

LV-Link 3.0

Software Interface for LabVIEW®

Overview

LV-Link™ is a library of virtual instruments (VIs) that enable LabVIEW® programmers to access the data acquisition features of DT-Open Layers-compliant devices. This library is consistent with the design and layout of the LabVIEW DAQmx VIs to speed development time and minimize learning curve issues.

LV-Link provides the ability to measure and control analog I/O, digital I/O, quadrature decoders, and counter/timer signals, and stream data at full-speed. To get up and running quickly, numerous application examples are provided with the software. The source code for the examples is also included so you can easily modify them to speed your development time.

Key Features

- Create test and measurement applications for Data Translation DT-Open Layers compliant USB and PCI hardware using LabVIEW®
- Integrate Data Translation and National Instruments hardware in the same application



- Measure and control analog I/O, digital I/O, quadrature decoders, counter/timer signals
- Stream data at full-speed
- Numerous example programs to aid application development

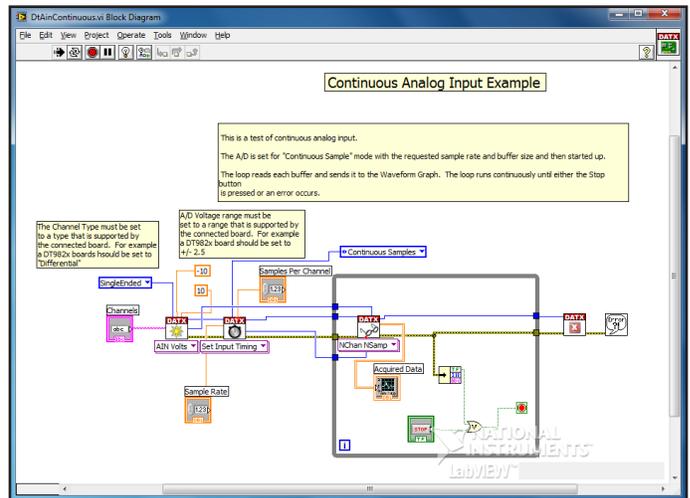
Supported Operating Systems

- Windows® 10/8/7 (32/64-bit)

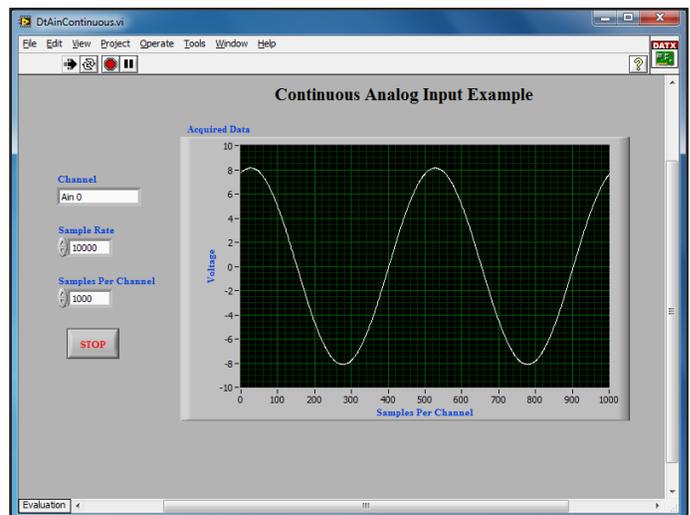
A task in LabVIEW is a collection of one or more virtual channels with timing, triggering, and other properties. A task represents a measurement or output operation to be performed using a specific subsystem of a device. The following operations, or tasks, are supported in LV-Link:

• Analog Input	• Digital Output
• Analog Output	• Counter/Timer
• Digital Input	• Quadrature Decoder

LV-Link provides a number of example programs that demonstrate how to perform these tasks using the LV-Link VIs.



DtAinContinuous.vi Block Diagram demonstrates how to access the power of Data Translation DT-Open Layers compliant devices using LabVIEW and LV-Link.



DtAinContinuous.vi Front Panel demonstrates how to continuously acquire data from an analog input channel.

Analog Input Tasks

LV-Link supports the following analog input tasks:

- **Single value** – Acquires a single sample from a single analog input channel and returns the value immediately. Specify whether to return the data either as a voltage or a raw count. Single-value operations are the simplest to use but offer the least flexibility and efficiency.
- **Finite** – Acquires a specified number of samples from one or more analog input channels one time, and then stops. Specify whether to return the data either in voltage or raw counts. Depending on your device, you can specify a sample clock to pace the operation, the number of samples to acquire, and a trigger to start the acquisition. Some devices also allow you to acquire the value of the digital input ports, counter/timers, and quadrature decoders using an analog input task.

- **Continuous** – Acquires multiple samples from one or more analog input channels continuously. Specify whether to return the data either in voltage or raw counts. Depending on your device, you can specify a sample clock to pace the acquisition of each sample, the number of buffers to use (and their sizes), and a trigger to start the acquisition. Some devices also allow you to continuously acquire the value of the digital input ports, counter/timers, and quadrature decoders using an analog input task.

Analog Output Tasks

LV-Link supports the following analog output tasks:

- **Single value** – Writes a single sample to a single analog output channel. Specify whether to output the data as a voltage or a raw count. Single-value operations are the simplest to use but offer the least flexibility and efficiency.
- **Finite** – Writes a specified number of samples to one or more analog output channels one time, and then stops. Specify whether to output the data in voltage or raw counts. Depending on your device, you can specify a sample clock to pace the operation, and/or a trigger to start the operation. Some devices also allow you to update the value of the digital output ports using an analog output task.
- **Continuous** – Writes a single buffer or multiple buffers to one or more analog output channels continuously. Specify whether to output the data in voltage or raw counts. Depending on your device, you can specify a sample clock to pace the operation, and/or a trigger to start the operation. Some devices also allow you to continuously update the value of the digital output ports using an analog output task.
- **Waveform** – Writes a waveform to a single analog output channel once or continuously.

Digital I/O Tasks

LV-Link supports the following digital I/O tasks:

- **Single value digital input** – Reads the value of a single digital input port once and returns the value immediately. The port is configured with the default resolution specified by the device.
- **Single value digital output** – Updates the value of a single digital output port immediately. The port is configured with the default resolution specified by the device.

Counter/Timer Tasks

LV-Link supports the following counter/timer tasks:

- **Event counting** – Counts digital pulses from an external signal, which is connected to the counter/timer's clock input source, when the counter/timer is enabled (determined by the counter/timer's gate input signal).
- **Up/Down counting** – Counts digital pulses from an external signal that is connected to the counter/timer's clock input source. If the gate input signal of the counter/timer is high, the count is incremented. If the gate input signal of the counter/timer is low, the count is decremented.

- **Frequency measurement** – Measures the frequency, in kHz, of an external digital signal that is connected to the counter/timer's clock input or gate input source.

Note: Internally, the frequency of the signal is calculated using two consecutive rising edges on the specified input line. Therefore, to perform a frequency measurement task, your device must support edge-to-edge measurement mode.

- **Period measurement** – Measures the period, in milliseconds, of a signal pulse from an external digital signal that is connected to the counter/timer's clock input or gate input source.
- Note:** Internally, the period of the signal is calculated using two consecutive rising edges on the specified input line. Therefore, to perform a period measurement task, your device must support edge-to-edge measurement mode.

- **Edge-to-edge measurement** – Measures the time, in milliseconds, between a specified start edge and stop edge of the counter/timer's clock or gate input signal, then stops. The start edge and the stop edge can occur on the rising edge of the gate input signal, the falling edge of the gate input signal, the rising edge of the clock input signal, or the falling edge of the clock input signal.

- **Continuous edge-to-edge measurement** – Measure the time, in milliseconds, between a specified start edge and stop edge of a counter/timer's clock or gate input signal, then automatically restart the next measurement. The start edge and the stop edge can occur on the rising edge of the gate input signal, the falling edge of the gate input signal, the rising edge of the clock input signal, or the falling edge of the clock input signal.

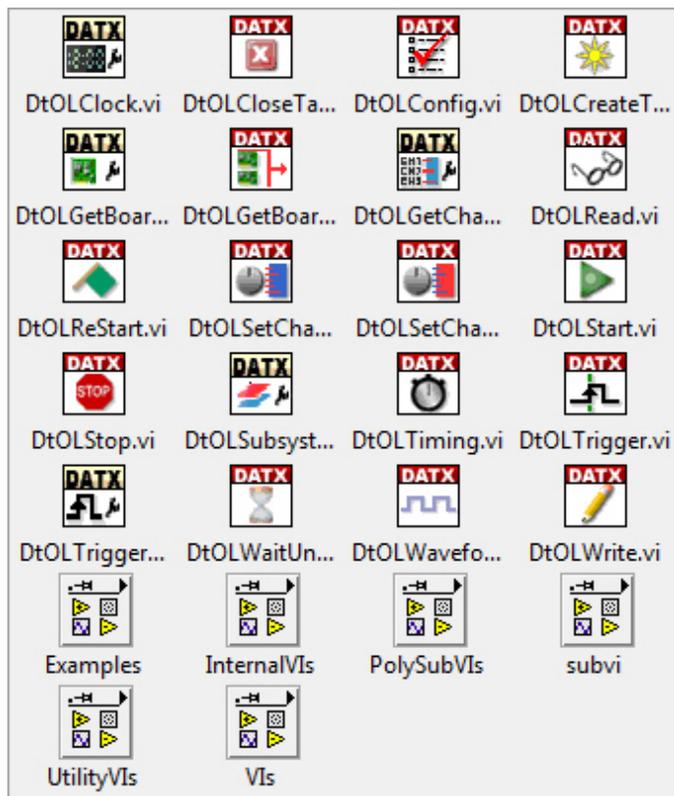
- **One-shot** – Outputs a single pulse for a specified duration (in milliseconds) the first time that the device detects a trigger (determined by the counter/timer’s gate input signal).
- **Repetitive one-shot** – Outputs a single pulse for a specified duration (in milliseconds) each time that the device detects a trigger (determined by the counter/timer’s gate input signal).
- **Rate generation** – Generates output pulses continuously at a specified frequency (in Hz) when the counter/timer is enabled (determined by the counter/timer’s gate input signal).

Quadrature Decoder Tasks

Some devices support quadrature decoder operations. A quadrature decoder accepts signals (A, B, and Index) from a quadrature encoder as inputs and converts these signals into a clock output whose pulses are counted by the decoder.

LV-Link VIs

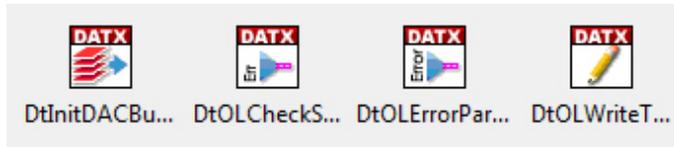
LV-Link provides VIs for developing data acquisition applications that work with DT-Open Layers-compliant PCI and USB devices.



LV-Link VIs	
DtOLClock	Sets and returns information pertaining to the clock source of a device
DtOLCloseTask	Stops the task and releases all associated resources
DtOLConfig	Configures the specified task
DtOLCreateTask	Creates virtual channels and configures the tasks with specified settings
DtOLGetBoard	Returns information about device, including board name, driver name, driver revision, and device name
DtOLGetBoardNames	Returns the name of all DT-Open Layers-compliant devices that are installed
DtOLGetChanList	Returns information about the channel-gain list
DtOLRead	Reads samples from the virtual channels of a task you specify
DtOLReStart	Restarts a task
DtOLSetChanGain	Sets the gain for a virtual analog channel
DtOLSetChanOptions	Specifies the sensor gain and offset, and if IEPE inputs are supported, the excitation current source and input coupling type for a virtual analog channel
DtOLStart	Either starts a task explicitly or groups two tasks so that they can be started simultaneously.
DtOLStop	Stops a task and returns it to its original state
DtOLSubsystem	Sets and returns information about the subsystem of the device
DtOLTiming	Specifies the timing- or clock-related attributes of an analog input or analog output task
DtOLTrigger	Specifies trigger-related attributes of analog input or analog output task
DtOLTriggerSource	Sets and returns information pertaining to the trigger source of a device
DtOLWaitUntilDone	Waits for a specified task to complete or for the timeout interval to elapse before stopping
DtOLWaveformGenerate	Creates one cycle of a sine, triangle, square, or sawtooth wave with a specified number of samples, frequency, and amplitude per cycle
DtOLWrite	Outputs samples to the virtual channels of a task you specify

Utility VIs

Utility VIs are used to perform specific operations when used with other VIs in LV-Link.



LV-Link VIs	
DtInitDACBuffers	Initializes the values in the buffers used by analog output tasks
DtOLCheckStatus	Calls LV-Link to determine whether an error has occurred
DtOLErrorParser	Converts error codes from DT-Open Layers into LV-Link error codes for use with LabVIEW's error handler VIs
DtOLWriteTwoChannelSingle	Outputs a single sample, formatted as a 64-bit floating-point number, to two virtual channels of a task you specify

Examples

LV-Link includes a number of example programs that illustrate how to perform data acquisition operations on DT-Open Layers-compliant devices. You can easily modify these examples to speed your development time.



Examples	
DtAinAoutContinuous	Demonstrates how to continuously acquire data from an analog input channel and continuously output the data to an analog output channel
DtAinAoutSimultaneous	Demonstrates how to start an analog input and analog output operation at the same time
DtAinContinuous	Demonstrates how to continuously acquire data from an analog input channel

Examples	
DtAinGainPerChAn	Demonstrates how to set up different gains and acquire data from multiple analog input channels
DtAinRawContinuous	Demonstrates how to continuously acquire raw counts from analog input channels
DtSetChanOptions	Demonstrates how to set up analog input options, including the sensor gain and offset, and, if IEPE inputs are supported, the current excitation source and the input coupling type for a specified analog input channel
DtAinSingle	Demonstrates how to acquire a single value from an analog input channel repetitively in a loop
DtAinTrig	Demonstrates how to continuously acquire data when an analog trigger threshold is detected
DtAoutRawSingle	Demonstrates how to write a single raw count to an analog output channel repetitively in a loop
DtAoutSingle	Demonstrates how to write a single voltage value to an analog output channel repetitively in a loop
DtAoutTwoSingle	Demonstrates how to write a single voltage value to two analog output channels repetitively in a loop
DtAoutWaveform	Demonstrates how to output a waveform from an analog output channel repetitively in a loop
DtCtrEvents	Demonstrates how to count digital pulses from an external signal
DtCtrFreq	Demonstrates how to measure the frequency of an external digital signal
DtCtrOneShot	Demonstrates how to generate a single output pulse for a specified duration
DtCtrOneShotRepeat	Demonstrates how to output a single pulse for a specified duration each time a trigger is detected
DtCtrPeriod	Demonstrates how to measure the period of an external digital signal
DtCtrRate	Demonstrates how to generate an output pulse at a specified frequency when the C/T is enabled
DtCtrTwoEdgeTiming	Demonstrates how to measure the time between a specified start and stop edge
DtCtrUpDown	Demonstrates how to count digital pulses from an external decremented signal that is connected to the C/T input source. If the gate input signal of the C/T is high, the counter is the gate input signal of the C/T is low, the count is incremented.
DtDinSingle	Demonstrates how to read a single value from a digital input port repetitively in a loop
DtDoutSingle	Demonstrates how to write a single value from a digital output port repetitively in a loop.
Quadrature	Demonstrates how to read the value of a quadrature decode, repetitively in a loop

Building and Distributing an Executable

If you want to create a stand-alone executable of a VI that you have created, you need LabVIEW's Application Builder. The Application Builder is included as part of the LabVIEW Professional Development System and is also available as a separate option that you can purchase from National Instruments.

The Application Builder creates executables from user-specified files (such as VIs, libraries, documentation, data files, and so on) and saves individual build settings as part of the project file.

Porting Code from LV-Link 2.0 to LV-Link 3.0

Where LV-Link 2.0 is based on the DT-Open Layers for .NET Class Library, LV-Link 3.0 is based on the DT-Open Layers DataAcq SDK.

If you have a LabVIEW application that was written using LV-Link 2.0 and you want to port that application to use LV-Link 3.0, keep the following information in mind:

- All of the top-level VIs in LV-Link 3.0 have been renamed.
- Some terminals and data types have been changed for the top-level VIs in LV-Link; application modifications will be required to appropriately deal with these changes.
- New VIs have been added to LV-Link 3.0 to replace the .NET interface. These low-level VIs call directly into the entry points of the DLL of the DataAcq SDK and are used by the higher level VIs. To access the DataAcq SDK directly, use the new VIs in your application. Some LV-Link 2 VIs have been removed and no longer exist.

Documentation

A comprehensive help file is included with LV-Link.

Technical Support

Application engineers are available by phone and email during normal business hours to discuss your application requirements. Extensive product information, including drivers, example code, pinouts, a searchable Knowledge Base, and much more, is available 24 hours a day on our web site at www.mccdaq.com/Support.aspx.

LV-LINK 3.0

- **SP0811-CD** – LV-Link, is available for download from our web site at www.mccdaq.com/Data-Translation-Software.aspx.

SYSTEM REQUIREMENTS

Before using LV-Link, make sure that you have installed the following:

- LabVIEW 8.5.1 or greater for 32-bit support, or LabVIEW 2009 or higher for 64-bit or 32-bit support. Refer to your LabVIEW documentation for details
- LV-Link 3
- One or more DT-Open Layers-compliant devices, including the software for the devices