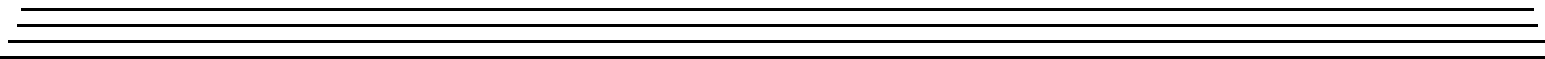
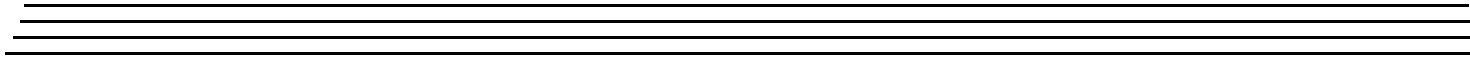
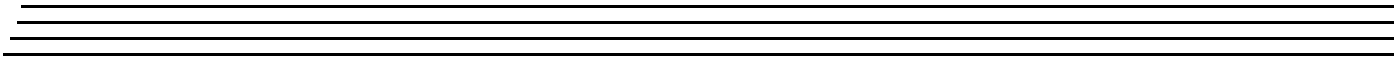




UM-23780-J

DT8824 and DT8824-HV

LXI Instrument Modules User's Manual



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This equipment has been tested and found to comply with CISPR EN55022 Class A and EN61000-6-1 requirements and also with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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Note: This product was verified to meet FCC requirements under test conditions that included use of shielded cables and connectors between system components. It is important that you use shielded cables and connectors to reduce the possibility of causing interference to radio, television, and other electronic devices.

Canadian Department of Communications Statement

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.

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About this Manual

The first part of this manual describes how to install and set up your DT8824 or DT8824-HV instrument module, and verify that the instrument module is working properly.

The second part of this manual describes the features and capabilities of the DT8824 and DT8824-HV instrument modules using the IVI-COM driver software. Troubleshooting information is also provided.

Note: If you are programming the DT8824 or DT8824-HV using the IVI-COM driver, refer to the DT8824 IVI-COM driver online help for more information.

If you are using Standard Commands for Programmable Instruments (SCPI) to program the DT8824 or DT8824-HV, refer to the *SCPI Programmer's Manual for the DT8824* for more information.

Intended Audience

This document is intended for engineers, scientists, technicians, or others responsible for using and/or programming the DT8824 or DT8824-HV instrument module for data acquisition operations. It is assumed that you have some familiarity with data acquisition principles and that you understand your application.

How this Manual is Organized

This manual is organized as follows:

- [Chapter 1, "Overview,"](#) describes the major features of the DT8824 and DT8824-HV instrument modules, as well as the supported software and accessories for the instrument modules.
- [Chapter 2, "Preparing to Use the DT8824 or DT8824-HV,"](#) describes how to unpack the DT8824 and DT8824-HV, check the system requirements, install the software, and view the DT8824 documentation online.
- [Chapter 3, "Setting Up and Installing the DT8824 or DT8824-HV,"](#) describes how to install the DT8824 and DT8824-HV instrument modules, how to apply power, and connect the instrument module to the network.
- [Chapter 4, "Wiring Signals,"](#) describes how to wire signals to the DT8824 and DT8824-HV instrument modules.
- [Chapter 5, "Verifying the Operation of the DT8824 or DT8824-HV,"](#) describes how to verify the operation of a DT8824 and DT8824-HV instrument modules.
- [Chapter 6, "Principles of Operation,"](#) describes all of the features of the DT8824 and DT8824-HV instrument modules in detail.

- [Chapter 7, “Troubleshooting,”](#) provides information that you can use to resolve problems with the DT8824 and DT8824-HV instrument modules and device driver, should they occur.
- [Appendix A, “Specifications,”](#) lists the specifications of the DT8824 and DT8824-HV.
- [Appendix B, “Connector Pin Assignments,”](#) lists the pins for each of the connectors on the DT8824 and DT8824-HV.
- [Appendix C, “Configuring Network Settings on Your PC,”](#) describes how to configure the network settings of your PC to use Auto-IP or a static IP address.
- [Appendix D, “Using the Bonjour Discovery Utility,”](#) describes how to use the Bonjour utility to discover a DT8824 or DT8824-HV instrument module on the network.
- [Appendix E, “About ISO-Channel Technology,”](#) describes the benefits of the ISO-Channel™ design.
- An index completes this manual.

Conventions Used in this Manual

The following conventions are used in this manual:

- Notes provide useful information or 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**.

Related Information

Refer to the following documents for more information on using the DT8824 instrument module:

- DT8824 IVI-COM Driver online help. For programmers who are developing their own application programs, this document describes how to use the IVI-COM driver to access the capabilities of the DT8824 and DT8824-HV instrument modules. The DT8824 IVI-COM driver works with any development environment that supports COM programming, including MATLAB® from The MathWorks™, Microsoft® Visual C#.NET or Visual Basic®.NET, Agilent® VEE Pro, National Instruments™ LabVIEW™ or LabWindows™, and so on.
- *QuickDAQ User’s Manual (UM-24774)*. This manual describes how to create a QuickDAQ application to acquire and analyze data from a data acquisition device.
- *SCPI Programmer’s Manual for the DT8824 and DT8824-HV (UM-24017)*. For programmers who want to use the SCPI interface to program DT8824 or DT8824-HV instrument module, this document describes the supported SCPI commands and example programs for the DT8824 and DT8824-HV instrument modules.
- IVI foundation (www.ivifoundation.org)
- LXI Consortium (www.lxistandard.org)

Where To Get Help

Should you run into problems installing or using a DT8824 or DT8824-HV instrument module, the Data Translation Technical Support Department is available to provide technical assistance. Refer to [page 89](#) for more information. If you are outside the United States or Canada, call your local distributor, whose number is listed on our web site (www.mccdaq.com).



Overview

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DT8824 and DT8824-HV Hardware Features

The DT8824 and DT8824-HV instrument modules, are high-performance, multifunction data acquisition devices for the Ethernet (LXI) bus. They are class C devices and comply with LXI version 1.3. [Figure 1](#) shows the DT8824 instrument module.



Figure 1: DT8824 Instrument Module

The key hardware features of the DT8824 and DT8824-HV instrument modules are as follows:

- LXI Class C compliance with built-in Ethernet connectivity
- ISO-Channel™ protection eliminates noise and ground loops.

The DT8824 provides ± 500 V galvanic isolation channel-to-channel on all analog input signals and to the host computer to protect signal integrity.

The DT8824-HV provides ± 1000 V galvanic isolation channel-to-channel on all analog input signals and to the host computer to protect signal integrity. (See [Appendix E](#) for more information on ISO-Channel.)

- Four simultaneous, 24-bit analog input channels
- Sampling frequency of up to 4800 Hz
- The DT8824 supports input gains of 1, 8, 16, and 32 with input ranges of ± 10 V to support the following effective ranges: ± 10 V, ± 1.25 V, ± 0.625 V, or ± 0.3125 V
- The DT8824-HV supports input gains of 1, 8, 16, and 32 with input ranges of ± 600 V to support the following effective ranges: ± 600 V, ± 75 V, ± 37.5 V, or ± 18.75 V
- Continuously paced analog input operations
- Software-programmable trigger type (software, external digital trigger, Trigger Bus, or LAN trigger) to start analog input operations.
- Software calibration of the analog input subsystem

- 4 opto-isolated digital output lines; the outputs are solid-state relays that operate from ± 30 V at currents up to 400 mA (peak) AC or DC
- Digital outputs are galvanically isolated to ± 250 V when using all digital output lines

Supported Software

The following software is available for use with the DT8824 and DT8824-HV instrument modules:

- **Eureka Discovery Utility** – This utility helps you locate or "discover" all LXI (Ethernet) instruments that are connected to your system and provides the following information about your instrument: the IP address, manufacturer, model number, serial number, and version of the firmware that is running on your instrument. In addition, you can use this utility to configure Windows firewall settings and update the firmware for your Data Translation LXI instrument module.
- **DT8824 Web Interface** – This built-in interface, described in [Chapter 5](#), allows you to calibrate a DT8824 or DT8824-HV instrument module, configure your instrument module, measure input signals, and save results to disk using Internet Explorer and no additional software.
- **QuickDAQ Base Version** – The base version of QuickDAQ is free-of-charge and allows you to acquire and analyze data from all Data Translation USB and Ethernet devices, except the DT9841 Series, DT9817, DT9835, and DT9853/54. Using the base version of QuickDAQ, you can perform the following functions:
 - Discover and select your devices.
 - Configure all input channel settings for the attached sensors.
 - Load/save multiple hardware configurations.
 - Generate output stimuli (fixed waveforms, swept sine waves, or noise signals).
 - On each supported data acquisition device, acquire data from all channels supported in the input channel list.
 - Choose to acquire data continuously or for a specified duration.
 - Choose software or triggered acquisition.
 - Log acquired data to disk in an .hpf file.
 - Display acquired data during acquisition in either a digital display using the Channel Display window or as a waveform in the Channel Plot window.
 - Choose linear or logarithmic scaling for the horizontal and vertical axes.
 - View statistics about the acquired data, including the minimum, maximum, and mean values and the standard deviation in the Statistics window.
 - Export time data to a .csv or .txt file; you can open the recorded data in Microsoft Excel® for further analysis.
 - Read a previously recorded .hpf data file.
 - Customize many aspects of the acquisition, display, and recording functions to suit your needs, including the acquisition duration, sampling frequency, trigger settings, filter type, and temperature units to use.

- **QuickDAQ FFT Analysis Option** – When enabled with a purchased license key, the QuickDAQ FFT Analysis option includes all the features of the QuickDAQ Base version plus basic FFT analysis features, including the following:
 - The ability to switch between the Data Logger time-based interface and the FFT Analyzer block/average-based interface.
 - Supports software, freerun, or triggered acquisition with accept and reject controls for impact testing applications.
 - Allows you to perform single-channel FFT (Fast Fourier Transform) operations, including AutoSpectrum, Spectrum, and Power Spectral Density, on the acquired analog input data. You can configure a number of parameters for the FFT, including the FFT size, windowing type, averaging type, integration type, and so on.
 - Allows you to display frequency-domain data as amplitude or phase.
 - Supports dB or linear scaling with RMS (root mean squared), peak, and peak-to-peak scaling options
 - Supports linear or exponential averaging with RMS, vector, and peak hold averaging options.
 - Supports windowed time channels.
 - Supports the following response window types: Hanning, Hamming, Bartlett, Blackman, Blackman Harris, and Flat top.
 - Supports the ability to lock the waveform output to the analysis frame time.
 - Allows you to configure and view dynamic performance statistics, including the input below full-scale (IBF), total harmonic distortion (THD), spurious free dynamic range (SFDR), signal-to-noise and distortion ratio (SINAD), signal-to-noise ratio (SNR), and the effective number of bits (ENOB), for selected time-domain channels in the Statistics window.
- **QuickDAQ Advanced FFT Analysis Option** – When enabled with a purchased software license, the QuickDAQ Advanced FFT Analysis option includes all the features of the QuickDAQ Base version with the FFT Analysis option plus advanced FFT features, including the following:
 - Allows you to designate a channel as a Reference or Response channel.
 - Allows you to perform two-channel FFT analysis functions, including Frequency Response Functions (Inertance, Mobility, Compliance, Apparent Mass, Impedance, Dynamic Stiffness, or custom FRF) with H1, H2, or H3 estimator types, Cross-Spectrum, Cross Power Spectral Density, Coherence, and Coherent Output Power.
 - Supports the Exponential response window type.
 - Supports the following reference window types: Hanning, Hamming, Bartlett, Blackman, Blackman Harris, FlatTop, Exponential, Force, and Cosine Taper windows.
 - Supports real, imaginary, and Nyquist display functions.
 - Allows you to save data in the .uff file format.





- **Dtx8824 IVI-COM driver** – This driver provides access to the functions of the DT8824 and DT8824-HV instrument modules through a COM server. The IVI-COM driver works in any development environment that supports COM programming, including MATLAB, Visual Basic.NET, Visual C#.NET, Agilent VEE Pro, LabVIEW, LabWindows, and others.
- **SCPI commands** – Use SCPI commands to program DT8824 and DT8824-HV instrument modules. Refer to the *SCPI Programmer's Manual for the DT8824 and DT8824-HV* (UM-24017) for information on the supported SCPI commands and example programs.

Refer to the Data Translation web site (www.mccdaq.com) for information about selecting the right software package for your needs.

Accessories

Table 1 lists the optional accessories are available for the DT8824 and DT8824-HV.

Table 1: Optional Accessories Available for the DT8824 and DT8824-HV

Accessory		Description
STP8837 Assembly		Screw terminal panel assembly for attaching digital output and trigger signals to the DT8824 and DT8824-HV instrument modules. In addition to the screw terminal panel, this assembly also includes the EP378 cable for connecting the screw terminal panel to the instrument module and two DIN rail adaptors for attaching the STP8837 screw terminal panel to a DIN rail.
EP377		Trigger Bus cable (25-pin, .5 M) for attaching two DT8824 and/or DT8824-HV instrument modules together.
EP380		Single rack-mount kit for mounting one DT8824 or DT8824-HV instrument module into a 1U rack.
EP379		Dual Rack-mount kit for mounting two DT8824 and/or DT8824-HV instrument modules side by side into a 1U rack.

Getting Started Procedure

The flow diagram shown in [Figure 2](#) illustrates the steps needed to get started using the DT8824 and DT8824-HV instrument modules. This diagram is repeated in each Getting Started chapter; the shaded area in the diagram shows you where you are in the getting started procedure.

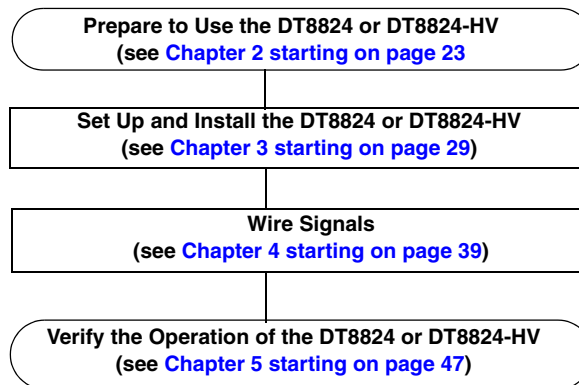


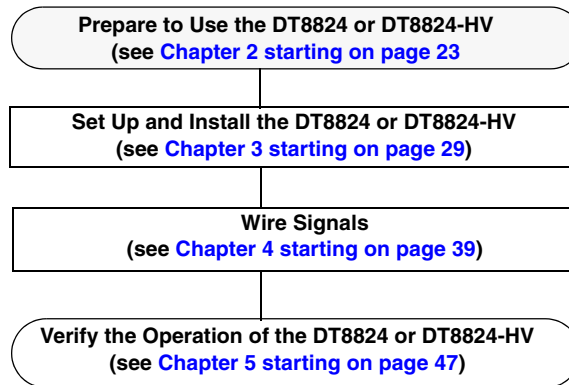
Figure 2: Getting Started Flow Diagram

Part 1: Getting Started



Preparing to Use the DT8824 or DT8824-HV

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Unpacking

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

- DT8824 or DT8824-HV instrument module
- EP372 Ethernet cable
- EP361 +5V power supply and cable
- Trigger Bus terminators
- DT8824 CD-ROM
- A bag of pluggable screw terminable blocks and a screwdriver

If an item is missing or damaged, contact Data Translation. If you are in the United States, call the Customer Service Department at (508) 946-5100. An application engineer will guide you through the appropriate steps for replacing missing or damaged items. If you are located outside the United States, call your local distributor, listed on Data Translation's web site (www.mccdaq.com).

Checking the System Requirements

For reliable operation, the computer that accesses your DT8824 or DT8824-HV instrument module requires the following configuration:

- Processor: Pentium 4/M or equivalent
- RAM: 1 GB
- Screen Resolution: 1024 x 768 pixels
- Disk Space: 4 GB
- Ethernet port
- CD-ROM drive
- Administrator privileges for software installation
- For access to the instrument web interface:
 - Java Version 6, Update 5 or greater
 - Internet Explorer web browser, preferably version 8.0

Refer to [page 49](#) for more information on installing Java and configuring your browser settings

- Acrobat Reader 5.0 or later for viewing documentation

Installing the Software

This section describes how to install the software you need to use a DT8824 or DT8824-HV instrument module.

Prerequisite Software

No prerequisite software is required if you are using a single client to access a DT8824 or DT8824-HV instrument module on the LXI bus, or if you are managing how multiple clients concurrently access a DT8824 or DT8824-HV instrument module on the LXI bus. (In these case, your application can use sockets to communicate with the instrument module.)

If, however, you want multiple clients to access the DT8824 or DT8824-HV instrument module on the LXI bus, and you want to "lock" access to the instrument module so that one client cannot change the configuration of an instrument module that another client is accessing, you need to install VISA; we recommend either Agilent VISA or NI-VISA from National Instruments. You can then use the VISA methods viLock/viUnlock to prevent other clients from accessing the instrument module.

To install Agilent VISA, do the following:

1. Go to **www.agilent.com**, enter **IO Libraries Suite** in the search field, and select **Agilent IO Libraries Suite 15.0** from the search results.
2. Follow the instructions on Agilent's web site to download and install the Agilent IO Libraries, which include VISA support, VISA COM support, and the Agilent Connection Expert tool.

We recommend that you run Data Translation's Eureka Discovery Utility that is provided with the instrument module to locate your DT8824 or DT8824-HV LXI instrument module on the network (see [page 54](#) for more information).

Installing the DT8824 Software

To install the DT8824 software (including the DT8824 IVI-COM driver, Eureka Discovery Utility, and DT8824 SCPI Support) and related documentation, perform the following steps:

1. Insert the DT8824 CD into your CD-ROM or DVD drive.
The installation program should automatically start, and the DT8824 installation program should appear.
2. If the installation program does not automatically start, double-click **Setup.exe** from the CD.
The DT8824 installation program appears.
3. Click **Install from Web (recommended)** to get the latest version of the software or **Install from CD** to install the software from the CD.
4. If you are installing from the web, click **DT8824 Software** to install the DT8824 software.
5. If you are installing from the DT8824 CD, click **Install Features**. When you are finished with the DT8824 CD, click **Quit Installer**.

Viewing the Documentation

Note: To view the documentation, you must have Adobe Reader 5.0 or greater installed on your system.

You can access the documentation for your DT8824 Series instrument module from the Windows Start menu as follows:

- For documentation about the DT8824, click **Programs -> Data Translation, Inc -> Instruments -> DT8824 -> DT8824 User's Manual.**
- For documentation on the DT8824 IVI-COM driver, click **Programs -> Data Translation, Inc -> IVI -> DT8824 -> Documentation.**
- For documentation on the Eureka Discovery Utility, click **Programs -> Data Translation, Inc -> Instrument Support -> Eureka LXI Instrument Discovery Help.**
- For documentation about SCPI support for the DT8824, click **Programs -> Data Translation, Inc -> Instruments -> DT8824 -> SCPI Support -> SCPI Programmer's Manual for the DT8824.**

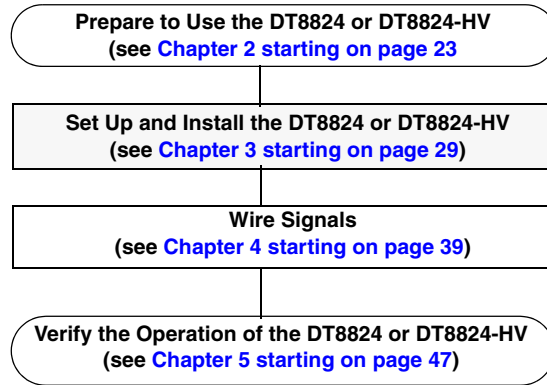
The following may be helpful when using Adobe Reader:

- To navigate to a specific section of the document, click a heading from the table of contents on the left side of the document.
- Within the document, click the text shown in blue to jump to the appropriate reference (the pointer changes from a hand to an index finger).
- To go back to the page from which the jump was made, click the right mouse button and **Go Back**, or from the main menu, click **Document**, and then **Go Back**.
- To increase or decrease the size of the displayed document, from the main menu, click **View**, and then **Zoom**.
- By default, Adobe Reader smooths text and monochrome images, sometimes resulting in blurry images. If you wish, you can turn smoothing off by clicking **File**, and then **Preferences/General**, and unchecking **Smooth Text and Images**.



Setting Up and Installing the DT8824 or DT8824-HV

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Connecting the DT8824 or DT8824-HV to the LAN

This section describes how to connect the DT8824 or DT8824-HV instrument module to the LAN (Local Area Network). Two connection schemes are shown:

- Site LAN connections, described on this page
- Private LAN connections, described on [page 41](#)

Note: It is recommended that you consult with your network administrator to ensure that all network security, performance, and reliability issues are considered when connecting DT8824 instrument modules to the LAN.

Connecting to a Site LAN

A site LAN is useful in applications that require access by many users or access by users at distributed sites. In this connection scheme, a DHCP (Dynamic Host Configuration Protocol) server is used to assign an IP address to the DT8824 or DT8824-HV instrument module.

[Figure 2](#) shows a typical site LAN connections using a dedicated Ethernet hub, switch, or router. [Figure 3](#) shows typical site LAN connections without using a dedicated Ethernet hub, switch, or router.

Note: Use standard LAN cables for network connections. The DT8824 and DT8824-HV ship with a standard LAN cable (EP372) for connecting to the LAN (RJ45) connector on the rear panel of the instrument module.

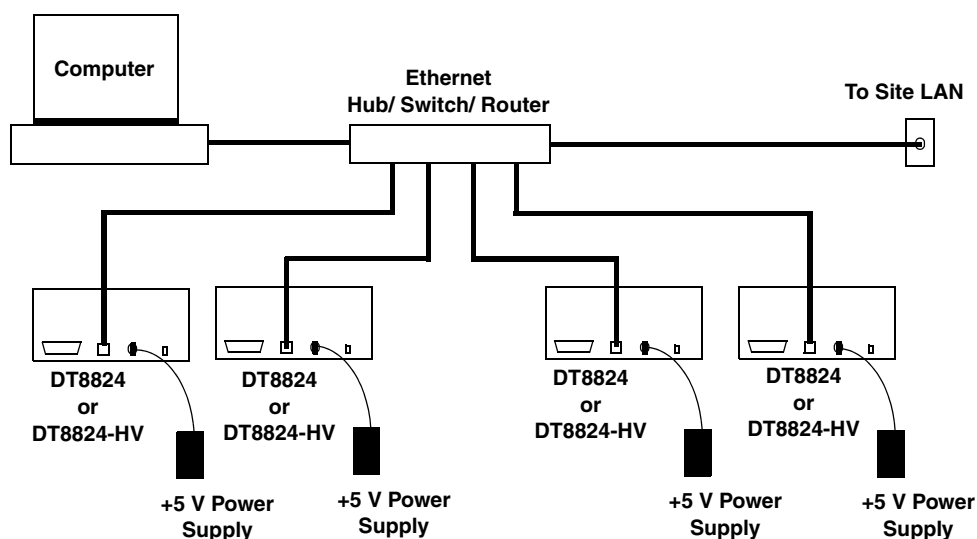


Figure 3: Typical Site LAN Connections using a Hub, Switch, or Router

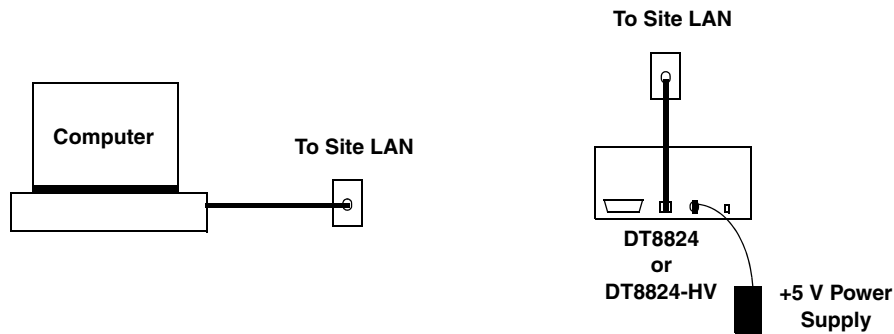


Figure 4: Typical Site LAN Connections Without Using a Hub, Switch, or Router

Connecting to a Private LAN

A private LAN (or subnet) generally involves the direct connection of the instrument modules to the computer, and may include Ethernet hubs or switches. Access to the instrument modules is limited to users that are directly connected to the private LAN; therefore, security, performance, and reliability are generally better on a private LAN than on a site LAN.

In this connection scheme, the DHCP (Dynamic Host Configuration Protocol) server is typically not available; therefore, Auto-IP is used to assign an IP address to the DT8824 or DT8824-HV instrument module.

Note: If no DHCP server exists and your PC is set up to use a static IP address, you must temporarily reconfigure your PC to use Auto-IP, as described in [Appendix C](#) on [page 114](#).

Connecting Using a Hub or Switch

[Figure 4](#) shows a typical connection scheme when connecting DT8824 or DT8824-HV instrument modules to a private LAN using a dedicated Ethernet hub or switch.

Note: Use standard LAN cables for network connections. The DT8824 and DT8824-HV ship with a standard LAN cable (EP372) for connecting to the LAN (RJ45) connector on the rear panel of the instrument module.

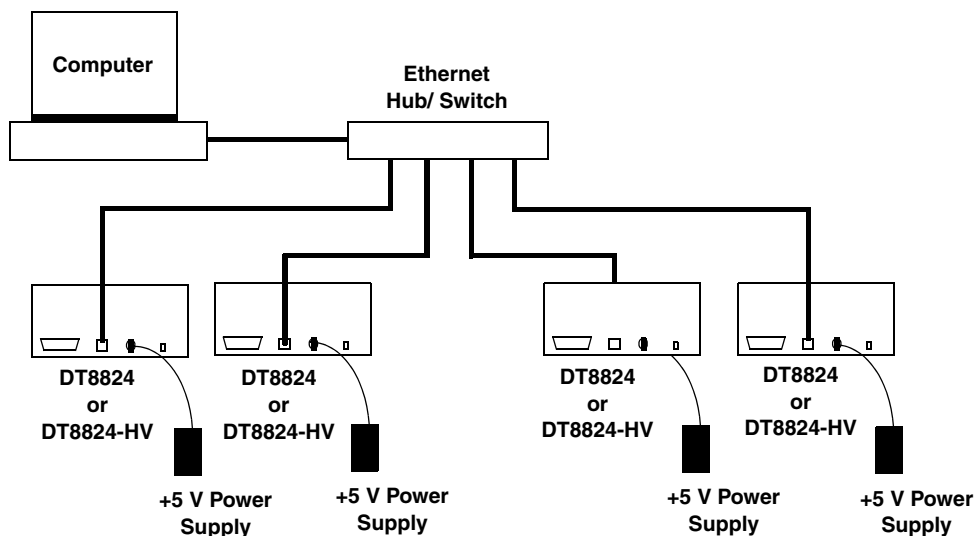


Figure 5: Typical Private LAN Connections using a Hub or Switch

Connecting Directly to a Computer

Optionally, you can connect the DT8824 or DT8824-HV directly to your computer, creating an ad hoc network, as shown in Figure 5. Be aware that the time and date settings of the instrument module will not be updated using this connection method. Therefore, this connection scheme is generally recommended for quick set up and verification only.

Note: DT8824 and DT8824-HV instrument modules do not support the Auto-MDIX function; therefore, use a crossover cable rather than a standard LAN cable to connect your DT8824 instrument module unless your computer has enabled the Auto-MDIX function.

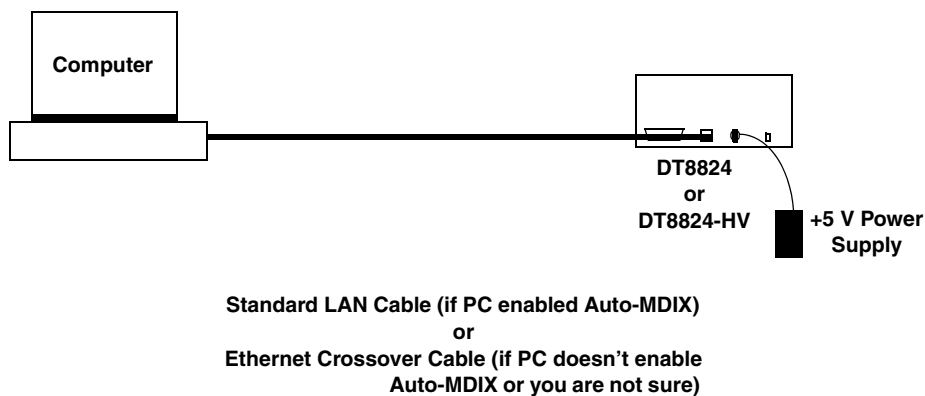


Figure 6: Typical Private LAN Connections when Connecting Directly to a Computer

Applying Power

The DT8824 and DT8824-HV instrument modules are shipped with an EP361 +5V power supply and cable. To apply power to the instrument module, do the following:

1. Connect the +5 V power supply to the power connector on the rear panel of the DT8824 or DT8824-HV. Refer to [Figure 6](#).



Figure 7: Attaching a +5 V Power Supply to the DT8824 or DT8824-HV

2. Plug the power supply into a wall outlet.
3. Press the Power switch on the rear panel of the instrument module, shown in [Figure 6](#), to turn on the DT8824 or DT8824-HV instrument module.
The Power LED on the front panel lights to indicate that power is on.

[Figure 7](#) shows the front panel of the DT8824 and DT8824-HV, including the locations of the LEDs.



Figure 8: Front Panel of the DT8824 and DT8824-HV

Table 2 describes the LEDs on the front panel. Use these LEDs along with the LEDs on the rear panel, described on page 38, to determine the status of operation on the DT8824 and DT8824-HV.

Table 2: The LEDs on the Front Panel of the DT8824 and DT8824-HV

LEDs	Color	Description
LAN LED	Solid Green	Instrument module has valid IP address.
	Blinking Green	Instrument module identified using the Web interface; see page 54 for more information.
	Red	If the Ethernet link is operational, the instrument module does not have a valid IP address. Otherwise, the Ethernet link is not operational.
Power LED	Off	Instrument module not powered on.
	Solid Green	Instrument module powered on.
Trig In	Off	Instrument module is idle.
	Solid Amber	Analog input subsystem is armed.
	Solid Green	Analog input subsystem is triggered.

Getting an IP Address and Host Name

Once your DT8824 or DT8824-HV is connected to the LAN and powered on, the instrument module automatically requests an Ethernet address from a DHCP (Dynamic Host Configuration Protocol) server, if available, and a host name from a DNS (Dynamic Domain Name Service) server, if available.

If these services are not available on the LAN, the DT8824 or DT8824-HV uses Auto-IP to set up its TCP/IP configuration. In this case, the IP address will be in the range of 169.254.0.0 to 169.254.255.255 with a subnet mask of 255.255.255.0.

Note: If no DHCP server exists and your PC is set up to use a static IP address, you must temporarily reconfigure your PC to use Auto-IP, then configure your DT8824 instrument module to use a static IP address, as described in [Appendix C](#) on [page 117](#).

You can use the DT8824 web interface, described in [Chapter 5](#) starting on [page 47](#), to see the IP address and host name that is assigned to your DT8824 or DT8824-HV instrument module.

Note: When programming a DT8824 or DT8824-HV, you access the instrument module through its address string, which consists of an IP address or host name, such as **TCPIP0::192.43.218.69::inst0::INSTR** or **TCPIP0::192.43.218.69::SOCKET**. If a host name was returned by the DNS server, you can also address the instrument module using its host name, such as **TCPIP0::arrakis.datx.com::inst0::INSTR**.

For IVI-COM programmers, you can also assign a VISA alias to the instrument module. For example, rather than addressing the DT8824 as **TCPIP0::192.43.218.69::inst0::INSTR**, you can use the VISA alias **DT8824_1** instead. See your VISA documentation for more information on VISA resource strings and creating VISA aliases.

Determining Ethernet Activity

You can use the ENet Link and ENet Activity LEDs on the rear panel of the DT8824 or DT8824-HV, shown in [Figure 9](#), with the LAN LED on the front panel of the DT8824 or DT8824-HV, shown in [Figure 8](#), to determine the Ethernet activity of your instrument module.

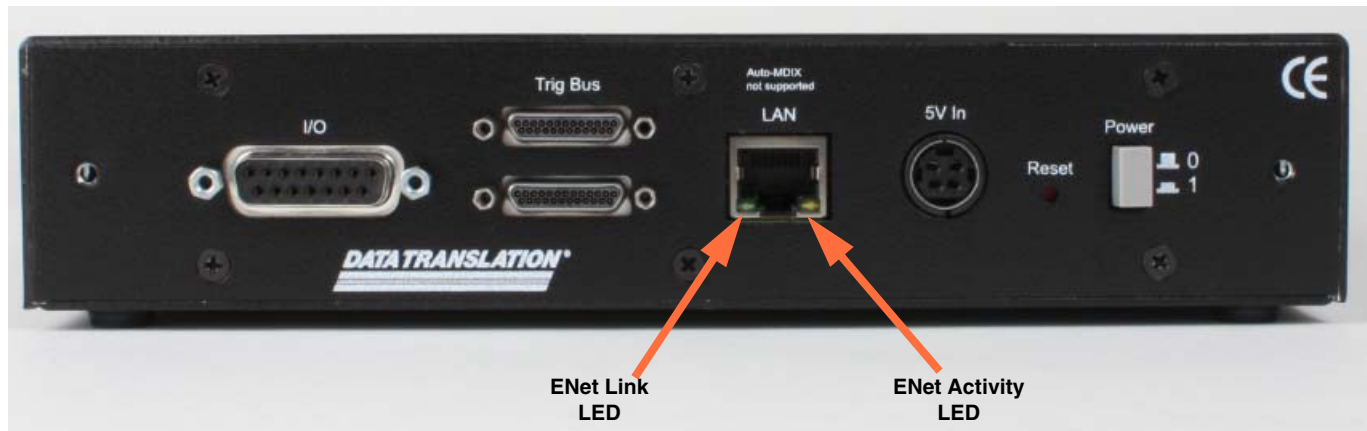


Figure 9: Rear Panel of the DT8824 and DT8824-HV

[Table 1](#) describes the LEDs on the rear panel.

Table 3: LEDs on the Rear Panel of the DT8824 and DT8824-HV

LEDs	Color	Description
ENet Link LED (on rear panel)	Yellow	Ethernet link operational.
	Off	Ethernet link not operational.
ENet Activity LED (on rear panel)	Green	Network traffic detected.
	Off	No network traffic detected.

Resetting the Instrument Module

If needed, you can restore the default configuration of the DT8824 or DT8824-HV by pressing the Reset pin on the rear panel of the instrument module, shown in [Figure 10](#), until the LAN LED on the front panel turns off (which takes approximately 5 seconds), and then releasing the Reset pin.



Figure 10: Reset Pin

The instrument module reboots automatically using the factory-default LAN configuration (DHCP and auto-IP enabled); this process typically takes up to 40 seconds to complete. This forces the instrument module to re-acquire an IP address from the DHCP server, or if that fails, to use Auto-IP to get an IP address.

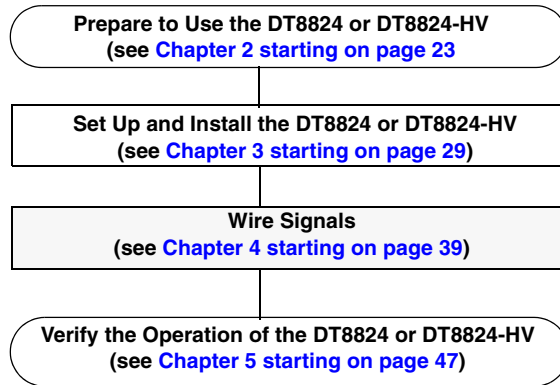
Note: The default configuration overwrites any changes that you have made to the LAN configuration (IP address and password) using the instrument module's web interface.

The calibration parameters are not affected by the reset.



Wiring Signals

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Preparing to Wire Signals

The DT8824 and DT8824-HV provide four analog input channels with screw terminal connectors for connecting analog input signals, shown in [Figure 11](#), and a 37-pin digital I/O connector for attaching 4 opto-isolated digital output signals, shown in [Figure 12](#).

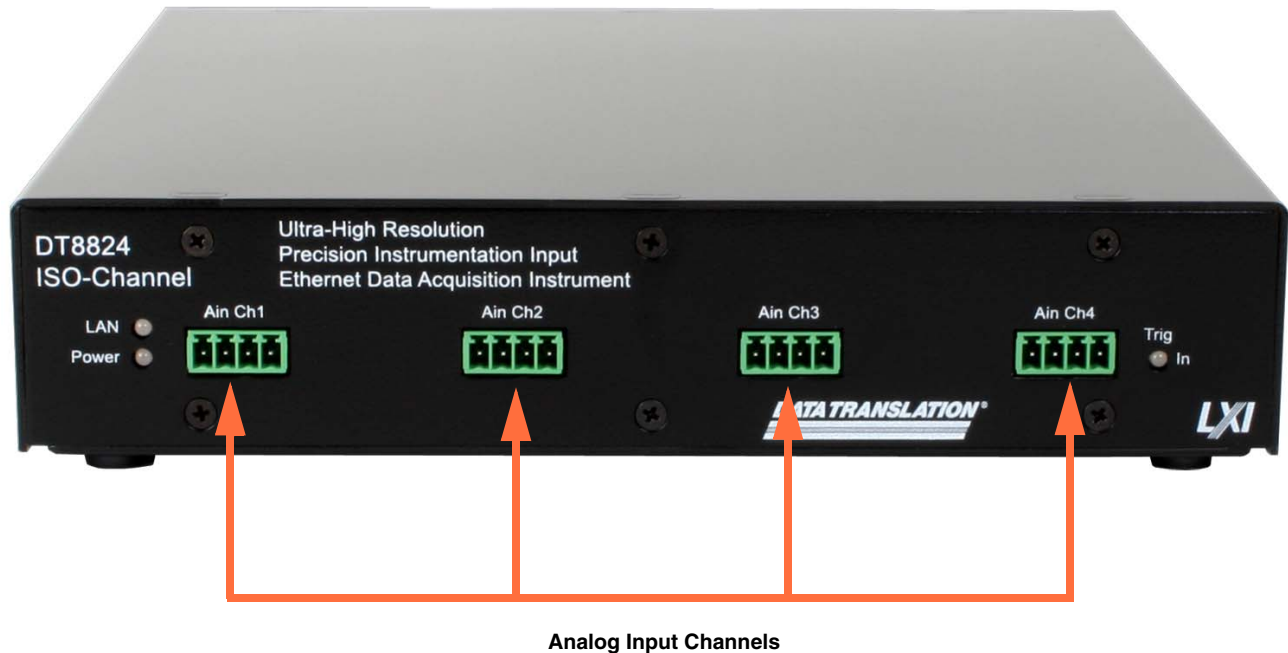


Figure 11: Analog Input Connectors on the DT8824 and DT8824-HV (Front Panel)



Figure 12: Digital I/O Connector on the DT8824 and DT8824-HV (Rear Panel)

Keep the following recommendations in mind when wiring signals to the DT8824 and DT8824-HV instrument modules:

- Follow standard ESD procedures when wiring signals to the instrument module.
- Use individually shielded twisted-pair wire (size 14 to 26 AWG) when using the DT8824 and DT8824-HV instrument modules 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 DT8824 and DT8824-HV instrument modules 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 DT8824 and DT8824-HV instrument modules are operational.
- Connect all unused analog input channels to analog ground.

Connecting Digital Output Signals

The digital output lines on the DT8824 and DT8824-HV act as solid-state relays. The customer-supplied signal can be ± 30 V at up to 400 mA (peak) AC or DC. You can use the digital output lines of the module to control solid-state or mechanical relays or high-current electric motors.

To make digital output connections easier, you can use the optional STP8837 screw terminal panel and EP378 cable with your DT8824 or DT8824-HV instrument module. Connect the STP8837 to the digital output connector of the DT8824 or DT8824-HV as shown in [Figure 15](#):



Figure 15: Connecting the DT8824 or DT8824-HV to the STP8837

Figure 16 shows the layout of the STP8837 screw terminal panel and lists the assignments of each screw terminal.

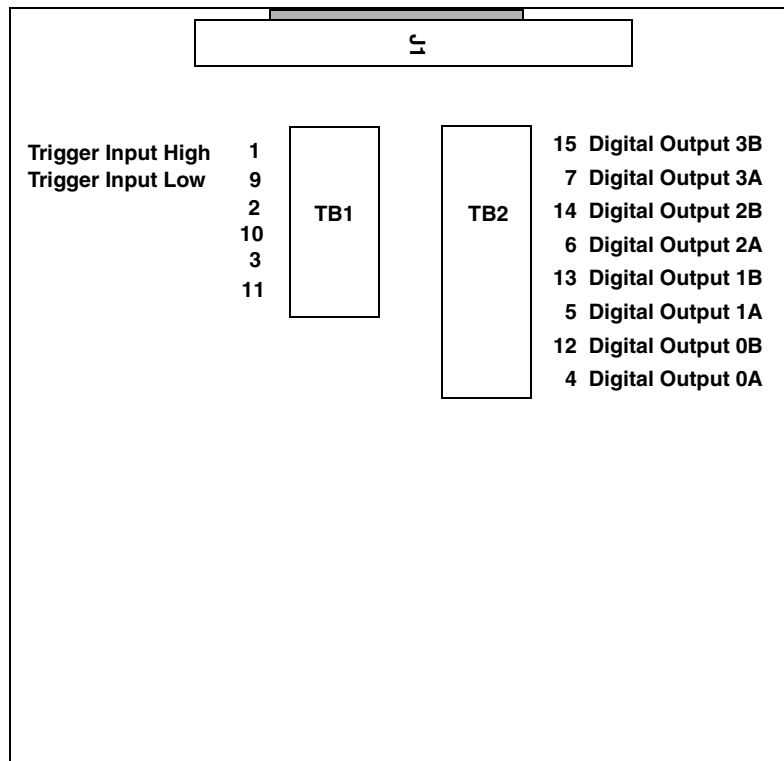


Figure 16: STP8837 Screw Terminal Panel

Figure 17 shows how to connect digital output signals to line 0 of a DT8824 or DT8824-HV instrument module to control a motor relay.

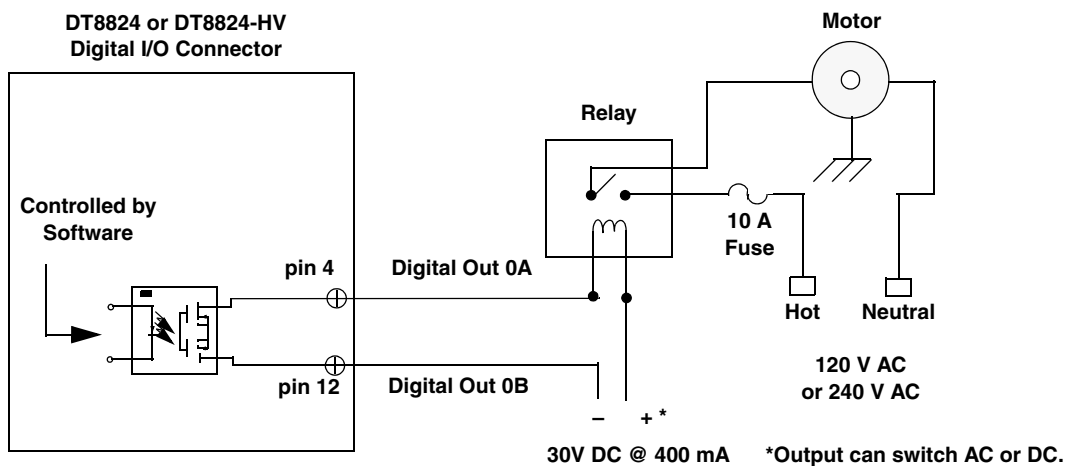
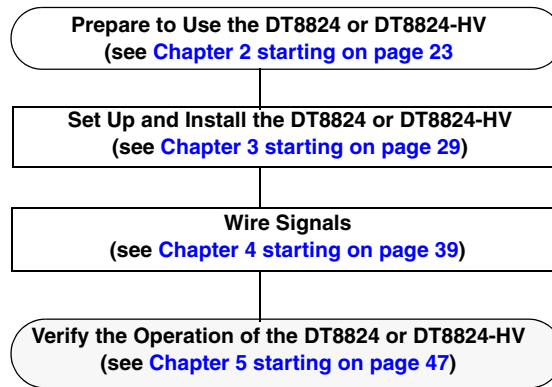


Figure 17: Switching up to 30 V at 400 mA



Verifying the Operation of the DT8824 or DT8824-HV

Before Using the Web Interface	49
Locating Your Instrument Module on the LAN	54
Configuring the DT8824 or DT8824-HV Instrument Module	57
Measuring Data and Controlling the Instrument	68



You can configure, measure, and control the DT8824 instrument module either locally or remotely using the DT8824 web interface, described in this chapter. This utility also allows you to calibrate the DT8824 instrument module.

Before Using the Web Interface

This section describes system requirements and browser settings for proper operation of the instrument module's web interface.

Note: At any instant, up to 8 clients can access the DT8824 or DT8824-HV instrument module concurrently using the web interface.

Up to 12 additional clients can access the DT8824 or DT8824-HV instrument module concurrently using SCPI commands over VISA or sockets. Of these, 4 can be VXI-11 clients, which use the ::SOCKETS or VISA::INSTR resource to access the instrument module.

At this time, the web and SCPI interfaces cannot be "locked;" therefore, one client can change the configuration of the instrument module that another client is accessing. However, you can optionally lock the VXI-11 interface using the VISA APIs viLock/viUnlock; this prevents other VXI-11 clients (including VXI-11 discovery) from accessing the instrument module. Refer to the SCPI documentation for your instrument module for more information on supported SCPI commands.

Java Requirements

Before using the instrument web interface, ensure that your computer has Version 6, Update 5 or greater of Java installed; this version of Java installs version 1.6 of the Java plug-in. You can verify Java versions and settings by accessing the Java Control Panel, select Windows **Start** -> **Control Panel** and open the **Java** dialog. To download or upgrade Java, go to www.java.com.

Browser Settings

To access the web pages for your instrument, you can use Internet Explorer or Firefox.

If you are using Internet Explorer, ensure that your browser is configured as follows:

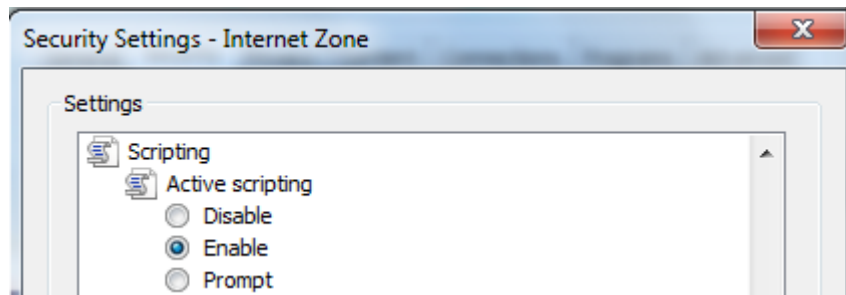
- JavaScript (Active Scripting) must be enabled
- Security level of the DT8824 instrument module IP address must be Medium-high or lower
- Pop-up blockers must be disabled

The following sections describe how to configure these settings.

JavaScript

To enable JavaScript (also referred to as Active Scripting), perform the following steps:

1. From the Internet Explorer browser, select **Tools** -> **Internet Options**.
2. Click the **Security** tab.
3. Select **Internet**, and then click **Custom Level**.
4. Scroll down to the **Scripting** section.



5. Under **Active Scripting**, select **Enable**, and then click **OK**.

Security Levels

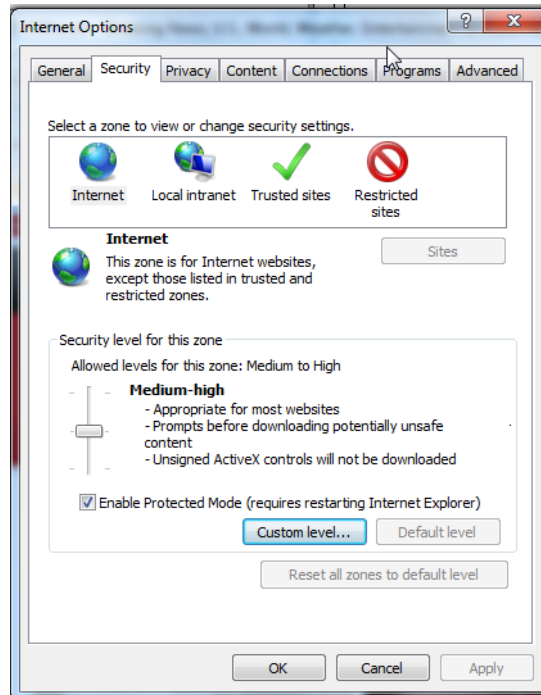
By default, the IP address of the DT8824 or DT8824-HV instrument module is added to the Internet zone. If you'd rather leave the settings of the Internet zone at a level higher than Medium-high, then you can add the IP address of the instrument module to either the Local intranet or Trusted sites zone and configure the security level of that zone to Medium-high or lower.

The following section describe how to configure each zone.

Internet Zone

To configure the security level of the DT8824 or DT8824-HV instrument module's IP address in the Internet zone, perform the following steps:

1. From the Internet Explorer browser, select **Tools** -> **Internet Options**.
2. Click the **Security** tab.

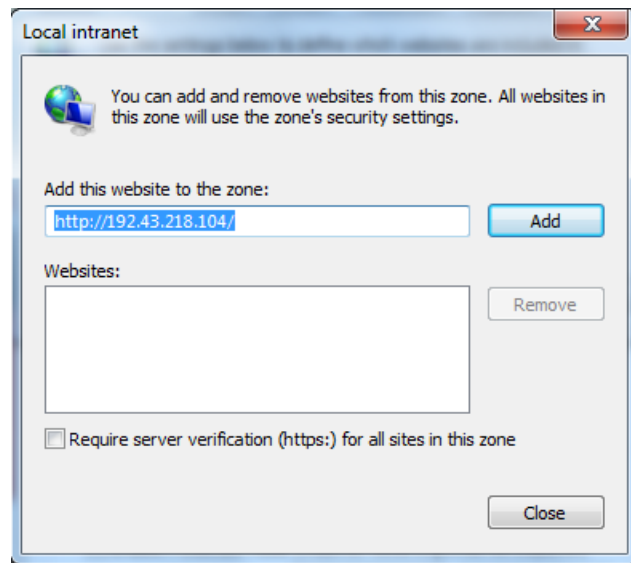


3. Select **Internet** and move the slide bar to select a security level of Medium-high or lower.
4. Click **OK**.

Local Intranet Zone

To add the IP address of the DT8824 or DT8824-HV to the **Local intranet** zone and configure its security level, do the following:

1. From the Internet Explorer browser, select **Tools** -> **Internet Options**.
2. Click the **Security** tab.
3. Click **Local intranet**, and click **Sites**.
4. Select which web sites to add to the zone, and then click **Advanced**.
5. Enter the IP address of the DT8824 or DT8824-HV to the zone (note that the address must be prefaced by (http://)), and click **Add**.

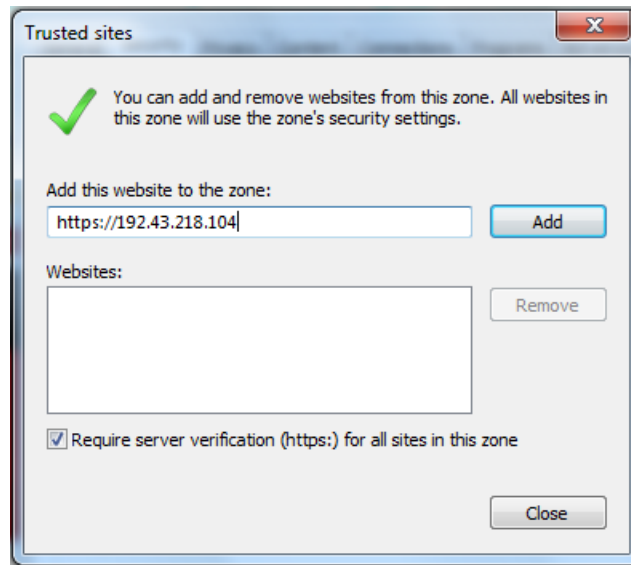


6. Click **Close**, and then click **OK**.
7. Move the slide bar to select a security level of Medium-high or lower.
8. Click **OK**.

Trusted Sites Zone

To add the IP address of the DT8824 or DT8824-HV to the **Trusted sites** zone and configure its security level, do the following:

1. From the Internet Explorer browser, select **Tools** -> **Internet Options**.
2. Click the **Security** tab.
3. Click **Trusted sites**, and click **Sites**.
4. Enter the IP address of the DT8824 or DT8824-HV to the zone (note that the address must be prefaced by (https://), and click **Add**.



5. Click **Close**.
6. Move the slider bar to select a security level of Medium-high or lower.
7. Click **OK**.

Pop-up Blockers

To disable pop-up blockers, perform the following steps:

1. From the Internet Explorer browser, select **Tools ->Pop-up Blocker**.
2. Select **Turn Off Pop-up Blocker**.

Locating Your Instrument Module on the LAN

To access the web interface of your instrument module, you must determine its IP address on your TCP/IP network.

Note: Discovery will work only for devices on the same subnet.

We recommend that you run Data Translation's Eureka Discovery Utility that is provided with the DT8824 software to locate your DT8824 or DT8824-HV instrument module quickly.

Alternatively, you can use other LXI discovery tools, such as Bonjour from Apple (described in [Appendix D](#) starting on [page 119](#)) or Agilent Connection Expert, if you have them installed on your computer. Or you can check your router's address assignments or locate the instrument module's MAC (Ethernet hardware) address in your DHCP server log.

Running the Eureka Discovery Utility

To use the Eureka Discovery Utility, from the Windows Start menu, click **Programs -> Data Translation, Inc -> Instrument Support -> Eureka LXI Instrument Discovery**.

A screen similar to the one shown in [Figure 18](#) appears.

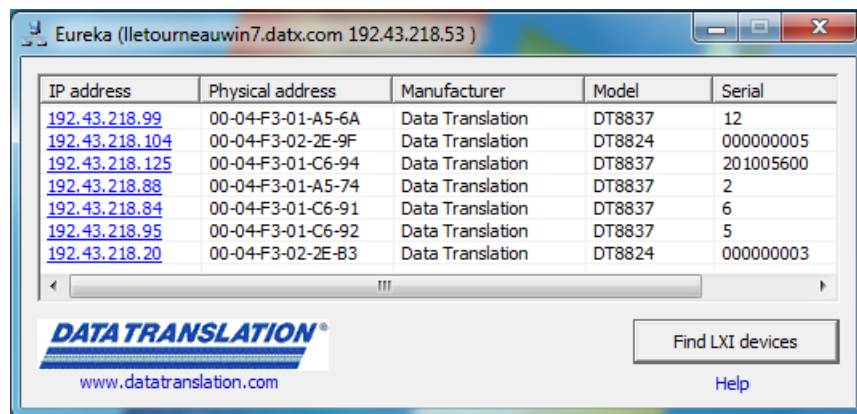


Figure 18: Eureka LXI Discovery Utility

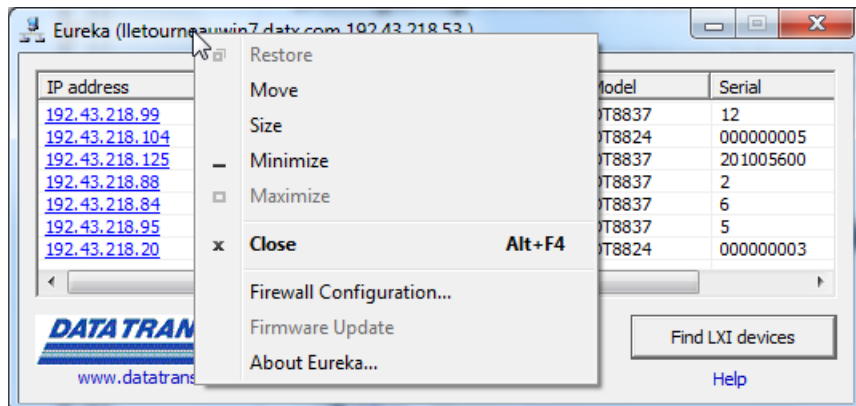
If you are having trouble seeing your instrument module in this list, check your Windows firewall settings using the information in the next section; otherwise, skip this section and continue with ["Launching the Web Interface"](#) on [page 56](#).

Configuring Windows Firewall Settings

If you are having trouble seeing your instrument module using the Eureka Discovery Utility, check your Windows firewall settings by doing the following:

1. Right click in the tile bar of the Eureka Discovery Utility.

The following menu options appear:



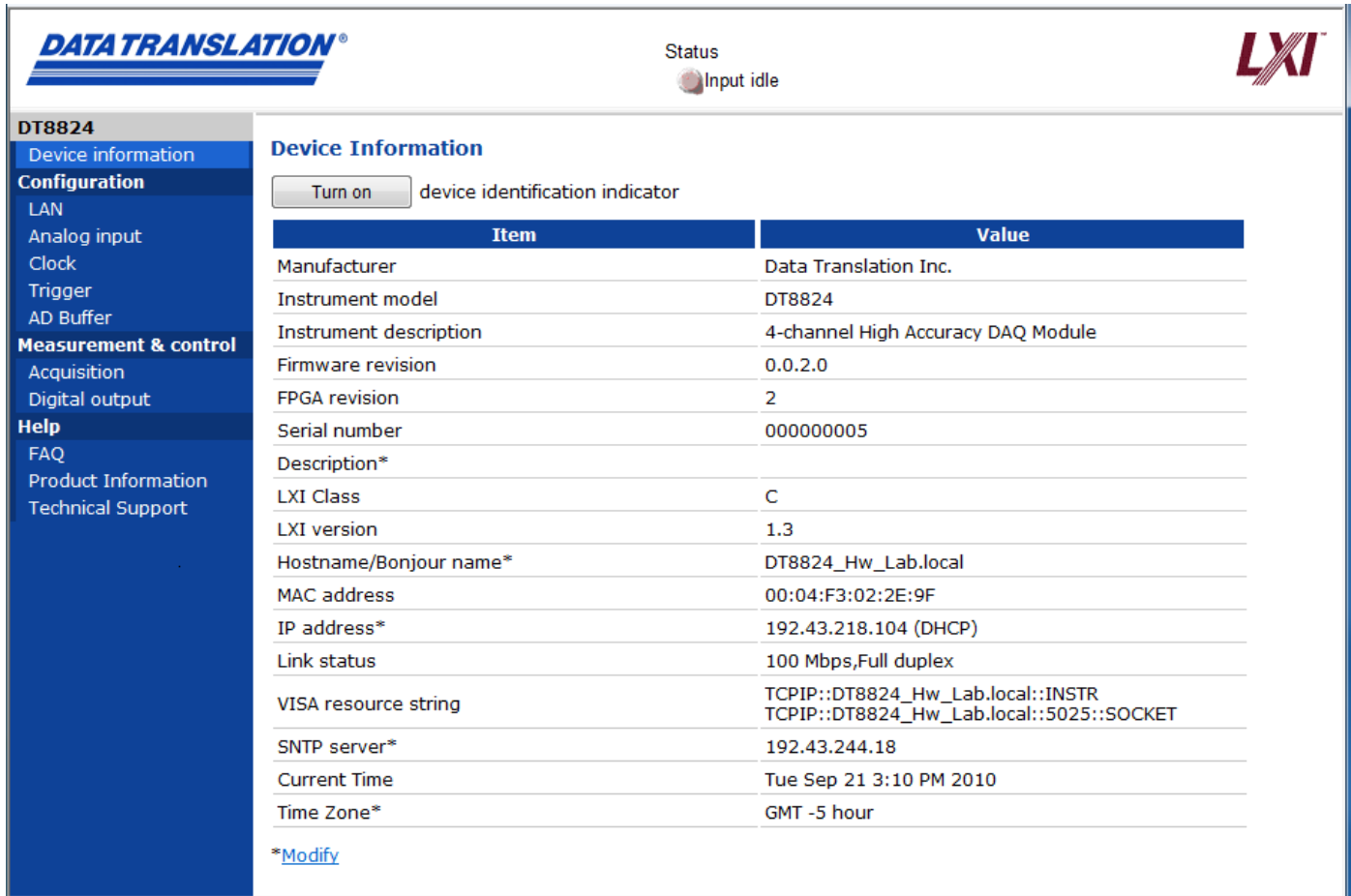
2. Click the **Firewall Configuration...** option.
3. *In Windows XP:*
 - a. From the **General** tab, select the **On (recommended)** setting for proper operation of the Eureka Discovery Utility.
 - b. Click the **Exceptions** tab, and ensure that Eureka LXI Instrument Discovery is included in the list of exceptions.
 - c. If Eureka LXI Instrument Discovery is not included in the exception list, add the utility to the list of exceptions by clicking **Add Program...**, browse to **C:\Program Files\Data Translation\Instrument Support\Eureka.exe**, and then click **OK** to add the utility to the list of exceptions.
 - d. Click **OK** to exit from the Windows Firewall Configuration menu.
4. *In Windows 7:*
 - a. Click **Turn Windows Firewall on or off**.
 - b. For each network, click **Turn on Windows Firewall**, and then click **OK**.
 - c. Click **Allow a program or feature through Windows Firewall**, and ensure that Eureka LXI Discovery is included in the list of allowed programs.
 - d. If Eureka LXI Discovery is not included in the list, add the utility to the list of allowed programs by clicking **Allow another program...**, browse to **C:\Program Files\Data Translation\Instrument Support\Eureka**, click **Open**, and the click **Add** to add the utility to the list of allowed programs.
 - e. Click **OK**, and then click **OK** again to exit from the Windows Firewall Configuration menu.

Launching the Web Interface

From the Eureka utility, double-click the appropriate IP address to open the web pages for your instrument module using your default web browser.

Alternatively, you can enter the IP address of your instrument module directly in your Internet Explorer address bar to see the instrument module's web interface.

The main web page shows information about your DT8824 or DT8824-HV instrument module on the network:



The screenshot displays the web interface for a DT8824 instrument module. The page features the Data Translation logo at the top left and the LXI logo at the top right. The status is indicated as "Input idle". A navigation menu on the left includes sections for "DT8824", "Configuration", "Measurement & control", and "Help". The main content area is titled "Device Information" and includes a "Turn on" button for the "device identification indicator". Below this is a table listing various device parameters and their values.

Item	Value
Manufacturer	Data Translation Inc.
Instrument model	DT8824
Instrument description	4-channel High Accuracy DAQ Module
Firmware revision	0.0.2.0
FPGA revision	2
Serial number	000000005
Description*	
LXI Class	C
LXI version	1.3
Hostname/Bonjour name*	DT8824_Hw_Lab.local
MAC address	00:04:F3:02:2E:9F
IP address*	192.43.218.104 (DHCP)
Link status	100 Mbps, Full duplex
VISA resource string	TCPIP::DT8824_Hw_Lab.local::INSTR TCPIP::DT8824_Hw_Lab.local::5025::SOCKET
SNTP server*	192.43.244.18
Current Time	Tue Sep 21 3:10 PM 2010
Time Zone*	GMT -5 hour

*[Modify](#)

If you have multiple DT8824 or DT8824-HV instrument modules, you can click the **Turn on** button to light the LAN LED on the instrument module, described on [page 35](#), to indicate which device you are using.

If you want to make changes to this page, click the **Modify** button at the bottom of the page or click **Configuration** -> **LAN** on the left side of the page to navigate to the LAN Configuration page, described on [page 57](#).


Configuring the DT8824 or DT8824-HV Instrument Module

Web pages are provided for configuring the following aspects of your DT8824 or DT8824-HV instrument module:


- Local Area Network (LAN) settings
- Analog input channels
- Clock frequency
- Trigger settings
- A/D Buffer mode

LAN Configuration

Use the **Configuration** -> **LAN** web page to configure the Local Area Network (LAN) settings of the DT8824 or DT8824-HV:



Status
 Input idle



DT8824
 Device information
Configuration
 LAN
 Analog input
 Clock
 Trigger
 AD Buffer
Measurement & control
 Acquisition
 Digital output
Help
 FAQ
 Product Information
 Technical Support

LAN configuration

[Help](#)

Item	Value						
Hostname/Bonjour name	<input type="text" value="DT8824_Hw_Lab"/>						
Description	<input type="text"/>						
IP address assignment	<input checked="" type="radio"/> DHCP <input checked="" type="checkbox"/> Automatic private IP address enabled <input type="radio"/> Static Static IP Address configuration <table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 40%;"><input type="text" value="192.168.187.163"/></td> <td>IP</td> </tr> <tr> <td><input type="text" value="255.255.255.0"/></td> <td>Mask</td> </tr> <tr> <td><input type="text" value="192.168.187.218"/></td> <td>Gateway</td> </tr> </table>	<input type="text" value="192.168.187.163"/>	IP	<input type="text" value="255.255.255.0"/>	Mask	<input type="text" value="192.168.187.218"/>	Gateway
<input type="text" value="192.168.187.163"/>	IP						
<input type="text" value="255.255.255.0"/>	Mask						
<input type="text" value="192.168.187.218"/>	Gateway						
SNTP server	<table style="width: 100%; margin-top: 5px;"> <tr> <td style="width: 40%;"><input type="text" value="192.43.244.18"/></td> <td>Primary</td> </tr> <tr> <td><input type="text" value="132.163.4.101"/></td> <td>Secondary</td> </tr> </table>	<input type="text" value="192.43.244.18"/>	Primary	<input type="text" value="132.163.4.101"/>	Secondary		
<input type="text" value="192.43.244.18"/>	Primary						
<input type="text" value="132.163.4.101"/>	Secondary						
Time zone	GMT <input type="text" value="-5"/> hours						
Event domain	<input type="text" value="0"/>						
Password	<input type="text"/>						

When you first access your DT8824 or DT8824-HV instrument module, the LAN settings that the instrument module obtained through DHCP or Auto-IP should be sufficient. If you need to make changes later, click the **Modify** button at the top of the page

Note: If you want to assign a static IP address, ensure that you uncheck the checkbox called **Automatic private IP address enabled**.

When you click **Modify**, you must supply a user name and password for the instrument module. The user name is **admin**; it cannot be changed. The default password is **admin**.

You can configure the following settings on the **LAN** web page:

- **Hostname** – The mDNS (or Bonjour) name. This is the name in the link-local domain. On power up, each device is registered with the DNS name "hostname.local" where *hostname* is the string entered here.
- **Description** – Enter additional textual information to identify the instrument on your network. For example, you could change this field to "Lab6 furnace."
- **DHCP** – Select this radio button to obtain an IP address automatically from a DHCP (dynamic host configuration protocol) server on your local area network (recommended). When it first starts up, the instrument is configured for DHCP, by default.
- **Automatic private IP address enabled** – Check this box to turn on Auto-IP. If DHCP is unavailable and Auto-IP is on, the instrument automatically determines a valid IP address, subnet mask, and default gateway on the local physical link. You can use Auto-IP in an "ad hoc" network configuration, such as when the device is connected directly to your computer through a crossover cable or hub.
- **Static** – Select this radio button to configure the instrument's IP address parameters manually.
- **Static IP address** – If Static is selected, enter an available LAN IP address for your instrument module.
- **Mask** – If Static is selected, enter an IP address mask to identify the subnet where the instrument resides.
- **Gateway** – If Static is selected, enter the IP address of the LAN device that serves as a gateway to other subnets and the wide area network.
- **Primary/Secondary SNTP Server** – Enter the IP addresses of SNTP (simple network time protocol) servers that synchronize the instrument module's internal clock to the rest of your LAN.
- **Time Zone** – Configure the time zone as an integral number of one-half hours either ahead or behind Greenwich Mean Time (GMT). For example, for US Eastern Standard Time (EST), enter –5 hours, as US EST is –5 hours behind GMT.
- **Event Domain** – Enter a value between 0 and 255. This value is used with LAN events in device-to-device communication. All devices that have identical event domains can send LAN events to each other or receive LAN events from each other.

- **Password** – Use this field to change the instrument's password for the LAN web page. Note that the new password goes into effect after the device reboots. If you are prompted for a password before the device reboots, you must enter your original password.

Notes: Contact your system administrator to determine the correct LAN settings for your device on the network.

If needed, you can restore the default configuration of your DT8824 or DT8824-HV instrument module by pressing the Reset pin on the rear panel of the instrument module. For more information, refer to [page 38](#).

Analog Input Configuration and Calibration

Use the **Configuration -> Analog input** web page to enable the analog input channels that you want to measure, specify the gain for each channel, and if desired, calibrate the analog input channels:

DATA TRANSLATION® Status
Input idle **LXI**

DT8824

- Device information
- Configuration**
- LAN
- Analog input**
- Clock
- Trigger
- AD Buffer
- Measurement & control
- Acquisition
- Digital output
- Help
- FAQ
- Product Information
- Technical Support

Analog Input Configuration

[Save changes](#) [Discard changes](#) [Help](#)

Channel	Enable	Gain/Range
AIN1	<input checked="" type="checkbox"/>	x1 ±10 V
AIN2	<input type="checkbox"/>	x1 ±10 V
AIN3	<input type="checkbox"/>	x1 ±10 V
AIN4	<input type="checkbox"/>	x1 ±10 V

[Calibration](#)

Configuring Analog Input Channels

To change your channel configuration, do the following:

1. Under **Enable Channel**, check the boxes next to the channels whose data you want to acquire.
2. Under **Gain/Range**, select one of the following gain values for each analog input channel:

Gain	Range
x1	±10 V
x8	±1.25 V
x16	±0.625 V
x32	±0.3125 V

- Click **Save changes** to apply your changes. If you do not save before leaving this page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

Calibrating Analog Input Channels

DT8824 and DT8824-HV instrument modules are calibrated at the factory and should not require calibration for initial use. We recommend that you check and, if necessary, readjust the calibration of the analog input circuitry on the DT8824 and DT8824-HV instrument modules every six months using the DT8824 web application.

To calibrate the 24-bit A/D offset and A/D gain circuits on your instrument module, the following equipment is recommended:

- A precision voltage standard.
- A 6 1/2 digit precision voltmeter that is connected to the input to help verify and adjust the voltage source at the input precisely.
- Twisted pair wires, since BNC cables can have thermal EMF greater than the accuracy of your device.
- Dead short for calibrating the offset at 0 V.

Note: Ensure that you let the DT8824 or DT8824-HV instrument module warm up for a minimum of 1 hour before calibrating it.

To calibrate the analog input channels, do the following:

- Select the **Calibration** link at the bottom of the **Analog input** web page.
A Windows Security dialog box appears.
- You must supply a user name and password for the instrument module. The user name is **admin**; it cannot be changed. The default password is **admin**. If you changed the default password by configuring the LAN settings (described on [page 59](#)), enter the new password here.
For the DT8824, a page similar to [Figure 19](#) appears. For the DT8824-HV, a page similar to [Figure 20](#) appears.

DATA TRANSLATION® Status
● Input triggered **LXI**

DT8824

- Device information
- Configuration**
- LAN
- Analog input
- Clock
- Trigger
- AD Buffer
- Measurement & control**
- Acquisition
- Digital output
- Help**
- FAQ
- Product Information
- Technical Support

A/D Calibration

Gain **1** Sampling frequency **10.0 Hz** Save calibration

AIN1	AIN2	AIN3	AIN4
<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Factory default			
Offset: 8388619	Offset: 8388620	Offset: 8388631	Offset: 8388633
Full Scale: 5586727	Full Scale: 5586683	Full Scale: 5586739	Full Scale: 5588113
Write to A/D			
AIN1 -7.926 mV	AIN2 -3.639 mV	AIN3 -8.026 mV	AIN4 -6.216 mV

[Display calibration parameters](#)

Figure 19: A/D Calibration for the DT8824

Device information

Configuration

LAN

Analog input

Clock

Trigger

AD Buffer

Measurement & control

Acquisition

Digital output

Help

FAQ

Product Information

Technical Support

A/D Calibration

Fullscale 600.0V
Gain **1**
Sampling frequency **10.0 Hz**
Save calibration

AIN1	AIN2	AIN3	AIN4
<input checked="" type="radio"/> AIN1 Factory default Offset: <input type="text" value="8388598"/> Full Scale: <input type="text" value="5597221"/> Write to A/D	<input type="radio"/> AIN2 A/D gain to calibrate Offset: <input type="text" value="8388620"/> Full Scale: <input type="text" value="5592241"/>	<input type="radio"/> AIN3 Sampling rate Offset: <input type="text" value="8388573"/> Full Scale: <input type="text" value="5594411"/>	<input type="radio"/> AIN4 Offset: <input type="text" value="8388615"/> Full Scale: <input type="text" value="5594055"/>

AIN1
-79.346
uV

AIN2
-85.449
uV

AIN3
-1.031
mV

AIN4
158.691
uV

[Display calibration parameters](#)

Fullscale 600.0V	Gain 1
75.0V	8
37.5V	16
18.75V	32

Figure 20: A/D Calibration for the DT8824-HV

3. Select the analog input channel to calibrate (AIN1 to AIN4).

Note: At any time, you can click **Restore Default** to reset the A/D calibration values to their original factory settings. This process will undo any manual calibration settings.

4. Select the frequency to use for the calibration (10.0 Hz or 1200 Hz). If you select 10.0 Hz, the chopper is enabled for the A/D converter at frequencies equal to or lower than 960 Hz. If you select 1200, the chopper is disabled for the A/D converter at frequencies greater than 960 Hz.
5. Adjust the offset for the selected analog input channel as follows:
 - a. Select the gain to apply to the channel (1, 8, 16, or 32).
 - b. Short the analog input channel.

- c. Adjust the offset by entering a value in the **Offset** edit box, or by clicking the up/down arrows, and then click the **Write to A/D** button.
 - d. Repeat step 5c until the voltage that is displayed for the selected channel is 0 V.
 - e. Click the **Save calibration** button to save the calibration settings.
 - f. Repeat steps 5a to 5e, selecting the next gain in the list, until the offset value is calibrated for each gain setting.
6. Adjust the full-scale range for the selected analog input channel as follows:
 - a. Select the gain to apply to the channel (1, 8, 16, or 32).
 - b. Apply the appropriate voltage, shown in [Table 4](#), for the selected gain.

Table 4: Voltages for Calibrating the Full-Scale Range

Gain	DT8824 Voltage to Apply	DT8824-HV Voltage to Apply
1	9.60000 V	90 V
8	1.20000 V	70 V
16	0.60000 V	35 V
32	0.30000V	17.5 V

- c. Adjust the full-scale range by entering a value in the **Full Scale** edit box, or by clicking the up/down arrows, and then click the **Write to A/D** button.
 - d. Repeat step 6c until the voltage that is displayed matches the voltage you supplied.
 - e. Click the **Save calibration** button to save the calibration settings.
 - f. Repeat steps 6a to 6e, selecting the next gain in the list, until the full-scale range is calibrated for each gain setting.
7. Repeat steps 4 to 6, selecting the remaining frequency, until the offset and full-scale range are calibrated for each gain for the selected channel.
 8. Repeat steps 3 to 6 for the remaining A/D channels that you want to calibrate.

If you want a list of all the user calibration and factory default calibration parameters, click the **Display calibration parameters** link at the bottom of the **A/D Calibration** web page. You can then print this page if you wish.

Clock Frequency

Use the **Configuration** -> **Clock** web page to configure the scan frequency of the analog input subsystem and the reference clock.

The screenshot shows the web interface for the DT8824 instrument. The top left features the 'DATA TRANSLATION' logo. The top right shows the 'LXI' logo and a 'Status' indicator with a red light and the text 'Input idle'. A navigation menu on the left lists various settings: Device information, Configuration (LAN, Analog input, Clock, Trigger, AD Buffer), Measurement & control (Acquisition, Digital output), and Help (FAQ, Product Information, Technical Support). The main content area is titled 'A/D Subsystem Clock Configuration' and has two tabs: 'A/D' (selected) and 'Reference'. Below the tabs are two buttons: 'Save changes' (red text) and 'Discard changes' (green text). A 'Help' link is also present. The 'Sampling frequency' is set to '960.000 Hz'. Below this field are links for 'Minimum' and 'Maximum' values.

A/D Scan Frequency

To configure the scan frequency of the analog input subsystem, do the following:

1. Select the **A/D** tab of the Clock web page.
2. Enter a value, in Hertz, between the minimum and maximum shown in the A/D Subsystem **Clock Frequency** field.

Note: The scan frequency that you specify is rounded to the closest "correct" value that the instrument module can accept without error. When you save the A/D clock configuration, the actual scan frequency is shown.

The DT8824 and DT8824-HV instrument modules use a 4096 sample input FIFO, but start transferring data to the host when the input FIFO has 16 samples. If you specify a slow sampling frequency, you may experience a long delay before the acquired data is available. For example, if you want to acquire data from one channel at a sampling frequency of 1.173 Hz, you have to wait 13.6 s (to acquire 16 samples in the input FIFO) before you can access the data. The delay is minimized at faster sampling frequencies

3. Click **Save changes** to apply your changes. If you do not save before leaving this page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

Reference Clock

To configure the reference clock used by the instrument module, do the following:

1. Select the **Reference** tab of the Clock web page.
2. For **Source**, set the reference clock for the instrument module to **Internal** (the default setting) to use the internal reference clock on the instrument module, or **LXI7** to use the clock from the Trigger Bus.
3. For **Output**, select **LXI7** if you want to drive out the clock on the Trigger Bus, or select **Disabled** (the default setting) if you do not want to drive out the clock signal on the Trigger Bus.
4. Click **Save changes** to apply your changes. If you do not save before leaving this page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

Trigger Configuration

Use the **Configuration -> Trigger** web page to configure the trigger type used by the instrument module for starting the analog input subsystem and to drive out a Trigger Bus LXI trigger or send a LAN trigger packet.

The screenshot displays the web interface for the DT8824 instrument. The top navigation bar includes the 'DATA TRANSLATION' logo, a 'Status' indicator showing 'Input idle', and the 'LXI' logo. A left-hand menu lists various configuration options, with 'Trigger' selected. The main content area is titled 'A/D Subsystem Trigger Configuration' and contains two buttons: 'Save changes' and 'Discard changes'. Below these buttons is a 'Trigger source' dropdown menu. The dropdown is open, showing the following options: 'Immediate' (selected), 'External TTL', 'Trigger Bus' (with sub-items LXI0, LXI1, LXI2, LXI3, LXI4, LXI5), and 'LAN event' (with sub-items LAN0, LAN1, LAN2, LAN3, LAN4, LAN5, LAN6, LAN7). A 'Help' link is located in the top right corner of the configuration area.

A/D Trigger

To configure the trigger source for the analog input subsystem, do the following:

1. Select the **A/D** tab of the Trigger web page.
2. Select one of the following trigger sources:
 - **Immediate** – A software trigger event occurs when you start the analog input operation (the computer issues a write to the instrument module to begin conversions).
 - **External TTL** – An external digital (TTL) trigger event occurs when the instrument module detects either a falling-edge or rising-edge on External Trigger line. The trigger accepts logic level signals of +5 V and has a triggering threshold of 1.25 V.
 - **Trigger Bus** – When multiple DT8824 and/or DT8824-HV instrument modules are connected together using the Trigger Bus, you can synchronize the start of acquisition using one of six LXI trigger signals: LXI0 to LXI5.
 - **Lan Event** – When multiple DT8824 and/or DT8824-HV instrument modules are connected together over the local area network (LAN), you can synchronize the start of analog input operations by using a LAN trigger packet (0 to 7).
3. Click **Save changes** to apply your changes. If you do not save before leaving this web page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

Trigger Bus

To drive out a Trigger Bus LXI trigger or send a LAN trigger packet, do the following:

1. Select the **Output** tab of the Trigger web page.
2. If you want to drive out a signal on the Trigger Bus, select the LXI line that you want to drive out: **LXI0 to LXI5**.
3. If you want to send out a LAN trigger packet, select the LAN event (**LAN0 to LAN7**) to broadcast.
4. Click **Save changes** to apply your changes. If you do not save before leaving this web page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

A/D Buffer Configuration

Use the **Configuration -> Buffer** web page to configure the buffering mode used by the instrument module for analog input operations.

To configure the buffer mode for analog input operations, do the following:

The screenshot shows the web interface for the DT8824 instrument. The top left features the 'DATA TRANSLATION' logo. The top right shows the 'Status' as 'Input idle' and the 'LXI' logo. A navigation menu on the left lists various settings, with 'AD Buffer' selected under the 'Configuration' section. The main content area is titled 'A/D Subsystem Buffer' and contains a 'Mode' section with two radio button options: 'Wrap' and 'Non wrap'. The 'Non wrap' option is selected. Below the options are 'Save changes' and 'Discard changes' buttons, and a 'Help' link.

Mode	
<input type="radio"/> Wrap	Buffer is circular. Oldest scans are overwritten by newer scans and acquisition continues until stopped.
<input checked="" type="radio"/> Non wrap	Buffer is linear. Acquisition will stop automatically after buffer is full (3115132 scans)

- Select one of the following buffer modes:
 - Wrap** – Use this mode if you want the input operation to continue indefinitely. In this case, when the end of the input buffer is reached, the operation wraps to the beginning of the input buffer overwriting the oldest scan data with the latest scan data.
 - Non wrap** – Use this mode if you want the input operation to stop automatically when the input buffer is filled. The size of this buffer depends on how many channels are enabled.
- Click **Save changes** to apply your changes. If you do not save before leaving this web page, your changes are lost.

You can also click the **Discard changes** button (before you save) to return to the previous configuration, if desired.

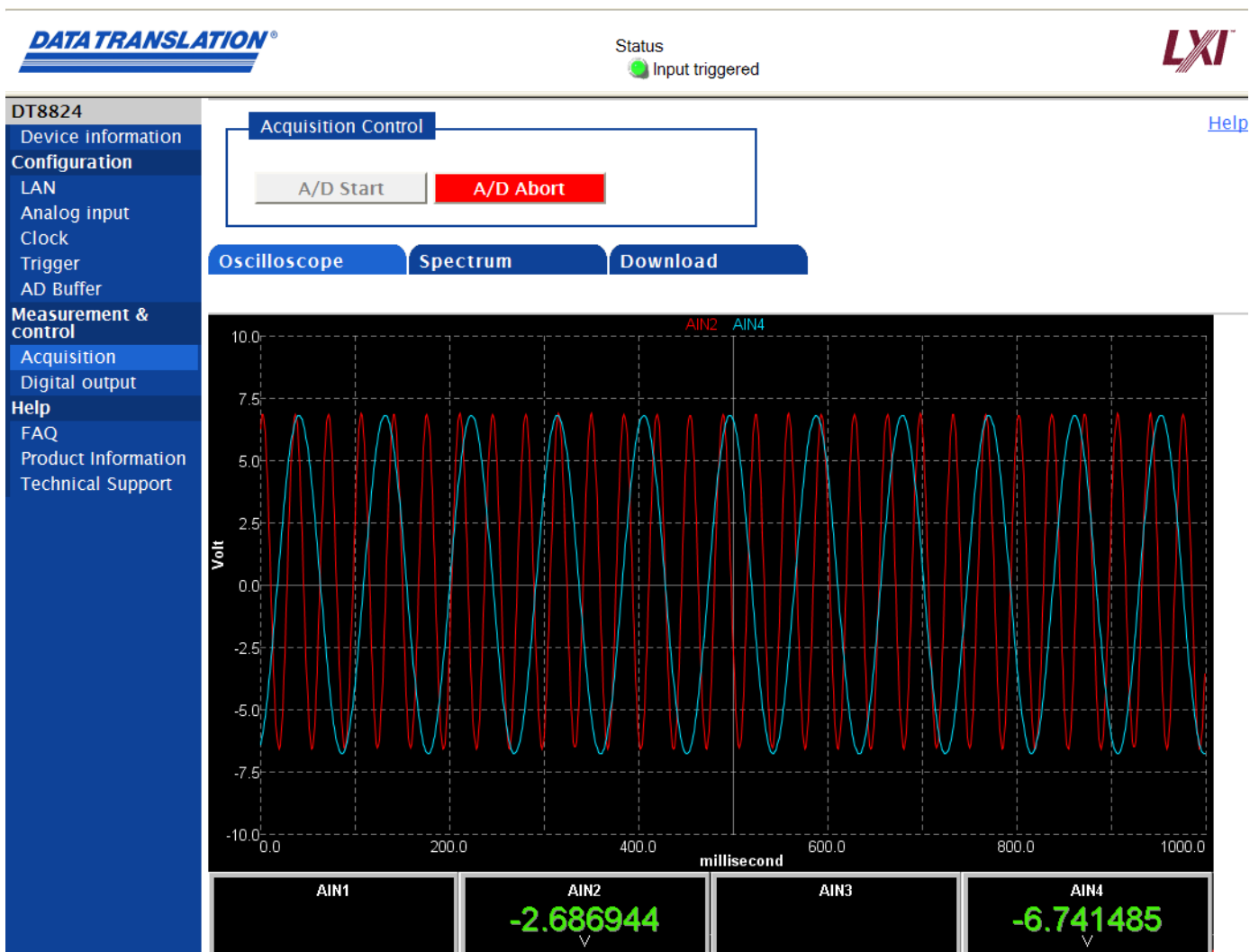
Measuring Data and Controlling the Instrument

Use the Measurement & control web pages to perform the following functions:

- Start and stop acquisition on the analog input subsystem
- View data in oscilloscope
- View FFT results in a spectrum analyzer
- Download measurements
- Save data to disk
- Control digital outputs

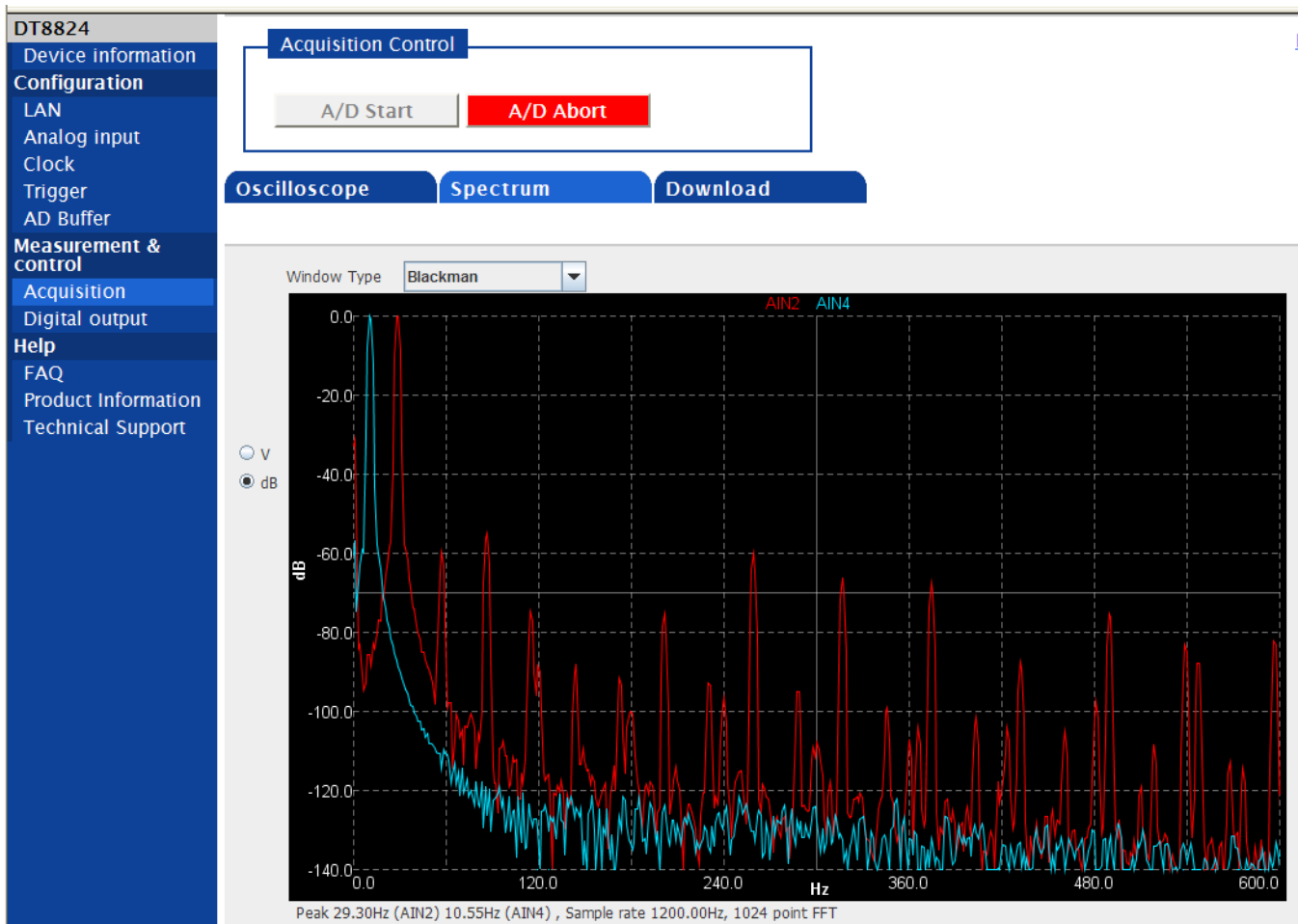
Starting and Stopping a Scan

Use the **Measurement & control** -> **Acquisition** web page and click the **A/D Start** button to start the A/D subsystem. You can see the results of your measurements under in an oscilloscope view under the **Display** tab.



Viewing FFT Data

If you want to perform an FFT (Fast Fourier Transform) on the data and view the results in a spectrum analyzer display, click the **Spectrum** tab. A screen similar to the following appears:



You can select from a number of Windowing functions to generate the FFT results. You can also choose the units (dB or voltage) for the y-axis.

Note that even after acquisition is aborted, the FFT data points remain on screen for post-acquisition analysis. The number of FFT points is determined by the number of channels and the sample rate selected.

Downloading Measurements

To download the raw measurement results to disk, use the **Measurement & control** -> **Acquisition** web page and select the **Download** tab.

Note: Only the raw data is downloaded; the FFT results are not saved to disk.

The screenshot shows the web interface for the DT8824 device. The left sidebar contains navigation links: DT8824, Device information, Configuration, LAN, Analog input, Clock, Trigger, AD Buffer, Measurement & control (selected), Acquisition (selected), Digital output, Help, FAQ, Product Information, and Technical Support. The main content area is titled 'Acquisition Control' and features 'A/D Start' and 'A/D Abort' buttons. Below this are tabs for 'Oscilloscope', 'Spectrum', and 'Download' (selected). The 'Download' section is titled 'Download measurement from AD buffer and save to file' and includes a 'Start Download' button. A text area displays the following CSV-formatted data:

```

AIN1,gain 1
AIN2,gain 1
AIN3,gain 8
AIN4,gain 1
AD clock,960.000
Reference clock,INteRnal
AD trigger,IMMediate
AD buffer,NOWRAp
WTB output 0 enabled
WTB output 6 enabled
WTB output 7 enabled
Time stamp,Scan #,AD1 (V),AD2 (V),AD3 (V),AD4 (V)
2010-09-21 14:34:59:0,1,-0.0013,-0.0041,-0.5298,-0.0006
2,-0.0015,-0.0042,-0.5500,-0.0007
3,-0.0017,-0.0043,-0.5703,-0.0007
4,-0.0019,-0.0044,-0.5907,-0.0007
5,-0.0020,-0.0044,-0.6110,-0.0007

```

At the bottom of the download section, there is a 'Save As ...' button, a 'File size 563.3 KB' indicator, and a '100% downloaded' progress bar.

1. Click the **Start Download** button on this page. Data is fetched from the beginning of the buffer and is formatted and displayed in the text area as comma-separated values (CSV). This process continues until either you click **Stop Download** or the end of the buffer is reached.

Note: Before you click **Start Download**, there must be data in the A/D buffer; acquisition must be in progress or has been started and aborted.

2. Once download is stopped, click the **Save As...** button to save this CVS formatted text file to a local directory on your computer. You can specify the name of the file and give it any extension you want; the contents of the text area are written to the file.

Controlling the Digital Outputs

Use the **Measurement & control -> Digital output** web page to view the current state of the digital output lines, and manually change them if desired. A screen similar to the following appears:

The screenshot shows the web interface for the DT8824 device. At the top left is the "DATA TRANSLATION" logo. At the top right is the "LXI" logo. Below the logo is the text "Status" and "Input idle". The main content area is titled "Digital Output" and contains a table with the following data:

Output	Status	Control
DOUT0	Open	<input type="button" value="Close"/>
DOUT1	Open	<input type="button" value="Close"/>
DOUT2	Closed	<input type="button" value="Open"/>
DOUT3	Closed	<input type="button" value="Open"/>

The left navigation menu includes: DT8824, Device information, Configuration (LAN, Analog input, Clock, Trigger, AD Buffer), Measurement & control (Acquisition, Digital output), and Help (FAQ, Product Information, Technical Support). A "Help" link is also visible in the top right corner of the main content area.

Green indicates that the digital output line/relay is closed; red indicates that the digital output line/relay is open.

To change the status of a digital output line/relay, click the **Open/Close** toggle buttons under the **Control** heading for the digital output lines that you want to change.

Part 2: Using Your Instrument Module



Principles of Operation

Analog Input Features	77
Digital Output Features	81

Figure 21 shows a block diagram of the DT8824 and DT8824-HV instrument modules.

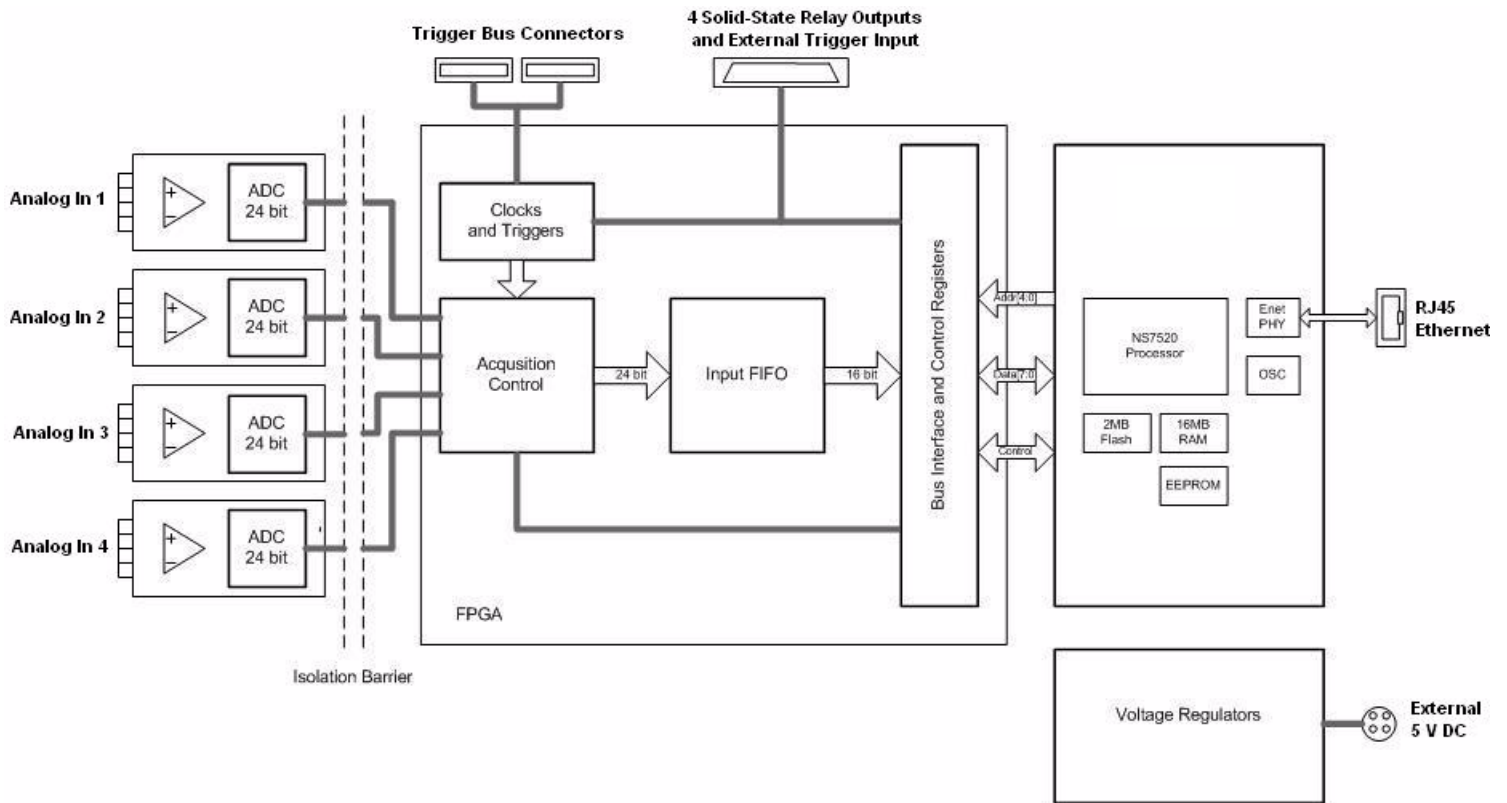


Figure 21: Block Diagram of the DT8824 and DT8824-HV Instrument Modules

Analog Input Features

This section describes the following features of the analog input (A/D) subsystem on the DT8824 and DT8824-HV instrument modules:

- Analog input channels, described on [page 77](#)
- Input resolution, described on [page 77](#)
- Input ranges and gains, described on [page 77](#)
- A/D sample clock, described on [page 78](#)
- Input buffer, described on [page 79](#)
- Triggers, described on [page 80](#)
- Error conditions, described on [page 80](#)

Analog Input Channels

The DT8824 and DT8824-HV support four, simultaneous, analog input channels, configured differentially. Refer to [Chapter 4](#) for more information on wiring to the analog input channels.

Using software, you enable the channels that you want to sample; channels are numbered 1 to 4. All analog input channels are simultaneously clocked.

Note: To maintain simultaneous operation, all analog input connections must have the same lead lengths.

The DT8824 and DT8824-HV use Delta-Sigma analog-to-digital converters (ADCs) that provide anti-aliasing filters based on the clock rate. These filters remove *aliasing*, which is a condition where high frequency input components erroneously appear as lower frequencies after sampling.

Input Resolution

The analog input resolution of the DT8824 and DT8824-HV is fixed at 24 bits.

Input Ranges and Gains

The DT8824 supports a bipolar range of ± 10 V. The DT8824-HV supports a bipolar range of ± 600 V.

In addition, you can choose from up to 4 gains (1, 8, 16, or 32). [Table 5](#) lists the supported gains and effective input range of each input range on the DT8824 and DT8824-HV.

Table 5: Effective Input Ranges

Gain	Input Range of DT8824	Input Range of DT8824-HV
1	± 10 V	± 600 V
8	± 1.25 V	± 75 V
16	± 0.625 V	± 37.5 V
32	± 0.3125 V	± 18.75 V

Choose the gain that has the smallest effective range that includes the signal you want to measure. For example, if you are using the DT8824 and the range of your analog input signal is ± 1.05 V, specify a range of ± 10 V for the A/D subsystem and use a gain of 8 for the channel; the effective input range for this channel is then ± 1.25 V, which provides the best sampling accuracy for that channel.

A/D Sample Clock

The DT8824 and DT8824-HV support an internal master clock and an internal sync signal that synchronizes all the analog-to-digital converters on the instrument module.

Use software to specify the internal clock source, the internal A/D sync signal, and the frequency at which to pace the input operations and to start the sample clock. The sampling frequency ranges from 1.173 Hz to 4800 Hz. All channels that are specified in the analog input channel list are sampled simultaneously at the specified sampling frequency.

As a guideline, the sampling frequency of the DT8824 and DT8824-HV should be at least 2.5 times the highest input signal frequency that you are trying to measure. For example, to accurately sample a 400 Hz signal, it is recommended that you specify a sampling frequency of at least 1000 Hz.

The actual sampling frequency that the instrument module can achieve may be slightly different than the frequency you specified due to the accuracy of the clock. You can determine the actual clock frequency using software.

Note: The DT8824 and DT8824-HV instrument modules use a 4096 sample input FIFO, but start transferring data to the host when the input FIFO has 16 samples. If you specify a slow sampling frequency, you may experience a long delay before the acquired data is available. For example, if you want to acquire data from one channel at a sampling frequency of 1.173 Hz, you have to wait 13.6 s (to acquire 16 samples in the input FIFO) before you can access the data. The delay is minimized at faster sampling frequencies.

If you are synchronizing analog input operations on multiple DT8824 and/or DT8824-HV instrument modules using the Trigger Bus, refer to [“Synchronizing Operations on Multiple Instrument Modules”](#) on page 83 for more information on the LXI clock and sync signals that are needed.

Input Buffer

The DT8824 and DT8824-HV use an 8 MB input buffer for storing data from each of up to 4 enabled input channels (analog input channels 1, 2, 3, 4). One sample from each of the enabled input channels is called a scan.

You can specify one of the following wrap modes for the input buffer in software:

- Continuous wrap mode – Use this mode if you want the input operation to continue indefinitely. In this case, when the end of the input buffer is reached, the operation wraps to the beginning of the input buffer overwriting the oldest scan data with the latest scan data.
- No wrap mode – Use this mode if you want the input operation to stop automatically when the input buffer is filled.

Notes: Since the maximum input buffer size is 8 MB and each sample is 4 bytes, you can store a maximum of 2 M samples in the input buffer. If you sample each input channel at the maximum input frequency (4800 Hz), the input buffer will fill in approximately 106 seconds (4800 samples/s per channel).

The maximum size of data transfer over Ethernet is 32 kB. Since each sample is 4 bytes, the maximum number of samples that you can transfer at one time is 8 ksamples. Therefore, if you are using continuous wrap mode, use a tight loop to ensure that you retrieve all the samples in the input buffer before the buffer is overwritten.

Figure 22 illustrates continuous wrap mode using a channel list with four entries: analog input channels 1, 2, 3, 4. In this example, data is acquired simultaneously on all channels on each clock pulse of the input sample clock. Data is acquired continuously until all the queued buffers have been filled or you stop the operation.

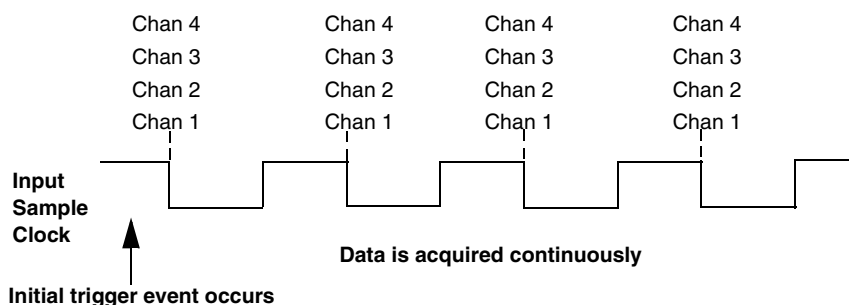


Figure 22: Continuous Wrap Mode

Triggers

A trigger is an event that occurs based on a specified set of conditions. Once the analog input subsystem is armed using software (and if the trigger source is immediate, started using software), acquisition starts when the instrument module detects the initial trigger event and stops when either the input buffer has been filled (if no wrap mode was selected), or you stop the operation (if continuous mode is selected).

Note: The Input Trigger LED on the front panel of the DT8824 and DT8824-HV turns solid amber when the analog input subsystem is armed and solid green when the analog input subsystem is triggered. When the analog input subsystem is idle, the Input Trigger LED is off.

The DT8824 and DT8824-HV support the following trigger sources for starting analog input operations:

- **Software trigger** – A software trigger event occurs when you start the analog input operation (the computer issues a write to the module to begin conversions). Using software, specify the trigger source as a software trigger.
- **External trigger** – An external digital trigger occurs when the DT8824 or DT8824-HV detects either a falling-edge or rising-edge on the External trigger line. The edge-type is software-programmable.

The external trigger connection is implemented as a differential input with 2 k Ω of isolation to the digital ground of the instrument module, allowing for TTL-level or switch connections. The trigger accepts logic level signals of +5 V and has a triggering threshold of 1.25 V. The positive side is pulled up to +5 V. If you are using the external trigger to detect a contact closure, ensure that you configure the polarity of the external trigger for a falling-edge (high-to-low) transition.

- **Trigger Bus** – When multiple DT8824 or DT8824-HV instrument modules are connected together using the Trigger Bus, described on [page 83](#), you can receive a trigger from one of six LXI trigger signals (LXI0 to LXI5) to synchronize the start of acquisition.
- **LAN Trigger Packet** – When multiple DT8824 or DT8824-HV instrument modules are connected together over the local area network (LAN), you can synchronize the start of analog input operations by using LAN trigger packets. Refer to [page 83](#) for more information.

Error Conditions

The DT8824 and DT8824-HV can report an A/D overrun error if the input FIFO overflows. The error occurs if the sampling frequency is too fast. The host computer can clear this error. To avoid this error, use a slower sampling frequency.

Digital Output Features

This section describes the following digital output features of the DT8824 and DT8824-HV instrument modules:

- Digital output lines, described on [page 81](#)
- Channel-to-channel isolation, described on [page 81](#)
- Resolution, described on [page 82](#)
- Operation modes, described on [page 82](#)

Digital Output Lines

The DT8824 and DT8824-HV feature four, latched and isolated digital output lines. The outputs are solid-state relays that operate at ± 30 V and 400 mA peak (AC or DC). Switching time is 2 ms maximum.

[Figure 23](#) shows the digital output circuitry for each digital output line.

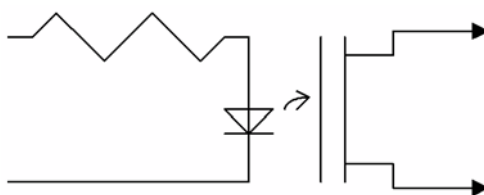


Figure 23: Digital Output Circuitry

Digital outputs resemble a switch; the switch is closed if the state of the digital output line is 1, and the switch is open if the state of the digital output line is 0. On power up or reset, the digital outputs are disabled.

Channel-to-Channel Isolation

The DT8824 and DT8824-HV include channel-to-channel isolation of up to ± 250 V between digital output lines. If you require greater channel-to-channel isolation, use every other digital line. This reduces the number of digital lines, but provides channel-to-channel isolation of ± 500 V (one channel can be +500 V while the adjacent channel can be -500 V).

Resolution

The DT8824 and DT8824-HV provide a resolution of four bits for the digital output port to accommodate the four isolated digital output lines. These lines are organized as an isolated, dedicated port. You cannot configure port resolution through software.

Operation Modes

Using software, you can write to a single digital output line or to the entire digital output port.

Synchronizing Operations on Multiple Instrument Modules

You can synchronize the start of acquisition on multiple instrument modules using LXI triggers on the Trigger Bus or LAN trigger packets. If you want the clock to be synchronous, you need to use the Trigger Bus.

Using the Trigger Bus

Up to 16 LXI devices can be connected together using the Trigger Bus. DT8824 and DT8824-HV instrument modules may be connected using a daisy-chain configuration, as shown in [Figure 24](#), using the 25-pin Trigger Bus connectors, EP377 Trigger Bus cables, and Trigger Bus terminators. Both the first device and the last device in the chain must have Trigger Bus terminators installed. Terminators must also be installed on both Trigger Bus connectors if you are using only one instrument module.

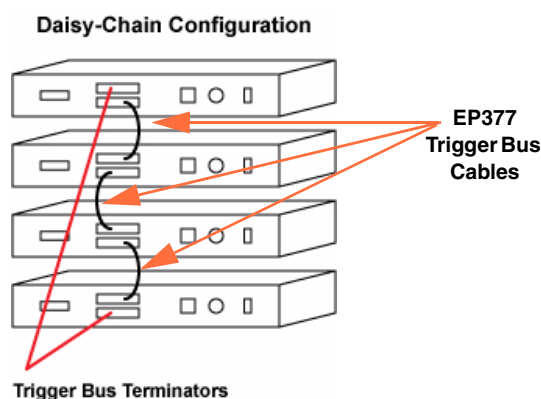


Figure 24: DT8824 and/or DT8824-HV Instrument Modules in a Daisy-Chain Configuration

When multiple DT8824 and/or DT8824-HV instrument modules are connected together using the Trigger Bus, you can synchronize the start of acquisition using one of six LXI trigger signals: LXI0 to LXI5. As shown in [Figure 25](#), one instrument module is the clock master, responsible for driving out the clock signal (LXI7) and sync signal (LXI6) for use by the other slave instrument modules. The slave instrument modules must be configured to accept these signals.

Note: The order in which you set up the clock and triggers is important; refer to your software documentation for more information. While the clock frequencies can be different on each instrument module, we recommend that you choose the same clock frequency for all instrument modules.

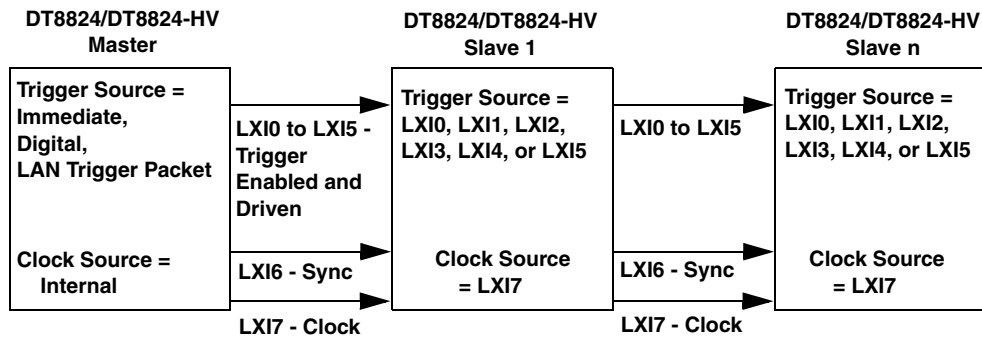


Figure 25: Synchronizing the Start of Acquisition When Connecting Multiple Instrument Modules to the Trigger Bus

Note: When using LXI triggers, the timing from device to device is guaranteed to be within one sample pulse.

Unlike when synchronizing the clock of multiple instrument modules, which requires one instrument module dedicated as the clock master, you can have more than one trigger master, if desired, to trigger multiple instrument modules. Additionally, the trigger master need not be the clock master. Figure 26 shows an example of using two trigger masters on the Trigger Bus.

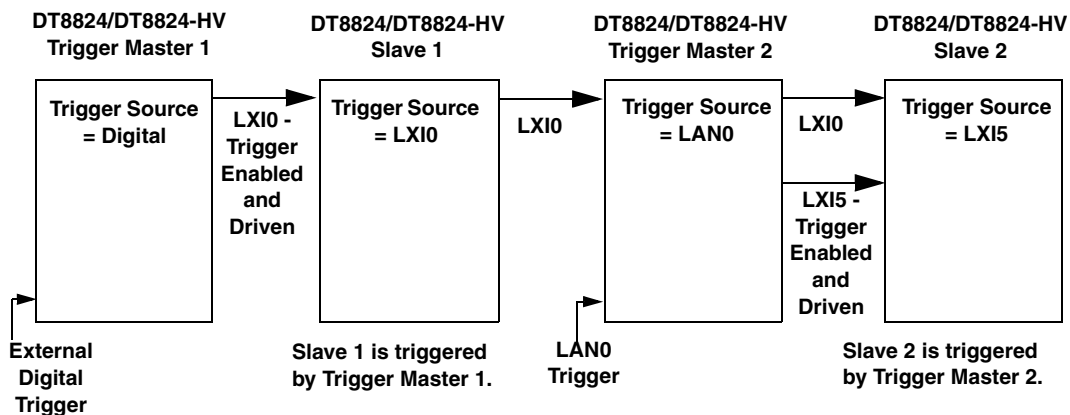


Figure 26: An Example of Using Two Trigger Masters on the Trigger Bus

On the trigger master, use software to set the trigger source to software trigger, external digital trigger, or LAN trigger packet (LAN0 to LAN7). Then, use software to drive out the LXI trigger signal (LXI0 to LXI5) on the Trigger Bus.

Note: While a trigger master can drive out more than one trigger signal on the Trigger Bus, the slave can accept only one trigger signal to start the analog input operation.

On each slave, use software to select the trigger signal (LXI0 to LXI5) that was driven out by the trigger master on the Trigger Bus and arm the analog input subsystem.

Once the master is armed and triggered, the specified LXI trigger signal is driven out on the Trigger Bus to all slaves that were configured to accept it. Acquisition starts on the first sample after the trigger is received.

Using LAN Trigger Packets

When multiple DT8824 and/or DT8824-HV instrument modules are connected together over the local area network (LAN), as shown in [Figure 27](#), you can synchronize the start of analog input operations by transmitting one of eight LAN trigger packets (LAN0 to LAN7) over the network.

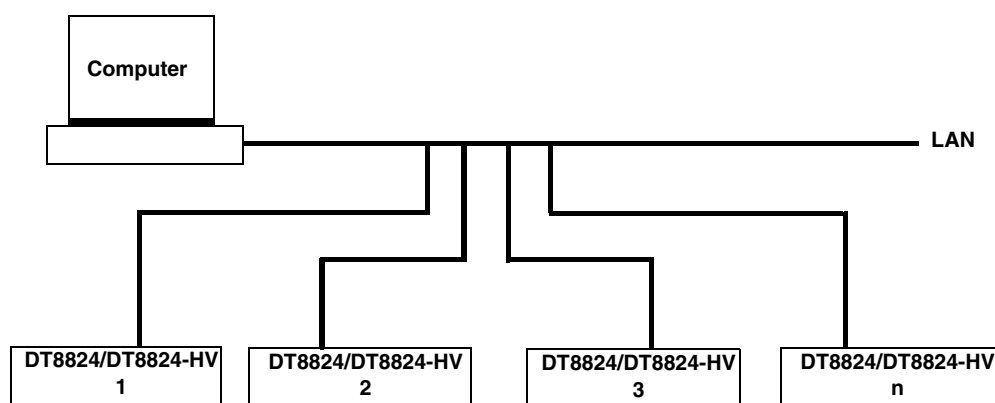


Figure 27: Synchronizing the Start of Analog Input Operations When Triggering Instruments Modules Over the LAN

The timing of the trigger packets from device to device is dependent on the network traffic on the LAN.

The DT8824 and DT8824-HV support multicast transmission of LAN trigger packets using UDP (User Datagram Protocol) port 5044 and UDP multicast address 224.0.23.159. The DT8824 and DT8824-HV do not support unicast LAN events transmitted via TCP connections.

Figure 28 shows the format of a LAN trigger packet:

HW Detect (3 bytes)	Domain (1 byte)	Event ID (16 bytes)	Sequence (UInt32)	Time stamp (10 bytes)	Epoch (UInt16)	Flags (UInt16)	Data Fields	0 (2 Bytes)
--------------------------------	----------------------------	--------------------------------	------------------------------	----------------------------------	---------------------------	---------------------------	--------------------	------------------------

Figure 28: Format of a LAN Trigger Packet

The fields of the LAN trigger packet are described as follows:

- **HW Detect** – Identifies valid packets and is reserved for future hardware detection of LAN events. This field should be set to *LXI*. Note that the third byte, ASCII 'T', is also used as a version identifier; future revisions to the LXI standard may change this value.
- **Domain** – This field represents a group of devices that are managed by a single directory and use shared resources. Values for the LXI domain range from 0 to 255. The default value is 0. This field is treated as an unsigned byte.

To transmit LAN trigger packets to or from a DT8824 or DT8824-HV instrument module, ensure that you set the domain field of each DT8824 or DT8824-HV instrument module to the same value using software.

- **Event ID** – This field contains the first 16 bytes of the event name (a string). By default, the LAN event names are defined as LAN0 to LAN7.

To transmit LAN trigger packets to or from a DT8824 or DT8824-HV instrument module, ensure that you set the event ID of each DT8824 or DT8824-HV instrument module to the same value using software.

- **Sequence** – Each instrument module maintains its own sequence; the sequence number is incremented every time a unique packet is transmitted. (Note that if packets are retransmitted to enhance reliability, re-transmitted packets contain the same sequence number as the original.)
- **Time stamp** – For DT8824 and DT8824-HV instrument modules, the time stamp of received LAN event packets is ignored, while generated LAN event packets have a time stamp of 0.
- **Epoch** – For DT8824 and DT8824-HV instrument modules, this value is 0.
- **Flags** – Contains data about the packet. This value is generated automatically by DT8824 and DT8824-HV instrument modules.
- **Data Fields** – Arbitrary number of bytes, up to the capacity of the data packet. This field is generated automatically by DT8824 and DT8824-HV instrument modules.

To trigger analog input operations on a DT8824 or DT8824-HV using a LAN trigger packet, set up the domain and the event ID of the LAN trigger packet, as described on [page 86](#), and then do the following:

1. Use software to set the trigger source for the analog input subsystem of each DT8824 or DT8824-HV to the enabled LAN trigger packet (LAN0 to LAN7).
2. Enable the LAN event (LAN0 to LAN7) for transmission using software.
3. Specify the destination or source address for the enabled LAN event (LAN0 to LAN7) using software.
4. Arm the analog input subsystem.

Acquisition starts with the first sample after the specified LAN trigger packet is received.



Troubleshooting

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General Checklist

Should you experience problems using a DT8824 or DT8824-HV, do the following:

1. Read all the documentation provided for your product, including any "Read This First" information.
2. Check the DT8824 CD for any README files and ensure that you have used the latest installation and configuration information available.
3. Check that your system meets the requirements as stated in the README file on the DT8824 CD.
4. Check that you have installed your hardware properly using the instructions in [Chapter 3](#).
5. Check that you have wired your signals properly using the instructions in [Chapter 4](#).
6. Check that you have installed Java and configured your web browser appropriately using the instructions on [page 49](#).
7. Search the DT Knowledgebase in the Support section of the Data Translation web site (at www.mccdaq.com) for an answer to your problem.

If you still experience problems, try using the information in [Table 6](#) to isolate and solve the problem. If you cannot identify the problem, refer to [page 92](#).

Table 6: Troubleshooting Problems

Symptom	Possible Cause	Possible Solution
DT8824 or DT8824-HV is not found.	The DT8824 or DT8824-HV cannot communicate with the network.	Ensure that your DT8824 or DT8824-HV is properly connected; see the instructions in Chapter 3 .
		If your PC has a static IP address, reconfigure it for Auto-IP using the instructions on Appendix C .
		Check the LAN configuration of the instrument module; see the instructions in Chapter 3 .
		Check the IP address of the instrument module by opening a Command Prompt window (Start -> Programs -> Accessories -> Command Prompt) and entering the command "ipconfig /all". The IP settings of your instrument module are returned.
		Ping the instrument module by opening a Command Prompt window (Start -> Programs -> Accessories -> Command Prompt) and entering the command "ping address", where <i>address</i> is the IP address of your instrument module. If a timeout message is returned, the IP address is incorrect. If a "no host" error message is returned, the subnet mask is incorrect. Refer to Appendix C for more information on IP and subnet addresses.
		If needed, reset the instrument module using the instructions on page 38 .

Table 6: Troubleshooting Problems (cont.)

Symptom	Possible Cause	Possible Solution
DT8824 or DT8824-HV does not respond.	The configuration is incorrect.	Check the LAN configuration of your instrument module; see the instructions in Chapter 3 .
		Check the IP address of the instrument module by opening a Command Prompt window (Start -> Programs -> Accessories -> Command Prompt) and entering the command "ipconfig /all". The IP settings of your instrument module are returned.
		Ping the instrument module by opening a Command Prompt window (Start -> Programs -> Accessories -> Command Prompt) and entering the command "ping address", where <i>address</i> is the IP address of your instrument module. If a timeout message is returned, the IP address is incorrect. If a "no host" error message is returned, the subnet mask is incorrect. Refer to Appendix C for more information on IP and subnet addresses.
	If needed, reset the instrument module using the instructions on page 38 .	
	The instrument module is damaged.	Contact Data Translation for technical support; refer to page 92 .
Intermittent operation.	Loose connections or vibrations exist.	Check your wiring and tighten any loose connections or cushion vibration sources; see the instructions in Chapter 4 .
	The instrument module is overheating.	Check environmental and ambient temperature; consult the specifications on page 103 and the documentation provided by your computer manufacturer for more information.
	Electrical noise exists.	Check your wiring and either provide better shielding or reroute unshielded wiring; see the instructions in Chapter 4 .
Data appears to be invalid.	An open connection exists.	Check your wiring and fix any open connections; see the instructions in Chapter 4 .
	A transducer is not connected to the channel being read.	Check the transducer connections; see the instructions in Chapter 4 .
	The channel configuration does not match the software configuration for that channel.	Check your wiring and ensure that what you specify in software matches your hardware configuration; see the instructions in Chapter 4 .
	The instrument module may need recalibration.	The DT8824 and DT8824-HV are calibrated at the factory. Thereafter, yearly calibration is recommended using the DT8824 web application, described in Chapter 5 .

Technical Support

If you have difficulty using a DT8824 or DT8824-HV, Data Translation's Technical Support Department is available to provide technical assistance.

To request technical support, go to our web site at <http://www.mccdaq.com> and click on the Support link.

When requesting technical support, be prepared to provide the following information:

- Your product serial number
- The hardware/software product you need help on
- The version of the CD you are using
- Your contract number, if applicable

If you are located outside the USA, contact your local distributor; see our web site (www.mccdaq.com) for the name and telephone number of your nearest distributor.

If Your Instrument Module Needs Factory Service

Most hardware models can be functionally tested, evaluated for repairs (if needed), and calibrated to factory specifications. An RMA # must be obtained from Application Engineering in advance of sending any product back to Measurement Computing. Customers outside the USA must contact their local distributor for a return procedure. Calibration certificates for most analog models can be obtained for a fee (certificate must be requested at time of RMA # assignment).



Specifications

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Analog Input Specifications

Table 7 lists the specifications for the A/D subsystem on the DT8824 and DT8824-HV instrument modules.

Table 7: A/D Subsystem Specifications

Feature	DT8824 Specifications	DT8824-HV
Number of analog inputs	4 Differential	4 Differential
Number of gains	4 (1, 8, 16, 32)	4 (1, 8, 16, 32)
Input range Gain = 1: Gain = 8: Gain = 16: Gain = 32:	± 10 V ± 1.25 V ± 0.625 V ± 0.3125 V	± 600 V ± 75 V ± 37.5 V ± 18.75 V
Resolution	24 bits	24 bits
Data encoding	Offset binary	Offset binary
Coupling	DC	DC
Sample frequency per channel	1.173 Hz to 4800 Hz	1.173 Hz to 4800 Hz
System accuracy @ 10 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.005%	0.008% 0.008% 0.012% 0.020%
System accuracy @ 100 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.006%	0.008% 0.008% 0.012% 0.024%
System accuracy @ 1200 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.004% 0.007%	0.008% 0.008% 0.016% 0.028%
System accuracy @ 4800 Hz (full-scale = 10 V for DT8824; 600 V for DT8824-HV) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.003% 0.005% 0.010%	0.008% 0.008% 0.02% 0.04%
Nonlinearity (integral) Gain = 1: Gain > 1:	± 5 ppm full-scale maximum ± 15 ppm full-scale maximum	± 25 ppm full-scale maximum ± 35 ppm full-scale maximum
Differential linearity	± 1 LSB (no missing codes)	± 1 LSB (no missing codes)

Table 7: A/D Subsystem Specifications (cont.)

Feature	DT8824 Specifications	DT8824-HV
Offset drift versus temperature ≤ 600 Hz: > 600 Hz:	50 nV/°C 150 nV/°C	3 μV/°C 9 μV/°C
Offset drift versus time	25 nV/1000 hours typical	1.5 μV/1000 hours typical
Gain drift versus temperature	±10 ppm/°C	±25 ppm/°C
Gain drift versus time	10 ppm/1000 hours typical	25 ppm/1000 hours typical
Input impedance Power off: Power on:	3 kΩ 10 MΩ// 3 kΩ in series with 4700 pF	3 kΩ 1 MΩ// 3 kΩ in series with 4700 pF
Input bias current	≤ ±1 nA	≤ ±1 nA
Input noise (@ 10 Hz sample rate; gain of 1)	3.6 μV rms = 23.8 μV pp or < 1.5 ppm	209.0 μV rms = 1.4 mV pp or < 1.5 ppm
System noise	See Table 8 and Figure 29 on page 98	See Table 9 and Figure 30 on page 99
Analog input filter	3 kHz	3 kHz
Common mode rejection @ 10 Hz	> -150 dB @ 50 Hz and 60 Hz	> -150 dB @ 50 Hz and 60 Hz
Common mode voltage	±500 V maximum (operational)	±1000 V maximum (operational)
Maximum input voltage	±40 V maximum (protection)	±800 V maximum (protection)
Channel-to-channel offset	±10 μV	±600 μV
Effective number of bits (ENOB) @ 100 Hz with a 10 Hz, ±9.9 V sine wave input	21 bits typical	20 bits typical
Channel crosstalk	-150 dB @ 1 kHz	-150 dB @ 1 kHz
Input coupling	DC	DC
Isolation voltage	±500 V to computer ground	±1000 V to computer ground
Channel-to-channel isolation	±500 V	±2000 V
ESD protection Arc: Contact:	8 kV 4 kV	8 kV 4 kV
Internal reference	1.25 V ±0.001 V	1.25 V ±0.001 V
-3 dB point (low pass) ^a Sample rate less than or equal to 600 Samples/s Sample greater than 600 Samples/s	f -3 dB = 0.24 x fADC f -3 dB = 0.23 x fADC	f -3 dB = 0.24 x fADC f -3 dB = 0.23 x fADC
Internal clock	±100 ppm maximum (typical initial ±25 ppm) ^b	±100 ppm maximum (typical initial ±25 ppm) ^b
Warm-up time	1 hour	1 hour

a. Refer to [page 100](#) for more information about the frequency response, input bandwidth, and correction factors.

b. This clock is derived from the crystal oscillator. The specification includes initial tolerance, power supply variations, temperature drift, and 1 year stability.

System Noise Of the DT8824

Table 8 lists the typical RMS noise, in microvolts, of the DT8824 at sampling rates of 10 Samples/s, 100 Samples/s, 960 Samples/s, and 4800 Samples/s and gains of 1, 8, 16, and 32.

Table 8: DT8824 System Noise

Gain	10 Samples/s	100 Samples/s	960 Samples/s	4800 Samples/s
1	3.6 μ Vrms	12.0 μ Vrms	25.0 μ Vrms	63.0 μ Vrms
8	0.7 μ Vrms	2.0 μ Vrms	4.2 μ Vrms	11.0 μ Vrms
16	0.6 μ Vrms	1.8 μ Vrms	2.8 μ Vrms	7.5 μ Vrms
32	0.4 μ Vrms	1.3 μ Vrms	2.3 μ Vrms	6.5 μ Vrms

Figure 29 shows this data in graphical form.

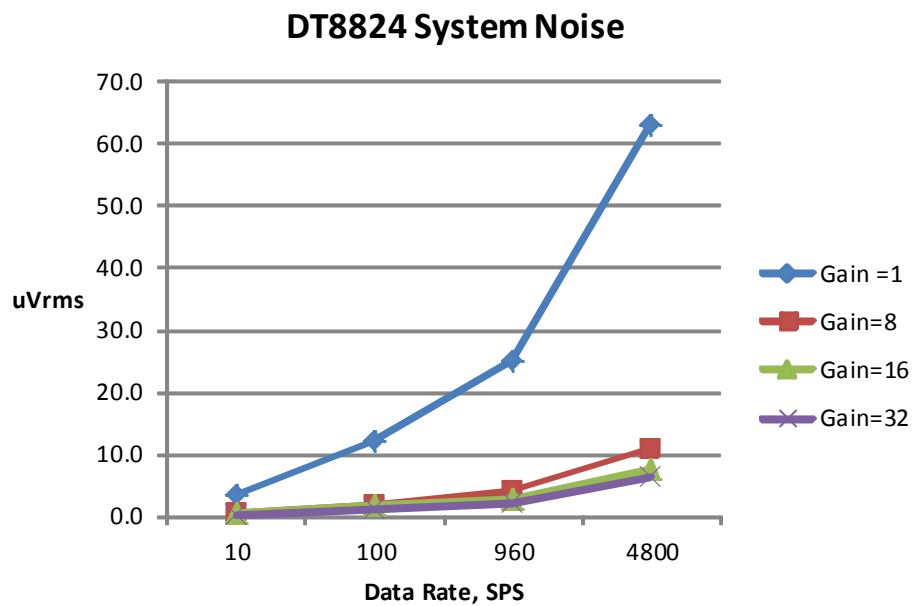


Figure 29: System Noise Specification for the DT8824

System Noise Of the DT8824-HV

Table 9 lists the typical RMS noise, in microvolts, of the DT8824-HV at sampling rates of 10 Samples/s, 100 Samples/s, 960 Samples/s, and 4800 Samples/s and gains of 1, 8, 16, and 32.

Table 9: DT8824-HV System Noise

Gain	10 Samples/s	100 Samples/s	960 Samples/s	4800 Samples/s
1	209.0 μ Vrms	680.0 μ Vrms	1470.0 μ Vrms	3760.0 μ Vrms
8	71.0 μ Vrms	209.0 μ Vrms	475.0 μ Vrms	1100.0 μ Vrms
16	63.0 μ Vrms	200.0 μ Vrms	435.0 μ Vrms	960.0 μ Vrms
32	58.0 μ Vrms	185.0 μ Vrms	415.0 μ Vrms	930.0 μ Vrms

Figure 30 shows this data in graphical form.

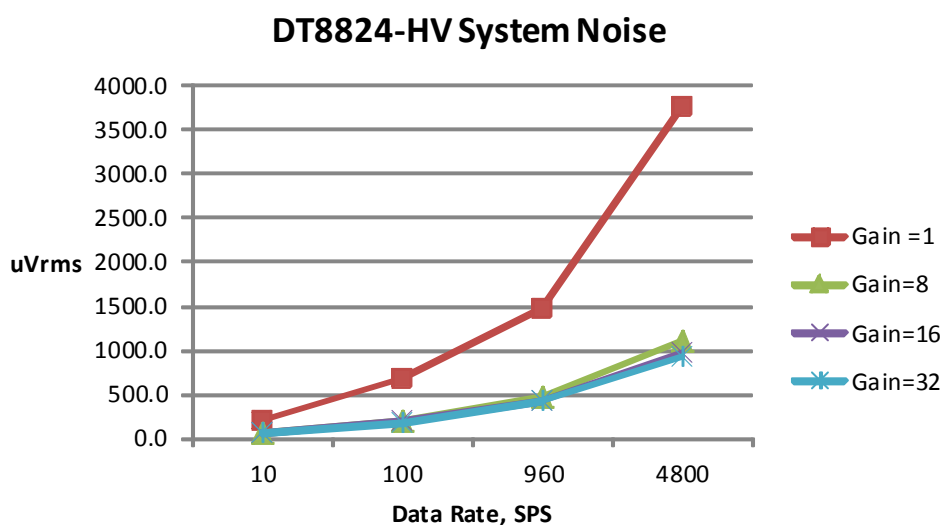


Figure 30: System Noise Specification for the DT8824-HV

Frequency Response and Input Bandwidth

Each channel of the DT8824 and DT8824-HV instrument modules include a dedicated 24-bit Sigma-Delta A/D converter. The ultra-low noise and accuracy of these converters is achieved using an oversampling Sigma-Delta modulator followed by a multi-order Sinc filter and a digital low-pass filter/decimator.

The filter response has a gentle rolloff from DC with a 3 dB signal bandwidth that is determined by the user-selected sampling rate, shown in [Table 10](#).

Table 10: -3 dB Bandwidth

Sampling Frequency	-3 dB Bandwidth Point
Less than or equal to 600 Samples/s	0.24 x sample rate
Greater than 600 Samples/s	0.23 x sample rate

[Figure 31](#) shows the frequency response using a sampling rate of 4800 Samples/s.

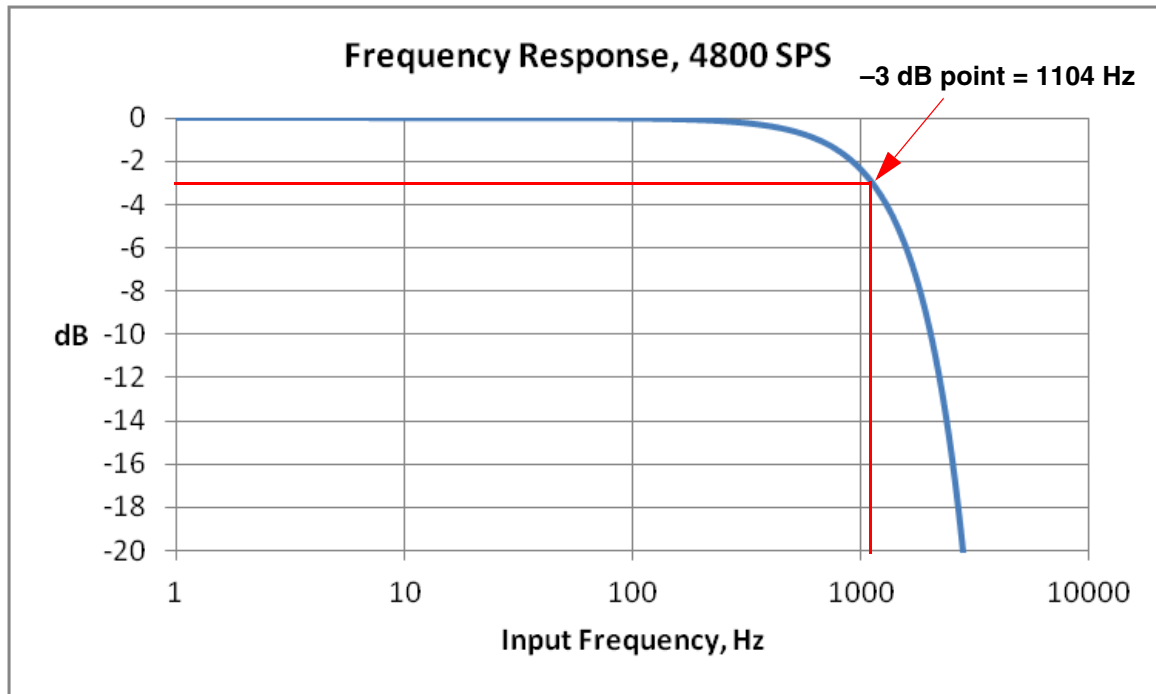


Figure 31: Frequency Response of the DT8824 and DT8824-HV When Using a Sampling Rate of 4800 Samples/s

As you can see, the frequency response of the DT8824 and DT8824-HV gently rolls off from DC due to the filtering of the Sigma-Delta A/D converter. You can use software to apply a correction factor to the acquired data to compensate for the filter response of the A/D converter. The correction factor depends on the input frequency of the signal you are trying to measure and the sampling rate of the instrument module. [Table 11](#) shows the gain correction factors for typical input frequencies and sampling rates.

Table 11: Gain Correction Factors

Frequency of the Input Signal (Hz)	Sampling Rate of the DT8824 or DT8824-HV							
	10 Samples/s	25 Samples/s	60 Samples/s	100 Samples/s	600 Samples/s	960 Samples/s	1600 Samples/s	4800 Samples/s
DC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	1.257	1.035	1.006	1.002	1.000	1.000	1.000	1.000
10	–	3.456	1.168	1.056	1.001	1.001	1.000	1.000
50	–	–	–	–	1.038	1.017	1.006	1.001
60	–	–	–	–	1.055	1.024	1.008	1.001
100	–	–	–	–	1.167	1.068	1.023	1.003
200	–	–	–	–	2.087	1.304	1.095	1.011
500	–	–	–	–	–	6.040	1.791	1.073
1000	–	–	–	–	–	–	–	1.325
2000	–	–	–	–	–	–	–	3.158

Digital Output Specifications

Table 12 lists the specifications for the digital output (DOUT) subsystem on the DT8824 and DT8824-HV.

Table 12: Digital Output Specifications

Feature	DT8824 and DT8824-HV Specifications
Number of digital output lines	4 isolated outputs
Number of ports	1, 4-bit output port
Outputs Output type: Output driver: High output: Low output: Breakdown voltage: Contact impedance:	Solid-state relay CMOS ± 30 V 0.4 V @ 400 mA ± 60 V 1 Ω
Isolation voltage To computer ground: Channel to channel	±500 V ±250 V ^a

- a. Determined by the pin spacing in the 37-pin digital connector. For greater channel-to-channel isolation, use every other digital line; using every other digital line allows ±500 V isolation channel-to-channel.

Power, Physical, and Environmental Specifications

Table 13 lists the power, physical, and environmental specifications for the DT8824 and DT8824-HV.

Table 13: Power, Physical, and Environmental Specifications

Feature	DT8824 Specifications	DT8824-HV Specifications
Power +5 V Standby: +5 V Enumeration: +5 V Power ON: Power Consumption:	500 μ A maximum 100 mA maximum (75 mA typical) 500 mA maximum (420 mA typical) 425 mA current draw	500 μ A maximum 100 mA maximum (75 mA typical) 500 mA maximum (420 mA typical) 425 mA current draw
Physical Dimensions Width: Length: Height: Weight:	8.380 inches (212.85 mm) 9.319 inches (236.7 mm) 1.720 inches (43.69 mm) 31 ounces (880 g)	8.380 inches (212.85 mm) 9.319 inches (236.7 mm) 1.720 inches (43.69 mm) 31 ounces (880 g)
Environmental Operating temperature range: Storage temperature range: Relative humidity:	0° C to 55° C -25° C to 85° C To 95%, noncondensing	0° C to 55° C -25° C to 85° C To 95%, noncondensing

Regulatory Specifications

The DT8824 and DT8824-HV are CE-compliant. [Table 14](#) lists the regulatory specifications for the DT8824 and DT8824-HV.

Table 14: Regulatory Specifications

Feature	Specifications
Emissions (EMI)	FCC Part 15, Class A EN55011:2007 (Based on CISPR-11, 2003/A2, 2006)
Immunity	EN61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use <u>EMC Requirements</u> EN61000-4-2:2009 Electrostatic Discharge (ESD) 4 kV contact discharge, 8 kV air discharge, 4 kV horizontal and vertical coupling planes EN61000-4-3:2006 Radiated electromagnetic fields, 3 V/m, 80 to 1000 MHz; 3 V/m, 1.4 GHz to 2 GHz; 1 V/m, 2 GHz to 2.7 GHz EN61000-4-4:2004 Electrical Fast Transient/Burst (EFT) 1 kV on data cables EN61000-4-6:2009 Conducted immunity requirements, 3 Vrms on data cables 150 kHz to 80 MHz
RoHS (EU Directive 2002/95/EG)	Compliant (as of July 1st, 2006)

Connector Specifications

Table 15 lists the cable and connector specifications for the DT8824 and DT8824-HV.

Table 15: Connector Specifications

Feature	DT8824 and DT8824-HV Specifications
RJ45 Ethernet Connector	Bothhand part number LU1S041C-43-LF
Digital Input/Output Connector	Tyco part number 5747845-4
4-Position Screw Terminal Block	Header: Phoenix Contact 1803293 Plug: Phoenix Contact 1803594
Trigger Bus Connectors	Molex part number 83619-9011

External Power Supply Specifications

Table 16 lists the specifications for the EP361 +5 V external power supply that is used with the DT8824 and DT8824-HV.

Table 16: External Power Supply (EP361) Specifications

Feature	Specifications
Type	Total Power medical power supply (TPES22-050400 or TPEMG24-S050400-7)
Input voltage	Typical 90 - 264 V AC
Input current TPES22-050400	Typical 0.38 A at 115 V AC, 0.15 A at 230 V AC
TPEMG24-S050400-7	Typical 0.347 A at 115 V AC, 0.215 A at 230 V AC
Frequency	47 to 63 Hz
Inrush current TPES22-050400	35 A at 230 V AC typical or less than 30 A by adding thermistor
TPEMG24-S050400-7	6.274 A RMS at 230 V AC
Output voltage	5 V DC
Output current	4.0 A
Output wattage TPES22-050400	Typical 22 - 24 W
TPEMG24-S050400-7	Typical 20 - 24 W
Noise and ripple	1% peak to peak
Regulatory specifications TPES22-050400	UL, N, CE, FCC Class B
TPEMG24-S050400-7	UL, ITE, CE, FCC Class B, Energy Star compliant



Connector Pin Assignments

Analog Input Screw Terminals	108
Digital I/O Connector	109
RJ45 (LVDS) Ethernet Connector	110
External 5V DC Connector	111
LXI Wired Trigger Bus Connector	112

Analog Input Screw Terminals

Figure 32 shows the terminal blocks for each analog input channel on the DT8824 and DT8824-HV instrument modules.

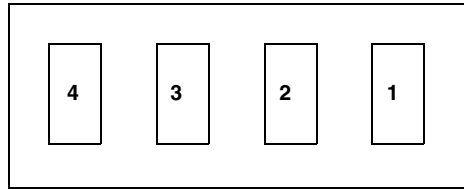


Figure 32: Screw Terminals of the Analog Input Channels

Table 17 summarizes the screw terminal assignments.

Table 17: Screw Terminal Assignments for the Analog Input Channels

Screw Terminals	Signal Description
1	Analog Input +
2	Not Connected
3	Analog Input –
4	Analog Ground

Digital I/O Connector

Figure 33 shows the pin locations of the digital I/O connector on the DT8824 and DT8824-HV.



Figure 33: Digital I/O Connector

Table 18 lists the pin assignments of the digital I/O connector.

Table 18: Digital I/O Connector Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	External Trigger High	9	External Trigger Low
2	No Connect	10	Digital Ground
3	No Connect	11	Digital Ground
4	Digital Output 0 A	12	Digital Output 0 B
5	Digital Output 1 A	13	Digital Output 1 B
6	Digital Output 2 A	14	Digital Output 2 B
7	Digital Output 3 A	15	Digital Output 3 B
8	No Connect		

Note: The outer shell of the connector provides the cable shield to chassis ground.

RJ45 (LVDS) Ethernet Connector

Figure 34 shows the RJ45 (LVDS) Ethernet connector.

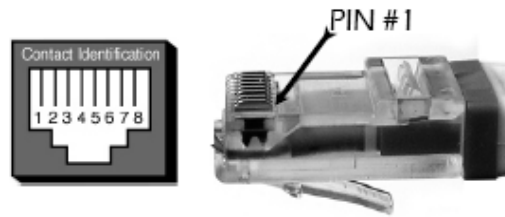


Figure 34: RJ45 (LVDS) Ethernet Connector

Table 19 lists the pin assignments for the RJ45 (LVDS) Ethernet connector on the DT8824 and DT8824-HV.

Table 19: RJ45 (LVDS) Ethernet Connector Pin Assignments

Pin	Description
1	TX +
2	TX –
3	RX +
4	Reserved
5	Reserved
6	RX –
7	Reserved
8	Reserved

External 5V DC Connector

Figure 34 shows the 5 V DC connector.



Figure 35: 5 V DC Connector

Table 19 lists the pin assignments for the 5 V DC connector on the DT8824 and DT8824-HV.

Table 20: 5 V DC Connector Pin Assignments

Pin	Description	Pin	Description
1	+5 V	3	GND
2	+5 V	4	GND

LXI Wired Trigger Bus Connector

Figure 34 shows the LXI Wired Trigger Bus connector.

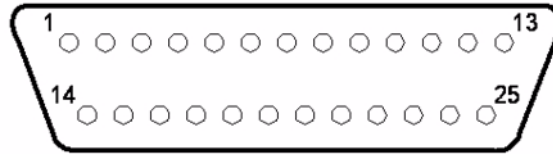


Figure 36: 5 V DC Connector

Table 19 lists the pin assignments for the LXI Wired Trigger Bus connector on the DT8824 and DT8824-HV.

Table 21: LXI Wired Trigger Bus Connector Pin Assignments

Pin	Description	Pin	Description
1	+3.3 V	14	Signal 0+
2	+3.3 V Return	15	Signal 0–
3	Signal 1+	16	Reserved
4	Signal 1–	17	Signal 2+
5	GND	18	Signal 2–
6	Signal 3+	19	GND
7	Signal 3–	20	Signal 4+
8	GND	21	Signal 4–
9	Signal 5+	22	GND
10	Signal 5–	23	Signal 6+
11	Reserved	24	Signal 6–
12	Signal 7+	25	Reserved
13	Signal 7–		



Configuring Network Settings on Your PC

Configuring the PC to Use Auto-IP	114
Specifying a Static IP Address for the DT8824 or DT8824-HV	117
Reconfiguring the PC to Use a Static IP Address	118

Configuring the PC to Use Auto-IP

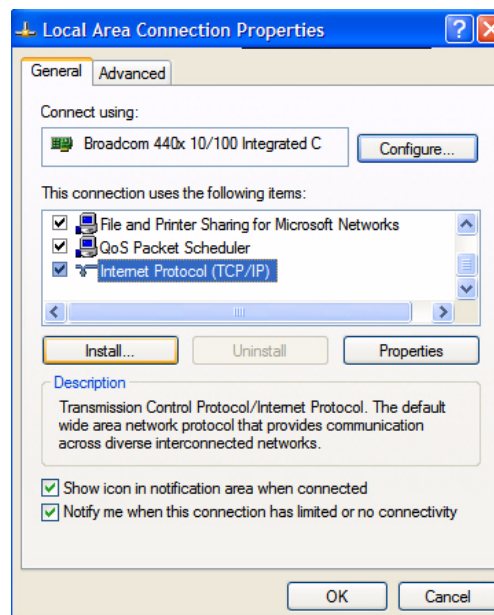
Once your DT8824 or DT8824-HV is connected to the LAN and powered on, the instrument module automatically requests an Ethernet address from a DHCP (Dynamic Host Configuration Protocol) server, if available, and a host name from a DNS (Dynamic Domain Name Service) server, if available.

If these services are not available on the LAN, the instrument module uses Auto-IP to set up its TCP/IP configuration. In this case, the IP address will be in the range of 169.254.0.0 to 169.254.255.255 with a subnet mask of 255.255.255.0.

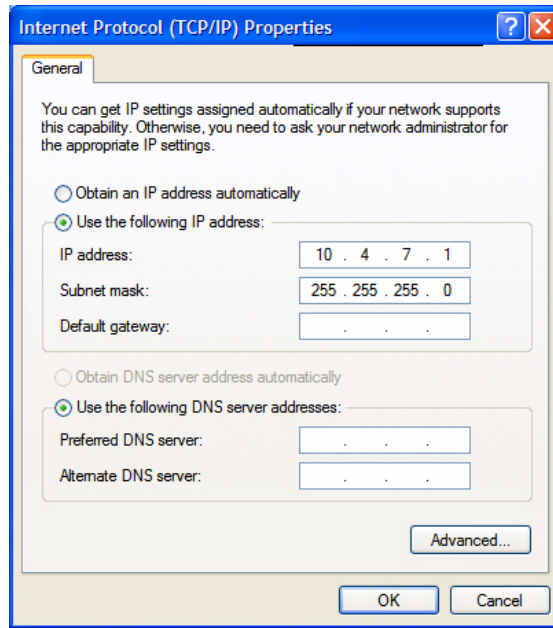
If your LAN does not support a DHCP server and your PC is configured to use a static IP address, you must temporarily reconfigure the PC to use Auto-IP before setting up the DT8824 or DT8824-HV using the following procedure.

Note: This procedure may differ slightly depending on your computer and the version of Windows you are using. Windows XP instructions are shown here. Consult your system administrator and/or the documentation for your operating system if you need additional help.

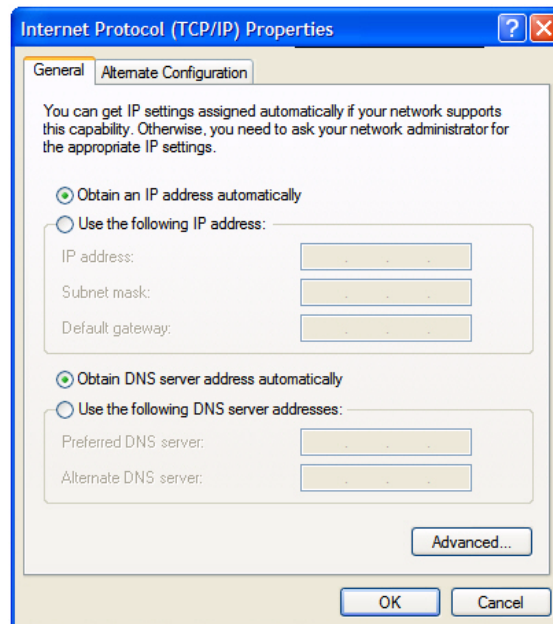
1. From the Windows Start menu, click **Settings**, and then click **Network Connections**.
2. Right-click **Local Area Connection**, and select **Properties**.



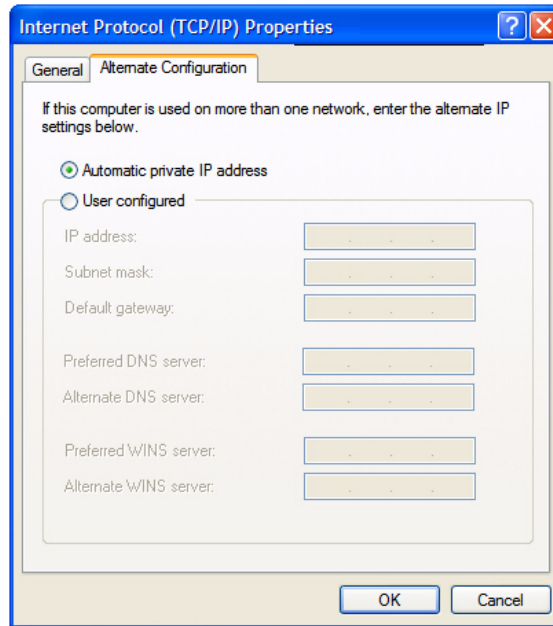
3. In the General tab window, double-click **Internet protocol (TCP/IP)**. (If a TCP/IP selection is not listed, click **Install**, select **Protocol**, click **Add**, select the TCP/IP protocol, and click **Install**, and repeat step 3).



4. **IMPORTANT:** Write down the IP address and subnet mask that is displayed! You will need this information later.
5. Select **Obtain an IP address automatically**, and then click **OK**.



6. Select the **Alternate Configuration** tab, and ensure that **Automatic private IP address** is selected.



7. Renew the IP address of the computer. From the Windows Start menu, click **Settings** -> **Network Connections** -> **Local Area Connection** -> **Support** -> **Repair**.

Or, if you prefer to do this from the command prompt window, click **Run** from the Windows Start menu, enter **cmd**, and click **OK** to bring up the command prompt window. Then, from the command prompt window, enter:

```
ipconfig /renew  
ipconfig /all
```

renews the IP address
checks the IP address

Specifying a Static IP Address for the DT8824 or DT8824-HV

To specify a static IP address for the DT8824 or DT8824-HV, use the LAN Configuration page of the web interface as follows:

1. From the LAN Configuration page, click **Modify**.
2. Specify the username as **admin**, and specify the password (the default is **admin**). You can change the password, if you desire.
3. Uncheck the checkbox called **Automatic private IP address enabled**.
4. Click **Static**.
5. Specify a static IP address for the DT8824 or DT8824-HV, so that it will be on the same subnet as your PC:

The screenshot shows the LAN configuration page for a DT8824 device. The interface includes a sidebar with navigation options like Device information, Configuration, LAN, Analog input, Clock, Trigger, AD Buffer, Measurement & control, Acquisition, Digital output, and Help. The main content area is titled 'LAN configuration' and contains a table of settings. The 'IP address assignment' section is expanded to show 'Static' configuration with fields for IP (192.168.187.163), Mask (255.255.255.0), and Gateway (192.168.187.218). Other settings include Hostname/Bonjour name (DT8824_Hw_Lab), Description, SNTP server (192.43.244.18 Primary, 132.163.4.101 Secondary), Time zone (GMT -5 hours), Event domain (0), and Password (admin). Buttons for 'Save changes' and 'Discard changes' are visible at the top of the configuration area.

Item	Value
Hostname/Bonjour name	DT8824_Hw_Lab
Description	
IP address assignment	<input type="radio"/> DHCP <input type="checkbox"/> Automatic private IP address enabled <input checked="" type="radio"/> Static Static IP Address configuration 192.168.187.163 IP 255.255.255.0 Mask 192.168.187.218 Gateway
SNTP server	192.43.244.18 Primary 132.163.4.101 Secondary
Time zone	GMT -5 hours
Event domain	0
Password	admin

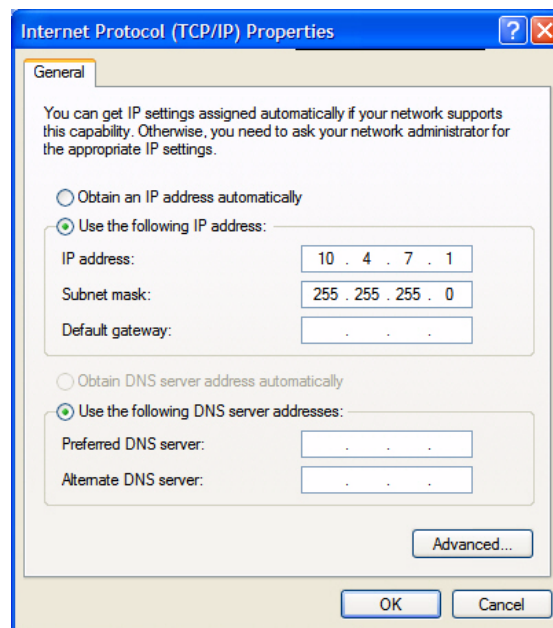
Note: You need a Simple Network Time Protocol (SNTP) time server on the LAN; otherwise, you need to provide a gateway. See your network administrator for more details.

Reconfiguring the PC to Use a Static IP Address

After you have set up your DT8824 or DT8824-HV, you can reconfigure your PC to use a static IP address.

Note: This procedure may differ slightly depending on your computer and the version of Windows you are using. Windows XP instructions are shown here. Consult your system administrator and/or the documentation for your operating system if you need additional help.

1. From the Windows Start menu, click **Settings**, and then click **Network Connections**.
2. Right-click **Local Area Connection**, and select **Properties**.
3. In the General tab window, double-click **Internet protocol (TCP/IP)**.
4. Select **Use the following IP address:**, specify the static IP address and subnet mask that was initially assigned to the PC (see [page 114](#)), and click **OK**.



5. Renew the IP address of the computer. From the Windows Start menu, click **Settings** -> **Network Connections** -> **Local Area Connection** -> **Support** -> **Repair**.

Or, if you prefer to do this from the command prompt window, click **Run** from the Windows Start menu, enter **cmd**, and click **OK** to bring up the command prompt window. Then, from the command prompt window, enter:

```
ipconfig /renew           renews the IP address  
ipconfig /all           checks the IP address
```



Using the Bonjour Discovery Utility

If you wish, you can use the Bonjour utility from Apple®, rather than the Eureka utility to discover devices on your network.

Once you have downloaded and installed the Bonjour SDK from Apple (<http://developer.apple.com/opensource/>), open your browser, and then open the Bonjour Explorer bar. To do this using Internet Explorer, for example, follow these steps:

1. From Internet Explorer, click the **View** menu.
2. Click **Explorer Bars**.
3. Click **Bonjour**.
A list of devices on the network appears in the left pane.
4. Double-click the DT8824 or DT8824-HV device to see the web pages for that instrument module.

A screen similar to the following appears:

The screenshot shows a Windows Internet Explorer browser window displaying the Bonjour Explorer bar on the left and the DT8824 web interface on the right. The Bonjour Explorer bar lists several devices, including DT8824 - Linda's office. The DT8824 web interface shows the device information page, which includes a table of device details.

Item	Value
Manufacturer	Data Translation Inc.
Instrument model	DT8824
Instrument type	4-channel High Accuracy DAQ Module
Firmware revision	0.0.4.1
FPGA revision	3
Serial number	000000001
Description*	DT8824 - Linda's office
LXI Class	C
LXI version	1.3
Hostname*	DT8824.local
MAC address	00:04:F3:02:2E:96
IP address*	192.43.218.96 (DHCP)
Link status	100 Mbps, Full duplex
VISA resource string	TCPIP::DT8824.local::INSTR TCPIP::DT8824.local::5025::SOCKET
SNTP server*	192.43.244.18
Current Time	Tue Nov 16 10:38 AM 2010
Time Zone*	GMT -5 hour

Note that Bonjour automatically resolves the hostname and description.

The screenshot shows a Windows Internet Explorer browser window with the address bar displaying `http://dt8824.local/`. The Bonjour sidebar on the left lists several devices, including `DT8824 - Linda's office`. The LAN configuration page shows a table with 'Item' and 'Value' columns. The 'Hostname' is `DT8824-96` and the 'Description/Service name' is `DT8824 - Linda's office`. The DHCP section is selected, and the 'Automatic private IP address enabled' checkbox is checked. The IP address assignment table shows `192.168.187.163` for IP, `255.255.255.0` for Mask, and `192.168.187.218` for Gateway.

The Bonjour/mDNS resolved Hostname is the user-configured hostname appended with `.local`. You can use the resolved Hostname instead of the device's IP address to communicate with the device. The hostname does not change unless more than one device is configured with the same hostname. This feature is especially useful when IP addresses are assigned by DHCP and may change.

If more than one device is configured with the same Hostname and/or Description/Service name, Bonjour resolves each hostname by appending a number to the configured Hostname and/or Description/Service name. In this case, the LAN configuration page and the Device Info page show the unique Hostnames and Description/Service names.



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ISO-Channel Technology

DT8824 and DT8824-HV instrument modules use ISO-Channel™ technology to eliminate common mode noise and ground loop problems.

This appendix includes two white papers that describe the benefits of using ISO-Channel technology.

Why ISO-Channel Technology is Your Best Return on Investment

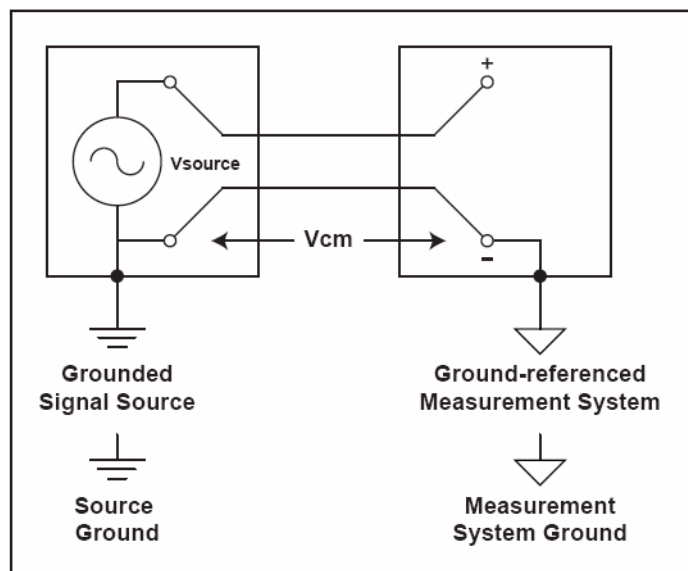
When connecting signal sources to an instrument, it is important to eliminate the sources of error that can contribute to inaccuracies in your measurements. In most measurement instruments, this burden is on the customer. Instruments that use ISO-Channel technology, however, solve this problem for you – saving you tremendous setup and debug time and reducing costly grounding problems when connecting signals.

In today's economy, we understand that every equipment decision needs to make good fiscal sense. This section describes why instruments with ISO-Channel technology offer you the best return on investment.

Understanding Ground Loops

When measuring signals, users often assume that the grounds of their signals and their measurement system are at the same potential. However, these ground potentials can differ by hundreds of millivolts.

If the difference in ground potential is large enough, current flows between the signal and your measurement system; this is called a ground loop (see [Figure 37](#)). Ground loops contribute noise that can greatly affect the accuracy of your measurements, especially when you are trying to measure low level signals precisely. Ground loop problems are the most common source of error in all measurements! Eliminating these errors, therefore, is critical when taking high accuracy measurements.



When a ground loop exists, the measured voltage, V_{out} , is the sum of the signal voltage, V_{source} , and the ground potential difference, V_{cm} , which exists between the signal source ground and the measurement system ground. These errors often appear as transients or periodic signals in the measurement. For example, if a ground loop is formed with 50 Hz or 60 Hz AC power lines, the unwanted AC signal appears as a periodic voltage error in the measurement.

Figure 37: Measurement System with a Ground Loop

ISO-Channel Eliminates Ground Loops and Increases Common-Mode Rejection

ISO-Channel technology eliminates ground loop problems by using a **differential, isolated, floating front-end**. As you can see in [Figure 38](#), a floating voltage signal is not referenced to system ground.

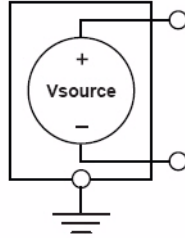


Figure 38: Floating Signals

To measure floating signal sources, ISO-Channel technology uses differential analog input signals, a 24-bit Delta-Sigma A/D converter for each channel, and channel-to-channel isolation, as shown in [Figure 39](#).

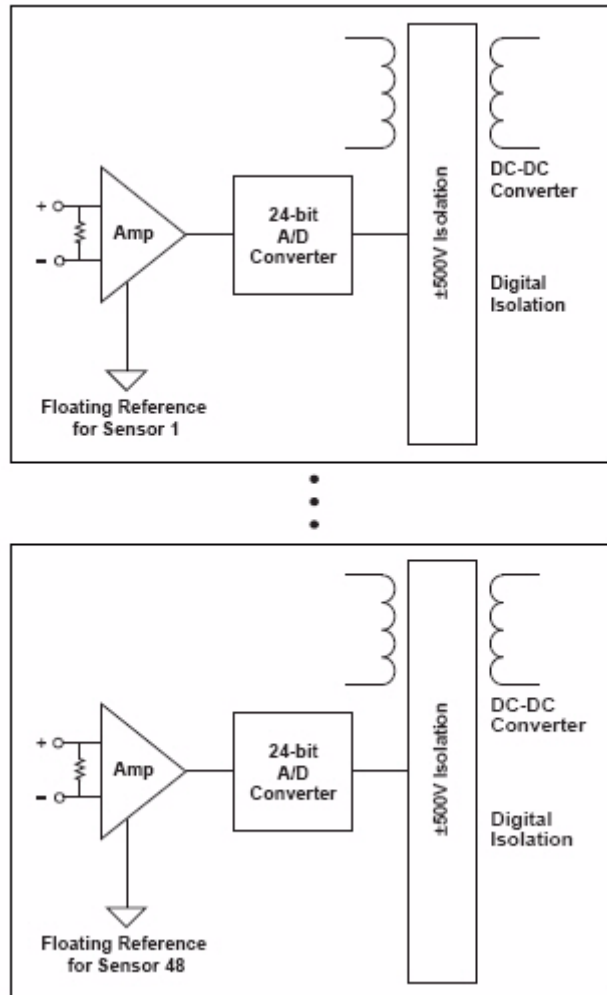


Figure 39: ISO-Channel Technology

Floating, Differential Signals

ISO-Channel technology implements a virtually ideal differential measurement system that reads only the potential difference between the positive and negative terminals of the amplifier. For each channel, the differential signals are isolated in that they are referenced to a ground reference point that is not connected to earth ground. Ground loop problems are eliminated by ensuring that only one ground reference is used for each channel in the measurement system. The signal sources are isolated from each other and from the measurement instrument.

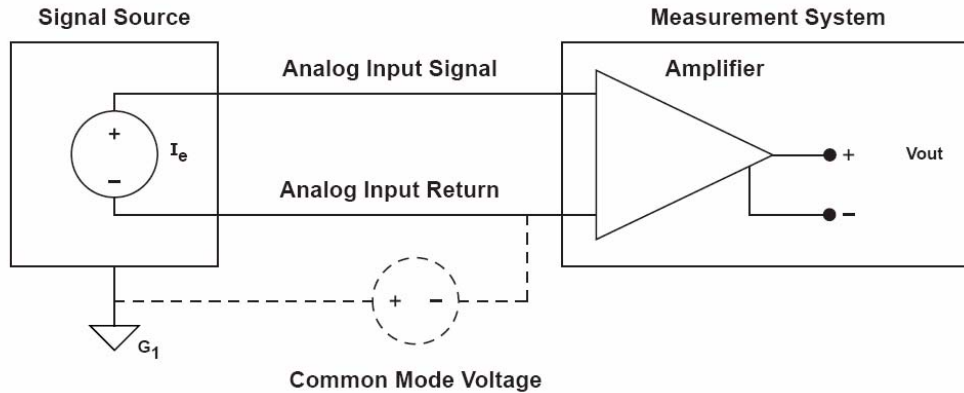


Figure 40: Differential Signals and Common-Mode Voltage

When the measurement instrument and signal source are at different ground potentials, the difference in potential is called common-mode voltage. The measurement instrument cannot discern between the signal and the common-mode voltage believing that the sum of these voltages is the actual signal. Of course, the common-mode potential is simply an error.

ISO-Channel technology provides common-mode rejection of 150 dB, which contributes an almost imperceptible error (33.5 million to 1) to V_{out} . Compare this to traditional data acquisition measurement instruments, which typically provide only 80 dB of common-mode rejection and therefore, contribute much more error on the order of 1 part per 10,000.

Simultaneous Architecture

Many measurement instruments on the market today provide multiplexed architectures, where one A/D is used to measure multiple channels. In this kind of architecture, if one channel goes down, all channels go down.

ISO-Channel technology, on the other hand, uses a simultaneous architecture, where each channel has its own dedicated 24-bit Delta-Sigma A/D, as shown in [Figure 41](#).

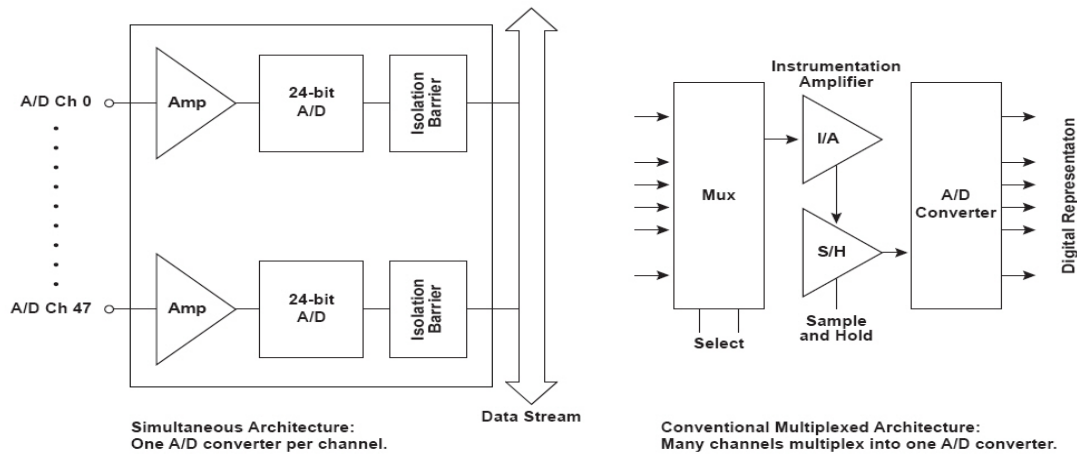


Figure 41: Simultaneous vs. Multiplexed Architectures

Channel-to-Channel Isolation

Besides differential inputs, floating channels, and a simultaneous architecture, ISO-Channel technology provides channel-to-channel isolation, not just isolation from the analog front-end to the computer ground. With this kind of isolation, the channels are individually isolated from each other and from other system components.

Typically, instrument manufacturers have used relays, isolation amplifiers, or optical isolation to provide channel-to-channel isolation. These methods have the following advantages and limitations:

- Relays – This technology provides good galvanic separation and can provide good accuracy and thermal properties, but relays are slow as they operate on one channel at a time (10 cycles/s), wear out over time, and are sensitive to magnetic fields. If one relay sticks, staying closed, the entire system fails!
- Isolation amplifiers – Isolation amplifiers are used in multiplexed architectures. While they are solid-state, they are expensive, not as accurate, require more power, and generate more noise and heat than other solutions.
- Optical isolation - Optical isolation is good in digital isolation systems but causes accuracy problems in analog isolation systems. It is also subject to long-term drift and requires considerably more power.

With ISO-Channel technology, the A/D is on the sensor side and has its own custom DC/DC converter. Then, optical or transformer isolation is used to transfer the A/D output data (the sensor data) **digitally**. And, due to the simultaneous architecture of ISO-Channel technology, all data is transferred in parallel.

Summary

ISO-Channel technology offers built in system redundancy to protect your investment - if one channel fails, the remaining channels are completely unaffected! Instruments with ISO-Channel technology also adapt to the sensors that they are connected to, allowing a different ground reference for each signal without introducing errors! For these key reasons, ISO-Channel technology protects against problems in the field, and thereby, reduces costs – what a great return on your investment.

Floating Signal Inputs Offer New Application Advantages

Precision measurement systems are often limited in that all inputs are connected to a single ground. Typically, multiplexer input configurations are set up this way, since all signal inputs are connected to the same return. Even differential input configurations use the same ground reference. The result is that accuracy and flexibility for accurate measurements can be severely compromised when noise or common mode voltage is present (see [Figure 42](#)).

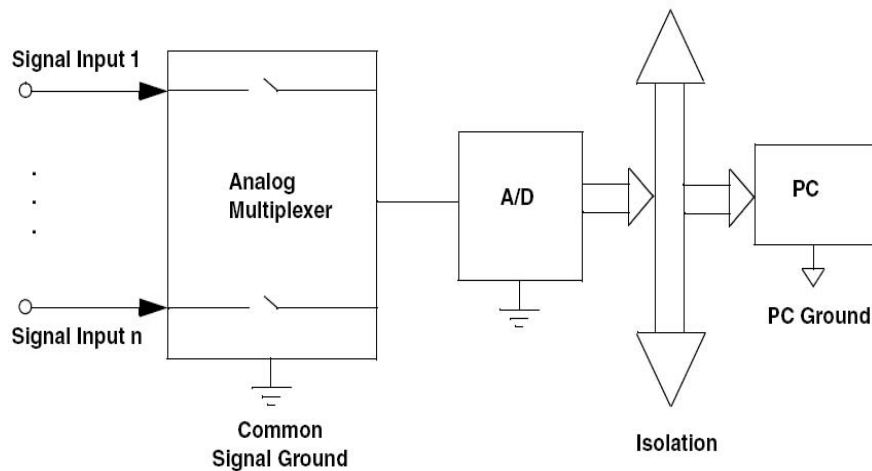


Figure 42: In multiplexed systems, all inputs are connected to a signal ground, which can cause errors when noise or common mode voltage is present.

Crosstalk from one input signal can easily be reflected onto another input. The design movement to an A/D per channel can help this problem. But that is not sufficient in many cases (see [Figure 43](#)).

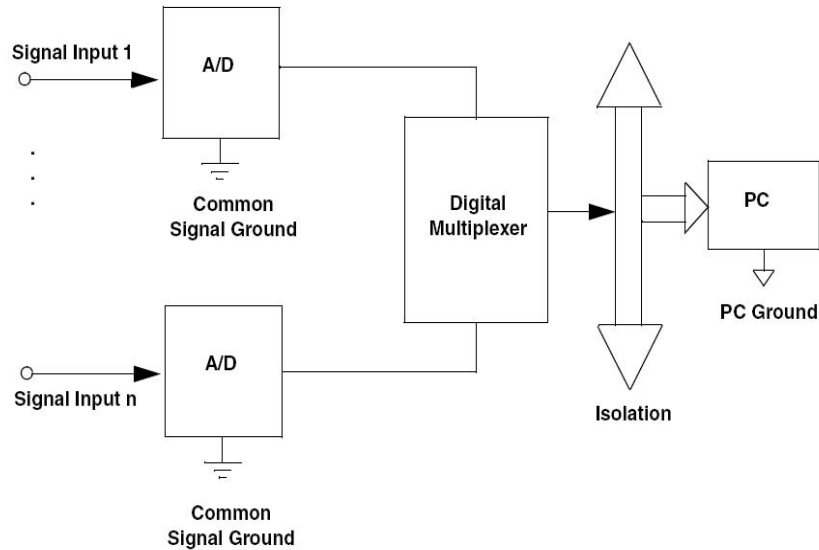


Figure 43: Even when using an A/D per channel, noise can contribute errors to your measurement results.

To minimize noise and ground loops, some newer systems offer isolation between the input signal ground reference and the computer ground. This effectively separates the computer ground from the measurement portion of the system. But still, there is no isolation between input sensor channels, which is a common source of error and frustration for user applications. Why?

The assumption is made that all signal sources have the same exact ground reference. After all...ground is ground...isn't it? Often this is not the case. For example, thermocouples for measuring temperature may be dispersed widely throughout an industrial setting, such as in the manufacture of air frames or in curing ovens. Grounds for these sensors may differ by several volts or even hundreds of volts. The resulting common mode voltage causes current to flow in the signal path, producing serious errors, which are very hard to diagnose and correct.

Isolating Each Input

Oftentimes it is NOT apparent that ground references from various sensors such as thermocouples, RTDs, strain gages, etc., are at different voltage potentials. Factors that can contribute to these ground differences are extensive wiring from long runs, crosstalk from motors or generators, or high source impedance from the signal source. Without recognizing this extraneous voltage, the measurement system "sees" this noise or common mode voltage as the actual signal. These unwanted noise sources lead to measurement errors (see [Figure 44](#)).

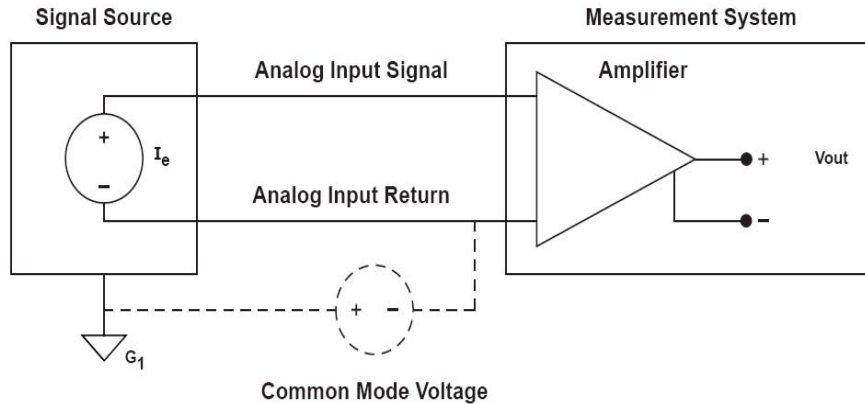


Figure 44: Common mode voltage is present when different ground potentials exist in your measurement system.

In many applications, noise is a fact and a common occurrence. To prevent this noise from entering the signal path, the signal must be isolated on a channel-to-channel basis as well as from the PC ground reference.

Technology breakthroughs now allow channel-to-channel isolation to be accomplished effectively. Using an A/D per channel with a DC-DC converter for each A/D allows each signal input channel to be isolated from one another (see [Figure 45](#)). With this individual isolation per channel, each input channel can now “float” to its own ground reference. Separate channels are then effectively isolated from each other by the isolation barrier, up to ± 500 V for each channel on the DT8824 or ± 1000 V for each channel on the DT8824-HV. Now any noise or common mode voltage to that level is eliminated from the system measurement, allowing pristine results from each sensor without any interaction from any other sensor.

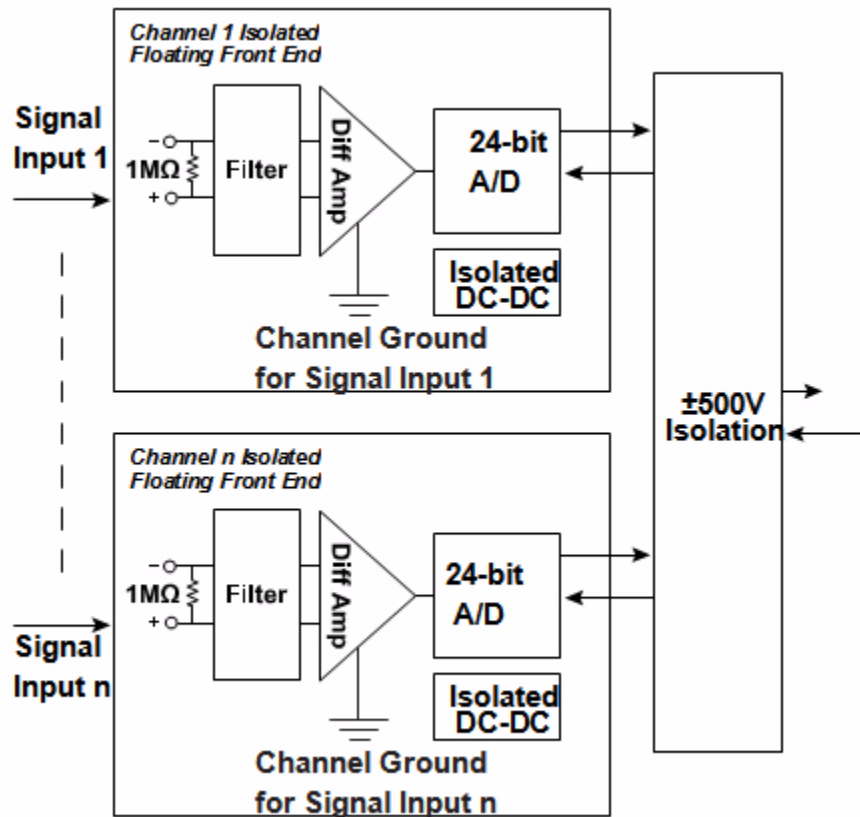


Figure 45: An A/D per channel and a DC-to-DC converter for each A/D provides channel-to-channel isolation, where each signal can float to its own ground reference.

Input channel return references are effectively separate instruments when the inputs are isolated. This individual isolation now allows the ground reference of each channel to measure at the level of this common mode voltage, up to ± 500 V on the DT8824 and ± 1000 V on the DT8826-HV. This capability allows some new application ideas to flourish.

Measurement of two signals, as shown in [Figure 46](#), can now have essentially 3 separate ground references: each signal input (signal 0 and signal 1) has a separate return reference; additionally, the PC has a third ground reference. This scheme can be extended for many signal inputs, such as 48 inputs in a single small measurement box, for a total of 49 different ground references.

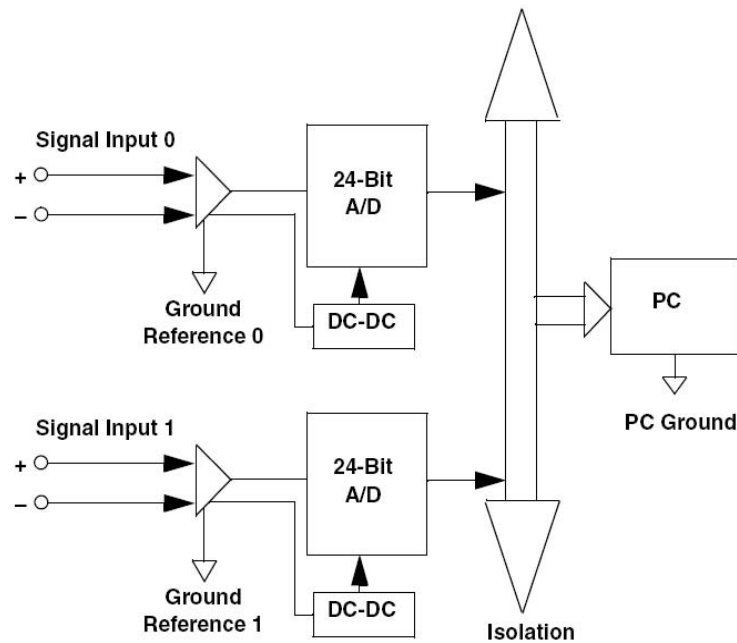


Figure 46: When measuring two input signals with channel-to-channel isolation, three ground references are provided (signal 0, signal 1, and PC ground).

New Application Derived from Isolated Channels

A typical application of measuring 48 channels of varying voltages from sensors, such as batteries, thermocouples, RTDs pressure sensors, etc., often must use different instruments because of the various ranges needed. Standard ranges of ± 10 V may handle some applications, but not others, to the required resolution and accuracy.

With isolation per channel, combinations of channels can be used to measure higher voltage ranges. [Figure 47](#) shows a configuration of 2 separate channels “ganged up” to measure a signal of up to 20 V. Normally each input would measure ± 10 V. But, by using two identical channels, a range of twice that level can be accommodated. The output readings of each A/D are then summed to give the very accurate result. This is possible because the isolation between channels allows the return of the first channel to “float up” to a level halfway between the input signal. This reflects the accurate impedance balance of each input, and the high common mode rejection of each stage.

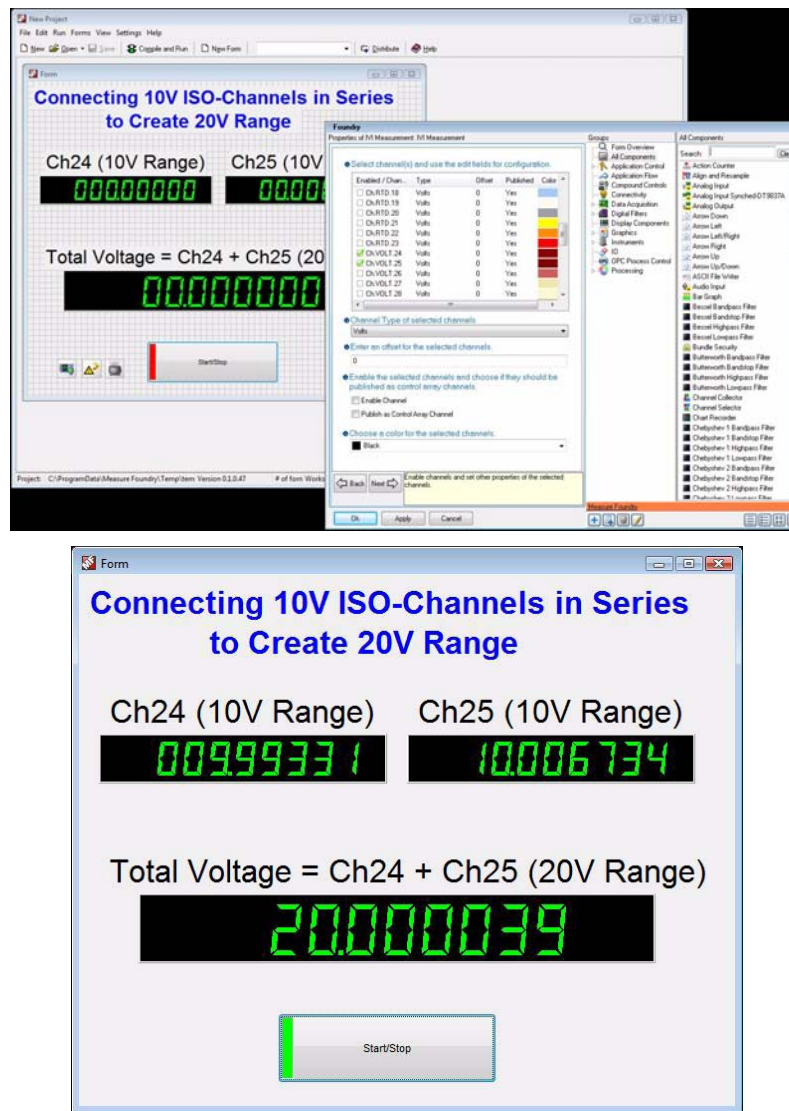


Figure 47: Because each floating signal input is isolated from each other, you can use two separate channels, normally each configured for $\pm 10\text{V}$, to measure a $\pm 20\text{V}$ signal. Simply sum the result of each channel to get your result.

Summary

When you need the highest accuracy and the most flexibility from your measurement system, ensure that floating signal inputs are provided. This approach allows noise-free measurements in tough industrial settings. It also saves countless days of tracking down erroneous readings that inevitably result if these precautions are not taken from the project's beginning.

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