



# **Installation and Getting Started Guide**

**Metrics ICS**

**Version 3.7.0**

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# Installation and Configuration

## Metrics Codewords

Metrics Technology software products use a combination of a Security Key and Codeword. The unique combination of a Codeword and Security Key allows the software product to be run. The software includes a thirty day period to obtain the security codeword.

### *The Software Codeword Certificate*

The Codeword is found on the Software Codeword Certificate included in the packaging. There will be a certificate for each software component ordered. The certificate is made up of two (2) parts, the Registration Information and Codeword Information.

#### **The Registration Information**

We encourage all customers to register their software with Metrics Technology. Only registered users will receive technical support for their products.

*Note:* Only one user may be registered per copy of software. This person is the only person that will receive support.

#### **Customer ID**

The Customer ID is a number that has the form IAXXXXXA. Where the X is a number. Variations include IHXXXXA, MHXXXXA, and MKXXXXA. This number must match the number on the Security Key.

**Product Desc**

This is the Product Description. This will be the name of the product, such as Metrics I/CV or Metrics ICS.

**Product ID**

The product ID is a second description of the software.

**Version**

This is the version of the software.

*Note:* The version number and the codeword are matched. Thus, customers who have not purchased an upgrade will not be able to run it without purchasing the correct codeword.

**Codeword Serial**

This is the codeword for the software. During installation you are prompted to enter this number. You must enter it exactly as it is printed on the certificate, including the hyphens. i.e. 111-111-1-1111111

## ***Manual Entry of the Codeword Serial Number***

The software Codeword Serial number can be manually entered in ICS.

### **To manually enter the ICS Codeword Serial number:**

1. Open the ICS program. In ICS select Help » Codeword to open the *Software License Codeword* window.
2. Enter the ICS Codeword Serial number supplied on the product registration form.
3. Click the **OK** button.

# Installing the ICS Software

**Note:** Do not install the USB or Parallel Security Key until after the Metrics ICS Software is installed and the PC is restarted. The security key requires special drivers that are installed with ICS. If the key is accidentally installed it will be necessary to remove it and uninstall the default driver that Windows installs.

. The installation program for the Metrics ICS software installs all components necessary to run Metrics ICS. During the installation you will be prompted to furnish a codeword for the various components of the software.

## *Obtain a Codeword*

This codeword is obtained by registering your software with Metrics Technology. Please submit the provided registration form via fax or visit our website at [www.metricstech.com](http://www.metricstech.com) to register your software and obtain the codeword.

The software will run for 30 days without the codeword

## *Important Note for people upgrading*

The Metrics ICS setup program requires that you backup and uninstall the previous version. To do this, please perform the following steps:

1. Please backup your ICS database (\Metrics\ics\data) and other data files.
2. Run the Uninstall Programs from the Control Panel of Microsoft Windows.
3. Delete the Metrics directory.

After upgrading, some of the functions of the software will require that older projects or features be modified. A brief list of the modifications are:

1. Metrics ICS files can now be stored in the windows file system. Existing tests should be opened and then saved in the Metrics\ics\projects directory.

## *Procedure to Install ICS*

1. Insert the Metrics ICS CD into the CD-ROM drive of your computer.
2. The CD-ROM will automatically start the installation program.
3. Choose "Install Products" » "Install ICS".
4. Click **Next** button on the "Welcome" panel.
5. Read the "Software License Agreement" and click the **Yes** button to agree to the terms.
6. Complete the User Information fields. The Codeword is found on the "Metrics Software Codeword Certificate" for ICS. Click the **Next** button.
7. Choose "destination location" for installation and click the **Next** button.
8. Select "Typical" setup type and click the **Next** button.
9. After the installation is finished, re-start the computer.
10. Connect the Security plug to the USB or Parallel port of your computer.  
**Note:** It is recommended the security plug be connected directly to the computer.



# **ICS Getting Started Guide**

**Version 3.7.0**

# Introductory Information

## *Goal of This Manual*

The goal of this manual is provide a process for the user to be able to create a test and analyze the data with Metrics ICS. A test setup will be created that measures the Threshold Voltage of a MOSFET device. The measured data will then be plotted and the  $V_t$  value will be extracted.

# Chapter 1- ICS Getting Started Guide

## *Introduction*

The first Chapter of the Self-Paced Guide introduces the Metrics ICS software. This Chapter also provides important information on software versions and support.

Please note that each Chapter builds upon the information presented in the previous Chapters. It is recommended that the Guide is followed in the order presented.

## *Topics Covered*

- What is Metrics ICS Software?
- Overview of Metrics ICS Software
- Updating Versions
- Support

## ***What is Metrics ICS Software?***

The Metrics ICS Software is a Windows based environment designed for Semiconductor testing applications. Measurements for the characterization of devices can be created in a matter of minutes without programming.

<b>Metrics I/CV Controls:</b>
-------------------------------

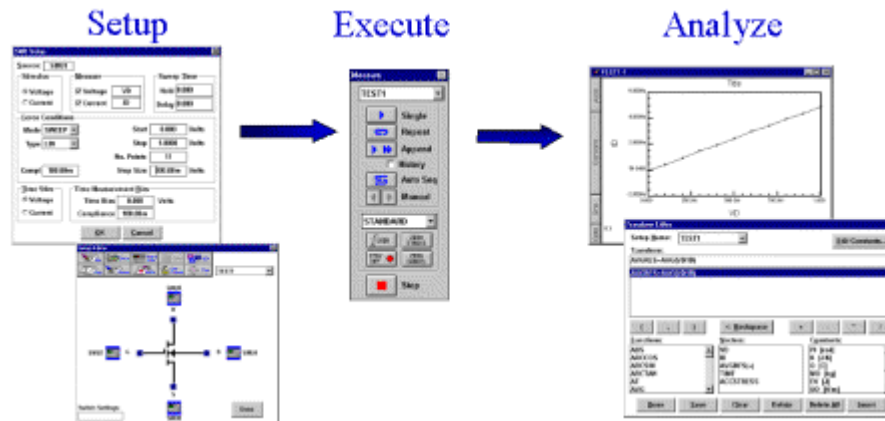
- Semiconductor Parameter Analyzers
- C-V Meters
- Source Meters

## Overview of Metrics I/CV Software

Metrics ICS Software allows provides an environment for the collection of data in three steps: Setup, Execute, and Analyze. The Setup of a Measurement typically takes no more than 1-2 minutes.

ICS supports several measurement modes to accommodate most testing methods.

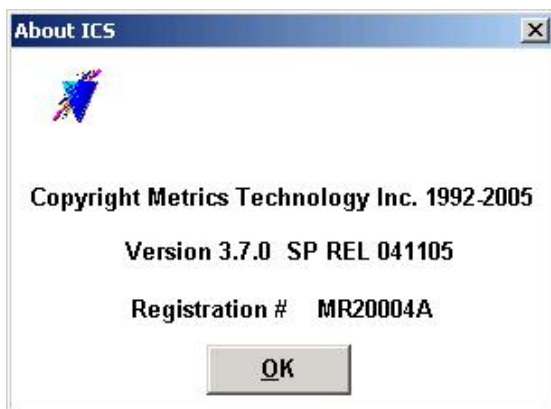
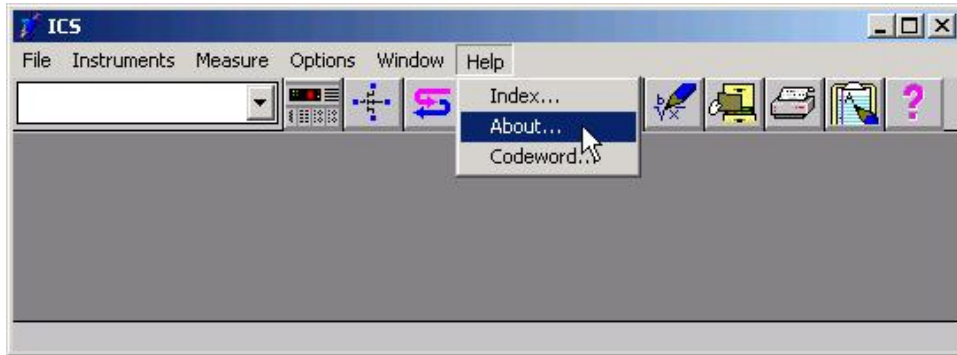
The Analysis tools in ICS include plotting and data extraction. Once the functions are created, they can be saved with the data.



The beauty of ICS is that once a test is created and saved it can be re-opened and used again, including the analysis.

## *Determining Software Version*

The software version and build date are very important when requesting support. Without this information it is impossible to provide efficient service. Please be prepared to provide this information when seeking support.



### **To determine the software version:**

1. Open the ICV Software.
2. Click the Help menu item.
3. Click the About item.

## *Updating the Metrics I/CV Software*

Please keep your software up to date by downloading and installing the Metrics Technology Hot Fixes. Your software will remind you monthly with a simple reminder message to check for updated Hot Fixes. Often the issues addressed in the updates are ones that you may just now be encountering.

Metrics Technology provides Service Patches to registered customers. Once a patch has been created and verified by Metrics Technology, it is placed on our web site ([www.metricstech.com](http://www.metricstech.com)).

The patch can be downloaded from the web site. Please note the patches are very large and will take time to download depending upon your connection speed. Once downloaded the file is an .EXE application that requires a password to open. Please contact Metrics Technology support ([support@metricstech.com](mailto:support@metricstech.com)) for the codeword. Please note that only registered customers will be provided the codeword.

## *Support*

Metrics Technology provides technical support to customers for one year after the purchase of the Metrics ICS software. This support period includes a ninety day period when telephone support is available. The remainder of the year's support is provided by email. Please refer to the Metrics Technology website [www.metricstech.com](http://www.metricstech.com) for options available to extend the support period.

All customers who request support must have registered their copy of ICS with Metrics Technology. The form is provided as part of the software package or you can visit the Metrics Technology web site and select the support link to access the registration forms.

**Support is available from Metrics Technology**

Contact Metrics Technology by:

- Reviewing our web site.
- Sending email to [support@metricstech.com](mailto:support@metricstech.com)

To receive Technical Support services you will need:

- Registration Number (Customer ID)
- Version and Hot Fix Number
- Complete description of issue, including any error messages



# Chapter 2- Selecting Instruments

## *Introduction*

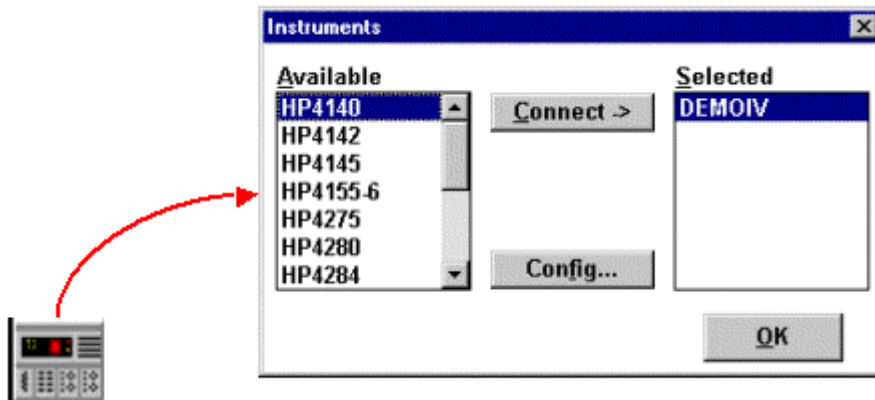
The Module introduces the Metrics ICS (Interactive Characterization Software) measurement engine and demonstrates how to create measurements with it.

## *Topics Covered:*

- Selecting an Instrument
- Configuring the Instrument
- Polling an Instrument

## *Selecting an Instrument Driver*

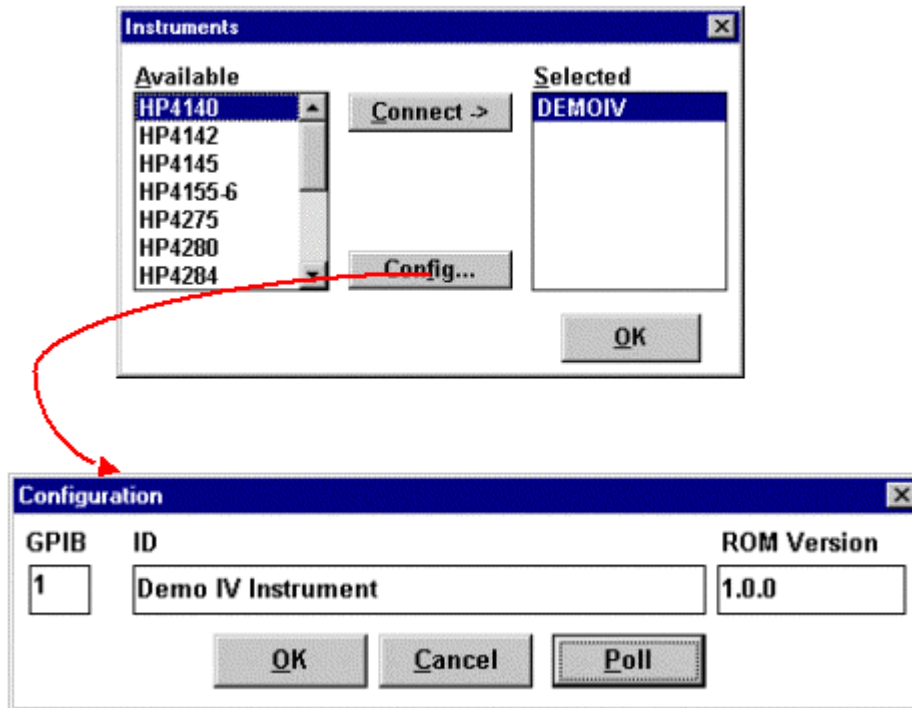
Before creating a measurement, ICS must know what instrument is being used. This is accomplished by configuring ICS. Once an instrument has been configured, ICS will remember this configuration. The only time ICS must be reconfigured is when the instrument is changed or the ICS35.INI file is erased.



1. Click the "Select Instrument" button.
2. Highlight the instrument to be added and click the "Connect" button.

## *Configuring the Instrument*

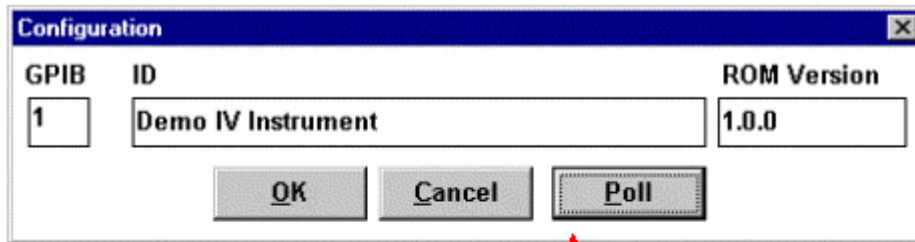
After the Instrument driver is selected, it must be configured.



1. Highlight the instrument to be configured and click the "Config" button.
2. Enter the GPIB address.

## *Polling an Instrument*

To confirm that the instrument and ICS are communicating properly, poll the instrument.



1. Click the "Poll" button.
2. Click the "OK" button to close the Configuration window.
3. Click the "OK" button to close the Instruments window.

# Chapter 3- Creating Measurements

## *Introduction*

The Module introduces the Metrics ICS (Interactive Characterization Software) measurement engine and demonstrates how to create measurements with it. Special demonstration drivers have been created to allow the development to be independent of the instrument. For details about the instrument drivers provided with Metrics ICS, please refer to the Metrics ICS documentation. The steps to creating a test method will be covered.

## *Topics Covered*

- Creating a Sweep Measurement
- Creating a Spot Measurement
- Creating a Time-Based Measurement

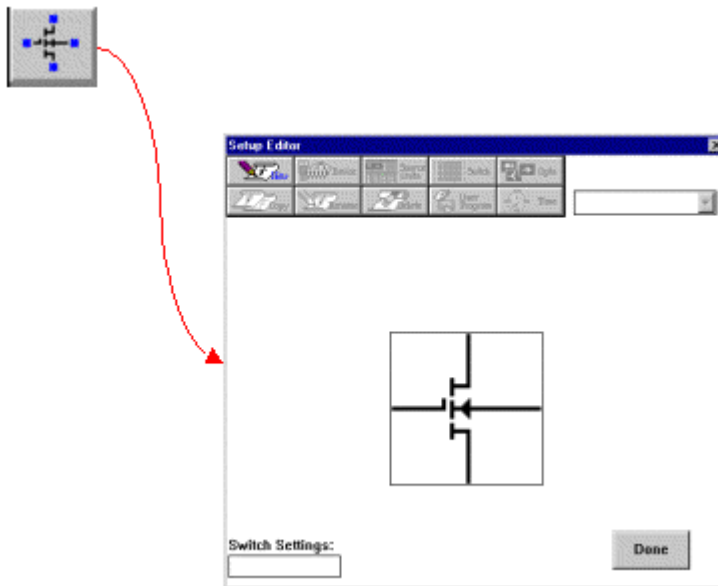
## *Create a Sweep Measurement*

The following example demonstrates how to create a sweep measurement using ICS. This example uses the demonstration driver within ICS.

### **To Create a Sweep:**

#### **1. Open the setup editor.**

The Setup Editor is the place in ICS where the measurement is configured. It can be opened by clicking the Setup Editor button.



## 2. Name the Measurement Setup.

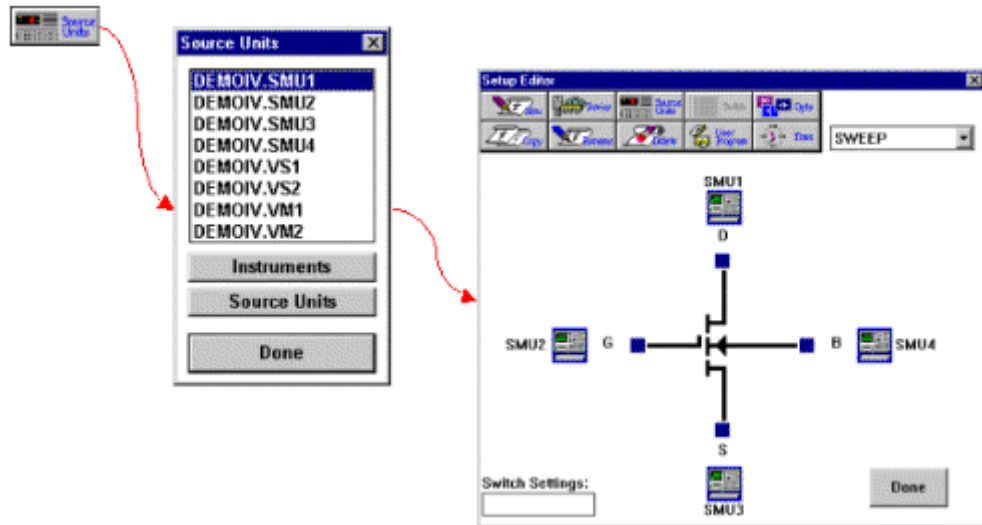
Each measurement must have a unique name. Before the measurement can be created, it must be given a name. To name the measurement:



- a. Click the New button and type in a name.
- b. Click the OK button after entering the name.

### 3. Select Source Units.

The source units correspond to the outputs of the instrument you are using. Metrics ICS provides a graphical way to document the connections for later reference. To add a source unit:



- Click on the Source Units button to open the Source Units window.
- Highlight the specific unit.
- Click the blue box beside the device lead in the Setup Editor.

#### To remove a source unit:

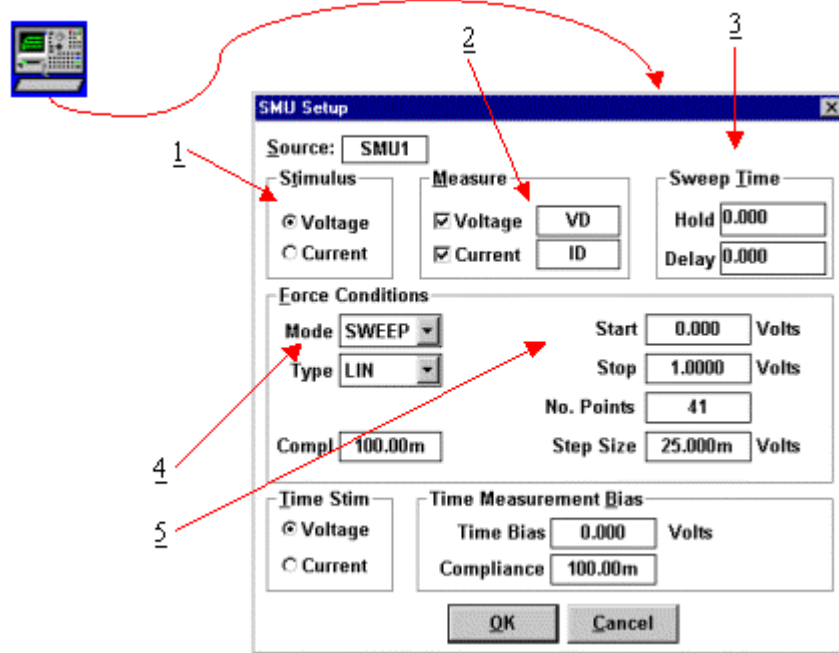
- Highlight the specific unit.
- Click the blue box beside the device lead in the Setup Editor.
- Click the Yes button.

**Note:** The graphic is merely a representation of the device. The software does not expect behaviors from the data. Thus, the pinout does not have to exactly match, rather it is only for reference.



#### 4. Configure Source Units.

In this example we are creating a sweep source, so we must configure the source unit properly. To setup a sweep source:



1. Select the stimulus type.
2. Select the values to be measured (see note below).
3. Click the blue box beside the device lead in the Setup Editor.
4. Select the sweep timing (see note below).
5. Select the Source Mode. In this case we want it to be Sweep.
6. Setup the sweep parameters.

**Note:** Most SMU's can only measure the signal that is not being sourced. Therefore in this case we have selected the Stimulus to be Voltage resulting in the Current being measured. The values returned for Voltage in this case would be the calculated voltage steps. The opposite is true when the Stimulus mode is set to Current. The Sweep Time parameters are to control the rate of the sweep. Please note that these inputs vary for different instruments.

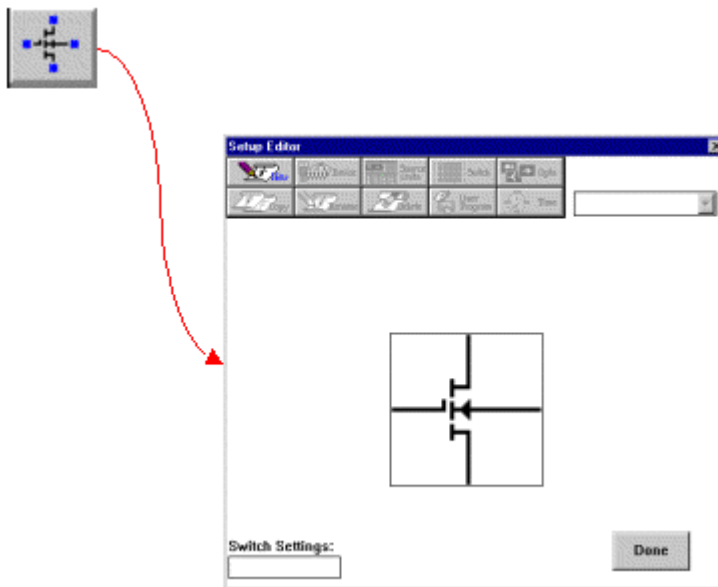
## *Create a Spot Measurement*

In this example we will create a spot (or single point) measurement. Most of the steps are the same or similar to creating a sweep measurement. The first step is to open the setup editor. The setup editor can be opened by clicking the Setup Editor button.

### **To Create a Spot Measurement:**

#### **1. Open the setup editor.**

The Setup Editor is the place in ICS where the measurement is configured. It can be opened by clicking the Setup Editor button.



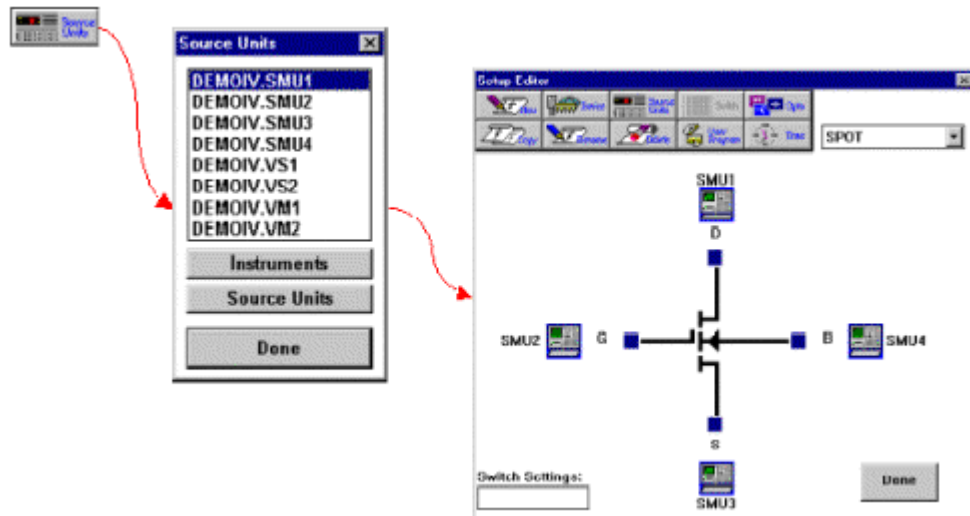
## 2. Name the Measurement Setup.

Each measurement must have a unique name. Before the measurement can be created, it must be given a name. To name the measurement:



- a. Click the New button and type in a name.
- b. Click the OK button after entering the name.
- c. Select Source Units.

The source units correspond to the outputs of the instrument you are using. Metrics ICS provides a graphical way to document the connections for later reference. To add a source unit:



- a. Click on the Source Units button to open the Source Units window.
- b. Highlight the specific unit.
- c. Click the blue box beside the device lead in the Setup Editor.

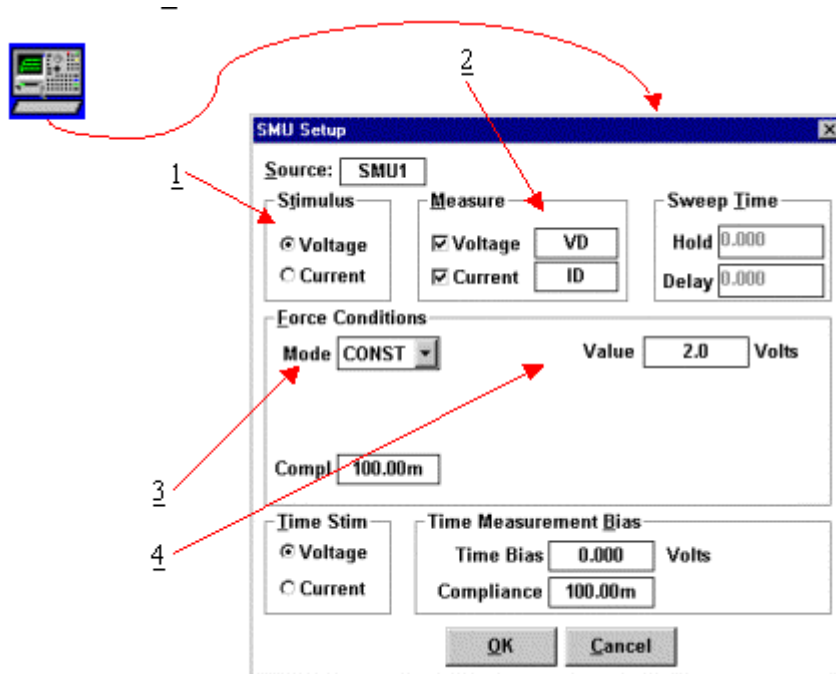
**To remove a source unit:**

- a. Highlight the specific unit.
- b. Click the blue box beside the device lead in the Setup Editor.
- c. Click the Yes button.

**Note:** The graphic is merely a representation of the device. The software does not expect behaviors from the data. Thus, the pinout does not have to exactly match, rather it is only for reference.

### 3. Configure Source Units.

In this example we are creating a spot source, so we must configure the source unit properly. To setup a spot source:



1. Select the stimulus type.
2. Select the values to be measured (see note below).
3. Select the Source Mode. In this case we want it to be Const.
4. Setup the source bias.

**Note:** Most SMU's can only measure the signal that is not being sourced. Therefore in this case we have selected the Stimulus to be Voltage resulting in the Current being measured. The values returned for Voltage in this case would be the calculated voltage steps. The opposite is true when the Stimulus mode is set to Current. Please note that these inputs vary for different instruments.

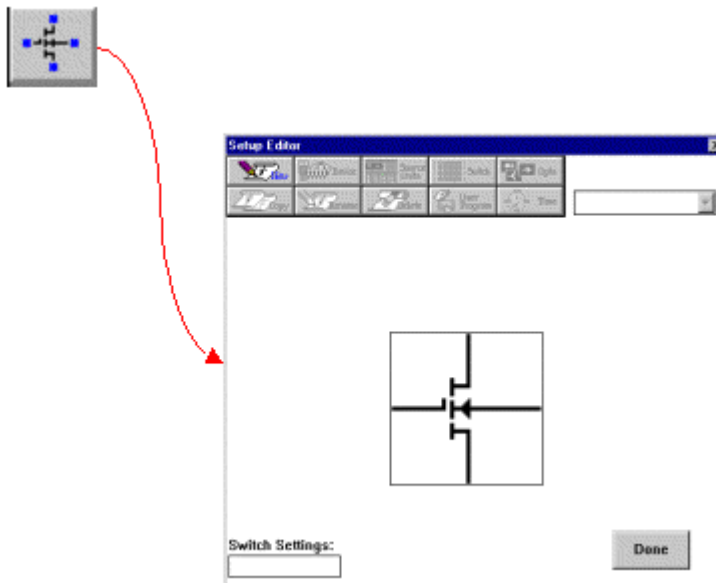
## *Creating a Time-Based Measurement*

In this example we will create a time-based measurement. Most of the steps are the same or similar to creating a spot measurement. The first step is to open the setup editor.

### **To Create a Time-Based Measurement:**

#### **1. Open the setup editor.**

The Setup Editor is the place in ICS where the measurement is configured. It can be opened by clicking the Setup Editor button.



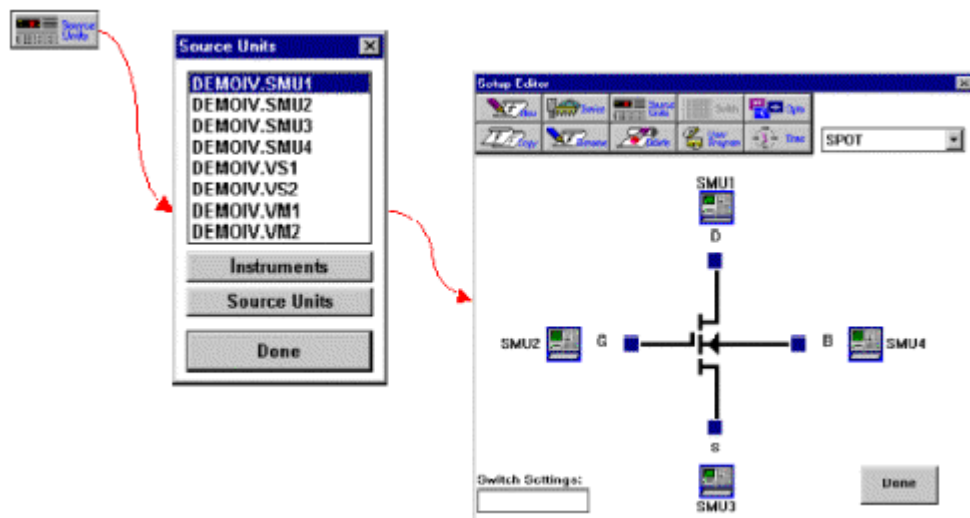
## 2. Name the Measurement Setup.

Each measurement must have a unique name. Before the measurement can be created, it must be given a name. To name the measurement:



- a. Click the New button and type in a name.
- b. Click the OK button after entering the name.
- c. Select Source Units.

The source units correspond to the outputs of the instrument you are using. Metrics ICS provides a graphical way to document the connects for later reference. To add a source unit:



- a. Click on the Source Units button to open the Source Units window.

- b. Highlight the specific unit.
- c. Click the blue box beside the device lead in the Setup Editor.

**To remove a source unit:**

Highlight the specific unit.

Click the blue box beside the device lead in the Setup Editor.

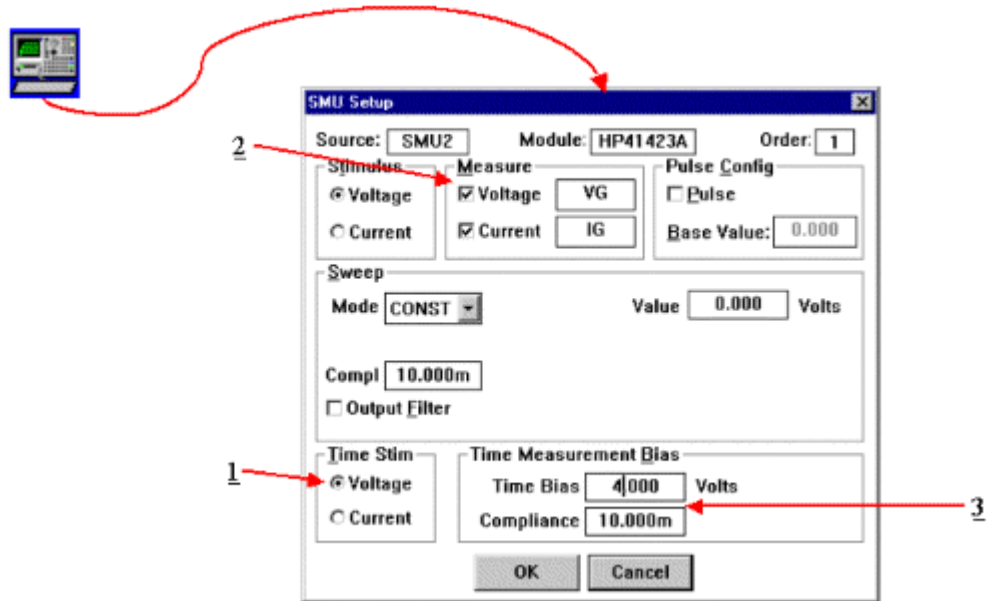
Click the Yes button.

**Note:** The graphic is merely a representation of the device. The software does not expect behaviors from the data. Thus, the pinout does not have to exactly match, rather it is only for reference.



### 3. Configure Source Units.

In this example we are creating a time stimulus source, so we must configure the source unit properly. To setup a time stimulus source:

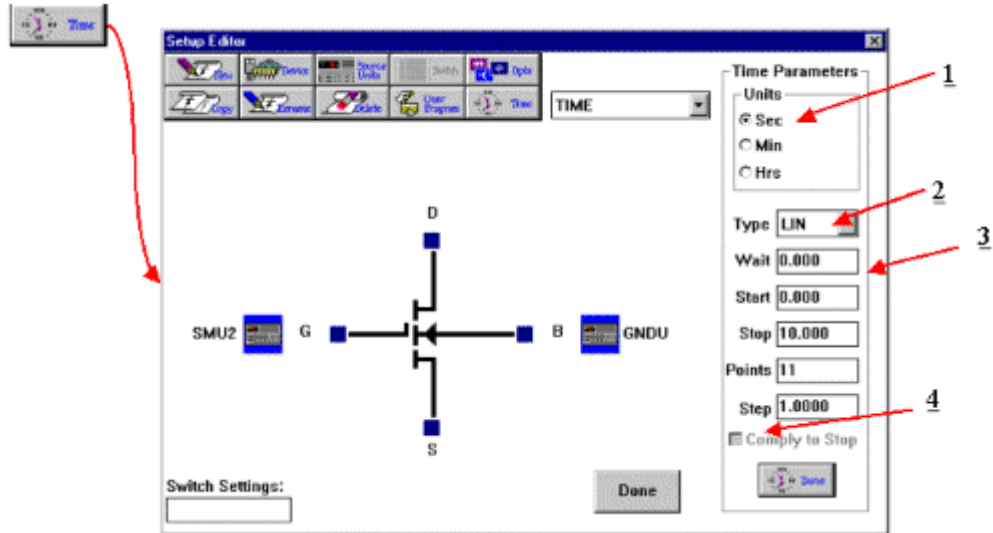


1. Select the stimulus type.
2. Select the values to be measured (see note below).
3. Select the Time Bias and Compliance.

**Note:** Most SMU's can only measure the signal that is not being sourced. Therefore in this case we have selected the Stimulus to be Voltage resulting in the Current being measured. The values returned for Voltage in this case would be the calculated voltage steps. The opposite is true when the Stimulus mode is set to Current. Please note that these inputs vary for different instruments.

#### 4. Set Time Parameters.

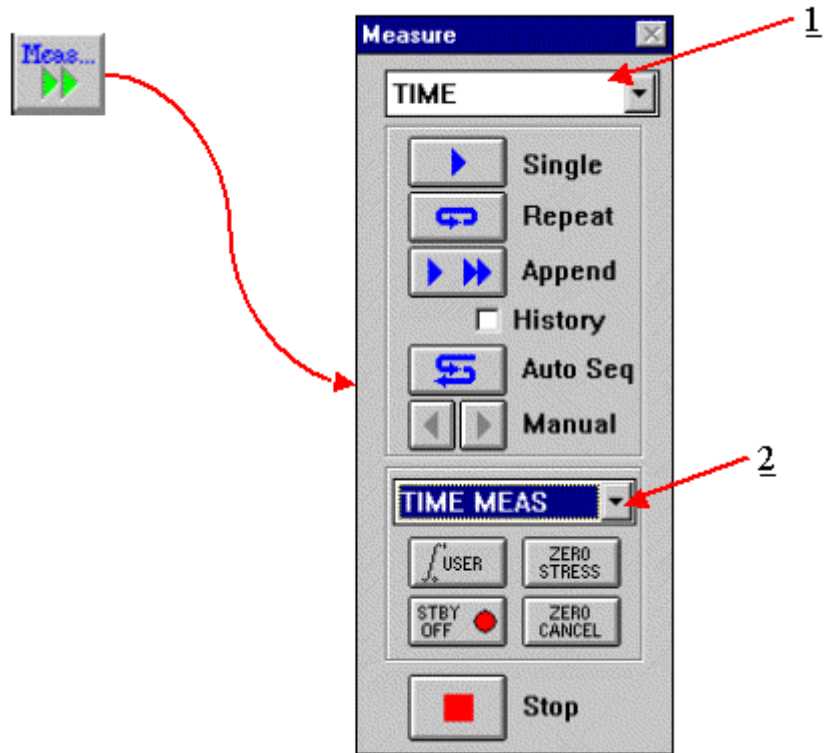
We must specify the time interval that the measurements will be made. To setup the time parameters:



1. Select the Time Units.
2. Select the sampling type.
3. Enter the Wait time.
4. Enter the Start, Stop, and Step values. Select the Comply to Stop, option if desired.

## 5. Set Measurement Mode.

We must specify the measurement mode as Time Meas. To setup the measurement mode:



1. Select the Setup.
2. Select the Time Meas mode.

# Chapter 4- Executing Measurements

## *Introduction*

This Module details the execution of the measurement using ICS.

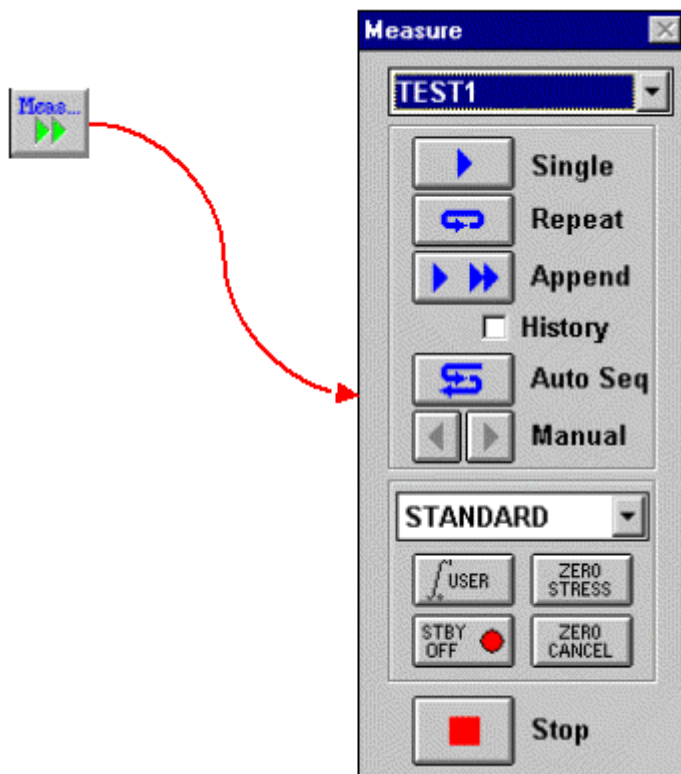
**Note:** When creating new tests it is recommended that the data be measured before the analysis is created.

## *Topics Covered*

- Measurement Remote Control
- The Date Window

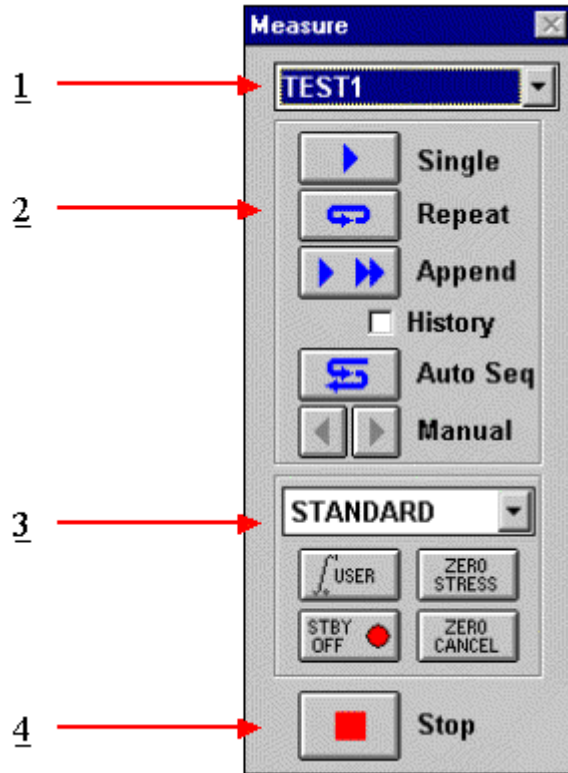
## *Measurement Remote Control*

Metrics ICS contains a tool named the Measurement Remote Control. This control is activated by clicking the Measure button on the ICS toolbar.



This toolbar contains buttons to begin the measurement as well as menus to select the measurement and mode.

**Note:** The remote control window can be moved anywhere on the desktop.



The Measurement Remote Control has four sections.

#### **Section 1: Measurement Menu**

This pull-down menu allows the selection of a specific test to be executed.

#### **Section 2: Execute Buttons**

This section contains the buttons that will start the measurement. Several modes of measurement are available and the buttons correspond to the selected mode.

#### **Section 3: Measurement Mode Menu**

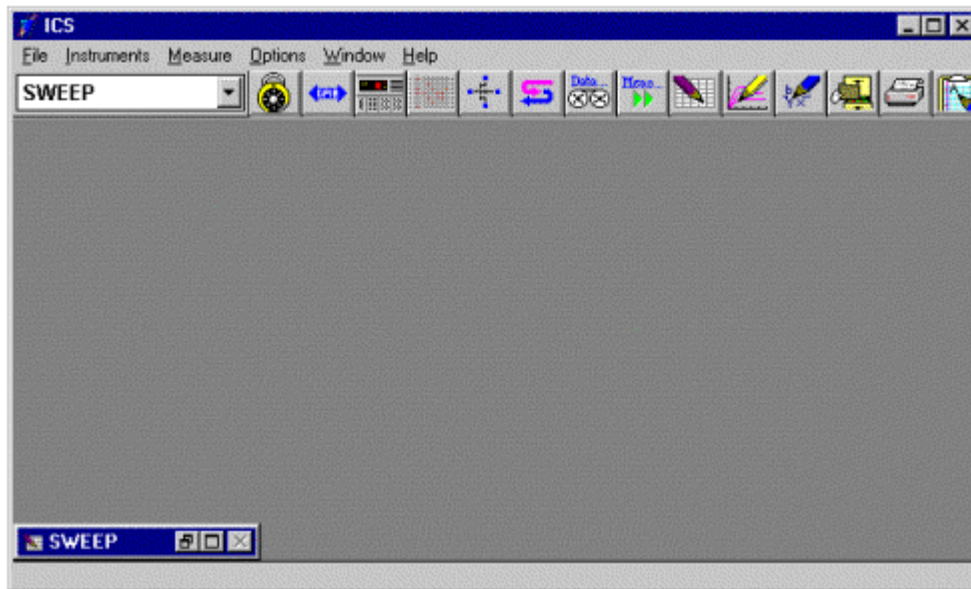
This pull-down menu allows the selection of the measurement mode. Most measurements are made in standard mode, however ICS does support several specialized measurement modes which require this to be modified.

#### **Section 4: Stop Button**

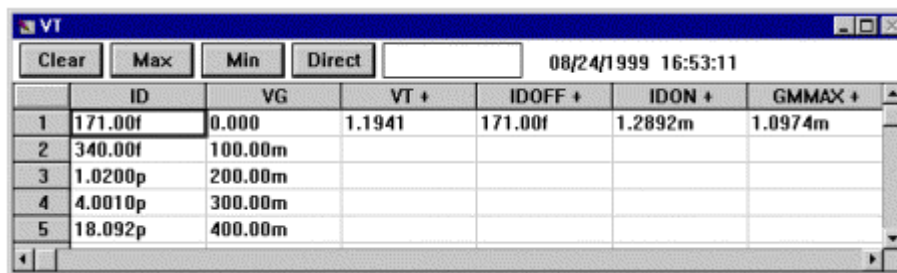
This button allows the user to stop the measurement.

## The Data Window

When a new setup is created the spreadsheet is automatically created when a test setup is created. It will begin as a minimized window in the lower left corner of the ICS window. To view the data simply double-click the window that has the same name as the test setup.



The Data window automatically returns the measured data and displays it. When parameters are extracted the values are also displayed.

The image shows a screenshot of the 'Data View' window. At the top, there are buttons for 'Clear', 'Max', 'Min', and 'Direct', followed by a date and time stamp '08/24/1999 16:53:11'. Below this is a table with the following data:

	ID	VG	VT +	IDOFF +	IDON +	GMMAX +
1	171.00f	0.000	1.1941	171.00f	1.2892m	1.0974m
2	340.00f	100.00m				
3	1.0200p	200.00m				
4	4.0010p	300.00m				
5	18.092p	400.00m				

**Note:** ICS has a feature named "Data View". This feature allows the user to select that only data vectors that are chosen be displayed. To enable or disable this feature select Workspace from the Options menu.



# Chapter 5- Plotting Data

## *Introduction*

This Module introduces the plotting tool of the ICS software. The plotting tool allows for the graphical analysis of data measured with ICS.

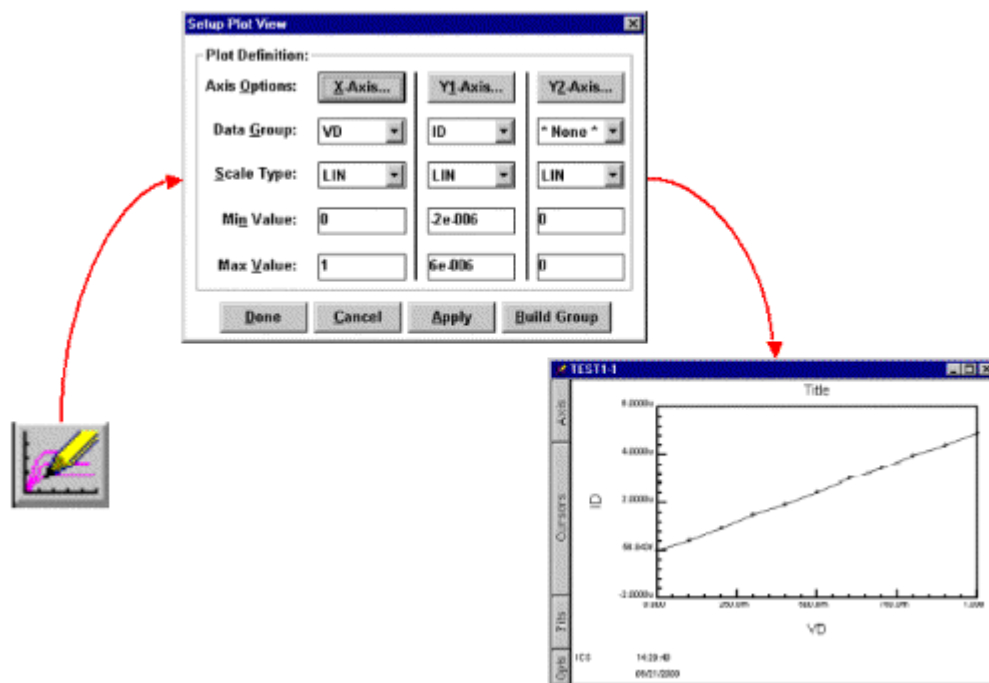
## *Topics Covered*

- Creating a Plot
- Editing a Plot

## Creating a Plot

The Metrics I/CV software uses the above illustrated sequence of execution for testing. Once all of the components have been created they are linked together within the scripts to control when and if they are executed.

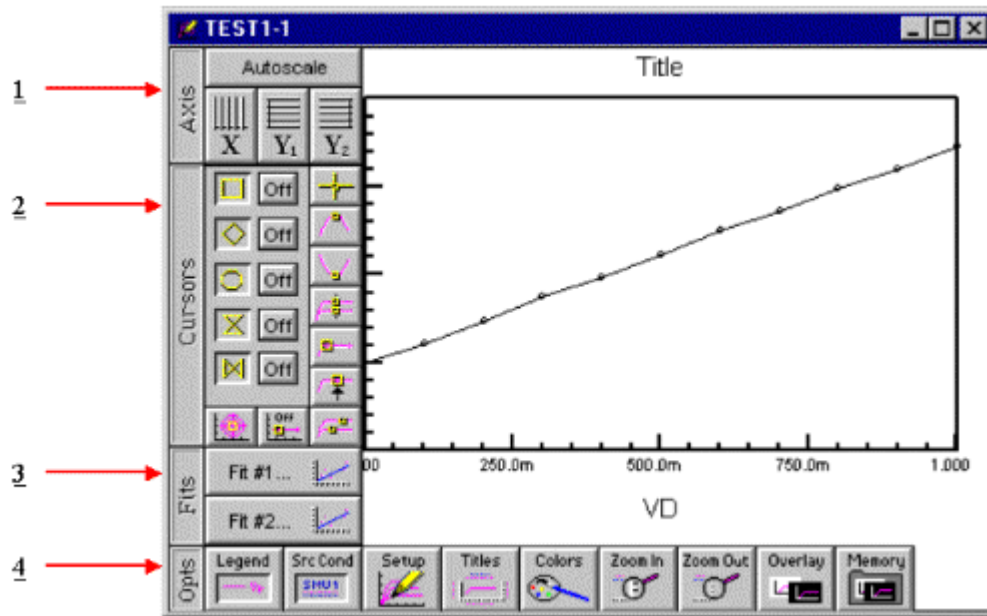
**To create a new plot:**



1. Click the Plot button on the toolbar.
2. Configure the plot.
3. Click the Done button and the plot will be created.

**Note:** The plot is made from whatever data window is currently active. The name of the plot in the Window title is the setup name followed by a dash and a number. Multiple plots can be created from the same data set, the number will just increase.

## *Editing a Plot*



The plot window contains the editing tools for the plot.

1. The Axis button reveals the tools to change the axis from linear to logarithmic and to auto scale the plot.
2. The Cursors button allows the addition and control of cursors on the plot.
3. The Fits button allows the application of curve fits related to the cursors.
4. The Opts button presents several options for adding notes to the plot, overlaying plots, zooming features, and setup changes.

These functions are discussed in great detail within the ICS Reference Manual.

# Chapter 6- Extracting Data

## *Introduction*

After executing a measurement, ICS can extract parameters. Once the procedures are defined, each time the measurement is run the calculations are performed automatically.

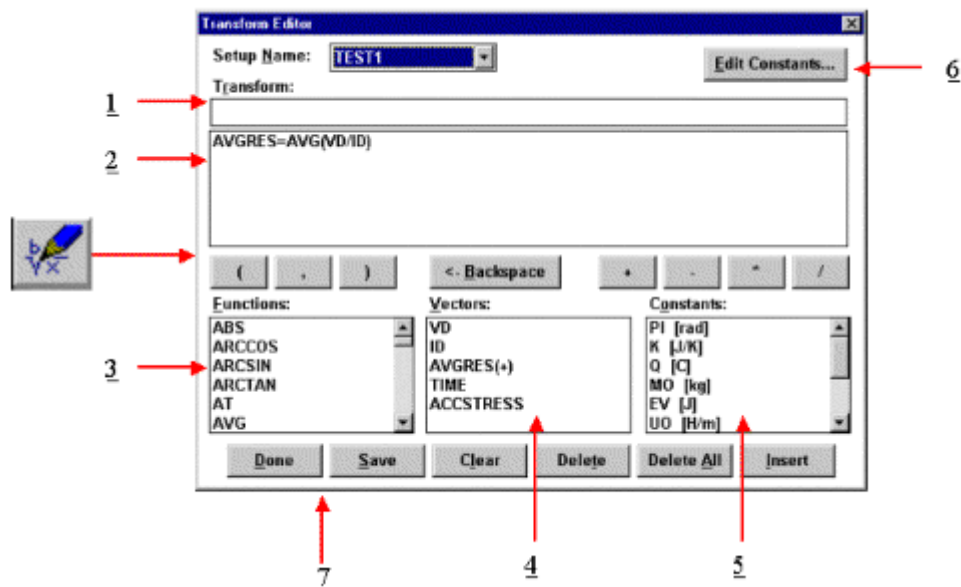
This Module demonstrates how to extract parameters from the raw data using the Transform Editor within ICS.

## *Topics Covered*

- The Transform Editor
- Defining a Transform
- Sharing Data Between Transforms

## The Transform Editor

Calculations are created within the Transform Editor. To open the editor, click the "Transform Editor" button on the ICS toolbar.



The Transform Editor contains several areas:

### 1. Transform Entry Box

The location to enter the transform.

### 2. Defined Transform List

A list of all transforms defined for this setup.

### 3. Function List

A predefined functions available for the calculation of parameters.

#### **4. Vector List**

A list of the measured and calculated data vectors.

#### **5. Constant List**

A list of constants that can be used in calculations.

#### **6. Edit Constant Button**

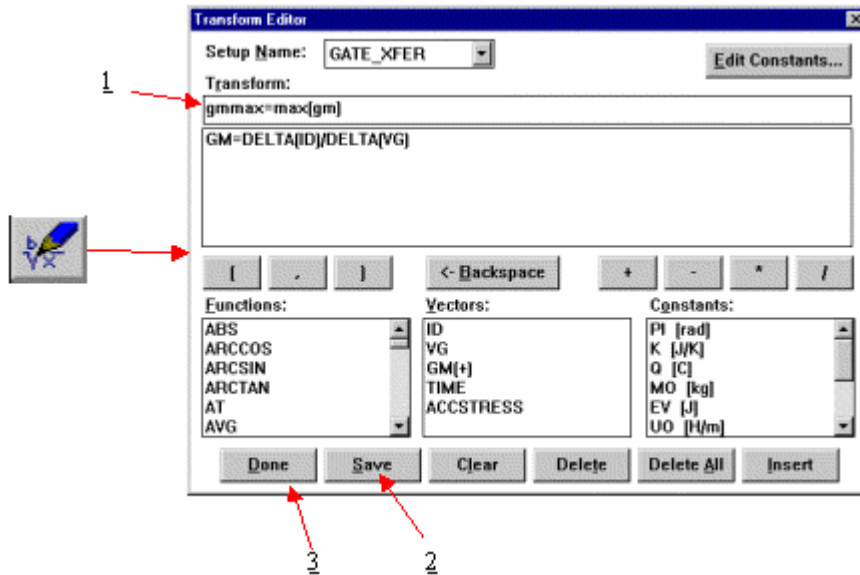
Allows constants to be defined and edited.

#### **7. Action Buttons**

Controls for the saving of transforms, deleting of transforms, and exiting the Transform Editor.

## Defining a Transform

Calculations are created within the Transform Editor. To open the editor click the "Transform Editor" button on the ICS toolbar.



### To create a calculation:

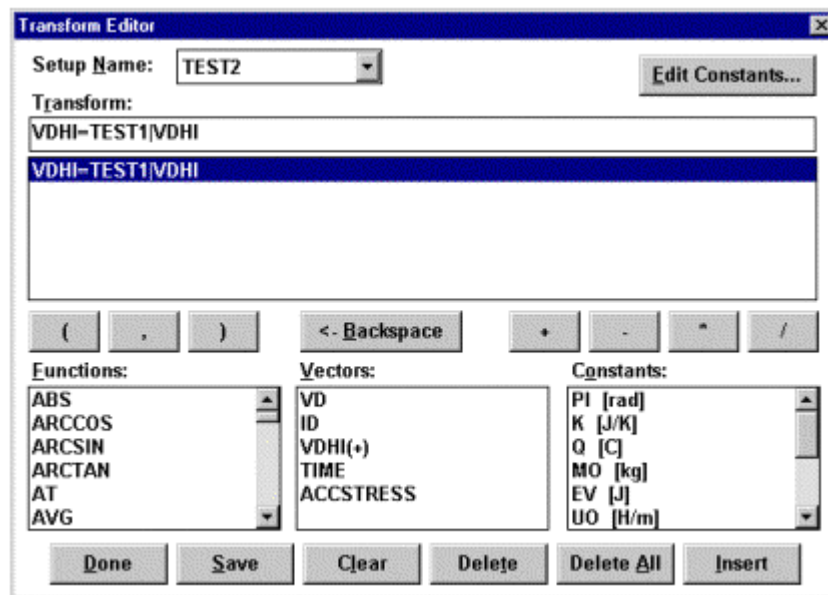
1. Enter the calculation in the "Transform" box. The calculation must be in the form result=function(vector)
2. Click the "Save" button to save the new calculation.
3. Once all calculations have been saved, click the "Done" button.

## Sharing Data Between Transforms

Data vectors from one setup can be shared with another setup in the same project file. For instance, if one setup (TEST2) measures the resistance from 0-1 Volts and the second (TEST1) from 1.1-2 Volts the data can be merged to form a full sweep from 0-2 Volts.

### To Share Data:

We must first create two different setups with TEST2 being the sweep from 0-1 Volts and TEST1 being the sweep from 1.1 to 2 Volts.



1. Open the Transform Editor and make sure the setup name is TEST2.
2. Create a new Transform as shown above.
3. Click the Save button.

The use of the transform result=setup name|vector name allows the data to be moved from one setup to another.



# Chapter 7- Saving Data

## *Introduction*

Metrics ICS version 3.7.0 saves the data within the standard Windows File System. This Module covers the data. Where it is stored, how it is stored, and how to retrieve it are covered.

## *Topics Covered*

- Where is the Data?
- Saving a Project

## *Where is the Data?*

Metrics ICS version 3.7.0 allows the data to be stored anywhere within the windows file system.

**Note:** If you want the ICS Backup utility to save the data, make sure it is saved within the Metrics\ICS\projects directory.

## *Saving a Project*

The project is a collection of the test method(s) and the data. To save the data simply select File >> Save As and select the directory and filename.

