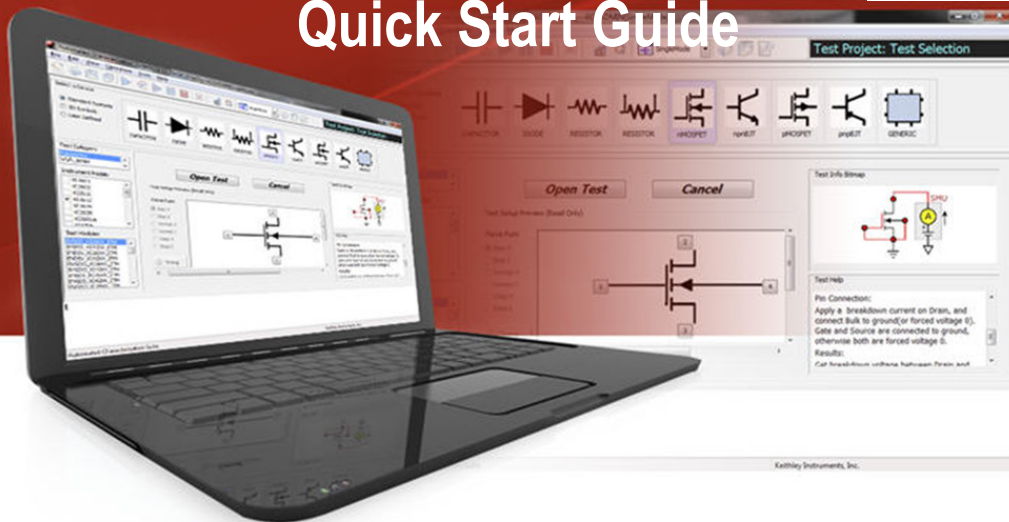


RE-INVENTING TEST & MEASUREMENT THROUGH *SPEED* AND *SIMPLICITY*



# ACS Basic Software Quick Start Guide



A GREATER MEASURE OF CONFIDENCE

**KEITHLEY**

## Safety precautions

Observe the following safety precautions before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

**Responsible body** is the individual or group responsible for use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

**Operators** use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

**Maintenance personnel** perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

**Service personnel** are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley Instruments products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II connections require protection for high transient overvoltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation. Main supply voltage fluctuations not to exceed  $\pm 10\%$  of the nominal voltage.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 V DC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.



If a screw is present, connect it to safety earth ground using the wire recommended in the user documentation.



This symbol on an instrument means caution, risk of danger. The user should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.



This symbol on an instrument means caution, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.



This symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.



This symbol indicates a connection terminal to the equipment frame.



If the mercury symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

**WARNING** This heading in the user documentation explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

**CAUTION** This heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

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To maintain protection from electric shock and fire, replacement components in mains circuits - including the power transformer, test leads, and input jacks - must be purchased from Keithley Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, remove power from the instrument. Use a damp cloth or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning and servicing.



## CAUTION

**Carefully consider and configure the appropriate output-off state, and source and compliance levels before connecting the instrument to a device that can deliver energy. Failure to consider the output-off state, and source and compliance levels may result in damage to the instrument or to the device under test.**

## NOTE

When the Series 2600B System SourceMeter<sup>®</sup> instruments are referenced, it also includes the Series 2600A System SourceMeter instruments, since these two series of instruments are fully interchangeable. However, the following instruments are not supported in ACS Basic: Model 2604B, Model 2614B, and Model 2634B.

# Introduction to ACS Basic software

Optimized for parametric testing of component and discrete (packaged) semiconductor devices, ACS Basic Edition maximizes the productivity of technicians and engineers in research and development. The versatile architecture of this software allows it to meet the wide ranging and ever changing requirements of semiconductor device testing. It supports all of Keithley's source and measure instrument products, including Series 2600B, Series 2400, and Models 2651A and 2657A SourceMeter® instruments, Model 237 SMU, and Model 4200-SCS SMUs. This powerful, yet cost effective solution includes Keithley's rich set of proven parametric libraries. Simply choose the desired test and begin running it to immediately start gathering data and analyzing it. You also have the option of customizing any test with the embedded script editor. The built-in data analysis tools allow you to quickly analyze the parametric data. For example, place device curves developed from newly collected data over "golden" curves for fast comparisons. To perform specialized calculations on raw data, use the mathematical formulator tool to create customized parameter calculations. Data can be easily saved in graphical and/or tabular formats.

ACS Basic offers three modes of operation:

- **Single-test mode:** allows you to perform a single test on a single device. You can select a test from one of three libraries based on the device and instruments available. You can also create your own test or modify available tests.
- **Multi-test mode:** allows you to perform multiple tests on a single device (target application), or multiple tests on multiple devices. It is easier to use external instruments (DMM, switch, etc.) in multi-mode.
- **Trace mode:** allows you to perform interactive operations with a SourceMeter. You can adjust the maximum sweep value and maximum power to the device. You can also easily transition between DC and pulse forcing modes.

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## CD-ROM contents

The CD-ROM that is included with your software contains:

- ACS Basic Software
- Product documentation, including PDFs of this Quick Start Guide, Reference Manual, Libraries Reference Manual, and Release Notes

For updated documents and additional support information, see <http://www.keithley.com/support>.

### NOTE

After you have installed ACS Basic software, and before you begin to set up any projects or run any tests, it is recommended that you review the Release Notes. The Release Notes contain valuable information about known issues and provide guidance on how to handle issues that you may encounter. The Release Notes can be found by clicking on your Windows® Start icon > All Programs > ACS Basic > Reference > Release Notes.

The ACS Basic Software documentation includes:

- **Quick Start Guide:** shows you how to install the software, connect hardware, and set up an instrument to perform a test.
- **Reference Manual:** provides comprehensive information about the software features.
- **Libraries Reference Manual:** contains LPT library programming commands and device library commands.

The manuals are in PDF format on the CD-ROM that is included with the software. If you do not have Adobe Reader® to view the files, you can download a free copy of it at <http://get.adobe.com/reader/>.

# Connect instruments to a computer

When using ACS Basic to control hardware, you must select and configure a communications interface. If the hardware is configured with a communications interface, when ACS Basic starts it will automatically scan and find the hardware.

## Supported communication interface

ACS Basic software supports the following communication interfaces:

- GPIB (general purpose interface bus)
- Ethernet (also referred to as a LAN)
- TSP-Link™ (subordinate)

### NOTE

ACS Basic can also control multiple TSP instruments as a group connected to a single GPIB or Ethernet interface. Each group uses TSP-Link to connect instruments together.

The following table indicates how instruments communicate with ACS Basic:

Instrument Series	Platform	Communication interface
2400	Desktop / laptop computer	GPIB
2600	Desktop / laptop computer or 4200	GPIB, TSP subordinate
2600B	Desktop / laptop computer or 4200	GPIB, Ethernet, TSP subordinate
4200	4200 only	Internal
3700	Desktop / laptop computer or 4200	GPIB, Ethernet, TSP subordinate
Other external instruments	Desktop / laptop computer or 4200	GPIB

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### Select an interface

Make sure you choose an interface that is consistent with your instrument's connection: GPIB or Ethernet. Some instruments allow multiple communication interfaces to be enabled, however you can only communicate with one interface at a time using ACS Basic.

#### NOTE

See the instrument's manual for more information on the GPIB and Ethernet communication interfaces.

### Configure the interface through GPIB

ACS Basic automatically scans the GPIB instruments during start.

ACS Basic software supports these GPIB interfaces:

- KUSB-488, KUSB-488A, KUSB-488B
- KPCI-488, KPCI-488A, KPCI-488LP, KPCI-488LPA
- NI USB-488, NI PCI-488

### GPIB card installation

It is recommended that you install the GPIB card and its associated driver prior to installing ACS Basic.

#### NOTE

For more information on the installation of a GPIB card driver, refer to the GPIB manufacturer's interface documentation for installation instructions.

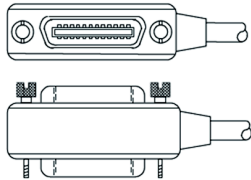
### Check the GPIB communication

Prior to starting ACS Basic, it is recommended that you verify that the GPIB card and driver are installed correctly and are properly functioning in your operating system. For the Keithley/CEC GPIB interfaces, you can use the following diagnostic utilities: "KI-488 Configuration Utility" and the "KI-488 Diagnostic Tool."



## Connect instruments with GPIB

To connect the instruments to the GPIB bus, use an IEEE-488 GPIB cable:



Establish the instrument's GPIB address and make sure that any additional instruments are configured for a GPIB connection and that they have a valid, unique address. For example, the Series 2600B ships from the factory with a GPIB primary address of 26. If the GPIB interface is enabled, it momentarily displays the primary address on power-up. You can set the address to a value from 0 to 30, but do not assign the same address to another instrument or to a controller that is on the same GPIB bus.

### NOTE

Controller GPIB addresses are usually 0 or 21.

The next figure shows a single instrument connected to a computer with a GPIB:



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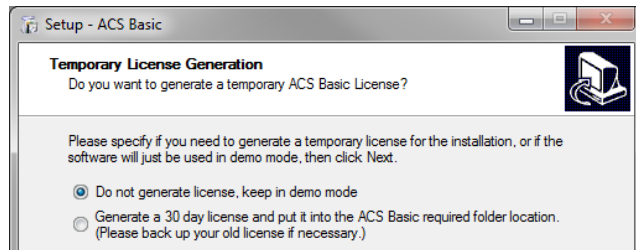
## Software installation

### Install ACS Basic:

1. Restart your computer.
2. Log in as an Administrator .
3. Insert the ACS Basic setup disk into the CD-ROM drive.
4. The setup process should start automatically. If the setup does not start automatically, click My Computer and then open the CD-ROM device folder.
5. Click the drivers folder, then the ACS\_Basic\_Vx.x to start the process.
6. Once the ACS Basic Setup Wizard dialog box opens, follow the instructions given to specify how you would like the software to be installed on your system.

### License information

Once the installation process is complete, the Temporary License Generation dialog box opens (note that if you already have a USB license key, select "Do not generate license, keep in demo mode" in order to continue installation):



## USB license key

The ACS Basic SafeNet Sentinel USB license key is similar to a standard USB flash drive. The USB license key is included with the ACS Basic Software package. The USB license key allows you to operate ACS Basic in professional mode or evaluation mode, and can be moved from one computer to another (multiple installations) without buying additional licenses.



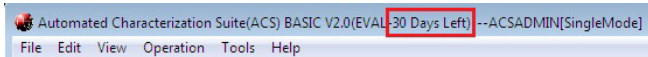
If you do not have a USB license key inserted when you open the software, you will see a dialog box asking if you want to open ACS Basic in demo mode. In demo mode you cannot communicate with test and measurement hardware.

## NOTE

The evaluation license is a temporary key that you can use for 30 days.

Before you start running the ACS Basic software, insert your USB license key into the computer's USB interface. The computer and ACS Basic software will automatically detect the USB key.

If you have the temporary key, ACS Basic will start in the evaluation mode, which has the same functionality as professional mode. The status of the temporary license key and the amount of days that you have available are displayed in the title bar:



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## Start ACS Basic

Make sure that all of the instruments are connected with a GPIB/LAN cable. If more than one Series 2600B SourceMeter instrument is used in a group, make sure that the TSP-Link connection has been made correctly. Assign GPIB addresses and node numbers. Make sure that all the instruments are turned on and self-testing is completed on all of the instruments then start ACS Basic.



### CAUTION


**FATAL ERROR POSSIBLE.** To avoid fatal errors to instruments, never start ACS Basic software until all of the instruments have started and completed self-testing.

Click the ACS Basic icon (either a desktop icon or a quick launch icon chosen at installation). The User Login opens. The default User Name is ACSADMIN, and there is not a default password. Click **OK** to log in to professional mode (license key required).



# Hardware configuration

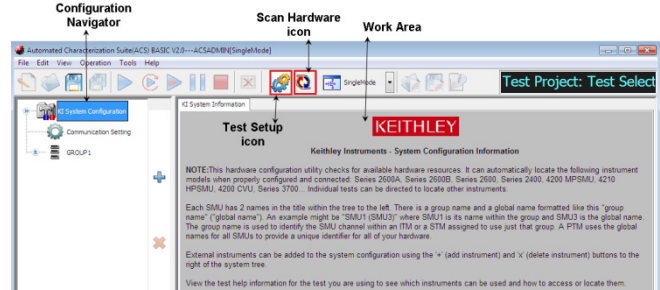
The Configure Hardware function is used to get information while scanning the hardware instruments and to modify configurable instrument properties.

ACS Basic automatically scans the instruments when you open the software. To check if the instruments are properly configured and connected, click the Configure Hardware option from the Tools menu or click the Configure Hardware icon  on the toolbar. To scan the hardware manually, click the Scan Hardware icon on the toolbar.

The interface of the hardware configuration utility has two parts: the left panel is the configuration navigator; the right panel is the work area.

The configuration navigator provides a tree view of the currently connected instruments and equipment. The tree branches can be expanded and minimized by clicking on the arrows to the left of each branch.

The work area shows each instrument in the system configuration and its associated properties. Click an instrument in the configuration navigator and the associated properties display in the work area.



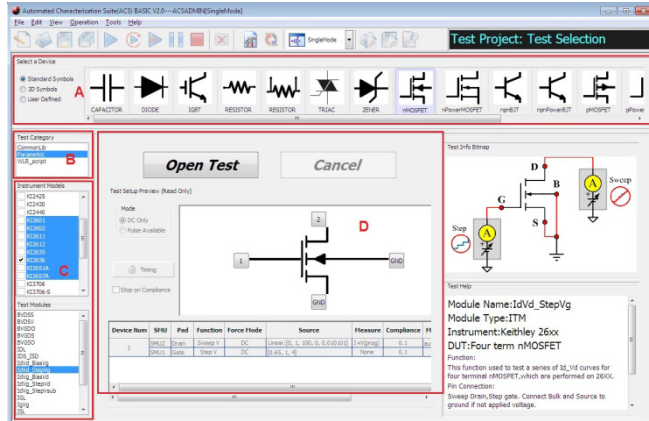
## NOTE

To exit the hardware configuration and go back to Test Setup, click the Test Setup icon on the toolbar.



## Test setup

First you must **select a device** and **select a test** from the ACS Basic GUI:



## Select a test module in single-test mode

1. Select a device view (Standard, 3D Symbols, or User Defined)(refer to graphic, area **A**).
2. Click on the desired device and the selected icon will highlight (refer to graphic, area **A**).
3. All test categories belonging to this device are listed in the Test Category area (refer to graphic, area **B**). Select a test category.
4. Select the test instrument model. The test modules applicable for this instrument are listed in the Test Modules area. If two or more instruments are selected the Test Modules area will display all of the modules available to any of the selected instruments (refer to graphic, area **C**).
5. Select a test module (refer to graphic, area **C**).
6. The test information preview is displayed on the right panel. This information includes Test Setup Preview, Test Information Bitmap, and Test Help (refer to graphic, area **D**).

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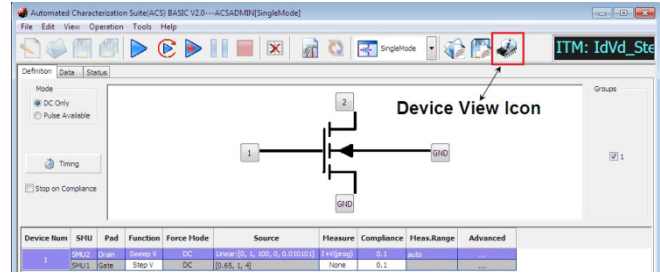
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## Open and edit the test module

1. Click **Open Test** to open the test view GUI. In this GUI, you can modify the test module settings and run the test module.
2. In the test view GUI, click the **Device view** icon to open the device view GUI. Use Device View to designate the test and measurement instruments that are connected to each device terminal. Assign the pads to the appropriate SMU.
3. In the device view GUI, click the **Test view** icon to return to the test view GUI.

## Run the test module

1. Assign the force Function to apply voltage, current, or to ground, and the other measurement parameters accordingly.
2. Once the test setup is complete, click the **run** icon .
3. The test results appear in the **Data** tab.

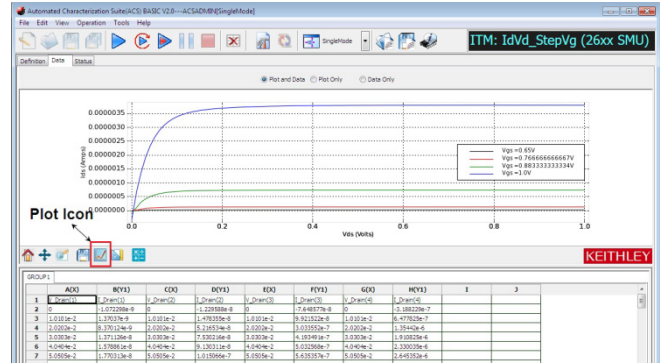




# Data Plotting

Define the data to be graphed:

1. Highlight the data you want to plot.
2. Click the Plot icon (see the graphic).
3. Select New Plot.
4. In the pop-up XY settings window, assign data to the axis.
5. Click **OK**.



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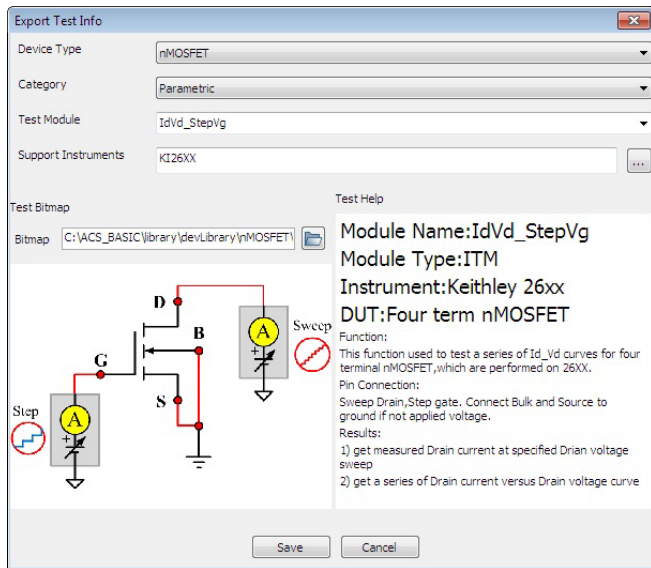
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## Save the test module to the library

The test module can be saved to the device library for future use. The saved information includes both test settings and test results.

1. Click the **Export Test** icon  on the toolbar; the save test information GUI opens. To save a test:
  - a. Select the device type for the module in the Device Type drop-down list.
  - b. Select a test category in the Category list.
  - c. Input a test name in the Test Module edit box. Note that the new Test Module name should be different from the existing name to avoid overwriting the original module.
  - d. Click the ellipsis of the Support Instruments edit box. In the pop-up dialog box, choose your desired instruments for the library by clicking the box next to the instrument. Click **OK**.
  - e. If desired, change the bitmap by clicking on the folder icon to find a new bitmap.
  - f. If desired, change the description by entering the text in the right panel editing panel.
2. Click **Save** to save the test module to the test library .
3. After the test module is saved, ACS Basic returns to the test selection GUI where the previous test can be opened and used again.



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### **What happens if I remove my USB license key while using ACS Basic software?**

**DO NOT** remove the USB key from the computer while you are using the ACS Basic software in professional or evaluation mode. If the key is removed, you will receive a warning message that indicates you have 30 seconds to insert the USB key back in the computer. After the key is reinserted in the computer, you must click **Continue** in order to keep ACS Basic functioning. If the key is not inserted in the computer before the time has elapsed, the software will close and you will lose all data from your current session.

### **I just connected an instrument to my computer, but I can't select the instrument in ACS Basic.**

If you make changes to the hardware, do the following:

1. Click the Configure Hardware icon.
2. Click the Scan Hardware icon in the toolbar to re-scan the hardware.

3. Click the Save function to update the changes.
4. Close and restart ACS Basic for the changes to take effect.
5. Check the test setup to ensure the new hardware configuration is correct.

## Next steps

### **Refer to the ACS Basic Reference Manual**

This manual provides detailed information about all of the features of the software. This manual is on the Product Information CD-ROM that came with your order.

### **Refer to the ACS Basic Libraries Reference Manual**

It contains detailed information about the Series 2600B LPT library, as well as other LPT libraries, and the device library. This manual is on the Product Information CD-ROM that came with your order.

### **Keithley Instruments website**

See [www.keithley.com](http://www.keithley.com) for support and additional information about ACS Basic software.

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