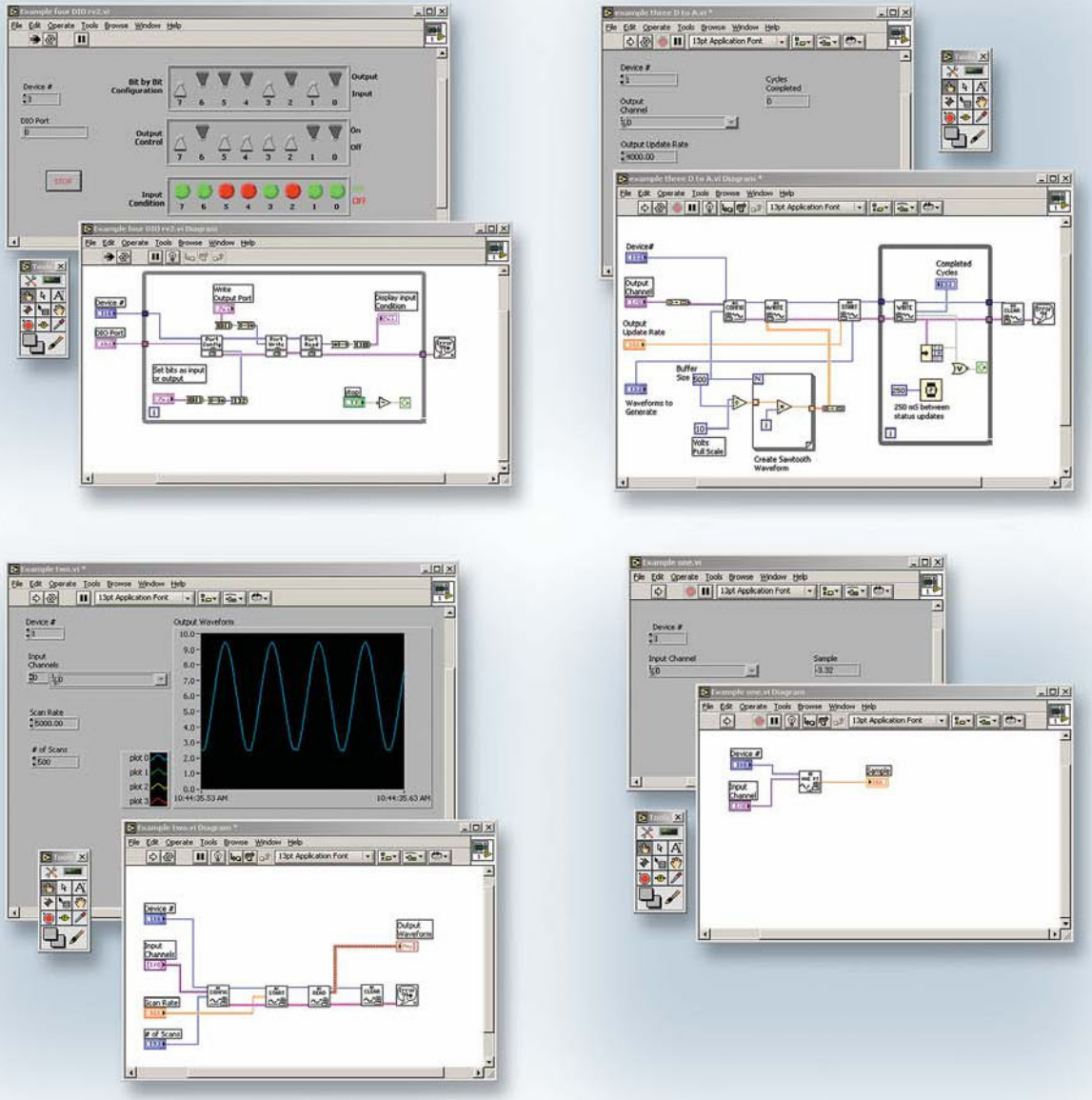
LabVIEW™ drivers for Measurement Computing hardware

UNIVERSAL LIBRARY for LabVIEW™

User's Guide



MEASUREMENTCOMPUTING™

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Universal Library for LabVIEW™

User's Guide

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Table of Contents

Introducing the Universal Library for LabVIEW™

With the Universal Library for LabVIEW (UL for LabVIEW) software, you can construct your own LabVIEW programs using UL Extension VIs with supported Measurement Computing's data acquisition and control devices.

The UL for LabVIEW Extension VIs are supported with LabVIEW version 6 and greater.

The UL for LabVIEW includes a set of LabVIEW virtual instruments (VIs) that you use to construct your own programs in LabVIEW using Measurement Computing's data acquisition and control boards. Each low-level VI corresponds to one UL function.

This manual details the syntax of each VI. Although the LabVIEW extensions closely follow the syntax of the UL, there are some differences. For information on the UL functions, refer to the Universal Library Function Reference (this manual is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf).

To use the UL with another language, refer to the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) and the Universal Library Function Reference (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf).

Installing and Configuring UL for LabVIEW

This chapter explains how to install the software on your computer, and how to configure the software for the boards that you will be using with it.

The UL for LabVIEW software contains the following components:

- UL for LabVIEW rev. 7.11 software, which includes the UL Extension VIs
- Sample programs for use with Extension VIs and MCC hardware
- readme.txt

You can install this software on all operating systems that are supported by the UL and your version of LabVIEW.

Installing the software

The UL for LabVIEW software is installed from the *Measurement Computing Data Acquisition Software CD.*

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Configuring your MCC hardware for use with UL for LabVIEW VIs

Before starting the LabVIEW environment, configure your Measurement Computing data acquisition board(s) using InstaCal. InstaCal stores all board-specific configuration information in a configuration file named CB.CFG. InstaCal creates and/or modifies the CB.CFG file when board configurations are added or updated.

The CB.CFG file is read by the UL. The LabVIEW Extension VIs use the CB.CFG file to access the hardware.

Overview of the Universal Library VIs

The Universal Library for LabVIEW contains a set of low-level VIs that you "wire" together to build your application. These VIs are grouped according to their purpose. All of the groups except for "Miscellaneous" are based on the type of devices they are used with.

Analog I/O VIs

The analog I/O VIs perform analog input and output and convert analog data.

AIn.VI - Single analog input

Takes a single reading from an analog input channel (A/D).

AInScBg.VI - Background analog input scan

Repeatedly scans a range of analog input (A/D) channels in the background. The channel range, the number of samples, the sampling rate, and the A/D range can all be specified. The collected data is stored in an array.

AInScFg.VI - Foreground analog input scan

Repeatedly scans a range of analog input (A/D) channels in the foreground. The channel range, the number of samples, the sampling rate, and the A/D range can all be specified. The data that is collected is stored in an array.

ALoadQue.VI - Load channel/gain queue

Loads a series of channel/gain pairs into A/D board's queue. These channel/gains will be used with all subsequent analog input VIs.

AOut.VI - Single analog output

Outputs a single value to an analog output (D/A).

AOutScBg.VI - Background analog output scan

Repeatedly updates a range of analog output (D/A) channels in the background. The channel range, the number of samples, and the rate can all be specified. The data values from consecutive elements of an array are sent to each D/A channel in the scan.

AOutScFg.VI - Foreground analog output scan

Repeatedly updates a range of analog output (D/A) channels in the foreground. The channel range, the number of samples, and the rate can all be specified. The data values from consecutive elements of an array are sent to each D/A channel in the scan.

APretrBg.VI - Analog pre-triggered input in the background

Repeatedly scans a range of analog input (A/D) channels in the background while waiting for a trigger signal. When a trigger occurs, it returns the specified number of samples before and after the trigger occurred. The channel range, the sampling rate, and the A/D range can all be specified. The data that is collected is stored in an array.

APretrFg.VI - Analog pre-triggered input in the foreground

Repeatedly scans a range of analog input (A/D) channels in the foreground while waiting for a trigger signal. When a trigger occurs it returns the specified number of samples before and after the trigger occurred. The channel range, the sampling rate, and the A/D range can all be specified. The data that is collected is stored in an array.

ATrig.VI - Analog trigger

Reads the specified analog input until it goes above or below a specified threshold. When the trigger condition is met the current sample is returned.

OptAIn.VI – Specifies analog input options.

Both AInScBg.VI and AInScFg.VI have an input called options which should be wired to this VIs output. It generates a value based on the Anded values of its inputs.

SetTrig.VI - Set the trigger source.

Configures the type and threshold value of external trigger signals.

TIn.VI - Single temperature input

Reads a temperature input channel and, as necessary, filters it, performs cold junction compensation, and linearization.

TInScan.VI - Scans a range of thermocouple inputs.

Reads the temperature from a range of channels as described above. Returns the temperature values to an array.

Signal conditioning VIs

ACvtData.VI - Converts analog data

Each raw sample from an analog input is a 16-bit value. On some 12-bit A/D boards it consists of a 12-bit A/D value along with a four bit channel number. On 16-bit A/D boards it contains the 16-bit A/D value.

This conversion is done automatically by the AIn VI. It can also be done automatically by the AInScBg.VI or the AInScFg.VI with the `CONVERTDATA` option. In some cases though, it may be useful or necessary to collect the data and then do the conversion sometime later. The ACvtData.VI takes a buffer full of unconverted data and converts it.

ACnvPrDt.VI - Convert pre-trigger data

When data is collected by either APretrBg.VI or APretrFg.VI, the same conversion needs to be done as described above for ACvtData.VI.

However, both APretrBg.VI and APretrFg.VI collect analog data into an array. They treat the array like a circular buffer. While they are waiting for the trigger to occur, they fill the buffer. When the end of the buffer is reached, they return to the beginning of the buffer. When the trigger signal occurs, the VIs continue collecting data into the circular buffer until the requested number of samples have been collected.

When the data acquisition is complete, all of the data is in the array, but it is in the wrong order. The first element of the array does not contain the first data point. The data has to be rotated to the correct order.

This conversion can be done automatically by the APretrBg.VI or APretrFg.VI with the `CONVERTDATA` option. In some cases, though, it may be useful or necessary to collect the data and then do the conversion sometime later. The ACnvPrDt.VI takes a buffer full of unconverted data and converts it.

ACalData.VI - Calibrates raw data.

Calibrates raw data collected by `cbAInScan()` when the real-time software calibration is turned off.

FromEng.VI - Convert to raw data.

Converts one data sample or an array of data samples from engineering units to raw data format. Can also convert a single voltage (or current) to a D/A count value for use as an analog trigger threshold value.

ToEng.VI - Convert to engineering units.

Converts one data sample or an array of data samples from raw data format to engineering units.

ScalePnt.VI - Converts a raw data point to engineering units.

ScaleArray.VI - Converts raw data in an array to engineering units data in an array.

Counter VIs

The counter VIs load, read, and configure counters. There are four types of counter chips used in Measurement Computing products - 8254s, 8536s, 7266s, and 9513s. Some of the counter commands only apply to one type of counter. To gain full access to the power of these counter VIs, you should refer to the data sheet for the type of counter you are using:

- 82C54 data sheet (available on our web site at www.mccdaq.com/PDFmanuals/82C54.pdf)
- LS7266 data sheet (available on our web site at www.mccdaq.com/PDFmanuals/LS7266R1.pdf)
- 9513A data sheet (available on our web site at www.mccdaq.com/PDFmanuals/9513A.pdf)

C7266Config.VI – Configures an LS7266 counter.

Selects all of the programmable options that are associated with the LS7266 counter.

C8254Cfg.VI - Configures an 8254 counter.

Selects the basic operating mode of an 8254 counter.

C8536Cfg.VI - Sets the operating mode of an 8536 counter.

Sets all of the programmable options associated with an 8536 counter chip.

C8536Ini.VI - Initializes an 8536 counter.

Initializes and selects all of the chip level features for an 8536 counter board. The options that are set by this command are associated with each counter chip, and not the individual counters within it.

C9513Cfg.VI - Sets the operating mode of a 9513 counter.

Sets all of the programmable options associated with a 9513 counter chip. It is similar in purpose to C8254Cfg.VI, except that it is used with a 9513 counter.

C9513Ini.VI - Initializes a 9513 counter.

Initializes and selects all of the chip level features for a 9513 counter board. The options that are set by this command are associated with the specified counter chip, and not the individual counters within it.

CFreqIn.VI - Measures the frequency of a signal.

Measures the frequency of a signal by counting it for a specified period of time (`GatingInterval`) and then converting the count to counts/sec (Hz). This VI only works with 9513 counters.

CIn.VI - Reads a counter.

Reads a counter's current value and returns the value as a 16-bit integer.

CIn32.VI - Reads a counter.

Reads a counter's current value and returns the value as a 32-bit integer.

CLoad.VI - Loads a counter.

Loads a counter with an initial 16-bit count value.

CLoad32.VI - Loads a counter.

Loads a counter with an initial 32-bit count value.

CStatus.VI – Gets a counter status.

Retrieves status information about a LS7266 based counter. This VI only works with LS7266 counters.

CStore.VI - Stores the counter value when an interrupt occurs.

Installs an interrupt handler that stores the current count whenever an interrupt occurs. This VI only works with 9513 counters.

Digital I/O VIs

To gain full access to the power of these digital I/O VIs, you should refer to the data sheet for the type of digital interface you are using:

- the 82C55 data sheet (available on our web site at www.mccdaq.com/PDFmanuals/82C55.pdf)
- the 8536 data sheet (not available on our web site)

DBitIn.VI - Digital bit input.

Reads a single bit from a digital input port.

DBitOut.VI - Digital bit output.

Sets a single bit on a digital output port.

DCfgBit.VI - Configures a specific digital bit within a digital port.

Configures a specific bit within a digital port as an input or an output.

DCfgPort.VI - Configures digital outputs.

Configures a digital port as an input or an output.

DIn.VI - Digital input.

Reads a specified digital input port.

DInScBg.VI - Digital multiple byte or word input in the background.

Reads a specified number of bytes or words from a digital input port at a specified rate.

DInScFg.VI - Digital multiple byte or word input in the foreground.

Reads a specified number of bytes or words from a digital input port at a specified rate.

DOut.VI - Digital output.

Writes a byte or word to a digital output port.

DOutScBg.VI - Digital multiple byte or word output in the background.

Writes a series of bytes or words to a digital output port at a specified rate.

DOutScFg.VI - Digital multiple byte or word output in the foreground.

Writes a series of bytes or words to a digital output port at a specified rate.

Streamer file VIs

These VIs create, fill, and read "streamer" files. These VIs also let you collect and store large amounts of analog input data. The amount of data is limited only by available disk space.

FileAInS.VI - Transfer analog input data directly to file.

Very similar to AInScFg.VI, except that data is stored in a file instead of an array.

FilePret.VI - Pre-triggered analog input to a file.

Very similar to APretrFg.VI, except that data is stored in a file instead of an array.

FileInfo.VI - Reads "streamer" file information.

Each streamer file contains information about how much data is in the file and the conditions under which it was collected (sampling rate, channels, etc.). This VI reads that information.

FileRead.VI - Reads data from a "streamer" file.

Reads a selected number of data points from a streamer file into an array.

Memory board VIs

The memory board VIs read from, write to, and control memory boards (MEGA-FIFO). The most common use for the memory boards is to store large amounts of data from an A/D board via a DT-Connect cable between the two boards. To do this, you should use the `EXTMEMORY` option with AInScBg.VI, AInScFg.VI, APretrBg.VI, or APretrFg.VI.

After data is transferred to the memory board, you can use the memory VIs to retrieve the data.

MemSetDT.VI - Sets DT-Connect mode on a memory board

The memory boards have a DT-Connect interface which can be used to transfer data through a cable between two boards rather than through the PC's system memory. The DT-Connect port on the memory board can be configured as either an input (from an A/D) or as an output (to a D/A). This VI configures the port.

MemReset.VI - Resets the memory board address

The memory board is organized as a sequential device. When data is transferred to the memory board it is automatically put in the next address location. This VI resets the current address to the location 0.

MemRead.VI - Reads data from a memory board.

Reads a specified number of points from a memory board starting at a specified address.

MemWrite.VI - Writes data to a memory board.

Writes a specified number of points to a memory board starting at a specified address.

MemRdPrt.VI - Reads data collected with APretrBg.VI or APretrFg.VI.

Both APretrBg.VI and APretrFg.VI write the pre-triggered data to the memory board in a shifted order. This VI shifts the data and returns it in the correct order.

Miscellaneous VIs

These VIs perform error handling, configuration, and other miscellaneous operations.

ErrHdlng.VI - Selects the type of error handling.

The Universal Library has a number of different methods of handling errors. This VI selects which of these methods will be used with all subsequent library calls. The options include stopping the program when an error occurs and printing error messages.

ErrMsg.VI - Returns an error message for a given error.

All library VIs return error codes. This VI converts an error code to an error message.

GetBoard.VI - Get the board name.

Returns the name of the selected target board.

GetCfg.VI - Get configuration options.

Extracts hardware configuration options from board configuration file.

GetStatus.VI - Returns the status of background operations.

After a background operation is started your program will need to periodically check on its progress. This VI returns the current status of the process that is running.

InByte.VI - Read one byte.

Reads one byte of data from the specified port.

InWord.VI - Read one word.

Reads one word of data from the specified port.

OutByte.VI - Write one byte.

Writes one byte of data to the specified port.

OutWord.VI - Write one word.

Writes one word of data to the specified port.

SelChan.VI – Selects specific channel data from an array.

Allows one channel of data to be extracted from an array of interleaved data for multiple channels.

SetCfg.VI - Set configuration options.

Sets hardware configuration options for a selected board.

StopBg.VI - Stop a background process.

It is sometimes necessary to stop a background process in the case of an error or if the process has been set up to run continuously. This VI will stop a background process.

How to use the LabVIEW Extensions (VIs)

Using the Library with LabVIEW

The Universal Library LabVIEW extensions provide a complete set of virtual instruments (VIs) for interfacing all Measurement Computing data acquisition hardware. Each low-level VI corresponds to one Universal Library function. All of the VIs are combined into a LabVIEW Library named DAS16.LLB. There are two approaches you can use in developing new LabVIEW applications that can interface to Measurement Computing hardware.

- Modify one of the example applications.
- Build a new application from scratch using the low-level VIs supplied in the DAS16.LLB library.

The easiest way to get started is to modify one of the sample applications. Select an example application that contains the operating behavior you are looking for. The example applications contain the basic requirements for transferring data to and from the target hardware. Additional capability can be added by selecting new functions and placing them on the diagram window. The corresponding controls can then be selected and placed on the panel window. Wire the new functions to the existing application and test the program.

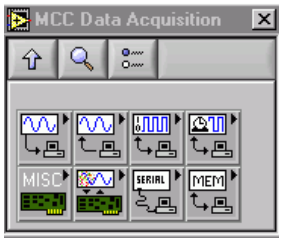
If you prefer to build an application from scratch, you can wire any LabVIEW functions together to build your application. When the application requires interaction with the data acquisition hardware, simply select the appropriate VI from the DAS16.LLB and add it to the working diagram.

To access the DAS16.LLB library VIs, do the following:

1. Make the **Diagram** window of the project the active window. If the **Panel** window is currently active, select the **Show Diagram** option from the **Window** menu.
2. From the **Diagram** window, select the **Show Functions Palette** option from the **Window** menu to open the **Functions** palette.
3. From the **Functions** palette, click on the **User Libraries** icon to open the **User Libraries** palette.

4. From the **User Libraries** palette, click on the **MCC** icon to open the **MCC Data Acquisition** palette.

5. Select the VI you want to use by clicking on the appropriate icon. Move the cursor back to the **Diagram** window and click to place the VI.



After placing the VIs you want to use on the **Diagram** window, you can wire them together. Save the application prior to testing. Refer to the documentation of each VI for specifics on the input and output parameters.

UL function contexts: foreground (__Fg) and background (__Bg)

There are two distinct VIs for every UL function featuring background operation. One is for foreground operation only, and the other is for background operation only. The last two letters of the function names are "Fg" and "Bg" for foreground and background, respectively. Their parameter lists differ, in that background VIs have a Context output that must be wired to subsequent VIs (GetStatus.VI and StopBg.VI).

Context is an output data structure that contains information such as the board number, the data array, the size of the data array, the initial status of the operation, and the error code. Connecting a probe to the Context wire displays the elements in the data structure. You can check the intermediate values if desired. In general, the background VIs should conform to the wiring pattern shown in Figure 1. There are several example programs that effectively demonstrate the correct wiring and use of Contexts. Please refer to example VIs whose names end in "BG."

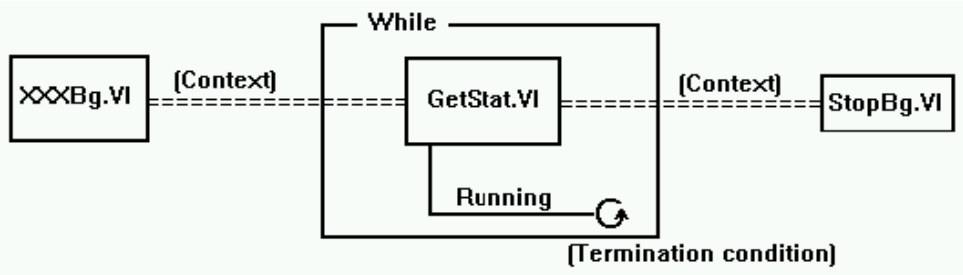


Figure 1. Background VIs General Wiring Pattern

UL Extension VI example programs

The UL for LabVIEW software package includes example programs which demonstrate how to use the Universal Library low-level extension VIs. We strongly suggest that you review the example programs to help you understand how to integrate the VIs into your program. The following example programs are included to demonstrate the LabVIEW interface:

Example	VI explanation
XAIN	Single analog input in a while loop with a metered display.
XAINSCBG	Analog input scan in the background. Display data on a graph. Uses GetStatus.VI, StopBg.VI and OptAIn.VI.
XAICNBG	Analog input scan in the background in the CONTINUOUS mode. Same as XAINSCBG but runs continuously displaying data in real time.
XAINSCFG	Analog input scan in the foreground. Displays data on a graph. Uses SelChan.VI and OptAIn.VI.
XAIOSCB	Demonstrates concurrent analog input and output scans.
XAOUT	Single analog output. Demonstrates sequences, case statements, for loops, and while loops.
XAOUTSCB	Analog output scan in the background. Uses GetStatus.VI and StopBg.VI.
XAOUTSCF	Analog output scan in the foreground. Generates sinusoidal data.
XAPRETRB	Analog pre-trigger in the background. Display data on a graph. Uses GetStatus.VI, StopBg.VI and ACnvPrDt.VI.
XAPRETRF	Analog pre-trigger in the foreground. Displays data on a graph. Uses SelChan.VI and ACnvPrDt.VI.
XASCFILE	Analog input to a file. Displays data on a graph. Uses FileAInS.VI and FileRead.VI.
XASCMEM	Analog input to memory board. Displays data on a graph. Uses MemReset.VI and MemRead.VI.
XCFREQ	Displays frequency of signal at counter input. Uses C9513Init.VI and CFreqIn.VI.

XCSTORE	Stores counter values when interrupts occur and displays them. Uses CStore.VI, GetStatus.VI, and StopBg.VI.
XCTR8254	Configures, loads and reads the counter. Displays the count. Uses C8254Cfg.VI, CLoad.VI, and CIn.VI.
XCTR8536	Initializes, configures, loads, and reads the counter. Displays the count. Uses C8536Cfg.VI, CLoad.VI, and CIn.VI.
XCTR9513	Initializes, configures, loads, and reads the counter. Displays the count. Uses C9513Cfg.VI, CLoad.VI, and CIn.VI.
XCTR7266	Configures, loads, and reads the counter. Displays count and status. Uses C7266Cfg.VI, CLoad32.VI, CIn32.VI, and CStatus.VI.
XDBITIN	Configures and reads a digital bit. Toggles an LED accordingly. Uses DCfgPort.VI and DBitIn.VI.
XDBITOUT	Configures and writes a digital bit. Uses DCfgPort.VI and DBitOut.VI.
XDIN	Configures and reads a digital port. Toggles eight LEDs accordingly. Uses DCfgPort.VI and DIn.VI.
XDCFGBIT	Configures a bitwise configurable digital port.
XDINSCBG	Reads multiple bytes in the background. Uses DCfgPort.VI, DInScBg.VI, GetStatus.VI, and StopBg.VI.
XDINSCFG	Reads multiple digital bytes or words in the foreground. Uses DCfgPort.VI and DInScFg.VI.
XDOUT	Configures and writes to a digital port. Uses DCfgPort.VI and DOut.VI.
XDOUTSCB	Writes multiple digital bytes or words in the background. Uses DCfgPort.VI, DOutScBg.VI, GetStatus.VI, and StopBg.VI.
XDOUTSCF	Writes multiple digital bytes or words in the foreground. Uses DCfgPort.VI and DOutScFg.VI.
XEVENTCTR	Uses the event counters available from MCC's Personal Measurement Device™ and Measurement Advantage™ USB devices. Uses CIn32.VI.
XTIN	Single temperature input in a while loop with a metered display. Uses TIn VI.
XTINSCAN	Temperature input scan across multiple channels in a while loop. Data is displayed on a strip chart. Uses TInScan VI.

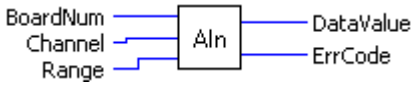
Universal Library Virtual Instruments (VIs)

Analog Input VIs

AIn.VI

Reads an A/D input channel. This VI reads the specified A/D channel from the specified board. If the A/D board has programmable gain, it sets the gain to the specified range. The raw A/D value is converted to an A/D value and returned to DataValue.

Summary:



Inputs:

BoardNum [U32] - The board number when installed with InstaCal; can be 0 to 100.

Channel [I32] - A/D channel number

Range [I32] - A/D Range

Outputs:

DataValue [U16] - Value of A/D sample

ErrCode [I32] - Error code. See ErrMsg.VI on page 97.

Arguments:

BoardNum

The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D. BoardNum can be from 0 to 100.

Channel

The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has eight channels for differential, 16 for single-ended input mode.

Range

If the selected A/D board does not have a programmable gain feature, this argument is ignored. If the A/D board does have programmable gain, set the Range argument to the desired A/D range.

The Range input values table on page 19 lists the constants you can use in the Range argument for most functions. Not all A/D boards support the same A/D ranges. Refer to the board's hardware manual for a list of supported A/D ranges.

Range input values

Range	Input value	Range	Input value
±20 V	27	0 to 5 V	14
±10 V	1	0 to 4 V	36
±5 V	2	0 to 2.5 V	15
±4 V	28	0 to 2 V	16
±2.5 V	3	0 to 1.67 V	17
±2 V	29	0 to 1.25 V	18
±1.67 V	4	0 to 1 V	19
±1.25 V	5	0 to 0.5 V	32
±1 V	6	0 to 0.25 V	33
±0.625 V	7	0 to 0.2 V	34
±0.5 V	8	0 to 0.1 V	20
±0.25 V	30	0 to 0.01 V	21
±0.2 V	31	0 to 0.02 V	35
±0.1 V	9	4 to 20 mA	22
±0.05 V	10	0 to 20 mA	26
±0.01 V	11	2 to 10 mA	23
±0.005 V	12	1 to 5 mA	24
0 to 10 V	13	0.5 to 2.5 mA	25

DataValue — Value of A/D measurement in binary counts. Use ToEng.VI (on page 48) to convert into engineering units (volts or milliamps).

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI (on page 97) to convert ErrCode into a readable string.

AInScBg.VI

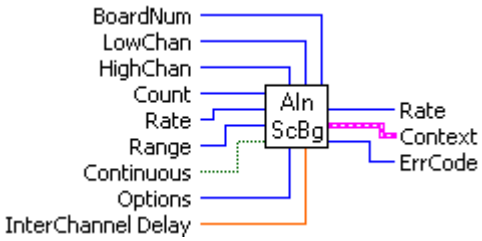
Changed R3.3 ID, R5.4 ID'

Scans a range of A/D channels in the background and stores the samples in an array. This VI reads the specified number of A/D samples at the specified sampling rate from the specified range of A/D channels from the specified board. If the A/D board has programmable gain, it sets the gain to the specified range. The collected data is returned to the data array. This VI immediately returns control to your program and the data transfer from the A/D board into ADData will continue in the background. ADData is the array contained in the context output. Use the GetStatus.VI to check on the status of the background operation and to get data as it is being collected. Use StopBg.VI to terminate the background process before it has completed. Always execute StopBg.VI after any background operation has terminated normally to clear variables and flags.

Revision 3.3: added an option to disable real-time calibration. See OptAIn.VI on page 30 for details.

Revision 5.4: added InterChannel Delay input.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan

HighChan [I32] - Last A/D channel of scan

Count [I32] - Number of A/D samples to collect

Rate [I32]- Sample rate in scans per second

Range [I32]- A/D range code

Continuous [TF] - Run the VI in an endless loop

Options [I32] - Bit fields that control various options.

InterChannel Delay [SGL] - Delay in seconds between channels in a scan.

Outputs:

Rate [I32] - Actual rate the board sampled

Context [cluster] - Output data structure.

ErrCode [I32] - Error code. See ErrMsg.VI on page 97.

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D. Can be from 0 to 100.

LowChan — First A/D channel of scan.

HighChan — Last A/D channel of scan.

Low/High Channel #: The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single-ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended mode.

Count — Specifies the total number of A/D samples that will be collected. If more than one channel is being sampled then the number of samples collected per channel is equal to Count / (HighChan- LowChan+1).

Rate (input)	This is the rate at which scans are triggered. If you are sampling four channels, 0-3, specifying a rate of 10,000 scans per second (10 kS/s) will result in the A/D converter rate of 40 kS/s: (4 channels at 10,000 samples per channel per second). This is different from some software where you specify the total A/D chip rate. In those systems, the per channel rate is equal to the A/D rate divided by the number of channels in a scan. This argument also returns the value of the actual rate set. This may be different from the requested rate because of pacer limitations.

Caution! You will generate an error if you specify a total A/D rate beyond the capability of the board. For example; if you specify LowChan = 0, HighChan = 7 (8 channels total) and Rate = 40,000 and you are using a PCI-DAS6025, you will get an error. You have specified a total rate of 8 x 40,000 = 320,000.
The PCI-DAS6025 is capable of converting 200,000 samples per second. The maximum sampling rate depends on the A/D board that is being used and on the sampling mode options.

Range	If the selected A/D board does not have a programmable range feature, this argument is ignored. Otherwise the gain can be set to any of the following ranges that are supported by the selected A/D board. Refer to the board-specific information for the list of ranges supported by each board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for a list of the A/D ranges supported by each board.
Continuous	This option (True) puts the VI in an endless loop. After it collects the required number of samples, it resets to the start of the buffer and begins again. The only way to stop this operation is with StopBg.VI.
Options	For a detailed explanation of the Options field, refer to OptAIn.VI on page 30. The OptAIn.VI must be wired to this input.
InterChannel Delay	Delay in seconds between channels in a scan. Negative values indicate that the interchannel delay will automatically be minimized. Currently, positive values will result in interchannel delays corresponding to the Rate sampling rate. For example: 1/(Rate*(HighChan-LowChan+1)).
Rate (output)	Actual sampling rate in channel scans per second. This may be different from the requested rate because of pacer limitations.
Context	Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation. Follow the steps below when wiring this VI: **1.** Start a background operation. **2.** GetStatus.VI checks for completion (boolean output called "Running"). **3.** StopBg.VI terminates the operation, if not already done, and frees memory aliases. **4.** Data output from the background operation is passed to GetStatus.VI and StopBg.VI via "Context", and can be wired from one or both of them for intermediate or final actions, respectively. The demo VIs illustrate this process effectively.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Important - Read board-specific information in UL User's Guide

In order to understand the functions, read the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf). The example programs should be examined and run prior to attempting any programming of your own.

AInScFg.VI

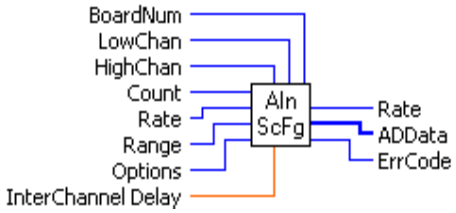
Changed R3.3 ID, R5.4 ID

Scans a range of A/D channels in the foreground and stores the samples in an array. This VI reads the specified number of A/D samples at the specified sampling rate from the specified range of A/D channels from the specified board. If the A/D board has programmable gain, it sets the gain to the specified range. The collected data is returned to the data array. This VI will not return control to your program until all requested data has been collected and returned to ADData.

Revision 3.3: added an option to disable real-time calibration. See OptAIn.VI on page 30 for details.

Revision 5.4: added InterChannel Delay input.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan

HighChan [I32] - Last A/D channel of scan

Count [I32] - Number of A/D samples to collect

Rate [I32] - Sample rate in scans per second

Range [I32] - A/D range code

Options [I32] - Bit fields that control various options. See Note 1.

InterChannel Delay [SGL]- Delay in seconds between channels in a scan.

Outputs:

Rate [I32] - Actual rate the board sampled

ADData [U16] - Data array that stores A/D values

ErrCode [I32] - Error code. See ErrMsg.VI on page 97.

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.

LowChan — First A/D channel of scan.

HighChan — Last A/D channel of scan.

Low/High Channel #**:** The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single-ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended mode.

Count — Specifies the total number of A/D samples that will be collected. If more than one channel is being sampled then the number of samples collected per channel is equal to Count / (HighChan- LowChan+1).

Rate — This is the rate at which scans are triggered. If you are sampling four channels, 0-3, then specifying a rate of 10,000 scans per second (10 kS/s) will result in the A/D converter rate of 40 kS/s: (4 channels at 10,000 samples per channel per second). This is different from some software where you specify the total A/D chip rate. In those systems, the per channel rate is equal to the A/D rate divided by the number of channels in a scan. This argument also returns the value of the actual rate set. This may be different from the requested rate because of pacer limitations.

Caution! You will generate an error if you specify a total A/D rate beyond the capability of the board. For example, if you specify LowChan = 0, HighChan = 7 (8 channels total) and Rate = 40,000 and you are using a PCI-DAS6025, you will get an error. You have specified a total rate of 8 x 40,000 = 320,000. The PCI-DAS6025 is capable of converting 200,000 samples per second. The maximum sampling rate depends on the A/D board that is being used. It is also dependent on the sampling mode options.

Range	If the selected A/D board does not have a programmable range feature, then this argument will be ignored. Otherwise the gain can be set to any of the following ranges that are supported by the selected A/D board. Refer to board-specific information for the list of ranges supported by each board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for a list of the A/D ranges supported by each board.
Options	For a detailed explanation of the Options field refer to OptAIn.VI on page 30. The OptAIn.VI must be wired to this input.
InterChannel Delay	Delay in seconds between channels in a scan. Negative values indicate that the interchannel delay will automatically be minimized. Currently, positive values will result in interchannel delays corresponding to the Rate sampling rate. For example: 1/(Rate*(HighChan-LowChan+1)).
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

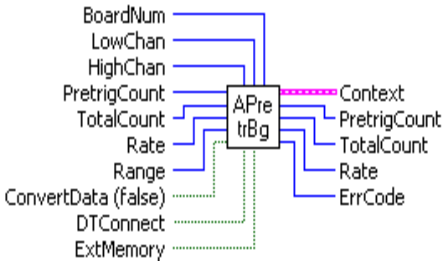
Important - Read board-specific information in UL User's Guide

In order to understand the functions, read the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf). The example programs should be examined and run prior to attempting any programming of your own.

APretrBg.VI

Waits for a trigger to occur and then returns a specified number of analog samples before and after the trigger occurred. If only 'polled gate' triggering is supported, the trigger input line (see board user's manual) must be at TTL low before this VI is called or a `TRIGSTATE` error will occur. The trigger occurs when the trigger condition is met. See SetTrig.VI and board-specific information. After this VI is called, execution will return immediately to the next point in your program and the data collection —from the A/D into the Data portion of the Context cluster—will continue in the background. Use GetStatus.VI to check on the status of the background operation. Use StopBg.VI to terminate the background process before or after it has completed its function.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan

HighChan [I32] - Last A/D channel of scan

PretrigCount [I32] - Number of pre-trigger A/D samples to collect

TotalCount [I32] - Total number of A/D samples to collect

Rate [I32] - Sample rate in scans per second

Range [I32] - A/D Range code or 0

ConvertData [TF] - Convert data option (Boolean)

DTConnect [TF] - DT connect option (Boolean)

ExtMemory [TF] - External memory option (Boolean)

Outputs:

Context [cluster] - Output data structure.

PretrigCount [I32] - Number of pre-trigger A/D samples collected

TotalCount [I32] - Total number of A/D samples collected

Rate [U32] - Actual sample rate in scans per second

ErrCode [I32] - Error code. See ErrMsg.VI on page 97.

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.

LowChan — First A/D channel of scan.

HighChan — Last A/D channel of scan.

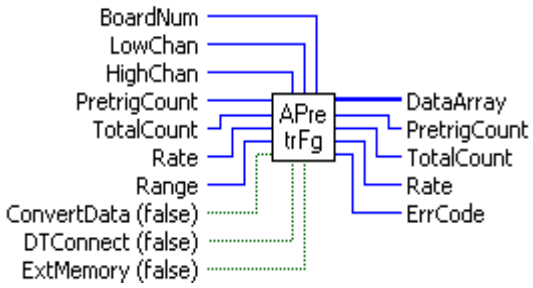
Low/High Channel #**:** The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single-ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended mode.

PretrigCount	Specifies the number of samples before the trigger that will be returned. PretrigCount must be less than TotalCount - 512. If the trigger occurs too early, then fewer than the requested number of pre-trigger samples will be collected. In that case a TOOFEW error will occur. The PretrigCount will be set to indicate how many pretrigger samples were collected and the post-trigger samples will still be collected.
TotalCount	Specifies the total number of samples that will be collected and stored in DataArray. TotalCount must be greater than or equal to PretrigCount + 512. If the trigger occurs too early, then fewer than the requested number of samples will be collected. In that case a TOOFEW error will occur. The TotalCount will be set to indicate how many total samples were actually collected.
Rate	Desired sample rate in samples per channel per second.
Range	If the selected A/D board does not have a programmable gain feature, this argument will be ignored. Otherwise the Range can be set to any of the ranges that are supported by the selected A/D board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for a list of the A/D ranges supported by each board.
ConvertData	Set this option to False (default) when using APretrBg.VI.
DTConnect	When the DTCONNECT option (True) is used with this VI, the data from ALL A/D conversions is sent out the DT-CONNECT interface. While this VI is waiting for a trigger to occur, it will send data out the DT-CONNECT interface continuously. If you have a MCC memory board plugged into the DT-CONNECT interface then you should use EXTMEMORY option rather than this option.
ExtMemory	If you use this option (True) to send the data to a connected memory board then you must use MemRdPrt.VI to later read the pre-trigger data from the memory board. If you use MemRead.VI, the data will NOT be in the correct order. Every time this option is used it will overwrite any data that is already stored in the memory board. Read all data from the board (with MemRdPrt.VI) before collecting any new data. The Mega Fifo memory must be fully populated to use the APretrBg.VI or APretrFg.VI.
Context	The data array for the pretrigger data. This is a data structure containing output information including the board number, the contents of DataArray, the size of DataArray, and the initial status of the background operation. CONTEXT must be wired to subsequent VIs in order to process this VI correctly. Follow the steps below when wiring this VI: **1.** Start a background operation. **2.** GetStatus.VI checks for completion (boolean output called "Running"). **3.** StopBg.VI terminates the operation, if not already done, and frees memory aliases. **4.** Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively. The demo VIs illustrate this process effectively.
PretrigCount	Actual number of pre-trigger A/D samples collected.
TotalCount	Total number of A/D samples collected.
Rate	Actual sample rate in scans per second .
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

APretrFg.VI

Waits for a trigger to occur and then returns a specified number of analog samples before and after the trigger occurred. If only 'polled gate' triggering is supported, the trigger input line (refer to the hardware user's manual) must be at TTL low before this VI is called or a TRIGSTATE error will occur. The trigger occurs when the trigger condition is met. See SetTrig.VI on page 33 and board-specific information for details. This VI will not return to your program until all of the requested data has been collected and returned to DataArray.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan

HighChan [I32] - Last A/D channel of scan

PretrigCount [I32] - Number of pre-trigger A/D samples to collect

TotalCount [I32] - Total number of A/D samples to collect

Rate [U32] - Sample rate in scans per second

Range [I32] - A/D range code or 0

ConvertData [TF] - Convert data option (Boolean)

DTConnect [TF] - DT connect option (Boolean)

ExtMemory [TF] - External memory option (Boolean)

Outputs:

DataArray [U32] - Data array that stores A/D values

PretrigCount [I32]- Actual number of pre-trigger A/D samples collected

TotalCount [I32] - Total number of A/D samples collected

Rate [U32] - Actual sample rate in scans per second

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

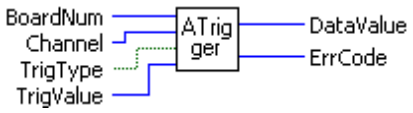
BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.
LowChan/HighChan	The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single ended and differential inputs, the maximum allowable channel number also depends on how the board is configured (8 channels for differential, 16 for single-ended).
PretrigCount	Specifies the number of samples before the trigger that will be returned. PretrigCount must be less than TotalCount - 512. If the trigger occurs too early, fewer than the requested number of pre-trigger samples will be collected. In that case a TOOFEW error will occur. The PretrigCount will be set to indicate how many samples were collected and the post trigger samples will still be collected.
TotalCount	The total number of samples that will be collected and stored in DataArray. TotalCount must be greater than or equal to PretrigCount + 512. If the trigger occurs too early then fewer than the requested number of samples will be collected. In that case, a TOOFEW error will occur. The TotalCount will be set to indicate how many samples were actually collected.

Range	If the selected A/D board does not have a programmable gain feature, this argument is ignored. Otherwise the Range can be set to any of the ranges that are supported by the selected A/D board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for a list of the A/D ranges supported by each board.
ConvertData	The data is collected into a "circular" buffer. When the data collection is complete, the data is in the wrong order. If using the CONVERTDATA option (True), when data acquisition is complete, the data is automatically rotated into the correct order and converted to 12-bit values. Otherwise, you must call ACnvPrDt.VI to rotate the data.
DTConnect	When the DTConnect option (True) is used with this VI, the data from all A/D conversions is sent out the DT-CONNECT interface. While this VI is waiting for a trigger to occur, it will send data out the DT-CONNECT interface continuously. If you have a memory board plugged into the DT-CONNECT interface, use the ExtMemory option rather than this option.
ExtMemory	If using this option (True) to send the data to a connected memory board, you must use MemRdPrt.VI to read the pre-trigger data from the memory board later. If you use the MemRead.VI, the data will not be in the correct order. Every time this option is used it will overwrite any data that is already stored in the memory board. All data should be read from the board (with MemRdPrt.VI before collecting any new data. The Mega-Fifo memory must be fully populated to use the APretrBg.VI or APretrFg.VI.
DataArray	The data array for the pretrigger data.
PretrigCount [	Actual number of pre-trigger A/D samples collected.
TotalCount	Total number of A/D samples collected.
Rate	Actual sample rate in scans per second.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

ATrigger.VI

Waits for a specified analog input channel to go above or below a specified value. This VI continuously reads the specified channel and compares its value to `TrigValue`. Depending on whether `TrigType` is ABOVE or BELOW it waits for the first A/D sample that is above or below TrigValue. It returns the first sample that meets the trigger criteria to DataValue.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

Channel [I32] - A/D channel number

TrigType [TF] - `TRIGABOVE` (True) or `TRIGBELOW` (False) - Specifies whether to wait for the analog input to be above or below the specified trigger value.

TrigValue [I32] - The threshold value that all A/D values are compared to

Outputs:

DataValue [U16] - The value of the first A/D sample that met the trigger criteria is returned here.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.

Channel — The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended.

TrigType — Specifies whether to wait for the analog input to be ABOVE or BELOW the specified trigger value.

TRIGABOVE - Wait for analog input to be above the specified trigger value.

TRIGBELOW - Wait for analog input to be below the specified trigger value.

TrigValue — Must be in the range 0 to 4095 for 12-bit A/D boards, or 0 to 65,535 for 16-bit A/D boards.

Use this VI with caution in Windows programs. All active windows will be locked on the screen until the trigger condition is satisfied. All keyboard and mouse actions will also be locked until the trigger condition is satisfied.

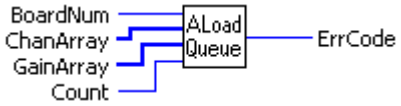
DataValue — First sample that meets trigger criteria. Use ToEng.VI to convert from binary counts to engineering units (volts or milliamps).

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

ALoadQue.VI

Loads the A/D board's channel/gain queue. This VI only works with A/D boards that have channel/gain queue hardware.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	ChanArray [I16] - Array containing channel values
	GainArray [I16] - Array containing A/D range values
	Count [I32] - Number of elements in ChanArray and GainArray, or (0) to disable the board's channel/gain queue.
Outputs:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed. The specified board must have an A/D and a channel/gain queue.
ChanArray	This array should contain all of the channels that will be loaded into the channel gain queue.
GainArray	This array should contain each of the A/D ranges that will be loaded into the channel gain queue.
Count	Specifies the total number of channel/gain pairs that will be loaded into the queue. ChanArray and GainArray should contain at least Count elements. Set Count=0 to disable the board's channel/gain queue. The maximum value is specific to the queue size of the A/D boards channel gain queue.
	Normally the AInScBg.VI or AInScFg.VI scans a fixed range of channels (from LowChan to HighChan) at a fixed A/D range. If you load the channel gain queue with this VI, all subsequent calls to AInScFg.VI or AInScBg.VI cycle through the channel/gain pairs that you have loaded into the queue.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

OptAIn.VI

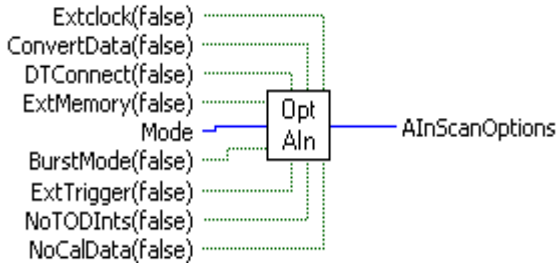
Changed R3.3ID

Generates option input for AInScBg.VI or AInScFg.VI.

Rev.3.3: Added NoCalibrateData option.

Rev. 7.1: Added BurstIO setting for Mode option

Summary:



Inputs:

ExtClock [TF] - External (True) or internal clock (False = "TIMED")

ConvertData [TF] - Separate data and channel tags (True). (False = NOCONVERTDATA")

DTConnect [TF] - DT connect option (True). (False = "NODTCONNECT")

ExtMemory [TF] - External memory option (Mega Fifo board) (True). False= "NORMMEMORY")

Mode [I32] - Sampling mode used.

BurstMode [TF] - Burst mode option (board-specific) (True). (False = "NOBURSTMODE")

ExtTrigger [TF] - External trigger option (True). (False = "NOEXTRIGGER")

NoToDints [TF] - Option to disable time of day interrupts (True). (False = "TODInts")

NoCalData [TF] - Option to disable real time software calibration (True). (False = "CalData")

Output:

AInScanOptions [I32] - Anded value of input options.

Arguments:

ExtClock

If this option is used, then conversions will be controlled by the signal on the trigger input line rather than by the internal pacer clock. Each conversion will be triggered on the appropriate edge of the trigger input signal (refer to board-specific information). When this option is used, the Rate argument is ignored. The sampling rate is dependent on the trigger signal. Options for the board will default to a transfer mode that will allow the maximum conversion rate to be attained unless otherwise specified.

ConvertData

If the CONVERTDATA option is used for 12-bit boards, then the data that is returned to data buffer (array) will automatically be converted to 12-bit A/D values. If NOCONVERTDATA is used, data from 12-bit A/D boards will be returned as 16-bit values that will contain both a 12-bit A/D value and a 4-bit channel number. After the data collection is complete, you can call ACvtData.VI to convert the data after the fact. CONVERTDATA cannot be specified if you are using a background VI and DMA transfers. This option is ignored for 16-bit boards.

DTConnect

All A/D values will be sent to the A/D board's DT CONNECT port. This option is incorporated into the EXTMEMORY option. Use DTCONNECT only when the external board is not supported by the Universal Library.

ExtMemory

Data is returned to a data buffer (array). EXTMEMORY causes the command to send the data to a connected memory board via the DT-Connect interface rather than returning the data to data buffer (array). Every time this option is used it overwrites any data already stored in the memory board. The data should be unloaded with the MemRead.VI before collecting new data.

Do not use EXTMEMORY and DTCONNECT together.

Mode

Trigger and transfer method options

Mode	Setting	Explanation
DEFAULTIO	0	Default and recommended sampling mode. The optimum sampling mode is chosen based on board type and sampling speed.
SINGLEIO	1	A/D conversions and transfers to memory are initiated by an interrupt. One interrupt per conversion.
DMAIO	2	A/D conversions are initiated by a trigger. Transfers are initiated by a DMA request.
BLOCKIO	3	A/D conversions are initiated by a trigger. Transfers are handled by REP-INSW.
BURSTIO	4	Allows higher sampling rates for sample counts up to full FIFO. Data is collected into the local FIFO. Data transfers to the PC are held off until after the scan is complete. BURSTIO is the default mode for non-Continuous fast scans (aggregate sample rates above 1000 Hz) with sample counts up to full-FIFO. To avoid the BURSTIO default, specify BLOCKIO. BURSTIO is not a valid option for most boards. It is used mainly for USB products.

BurstMode

Enables burst mode sampling. Scans from LowChan to HighChan are clocked at the maximum A/D rate between samples to minimize channel-to-channel skew. Scans are initiated at the rate specified by Rate.

ExtTrigger

If this option is specified, the sampling will not begin until the trigger condition is met. On many boards, this trigger condition is programmable (see SetTrig.VI on page 33 and board-specific information for details). On other boards, only 'polled gate' triggering is supported. In this case, assuming active high operation, data acquisition will commence immediately if the trigger input is high. If the trigger input is low, acquisition will be held off until it goes high. If only 'polled gate' triggering is supported, this option is most useful if the signal is a pulse with a very low duty cycle (trigger signal in TTL low state most of the time) so that triggering will be held off until the occurrence of the pulse.

NoToDints

If this option is specified, the system's time-of-day interrupts are disabled for the duration of the scan. These interrupts are used to update the system's real time clock and are also used by various other programs. These interrupts can limit the maximum sampling speed of some boards - particularly the PCM-DAS08. If the interrupts are turned off using this option, the real-time clock will fall behind by the length of time that the scan takes.

NoCalData

Turns off real-time software calibration for boards which are software-calibrated by applying calibration factors to the data on a sample by sample basis as it is acquired. Examples are the PC-CARD-DAS16/330 and PC-CARD-DAS16x/12. Turning off software calibration saves CPU time during a high speed acquisition run. This may be required if your processor is less than a 150 MHz Pentium and you desire an acquisition speed in excess of 200 kHz. These numbers may not apply to your system. Only trial and error testing will tell for sure.

DO NOT use this option if it is not necessary. If this option is used, the data must be calibrated after the data acquisition with the ACalData.VI.

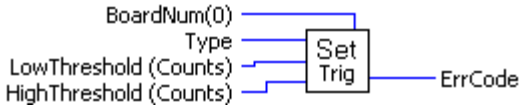
AInScanOptions	All of the inputs are Anded together and the result is passed to this parameter for input to AInScBg.VI and AInScFg.VI. The AInScanOptions output of this VI must be wired to the options input of the AInScFg.VI or AInScBg.VI.

SetTrig.VI

Selects the trigger source and sets up its parameters. This trigger is used to initiate analog to digital conversions using the following UL for LabVIEW VIs:

- AInScBg.VI or AInScFg.VI, if the EXTRIGGER option is selected.
- APretrFg.VI or APretrBg.VI
- FilePret.VI

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

Type [U32] -Trigger type (see table below)

LowThreshold [U32] - Low threshold for analog trigger

HighThreshold [U32] - High threshold for analog trigger

Outputs: ErrCode [I32] - Error code. See ErrMsg.VI

Arguments

BoardNum — The board number associated with a board when it was installed with InstaCal. The board must have the software-selectable triggering source and/or options.

Type — Specifies the trigger or gate type to configure. This can be one of the constants specified in the **Type** column below.

Trigger Source	Type	Explanation
Analog	GATE_NEG_HYS	A/D conversions are enabled when the external analog trigger input is more positive than HighThreshold. A/D conversions are disabled when the external analog trigger input is more negative than LowThreshold. Hysteresis is the level between LowThreshold and HighThreshold.
Analog	GATE_POS_HYS	A/D conversions are enabled when the external analog trigger input is more negative than LowThreshold. A/D conversions are disabled when the external analog trigger input is more positive than HighThreshold. Hysteresis is the level between LowThreshold and HighThreshold.
Analog	GATE_ABOVE	A/D conversions are enabled as long as the external analog trigger input is more positive than HighThreshold.
Analog	GATE_BELOW	A/D conversions are enabled as long as the external analog trigger input is more negative than LowThreshold.
Analog	TRIG_ABOVE	A/D conversions are enabled when the external analog trigger makes a transition from below HighThreshold to above. After conversions are enabled, the external trigger is ignored.
Analog	TRIG_BELOW	A/D conversions are enabled when the external analog trigger input makes a transition from above LowThreshold to below. After conversions are enabled, the external trigger is ignored.
Analog	GATE_IN_WINDOW	A/D conversions are enabled as long as the external analog trigger is inside the region defined by LowThreshold and HighThreshold.
Analog	GATE_OUT_WINDOW	A/D conversions are enabled as long as the external analog trigger is outside the region defined by LowThreshold and HighThreshold.
Digital	GATE_HIGH	A/D conversions are enabled as long as the external digital trigger input is 5V (logic HIGH or "1").
Digital	GATE_LOW	A/D conversions are enabled as long as the external digital trigger input is 0V (logic LOW or "0").

Trigger Source	Type	Explanation
Digital	TRIG_HIGH	A/D conversions are enabled when the external digital trigger is 5 V (logic HIGH or "1"). After conversions are enabled, the external trigger is ignored.
Digital	TRIG_LOW	A/D conversions are enabled when the external digital trigger is 0 V (logic LOW or "0"). After conversions are enabled, the external trigger is ignored.
Digital	TRIG_POS_EDGE	A/D conversions are enabled when the external digital trigger makes a transition from 0 V to 5 V (logic LOW to HIGH). After conversions are enabled, the external trigger is ignored.
Digital	TRIG_NEG_EDGE	A/D conversions are enabled when the external digital trigger makes a transition from 5 V to 0 V (logic HIGH to LOW). After conversions are enabled, the external trigger is ignored.

LowThreshold (unsigned) Selects the low threshold used when the trigger input is analog. The value must be specified in counts within the range of the board's A/D trigger circuit resolution. Refer below to "Notes."

This parameter is ignored when the trigger input is digital.

HighThreshold (unsigned) Selects the high threshold used when the trigger input is analog. The value must be specified in counts within the range of the board's A/D trigger circuit resolution. Refer below to "Notes."

ErrCode Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

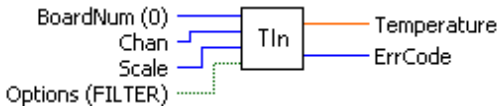
The value of the threshold must be within the range of the analog trigger circuit associated with the board. Please refer to board-specific information. For example, on the PCI-DAS1602/16 the analog trigger circuit handles ±10 V. Therefore, a value of 0 corresponds to -10 V and a value of 65535 corresponds to +10 V.

TIn.VI

Changed R3.3 ID

Reads a temperature input channel, linearizes it according to the configured temperature sensor type, and returns the temperature in degrees. The CJC channel, gain, and sensor type are read from the configuration file. They should be set by running the InstaCal configuration program.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100..

Chan [U32] - Channel to read

Scale [U32] - The temperature scale used to calculate the temperature in degrees.

Options [TF] - Bit that controls data smoothing (averaging) option (True). "FILTER" (True) is default.

Outputs:

Temperature [SGL] - Temperature returned here.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

Chan — Input channel to read. For EXP boards, the channel number is calculated using the following formula:

A/DChan = A/D channel the multiplexer ("mux") is connected to
MuxChan = Mux board input channel number
Chan = (ADChan+1) * 16 + MuxChan

For example, if you had an EXP16 connected to a PCI-DAS08 via the PCI-DAS08 channel 0 (remember, DAS08 channels are numbered 0, 1, 2, 3, 4, 5, 6, and 7), and if you had a thermocouple connected to channel 5 of the EXP16, the value for Chan would be (0 + 1) x 16 + 5 = 21.

Scale — Specifies the temperature scale that the input will be converted to. Choices are CELSIUS, FAHRENHEIT and KELVIN.

Options — FILTER: The TIn.VI applies a smoothing function to thermocouple readings very much like the electrical smoothing inherent in all thermocouple instruments. When selected, 10 samples are read from the specified channel and averaged. The average is the reading returned. This is the default.

NOFILTER: If you use the NOFILTER option (False), the thermocouple readings will not be smoothed and you will see a scattering of readings around a mean.

Temperature — The temperature in degrees is returned here. Resolution is hardware dependent.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

A/D Range – IMPORTANT

If an EXP board is connected to an A/D that does not have programmable gain then the A/D board input range is read from the configuration file (CB.CFG). In most cases, hardware-selectable ranges should be set for ±5 V for thermocouples and 0 to 10 V for RTDs. If the board does have programmable gains, the TIn.VI will set the appropriate A/D range. Refer to the board-specific information for details.

Note on CJC Channel: The CJC channel is set in the InstaCal program. If you have multiple EXP boards, the LabVIEW VI will apply the CJC reading to the linearization formula in the following manner:

- If you have chosen a CJC channel for the EXP board that the channel you are reading is on, it will use the CJC temp reading from that board.
- If you have left the CJC channel for the EXP board that the channel you are reading is on to NOT SET, the VI will use the CJC reading from the next lower EXP board with a CJC channel selected.

For example: Assume you have four CIO-EXP16 boards connected to a PCI-DAS08 on channel 0, 1, 2, and 3, and you have chosen CIO-EXP16 #1 (connected to PCI-DAS08 channel 0) to have its CJC read on PCI-DAS08 channel 7.

- If you have left CIO-EXP16 CJC channels 2, 3, and 4 to NOT SET, those CIO-EXP boards will all use the CJC reading from CIO-EXP16 #1, connected to channel 7 for linearization.

Note that it is important to keep the CIO-EXP boards in the same case and out of any breezes to ensure valid CJC readings.

Important - Read board-specific information in UL User's Guide

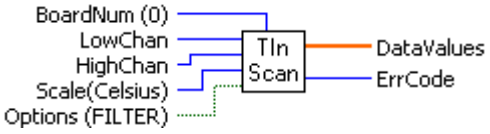
In order to understand the functions, read the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf). The example programs should be examined and run prior to attempting any programming of your own.

TInScan.VI

Changed R3.3 ID

Reads a range of temperature input channels, linearizes them according to temperature sensor type, and returns the temperatures to an array in degrees. The CJC channel, the gain, and sensor type are read from the configuration file. Use InstaCal to change any of these options.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	LowChan {U32] - Low mux channel of scan.
	HighChan [U32] - High mux channel of scan.
	Scale [U32] - The temperature scale used to calculate the temperature in degrees.
	Options [TF] -Bit that controls data smoothing (averaging) option (T). "FILTER" (T) is default
Outputs:	DataValues [SGL] – Array of temperatures returned here.
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
LowChan	First A/D channel of scan.
HighChan	Last A/D channel of scan.
	Low/High Channel #: Specify the range of multiplexer channels that will be scanned. For EXP boards, these channel numbers are calculated using the following formula:
	A/DChan = A/D channel that mux is connected to MuxChan = Mux board input channel number Chan = (ADChan+1) * 16 + MuxChan (where MuxChan ranges from 0 to 15, indicating which channel on a particular board).
	For example, if you had an EXP16 connected to a PCI-DAS08 via the PCI-DAS08 channel 0 (remember, DAS08 channels are numbered 0, 1, 2, 3, 4, 5, 6, and 7), and if you had a thermocouple connected to channel 5 of the EXP16, the value for Chan would be (0 + 1) x 16 + 5 = 21. For 6 and 7 of the EXP16, the value for LowChan would be (0 + 1) x 16 + 6 = 22 and the value for HighChan would be (0 + 1) x 16 + 7 = 23.
Scale	Specifies the temperature scale that the input will be converted to. Choices are CELSIUS, FAHRENHEIT and KELVIN.
Options	FILTER (T) - The TInScan.VI applies a smoothing function to thermocouple readings very much like the electrical smoothing inherent in all thermocouple instruments. When selected, 10 samples are read and averaged on each channel. The average is the reading returned. This is the default.
	NOFILTER (F) - If you use the NOFILTER option then the thermocouple readings will not be smoothed and you will see a scattering of readings around a mean.
DataValues[]	The temperature is returned in degrees. Each element in the array corresponds to a channel in the scan. DataValues must be at least large enough to hold HighChan - LowChan + 1 temperature values.

ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

A/D Range – IMPORTANT

If an EXP board is connected to an A/D board that does not have programmable gain then the A/D board input range is read from the configuration file (CB.CFG). In most cases, hardware-selectable ranges should be set for ±5 V for thermocouples and 0 to 10 V for RTDs. If the board does have programmable gains, the `TInScan.VI` will set the appropriate A/D range. Refer to the board-specific information for details.

Note on CJC Channel: The CJC channel is set in the install program. If you have multiple EXP boards, the LabVIEW VI will apply the CJC reading to the linearization formula in the following manner:

- If you have chosen a CJC channel for the EXP board that the channel you are reading is on, it will use the CJC temp reading from that board.
- If you have left the CJC channel for the EXP board that the channel you are reading is on to NOT SET, the VI will use the CJC reading from the next lower EXP board with a CJC channel selected.

  For example: Assume you have four CIO-EXP16 boards connected to a PCI-DAS08 on channel 0, 1, 2, and 3, and you have chosen CIO-EXP16 #1 (connected to PCI-DAS08 channel 0) to have its CJC read on PCI-DAS08 channel 7.
- If you have left CIO-EXP16 CJC channels 2, 3, and 4 to NOT SET, those CIO-EXP boards will all use the CJC reading from CIO-EXP16 #1, connected to channel 7 for linearization.

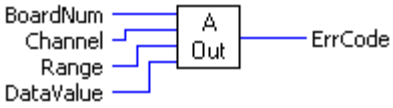
Note that it is important to keep the CIO-EXP boards in the same case and out of any breezes to ensure valid CJC readings.

Analog Output VIs

AOut.VI

Sets the value of a D/A output.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

Channel [I32] - Number of D/A channel to update.

Range [I32] - A/D Range code

DataValue [U16] - Value to update D/A.

Outputs: ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

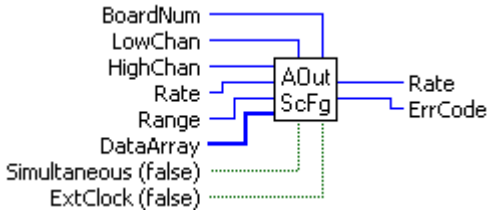
BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have a D/A.
Channel	The maximum allowable channel depends on which type of D/A board is being used.
DataValue	Must be in the range 0 – N, where N is the value $2^{Resolution}$ - 1 of the converter.
Range	If the selected D/A board does not have a programmable range feature, this argument will be ignored. Otherwise, the gain can be set to any of the ranges that are supported by the selected D/A board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.

For simultaneous-update boards: If you have set the simultaneous update jumper for simultaneous operation, you should use AOutScBg.VI or AOutScFg.VI for simultaneous update of multiple channels. AOut.VI always writes the D/A data then reads the D/A, which causes the D/A output to be updated.

AOutScFg.VI

Outputs the values to a range of D/A channels in the foreground.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First D/A channel of scan.

HighChan [I32] - Last D/A channel of scan

Rate [I32] - Sample rate in scans per second [U32]

Range [I32] - D/A range code

Data Array [U16] - Data array to output D/A values from.

Simultaneous [TF] - Simultaneous update mode

ExtClock [TF] - Pace conversions externally

Outputs:

ErrCode [I32] -Error code. See ErrMsg.VI

Rate [I32] - Actual output rate in samples per second

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have a D/A.

LowChan — First D/A channel of scan.

HighChan — Last D/A channel of scan.

Low/High Channel #: The maximum allowable channel depends on which type of D/A board is being used.

Rate (input) — Sample rate in scans per second. For many D/A boards the Rate is ignored and can be set to NOTUSED. For D/A boards with trigger and transfer methods which allow fast output rates, such as the CIO-DAC04/12-HS, Rate should be set to the D/A output rate (in scans/sec). This argument also returns the value of the actual rate set. This value may be different from the user specified rate because of pacer limitations.

If supported, scans are triggered at this rate. If you are updating four channels, 0-3, specifying a rate of 10,000 scans per second (10 kS/s) will result in the D/A converter rates of 10 kS/s: (one D/A per channel). The data transfer rate will be 40,000 words per second; (4 channels x 10,000 updates per scan).

The maximum update rate depends on the D/A board that is being used.

Range (input) — If the selected D/A board does not have a programmable range feature, then this argument will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected board. See the "Range input values" on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.

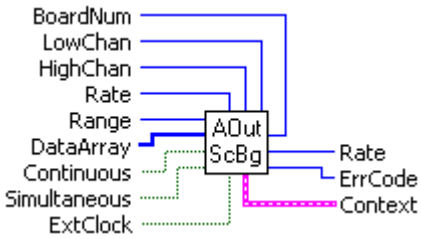
DataArray — Must be in the range 0 – N, where N is the value $2^{Resolution}$ - 1 of the converter. There should be at least HighChan-LowChan+1 elements in the array.

Simultaneous	When this option is set (True) (if the board supports it and the appropriate switches are set on the board) all of the D/A voltages will be updated simultaneously when the last D/A in the scan is updated. This generally means that all the D/A values will first be written to the board, then a read of a D/A address causes all D/As to be updated with new values simultaneously.
ExtClock	If this option (True) is used, conversions will be paced by the signal on the external clock input line rather than by the internal pacer clock. Each conversion will be triggered on the appropriate edge of the external clock input signal (see board-specific info). When this option is used, the Rate argument is ignored. The sampling rate is dependent on the trigger signal. Options for the board will default to transfer types that allow the maximum conversion rate to be attained unless otherwise specified.
Rate (output	Actual output rate (in samples per channel per second).
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

AOutScBg.VI

Outputs the values to a range of D/A channels in the background. This VI can only be used with boards that support interrupt, DMA or REP-INSW transfer methods. When this option is used the D/A operations will begin running in the background and control will immediately return to the VI. Use GetStatus.VI to check the status of a background operation. Use StopBg.VI to terminate background operations before they are completed. Always run StopBg.VI after running a background operation to clear variables and flags.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	LowChan [I32] - First D/A channel of scan
	HighChan [I32] - Last D/A channel of scan
	Rate [I32] - Sample rate in scans per second
	Range [I32] - D/A range code
	DataArray [U16] - Data array to output D/A values from.
	Continuous [TF] - Run the VI in an endless loop
	Simultaneous [TF] - Simultaneous update mode
	ExtClock [TF] - Pace conversions externally
Outputs:	Error code [I32] - Error code. See ErrMsg.VI
	Context [cluster] - Output data structure..

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have a D/A.
LowChan	First D/A channel of scan.
HighChan	Last D/A channel of scan.
Low/High Channel #	The maximum allowable channel depends on which type of D/A board is being used.
Rate (input)	For many D/A boards, the Rate is ignored and can be set to NOTUSED. For D/A boards with trigger, and transfer methods which allow fast output rates, set Rate to the D/A output rate (in scans/sec). A typical fast board is the CIO-DAC04/12-HS.
	If supported, this is the rate at which scans are triggered. If you are updating 4 channels, 0-3, then specifying a rate of 10,000 scans per second (10 kHz) will result in the D/A converter rates of 10 kHz: (one D/A per channel). The data transfer rate will be 40,000 words per second; (4 channels x 10,000 updates per scan).
	The maximum update rate depends on the D/A board that is being used.
DataArray	The data array should be filled with D/A values in the range 0 – n, where n is the value $2^{Resolution} - 1$ of the converter. There should be at least HighChan-LowChan + 1 elements in the array.

Continuous	This option (True) can only be used with boards which support interrupt, DMA or REP-INSW transfer methods. This option puts the VI in an endless loop. After it outputs the specified (by Count) number of D/A values, it resets to the start of DataArray and begins again. The only way to stop this operation is with StopBg.VI.
Simultaneous	When this option is set (True) (if the board supports it and the appropriate switches are set on the board) all of the D/A voltages will be updated simultaneously when the last D/A in the scan is updated. This generally means that all the D/A values will be written to the board, then a read of a D/A address causes all D/As to be updated with new values simultaneously.
ExtClock	If this option (True) is used then conversions will be paced by the signal on the external clock input line rather than by the internal pacer clock. Each conversion will be triggered on the appropriate edge of the external clock input signal (refer to the board-specific information). When this option is used the Rate argument is ignored. The sampling rate is dependent on the trigger signal. Options for the board will default to transfer types that allow the maximum conversion rate to be attained unless otherwise specified.
Range	If the selected D/A board does not have a programmable range feature, this will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected D/A board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
Rate (output)	Actual sampling rate in channel scans per second. This may be different from the requested rate because of pacer limitations.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.
Context	Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation. Follow the steps below when wiring this VI: **1.** Start a background operation. **2.** GetStatus.VI checks for completion (boolean output called "`Running`"). **3.** StopBg.VI terminates the operation, if not already done, and frees memory aliases. **4.** Data output from the background operation is passed to GetStatus.VI and StopBg.VI via "`Context`", and can be wired from one or both of them for intermediate or final actions, respectively. The demo VIs illustrate this process effectively.

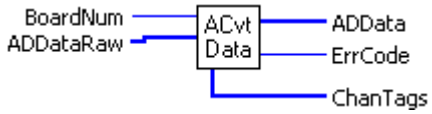
Signal conditioning VIs

ACvtData.VI

Changed R3.3 RW (MOD)

Converts the raw data collected by AInScFg.VI or AInScBg.VI into 12-bit A/D values. The AInScFg.VI and AInScBg.VI can return either raw A/D data or converted data depending on whether or not the CONVERTDATA option was set. For many 12-bit A/D boards, the raw data is a 16-bit value that contains a 12-bit A/D value and a 4-bit channel tag (refer to board-specific information or the board's hardware manual). The converted data consists of just the 12-bit A/D value.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	ADDataRaw [U16] - Data and channel tags from AInScBg.VI or AInScFg.VI.
Outputs:	ADData [U16] - Converted A/D values.
	ChanTags [U16] - Channel tags if available.
	ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.
ADDataRaw	Array of raw A/D values that include data and channel tags.
ADData	Array of converted A/D values.
ChanTags	Array of channel tags, if available.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

When you collect data with AInScBg.VI or AInScFg.VI and you don't use the CONVERTDATA option, you may need to use this VI to convert the data after it is collected. There are cases where the CONVERTDATA option is not allowed—for example, if you are using the DMAIO option with AInScBg.VI. In this case, use this VI to convert the data after the data collection is complete.

On some boards, each raw data point consists of a 12-bit A/D value with a 4-bit channel number. This VI separates the two and puts the A/D value into the ADData array and the channel number into the ChanTags array.

12-bit A/D boards: Upon returning from ACvtData.VI, ADData array contains only 12-bit A/D data.

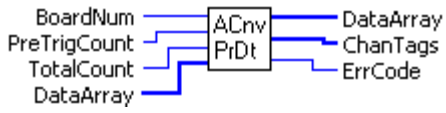
16-bit A/D boards: Do not use this VI is with 16-bit A/D boards. If this function is called for a 16-bit board, it is simply ignored. No error is returned.

ACnvPrDt.VI

Changed R3.3 RW (MOD)

Converts the raw data collected by APretrFg.VI or APretrBg.VI. APretrBg.VI and APretrFg.VI can return either raw A/D data or converted data depending on whether or not the CONVERTDATA option was used. The raw data as it is collected is not in the correct order. After the data collection is completed it must be rearranged into the correct order. This VI correctly orders the data, starting with the first pretrigger data point and ending with the last post-trigger point.

Change at revision 3.3 to support multiple background operations.



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	PreTrigCount [I32] - Number of pre-trigger samples
	TotalCount [I32] - Total number of A/D samples that were collected
	DataArray [U32] - Data and channel tags
Outputs:	DataArray [U32] - Converted data
	ChanTags [I16] - Channel tags if available
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D. Can be 0 to 100.
PreTrigCount	Number of pre-trigger samples.
TotalCount	Total number of A/D samples that were collected.
DataArray (In)	Array of raw samples that require ordering.
DataArray (Out)	Array of converted samples ordered with oldest samples first.
ChanTags	Array of channel tags, if available.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

When you collect data with APretrFg.VI or APretrBg.VI and you don't use the CONVERTDATA option, you must use this VI to convert the data after it is collected. There are cases where the CONVERTDATA option is not allowed—for example, if you use the BACKGROUND option with APretrBg.VI or APretrFg.VI. In those cases, use this VI to convert the data after the data collection is complete.

12-bit A/D boards: On some 12-bit boards, each raw data point consists of a 12-bit A/D value with a 4-bit channel number. This VI separates the two and puts the A/D value into the DataArray, and the channel number into the ChanTags array. Upon returning from APretrBg.VI or APretrFg.VI, DataArray contains only 12-bit A/D data.

16-bit A/D boards: This VI is used with 16-bit A/D boards only corrects the order of the data. No channel tags are returned.

ACal.VI

New R3.3

Calibrates the raw data collected by AInScBg.VI or AInScFg.VI from boards with real-time software calibration capability but the real-time calibration has been turned off. AInScBg.VI or AInScFg.VI can return either raw A/D data or calibrated data depending on whether or not the NOCALIBRATEDATA option was used.

Summary:

Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	Range [I32] - The programmable gain/range used when the data was collected
	ADDataRaw [U16] - Raw A/D data
Outputs:	ADData [U16] - Pointer to data array
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed. The specified board must have an A/D. Can be 0 to 100.
ADDataRaw	Array of raw A/D measurements that require calibration.
Range	If the selected A/D board does not have a programmable range feature, this will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected A/D board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
ADData	Array of calibrated data.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

When you collect data with AInScBg.VI or AInScFg.VI, and you use the NOCALIBRATEDATA option, then you must use this VI to calibrate the data after it is collected.

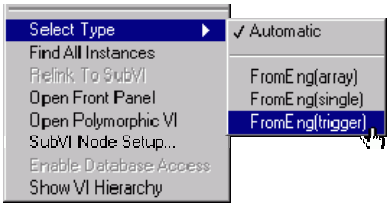
FromEng.VI

Changed R5.4 ID, R7.1 ID

Performs the following conversion operations:

- Converts a single voltage (or current) in engineering units to a D/A count value for output to a D/A.
- Converts an array of voltages (or currents) in engineering units to an array of D/A count values for output to a D/A.
- Converts a single voltage (or current) in engineering units to a D/A count value for output as an analog trigger threshold based on the hardware's trigger circuit. If hardware does not support analog triggering, output is 0.

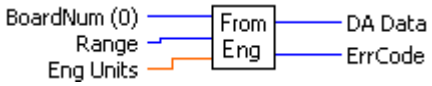
  To use FromEng.VI to output an analog trigger threshold to the SetTrig.VI, right-mouse-click on the VI and select the **Select Type ► FromEng(trigger)** option from the menu.



Change at revision 5.4 to support processing of single values and arrays of values.

Change at revision 7.1 to support processing of analog trigger values.

Summary:



Inputs	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	Range [I32] - D/A range to use in conversion
	EngUnits [SGL] - Voltage (or current) value or array of values to convert
Outputs	DA Data [I16] - D/A count equivalent to voltage returned here
	ErrCode [I32] - Error code. See ErrMsg VI.

Arguments:

BoardNum	The board number associated with a D/A board when it was installed with InstaCal. This function uses the board number to determine whether to do a 12-bit or 16-bit conversion.
Range	If the selected D/A board does not have a programmable range feature, this will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected D/A board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
EngUnits	Either a single voltage/current value or an array of voltage/current values that you want to set the D/A to. Values should be within the range specified by the Range argument.
DA Data	Returns a D/A count or an array of D/A counts to this output that is equivalent to the EngUnits argument.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

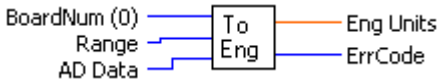
ToEng.VI

Changed R5.4 ID

Converts a single A/D count value to an equivalent voltage value, or converts an array of A/D counts to an array of equivalent voltage values.

Change at revision 5.4 to support processing of single values and arrays of values.

Summary:



Inputs:

BoardNum - The board number assigned when installed with InstaCal. Can be 0 to 100.

Range - A/D range to use in conversion

AD Data – A/D count value returned from an A/D board

Outputs:

EngUnits - Equivalent voltage (or current) value returned to this variable

ErrCode - Error code. See ErrMsg.VI

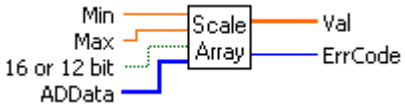
Arguments:

BoardNum	The board number associated with an A/D board when it was installed with InstaCal. This function uses the board number to determine whether to do a 12-bit or 16-bit conversion.
Range	A/D voltage (or current) range. Some A/D boards have programmable voltage ranges, others set the voltage range via switches on the board. In either case the selected range must be passed to this function. Each A/D board supports different voltage and/or current ranges. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
AD Data	A/D measurement in binary counts to be converted to engineering units.
EngUnits	The voltage (or current) value that is equivalent to AD Data is returned to this variable. The value will be within the range specified by the Range argument.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

ScaleArr.VI

Scales raw data from an entire array to a user-specified range.

Summary:



Inputs:	Min [SGL] - Lower limit of range
	Max [SGL]- Upper limit of range
	16 or 12 bit [TF] - Length of raw data; 1 to 16 bits (True), 0 to 12 bits (False = default).
	ADData [U16] - Unconverted data array
Output:	Val [SGL] - Converted data array
	ErrCode [I32] - Error code. See ErrMsg.VI

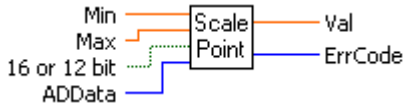
Arguments:

Min	Lower limit of selected range.
Max	Upper limit of selected range.
16 or 12 bit	Length of data to be converted. Depends on the type of hardware being used.
ADData	Array with unconverted raw data.
Val	Array with converted engineering data.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

ScalePnt.VI

Scales raw data point to a user-specified range.

Summary:



Inputs:	Min [SGL] - Lower limit of range
	Max [SGL] - Upper limit of range
	16 or 12 bits [TF] - Length of raw data; 1-16 bits (T), or 1 to 12 bits (F = default)
	ADData [U16] - Unconverted data array single element.
Output:	Val [SGL] - Converted data array element
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

Min	Lower limit of selected range.
Max	Upper limit of selected range.
16 or 12 bit	Length of data to be converted. Depends on the type of hardware being used.
ADData	Array element with unconverted raw data.
Val	Converted engineering data.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Counter VIs

The Universal Library for LabVIEW extensions provides VIs for the initialization and configuration of counter chips. It is important to note what this means:

- VIs can configure a counter for any of the counter's operations.

  Counter configuration does not include the use of counters —such as event counting and pulse width. Counter use is accomplished by programs which use the counter VIs. Some counter-use VIs are available.

To use a counter for any but the simplest counting VI, you must use the information contained in the chip manufacturer's data sheet. Technical support of the VIs does *not* include providing, interpreting or explaining the counter chip data sheet.

- 82C54 counter chip

  The 82C54 data sheet is available on our web site at www.mccdaq.com/PDFmanuals/82C54.pdf.

- AM9513 counter chip

  The 9513A data sheet is available on our web site at www.mccdaq.com/PDFmanuals/9513A.pdf

- Z8536 counter chip

  As of this writing, the only Measurement Computing boards that use the Z8536 are the PCI/CIO-INT32 products. The data book for the chip is included with these products.

- LS7266 counter chip

  The LS7266 data sheet is available on our web site at www.mccdaq.com/PDFmanuals/LS7266R1.pdf, or contact US Digital at www.usdigital.com.

C8254Cfg.VI

Configures an 8254 counter for desired operation. This VI can only be used with 8254 counters.

Summary:

Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [U32] - The counter number to configure

Config [U32] - Sets the mode of the counter.

Outputs:

BoardNum (Out) [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.

ErrCode [U32] - Error code. See ErrMsg.VI

Arguments:

BoardNum (input)

The board number associated with a board when it was installed with InstaCal. The specified board must have an 8254 counter.

CounterNum

Selects a counter channel. An 8254 has three counters. The value can be 1-n, where n is the number of 8254 counters on the board.

Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Config

Sets the mode of the counter which defines the terminal count behavior and/or the waveform of the counter OUT pin. Refer to the 8254 data sheet for a detailed description of each of the configurations. Config can be set to one of the following constants:

HIGHONLASTCOUNT: Output of the counter (OUT N) transitions from low to high on terminal count and remains high until reset. See mode 0 on the 8254 data sheet.

ONESHOT: Output of the counter (OUT N) transitions from high to low on rising edge of GATE N, then back to high on terminal count. See mode 1 on the 8254 data sheet.

RATEGENERATOR: Output of the counter (OUT N) pulses low for one clock cycle on terminal count and reloads the counter and recycles. See mode 2 on the 8254 data sheet.

SQUAREWAVE: Output of the counter (OUT N) is high for count < 1/2 terminal count then low until terminal count, whereupon it recycles. This mode generates a square wave. See mode 3 on the 8254 data sheet.

SOFTWARESTROBE Output of the counter (OUT N) pulses low for one clock cycle on terminal count. Count starts after counter is loaded. See mode 4 on the 8254 data sheet.

HARDWARESTROBE : Output of the counter (OUT N) pulses low for one clock cycle on terminal count. Count starts on rising edge at GATE N input. See mode 5 on the 8254 data sheet.

BoardNum (output)

The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.

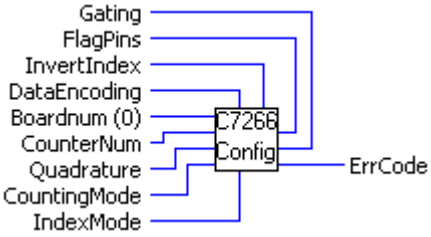
ErrCode

Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

C7266Config.VI

Configures a 7266 counter for desired operation. This function can only be used with boards that contain a 7266 counter chip (Quadrature Encoder boards).

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [I32] - Counter number (1 to n) to configure

Quadrature [I32] - NO_QUAD, X1_QUAD, X2_QUAD or X4_QUAD

CountingMode [I32] - NORMAL_MODE, RANGE_LIMIT, NO_RECYCLE, MODULO_N

DataEncoding [I32] - BCD_ENCODING, BINARY_ENCODING

IndexMode [I32] - INDEX_DISABLED, LOAD_CTR, LOAD_OUT_LATCH, RESET_CTR

InvertIndex [I32] - DISABLED or ENABLED

FlagPins [I32] - Selects function for X1FLG and X2FLG pins. CARRY_BORROW, COMPARE_BORROW, CARRYBORROW_UPDOWN, INDEX_ERROR.

Gating [TF] - DISABLED or ENABLED

Outputs:

ErrCode – Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Arguments:

BoardNum

The board number associated with a board when it was installed with InstaCal. The specified board must have an LS7266 counter.

CounterNum

Counter number (1n) where n is the number of counters on the board. A PCM-QUAD02 has two counters. A PCI-QUAD04 has four counters.

Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Quadrature

Selects the resolution multiplier (X1_QUAD, X2_QUAD, or X4_QUAD) for quadrature input or disables quadrature input (NO_QUAD) so that the counters can be used as standard TTL counters.

CountingMode

Selects one of the following operating modes for the counter:

NORMAL_MODE - Each counter operates as a 24-bit counter that rolls over to 0 when the maximum count is reached.

RANGE_LIMIT - In range limit count mode, an upper and lower limit is set, mimicking limit switches in the mechanical counterpart. The upper limit is set by loading the PRESET register with the cbCLoad function after the counter has been configured. The lower limit is always 0. When counting up, the counter freezes whenever the count reaches the value loaded into the PRESET register. When counting down, the counter freezes at 0. In each case the counting is resumed only when the count direction is reversed.

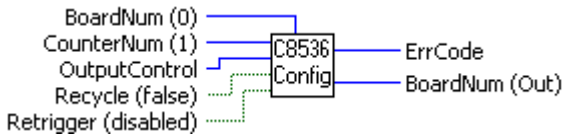
NO_RECYCLE - In non-recycle mode, the counter is disabled whenever a count overflow or underflow takes place. The counter is re-enabled when a reset or load operation is performed on the counter.

	MODULO_N - In modulo-n mode, an upper limit is set by loading the PRESET register with a maximum count. When counting up, if the maximum count is reached, the counter will roll-over to 0 and continue counting up. Likewise, when counting down, if the count reaches 0, it will roll over to the maximum count (in the PRESET register) and continue counting down.
DataEncoding	Selects the format of the data that is returned by the counter (Binary or BCD).
IndexMode	Selects which action will be taken when the Index signal is received. IndexMode must be set to INDEX_DISABLED whenever Quadrature is set to NON_QUAD or when Gating is set to ENABLED. INDEX_DISABLED - The Index signal is ignored. LOAD_CTR - The counter is loaded whenever the Index signal ON the LCNTR pin occurs LOAD_OUT_LATCH - The current count is latched whenever the Index signal on the LCNTR pin occurs. When this mode is selected, the CIn() function returns the same count each time it is called until the Index signal occurs. RESET_CTR - The counter is reset to 0 whenever the Index signal on the RCNTR pin occurs
InvertIndex	Selects the polarity of the Index signal. If set to DISABLED the Index signal is assumed to be positive polarity. If set to ENABLED the Index signal is assumed to be negative polarity.
FlagPins	Selects which signals will be routed to the FLG1 and FLG2 pins. CARRY_BORROW - FLG1 pin is CARRY output, FLG2 is BORROW output COMPARE_BORROW - FLG1 pin is COMPARE output, FLG2 is BORROW output CARRYBORROW_UPDOWN - FLG1 pin is CARRY/BORROW output, FLG2 is UP/DOWN signal INDEX_ERROR - FLG1 is INDEX output, FLG2 is error output
Gating	If Gating is set to ENABLED (True), the RCNTR pin will be used as a gating signal for the counter. Whenever Gating=ENABLED, IndexMode must be set to DISABLE_INDEX.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

C8536Cfg.VI

Configures an 8536 counter for desired operation. This VI can only be used with 8536 counters.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [U32] - Counter number to configure

OutputControl [U32] - Specifies counter output signal used.

Recycle [TF] - Execute once or reload and re-execute until stopped.

Retrigger [TF] - Enable or disable retriggering.

Outputs:

ErrCode [I32] - Error code. See ErrMsg.VI

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.

Arguments:

BoardNum (input) — The board number associated with a board when it was installed with InstaCal. The specified board must have an 8536 counter

CounterNum — Selects one of the counter channels. An 8536 has three counters. The value can be 1-n, where n is the number of 8536 counters on the board.

Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

OutputControl — Specifies one of the following the actions of the output signal.

`HIGHPULSEONTC` - Output will transition from low to high for one clock pulse on terminal count.

`TOGGLEONTC` - Output will change state on terminal count.

`HIGHUNTILTC` - Output will transition to high at the start of counting then go low on terminal count.

RecycleMode — If set to `RECYCLE` (False, as opposed to `ONETIME`), the counter will automatically reload to the starting count every time it reaches 0, then continue counting.

Retrigger — If set to `ENABLED` (True), every trigger on the counter's trigger input will initiate loading of the initial count. Counting will proceed from initial count.

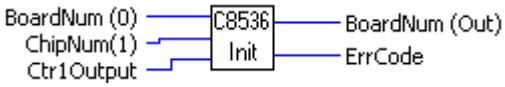
BoardNum (output) — The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

C8536Init.VI

Initializes the counter linking features of an 8536 counter chip. Refer to the "Counter/Timer Link Controls" section on the 8536 data sheet, for a complete description of the hardware affected by this mode. Counters 1 and 2 must be linked before enabling the counters.

Summary:



Inputs: BoardNum [U32]: Board number when installed with InstaCal. Can be 0 to 100.

ChipNum [U32] - Chip number to configure

CtrlOutput [U32] - Specifies counter output signal used.

Outputs: ErrCode [I32] - Error code. See ErrMsg.VI

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.

Arguments:

BoardNum (input) — The board number associated with a board when it was installed with InstaCal. The specified board must have an 8536 counter.

ChipNum — Selects one of the 8536 chips on the board, 1 to n.

Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

CtrlOutput — Specifies how counter 1 is to be linked to counter 2, based on the following options.

NOTLINKED -Counter 1 is not connected to any other counters inputs.

GATECTR2 - Output of counter 1 is connected to the GATE of counter #2.

TRIGCTR2 - Output of counter 1 is connected to the trigger of counter #2.

INCTR2 - Output of counter 1 is connected to counter #2 clock input.

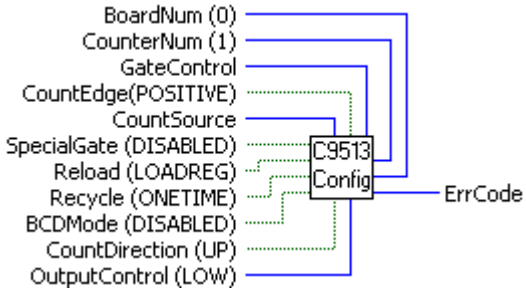
BoardNum (output) — The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

C9513Config.VI

Sets all of the configurable options of a 9513 counter.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [U32] - Counter number (1 - n)

GateControl [U32] - Gate control

CountEdge [TF] - Which edge to count

CountSource [U32] - Which of the available count sources to use.

SpecialGate [TF] - Special gate can be enabled or disabled.

Reload [TF] - Load or load and hold.

Recycle [TF] - Execute once or reload and recycle.

BCDMode [TF] - Counter can operate in Binary Coded Decimal if desired.

CountDirection [TF]- AM9513 can count up or down.

OutputControl [U32] - The type of output desired.

Outputs: ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

Important

The information provided here will only help you understand how Universal Library syntax corresponds to the 9513 data sheet. It is not a substitute for the data sheet. You cannot program a 9513 without the manufacturer's data sheet. The 9513 data sheet is available from out web site at www.mccdaq.com/PDFmanuals/9513A.pdf.

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have a 9513 counter.

CounterNum — Counter number (1 ~ n) where n is the number of counters on the board. (For example, a PCI-CTR05 has five, a PCI-CTR20HD has 20, etc.). Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

GateControl — Gate control variables are:

NOGATE	No gating
AHLTCPREVCTR	Active high TCN-1
AHLNEXTGATE	Active High Level GATE N + 1
AHLPREVGATE	Active High Level GATE N - 1
AHLGATE	Active High Level GATE N
ALLGATE	Active Low Level GATE N
AHEGATE	Active High Edge GATE N
ALEGATE	Active Low Edge GATE N

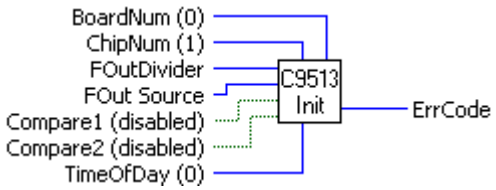
CountEdge	The edge to count. Refer to as Source Edge in 9513 data book. Corresponds to the 9513 description in Counter Mode Register Description. Edge control variables are:
	`POSITIVEEDGE` Count on Rising Edge (False)
	`NEGATIVEEDGE` Count on Falling Edge
CountSource	Corresponds to the 9513 description in Counter Mode Register Description
	`TCPREVCTR` TCN - 1 (Terminal count of previous counter)
	`CTRINPUT1` SRC 1 (Counter Input 1)
	`CTRINPUT2` SRC 2 (Counter Input 2)
	`CTRINPUT3` SRC 3 (Counter Input 3)
	`CTRINPUT4` SRC 4 (Counter Input 4)
	`CTRINPUT5` SRC 5 (Counter Input 5)
	`GATE1` GATE 1
	`GATE2` GATE 2
	`GATE3` GATE 3
	`GATE4` GATE 4
	`GATE5` GATE 5
	`FREQ1` F1
	`FREQ2` F2
	`FREQ3` F3
	`FREQ4` F4
	`FREQ5` F5
SpecialGate	Corresponds to 9513 description in Counter Mode Register Description.
	`ENABLED` Enable Special Gate
	`DISABLED` Disable Special Gate (False)
Reload	Corresponds to 9513 description in Counter Mode Register Description.
	`LOADREG` Reload from Load (False)
	`LOADANDHOLDREG` Reload from Load or Hold except in Mode X which reloads only from Load.
RecycleMode	Corresponds to 9513 description in Counter Mode Register Description.
	`ONETIME` Count Once (False)
	`RECYCLE` Count Repetitively
BCDMode	Corresponds to 9513 description in Counter Mode Register Description:
	`DISABLED` Binary Count (False)
	`ENABLED` BCD Count
CountDirection	Corresponds to 9513 description in Counter Mode Register Description.
	`COUNTDOWN` Count Down
	`COUNTUP` Count Up (False)

OutputControl	Corresponds to 9513 description in Counter Mode Register Description. `ALWAYSLOW` Inactive, Output Low `HIGHPULSEONTC` Active High Terminal Count Pulse `TOGGLEONTC` TC Toggled `DISCONNECTED` Inactive, Output High Impedance `LOWPULSEONTC` Active Low Terminal Count Pulse 3, 6, 7 (numeric values) Illegal
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

C9513Init.VI

Initializes all of the chip level features of a 9513 counter chip.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

ChipNum [U32] - Specifies which 9513 chip is to be initialized. FoutDivider [U32] - F-Out divider (0-15)

FoutSource [U32] - Specifies source of the signal for F-Out signal.

Compare1 [TF] - ENABLED or DISABLED

Compare2 [TF]- ENABLED or DISABLED

TimeOfDay [U32] - DISABLED (0) or 1-3

Output:

ErrCode [U32] - Error code. See ErrMsg.VI

Arguments:

BoardNum

The board number associated with a board when it was installed with InstaCal. The specified board must have a 9513 counter.

ChipNum

Specifies which 9513 chip is to be initialized. For a CTR05 board, this should be set to 1. For a CTR10 board, it should be either 1 or 2. For a CTR20, it should be 1 to 4.

Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

FoutDivider

Corresponds to 9513 description in Counter Mode Register Description

0	Divide by 16
1	Divide by 1
2 ... 15	Divide by the number 2 ... 15

FoutSource

Corresponds to 9513 description in Counter Mode Register Description

TCPREVCTR	TCN - 1 (Terminal count of previous counter)
CTRINPUT1	SRC 1 (Counter Input 1)
CTRINPUT2	SRC 2 (Counter Input 2)
CTRINPUT3	SRC 3 (Counter Input 3)
CTRINPUT4	SRC 4 (Counter Input 4)
CTRINPUT5	SRC 5 (Counter Input 5)
GATE1	GATE 1
GATE2	GATE 2
GATE3	GATE 3
GATE4	GATE 4
GATE5	GATE 5
FREQ1	F1
FREQ2	F2

	`FREQ3`	F3
	`FREQ4`	F4
	`FREQ5`	F5
Compare1	Corresponds to 9513 description in Counter Mode Register Description.	
	`DISABLED`	Disabled (False)
	`ENABLED`	Enabled
Compare2	Corresponds to 9513 description in Counter Mode Register Description.	
	`DISABLED`	Disabled (False)
	`ENABLED`	Enabled
TimeOfDay	Corresponds to 9513 description in Counter Mode Register Description	
	`0`	TOD Disabled
	`1`	TOD Enabled / 5 Input
	`2`	TOD Enabled / 6 Input
	`3`	TOD Enabled / 10 Input
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.	

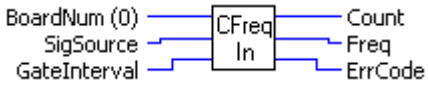
No Arguments for:

VI Set To:	Corresponds to 9513 description in Counter Mode Register Description.	
	`0` (FOUT on)	FOUT Gate
	`0` (Data bus matches board)	Data Bus Width
	`1` (Disable Increment)	Data Pointer Control
	1 (BCD Scaling)	Scalar Control

CFreqIn.VI

Measures the frequency of a signal. This VI can only be used with 9513 counters, and uses internal counters #5 and #4.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

SigSource [U32] - Specifies which signal will be measured

GateInterval [I16] - Gating interval in milliseconds

Outputs: Count [U32] - The raw count is returned here

Freq [U32] - The measured frequency in Hz returned here.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have a 9513 counter.

SigSource — Specifies the source of the signal from which the frequency will be calculated.

The signal to be measured is routed internally from the source specified by SigSource to the clock input of counter 5. On boards with more than one 9513 chip, there is more than one counter 5. Which counter 5 is used is also determined by SigSource. SigSource can be set to one of the following values:

One 9513 chip:	CTRINPUT1 through CTRINPUT5	Chip 1 used
	GATE1 through GATE4	
	FREQ1 through FREQ5	
Two 9513 chips:	CTRINPUT1 through CTRINPUT10	Chip 1 or Chip 2 used
	GATE 1 through GATE 9 (excluding gate 5)	
	FREQ1 through FREQ10	
Four 9513 chips:	CTRINPUT1 through CTRINPUT20	Chips 1- 4 can be used
	GATE1 through GATE19 (excluding gates 5, 10 & 15)	
	FREQ1 through FREQ20	

The SigSource value determines which chip is used. CTRINPUT6 through CTRINPUT10, FREQ6 through FREQ10 and GATE6 through GATE9 indicate chip 2 will be used. The signal to measure must be present at the chip 2 input specified by SigSource. Also, the gating connection from counter 4 output to counter 5 gate must be made between counters 4 and 5 of this chip (see "Notes" on page 63). See board-specific information to determine valid values for your board.

GateInterval — Specifies the time (in milliseconds) that the counter will be counting. The optimum GateInterval depends on the frequency of the measured signal. The counter can count up to 65535.

If the gating interval is too low, then the count will be too low and the resolution of the frequency measurement will be poor. For example, if the count changes from 1 to 2 the measured frequency doubles.

If the gating interval in too long then the counter will overflow and a `FREQOVERRUN` error will occur.

Count — The counts reached during the gating interval.

Freq — The measured frequency in Hz.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

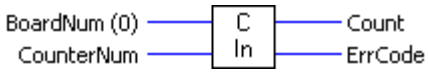
This function requires an electrical connection between counter 4 output and counter 5 gate. This connection must be made between counters 4 and 5 on the chip determined by SigSource.

Also, C9513Init.VI must be called for each ChipNum that will be used by this function. The values of FoutDivider, FoutSource, Compare1, Compare2, and Time of Day are irrelevant to this function and can be any value shown in the C9513Init.VI description.

CIn.VI

Reads the current count from a counter.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [I32] - Counter number to read

Outputs: Count [I32] - Count returned here

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal. The specified board must have a counter.
CounterNum	The counter to read current count from. Valid values are 1 to 20, up to the number of counters on the board.
	1 Counter input to counter 1.
	2 ...20 Counter inputs 2 through 20
Count	Current count value from selected counter is returned here.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

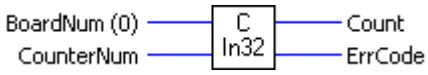
CIn.VI vs. CIn32.VI: Although the CIn.VI and CIn32.VI perform the same operation, CIn32.VI is the preferred function to use.

The only difference between the two is that CIn.VI returns a 16-bit count value and CIn32.VI returns a 32-bit value. Both CIn.VI and CIn32.VI can be used, but CIn32.VI is required whenever you need to read count values greater than 16 bits (counts > 65535). For instance, LS7266 based counters are 24-bit counters and can return values larger than a 16-bit value.

CIn32.VI

Reads the current count from a counter and returns it as a 32-bit integer.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	CounterNum [I32] - Counter number (1˜ n) to read.
Outputs:	Count [I32] - Current count is returned here
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed. The specified board must have a counter.
CounterNum	The counter to read current count from. Valid values are 1 to N, where N is the number of counters on the board.
Count	Current count value from selected counter is returned here.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

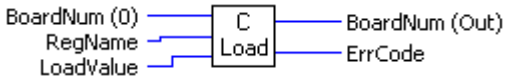
Notes:

CIn.VI() vs. CIn32.VI: Although the CIn.VI and CIn32.VI perform the same operation, CIn32.VI is the preferred function to use.

The only difference between the two is that CIn.VI returns a 16-bit count value and CIn32.VI returns a 32-bit value. Both CIn.VI and CIn32.VI can be used, but CIn32.VI is required whenever you need to read count values greater than 16 bits (counts > 65535). For instance, LS7266 based counters are 24-bit counters and can return values larger than a 16-bit value.

CLoad.VI

Loads the specified counter's register with a count value. The counter and register are specified by the RegName argument. When you want to load a counter with a value to count from, it is never loaded directly into the counter's count register. It is loaded into the load or hold register. From there, the counter, after enabled, loads the count from the appropriate register, generally on the first valid pulse.



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

RegName [U32] - Register to load with LoadValue.

LoadValue [U16] - Value to load into RegName register.

Outputs:

BoardNum [U32] The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI..

ErrCode [U32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed.

RegName — The register to load the count to. Valid values are:

`LOADREG1 .. 20`: Load registers 1 through 20. This may span several chips.

`HOLDREG1 .. 20`: Hold registers 1 through 20. This may span several chips. (9513 only)

`ALARM1CHIP1`: Alarm register 1 of the first counter chip. (9513 only)

`ALARM2CHIP1`: Alarm register 2 of the first counter chip. (9513 only)

`ALARM1CHIP2`: Alarm register 1 of the second counter chip. (9513 only)

`ALARM2CHIP2`: Alarm register 2 of the second counter chip. (9513 only)

`ALARM1CHIP3`: Alarm register 1 of the third counter chip. (9513 only)

`ALARM2CHIP3`: Alarm register 2 of the third counter chip. (9513 only)

`ALARM1CHIP4`: Alarm register 1 of the four counter chip. (9513 only)

`ALARM2CHIP4`: Alarm register 2 of the four counter chip. (9513 only)

`COUNT1...4`: Current Count (LS7266 only)

`PRESET1...4`: Preset register (LS7266 only)

`PRESCALER1...4`: Prescaler register (LS7266 only)

LoadValue — The value to be loaded. Must be between 0 and $2^{Resolution}$ - 1 of the counter. For example, a 16-bit counter is 2^{16} - 1, or 65,535.

BoardNum (output) — The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

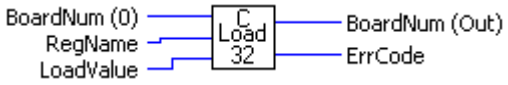
CLoad.VI vs. CLoad32.VI: Although the CLoad.VI and CLoad32.VI perform the same operation, CLoad32.VI is the preferred function to use.

The only difference between the two is that CLoad.VI loads a 16-bit count value and CLoad32.VI loads a 32-bit value. Both CLoad.VI and CLoad32.VI can be used, but CLoad32.VI is required whenever you need to load count values greater than 16 bits (counts > 65535).

CLoad32.VI

Loads the specified counter's COUNT, PRESET or PRESCALER register with a count.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

RegName [U32] - Register to load LoadValue into.

LoadValue [U32] - Value to be loaded into RegName.

Outputs: BoardNum [U32] The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.

ErrCode [U32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
RegName	The register to load the value into. Valid register names are:
	`LOADREG1 .. 20`: Load registers 1 through 20. This may span several chips.
	`HOLDREG1 .. 20`: Hold registers 1 through 20. This may span several chips. (9513 only)
	`ALARM1CHIP1`: Alarm register 1 of the first counter chip. (9513 only)
	`ALARM2CHIP1`: Alarm register 2 of the first counter chip. (9513 only)
	`ALARM1CHIP2`: Alarm register 1 of the second counter chip. (9513 only)
	`ALARM2CHIP2`: Alarm register 2 of the second counter chip. (9513 only)
	`ALARM1CHIP3`: Alarm register 1 of the third counter chip. (9513 only)
	`ALARM2CHIP3`: Alarm register 2 of the third counter chip. (9513 only)
	`ALARM1CHIP4`: Alarm register 1 of the four counter chip. (9513 only)
	`ALARM2CHIP4`: Alarm register 2 of the four counter chip. (9513 only)
	`COUNT1...4`: Current Count (LS7266 only)
	`PRESET1...4`: Preset register (LS7266 only)
	`PRESCALER1...4`: Prescaler register (LS7266 only)
LoadValue	The value to be loaded.
BoardNum (Out)	The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

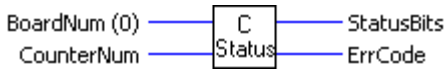
CLoad.VI vs. CLoad32.VI: Although the CLoad.VI and CLoad32.VI perform the same operation, CLoad32.VI is the preferred function to use.

The only difference between the two is that CLoad.VI loads a 16-bit count value and CLoad32.VI loads a 32-bit value. Both CLoad.VI and CLoad32.VI can be used, but CLoad32.VI is required whenever you need to load count values greater than 16 bits (counts > 65535).

CStatus.VI

Returns status information about the specified counter (7266 counters only)

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

CounterNum [I32] - Counter number (1 - n) to read.

Outputs: StatusBits [U32] - Status information is returned here.

ErrCode [U32] - Error code. See ErrMsg.VI.

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an LS7266 counter.

CounterNum — The counter to read current count from. Valid values are 1 to n, where n is the number of counters on the board.

StatusBits — Current status from selected counter is returned here. The status consists of individual bits that indicate various conditions within the counter. The currently defined status bits are:

`C_UNDERFLOW` - Is set to 1 whenever the count decrements past 0. Is cleared to 0 whenever CStatus.VI is called.

`C_OVERFLOW` - Is set to 1 whenever the count increments past it's upper limit. Is cleared to 0 whenever CStatus.VI is called.

`C_COMPARE` - Is set to 1 whenever the count matches the preset register. Is cleared to 0 whenever CStatus.VI is called.

`C_SIGN` - Is set to 1 when the MSB of the count is 1. Is cleared to 0 whenever the MSB of the count is set to 0.

`C_ERROR` - Is set to 1 whenever an error occurs due to excessive noise on the input. Is cleared to 0 by calling C7266Config.VI.

`C_UP_DOWN` - Is set to 1 when counting up. Cleared to 0 when counting down

`C_INDEX` - Is set to 1 when index is valid. Cleared to 0 when index is not valid.

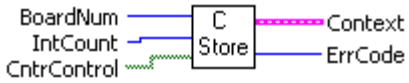
ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

CStore.VI

Changed R4.0 RW (MOD)

Installs an interrupt handler that will store the current count whenever an interrupt occurs. This VI can only be used with 9513 counters. This VI will continue to operate in the background until either IntCount is satisfied or StopBg.VI is called.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

IntCount [I16] - Number of interrupts.

CntrControl [TF] - Array with each element set to either ENABLED or DISABLED.

Outputs: Context [cluster] - Output data structure

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have a 9513 counter.

IntCount — The counters will be read every time an interrupt occurs until IntCount interrupts have occurred. If IntCount is = 0 then the VI will run until StopBg.VI is called.

CntrControl — The array should have an element for each counter on the board (five elements for CTR-05 board, 10 elements for a CTR-10, etc.). Each element corresponds to a possible counter channel. Each element should be set to either DISABLED (False) or ENABLED (True). All channels that are set to ENABLED will be read when an interrupt occurs.

Context — Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation.

Follow the steps below when wiring this VI:

1. DInScBg.VI starts a background operation.
2. GetStatus.VI checks for completion (boolean output called "Running").
3. StopBg.VI terminates the operation, if not already done, and frees memory aliases.
4. Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively.

The demo VIs illustrate this process effectively.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

New Functionality**:**

If the Library Revision is set to 4.0 or greater then the following code changes are required.

If IntCount is non-zero then the Context object will contain IntCount samples for each counter. Counter elements that are DISABLED will return 0.

For example, if IntCount is set to 100 for a CTR-05 board, then the new functionality keeps the user application from having to move the data out of the context buffer for every interrupt, before it is overwritten. Now, for each interrupt the counter values will be stored in adjacent memory locations within the context.

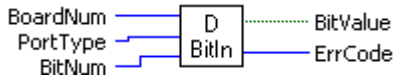
Note:

Specifying IntCount to be a non-zero value and failing to allocate the proper sized array will result in a runtime error. There is no way for the Universal Library to determine if the array has been allocated with the proper size. If IntCount = 0, the functionality is unchanged.

Digital I/O VIs

DBitIn.VI

Reads the state of a single digital input bit. This VI treats all of the digital I/O ports on a board as a single very large port. It lets you read the state of any individual bit within this large port. If the bit or port direction is programmable, you must first use DCfgPort.VI or DCfgBit.VI to configure the bit or port for input.



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortType [I32] - Specifies the type of digital port to read.

BitNum [I32] - Specifies the bit where BitValue is read.

Outputs: BitValue [TF] - Placeholder for return value of bit - the bit's value (0 or 1)

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

PortType — There are two general types of digital I/O: 8255 and other. Some boards (DIO Series) use an 8255 for digital I/O. For these boards PortType should be set to `FIRSTPORTA`. Other boards don't use an 8255. For these boards, PortType should be set to `AUXPORT`. Some boards have both types of digital I/O (PCI-DAS6025). Set PortNum to either `FIRSTPORTA` or AUXPORT depending on which digital inputs you wish to read.

BitNum — Specifies the bit number within the single large port. The specified bit must be in a port that is currently configured as an input.

The table below shows which bit numbers are in which 82C55 and 8536 digital chips. The CIO-DIO192 supports eight 82C55 chips—the most available on a single board. The PCI-INT32 supports two 8536 chips—the most available on a single board.

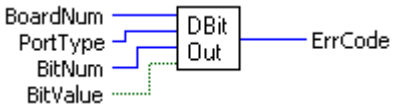
82C55 Bit#	Chip #	Address	8536 Bit#	Chip #	Address
0 - 23	1	Base + 0	0 - 19	1	Base + 0
24 - 47	2	Base + 4	20 - 39	2	Base + 4
48 - 71	3	Base + 8			
72 - 96	4	Base + 12			
96 - 119	5	Base + 16			
120 - 143	6	Base + 20			
144 - 167	7	Base + 24			
168 - 191	8	Base + 28			

BitValue — Placeholder for return value of bit. Value will be 0 or 1. A 0 indicates a low reading, a 1 indicates a logic high reading. Logic high does not necessarily mean 5 V. See the board manual for chip input specifications.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

DBitOut.VI

Sets the state of a single digital output bit. This VI treats all of the DIO chips on a board as a single very large port. It lets you set the state of any individual bit within this large port. If the bit or port direction is programmable you must first use DCfgBit.VI or DCfgPort.VI to configure the bit or port for output.



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortType [U32] - Specifies which digital port (AUXPORT, FIRSTPORTA).

BitNum [U32] - Specifies the bit to set.

BitValue [TF] - The bit's value (0 or 1)

Output: ErrCode - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

PortType — There are two general types of digital I/O - 8255 and other. Some boards (DIO Series) use an 8255 for digital I/O. For these boards, PortType should be set to FIRSTPORTA. Other boards don't use an 8255. For these boards PortType should be set to AUXPORT. Some boards have both types of digital I/O (PCI-DAS6025). Set PortType to either FIRSTPORTA or AUXPORT depending on which digital outputs you wish to write.

BitNum — Specifies the bit number within the single large port. The specified bit must be in a port that is currently configured as an output.

The table below shows which bit numbers are in which 82C55 and 8536 digital chips. The CIO-DIO192 supports eight 82C55 chips—the most available on a single board. The PCI-INT32 support two 8536 chips— the most available on a single board.

82C55 Bit#	Chip #	Address	8536 Bit#	Chip #	Address
0 - 23	1	Base + 0	0 - 19	1	Base + 0
24 - 47	2	Base + 4	20 - 39	2	Base + 4
48 - 71	3	Base + 8			
72 - 96	4	Base + 12			
96 - 119	5	Base + 16			
120 - 143	6	Base + 20			
144 - 167	7	Base + 24			
168 - 191	8	Base + 28			

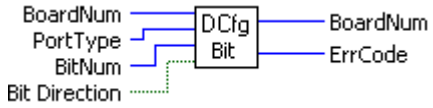
BitValue — The output value of the bit. Value will be 0 or 1. A (0) indicates a logic-low output; a (1) indicates a logic high output. Logic-high does not necessarily mean 5 V. See the board manual for chip specifications.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

DCfgBit.VI

Configures a specific digital bit within a digital port for input or output. This function treats all DIO ports on a board as a single port (AUXPORT). This function is not supported by 8255 type DIO ports. Please refer to board-specific information for details.

Summary:



Input:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	PortType [I32] - Digital I/O port containing the bit to configure.
	BitNum - The bit number to configure as input or output.
	Bit Direction [TF] - `DIGITALOUT` or `DIGITALIN`
Output:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.
	ErrCode [I32] - Error code. See ErrMsg.VI

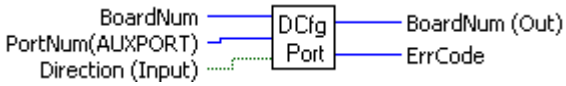
Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
PortType	Specifies the digital I/O port whose bit to configure. The DCfgBit.VI supports `AUXPORT` types only.
BitNum	The bit number to configure as input or output. Can be 0 to 7 for `AUXPORT` types.
Bit Direction	DIGITALOUT (True) or DIGITALIN (False - default) sets the digital bit as input or output.
BoardNum (Out)	The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use ErrMsg.VI to convert ErrCode into a readable string.

DCfgPort.VI

Configures a digital port as Input or Output. This mode is primarily for use with 82C55 chips and 8536 chips. See the board user's manual for details of chip operation.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies which digital I/O port to configure.

Direction [TF]- `DIGITALOUT` or `DIGITALIN`

Outputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

PortNum — The specified port must be configurable.

For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.

The table below shows which ports and bit numbers are in which 82C55 and 8536 digital chips. The CIO-DIO192 supports eight 82C55 chips—the most available on a single board. The PCI-INT32 support two 8536 chips— the most available on a single board.

Mnemonic	Bit #	8255 Chip #	Chip Address	8536 Chip #	Chip Address
FIRSTPORTA	0 - 7	1A	Base + 0	1A	Base + 0
FIRSTPORTB	8 - 15	1B		1B	
FIRSTPORTCL	16 - 19	1CL		1C	
FIRSTPORTCH	20 - 23	1CH		Not present	
SECONDPORTA	24 - 31	2A	Base + 4	2A	Base + 4
SECONDPORTB	32 - 39	2B		2B	
SECONDPORTCL	40 - 43	2CL		2C	
SECONDPORTCH	44 - 47	2CH	No port C High in 8536 chips		
and so on, to the last chip on the board as: THIRDPORTx, FOURTHPORTx, FIFTHPORTx, SIXTHPORTx, SEVENTHPORTx and...					
EIGHTHPORTA	168 - 175	8A	Base + 28		
EIGHTHPORTB	176 - 183	8B			
EIGHTHPORTCL	184 - 187	8CL			
EIGHTHPORTCH	188 - 191	8CH			

Direction — DIGITALOUT (True) or DIGITALIN (False - default) configures an entire eight- or four-bit port for output or input.

BoardNum (Out) — The board number used when installed with InstaCal. This parameter can be used to serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.

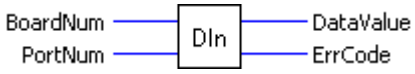
Notes

Using this function will reset all ports on a chip configured for output to a zero state. This means that if you set an output value on `FIRSTPORTA` and then change the configuration on `FIRSTPORTB` from `OUTPUT` to `INPUT`, the output value at `FIRSTPORTA` will be all zeros. You can, however, set the configuration on `SECONDPORTX`

without affecting the value at `FIRSTPORTA`. For this reason, this function is usually called at the beginning of the program for each port requiring configuration.

DIn.VI

Reads a digital input port.



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies which digital I/O port to read.

Outputs: DataValue [I16] - Digital input value.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

PortNum — If the port type is not AUXPORT, the specified port must be configured for input.

For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.

The table below shows which ports are in which 82C55 and 8536 digital chips. The CIO-DIO192 supports eight 82C55 chips—the most available on a single board. The PCI-INT32 support two 8536 chips— the most available on a single board.

Mnemonic	Bit #	8255 Chip #	Chip Address	8536 Chip #	Chip Address
FIRSTPORTA	0 - 7	1A	Base + 0	1A	Base + 0
FIRSTPORTB	8 - 15	1B		1B	
FIRSTPORTCL	16 - 19	1CL		1C	
FIRSTPORTCH	20 - 23	1CH		Not present	
SECONDPORTA	24 - 31	2A	Base + 4	2A	Base + 4
SECONDPORTB	32 - 39	2B		2B	
SECONDPORTCL	40 - 43	2CL		2C	
SECONDPORTCH	44 - 47	2CH	No port C High in 8536 chips		
and so on, to the last chip on the board as: THIRDPORTx, FOURTHPORTx, FIFTHPORTx, SIXTHPORTx, SEVENTHPORTx and...					
EIGHTHPORTA	168 - 175	8A	Base + 28		
EIGHTHPORTB	176 - 183	8B			
EIGHTHPORTCL	184 - 187	8CL			
EIGHTHPORTCH	188 - 191	8CH			

DataValue — Digital input value. The size of the ports vary. If it is an eight-bit port, then the returned value will be in the range 0- 255. If it is a four bit port the value will be in the range 0-15.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Important - Read board-specific information in UL User's Guide

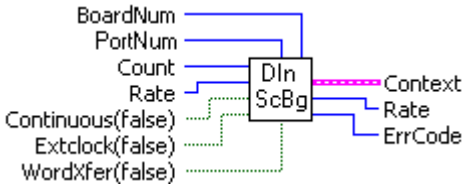
Refer to the example programs and the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for clarification of valid PortNum values.

DInScBg.VI

Performs multiple reads of digital input port of a high speed digital port on a board with a pacer clock such as the CIO-PDMA16.

When this VI is used, control will return immediately to the next point in your program and the transfer from the digital input port to the array in the Context will continue in the background. Use GetStatus.VI to check on the status of the background operation. Use StopBg.VI to terminate the background process before it has completed. StopBg.VI should be used after any background operation to clear variables and flags.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies which digital I/O port to read.

Count [I32] - Number of times to read digital input.

Rate [I32] - Number of times per second (Hz) to read.

Continuous [TF] - Continuous or single

ExtClock [TF] - External or internal clock

WordXfer [TF] - Word or byte transfer

Outputs:

Context [cluster] - Output data structure.

Rate [I32]- Actual rate returned here

ErrCode [I32] - Error code. See ErrMsg.VI

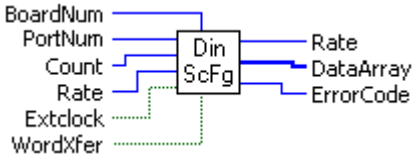
Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
PortNum	If the port type is not AUXPORT, the specified port must be configured for input. For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.
Count	The number of times to read digital input.
Rate	Number of times per second (Hz) to read the port. The actual sampling rate in some cases will vary a small amount from the requested rate. The actual rate will be returned to the Rate output argument.
Continuous	This option (if True) puts the VI in an endless loop. After it transfers the required number of bytes it resets to the start of the input array and begins again. The only way to stop this operation is with StopBg.VI (a single execution is False).
ExtClock	If this option is used (True) then transfers will be controlled by the signal on the trigger input line rather than by the internal pacer clock. Each transfer will be triggered on the appropriate edge of the trigger input signal (see board-specific info). When this option is used, the Rate argument is ignored. The transfer rate is dependent on the trigger signal. The default is TIMED (False).
WordXfer	Normally (default is False) this VI reads a single (byte) port (BYTEXFER). If WORDXFER is specified, it will read two adjacent ports on each read and store the value of both ports together as the low and high byte of a single array element in the input array.
Rate (output)	Actual sampling rate in samples per second.

Context	Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation. Follow the steps below when wiring this VI: **1.** DInScBg.VI starts a background operation. **2.** GetStatus.VI checks for completion (boolean output called "`Running`"). **3.** StopBg.VI terminates the operation, if not already done, and frees memory aliases. **4.** Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively. The demo VIs illustrate this process effectively.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

DInScFg.VI

Multiple reads of digital input port of a high-speed digital port on a board with a pacer clock such as the CIO-PDMA16. The DInScFg.VI will not return to your program until all of the requested data has been collected and returned to input array.



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies the digital I/O port to read.

Count [I32] - Number of times to read digital input

Rate [I32]- Number of times per second (Hz) to read

ExtClock [TF] - External or internal clock

WordXfer [TF] - Word or byte transfer

Outputs:

Rate [I32] - Actual rate returned here

DataArray [I16] - Data from scan is returned here

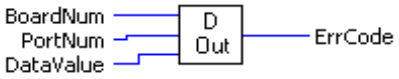
ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated when it was installed with InstaCal.
PortNum	If the port type is not AUXPORT, the specified port must be configured for input. For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.
Count	The number of times to read digital input
Rate	Number of times per second (Hz) to read the port. The actual sampling rate in some cases will vary a small amount from the requested rate. The actual rate will be returned to the Rate argument.
ExtClock	If this option (True) is used, transfers are controlled by the signal on the trigger input line, rather than by the internal pacer clock. Each transfer is triggered on the appropriate edge of the trigger input signal. When this option is used the Rate argument is ignored. The transfer rate is dependent on the trigger signal. The default is TIMED (False).
WordXfer	Normally, this VI reads a single (byte) port (default is False). If WORDXFER is specified (True), it will read two adjacent ports on each read and store the value of both ports together as the low and high byte of a single array element in DataArray[].
Rate (output)	Actual input rate in samples per second.
DataArray	Data from the scan is returned here.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

DOut.VI

Writes a byte to a digital output port.



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies which digital I/O port to set.

DataValue [I32] - Byte value to output to port.

Output: ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed.

PortNum — If the port type is not AUXPORT, the specified port must be configured for output.

For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.

The table below shows which ports are in which 82C55 and 8536 digital chips. The most 82C55 chips on a single board is eight (8), on the CIO-DIO192. The most (2) 8536 chips occur on the CIO-INT32.

Mnemonic	Bit #	8255 Chip #	Chip Address	8536 Chip #	Chip Address
FIRSTPORTA	0 - 7	1A	Base + 0	1A	Base + 0
FIRSTPORTB	8 - 15	1B		1B	
FIRSTPORTCL	16 - 19	1CL		1C	
FIRSTPORTCH	20 - 23	1CH		Not present	
SECONDPORTA	24 - 31	2A	Base + 4	2A	Base + 4
SECONDPORTB	32 - 39	2B		2B	
SECONDPORTCL	40 - 43	2CL		2C	
SECONDPORTCH	44 - 47	2CH	No port C High in 8536 chips		
and so on, to the last chip on the board as: THIRDPORTx, FOURTHPORTx, FIFTHPORTx, SIXTHPORTx, SEVENTHPORTx and...					
EIGHTHPORTA	168 - 175	8A	Base + 28		
EIGHTHPORTB	176 - 183	8B			
EIGHTHPORTCL	184 - 187	8CL			
EIGHTHPORTCH	188 - 191	8CH			

Data Value — Value to write to the specified port. The size of the ports varies. If it is an eight-bit port, then the output value must be in the range 0 to 255. If it is a four-bit port, the value must be in the range 0 to 15.

ErrCode — Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

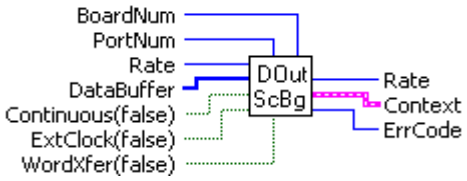
Important - Read board-specific information in UL User's Guide

Refer to the example programs and the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for clarification of valid PortNum values.

DOutScBg.VI

Performs multiple writes to the digital output port of a high speed digital port on a board with a pacer clock like the CIO-PDMA16. When this VI is used, control will return immediately to the next point in your program and the transfer to the digital output port from DataBuffer will continue in the background. Use GetStatus.VI to check on the status of the background operation. Use StopBg.VI to terminate the background process before it has completed. Always use the StopBg.VI after all background operations to clear variables and flags.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies the digital I/O port to set.

Rate [U32] - Number of times per second (Hz) to write.

DataBuffer [I16] - Digital output values.

Continuous [TF] - Run the VI in an endless loop (True).

ExtClock [TF] - External (True) or internal clock (False).

WordXfer [TF] - Word (True) or byte transfer (False).

Outputs:

Rate [I32] - Actual scan rate.

Context - [cluster] - Output data structure.

ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

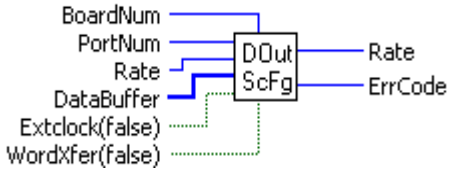
BoardNum	The board number associated with a board when it was installed with InstaCal.
PortNum	If the port type is not AUXPORT, the specified port must be configured for output. For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.
Rate	Number of times per second (Hz) to write to the port. The actual update rate in some cases will vary a small amount from the requested rate. The actual rate will be returned to the Rate argument.
DataBuffer	Array of digital values to output.
Continuous	This option puts the VI in an endless loop. After it transfers the required number of bytes it resets to the start of DataBuffer and begins again. The only way to stop this operation is with StopBg.VI.
ExtClock	If this option is used, then transfers will be controlled by the signal on the trigger input line rather than by the internal pacer clock. Each transfer will be triggered on the appropriate edge of the trigger input signal (see board-specific info). When this option is used, the Rate argument is ignored. The transfer rate is dependent on the trigger signal.
WordXfer	Normally, this VI sets a single (byte) port (default is False). If WORDXFER is specified (True), it will set two adjacent ports on each write and store the value of both ports together as the low and high byte of a single array element in DataBuffer[].

Context	Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation. Follow the steps below when wiring this VI: **1.** DInScBg.VI starts a background operation. **2.** GetStatus.VI checks for completion (boolean output called "`Running`"). **3.** StopBg.VI terminates the operation, if not already done, and frees memory aliases. **4.** Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively. The demo VIs illustrate this process effectively.
Rate (output)	Actual update rate in samples per second.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

DOutScFg.VI

Multiple writes to digital output port of a high speed digital port on a board with a pacer clock, like the CIO-PDMA16. The DOutScFg.VI will not return to your program until all of the requested data has been output.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

PortNum [I32] - Specifies the digital I/O port to set.

Rate [I32] - Number of times per second (Hz) to write.

DataBuffer [I16] - Digital output values.

ExtClock [TF] - External (True) or internal clock (False).

WordXfer [TF] - Word (True) or byte transfer (False).

Outputs:

Rate [I32] - Actual rate is returned here.

ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

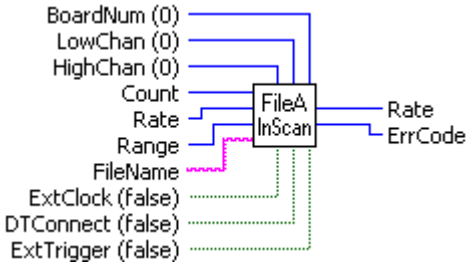
BoardNum	The board number associated with a board when it was installed with InstaCal.
PortNum	If the port type is not AUXPORT, the specified port must be configured for output. For many boards, AUXPORT is not configurable. However, some later boards do require that the AUXPORT be configured using DCfgPort.VI or DCfgBit.VI. Please see board details for more information.
Rate (input)	Number of times per second (Hz) to write to the port. The actual update rate in some cases will vary a small amount from the requested rate. The actual rate will be returned to the Rate argument.
DataBuffer	Array of digital values to output.
ExtClock	If this option is used, then transfers will be controlled by the signal on the trigger input line rather than by the internal pacer clock. Each transfer will be triggered on the appropriate edge of the trigger input signal (see board-specific info). When this option is used, the Rate argument is ignored. The transfer rate is dependent on the trigger signal.
WordXfer	Normally, this VI sets a single (byte) port (default is False). If WORDXFER is specified (True), it will set two adjacent ports on each write and store the value of both ports together as the low and high byte of a single array element in DataBuffer[].
Rate (output)	Actual update rate in samples per second.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Streamer File VIs

FileAInScan.VI

Scan a range of A/D channels and store the samples in a disk file. This VI reads the specified number of A/D samples at the specified sampling rate from the specified range of A/D channels from the specified board. If the A/D board has programmable gain then it sets the gain to the specified range. The collected data is returned to a file in binary format. Use FileRead.VI to load data from that file into an array. Refer to the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) to determine if this function is supported on your board.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan.

HighChan [I32] - Last A/D channel of scan.

Count [I32] - Number of samples to collect.

Rate [I32] - Sample rate in samples per second (Hz) per channel.

Range [I32] - Range code.

FileName [abc] - Name of disk file.

ExtClock [TF] - External (True) or internal clock (False).

DTConnect [TF] - DT connect option (True). No DTConnect is (False).

ExtTrigger [TF] - External trigger (True). Internal is (False).

Outputs:

Rate - Actual sampling rate

ErrCode - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D.

LowChan — First A/D channel of scan.

HighChan — Last A/D channel of scan.

Low/High Channel #**:** The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single-ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended mode.

Count — Specifies the total number of A/D samples that will be collected. If more than one channel is being sampled then the number of samples collected per channel is equal to Count/(HighChan - LowChan + 1).

Rate (input) — The maximum sampling rate depends on the A/D board that is being used.

Range	If the selected A/D board does not have a programmable range feature, then this argument will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected A/D board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
FileName	Name of the streamer file to create. Use FileRead.VI to read the data from this file. Refer to the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for information on the streamer file functions.
ExtClock	If this option is used, then conversions will be controlled by the signal on the external clock input line rather than by the internal pacer clock. Each conversion will be triggered on the appropriate edge of the external clock input signal (see board-specific information). When this option is used, the Rate argument is ignored. The sampling rate is dependent on the trigger signal.
DTConnect	If True, samples are sent to the DT-Connect port if the board is equipped with one. If False, samples are not output to the DT-Connect port. This is the default.
ExtTrigger	Wait until trigger input line is asserted. When set to True, the sampling will not begin until the trigger condition is met.
Rate (output)	Actual update rate in samples per second.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

OVERRUN Error: This error indicates that the data was not written to the file as fast as the data was sampled. Consequently, some data was lost. The value returned from FileInfo.VI in Count will be the number of points that were successfully collected.

Important - Read board-specific information in UL User's Guide

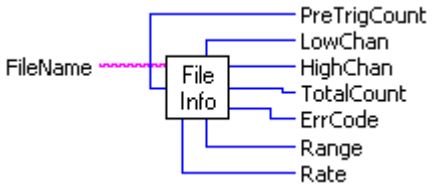
In order to understand the functions, read the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf). The example programs should be examined and run prior to attempting any programming of your own.

FileInfo.VI

Returns information about a streamer file. When FileAInS.VI or FilePret.VI fill the streamer file, information is stored about how the data was collected (sample rate, channels sampled etc.). This VI returns that information.

Refer to the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) to determine if this function is supported on your board.

Summary:



Inputs:	FileName [abc] - Name of streamer file.
Outputs:	PreTrigCount [I32] - Number of pre-trigger samples collected.
	LowChan [I32] - First A/D channel of scan.
	HighChan [I32] - Last A/D channel of scan.
	TotalCount [I32] - Total number of samples collected.
	ErrCode [I32] - Error code. See ErrMsg.VI.
	Range [I32] - A/D range used to collect samples.
	Rate [I32] - Sampling rate used to collect samples.

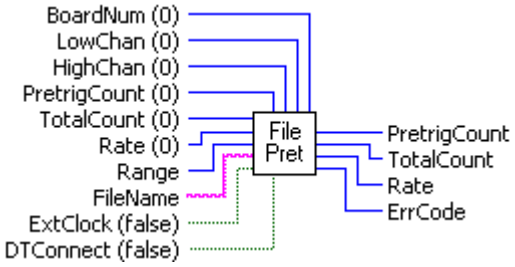
Arguments:

FileName	The name of the streamer file to read information from.
PreTrigCount	Number of pre-trigger samples collected.
LowChan	First A/D channel of scan.
HighChan	Last A/D channel of scan.
TotalCount	Total number of samples collected.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.
Range	A/D range of the collected data.
Rate	Sampling rate of the collected data.

FilePret.VI

Scan a range of channels continuously while waiting for a trigger. After the trigger occurs, return the specified number of samples including the specified number of pre-trigger samples to a disk file. This VI waits for a trigger signal to occur on the Trigger Input. After the trigger occurs, it returns the specified number (TotalCount) of A/D samples including the specified number of pre-trigger points. It collects the data at the specified sampling rate (Rate) from the specified range (LowChan-HighChan) of A/D channels from the specified board. If the A/D board has programmable gain then it sets the gain to the specified range. The collected data is returned to a file. Refer to the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) to determine if this function is supported by your board.

Summary:



Inputs:

BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

LowChan [I32] - First A/D channel of scan.

HighChan [I32] - Last A/D channel of scan.

PretrigCount [I32] - Number of pre-trigger samples to collect.

TotalCount [I32] - Total number of samples to collect.

Rate [I32] - Sample rate in samples per second (Hz) per channel.

Range [I32] - A/D range.

FileName [abc] - Name of disk file.

ExtClock [TF] - External (True) or internal clock (False - default).

DTConnect [TF] - DT connect option (True).

Outputs:

PretrigCount [I32] - Number of pre-trigger sample collected.

TotalCount [I32] - Total number of samples collected.

Rate [I32] - Actual sampling rate.

ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal. The specified board must have an A/D and pretrigger capability.

LowChan — First A/D channel of scan.

HighChan — Last A/D channel of scan.

Low/High Channel #**:** The maximum allowable channel depends on which type of A/D board is being used. For boards that have both single-ended and differential inputs, the maximum allowable channel number also depends on how the board is configured. For example, a PCI-DAS6025 has 8 channels for differential, 16 for single-ended mode.

PretrigCount — Specifies the number of samples before the trigger that will be returned. PreTrigCount must be less than TotalCount - 512.

	If the trigger occurs too early, then fewer than the requested number of pre-trigger samples will be collected. In that case a TOOFEW error will occur. The PretrigCount will be set to indicate how many samples were collected and the post trigger samples will still be collected.
TotalCount	Specifies the total number of samples that will be collected and stored in the file. TotalCount must be greater then or equal to PretrigCount + 512. If the trigger occurs too early then fewer than the requested number of samples will be collected. In that case a TOOFEW error will occur. The TotalCount will be set to indicate how many samples were actually collected.
Rate (input)	The maximum sampling rate depends on the A/D board that is being used.
Range	If the selected A/D board does not have a programmable range feature, then this argument will be ignored. Otherwise the gain can be set to any of the ranges that are supported by the selected A/D board. See the "Range input values" table on page 19 for valid values. Refer to board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for the list of ranges supported by each board.
FileName	The name of the streamer file to create. Use FileRead.VI to read the data from this file. Refer to the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) for information on the streamer file functions.
ExtClock	If this option is used, then conversions will be controlled by the signal on the external clock input line rather than by the internal pacer clock. Each conversion will be triggered on the appropriate edge of the external clock input signal (see board-specific information). When this option is used, the Rate argument is ignored. The sampling rate is dependent on the trigger signal.
DTConnect	If True, samples are sent to the DT-Connect port if the board is equipped with one. If False, samples are not output to the DT-Connect port. This is the default.
PretrigCount	Actual number of pre-trigger A/D samples collected.
TotalCount	Total number of A/D samples collected.
Rate (output)	The maximum sampling rate depends on the A/D board that is being used. This is the rate at which scans are triggered. If you are sampling four channels, 0 to 3, then specifying a rate of 10,000 scans per second (10 kS/s) will result in the A/D converter rate of 40 kS/s (four channels at 10,000 samples per channel per second). This is different from some software where you specify the total A/D chip rate. In those systems, the per channel rate is equal to the A/D rate divided by the number of channels in a scan. This argument also returns the value of the actual set. This may be different from the requested rate because of pacer limitations.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

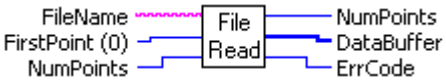
Notes:

OVERRUN error: This error indicates that the data was not written to the file as fast as the data was sampled. Consequently, some data was lost. The value in TotalCount will be the number of points that were successfully collected.

FileRead.VI

Reads data from a streamer file. Refer to the board-specific information contained in the Universal Library User's Guide (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf) to determine if this function is supported on your board.

Summary:



Inputs:	FileName [abc] - Name of streamer file.
	FirstPoint [I32] - Index of first sample to read.
	NumPoints [I32] - Number of samples to read.
Outputs:	NumPoints [I32] - Number of samples read.
	DataBuffer [I32] - Data buffer that data is read into.
	ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

FileName	Name of streamer file in which the A/D measurements are stored.
FirstPoint	Index of first sample to read from the streamer file.
NumPoints (input)	Number of samples to read from the streamer file.
NumPoints (output)	Number of samples actually read.
DataBuffer	Array of A/D measurements in binary counts read from the file. Use ToEng.VI to convert from binary counts to engineering units (volts or mAmps).
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

Data format: The data is returned as 16 bits. The 16 bits can represent 12 bits of analog, 12 bits of analog plus 4 bits of channel, or 16 bits of analog. Use ACvtData.VI to correctly load the data into an array.

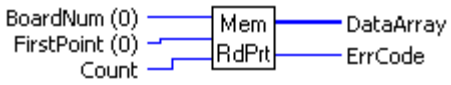
Loading portions of files: The file can contain much more data than can fit in DataBuffer. In those cases, use TotalCount and FirstPoint to read a selected piece of the file into DataBuffer. Call FileInfo.VI first to find out how many points are in the file.

Memory board VIs

MemRdPrt.VI

Reads pre-trigger data from a memory board that has been collected with either APretrBg.VI or APretrFg.VI and arranges the data in the correct order (pre-trigger data first, then post-trigger data). This VI can only be used to retrieve data that has been collected by either APretrBg.VI or APretrFg.VI with the ExtMemory option set to TRUE. After each APretrFg.VI or APretrBg.VI call, all data must be unloaded from the memory board with this VI. If any more data is sent to the memory board then the pre-trigger data will be lost.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	FirstPoint [I32] - Index of first point to read or FROMHERE.
	Count [U32] - Number of points (words) to read.
Outputs:	DataArray [U16] - Output data array.
	ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
FirstPoint	Use the FirstPoint argument to specify the first point to be read. For example, to read points #200 - #250, set FirstPoint=200 and Count=50.
	If you are going to read a large amount of data from the board in small chunks then set FirstPoint to FROMHERE (-1) to read each successive chunk. Using FROMHERE (-1) speeds up the operation of MemRdPrt.VI when working with large amounts of data.
Count	Number of points (words) to read.
DataArray	Data read from memory board.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

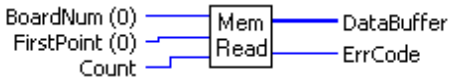
Notes:

DT Connect conflicts - The .MemRdPrt.VI can not be called while a DT Connect transfer is in progress. For example, if you start collecting A/D data to the memory board in the background (by calling AInScBg.VI or AInScFg.VI with the DTCONNECT + BACKGROUND options), you can not call MemRdPrt.VI until the AInScBg.VI or AInScFg.VI has completed. If you do, you will get a DTACTIVE error.

MemRead.VI

Reads data from a memory board into an array.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	FirstPoint [I32] - Index of first point to read or FROMHERE.
	Count [U32] - Number of samples (words) to read
Outputs:	DataBuffer [U16] - Output data array.
	ErrCode [I32] - Error code. See ErrMsg.VI.

Arguments:

BoardNum	The memory board number associated with a board when it was installed with InstaCal.
FirstPoint	Use the FirstPoint argument to specify the first point to be read. For example, to read points #200 - #250, set FirstPoint=200 and Count=50.
	To read a large amount of data from the board in small portions, set FirstPoint to FROMHERE (-1) to read each successive portion. Using FROMHERE (-1) speeds up the operation of MemRead VI when working with large amounts of data.
Count	Number of samples (words) to read.
DataBuffer	Data read from memory board.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

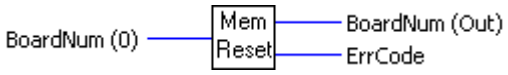
Notes:

DT-Connect conflicts - The MemRead.VI can not be called while a DT-CONNECT transfer is in progress. For example, if you start collecting A/D data to the memory board in the background (by calling AInScBg.VI or AInScFg.VI with the DTCONNECT + BACKGROUND options). You cannot call MemRead.VI until the AInScBg.VI or AInScFg.VI has completed. If you do, you will get a DTACTIVE error.

MemReset.VI

Resets the memory board pointer to the start of memory. The memory boards are sequential devices. They contain a counter which points to the 'current' word in memory. Every time a word is read or written, this counter increments to the next word.

Summary:



Input:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
Outputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100. Can be used to pass BoardNum parameter to another VI.
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum (input)	The memory board number assigned when installed with InstaCal. Can be 0 to 100.
BoardNum (output)	The memory board number assigned when installed with InstaCal. This parameter can be used serialize VIs such that this VI precedes the next VI whose BoardNum is attached to this output.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes

This VI is used to reset the counter back to the start of the memory. Between successive calls to AInScBg.VI or AInScFg.VI you would call this VI so that the second AInScBg.VI or AInScFg.VI overwrites the data from the first call. Otherwise the data from the first AInScBg.VI or AInScFg.VI will be followed by the data from the second AInScBg.VI or AInScFg.VI in the memory on the card.

Likewise, anytime you call MemRead.VI or MemWrite.VI, the counter is left pointing to the next memory location after the data that you read or wrote. Call MemReset.VI to reset back to the start of the memory buffer before the next call to AInScBg.VI or AInScFg.VI.

MemSetDT.VI

Sets the DT Connect mode of a memory board.

Summary:

Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	Mode [TF] - Direction of memory board DT transfer.
Output:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
Mode	Must be set to either DTIN (default) or DTOUT. Set the Mode on the memory board to DTIN to transfer data from an A/D board to the memory board. Set Mode=DTOUT (True) to transfer data from a memory board to a D/A board.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

This command only controls the direction of data transfer between the memory board and another board that is connected to it via a DT Connect cable.

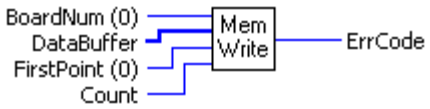
Do not use this VI when you are using the EXTMEMORY option with AInScBg.VI or AInScFg.VI, etc., as the memory board mode is already set through AInScBg.VI or AInScFg.VI EXTMEMORY option.

Use this VI only if the parent board is *not* supported by the Universal Library.

MemWrite.VI

Writes data from an array to the memory card.

Summary:



Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	DataBuffer [U16] - Pointer to the data array.
	FirstPoint [I32] - Index of first point to write or FROMHERE.
	Count [I32] - Number of samples (words) to write.
Output:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal.
DataBuffer	Buffer containing data to be written to the external memory board.
FirstPoint	Use the FirstPoint argument to specify where in the board's memory to write the first point. For example, to write to locations #200 - #250, set FirstPoint=200 and Count=50.
	To write a large amount of data to the board in small portions, set FirstPoint to FROMHERE (-1) to write each successive portion. Using FROMHERE (-1) speeds up the operation of MemWrite when working with large amounts of data.
Count	Specifies the number of words to be written to the external memory card. Count must be equal to or less than the size of DataBuffer.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

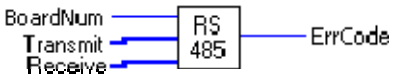
DT Connect conflicts - The MemWrite VI can not be called while a DT Connect transfer is in progress. For example, if you start collecting A/D data to the memory board in the background (by calling AInScBg.VI or AInScFg.VI with the DTCONNECT + BACKGROUND options). You can not call MemWrite until the AInScBg.VI or AInScFg.VI has completed. If you do you will get a DTACTIVE error.

Serial VIs

RS485.VI

Sets the direction of RS-485 communications port buffers..

Summary:



Input:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	Transmit [I32] - Enable (1) or disable (0) the transmit RS-485 line driver.
	Receive [I32] - Enable (1) or disable (0) the receive RS-485 buffer.
	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
Output:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The number associated with the board when it was installed with the *Insta*Cal configuration program. BoardNum may be 0 to 99.
Transmit	Set to enabled (1) or disabled (0). The transmit RS-485 line driver is turned on. Data written to the RS-485 UART chip is transmitted to the cable connected to that port.
Receive	Set to enabled (1) or disabled (0). The receive RS-485 buffer is turned on. Data present on the cable connected to the RS-485 port is received by the UART chip.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Notes:

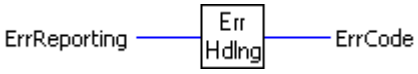
You can simultaneously enable or disable the transmit and receive buffers. If both are enabled, data written to the port is also received by the port. For a complete discussion of RS485 network construction and communication, refer to the CIO-COM485 User's Manual (www.mccdaq.com/PDFmanuals/cio-com485.pdf).

Miscellaneous VIs

ErrHdlng.VI

Sets the error handling for all subsequent VI calls. Most VIs return error codes after each call. In addition other error handling features have been built into the library. This VI controls those features. If the UL LabVIEW Extension cannot find the configuration file CB.CFG, it always terminates the program regardless of the ErrHdlng.VI setting.

Summary:



Input:	ErrReporting [I32] - Type of error reporting.
Output:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

ErrReporting	This argument controls when the library will print error messages on the screen. The default is `DONTPRINT`. If it is set to: `DONTPRINT` - Errors will not generate a message to the screen. In that case your program must always check the returned error code after each library call to determine if an error occurred. `PRINTWARNINGS` - Only warning errors will generate a message to the screen. Your program will have to check for fatal errors. `PRINTFATAL` - Only fatal errors will generate a message to the screen. Your program must check for warning errors. `PRINTALL` - All errors will generate a message to the screen.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

Warnings vs. Fatal Errors: All errors that can occur are classified as either "warnings" or "fatal." Errors that can occur in normal operation in a bug free program (disk is full, too few samples before trigger occurred) are classified as "warnings." All other errors indicate a more serious problem and are classified as "fatal."

ErrMsg.VI

Returns the error message associated with an error code. Each VI returns an error code. If the error code is not equal to 0 it indicates that an error occurred. Call this VI to convert the returned error code to a descriptive error message.

Summary:

Input:	ErrCode [I32] - Error code that was returned by any VI.
Outputs:	ErrMsg [abc] - Error message.
	ErrCode [I32] - Error code, or 0 if no error.

GetBoard.VI

Returns the board name of a specified board.

Summary:

Input:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100, or GETFIRST or GETNEXT
Outputs:	BoardName [abc] - Name of the specified board.
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed with InstaCal, or GETFIRST or GETNEXT.
BoardName	A string variable that the board name will be returned to. This string variable must be pre-allocated to be at least as large as BOARDNAMELEN. This size is guaranteed to be large enough to hold the longest board name string.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

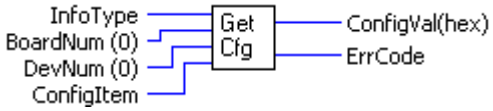
Notes:

There are two distinct ways of using this function:

- Pass a board number as the BoardNum argument. In that case the string that is returned will describe the board type of the installed board.
- Set BoardNum to GETFIRST(-2) or GETNEXT(-3), to get a list of all board types that are supported by the library. If BoardNum is set to GETFIRST, it will return the first board type in the list of supported boards. Subsequent calls with BoardNum=GETNEXT will return each of the other board types supported by the library. When you reach the end of the list BoardName will be set to an empty string.

GetCfg.VI

Returns a configuration option for a board. The configuration information for all boards is stored in the CB.CFG file. This information is loaded from CB.CFG by all programs that use the library. The current configuration can be changed within a running program with the SetCfg.VI VI function. This GetCfg.VI returns the current configuration information.



Inputs:	InfoType [I32] - The class of configuration information that you want to retrieve.
	BoardNum [I32] - The board number assigned when installed with InstaCal. Can be 0 to 100.
	DevNum [I32] - Specifies the board device.
	ConfigItem [I32] - Specifies the configuration item.
Outputs:	ConfigVal [I32] - Current configuration value.
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

InfoType	The configuration information for each board is grouped into different categories. This argument specifies which category you want. It should be set to one of the following constants:
	GLOBALINFO - Information about the configuration file.
	BOARDINFO - General information about a board.
	DIGITALINFO - Information about a digital device.
	COUNTERINFO - Information about a counter device.
	EXPANSIONINFO - Information about an expansion device.
	MISCINFO - One of the miscellaneous options for the board.
BoardNum	The board number associated with a board when it was installed with InstaCal.
DevNum	Selects a particular device. If InfoType=DIGITALINFO then DevNum specifies which of the board's digital devices you want information on. If InfoType=COUNTERINFO then DevNum specifies which of the board's counter devices.
ConfigItem	Specifies the configuration item you want to retrieve.
	The ConfigItem value depends on the InfoType value. Refer to the "Notes" section for a list of all possible values for ConfigItem.
ConfigVal	The specified configuration item is returned to this variable.

Notes:

The list of ConfigItem values for each category of configuration information is:

InfoType = GLOBALINFO

- GIVERSION - CB.CFG file format. This information is used by the library to determine compatibility.
- GINUMBOARDS - Maximum number of installable boards
- GINUMEXPBOARDS - Maximum number of expansion boards allowed to be installed.

InfoType = BOARDINFO

- BIBASEADR - Base address of board
- BIBOARDTYPE - Returns a number in the range of 0 to 8000 Hex.
- BIINTLEVEL - Interrupt level. 0 for none or 1 - 15

- BIDMACHAN - DMA channel. 0, 1 or 3
- BIINITIALIZED - TRUE (non-zero) or FALSE (0)
- BICLOCK - Clock frequency in MHz (1, 4, 6, or 10); or (0) for not supported.
- BIRANGE - Selected voltage range. For switch-selectable gains only. If the selected A/D board does not have a programmable gain feature, this argument returns the range as defined by the installed InstaCal settings which correspond to the input range as set via the switches on the board. Refer to board-specific information for a list of the A/D ranges supported by each board.

Range	Value	Range	Value
±20 V	15	0 - 5 V	101
±10 V	1	0 - 4 V	114
±5 V	0	0 - 2.5 V	102
±4 V	16	0 - 2 V	103
±2.5 V	2	0 - 1.67 V	109
±2 V	14	0 - 1.25 V	104
±1.67 V	11	0 - 1 V	105
±1.25 V	3	0 - 0.5 V	110
±1 V	4	0 - 0.25 V	111
±0.625 V	5	0 - 0.2 V	112
±0.5 V	6	0 - 0.1 V	106
±0.25 V	12	0 - 0.01 V	107
±0.2 V	13	0 - 0.02 V	108
±0.1 V	7	4 -20 mA	200
±0.05 V	8	0 -20 mA	204
±0.01 V	9	2 -10 mA	201
±0.005 V	10	1- 5 mA	202
0 - 10 V	100	0.5 to 2.5 mA	203

- BINUMADCHANS - Number of A/D channels
- BIUSESEXPS - Supports expansion boards TRUE/FALSE
- BIDINUMDEVS - Number of digital devices
- BIDIDEVNUM - Index into digital information for first device
- BICINUMDEVS - Number of counter devices
- BICIDEVNUM - Index into counter information for first device
- BINUMDACHANS - Number of D/A channels
- BIWAITSTATE - Setting of Wait State jumper. 1 = enabled, 0 = disabled
- BINUMIOPORTS - Number of IO ports used by board
- BIPARENTBOARD - Board number of parent board
- BIDTBOARD - Board number of connected DT board

InfoType = DIGITALINFO

- DIBASEADR - Base address
- DIINITIALIZED - TRUE (non-zero) or FALSE (0)
- DIDEVTYPE - Device Type - AUXPORT, FIRSTPORTA etc
- DIMASK - Bit mask for this port
- DIREADWRITE - Read required before write TRUE/FALSE
- DICONFIG - Current configuration INPUT or OUTPUT
- DINUMBITS - Number of bits in port
- DICURVAL - Current value of outputs

InfoType = COUNTERINFO

- CIBASEADR - Base address
- CIINITIALIZED - TRUE (non-zero) or FALSE (0)
- CICTRTYPE - 1 = 8254, 2 = 9513, 3 = 8536, 4 = 7266 type counter chip.
- CICTRNUM - Which counter on chip
- CICONFIGBYTE - Configuration byte

InfoType = EXPANSIONINFO

- XIBOARDTYPE - Board type
- XIMUXADCHAN1 - A/D channel board is connect to
- XIMUXADCHAN2 - 2nd A/D channel board is connected to
- XIRANGE1 - Range (gain) of low 16 channels
- XIRANGE2 - Range (gain) of high 16 channels
- XICJCCHAN - A/D channel that CJC is connected to
- XITHERMTYPE - Thermocouple type
- XINUMEXPCHANS - Number of expansion channels on board
- XIPARENTBOARD - Board number of parent A/D board

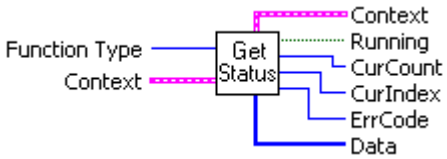
GetStatus.VI

Changed R5.4 ID

Returns the status of a background operation that is currently running.

Revision 5.4 added FunctionType Delay input.

Summary:



Inputs:

Function Type [I32] - Specifies the function type whose status to get.

Context [cluster] - Input data structure from a background operation. *Refer to "Notes" below.

Output:

Context [cluster] - Output data structure

Running [TF] - Status of background operation.

CurCount [I32] - Current count returned to this variable.

CurIndex [I32] - Current index returned to this variable.

ErrCode [I32] - Error code. See ErrMsg.VI

Data [U16] - Data array from context

Arguments:

Function Type

Specifies the function type of the background operation.

The following are valid Function Types:

AI FUNCTION - Get the status of a background operation that started with AInScBg.VI or APretrBg.VI

AO FUNCTION - Get the status of a background operation that started with AOutScBg.VI.

DI FUNCTION - Get the status of a background operation that started with DInScBg.VI .

DO FUNCTION - Get the status of a background operation that started with DOutScBg.VI

CTR FUNCTION - Get the status of a background operation that started with CStore.VI

Context

Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation.

Follow the steps below when wiring this VI:

1. Start a background operation.
2. GetStatus.VI checks for completion (boolean output called "`Running`").
3. StopBg.VI terminates the operation, if not already done, and frees memory aliases.
4. Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively.

The demo VIs illustrate this process effectively.

Running

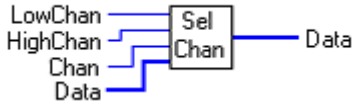
Indicates whether or not a background process is currently executing. "Idle" = False.

CurCount	Specifies how many points have been input or output. It can be used to gauge how far along the operation is towards completion. Generally the CurCount will return the total number of samples collected at the time of the call to `cbGetStatus()`. However, in cases where `CONTINUOUS` and `BACKGROUND` options are both set, the way that CurCount behaves will depend on board type and transfer mode. This value may recycle as the circular buffer recycles, or may continuously increment with the number of counts transferred. Also, CurCount may not update on each sample. For example, when running in `BLOCKIO` mode, CurCount will update after each packet of data has been transferred. The packet size is board dependent. Refer to board-specific information for details.
CurIndex	This is an index into the data buffer that points at the start of the last completed channel scan. This can be used to provide a real- time display for a background operation. Data[CurIndex] points to the start of the last complete channel scan that was put in or taken out of the buffer. You should expect CurIndex to increment by the number of channels in the scan as well. If no points in the buffer have been accessed yet then CurIndex will equal -1. This value can also behave differently in cases where `CONTINUOUS` and `BACKGROUND` options are both set (see CurCount description). Refer to board-specific information for details. If you use the `CONVERTDATA` option with either the `CONTINUOUS` option or with pre-triggering functions then CurIndex will return the index of the last A/D sample, rather than the start of the last completed channel scan. For many background operations CurCount = CurIndex. For pre-trigger inputs though, they are different. If the hardware allows background trigger operations, CurCount indicates how many points of the TotalCount have been collected. CurCount will rise to PreTrigCount, stop until the trigger occurs then rise to TotalCount. CurIndex though will constantly increase and reset as it goes around and around the circular buffer while waiting for the trigger to occur.
Data	Array of acquired data or output data, depending on the background operation. CurCount and CurIndex refer to this array.
ErrCode	Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

SelChan.VI

Selects data for one channel from array with interleaved data for several channels.

Summary:



Inputs:	LowChan [I32] - Low channel
	HighChan [I32] - High channel
	Chan [I32] - Channel to view
	Data [U16] - Input array
Output:	Data [U16] - Output array

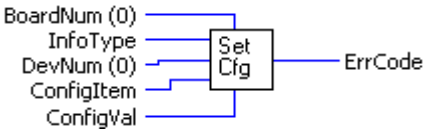
Arguments:

LowChan	Low channel of the scan specified in one of the scanning VIs.
HighChan	High channel of the scan specified in one of the scanning VIs.
Chan	The channel data you wish to view.
Data	Array holding data for all channels.
Data (output)	Array holding data for the channel specified by the Chan argument.

SetCfg.VI

Sets a configuration option for a board. The configuration information for all boards is stored in the CB.CFG file. All programs that use the library read this file. This function can be used to override the configuration information stored in the CB.CFG file.

Summary:



Inputs: BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100.

InfoType [I32] - Specifies which configuration item you wish to retrieve.

DevNum [I32] - Specifies the board device.

ConfigItem [I32] - Specifies the configuration item to set.

ConfigVal [I32] - Set ConfigItem to this value.

Output: ErrCode - Error code. See ErrMsg.VI

Arguments:

BoardNum — The board number associated with a board when it was installed with InstaCal.

InfoType — The configuration information for each board is grouped into different categories. This argument specifies which category you want. It should be set to one of the following constants:

`GLOBALINFO` - Information about the configuration file.

`BOARDINFO` - general information about a board.

`DIGITALINFO` - information about a digital device.

`COUNTERINFO` - information about a counter device.

`EXPANSIONINFO` - information about an expansion device.

`MISCINFO` - One of the miscellaneous options for the board.

DevNum — Selects a particular device. If InfoType=`DIGITALINFO` then DevNum specifies which of the board's digital devices you want to set information on. If InfoType = `COUNTERINFO` then DevNum specifies which of the board's counter devices.

ConfigItem — Specifies the configuration item you want to set.

The ConfigItem value depends on the InfoType value. Refer to the "Notes" section for a list of all possible values for ConfigItem.

ConfigVal — The value to set the specified configuration item to.

Notes:

The list of ConfigItem values for each category of configuration information is:

InfoType = `GLOBALINFO`

- `GIVERSION` - CB.CFG file format
- `GINUMBOARDS` - Number of configured boards
- `GINUMEXPBOARDS` - Number of expansions configured boards

InfoType = `BOARDINFO`

- `BIBASEADR` - Base address of board
- `BIBOARDTYPE` - Board Type
- `BIINTLEVEL` - Interrupt level

- BIDMACHAN - DMA channel
- BIINITIALIZED - TRUE (non-zero) or FALSE (0)
- BICLOCK - Clock freq in MHz.
- BIRANGE - Selected voltage range
- BINUMADCHANS - Number of A/D channels
- BIUSESEXPS - Supports expansion boards TRUE/FALSE
- BIDINUMDEVS - Number of digital devices
- BIDIDEVNUM - Index into digital information for first device
- BICINUMDEVS - Number of counter devices
- BICIDEVNUM - Index into counter information for first device
- BINUMDACHANS - Number of D/A channels
- BIWAITSTATE - Setting of Wait State jumper
- BINUMIOPORTS - Number of IO ports used by board
- BIPARENTBOARD - Board number of parent board
- BIDTBOARD - Board number of connected DT board

InfoType = DIGITALINFO

- DIBASEADR - Base address
- DIINITIALIZED - TRUE (non-zero) or FALSE (0)
- DIDEVTYPE - Device Type - AUXPORT, FIRSTPORTA etc
- DIMASK - Bit mask for this port
- DIREADWRITE - Read require before write TRUE/FALSE
- DICONFIG - Current configuration INPUT or OUTPUT
- DINUMBITS - Number of bits in port
- DICURVAL - Current value of outputs

InfoType = COUNTERINFO

- CIBASEADR - Base address
- CIINITIALIZED - TRUE (non-zero) or FALSE (0)
- CICTRTYPE - 8254 or 9513 counter, 8536, 7266
- CICTRNUM - Which counter on chip
- CICONFIGBYTE - Configuration byte

InfoType = EXPANSIONINFO

- XIBOARDTYPE - Board type
- XIMUXADCHAN1 - A/D channel board is connect to
- XIMUXADCHAN2 - 2nd A/D channel board is connected to
- XIRANGE1 - Range (gain) of low 16 channels
- XIRANGE2 - Range (gain) of high 16 channels
- XICJCCHAN - A/D channel that CJC is connected to
- XITHERMTYPE - Thermocouple type
- XINUMEXPCHANS - Number of expansion channels on board
- XIPARENTBOARD - Board number of parent A/D board

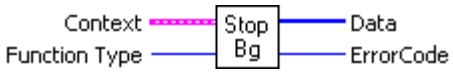
StopBg.VI

Changed R5.4 ID

Stops any background operation that is in progress for the specified board. This VI can be used to stop any VI that is running in the background. It should always be called after any background operation, even when the operation terminates normally.

Rev. 5.4: Added Function Type input.

Summary:



Input:
Context [cluster] - Input data structure from a background operation.
Function Type [I32] - Specifies the type of background operation to stop.

Output:
Data [U16] - Output array extracted from Context.
ErrorCode [I32] - Error code. See ErrMsg.VI.

Arguments:

Context

Data structure describing a background operation. It is generated by scan VIs such as AInScFg.VI or AInScBg.VI, and has to be wired to the corresponding GetStatus.VI's input, which in turn passes it to StopBg.VI.

Follow the steps below when wiring this VI:

1. Start a background operation.
2. GetStatus.VI checks for completion (boolean output called "Running").
3. StopBg.VI terminates the operation, if not already done, and frees memory aliases.
4. Data output from the background operation is passed to GetStatus.VI and StopBg.VI via Context, and can be wired from one or both of them for intermediate or final actions, respectively.

The demo VIs illustrate this process effectively.

Function Type

Specifies the background operation to stop.. The following are valid Function Types:

AI FUNCTION: Stop background operation that started with AInScBg.VI or APretrBg.VI.

AO FUNCTION: Stop background operation that started with AOutScBg.VI.

DI FUNCTION: Stop background operation that started with DInScBg.VI .

DO FUNCTION: Stop background operation that started with DOutScBg.VI

CTR FUNCTION: Stop background operation that started with CStore.VI

Data

Data structure containing information from a background operation. Some of the information included is the board number, the data array, the array size, and the initial status of the background operation.

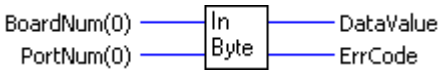
ErrCode

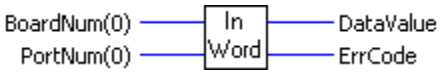
Error code returned from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

InByte.VI / InWord.VI

Reads a byte or a word from a hardware register on a board.

Summary:





Inputs:	BoardNum [U32] - The board number assigned when installed with InstaCal. Can be 0 to 100
	PortNum [U32] - Register on the board to read.
Outputs:	DataValue [I32] - Value read from port.
	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed.
PortNum	Register within the board. Boards are set to a particular base address. The registers on the boards are at addresses that are offsets from the base address of the board (BaseAdr + 0, BaseAdr + 2, etc.). This argument should be set to the offset for the desired register. This function takes care of adding the base address to the offset so that the board's address can be changed without changing the code.
DataValue	Current value of the specified register.
ErrCode	Error code from the Universal Library. Zero if no error occurred. Use the ErrMsg VI to convert ErrCode into a readable string.

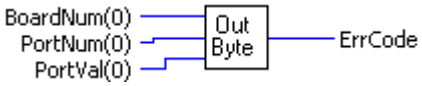
Notes:

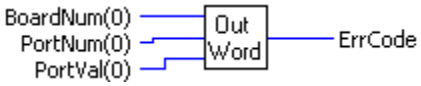
InByte.VI is used to read eight-bit ports. InWord.VI is used to read 16-bit ports.

OutByte.VI / OutWord.VI

Writes a byte or a word to a hardware register on a board.

Summary:





Inputs:	BoardNum [U32] - The board number assigned when installed with *Insta*Cal. Can be 0 to 100.
	PortNum [U32] - Register on the board to set.
	PortVal [U32] - Value to write to register.
Outputs:	ErrCode [I32] - Error code. See ErrMsg.VI

Arguments:

BoardNum	The board number associated with a board when it was installed.
PortNum	Register within the board. Boards are set to a particular base address. The registers on the boards are at addresses that are offsets from the base address of the board (BaseAdr+0, BaseAdr+2, etc). This argument should be set to the offset for the desired register. This function takes care of adding the base address to the offset, so that the board's address can be changed without changing the code.
PortVal	Value that will be written to the register

Notes:

OutByte.VI is used to write to 8-bit ports. OutWord.VI is used to write to 16-bit ports.

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