid when used in the Compensation Model Environment.

Compensation Model

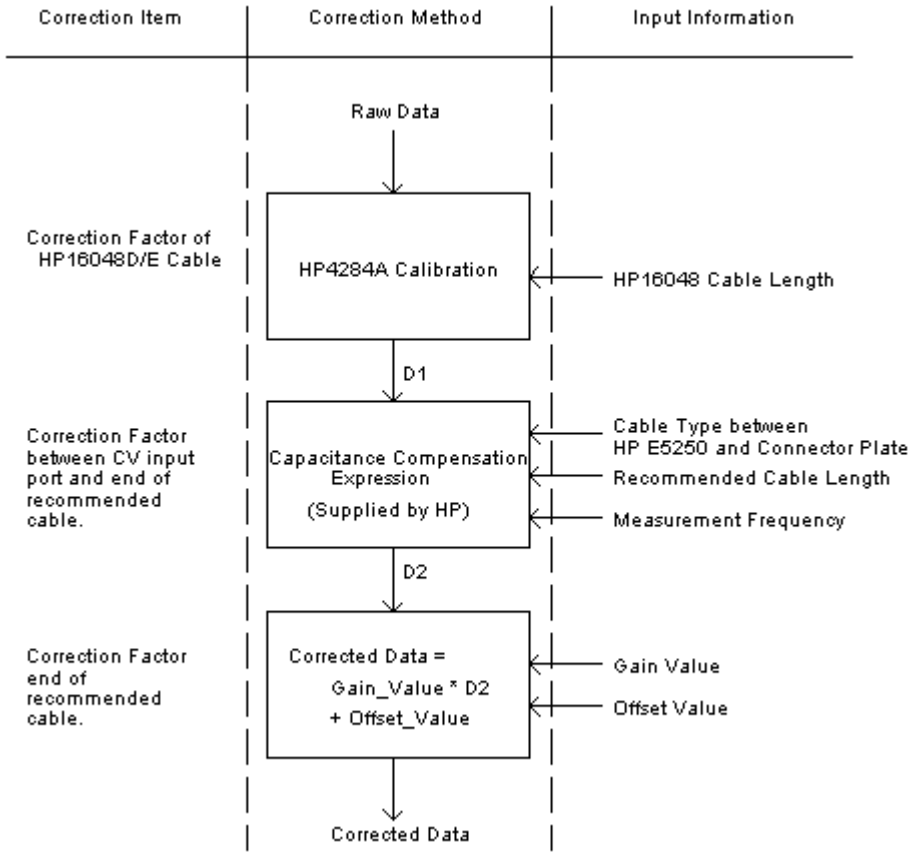


Figure 4: HP Switch Compensation Model.

Configuring Switch Compensation

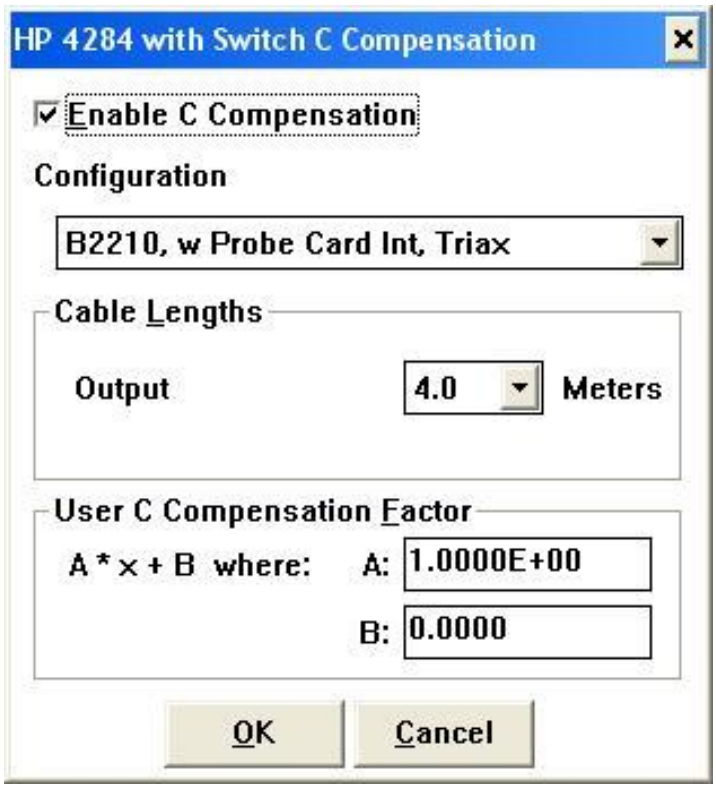


Figure 5: How to Configure Switch C Compensation.

How to Configure Switch Compensation:

1. Open the Switch Compensation dialogue box by clicking the Switch Compensation button from the CMH setup dialog.
2. Enable the Compensation feature by checking the Enable C Compensation box.
3. Select the Switch Card Type, Interface Type, and Cable Type combination that matches your system from the pull-down list.
4. Select the cable length for the cables connected from the HP E5250 or B220X outputs to the probes.
5. Input the user Compensation factors in the A and B fields.
6. Press the OK button to complete the configuration.

Acquiring User Compensation Coefficients

User Compensation may be used to correct for Probe Cards, Device Sockets, and other connectors used after the coax cables.

How to Acquire User Compensation Coefficients:

1. Setup the Capacitance measurement conditions in the HP 4284 with Switch Compensation enabled using the default A and B factors.
2. Setup measurement path through the Switch from the Device Connections Application of I/CV.
3. Remove the device on the test fixture and measure the capacitance value with the default A and B factors.
4. Attach a device with a known capacitance value and measure the capacitance with the default A and B factors.
5. Calculate the A and B factors:

A = <known cap value> / (<measured value from #4> - <measured value from #3>)

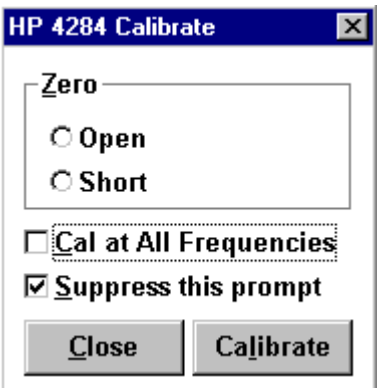
B = -1 * <known cap value> * <measured value from #3> / (<measured value from #4> - <measured value from #3>)

Using Switch C Compensation with the HP 4284

How to Perform a Corrected Measurement:

1. Setup the Capacitance measurement conditions in the HP 4284 with Switch Compensation enabled and configured.
2. Use the HP 4284 Calibration dialog to calibrate the HP 4284 to correct for the cables connected between the HP 4284 and the Agilent (HP) switch matrix.
3. Setup measurement path through the Switch matrix from the Device Connections Editor.
4. Perform the measurement. Corrected C data will be displayed in the data sheet.

The HP4284 Calibration Dialogue Box



The parasitic effects of the test fixture or test leads introduce device measurement inaccuracies. To eliminate this problem, the HP4284 includes three calibration functions that compensate for the LCR characteristics inherent to the test fixture or leads: Open Correction, Short Correction, and Load Correction. ICS supports the Open and Short functions; the Load function is not presently supported.

The Open function cancels errors due to the stray admittance in parallel with the device under test. The Short function corrects for the residual impedance in series with the device under test.

The calibration functions are controlled from the Calibration dialogue box. The Calibration dialogue box can be displayed by clicking the Setup Editor OPTIONS button.

If a test setup is executed without first calibrating the instrument, ICS will display the Calibrate dialogue box as a reminder that the instrument is uncalibrated. If you wish to calibrate the instrument, follow the procedure on the following page. After one of the calibration functions is performed, the calibration prompt will no longer be displayed for the current session of ICS. If you do not wish to calibrate the instrument, click the CLOSE button and the instrument will execute the measurement. If desired, select the Suppress switch before closing the Calibrate dialogue box to suppress any future appearance of the calibration prompt (see *Suppressing the Calibration Prompt* later in this chapter). This feature provides for the use of an uncalibrated instrument without the need to acknowledge the calibration prompt every time a measurement is executed.

Each calibration function must be performed individually. You cannot perform more than one calibration method at a time. To perform a calibration function, designate the desired calibration method by selecting the corresponding switch. Click the CALIBRATE button. The Calibrate dialogue box will remain displayed throughout the calibration process. After the calibration method is complete, the corresponding switch will remain selected as an indication that the calibration method was performed. The calibration switch will remain selected throughout the current session of ICS or until the HP4284 driver is disconnected.

The HP4284 Open and Short calibration methods generate correction data in one of two ways: 1) Correction data is measured at 48 preset frequencies. The correction factor applied to a specific measurement point is calculated by interpolating between the correction measurements obtained at the two nearest preset frequencies. 2) Correction data is measured directly at up to three frequency points specified by the user. ICS supports the first method: measuring the correction data at the 48 preset frequencies and interpolating the correction factor at the measured frequency.

How to Calibrate HP4284:

1. Open the Calibrate dialogue box by clicking the Setup Editor OPTIONS button. The dialogue box will be displayed automatically if the instrument was actuated without being calibrated.
2. If you wish to perform the Open function, make certain that there is no device inserted in the test fixture. If you wish to perform the Short function, short the test fixture HIGH/LOW terminals. Select the desired switch and click the CALIBRATE button. The Calibrate dialogue box will remain displayed while the calibration function is performed. The designated switch will remain selected after the calibration function is completed.
3. If desired, execute the remaining function.
4. The instrument is successfully calibrated. At the end of each calibration function, ICS will automatically configure the instrument to enable the correction calculations for subsequent measurements. Click the CLOSE button to restore control to the Setup Editor. If you calibrated the instrument after initiating the measurement, the instrument will automatically continue with the measurement after the CLOSE button is selected.

Suppressing the Calibration Prompt

If the user selects the toolbar MEASURE button without first calibrating the instrument, ICS will display the Calibrate dialogue box as a reminder to the user that the instrument is uncalibrated. If you wish to continue testing without calibrating the instrument, select the Suppress switch in the Calibrate dialogue box. This feature will suppress any future calibration prompt.

When the Suppress switch is selected, the suppression of the calibration prompt is applied to every test setup in the project file. However, the suppression option will not be preserved if ICS is closed or the HP4284 driver is unloaded.

If the HP4284 is used in a time domain test setup, the calibration prompt will be suppressed automatically while executing the time domain measurement (refer to Chapter 2, Creating a Time Domain Test Setup). If a time domain test setup is included in a test sequence, the calibration prompt will be suppressed while executing the time domain measurement but not during any of the static measurements. The status of the calibration prompt during the static test setups is determined by the position of the Suppress switch in the Calibrate dialogue box.