Metrics ICS Driver Manual

HP4142

Metrics ICS

Version 4.5

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The HP4142 Instrument Driver

Getting Started: Creating and Executing a Test Setup

The Agilent (HP) 4142 DC Source/Monitor Unit is a high performance DC parametric measurement instrument. The HP4142 is composed of up to eight user-selected plug-in modules. The following HP4142 modules are supported by Interactive Characterization Software (ICS):

1. HP41420A High-Power SMU
2. HP41421B Medium-Power SMU
3. HP41422A High-Current SMU
4. HP41423A High-Voltage SMU
5. HP41424A High-Voltage Source/Voltage Monitor Unit (VS/VMU).

The HP41425A Analog Feedback Unit (AFU) and the current measuring mode of the HP41424A VS/VMU are not supported.

This section will walk you through the steps required to create and execute a test setup that measures diode turn-on voltage using the HP4142 DC Source/Monitor Unit. This is simple measurement, but it will provide you with a general understanding of how ICS and the HP4142 are used to measure device characteristics.

Step 1: Cable the Hardware Connections

Cable all the necessary connections between the instrument source units and the test fixture. Connect the required jumpers between the test fixture sockets and personality board. The hardware connections configured in this step will be designated later in ICS' graphic workspace.

The test setup example presented in this section was executed using the HP4142B DC Source/Monitor Unit along with the HP16058A-60003 Personality Board and the HP16058-60005 Socket Board. A schematic of the hardware arrangement is shown below.

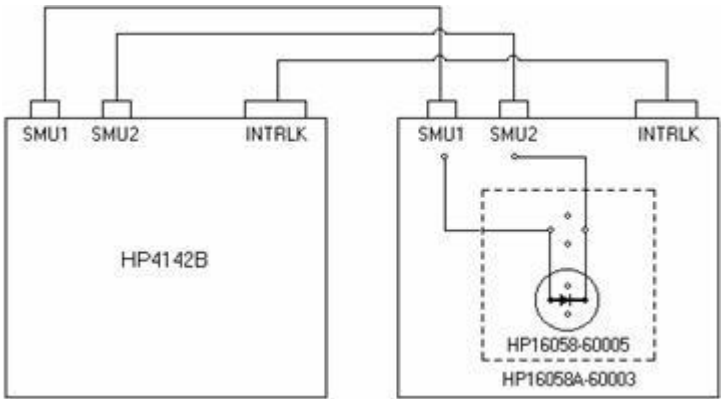
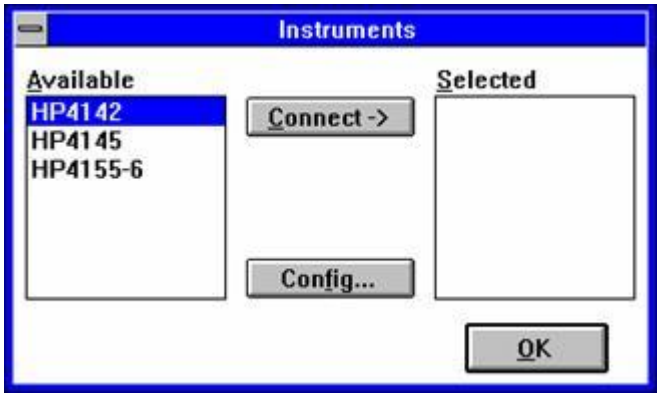


Figure 1: A Schematic of the Hardware Arrangement Used to Measure V_{ON} for an NP Diode.

Step 2: Connect the HP4142 Instrument Driver



The HP4142 Driver is connected using the Connect Instruments dialogue box accessed from the measurement mode menu bar.

How to Connect the HP4142 Driver:

1. Click the CONNECT INSTRUMENTS toolbar button or select INSTRUMENTS/SELECT INSTRUMENT from the ICS measurement mode menu bar. This will open the Connect Instruments dialogue box.
2. Highlight the HP4142 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: Specify the GPIB Address and the Plug-In Module Identities

The HP4142 must be connected to your computer with the use of a standard IEEE-488 GPIB. Please refer to Chapter 1 of the HP4142B Operation Manual to review the cable length limitations specified by Hewlett-Packard. The GPIB address and the plug-in module identities are specified in the HP4142 Configuration dialogue box.

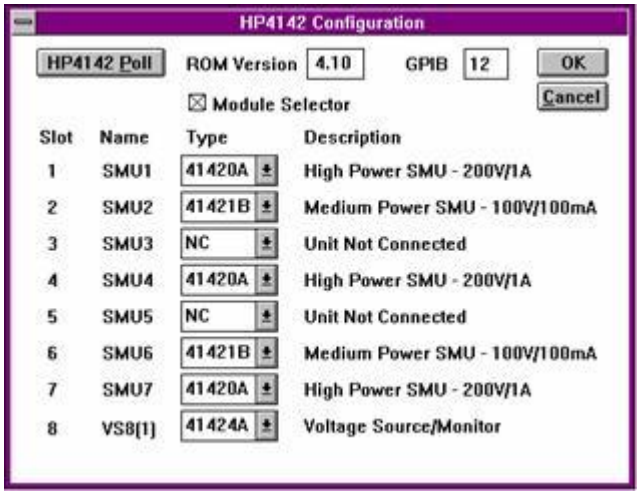


Figure 2: The HP4142 Configuration Dialogue Box

How to Automatically Configure the HP4142 Module Identities:

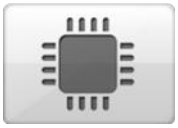
1. If the Connect Instruments dialogue box is no longer displayed from Step 2, click the toolbar CONNECT INSTRUMENTS button or select INSTRUMENT/SELECT INSTRUMENTS from the measurement mode menu bar.
2. Open the HP4142 Configuration dialogue box by clicking the CONFIG button at the bottom of the Connect Instruments dialogue box.
3. Designate the instrument GPIB address in the GPIB field. Determine the GPIB address of the instrument by viewing the HP-IB Address Switch on the instrument's back panel. The HP4142 leaves the factory with the HP-IB Address Switch set to 17. If you wish to change the GPIB setting, please refer to Chapter 1 of the HP4142B Operation Manual.
4. The eight source unit fields displayed in the Configuration dialogue box correspond to the eight module slots in the HP4142 mainframe. Each source unit field is referenced by a label displayed in the "Name" column. Each field label identifies the function and slot position of the corresponding module; for example, "SMU1", "SMU2", etc.

5. Each source unit field identifies the model number of the instrument module installed at the corresponding mainframe slot. Designate the module identities of all eight source unit fields by clicking the POLL button located in the left-hand corner of the dialogue box. Clicking the POLL button interrogates the instrument and automatically identifies the modules installed at each slot position (for example, "41421B") and designates each field label according to the function and slot position of the installed hardware (for example, "SMU1").
6. Any source unit field corresponding to an unoccupied HP4142 slot will be designated with an "NC". "NC" stands for "Not Connected". Please note that modules requiring two slots are controlled through the right-most slot. For example, if an HP41420A High-Power SMU is installed into Slots #3 and #4, Slot #3 will be designated as "NC", and Slot #4 will be designated with the module identity.
7. Click the OK button located at the bottom of the dialogue box. This will close the Configuration dialogue box. Click the OK button in the upper right-hand corner of the Connect Instrument dialogue box to restore control to the ICS desktop.

The module identity of each source unit field listed in the HP4142 Configuration dialogue box can be designated manually. Manual designation is necessary if there is no instrument connected to the other end of the GPIB cable. To manually designate the Configuration dialogue box, refer to *The HP4142 Configuration Dialogue Box, Configuring Module Identities Manually* later in this chapter.

Step 4: Create the Test Setup

Test setups are created in the Setup Editor. Open the Setup Editor by selecting the SETUP EDITOR toolbar button. In this example, we will create a test setup that measures the forward current of an NP diode with respect to a forward voltage sweep.



Click the corresponding toolbar button to display the Setup Editor.

Step 4A: 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 "DiodeOn".
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 4B: Select a Device Schematic Corresponding to the DUT

A device schematic is located at the center of the Setup Editor. The device schematic is designed to provide a graphic image of the test fixture socket.

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 diode schematic. The MOSFET device is the default Setup Editor schematic. To change the default device schematic, refer to *Chapter 2: The Setup Editor, Selecting a Device Schematic of the ICS Technical Reference Guide*.

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 DIODE. Notice the selected schematic is previewed in the small window to the right of the Device Type window.
3. Some device schematics will display a set of polarity switches when selected. Select the "NP" designation for this example.
4. Click OK. This will close the Device dialogue box and display the diode schematic at the center of the Setup Editor.

Step 4C: Designate the Source Unit/DUT Connections

The Source Unit/DUT connections are designated in the Setup Editor. The Setup Editor display is provided as a tool to document the hardware connections required for the corresponding device measurement. The Source Unit/DUT connections designated in the Setup Editor are a graphic representation of the physical connections between the instrument and the test fixture personality board. The connections designated in the Setup Editor must correspond to the reality of your hardware arrangement.

The Setup Editor displays a device schematic representing the DUT. Connections are designated by first clicking one of the available source units listed in the Source Units dialogue box. After the source unit is selected, click the blue pad next to one of the device schematic pins. Select the blue pad corresponding to the DUT pin that the source unit will be physically connected to. An instrument icon, along with the name of the connected source unit, will appear above the device schematic pin as a means of indicating the connection. This example will show how to connect a medium power SMU to both ends of an NP diode.

How to Designate the Source Unit/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 a list of instrument modules installed in the HP4142 and designated in *Step 3: Specify the GPIB Address and Plug-In Module Identities*.
3. Click on a module designation corresponding to an HP41421B Medium Power SMU. This test setup example was created with an HP41421B that was designated "SMU1".

4. Designate the Source Unit/DUT connection by clicking on the blue pad corresponding to the appropriate device schematic location. For this example, connect the HP41421B to the diode anode by clicking on the corresponding blue pad.
5. Repeat this process for each source connected to the DUT. For this example, select a second HP41421B designation and connect it to the cathode.
6. After all of the Source Unit/DUT connections are designated, close the Source Units dialogue box by double-clicking the "-" in the upper left-hand corner of the dialogue box.
7. If an incorrect Source Unit/DUT connection is mistakenly designated, undesignate the connection as described in *Chapter 2, Removing Instrument/DUT Connections*.

Step 4D: Specify the Source/Measure Configuration of Each Source

Every available source has its own Source Unit Setup dialogue box. This Source Unit Setup dialogue box is used to specify the source/measure configuration of the respective module. Once a Source Unit/DUT connection is designated, the corresponding Source Unit Setup dialogue box is opened by clicking on the instrument icon displayed above the respective device schematic location.

In this example, SMU1 (connected to the anode) will source a linear voltage sweep. The sweep will start at 0.0V and stop at 1.0V and consist of 51 data points. SMU1 will measure voltage (V) and current (I). SMU2 (connected to the cathode) will source a constant voltage of 0.0V and will not measure anything.

How to Specify the Source/Measure Configuration of Each Source:

1. Click once on one of the displayed instrument icons to open the Source Unit Setup dialogue box corresponding to the connected SMU.
2. Configure the SMU1 controls as shown in Figure 3. Configure the SMU2 controls as shown in Figure 4. Use the mouse or TAB key to move between the different switches and fields in each Source Unit Setup dialogue box.
3. Click OK to close a Source Unit Setup dialogue box. Only one Source Unit Setup dialogue box can be opened at a time.

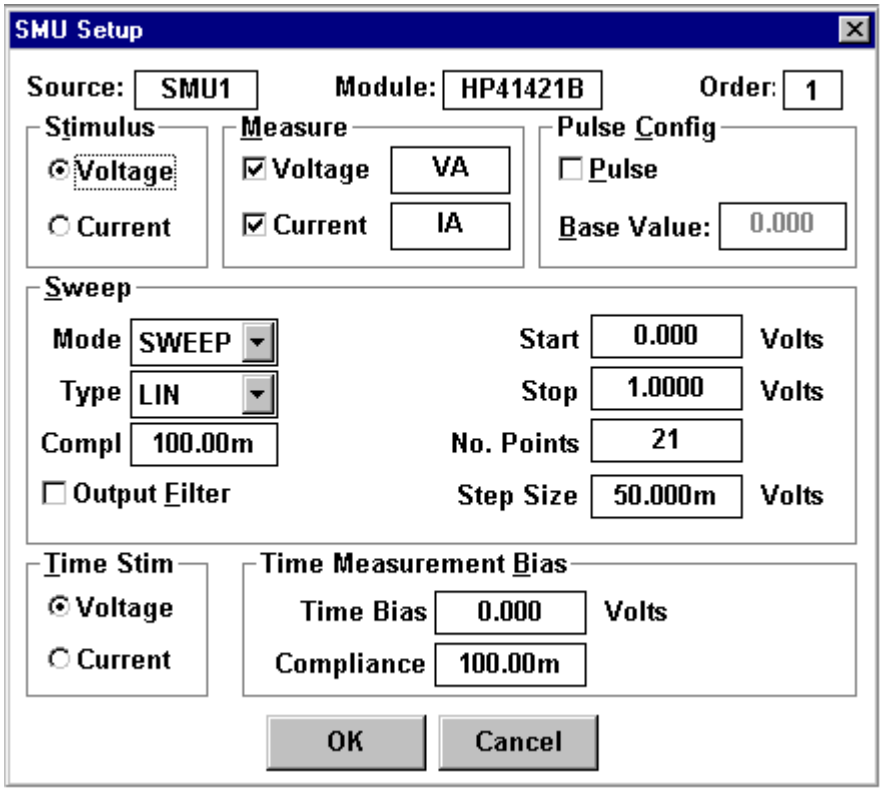


Figure 3: SMU1 Source/Measure Configuration for the DiodeOn Test Setup

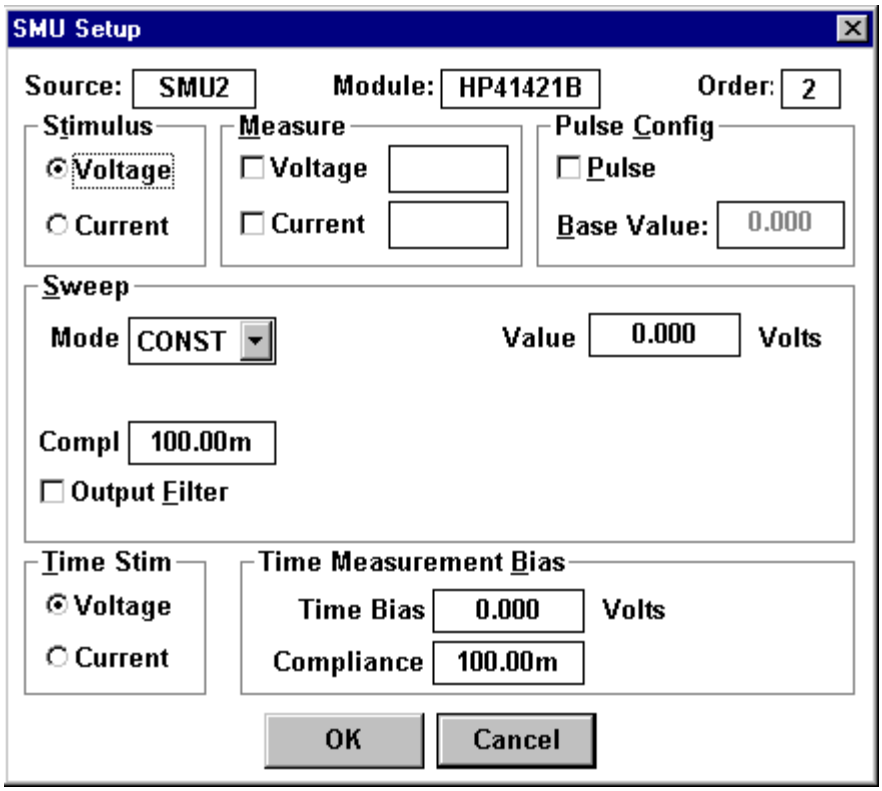


Figure 4: SMU2 Source/Measure Configuration for the DiodeOn Test Setup

Step 5: Insert the DUT Into the Test Fixture

Insert the DUT into the test fixture personality board according to the Source Unit/DUT connections designated in the Setup Editor.

Step 6: Execute the Measurement

Execute the DiodeOn test setup by clicking the toolbar MEASURE button. Shortly after the measurement is in process, a message will appear on your screen telling you that the test setup is being executed.

After a few moments another message will be displayed telling you that SMU1 reached compliance. Click IGNORE to complete the measurement.

Step 7: View the Results

Data is automatically generated in the corresponding data window spreadsheet each time the measurement is executed. To display the numerical data, double-click on the white spreadsheet icon labeled "DiodeOn" at the bottom of the ICS desktop. The spreadsheet existed before you executed the measurement, 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 8: 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 diode current with respect to the forward voltage sweep. This plot will correspond to the DiodeOn data.

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:
    a. Click once on the appropriate data window spreadsheet icon (the data window can be either displayed or minimized).
    b. Click the toolbar setup window arrow and select the desired setup from the displayed drop-down list.
2. Click the NEW PLOT toolbar button. This will open an empty plot window and the Plot Data dialogue box.

3. Designate the independent variable of the plot by double-clicking on the appropriate data vector listed in the Data window. Only two quantities were measured in the DiodeOn test setup, voltage and current. There should be two data vectors in the dialogue box Data window: "V" and "I". This example will create a plot of current with respect to voltage. Since voltage will be the independent variable, double-click on "V". Notice that the X-button is now labeled with a "V".
4. Designate the first dependent variable of the plot (in our case the only dependent variable) by double-clicking the appropriate data vector in the dialogue box Data window. For this example, double-click on the "I". Notice that the Y1-button is now labeled with an "I".
5. 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.
6. Click the dialogue box APPLY button. This will create the plot but will not close the Plot Data dialogue box. You should notice that at about 0.6V the diode turned on.
7. Click the CLOSE button to close the Plot Data dialogue box.

Step 9: 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*.

How to Save Your Work

1. Click the SAVE AS toolbar button or select FILE/SAVE AS... from the menu bar. This will open the File Save Dialog.
2. Select a directory and filename. Click Save.

The HP4142 Configuration Dialogue Box

The HP4142 Configuration dialogue box identifies the instrument GPIB address and the model number and position of each plug-in module installed in the HP4142 mainframe.

The HP4142 Driver must be connected to ICS before the Configuration dialogue box can be opened. If necessary, refer to *Step #2, Connecting the HP4142 Instrument Driver*. After connecting the HP4142 Driver, the HP4142 Configuration dialogue box can be opened from the Connect Instruments dialogue box.

Open the Connect Instruments dialogue box by clicking the corresponding toolbar button. Open the HP4142 Configuration dialogue box from the Connect Instruments dialogue box by clicking the Connect Instruments CONFIG button.

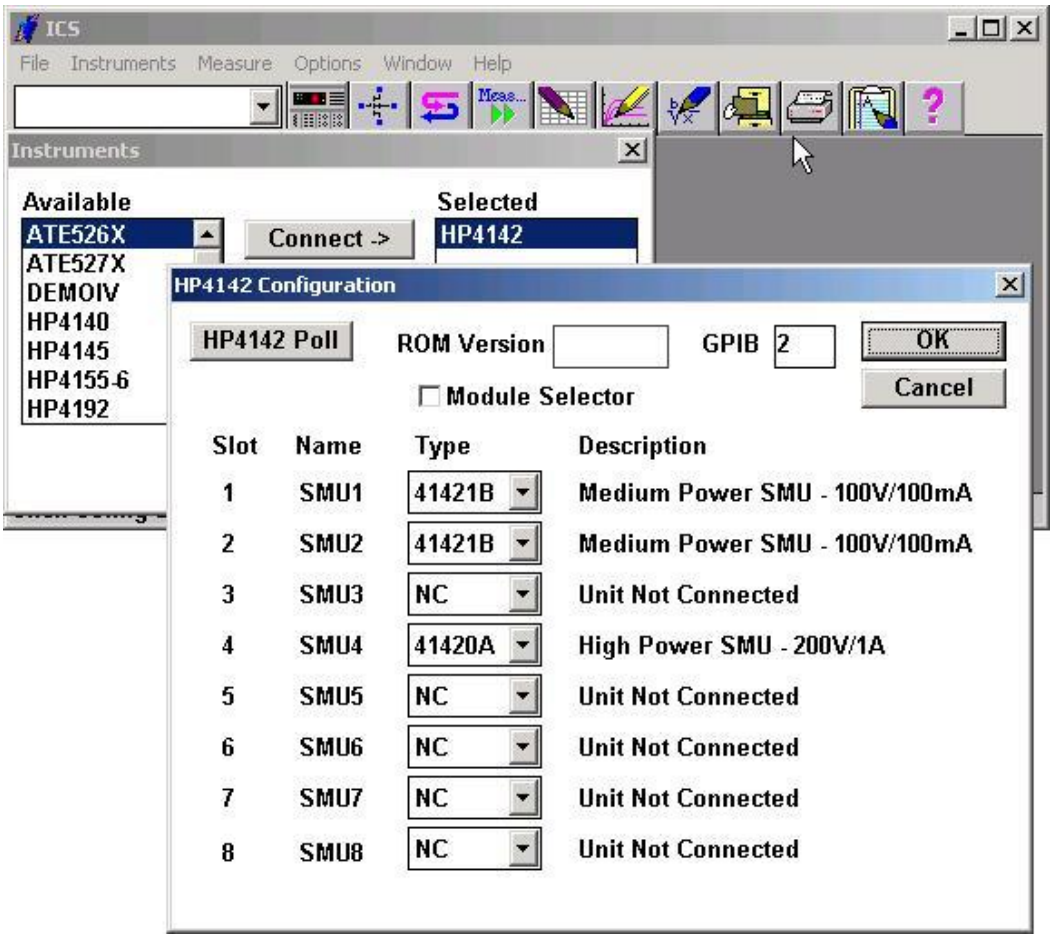


Figure 5: Open the HP4142 Configuration Dialogue Box from the Connect Instruments Dialogue Box.

Source Unit Fields and Labels

The HP4142 Configuration dialogue box includes eight source unit fields corresponding to the eight slots available in the HP4142 mainframe. Each source unit field is used to identify the hardware installed at the corresponding mainframe slot. When a user designates source units later in the application, each instrument module will be identified by the corresponding "SMU" or "VS" label designated in the "Name" column of the HP4142 Configuration dialogue box. Instrument modules are identified by "SMU" or "VS" labels instead of the model numbers configured in the source unit fields. This eliminates confusion when two or more identical modules are installed in the HP4142.

Configuring the Instrument GPIB Address and Module Identities

When designating the HP4142 Configuration dialogue box, the user must be certain that the specified configuration agrees with the physical installation of the hardware modules. For example, if an HP41421B Medium Power SMU is installed in the first mainframe slot, then the "41421B" designation must be configured in the first source unit field. The mainframe slot position corresponding to each source unit field is identified in the dialogue box "Slot" column. Since this slot holds an SMU (as opposed to a VSU or AFU), it will be labeled "SMU1". The numerical component of each field label corresponds to the slot identity and not the order in which the particular module type appears in the mainframe. For example, if a VSU is installed in Slot #1, and an SMU is installed in Slot #2, Slot #2 will be labeled "SMU2" even though this is the first SMU module encountered from left to right.

The HP4142 Configuration dialogue box is most easily configured by first designating the instrument GPIB address and then clicking the POLL button at the top of the dialogue box. The POLL function interrogates the instrument and automatically identifies the modules installed at each slot position (for example, "HP41421B") and designates the name of each field according to the installed hardware (for example, "SMU1"). Alternatively, the user may choose to manually designate the Configuration dialogue box. The HP4142 Configuration dialogue box must be manually designated if there are no instruments connected to the other end of the GPIB cable. This situation occurs when test setups are created on a copy of ICS other than the copy that will be used to execute the testing.

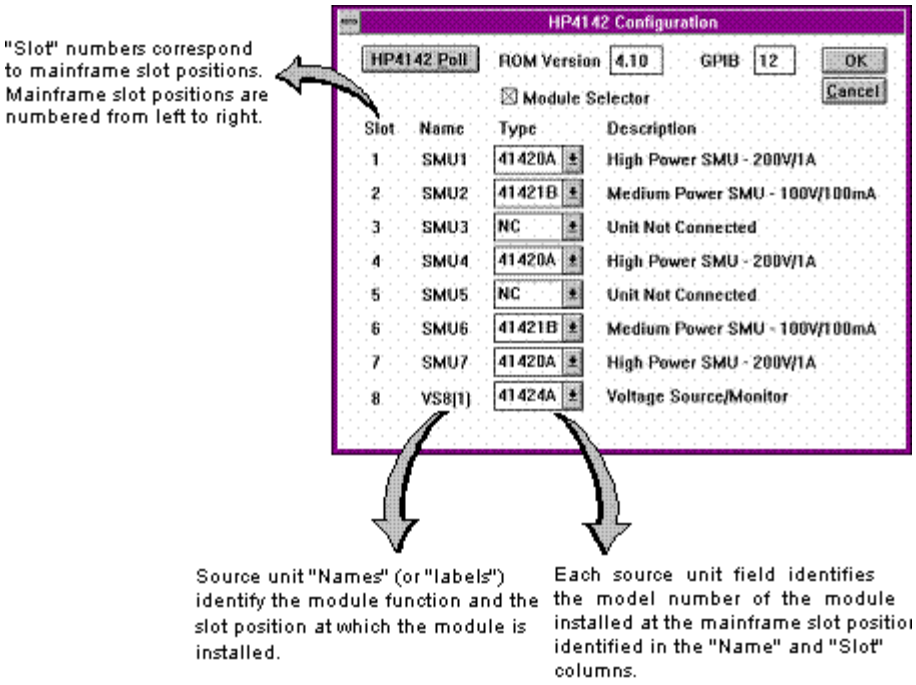


Figure 6: The HP4142 Configuration Dialogue Box.

Any source unit field corresponding to an unoccupied mainframe slot must be designated with the "NC" selection. "NC" stands for "Not Connected". Modules requiring two slots are controlled through the right-most slot. For example, if an HP41420A High-Power SMU is installed in Slots #3 and #4, Slot #3 will be designated as "NC", and Slot #4 will be designated with the module identity.

Configuring Module Identities Automatically

The HP4142 Driver includes a Poll function that will automatically arrange the HP4142 Configuration dialogue box. Arranging the Configuration dialogue box with the POLL button is faster than arranging the box manually. The Poll function is activated by first designating the instrument GPIB address and then clicking the POLL button at the top of the dialogue box. The POLL function interrogates the instrument and automatically identifies the modules installed at each slot position and designates the name of each field according to the installed hardware. Empty mainframe slots will be designated as "NC" (Not Connected).

Polling Errors and Warnings

ICS will display a short sequence of error messages if the GPIB card times-out after attempting to locate the instrument on the GPIB bus. (The time-out limit is designated in the GPIB Setup dialogue box. The GPIB Setup dialogue box is opened by selecting INSTRUMENTS/GPIB SETUP from the measurement mode menu bar.) The GPIB card will time-out if the instrument is OFF or if the instrument is not connected to the GPIB cable. If the instrument is connected to your computer through a daisy-chain of GPIB cable connections, each instrument in the cable path must be turned ON.

Configuring Module Identities Manually

It is not necessary for the user to select the Poll function when designating the HP4142 Configuration dialogue box. The user has the option of designating the HP4142 Configuration dialogue box by manually specifying each source unit field. The HP4142 Configuration dialogue box must be manually designated if there is no instrument connected to the other end of the GPIB cable. This situation occurs when test setups are created on a copy of ICS other than the copy that will be used to execute the testing.

To manually specify a source unit field, click on the scroll arrow at the end of the field to display a list of possible model number designations. Click once on the desired option. The selected model number must identify the module that is installed at the respective mainframe slot in order to execute measurements correctly. Use the TAB key to advance to each consecutive source unit field.

Note: Manually specifying each source unit field will not update the field name until the HP4142 Configuration dialogue box is closed.

How to Manually Configure the HP4142 Module Identities:

1. Open the HP4142 Configuration dialogue box by clicking the CONFIG button at the bottom of the Connect Instruments dialogue box. If necessary, click the toolbar CONNECT INSTRUMENTS button or select INSTRUMENT\SELECT INSTRUMENTS to open the Connect Instruments dialogue box.
2. Designate the instrument GPIB address in the GPIB field. The HP4142 leaves the factory with the GPIB address set to 17.
3. The HP4142 Configuration dialogue box includes eight source unit fields. Each source unit field corresponds to a mainframe slot position. The mainframe slot positions are numbered from left to right. The slot position corresponding to each source unit field is identified in the dialogue box "Slot" column. Identify the module installed at each of the eight mainframe positions. Click the scroll arrow at the right of each field to display a list of available model numbers. Click on the desired designation.
4. Designate each source unit field corresponding to an empty mainframe slot with the "NC" selection. "NC" stands for "Not Connected".
5. Click the OK button to close the HP4142 Configuration dialogue box. Click the OK button in the Connect Instruments dialogue box to restore control to the ICS desktop.

When to Update the HP4142 Configuration Dialogue Box

It is only necessary to configure or update the HP4142 Configuration dialogue box when either of two situations occur:

1. The HP4142 Driver is connected to ICS for the first time.
2. The HP4142 module configuration is altered or the instrument GPIB address is changed.

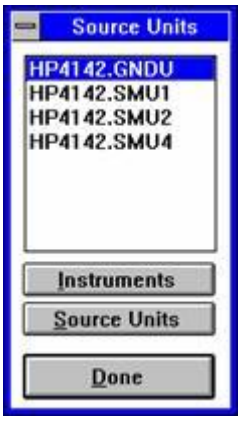
The information displayed in the HP4142 Configuration dialogue box is stored in memory when the user manually specifies the box contents or after the user polls the instrument. The HP4142 configuration is written to the ICS.INI file as soon as the OK button is selected in the Configuration dialogue box. The HP4142 Driver connection is documented in the corresponding project file when FILE/SAVE or FILE/SAVE AS is selected. When the project file is opened, ICS will automatically connect the HP4142 Driver and arrange the HP4142 Configuration dialogue box according to the designations recorded in the ICS.INI file. This eliminates the need to repeatedly connect the HP4142 Driver or arrange the Configuration dialogue box each time an HP4142 project file is opened. After initially arranging the HP4142 Configuration dialogue box, there is no need for the user to review the dialogue box unless the module configuration is altered or the instrument GPIB address is changed.

Module Selector Switch

The Module Selector switch at the top of the HP4142 Configuration dialogue box enables and disables the Selected Module field and the User Relay Controls in the Mainframe Setup dialogue box. (The Mainframe Setup dialogue box is opened by clicking the Setup Editor OPTIONS button after designating at least one Source Unit/DUT connection.) If the Module Selector switch is not selected, the related controls in the Mainframe Setup dialogue box will be inaccessible to the user. The function of the Module Selector switch is pictured in Figure 7.

Source Unit Availability

The SOURCE UNITS dialogue box contains a list of available instrument modules that can be used to build a test setup. The contents of this dialogue box represent the instrument modules installed in the HP4142 and designated in the HP4142 Configuration dialogue box.



In addition to the designated modules, the SOURCE UNITS dialogue box will also include a source unit entitled "HP4142.GNDU". HP4142.GNDU is the designation for the Ground Unit (GNDU) connection included on the front panel of the HP4142. The Ground Unit is a 0.0V constant supply that provides a measurement ground reference for the Device Under Test (DUT). Please refer to Chapter 2 of the HP4142B Operations Manuals for a more detailed description of this feature.

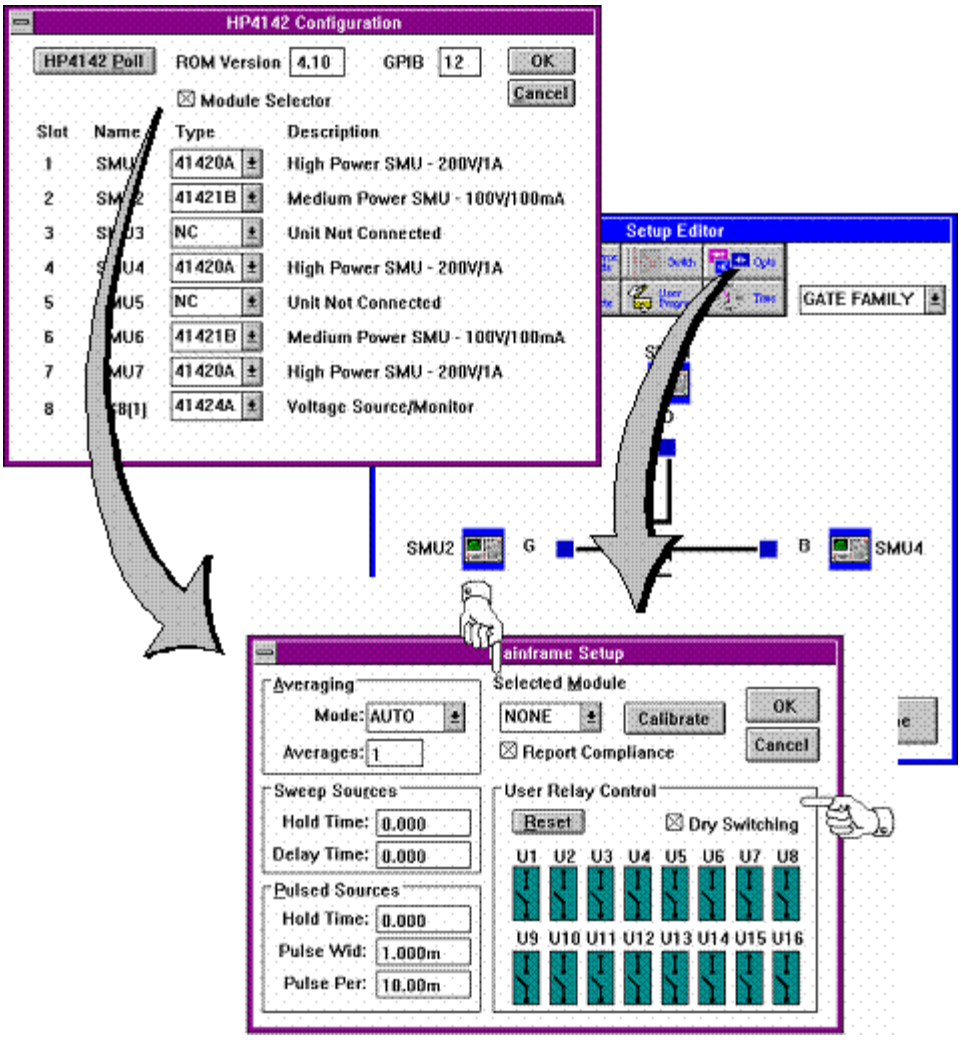


Figure 7: Selecting the Module Selector Switch Enables the "Selected Module" Field and the "User Relay Controls" in the Mainframe Setup Dialogue Box.

It is possible to open a project file that was created with a mainframe configuration that does not match the configuration of the instrument presently available. This is called a hardware mismatch. A hardware mismatch is more precisely defined in the paragraphs that follow.

When a test setup is created, the association between the module identity (for example, "HP41421B") and the source unit field label (for example, "SMU1") is stored as part of the test setup. This association is obtained from the HP4142 configuration defined in memory when the test setup is created. Test setups are stored in project files, thus the HP4142 configuration associated with each test setup is recorded in the corresponding project file. After the project file is created, the user may alter the HP4142 configuration. The user may change the GPIB address, or the user may add new modules or move

existing modules to new slot positions. Any one or more of these situations will alter the HP4142 configuration. If the HP4142 configuration changes, the user must update the HP4142 Configuration dialogue box. Failing to do so will generate a hardware mismatch error when the user attempts to execute a test setup. The user can update the HP4142 Configuration dialogue box either manually or automatically (using the Poll function). As soon as the HP4142 Configuration dialogue box is updated, the new HP4142 configuration is stored in memory. The new HP4142 configuration is written to the ICS.INI file as soon as the OK button is selected in the Configuration dialogue box.

When a user opens a project file, ICS will verify that the correspondence between the test setup source unit labels and the module identities agree with the HP4142 configuration stored in memory. (For example, does the first slot position identified as "SMU1" really correspond to an "HP41421B"?) If there is a disagreement, ICS will identify the inconsistency but will not display a hardware mismatch error until the respective test setup is executed.

When the user selects a test setup and clicks the toolbar MEASURE button, ICS will do two things. First, ICS will display an error message reporting any hardware inconsistencies that were detected when the project file was opened. If there were none, ICS will then interrogate the instrument and insure that the correspondence between the module identities and slot positions reported by the instrument agrees with the HP4142 configuration stored in memory. This verification detects inconsistencies that result when the user changes the HP4142 configuration but fails to update the HP4142 Configuration dialogue box. If this comparison agrees, ICS will execute the test setup. If it does not, ICS will display a hardware mismatch error.

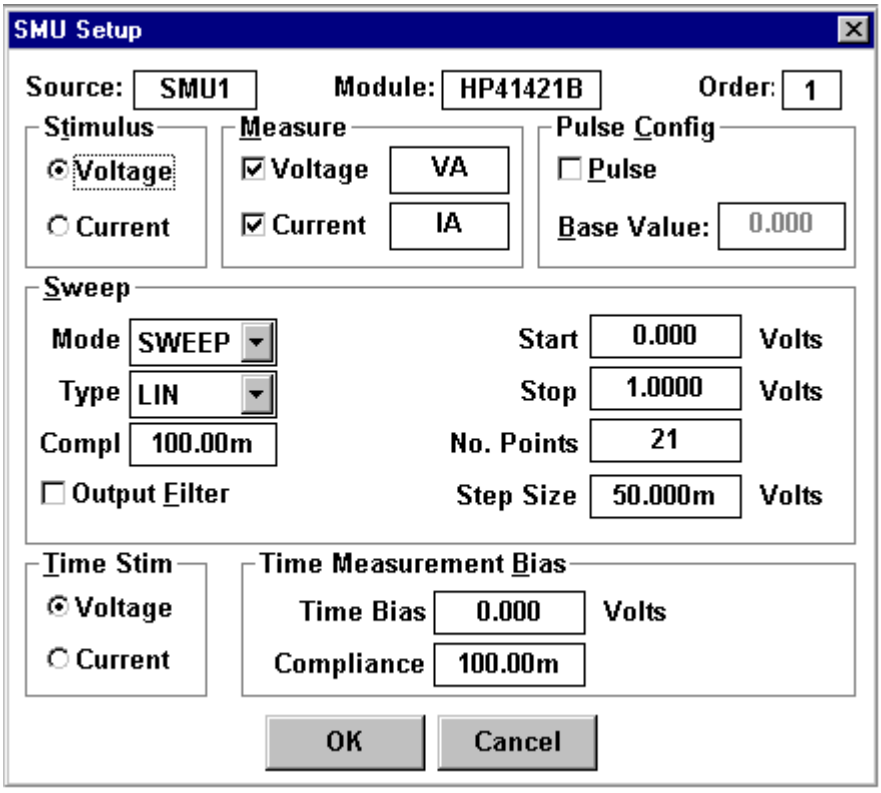
Figure 8: A hardware mismatch error is generated when either the hardware configuration stored in the project file or the hardware configuration reported by the instrument does not agree with the hardware configuration stored in memory.

When the user attempts to execute a test setup that includes a hardware mismatch, ICS will display a message box informing the user of the problem. The message box will identify the source unit label (which also identifies the slot position) corresponding to the error. The message box will also list the module identity stored in memory followed by the module identity returned from the corresponding mainframe position.

The user has three options when a hardware mismatch is encountered:

1. Delete the test setup and create a new test setup using the active HP4142 configuration.
2. Restore the mainframe configuration to the original configuration reported by the error message(s).
3. Undesignate the mismatched source unit connection displayed in the Setup Editor and designate an alternative connection. If necessary, refer to *Chapter 2, Removing Instrument/DUT Connections* or *Removing Unlisted Source Units*. When designating a connection between the DUT and a source unit located at a mainframe slot that is different than the position of the original source unit, re-cable the hardware connections between the instrument and the test fixture so that the physical connections of the test hardware agree with the connections designated in the Setup Editor. If the functionality of the module that now corresponds to the mismatched source unit label meets the requirements of the device measurement, simply re-attach the same source unit label. The module identity corresponding to the source unit label will now be correct and no error will be generated. However, you must configure the module setup from the corresponding Source Unit Setup dialogue box.

The Source Unit Setup Dialogue Box



The setup conditions of each source unit are independently controlled with the Source Unit Setup dialogue box. There is a Source Unit Setup dialogue box that corresponds to each HP4142 module, except the HP4142.GND (hard ground). A module's Source Unit Setup dialogue box is accessed from the Setup Editor.

How to Display a Source Unit Setup Dialogue Box:

In order to display a Source Unit Setup dialogue box, the corresponding source must be assigned to a DUT pin represented by the device schematic.

1. If only one source unit is assigned to the device schematic pin, click once on the instrument icon to open the corresponding Source Unit Setup dialogue box. If more than one source unit is assigned, proceed to Step #1b.
2. If more than one source unit is assigned to the device schematic pin, click once on the instrument icon to open a list box that displays all of the source units assigned to the selected pin.
3. Click once on the desired source unit designation to select the source unit; double click on the source unit designation to open the corresponding Source Unit Setup dialogue box.

The Source Unit Setup dialogue box is used to specify the source/measure configuration of each HP4142 module. The contents of Source Unit Setup dialogue box are outlined below:

1. **Source Field:** This field displays the corresponding ICS designation.
2. **Module Field:** This field displays the model number of the corresponding HP4142 module.
3. **Order Field:** This field displays the power up order of the corresponding HP4142 module.
4. **Sweep Controls:** The fields included in this group are used to define the shape of the sourcing signal as well as the sourcing signal's start and stop values. The compliance field is also included in this group.
5. **Stimulus Controls:** This group consists a switch pair used to identify whether the sourcing signal is a voltage or a current.
6. **Measure Controls:** This group includes the switches necessary to specify the type of signal the source unit will return as a measurement. This group also includes the necessary fields to label the returned measurements.
7. **Pulse Configuration Controls:** This group consists of the switch and fields necessary to configure the sourcing signal in a pulse mode.
8. **Output Filter Switch:** This switch turns on and off the source unit's output filter mode.
9. **Time Stimulus Switch:** The Time Stimulus Switch allows the user to select the type of stimulus to use during ICS Time measurements.
10. **Time Measurement Bias:** The Time Measurement Bias value indicates the source value to be used during ICS Time measurements.

Sweep Controls

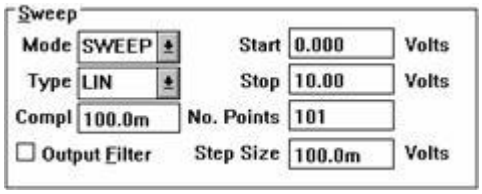
Sweep controls are used to specify the shape and boundaries of the sourcing signal, as well as the sourcing signal's compliance limit. Timing and averaging configurations are defined in the HP4142 Mainframe Setup dialogue box.

Mode

The sourcing signal shape is selected from a list of signal shapes available in the sweep group MODE field. The sourcing signal may be characterized as a sweep, synchronized sweep, step, constant supply, or quasi-pulse. To select the desired sweep mode, click the scroll arrow in the MODE field. Clicking on the scroll arrow will display the available sweep mode selections. Click on the desired mode.

For an explanation of the sweep, synchronized sweep, step, and constant supply modes used in conjunction with the pulse option, please refer to the *Pulse Configuration* section of this section.

Sweep Mode



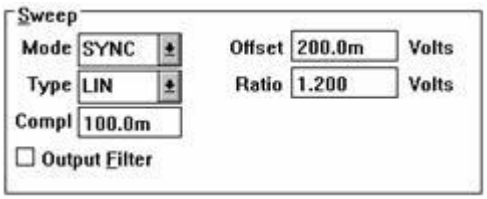
The sweep mode generates either a linear or logarithmic staircase sweep signal between two specified boundary values.

When creating a test setup that includes a second, synchronized sweep signal, the sweep application described in this section is the primary sweep signal. Double sweeps consisting of ascending and descending sweep directions are not supported by ICS.

How to Source a Sweep Signal:

1. Select the "SWEEP" designation from the available options listed in the MODE field.
2. The data point distribution of the sweep signal can be either linearly or logarithmically distributed between the START and STOP values specified in Step #3. Select between a linear or logarithmic distribution by selecting the appropriate designation in the TYPE field.
3. Specify the sweep signal boundary values in the START and STOP fields.
4. Hitting the tab key from the STOP field will move the cursor to the NO. POINTS field. Enter the number of data points that will comprise the sweep signal.
5. If a linear sweep type is selected in Step #2, the Sweep controls will include a STEP SIZE field. The STEP SIZE field will be calculated automatically after a value is entered in the NO. POINTS field and the cursor is moved to another location (or OK is selected). If desired, the calculated STEP SIZE can be updated by the user. If a new value is entered in the STEP SIZE field, the STOP field will be updated to accommodate the new STEP SIZE value. If any of the other fields are edited, the STEP SIZE field will be automatically updated to accommodate the change.

Synchronized Sweep Mode



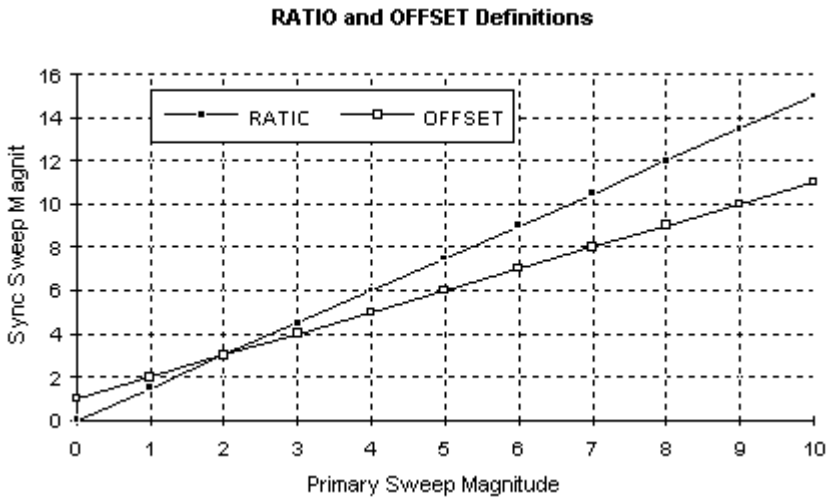
A synchronized sweep is a linear sweep signal that is synchronized in time with a primary sweep signal applied by another source unit.

A source unit can force a synchronized output only when the output of another source unit in the test setup is configured in a linear sweep mode. If a synchronized sweep mode is designated in a test setup that does not include a primary linear sweep signal, ICS will display an error message when the user attempts to execute the test setup.

The stimulus of the synchronized sweep signal must match the stimulus of the primary sweep. In other words, if the primary sweep is a voltage output, the

synchronized sweep must be a voltage output also. If the stimulus modes of the primary and synchronous outputs disagree, ICS will generate an error message when the user attempts to execute the test setup.

While the *timing* of the primary and secondary sweep signals are synchronized, the magnitudes can differ. The magnitude of the synchronized sweep signal is specified relative to the primary sweep by designating a constant ratio and/or a constant offset. The meaning of "ratio" and "offset" is explained with the illustration below.



When a RATIO is specified:

Sync Sweep Mag = Primary Mag x (Ratio)

When an OFFSET is specified:

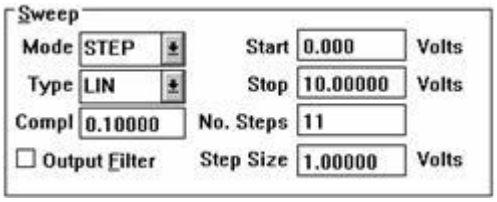
Sync Sweep Mag = Primary Mag + (Offset).

How to Source a Synchronized Sweep Signal:

A synchronized sweep signal is functional only when a linear sweep signal is forced by another source unit.

1. Select the "SYNC" designation from the available options listed in the MODE field.
2. Select the "LIN" designation in the TYPE field. The synchronous output must be configured as a linear signal. If you attempt to select the "LOG" designation after selecting the "SYNC" designation in the MODE field, ICS will generate an error message when the use attempts to close the Source Unit Setup dialogue box.
3. Make certain that the selected Stimulus switch (VOLTAGE or CURRENT) agrees with the output stimulus of the primary sweep signal. If the stimulus mode of the output signals disagree, ICS will generate an error message when the user attempts to execute the test setup.
4. If desired, specify a value in the OFFSET field. When an offset value is specified, the offset component of the synchronized sweep magnitude is the sum of the primary sweep magnitude and the OFFSET value.
5. If desired, specify a value in the RATIO field. When a ratio value is specified, the ratio component of the synchronized sweep magnitude is the product of the primary sweep magnitude and the RATIO value. A synchronized ratio can be specified in combination with a synchronized offset.

Step Mode



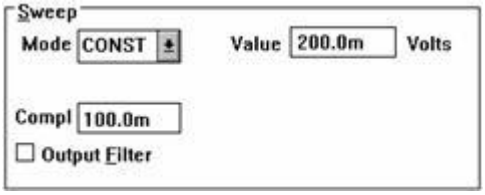
The step mode forces a constant output while another source unit in the test setup forces a sweep signal. The step mode is functional only in test setups that include a second source unit configured in sweep mode.

The step mode generates a constant output signal while a second source unit generates a staircase sweep signal. After the staircase sweep signal reaches the specified STOP value, the magnitude of the step output is incremented by the STEP value and the staircase sweep signal is triggered again. This process continues until the STOP value of the step signal is reached.

How to Source a Step Signal:

1. Select the "STEP" designation from the available options listed in the MODE field.
2. The step sequences can be either linearly or logarithmically calculated between the START and STOP values specified in Step #3. Select between either a linear or logarithmic step sequence by specifying the appropriate designation in the TYPE field.
3. Specify the range of the step signal in the START and STOP fields.
4. Specify the increment quantity in the NO. STEPS field.
5. If a linear step sequence is configured in the TYPE field, the increment size will be displayed in the STEP SIZE field. After a value is entered in the NO. STEPS field and the cursor is moved to another location (or OK is selected), the STEP SIZE field will be calculated automatically. If desired, the calculated STEP SIZE can be updated by the user. If a new value is entered in the STEP SIZE field, the STOP field will be updated to accommodate the new STEP SIZE value. If any of the other fields are edited, the STEP SIZE field will be updated automatically to accommodate the change. If a logarithmic step sequence is configured in the TYPE field, the STEP SIZE field will not be displayed.

Constant Mode

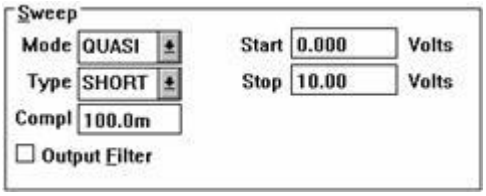


The constant mode generates a signal that remains at a constant magnitude throughout the duration of the test setup.

How to Source a Constant Signal:

1. Select the "CONST" designation from the available options listed in the MODE field.
2. Specify the signal magnitude in the VALUE field.

Quasi-Pulse Mode



The Quasi-Pulse mode is a limited voltage-forcing function unique to the HP4142.

The Quasi-Pulse mode is designed to limit potential damage to the Device Under Test while measuring leakage current or breakdown voltage. The Quasi-Pulse mode applies an increasing voltage signal while at the same time monitoring the magnitude of its own output. The output of the SMU is monitored at long or short detection intervals to detect if the applied signal has reached either the stop value or current compliance. As soon as either settling condition is met, the measurement is completed and the source unit output signal is dropped to some defined nominal magnitude. For a detailed explanation of the Quasi-Pulse mode, please refer to Chapter 5 of the HP4142B Operation Manual.

How to Source a Quasi-Pulse Signal:

1. Select the "QUASI" designation from the available options listed in the MODE field.
2. Select either the LONG or SHORT detection interval in the TYPE field. The detection interval is the time interval at which the module sourcing the quasi-pulse signal will monitor the quasi-pulse magnitude. By monitoring the change in quasi-pulse magnitude from one sampling point to another, the source unit can determine when the appropriate settling condition is achieved.
3. Specify the current compliance in the COMPLIANCE field. Depending upon which module is being used to source the quasi-pulse, the COMPLIANCE limit may be locked at a particular value.
4. Specify the boundaries of the voltage range in the START and STOP fields. The START value is the nominal voltage value the SMU will source after the settling condition has been detected and measured. The specified voltage range must be a minimum of 10V.

Type

The TYPE field is used to designate the data point distribution of a sweep output. This field is displayed when the SWEEP, STEP, SYNC, or QUASI designation is selected in the MODE field.

When the output signal is configured in QUASI mode, the TYPE field designates the configuration of the detection interval.

Start

The START field is used to specify the starting value of the sourcing signal. This field is displayed when the SWEEP, STEP, or QUASI designation is selected in the MODE field.

Stop

The STOP field is used to specify the stopping value of the sourcing signal. This field is displayed when the SWEEP, STEP, or QUASI designation is selected in the MODE field.

No. Points

The NO. POINTS field is used to specify the data point quantity in a linear or logarithmic sweep signal. This field is displayed when the SWEEP designation is selected in the MODE field.

No. Steps

The NO. STEPS field is used to specify the increment quantity of a step signal. This field is displayed when the STEP designation is selected in the MODE field.

Step Size

The STEP SIZE field designates the linear increment of a sweep or step signal. The value of this field is automatically calculated after the user specifies either the NO. POINTS in a linear sweep or the NO. STEPS in a step output. If the value of this field is changed by the user, the value of the STOP field will be updated to accommodate the change. This field is displayed when either the SWEEP or STEP designation is selected in the MODE field, and the LINEAR characteristic is selected in the TYPE field.

Value

The VALUE field is used to specify the magnitude of a constant signal. This field is displayed when the CONSTANT designation is selected in the MODE field.

Offset and Ratio

These fields are used to configure the output a synchronous output. These fields are displayed when the SYNC designation is selected in the MODE field.

Compliance

The COMPLIANCE field is used to specify the limiting magnitude of a measured signal. When a source unit is sourcing voltage and measuring current, a current compliance must be specified. Similarly, if a source unit is sourcing current and measuring voltage, a voltage compliance must be specified.

The compliance limit allows the user to execute a test setup that is within an acceptable power range of the device by limiting the operating range of the source unit. For example, if a 100mA compliance limit is specified for a source unit that is sourcing a sweep voltage and returning a current, the source unit will supply an increasing voltage signal until a 100mA current is returned.

The maximum compliance limit that ICS will allow is determined by the operating boundaries of the instrument. Please refer to Chapter 6 of the HP4142B Operation Manual for an overview of the HP4142 compliance configurations and power limitations. Depending upon the module being used, the compliance limit may be locked at a particular value.

Detecting Compliance Events

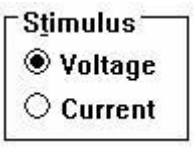
If the Report Compliance switch is selected in the Mainframe Setup dialogue box, ICS will halt the active measurement and display a message if a compliance limit is detected. (The Mainframe Setup dialogue box is opened by clicking the Setup Editor OPTIONS button.) The message box will identify the source unit in compliance and present the user with the options of retrying the test setup, aborting the test setup, or ignoring the message. After selecting an option, ICS will close the message box and proceed as instructed.

As a default, the Report Compliance switch is OFF. If you want ICS to identify compliance events, make certain that the Report Compliance switch is selected in the Mainframe Setup dialogue box.

Output Filter Switch

Certain HP4142 modules include a low-pass filter at the digital-to-analog converter (DAC) output. Under normal conditions, a spike will occur at the DAC each time the output changes. When the filter is ON, any spikes will be reduced to 1/30 of their original value. If available, the default position of this switch is ON. For more details concerning the function and applicability of the Output Filter switch, please refer to Chapter 6 of the HP4142B Operation Manual.

Stimulus Controls



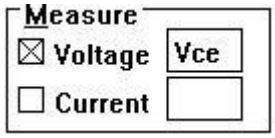
The stimulus control box consists of two switches: VOLTAGE and CURRENT. These switches are used to specify the characteristic of the forcing signal. Timing and averaging configurations are defined in the HP4142 Mainframe Setup dialogue box.

Depending upon the HP4142 module, one of the two switches may be unavailable. For example, the HP41424A is a Voltage Source/Voltage Monitor Unit used for high resolution voltage applications. The HP41424A can NOT be configured to source a current. Please refer Chapter 2 of the HP4142B Operation Manual for an overview of each module's capabilities.

When configuring modules that can source and monitor either voltage or current, selecting the characteristic of the forcing signal defines the characteristic of the measured signal. For example, the HP41421B can be configured to source a voltage and monitor a current, or source a current and monitor a voltage. However, selecting the forcing signal characteristic DOES NOT automatically specify the data that will be written to the corresponding data window. The characteristic of the sourcing signal is completely of the specified data return. Data doesn't have to be returned at all, but if data values are returned, the data can be the sourcing signal itself (calculated), the complement of the sourcing signal (measured), or both. Data return specifications are defined in the Measure Group control box.

The default compliance limit specified in the Sweep Group control box was written with the intent of applying a voltage and returning a current. When a current source is specified along with a returned voltage, be sure to review the compliance field. It is likely that the default compliance value will be unacceptable.

Measure Controls



The Measure Group control box consists of two switches: VOLTAGE and CURRENT. In addition to the two measure switches, a text field is located to the right of each switch.

These switches and text fields are used to specify and label the data that will be returned when the test setup is executed. Timing and averaging configurations are defined in the HP4142 Mainframe Setup dialogue box.

Specifying Returned Data

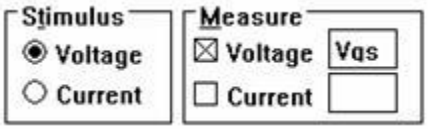
Depending upon the particular HP4142 module, ICS may be configured to return the sourcing signal, the sourcing signal complement, both, or none. Please refer to Chapter 2 of the HP4142B Operation Manual for an overview of each module's capabilities.

The HP41424A VS/VMU includes a specialized data return mode in which the module will return a voltage difference, VM1-VM2. Please refer to Chapter 2 for an overview of the HP41424A differential mode.

A source unit's measurement configuration is specified by turning on or off the VOLTAGE and CURRENT switches located in the Measure Group control box. Depending upon the particular module, one of the two switches may be unavailable.

Four possible measurement configurations are described below along with the HP41424A voltage differential mode. For an explanation of these configurations used in conjunction with the HP4142 pulse mode, please refer to the *Pulse Configuration* section of this chapter.

1. **THE SOURCING SIGNAL IS RETURNED**: To specify this configuration, select the switch that matches the characteristic of the sourcing signal.

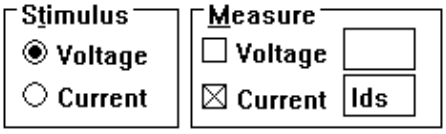


In this mode of operation, the returned values are not true measurements. The returned values are calculations based

For example, consider the gate threshold characteristic of a MOSFET. In a gate threshold test setup, a constant voltage is applied to the drain, while a swept voltage is applied to the gate. The gate threshold characteristic is a plot of I_{ds} vs. V_{gs}. Therefore, V_{gs}, the voltage sweep applied to the gate, must be returned since V_{gs} data is required for the plot. The gate current is not important in this test setup. The source unit connected to the gate is configured to apply a voltage sweep and return only the values of the applied sweep.

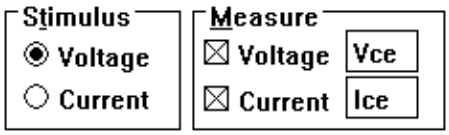
Do not confuse this measurement configuration with the self-monitoring capability of the quasi-pulse sourcing mode. The self-monitoring capability is restricted to the quasi-pulse sourcing mode. The voltage detection that occurs during the increasing magnitude of the applied voltage signal is not returned data as described in this section. The voltage detection allows the source unit to assess when a settling condition is achieved, and it is after this assessment that a measurement is completed and returned as data.

2. **THE SOURCING SIGNAL COMPLEMENT IS RETURNED**: To specify this configuration, select the switch corresponding to the opposite characteristic of the sourcing signal.



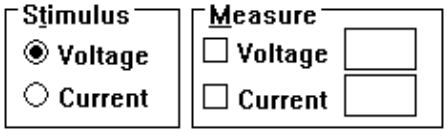
For example, consider the gate threshold example described above. The sourcing signal on the drain is a constant voltage supply. However, the same source unit is also measuring I_{ds}, the drain current. Returning V_{ds} would not provide any useful information, because V_{ds} is a constant value throughout the test setup.

3. **BOTH THE SOURCING SIGNAL AND THE SOURCING SIGNAL COMPLEMENT ARE RETURNED:** To specify this configuration, both switches should be ON.



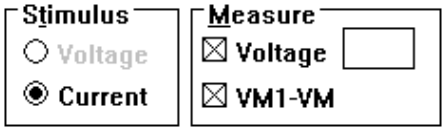
For example, consider the DC forward current gain of a bipolar transistor in common emitter mode. In this test setup a swept voltage supply is applied to the collector. The plot of the forward current gain is a plot of I_{CE} vs. V_{CE}. Therefore, both I_{CE} and V_{CE} must be returned since I_{CE} and V_{CE} data is required to construct the plot.

4. **NO RETURN MEASUREMENTS ARE SPECIFIED:** To specify this configuration, both switches should be OFF.



For example, consider the forward transfer characteristics of a MOSFET. In this test setup a constant supply of 0.0V is applied to the source in order to establish a grounding condition. The forward transfer characteristic is a plot of I_{ds} vs. V_{ds}. Both of these measurements are obtained from the source unit connected to the drain. Since the gate current present in this mode is very small relative to the drain current, measuring the source current will not provide any useful information. As a result, the source unit connected to the source supplies a constant 0.0V, but returns nothing.

5. **DIFFERENTIAL VOLTAGE RETURN, (HP41424A VS/VMU ONLY):** To specify this configuration, select the VM1-VM2 switch. The differential voltage mode cannot be used in conjunction with pulsed source units.



Labeling Measured Data

All of the data that corresponds to a single curve 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 VOLTAGE or CURRENT switch. A data vector label can be any alphanumeric string up to three characters in length.

The presence of only two data vector fields does not mean that only two data vectors can be specified in a test setup. In fact, by using a combination of step and sweep source units, up to 42 data vectors can be defined per test setup.

Test setups that use a combination of stepped sources and swept sources can return both sequential and non-sequential data vectors. Test setups that use a combination of constant sources and swept sources only return non-sequential data vectors.

Sequential Data Vectors

A sequential data vector is a device characteristic that is described by a family of unique curves. Each curve is measured in response to a stepped bias condition. Sequential data vectors are the result of test setups that include stepped sources and repeated sweeps.

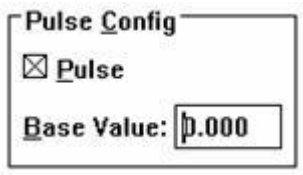
For example, consider the DC collector characteristics of a bipolar transistor. The DC collector characteristics are obtained by generating a family of I_{CE} vs. V_{CE} curves. This setup was created by applying a stepped current supply to the base and a swept voltage supply to the collector. The source unit connected to the collector returned both collector voltage (V_{CE}) and collector current (I_{CE}). Each time the base current was stepped to a new value, a unique I_{CE} curve was obtained in response to the collector voltage sweep. The result of this test setup was a family of unique I_{CE} curves. I_{CE} is a sequential data vector because collector current is described by a family of unique curves measured in response to stepped base current.

Non-Sequential Data Vectors

A non-sequential data vector is a device characteristic that is described by a single curve.

For example, consider the example presented in the previous section, *Sequential Data Vectors*. The DC collector characteristics of a bipolar transistor were obtained by generating a family of I_{CE} vs. V_{CE} curves. This test setup was created by applying a stepped current supply to the base and a swept voltage supply to the collector. The source unit connected to the collector returned both collector voltage (V_{CE}) and collector current (I_{CE}). Because the base current was stepped, this test setup returned a family of I_{CE} curves. The voltage sweep applied to the collector during each base current step was the same. Therefore, V_{CE} is a non-sequential data vector, because V_{CE} can be described by a single curve.

Pulse Configuration Controls



The Pulse Configuration Controls are used to apply the selected sourcing mode in a pulse configuration. The pulse configuration cannot be used in conjunction with a quasi-pulse sourcing signal mode.

The BASE VALUE field is used to designate the base value. All other timing considerations are not specific to any single module, but are global to every module within the test setup; therefore, timing considerations associated with pulse mode are specified in the HP4142 Mainframe Setup dialogue box.

The Mainframe Setup Dialogue Box

Clicking the OPTIONS button in the Setup Editor will open the HP4142 Mainframe Setup dialogue box. The HP4142 Mainframe Setup dialogue box includes the controls necessary to specify the timing, averaging, and selectable module configurations. (Selectable module capability is applicable to the HP16087A or HP16088B Test Fixtures.) The HP4142 Mainframe Setup dialogue box also includes the controls necessary to specify the configuration of up to 16 external relays.

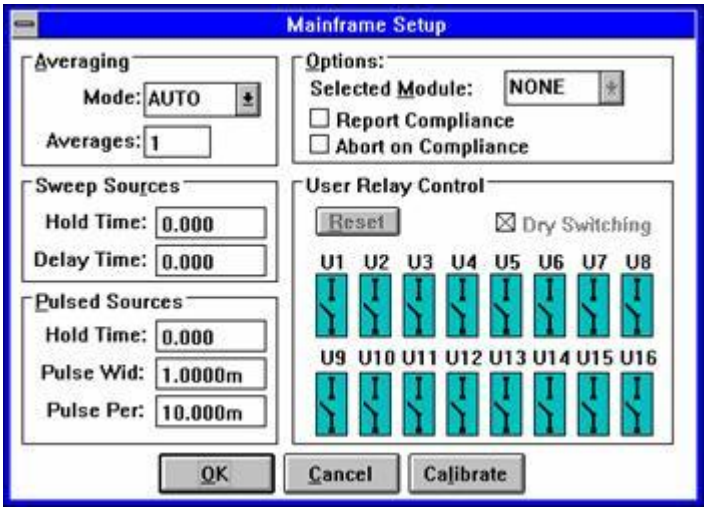
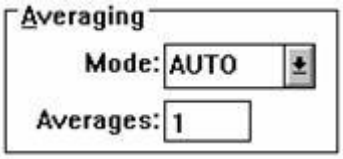


Figure 9: The Mainframe Setup Dialogue Box

The contents of the HP4142 Mainframe Setup dialogue box are global to every module in the test setup. The HP4142 mainframe options are only applied to the test setup in which they were specified. Once a new test setup is defined, the mainframe options can be re-specified without changing the configuration of the mainframe options in a previously defined test setup.

The HP4142 Mainframe Setup dialogue box is displayed by clicking the Setup Editor OPTIONS button after first designating at least one Source Unit/DUT connection.

Averaging Controls



In order to minimize the possibility of reduced measurement accuracy due to line frequency or other environmental noise, the HP4142 includes an averaging function that will average the results of two or more samples.

The HP4142 provides three averaging modes. Each averaging mode calculates the number of measurement samples based upon a user defined averaging number. Each mode is summarized below. Please refer to Chapter 6 of the HP4142B Operation Manual for a detailed overview of the HP4142 averaging function.

Auto Mode

In the Auto Mode, the measurement sample size is equal to the required number of minimum samples multiplied by the averaging number. The required number of minimum samples is determined by the source unit measurement mode and output range. The Auto Mode used with an averaging number equal to "1" is the default configuration of the averaging controls.

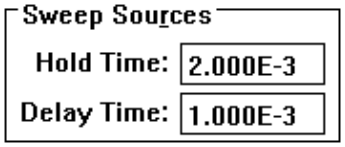
Manual Mode

In the Manual Mode, the measurement sample size is equal to the averaging number.

Power Line Cycle Mode

In the Power Line Cycle Mode, 32 samples are measured for each line frequency period. The total sample size equals the averaging number multiplied by 32. The averaging number specified in this mode can be either positive or negative.

Sweep Source Timing Controls



The Sweep Source Timing Controls specify the timing configurations of any sweep mode sourcing signal. Values entered in the sweep source timing fields are interpreted in units of seconds.

Hold Time

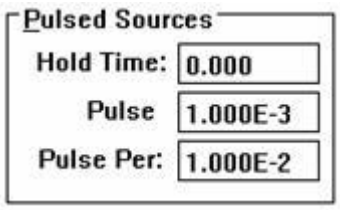
The hold time is the length of time the HP4142 will wait while allowing the starting value of the sweep signal to settle. The hold time is only applicable to the initial application of the sweep signal. After the sweep signal starts to increment, the delay time is the only parameter used to accommodate settling times. When applying a sweep source, the total delay prior to measuring the starting magnitude of the sweep signal is actually the sum of the hold time and delay time. The sweep source hold time specification is independent of the pulsed source hold time.

Delay Time

The delay time is the length of time between the sweep signal magnitude increment and the point at which an SMU obtains a measurement. The delay time allows the output at each sweep increment to settle before a measurement is made.

Pulsed Source Timing Controls

The Pulsed Source Timing Controls specify the timing configuration of any pulsed mode sourcing signals. Values entered in the pulsed source timing fields are interpreted in units of seconds.



Hold Time

The hold time is the length of time the HP4142B will wait while allowing the initial application of the pulse signal's base value to settle. The hold time is only applicable to the first application of the pulse signal base value. After the first application of the pulse signal base value, the pulse width and pulse period are the only parameters used to accommodate settling times. The pulsed source hold time specification is independent of the sweep source hold time.

Pulse (Width)

The pulse width is the length of time during which the HP4142 will force the pulse value. The pulse width specification does not include the time during which the HP4142 forces the base value of the pulse.

Pulse Period

The pulse period is the total cycle time between consecutive pulse triggers. The pulse period is the sum of the pulse width and the base value output duration. Therefore, the base value output duration of each pulse period is equal to the pulse period minus the pulse width. The base value magnitude can be specific to each source unit; as a result, the base value magnitude is specified in the Pulse Configuration Controls located in each Source Unit Setup dialogue box.

Selected Module

The HP16087A Module Selector and the HP16088B Test Fixture with Option 300 include module selection capability. This capability is used to wire a test fixture device terminal so that the device terminal can be switched between the outputs of an SMU, HCU, or HVU. The module selection switch can also be configured in an open position so that no module output is applied to the terminal. Please refer to Chapter 3 of the HP4142B Operation Manual for a detailed overview of the above units. Please refer to Chapter 6 in the same document for an overview of module selection capability.

The Selected Module field is used to designate the module selector switch position. If the HP16087A Module Selector or the HP16088B Test Fixture with Option 300 is not being used, the Selected Module designation will have no effect upon the test setup.

NOTE: The Module Selector switch must be selected in the HP4142 Configuration dialogue box in order to access this control.

Report Compliance

Selecting the Report Compliance switch will configure ICS to report compliance events. If the Report Compliance switch is selected, ICS will halt the active measurement and display a message box when a compliance event is detected. The message box will identify the source unit in compliance and present the user with the options of retrying the test setup, aborting the test setup, or ignoring the message. After selecting an option, ICS will close the message box and proceed as instructed.

Figure 10: ICS Reports Compliance Events if the Report Compliance Switch is Selected in the Mainframe Setup Dialogue Box.

As a default, the Report Compliance switch is OFF. If you wish ICS to identify compliance events, make certain that the Report Compliance switch is selected in the Mainframe Setup dialogue box.

Note: Turning on the Report Compliance can have unintended consequences. The Warning Message will stop the probe stepping and wait for a response.

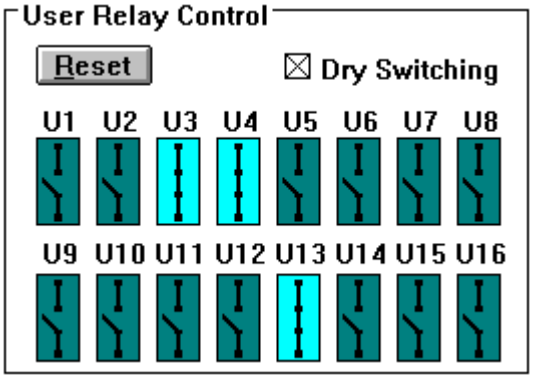
Calibrate

Click the CALIBRATE button to actuate the HP4142 Self-Test function performed during instrument power-up.

The Self-Test function verifies that the instrument is operating but does not verify output accuracy. For more information about the HP4142 Self-Test function, refer to Chapter 4 of the HP4142B Modular DC Source/Monitor Operation Manual.

User Relay Control

The HP4142 Relay Control Unit includes a 25-pin cable connection used to communicate with the HP16087A, HP16088B, or any custom designed test fixture. The first 16 pins of the relay control connector provide 16 TTL digital output signals that can be used to control external relays or any other TTL logic. Please refer to Chapter 6 of the HP4142B Operation Manual for an overview of external relay control.



The configuration of the TTL output signals is controlled with the User Relay Control box. Each of the 16 relay icons depicts the TTL output levels. If a relay icon is open, the corresponding output is low, if the relay icon is closed, the corresponding output is high. To change the state of a TTL output signal, click the corresponding icon.

If the first 16 pins of the HP4142 Relay Control Unit connection are not being used, the relay configurations in the User Relay Control box will have no effect upon the test setup.

NOTE: The Module Selector switch must be selected in the HP4142 Configuration dialogue box in order to access these controls.

Select the User Relay Control RESET button to configure all TTL states to LOW.

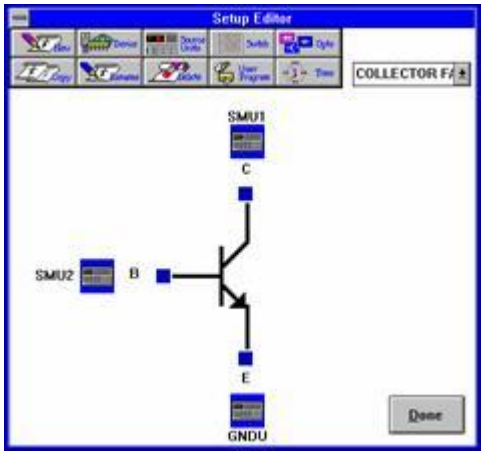
Dry Switching Specification

The Dry Switching specification defines how the HP4142 will switch the TTL output levels. If dry switching is selected, the HP4142 will set all sourcing outputs to zero, change the TTL outputs, and then return the sourcing outputs to their specified value. If dry switching is not selected, the HP4142 will change the TTL output levels without changing any sourcing outputs.

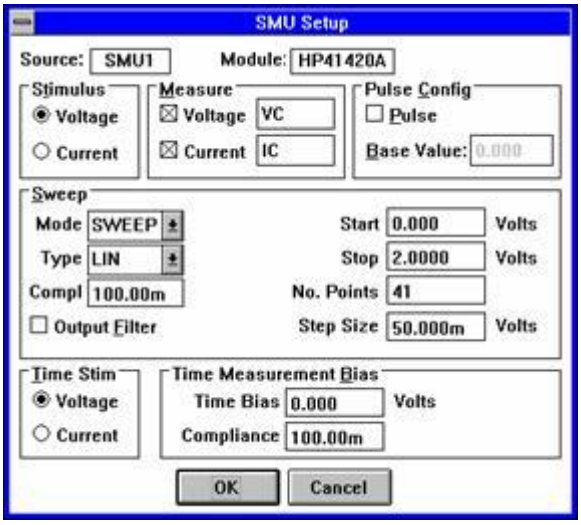
Setup Example

Collector Family

This setup measured the DC collector characteristics of a 2N3700 bipolar transistor. A voltage sweep was applied to the collector for a series of stepped base currents. A family of curves was generated by measuring and plotting the collector current with respect to the collector voltage sweep for each base current step. The following source units and setup conditions were used:



Collector Family Setup Conditions

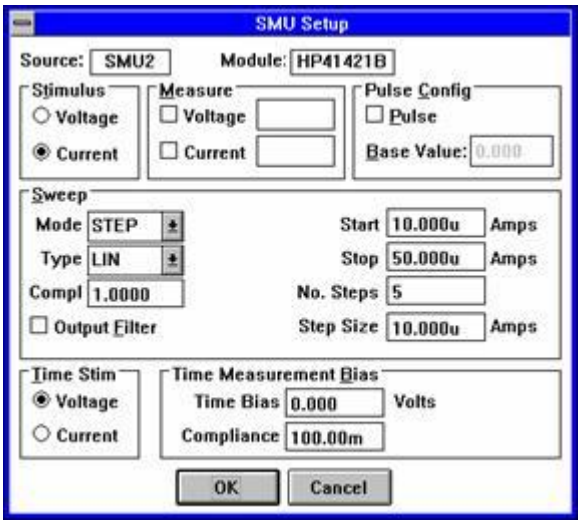


Collector: SMU1

Mode: Voltage Sweep

Output: 0V-2V

Return: VC, IC



No Setup Required

Base: SMU2

Mode: Current Step

Start: 10u

Step Size: 50u

Step Qty: 5

Return: None

Emitter: GNDU

Results