

# KUSB-3160

## Getting Started Manual

KUSB3160-903-01 Rev. A / January 2005

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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.

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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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# KUSB-3160

## Getting Started Manual

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# 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 KUSB3160-903-01A)..... January 2005

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.


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.

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# ***About this Manual***

This manual describes how to install and set up your KUSB-3160 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-3160 module to perform digital I/O 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 operating system.

## **How this Manual is Organized**

This manual is organized as follows:

- [Chapter 1, “Overview,”](#) describes the key features of the KUSB-3160 hardware and software, and provides an overview of the getting started procedure.
- [Chapter 2, “Preparing to Use a Module,”](#) describes how to unpack the KUSB-3160 package, check the system requirements, and install the software.
- [Chapter 3, “Installing a Module and Configuring the Device Driver,”](#) describes how to install the KUSB-3160 module and configure the device driver.
- [Chapter 4, “Wiring Signals,”](#) describes how to attach the KUSB-STP100 screw terminal panel and wire signals to the KUSB-3160 module.

- [Chapter 5, “Verifying the Operation of a Module,”](#) describes how to verify the operation of a KUSB-3160 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-3160 module:

- *KUSB-3160 User’s Manual*, included on the Keithley CD provided with the KUSB-3160 module. This manual describes the features of the KUSB-3160 module and the device driver in detail.
- *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-3160 module, please call the Keithley Technical Support Department.





# ***Overview***

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## ***Key Hardware Features***

The KUSB-3160 module provides 64 shared digital I/O lines (grouped in banks of eight) and 32 dedicated digital input lines.

Sixteen of the 32 dedicated digital input lines are capable of generating an interrupt to the host computer if the value of the line changes state.

The digital outputs are capable of driving external solid-state relay modules (sink 12 mA, source 100 k $\Omega$  pullup). In addition, the board provides isolated output common from the USB bus to 500 V peak.

# Software

1

The software for the KUSB-3160 module, which is shipped on the CD with the module, includes the following components:

- **Device Driver** –This software must be installed and loaded before you can use a KUSB-3160 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-3160 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-3160 modules.
- **DT-LV Link** –This software package allows LabVIEW® programmers to access the capabilities of the KUSB-3160 modules.

## ***Accessories***

The following accessories are provided for the KUSB-3160:

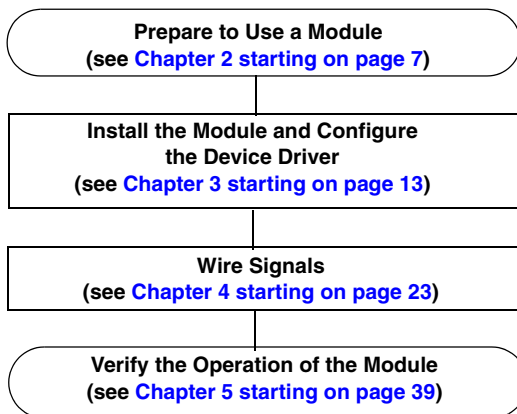
- **KUSB-STP100** –a 100 mm x 160 mm screw terminal panel that connects to the KUSB-3160 module using the KUSB-CABDIO cable. This screw terminal panel allows you to connect all of the input and output connections that are supported by a KUSB-3160 module. LEDs on up to 64 of the outputs light when the outputs are low. Note that LEDs are not provided for the dedicated digital input lines.
- **KUSB-CABDIO** –a 1-meter, 100-conductor cable that connects the KUSB-STP100 screw terminal panel to the KUSB-3160 module.



# Getting Started Procedure

1

The flow diagram shown in [Figure 1](#) illustrates the steps needed to get started using the KUSB-3160 module. This diagram is repeated in each chapter; the shaded area in the diagram shows you where you are in the getting started procedure.



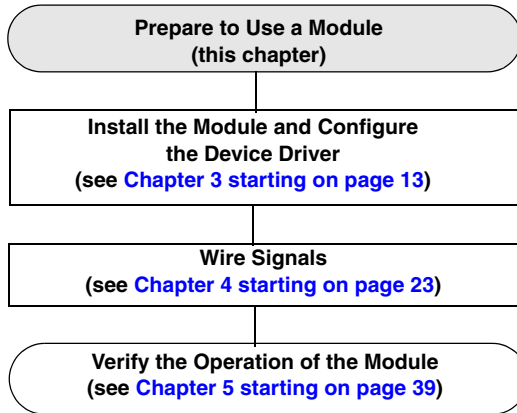
**Figure 1: Getting Started Flow Diagram**





## ***Preparing to Use a Module***

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## ***Unpacking***

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

- KUSB-3160 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.

# Checking the System Requirements

For reliable operation, your KUSB-3160 module requires the minimum system requirement listed in [Table 1](#).

**Table 1: Minimum System Requirements**

Feature	Minimum Requirements
Operating System	Windows 2000 or Windows XP
Processor	80486, Pentium, or compatible
USB Ports	One or more
RAM	16 MB or more
CD-ROM Drives	One or more
Monitor	VGA, or compatible, display (640 x 480 or higher, 256 colors recommended)

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

## Installing the Software

# 2

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**.

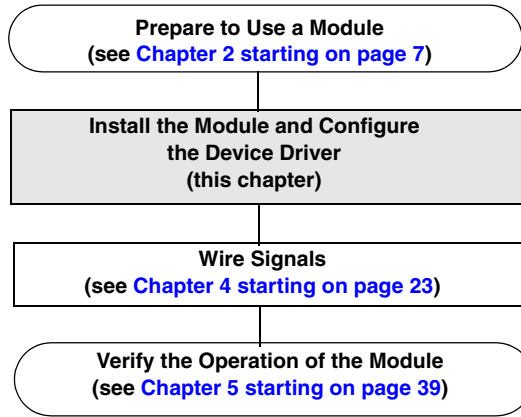






# ***Installing a Module and Configuring the Device Driver***

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## Overview

You can attach a KUSB-3160 module to the host computer in one of two ways:

- Connect directly to a USB port of the host computer, described on [page 16](#). Use this method if one or two KUSB-3160 modules are sufficient for your application.
- Connect to one or more self-powered USB hubs, described on [page 18](#). Use this method if your application requires more than two KUSB-3160 modules connected to the host computer.

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**Note:** The KUSB-3160 module is a high-power device (using 500 mA); however, it does not require an external power supply.

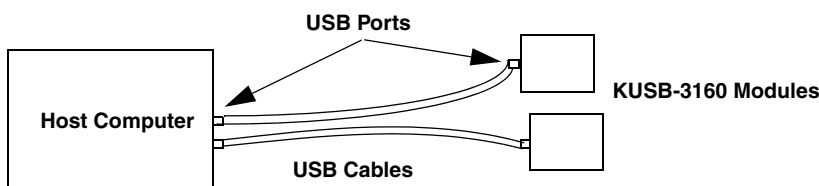
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## Connecting Directly to the Host Computer

Generally, host computers have two USB ports. These ports are completely independent. To connect a KUSB-3160 module directly to a USB port of the computer, perform the following steps:

1. Attach one end of the USB cable, which is shipped with the KUSB-3160 module, 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 device.*



**Figure 2: Attaching the Module Directly to the Host Computer**

3. If the device driver has not been installed, the New Hardware Found wizard appears. Click **Next** to have the wizard search for the device driver, then proceed to step 4.
4. Click the option to search for the driver, then click **Next**.
5. Click the option to specify the location, browse to the location on the CD that contains the driver files, then click **Next**.
6. Click **Next**.
7. Click **Finish**.

*A New Hardware Found dialog box appears indicating that Windows is installing the driver for the USB device.*

8. Repeat the steps 1 to 3 to attach another KUSB-3160 module to the host computer, if desired.

---

**Note:** 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 to a Self-Powered USB Hub

Self-powered USB hubs are USB hubs that are powered by their own external power supply. You can connect multiple USB hubs to a USB port on the host computer. Each of these hubs supports multiple KUSB-3160 modules.

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**Note:** Belken hubs are known to work properly with the KUSB-3160 modules.

---

To connect a KUSB-3160 module to a self-powered USB hub, perform the following steps:

1. Attach one end of the USB cable to the KUSB-3160 module and the other end of the USB cable to a self-powered USB hub.
2. Connect the power supply for the self-powered USB hub to an external power supply.
3. Connect the hub to the USB port on the host computer using another USB cable.  
*The operating system automatically detects the USB device.*
4. If you previously installed the device driver, ignore the remaining steps, and repeat steps 1 to 3 until you have attached the number of hubs (up to five) and modules (up to four per hub) that you desire.

If you have not installed the device driver, the New Hardware Found wizard appears. Click **Next** to have the wizard search for the device driver. Proceed to step 5.

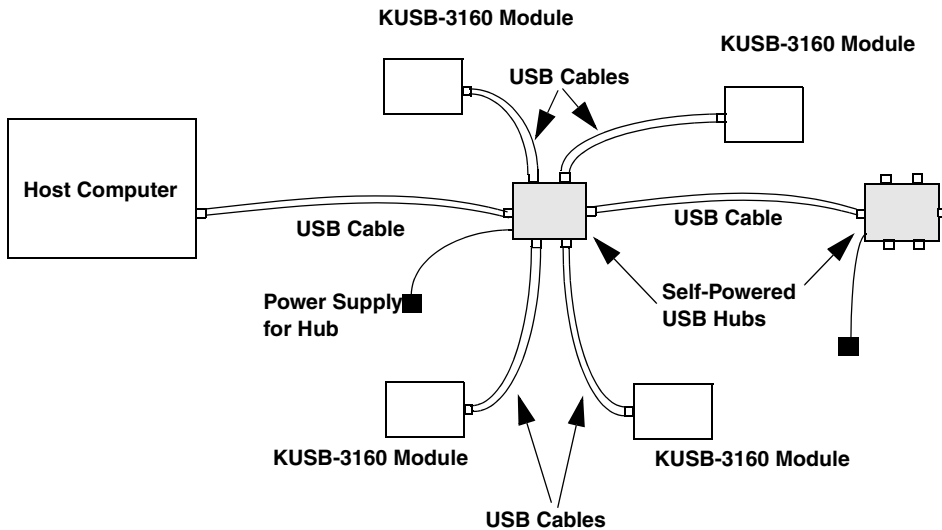
5. Click the option to search for the driver, then click **Next**.
6. Click the option to specify the location, browse to the location on the CD that contains the driver files, then click **Next**.
7. Click **Next**.

8. Click **Finish**.

*A New Hardware Found dialog box appears indicating that Windows is installing the driver for the USB device.*

9. Repeat steps 1 to 3 until you have attached the number of hubs (up to five) and modules (up to four per hub) that you desire. Refer to [Figure 3](#).

*The operating system automatically detects the USB devices as they are installed.*



**Figure 3: Attaching Modules to the Host Computer Using Self-Powered USB Hubs**

**Note:** 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.

## Configuring the Device Driver

To configure the device driver, perform the following steps:

1. If you have not already done so, power up the host computer and all peripherals.
2. From the Control Panel, double-click the **Open Layers Data Acquisition Control Panel** icon.  
*The Open Layers dialog box appears.*
3. Click the module that you want to configure, then click **Advanced**.  
*The Control Panel dialog box appears.*
4. Check the bits of banks 10 and 11 that you want to generate an interrupt when the bit changes state, where bit 0 corresponds to digital input line 0 and bit 7 corresponds to digital input line 7. Refer to Chapter 2 of the *KUSB-3160 User's Manual* for more information on interrupts.
5. To generate a debounce delay of 5 ms for the digital inputs, click the **Debounce Inputs** checkbox. If this box is left unchecked, a delay of less than 1 ms is used.
6. To continuously power the digital outputs, select the **Power Always On** checkbox. The KUSB-3160 module will remain on even when you exit from the applications that use the module.

If you want to shut down power to the module, you must uncheck this checkbox and close the control panel. Once all applications that use this module are exited, the module will power down. The module will remain off until you either run an application that uses the module or click the Advanced button from the Open Layers Data Acquisition Control Panel.

7. Click **OK**.
8. If you want to rename the module, click **Edit Name**; otherwise, go to step 10.
9. Enter a new name for the module, then click **OK**.



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**Note:** This name is used to identify the module in all subsequent applications.

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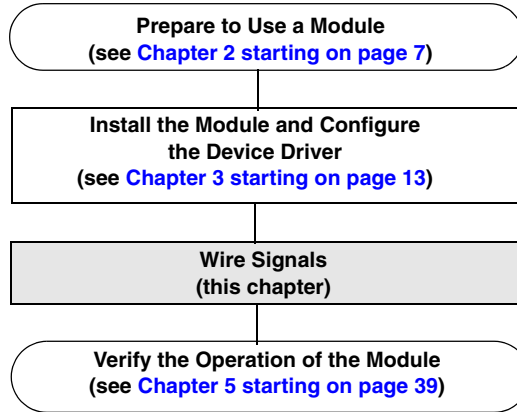
10. When you are finished configuring the module, click **Close**.
11. Repeat steps 3 to 10 for the other modules that you want to configure.
12. Close the Control Panel.





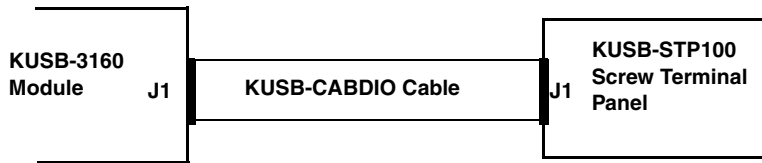
## ***Wiring Signals***

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## Attaching the Screw Terminal Panel

Before you can wire signals, you first need to attach the KUSB-STP100 screw terminal panel to connector J1 on your KUSB-3160 module. [Figure 4](#) illustrates how to attach the KUSB-STP100 screw terminal panel to a KUSB-3160 module using the KUSB-CABDIO cable.



**Figure 4: Connecting a Module to the KUSB-STP100 Screw Terminal Panel**

[Table 2](#) lists the pin assignments of the J1 connector on the KUSB-3160 module and on the KUSB-STP100 screw terminal panel.

**Table 2: Pin Assignments for Connector J1**

<b>Pin Number</b>	<b>Signal Description</b>	<b>Pin Number</b>	<b>Signal Description</b>
1	Bank 0, Bit 0	2	Bank 0, Bit 1
3	Bank 0, Bit 2	4	Bank 0, Bit 3
5	Bank 0, Bit 4	6	Bank 0, Bit 5
7	Bank 0, Bit 6	8	Bank 0, Bit 7
9	Bank 1, Bit 0	10	Bank 1, Bit 1
11	Bank 1, Bit 2	12	Bank 1, Bit 3
13	Bank 1, Bit 4	14	Bank 1, Bit 5
15	Bank 1, Bit 6	16	Bank 1, Bit 7
17	Bank 2, Bit 0	18	Bank 2, Bit 1
19	Bank 2, Bit 2	20	Bank 2, Bit 3
21	Bank 2, Bit 4	22	Bank 2, Bit 5
23	Bank 2, Bit 6	24	Bank 2, Bit 7
25	Bank 3, Bit 0	26	Bank 3, Bit 1
27	Bank 3, Bit 2	28	Bank 3, Bit 3
29	Bank 3, Bit 4	30	Bank 3, Bit 5
31	Bank 3, Bit 6	32	Bank 3, Bit 7
33	Bank 4, Bit 0	34	Bank 4, Bit 1
35	Bank 4, Bit 2	36	Bank 4, Bit 3
37	Bank 4, Bit 4	38	Bank 4, Bit 5
39	Bank 4, Bit 6	40	Bank 4, Bit 7
41	Bank 5, Bit 0	42	Bank 5, Bit 1
43	Bank 5, Bit 2	44	Bank 5, Bit 3

**Table 2: Pin Assignments for Connector J1 (cont.)**

Pin Number	Signal Description	Pin Number	Signal Description
45	Bank 5, Bit 4	46	Bank 5, Bit 5
47	Bank 5, Bit 6	48	Bank 5, Bit 7
49	Isolated +5 V	50	Isolated Ground
51	Bank 6, Bit 0	52	Bank 6, Bit 1
53	Bank 6, Bit 2	54	Bank 6, Bit 3
55	Bank 6, Bit 4	56	Bank 6, Bit 5
57	Bank 6, Bit 6	58	Bank 6, Bit 7
59	Bank 7, Bit 0	60	Bank 7, Bit 1
61	Bank 7, Bit 2	62	Bank 7, Bit 3
63	Bank 7, Bit 4	64	Bank 7, Bit 5
65	Bank 7, Bit 6	66	Bank 7, Bit 7
67	Bank 8, Bit 0 <sup>a</sup>	68	Bank 8, Bit 1 <sup>a</sup>
69	Bank 8, Bit 2 <sup>a</sup>	70	Bank 8, Bit 3 <sup>a</sup>
71	Bank 8, Bit 4 <sup>a</sup>	72	Bank 8, Bit 5 <sup>a</sup>
73	Bank 8, Bit 6 <sup>a</sup>	74	Bank 8, Bit 7 <sup>a</sup>
75	Bank 9, Bit 0 <sup>a</sup>	76	Bank 9, Bit 1 <sup>a</sup>
77	Bank 9, Bit 2 <sup>a</sup>	78	Bank 9, Bit 3 <sup>a</sup>
79	Bank 9, Bit 4 <sup>a</sup>	80	Bank 9, Bit 5 <sup>a</sup>
81	Bank 9, Bit 6 <sup>a</sup>	82	Bank 9, Bit 7 <sup>a</sup>
83	Bank 10, Bit 0 <sup>a</sup>	84	Bank 10, Bit 1 <sup>a</sup>
85	Bank 10, Bit 2 <sup>a</sup>	86	Bank 10, Bit 3 <sup>a</sup>
87	Bank 10, Bit 4 <sup>a</sup>	88	Bank 10, Bit 5 <sup>a</sup>

**Table 2: Pin Assignments for Connector J1 (cont.)**

Pin Number	Signal Description	Pin Number	Signal Description
89	Bank 10, Bit 6 <sup>a</sup>	90	Bank 10, Bit 7 <sup>a</sup>
91	Bank 11, Bit 0 <sup>a</sup>	92	Bank 11, Bit 1 <sup>a</sup>
93	Bank 11, Bit 2 <sup>a</sup>	94	Bank 11, Bit 3 <sup>a</sup>
95	Bank 11, Bit 4 <sup>a</sup>	96	Bank 11, Bit 5 <sup>a</sup>
97	Bank 11, Bit 6 <sup>a</sup>	98	Bank 11, Bit 7 <sup>a</sup>
99	Isolated +5 V	100	Isolated Ground

a. Dedicated digital input only. The KUSB-3160 module can generate a PCI-bus interrupt when any of the digital input lines (bits) corresponding to banks 10 and 11 changes state.



Figure 5 shows the layout of the KUSB-STP100 screw terminal panel.

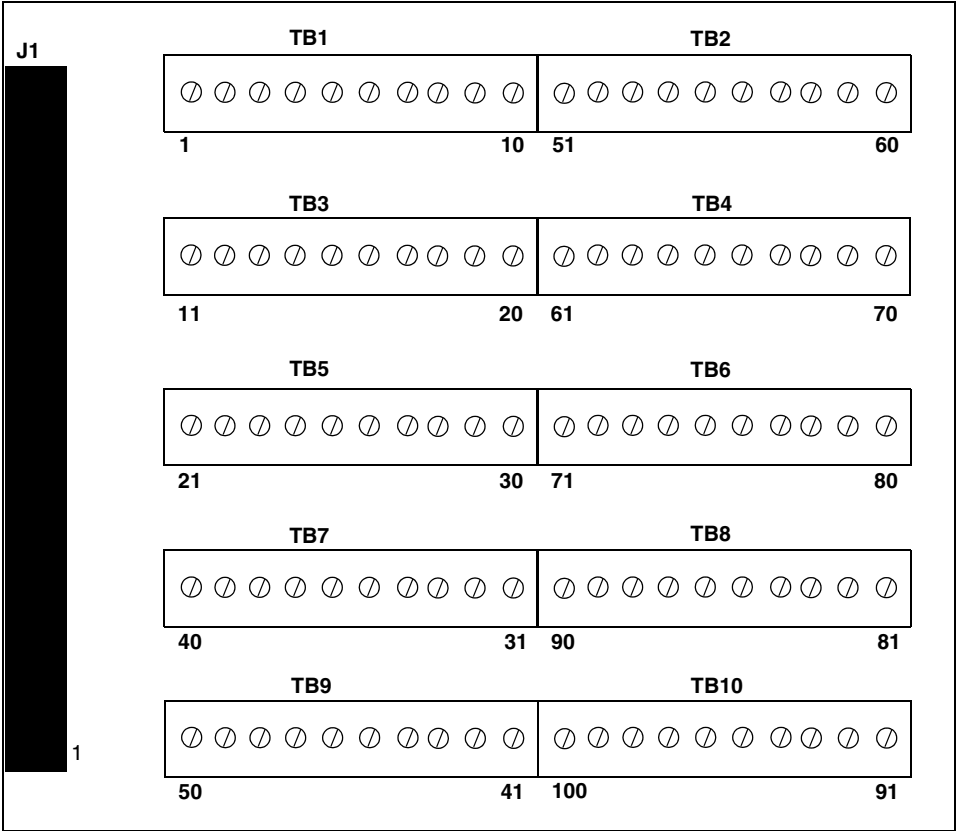


Figure 5: KUSB-STP100 Screw Terminal Panel

Table 3 lists the screw terminal assignments on the KUSB-STP100 screw terminal panel.

**Table 3: Screw Terminal Assignments of the  
KUSB-STP100 Screw Terminal Panel**

Screw Terminal Block	Terminal Number	Signal Description
TB1	1	Bank 0, Bit 0
	2	Bank 0, Bit 1
	3	Bank 0, Bit 2
	4	Bank 0, Bit 3
	5	Bank 0, Bit 4
	6	Bank 0, Bit 5
	7	Bank 0, Bit 6
	8	Bank 0, Bit 7
	9	Bank 1, Bit 0
	10	Bank 1, Bit 1
TB2	51	Bank 6, Bit 0
	52	Bank 6, Bit 1
	53	Bank 6, Bit 2
	54	Bank 6, Bit 3
	55	Bank 6, Bit 4
	56	Bank 6, Bit 5
	57	Bank 6, Bit 6
	58	Bank 6, Bit 7
	59	Bank 7, Bit 0
	60	Bank 7, Bit 1

**Table 3: Screw Terminal Assignments of the  
KUSB-STP100 Screw Terminal Panel (cont.)**

Screw Terminal Block	Terminal Number	Signal Description
TB3	11	Bank 1, Bit 2
	12	Bank 1, Bit 3
	13	Bank 1, Bit 4
	14	Bank 1, Bit 5
	15	Bank 1, Bit 6
	16	Bank 1, Bit 7
	17	Bank 2, Bit 0
	18	Bank 2, Bit 1
	19	Bank 2, Bit 2
	20	Bank 2, Bit 3
TB4	61	Bank 7, Bit 2
	62	Bank 7, Bit 3
	63	Bank 7, Bit 4
	64	Bank 7, Bit 5
	65	Bank 7, Bit 6
	66	Bank 7, Bit 7
	67	Bank 8, Bit 0 <sup>a</sup>
	68	Bank 8, Bit 1 <sup>a</sup>
	69	Bank 8, Bit 2 <sup>a</sup>
	70	Bank 8, Bit 3 <sup>a</sup>

**Table 3: Screw Terminal Assignments of the  
KUSB-STP100 Screw Terminal Panel (cont.)**

Screw Terminal Block	Terminal Number	Signal Description
TB5	21	Bank 2, Bit 4
	22	Bank 2, Bit 5
	23	Bank 2, Bit 6
	24	Bank 2, Bit 7
	25	Bank 3, Bit 0
	26	Bank 3, Bit 1
	27	Bank 3, Bit 2
	28	Bank 3, Bit 3
	29	Bank 3, Bit 4
	30	Bank 3, Bit 5
TB6	71	Bank 8, Bit 4 <sup>a</sup>
	72	Bank 8, Bit 5 <sup>a</sup>
	73	Bank 8, Bit 6 <sup>a</sup>
	74	Bank 8, Bit 7 <sup>a</sup>
	75	Bank 9, Bit 0 <sup>a</sup>
	76	Bank 9, Bit 1 <sup>a</sup>
	77	Bank 9, Bit 2 <sup>a</sup>
	78	Bank 9, Bit 3 <sup>a</sup>
	79	Bank 9, Bit 4 <sup>a</sup>
	80	Bank 9, Bit 5 <sup>a</sup>

**Table 3: Screw Terminal Assignments of the  
KUSB-STP100 Screw Terminal Panel (cont.)**

Screw Terminal Block	Terminal Number	Signal Description
TB7	31	Bank 3, Bit 6
	32	Bank 3, Bit 7
	33	Bank 4, Bit 0
	34	Bank 4, Bit 1
	35	Bank 4, Bit 2
	36	Bank 4, Bit 3
	37	Bank 4, Bit 4
	38	Bank 4, Bit 5
	39	Bank 4, Bit 6
	40	Bank 4, Bit 7
TB8	81	Bank 9, Bit 6 <sup>a</sup>
	82	Bank 9, Bit 7 <sup>a</sup>
	83	Bank 10, Bit 0 <sup>a</sup>
	84	Bank 10, Bit 1 <sup>a</sup>
	85	Bank 10, Bit 2 <sup>a</sup>
	86	Bank 10, Bit 3 <sup>a</sup>
	87	Bank 10, Bit 4 <sup>a</sup>
	88	Bank 10, Bit 5 <sup>a</sup>
	89	Bank 10, Bit 6 <sup>a</sup>
	90	Bank 10, Bit 7 <sup>a</sup>

**Table 3: Screw Terminal Assignments of the KUSB-STP100 Screw Terminal Panel (cont.)**

Screw Terminal Block	Terminal Number	Signal Description
TB9	41	Bank 5, Bit 0
	42	Bank 5, Bit 1
	43	Bank 5, Bit 2
	44	Bank 5, Bit 3
	45	Bank 5, Bit 4
	46	Bank 5, Bit 5
	47	Bank 5, Bit 6
	48	Bank 5, Bit 7
	49	Isolated +5 V
	50	Isolated Ground
TB10	91	Bank 11, Bit 0 <sup>a</sup>
	92	Bank 11, Bit 1 <sup>a</sup>
	93	Bank 11, Bit 2 <sup>a</sup>
	94	Bank 11, Bit 3 <sup>a</sup>
	95	Bank 11, Bit 4 <sup>a</sup>
	96	Bank 11, Bit 5 <sup>a</sup>
	97	Bank 11, Bit 6 <sup>a</sup>
	98	Bank 11, Bit 7 <sup>a</sup>
	99	Isolated +5 V
	100	Isolated Ground

a. Dedicated digital input only.

## Preparing to Wire Signals

### CAUTION:

**To avoid electrostatic sensitivity, it is recommended that you unplug your KUSB-3160 module from the computer before wiring signals.**

Keep the following recommendations in mind when wiring signals to a KUSB-3160 module:

- Use individually shielded twisted-pair wire (size 14 to 26 AWG) when using the KUSB-3160 module 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 KUSB-3160 module 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 KUSB-3160 module is operational.
- When first installing the module, try wiring the signals as follows:
  - Wire a digital input to digital input line 0 of bank 11.
  - Wire a digital output to digital output line 0 of bank 5.
  - Then, run the Quick Data Acq application (described in [Chapter 5 starting on page 39](#)) to verify that the module is operating properly.

Once you have determined that the module is operating properly, wire the signals according to your application's requirements.

# Connecting Digital Input Signals

Figure 6 shows how to connect digital input signals (lines 0 and 1 of bank 0, in this case) to the KUSB-STP100 screw terminal panel.

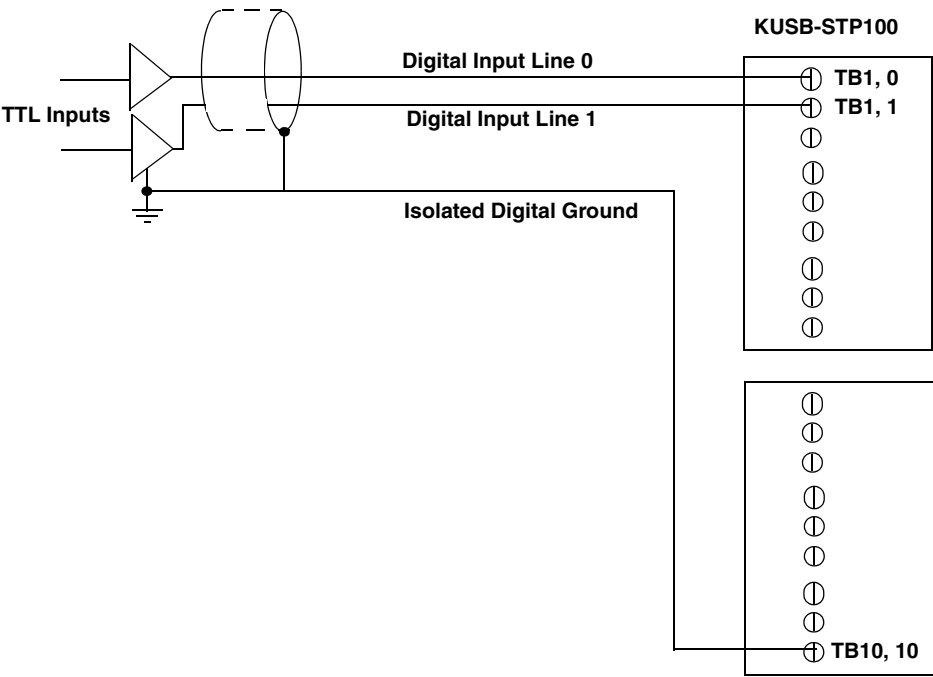
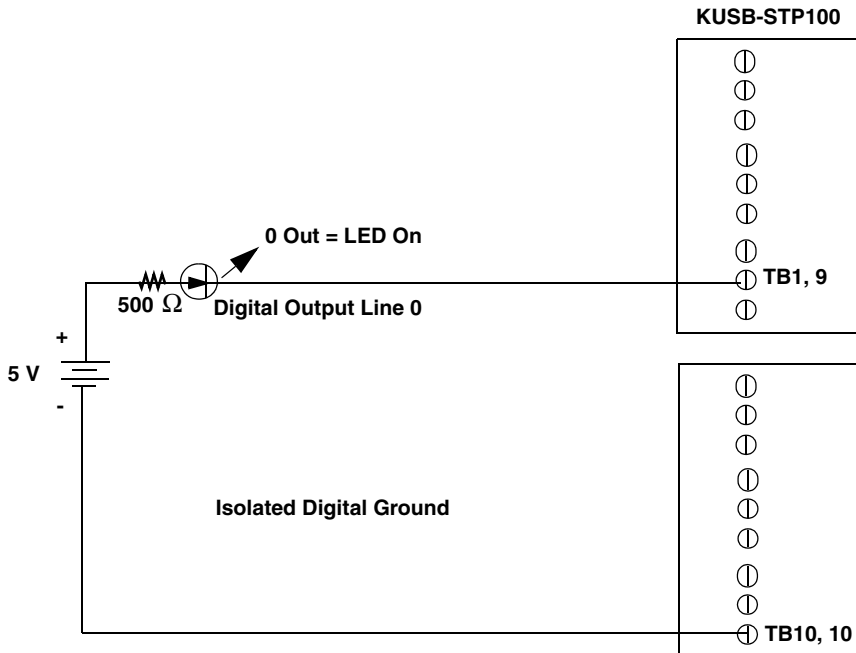


Figure 6: Connecting Digital Inputs (Shown for Lines 0 and 1 of Bank 0)



## Connecting Digital Output Signals

Figure 7 shows how to connect a digital output (line 0 of bank 1, in this case) to the KUSB-STP100 screw terminal panel.



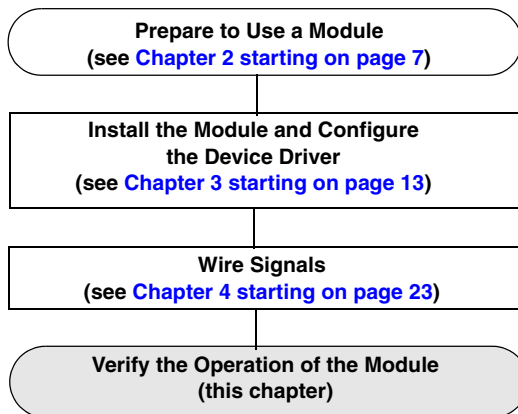
**Figure 7: Connecting Digital Outputs (Shown for Line 0 of Bank 1)**





# ***Verifying the Operation of a Module***

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## **Overview**

The Quick Data Acq application allows you to perform the following operations with the KUSB-3160 module:

- Acquire data from a single digital input port, and
- Output data from a single digital output port.

Quick Data Acq is installed automatically when you install the driver software, described on [page 11](#).

## ***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-3160 User's Manual*.

---

## 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 bank 0 on the KUSB-3160 module. Refer to [page 43](#) for more information on connecting digital inputs.
2. Click the **Acquisition** menu.
3. Click **Digital Input**.
4. Select the appropriate KUSB-3160 module from the Board list box.
5. Select digital input port 0 by clicking **Port A**.
6. Click **Get**.  
*The value of each digital input line of bank 0 is displayed on the screen in both text and graphical form.*

5

## Performing a Single-Value Digital Output Operation

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

1. Connect a digital output to digital output line 0 of bank 1 on the KUSB-3160 module. Refer to [page 43](#) for an example of how to connect a digital output.
2. Click the **Control** menu.
3. Click **Digital Output**.
4. Select the appropriate KUSB-3160 module from the Board list box.
5. Select digital output bank 1 by clicking **Port B**.

6. Click the appropriate bits to select the digital output lines to write to. If the bit is selected, a high-level signal is output to the digital output line; if the bit is not selected, a low-level signal is output to 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 bank 1 is displayed on the screen in both text and graphical form.*



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