KEITHLEY

KUSB-3100
Getting Started Manual

KUSB3100-903-01 Rev. A / January 2005

KEITHLEY

A G R E A T E R M E A S U R E O F C O N F I D E N C E

WARRANTY

Keithley Instruments, Inc. warrants this product to be free from defects in material and workmanship for a period of 3 years from date of shipment.

Keithley Instruments, Inc. warrants the following items for 90 days from the date of shipment: probes, cables, rechargeable batteries, diskettes, and documentation.

During the warranty period, we will, at our option, either repair or replace any product that proves to be defective.

To exercise this warranty, write or call your local Keithley representative, or contact Keithley headquarters in Cleveland, Ohio. You will be given prompt assistance and return instructions. Send the product, transportation prepaid, to the indicated service facility. Repairs will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

LIMITATION OF WARRANTY

This warranty does not apply to defects resulting from product modification without Keithley's express written consent, or misuse of any product or part. This warranty also does not apply to fuses, software, non-rechargeable batteries, damage from battery leakage, or problems arising from normal wear or failure to follow instructions.

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A G R E A T E R M E A S U R E O F C O N F I D E N C E

Keithley Instruments, Inc.

KUSB-3100
Getting Started Manual

Manual Print History

The print history shown below lists the printing dates of all Revisions and Addenda created for this manual. The Revision Level letter increases alphabetically as the manual undergoes subsequent updates. Addenda, which are released between Revisions, contain important change information that the user should incorporate immediately into the manual. Addenda are numbered sequentially. When a new Revision is created, all Addenda associated with the previous Revision of the manual are incorporated into the new Revision of the manual. Each new Revision includes a revised copy of this print history page.

Revision A (Document Number KUSB3100-903-01A)... January 2005

KEITHLEY **Safety Precautions**

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with non-hazardous 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 manual for complete product specifications.

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

The types of product users are:

Responsible body is the individual or group responsible for the 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 manual. 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, and perform safe installations and repairs of products. Only properly trained service personnel may perform installation and service procedures.

Keithley 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 over-voltages. Measurement Category II connections require protection for high transient over-voltages 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 Manual.

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 30V RMS, 42.4V peak, or 60VDC 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 volts, **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, make sure 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 same type and rating for continued protection against fire hazard.

5/03

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.

The ⚠ symbol on an instrument indicates that the user should refer to the operating instructions located in the manual.

The ⚡ symbol on an instrument shows that it can source or measure 1000 volts or more, including the combined effect of normal and common mode voltages. Use standard safety precautions to avoid personal contact with these voltages.

The ⏚ symbol indicates a connection terminal to the equipment frame.

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

The **CAUTION** heading in a manual 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.

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, 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., 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/servicing.

Table of Contents

About this Manual

This manual describes how to install and set up your KUSB-3100 module and device driver, and verify that your module is working properly.

Intended Audience

This document is intended for engineers, scientists, technicians, or others responsible for installing and setting up a KUSB-3100 module to perform data acquisition operations. It is assumed that you are familiar with the requirements of your application. It is also assumed that you are familiar with the Microsoft® Windows® 2000 or Windows XP.

How this Manual is Organized

This manual is organized as follows:

- Chapter 1, "Overview," describes the key features of the KUSB-3100 hardware and software, and provides an overview of the getting started procedure.

- Chapter 2, "Preparing to Use a Module," describes how to unpack the module, check the system requirements, and install the software using Windows 2000 or Windows XP.

- Chapter 3, "Setting Up and Installing the Module," describes how to set up the KUSB-3100 module and configure the device driver.

- Chapter 4, "Wiring Signals," describes how to wire signals to the module.

- Chapter 5, "Verifying the Operation of a Module," describes how to verify the operation of the module with the Quick Data Acq application.

An index completes this manual.

Conventions Used in this Manual

The following conventions are used in this manual:

- Notes provide useful information that requires special emphasis, cautions provide information to help you avoid losing data or damaging your equipment, and warnings provide information to help you avoid catastrophic damage to yourself or your equipment.

- Items that you select or type are shown in **bold**.

- Courier font is used to represent source code.

Related Information

Refer to the following documents for more information on using the KUSB-3100 module:

- *KUSB-3100 User's Manual* provided with the module. This manual describes the features of the KUSB-3100 module and device driver.

- *DataAcq SDK User's Manual*. For programmers who are developing their own application programs using the Microsoft C compiler, this manual describes how to use the DT-Open Layers™ DataAcq SDK™ in Windows 2000 or Windows XP to access the capabilities of your module.

- *DTx-EZ Getting Started Manual*. This manual describes how to use the ActiveX controls provided in DTx-EZ™ to access the capabilities of your module in Microsoft Visual Basic® or Visual C++®.

- *DT-LV Link Getting Started Manual.* This manual describes how to use DT-LV Link™ with the LabVIEW® graphical programming language to access the capabilities of your module.

- Microsoft Windows 2000 or Windows XP documentation.

- USB web site (http://www.usb.org).

Where To Get Help

Should you run into problems installing or using your KUSB-3100 module, please call the Keithley Technical Support Department.

1

Overview

1

Key Hardware Features

Table 1 lists the key features of the KUSB-3100 module.

Table 1: Key Features of the KUSB-3100 Module

	Analog Outputs	Resolution	I/O Range	Sample Rate	Digital I/O	Counter/ Timer[a]
8 SE	2	12-bit	±10 V	50 kS/s	8 input, 8 output	1

a. This counter/timer channel allows you to perform event counting, frequency measurement, edge-to-edge measurement, and continuous pulse output (rate generation) operations.
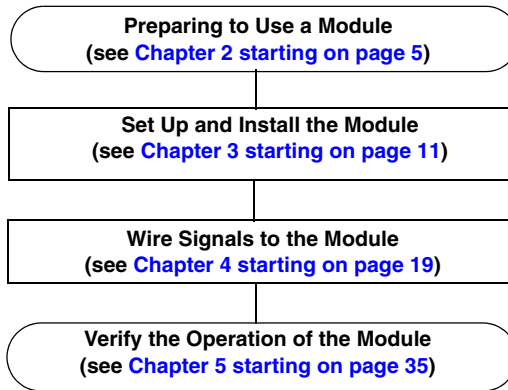
Software

1

The software for the KUSB-3100 module, which is shipped on the Keithley CD that is provided with the module, includes the following software components:

- **Device Driver** –This software must be installed and loaded before you can use a KUSB-3100 module with any of the supported software packages or utilities.

- **The Quick Data Acq application** –This application provides a quick way to get your module up and running. Using the Quick Data Acq application, you can verify the features of the module, display data on the screen, and save data to disk.

- **DataAcq SDK** –This DT-Open Layers Software Develop Kit (SDK) allows programmers to develop application programs for the KUSB-3100 using the Microsoft C compiler in Windows 2000 or Windows XP.

- **DTx-EZ** –This software package contains ActiveX controls that allow Microsoft Visual Basic® or Visual C++® programmers to access the capabilities of the KUSB-3100 module.

- **DT-LV Link** –This software package allows LabVIEW® programmers to access the capabilities of the KUSB-3100 module.

Getting Started Procedure

The flow diagram shown in Figure 1 illustrates the steps needed to get started using the KUSB-3100 module. This diagram is repeated in each chapter; the shaded area in the diagram shows you where you are in the getting started procedure.

**Preparing to Use a Module
(see Chapter 2 starting on page 5)**

**Set Up and Install the Module
(see Chapter 3 starting on page 11)**

**Wire Signals to the Module
(see Chapter 4 starting on page 19)**

**Verify the Operation of the Module
(see Chapter 5 starting on page 35)**

Figure 1: Getting Started Flow Diagram

2

Preparing to Use a Module

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│   Prepare to Use a Module           │
│   (this chapter)                    │
└─────────────────────────────────────┘
                │
┌─────────────────────────────────────┐
│   Set Up and Install the Module     │
│   (see Chapter 3 starting on page 11)│
└─────────────────────────────────────┘
                │
┌─────────────────────────────────────┐
│   Wire Signals to the Module        │
│   (see Chapter 4 starting on page 19)│
└─────────────────────────────────────┘
                │
┌─────────────────────────────────────┐
│   Verify the Operation of the Module │
│   (see Chapter 5 starting on page 35)│
└─────────────────────────────────────┘
```

Unpacking

Open the shipping box and verify that the following items are present:

- KUSB-3100 module,

- USB cable, and

- Keithley CD.

If an item is missing or damaged, contact Keithley Technical Support. Once you have unpacked your module, check the system requirements, as described in the next section.

2

Checking the System Requirements

For reliable operation, your KUSB-3100 module requires the following:

- Windows 2000 or Windows XP (Professional Edition) operating system.

  For USB Ver. 2.0 support, make sure that you install Service Pack 1 (for Windows XP) or Service Pack 4 (for Windows 2000). In addition, for some systems, you may have to disable standby mode. If you are not sure whether you are using USB Ver. 1.1 or Ver. 2.0, run the Open Layers Control Panel applet, described on .

- One or more USB ports (Ver. 2.0 or Ver. 1.1). USB Ver. 2.0 is recommended for optimal performance.

- One CD-ROM drive.

Once you have verified that your system meets the system requirements, install the software, as described in the next section.

Installing the Software

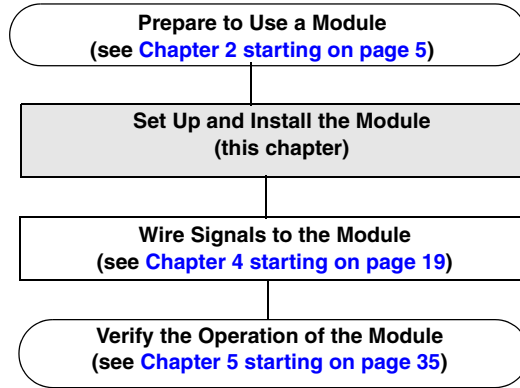To install the driver software, Data Acq SDK, DTx-EZ, and the Quick Data Acq software, perform the following steps:

1. Insert the Keithley CD into your CD-ROM drive.

2. Click **Start** from the Task Bar, then click **Run**.
The Run dialog box appears.

3. In the Command Line edit box, enter **D:\Setup.Exe**.
If your CD-ROM is not in drive D:, enter the letter of the drive where your CD-ROM is located. The welcome screen appears.

4. Click **Install Drivers and SDK**.

5. Click **Install now!**
The installation wizard appears.

6. Click **Next**.
You are prompted for the destination location.

7. Either change the directory path and/or name using **Browse** or accept the default directory, then click **Next**.

8. Click **Next** to copy the files.

9. Click **Finish**.

10. Click **Quit Installer**.

2

3

Setting Up and Installing the Module

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        ╭─────────────────────────────────────╮
        │      Prepare to Use a Module         │
        │  (see Chapter 2 starting on page 5)  │
        ╰─────────────────────────────────────╯
                        │
        ┌─────────────────────────────────────┐
        │     Set Up and Install the Module    │
        │           (this chapter)             │
        └─────────────────────────────────────┘
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        ┌─────────────────────────────────────┐
        │       Wire Signals to the Module     │
        │  (see Chapter 4 starting on page 19) │
        └─────────────────────────────────────┘
                        │
        ╭─────────────────────────────────────╮
        │   Verify the Operation of the Module │
        │  (see Chapter 5 starting on page 35) │
        ╰─────────────────────────────────────╯
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Note: The KUSB-3100 module is factory-calibrated. You can recalibrate the module using the instructions in the *KUSB-3100 User's Manual.*

Overview

You can attach a KUSB-3100 module to the host computer in one of two ways:

- Connect directly to a USB port of the host computer, described on page 13. Use this method if one or two modules are sufficient for your application.

- Connect to one or more self-powered USB hubs, described on page 16. Use this method if your application requires more than two modules connected to the host computer.

3

Note: The KUSB-3100 module is a low-power device (using less than 200 mA); therefore, it does not require an external power supply.

Attaching Modules to the Computer

This section describes how to attach a KUSB-3100 module to the host computer.

Note: Most computers have two USB ports that allow direct connection to USB devices. If your application requires more than two KUSB-3100 modules, you can expand the number of USB devices attached to a single USB port by using expansion hubs. For more information, refer to page 16.

You can unplug a module, then plug it in again, if you wish, without causing damage. This process is called hot-swapping. Your application may take a few seconds to recognize a module once it is plugged back in.

Connecting One or Two Modules Directly to the USB Ports of Your Computer

To connect one or two KUSB-3100 modules directly to the USB ports of your computer, perform the following steps:

1. Attach one end of the USB cable to the USB port on the module.

2. Attach the other end of the USB cable to one of the USB ports on the host computer, as shown in Figure 2.
    The operating system automatically detects the USB module. If the module is attached correctly, the LED on the module turns green.
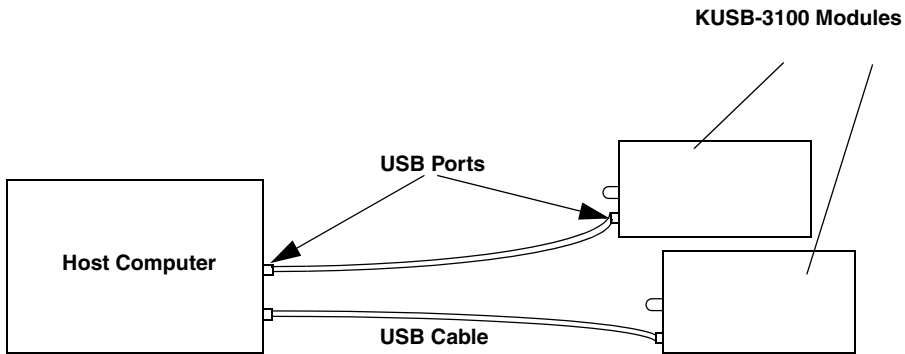
Figure 2: Attaching the Module to the Host Computer

3. Repeat the steps to attach another KUSB-3100 module to the host computer, if desired.

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Connecting Multiple Modules Using an Expansion Hub

Expansion hubs are powered by their own external power supply. Theoretically, you can connect up to five expansion hubs to a USB port on the host computer. However, the practical number of KUSB-3100 modules that you can connect to a single USB port depends on the throughput you want to achieve. Each of the hubs supports up to four modules.

Note: The bandwidth of the USB Ver. 1.1 bus is 12 Mbits/second; the bandwidth of the USB Ver. 2.0 bus is 480 Mbits/second. Particularly if you are using the USB Ver. 2.0 bus, you may be limited in the number of modules that you can connect to a single USB port.

To connect multiple KUSB-3100 modules to an expansion hub, perform the following steps:

1. Attach one end of the USB cable to the module and the other end of the USB cable to an expansion hub.

2. Connect the power supply for the expansion hub to an external power supply.

3. Connect the expansion hub to the USB port on the host computer using another USB cable.
    The operating system automatically detects the USB device. If the module is attached correctly, the LED on the module turns green.

4. Repeat these steps until you have attached the number of expansion hubs (up to five) and modules (up to four per hub) that you require. Refer to Figure 3.
The operating system automatically detects the USB devices as they are installed.
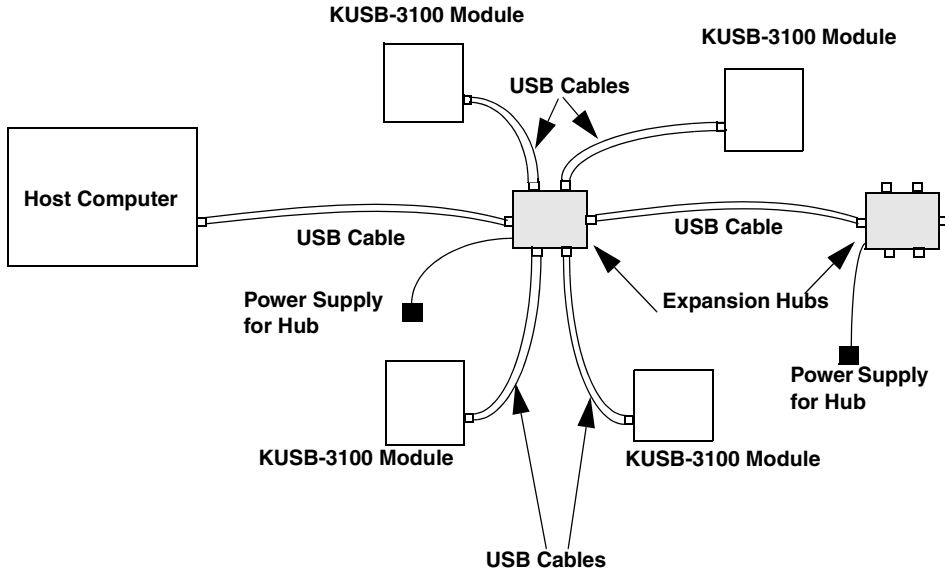
Figure 3: Attaching Multiple KUSB-3100 Modules Using Expansion Hubs

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Changing the Name of a Module (Optional)

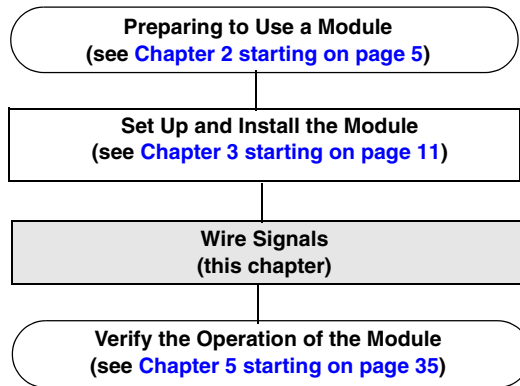To change the name of a KUSB-3100 module, configure the device driver by performing the following steps:

1. From the Windows Start menu, select **Settings | Control Panel**.

2. From the Control Panel, double-click **Open Layers Control Panel**.
   The Data Acquisition Control Panel dialog box appears.

3. If you want to rename the module, click the KUSB-3100 module that you want to rename, then click **Edit Name.**

4. Enter a new name for the module, then click **OK**. The name is used to identify the module in all subsequent applications.

5. When you are finished configuring the module, click **Close**.

6. Repeat steps 3 to 5 for the other modules that you want to configure.

7. Close the Data Acquisition Control Panel dialog box.

Continue with the instructions on wiring in .

4

Wiring Signals

Preparing to Use a Module
(see **Chapter 2 starting on page 5**)

Set Up and Install the Module
(see **Chapter 3 starting on page 11**)

Wire Signals
(this chapter)

Verify the Operation of the Module
(see **Chapter 5 starting on page 35**)

Preparing to Wire Signals

Note: To avoid electrostatic sensitivity, it is recommended that you unplug your KUSB-3100 module from the computer before wiring signals.

This section provides recommendations and information about wiring signals to a KUSB-3100 module.

Wiring Recommendations

4

Keep the following recommendations in mind when wiring signals to an ECONseries module:

- Use individually shielded twisted-pair wire (size 16 to 26 AWG) in highly noisy electrical environments.

- Separate power and signal lines by using physically different wiring paths or conduits.

- To avoid noise, do not locate the box and cabling next to sources that produce high electromagnetic fields, such as large electric motors, power lines, solenoids, and electric arcs, unless the signals are enclosed in a mumetal shield.

- Prevent electrostatic discharge to the I/O while the box is operational.

- Connect all unused analog input channels to analog ground.

Wiring Method

You wire signals to the KUSB-3100 module using the screw terminals on the module. Table 2 lists the screw terminal assignments for the modules.

Table 2: KUSB-3100 Screw Terminal Assignments

Screw Terminal	Signal	Screw Terminal	Signal
20	USB +5 V Out	40	Ext Trig In
19	Ground	39	Ext Clock In
18	Counter 0 In	38	Ground
17	Counter 0 Out	37	Digital Output 7
16	Counter 0 Gate	36	Digital Output 6
15	Ground	35	Digital Output 5
14	DAC 1	34	Digital Output 4
13	DAC 1 Return	33	Digital Output 3
12	DAC 0	32	Digital Output 2
11	DAC 0 Return	31	Digital Output 1
10	2.5 V Reference	30	Digital Output 0
9	Analog Ground	29	Ground
8	Analog Input CH7 High	28	Digital Input 7
7	Analog Input CH6 High	27	Digital Input 6
6	Analog Input CH5 High	26	Digital Input 5
5	Analog Input CH4 High	25	Digital Input 4
4	Analog Input CH3 High	24	Digital Input 3

Table 2: KUSB-3100 Screw Terminal Assignments (cont.)

Screw Terminal	Signal	Screw Terminal	Signal
3	Analog Input CH2 High	23	Digital Input 2
2	Analog Input CH1 High	22	Digital Input 1
1	Analog Input CH0 High	21	Digital Input 0

4

Connecting Single-Ended Analog Input Signals

The KUSB-3100 module supports 8 single-ended analog input channels. Figure 4 shows how to connect single-ended voltage input signals (channels 0 and 1, in this case) to the screw terminals of the module.
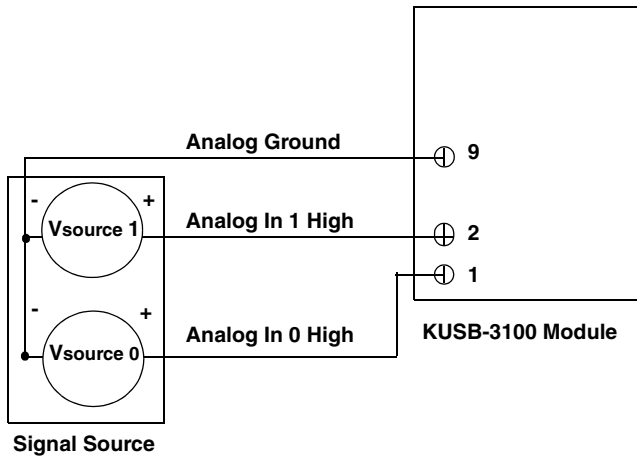
Figure 4: Connecting Single-Ended Inputs

Connecting Analog Output Signals

The KUSB-3100 module supports two analog output channels (DAC0 and DAC1). Figure 5 shows how to connect an analog output voltage signal (DAC0, in this case) to the KUSB-3100 module.
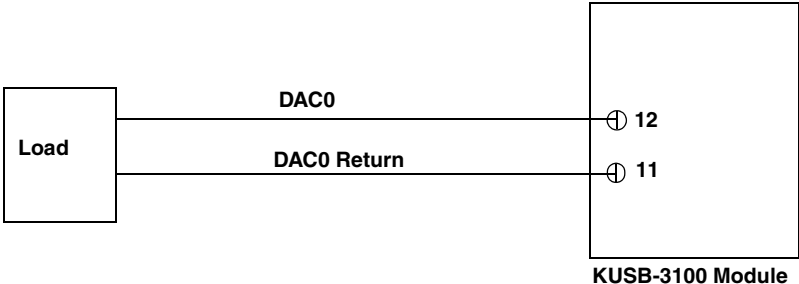
Figure 5: Connecting Analog Outputs to a Screw Terminal Panel

Connecting Digital I/O Signals

The KUSB-3100 module supports eight, fixed digital input lines and eight, fixed digital output lines. Figure 6 shows how to connect digital input signals (lines 0 and 1, in this case) to the screw terminals of a KUSB-3100 module.
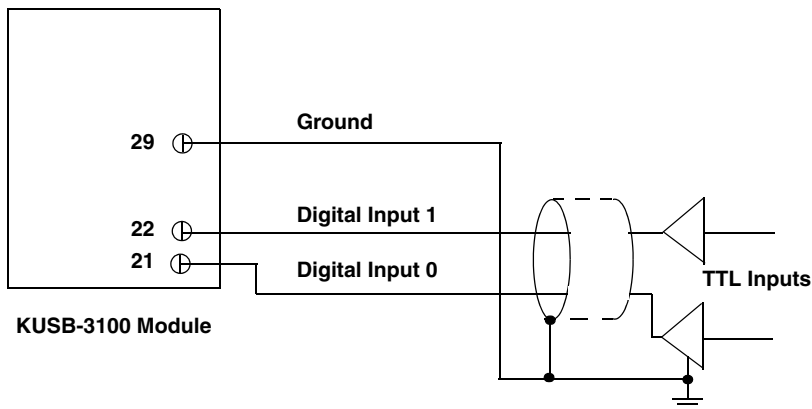
Figure 6: Connecting Digital Inputs

Figure 7 shows how to connect digital output signals (line 0, in this case) to the screw terminals of aKUSB-3100 module.
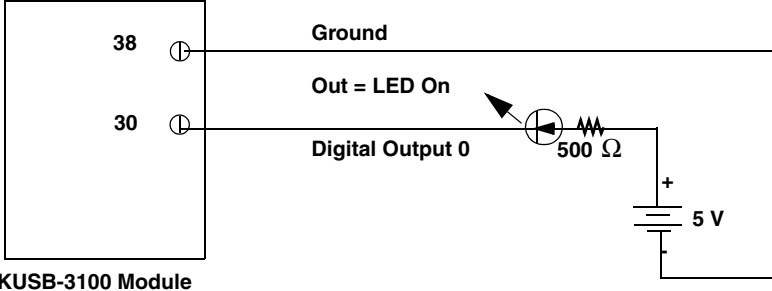
Figure 7: Connecting Digital Outputs

Connecting Counter/Timer Signals

The KUSB-3100 module provides one counter/timer channel that you can use to perform the following operations:

- Event counting,

- Frequency measurement,

- Edge-to-edge measurement, and

- Continuous pulse output (rate generation).

This section describes how to connect counter/timer signals for these operation modes. Refer to the *KUSB-3100 User's Manual* for more information about using the counter/timers.

Connecting Signals for an Event Counting Operation

Figure 8 shows how to connect counter/timer signals to the screw terminals on the KUSB-3100 module to perform an event counting operation using an external gate.

In this example, the counter counts the number of rising edges that occur on the Counter 0 In signal when the Counter 0 Gate signal is in the active state (as specified by software). Refer to the *KUSB-3100 User's Manual* for more information.
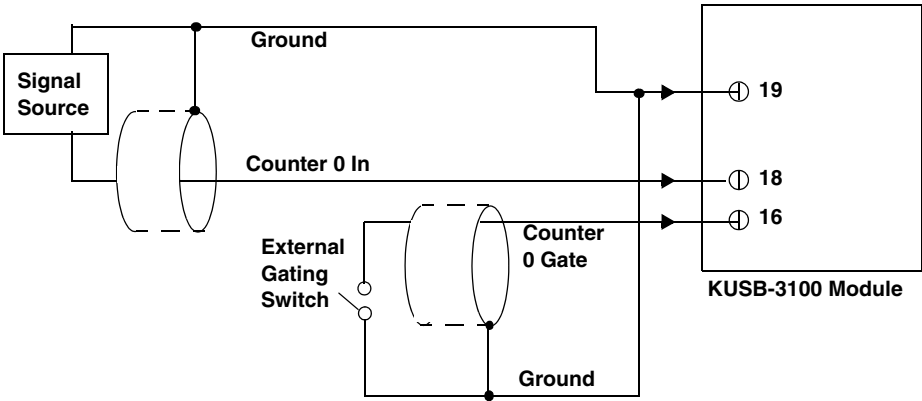
**Figure 8: Connecting Counter/Timer Signals for an Event Counting
Operation Using an External Gate**

4

Figure 9 shows how to connect counter/timer signals to the screw
terminals on the KUSB-3100 module to perform an event counting
operation without using a gate (also called a software gate). The
counter counts the number of rising edges that occur on the Counter
0 In signal.
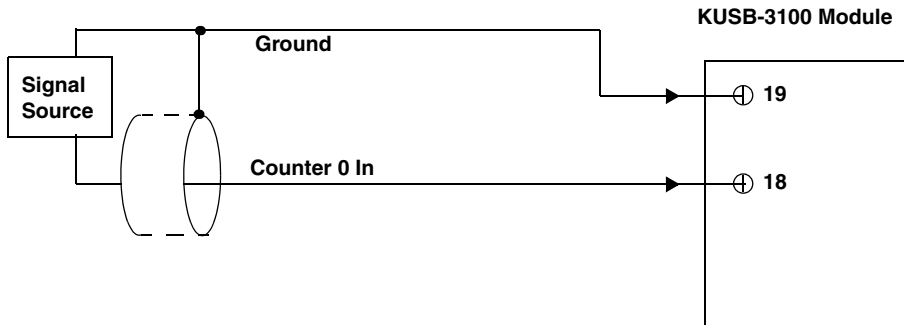
Figure 9: Connecting Counter/Timer Signals for an Event Counting Operation Without Using a Gate

Connecting Signals for a Frequency Measurement Operation

One way to measure frequency is to use the same wiring as a standard event counting application that does not use a gate (see Figure 9 on page 30), then use the Windows timer to determine the duration over which to count the number of pulses connected to the Counter 0 In signal. The frequency of the Counter 0 In signal is the number of counts divided by the duration of the Windows timer.

If you need more accuracy than the Windows timer can provide, you can connect a pulse of a known duration to the Counter 0 Gate signal, as shown in Figure 10. In this case, the frequency of the Counter 0 In signal is the number of counts divided by the period of the signal connected to the Counter 0 Gate input.
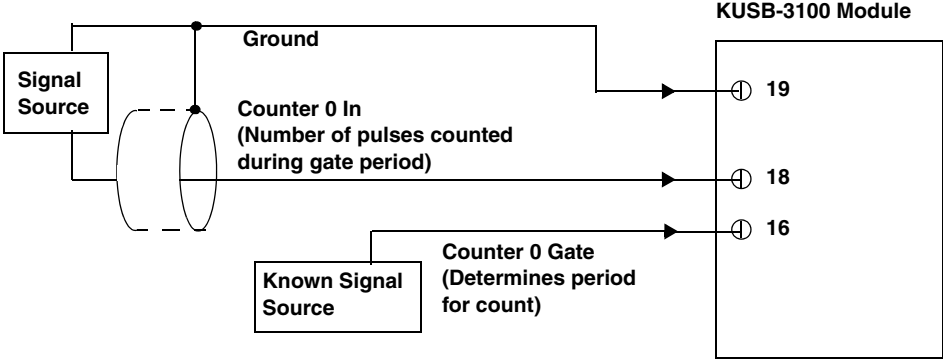
Figure 10: Connecting Counter/Timer Signals for a Frequency Measurement Operation Using an External Pulse

Connecting Signals for an Edge-to-Edge Measurement Operation

Figure 11 shows how to connect counter/timer signals to the KUSB-3100 module to perform an edge-to-edge measurement operation on one signal sources. The counter measures the number of counts between the start edge (in this case, a rising edge on the Counter 0 Gate signal) and the stop edge (in this case, another rising edge on the Counter 0 Gate signal).

You specify the start edge and the stop edge in software. Refer to the *KUSB-3100 User's Manual* for more information.
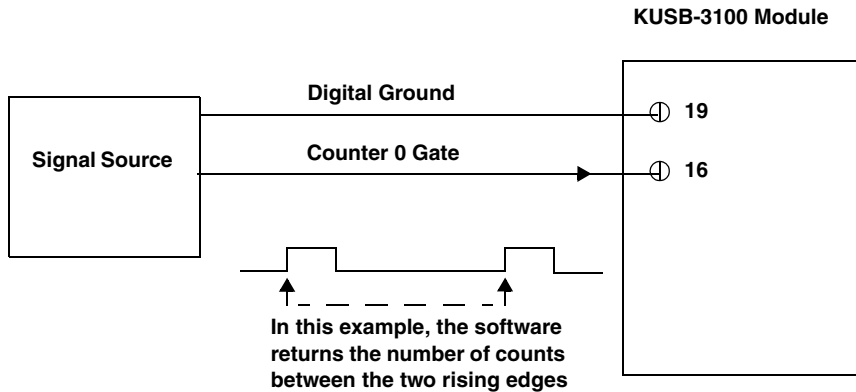
Figure 11: Connecting Counter/Timer Signals for an Edge-to-Edge Measurement Operation

You can use edge-to-edge measurement to measure the following characteristics of a signal:

- Pulse width – The amount of time that a signal pulse is in a high or a low state, or the amount of time between a rising edge and a falling edge or between a falling edge and a rising edge. You can calculate the pulse width as follows:

  – Pulse width = Number of counts/24 MHz

- Period – The time between two occurrences of the same edge (rising edge to rising edge, or falling edge to falling edge). You can calculate the period as follows:

  – Period = 1/Frequency

  – Period = Number of counts/24 MHz

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- Frequency – The number of periods per second. You can calculate the frequency as follows:

  – Frequency = 24 MHz/Number of Counts

Connecting Signals for a Rate Generation Operation

Figure 12 shows how to connect counter/timer signals to the screw terminals of a KUSB-3100 module to perform a rate generation (continuous pulse output) operation; in this example, an external gate is used.
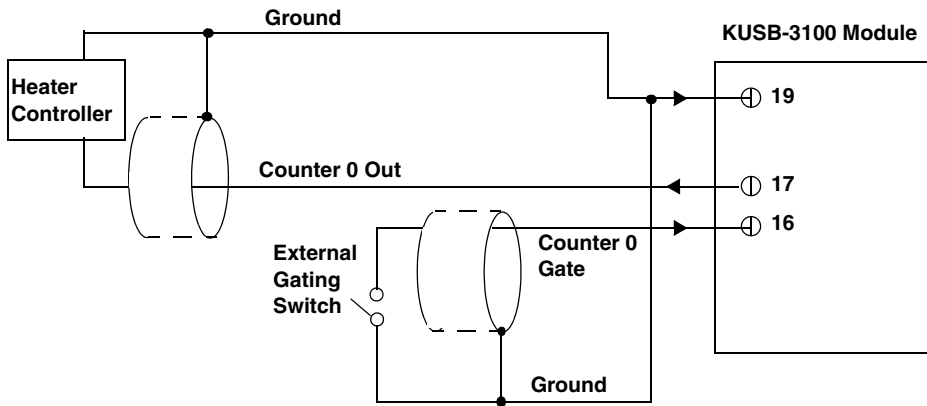
Figure 12: Connecting Counter/Timer Signals for a Rate Generation Operation Using an External Gate

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Verifying the Operation of a Module

**Prepare to Use a Module
(see Chapter 2 starting on page 5)**

**Set Up and Install the Module
(see Chapter 3 starting on page 11)**

**Wire Signals to the Module
(see Chapter 4 starting on page 19)**

**Verify the Operation of the Module
(this chapter)**
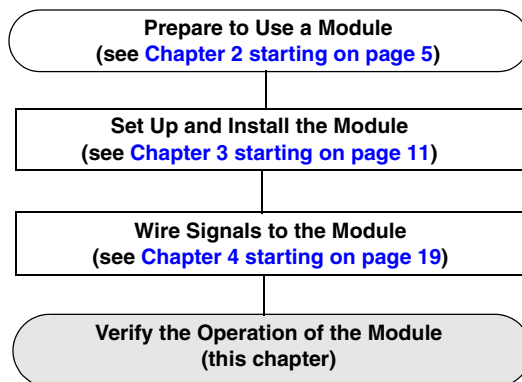
Overview

Quick Data Acq allows you to perform the following operations:

- Acquire data from a single analog input channel or digital input port;

- Acquire data continuously from one or more analog input channels using an oscilloscope, strip chart, or Fast Fourier Transform (FFT) view;

- Measure the frequency of events (using the Windows system timer);

- Output data from a single analog output channel or digital output port;

- Output pulses continuously; and

- Save the input data to disk.

Quick Data Acq is installed automatically when you install the driver software, described on .

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Running the Quick Data Acq Application

To run the Quick Data Acq application, perform the following steps:

1. If you have not already done so, power up your computer and any attached peripherals.

2. Select **Quick Data Acq** from the Keithley Instruments\Quick Data Acq program group.

Note: The Quick Data Acq application allows you to verify basic operations on the module; however, it may not support all of the module's features.

For information on each of the features provided, use the online help for the Quick Data Acq application by pressing F1 from any view or selecting the **Help** menu.

For detailed information on the supported features of the module, refer to the *KUSB-3100 User's Manual*.

Performing a Single-Value Analog Input Operation

To verify that the module can read a single analog input value, perform the following steps:

1. Connect a voltage source, such as a function generator, to analog input channel 0 (single-ended mode) on the module. Refer to page 24 for an example of how to connect a single-ended analog input.

2. Click the **Acquisition** menu.

3. Click **Single Analog Input**.

4. Select the appropriate module from the Board list box.

5. In the Channel list box, select analog input channel 0.

6. In the Range list box, select the range for the channel (±10 V, ±5 V, ±2.5 V, or ±1.25 V). The default is ±10 V.

7. Select **Single-ended**.

8. Click **Get** to acquire a single value from analog input channel 0. *The value is displayed on the screen in both text and graphical form.*

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Performing a Single-Value Analog Output Operation

To verify that the module can output a single analog output value, perform the following steps:

1. Connect an oscilloscope or voltmeter to DAC 0 on the module. Refer to page 25 for an example of how to connect analog output signals.

2. Click the **Control** menu.

3. Click **Single Analog Output**.

4. Select the appropriate module from the Board list box.

5. In the Channel list box, select analog output channel 0.

6. In the Range list box, select the output range of DAC 0. The default is ±10 V.

7. Enter an output value, or use the slider to select a value to output from DAC0.

8. Click **Send** to output a single value from DAC 0. *The value that is output is displayed on the screen in both text and graphical form.*

Performing a Continuous Analog Input Operation

To verify that the module can perform a continuous analog input operation, perform the following steps:

1. Connect known voltage sources, such as the outputs of a function generator, to analog input channels 0 and 1 on the module (using the single-ended configuration). Refer to for an example of how to connect a single-ended analog input.

2. Click the **Acquisition** menu.

3. For this example, click **Scope**.

4. Select the appropriate module from the Board list box.

5. In the Sec/Div list box, select the number of seconds per division (.1 to .00001) for the display.

6. In the Channels list box, select analog input channel 1, then click **Add** to add the channel to the channel list.
    Note that, by default, channel 0 is included in the channel list.

7. Click **Config** from the Toolbar.

8. From the Config menu, select **ChannelType**, then select **Single-ended**.

9. From the Config menu, select **Range**, then select **Bipolar**.
    This is the default configuration.

10. From the Scope view, double-click the input range of the channel to change the input range of the module (±10 V, ±5 V, ±2.5 V, or ±1.25 V). The default is ±10 V.
    The display changes to reflect the selected range for all the analog input channels on the module.

11. In the Trigger box, select **Auto** to acquire data continuously from the specified channels or **Manual** to acquire a burst of data from the specified channels.

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12. Click **Start** from the Toolbar to start the continuous analog input operation.
The values acquired from each channel are displayed in a unique color on the oscilloscope view.

13. Click **Stop** from the Toolbar to stop the operation.

Performing a Single-Value Digital Input Operation

To verify that the module can read a single digital input value, perform the following steps:

1. Connect a digital input to digital input line 0 of port A on the module. Refer to for an example of how to connect a digital input.

2. Click the **Acquisition** menu.

3. Click **Digital Input**.

4. Select the appropriate module from the Board list box.

5. Select digital input port A by clicking **Port A**.

6. Click **Get**.
The value of each digital input line in port A is displayed on the screen in both text and graphical form.

Performing a Single-Value Digital Output Operation

To verify that the module can output a single digital output value, perform the following steps:

1. Connect a digital output to digital output line 0 of digital output port A on the module. Refer to for an example of how to connect a digital output.

2. Click the **Control** menu.

3. Click **Digital Output**.

4. Select the appropriate module from the Board list box.

5. Select digital output port A by clicking **Port A**.

6. Click the appropriate bits to select the type of signal to write from the digital output lines. If the bit is selected, a high-level signal is output from the digital output line; if the bit is not selected, a low-level signal is output from the digital output line. Optionally, you can enter an output value in the Hex text box.

7. Click **Send**.
   The value of each digital output line of digital output port A is output and displayed on the screen in both text and graphical form.

Performing a Frequency Measurement Operation

To verify that the module can perform a frequency measurement operation (using the Windows timer), perform the following steps:

1. Wire an external clock source to counter/timer 0 on the module. Refer to for an example of how to connect an external clock.

2. Click the **Acquisition** menu.

3. Click **Frequency Counter**.

4. Select the appropriate module from the Board list box.

5. In the Count Duration text box, enter the number of seconds during which events will be counted.

6. Click **Start** to start the frequency measurement operation.
   The operation automatically stops after the number of seconds you specified has elapsed, and the frequency is displayed on the screen.

If you want to stop the frequency measurement operation when it is in progress, click **Stop**.

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Performing a Pulse Output Operation

To verify that the module can perform a pulse output operation, perform the following steps:

1. Connect a scope to counter/timer 0 on the module. Refer to for an example of how to connect a scope (a pulse output) to counter/timer 0.

2. Click the **Control** menu.

3. Click **Pulse Generator**.

4. Select the appropriate module from the Board list box.

5. Select **Continuous** to output a continuous pulse stream.

6. Click **Start** to generate the pulse(s).
   The results are displayed both in text and graphical form.

7. Click **Stop** to stop a continuous pulse output operation.

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