



Metrics ICS Driver Manual

HP4140

Metrics ICS

Version 4.5

Table of Contents

The HP4140 Instrument Driver	2
Getting Started: Creating and Executing a Test Setup.....	2
Connecting the HP4140 Instrument Driver	2
Designating the GPIB Address	3
Creating the Test Setup	4
The HP4140 Input "I" Dialog Box.....	12
Function	12
Data Labels	12
The HP4140 Output "V-A" Dialog Box	13
Output Mode	13
Parameters	15
The HP4140 Output "V-B" Dialog Box	17
Output Modes.....	17
Current Limit	17
The HP4140 Setup Dialog Box.....	18
Ranging	18
Integration	19
C%.....	19
Trigger.....	19
Filter	19

The HP4140 Instrument Driver

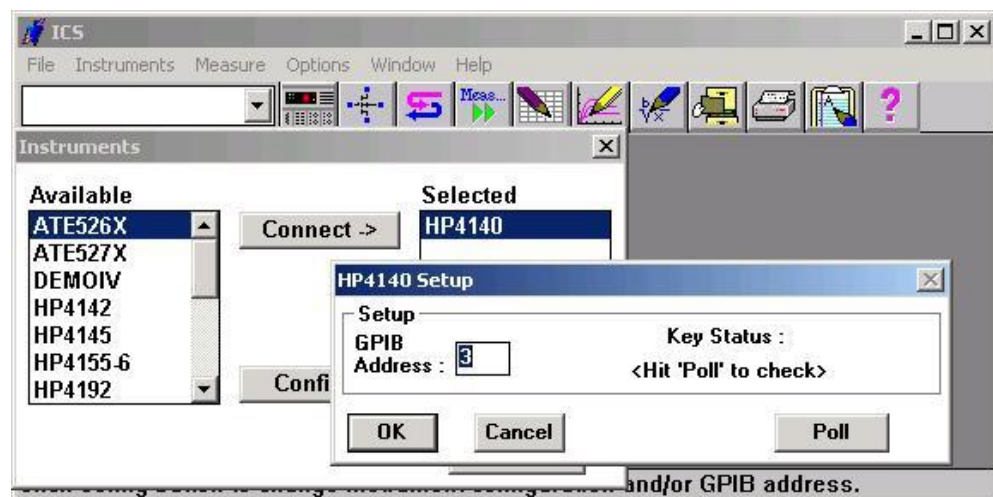
Getting Started: Creating and Executing a Test Setup


This section describes the steps required to create and execute a sample test setup. The sample test setup will be used to measure capacitance of a diode as a function of voltage. The HP4140B pA Meter/DC Voltage Source and the HP 16058A Test Fixture were used to perform the measurements in this manual.

Connecting a Test Fixture or Cable Set to the Instrument

The capacitance example presented in this section was performed using the HP16058A Test Fixture. Connection of the device, test fixture, and instrument are the same as for a standard measurement using the HP4140.

Connecting the HP4140 Instrument Driver

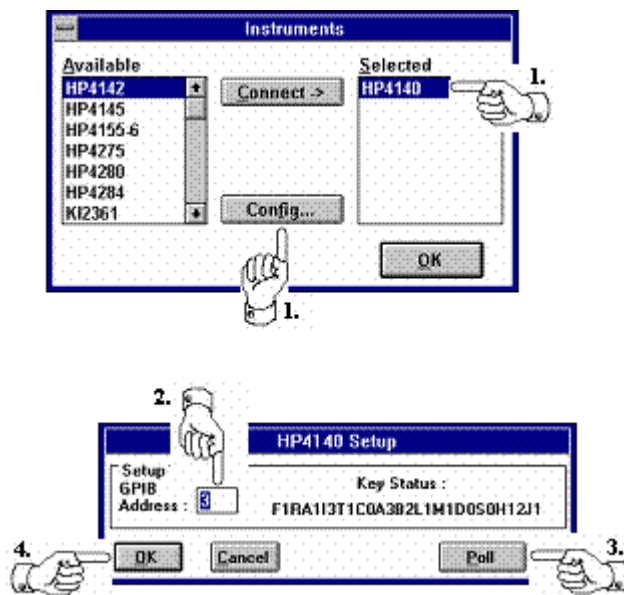


1. Click the **Instruments** button  on the toolbar or select **Instruments/Select Instrument..** from the ICS measurement mode menu.
2. Highlight **HP4140** in the **Available** field and click on the **Connect** button.
3. Your choice will be displayed in the **Selected** field, and removed from the **Available** field.

Designating the GPIB Address

Connect the HP4140 to your computer using a standard IEEE-488 GPIB (General Purpose Interface Bus) as described in the HP4140B Operation and Service Manual. The HP-IB hardware discussed in the Operation and Service Manual is Hewlett-Packard's implementation of the IEEE-488 Standard Digital Interface for programmable instrumentation.

The HP4140 Setup dialog box is used to designate the GPIB address of the instrument and poll the instrument for Key Status.



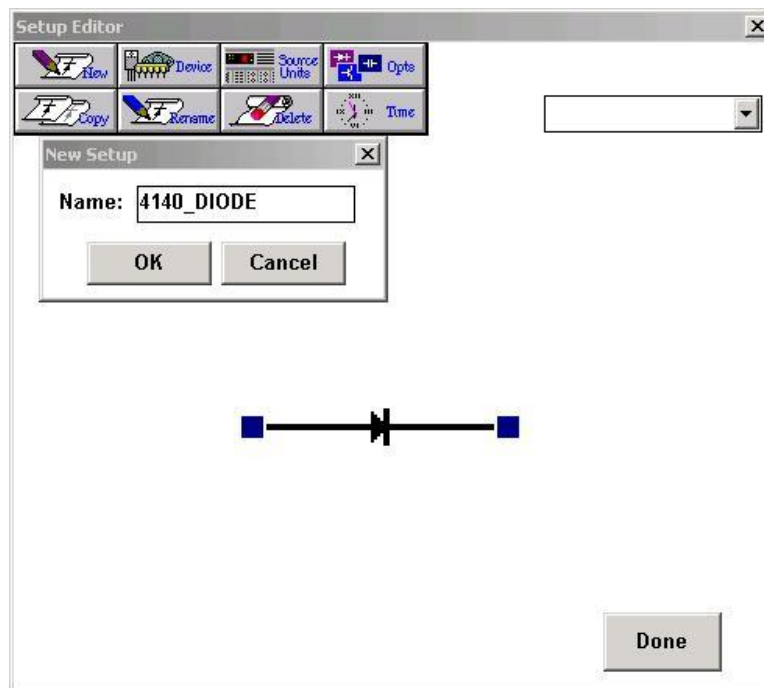
1. With the **HP4140** highlighted in the **Selected** field, click on the **Config...** button.
2. Enter the GPIB address of the HP4140 in the **GPIB Address** field. The GPIB address will be displayed momentarily when the instrument is turned on.
3. Click on the **Poll** button to verify communication with the instrument.
4. Click on the **OK** button.



Creating the Test Setup

Test setups in ICS are created using the Setup Editor. A device schematic is located at the center of the Setup Editor to provide the user with a method of documenting the terminal connections required for the corresponding test setup. The device schematic does not have to match the pin layout of the Device Under Test.


A library of different device schematics is provided in ICS. A MOSFET is the default device type and a MOSFET schematic will appear at the center of the Setup Editor when the Setup Editor is first opened. To change the default device schematic, refer to *Chapter 2: The Setup Editor*.

Naming the Setup

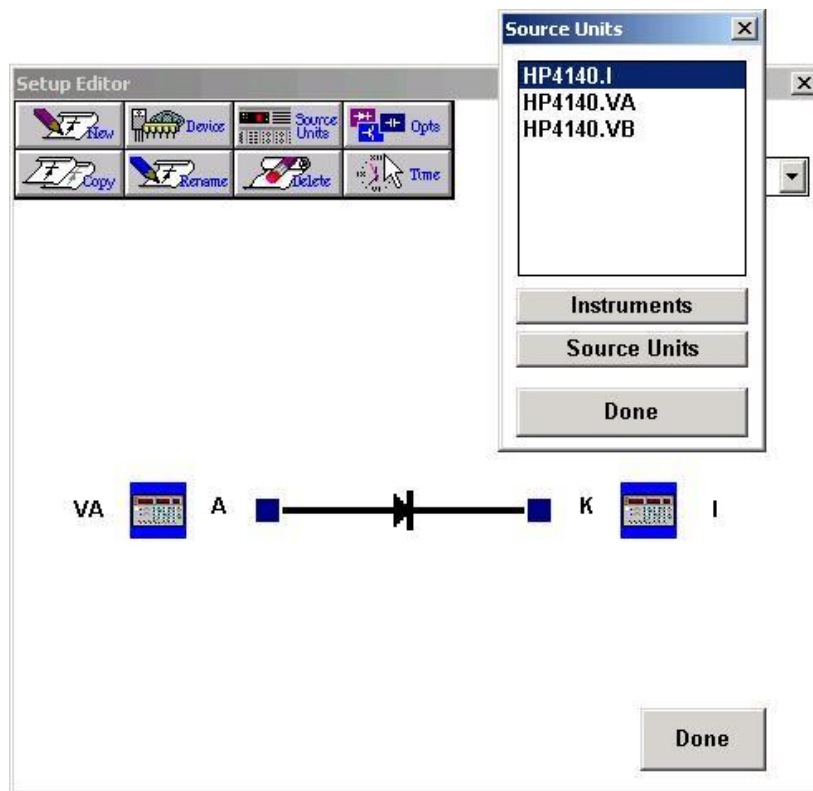



1. Click on the **SETUP EDITOR** button  on the toolbar.
2. Click on the **New** button  in the Setup Editor window.
3. Enter a **Name** for the test setup. Setup names should not contain spaces.
4. Click on the **OK** button. Note that the setup name appears in the pull-down menu in the Setup Editor window and a data spreadsheet icon with the setup name appears at the bottom of the ICS workspace.

Selecting a Device Type

1. Click the **Device** button  in the Setup Editor window.
2. The Device Type window will display a list of available device schematics. Select **Diode** from this list. Notice that a preview of the schematic is shown to the right of the list of devices.
3. Selecting the Diode schematic will display polarity options. Select the **NP** option.
4. Click **OK**. This will close the Device dialog box and display the selected schematic at the center of the Setup Editor window.

Designating the Instrument/DUT Connections

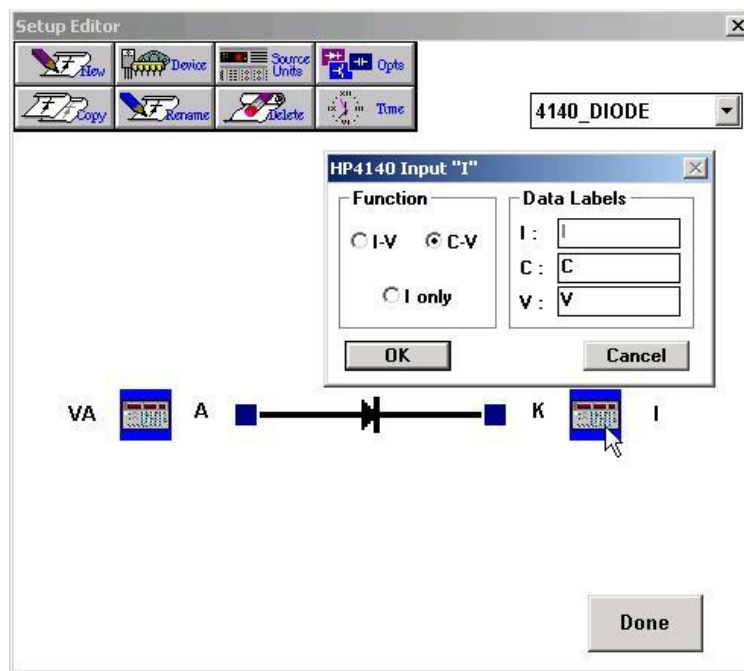


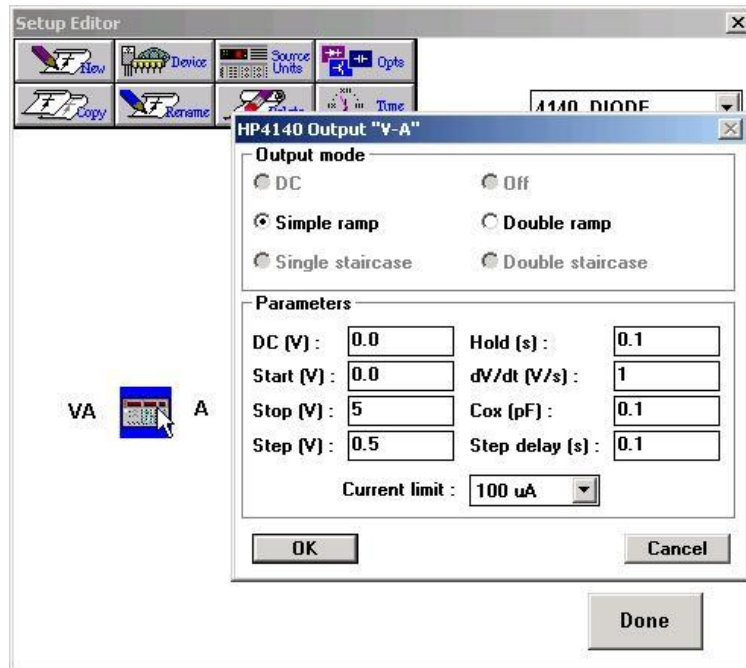
1. Select the Setup Editor **Source Units** button  to open the Source Units dialog box. The Source Units dialog box will list three sources: HP4140.I, HP4140.VA, and HP4140.VB.
2. Click on the **HP4140.I** source.

3. Assign the HP4140.I source to the cathode by clicking the blue pad next to the letter **K**. An instrument icon will appear next to the connection.
4. Assign the HP4140.VA source to the anode by selecting the **HP4140.VA** source and then clicking the blue pad next to the letter **A**.
5. Click on the **Done** button to close the Source Units dialog box.

Note: Source assignments can be changed by selecting a source in the Source Units dialog box and then clicking on the blue pad indicating the terminal where it is to be removed.

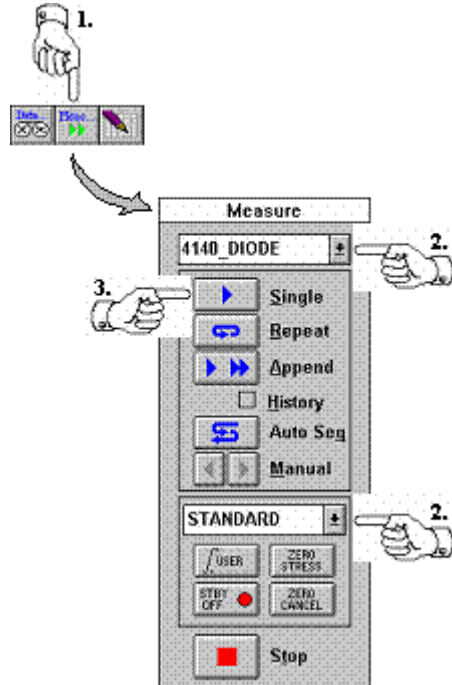
Specifying the Instrument Configuration






1. Click once on the **I** instrument icon to open the HP4140 Input "I" setup dialog box.
2. Select the **C-V** function. Click on the **OK** button.
3. Click on the **VA** instrument icon to open the HP4140 Output "V-A" setup dialog box. Configure the VA source for the measurement. Click on the **OK** button.
4. Click on the **Done** button to close the Setup Editor.


Executing the Measurement



1. Click on the **Measure** button  on the toolbar to access the Measurement Remote Control.
2. Verify that the test setup to be executed is selected and that **Standard** mode is selected.
3. Click on the **Single** button to execute the measurement.

Viewing the Results

Data values are written to the corresponding data window spreadsheet each time the measurement is executed. To display the numerical data, double click on the white spreadsheet icon corresponding to the test setup.



	C	V
1	424.00p	-500.00m
2	516.00p	-1.0000
3	587.00p	-1.5000
4	646.00p	-2.0000
5	699.00p	-2.5000
6	743.00p	-3.0000
7	788.00p	-3.5000
8	828.00p	-4.0000
9	864.00p	-4.5000
10	901.00p	-5.0000
11	934.00p	-5.5000

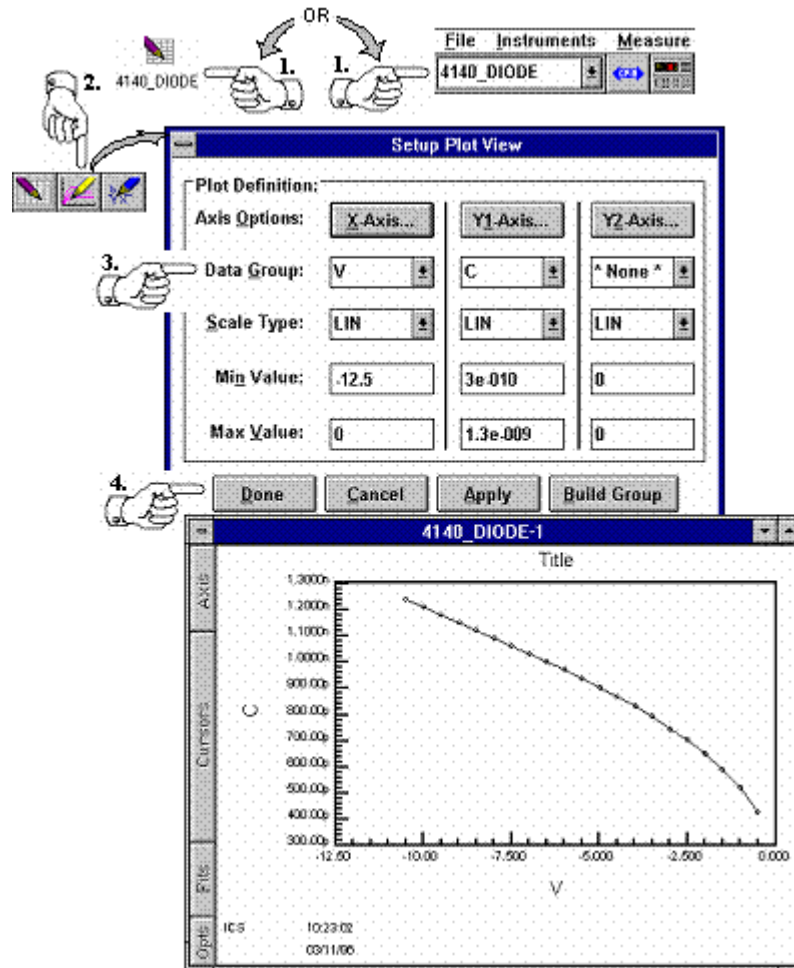
Data window spreadsheets are linked dynamically to the test setup. Each time the corresponding test setup is executed, the spreadsheet data is replaced with the most recently measured data. Each spreadsheet has the same name as the setup that was executed to measure the data.

NOTE


A new vector has been added when performing C-V measurements. The C_Adj has been added to smooth out the C vector during sweeps when all data points are not collected by the 4140. The original measured vector is retained as C and represents what the instrument actually measured.

Creating a Plot of the Results

Plot windows are linked dynamically to a corresponding data window spreadsheet. Just as the spreadsheets are updated after each measurement, the plots are regenerated anytime 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. Up to ten plots can be created from a single data window spreadsheet; each plot can be formatted independent of the others.

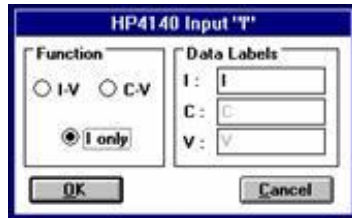


1. If there is more than one defined test setup, designate the active test setup by using the pull-down menu at the left end of the toolbar. A setup can also be made active by clicking once on the corresponding data window spreadsheet icon. Clicking once on a data window spreadsheet icon will display a system menu; ignore this display.

2. Click the **Create Plot** button  on the toolbar. This will open an empty plot window and the Plot Data dialog box.
3. Using the **Data Group** pull-down lists, select the vectors to be plotted on the x- and y-axes.
4. Click the **Done** button.

The HP4140 Input "I" Dialog Box

Options for configuring the I source unit of the HP4140 can be found in the HP4140 Input "I" dialog box. This dialog box is accessed by clicking on the I source icon in the Setup Editor schematic.



Function

The function controls are used to select the measurement type.

I-V

The I-V function is used for I-V characteristics measurements. Staircase and ramp wave source modes are available.

C-V

The C-V function is used to make quasi-static C-V characteristics measurements. A ramp wave source mode is used.

I Only

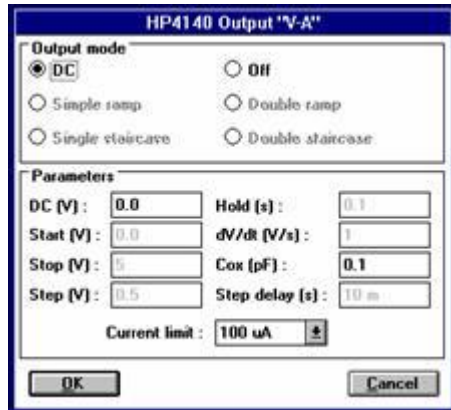
The I Only function operates as a universal pA meter and DC voltage source. ICS supports only the DC source mode.

Data Labels

The Data Labels allow the user to customize the labels for the data vectors in ICS.

The HP4140 Output "V-A" Dialog Box

Options for configuring the VA source unit of the HP4140 can be found in the HP4140 Output "V-A" dialog box. This dialog box is accessed by clicking on the VA source icon in the Setup Editor schematic.



Output Mode

The Output Mode controls are used to specify the form of the voltage source output.

DC

The DC mode allows the user to specify a DC voltage output. This option is available only when the I Only function is selected.

Off

Off specifies that VA is not operating. This option is available only for the I Only function.

Single/Double Ramp

When using the ramp modes, the output voltage changes continuously from the start value to the stop value at a rate of dV/dt , as specified by the user. For a single ramp, the measurement is complete at the stop value, where a double ramp continues the measurement from the stop value back to the start value at a rate of dV/dt . These modes are available for I-V and C-V functions.

Single/Double Staircase

When using the staircase modes, output voltage is changed from the start value to the stop value in increments of the step value for the single staircase mode. The double staircase mode returns the output voltage to the start value in the same step increments. The staircase modes are available for the I-V functions.

Parameters

DC

The DC parameter specifies the voltage level for the DC Output Mode. This parameter is available only for the I Only function.

Start

The Start parameter specifies the starting voltage for the ramp and staircase modes.

Stop

The Stop parameter controls the stopping voltage for the ramp and staircase modes.

Step

The Step parameter specifies the voltage increments between Start and Stop for the ramp and staircase modes.

Hold

Hold specifies the time that the start voltage is sustained before the first measurement and the stop voltage is sustained after the final measurement for the ramp and staircase modes.

dV/dt

The dV/dt parameter specifies the time rate of change in the voltage output. This parameter is used only for the ramp modes.

Cox

The Cox parameter specifies the reference capacitance (C oxide) for C-V measurements. This parameter is used to calculate percent C-V measurements.

Step Delay

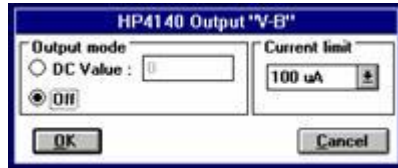
The Step Delay parameter is used to specify the time before a measurement is made after each voltage change for the staircase wave modes.

Current Limit

This parameter sets the current limit to 100 μ A, 1mA, or 10mA.

The HP4140 Output "V-B" Dialog Box

Options for configuring the VB voltage source of the HP4140 can be found in the HP4140 Output "V-B" dialog box. This dialog box is accessed by clicking on the VB source icon in the Setup Editor schematic, and is available only for the I Only function.



Output Modes

DC Value

The DC parameter specifies the voltage level for the measurements. This option is used only with the I Only function.

Off

The Off output mode specifies that the VB voltage source is not operating. This option is available only for the I Only function.

Current Limit

This parameter sets the current limit to 100 μ A, 1mA, or 10mA.

The HP4140 Setup Dialog Box

Additional settings for the HP4140 can be found in the HP4140 Setup window, which can be accessed by clicking on the Options button in the Setup Editor.



Ranging

Range

The range function allows the user to choose how the range will be determined.

Auto specifies the automatic range selection of the HP4140. **Range** specifies the value for a fixed range measurement. Values can be selected from a pull-down menu, and vary from 1pA to 10mA. **Hold** specifies that the range selected when the test is initiated, either from a previous measurement or manually set on the front panel of the HP4140, is to be used for the measurement.

Limit Auto Range

The lower limit of the automatic mode of current ranging can be set with this option. Several values are available from 1pA to 10mA.

Integration

Short

Short Integration times for a 50 Hz line frequency are 20ms for the 10^{-2} - 10^{-10} A range, 80ms for the 10^{-11} A range, and 160ms for the 10^{-12} A range.

For a 60 Hz line frequency, the short integration times are 16.7ms for the 10^{-2} - 10^{-10} A range, 66.7ms for the 10^{-11} A range, and 133.3ms for the 10^{-12} A range.

Medium

Medium Integration times for a 50 Hz line frequency are 80ms for the 10^{-2} - 10^{-10} A range, 320ms for the 10^{-11} A range, and 640ms for the 10^{-12} A range.

For a 60 Hz line frequency, the medium integration times are 66.7ms for the 10^{-2} - 10^{-10} A range, 266.7ms for the 10^{-11} A range, and 533.3ms for the 10^{-12} A range.

Long

Long Integration times for a 50 Hz line frequency are 320ms for the 10^{-2} - 10^{-10} A range, 1280ms for the 10^{-11} A range, and 2560ms for the 10^{-12} A range.

For a 60 Hz line frequency, the long integration times are 266.7ms for the 10^{-2} - 10^{-10} A range, 1066.7ms for the 10^{-11} A range, and 2133.3ms for the 10^{-12} A range.

C%

pF

This option specifies that capacitance values are to be returned in pF.

%

The % option specifies that the capacitance values are to be returned as a percentage of the reference value defined by Cox.

Trigger

Trigger options are not available for use with ICS.

Filter

This option controls the HP4140 internal filter for rejecting AC noise.