Metrics ICS Driver Manual

HP4155-6

Metrics ICS

Version 4.5

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The Agilent 4155/56 Instrument Driver

Getting Started: Creating and Executing a Test Setup

The Agilent Technologies (HP) 4155/56 Semiconductor Parameter Analyzer is a high-performance DC parametric measurement instrument used to measure the DC characteristics of microelectronic devices.

This section will walk you through the steps required to create and execute a test setup that measures diode turn-on voltage using the Agilent 4155/56 Semiconductor Parameter Analyzer. This is simple measurement, but it will provide you with a general understanding of how Interactive Characterization Software (ICS) and the HP4155/56 are used to measure device characteristics.

Step 1: Cable the Hardware Connections

Cable all the necessary connections between the instrument sources 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 Agilent 4156A Semiconductor Parameter Analyzer along with a Agilent 16442A Test Fixture and a Agilent 16088-60001 Socket Module. A schematic of the hardware arrangement is shown below.

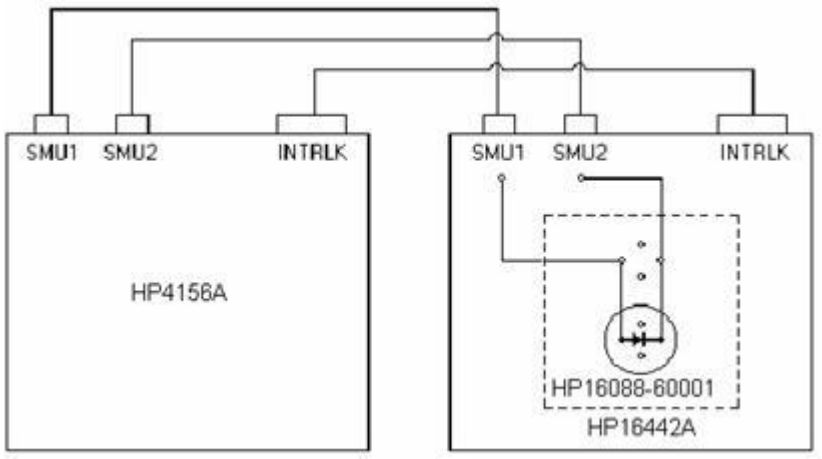


Figure 1: A Schematic of the Hardware Arrangement Used to Measure V_{ON} for an NP Diode.

Step 2: Connect the HP4155-6 Instrument Driver

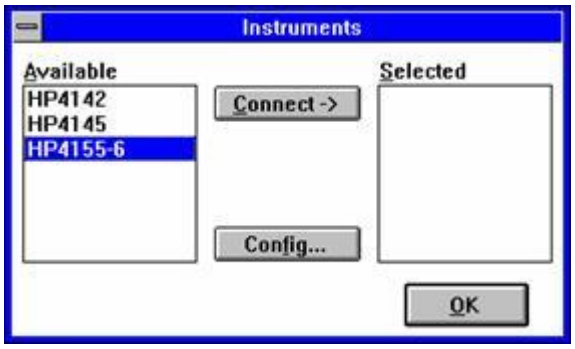


Figure 2: Instrument Driver Connect Dialogue Box.

The HP4155-6 Driver is connected using the Connect Instruments dialogue box accessed by choosing INSTRUMENTS/SELECT INSTRUMENT from the main menu bar or by clicking the CONNECT INSTRUMENTS toolbar button

How to Connect the HP4155-6 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 HP4155-6 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

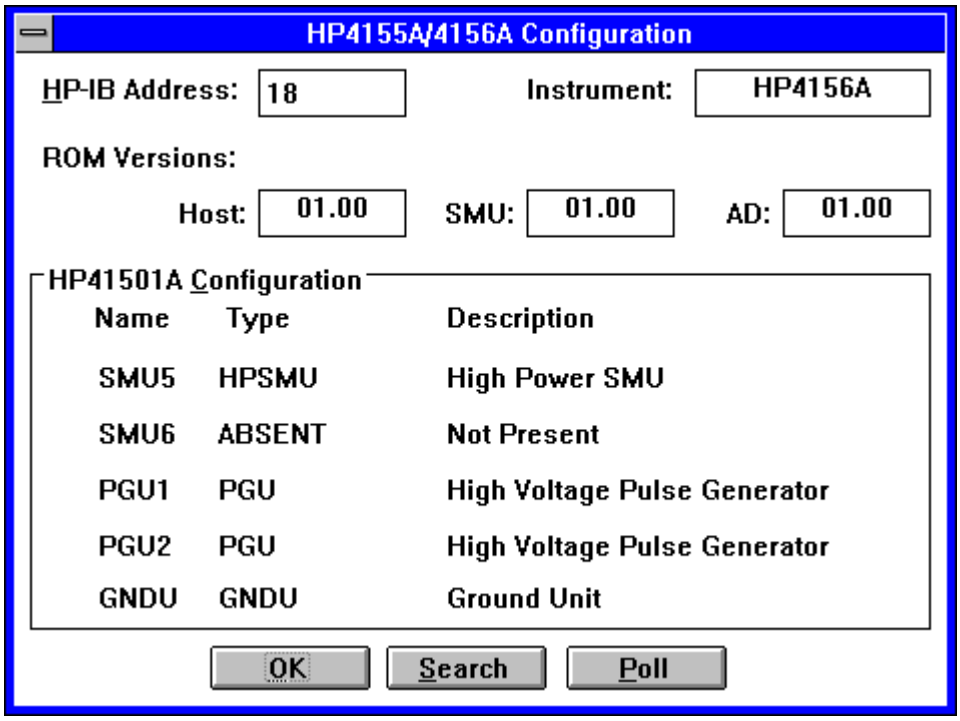


Figure 3: The Instrument GPIB Address is designated in the HP4155/56 Configuration Dialogue Box.

The HP4155/56 must be connected to your computer with the use of a standard IEEE-488 GPIB. The HP4155/56 Operation Manuals specify the use of an HP-IB interface in order to control the instrument remotely. The HP-IB designation is Hewlett-Packard's implementation of the IEEE-488 Standard Digital Interface for programmable instrumentation.

This section provides the basic information necessary to remotely control the HP4155/56 using ICS. Please refer to HP4155/56 Task Guide - Introducing the HP 4155A/4156A to review locations of back panel connections. At this point make sure an HP 10833A/B/C/D HP-IB cable is connected between the PC and the HP4155/56.

The HP4155/56 Configuration dialogue box is used to specify the GPIB address configured on the instrument's SYSTEM, MISCELLANEOUS control panel and to display the type of instrument connected. The Instrument display, ROM Version displays, and the HP41501A display are all static display fields only and do not require any definition by the user.

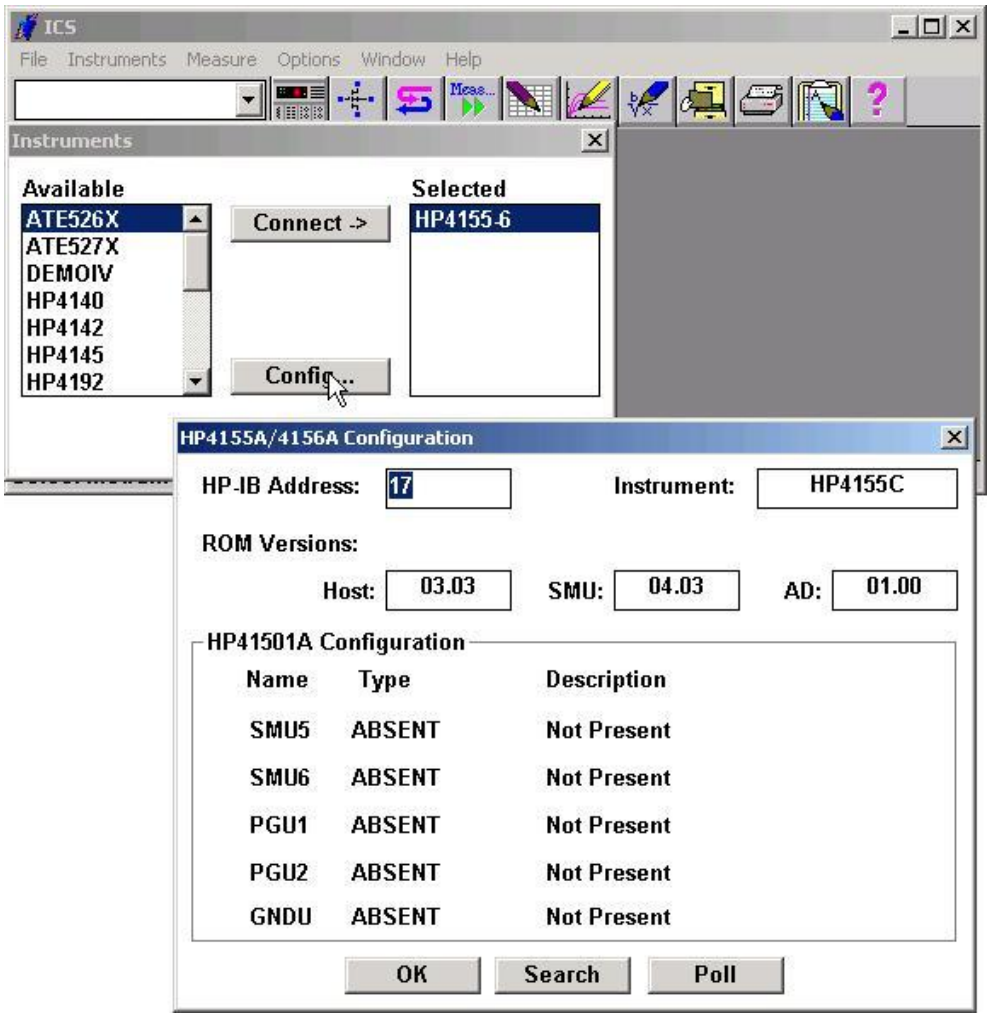


Figure 4: How to Define the HP4155/56 GPIB Address

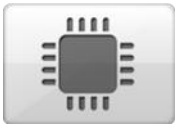
How to Define the HP4155/56 GPIB Address:

1. Open the Connect Instruments dialogue box by selecting the CONNECT INSTRUMENTS toolbar button or by selecting INSTRUMENTS/SELECT INSTRUMENT from the measurement mode menu bar.
2. Make certain that the HP4155-6 Driver is connected. If not, highlight the HP4155-6 Driver in the AVAILABLE field and click the CONNECT button. Refer *Step 2: Connect the HP4155-6 Instrument Driver* for more information regarding the connection procedure.
3. Open the HP4155/56 Configuration dialogue box by clicking the CONFIG button at the bottom of the Connect Instruments dialogue box.

4. Enter the HP4155/56 HP-IB address in the HP-IB Address field. The HP-IB address is determined by reading the HP-IB address from the SYSTEM MISCELLANEOUS panel on the HP4155/56 or the address may be automatically searched for by clicking on the SEARCH button.
5. Click the OK button. This will close the Configuration dialogue box. Click the OK button in the Connect Instruments dialogue box to restore control to the ICS desktop.

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*.

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/DUT Connections

The source/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/DUT connections designated in the Setup Editor are a graphic representation of the physical connections between the instrument and the test fixture. 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 connect an HP4155/56 SMU to each end of an NP diode.

How to Designate the Source/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 available sources. The Source Units dialogue box will display four stimulus/measurement units, two voltage source units, and two voltage monitor units.
3. Click on the desired source. For this example, click on the "HP4155-6.SMU1" designation.
4. Designate the source/DUT connection by clicking on the blue pad corresponding to the appropriate device schematic location. For this example, connect SMU1 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 the "HP4155-6.SMU2" designation and connect it to the cathode.
6. After all of the source/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/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 used to specify the source/measure configuration of the respective SMU, Vs, or Vm. Once an source/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 5. Configure the SMU2 controls as shown in Figure 6. 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.

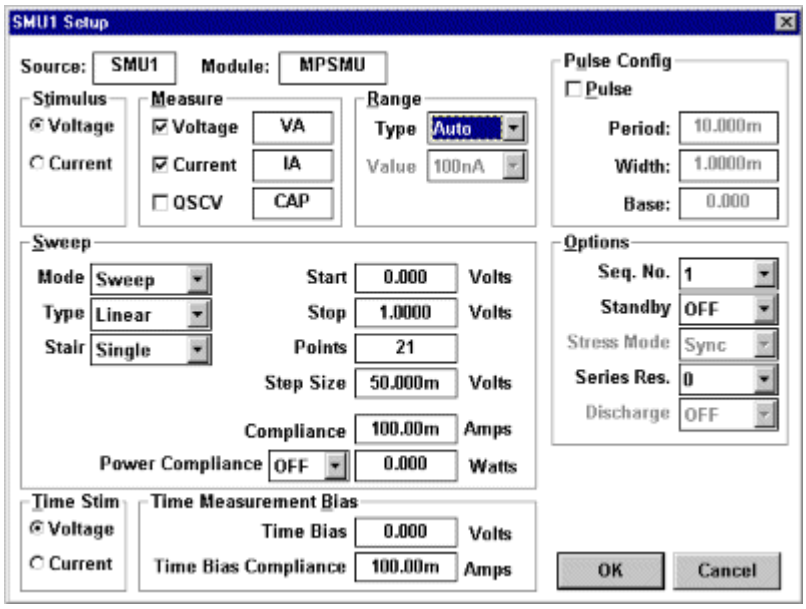


Figure 5: SMU1 Source/Measure Configuration for the DIODEON Test Setup

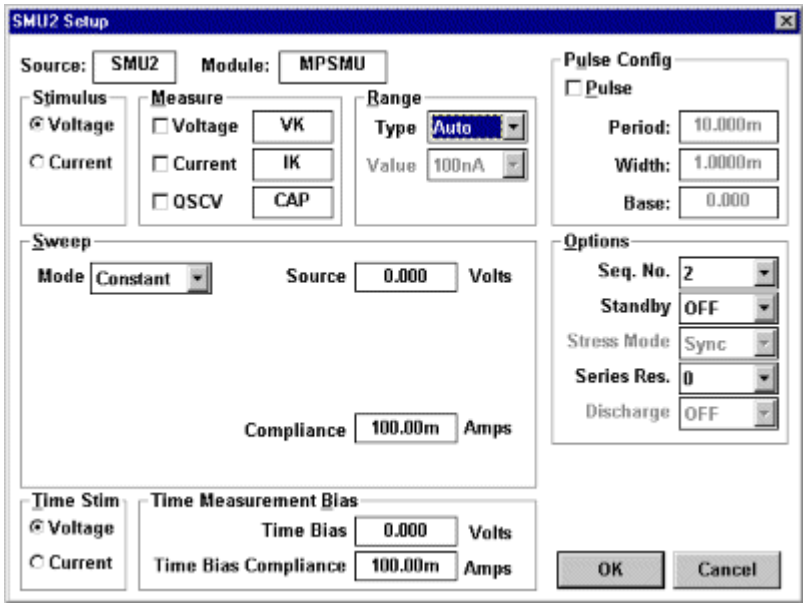


Figure 6: SMU2 Source/Measure Configuration for the DIODEON Test Setup

Step 5: Insert the DUT Into the Test Fixture

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

Step 6: Execute the Measurement

Execute the DIODEON test setup by clicking the toolbar MEASURE button and the Measure Remote Control will appear. Click the SINGLE measurement button to execute the measurement. 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. C

Click the IGNORE button 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 as soon as the cell edit is completed. 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 selecting the variable from the Data Group combo-box corresponding to the X-Axis. This example will create a plot of current with respect to voltage. Since voltage will be the independent variable, select "VA" from the X-Axis Data Group combo-box.
4. Designate the first dependent variable of the plot (in our case the only dependent variable) by selecting the variable from the Data Group combo-box corresponding to the Y1-Axis. Since current will be the dependent variable select "IA" from the Y1-Axis Data Group combo-box.
5. You could plot any number 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 DONE 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 as a Project File

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

Source Unit Availability

The HP4155/56 is comprised of up to thirteen channels depending on the instruments options. Channels #1 through #6 are Stimulus/Measurement Units (SMUs), Channels #7 and #8 are Voltage Source Units (VSs), Channels #9 and #10 are Voltage Monitor Units (VMs), Channels #11 and #12 are Pulse Generator Units (PGUs), and Channel #13 is a Ground Unit (GNDU). In ICS, each HP4155/56 channel is referred to as a "source unit" (even though the VMs don't source an output). Each of the thirteen source units, when installed as options, are listed in the Source Units dialogue box opened by clicking the SOURCES button in the Setup Editor. All source units are identified by an instrument prefix followed by a functional designation and a sequence number. For example, ICS identifies Channel #3 as "HP4155-6.SMU3", and Channel #7 as "HP4155-6.VS1".

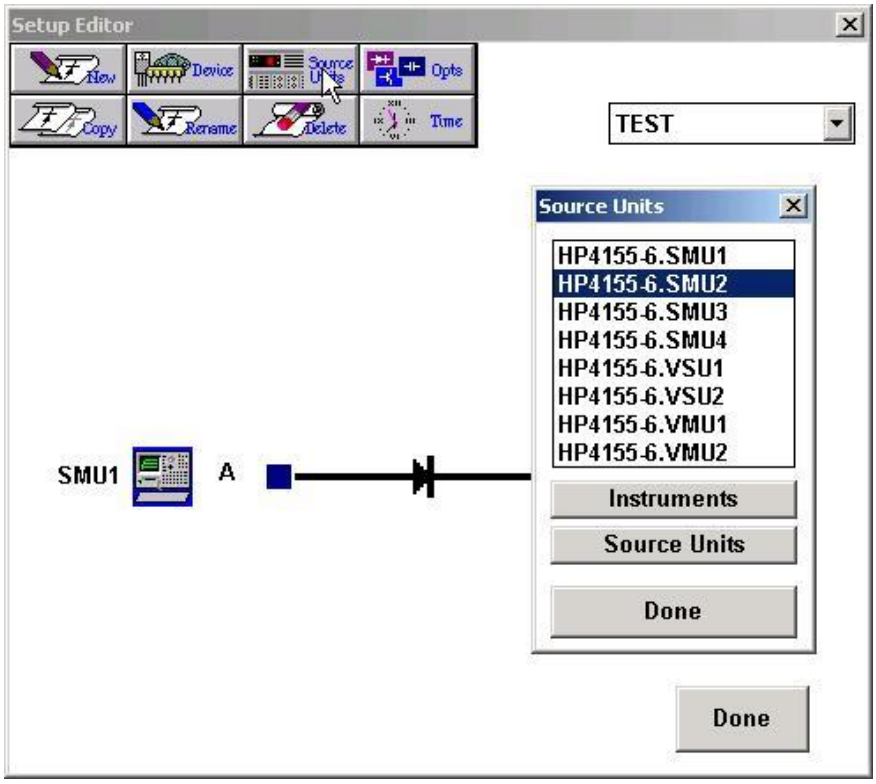


Figure 7: Each HP4155/56 Channel is identified as a "Source Unit". All Source Units are identified by an Instrument Prefix Followed by a Functional Designation and a Sequence Number.

The Source Unit Setup Dialogue Box

The setup conditions of each instrument source unit are independently controlled from a Source Unit Setup dialogue box. There is a Source Unit Setup dialogue box that corresponds to each HP4155/56 source unit. Each Source Unit Setup dialogue box is accessed from the Setup Editor. An example of a Source Unit Setup dialogue box is shown in Figure 8.

How to Display a Source Unit Setup Dialogue Box:

In order to display a Source Unit Setup dialogue box, the corresponding source must be attached to the device schematic in the Setup Editor.

1. If only one source unit connection is designated at the same schematic pin, click once on the instrument icon to open the corresponding Source Unit Setup dialogue box.
2. If more than one source unit connection is designated at the same schematic pin, click once on the instrument icon to display a list of designated source unit connections.
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 layout of a Source Unit Setup dialogue box is similar to the example pictured on the next page.

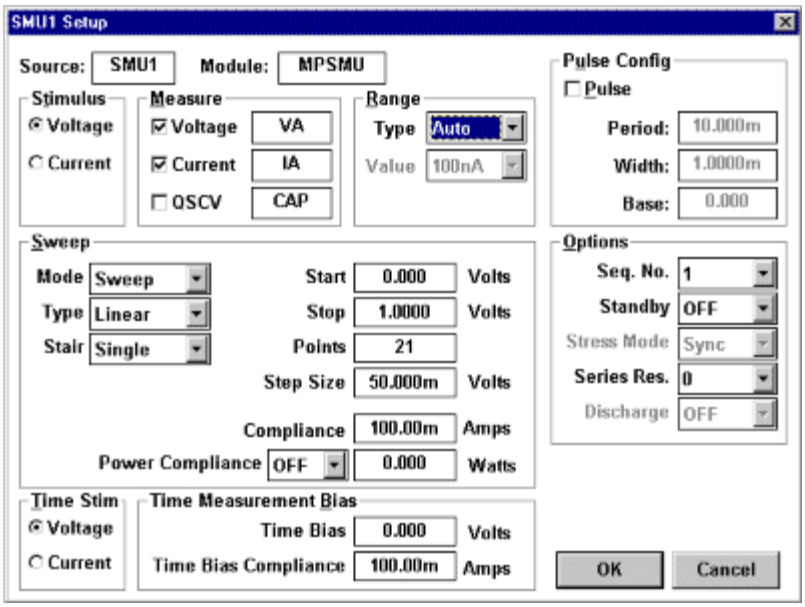
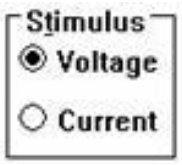


Figure 8: The Source Unit Setup Dialogue Box Corresponding to "SMU1" (Channel #1).

1. **Source and Module Unit Identity Field**: These fields are static display fields identifying the source unit and the type of module.
2. **Stimulus Controls**: This group consists of a pair of switches used to identify whether the forcing signal is a voltage or a current.
3. **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.
4. **Range Controls**: This group includes the fields necessary to specify the measurement range parameters.
5. **Force or Sweep Condition Controls**: The fields included within this group are used to define the shape of the forcing signal as well as the forcing signal's start and stop values. The compliance field is also included within this group.
6. **Time Stimulus Controls**: This group consists of a pair of switches used to identify whether the forcing signal is a voltage or a current for ICS Time Measurements.
7. **Time Measurement Bias Condition Controls**: The fields included within this group are used to define the forcing signal and compliance for ICS Time Measurements.
8. **Pulse Configuration Controls**: The fields included within this group are used to define the shape of the pulses to be output.
9. **Option Controls**: The fields included within this group are used to define optional parameters.

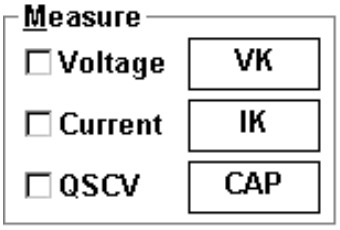
Stimulus Controls



The Stimulus controls consist of two switches: VOLTAGE and CURRENT. These switches are used to specify the electrical characteristic of the forcing signal.

Depending upon the source, one of the two switches may be unavailable. For example, the HP4155/56 Voltage Monitor Units (VMs) are designed for high resolution voltage measurements. VMs can NOT be configured to force a voltage or current.

Measure Controls



The Measure controls consist of three switches: VOLTAGE, CURRENT, and QSCV. In addition to each measure switch, 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. These labels cannot end in numbers.

Specifying Returned Data

Depending upon the particular HP4155/56 source, ICS may be configured to return the forcing signal, the forcing signal complement, both, or none. For an overview of each source's capability please refer to Hewlett Packard documentation on the individual HP4155/56 sources.

A source's measurement configuration is specified by turning on or off the VOLTAGE and CURRENT switches. Depending upon the particular source, one of the two switches may be unavailable.

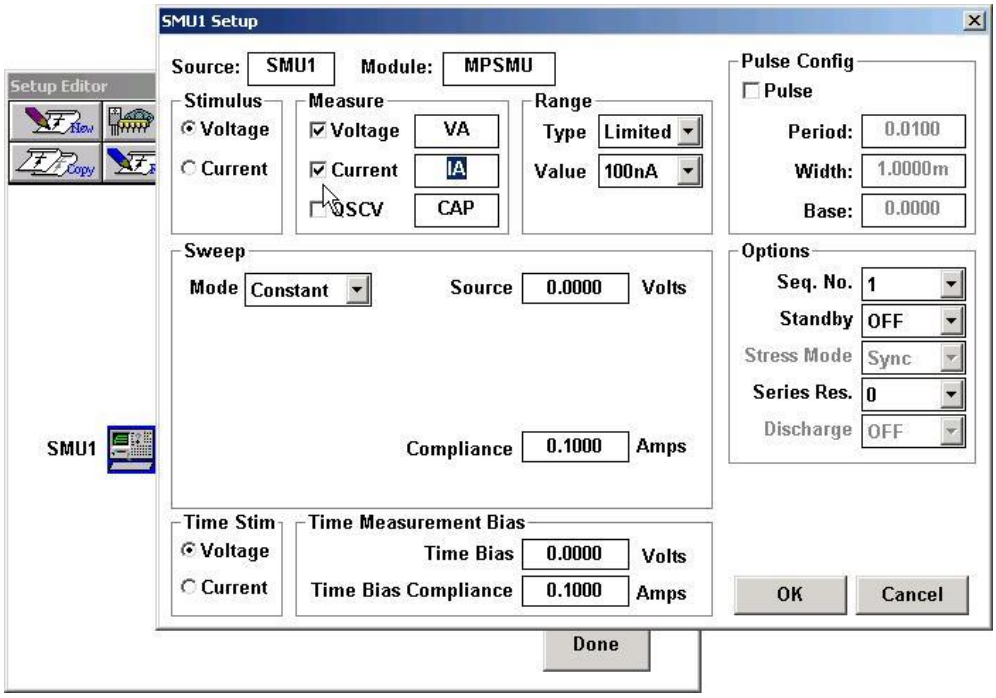


Figure 9: How to Specify Returned Data

How to Specify Returned Data:

1. Open the Source Unit Setup dialogue box corresponding to the source that will return data.
2. Click on one or both of the measure switches.
3. After you select either of the measure switches, a default text label will appear in the field next to the corresponding switch. If the default label is unacceptable, specify an alternative name for the measured characteristic.

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 six 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 sources, up to 42 data vectors per test setup can be measured.

Test setups that use a combination of step sources and sweep sources can return sequential and non-sequential data vectors. Test setups that use a combination of constant sources and sweep sources can 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.

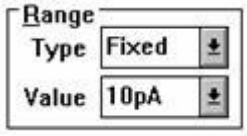
For example, consider the DC collector characteristics of a bipolar transistor. The DC collector characteristics were obtained by generating a family of ICE vs. VCE curves. This setup was created by applying a stepped current supply to the base and a swept voltage supply to the collector. The source unit connected to the collector returned both collector voltage (VCE) and collector current (ICE). Each time the base current was stepped to a new value, a unique ICE curve was obtained in response to the collector voltage sweep. The result of this test setup was a family of unique ICE curves. ICE 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 ICE vs. VCE 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 (VCE) and collector current (ICE). Because the base current was stepped, the test setup returned a family of ICE curves, but the voltage sweep applied to the collector during each base current step was the same. Therefore, VCE is a non-sequential data vector because VCE can be described by a single curve.

Range Controls



The Range of the measurement may be specified if desired. The TYPE control allows for the selection of either AUTO, FIXED, or LIMITED type of ranges, and the VALUE control corresponds to the valid measurement ranges available for the TYPE selected and the source type being configured.

Force or Sweep Condition Controls

The Force Condition controls are used to specify the shape and boundaries of the forcing signal, as well as the forcing signal's compliance limit.

Mode

The shape of the forcing signal is selected from a list of available signal outputs in the MODE field. The forcing signal may be characterized as a SWEEP, SYNCHRONIZED SWEEP, STEP, COMMON or CONSTANT supply. (These designations are the ICS equivalent of the VAR1, VAR1', VAR2, COMMON, and CONST front panel source functions.) To select the desired sweep mode, click the MODE field scroll arrow. Clicking on the scroll arrow will display a list of available sweep modes. Click on the desired selection.

Sweep Mode

The sweep mode generates either a linear or logarithmic single or double staircase sweep signal between two specified boundary values with the number of steps being equal to the value in points.

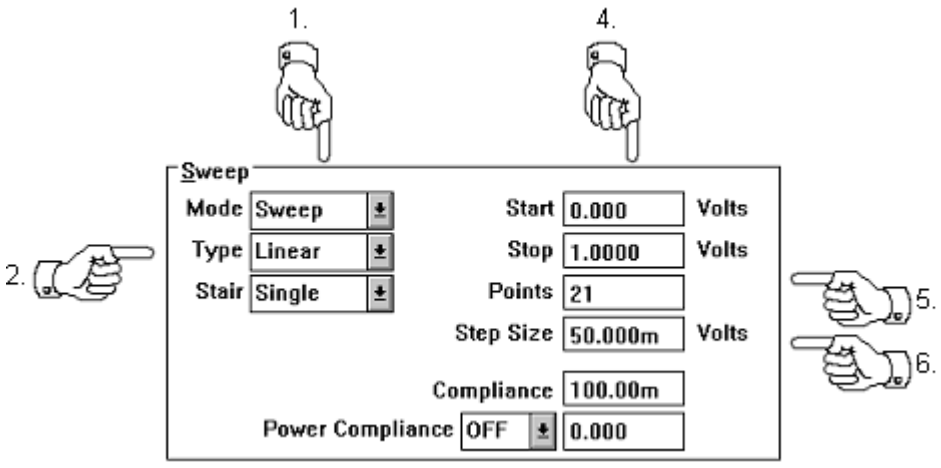


Figure 10: How to Source a Sweep Signal

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 #5. Select between a linear or logarithmic distribution by selecting the appropriate designation in the TYPE field.
3. The data point distribution of the sweep signal can be shaped as either a single or double stair. Select between a single or double stair shape by selecting the appropriate designation in the STAIR field.
4. Specify the range of the sweep signal in the START and STOP fields.
5. 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.
6. 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 source unit can force a synchronized output only when a primary sweep signal is forced by another source unit in the test setup. If a synchronized sweep mode is designated in a test setup that does not include a primary sweep signal, ICS will display an error message when the user attempts to execute the test setup.

The data point distribution of both the primary sweep signal and the synchronized sweep signal must be linearly calculated. The data point distribution of the synchronized sweep signal is automatically designated to be identical to the primary sweep source.

The stimulus of the synchronized sweep signal must match the stimulus of the primary sweep. In other words, if the primary sweep signal forces a voltage, the synchronized sweep signal must also force a voltage.

While the *timing* of the primary and secondary sweep signals are synchronized, the magnitudes can differ. The magnitude of the synchronous 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 in Figure 11.

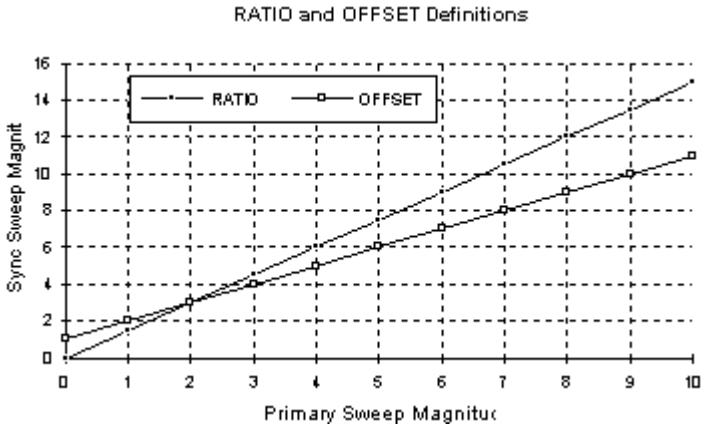


Figure 11: Synchronous Sweep "Ratio" and "Offset" Definitions.

When a RATIO is specified:

Sync Sweep Mag = Primary Mag * (Ratio)

When an OFFSET is specified:

Sync Sweep Mag = Primary Mag + (Offset).

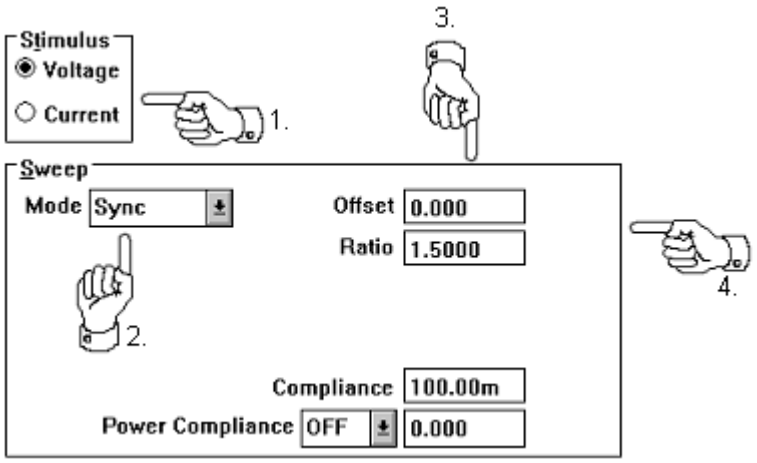


Figure 12: How to Source a Synchronized Sweep Signal

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. The output stimulus of the synchronous sweep must match the output stimulus of the primary sweep. Select the output stimulus of the synchronous sweep source, either VOLTAGE or CURRENT, from the Stimulus group of controls to match the stimulus of the primary sweep source.
2. Select the "SYNC" designation from the available options listed in the MODE field.
3. 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.
4. 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 generates a constant output signal while a second source unit generates a sweep signal. After the sweep signal reaches the specified STOP value, the magnitude of the step output is incremented by the STEP value and the sweep output is triggered again. This process continues until the STOP value of the step signal is reached.

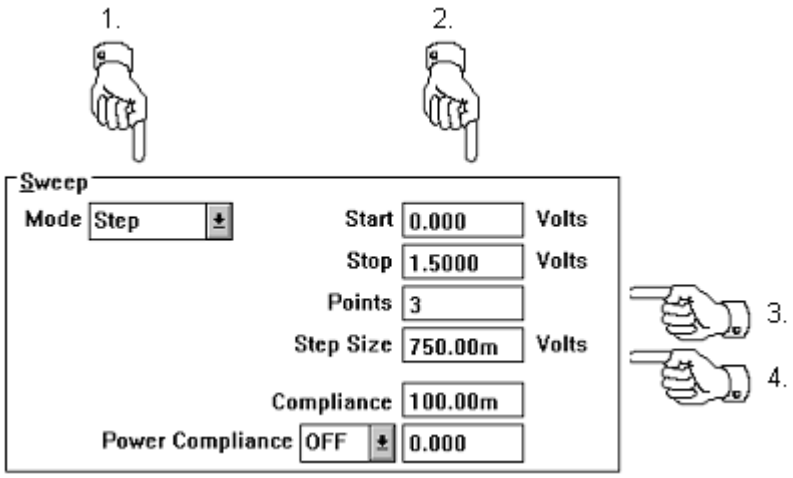


Figure 13: How to Source a Step Signal

How to Source a Step Signal:

1. Select the "STEP" designation from the available options listed in the MODE field.
2. Specify the range of the step signal in the START and STOP fields.
3. Specify the increment quantity in the POINTS field.
4. The increment size will be displayed in the STEP SIZE field. After a value is entered in the POINTS 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. The step mode can only be used in test setups that also include the specification of a sweep signal. A source unit configured in a step mode will force a constant value signal while a second source unit generates a sweep signal. After the sweep signal has been applied, the step value will be incremented in preparation for another sweep application. This process continues until the stop value of the step signal is reached.

Constant Mode

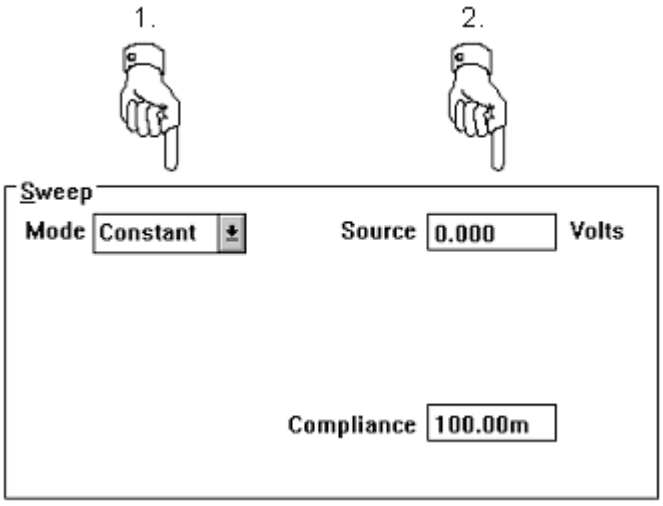


Figure 14: How to Force a Constant Signal

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 SOURCE field.

Type

The TYPE field is used to designate whether the data point distribution of a sweep output is linearly or logarithmically calculated. This field is displayed when the SWEEP designation is selected in the MODE field.

Stair

The STAIR field is used to designate whether the data point distribution of a sweep output will be or single or double stair shape. This field is displayed when the SWEEP designation is selected in the MODE field.

Start

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

Points

The POINTS field is used to specify the data point quantity in all MODEs.

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 POINTS in a linear sweep or 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.

Source

The SOURCE 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 forcing 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. Depending upon the source units being used, the compliance limit may be locked at a particular value.

Power Compliance

The POWER COMPLIANCE controls are used to specify the limiting magnitude of the power of a measured signal.

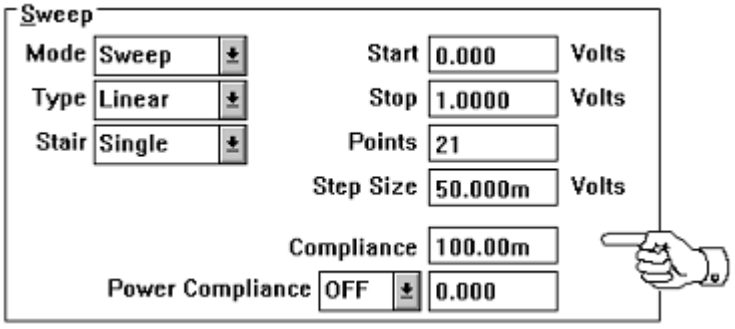


Figure 15: Designating a Measurement Compliance

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 Hewlett Packard documentation on the individual SMUs for an overview of the HP4155/56 compliance configurations and power limitations.

Detecting Compliance Events

If the Display Errors switch is selected in the Mainframe Setup dialogue box, ICS will display a message if a compliance limit is detected and all other errors detected during the measurement. (The Mainframe Setup dialogue box is opened by clicking the Setup Editor OPTIONS button.)

Power Compliance Field

The POWER COMPLIANCE field is used to specify the limiting magnitude of power for an SMU. Power compliance may be selected as ON or OFF. When Power Compliance is ON the limiting magnitude of power is set in the field.

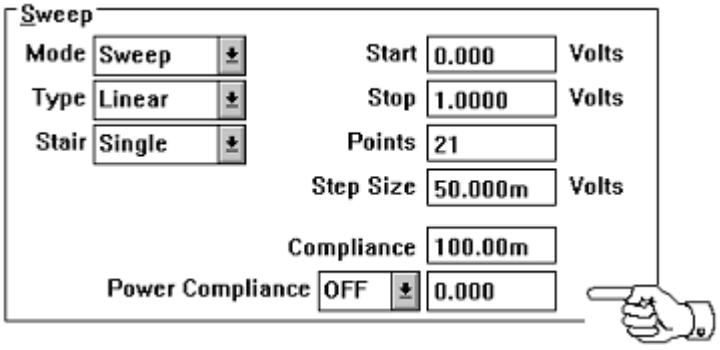
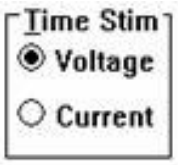


Figure 16: Designating a Measurement Power Compliance



Time Stimulus Controls

The Time Stimulus controls consist of two switches: VOLTAGE and CURRENT. These switches are used to specify the electrical characteristic of the forcing signal during ICS controlled Time Measurements which include Time Measure and Bias Delay measurements.

Time Measurement Bias Condition Controls

The Time Measurement Bias condition controls are used to generate a signal that remains at a constant magnitude throughout the duration of the time period of the time measurement. Time Measurement Bias conditions are utilized by ICS and not by the HP4155/56. Time Measurement bias is set using "4156 User Mode". When this mode is used on the 4156 the interlock must be closed or the system will return an error requesting the interlock be connected. See the HP4156 manual from HP for further information regarding the 4156 interlock feature.

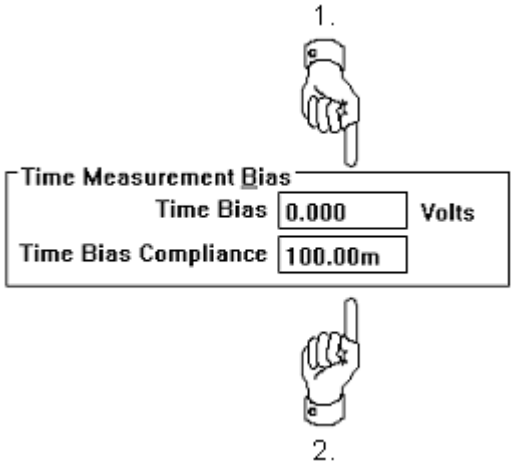


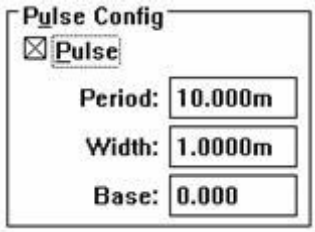
Figure 17: How to Force a Time Measurement Signal

How to Source a Time Measurement Bias:

1. Specify the signal magnitude in the TIME BIAS field.

2. Specify the compliance magnitude in the TIME BIAS COMPLIANCE field.

SMU Pulse Configuration Controls

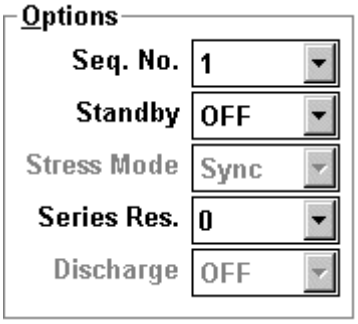


The SMU Pulse Configuration Controls are used to apply the selected sourcing mode in a pulse configuration. Only one SMU may be configured as a pulse unit. This rule does not apply to Pulse Generator Units.

How to Configure an SMU in Pulse Mode:

1. Select PULSE in the Pulse Config group of controls. The PULSE switch enables, if selected, or disables, if not selected, the pulse mode of an SMU.
2. Specify the pulse period in the PERIOD field. The pulse period specifies the length of the complete period of a single pulse.
3. Specify the pulse width in the WIDTH field. The pulse width specifies the width of a single pulse during the time the SMU is forcing the source value.
4. Specify the pulse base value in the BASE field. The base value specifies the source value during the pulse off time.

Option Controls



The Option Controls include various controls for setting options for individual Source Measure Units.

Seq. No.

The Sequence Number control is used to specify the power and measurement sequencing order of the SMUs.

Standby

The Standby control is used to specify the Standby state of an SMU. The state may either be ON or OFF corresponding to continue or stop forcing the source value after measurement is completed.

Stress Mode

The Stress Mode control is used to specify the Stress Mode state of an SMU. The state may either be Sync or NSync corresponding to the SMU being or not being one of four syncronizeable sources during the Stress Mode.

Series Res.

The Series Resistance control is used to specify the series resistor to be switched into use during the measurement for the SMU.

Discharge

The Discharge control is used to control the new discharge feature of the VMU's of the 4155-6C.

The Pulse Generator Unit Setup Dialogue Box

The setup conditions of each Pulse Generator Unit are independently controlled from a PGU Setup dialogue box. There is a PGU Setup dialogue box that corresponds to each HP4155/56 PGU. Each PGU Setup dialogue box is accessed from the Setup Editor. An example of a Pulse Generator Unit Setup dialogue box is shown in Figure 18.

How to Display a Pulse Generator Unit Setup Dialogue Box:

In order to display a Pulse Generator Unit Setup dialogue box, the corresponding source must be attached to the device schematic in the Setup Editor.

1. If only one source unit connection is designated at the same schematic pin, click once on the instrument icon to open the corresponding Pulse Generator Unit Setup dialogue box.
2. If more than one source unit connection is designated at the same schematic pin, click once on the instrument icon to display a list of designated source unit connections.
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 Pulse Generator Unit Setup dialogue box.

The layout of a Pulse Generator Unit Setup dialogue box is similar to the example pictured below.

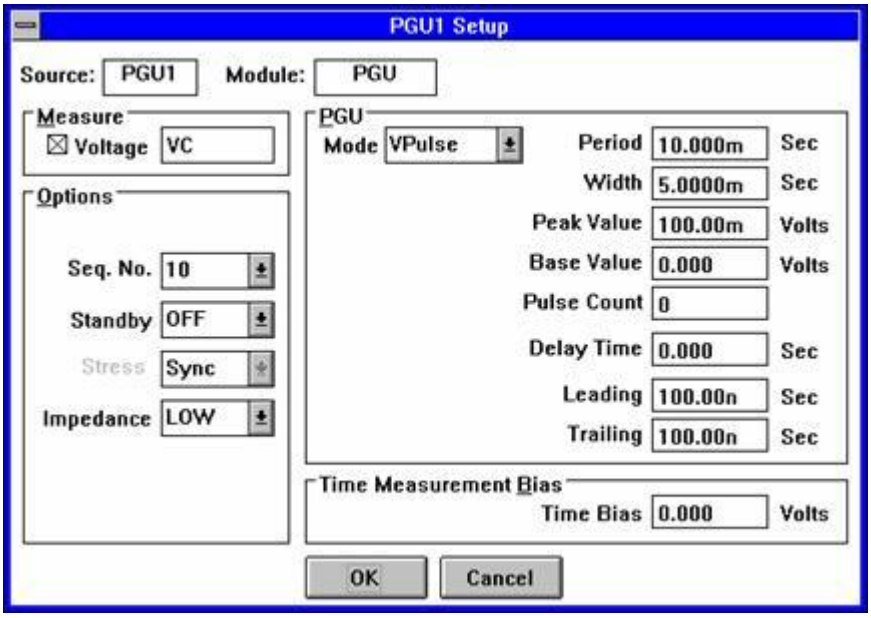
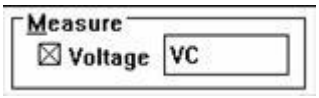


Figure 18: The Pulse Generator Unit Setup Dialogue Box Corresponding to "PGU1".

1. **Source and Module Unit Identity Field**: These fields are static display fields identifying the source unit and the type of module.
2. **Measure Control**: This group includes the switch necessary to specify the type of signal the source unit will return as a measurement. This group also includes the necessary field to label the returned measurement.
3. **Pulse Force Condition Controls**: The fields included within this group are used to define the shape of the pulse forcing signal.
4. **Time Measurement Bias Condition Control**: The field included within this group is used to define the forcing signal for ICS Time Measurements.
5. **Option Controls**: The fields included within this group are used to define optional parameters.

Measure Control



The Measure control consist of a single switch labeled VOLTAGE. In addition to the measure switch, a text field is located to the right of the switch. This switch and text field is used to specify and label the data that will be returned when the test setup is executed.

Specifying Returned Data

For Pulse Generator Units the only signal which may be selected for return is the source value of the PGU. For an overview of a PGU's sourcing capability, please refer to Hewlett Packard documentation on the HP4155/56.

A PGU's measurement configuration is specified by turning on or off the VOLTAGE switch.

How to Specify Returned Data:

1. Open the PGU Setup dialogue box corresponding to the PGU that will return data.
2. Click on the VOLTAGE switch.
3. After you select the measurement switch, a default text label will appear in the field next to the switch. If the default label is unacceptable, specify an alternative name for the measured characteristic.

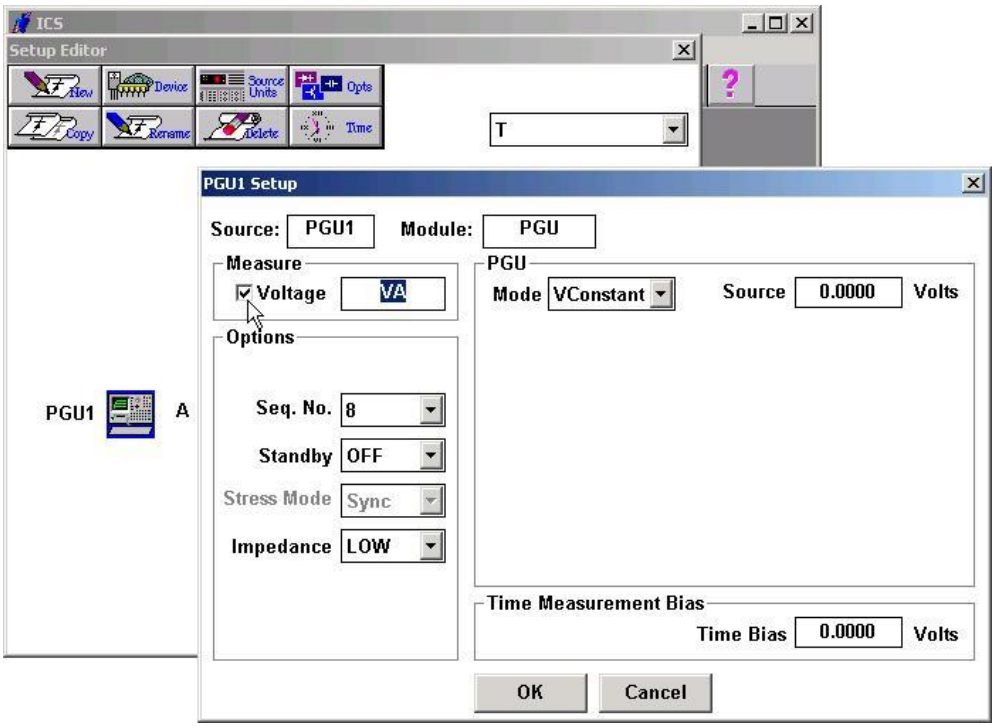


Figure 19: How to Specify Returned Data

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 switch. A data vector label must be unique and can be any alphanumeric string up to three characters in length.

The presence of only one data vector field does not mean that only one data vector can be specified in a test setup. In fact, by using a combination of step, sweep, and pulse sources, up to 42 data vectors per test setup can be measured.

Test setups that use a combination of step sources, sweep sources, and pulse sources can return sequential and non-sequential data vectors. Test setups that use a combination of constant sources, sweep sources, and pulse sources can 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.

Non-Sequential Data Vectors

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

Pulse Force Condition Controls

The Pulse Force Condition controls are used to specify the shape and boundaries of the pulse forcing signal.

Mode

The shape of the forcing signal is selected from a list of available signal outputs in the MODE field. The forcing signal may be characterized as a VCONSTANT or VPULSE supply. To select the desired sweep mode, click the MODE field scroll arrow. Clicking on the scroll arrow will display a list of available sweep modes. Click on the desired selection.

VConstant

The VConstant mode generates constant value, non-pulsed, signal.

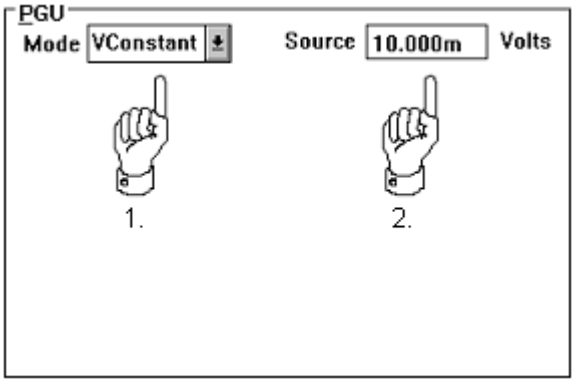


Figure 20: How to Source a VConstant Signal

How to Source a VConstant Signal:

1. Select the "VConstant" designation from the available options listed in the MODE field.
2. Specify the value of the constant signal in the SOURCE field.

VPulse Mode

The VPulse mode generates pulsed constant value signal.

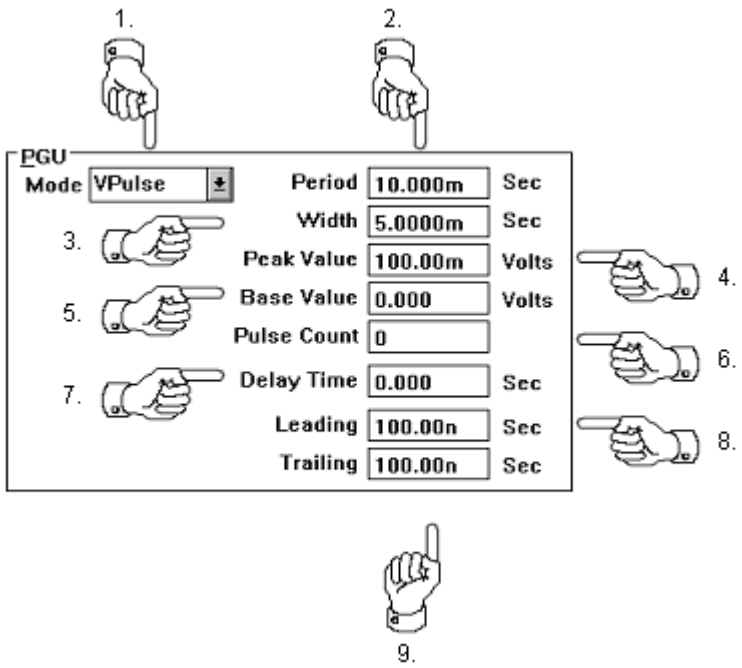


Figure 21: How to Source a VPulse Signal.

How to Source a VPulse Signal:

1. Select the "VPulse" designation from the available options listed in the MODE field.
2. Specify the pulse period in the PERIOD field.
3. Specify the pulse width in the WIDTH field.
4. Specify the force value of the pulsed signal in the PEAK VALUE field.
5. Specify the base force value of the pulsed signal in the BASE VALUE field.
6. Specify the number of pulses, if required, in the PULSE COUNT field.
7. Specify the delay time in the DELAY TIME field.
8. Specify the leading time of the pulses in the LEADING field.
9. Specify the trailing time of the pulses in the TRAILING field.

Time Measurement Bias Condition Controls

The Time Measurement Bias condition controls are used to generate a signal that remains at a constant magnitude throughout the duration of the time period of the time measurement. Time Measurement Bias conditions are utilized by ICS and not by the HP4155/56.

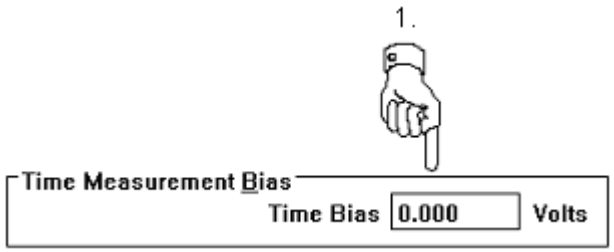


Figure 22: How to Force a Time Measurement Signal

How to Source a Time Measurement Bias:

1. Specify the signal magnitude in the TIME BIAS field.

Option Controls

The Option Controls include various controls for setting options for individual Pulse Generator Units.

Seq. No.

The Sequence Number control is used to specify the power and measurement sequencing order of the PGU.

Standby

The Standby control is used to specify the Standby state of an PGU. The state may either be ON or OFF corresponding to continue or stop forcing the source value after measurement is completed

Stress Mode

The Stress Mode control is used to specify the Stress Mode state of an PGU. The state may either be Sync or NSync corresponding to the PGU being or not being one of four syncronizeable sources during Stress Mode.

Impedance

The Impedance control is used to specify the internal impedance of the PGU.

Mainframe Setup Dialogue Box

The Mainframe Setup dialogue box provides access to the Sampling and Stress Measurement Setups functions as well as Measure Times, Trigger control, Integration control, Disk I/O, Auto Analysis, Calibration, and global Options. The configuration of the Mainframe Setup dialogue box can be uniquely specified for each test setup. Mainframe Setup parameters are not specific to a single source unit; instead, the options are applicable to the overall control of the Mainframe during test setup execution. In general, the default specifications in this dialogue box will be sufficient for most measurement applications.

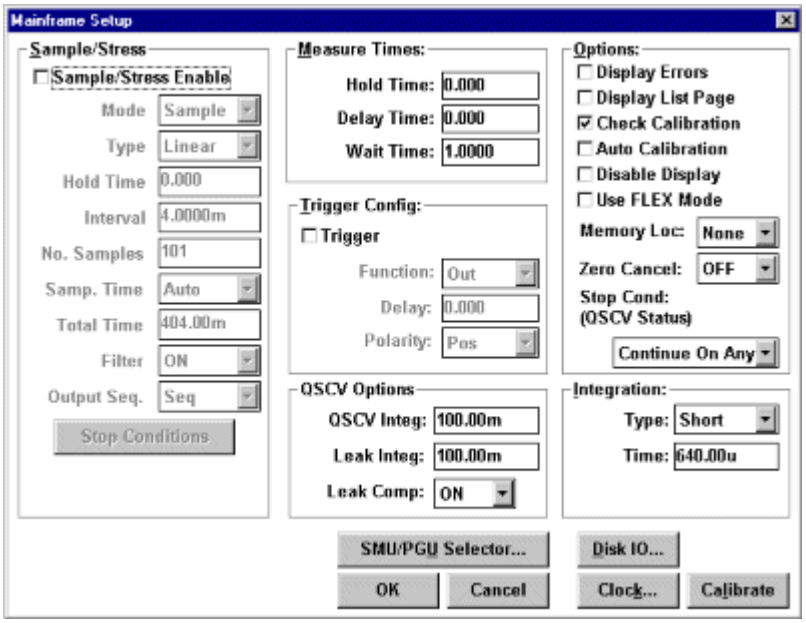


Figure 23: Mainframe Setup Dialogue Box.

The Mainframe Setup dialogue box is opened by clicking the Setup Editor OPTIONS button after designating at least one Source Unit/DUT connection. The HP4155/56 Mainframe specifications are applicable to every source unit in the test setup. When a new test setup is created, the Mainframe Setup dialogue box can be designated without affecting the mainframe setup configuration in the original test setup(s).

Sampling Measurement Setup

Sampling Measurement Setup is used to perform constant bias measurements, at specified intervals of time, until either a stop conditions is reached or a specified number of measurements are taken.

Sampling Parameter Setup

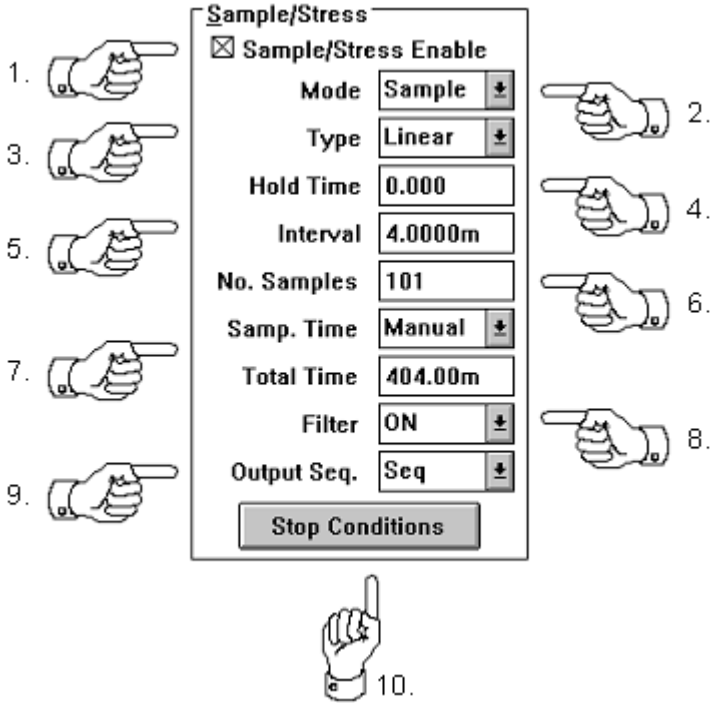


Figure 24: How to Setup Sampling Measurement parameters.

How to Setup Sampling Measurement Parameters:

1. Click on the Sample/Stress Enable switch.
2. Select Sample from the MODE selection control.
3. Select the type of sampling to be performed from the TYPE control.
4. Specify the hold time in the HOLD TIME field.
5. Specify the sampling time interval in the INTERVAL field.
6. Specify the number of samples, if required, in the NO. SAMPLES field.
7. Select the sampling time from the SAMP. TIME and TOTAL TIME controls. To enter a total sampling time other than AUTO or NO LIMIT select MANUAL from the SAMP. TIME control and enter the total time value in the TOTAL TIME field.
8. Select the filter state from the FILTER control.

9. Select the output sequence state from the OUTPUT SEQ. control.
10. Setup the sampling stop conditions by accessing the Sampling Stop Conditions Dialogue Box through the Stop Conditions push button. See Sampling Stop Conditions Dialogue Box for a description of how to setup the sampling stop conditions.

Sampling Stop Condition Dialogue Box

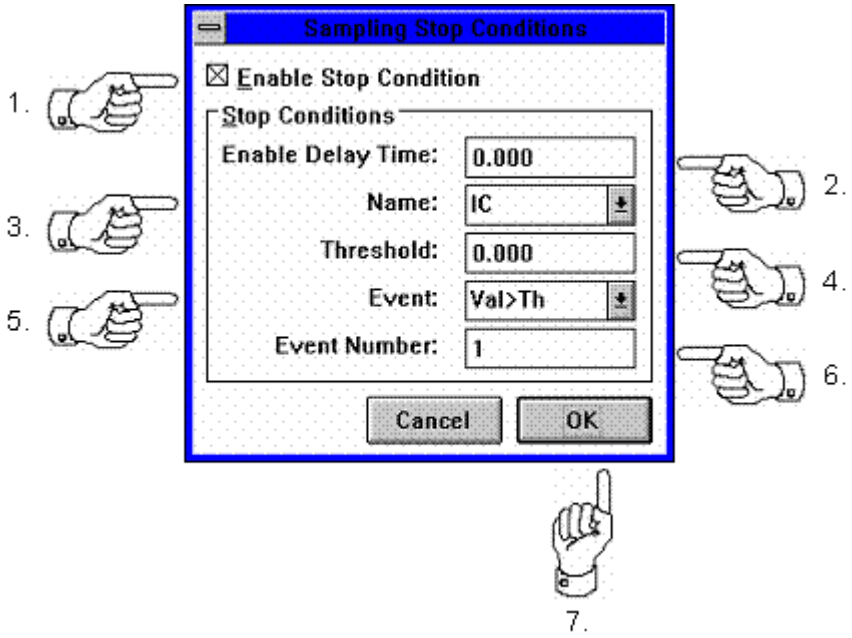


Figure 25: How to Setup Sampling Stop Conditions.

How to Setup Sampling Stop Conditions:

1. Click on the Enable Stop Condition switch.
2. Specify the enabling of the stop condition delay time in the ENABLE DELAY TIME field.
3. Select the data vector to on which to perform the stop condition test.
4. Specify the threshold value, against which to test the return value, in the THRESHOLD field.
5. Select the event or condition type to use from the EVENT control.
6. Specify the stop condition occurrence or event number on which to stop in the EVENT NUMBER field.
7. Click on OK to return to the Mainframe Setup Dialogue.

Stress Measurement Setup

Stress Measurement Setup is used to perform constant bias stressing on devices for specified intervals of time.

Stress Parameter Setup

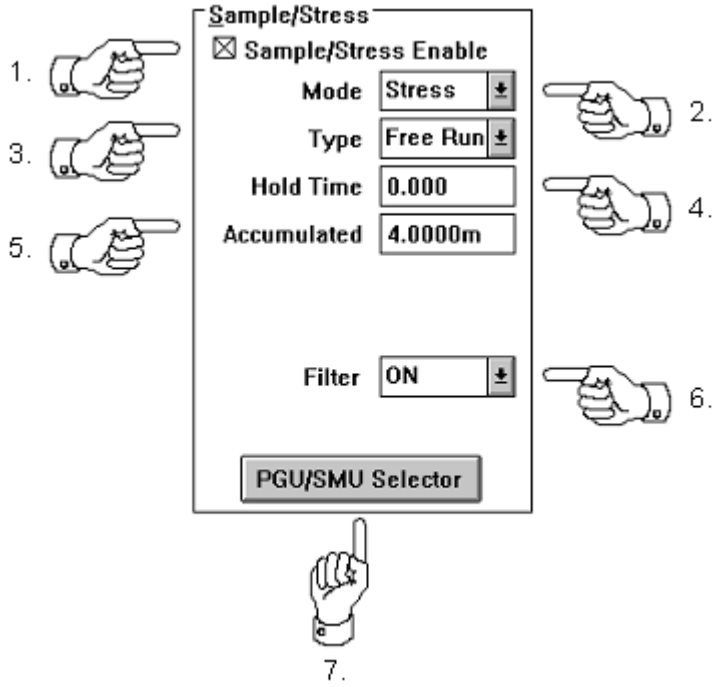


Figure 26: How to Setup Stress Measurement parameters.

How to Setup Stress Measurement Parameters:

1. Click on the Sample/Stress Enable switch.
2. Select Stress from the MODE selection control.
3. Select the type of stress to be performed from the TYPE control.
4. Specify the hold time in the HOLD TIME field.
5. Specify the accumulated stress time in the ACCUMULATED field.
6. Select the filter state from the FILTER control.
7. Setup the SMU/PGU Selector controller by accessing the SMU/PGU Selector Dialogue Box through the SMU/PGU Selector push button. See SMU/PGU Selector Dialogue Box for a description of how to setup the selector controller.

SMU/PGU Selector Dialogue Box

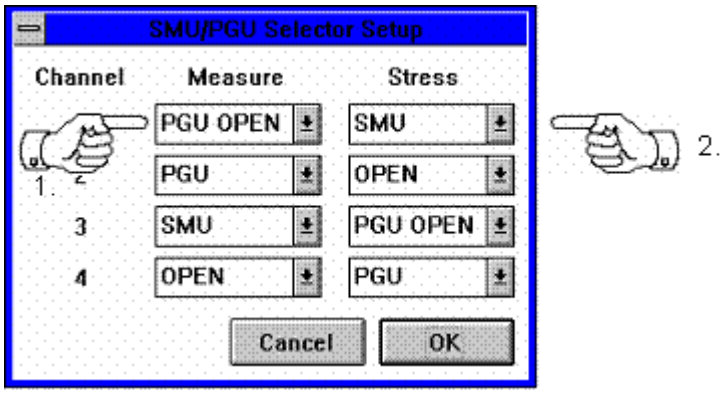


Figure 27: How to Setup the SMU/PGU Selector.

How to Setup the SMU/PGU Selector:

For each channel being utilized through the SMU/PGU Selector the following must be setup:

1. For channels one through four select the state of the measure relay in the MEASURE control corresponding the desired channel.
2. For channels one through four select the state of the stress relay in the STRESS control corresponding the desired channel.

Mainframe Options

Mainframe Options provides access to Measure Times, Trigger control, Integration control, Disk I/O, Auto Analysis, Calibration, and global Options for the HP4155/56 driver.

Measure Times

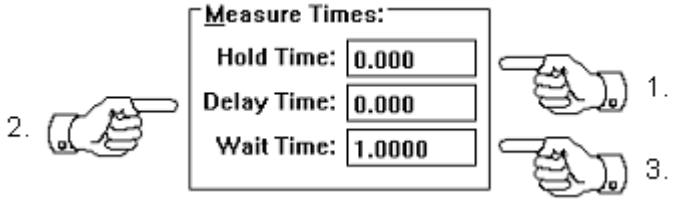


Figure 28: How to Setup Measurement Times.

How to Setup Measure Times:

1. Specify the measurement hold time in the HOLD TIME field. Hold time is the amount of time the instrument will wait after applying the first sweep point before beginning the measurement. This applies only to the first point of a swept measurement.
2. Specify the measurement delay time in the DELAY TIME field. Delay time is the time the instrument will wait between consecutively forced measurement points.
3. Specify the measurement wait time in the WAIT TIME field. Wait time is the auto ranging delay. Please refer to the 4156 manuals for a complete description of this feature.

Trigger Configuration

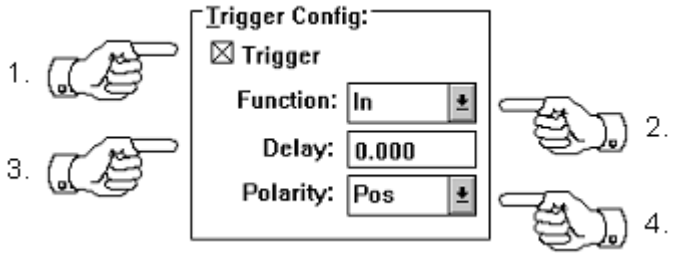


Figure 29: How to Setup the Trigger Configuration.

How to Setup the Trigger Configuration:

1. Click on the trigger switch labeled TRIGGER to enable the Instrument's triggering function.
2. Select the triggering function from the FUNCTION control. Trigger IN allows an external instrument to trigger a measurement on the HP4155/56. Trigger OUT allows the HP4155/67 to trigger a measurement on an external instrument.
3. Specify the trigger delay time in the DELAY field.
4. Select the triggering polarity from the POLARITY control.

Integration Configuration

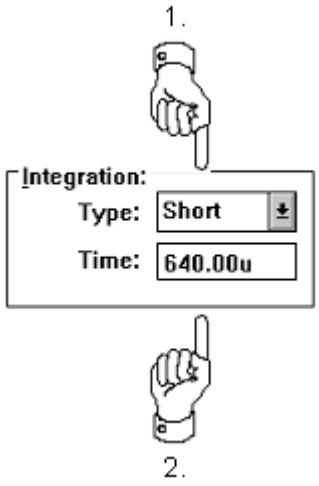


Figure 30: How to Setup the Integration Configuration.

How to Setup the Integration Configuration:

1. Specify the integration type in the TYPE field. Long Integration reduces the measurement errors caused by external noise sources. To perform high speed measurements use Short integration and to perform more accurate measurements use Med or Long integration.
2. Specify the integration time in the TIME field. Integration time for Short and Long integration may be adjusted utilizing the TIME field. Med integration time may not be changed and is fixed to 1 Power Line Cycle.

Note:

Short Integration is specified in terms of seconds, Medium is pre-defined, and long is defined in terms of Power Line Cycles (PLC).

QSCV Options

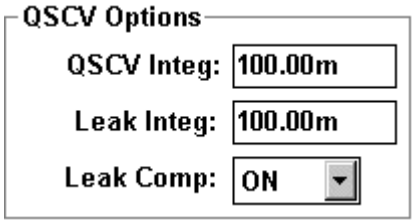


Figure 31: QSCV Options.

How to Setup the QSCV Options:

1. Specify the QSCV integration time.
2. Specify the Leak integration time.
3. Select the Leak Comp state. If the Leak Comp option is turned on the system will use the leakage value measured by performing a zero cancel.

Options Descriptions

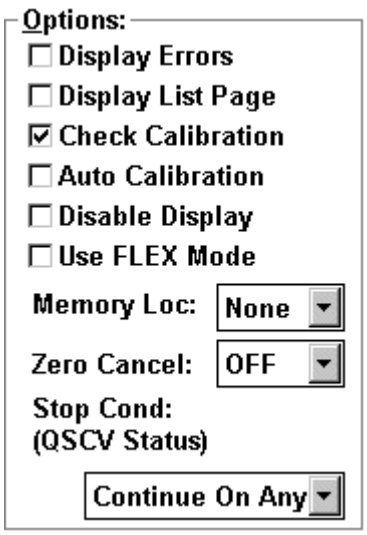


Figure 32: HP4155/56 Option Parameters.

Display Errors

The DISPLAY ERRORS switch is used to designate whether errors or problems, which the instrument reports, should be displayed to the user.

Display List Page

The DISPLAY LIST PAGE switch is used to designate that the 4155(6) presents data in the list page view only.

Check Calibration

The CHECK CALIBRATION switch is used to designate that the instrument verify no calibration errors exist before each measurement..

Auto Calibration

The AUTO CALIBRATION switch us used to designate whether the Auto Calibration switch on the instrument is in the ON or OFF position. If Auto Calibration is in the ON position then self-calibration is performed automatically every 30 minutes.

Disable Display

The DISABLE DISPLAY switch is used to turn off the display update feature.

Use FLEX Mode

The USE FLEX MODE switch is used to designate that the 4156C uses FLEX commands as opposed to SCPI. This mode is only supported for single point, sweep, and synchronous sweep modes.

Memory Loc

The MEMORY LOC control is used to designate that the current test setup be stored in the 4156 Memory on the instrument. Up to 4 locations may be selected. If a setup is stored in memory it is loaded faster each time the test is run. If more than one ICS project is used, the Memory Loc feature is disabled since the software does not know the state of the memory locations.

Zero Cancel

The ZERO CANCEL control is used to designate the state of the Zero Cancel control on the instrument. Valid selections include ON or OFF. The Zero Cancel function measures the zero offset data and then uses this data to compensate the measurement results.

Stop Condition

The STOP CONDITION control corresponds to the Sweep Status control on the Instrument's Measurement Page. This control is used to designate what happens in the occurrence of or an abnormal or compliance status. Valid selections include CONTINUE ON ANY, ABNORMAL STATUS, and COMPLIANCE.

Disk I/O Functions

Disk I/O Functions provides access to all HP4155/56 floppy disk functions except for the disk initialize functions. These functions include Save setup to disk, Purge a file from disk, Copy a file, Rename a file, Catalog of files on the disk, and Execution of an IBASIC or Measurement setup file.

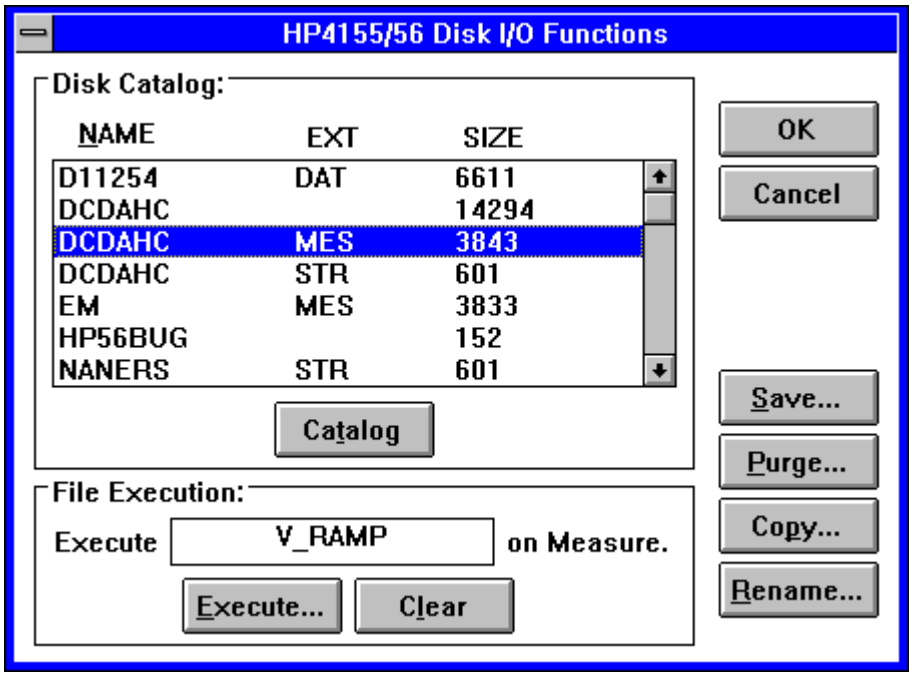


Figure 33: Disk I/O Functions Dialogue Box.

Using the HP4155/56's File Save Function

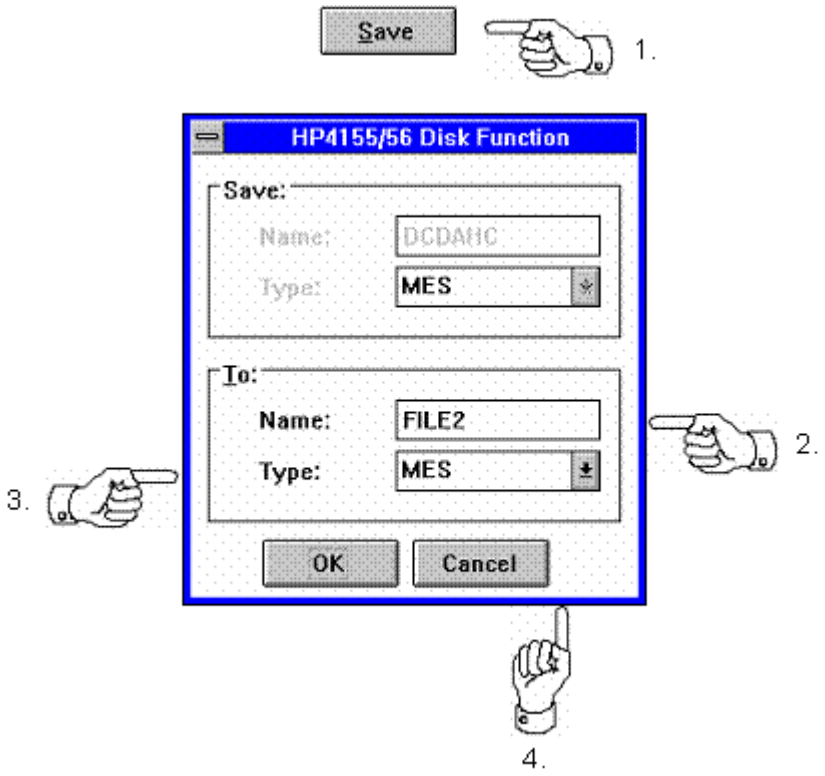


Figure 34: How to Save the current setup on the HP4155/56 to the HP4155/56's disk.

How to use the HP4155/56's File Save Function:

To get to the Auto Analysis Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the DISK I/O push button.

1. Click on the SAVE push button on the HP4155/56 Disk Functions dialogue box. This will cause the HP4155/56 Disk Function dialog box to appear in the save function state.
2. Designate the name to be used for the file in the NAME field. Maximum number of characters for LIF format names is 6 and for DOS format names is 8.
3. Designate the type of file to be saved in the TYPE field. Valid types include MES for measurement setup, STR for stress setup, DAT for measurement setup and result data, and CST for customized system data.
4. Select the OK button to perform the SAVE function.

Using the HP4155/56's File Purge Function

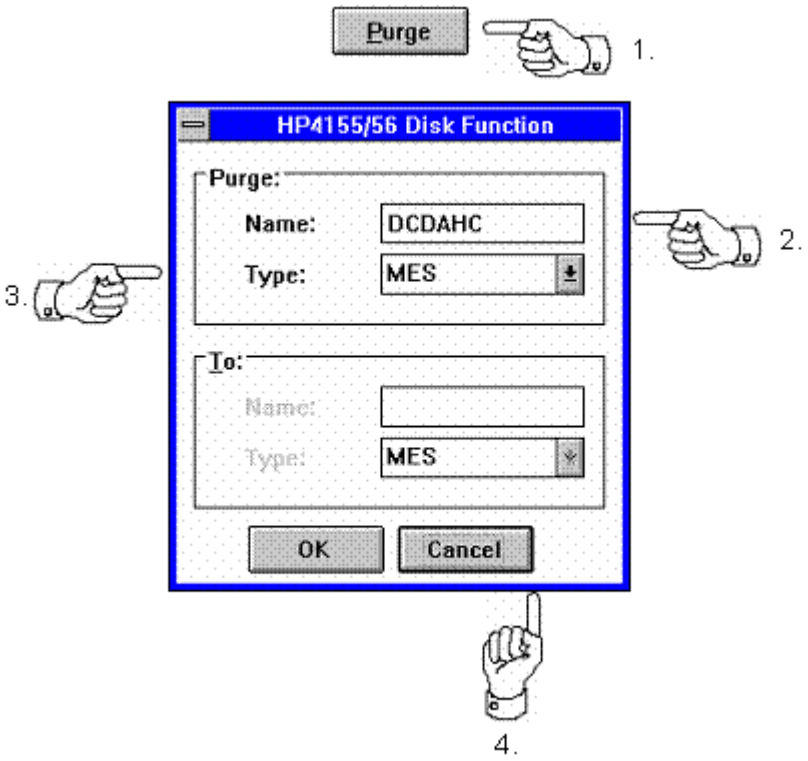


Figure 35: How to Purge a file from the HP4155/56's disk.

How to use the HP4155/56's File Purge Function:

To get to the Auto Analysis Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the DISK I/O push button.

1. Click on the PURGE push button on the HP4155/56 Disk Functions dialogue box. This will cause the HP4155/56 Disk Function dialog box to appear in the purge function state.
2. Designate the name of the file to be purged in the NAME field. Maximum number of characters for LIF format names is 6 and for DOS format names is 8.
3. Designate the type of file the file to be purged in the TYPE field. Valid types include MES for measurement setup, STR for stress setup, DAT for measurement setup and result data, and CST for customized system data.
4. Select the OK button to perform the PURGE function.

Using the HP4155/56's File Copy Function

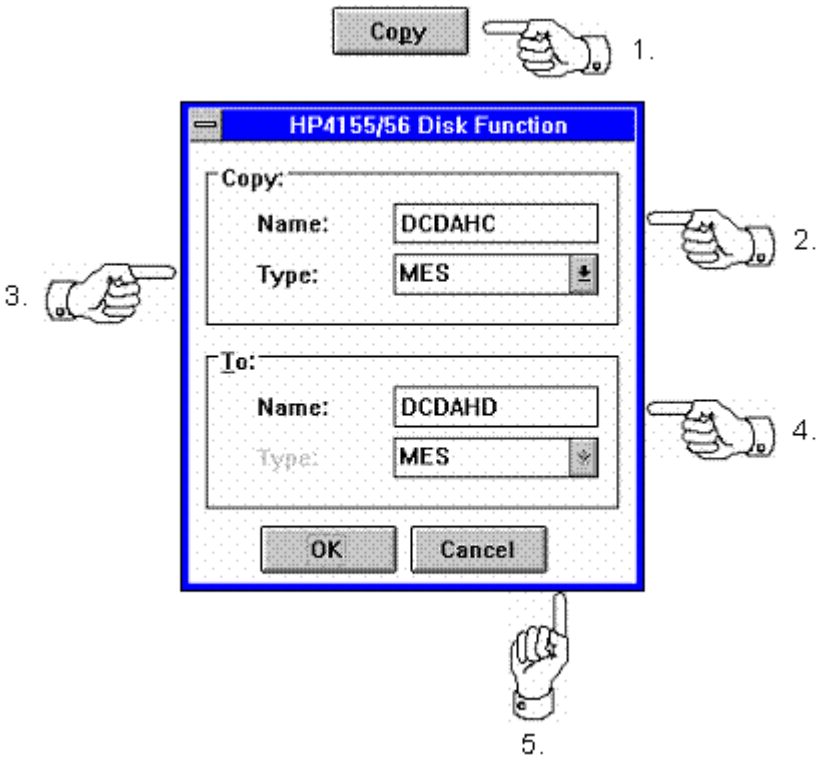


Figure 36: How to Copy a file on the HP4155/56's disk.

How to use the HP4155/56's File Copy Function:

To get to the Auto Analysis Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the DISK I/O push button.

1. Click on the COPY push button on the HP4155/56 Disk Functions dialogue box. This will cause the HP4155/56 Disk Function dialog box to appear in the copy function state.
2. Designate the source file name to be copied in the COPY NAME field. Maximum number of characters for LIF format names is 6 and for DOS format names is 8.
3. Designate the type of file to be saved in the TYPE field. Valid types include MES for measurement setup, STR for stress setup, DAT for measurement setup and result data, and CST for customized system data.
4. Designate the target file name to be used in the TO NAME field. Maximum number of characters for LIF format names is 6 and for DOS format names is 8.
5. Select the OK button to perform the COPY function.

Using the HP4155/56's File Rename Function

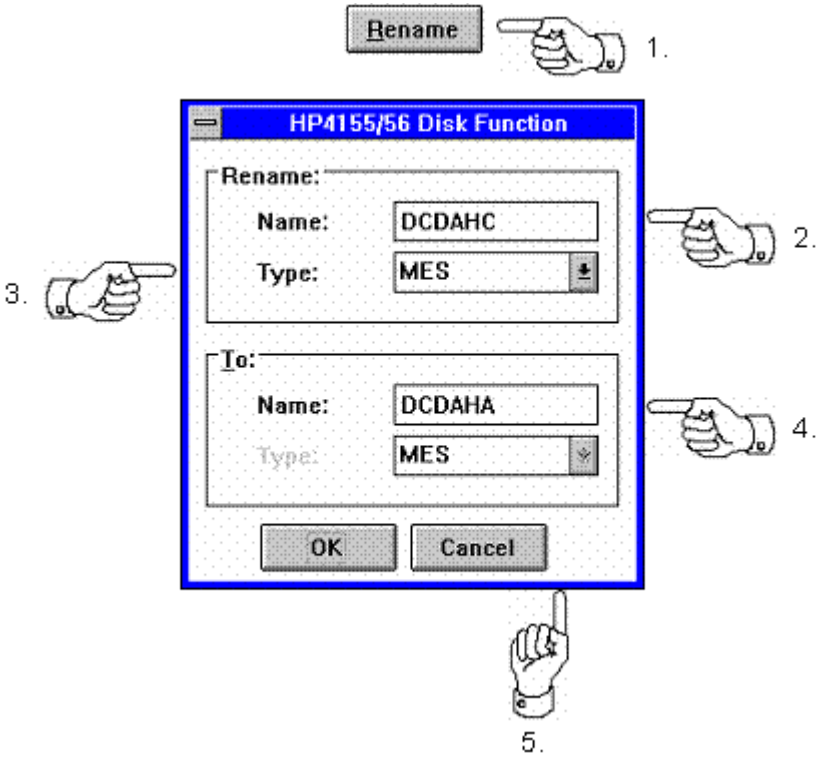


Figure 37: How to Rename a file on the HP4155/56's disk.

How to use the HP4155/56's File Rename Function:

To get to the Auto Analysis Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the DISK I/O push button.

1. Click on the RENAME push button on the HP4155/56 Disk Functions dialogue box. This will cause the HP4155/56 Disk Function dialog box to appear in the rename function state.
2. Designate the name to be used for the file in the NAME field. Maximum number of characters for LIF format names is 6 and for DOS format names is 8.
3. Designate the type of file to be saved in the TYPE field. Valid types include MES for measurement setup, STR for stress setup, DAT for measurement setup and result data, and CST for customized system data.
4. Select the OK button to perform the RENAME function.

Executing an IBASIC Program or an HP4155/56 Setup

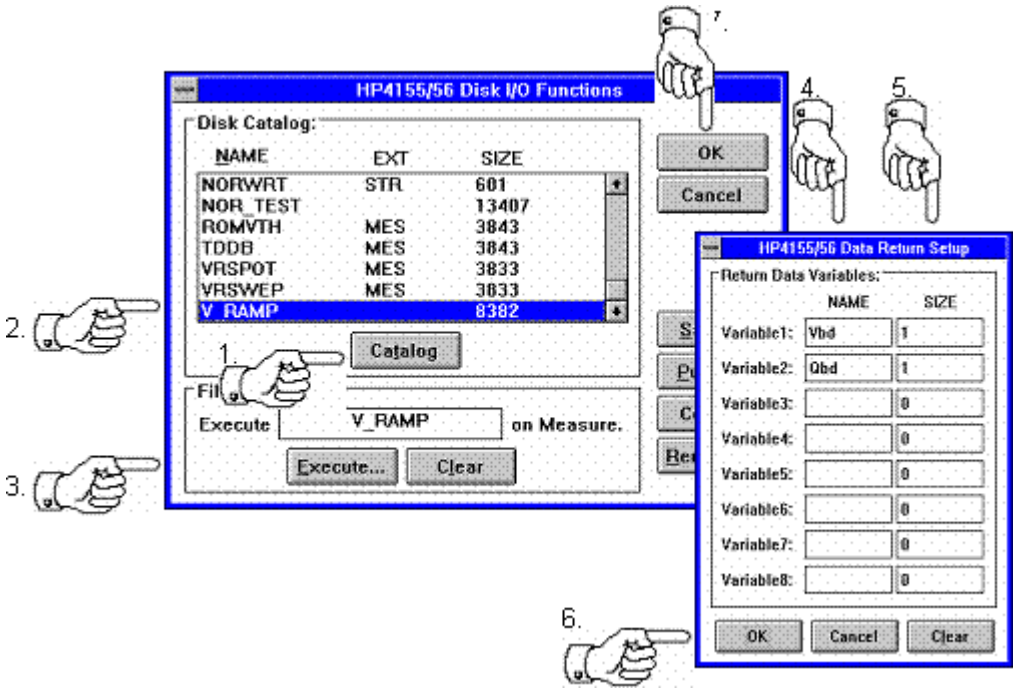


Figure 38: How to Execute and IBASIC Program or an HP4155/56 Setup from disk.

NOTE: The vector names for return variables are case sensitive. Also, be aware that not all variables are available to the GPIB bus. If you are able to query the Data using the command :DAT? '(dataname) and the data is returned without causing the GPIB bus to time out then ICS is able to return the data, otherwise the IBASIC program or setups must be changed to allow polling across the GPIB bus.

How to Execute an IBASIC Program or an HP4155/56 Setup:

To get to the Auto Analysis Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the DISK I/O push button.

1. Click on the CATALOG push button on the HP4155/56 Disk Functions dialogue box. This will retrieve a Catalog listing of the files located on the HP4155/56's disk.
2. Select the name of the file to be executed from the list of files by placing the mouse cursor on the name of the file and clicking on the left mouse button. The selected file will be highlighted.
3. Click on the EXECUTE push button to place the name of the file in the "Execute File ____ on Measure" control and to display the HP4155/56 Data Return Setup dialogue box.
4. Designate the name of the data variables to be returned in the NAME controls of the HP4155/56 Data Return Setup dialogue box.
5. Designate the array size of the data variables to be returned in the SIZE controls of the HP4155/56 Data Return Setup dialogue box.
6. Select the OK button to complete the definition of the variable names to be returned. If no data variables are defined for return the file will not be executed.
7. Select the OK button on the Disk I/O Functions dialogue box.

HP4155/56 Clock Set Function

Clock Set Function provides the ability to set the HP4155/56's internal time and date.

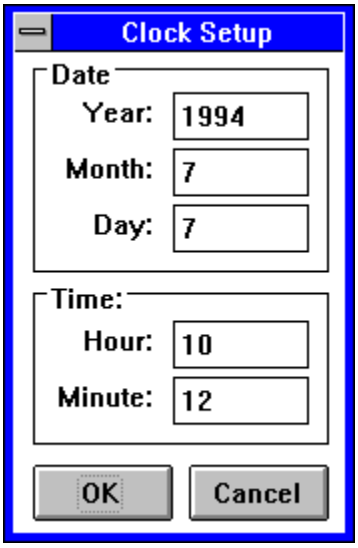


Figure 39: 4155/6 Clock Setup.

How to Set the HP4155/56's Internal Time and Date:

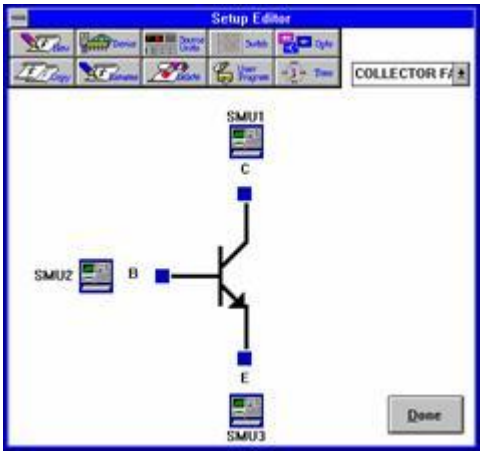
To get to the Clock Setup dialogue box, first click on the OPTS push button on the Setup Editor dialogue box to display the Mainframe Setup dialogue box. Then from the Mainframe Setup dialogue box click on the CLOCK push button.

1. Enter the Date and Time values in the corresponding controls.
2. Select the OK button to complete the definition of the Date and Time parameters and to setup the Date and Time in the HP4155/56.
3. Select the OK button on the Clock Setup dialogue box.

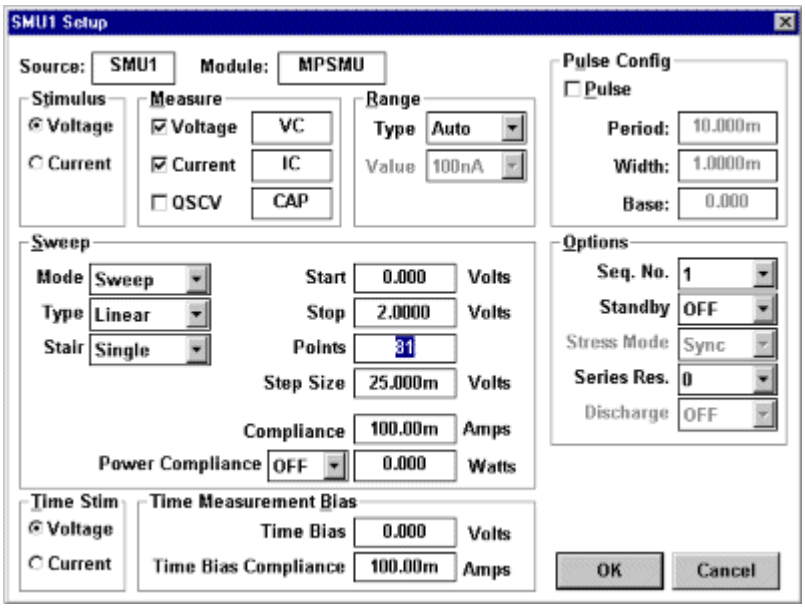
Setup Example

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

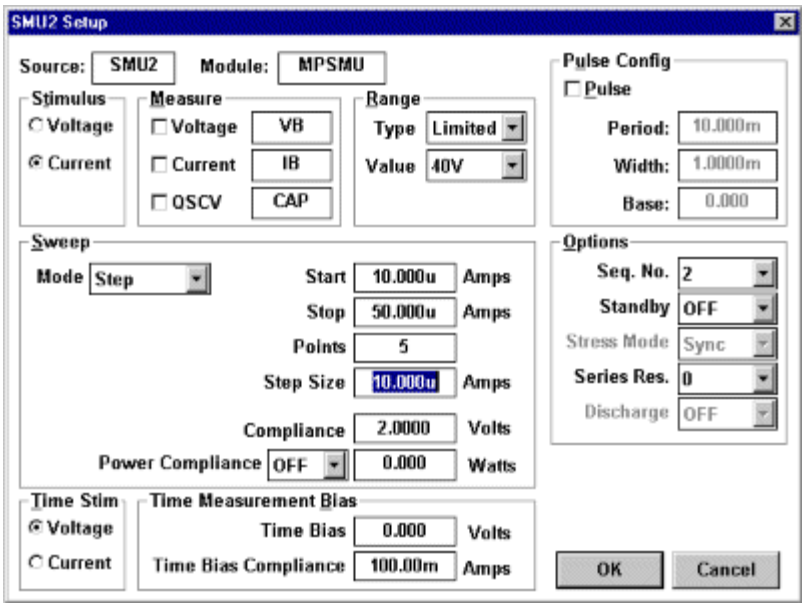


Collector: SMU1

Mode: Voltage Sweep

Output: 0V-2V

Return: VC, IC



Base: SMU2

Mode: Current Step

Start: 10u

Step Size: 50u

Step Qty: 5

Return: None

Emitter: SMU3

Mode: Ground

Output: 0V

Return: None

Results