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UM-19985-AD

DT9834 Series 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.

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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.

Table of Contents

About this Manual

This manual describes how to install and set up your DT9834 Series module and device driver, and verify that your module is working properly.

This manual also describes the features of the DT9834 Series modules, the capabilities of the DT9834 Series Device Driver, and how to program the DT9834 Series modules using the DT-Open Layers for .NET Class Library™ software. Troubleshooting information is also provided.

Notes: For information on checking system requirements, installing the software, and viewing the documentation, refer to the README file on the OMNI CD.

For more information on the class library, refer to the *DT-Open Layers for .NET Class Library User's Manual*. If you are using the DataAcq SDK or a software application to program your device, refer to the documentation for that software for more information.

The DT9834 Series module is available either installed in a metal BNC connection box, an STP (screw terminal panel) connection box (for the 32-analog input channel version only), or as a board-level OEM version that you can install in your own custom application. If the information in this manual applies to all versions of the DT9834 Series module, the manual uses the product name "DT9834 Series module." Otherwise, the specific product name is mentioned.

Intended Audience

This document is intended for engineers, scientists, technicians, or others responsible for using and/or programming the DT9834 Series modules for data acquisition operations in the Microsoft® Windows Vista®, Windows 7, or Windows 8 operating system. 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 DT9834 Series module, as well as the supported software and accessories for the modules.
- Chapter 2, "Setting Up and Installing the Module," describes how to install a DT9834 Series module, how to apply power to the module, and how to configure the device driver.
- Chapter 3, "Wiring Signals to the BNC or STP Connection Box," describes how to wire signals to a DT9834 Series BNC or STP connection box.
- Chapter 4, "Verifying the Operation of a Module," describes how to verify the operation of the DT9834 Series module with the Quick DataAcq application.

- Chapter 5, "Principles of Operation," describes all of the features of the DT9834 Series module and how to use them in your application.
- Chapter 6, "Supported Device Driver Capabilities," lists the data acquisition subsystems and the associated features accessible using the DT9834 Series Device Driver.
- Chapter 7, "Troubleshooting," provides information that you can use to resolve problems with the DT9834 Series module and device driver, should they occur.
- Chapter 8, "Calibration," describes how to calibrate the analog I/O circuitry of the DT9834 Series modules.
- Appendix A, "Specifications," lists the specifications of the DT9834 Series module.
- Appendix B, "Connector Pin Assignments and LED Status Indicators," shows the pin assignments for the connectors and the screw terminal assignments for the screw terminals on the DT9834 Series modules and accessory panels.
- Appendix C, "Ground, Power, and Isolation," describes the electrical characteristics of the DT9834 Series modules.
- 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 DT9834 Series modules:

- *Benefits of the Universal Serial Bus for Data Acquisition.* This white paper describes why USB is an attractive alternative for data acquisition. It is available on the Data Translation web site (www.mccdaq.com).
- *QuickDAQ User's Manual* (UM-24774). This manual describes how to create a QuickDAQ application to acquire and analyze data from DT-Open Layers data acquisition devices.
- *DT-Open Layers for .NET User's Manual* (UM-22161). For programmers who are developing their own application programs using Visual C# or Visual Basic .NET, this manual describes how to use the DT-Open Layers for .NET Class Library to access the capabilities of Data Translation data acquisition devices.
- *DataAcq SDK User's Manual* (UM-18326). For programmers who are developing their own application programs using the Microsoft C compiler, this manual describes how to use the DT-Open Layers DataAcq SDK™ to access the capabilities of Data Translation data acquisition devices.

- *DAQ Adaptor for MATLAB* (UM-22024). This document describes how to use Data Translation's DAQ Adaptor to provide an interface between the MATLAB Data Acquisition subsystem from The MathWorks and Data Translation's DT-Open Layers architecture.
- *LV-Link Online Help*. This help file describes how to use LV-Link™ with the LabVIEW™ graphical programming language to access the capabilities of Data Translation data acquisition devices.
- Microsoft Windows Vista, Windows 7, or Windows 8 documentation.
- USB web site (http://www.usb.org).

Where To Get Help

Should you run into problems installing or using a DT9834 Series module, the Data Translation Technical Support Department is available to provide technical assistance. Refer to Chapter 7 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).

1

Overview

DT9834 Hardware Features

The DT9834 Series is a family of high-performance, multifunction data acquisition modules, shown in Figure 1, for the USB (Ver. 2.0 or Ver. 1.1) bus.

Figure 1: DT9834 Series Modules (BNC Box Version Shown)

The key hardware features of the DT9834 Series modules are as follows:

- Available either installed in a metal BNC connection box, STP connection box (for the 32-analog input channel version only) or as a board-level OEM version that you can install in your own custom application.
- Simultaneous operation of analog input, analog output, digital I/O, and counter/timer subsystems.
- Analog input subsystem:
  - 12-bit or 16-bit A/D converter. The resolution depends on the model you purchase.
  - Throughput rate up to 500 kSamples/s (aggregate).
  - Up to 32 single-ended or 16 differential analog input channels. The channel type and the number of channels provided depend on the model you purchase. If you do not intend to perform analog input operations, you can also purchase a DT9834 Series module that contains no analog input channels.
  - Programmable gain of 1, 2, 4, or 8 provides input ranges of ±10, ±5, ±2.5, and ±1.25 V.
  - 1024-location channel-gain list. You can cycle through the channel-gain list using continuous scan mode or triggered scan mode. The maximum sampling rate when using the channel-gain list is 500 kSamples/s (aggregate).

- Analog output subsystem:
  - Four 12-bit or 16-bit D/A converters. The resolution depends on the model you purchase. If you do not intend to perform analog output operations, you can also purchase a DT9834 Series module that contains no D/A converters.
  - You can simultaneously update all four DACs at up to 500 kS/s per channel.
  - Output range of ±10 V.
  - The DACs are deglitched to prevent noise from interfering with the output signal.
  - Output channel list. You can cycle through the output channel list using continuous output mode or waveform generation mode.
- Digital I/O subsystem:
  - One digital input port, consisting of 16 digital input lines. You can program any of the first eight digital input lines to perform interrupt-on-change operations. For modules that support analog input channels, you can read the value of the digital input port using the analog input channel-gain list.
  - One digital output port, consisting of 16 digital output lines. For modules that support analog output channels, you can update the value of the digital output port using the output channel list.
  - An additional dynamic digital output line that changes state whenever an analog input channel is read.
- Five 32-bit counter/timer (C/T) channels that perform event counting, up/down counting, frequency measurement, edge-to-edge measurement, continuous pulse output, one-shot, and repetitive one-shot operations. You can read the value of one or more of the C/T channels using the analog input channel-gain list.
- External or internal clock source.
- Trigger operations using a software command, an analog threshold value, or an external digital trigger.
- 500 V galvanic isolation barrier that prevents ground loops to maximize analog signal integrity and protect your computer.

The key differences among the DT9834 Series modules are summarized in Table 1. Note that all modules provide 16 digital input lines, 16 digital output lines, five counter/timers, and a throughput rate of up to 500 kSamples/s.

OEM packaging refers to the board-level version; the power supply is not included.

Table 1: Summary of DT9834 Series Modules

Module	Analog Inputs	Analog Outputs	Resolution	Packaging
DT9834-00-4-12-OEM	None	4	12 bits	OEM
DT9834-00-4-12-BNC	None	4	12 bits	BNC[a]
DT9834-00-4-16-OEM	None	4	16 bits	OEM
DT9834-00-4-16-BNC	None	4	16 bits	BNC[a]
DT9834-16-0-12-OEM	16 single-ended or 8 differential[b]	0	12 bits	OEM
DT9834-16-0-12-BNC	16 single-ended[c]	0	12 bits	BNC[d]
DT9834-08-0-12-BNC	8 differential	0	12 bits	BNC[e]
DT9834-16-0-16-OEM	16 single-ended or 8 differential[b]	0	16 bits	OEM
DT9834-16-0-16-BNC	16 single-ended[c]	0	16 bits	BNC[d]
DT9834-08-0-16-BNC	8 differential	0	16 bits	BNC[e]
DT9834-16-4-12-OEM	16 single-ended or 8 differential[b]	4	12 bits	OEM
DT9834-16-4-12-BNC	16 single-ended[c]	4	12 bits	BNC[f]
DT9834-08-4-12-BNC	8 differential	4	12 bits	BNC[g]
DT9834-16-4-16-OEM	16 single-ended or 8 differential[b]	4	16 bits	OEM
DT9834-16-4-16-BNC	16 single-ended[c]	4	16 bits	BNC[f]
DT9834-08-4-16-BNC	8 differential	4	16 bits	BNC[g]
DT9834-32-0-16-STP	32 single-ended or 16 differential[b]	0	16 bits	STP[h]
DT9834-32-0-16-OEM	32 single-ended or 16 differential[b]	0	16 bits	OEM

a. A BNC connection box with no BNCs for analog inputs, 4 BNCs for analog outputs, 1 BNC for an external DAC clock, and 1 BNC for an external DAC trigger.
b. Software-selectable.
c. For single-ended-only BNC modules, you must specify the 16 single-ended channels through software; eight differential channels is the default software configuration.
d. A BNC connection box with 16 BNCs for single-ended analog inputs, no BNCs for analog outputs, 1 BNC for an external A/D clock, and 1 BNC for an external A/D trigger.
e. A BNC connection box with 8 BNCs for differential analog inputs, no BNCs for analog outputs, 1 BNC for an external A/D clock, and 1 BNC for an external A/D trigger.
f. A BNC connection box with 16 BNCs for single-ended analog inputs, 4 BNCs for analog outputs, 1 BNC for an external A/D clock, 1 BNC for an external DAC clock, 1 BNC for an external A/D trigger, and 1 BNC for an external DAC trigger.
g. A BNC connection box with 8 BNCs for differential analog inputs, 4 BNCs for analog outputs, 1 BNC for an external A/D clock, 1 BNC for an external DAC clock, 1 BNC for an external A/D trigger, and 1 BNC for an external DAC trigger.
h. An STP connection box with screw terminals for connecting up to 32 single-ended or 16 differential analog inputs, 16 digital inputs, 16 digital outputs, 5 counter/timers, an external A/D clock, and an external A/D trigger.

Supported Software

The following software is available for use with the DT9834 Series modules and is on the Data Acquisition OMNI CD:

- **DT9834 Series Device Driver –** The device driver allows you to use a DT9834 Series module with any of the supported software packages or utilities.
- **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, delta, 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.
  - Supports digital IIR (infinite impulse response) filters.
- **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 analysis 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.
- **Quick DataAcq application –** The Quick DataAcq application provides a quick way to get up and running using a DT9834 Series module. Using this application, you can verify key features of the modules, display data on the screen, and save data to disk.
- **DT-Open Layers for .NET Class Library** – Use this class library if you want to use Visual C# or Visual Basic for .NET to develop your own application software for a DT9834 Series module using Visual Studio 2003 to 2012; the class library complies with the DT-Open Layers standard.
- **DataAcq SDK –** Use the Data Acq SDK if you want to use Visual Studio 6.0 and Microsoft C or C++ to develop your own application software for a DT9834 Series module using Windows Vista, Windows 7, or Windows 8; the DataAcq SDK complies with the DT-Open Layers standard.

- **DAQ Adaptor for MATLAB –** Data Translation's DAQ Adaptor provides an interface between the MATLAB Data Acquisition (DAQ) subsystem from The MathWorks and Data Translation's DT-Open Layers architecture.
- **LV-Link –** A link to LV-Link is included on the Data Acquisition OMNI CD. Use LV-Link if you want to use the LabVIEW graphical programming language to access the capabilities of the DT9834 Series modules.

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

Accessories

You can purchase the following optional items from Data Translation for use with a DT9834 Series module:

Table 2: Accessories for the DT9834 Series

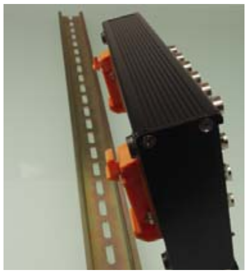
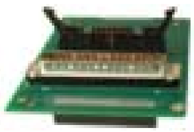
Accessory		Description
BNC DIN Rail Kit		Kit for mounting USB modules in a BNC or STP enclosure to a DIN rail. Includes mounting clips, screws, and instructions. Rail not included.
EP361		For OEM configurations only, +5 V power supply and cable. The power supply comes with BNC box versions.
EP353		For OEM configurations only, accessory panel that provides one 37-pin, D-sub connector for attaching analog input signals and one 26-pin connector for attaching a 5B Series signal conditioning backplane. Refer to page 165 for connection information.
EP355		For OEM configurations only, screw terminal panel that provides 14-position screw terminal blocks for attaching analog input, analog output, counter/timer, digital I/O, trigger, and clock signals. Refer to page 173 for connection information.
EP356		For OEM configurations only, accessory panel that provides two 37-pin, D-sub connectors for attaching digital I/O, analog output, counter/timer, trigger, and clock signals. Refer to page 169 for connection information.

Table 2: Accessories for the DT9834 Series

Accessory		Description
STP37		Screw terminal panel for connecting to the Analog Input, Digital I/O, or Counter/Timer, Analog Output, External Clock and Trigger connector on the BNC box version. For OEM configurations, connects to the EP353 accessory panel using the EP360 cable or to the EP356 accessory panel using the EP333 cable. Refer to page 167, page 170, and page 171 for connection information.
EP333		A 2-meter shielded cable with two 37-pin connectors, For BNC box versions, connects the STP37 screw terminal panel to the Digital I/O or Counter/Timer, Analog Output, External Clock and Trigger connector. For OEM configurations, connects the STP37 screw terminal panel to the EP356 accessory panel. Refer to page 170 and page 171 for connection information.
EP360		A 2-meter shielded cable with two 37-pin connectors. For BNC box versions, connects the STP37 to the Analog Input connector. For OEM configurations, connects the STP37 to the EP353 accessory panel. Refer to page 167 for connection information.

Getting Started Procedure

The flow diagram shown in Figure 2 illustrates the steps needed to get started using the DT9834 Series module. 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.

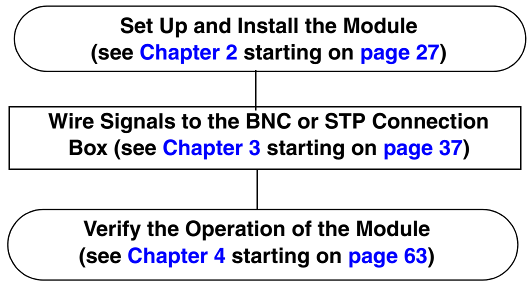
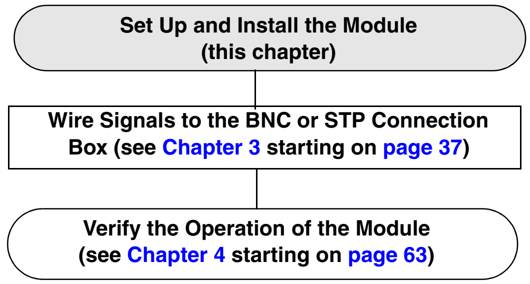


Figure 2: Getting Started Flow Diagram

Part 1: Getting Started

2

Setting Up and Installing the Module


Set Up and Install the Module
(this chapter)
Wire Signals to the BNC or STP Connection Box (see Chapter 3 starting on page 37)
Verify the Operation of the Module
(see Chapter 4 starting on page 63)

Unpacking

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

- BNC connection box, STP connection box, or OEM version of the DT9834 Series module
- Data Acquisition OMNI CD

Note that if you purchased a BNC or STP connection box, a USB cable and an EP361 power supply and power cable should also be included. Additionally, the BNC box includes an analog input mating connector (AMP #747917-2).

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).

Note: The DT9834 Series module is factory-calibrated. If you decide that you want to recalibrate the analog input or analog output circuitry, refer to the instructions in Chapter 8.

System Requirements

For reliable operation, ensure that your computer meets the following system requirements:

- Processor: Pentium 4/M or equivalent
- RAM: 1 GB
- Screen Resolution: 1024 x 768 pixels
- Operating System: Windows 8, Windows 7, Windows Vista (32- and 64-bit)
- Disk Space: 4 GB

Applying Power to the Module

The BNC and STP connection boxes are shipped with an EP361 +5V power supply and cable. For the OEM version of the DT9834 Series module, you must provide your own +5 V power source or purchase the EP361 power supply and cable from Data Translation.

To apply power to the module, do the following:

1. Connect the +5 V power supply to the power connector on the DT9834 Series module. Refer to Figure 3.

Figure 3: Attaching a +5 V Power Supply to the DT9834 Series Module

2. Plug the power supply into a wall outlet.

For more detailed information about ground, power, and isolation connections on a DT9834 Series module, refer to Appendix C starting on page 179.

Attaching Modules to the Computer

This section describes how to attach DT9834 Series modules to the host computer.

Notes: Most computers have several USB ports that allow direct connection to USB devices. If your application requires more DT9834 Series modules than you have USB ports for, you can expand the number of USB devices attached to a single USB port by using expansion hubs. For more information, refer to page 34.

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

You must install the device driver before connecting your DT9834 Series module(s) to the host computer.

Connecting Directly to the USB Ports

To connect a DT9834 Series module directly to a USB port on your computer, do the following:

1. Make sure that you have attached a power supply to the module.
2. Attach one end of the USB cable to the USB port on the module.
3. Attach the other end of the USB cable to one of the USB ports on the host computer, as shown in Figure 4.
   The operating system automatically detects the USB module and starts the Found New Hardware wizard.

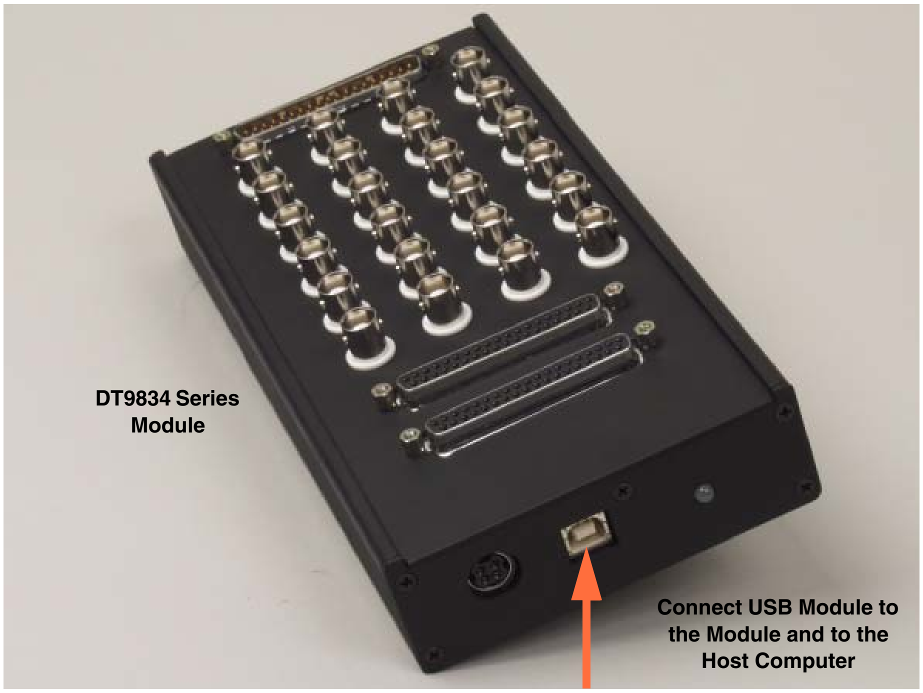


Figure 4: Attaching the Module to the Host Computer

4. *For Windows Vista:*
   - **a.** Click **Locate and install driver software (recommended)**.
     The popup message "Windows needs your permission to continue" appears.
   - **b.** Click **Continue**.
     The Windows Security dialog box appears.
   - **c.** Click **Install this driver software anyway**.
     The LED on the module turns green.

Note: Windows 7 and Windows 8 find the device automatically.

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5. Repeat these steps to attach another DT9834 Series module to the host computer, if desired.

Connecting to an Expansion Hub

Expansion hubs are powered by their own external power supply. The practical number of DT9834 Series modules that you can connect to a single USB port depends on the throughput you want to achieve.

To connect multiple DT9834 Series modules to an expansion hub, do the following:

1. Make sure that you have attached a power supply to the module.
2. Attach one end of the USB cable to the module and the other end of the USB cable to an expansion hub.
3. Connect the power supply for the expansion hub to an external power supply.
4. Connect the expansion hub to the USB port on the host computer using another USB cable.
   The operating system automatically detects the USB module and starts the Found New Hardware wizard.
5. For Windows Vista:
   a. Click **Locate and install driver software (recommended)**.
      The popup message "Windows needs your permission to continue" appears.
   b. Click **Continue**.
      The Windows Security dialog box appears.
   c. Click **Install this driver software anyway**.
      The LED on the module turns green.

Note: Windows 7 and Windows 8 find the device automatically.

6. Repeat these steps until you have attached the number of expansion hubs and modules that you require. Refer to Figure 5.
   The operating system automatically detects the USB devices as they are installed.

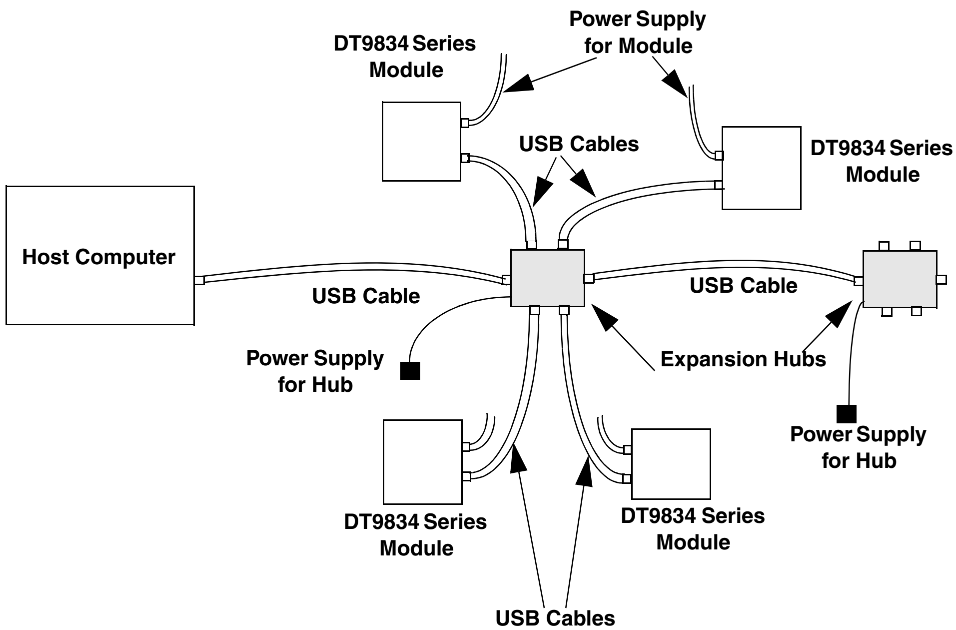


Figure 5: Attaching Multiple DT9834 Series Modules Using Expansion Hubs

Configuring the DT9834 Series Device Driver

Note: In Windows 7, Windows 8, and Vista, you must have administrator privileges to run the Open Layers Control Panel. When you double-click the Open Layers Control Panel icon, you may see the Program Compatibility Assistant. If you do, select **Open the control panel using recommended settings**. You may also see a Windows message asking you if you want to run the Open Layers Control Panel as a "legacy CPL elevated." If you get this message, click **Yes**.

If you do not get this message and have trouble making changes in the Open Layers Control Panel, right click the DTOLCPL.CPL file and select **Run as administrator**. By default, this file is installed in the following location:

Windows 7, Windows 8, and Vista (32-bit)
C:\Windows\System32\Dtolcpl.cpl

Windows 7, Windows 8, and Vista (64-bit)
C:\Windows\SysWOW64\Dtolcpl.cpl

To configure the device driver for the DT9834 Series module, do the following:

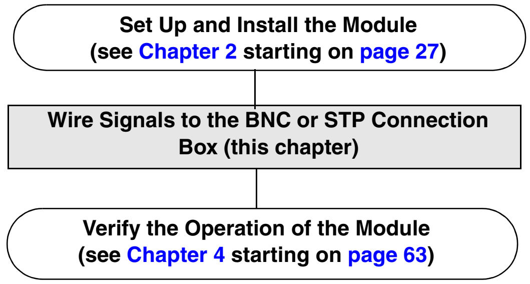
1. If you have not already done so, power up the host computer and all peripherals.
2. From the Windows Start menu, select **Settings | Control Panel**.
3. From the Control Panel, double-click **Open Layers Control Panel**.
   The Data Acquisition Control Panel dialog box appears.
4. Click the DT9834 Series module that you want to configure, and then click **Advanced**.
   The Configurable Board Options dialog box appears.
5. If you are using differential analog input channels, we recommend that you select the **10k Ohm Resistor Terminations** checkbox for each analog input channel on the module (the default setting). This ensures that 10 kΩ of bias return termination resistance is used for the analog input channels. Bias return termination resistance is particularly useful when your differential source is floating.

   If you are using single-ended analog input channels, this option is not used.
6. If required, select the digital input line(s) that you want to use for interrupt-on-change operations. When any of the selected lines changes state, the module reads the entire 16-bit digital input value and generates an interrupt.
7. Click **OK**.
8. If you want to rename the module, click **Edit Name**, enter a new name for the module, and then click **OK**. The name is used to identify the module in all subsequent applications.
9. Repeat steps 4 to 8 for the other modules that you want to configure.
10. When you are finished configuring the modules, click **Close**.

Continue with the instructions on wiring in Chapter 3 starting on page 37.

3

Wiring Signals to the BNC or STP Connection Box


Set Up and Install the Module
(see Chapter 2 starting on page 27)
Wire Signals to the BNC or STP Connection Box (this chapter)
Verify the Operation of the Module
(see Chapter 4 starting on page 63)

Preparing to Wire Signals

This section provides recommendations and information about wiring signals to the BNC or STP connection box.

Note: The STP connection box is provided for the 32-analog input channel version of the module only (DT9834-32-0-16-STP).

If you are using the D-sub connectors on the BNC box or the OEM version of the DT9834 Series module, use this chapter for conceptual information, and then refer to Appendix C for connector pin assignments and accessory panel information.

Wiring Recommendations

Keep the following recommendations in mind when wiring signals to a BNC connection box:

- Follow standard ESD procedures when wiring signals to the module.
- Use individually shielded twisted-pair wire (size 14 to 26 AWG) in highly noisy electrical environments.
- Separate power and signal lines by using physically different wiring paths or conduits.
- To avoid noise, do not locate the box and cabling next to sources that produce high electromagnetic fields, such as large electric motors, power lines, solenoids, and electric arcs, unless the signals are enclosed in a mumetal shield.
- Prevent electrostatic discharge to the I/O while the box is operational.
- Connect all unused analog input channels to analog ground.

Wiring to the BNC Box

The BNC connection box contains both BNC connectors and 37-pin, D-sub connectors. An example of a BNC connection box is shown in Figure 6.

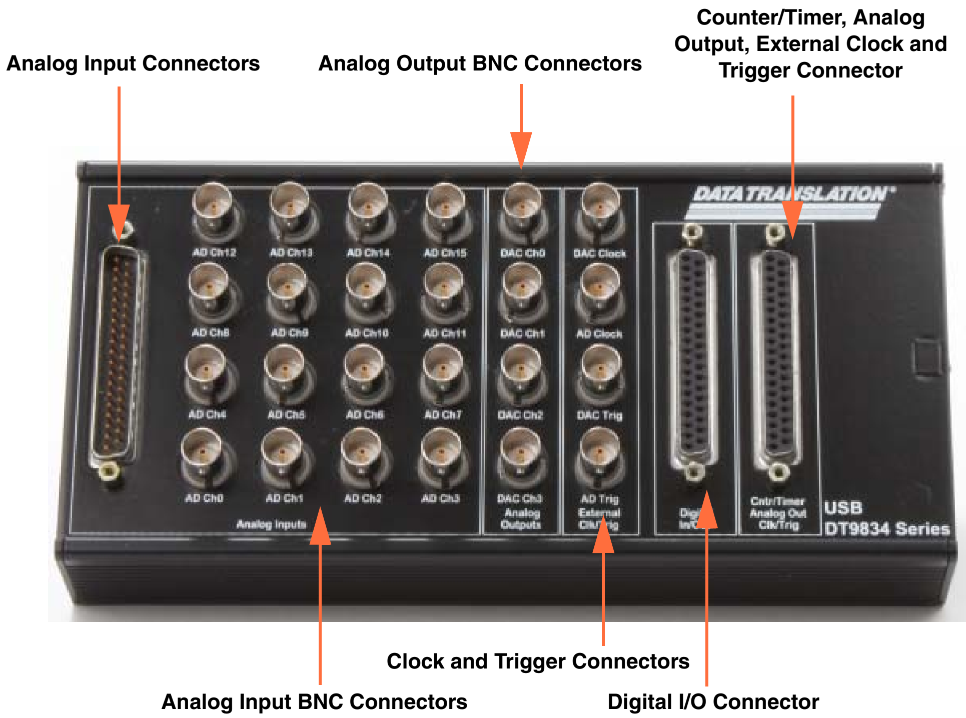


Figure 6: BNC Connection Box

You can wire signals to the BNC connection box as follows. Refer to Appendix C for information about the required D-sub mating connectors if you choose to use the D-sub connectors.

- **Analog input signals –** You can wire analog input signals in one of the following ways:
  - Using the BNC connectors labelled AD Ch0 to AD Ch15.
  - Using the appropriate pins on the Analog Input connector. You can access the pins either by using the EP360 cable and STP37 screw terminal panel (available from Data Translation), by plugging in the supplied 37-mating connector (AMP #747917-2), or by building your own cable/panel. Refer to page 42 for connector pin assignments.
- **Analog output signals –** You can wire analog output signals in one of the following ways:
  - Using the BNC connectors labelled DAC Ch0 to DAC Ch3.
  - Using the appropriate pins on the C\T, DAC, Clk, Trig connector. You can access the pins either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation) or by building your own cable/panel. Refer to page 44 for connector pin assignments.
- **Digital I/O signals –** To wire digital I/O signals, you must use the appropriate pins on the Digital I/O connector. You can access the pins either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation) or by building your own cable/panel. Refer to page 43 for connector pin assignments.

- **Counter/timer signals –** To wire counter/timer signals, you must use the appropriate pins on the C\T, DAC, Clk, Trig connector. You can access the pins either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation) or by building your own cable/panel. Refer to page 44 for connector pin assignments.
- **External A/D clock or trigger signal –** If your version of the BNC connection box supports analog input operations, you can wire external clock/trigger signals in one of the following ways:
  – Using the BNC connectors labelled AD Clock and AD Trig.
  – Using the appropriate pins on the C\T, DAC, Clk, Trig connector. You can access the pins either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation) or by building your own cable/panel. Refer to page 44 for connector pin assignments.
- **External DAC clock or trigger signal –** If your version of the BNC connection box supports analog output operations, you can wire external clock/trigger signals in one of the following ways:
  – Using the BNC connectors labelled DAC Clock and DAC Trig.
  – Using the appropriate pins on the C\T, DAC, Clk, Trig connector. You can access the pins either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation) or by building your own cable/panel. Refer to page 44 for connector pin assignments.

The following sections describe how to wire signals using the BNC or D-sub connectors.

Wiring Signals to the BNC Connectors

To wire signals using the BNC connectors, connect the appropriate BNC connector to the appropriate input/output using a BNC cable.

The number of BNC connectors available on the box varies, depending on the version of the box that you are using. For example, the DT9834-16-4-12-BNC version, shown in Figure 6 above, contains 24 BNC connectors (16 BNC connectors for single-ended analog inputs, four BNC connectors for analog outputs, and four BNC connectors for external clocks and triggers).

Wiring Signals to the D-Sub Connectors

If you do not want to use the BNC connectors or if you want to connect digital I/O or counter/timer signals to the BNC connection box, you can use the 37-pin, D-sub connectors. These connectors are described in the following sections.

Analog Input Connector

Note: The Analog Input connector, including the +5 V output, is available only if your version of the BNC connection box supports analog input operations.

The Analog Input connector allows you to access the analog input signals. Table 3 lists the pin assignments for the STP37 screw terminal panel when used with the Analog Input connector on the BNC box.

Table 3: STP37 Pin Assignments

Pin	Signal Description	Pin	Signal Description
19	Chassis Ground	37	Digital Ground
18	+5 V Analog	36	Analog Ground
17	Amplifier Low	35	Reserved
16	Reserved	34	Reserved
15	Reserved	33	Reserved
14	Reserved	32	Reserved
13	Reserved	31	Reserved
12	Reserved	30	Reserved
11	Reserved	29	Reserved
10	Reserved	28	Reserved
9	Reserved	27	Analog Input 7 DI Return/ Analog In 15 SE[a]
8	Analog Input 7	26	Analog Input 6 DI Return/ Analog In 14 SE[a]
7	Analog Input 6	25	Analog Input 5 DI Return/ Analog In 13 SE[a]
6	Analog Input 5	24	Analog Input 4 DI Return/ Analog In 12 SE[a]
5	Analog Input 4	23	Analog Input 3 DI Return/ Analog In 11 SE[a]
4	Analog Input 3	22	Analog Input 2 DI Return/ Analog In 10 SE[a]
3	Analog Input 2	21	Analog Input 1 DI Return/ Analog In 9 SE[a]
2	Analog Input 1	20	Analog Input 0 DI Return/ Analog In 8 SE[a]
1	Analog Input 0		

a. Applies to the DT9834-16-0-12-BNC, DT9834-08-0-12-BNC, DT9834-16-0-16-BNC, DT9834-08-0-16-BNC, DT9834-16-4-12-BNC, and DT9834-08-4-12-BNC modules only. The first signal description applies to the differential (DI) configuration. The second signal description applies to the single-ended (SE) configuration.

Digital In/Out Connector

The Digital In/Out connector allows you to access the digital I/O signals. Table 4 lists the pin assignments for both the Digital In/Out connector on the BNC connection box and the STP37 screw terminal panel.

Table 4: Digital In/Out Connector / STP37 Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Digital Input 0	20	Digital Output 0
2	Digital Input 1	21	Digital Output 1
3	Digital Input 2	22	Digital Output 2
4	Digital Input 3	23	Digital Output 3
5	Digital Input 4	24	Digital Output 4
6	Digital Input 5	25	Digital Output 5
7	Digital Input 6	26	Digital Output 6
8	Digital Input 7	27	Digital Output 7
9	Digital Input 8	28	Digital Output 8
10	Digital Input 9	29	Digital Output 9
11	Digital Input 10	30	Digital Output 10
12	Digital Input 11	31	Digital Output 11
13	Digital Input 12	32	Digital Output 12
14	Digital Input 13	33	Digital Output 13
15	Digital Input 14	34	Digital Output 14
16	Digital Input 15	35	Digital Output 15
17	Digital Ground	36	Dynamic Digital Output
18	Digital Ground	37	Digital Ground
19	No Connect		

C/T, DAC, Clk, Trig Connector

The C/T, DAC, Clk, Trig connector allows you to access the counter/timer, analog output, external clock, and external trigger signals. Table 5 lists the pin assignments for both the C/T, DAC, Clk, Trig connector on the BNC connection box and the STP37 screw terminal panel.

Table 5: C/T, DAC, Clk, Trig Connector

Pin	Signal Description	Pin	Signal Description
1	Analog Output 0	20	Analog Output 0 Return
2	Analog Output 1	21	Analog Output 1 Return
3	Analog Output 2	22	Analog Output 2 Return
4	Analog Output 3	23	Analog Output 3 Return
5	Digital Ground	24	Digital Ground
6	External DAC Clock	25	External DAC Trigger
7	External ADC Clock	26	External ADC Trigger
8	Counter 0 Clock	27	Digital Ground
9	Counter 0 Out	28	Counter 0 Gate
10	Counter 1 Clock	29	Digital Ground
11	Counter 1 Out	30	Counter 1 Gate
12	Counter 2 Clock	31	Digital Ground
13	Counter 2 Out	32	Counter 2 Gate
14	Counter 3 Clock	33	Digital Ground
15	Counter 3 Out	34	Counter 3 Gate
16	Counter 4 Clock	35	Digital Ground
17	Counter 4 Out	36	Counter 4 Gate
18	Digital Ground	37	Digital Ground
19	No Connect		

Wiring to the STP Box

The STP connection box is provided for the 32-analog input channel version of the module only (DT9834-32-0-16-STP). It contains blocks of screw terminals that allow you to access all the signals of the module. Figure 7 shows the layout of the STP connection box.

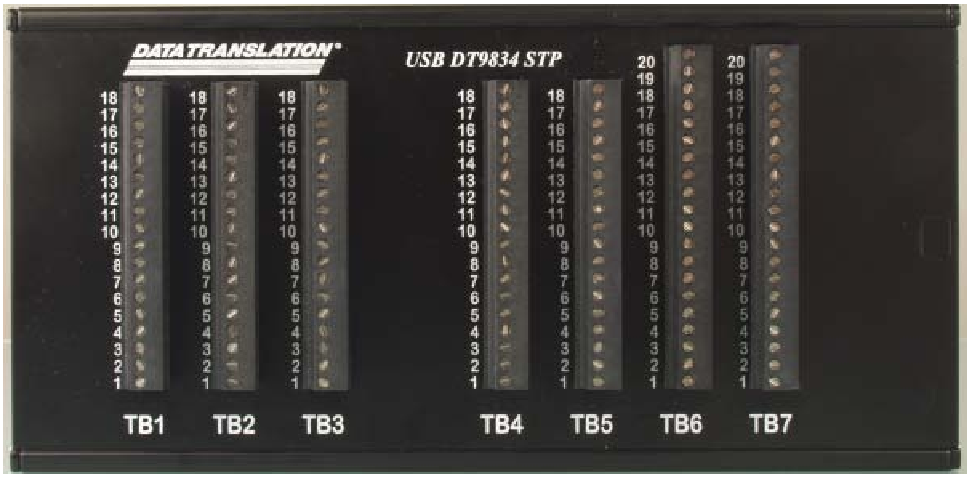


Figure 7: STP Connection Box

Table 6 lists the screw terminal assignments for screw terminal blocks TB1 through TB7.

Table 6: Screw Terminal Assignments for STP Connection Box

Terminal Block	Screw	Signal Description	Terminal Block	Screw	Signal Description
TB1	18	Analog Ground	TB2	18	Analog Ground
	17	Analog In 5 DI Return/ Analog In 13 SE[a]		17	Analog In 11 DI Return/ Analog In 27 SE[a]
	16	Analog In 5		16	Analog In 11 DI/ Analog In 19 SE[a]
	15	Analog Ground		15	Analog Ground
	14	Analog In 4 DI Return/ Analog In 12 SE[a]		14	Analog In 10 DI Return/ Analog In 26 SE[a]
	13	Analog In 4		13	Analog In 10 DI/ Analog In 18 SE[a]
	12	Analog Ground		12	Analog Ground
	11	Analog In 3 DI Return/ Analog In 11 SE		11	Analog In 9 DI Return/ Analog In 25 SE[a]
	10	Analog In 3		10	Analog In 9 DI/ Analog In 17 SE[a]
	9	Analog Ground		9	Analog Ground
	8	Analog In 2 DI Return/ Analog In 10 SE[a]		8	Analog In 8 DI Return/ Analog In 24 SE[a]
	7	Analog In 2		7	Analog In 8 DI/ Analog In 16 SE[a]
	6	Analog Ground		6	Analog Ground
	5	Analog In 1 DI Return/ Analog In 9 SE[a]		5	Analog In 7 DI Return/ Analog In 15 SE[a]
	4	Analog In 1		4	Analog In 7
	3	Analog Ground		3	Analog Ground
	2	Analog In 0 DI Return/ Analog In 8 SE[a]		2	Analog In 6 DI Return/ Analog In 14 SE[a]
	1	Analog In 0		1	Analog In 6

Table 6: Screw Terminal Assignments for STP Connection Box (cont.)

Terminal Block	Screw	Signal Description	Terminal Block	Screw	Signal Description
TB3	18	5 V Analog	TB4	18	Digital Ground
	17	Digital Ground		17	Digital Ground
	16	Analog Ground		16	External ADC Trigger
	15	Analog Ground		15	Digital Ground
	14	Amplifier Low		14	External ADC Clock
	13	Amplifier Low		13	Digital Ground
	12	Analog Ground		12	Not Used
	11	Analog In 15 DI Return/ Analog In 31 SE[a]		11	Digital Ground
	10	Analog In 15 DI/ Analog In 23 SE[a]		10	Not Used
	9	Analog Ground		9	Digital Ground
	8	Analog In 14 DI Return/ Analog In 30 SE[a]		8	Not Used
	7	Analog In 14 DI/ Analog In 22 SE[a]		7	Not Used
	6	Analog Ground		6	Not Used
	5	Analog In 13 DI Return/ Analog In 29 SE[a]		5	Not Used
	4	Analog In 13 DI/ Analog In 21 SE[a]		4	Not Used
	3	Analog Ground		3	Not Used
	2	Analog In 12 DI Return/ Analog In 28 SE[a]		2	Not Used
	1	Analog In 12 DI/ Analog In 20 SE[a]		1	Not Used

Table 6: Screw Terminal Assignments for STP Connection Box (cont.)

Terminal Block	Screw	Signal Description	Terminal Block	Screw	Signal Description
TB5	18	Digital Ground	TB6	20	Digital Ground
	17	Digital Input 15		19	Dynamic Digital Output
	16	Digital Input 14		18	Digital Ground
	15	Digital Input 13		17	Digital Output 15
	14	Digital Input 12		16	Digital Output 14
	13	Digital Input 11		15	Digital Output 13
	12	Digital Input 10		14	Digital Output 12
	11	Digital Input 9		13	Digital Output 11
	10	Digital Input 8		12	Digital Output 10
	9	Digital Ground		11	Digital Output 9
	8	Digital Input 7		10	Digital Output 8
	7	Digital Input 6		9	Digital Ground
	6	Digital Input 5		8	Digital Output 7
	5	Digital Input 4		7	Digital Output 6
	4	Digital Input 3		6	Digital Output 5
	3	Digital Input 2		5	Digital Output 4
	2	Digital Input 1		4	Digital Output 3
	1	Digital Input 0		3	Digital Output 2
TB7	20	Counter 4 Gate		2	Digital Output 1
	19	Counter 4 Out		1	Digital Output 0
	18	Counter 4 Clock			
	17	Digital Ground			
	16	Counter 3 Gate			
	15	Counter 3 Out			
	14	Counter 3 Clock			
	13	Digital Ground			
	12	Counter 2 Gate			
	11	Counter 2 Out			
	10	Counter 2 Clock			
	9	Digital Ground			

Table 6: Screw Terminal Assignments for STP Connection Box (cont.)

Terminal Block	Screw	Signal Description	Terminal Block	Screw	Signal Description
TB7 (cont.)	8	Counter 1 Gate			
	7	Counter 1 Out			
	6	Counter 1 Clock			
	5	Digital Ground			
	4	Counter 0 Gate			
	3	Counter 0 Out			
	2	Counter 0 Clock			
	1	Digital Ground			

a. This description applies to the DT9834-32-0-16-STP module only. The first signal description is for differential (DI) signals; the second signal description is for single-ended (SE) signals.

Connecting Analog Input Signals

The BNC and STP connection boxes support both voltage and current loop inputs. You can connect analog input signals to a BNC or STP connection box in the following ways:

- **Single-ended** – Choose this configuration when you want to measure high-level signals, noise is not significant, the source of the input is close to the module, and all the input signals are referred to the same common ground.
- **Pseudo-Differential** – Choose this configuration when noise or common-mode voltage (the difference between the ground potentials of the signal source and the ground of the screw terminal panel or between the grounds of other signals) exists and the differential configuration is not suitable for your application. This option provides less noise rejection than the differential configuration; however, the number of analog input channels available is the same as for single-ended configuration.
- **Differential** – Choose this configuration when you want to measure low-level signals, noise is a significant part of the signal, or common-mode voltage exists.

This section describes how to connect single-ended, pseudo-differential, and differential voltage inputs, as well as current loops, to a BNC or STP connection box.

Connecting Single-Ended Voltage Inputs

Note: If you are using single-ended inputs, make sure that bias return resistance is disabled in the Open Layers Control Panel applet. Refer to page 36 for more information.

Figure 8 shows how to connect single-ended voltage inputs (channels 0 and 1, in this case) to the BNC connectors on the BNC connection box.

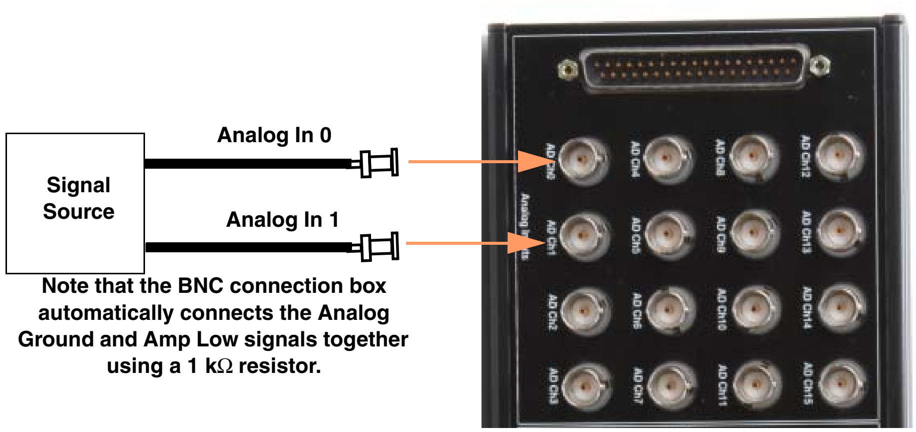


Figure 8: Connecting Single-Ended Inputs to the BNC Connection Box

Figure 9 shows how to connect single-ended voltage inputs (channels 0 and 1, in this case) to the STP connection box.

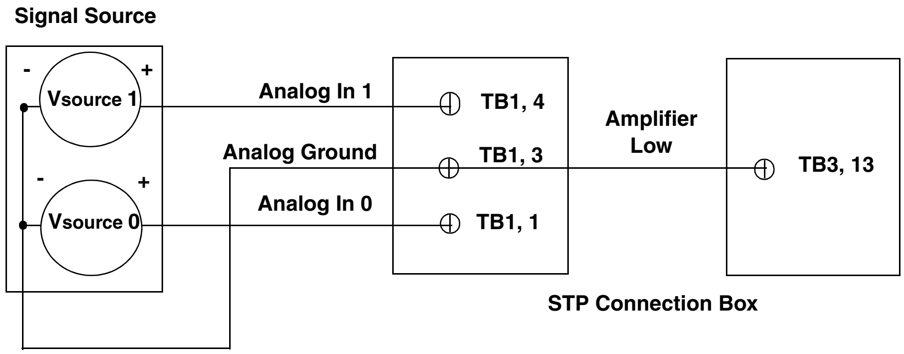


Figure 9: Connecting Single-Ended Inputs to the STP Connection Box

Connecting Pseudo-Differential Voltage Inputs

Figure 10 shows how to connect pseudo-differential voltage inputs (channels 0 and 1, in this case) to the BNC connectors on the BNC connection box.

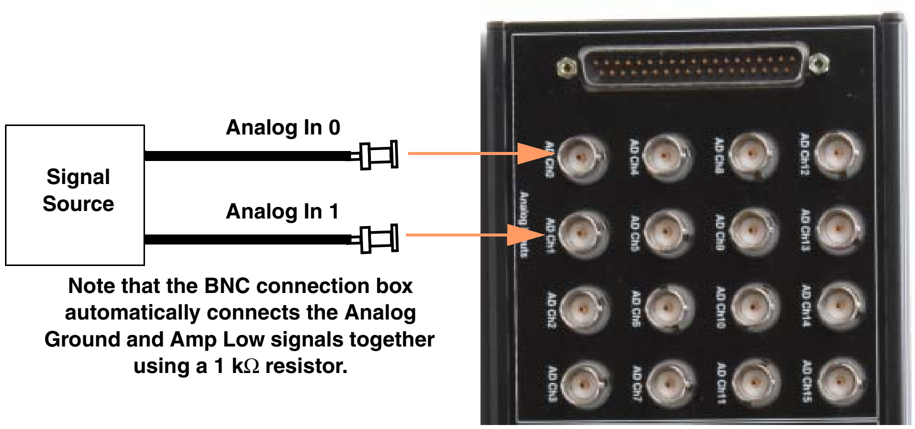


Figure 10: Connecting Pseudo-Differential Inputs to the BNC Connection Box

Figure 11 shows how to connect pseudo-differential voltage inputs (channels 0 and 1, in this case) to the STP connection box.

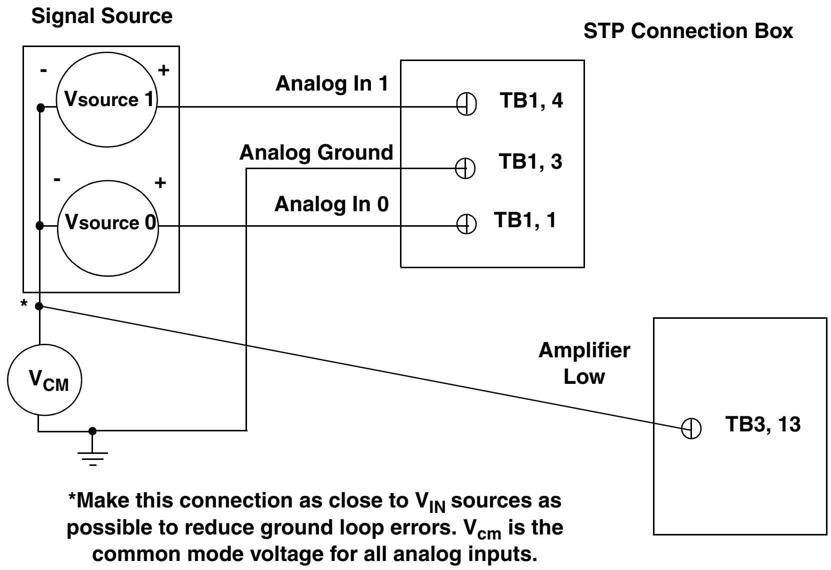


Figure 11: Connecting Pseudo-Differential Inputs to the STP Connection Box

Connecting Differential Voltage Inputs

Figure 12 shows how to connect differential voltage inputs (channels 0 and 1, in this case) to the BNC connectors on a BNC connection box.

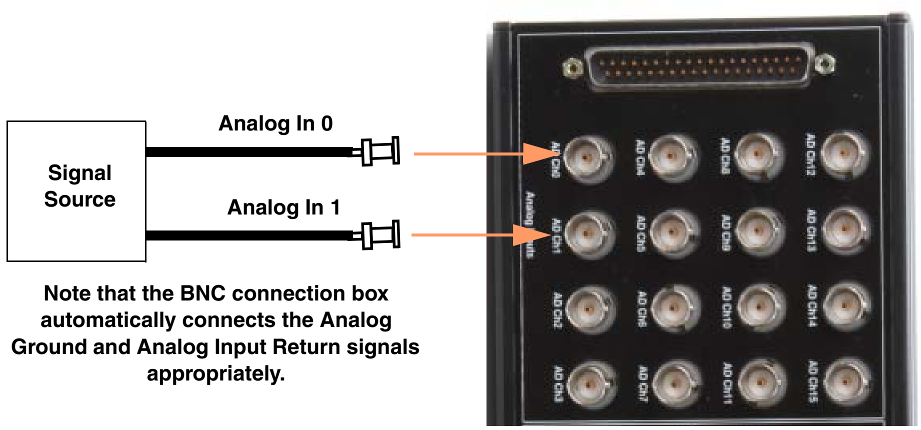


Figure 12: Connecting Differential Inputs to the BNC Connection Box

Figure 13A shows how to connect a floating signal source to the STP connection box using differential inputs. (A floating signal source is a voltage source that has no connection with earth ground.)

Note: For floating signal sources, we recommend that you provide a bias return path for the differential channels by using the Open Layers Control Panel applet to enable 10 kΩ of termination resistance. For more information, refer to page 36.

Figure 13B illustrates how to connect a nonfloating signal source to the STP connection box using differential inputs. In this case, the signal source itself provides the bias return path; therefore, you do not need to provide bias return resistance through software.

R_s is the signal source resistance while R_v is the resistance required to balance the bridge. Note that the negative side of the bridge supply must be returned to analog ground.

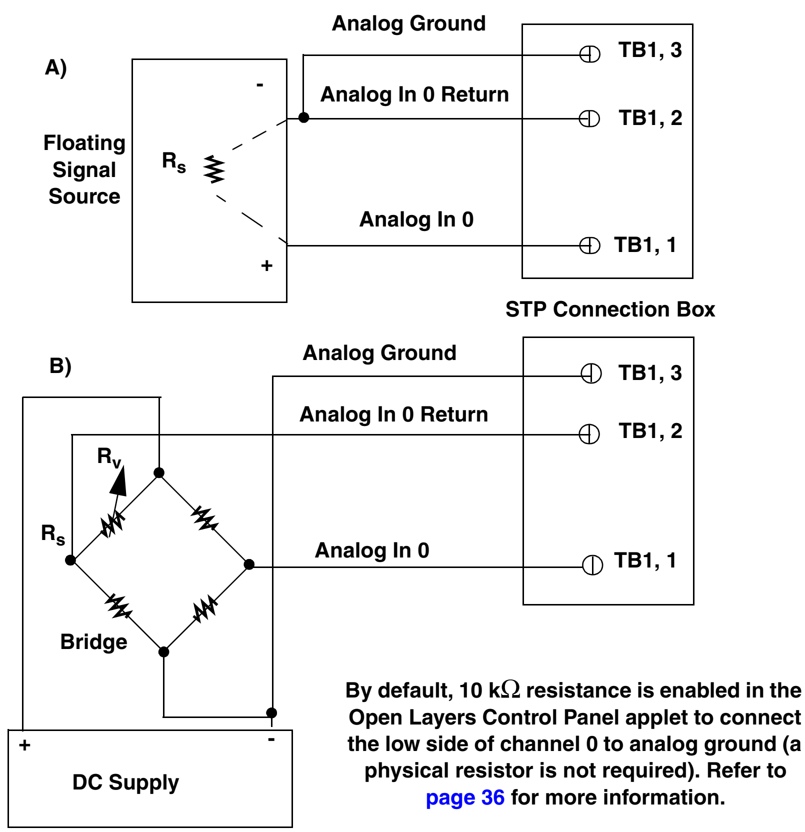


Figure 13: Connecting Differential Inputs to a Screw Terminal Panel

Note that since they measure the difference between the signals at the high (+) and low (–) inputs, differential connections usually cancel any common-mode voltages, leaving only the signal. However, if you are using a grounded signal source and ground loop problems arise, connect the differential signals as shown as Figure 14. In this case, make sure that the low side of the signal (–) is connected to ground at the signal source, not at the screw terminal panel, and do not tie the two grounds together.

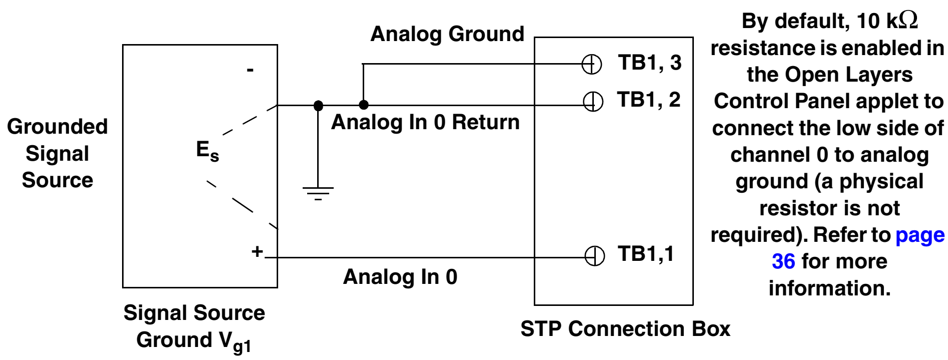
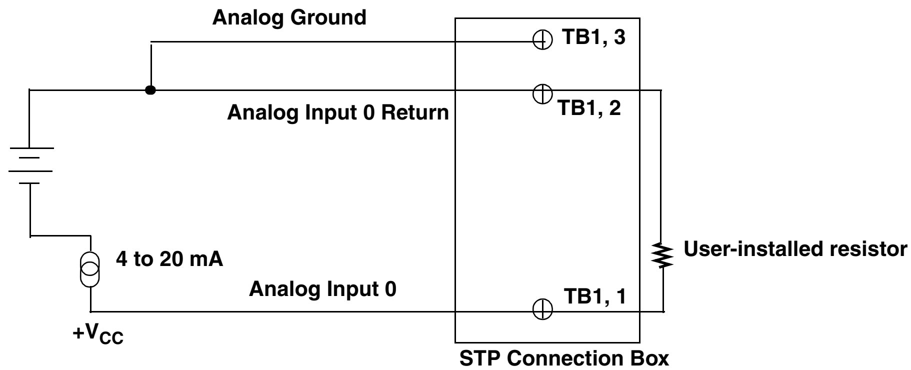


Figure 14: Connecting Differential Voltage Inputs from a Grounded Signal Source to an STP Connection Box

Connecting Current Loop Inputs

Note: You cannot connect a current loop input to the BNC connection box using the BNC connectors.

Figure 15 shows how to connect a current loop input (channel 0, in this case) to an STP connection box.



The user-installed resistor connects the high side of the channel to the low side of the corresponding channel, thereby acting as a shunt. For example, if you add a 250 Ω resistor and then connect a 4 to 20 mA current loop input to channel 0, the input range is converted to 1 to 5 V.

By default, 10 kΩ resistance is enabled in the Open Layers Control Panel applet to connect the low side of channel 0 to analog ground (a physical resistor is not required). Refer to page 36 for more information.

Figure 15: Connecting Current Inputs to the STP Connection Box

Connecting Analog Output Signals

Figure 16 shows how to connect an analog output voltage signal (channel 0, in this case) to the BNC connectors on the BNC connection box.

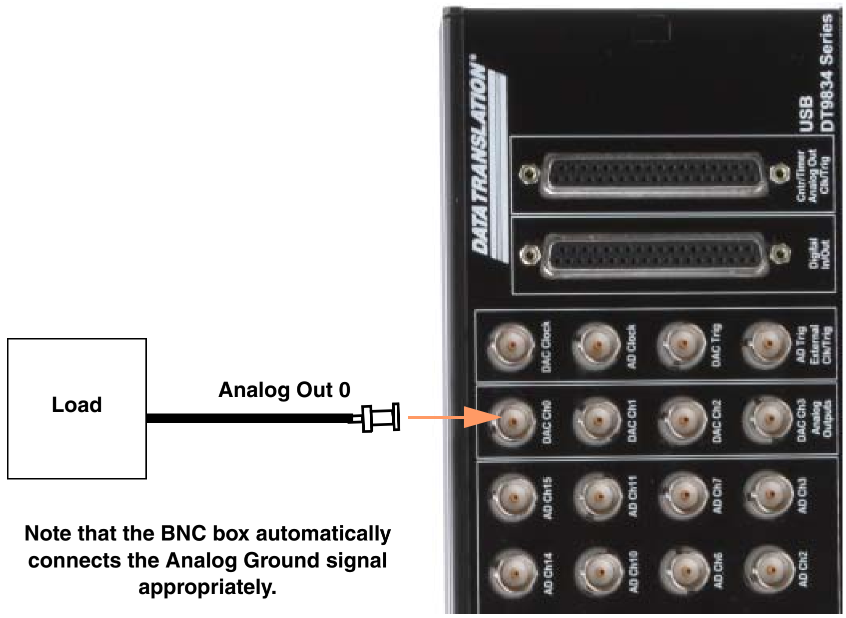


Figure 16: Connecting Analog Outputs to the BNC Connector Box

Figure 17 shows how to connect analog outputs to either the STP37 screw terminal panel or to your own screw terminal panel connection box.

Note: The STP connection box is provided for the DT9834-32-0-16-STP module only, which does not support analog output channels.

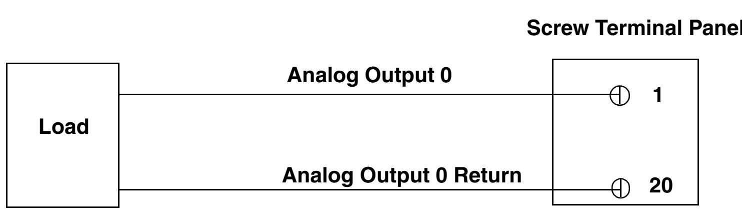


Figure 17: Connecting Analog Outputs to a Screw Terminal Panel

Connecting Digital I/O Signals

Figure 18 shows how to connect digital input signals (lines 0 and 1, in this case) to the STP connection box.

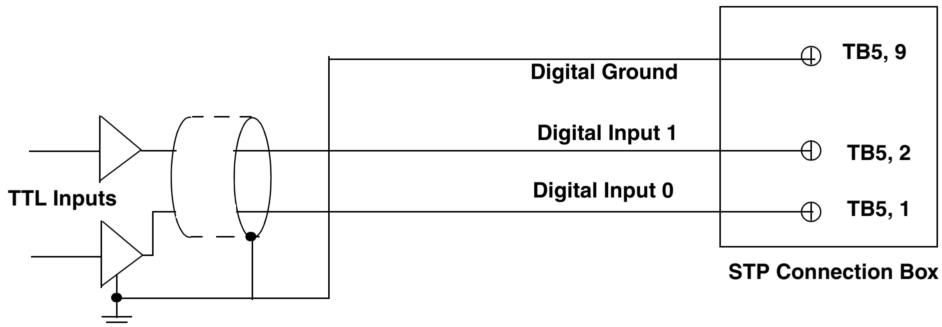
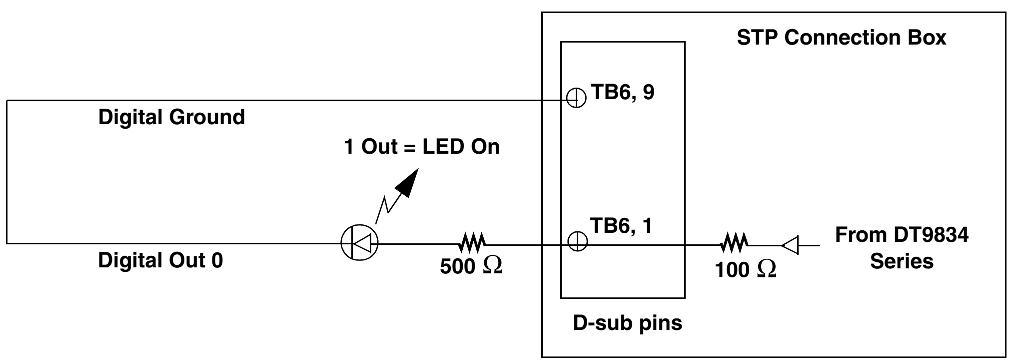


Figure 18: Connecting Digital Inputs to the STP Connection Box

Figure 19 shows how to connect a digital output (line 0, in this case) to the STP connection box.



The output current is determined using the following equation:

$$Current_{Out} = \frac{Voltage_{Out}}{R_{Internal} + R_{External}}$$

In this example, if the maximum output voltage is 3.3 V, the internal resistor is 100 Ω and the external resistor is 500 Ω, the maximum output current is 5.5 mA. Using the minimum output voltage of 2.4 V with the same resistor values, the minimum current output current is 4 mA.

Figure 19: Connecting Digital Outputs to the STP Connection Box

Connecting Counter/Timer Signals

The BNC connection box provides five counter/timer channels that you can use to perform the following operations:

- Event counting
- Up/down counting
- Frequency measurement
- Pulse width/period measurement
- Edge-to-edge measurement
- Continuous edge-to-edge measurement
- Pulse output (continuous, one-shot, and repetitive one-shot)

This section describes how to connect counter/timer signals. Refer to page 98 for more information about using the counter/timers.

Event Counting

Figure 20 shows how to connect counter/timer signals to the STP connection box to perform an event counting operation on counter/timer 0 using an external gate.

The counter counts the number of rising edges that occur on the Counter 0 Clock input when the Counter 0 Gate signal is in the active state (as specified by software). Refer to page 101 for more information.

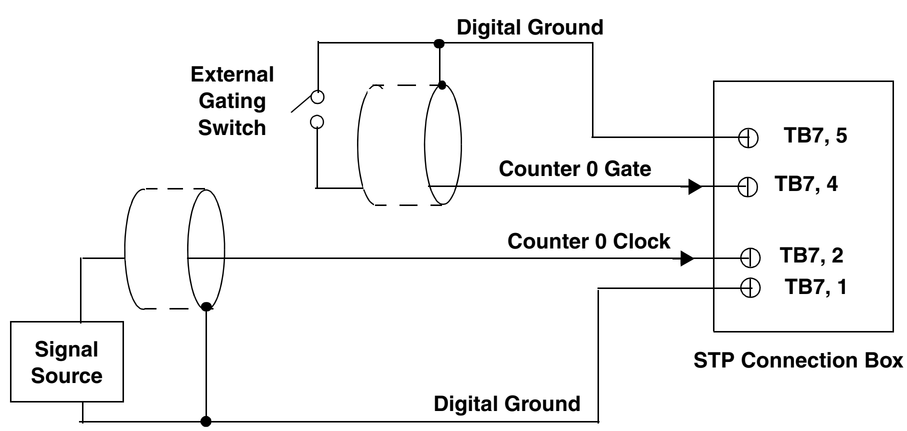


Figure 20: Connecting Counter/Timer Signals to the STP Connection Box for an Event Counting Operation Using an External Gate

Figure 21 shows how to connect counter/timer signals to the STP connection box to perform an event counting operation on counter/timer 0 without using a gate. The counter counts the number of rising edges that occur on the Counter 0 Clock input.

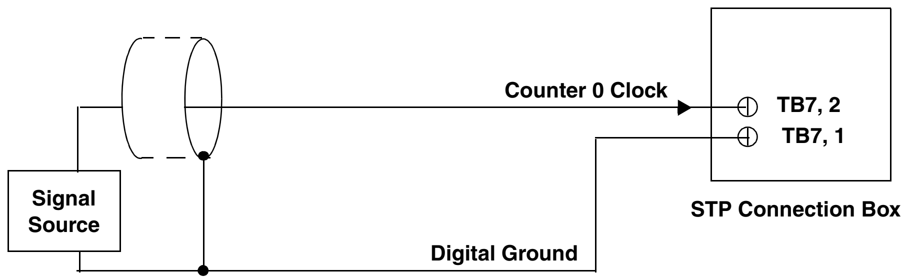


Figure 21: Connecting Counter/Timer Signals to the STP Connection Box for an Event Counting Operation Without Using a Gate

Up/Down Counting

Note: To use up/down counting mode, you need the latest version of DT-Open Layers.

Figure 22 shows how to connect counter/timer signals to an STP connection box to perform an up/down counting operation on counter/timer 0. The counter keeps track of the number of rising edges that occur on the Counter 0 Clock input. The counter increments when the Counter 0 Gate signal is high and decrements when the Counter 0 Gate signal is low.

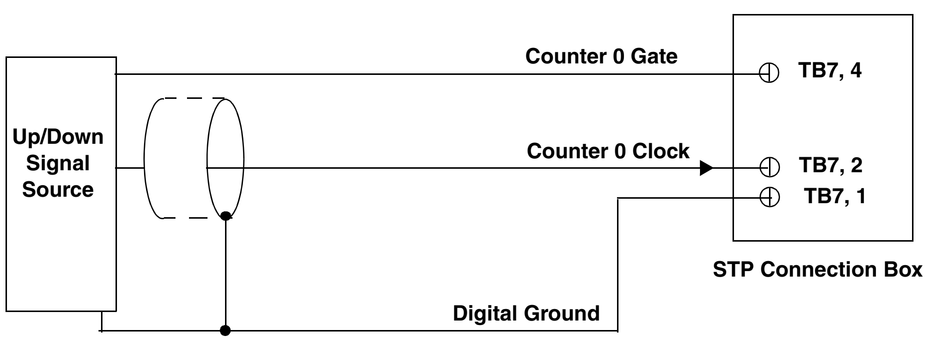


Figure 22: Connecting Counter/Timer Signals to the STP Connection Box for an Up/Down Counting Operation

Frequency Measurement

One way to measure frequency is to connect a pulse of a known duration (such as a one-shot output of counter/timer 1) to the Counter 0 Gate input.

Figure 23 shows how to connect counter/timer signals to the STP connection box. In this case, the frequency of the Counter 0 clock input is the number of counts divided by the period of the Counter 0 Gate input signal.

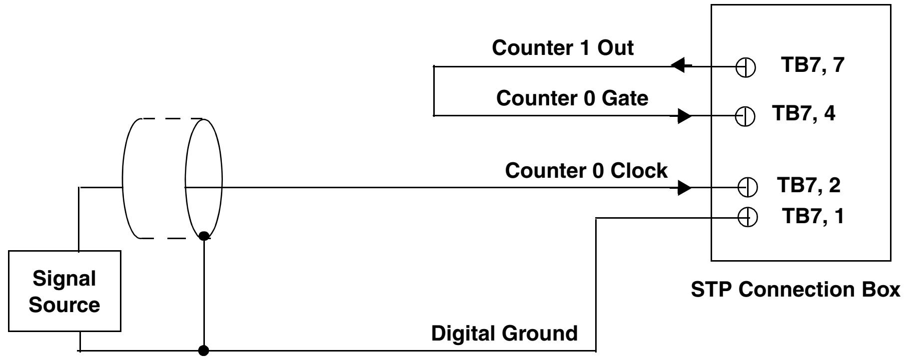


Figure 23: Connecting Counter/Timer Signals to the STP Connection Box for a Frequency Measurement Operation Using an External Pulse

Period/Pulse Width Measurement

Figure 24 shows how to connect counter/timer signals either to the STP connection box to perform a period/pulse width measurement operation on counter/timer 0. You specify the active pulse (high or low) in software. The pulse width is the percentage of the total pulse period that is active. Refer to Chapter 5 for more information about pulse periods and pulse widths.

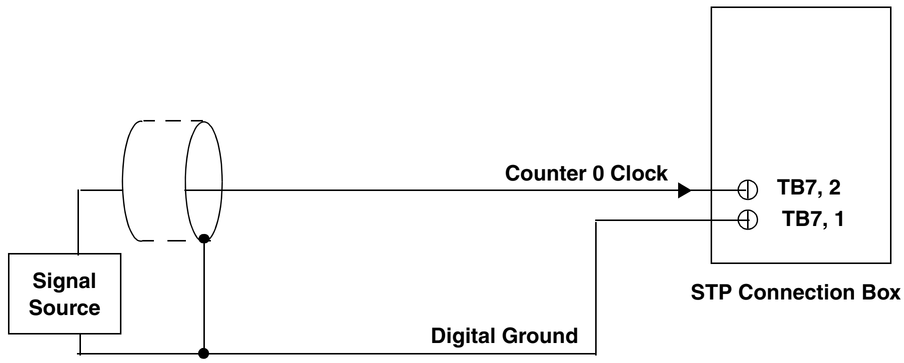


Figure 24: Connecting Counter/Timer Signals to the STP Connection Box for a Period/Pulse Width Measurement Operation

Edge-to-Edge Measurement

Figure 25 shows how to connect counter/timer signals to the STP connection box to perform an edge-to-edge measurement operation using two signal sources. The counter measures the number of counts between the start edge (in this case, a rising edge on the Counter 0 Clock signal) and the stop edge (in this case, a falling edge on the Counter 0 Gate signal).

You specify the start edge and the stop edge in software. Refer to page 102 for more information on edge-to-edge measurement mode.

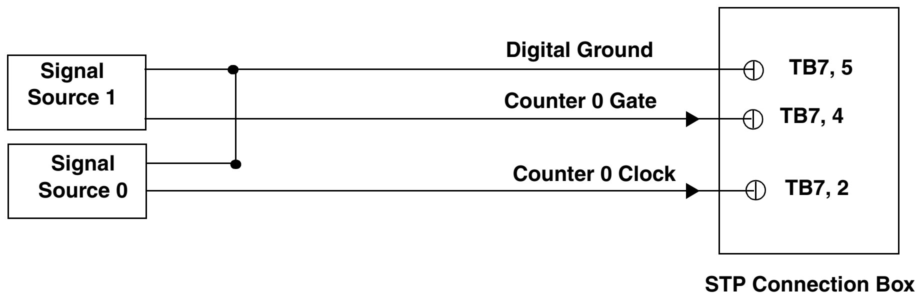


Figure 25: Connecting Counter/Timer Signals to the STP Connection Box for an Edge-to-Edge Measurement Operation

Continuous Edge-to-Edge Measurement

Figure 26 shows how to connect counter/timer signals to the STP connection box to perform a continuous edge-to-edge measurement operation. The counter measures the number of counts between two consecutive start edges (in this case, a rising edge on the Counter 0 Clock signal).

You specify the start edge in software. Refer to page 103 for more information on continuous edge-to-edge measurement mode.

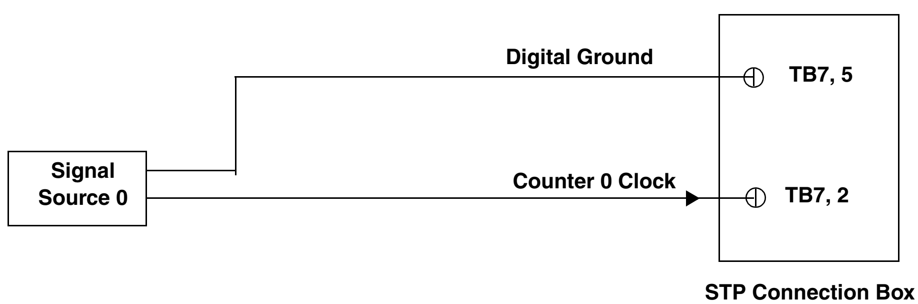


Figure 26: Connecting Counter/Timer Signals to the STP Connection Box for a Continuous Edge-to-Edge Measurement Operation

Pulse Output

Figure 27 shows how to connect counter/timer signals either to the STP37 screw terminal panel or to your own screw terminal panel to perform a pulse output operation on counter/timer 0; in this example, an external gate is used.

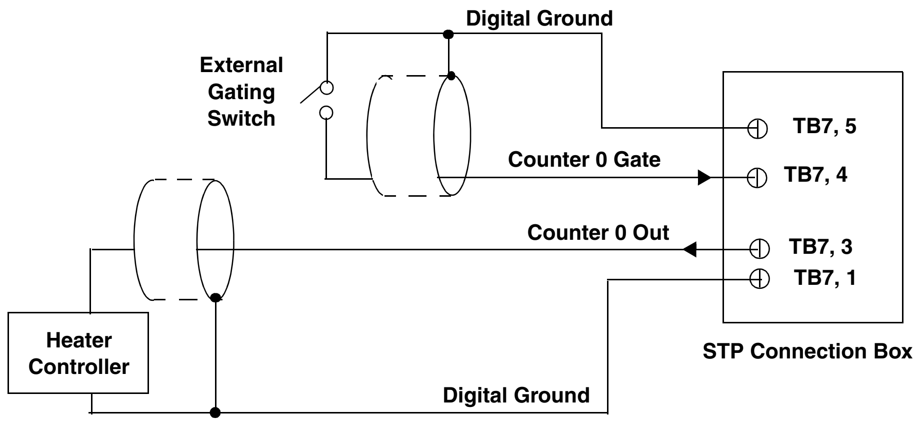
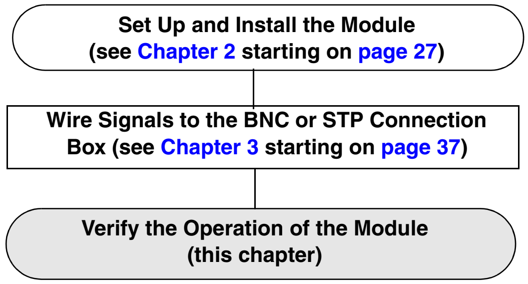


Figure 27: Connecting Counter/Timer Signals to the STP Connection Box for a Pulse Output Operation Using an External Gate

4

Verifying the Operation of a Module



You can verify the operation of a DT9834 Series module using the Quick DataAcq application. Quick DataAcq lets you do the following:

- Acquire data from a single analog input channel or digital input port
- Acquire data continuously from one or more analog input channels using an oscilloscope, strip chart, or Fast Fourier Transform (FFT) view
- Measure the frequency of events
- Output data from a single analog output channel or digital output port
- Output pulses either continuously or as a one-shot
- Save the input data to disk

The Quick DataAcq application is installed automatically when you install the driver software.

Running the Quick DataAcq Application

To run the Quick DataAcq application, do the following:

1. If you have not already done so, power up your computer and any attached peripherals.
2. Click **Start** from the Task Bar.
3. Browse to **Programs | Data Translation, Inc | DT-Open Layers for Win32 | QuickDataAcq**.
   The main menu appears.

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

For information on each of the features provided, use the online help for the Quick DataAcq application by pressing F1 from any view or selecting the **Help** menu. If the system has trouble finding the help file, navigate to C:\Program Files\Data Translation\Win32\dtdataacq.hlp, where C: is the letter of your hard disk drive.

Testing Single-Value Analog Input

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

1. Connect a voltage source, such as a function generator, to analog input channel 0 (differential mode) on the DT9834 Series module. Refer to page 52 for an example of how to connect a differential analog input.
2. In the Quick DataAcq application, choose **Single Analog Input** from the **Acquisition** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. In the **Channel** list box, select analog input channel 0.
5. In the **Range** list box, select the range for the channel. The default is ±10 V.
6. Select **Differential**.
7. Click **Get** to acquire a single value from analog input channel 0.
   The application displays the value on the screen in both text and graphical form.

Testing Single-Value Analog Output

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

1. Connect an oscilloscope or voltmeter to analog output channel 0 on the module. Refer to page 56 for an example of how to connect analog output signals.
2. In the Quick DataAcq application, choose **Single Analog Output** from the **Control** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. In the **Channel** list box, select analog output channel 0.
5. In the **Range** list box, select the output range of DAC0. The default is ±10 V.
6. Enter an output value, or use the slider to select a value, to output from DAC0.
7. Click **Send** to output a single value from analog output channel 0.
   The application displays the output value both on the slider and in the text box.

Testing Continuous Analog Input

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

1. Connect known voltage sources, such as the outputs of a function generator, to analog input channels 0 and 1 on the DT9834 Series module (differential mode). Refer to page 52 for an example of how to connect a differential analog input.
2. In the Quick DataAcq application, choose **Scope** from the **Acquisition** menu.
3. Select the DT9834 Series module from the **Board** list box.
4. In the **Sec/Div** list box, select the number of seconds per division (.1 to .00001) for the display.
5. In the **Channel** list box, select analog input channel 1, and then click **Add** to add the channel to the channel list. Note that, by default, channel 0 is included in the channel list.
6. Click **Config** from the Toolbar.
7. In the **Config** dialog, select **ChannelType**, and then select **Differential**.
8. In the **Config** dialog, select **Range,** and then select **Bipolar**.
9. Click **OK** to close the dialog box.
10. From the Scope view, double-click the input range of the channel to change the input range of the module (±10 V, ±5 V, ±2.5 V, or ±1.25 V). The default is ±10 V.
    The display changes to reflect the selected range for all the analog input channels on the module.
11. In the **Trigger** box, select **Auto** to acquire data continuously from the specified channels or **Manual** to acquire a burst of data from the specified channels.
12. Click **Start** from the Toolbar to start the continuous analog input operation.
    The application displays the values acquired from each channel in a unique color on the oscilloscope view.
13. Click **Stop** from the Toolbar to stop the operation.

Testing Single-Value Digital Input

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

1. Connect a digital input to digital input line 0 on the DT9834 Series module. Refer to page 57 for an example of how to connect a digital input.
2. In the Quick DataAcq application, choose **Digital Input** from the **Acquisition** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. Click **Get**.
   The application displays the entire 16-bit digital input value (0 to FFFF) in both the Data box and the Digital Input box.

   In addition, the application shows the state of the lower eight digital input lines (lines 0 to 7) in the graphical display. If an indicator light is lit (red), the line is high; if an indicator light is not lit (black), the line is low.

Note: Although the DT9834 Series modules contain 16 digital input lines, the Quick DataAcq application shows indicator lights for the lower eight digital input lines only. The 16-bit value is the correct value for all 16 lines.

Testing Single-Value Digital Output

Note: Although the DT9834 Series modules contain 16 digital output lines, the Quick DataAcq application allows you to perform a digital output operation on the lower eight digital output lines (lines 0 to 7) only.

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

1. Connect a digital output to digital output line 0 on the DT9834 Series module. Refer to page 57 for an example of how to connect a digital output.
2. In the Quick DataAcq application, choose **Digital Output** from the **Control** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. Click the appropriate indicator lights to select the types of signals to write from the digital output lines. If you select a light, the module outputs a high-level signal; if you do not select a light, the module outputs a low-level signal. You can also enter an output value for the lower eight digital output lines (0 to FF) in the **Hex** text box.
5. Click **Send**.
   The values of the lower eight digital output lines are output appropriately.

Testing Frequency Measurement

To verify that the module can perform a frequency measurement operation, do the following:

1. Wire an external clock source to counter/timer 0 on the DT9834 Series module. Refer to page 60 for an example of how to connect an external clock.

Note: The Quick DataAcq application works only with counter/timer 0.

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2. In the Quick DataAcq application, choose **Measure Frequency** from the **Acquisition** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. In the **Count Duration** text box, enter the number of seconds during which events will be counted.
5. Click **Start** to start the frequency measurement operation.
   The operation automatically stops after the number of seconds you specified has elapsed, and the frequency is displayed on the screen.

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

Testing Pulse Output

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

1. Connect a scope to counter/timer 0 on the DT9834 Series module. Refer to page 62 for an example of how to connect a scope (a pulse output) to counter/timer 0.

Note: The Quick DataAcq application works only with counter/timer 0.

2. In the Quick DataAcq application, choose **Pulse Generator** from the **Control** menu.
3. Select the appropriate DT9834 Series module from the **Board** list box.
4. Select either **Continuous** to output a continuous pulse stream or **One Shot** to output one pulse.
5. Select either **Low-to-high** to output a rising-edge pulse (the high portion of the total pulse output period is the active portion of the signal) or **High-to-low** to output a falling-edge pulse (the low portion of the total pulse output period is the active portion of the signal).
6. Under **Pulse Width**, enter a percentage or use the slider to select a percentage for the pulse width. The percentage determines the duty cycle of the pulse.
7. Click **Start** to generate the pulse(s).
   The application displays the results both in text and graphical form.
8. Click **Stop** to stop a continuous pulse output operation. One-shot pulse output operations stop automatically.

Part 2: Using Your Module

5

Principles of Operation

Figure 28 shows a block diagram of the DT9834 Series modules.

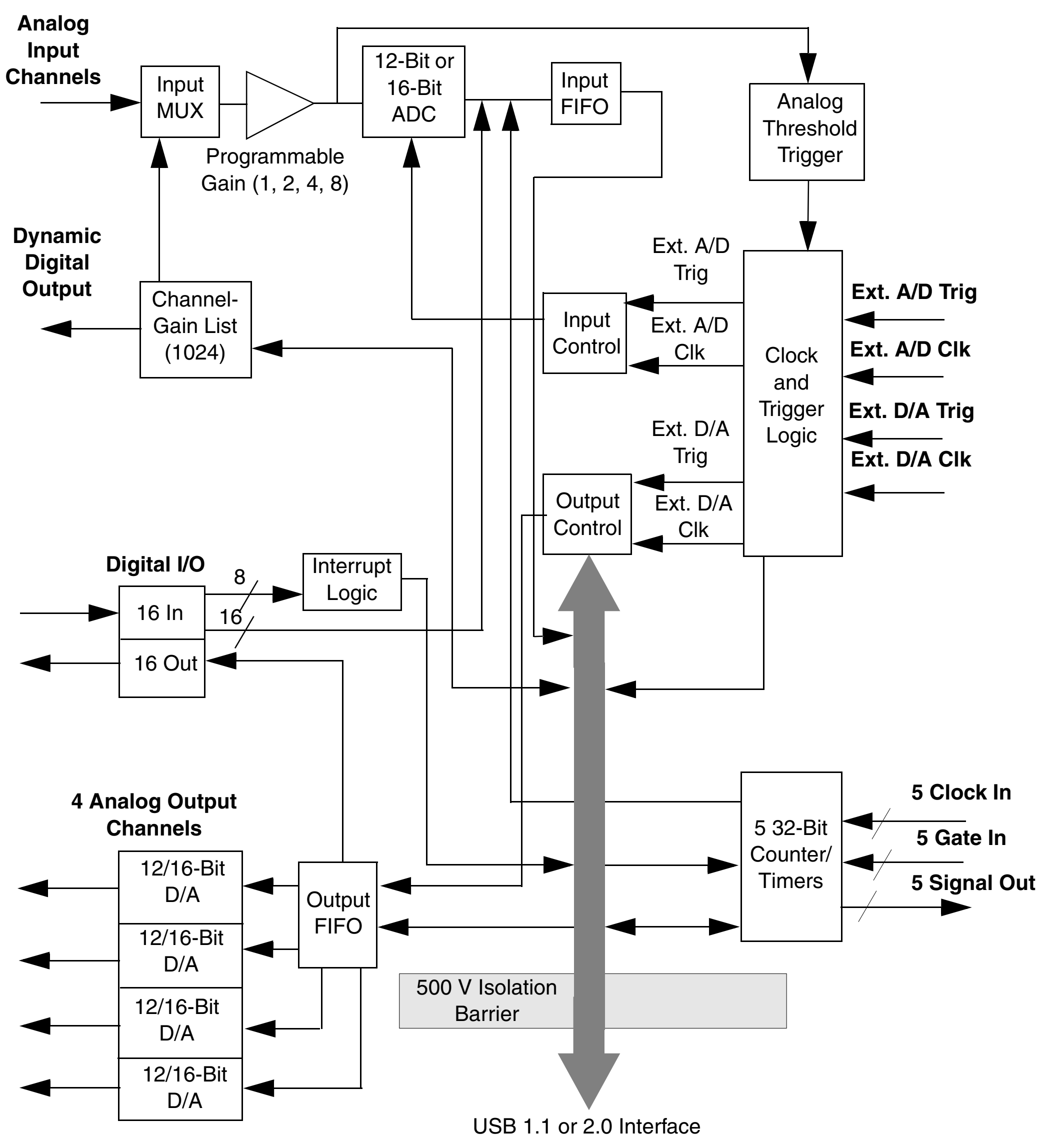

Figure 28: Block Diagram of the DT9834 Series Modules

Analog Input Features

This section describes the following features of analog input (A/D) operations on the DT9834 Series module:

- Input resolution, described below
- Analog input channels, described on page 78
- Input ranges and gains, described on page 83
- Input sample clock sources, described on page 84
- Analog input conversion modes, described on page 84
- Input triggers, described on page 87
- Data format and transfer, described on page 88
- Error conditions, described on page 89

Input Resolution

Table 7 lists the input resolution of the DT9834 Series modules that support analog input operations. The resolution is fixed at either 12 bits or 16 bits, depending on the module you are using; you cannot specify the resolution in software.

Table 7: Input Resolution

Module	Resolution	Module	Resolution
DT9834-16-0-12-OEM DT9834-16-0-12-BNC DT9834-08-0-12-BNC DT9834-16-4-12-OEM DT9834-16-4-12-BNC DT9834-08-4-12-BNC	12 bits	DT9834-16-0-16-OEM DT9834-16-0-16-BNC DT9834-08-0-16-BNC DT9834-16-4-16-OEM DT9834-16-4-16-BNC DT9834-08-4-16-BNC DT9834-32-0-16-STP DT9834-32-0-16-OEM	16 bits

Analog Input Channels

Table 8 lists the number and type of analog input channels supported by the DT9834 Series modules.

Table 8: Analog Input Channels

Module	Number of Single-Ended/ Pseudo-Differential Channels	Number of Differential Channels
DT9834-16-0-16-BNC	16 (numbered 0 to 15)	–
DT9834-16-0-16-OEM	16 (numbered 0 to 15)	8 (numbered 0 to 7)
DT9834-16-4-16-BNC	16 (numbered 0 to 15)	–
DT9834-16-4-16-OEM	16 (numbered 0 to 15)	8 (numbered 0 to 7)
DT9834-8-0-16-BNC	–	8 (numbered 0 to 7)
DT9834-8-4-16-BNC	–	8 (numbered 0 to 7
DT9834-32-0-16-STP	32 (numbered 0 to 31)	16 (numbered 0 to 15)
DT9834-32-0-16-OEM	32 (numbered 0 to 31)	16 (numbered 0 to 15)

You can use the analog input channels in one of the following configurations:

- **Single-ended** – Single-ended channels are useful when you are measuring high-level signals, when noise is not significant, when the source of the input is close to the module, and when all the input signals are referred to the same common ground.
- **Pseudo-Differential** – Pseudo-differential channels are useful when noise or common-mode voltage (the difference between the ground potentials of the signal source and the ground of the screw terminal panel or between the grounds of other signals) exists and when the differential configuration is not suitable for your application. This option provides less noise rejection than the differential configuration; however, more analog input channels are available.
- **Differential** – Differential channels are useful when you want to measure low-level signals, when noise is a significant part of the signal, or when common-mode voltage exists.

The BNC connection box is shipped in either a differential or single-ended channel configuration. For the STP and OEM versions of the module, you configure the channel type as single-ended or differential through software.

Note: For pseudo-differential inputs, specify single-ended in software; in this case, how you wire these signals determines the configuration.

Using the Open Layers Control Panel applet, you can also select whether to use 10 kΩ termination resistance between the low side of each differential channel and isolated analog ground. This feature is particularly useful with floating signal sources. Refer to page 52 for more information about wiring to inputs and configuring the driver to use bias return termination resistance.

The DT9834 Series modules can acquire data from a single analog input channel or from a group of analog input channels. The following subsections describe how to specify the channels.

Specifying a Single Analog Input Channel

The simplest way to acquire data from a single analog input channel is to specify the channel for a single-value analog input operation using software; refer to page 84 for more information about single-value operations.

You can also specify a single channel using the analog input channel list, described in the next section.

Specifying One or More Analog Input Channels

You can read data from one or more analog input channels using an analog input channel list. You can group the channels in the list sequentially (starting either with 0 or with any other analog input channel) or randomly. You can also specify a single channel or the same channel more than once in the list.

Using software, specify the channels in the order you want to sample them. You can enter up to 1,024 entries in the channel list. The channels are read in order (using continuously paced scan mode or triggered scan mode) from the first entry in the list to the last entry in the list. Refer to page 84 for more information about the supported conversion modes.

You can also use software to inhibit data collection from a specified entry in t he channel list. This feature is useful if you want to discard acquired values from specific entries in the channel list. Using software, you can enable or disable inhibition for each entry in the channel list. If enabled, the value is discarded after the channel is read; if disabled, the value is not discarded after the channel is read.

Analog Threshold Trigger in Channel List

If you select an analog input channel as the analog threshold trigger source, the channel used for this trigger source must be the first channel specified in the channel list; refer to page 87 for more information about this trigger source.

Maximum Rate

The maximum rate at which the module can read the analog input channels depends on the total number of analog input channels and/or counter/timer channels (see page 80) in the list, and whether or not you are reading the digital input port (see the next section).

For example, since the maximum throughput of the analog input subsystem is 500 kSamples/s, the module can read two analog input channels at a rate of 250 kSamples/s each or four analog input channels at a rate of 125 kSamples/s each.

Specifying the Digital Input Port in the Analog Input Channel List

The DT9834 Series modules allow you to read the digital input port (all 16 digital input lines) using the analog input channel list. This feature is particularly useful when you want to correlate the timing of analog and digital events.

To read the digital input port, specify channel 16 or channel 32 in the analog input channel list. Use channel 16 for modules with 16 single-ended channels or eight differential channels; use channel 32 for modules with 32 single-ended channels or 16 differential channels. You can enter channel 16 or 32 anywhere in the list, and you can enter it more than once, if desired.

The digital input port is treated like any other channel in the analog input channel list; therefore, all the clocking, triggering, and conversion modes supported for analog input channels are supported for the digital input port, if you specify them this way.

Maximum Rate

The maximum rate at which the module can read the digital input port depends on the total number of analog input channels (see page 79) and counter/timer channels (see the next section) in the channel list.

For example, since the maximum throughput of the analog input subsystem is 500 kSamples/s, the module can read one analog input channel and the digital input port (two channels/ports) at a rate of 250 kSamples/s each or three analog input channels and the digital input port (four channels/ports) at a rate of 125 kSamples/s each.

Specifying Counter/Timers in the Analog Input Channel List

On the DT9834 Series modules, you can read the value of one or more of the five counter/timer channels using the analog input channel list. This feature is particularly useful when you want to correlate the timing of analog and counter/timer events.

To read a counter/timer channel, specify the appropriate channel number in the analog input channel list (refer to Table 9 on page 81). You can enter a channel number anywhere in the list, and you can enter it more than once, if desired.

You need two channel list entries to read one 32-bit counter value. The first entry stores the lower 16-bit word, and the second entry stores the upper 16-bit word. If you need only the lower 16-bit word, you do not have to include the second entry. The entire 32-bit count value is latched when the lower 16-bit word is stored. This prevents the counter/timer value that is being read from changing between samples.

Table 9 lists the channel number(s) to use for each counter/timer.

Table 9: Using Counter/Timers in Analog Input Channel List

Counter/Timer Channel	Description	Channel to Specify in Channel List for: Modules with 16 SE or 8 DI Channels	Modules with 32 SE or 16 DI Channels
C/T_0_LOW	Lower 16 bits (0 to 15) of C/T 0	Channel 17	Channel 33
C/T_0_HI	Upper 16 bits (16 to 31) of C/T 0	Channel 18	Channel 34
C/T_1_LOW	Lower 16 bits (0 to 15) of C/T 1	Channel 19	Channel 35
C/T_1_HI	Upper 16 bits (16 to 31) of C/T 1	Channel 20	Channel 36
C/T_2_LOW	Lower 16 bits (0 to 15) of C/T 2	Channel 21	Channel 37
C/T_2_HI	Upper 16 bits (16 to 31) of C/T 2	Channel 22	Channel 38
C/T_3_LOW	Lower 16 bits (0 to 15) of C/T 3	Channel 23	Channel 39
C/T_3_HI	Upper 16 bits (16 to 31) of C/T 3	Channel 24	Channel 40
C/T_4_LOW	Lower 16 bits (0 to 15) of C/T 4	Channel 25	Channel 41
C/T_4_HI	Upper 16 bits (16 to 31) of C/T 4	Channel 26	Channel 42

Note: To read the entire 32-bit value, specify the channel corresponding to the lower 16-bit word first, followed by the channel corresponding to the upper 16-bit word.

While you can read the lower 16-bit word of a 32-bit counter, you cannot read just the upper 16-bit word.

The counter/timer channel is treated like any other channel in the analog input channel list; therefore, all the clocking, triggering, and conversion modes supported for analog input channels are supported for the counter/timers, if you specify them this way.

Maximum Rate

The maximum rate at which the module can read the counter/timers depends on the total number of counter/timer channels and analog input channels (see page 79) in the list and whether or not you are reading the digital input port (see page 80). Remember that each 32-bit counter requires two channels in the channel list.

For example, since the maximum throughput of the analog input subsystem is 500 kSamples/s, the module can read one analog input channel and one counter/timer (three channels total) at a maximum sample rate per channel of 166.667 kSamples/s. To read three analog input channels and one counter/timer (five channels total), the maximum sample rate per channel is 100 kSamples/s.

Performing Dynamic Digital Output Operations

Note: This feature is accessible using the DataAcq SDK. It is not supported in the DT-Open Layers for .NET Class Library.

Using software, you can enable a synchronous dynamic digital output operation for the analog input subsystem. This feature is particularly useful when you want to synchronize and control external equipment.

One dynamic digital output line is accessible through hardware. This line is set to a value of 0 on power up; a reset does not affect the value of the dynamic digital output line. Note that this line is provided in addition to the other 16 digital output lines; see page 96 for more information about the digital I/O features.

You specify the value (0 or 1) to write from the dynamic digital output line using the analog input channel list. A value of 0 indicates a low-level signal; a value of 1 indicates a high-level signal.

As each entry in the channel list is read, the corresponding value is output to the dynamic digital output line. For example, assume that dynamic digital output operations are enabled; that the channel list contains analog input channels 0, 1, 2, and 3; and that the channel list contains the dynamic digital output values 1, 0, 0, 1. Figure 29 shows this configuration.

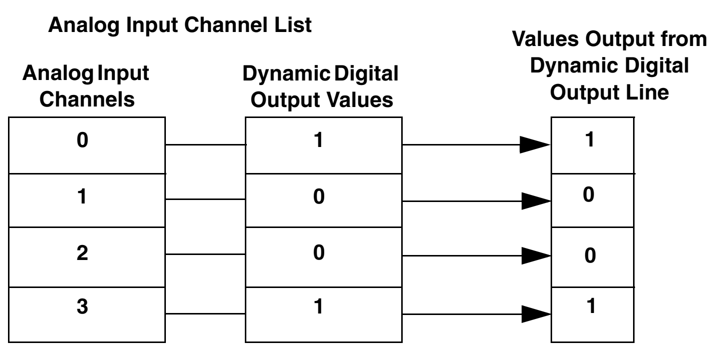

Figure 29: Example Using Dynamic Digital Outputs

As analog input channel 0 is read, a high-level signal is output to the dynamic digital output line. As analog input channels 1 and 2 are read, a low-level signal is output to the dynamic digital output line. As analog input channel 3 is read, a high-level signal is output to the dynamic digital output line.

Input Ranges and Gains

Table 10 lists the supported gains and effective bipolar input ranges for each.

Table 10: Effective Input Range

Gain	Input Range
1	±10 V
2	±5 V
4	±2.5 V
8	±1.25 V

Using software, specify a range of –10 V to +10 V. Note that this is the range for the entire analog input subsystem, not the range per channel.

For each channel, choose the gain that has the smallest effective range that includes the signal you want to measure. For example, if the range of your analog input signal is ±1.05 V, specify a range of –10 V to +10 V for the module 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.

The way you specify gain depends on how you specified the channels, as described in the following subsections.

The simplest way to specify gain for a single channel is to specify the gain for a single-value analog input operation using software; refer to page 84 for more information on single-value operations.

If you are using an analog input channel list, you can use software to specify the gain for each analog input channel entry in the analog input channel list.

Note: For channel 16 or 32 (the digital input port) and channels 17 through 26 or channels 33 through 42 (the counter/timer channels), specify a gain of 1.

Input Sample Clock Sources

DT9834 Series modules allow you to use one of the following clock sources to pace analog input operations:

- **Internal A/D clock** – Using software, specify the clock source as internal and the clock frequency at which to pace the operation. The minimum frequency supported is 0.75 Samples/s; the maximum frequency supported is 500 kSamples/s.

  This is the aggregate rate. To determine the per channel rate, you must divide the sample rate by the number of channels in the channel-gain list. For example, to read three analog input channels and the digital input port (four channels), the maximum sample rate per channel is 125 kSamples/s.

  Note: According to sampling theory (Nyquist Theorem), specify a frequency that is at least twice as fast as the input's highest frequency component. For example, to accurately sample a 20 kHz signal, specify a sampling frequency of at least 40 kHz. Doing so avoids an error condition called *aliasing*, in which high frequency input components erroneously appear as lower frequencies after sampling.

- **External A/D clock** – An external A/D clock is useful when you want to pace acquisitions at rates not available with the internal A/D clock or when you want to pace at uneven intervals.

  Connect an external A/D clock to the External ADC Clock input signal on the DT9834 Series module. Conversions start on the falling edge of the external A/D clock input signal.

  Using software, specify the clock source as external. The clock frequency is always equal to the frequency of the external A/D sample clock input signal that you connect to the module.

Note: If you specify channel 16 or 32 (the digital input port) and/or channels 17 through 26 or channels 33 through 42 (the counter/timer channels) in the channel list, the input sample clock (internal or external) also paces the acquisition of the digital input port and/or counter/timer channels.

Analog Input Conversion Modes

DT9834 Series modules support the following conversion modes:

- **Single-value operations** are the simplest to use. Using software, you specify the range, gain, and analog input channel. The module acquires the data from the specified channel and returns the data immediately. For a single-value operation, you cannot specify a clock source, trigger source, scan mode, or buffer.

  Single-value operations stop automatically when finished; you cannot stop a single-value operation.

- **Scan mode** takes full advantage of the capabilities of the DT9834 Series modules. For a scan, you can specify a channel list, clock source, trigger source, scan mode, and buffer using software. Two scan modes are supported: continuous scan mode and triggered scan mode (often called burst mode). These modes are described in the following subsections.

  Using software, you can stop a scan by performing either an orderly stop or an abrupt stop. In an orderly stop, the module finishes acquiring the data, stops all subsequent acquisition, and transfers the acquired data to host memory; any subsequent triggers are ignored.

  In an abrupt stop, the module stops acquiring samples immediately; the acquired data is not transferred to host memory, and any subsequent triggers are ignored.

Continuous Scan Mode

Use continuous scan mode if you want to accurately control the period between conversions of individual channels in a scan.

When it detects an initial trigger, the module cycles through the channel list, acquiring and converting the value for each entry in the list (this process is defined as the scan). The module then wraps to the start of the channel list and repeats the process continuously until either the allocated buffers are filled or until you stop the operation. Refer to page 88 for more information about buffers.

The conversion rate is determined by the frequency of the input sample clock; refer to page 84 for more information about the input sample clock. The sample rate, which is the rate at which a single entry in the channel list is sampled, is determined by the frequency of the input sample clock divided by the number of entries in the channel list.

To select continuous scan mode, use software to specify the data flow as Continuous and to specify the initial trigger (the trigger source that starts the operation). You can select a software trigger, an external, positive digital (TTL) trigger, an external, negative digital (TTL) trigger, or an analog threshold trigger as the initial trigger. Refer to page 87 for more information about the supported trigger sources.

Figure 30 illustrates continuous scan mode using a channel list with three entries: channel 0, channel 1, and channel 2. In this example, analog input data is acquired on each clock pulse of the input sample clock. When it reaches the end of the channel list, the module wraps to the beginning of the channel list and repeats this process. Data is acquired continuously.

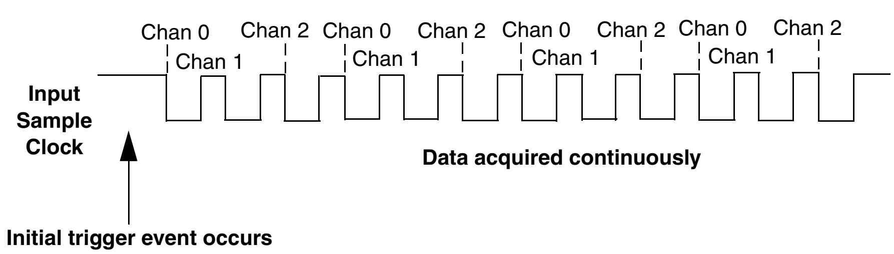

Figure 30: Continuous Scan Mode

Triggered Scan Mode

Use triggered scan mode if you want to accurately control both the period between conversions of individual channels in a scan and the period between each scan. This mode is useful in emulating simultaneous sample-and-hold and trigger-per-buffer operations. You can acquire up to 262,144 samples per trigger (256 times per trigger x 1024-location channel list).

DT9834 Series modules support two triggered scan modes: software retriggered and externally retriggered. These modes are described in the following subsections.

Software-Retriggered Scan Mode

In software-retriggered scan mode, the module waits for the initial trigger to occur. When it detects an initial trigger, the module scans the analog input channel list a specified number of times (up to 256), and then waits for a software retrigger to occur. When it detects a software retrigger, the module scans the channel list the specified number of times, and then waits for another software retrigger to occur. The process repeats continuously until either the allocated buffers are filled or you stop the operation; refer to page 88 for more information about buffers.

The sample rate is determined by the frequency of the input sample clock divided by the number of entries in the channel list; refer to page 84 for more information about the input sample clock. The conversion rate of each scan is determined by the frequency of the retrigger clock on the module. The minimum frequency supported is 0.75 Samples/s; the maximum frequency supported is 250 kSamples/s.

Specify the retrigger frequency as follows:

$$MinRetriggerPeriod = \frac{NumberOfCGLEntries \times CGLsPerTrigger}{InputSampleClockFrequency} + 2\mu s$$

$$MaxRetriggerFrequency = \frac{1}{MinRetriggerPeriod}$$

For example, if you are using 512 channels in the channel list, scanning the channel list 256 times every trigger or retrigger, and using an A/D sample clock with a frequency of 100 kHz, set the maximum retrigger frequency to 0.762 Hz, since

$$0.762Hz = \frac{1}{\left(\frac{512 \times 256}{100kHz}\right) + 2\mu s}$$

To select software-retriggered scan mode, use software to specify the following parameters:

- Dataflow as Continuous
- Triggered scan mode usage enabled
- The initial trigger (the trigger source that starts the acquisition)
- Retrigger source as Software
- The number of times to scan per trigger or retrigger (also called the multiscan count)
- The frequency of the retrigger clock

Externally-Retriggered Scan Mode

In externally-retriggered scan mode, the module waits for the initial trigger to occur. When it detects an initial trigger, the module scans the channel list up to 256 times, and then waits for an external retrigger to occur.

When the retrigger occurs, the module scans the channel list the specified number of times, and then waits for another external digital (TTL) trigger to occur. The process repeats continuously until either the allocated buffers are filled or you stop the operation; refer to page 88 for more information about buffers.

The conversion rate of each channel is determined by the frequency of the input sample clock; refer to page 84 for more information about the input sample clock. The conversion rate of each scan is determined by the period between external retriggers; therefore, it cannot be accurately controlled. The module ignores external triggers that occur while it is acquiring data. Only external retrigger events that occur when the module is waiting for a retrigger are detected and acted on.

To select externally retriggered scan mode, use software to specify the following parameters:

- Dataflow as Continuous
- Triggered scan mode enabled
- The initial trigger (the trigger source that starts the operation) as any of the supported trigger sources
- Retrigger source as either the external, positive digital (TTL) trigger, or the external, negative digital (TTL) trigger
- The number of times to scan per trigger or retrigger (also called the multiscan count)

Input Triggers

A trigger is an event that occurs based on a specified set of conditions. Acquisition starts when the module detects the initial trigger event and stops when all the allocated buffers have been filled or when you stop the operation.

If you are using triggered scan mode, the module continues to acquire data using the specified retrigger source to clock the operation. Refer to page 86 for more information about triggered scan mode.

The DT9834 Series module supports the following trigger sources:

- **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 digital (TTL) trigger** – An external digital (TTL) trigger event occurs when the DT9834 Series module detects a transition (rising-edge or falling-edge) on the External ADC Trigger input signal connected to the module. Using software, specify the trigger source as an external, positive digital (TTL) trigger for a rising-edge digital trigger, or an external, negative digital (TTL) trigger for a falling-edge digital trigger.
- **Analog threshold trigger** – An analog threshold trigger event occurs when the signal on the first channel in the analog input channel list rises above (low-to-high transition) a programmable threshold level. Using software, specify the trigger source as a positive threshold trigger.

  You can use any one of the analog input channels as the analog trigger. The analog trigger channel must be the first entry in the analog input channel list.

  You specify the threshold level by setting the value of D/A subsystem 1. Specify a value between 0 and 255, where 0 equals 0 V and 255 equals +10 V.

Data Format and Transfer

DT9834 Series modules use offset binary data encoding, such as 000 (for 12-bit modules) or 0000 (for 16-bit modules) to represent negative full-scale, and FFFh (for 12-bit modules) or FFFFh (for 16-bit modules) to represent positive full-scale. Use software to specify the data encoding as binary.

The ADC outputs FFFh (for 12-bit modules) or FFFFh (for 16-bit modules) for above-range signals, and 000 (for 12-bit modules) or 0000 (for 16-bit modules) for below-range signals.

Before you begin acquiring data, you must allocate buffers to hold the data. An event is returned whenever a buffer is filled. This allows you to move and/or process the data as needed.

We recommend that you allocate a minimum of two buffers for analog input operations. Data is written to multiple allocated input buffers continuously; when no more empty buffers are available, the operation stops. The data is gap-free.

Error Conditions

The DT9834 Series modules can report an error if one of the following conditions occurs:

- **A/D Over Sample –** The A/D sample clock rate is too fast. This error is reported if a new A/D sample clock pulse occurs while the ADC is busy performing a conversion from the previous A/D sample clock pulse. The host computer can clear this error. To avoid this error, use a slower sampling rate.
- **Input FIFO Overflow –** The analog input data is not being transferred fast enough to the host computer. The host computer can clear this error, but the error will continue to be generated if the Input FIFO, which can hold 8 kSamples (or 16 kBytes), is still full. To avoid this error, close other applications that may be running while you are acquiring data. If this has no effect, try using a computer with a faster processor or reduce the sampling rate.

If one of these error conditions occurs, the module stops acquiring and transferring data to the host computer.

Analog Output Features

This section describes the following features of analog output operations:

- Output resolution, described below
- Analog output channels, described on page 90
- Output ranges and gains, described on page 92
- Output triggers, described on page 92
- Output clocks, described on page 92
- Data format and transfer, described on page 95
- Error conditions, described on page 95

Output Resolution

Table 11 lists the output resolution of the DT9834 Series modules that support analog output operations. The resolution is fixed at either 12 bits or 16 bits, depending on the module you are using; you cannot specify the resolution in software.

Table 11: Output Resolution

Module	Resolution	Module	Resolution
DT9834-00-4-12-OEM DT9834-00-4-12-BNC DT9834-16-4-12-OEM DT9834-16-4-12-BNC DT9834-08-4-12-BNC	12 bits	DT9834-00-4-16-OEM DT9834-00-4-16-BNC DT9834-16-4-16-OEM DT9834-16-4-16-BNC DT9834-08-4-16-BNC	16 bits

Analog Output Channels

The following DT9834 Series modules support four DC-level analog output channels (DAC0, DAC1, DAC2, and DAC3):

- DT9834-00-4-12-OEM
- DT9834-00-4-12-BNC
- DT9834-16-4-12-OEM
- DT9834-16-4-12-BNC
- DT9834-08-4-12-BNC
- DT9834-00-4-16-OEM
- DT9834-00-4-16-BNC
- DT9834-16-4-16-OEM
- DT9834-16-4-16-BNC
- DT9834-08-4-16-BNC

Refer to page 56 for information about how to wire analog output signals to the module.

The DACs are deglitched to prevent noise from interfering with the output signal. They power up to a value of 0 V ±10 mV. Unplugging the module resets the DACs to 0 V.

The DT9834 Series modules can output data from a single DAC or simultaneously from one or more DACs and/or the digital output port. The following subsections describe how to specify the DACs/port.

Specifying a Single Analog Output Channel

The simplest way to output data from a single DAC is to specify the channel for a single-value analog output operation using software; refer to page 93 for more information about single-value operations.

You can also specify a single DAC using the output channel list, described in the next section.

Specifying Multiple Analog Output Channels and/or the Digital Output Port

You can output data from one or more DACs and/or the digital output port using the output channel list. This feature is particularly useful when you want to correlate the timing of analog and digital output events.

Using software, specify the data flow mode as continuous for the D/A subsystem (described on page 93) and specify the output channels you want to update, where 0 is DAC0, 1 is DAC1, 2 is DAC2, 3 is DAC3, and 4 is the digital output port. You can enter a maximum of 5 entries in the output channel list and the channels must be in order. Note that you can skip a channel in the list, however, if you do not want to update it.

For example, if you want to update only DAC3 and the digital output port, specify channels 3 and 4 in the output channel list. If you want to update all the DACs and the digital output ports, specify channels 0, 1, 2, 3, and 4 in the output channel list.

The amount of data that you can output for each channel depends on how many channels are in the output channel list. For example, if only one channel is entered in the output channel list, you can output up to 128K values; if all five channels are entered in the output channel list, you an output up to 24K values per channel.

Maximum Rate

The maximum rate at which the module can update the output channels depends on the total number of channels in the output channel list. Since the maximum throughput for each output channel is 500 kSamples/s, the module can update two output channels at a rate of 1000 kSamples/s or all five output channels at a rate of 2.5 MSamples/s.

Note: The digital output port is treated like any other channel in the output channel list; therefore, all the clocking, triggering, and conversion modes supported for analog output channels are supported for the digital output port, if you specify the digital output port in the output channel list.

Output Ranges and Gains

Each DAC on the DT9834 Series module can output bipolar analog output signals in the range of ±10 V.

Through software, specify the range for the entire analog output subsystem as –10 V to +10 V, and the gain for each DAC as 1.

Note: D/A subsystem 1 is used to set the threshold level for the analog threshold trigger. This subsystem has a output range of 0 to +10 V, where a raw count of 0 corresponds to 0 V and a raw count of 255 corresponds to a 10 V.

Output Triggers

A trigger is an event that occurs based on a specified set of conditions. The DT9834 Series modules support the following output trigger sources:

- **Software trigger** – A software trigger event occurs when you start the analog output operation. Using software, specify the trigger source as a software trigger.
- **External digital (TTL) trigger** – An external digital (TTL) trigger event occurs when the DT9834 Series module detects a transition (rising-edge or falling-edge) on the External DAC Trigger input signal connected to the module. Using software, specify the trigger source as either an external, positive digital (TTL) trigger for a rising-edge digital trigger, or an external, negative digital (TTL) trigger for a falling-edge trigger.

Output Clocks

DT9834 Series modules allow you to use one of the following clock sources to pace analog output operations:

- **Internal DAC clock** – Using software, specify the clock source as internal and the clock frequency at which to pace the operation. The minimum frequency supported is 0.75 Samples/s; the maximum frequency supported is 500 kSamples/s.
- **External DAC clock** – An external DAC clock is useful when you want to pace conversions at rates not available with the output sample clock or when you want to pace at uneven intervals.

  Connect an external DAC clock to the External DAC Clock input signal on the DT9834 Series module. Analog output operations start on the rising edge of the external DAC clock output signal.

Using software, specify the clock source as external. The clock frequency is always equal to the frequency of the external DAC clock output signal that you connect to the module.

Output Conversion Modes

DT9834 Series modules support the following conversion modes:

- **Single-value operations** are the simplest to use but offer the least flexibility and efficiency. Use software to specify the analog output channel that you want to update, and the value to output from that channel. For a single-value operation, you cannot specify a clock source, trigger source, or buffer. Single-value operations stop automatically when finished; you cannot stop a single-value operation.
- **Continuous analog output operations** take full advantage of the capabilities of the DT9834 Series modules. In this mode, you can specify an output channel list, clock source, trigger source, buffer, and buffer wrap mode. Two continuous analog output modes are supported: continuously paced and waveform generation mode. These modes are described in the following subsections.

  Note that in waveform mode, each channel in the output channel list must write the same number of values, use the same output clock (refer to page 92), and use the same output trigger (refer to page 92).

Continuously Paced Analog Output

Use continuously paced analog output mode if you want to accurately control the period between conversions of individual channels in the output channel list (refer to page 91 for information on specifying the output channel list).

Use software to fill the output buffer with the values that you want to write to the DACs and to the digital output port, if applicable. For example, if your output channel list contains only DAC0 and the digital output port, specify the values in the output buffer as follows: the first output value for DAC0, the first output value for the digital output port, the second output value for DAC0, the second output value for the digital output port, and so on.

When it detects a trigger, the module starts writing the values from the output buffer to the channels specified in the output channel list. The output channels are updated simultaneously. The operation repeats continuously until either all the data is output from the buffers or you stop the operation. Refer to page 95 for more information about buffers.

Make sure that the host computer transfers data to the output channel list fast enough so that the list does not empty completely; otherwise, an underrun error results.

To select continuously paced analog output mode, use software to specify the following parameters:

- Specify the data flow as Continuous
- Specify WrapSingleBuffer as False to use multiple buffers
- Specify the trigger source as any of the supported trigger sources. Refer to page 92 for more information about the supported trigger sources.

We recommend that you allocate a minimum of two buffers for a continuously paced analog output operation. Data is written from multiple output buffers continuously; when no more buffers of data are available, the operation stops. The data is gap-free.

To stop a continuously paced analog output operation, you can stop queuing buffers for the analog output system, letting the module stop when it runs out of data, or you can perform either an orderly stop or an abrupt stop using software. In an orderly stop, the module finishes outputting the specified number of samples, and then stops; all subsequent triggers are ignored. In an abrupt stop, the module stops outputting samples immediately; all subsequent triggers are ignored.

Waveform Generation

Use waveform generation mode if you want to output a waveform repetitively.

The waveform pattern can range from 2 to 120K (122,880) samples if you specify one output channel, 2 to 60K (61,440) samples for two output channels, 2 to 40K (40,960) samples for three output channels, 2 to 30K (30,720) samples for four output channels, or 2 to 24K (24,576) samples for five output channels.

Note: The waveform pattern size must be the same for all output channels, and the total number of samples must be a multiple of the total number of output channels.

Use software to fill the output buffer with the values that you want to write to the channels in the output channel list. For example, if your output channel list contains only DAC0 and the digital output port, specify the values in the output buffer as follows: the first output value for DAC0, the first output value for the digital output port, the second output value for DAC0, the second output value for the digital output port, and so on.

When it detects a trigger, the host computer transfers the entire waveform pattern to the module, and the module starts writing output values to the output channels, as determined by the output channel list. The output channels are updated simultaneously. Use software to allocate the memory and specify the waveform pattern.

To select waveform generation mode, use software to specify the following parameters:

- Specify the data flow as Continuous
- Specify WrapSingleBuffer as True to use a single buffer
- Specify the trigger source as any of the supported trigger sources (refer to page 92).

We recommend that you allocate one buffer for waveform generation mode. Data is written from a single output buffer continuously; when all the data in the buffer is written, the module returns to the first location of the buffer and continues writing data. This process continues indefinitely until you stop it.

The output FIFO can hold 128 kSamples (or 256 kBytes). If the allocated output buffer is equal to or less than the size of the output FIFO on the module, the data is written once to the module. The module recycles the data, allowing you to output the same pattern continuously without having to reload the data from the output channel list.

Data Format and Transfer

Data from the host computer must use offset binary data encoding for analog output signals, such as 000 (for 12-bit modules) or 0000 (for 16-bit modules) to represent –10 V, and FFFh (for 12-bit modules) or FFFFh (for 16-bit modules) to represent +10 V. Using software, specify the data encoding as binary.

Before you begin writing data to the output channels, you must allocate and fill buffers with the appropriate data. An event is generated whenever a buffer is output. This allows you to output additional data as needed.

Error Conditions

The DT9834 Series modules can report an error if one of the following conditions occurs:

- **Output FIFO Underflow –** The output channel list data is not being sent from the host fast enough. This error is reported if an output sample clock pulse occurs while the output channel list is empty. Note that if no new data is available to be output by either the DACs or the digital output port, the last value placed in the output channel list continues to be output by the DACs/port. You can ignore this error when performing a single-value operation.
- **DAC Over Sample error –** The output sample clock rate is too fast. This error is reported if a new output sample clock occurs while the module is busy loading the next values from the output channel list into the DACs and/or digital output port. To avoid this error, try slowing down the D/A clock, using a different wrap mode, increasing the buffer sizes, or using more buffers.

Digital I/O Features

This section describes the following features of digital I/O operations:

- Digital I/O lines, described below
- Operation modes, described on page 96

Digital I/O Lines

DT9834 Series modules support one digital input port, consisting of 16 digital input lines (lines 0 to 15) and one digital output port, consisting of 16 digital output lines (lines 0 to 15). The resolution is fixed at 16-bits.

You can specify the digital I/O line that you want to read or write in a single-value digital I/O operation. Refer to page 96 for more information about single-value operations.

In addition, if your module supports analog input channels, you can specify the entire digital input port in an analog input channel list to perform a continuous digital input operation. If your module supports analog output channels, you can specify the entire digital output port in an output channel list to perform a continuous digital output operation. Refer to page 97 for more information about continuous digital I/O operations.

A digital line is high if its value is 1; a digital line is low if its value is 0. On power up or reset, a low value (0) is output from each of the digital output lines.

The DT9834 Series modules allow you to program the first eight digital input lines to perform interrupt-on-change operations. Refer to page 97 for more information.

The DT9834 Series modules provide a dynamic digital output line that you can update whenever an analog input channel is read. The dynamic digital output line is in addition to the 16 digital output lines. Refer to page 97 for more information.

Operation Modes

The DT9834 Series modules support the following digital I/O operation modes:

- **Single-value operations** are the simplest to use but offer the least flexibility and efficiency. You use software to specify the digital I/O port and a gain of 1 (the gain is ignored). Data is then read from or written to all the digital I/O lines. For a single-value operation, you cannot specify a clock or trigger source.

  Single-value operations stop automatically when finished; you cannot stop a single-value operation.

- **Continuous digital I/O** takes full advantage of the capabilities of the DT9834 Series modules. You can specify a clock source, scan mode, trigger source, buffer, and buffer wrap mode for the operation.
  - ***Digital input*** **–** If your module supports analog input channels, enter the digital input port (all 16 digital input lines) as channel 16 or 32 in the analog input channel list; refer to page 80 for more information. The input sample clock (internal or external) paces the reading of the digital input port (as well as the acquisition of the analog input and counter/timer channels); refer to page 84 for more information.
  - ***Digital output*** **–** If your module supports analog output channels, enter the digital output port (all 16 digital output lines) as channel 4 in the output channel list; refer to page 91 for more information. The output clock (internal or external) paces the update of the digital output port (as well as the update of the analog output channels); refer to page 92 for more information.
- **Interrupt-on-change operations –** You can use the Open Layers Control Panel applet to select any of the first eight digital input lines to perform interrupt-on-change operations; refer to page 36 for more information.

  When any one of the specified digital input lines changes state, the module reads the entire 16-bit digital input value and generates an interrupt. Using software, you can determine which digital input lines change state and the current value of the digital input port.

Note: If you are using the DataAcq SDK to perform a continuous digital input operation, use the *lParam* parameter of the **olDaSetWndHandle** or **olDaSetNotificationProcedure** function to determine which digital input line changed state and the status of the digital input port when the interrupt occurred.

The low byte of the first word of *lParam* contains the state of the digital input subsystem, where bit 0 corresponds to digital input line 0 and bit 7 corresponds to digital input line 7.

The high byte of the first word of *lParam* contains the digital lines (bits) that changed state causing the interrupt to occur, where bit 8 corresponds to digital input line 0 and bit 15 corresponds to digital input line 7.

- **Dynamic digital output** is useful for synchronizing and controlling external equipment and allows you to output data to the dynamic digital output line each time an analog input value is acquired. This mode is supported by the DataAcq SDK (not by the DT-Open Layer for .NET Class Library) and is programmed through the analog input subsystem; refer to page 82 for more information.

Counter/Timer Features

This section describes the following features of counter/timer (C/T) operations:

- C/T channels, described below
- C/T clock sources, described on page 99
- Gate types, described on page 99
- Pulse types and duty cycles, described on page 100
- C/T operation modes, described on page 100

C/T Channels

The DT9834 Series modules provide five 32-bit counter/timers. The counters are numbered 0, 1, 2, 3, and 4. Each counter accepts a clock input signal and gate input signal and outputs a pulse (pulse output signal), as shown in Figure 31.

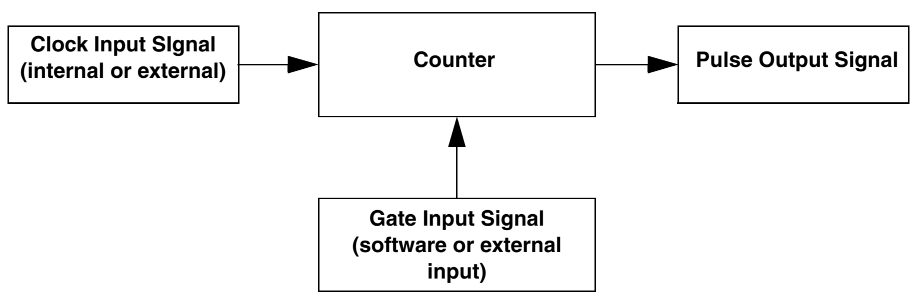

Figure 31: Counter/Timer Channel

To specify the counter/timer to use in software, specify the appropriate C/T subsystem. For example, counter/timer 0 corresponds to C/T subsystem element 0; counter/timer 3 corresponds to C/T subsystem element 3.

Using software, you can also specify one or more of the counter/timers in the analog input channel list. You need two channel list entries to read a 32-bit counter value. The first entry stores the lower 16-bit word, and the second entry stores the upper 16-bit word.

If you need only the lower 16-bit word, you do not have to include the second entry. The entire 32-bit count value is latched when the lower 16-bit word is stored. This prevents the counter/timer from incrementing between samples. Refer to page 80 for more information about using C/Ts in the channel list.

C/T Clock Sources

The following clock sources are available for the counter/timers:

- **Internal C/T clock** – The internal C/T clock always uses an 18 MHz time base. Through software, specify the clock source as internal, and specify the frequency at which to pace the operation (this is the frequency of the Counter *n* Out signal).
- **External C/T clock** – An external C/T clock is useful when you want to pace counter/timer operations at rates not available with the internal C/T clock or if you want to pace at uneven intervals. The frequency of the external C/T clock can range from 0.0042 Hz to 9 MHz.

  Connect the external clock to the Counter *n* Clock input signal on the DT9834 Series module. Counter/timer operations start on the rising edge of the clock input signal.

  Using software, specify the clock source as external and specify a clock divider between 2 and 4,294,967,296. Internally, the base frequency of C/T clock, which is 18 MHz, is divided by the specified clock divider to program the frequency of the external C/T clock.

Note: The external C/T clock (the clock connected to the Counter *n* Clock input signal) determines how often you want to count events, measure frequency, or measure the time interval between edges.

If you specify a counter/timer in the analog input channel list, the external A/D clock (the clock connected to the External ADC Clock input signal) determines how often you want to read the counter value. Refer to page 84 for more information about the external A/D clock.

Gate Types

The edge or level of the Counter *n* Gate signal determines when a counter/timer operation is enabled. DT9834 Series modules provide the following gate types:

- **None** – A software command enables any counter/timer operation immediately after execution.
- **Logic-low level external gate input** – Enables a counter/timer operation when the Counter *n* Gate signal is low, and disables the counter/timer operation when the Counter *n* Gate signal is high. Note that this gate type is used for event counting and rate generation modes; refer to page 100 for more information about these modes.
- **Logic-high level external gate input** – Enables a counter/timer operation when the Counter *n* Gate signal is high, and disables a counter/timer operation when the Counter *n* Gate signal is low. Note that this gate type is used for event counting and rate generation modes; refer to page 100 for more information about these modes.
- **Falling-edge external gate input** – Enables a counter/timer operation when a high-to-low transition is detected on the Counter *n* Gate signal. In software, this is called a low-edge gate type. Note that this gate type is used for edge-to-edge measurement, one-shot, and repetitive one-shot mode; refer to page 100 for more information about these modes.

- **Rising-edge external gate input –** Enables a counter/timer operation when a low-to-high transition is detected on the Counter *n* Gate signal. In software, this is called a high-edge gate type. Note that this gate type is used for edge-to-edge measurement, one-shot, and repetitive one-shot mode; refer to page 100 for more information about these modes.

Specify the gate type in software.

Pulse Output Types and Duty Cycles

The DT9834 Series modules can output the following types of pulses from each counter/timer:

- **High-to-low transitions –** The low portion of the total pulse output period is the active portion of the counter/timer clock output signal.
- **Low-to-high transitions –** The high portion of the total pulse output period is the active portion of the counter/timer pulse output signal.

You specify the pulse output type in software.

The duty cycle (or pulse width) indicates the percentage of the total pulse output period that is active. For example, a duty cycle of 50 indicates that half of the total pulse output is low and half of the total pulse output is high. You specify the duty cycle in software.

Figure 32 illustrates a low-to-high pulse with a duty cycle of approximately 30%.

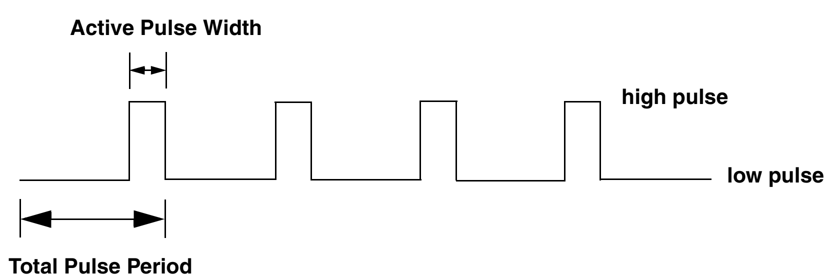

Figure 32: Example of a Low-to-High Pulse Output Type

Counter/Timer Operation Modes

DT9834 Series modules support the following counter/timer operation modes:

- Event counting
- Up/down counting
- Frequency measurement
- Edge-to-edge measurement
- Continuous edge-to-edge measurement
- Rate generation

- One-shot
- Repetitive one-shot

Note: The active polarity for each counter/timer operation mode is software-selectable.

The following subsections describe these modes in more detail.

Event Counting

Use event counting mode if you want to count the number of rising edges that occur on the Counter *n* Clock input when the Counter *n* Gate signal is active (low-level or high-level). Refer to page 99 for information about specifying the active gate type.

You can count a maximum of 4,294,967,296 events before the counter rolls over to 0 and starts counting again.

Using software, specify the counter/timer mode as event counting (count), the C/T clock source as external, and the active gate type as low-level or high-level.

Make sure that the signals are wired appropriately. Refer to page 58 for an example of connecting an event counting application.

Up/Down Counting

Use up/down counting mode if you want to increment or decrement the number of rising edges that occur on the Counter *n* Clock input, depending on the level of the Counter *n* Gate signal.

If the Counter *n* Gate signal is high, the C/T increments; if the specified gate signal is low, the C/T decrements.

Using software, specify the counter/timer mode as up/down counting (up/down), and the C/T clock source as external. Note that you do not specify the gate type in software.

Make sure that the signals are wired appropriately. Refer to page 59 for an example of connecting an up/down counting application.

Note: Initialize the counter/timer so that the C/T never increments above FFFFFFFFh or decrements below 0.

Frequency Measurement

Use frequency measurement mode if you want to measure the number of rising edges that occur on the Counter *n* Clock input over a specified duration.

You can connect a pulse of a known duration (such as a one-shot output of another user counter) to the Counter *n* Gate input signal. Use software to set up the counter/timers as follows:

1. Set up one of the counter/timers for one-shot mode, specifying the clock source as internal, the clock frequency, the gate type that enables the operation as rising edge or falling edge, and the polarity of the output pulse as high-to-low transition or low-to-high transition of the output pulse.
2. Set up the counter/timer that will measure the frequency for event counting mode, specifying the type of clock pulses to count and the gate type (this should match the pulse output type of the counter/timer set up for one-shot mode).
3. Start both counters (pulses are not counted until the active period of the one-shot pulse is generated).
4. Read the number of pulses counted. (Allow enough time to ensure that the active period of the one-shot occurred and that events have been counted.)
5. Determine the measurement period using the following equation:

$$MeasurementPeriod = \frac{1}{ClockFrequency} \times ActivePulseWidth$$

6. Determine the frequency of the clock input signal using the following equation:

$$FrequencyMeasurement = \frac{NumberOfEvents}{MeasurementPeriod}$$

Edge-to-Edge Measurement

Use edge-to-edge measurement mode if you want to measure the time interval between a specified start edge and a specified stop edge.

The start edge and the stop edge can occur on the rising edge of the Counter *n* Gate input, the falling edge of the Counter *n* Gate input, the rising edge of the Counter *n* Clock input, or the falling edge of the Counter *n* Clock input. When the start edge is detected, the counter/timer starts incrementing, and continues incrementing until the stop edge is detected. The C/T then stops incrementing until it is enabled to start another measurement. When the operation is complete, you can read the value of the counter.

You can use edge-to-edge measurement to measure the following:

- Pulse width of a signal pulse (the amount of time that a signal pulse is in a high or a low state, or the amount of time between a rising edge and a falling edge or between a falling edge and a rising edge). You can calculate the pulse width as follows:
  - Pulse width = Number of counts/18 MHz
- Period of a signal pulse (the time between two occurrences of the same edge - rising edge to rising edge or falling edge to falling edge). You can calculate the period as follows:
  - Period = 1/Frequency
  - Period = Number of counts/18 MHz
- Frequency of a signal pulse (the number of periods per second). You can calculate the frequency as follows:
  - Frequency = 18 MHz/Number of Counts

Using software, specify the counter/timer mode as edge-to-edge measurement mode (measure), the C/T clock source as internal, the start edge type, and the stop edge type.

Make sure that the signals are wired appropriately. Refer to page 61 for an example of connecting an edge-to-edge measurement application.

Continuous Edge-to-Edge Measurement

In continuous edge-to-edge measurement mode, the counter starts incrementing when it detects the specified start edge. When it detects the next start edge type, the value of the counter is stored and the next edge-to-edge measurement operation begins automatically.

Every time an edge-to-edge measurement operation completes, the previous measurement is overwritten with the new value. When you read the counter as part of the analog input data stream, the current value (from the last edge-to-edge measurement operation) is returned and the value of the counter is reset to 0. Refer to page 102 for more information on edge-to-edge measurement mode.

Note: If you read the counter before the measurement is complete, 0 is returned.

To select continuous edge-to-edge measurement mode, use software to specify the counter/timer mode as continuous measure, the C/T clock source as internal, and the start edge type.

Rate Generation

Use rate generation mode to generate a continuous pulse output signal from the Counter *n* Out line; this mode is sometimes referred to as continuous pulse output or pulse train output. You can use this pulse output signal as an external clock to pace other operations, such as analog input, analog output, or other counter/timer operations.

The pulse output operation is enabled whenever the Counter *n* Gate signal is at the specified level. While the pulse output operation is enabled, the counter outputs a pulse of the specified type and frequency continuously. As soon as the operation is disabled, rate generation stops.

The period of the output pulse is determined by the C/T clock source (either internal using a clock divider, or external). You can output pulses using a maximum frequency of 9 MHz (this is the frequency of the Counter *n* Out signal). Refer to page 99 for more information about the C/T clock sources.

Using software, specify the counter/timer mode as rate generation (rate), the C/T clock source as either internal or external, the clock divider (for an internal clock), the polarity of the output pulses (high-to-low transition or low-to-high transition), the duty cycle of the output pulses, and the active gate type (low-level or high-level). Refer to page 100 for more information about pulse output signals and to page 99 for more information about gate types.

Make sure that the signals are wired appropriately. Refer to page 62 for an example of connecting a rate generation application.

One-Shot

Use one-shot mode to generate a single pulse output signal from the Counter *n* Out line when the specified edge is detected on the Counter *n* Gate signal. You can use this pulse output signal as an external digital (TTL) trigger to start other operations, such as analog input or analog output operations.

After the single pulse is output, the one-shot operation stops. All subsequent clock input signals and gate input signals are ignored.

The period of the output pulse is determined by the C/T clock source (either internal using a clock divider, or external). Note that in one-shot mode, the internal C/T clock is more useful than an external C/T clock; refer to page 99 for more information about the C/T clock sources.

Using software, specify the counter/timer mode as one-shot, the clock source as internal (recommended), the clock divider, the polarity of the output pulse (high-to-low transition or low-to-high transition), and the active gate type (rising edge or falling edge). Refer to page 100 for more information about pulse output types and to page 99 for more information about gate types.

Note: In the case of a one-shot operation, a duty cycle of 100% is set automatically.

Make sure that the signals are wired appropriately. Refer to page 62 for an example of connecting a one-shot application.

Repetitive One-Shot

Use repetitive one-shot mode to generate a pulse output signal from the Counter *n* Out line whenever the specified edge is detected on the Counter *n* Gate signal. You can use this mode to clean up a poor clock input signal by changing its pulse width, and then outputting it.

The module continues to output pulses until you stop the operation. Note that any Counter *n* Gate signals that occur while the pulse is being output are not detected by the module.

The period of the output pulse is determined by the C/T clock source (either internal using a clock divider, or external). Note that in repetitive one-shot mode, the internal C/T clock is more useful than an external clock; refer to page 99 for more information about the C/T clock sources.

Using software, specify the counter/timer mode as repetitive one-shot, the polarity of the output pulses (high-to-low transition or low-to-high transition), the C/T clock source as internal (recommended), the clock divider, and the active gate type (rising edge or falling edge). Refer to page 100 for more information about pulse output types and to page 99 for more information about gates.

Note: In the case of a repetitive one-shot operation, a duty cycle of 100% is set automatically.

Make sure that the signals are wired appropriately. Refer to page 62 for an example of connecting a repetitive one-shot application.

6

Supported Device Driver Capabilities

The DT9834 Series Device Driver provides support for the analog input (A/D), analog output (D/A), digital input (DIN), digital output (DOUT), and counter/timer (C/T) subsystems. For information on how to configure the device driver, refer to Chapter 2.

Table 12: DT9834 Series Subsystems

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Total Subsystems on Module	1	2[a]	1[b]	1[c]	5	0	0

a. The first D/A subsystem (Element 0) is used for the analog output voltage. Element 0 is either 12-bits or 16-bits, depending on the model of the module that you are using. The output range is ±10 V. The second D/A subsystem (Element 1) is used for the analog input threshold trigger (see page 87) Element 1 has a resolution of 8-bits and a range of 0 to 255, where 0 equals 0 V and 255 equals +10 V.

b. The DIN subsystem contains 16 digital input lines.

c. The DOUT subsystem contains 16 digital output lines.

The tables in this chapter summarize the features available for use with the DT-Open Layers for .NET Class Library and the DT9834 Series modules. The DT-Open Layers for .NET Class Library provides properties that return support information for specified subsystem capabilities.

The first row in each table lists the subsystem types. The first column in each table lists all possible subsystem capabilities. A description of each capability is followed by the property used to describe that capability in the DT-Open Layers for .NET Class Library.

Note: The following tables include the capabilities that can be queried. However, some capabilities may not be supported by your device. Blank fields represent unsupported options.

For more information, refer to the description of these properties in the DT-Open Layers for .NET Class Library online help or *DT-Open Layers for .NET Class Library User's Manual*.

Data Flow and Operation Options

Table 13: Data Flow and Operation Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Single-Value Operation Support **SupportsSingleValue**	Yes	Yes	Yes	Yes			
Simultaneous Single-Value Output Operations **SupportsSetSingleValues**							
Continuous Operation Support **SupportsContinuous**	Yes	Yes	Yes[a]	Yes[b]	Yes[c]		
Continuous Operation until Trigger **SupportsContinuousPreTrigger**							
Continuous Operation before & after Trigger **SupportsContinuousPrePostTrigger**							
Waveform Operations Using FIFO Only **SupportsWaveformModeOnly**							
Simultaneous Start List Support **SupportsSimultaneousStart**	Yes	Yes					
Supports Programmable Synchronization Modes **SupportsSynchronization**							
Synchronization Modes **SynchronizationMode**							
Interrupt Support **SupportsInterruptOnChange**			Yes[d]				
FIFO Size, in samples **FifoSize**	8 kSamples	128 kSamples					
Muting and Unmuting the Output Voltage **SupportsMute**							
Auto-Calibrate Support **SupportsAutoCalibrate**							

a. If your module has analog input channels, the DIN subsystem supports continuous mode by allowing you to read the digital input port (all 16 digital input lines) using the analog input channel list.

b. If your module has analog output channels, the DOUT subsystem supports continuous mode by allowing you to output data from the digital output port (all 16 digital output lines) using the output channel list.

c. If your module has analog input channels, the C/T subsystem supports continuous mode by allowing you to read the value of one or more of the five counter/timer channels using the analog input channel list.

d. The first 8 digital input lines of the digital input port can generate an interrupt-on-change event. You enable the interrupts on a line-by-line basis during driver configuration; refer to page 36 for more information on configuring the driver. If you are using the DataAcq SDK, refer to page 96 for more information about determining which digital input lines changed state.

Buffering

Table 14: Buffering Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Buffer Support **SupportsBuffering**	Yes	Yes					
Single Buffer Wrap Mode Support **SupportsWrapSingle**		Yes					
Inprocess Buffer Flush Support **SupportsInProcessFlush**	Yes						

Triggered Scan Mode

Table 15: Triggered Scan Mode Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Triggered Scan Support **SupportsTriggeredScan**	Yes						
Maximum Number of CGL Scans per Trigger **MaxMultiScanCount**	256[a]	0	0	0	0		0
Maximum Retrigger Frequency **MaxRetriggerFreq**	250 kHz	0	0	0	0		0
Minimum Retrigger Frequency **MinRetriggerFreq**	0.75 Hz	0	0	0	0		0
Retrigger Source **RetriggerSource**	Software, TTLPos, TTLNeg						

a. The channel list depth of 1024 entries in conjunction with a multiscan of 256 provides an effective channel list depth of up to 256K entries.

Data Encoding

Table 16: Data Encoding Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Binary Encoding Support **SupportsBinaryEncoding**	Yes	Yes	Yes	Yes	Yes		
Twos Complement Support **SupportsTwosCompEncoding**							
Returns Floating-Point Values **ReturnsFloats**							

Channels

Table 17: Channel Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Number of Channels **NumberOfChannels**	27 or 43[a]	5[b]	1	1	1		0
SE Support **SupportsSingleEnded**	Yes						
SE Channels **MaxSingleEndedChannels**	16 or 32[c]	0	0	0	0		0
DI Support **SupportsDifferential**	Yes	Yes	Yes	Yes	Yes		
DI Channels **MaxDifferentialChannels**	8 or 16[d]	4[e]	1	1	1		0
Maximum Channel-Gain List Depth **CGLDepth**	1024	5	1	1	0		0
Simultaneous Sample-and-Hold Support **SupportsSimultaneousSampleHold**							
Channel-List Inhibit **SupportsChannelListInhibit**	Yes						
Support MultiSensor Inputs **SupportsMultiSensor**							
Bias Return Termination Resistor Support **SupportsInputTermination**							

a. For modules with 16 single-ended (SE) or 8 differential (DI) channels, channels 0 to 15 read the analog input channels; channel 16 reads all 16 bits from the DIN subsystem; channels 17 to 26 read the C/T channels. For modules with 32 single-ended (SE) or 16 differential (DI) channels, channels 0 to 31 read the analog input channels; channel 32 reads all 16 bits from the DIN subsystem; channels 33 to 42 read the C/T channels.

b. Channels 0 to 3 are the analog output channels, channel 4 is the digital output port.

c. The following modules support 16 single-ended or pseudo-differential channels, numbered 0 to 15: DT9834-16-0-16-BNC, DT9834-16-0-16-OEM, DT9834-16-4-16-BNC, and DT9834-16-4-16-OEM. These modules support 32 single-ended/pseduo-differential channels, numbered 0 to 31: DT9834-32-0-16-STP and DT9834-32-0-16-OEM.

d. The following modules support 8 differential channels, numbered 0 to 7: DT9834-8-0-16-BNC, DT9834-16-0-16-OEM, DT9834-8-4-16-BNC, and DT9834-16-4-16-OEM. These modules support 16 differential channels, numbered 0 to 15: DT9834-32-0-16-STP and DT9834-32-0-16-OEM.

e. The following modules support four analog output channels: DT98.34-16-4-12-OEM, DT9834-16-4-12-BNC, DT9834-0-4-12-BNC, DT9834-0-4-12-OEM, and DT9834-08-4-12-BNC, DT9834-16-4-16-OEM, DT9834-16-4-16-BNC, DT9834-0-4-16-BNC, DT9834-0-4-16-OEM, and DT9834-08-4-16-BNC.

Gain

Table 18: Gain Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Programmable Gain Support **SupportsProgrammableGain**	Yes						
Number of Gains **NumberOfSupportedGains**	4	1	1	1	0		0
Gains Available **SupportedGains**	1, 2, 4, 8	1	1	1			

Ranges

Table 19: Range Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Number of Voltage Ranges **NumberOfRanges**	1	1	0	0	0		0
Available Ranges **SupportedVoltageRanges**	±10 V	±10 V or 0 to 10 V[a]					

a. For D/A subsystem 1, the resolution is 0 to 10 V. A raw count of 0 corresponds to 0 V; a raw count of 255 corresponds to 10 V.

Resolution

Table 20: Resolution Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Software Programmable Resolution **SupportsSoftwareResolution**							
Number of Resolutions **NumberOfResolutions**	1[a]	1[a]	1	1	1		0
Available Resolutions **SupportedResolutions**	12 or 16[a]	8, 12 or 16[b]	16	16	32		

a. The following modules support 12-bit resolution: DT9834-16-0-12-OEM, DT9834-16-0-12-BNC, DT9834-08-0-12-BNC, DT98.34-16-4-12-OEM, DT9834-16-4-12-BNC, and DT9834-08-4-12-BNC.
These modules support 16-bit resolution: DT9834-16-0-16-OEM, DT9834-16-0-16-BNC, DT9834-08-0-16-BNC, DT9834-16-4-16-OEM, DT9834-16-4-16-BNC, DT9834-08-4-16-BNC, DT9834-32-0-16-STP, and DT9834-32-0-16-OEM.

b. The following modules support 12-bit resolution for D/A subsystem 0: DT98.34-16-4-12-OEM, DT9834-16-4-12-BNC, DT9834-0-4-12-BNC, DT9834-0-4-12-OEM, and DT9834-08-4-12-BNC.

These modules support 16-bit resolution for D/A subsystem 0: DT9834-16-4-16-OEM, DT9834-16-4-16-BNC, DT9834-0-4-16-BNC, DT9834-0-4-16-OEM, and DT9834-08-4-16-BNC.

For D/A subsystem 1, the resolution is 8-bits.

Current and Resistance Support

Table 21: Current and Resistance Support Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Current Support **SupportsCurrent**							
Current Output Support **SupportsCurrentOutput**							
Resistance Support **SupportsResistance**							
Software Programmable External Excitation Current Source for Resistance **SupportsExternalExcitationCurrentSrc**							
Software Programmable Internal Excitation Current Source **SupportsInternalExcitationCurrentSrc**							
Available Excitation Current Source Values **SupportedExcitationCurrentValues**							

Thermocouple, RTD, and Thermistor Support

Table 22: Thermocouple, RTD, and Thermistor Support Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Thermocouple Support **SupportsThernocouple**							
RTD Support **SupportsRTD**							
Thermistor Support **SupportsThermistor**							
Voltage Converted to Temperature **SupportsTemperatureDataInStream**							
Supported Thermocouple Types **ThermocoupleType**							
Supports CJC Source Internally in Hardware **SupportsCjcSourceInternal**							
Supports CJC Channel **SupportsCjcSourceChannel**							
Available CJC Channels **CjcChannel**							
Supports Interleaved CJC Values in Data Stream **SupportsInterleavedCjcTemperaturesInStream**							
Supported RTD Types **RTDType**							
RTD R0 Coefficient **RtdR0**							
Supports Data Filters **SupportsTemperatureFilters**							
Temperature Filter Types **TemperatureFilterType**							

IEPE Support

Table 23: IEPE Support Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
IEPE Support **SupportsIEPE**							
Software Programmable AC Coupling **SupportsACCoupling**							
Software Programmable DC Coupling **SupportsDCCoupling**							
Software Programmable External Excitation Current Source **SupportsExternalExcitationCurrent Src**							
Software Programmable Internal Excitation Current Source **SupportsInternalExcitationCurrentSrc**							
Available Excitation Current Source Values **SupportedExcitationCurrentValues**							

Bridge and Strain Gage Support

Table 24: Bridge and Strain Gage Support Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Bridge Support **SupportsBridge**							
Supported Bridge Configurations **BridgeConfiguration**							
Strain Gage Support **SupportsStrainGage**							
Supported Strain Gage Bridge Configurations **StrainGageBridgeConfiguration**							
External Excitation Voltage **SupportsExternalExcitationVoltage**							
Internal Excitation Voltage **SupportsInternalExcitationVoltage**							
Shunt Calibration **SupportsShuntCalibration**							
Voltage Excitation Per Channel **SupportedPerChannelVoltageExcitation**							
Minimum Excitation Voltage **MinExcitationVoltage**							
Maximum Excitation Voltage **MaxExcitationVoltage**							

Start Triggers

Table 25: Start Trigger Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Software Trigger Support **SupportsSoftwareTrigger**	Yes	Yes	Yes	Yes	Yes		
External Positive TTL Trigger Support **SupportsPosExternalTTLTrigger**	Yes	Yes			Yes		
External Negative TTL Trigger Support **SupportsNegExternalTTLTrigger**	Yes	Yes					
External Positive TTL Trigger Support for Single-Value Operations **SupportsSvPosExternalTTLTrigger**							
External Negative TTL Trigger Support for Single-Value Operations **SupportsSvNegExternalTTLTrigger**							
Positive Threshold Trigger Support **SupportsPosThresholdTrigger**	Yes						
Negative Threshold Trigger Support **SupportsNegThresholdTrigger**							
Digital Event Trigger Support **SupportsDigitalEventTrigger**							

Reference Triggers

Table 26: Reference Trigger Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
External Positive TTL Trigger Support **SupportsPosExternalTTLTrigger**							
External Negative TTL Trigger Support **SupportsNegExternalTTLTrigger**							
Positive Threshold Trigger Support **SupportsPosThresholdTrigger**							
Negative Threshold Trigger Support **SupportsNegThresholdTrigger**							
Digital Event Trigger Support **SupportsDigitalEventTrigger**							
Sync Bus Support **SupportsSyncBusTrigger**							
Analog Input Channels Supported for the Threshold Trigger **SupportedThresholdTriggerChannels**							
Post-Trigger Scan Count Support **SupportsPostTriggerScanCount**							

Clocks

Table 27: Clock Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Internal Clock Support **SupportsInternalClock**	Yes	Yes	Yes	Yes	Yes		
External Clock Support **SupportsExternalClock**	Yes	Yes			Yes		
Simultaneous Input/Output on a Single Clock Signal **SupportsSimultaneousClocking**		Yes					
Base Clock Frequency **BaseClockFrequency**	18 MHz	18 MHz	0	0	18 MHz		0
Maximum Clock Divider **MaxExtClockDivider**	1	1	1	1	4,294,967,296		0
Minimum Clock Divider **MinExtClockDivider**	1	1	1	1	2		0
Maximum Frequency **MaxFrequency**	500 kHz	500 kHz	0	0	9 MHz		0
Minimum Frequency **MinFrequency**	0.75 Hz	0.75 Hz	0	0	0.0042 Hz		0

Counter/Timers

Table 28: Counter/Timer Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Cascading Support **SupportsCascading**							
Event Count Mode Support **SupportsCount**					Yes		
Generate Rate Mode Support **SupportsRateGenerate**					Yes		
One-Shot Mode Support **SupportsOneShot**					Yes		
Repetitive One-Shot Mode Support **SupportsOneShotRepeat**					Yes		
Up/Down Counting Mode Support **SupportsUpDown**					Yes		
Edge-to-Edge Measurement Mode Support **SupportsMeasure**					Yes		
Continuous Edge-to-Edge Measurement Mode Support **SupportsContinuousMeasure**					Yes		
High to Low Output Pulse Support **SupportsHighToLowPulse**					Yes		
Low to High Output Pulse Support **SupportsLowToHighPulse**					Yes		
Variable Pulse Width Support **SupportsVariablePulseWidth**					Yes[a]		
None (internal) Gate Type Support **SupportsGateNone**					Yes		
High Level Gate Type Support **SupportsGateHighLevel**					Yes[b]		
Low Level Gate Type Support **SupportsGateLowLevel**					Yes[b]		
High Edge Gate Type Support **SupportsGateHighEdge**					Yes[b]		
Low Edge Gate Type Support **SupportsGateLowEdge**					Yes[b]		
Level Change Gate Type Support **SupportsGateLevel**							
Clock-Falling Edge Type **SupportsClockFalling**					Yes		
Clock-Rising Edge Type **SupportsClockRising**					Yes		
Gate-Falling Edge Type **SupportsGateFalling**					Yes		

Table 28: Counter/Timer Options (cont.)

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Gate-Rising Edge Type **SupportsGateRising**					Yes		
Interrupt-Driven Operations **SupportsInterrupt**					Yes		

a. In one-shot and repetitve one-shot mode, the pulse width is set to 100% automatically
b. High-edge and low-edge are supported for one-shot and repetitive one-shot modes. High-level and low-level are supported for event counting, up/down counting, frequency measurement, edge-to-edge measurement, continuous edge-to-edge measurement, and rate generation modes.

Tachometers

Table 29: Tachometer Options

DT9834 Series	A/D	D/A	DIN	DOUT	C/T	TACH	QUAD
Tachometer Falling Edges **SupportsFallingEdge**							
Tachometer Rising Edges **SupportsRisingEdge**							
Tachometer Stale Data Flag **SupportsStaleDataFlag**							

7

Troubleshooting

General Checklist

Should you experience problems using a DT9834 Series module, do the following:

1. Read all the documentation provided for your product, including any "Read This First" information.
2. Check the Data Acquisition OMNI 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 stated on page 30.
4. Check that you have installed your hardware properly using the instructions in Chapter 2.
5. Check that you have installed and configured the device driver properly using the instructions in Chapter 2.
6. Check that you have wired your signals properly using the instructions in Chapter 3.
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 30 to isolate and solve the problem. If you cannot identify the problem, refer to page 122.

Table 30: Troubleshooting Problems

Symptom	Possible Cause	Possible Solution
Module is not recognized	You plugged the module into your computer before installing the device driver.	From the Control Panel > System > Hardware > Device Manager, uninstall any unknown devices (showing a yellow question mark). Then, run the setup program on your OMNI CD to install the USB device drivers, and reconnect your USB module to the computer.
Module does not respond.	The module configuration is incorrect.	Check the configuration of your device driver.
	The module is damaged.	Contact Data Translation for technical support; refer to page 124.
Intermittent operation.	Loose connections or vibrations exist.	Check your wiring and tighten any loose connections or cushion vibration sources.
	The module is overheating.	Check environmental and ambient temperature; consult the module's specifications on page 142 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.

Table 30: Troubleshooting Problems (cont.)

Symptom	Possible Cause	Possible Solution
Device failure error reported.	The DT9834 Series module cannot communicate with the Microsoft bus driver or a problem with the bus driver exists.	Check your cabling and wiring and tighten any loose connections.
	The DT9834 Series module was removed while an operation was being performed.	Ensure that your DT9834 Series module is properly connected.
Data appears to be invalid.	An open connection exists.	Check your wiring and fix any open connections.
	A transducer is not connected to the channel being read.	Check the transducer connections.
	The module is set up for differential inputs while the transducers are wired as single-ended inputs or vice versa.	Check your wiring and ensure that what you specify in software matches your hardware configuration.
	The DT9834 Series module is out of calibration.	DT9834 Series modules are calibrated at the factory. If you want to readjust the calibration of the analog input or analog output circuitry, refer to Chapter 8 starting on page 127.
Computer does not boot.	The power supply of the computer is too small to handle all the system resources.	Check the power requirements of your system resources and, if needed, get a larger power supply; consult the module's specifications on page 142.
USB 2.0 is not recognized.	Your operating system does not have the appropriate Service Pack installed.	Ensure that you load the appropriate Windows Service Pack. If you are unsure of whether you are using USB 2.0 or USB 1.1, run the Open Layers Control Panel applet, described in Chapter 2.
	Standby mode is enabled on your PC.	For some PCs, you may need to disable standby mode on your system for proper USB 2.0 operation. Consult Microsoft for more information.

Technical Support

If you have difficulty using a DT9834 Series module, 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 OMNI 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 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).

8

Calibration

Using the Calibration Utility

DT9834 Series 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 and analog output circuitry on the DT9834 Series modules every six months using the DT9834 Calibration Utility.

Note: Ensure that you installed the DT9834 Series Device Driver prior to using the DT9834 Calibration Utility.

Start the DT9834 Calibration Utility as follows:

1. Click **Start** from the Task Bar, and then select **Programs | Data Translation, Inc | Calibration | DT9834 Calibration Utility**.
   The main menu of the DT9834 Series Calibration Utility appears.
2. Select the module to calibrate, and then click **OK**.

Once the DT9834 Calibration Utility is running, you can calibrate the analog input circuitry (either automatically or manually), described on page 129, or the analog output circuitry of the DT9834 Series module, described on page 131.

Calibrating the Analog Input Subsystem

This section describes how to use the DT9834 Calibration Utility to calibrate the analog input subsystem of aDT9834 Series module.

Connecting a Precision Voltage Source

To calibrate the analog input circuitry, you need to connect an external +9.3750 V precision voltage source to the DT9834 Series module as follows:

1. Connect the precision voltage source to Analog In 0 (AD Ch0).
2. Connect Analog In 1 (AD Ch1) to Analog Input 1 Return.

Using the Auto-Calibration Procedure

Auto-calibration is the easiest to use and is the recommended calibration method. To auto-calibrate the analog input subsystem, do the following:

1. Select the **A/D Configuration** tab of the DT9834 Calibration Utility.
2. Set the voltage supply on AD Ch0 to -9.375V.
3. Click **Start Auto Calibration**.
   A message appears notifying you to verify that -9.375 V is applied to AD Ch0.
4. Check that the supplied voltage to AD Ch0 is -9.375V, and then click **OK**.
   The offset value is calibrated. When the offset calibration is complete, a message appears notifying you to set the input voltage of AD Ch 0 to +9.375 V.
5. Check that the supplied voltage to AD Ch0 is +9.375V, and then click **OK**.
   The gain value is calibrated. When the gain calibration is complete, a message appears notifying you to set the input voltage of AD Ch 1 to 0 V.
6. Check that the supplied voltage to AD Ch1 is 0 V, and then click **OK**.
   The PGA zero value is calibrated and a completion message appears.
7. Click OK to finalize the analog input calibration process.

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

Using the Manual Calibration Procedure

If you want to manually calibrate the analog input circuitry instead of auto-calibrating it, do the following:

1. Adjust the offset as follows:
   a. Verify that –9.375V is applied to AD Ch0, and that A/D Channel Select is set to Channel 0.
   The current voltage reading for this channel is displayed in the A/D Value window.
   b. Adjust the offset by entering values between 0 and 255 in the Offset edit box, or by clicking the up/down buttons until the A/D Value is –9.3750 V.
2. Adjust the gain as follows:
   a. Verify that 9.375V is applied to AD Ch0, and that A/D Channel Select is set to Channel 0.
   The current voltage reading for this channel is displayed in the A/D Value window.
   b. Adjust the gain by entering values between 0 and 255 in the Gain edit box, or by clicking the up/down buttons until the A/D Value is 9.3750 V.
3. Adjust the PGA zero value as follows:
   a. Verify that 0 V is applied to AD Ch1, and that A/D Channel Select is set to Channel (which also sets the gain to 8).
   The current voltage reading for this channel is displayed in the A/D Value window.
   b. Adjust the PGA zero value by entering values between 0 and 255 in the PGA Zero edit box, or by clicking the up/down buttons until the A/D Value is 0.0000.

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

Once you have finished this procedure, continue with "Calibrating the Analog Output Subsystem" on page 131.

Calibrating the Analog Output Subsystem

This section describes how to use the DT9834 Calibration Utility to calibrate the analog output subsystem of a DT9834 Series module.

To calibrate the analog output circuitry, you need to connect an external precision voltmeter to analog output channels 0, 1, 2, and 3 of the DT9834 Series module.

Do the following to calibrate the analog output circuitry:

1. Select the D/A Configuration tab of the DT9834 Calibration Utility.
2. Connect an external precision voltmeter to Analog Output 0 (DAC Ch0) of the DT9834 Series module.
3. In the DAC Output Voltage box, select **–9.375 V**.
4. Adjust the offset by entering values between 0 and 255 in the DAC 0 Offset edit box or by clicking the up/down buttons until the voltmeter reads –9.375 V.
5. In the DAC Output Voltage box, select **9.375 V**.
6. Adjust the gain by entering values between 0 and 255 in the DAC 0 Gain edit box or by clicking the up/down buttons until the voltmeter reads 9.375 V.
7. Connect an external precision voltmeter to Analog Output 1 (DAC Ch1) of the DT9834 Series module.
8. In the DAC Output Voltage box, select **–9.375 V**.
9. Adjust the offset by entering values between 0 and 255 in the DAC 1 Offset edit box or by clicking the up/down buttons until the voltmeter reads –9.375 V.
10. In the DAC Output Voltage box, select **9.375 V**.
11. Adjust the gain by entering values between 0 and 255 in the DAC 1 Gain edit box or by clicking the up/down buttons until the voltmeter reads 9.375 V.
12. Connect an external precision voltmeter to Analog Output 2 (DAC Ch2) of the DT9834 Series module.
13. In the DAC Output Voltage box, select **–9.375 V**.
14. Adjust the offset by entering values between 0 and 255 in the DAC 2 Offset edit box or by clicking the up/down buttons until the voltmeter reads –9.375 V.
15. In the DAC Output Voltage box, select **9.375 V**.
16. Adjust the gain by entering values between 0 and 255 in the DAC 2 Gain edit box or by clicking the up/down buttons until the voltmeter reads 9.375 V.
17. Connect an external precision voltmeter to Analog Output 3 (DAC Ch3) of the DT9834 Series module.
18. In the DAC Output Voltage box, select **–9.375 V**.
19. Adjust the offset by entering values between 0 and 255 in the DAC 3 Offset edit box or by clicking the up/down buttons until the voltmeter reads –9.375 V.
20. In the DAC Output Voltage box, select **9.375 V**.

21. Adjust the gain by entering values between 0 and 255 in the DAC 3 Gain edit box or by clicking the up/down buttons until the voltmeter reads 9.375 V.

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

Once you have finished this procedure, the analog output circuitry is calibrated. To close the DT9834 Calibration Utility, click the close box in the upper right corner of the window.

A

Specifications

Analog Input Specifications

Table 31 lists the specifications for the A/D subsystem on the DT9834 Series modules.

Table 31: A/D Subsystem Specifications

Feature	Specifications
Number of analog input channels[a] Single-ended: Pseudo-differential: Differential:	 Up to 32 Up to 32 Up to 16
Number of gains	4 (1, 2, 4, 8)
Resolution	12 bits or 16 bits, depending on the model of the module that you are using[b]
Data encoding	Offset binary
System accuracy, to % of FSR 12-bit resolution Gain = 1: Gain = 2: Gain = 4: Gain = 8: 16-bit resolution Gain = 1: Gain = 2: Gain = 4: Gain = 8:	 ±0.03% ±0.04% ±0.05% ±0.07% ±0.01% ±0.02% ±0.02% ±0.03%
Range	±10 V, ±5 V, ±2.5 V, ±1.25 V
Nonlinearity	< ½ LSB
Differential nonlinearity	½ LSB
Inherent quantizing error	½ LSB
Drift Zero: Gain: Differential linearity: 16-bit resolution: 12-bit resolution:	 ±10 μV/°C ±30 ppm of FSR/°C ±2 ppm of FSR/°C ±3 ppm of FSR/°C
Input impedance Off channel: On channel:	 100 MΩ, 10 pF 100 MΩ, 100 pF
Input bias current	±20 nA
Common mode voltage	±11 V, maximum
Common mode rejection ratio 16-bit resolution: 12-bit resolution:	 80 dB, gain = 1 @ 1 kΩ 74 dB, gain = 1 @ 1 kΩ
Maximum input voltage (without damage) Power on: Power off:	 ±30 V ±20 V

Table 31: A/D Subsystem Specifications (cont.)

Feature	Specifications
A/D conversion time	2.0 µs
Channel acquisition time (±½ LSB)	1 µs, typical
Sample-and-hold Aperture uncertainty: Aperture delay:	 0.2 ns, typical 50 ns, typical
Throughput Single channel: Multiple channel:	 500 kSamples/s 500 kSamples/s ±0.05% per channel
ESD protection Arc: Contact:	 8 kV 4 kV
Reference	+5 V ±0.010 V
Monotonicity 16-bit resolution: 12-bit resolution:	 1 LSB Yes
Effective Number of Bits (ENOB) at full-scale	14.6 bits typical
Spurious Free Dynamic Range (SFDR)	100 dB typical

a. The channel type and the number of channels available depend on the model you purchase.

b. Of the modules that support analog input operations, models DT9834-16-0-12-OEM, DT9834-16-0-12-BNC, DT9834-08-0-12-BNC, DT9834-16-4-12-OEM, DT9834-16-4-12-BNC, and DT9834-08-4-12-BNC have 12-bit resolution; models DT9834-16-0-16-OEM, DT9834-16-0-16-BNC, DT9834-08-0-16-BNC, DT9834-16-4-16-OEM, DT9834-16-4-16-BNC, DT9834-08-4-16-BNC, DT9834-32-0-16-STP, and DT9834-32-0-16-OEM have 16-bit resolution.

Analog Output Specifications

Table 32 lists the specifications for the D/A subsystem on the DT9834 Series modules.

Table 32: D/A Subsystem Specifications

Feature	Specifications
Number of analog output channels	Up to 4 Simultaneous
Number of elements	2; element 0 is for the analog output voltage and element 1 is for the analog input threshold trigger
Resolution	Element 0: 12 bits or 16 bits, depending on the model of the module that you are using[a] Element 1: 8 bits
Data encoding	Offset binary
Nonlinearity 16-bit resolution: 12-bit resolution:	 1.0 LSB ½ LSB
Differential nonlinearity 16-bit resolution: 12-bit resolution:	 1.0 LSB ½ LSB
Inherent quantizing error 16-bit resolution: 12-bit resolution:	 1.0 LSB ½ LSB
Output range	±10 V
Error Zero: Gain:	 ±0.0003 V ±0.0003 V
Drift Zero (bipolar): Gain:	 ±10 ppm of FSR/°C ±30 ppm of FSR/°C
Throughput Waveform generation mode: Continuously paced analog output mode	 500 kSamples/s per channel 500 kSamples/s per channel
FIFO	128 kSamples, total
Current output	±5 mA maximum load
Output impedance	0.1 Ω maximum
Capacitive driver capability	0.004 µF
Protection	Short circuit to analog ground
Power-on voltage	0 V ±10 mV maximum

Table 32: D/A Subsystem Specifications (cont.)

Feature	Specifications
Settling time to 0.01% of FSR 16-bit resolution: 12-bit resolution:	 4.0 µs, 100 mV steps 5.0 µs, 10 V steps 1.0 µs, 100 mV steps 2.0 µs, 10 V steps
Slew rate	10 V/µs
Glitch energy	12 nV/s, typical
ESD protection Arc: Contact:	 8 kV 4 kV
Monotonicity 16-bit resolution: 12-bit resolution:	 1 LSB Yes

a. Of the modules that support analog output operations, models DT9834-00-4-12-OEM, DT9834-00-4-12-BNC, DT9834-16-4-12-OEM, DT9834-16-4-12-BNC, and DT9834-08-4-12-BNC have 12-bit resolution; models DT9834-00-4-16-OEM, DT9834-00-4-16-BNC, DT9834-16-4-16-OEM, DT9834-16-4-16-BNC, and DT9834-08-4-16-BNC have 16-bit resolution.

Digital I/O Specifications

Table 33 lists the specifications for the DIN/DOUT subsystems on the DT9834 Series modules.

Table 33: DIN/DOUT Subsystem Specifications

Feature	Specifications
Number of digital I/O lines	32 (16 digital input, 16 digital output)
Number of ports	2 (16 bits each)
Number of dynamic digital output lines	1
Input termination	Inputs tied to +3.3 V through 15 kΩ pull-up resistors
Logic family	LVTTL (+5 V tolerance)
Logic sense	Positive true
Inputs Input type: Input logic load: High input voltage: Low input voltage: Low input current:	 Level-sensitive 1 LVTTL 2.0 V minimum 0.8 V maximum –0.4 mA maximum
Outputs High output: Low output:	 2.4 V minimum with up to 6 mA 0.4 V maximum with up to 3 mA
Interrupt on change	Yes
Clocked with sample clock	Yes
Software I/O selectable	No

Counter/Timer Specifications

Table 34 lists the specifications for the C/T subsystems on the DT9834 Series modules.

Table 34: C/T Subsystem Specifications

Feature	Specifications
Number of counter/timers	5
Internal reference clock	18 MHz
Resolution	32 bits per channel
Clock divider Minimum: Maximum:	 2 4,294,967,296
Clock output Minimum: Maximum:	 0.0042 Hz 9 MHz
Maximum clock or gate input frequency	9 MHz
Minimum pulse width (minimum amount of time it takes a C/T to recognize an input pulse)	55.5 ns
Maximum input frequency	9.009 MHz
Logic family	LVTTL (+5 V tolerance)
Inputs Input logic load: High input voltage: Low input voltage: Low input current:	 1 LVTTL 2.0 V minimum 0.8 V maximum –0.4 mA maximum
Outputs High output: Low output:	 2.4 V minimum with up to 6 mA 0.4 V maximum with up to 3 mA

Trigger Specifications

Table 35 lists the specifications for the external A/D and D/A triggers on the DT9834 Series modules.

Table 35: External A/D and D/A Trigger Specifications

Feature	Specifications
Trigger sources Internal: External:	 Software-initiated Software-selectable
Input type	Edge-sensitive
Logic family	LVTTL (+5 V tolerance)
Inputs Input logic load: Input termination: High input voltage: Low input voltage: High input current: Low input current:	 1 LVTTL 2.2 kΩ pull-up to +3.3 V 2.0 V minimum 0.8 V maximum 25 µA maximum –0.25 mA maximum
Minimum pulse width High: Low:	 25 ns 25 ns
Triggering modes Single scan: Continuous scan: Triggered scan:	 Yes Yes Yes

Clock Specifications

Table 36 lists the specifications for the internal A/D and D/A clocks on the DT9834 Series modules.

Table 36: Internal A/D and D/A Clock Specifications

Feature	Specifications
Reference frequency	18 MHz
Divisor range	3 to 4,294,967,295
Usable range	0.00210 Hz to 500 kHz
Oscillator accuracy (recording time error)	±50 ppm

Table 37 lists the specifications for the external A/D and D/A clocks on the DT9834 Series modules.

Table 37: External A/D and D/A Clock Specifications

Feature	Specifications
Input type[a] A/D: D/A:	 falling edge rising edge
Logic family	LVTTL (+5 V tolerance)
Inputs Input logic load: Input termination: High input voltage: Low input voltage: Low input current:	 1 LVTTL 2.2 kΩ pull-up to +3.3 V 2.0 V 0.8 V 1.2 mA
Oscillator frequency	DC to 9 MHz
Minimum pulse width High: Low:	 25 ns 25 ns

a. A quiet (glitch-free) stable clock is required for best results and to prevent overclock conditions. In addition, it is recommended that you avoid gating the clock unless gating on and off is synchronous to the clock.

Power, Physical, and Environmental Specifications

Table 38 lists the power, physical, and environmental specifications for the DT9834 Series modules.

Table 38: Power, Physical, and Environmental Specifications

Feature	Specifications
Power, +5 V	±5% @ 2 A maximum
Physical Dimensions (OEM): Dimensions (BNC): Dimensions (STP): Weight (OEM): Weight (STP):	 190 mm x 100 mm x 20 mm 184.4 mm x 100 mm (7.30 X 3.94 inches) 216 mm x 106 mm x 51 mm 4.6 ounces 2.1 lbs
Environmental Operating temperature range (OEM): Operating temperature range (BNC): Operating temperature range (STP): Storage temperature range: Relative humidity:	 0° C to 55° C 0° C to 45° C 0° C to 45° C –25° C to 85° C To 95%, noncondensing

Connector Specifications

Table 39 lists the mating cable connectors for the connectors on the BNC connection box, the OEM version of the DT9834 Series module, and the EP353 and EP356 accessory panels.

Table 39: Mating Cable Connectors

Module/Panel	Connector	Part Number on Module (or Equivalent)	Mating Cable Connector
BNC connection box	Analog input	AMP/Tyco AMP 5747375-8	AMP/Tyco 5-747917-2
	Digital I/O	AMP/Tyco 5747301-8	AMP/Tyco 5-747916-2
	C\T, DAC, Clk, Trig	AMP/Tyco 5747301-8	AMP/Tyco 5-747916-2
OEM version	J2	AMP/Tyco 6-104068-8	AMP/Tyco 3-111196-4[a]
	J3	AMP/Tyco 6-104068-8	AMP/Tyco 3-111196-4[a]
	TB1[b]	Phoenix Contact 1707434	Phoenix Contact 1839610
EP353 accessory panel	J1	AMP/Tyco 5102321-6	AMP/Tyco 1658622-6
	J2	AMP/Tyco 5747375-8	AMP/Tyco 5-747917-2
EP356 accessory panel	J1	AMP/Tyco 5747301-8	AMP/Tyco 5-747916-2
	J2	AMP/Tyco 5747301-8	AMP/Tyco 5-747916-2

a. The mating PCB receptacle is AMP/Tyco 6-104078-3.
b. Secondary power connector.

Regulatory Specifications

The DT9834 Series modules are CE-compliant. Table 40 lists the regulatory specifications for the DT9834 Series module.

Table 40: 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 EMC Requirements 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)

External Power Supply Specifications

Table 41 lists the specifications for the EP361 +5 V external power supply that is used with the DT9834 Series modules.

Table 41: 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 TPEMG24-S050400-7	 Typical 0.38 A at 115 V AC, 0.15 A at 230 V AC Typical 0.347 A at 115 V AC, 0.215 A at 230 V AC
Frequency	47 to 63 Hz
Inrush current TPES22-050400 TPEMG24-S050400-7	 35 A at 230 V AC typical or less than 30 A by adding thermistor 6.274 A RMS at 230 V AC
Output voltage	5 V DC
Output current	4.0 A
Output wattage TPES22-050400 TPEMG24-S050400-7	 Typical 22 - 24 W Typical 20 - 24 W
Noise and ripple	1% peak to peak
Regulatory specifications TPES22-050400 TPEMG24-S050400-7	 UL, N, CE, FCC Class B UL, ITE, CE, FCC Class B, Energy Star compliant

B

Connector Pin Assignments and LED Status Indicators

OEM Version Connectors

This section describes the pin assignments for the J2 and J3 connectors on the OEM version of the DT9834 Series modules, as well as the secondary power connector, TB1. Figure 33 shows the orientation of the pins on these connectors.

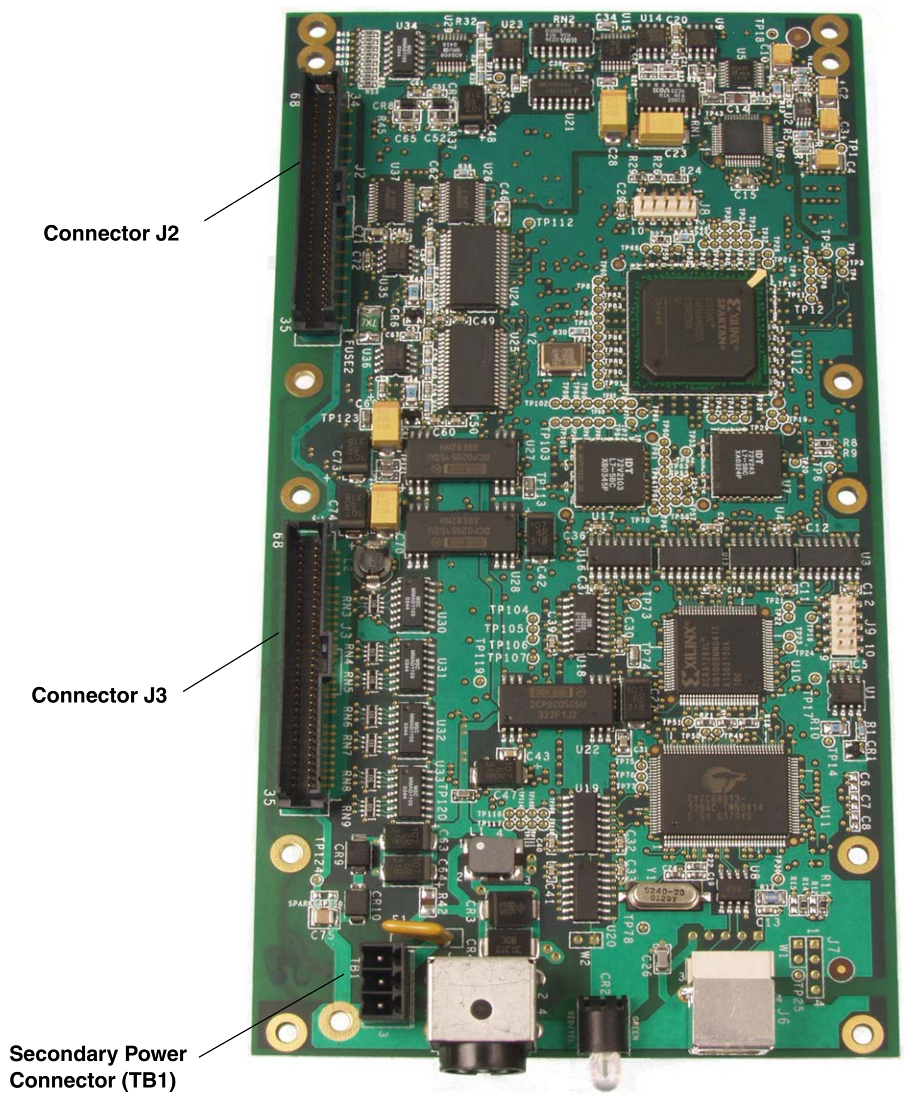

Figure 33: Orientation of Connectors J2 and J3

Table 42 lists the pin assignments for connector J2 on the OEM version of the DT9834 Series module. Table 43 lists the pin assignments for connector J3 on the OEM version of the DT9834 Series module. Table 44 lists the pin assignments for connector TB1 on the OEM version of the DT9834 Series modules.

Table 42: Pin Assignments for Connector J2 on the OEM Version of Module

Pin	Signal Description	Pin	Signal Description
1	+5 V Analog	35	Digital Ground
2	Amplifier Low[a]	36	Analog Ground
3	Analog Ground	37	Analog Ground
4	Analog Input 15 DI/ Analog Input 23 SE[b]	38	Analog Input 15 DI Return / Analog In 31 SE[b]
5	Analog Ground	39	Analog Ground
6	Analog Input 14 DI/ Analog Input 22 SE[b]	40	Analog Input 14 DI Return / Analog In 30 SE[b]
7	Analog Ground	41	Analog Ground
8	Analog Input 13 DI/ Analog Input 21 SE[b]	42	Analog Input 13 DI Return/ Analog In 29 SE[b]
9	Analog Ground	43	Analog Ground
10	Analog Input 12 DI/ Analog Input 20 SE[b]	44	Analog Input 12 DI Return/ Analog In 28 SE[b]
11	Analog Ground	45	Analog Ground
12	Analog Input 11 DI/ Analog Input 19 SE[b]	46	Analog Input 11 DI Return/ Analog In 27 SE[b]
13	Analog Ground	47	Analog Ground
14	Analog Input 10 DI/ Analog Input 18 SE[b]	48	Analog Input 10 DI Return/ Analog In 26 SE[b]
15	Analog Ground	49	Analog Ground
16	Analog Input 9 DI/ Analog Input 17 SE[b]	50	Analog Input 9 DI Return/ Analog In 25 SE[b]
17	Analog Ground	51	Analog Ground
18	Analog Input 8 DI/ Analog Input 16 SE[b]	52	Analog Input 8 DI Return/ Analog In 24 SE[b]
19	Analog Ground	53	Analog Ground
20	Analog In 7	54	Analog In 7 DI Return/ Analog In 15 SE[b]
21	Analog Ground	55	Analog Ground
22	Analog In 6	56	Analog In 6 DI Return/ Analog In 14 SE[c]
23	Analog Ground	57	Analog Ground

Table 42: Pin Assignments for Connector J2 on the OEM Version of Module (cont.)

Pin	Signal Description	Pin	Signal Description
24	Analog In 5	58	Analog In 5 DI Return/ Analog In 13 SE[c]
25	Analog Ground	59	Analog Ground
26	Analog In 4	60	Analog In 4 DI Return/ Analog In 12 SE[c]
27	Analog Ground	61	Analog Ground
28	Analog In 3	62	Analog In 3 DI Return/ Analog In 11 SE[c]
29	Analog Ground	63	Analog Ground
30	Analog In 2	64	Analog In 2 DI Return/ Analog In 10 SE[c]
31	Analog Ground	65	Analog Ground
32	Analog In 1	66	Analog In 1 DI Return/ Analog In 9 SE[c]
33	Analog Ground	67	Analog Ground
34	Analog In 0	68	Analog In 0 DI Return/ Analog In 8 SE[c]

a. If you are using the single-ended or pseudo-differential configuration, ensure that you connect this signal to analog ground on the module and to analog ground from your signal source. Refer to Chapter 3 for more information.

b. These pins are used for the DT9834-32-0-16-OEM module only. The first signal applies to the differential (DI) configuration and the second signal description applies to the single-ended (SE) configuration.

c. The first signal applies to the differential (DI) configuration and the second signal description applies to the single-ended (SE) configuration for all OEM modules.

Table 43: Pin Assignments for Connector J3 on the OEM Version of Module

Pin	Signal Description	Pin	Signal Description
1	Counter 4 Out	35	Counter 4 Gate
2	Counter 4 Clock	36	Digital Ground
3	Counter 3 Out	37	Counter 3 Gate
4	Counter 3 Clock	38	Digital Ground
5	Counter 2 Out	39	Counter 2 Gate
6	Counter 2 Clock	40	Digital Ground
7	Counter 1 Out	41	Counter 1 Gate
8	Counter 1 Clock	42	Digital Ground
9	Counter 0 Out	43	Counter 0 Gate
10	Counter 0 Clock	44	Digital Ground
11	Digital Ground	45	Dynamic Digital Out
12	Digital Input 15	46	Digital Out 15
13	Digital Input 14	47	Digital Out 14
14	Digital Input 13	48	Digital Out 13
15	Digital Input 12	49	Digital Out 12
16	Digital Input 11	50	Digital Out 11
17	Digital Input 10	51	Digital Out 10
18	Digital Input 9	52	Digital Out 9
19	Digital Input 8	53	Digital Out 8
20	Digital Input 7	54	Digital Out 7
21	Digital Input 6	55	Digital Out 6
22	Digital Input 5	56	Digital Out 5
23	Digital Input 4	57	Digital Out 4
24	Digital Input 3	58	Digital Out 3
25	Digital Input 2	59	Digital Out 2
26	Digital Input 1	60	Digital Out 1
27	Digital Input 0	61	Digital Out 0
28	External ADC Clock	62	External ADC Trigger
29	External DAC Clock	63	External DAC Trigger
30	Digital Ground	64	Digital Ground
31	Analog Out 3	65	Analog Out 3 Return

Table 43: Pin Assignments for Connector J3 on the OEM Version of Module (cont.)

Pin	Signal Description	Pin	Signal Description
32	Analog Out 2	66	Analog Out 2 Return
33	Analog Out 1	67	Analog Out 1 Return
34	Analog Out 0	68	Analog Out 0 Return

Table 44: Pin Assignments for Connector TB1 on the OEM Version of Module

TB1 Pin Assignment	Signal Description
1	+5 V
2	Ground
3	Shield (Chassis Ground)

BNC Connection Box Connectors

This section describes the pin assignments for the D-sub connectors on the BNC connection box. Note that the BNC connectors are labeled on the box.

Analog Input Connector

Figure 34 shows the orientation of the pins on the Analog Input connector on the BNC connection box.

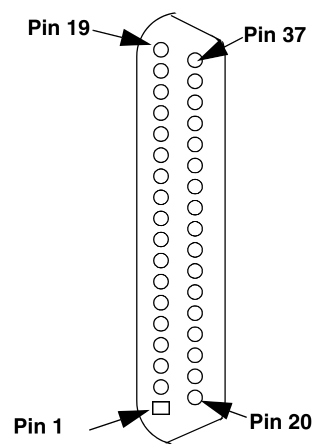

Figure 34: Orientation of the Analog Input Connector on the BNC Connection Box

Table 45 lists the pin assignments for the analog input connector on the BNC connection box.

Table 45: BNC Connection Box Analog Input Connector Pin Assignments

Pin	Signal Description	Pin	Signal Description
19	No Connect	37	Digital Ground
18	+5 V Analog	36	Analog Ground
17	Amplifier Low	35	Reserved
16	Reserved	34	Reserved
15	Reserved	33	Reserved
14	Reserved	32	Reserved
13	Reserved	31	Reserved
12	Reserved	30	Reserved
11	Reserved	29	Reserved
10	Reserved	28	Reserved

Table 45: BNC Connection Box Analog Input Connector Pin Assignments (cont.)

Pin	Signal Description	Pin	Signal Description
9	Reserved	27	Analog Input 7 Return/ Analog In 15[a]
8	Analog Input 7	26	Analog Input 6 Return/ Analog In 14[a]
7	Analog Input 6	25	Analog Input 5 Return/ Analog In 13[a]
6	Analog Input 5	24	Analog Input 4 Return/ Analog In 12[a]
5	Analog Input 4	23	Analog Input 3 Return/ Analog In 11[a]
4	Analog Input 3	22	Analog Input 2 Return/ Analog In 10[a]
3	Analog Input 2	21	Analog Input 1 Return/ Analog In 9[a]
2	Analog Input 1	20	Analog Input 0 Return/ Analog In 8[a]
1	Analog Input 0		

a. Applies to the DT9834-16-0-12-BNC, DT9834-08-0-12-BNC, DT9834-16-0-16-BNC, DT9834-08-0-16-BNC, DT9834-16-4-12-BNC, and DT9834-08-4-12-BNC modules only. The first signal description (Return) applies to the differential configuration. The second signal description applies to the single-ended configuration.

Digital I/O Connector

Figure 35 shows the orientation of the pins on the Digital I/O connector on the BNC connection box.

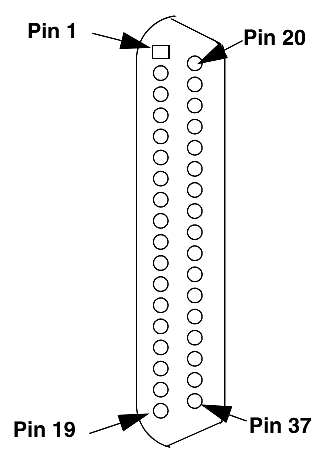

Figure 35: Orientation of the Digital I/O Connector on the BNC Connection Box

Table 46 lists the pin assignments for the digital I/O connector on the BNC connection box.

Table 46: BNC Connection Box Digital I/O Connector Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Digital Input 0	20	Digital Output 0
2	Digital Input 1	21	Digital Output 1
3	Digital Input 2	22	Digital Output 2
4	Digital Input 3	23	Digital Output 3
5	Digital Input 4	24	Digital Output 4
6	Digital Input 5	25	Digital Output 5
7	Digital Input 6	26	Digital Output 6
8	Digital Input 7	27	Digital Output 7
9	Digital Input 8	28	Digital Output 8
10	Digital Input 9	29	Digital Output 9
11	Digital Input 10	30	Digital Output 10
12	Digital Input 11	31	Digital Output 11
13	Digital Input 12	32	Digital Output 12
14	Digital Input 13	33	Digital Output 13
15	Digital Input 14	34	Digital Output 14
16	Digital Input 15	35	Digital Output 15
17	Digital Ground	36	Dynamic Digital Output
18	Digital Ground	37	Digital Ground
19	No Connect		

Analog Output, Counter/Timer, Clock, and Trigger Connector

Figure 36 shows the orientation of the pins on the Analog Output, Counter/Timer, Clock, and Trigger connector on the BNC connection box.

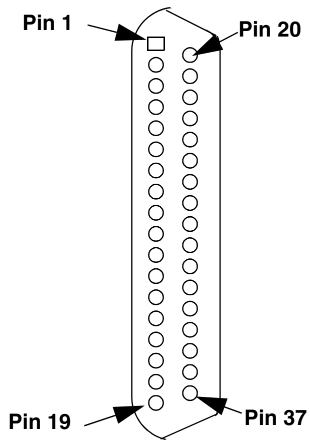

Figure 36: Orientation of the Analog Output, Counter/Timer, Clock, and Trigger Connector on the BNC Connection Box

Table 47 lists the pin assignments for the Analog output, Counter/timer, Clock, and Trigger connector on the BNC connection box.

Table 47: BNC Connection Box Analog Output, Counter/Timer, Clock, and Trigger Connector Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Analog Output 0	20	Analog Output 0 Return
2	Analog Output 1	21	Analog Output 1 Return
3	Analog Output 2	22	Analog Output 2 Return
4	Analog Output 3	23	Analog Output 3 Return
5	Digital Ground	24	Digital Ground
6	External DAC Clock	25	External DAC Trigger
7	External ADC Clock	26	External ADC Trigger
8	Counter 0 Clock	27	Digital Ground
9	Counter 0 Out	28	Counter 0 Gate
10	Counter 1 Clock	29	Digital Ground
11	Counter 1 Out	30	Counter 1 Gate
12	Counter 2 Clock	31	Digital Ground

Table 47: BNC Connection Box Analog Output, Counter/Timer, Clock, and Trigger Connector Pin Assignments (cont.)

Pin	Signal Description	Pin	Signal Description
13	Counter 2 Out	32	Counter 2 Gate
14	Counter 3 Clock	33	Digital Ground
15	Counter 3 Out	34	Counter 3 Gate
16	Counter 4 Clock	35	Digital Ground
17	Counter 4 Out	36	Counter 4 Gate
18	Digital Ground	37	Digital Ground
19	No Connect		

STP Connection Box Pin Assignments

This section describes the pin assignments for the screw terminals on the STP connection box. The STP connection box is used on the DT9834-32-0-16-STP module only. Note that the screw terminals are also labeled on the box.

Screw Terminal Block TB1

TB1 is used to connect analog input signals to the DT9834-32-0-16-STP module. Table 48 lists the screw terminal assignments for screw terminal block TB1.

Table 48: Screw Terminal Assignments for Terminal Block TB1

Screw Terminal	Signal Description
18	Analog Ground
17	Analog In 5 Return/Analog In 13[a]
16	Analog In 5
15	Analog Ground
14	Analog In 4 Return/Analog In 12[a]
13	Analog In 4
12	Analog Ground
11	Analog In 3 Return/Analog In 11
10	Analog In 3
9	Analog Ground
8	Analog In 2 Return/Analog In 10[a]
7	Analog In 2
6	Analog Ground
5	Analog In 1 Return/Analog In 9[a]
4	Analog In 1
3	Analog Ground
2	Analog In 0 Return/Analog In 8[a]
1	Analog In 0

a. The first signal description is for differential signals; the second signal description is for single-ended signals.

Screw Terminal Block TB2

TB2 is used to connect analog input signals to the DT9834-32-0-16-STP module. Table 49 lists the screw terminal assignments for screw terminal block TB2.

Table 49: Screw Terminal Assignments for Terminal Block TB2

Screw Terminal	Signal Description
18	Analog Ground
17	Analog In 11 Return/Analog In 27[a]
16	Analog In 11/Analog In 19[a]
15	Analog Ground
14	Analog In 10 Return/Analog In 26[a]
13	Analog In 10/Analog In 18[a]
12	Analog Ground
11	Analog In 9 Return/Analog In 25[a]
10	Analog In 9/Analog In 17[a]
9	Analog Ground
8	Analog In 8 Return/Analog In 24[a]
7	Analog In 8/Analog In 16[a]
6	Analog Ground
5	Analog In 7 Return/Analog In 15[a]
4	Analog In 7
3	Analog Ground
2	Analog In 6 Return/Analog In 14[a]
1	Analog In 6

a. The first signal description is for differential signals; the second signal description is for single-ended signals.

Screw Terminal Block TB3

TB 3 is used to connect analog input signals to the DT9834-32-0-16-STP module. Table 50 lists the screw terminal assignments for screw terminal block TB3.

Table 50: Screw Terminal Assignments for Terminal Block TB3

Screw Terminal	Signal Description
18	5 V Analog
17	Digital Ground
16	Analog Ground
15	Analog Ground
14	Amplifier Low
13	Amplifier Low
12	Analog Ground
11	Analog In 15 Return/Analog In 31[a]
10	Analog In 15/Analog In 23[a]
9	Analog Ground
8	Analog In 14 Return/Analog In 30[a]
7	Analog In 14/Analog In 22[a]
6	Analog Ground
5	Analog In 13 Return/Analog In 29[a]
4	Analog In 13/Analog In 21[a]
3	Analog Ground
2	Analog In 12 Return/Analog In 28[a]
1	Analog In 12/Analog In 20[a]

a. The first signal description is for differential signals; the second signal description is for single-ended signals.

Screw Terminal Block TB4

TB4 is used for connecting the external clock and trigger signals to the DT9834-32-0-16-STP module. Table 51 lists the screw terminal assignments for screw terminal block TB4.

Table 51: Screw Terminal Assignments for Terminal Block TB4

Screw Terminal	Signal Description
18	Digital Ground
17	Digital Ground
16	External ADC Trigger
15	Digital Ground
14	External ADC Clock
13	Digital Ground
12	Not Used
11	Digital Ground
10	Not Used
9	Digital Ground
8	Not Used
7	Not Used
6	Not Used
5	Not Used
4	Not Used
3	Not Used
2	Not Used
1	Not Used

Screw Terminal Block TB5

TB5 is used to connect digital inputs signals to the DT9834-32-0-16-STP module. Table 52 lists the screw terminal assignments for screw terminal block TB5.

Table 52: Screw Terminal Assignments for Terminal Block TB5

Screw Terminal	Signal Description
18	Digital Ground
17	Digital Input 15
16	Digital Input 14
15	Digital Input 13
14	Digital Input 12
13	Digital Input 11
12	Digital Input 10
11	Digital Input 9
10	Digital Input 8
9	Digital Ground
8	Digital Input 7
7	Digital Input 6
6	Digital Input 5
5	Digital Input 4
4	Digital Input 3
3	Digital Input 2
2	Digital Input 1
1	Digital Input 0

Screw Terminal Block TB6

TB6 is used to connect digital output signals to the DT9834-32-0-16-STP module. Table 53 lists the screw terminal assignments for screw terminal block TB6.

Table 53: Screw Terminal Assignments for Terminal Block TB6

Screw Terminal	Signal Description
20	Digital Ground
19	Dynamic Digital Output
18	Digital Ground
17	Digital Output 15
16	Digital Output 14
15	Digital Output 13
14	Digital Output 12
13	Digital Output 11
12	Digital Output 10
11	Digital Output 9
10	Digital Output 8
9	Digital Ground
8	Digital Output 7
7	Digital Output 6
6	Digital Output 5
5	Digital Output 4
4	Digital Output 3
3	Digital Output 2
2	Digital Output 1
1	Digital Output 0

Screw Terminal Block TB7

TB7 is used to connect counter/timer signals to the DT9834-32-0-16-STP module. Table 54 lists the screw terminal assignments for screw terminal block TB7.

Table 54: Screw Terminal Assignments for Terminal Block TB7

Screw Terminal	Signal Description
20	Counter 4 Gate
19	Counter 4 Out
18	Counter 4 Clock
17	Digital Ground
16	Counter 3 Gate
15	Counter 3 Out
14	Counter 3 Clock
13	Digital Ground
12	Counter 2 Gate
11	Counter 2 Out
10	Counter 2 Clock
9	Digital Ground
8	Counter 1 Gate
7	Counter 1 Out
6	Counter 1 Clock
5	Digital Ground
4	Counter 0 Gate
3	Counter 0 Out
2	Counter 0 Clock
1	Digital Ground

EP353 Accessory Panel Connectors

To attach an EP353 accessory panel to the OEM version of the DT9834 Series module, plug the EP353 panel into connector J2 on the OEM version of the module, as shown in Figure 37.

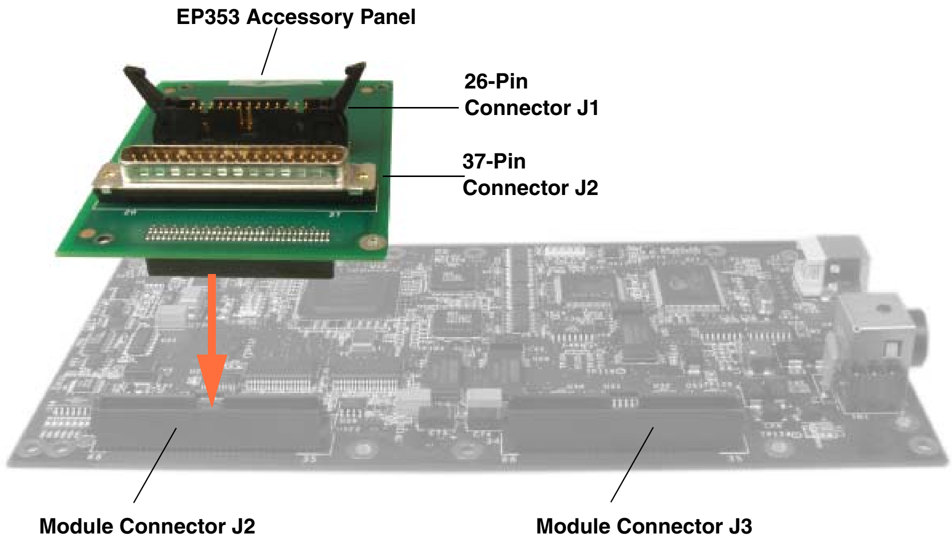

Figure 37: Connecting the EP353 Accessory Panel to Connector J2

This section describes the pin assignments for the connectors on the EP353 accessory panel.

Connector J1

Figure 38 shows the orientation of the pins for connector J1 on the EP353 panel.

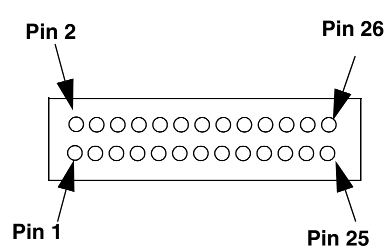

Figure 38: Orientation of the Pins for Connectors J1 on the EP353 Panel

Table 55 lists the pin assignments for connector J1 on the EP353 accessory panel.

Table 55: EP353 Connector J1 Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Analog Input 0	2	Analog Input 0 Return /Analog Input 8[a]
3	Analog Ground	4	Analog Input 1 Return /Analog Input 9[a]
5	Analog Input 1	6	Analog Ground
7	Analog Input 2	8	Analog Input 2 Return /Analog Input 10[a]
9	Analog Ground	10	Analog Input 3 Return /Analog Input 11[a]
11	Analog Input 3	12	Analog Ground
13	Analog Input 4	14	Analog Input 4 Return /Analog Input 12[a]
15	Analog Ground	16	Analog Input 5 Return /Analog Input 13[a]
17	Analog Input 5	18	Analog Ground
19	Analog Input 6	20	Analog Input 6 Return /Analog Input 14[a]
21	Analog Ground	22	Analog Input 7 Return /Analog Input 15[a]
23	Analog Input 7	24	Analog Ground
25	Amplifier Low	26	Reserved

a. The first signal description (Return) applies to the differential configuration for all modules. The second signal description applies to the single-ended configuration for all modules.

Connector J2

Figure 39 shows the orientation of the pins for connector J2 on the EP353 panel.

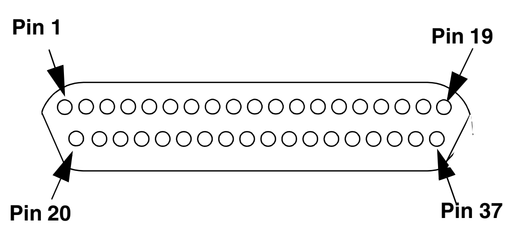

Figure 39: Orientation of the Pins for Connectors J2 on the EP353 Panel

You can access the pins on connector J2 either by using the EP360 cable and STP37 screw terminal panel (available from Data Translation), shown in Figure 40, or by building your own cable/panel. Refer to Appendix A for information about the required mating connectors.

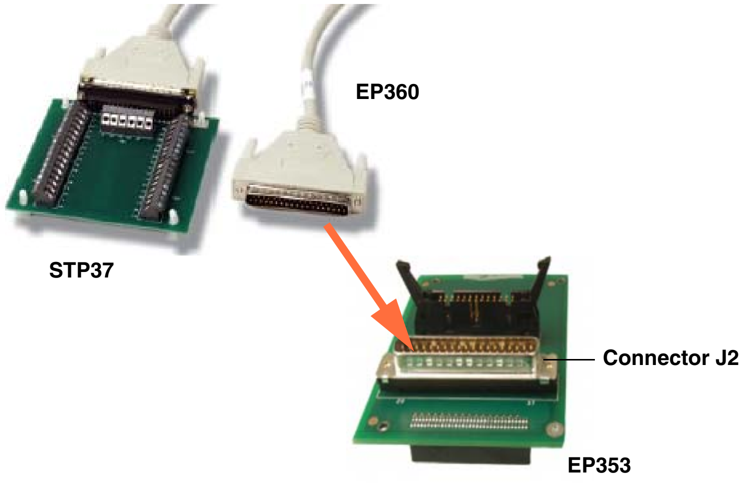

Figure 40: Connecting the STP37 Screw Terminal Panel to Connector J2 of the EP353 Accessory Panel Using the EP360 Cable

Table 56 lists the pin assignments for connector J2 on the EP353 accessory panel.

Table 56: EP353 Connector J2 Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Analog Input 0	20	Analog Input 0 DI Return/ Analog In 8 SE[a]
2	Analog Input 1	21	Analog Input 1 DI Return/ Analog In 9 SE[a]
3	Analog Input 2	22	Analog Input 2 DI Return/ Analog In 10 SE[a]
4	Analog Input 3	23	Analog Input 3 DI Return/ Analog In 11 SE[a]
5	Analog Input 4	24	Analog Input 4 DI Return/ Analog In 12 SE[a]
6	Analog Input 5	25	Analog Input 5 DI Return/ Analog In 13 SE[a]
7	Analog Input 6	26	Analog Input 6 DI Return/ Analog In 14 SE[a]
8	Analog Input 7	27	Analog Input 7 DI Return/ Analog In 15 SE[a]
9	Analog Input 8 DI/ Analog Input 16 SE[b]	28	Analog Input 8 DI Return/ Analog In 24 SE[b]
10	Analog Input 9 DI/ Analog Input 17 SE[b]	29	Analog Input 9 DI Return/ Analog In 25 SE[b]

Table 56: EP353 Connector J2 Pin Assignments (cont.)

Pin	Signal Description	Pin	Signal Description
11	Analog Input 10 DI/ Analog Input 18 SE[b]	30	Analog Input 10 DI Return / Analog In 26 SE[b]
12	Analog Input 11 DI/ Analog Input 19 SE[b]	31	Analog Input 11 DI Return/ Analog In 27 SE[b]
13	Analog Input 12 DI/ Analog Input 20 SE[b]	32	Analog Input 12 DI Return/ Analog In 28 SE[b]
14	Analog Input 13 DI/ Analog Input 21SE[b]	33	Analog Input 13 DI Return/ Analog In 29 SE[b]
15	Analog Input 14 DI/ Analog Input 22 SE[b]	34	Analog Input 14 DI Return/ Analog In 30 SE[b]
16	Analog Input 15 DI/ Analog Input 23 SE[b]	35	Analog Input 15 DI Return/ Analog In 31 SE[b]
17	Amplifier Low	36	Analog Ground
18	+5 V Analog	37	Digital Ground
19	Chassis Ground		

a. The first signal description applies to the differential (DI) configuration and the second signal description applies to the single-ended (SE) configuration for all OEM modules.

b. These pins are used for the DT9834-32-0-16-OEM module only. The first signal description applies to the differential (DI) configuration; the second signal description applies to the single-ended (SE) configuration.

EP356 Accessory Panel Connectors

To attach an EP356 accessory panel to the OEM version of the DT9834 Series module, plug the EP356 panel into connector J3 on the board, as shown in Figure 41.

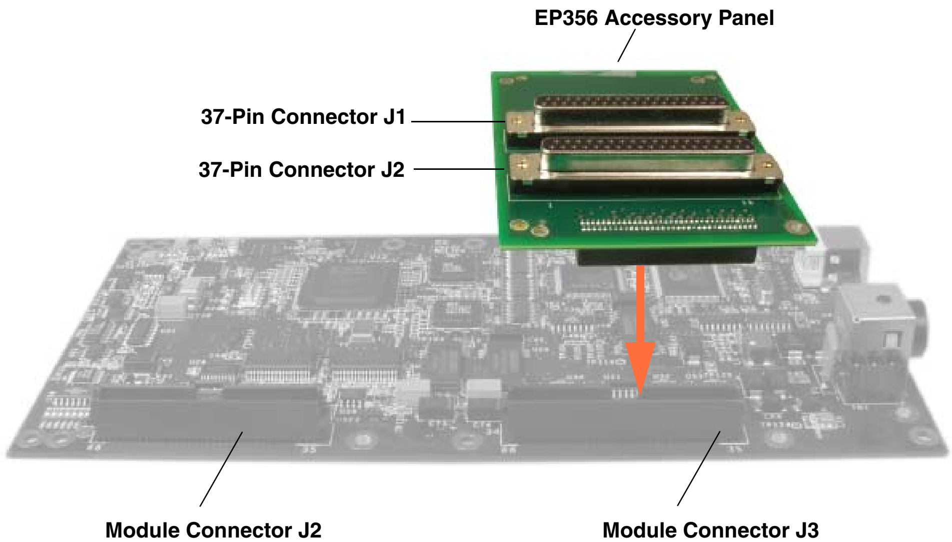

Figure 41: Connecting the EP356 Panel to the OEM Module

Figure 42 shows the orientation of the pins for connectors J1 and J2 on the EP356 panel.

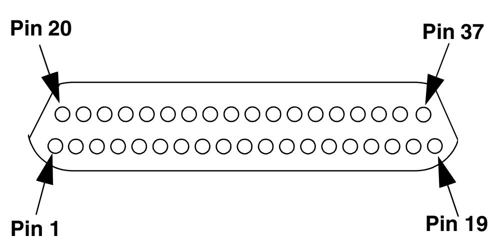

Figure 42: Orientation of the Pins for Connectors J1 and J2 of the EP356 Panel

Connector J1

Use connector J1 on the EP356 accessory panel to attach digital I/O signals. You can access the pins on connector J1 of the EP356 panel either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation), shown in Figure 43, or by building your own cable/panel. Refer to Appendix A for information about the required mating connectors.

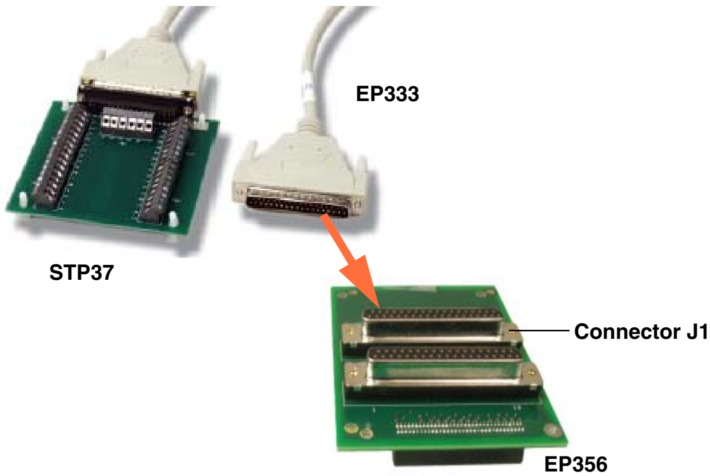

Figure 43: Connecting the STP37 Screw Terminal Panel to Connector J1 of the EP356 Accessory Panel Using the EP333 Cable

Table 57 lists the pin assignments for connector J1 on the EP356 accessory panel.

Table 57: EP356 Connector J1 Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Digital Input 0	20	Digital Output 0
2	Digital Input 1	21	Digital Output 1
3	Digital Input 2	22	Digital Output 2
4	Digital Input 3	23	Digital Output 3
5	Digital Input 4	24	Digital Output 4
6	Digital Input 5	25	Digital Output 5
7	Digital Input 6	26	Digital Output 6
8	Digital Input 7	27	Digital Output 7
9	Digital Input 8	28	Digital Output 8
10	Digital Input 9	29	Digital Output 9
11	Digital Input 10	30	Digital Output 10
12	Digital Input 11	31	Digital Output 11

Table 57: EP356 Connector J1 Pin Assignments (cont.)

Pin	Signal Description	Pin	Signal Description
13	Digital Input 12	32	Digital Output 12
14	Digital Input 13	33	Digital Output 13
15	Digital Input 14	34	Digital Output 14
16	Digital Input 15	35	Digital Output 15
17	Digital Ground	36	Dynamic Digital Output
18	Digital Ground	37	Digital Ground
19	Chassis Ground		

Connector J2

Use connector J2 on the EP356 accessory panel to attach analog output, counter/timer, trigger, and clock signals. You can access the pins on the connector J2 either by using the EP333 cable and STP37 screw terminal panel (available from Data Translation), shown in Figure 44, or by building your own cable/panel. To build your own cable/panel, refer to Appendix A for information about the required mating connectors.

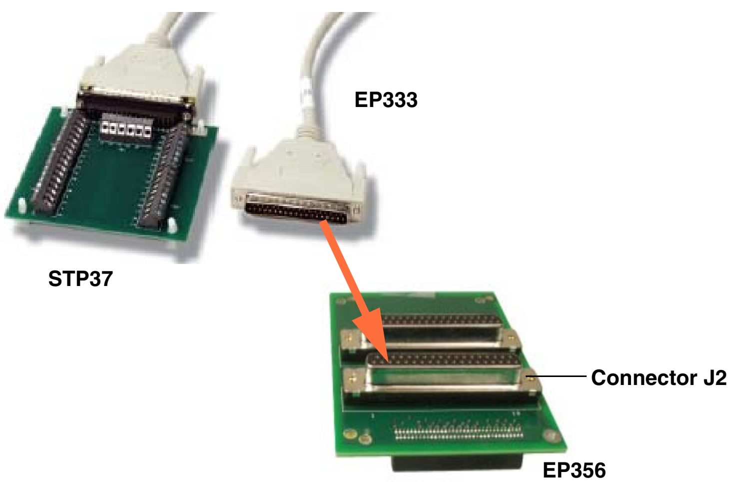

Figure 44: Connecting the STP37 Screw Terminal Panel to Connector J2 of the EP356 Accessory Panel Using the EP333 Cable

Table 58 lists the pin assignments for connector J2 on the EP356 accessory panel.

Table 58: EP356 Connector J2 Pin Assignments

Pin	Signal Description	Pin	Signal Description
1	Analog Output 0	20	Analog Output 0 Return
2	Analog Output 1	21	Analog Output 1 Return
3	Analog Output 2	22	Analog Output 2 Return
4	Analog Output 3	23	Analog Output 3 Return
5	Digital Ground	24	Digital Ground
6	External DAC Clock	25	External DAC Trigger
7	External ADC Clock	26	External ADC Trigger
8	Counter 0 Clock	27	Digital Ground
9	Counter 0 Out	28	Counter 0 Gate
10	Counter 1 Clock	29	Digital Ground
11	Counter 1 Out	30	Counter 1 Gate
12	Counter 2 Clock	31	Digital Ground
13	Counter 2 Out	32	Counter 2 Gate
14	Counter 3 Clock	33	Digital Ground
15	Counter 3 Out	34	Counter 3 Gate
16	Counter 4 Clock	35	Digital Ground
17	Counter 4 Out	36	Counter 4 Gate
18	Digital Ground	37	Digital Ground
19	Chassis Ground		

EP355 Screw Terminal Assignments

To access analog input signals from the EP355 screw terminal panel, plug the EP355 panel into connector J2 on the OEM version of the DT9834 Series module. To access analog output, digital I/O, counter/timer, external trigger, or external clock signals from the EP355 screw terminal panel, attach the EP355 panel to connector J3 on the OEM version of the DT9834 Series module. Refer to Figure 45.

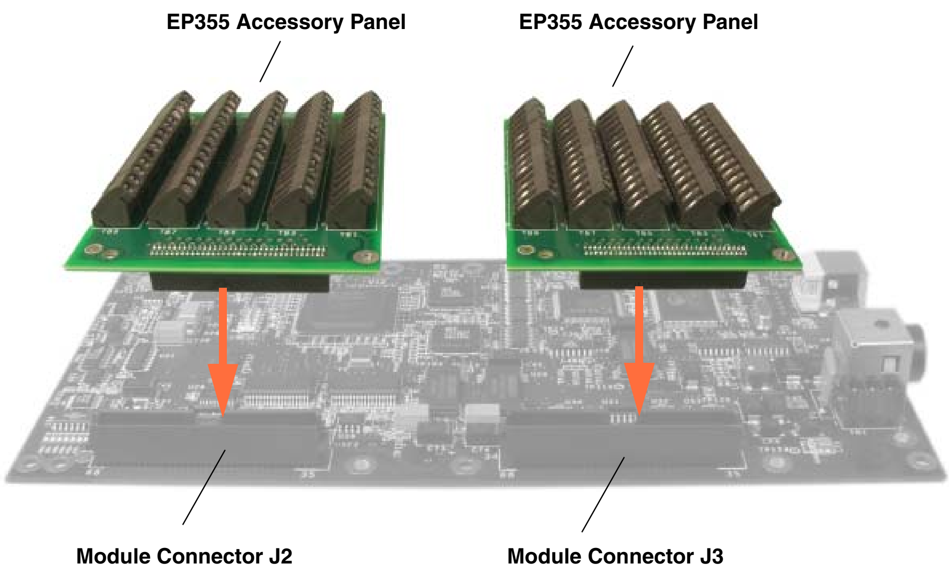

Figure 45: Connecting the EP355 Panel to the OEM Version of the DT9834 Series Module

Attached to Connector J2 on the OEM Module

Attach the EP355 screw terminal panel to connector J2 on the OEM version of the DT9834 Series module when you want to access the analog input signals. Table 59 lists the screw terminal assignments when the EP355 panel is attached to connector J2.

Table 59: Screw Terminal Assignments on the EP355 Screw Terminal Panel When Attached to Connector J2 of the Module

Screw Terminal	Terminal Block	Signal Description	Screw Terminal	Terminal Block	Signal Description
1	TB1	+5 V Analog	2	TB1	Amplifier Low
3	TB1	Analog Ground	4	TB2	Analog Input 15 DI/ Analog Input 23 SE[a]
5	TB2	Analog Ground	6	TB2	Analog Input 14 DI/ Analog Input 22 SE[a]
7	TB3	Analog Ground	8	TB3	Analog Input 13 DI/ Analog Input 21 SE[a]
9	TB3	Analog Ground	10	TB3	Analog Input 12 DI/ Analog Input 20 SE[a]
11	GND	Analog Ground	12	TB4	Analog Input 11 DI/ Analog Input 19 SE[a]
13	TB4	Analog Ground	14	TB5	Analog Input 10 DI/ Analog Input 18 SE[a]
15	TB5	Analog Ground	16	TB5	Analog Input 9 DI/ Analog Input 17 SE[a]
17	TB5	Analog Ground	18	TB6	Analog Input 8 DI/ Analog Input 16 SE[a]
19	TB6	Analog Ground	20	TB6	Analog In 7
21	TB7	Analog Ground	22	TB7	Analog In 6
23	TB7	Analog Ground	24	TB7	Analog In 5
25	TB8	Analog Ground	26	TB8	Analog In 4
27	TB8	Analog Ground	28	TB9	Analog In 3
29	TB10	Analog Ground	30	TB10	Analog In 2
31	TB10	Analog Ground	32	TB9	Analog In 1
33	TB9	Analog Ground	34	TB9	Analog In 0
35	TB1	Digital Ground	36	GND	Analog Ground
37	TB1	Analog Ground	38	TB2	Analog In 15 DI Return/Analog In 31 SE[a]
39	TB2	Analog Ground	40	TB2	Analog In 14 DI Return/Analog In 30 SE[a]
41	TB3	Analog Ground	42	TB3	Analog In 13 DI Return/Analog In 29 SE[a]
43	TB3	Analog Ground	44	TB3	Analog In 12 DI Return/Analog In 28 SE[a]
45	TB4	Analog Ground	46	TB4	Analog In 11 DI Return/Analog In 27 SE[a]
47	TB4	Analog Ground	48	TB5	Analog In 10 DI Return/Analog In 26 SE[a]
49	TB5	Analog Ground	50	TB5	Analog In 9 DI Return/Analog In 25 SE[a]
51	TB5	Analog Ground	52	TB6	Analog In 8 DI Return/Analog In 24 SE[a]
53	TB6	Analog Ground	54	TB6	Analog In 7 DI Return/Analog In 15 SE[b]
55	TB7	Analog Ground	56	TB7	Analog In 6 DI Return/Analog In 14SE[b]
57	TB7	Analog Ground	58	TB7	Analog In 5 DI Return/Analog In 13 SE[b]
59	TB8	Analog Ground	60	TB8	Analog In 4 DI Return/Analog In 12 SE[b]
61	TB8	Analog Ground	62	TB9	Analog In 3 DI Return/Analog In 11 SE[b]

Table 59: Screw Terminal Assignments on the EP355 Screw Terminal Panel When Attached to Connector J2 of the Module (cont.)

Screw Terminal	Terminal Block	Signal Description	Screw Terminal	Terminal Block	Signal Description
63	TB10	Analog Ground	64	TB10	Analog In 2 DI Return/Analog In 10 SE[b]
65	TB10	Analog Ground	66	TB9	Analog In 1 DI Return/Analog In 9 SE[b]
67	TB9	Analog Ground	68	TB9	Analog In 0 DI Return/Analog In 8 SE[b]

a. These screw terminals are used for the DT9834-32-0-16-OEM module only. The first signal description applies to the differential (DI) configuration; the second signal description applies to the single-ended (SE) configuration.

b. The first signal description applies to the differential (DI) configuration and the second signal description applies to the single-ended (SE) configuration for all OEM modules.

Attached to Connector J3 on the OEM Module

Attach the EP355 screw terminal panel to connector J3 on the OEM version of the DT9834 Series module when you want to access the analog output, counter/timer, digital I/O, trigger, and clock signals. Table 60 lists the screw terminal assignments when the EP355 panel is attached to connector J3.

Table 60: Screw Terminal Assignments on the EP355 Screw Terminal Panel When Attached to Connector J3 of the Module

Screw Terminal	Terminal Block	Signal Description	Screw Terminal	Terminal Block	Signal Description
1	TB1	Counter 4 Out	2	TB1	Counter 4 Clock
3	TB1	Counter 3 Out	4	TB2	Counter 3 Clock
5	TB2	Counter 2 Out	6	TB2	Counter 2 Clock
7	TB3	Counter 1 Out	8	TB3	Counter 1 Clock
9	TB3	Counter 0 Out	10	TB3	Counter 0 Clock
11	GND	Digital Ground	12	TB4	Digital Input 15
13	TB4	Digital Input 14	14	TB5	Digital Input 13
15	TB5	Digital Input 12	16	TB5	Digital Input 11
17	TB5	Digital Input 10	18	TB6	Digital Input 9
19	TB6	Digital Input 8	20	TB6	Digital Input 7
21	TB7	Digital Input 6	22	TB7	Digital Input 5
23	TB7	Digital Input 4	24	TB7	Digital Input 3
25	TB8	Digital Input 2	26	TB8	Digital Input 1
27	TB8	Digital Input 0	28	TB9	External ADC Clock
29	TB10	External DAC Clock	30	TB10	Digital Ground
31	TB10	Analog Out 3	32	TB9	Analog Out 2

Table 60: Screw Terminal Assignments on the EP355 Screw Terminal Panel When Attached to Connector J3 of the Module (cont.)

Screw Terminal	Terminal Block	Signal Description	Screw Terminal	Terminal Block	Signal Description
33	TB9	Analog Out 1	34	TB9	Analog Out 0
35	TB1	Counter 4 Gate	36	GND	Digital Ground
37	TB1	Counter 3 Gate	38	TB2	Digital Ground
39	TB2	Counter 2 Gate	40	TB2	Digital Ground
41	TB3	Counter 1 Gate	42	TB3	Digital Ground
43	TB3	Counter 0 Gate	44	TB3	Digital Ground
45	TB4	Dynamic Digital Out	46	TB4	Digital Out 15
47	TB4	Digital Out 14	48	TB5	Digital Out 13
49	TB5	Digital Out 12	50	TB5	Digital Out 11
51	TB5	Digital Out 10	52	TB6	Digital Out 9
53	TB6	Digital Out 8	54	TB6	Digital Out 7
55	TB7	Digital Out 6	56	TB7	Digital Out 5
57	TB7	Digital Out 4	58	TB7	Digital Out 3
59	TB8	Digital Out 2	60	TB8	Digital Out 1
61	TB8	Digital Out 0	62	TB9	External ADC Trigger
63	TB10	External DAC Trigger	64	TB10	Digital Ground
65	TB10	Analog Out 3 Return	66	TB9	Analog Out 2 Return
67	TB9	Analog Out 1 Return	68	TB9	Analog Out 0 Return

LED Status Indicators

Each DT9834 Series module has a single bi-color LED that indicates the status of the module, as described in Table 61.

Table 61: LED Status Indicators on the DT9834 Series Modules

Color of the LED	Status Description
Green	Module is powered
Blinking amber	Module is acquiring data

C

Ground, Power, and Isolation

Secondary Power Connector

The OEM version of the DT9834 Series module provides a secondary power connector, which is useful for embedded applications. The location of the connector is shown in Figure 46.

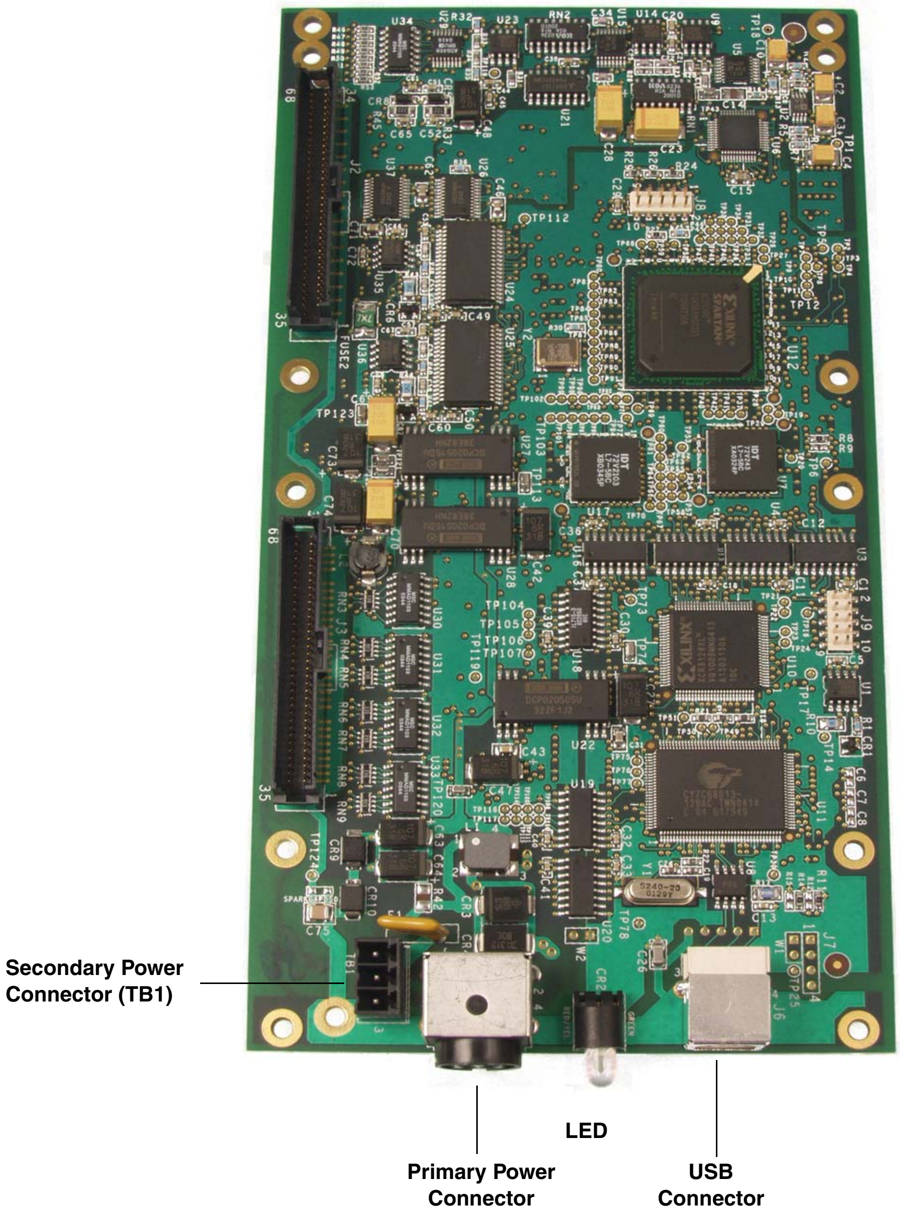

Figure 46: Secondary Power Connector

The pin assignments for the secondary power connector (TB1) are as follows:

- **Pin 1** = +5 V
- **Pin 2** = Ground
- **Pin 3** = Shield (chassis ground)

Ground, Power, and Isolation Connections

Figure 47 illustrates how ground, power, and isolation are connected on a DT9834 Series module.

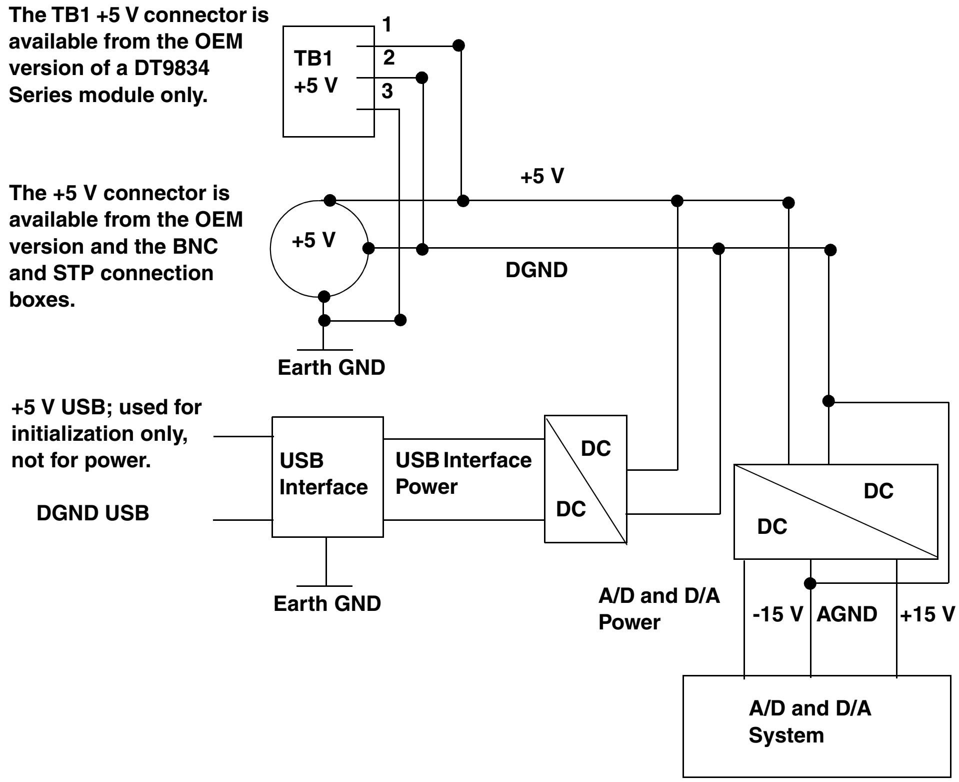

Figure 47: Ground, Power, and Isolation Connections

Keep the following in mind:

- Earth ground on the DT9834 module is not connected to DGND or AGND.
- Earth ground is connected to the aluminum case of the BNC connection box.
- You should connect earth ground to the power supply earth.
- You should isolate the +5V/DGND input. Note that the EP361 power supply (shipped with the BNC connection box and available from Data Translation for the OEM version of the module) has no connection between +5V/DGND and earth ground.
- The USB connector case is connected to earth ground.
- The USB data lines and USB GND are not connected to earth ground.
- The USB DGND is connected to the USB GND of the PC USB port.

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