

Agilent U2300A Series USB Multifunction DAQ Devices VEE Application Program

Quick Reference Guide



Agilent Technologies

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D R A F T C O P Y

Introduction

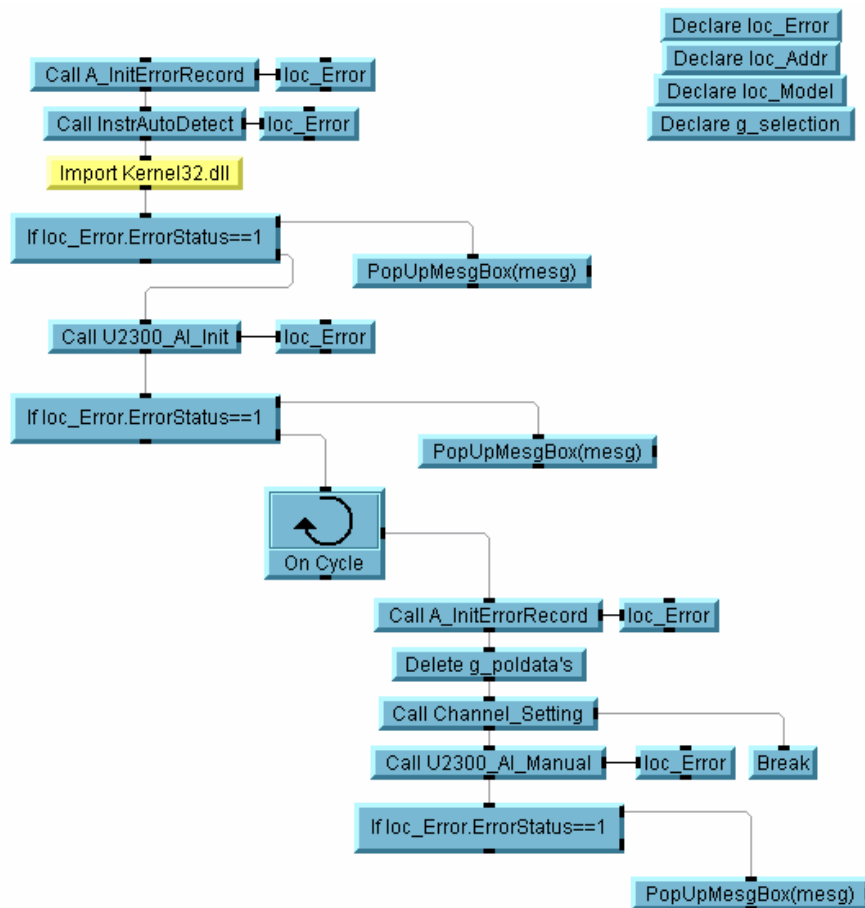
This document will describe the functionality of each of the application. These applications consist of the following:

- 1** U2300_AI.vee – Analog input application
- 2** U2300_AO.vee – Analog output application
- 3** U2300_DIO.vee – Digital input/output application
- 4** U2300_CNT.vee – General purpose counter application
- 5** U2300_TempMonitor.vee – A temperature monitoring application that uses functions from "Simple U2300_AI.vee" and "Simple U2300_AO.vee".
- 6** U2300 Auto Prog Tool.vee – A simple test application that uses functions from "Simple U2300_AI.vee" and "Simple U2300_DIO.vee".

D R A F T C O P Y

Analog Input (U2300_AI.vee)

This is a standalone application that provides control over the analog input of the U2300A Series DAQ devices. The user can control up to a maximum of six units of DAQ within the cardcage or via any USB port. Users can monitor the input data on all the analog input channels. The program will show the enabled channels and it can show up to six graphs on the screen for the monitored data. Users can switch to view different channels and also display either a continuous waveform or a scatter diagram.



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The main workspace is where all the main routine of the program is located. Once the program started, it will import the "kernel32.dll" file that will enable the program to read and write to initialize the files. It will then automatically detect any DAQ that is connected to the pc individually or in a cardcage. If it detects a cardcage, it will display the identification. It will also display all the DAQ that are either in the cardcage or on another USB port.

Cardcage detected

U2781A = USB0::2391::7704::TW46513552::0::INSTR

Instrument Selection

The instrument(s) below were detected. Assign the instrument types and click OK:

Slot	Model	VISA Address
2	U2351A	USB0::2391::3864::TW46400017::0::INSTR
5	U2353A	USB0::2391::4376::TW46401070::0::INSTR
EXT1	U2331A	USB0::2391::5400::TW46393082::0::INSTR

USB U2300A DAQ 1

2 U2351A USB0::2391::3864::TW46400017::0::INSTR

USB U2300A DAQ 2

5 U2353A USB0::2391::4376::TW46401070::0::INSTR

USB U2300A DAQ 3

EXT1 U2331A USB0::2391::5400::TW46393082::0::INSTR

USB U2300A DAQ 4

NONE

USB U2300A DAQ 5

NONE

USB U2300A DAQ 6

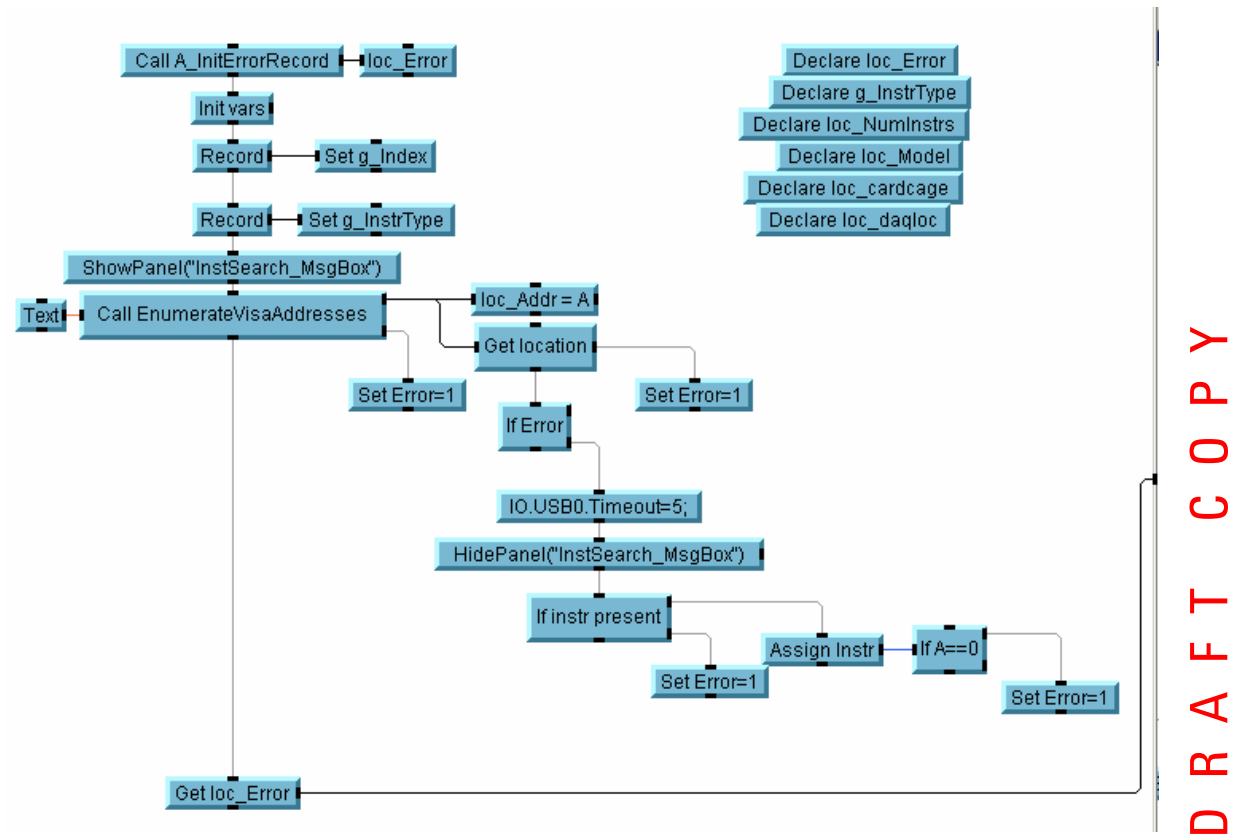
NONE

OK

Cancel

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The detailed view of "InstrAutoDetect" is as shown below. It employs the "visa32.dll" to detect the DAQ that are connected to the pc.



The program will then initialize all the program variables and establish communication with the instrument. It will obtain the serial and model number. It also checks for the maximum sampling rate and also how many analog input channels the attached unit has.

Analog Input Channel Settings

Model : U2351A

Serial : TW46400017

< Continuous
 < Single Shot
 < Polling

Sampling Rate
 1000

Trigger Source
 Software

Trigger Position
 Post

Analog Trigger Source
 Ext Analog Pin

Analog Trigger Condition
 Below Low Level

Digital Trigger Polarity
 Positive Edge

Unit Selection
 2

Channel Editor

Proceed

Quit

Trigger Low Threshold
 0

Trigger High Threshold
 0

Delay Trigger Count
 0

Polling Trigger Delay
 1

Single Shot Samp Size
 1000

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Once it has established the connection, the "Analog Input Channel Settings" screen will appear. This will enable the user to select the type of monitoring they want to perform, whether it is continuous mode, single shot mode or polling mode. The program will ask for the sampling rate they want to read the data. The user can set the triggering method and settings. Click the "Channel Editor" to configure which channel to run, otherwise the program cannot proceed.

Selected	Channel	Name	Mode	Signal Type	Polarity	Range
No	Channel 1	Channel 1	Continuous	RSE	Bipolar	-/+ 10
No	Channel 2	Channel 2	Continuous	RSE	Bipolar	-/+ 10
No	Channel 3	Channel 3	Continuous	RSE	Bipolar	-/+ 10
No	Channel 4	Channel 4	Continuous	RSE	Bipolar	-/+ 10
No	Channel 5	Channel 5	Continuous	RSE	Bipolar	-/+ 10
No	Channel 6	Channel 6	Continuous	RSE	Bipolar	-/+ 10
No	Channel 7	Channel 7	Continuous	RSE	Bipolar	-/+ 10
No	Channel 8	Channel 8	Continuous	RSE	Bipolar	-/+ 10
No	Channel 9	Channel 9	Continuous	RSE	Bipolar	-/+ 10
No	Channel 10	Channel 10	Continuous	RSE	Bipolar	-/+ 10
No	Channel 11	Channel 11	Continuous	RSE	Bipolar	-/+ 10
No	Channel 12	Channel 12	Continuous	RSE	Bipolar	-/+ 10
No	Channel 13	Channel 13	Continuous	RSE	Bipolar	-/+ 10
No	Channel 14	Channel 14	Continuous	RSE	Bipolar	-/+ 10
No	Channel 15	Channel 15	Continuous	RSE	Bipolar	-/+ 10
No	Channel 16	Channel 16	Continuous	RSE	Bipolar	-/+ 10

Confirm & Exit
Save to File & Exit
Load Setting

Model : U2331A
 Serial : TW46393082

Unit Selection
 EXT1

Channel 1

Select Channel ☐

Channel Name
Channel 1

Channel Mode
Continuous

Signal Type
RSE

Polarity
Bipolar

Range
-/+ 10

Polynomial Factor

1

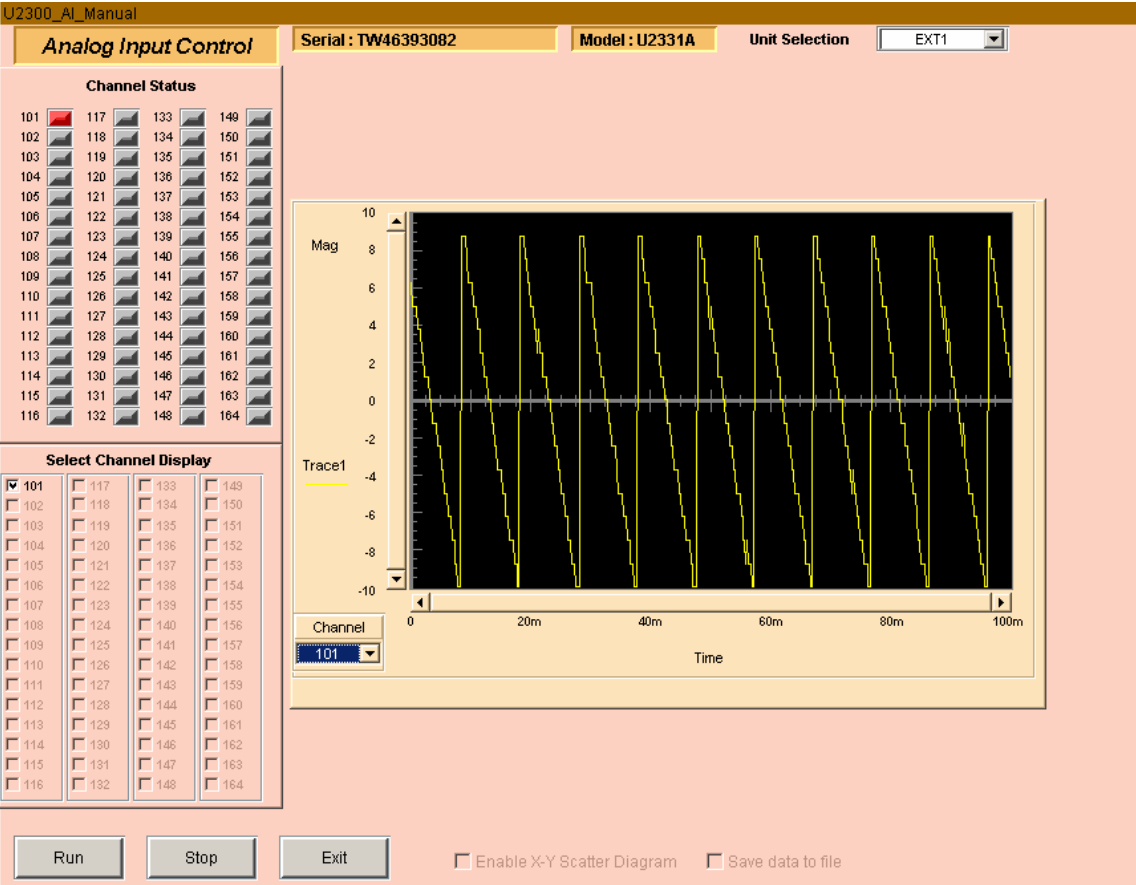
OK

The channel editor will show the channels available depending on the attached model. Users can select each channel and set the mode, signal type, polarity, range and also the polynomial factor to be used for that channel. The settings can be saved to a Windows configuration settings file or "ini" files.

Order	Data 'a0'	Data 'a'
+a0+x^1/20*a	0	0
+a0+x^1/19*a	0	0
+a0+x^1/18*a	0	0
+a0+x^1/17*a	0	0
+a0+x^1/16*a	0	0
+a0+x^1/15*a	0	0
+a0+x^1/14*a	0	0
+a0+x^1/13*a	0	0
+a0+x^1/12*a	0	0
+a0+x^1/11*a	0	0
+a0+x^1/10*a	0	0
+a0+x^1/9*a	0	0

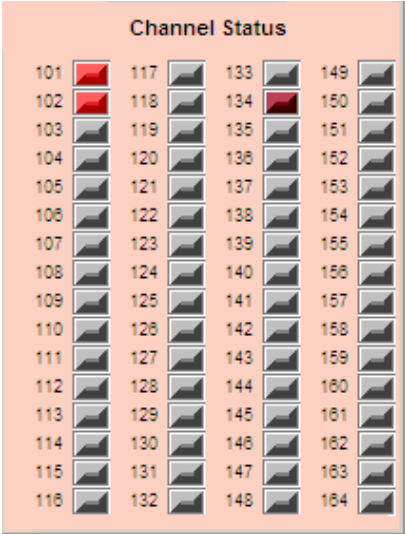
Confirm

The monitoring screen will display the channel status, whether it is set to differential, RSE or NRSE. The user may select to view the graph for the enabled channels. A maximum of six graphs can be shown on the screen at any one time. The user may switch to look at the data at other channels by clicking the drop-down list next to each graph. By default, the program will display a waveform unless the user specify it to display an X-Y scatter diagram. Data can be saved to a "csv" (comma separated value) file.



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Channel status will show in bright red for the selected channels, dark red for the corresponding low- differential input and gray for disabled channels.



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A list of all the userfunctions in the "U2300_AI.vee" application is as given;

No	Userfunction	Description
1	A_InitErrorRecord ()	Initializes the error handling variable record (loc_Error). Used for the functions that only sets the DAQ.
2	A_InitOutputRecord ()	Initializes the error handling variable of 6 records (loc_Output). Used for the functions that queries the DAQ.
3	A_InitSngOutputRecord()	Initializes the error handling variable of 1 record (loc_Output). Used for the functions that queries the DAQ.
4	Channel_Editor ()	Used as an internal function to allow users to select channels, set the monitoring mode, reference ground, etc. Uses the .NET datagrid function. Allows user to save and load the settings.
5	Channel_Popup (row)	Called by Channel_Editor()
6	Channel_Setting ()	Internal function to let user sets the sampling rate, monitoring mode, trigger settings, etc.
7	datagridView_MouseUp ()	Used by .NET datagrid
8	Disp_OneGraph () --> Disp_SixGraphs ()	Internal function to display the analog input data in graphical form. Able to display from one channel to six channels. User able to choose different channels to observe.
9	Disp_OneSChart () --> Disp_SixSCharts ()	Display the data in a strip chart format.
10	Disp_OneScatter () --> Disp_FourScatters ()	Display the data in a scatter diagram.
11	EnumerateVisaAddresses ()	Function that uses "visa32.dll" to detect all instruments that are connected to the pc.
12	Extract_ChancLoc (B)	Internal function to extract the channel data from an array.
13	FileSaving ()	Function that handles data file creation.
14	Get_BitBipData (Data, Bit, Rng)	Function that converts the bipolar data (byte) to decimal format for 12/16 bits.
15	Get_BitUniData (Data, Bit, Rng)	Function that converts the unipolar data (byte) to decimal format for 12/16 bits.
16	HandleVisaReturnCode ()	Function that handles error codes generated by "visa32.dll" while searching for instruments.
17	INI_Read (File, Section, Keyword)	Function that reads from "INI" file. Makes use of kernel32.dll.

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18	INI_Write (File, Section, Keyword, IniString)	Function that writes to "INI" file. Makes use of kernel32.dll
19	InstrAutoDetect ()	Function that automatically detects any instrument that is connected to the pc via GPIB, USB or LAN interface.
20	InstrInterfaceType (str)	Function that distinguish between a GPIB or USB interface.
21	InstSearch_MsgBox ()	Function that displays a message "Please wait... Searching for instrument"
22	LED_Display (BK1, BK2, BK3, BK4)	Internal function to display selected channels. Maximum channels = 64 Selected channel = Color "Warning Red" Unselected channel = Color "Dark Red" Disabled channel = Color "Dark Grey"
23	PopUpMesgBox (mesg)	Multipurpose display message box.
24	Select_Display (BK1, BK2, BK3, BK4)	Panel to allow user to display the channels they want to view while monitoring takes place. Maximum channels = 64. Separated into 4 inputs of 16 channels each.
25	String_IndexChar (string,char)	Finds the all the indices of the char in the string. Returns array of indices. If char doesn't exist in the string, this function returns -1. Limited to 100 indices.
26	U2300_AI_Init ()	This function must be called first to establish communication with the U2300 unit(s). It obtains the model and serial number and detects the numbers of channels and the maximum sampling rate.
27	U2300_AI_InitVar ()	This is called by U2300_AI_Init() function. It initializes all the variables used in this application.
28	U2300_AI_Manual ()	This function holds the main controls to the analog input application.
29	U2300_ConvertData (Select, Data, ChanPos)	Converts the data to the scaling that is input via the "Xth_Poly()" function.
30	U2300_Delay (X)	Common function for setting delay in seconds.
31	U2300_DigitizeUSB1~6 ()	Activate the U2300 "Digitize" function for each individual USB devices.
32	U2300_GetModel ()	Get the model of the attached U2300.
33	U2300_GetSerial ()	Get the serial number of the attached U2300.
34	U2300_GetWavCompUSB1~6 ()	Get the status of the availability of the waveform data for "digitize" mode.
35	U2300_GetWavDataUSB1~6 ()	Get the analog input data from the attached U2300 (Binary format).
36	U2300_Init ()	Perform a "Reset" and "Clear" the event registry and error queues of the U2300. Dynamically sets the interface address for the USB devices.

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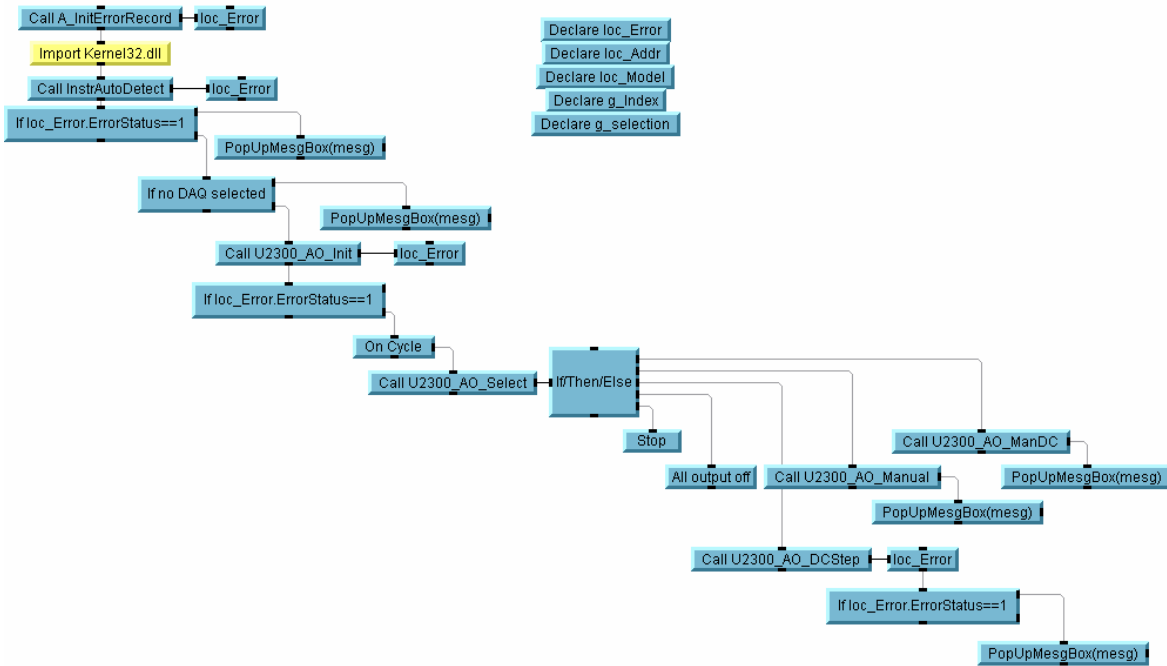
37	U2300_RunUSB1~6 ()	Activate the U2300 "Run" function.
38	U2300_ScanChan (Select, Chan)	Sets the channels for scanning on selected DAQ.
39	U2300_SetAnTrgCond (Select, Inp)	Sets the analog trigger condition on selected DAQ.
40	U2300_SetAnTrgHTrh (Select, Inp)	Sets the analog trigger high threshold value on selected DAQ.
41	U2300_SetAnTrgLTrh (Select, Inp)	Sets the analog trigger low threshold value on selected DAQ.
42	U2300_SetAnTrgSour (Select, Inp)	Sets the analog trigger source selection on selected DAQ.
43	U2300_SetChPolarity (Select, Pol, Chan)	Sets the channel polarity to bipolar or unipolar on selected DAQ.
44	U2300_SetChRange (Select, Range, Chan)	Sets the channel range on selected DAQ.
45	U2300_SetChType (Select, Stype, Chan)	Sets the reference ground for the channel on selected DAQ.
46	U2300_SetDigPol (Select, Inp)	Sets the polarity of the external digital trigger on selected DAQ.
47	U2300_SetSampRate (Select, MaxSamp, Chs, Inp)	Sets the sampling rate for the unit on selected DAQ.
48	U2300_SetTrgDCount (Select, Inp)	Sets the counter value for delay trigger mode on selected DAQ.
49	U2300_SetTrgSour (Select, Inp)	Sets the A/D trigger control source on selected DAQ.
50	U2300_SetTrgType (Select, Inp)	Sets the U2300 trigger mode on selected DAQ.
51	U2300_SetWavePoint (Select, Inp)	Sets the number of points for the waveform on selected DAQ.
52	U2300_StopUSB1~6 ()	Activate the U2300 "Stop" function.
53	U2300_TranslateData (Select, NoOfChans, ChanPos, data)	Converts the data from binary to decimal. Splits any interleave data from multiple channels.
54	Xth_Poly ()	Internal function that allows user to change the scaling factor.

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Analog Output (U2300_AO.vee)

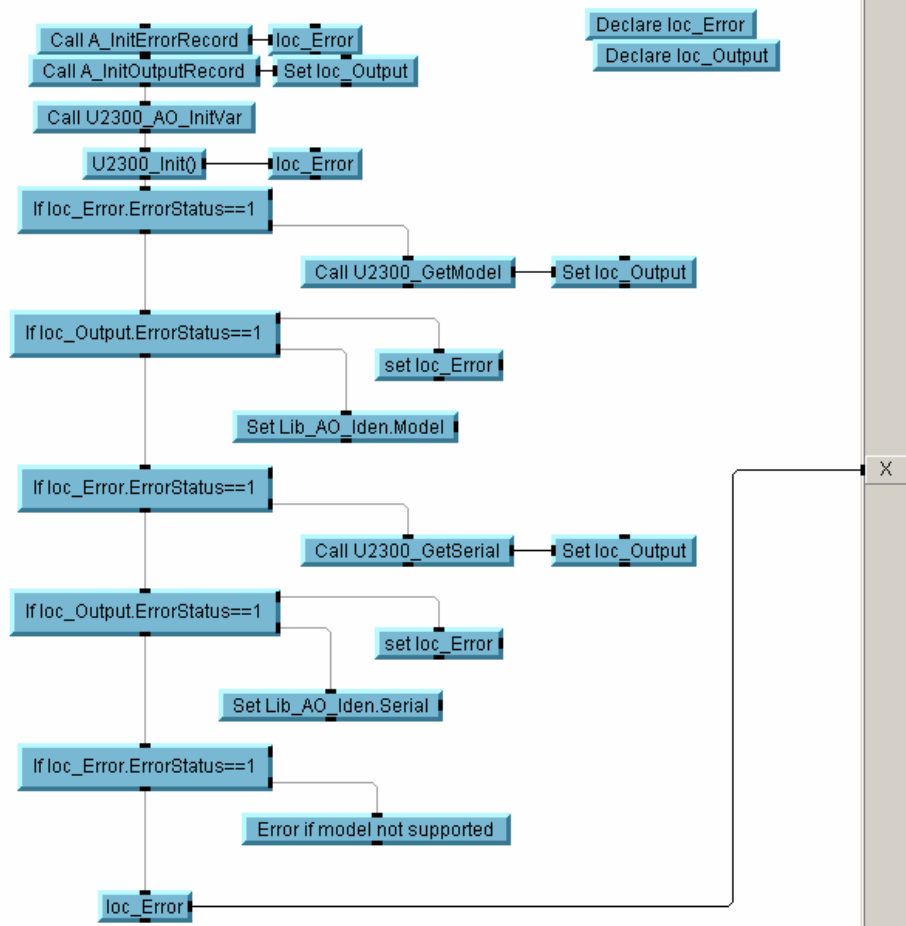
This is a standalone application that provides control over the analog output of the U2300A Series DAQ devices. The user can control up to a maximum of six units of DAQ within the cardcage or via any USB ports. Users can output dc voltages, standard waveforms and user-defined waveforms for analog output channel 201 and 202. The application will automatically detect the DAQ when it is connected to the pc via USB port.

The program will initialize all the program variables and establish communication with the instrument. It will obtain the serial and model number. It also checks if the attached U2300A Series DAQ devices support analog output. The following sequence is that it waits for the user to select DC voltage generation, standard waveform generation or DC step generation.



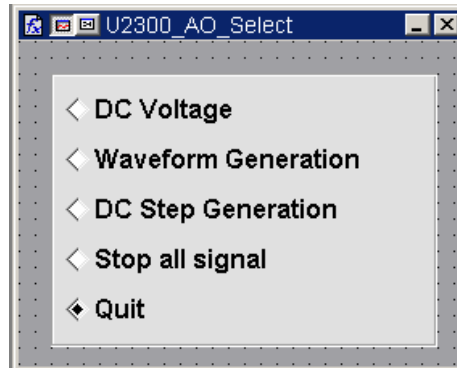
The main workspace is where all the main routine of the program is located. Once the program starts, it will import the "kernel32.dll" file that will enable the program to read and write to initialize the files. It then proceeds to automatically detect for any DAQ that is connected to the pc individually or in a cardcage.

Once the DAQ selection is made, the program will initialize all the DAQ and get its model and serial number.



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If no error is detected in the process, it will prompt the **U2300_AO_Select** dialog box for the user to select their choice of operation.

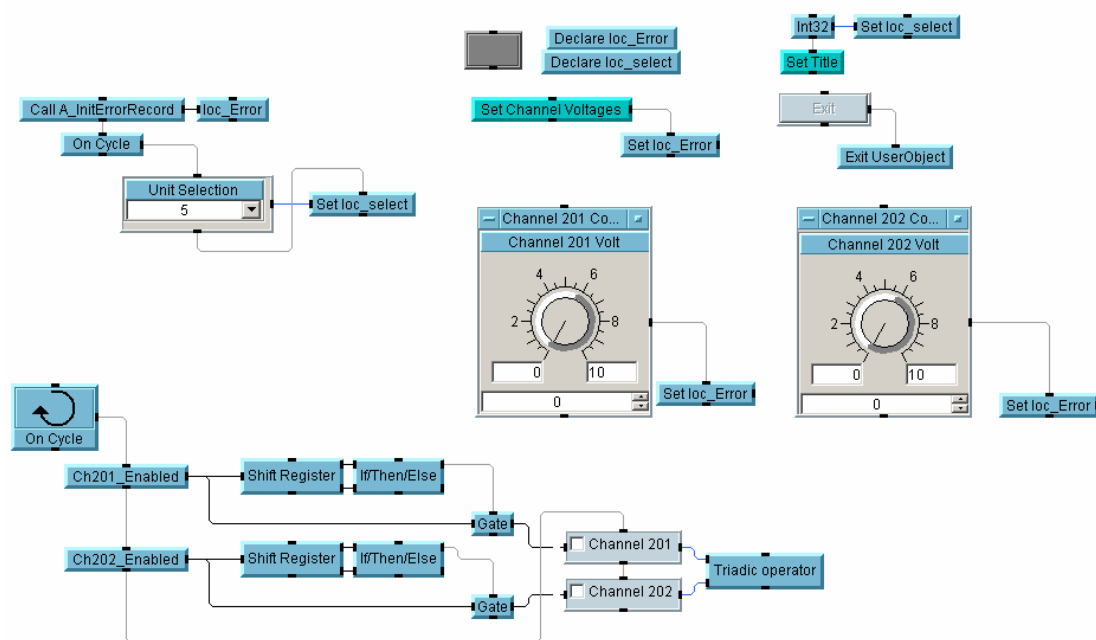


"DC Voltage" selection allows the user to simultaneously output voltage at channel 201 and 202 of any DAQ unit connected to the pc.



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The "Analog DC Manual" control is made up from multiple user objects running in their own thread.

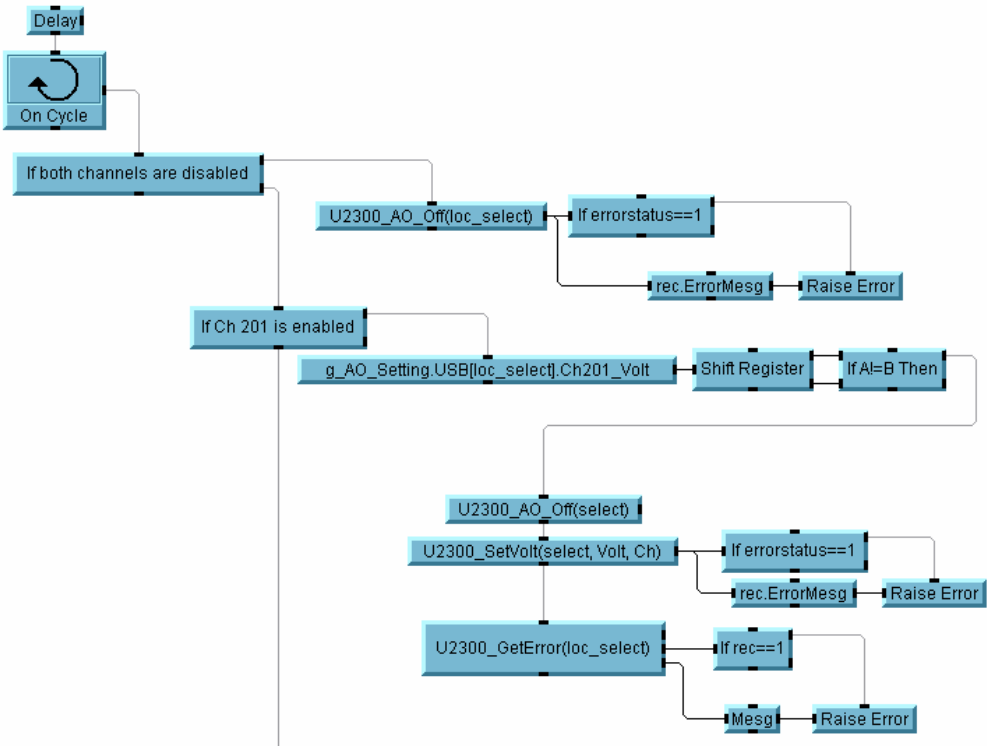


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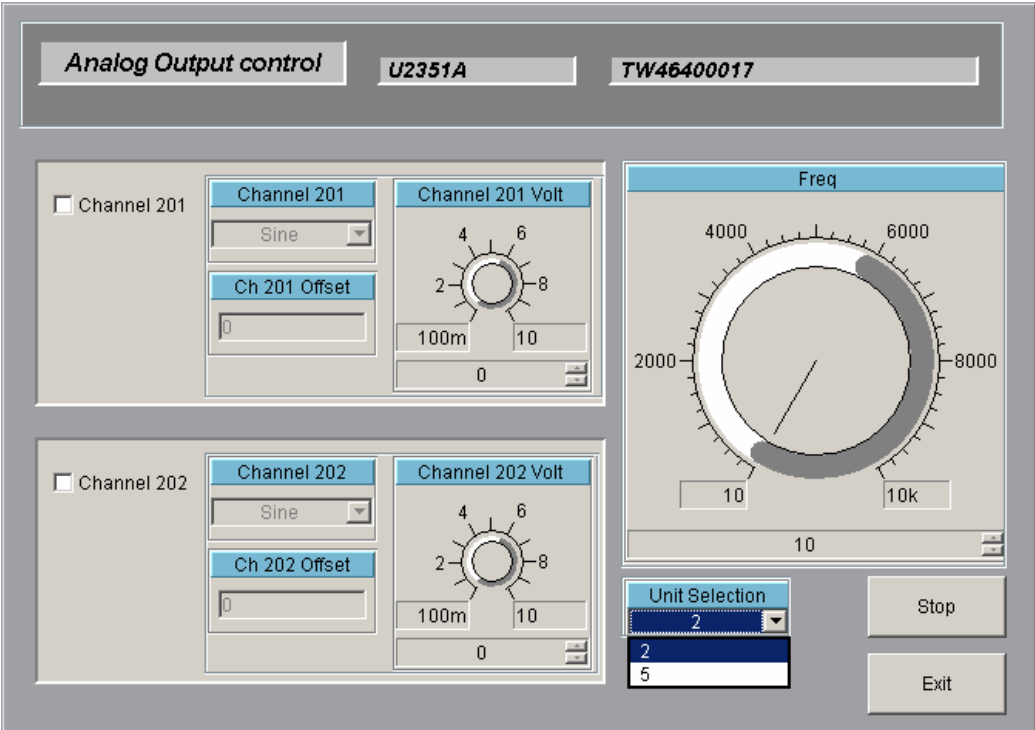


Once the variable is set, it will translate the data over to the DAQ in the "Set Channel Voltages" user- object.



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"Waveform Generation" has an array of waveforms such as sine, square, sawtooth, triangle and noise. User can simultaneously output different waveforms with varying amplitude and offset level for both channels. However, the frequency is fixed for both channels for each DAQ.



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The "DC Step Generation" is a user- defined step voltage output. The user determines which channel to output the signal, the number of points and the step sequence. The application comes with a "Step Editor" that allows the user to configure the dc steps. There is a "Load Step" button to retrieve stored dc steps. Once the dc steps are loaded, clicking the "Run Step" button to initiate the pattern and "Stop" to halt the sequence.

Analog Output Step Control

U2351A

TW46400017

Filename : step1.ini

Step	Voltage (V)	Duration(s)	Reset
1	2	0.5	0
2	1	1	0
3	1.5	1	0
4	2.5	2	1

Channel

201202

No. of Points

1000

Unit Selection

2

Step Editor

Load Step

Run Step

Stop

Configure Wave

Exit

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The "Step Editor" can cater up to 100 steps. User can define the voltage level, the duration of each step and whether to set the voltage to 0 V once it finishes that step. A "-9999" on the voltage level represents a non- operational step, hence that step will be ignored. Users can save the configured steps into Windows configuration settings file or ".ini" files.

#	Voltage (V)	Duration (s)	Reset
1	0.5	0.5	<input type="checkbox"/> Reset after each cycle
2	-0.5	0.5	<input type="checkbox"/> Reset after each cycle
3	0	1	<input type="checkbox"/> Reset after each cycle
4	1	2	<input checked="" type="checkbox"/> Reset after each cycle
5	-9999	-1	<input type="checkbox"/> Reset after each cycle
6	-9999	-1	<input type="checkbox"/> Reset after each cycle
7	-9999	-1	<input type="checkbox"/> Reset after each cycle
8	-9999	-1	<input type="checkbox"/> Reset after each cycle
9	-9999	-1	<input type="checkbox"/> Reset after each cycle
10	-9999	-1	<input type="checkbox"/> Reset after each cycle

<<

>>

F2:Insert Line...

F3:Delete Line...

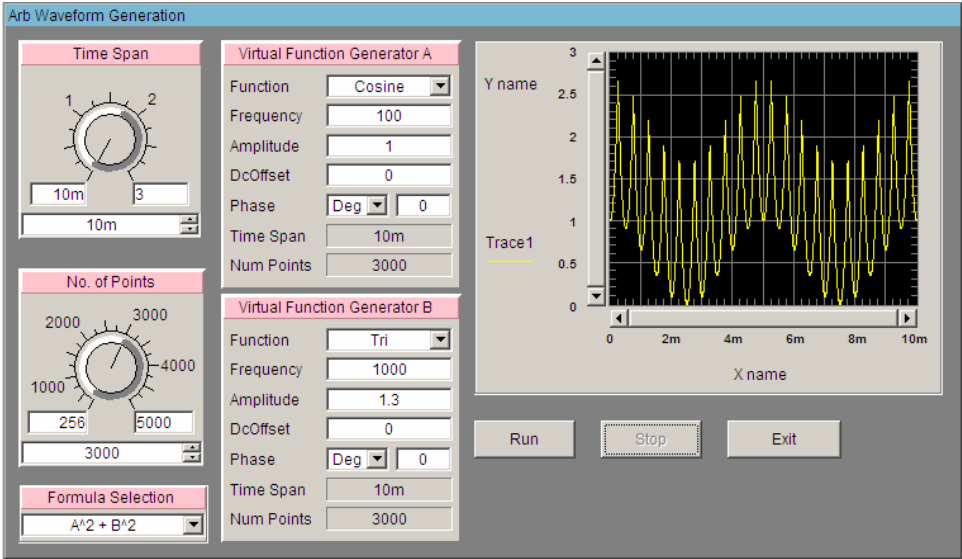
Clear All

Save and Exit

Cancel

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The "Configure Wave" button lets the user create an arbitrary waveform. Users can combine waveforms from two virtual waveform generators through a series of predefined formulas. Users also have to determine the time span and the number of points before running it.



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A list of all the userfunctions in the "U2300_AO.vee" application is as given;

No	Userfunction	Description
1	A_InitErrorRecord ()	Initializes the error handling variable record (loc_Error). Used for the functions that only sets the DAQ.
2	A_InitOutputRecord ()	Initializes the error handling variable of 6 records (loc_Output). Used for the functions that queries the DAQ.
3	A_InitSngOutputRecord()	Initializes the error handling variable of 1 record (loc_Output). Used for the functions that queries the DAQ.
4	AppendBackslash (path)	Appends a "\\" to the path name if it is not present in string.
5	Button_OnClick (Mode, Wildcard)	Internal function that allows the user to select a file (Reading or Writing mode will have to be given and also the wildcard extension). It will read from the current directory of this installed VEE file. It will output the selected file name and the path name.
6	Edit_Pattern ()	Internal function that allows user to visually set the step voltage for analog output. User can set the voltage, duration, reset to zero after each cycle and up to 100 steps. The settings can then be saved or retrieved from a configuration (*.ini) file.
7	EnumerateVisaAddresses ()	Function that uses "visa32.dll" to detect all instruments that are connected to the pc.
8	Editor_ArElemDelete (array, position)	Internal function that deletes a step in the analog output step editor.
9	Editor_ArElemInsert (array, position, newElem)	Internal function that inserts a step in the analog output step editor.
10	File_CheckExist (fname)	Function to check if the input file exists in the pc.
11	HandleVisaReturnCode ()	Function that handles error codes generated by "visa32.dll" while searching for instruments.
12	INI_Read (File, Section, Keyword)	Function that reads from "INI" file. Makes use of kernel32.dll.
13	INI_Write (File, Section, Keyword, IniString)	Function that writes to "INI" file. Makes use of kernel32.dll
14	InstrAutoDetect ()	Function that automatically detects any instrument that is connected to the pc via GPIB, USB or LAN interface.
15	InstrInterfaceType (str)	Function that distinguish between a GPIB or USB interface.
16	InstSearch_MsgBox ()	Function that displays a message "Please wait... Searching for instrument"

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17	Int_ExtractStepRec (iniFile)	Internal function to extract the analog output steps from a given "ini" file. It formats the data to be displayed on the step editor.
18	Load_Pattern ()	Function that loads the analog output pattern from a selected "ini" file. Uses the Button_OnClick () function.
19	PopUpMesgBox (mesg)	Multipurpose display message box.
20	PopUpMesgBoxDec (mesg)	Display message box with a "YES" and "NO" button.
21	String_IndexChar (string,char)	Finds the all the indices of the char in the string. Returns array of indices. If char doesn't exist in the string, this function returns -1. Limited to 100 indices
22	U2300_AO_DCStep ()	This is the analog output step control screen. User can edit, load, run and stop the step patterns. User can choose from channel 201 or 202 to set the output from any DAQ. User can also set the number of points in which the program will calculate the sampling rate based on the total duration of the pattern and number of points. There is also an arbitrary waveform generator via the "Configure Wave" button. User can set the time span, number of points and combine the signals of two virtual function generator to output the waveform. There is also an "XY Trace" to display the combined waveform on the screen. The output channel can be selected from the previous screen.
23	U2300_AO_Init ()	This function must be called first to establish communication with the U2300 unit. It obtains the model and serial number and detects if the connected unit supports analog output functions.
24	U2300_AO_InitVar ()	This is called by U2300_AO_Init () function. It initializes all the variables used in this application.
25	U2300_AO_ManDC ()	This screen enables the user to set DC output voltage a single or dual channel (201 and 202)
26	U2300_AO_Manual()	This is an extended version of the U2300_AO_ManDC () function. It includes waveform type, offset setting and also the frequency for the fixed waveform (Sine, Square, Sawtooth, Triangle and Noise). User can set for single or dual channel.
27	U2300_AO_Off (Select)	Switches off the analog outputs on selected DAQ.
28	U2300_AO_Select ()	A panel displaying the selection for different applications.
29	U2300_GetError ()	Retrieve error messages from the U2300 unit.
30	U2300_GetModel ()	Get the model of the attached U2300.

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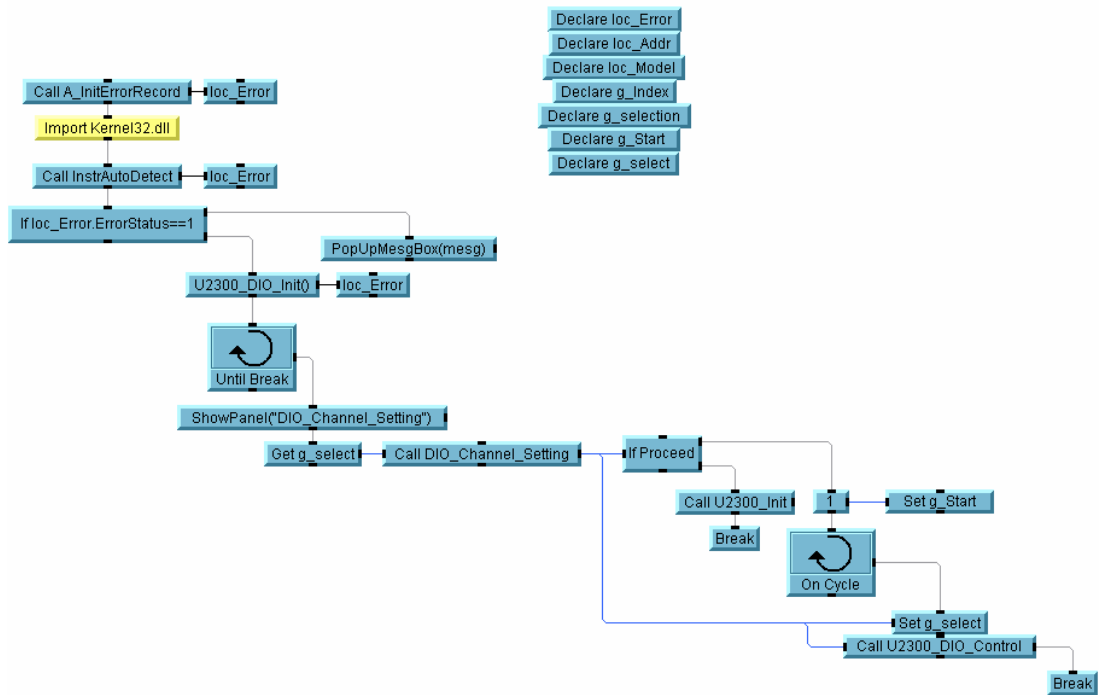
31	U2300_GetOutput ()	Query the U2300 for the output voltage.
32	U2300_GetSerial ()	Get the serial number of the attached U2300.
33	U2300_Init ()	Perform a "Reset" and "Clear" the event registry and error queues of the U2300. Dynamically sets the interface address.
34	U2300_SetFixWave (Select, Type, Volt, Offset, Channel)	Sets the waveform type (Sine, Square, Sawtooth, Triangle, Noise), output voltage, voltage offset and the particular output channel (201 or 202) on the selected U2300 unit.
35	U2300_SetFreq (Select, Freq)	Sets the frequency for the waveform generation.
36	U2300_SetOutput (Select, Output)	Sets the analog output to "ON" or "OFF" depending on the input and selected DAQ.
37	U2300_SetUserData (Select, Ch, Header, Pattern, SRate)	Sets the "user's" analog output. Requires user to input the channel, header is like "#800000200, pattern is the binary format of output pattern and the sampling rate.
38	U2300_SetVolt (Select, Volt, Ch)	Sets the analog output voltage and on the selected channel and DAQ.
39	Universal_AOFormat (Pol, Bit, A)	Internal function that converts the given data (A) to binary format. User will have to provide the polarity ("BIP" [bipolar] or "UNI" [unipolar]) and also whether it is 12 or 16 bits.

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Digital Input/Output (U2300_DIO.vee)

This is a standalone application that provides control over the digital port of the U2300A Series DAQ devices. The user can control up to a maximum of six units of DAQ within the cardcage or via any USB port. Users have control over four digital ports (Channel 501, 502, 503 and 504) and they can set it to be input or output. The application will automatically detect the DAQ when it is connected to the pc via USB port.

The program will initialize all the program variables and establish communication with the instrument. It will obtain the serial and model number. The main routine is located in the main workspace. Once the program starts, it will import the "kernel32.dll" file that will enable the program to read and write to initialize the files. It then proceeds to automatically detect for any DAQ that is connected to the pc individually or in a cardcage.



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Once the DAQ selection is made, the program will initialize all the DAQ and get its model and serial number.

On the "DIO Channel Setting" screen, users can set the direction of the digital ports, they can retrieve pre- saved digital output steps and activate them via output ports. Users can click the "Edit Pattern" button to edit the digital output steps.

DIO Channel Setting

Unit Selection

5

Model : U2353A

Serial : TW46401070

Channel 501

Input

Output

☒ Ch 501 Load Pattern

aab.ini

Channel 502

Input

Output

☐ Ch 502 Load Pattern

Channel 503

Input

Output

☐ Ch 503 Load Pattern

Channel 504

Input

Output

☐ Ch 504 Load Pattern

Proceed

Quit

Pattern Editor

#	B7	B6	B5	B4	B3	B2	B1	B0	Duration	Repeats	Reset
1									0.2	2	<input checked="" type="checkbox"/> Reset after each cycle
2									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
3									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
4									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
5									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
6									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
7									0.2	1	<input checked="" type="checkbox"/> Reset after each cycle
8									-1	-1	<input type="checkbox"/> Reset after each cycle
9									-1	-1	<input type="checkbox"/> Reset after each cycle
10									-1	-1	<input type="checkbox"/> Reset after each cycle

<<

>>

F2:Insert Line...

F3:Delete Line...

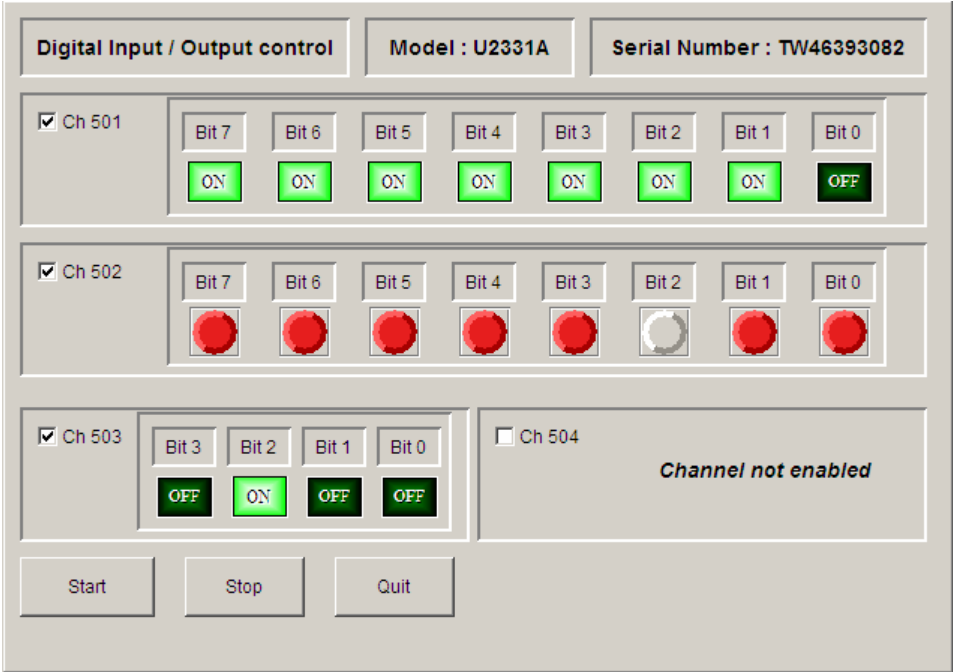
Clear All

Save and Exit

Cancel

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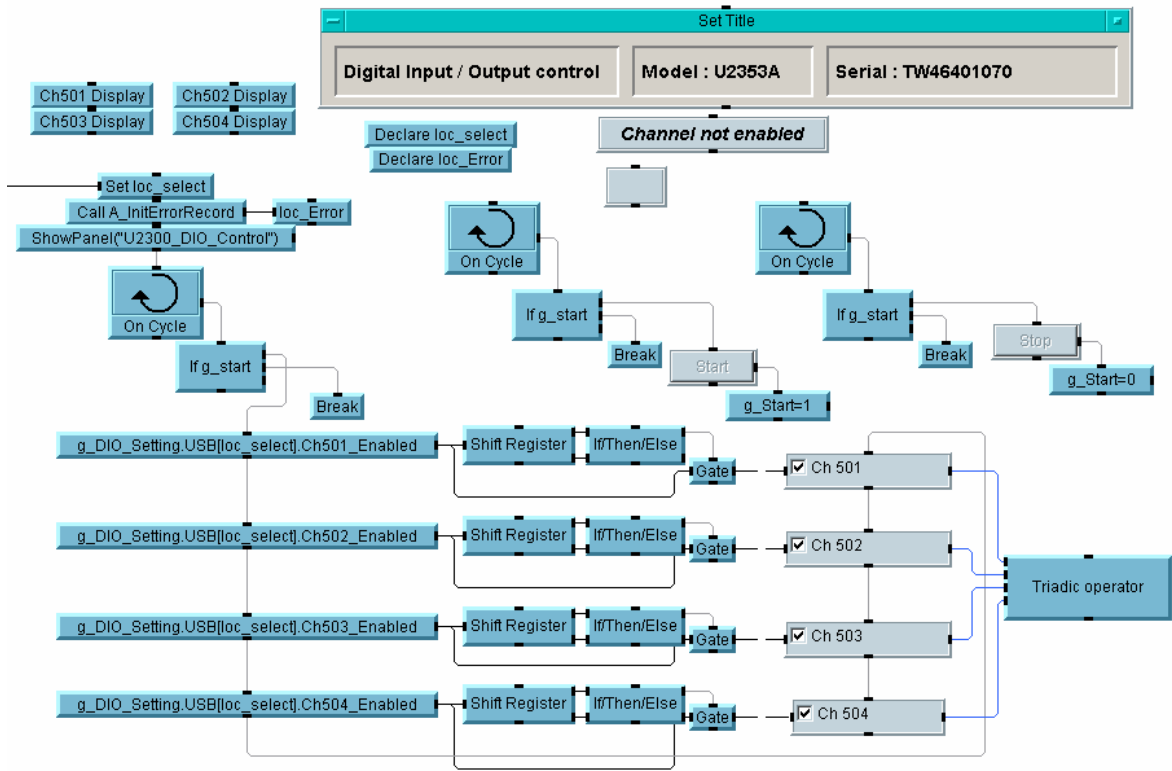
Within the pattern editor, users can define the output pattern bitwise, the duration, number of times to repeat and whether to reset after each step. It can cater up to 100 steps and a "-1" on the duration or repeats represents a non- operational step, hence it will be ignored. Users can save the configured steps into Windows configuration settings file or ".ini" files.



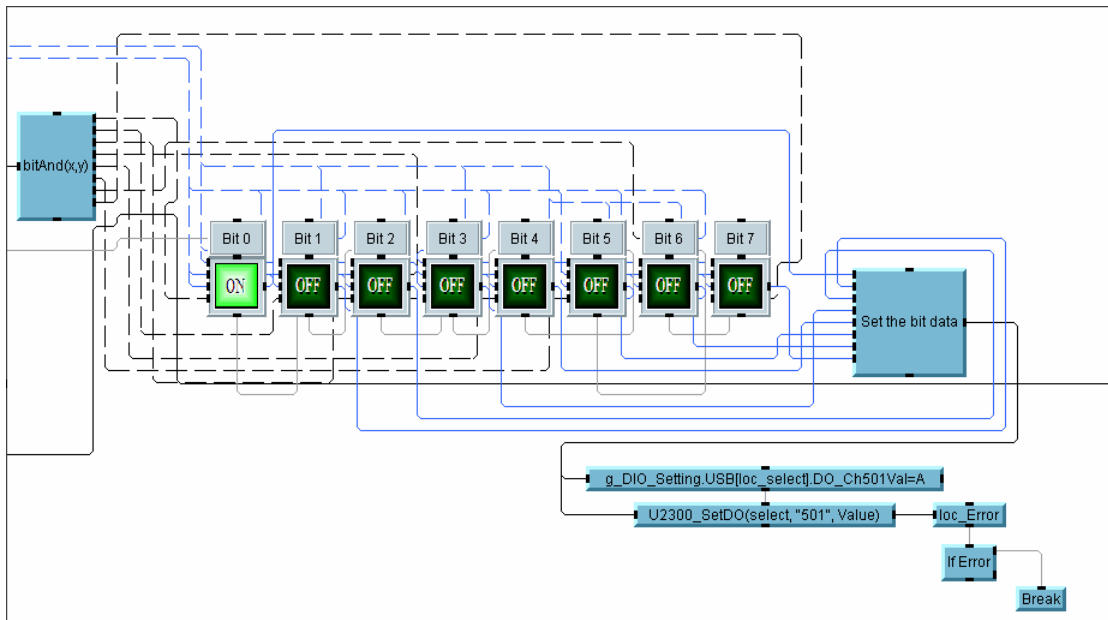
On the "Digital Input/Output control" screen, users have a choice to activate each channel. Based on the previously configured "DIO Channel Setting" screen, users can either control the output channels or view the input channels. The detailed view is as shown below. It has a few user- objects running in separate threads. The user's selection will determine what to display on the panel view.

The controls on this user- object are to update the variables that are referred by other user- objects.

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For example, the "Ch501 Display" user-object referred here is to determine what to display based on the user's selection.



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A list of all the userfunctions in the "U2300_DIO.vee" application is as given;

No	Userfunction	Description
1	A_InitErrorRecord ()	Initializes the error handling variable record (loc_Error). Used for the functions that only sets the DAQ.
2	A_InitOutputRecord ()	Initializes the error handling variable of 6 records (loc_Output). Used for the functions that queries the DAQ.
3	A_InitSngOutputRecord()	Initializes the error handling variable of 1 record (loc_Output). Used for the functions that queries the DAQ.
4	AppendBackslash (path)	Appends a "\\\" to the path name if it is not present in string.
5	Button_OnClick (Mode, Wildcard	Internal function that allows the user to select a file (Reading or Writing mode will have to be given and also the wildcard extension). It will read from the current directory of this installed VEE file. It will output the selected file name and the path name.
6	DIO_Channel_Setting (Select)	This screen allows the user to set the digital channel to input or output direction. For output direction, it also allows you to select pre-configured digital output pattern files. The user can also set the digital output patterns via this screen by clicking on the "Pattern Editor" button. User can select any DAQ present.
7	Edit_Pattern ()	Internal function that allows user to visually set the state of each bit for each step. User can set the duration, number of repeats for each step, reset to zero after each cycle and up to 100 steps. The settings can then be saved or retrieved from a configuration (*.ini) file.
8	Editor_ArElemDelete (array, position)	Internal function that deletes a step in the analog output step editor.
9	Editor_ArElemInsert (array, position, newElem)	Internal function that inserts a step in the analog output step editor.
10	EnumerateVisaAddresses ()	Function that uses "visa32.dll" to detect all instruments that are connected to the pc.
11	File_CheckExist (fname)	Function to check if the input file exists in the pc.
12	HandleVisaReturnCode ()	Function that handles error codes generated by "visa32.dll" while searching for instruments.
13	INI_Read (File, Section, Keyword)	Function that reads from "INI" file. Makes use of kernel32.dll.
14	INI_Write (File, Section, Keyword, IniString)	Function that writes to "INI" file. Makes use of kernel32.dll

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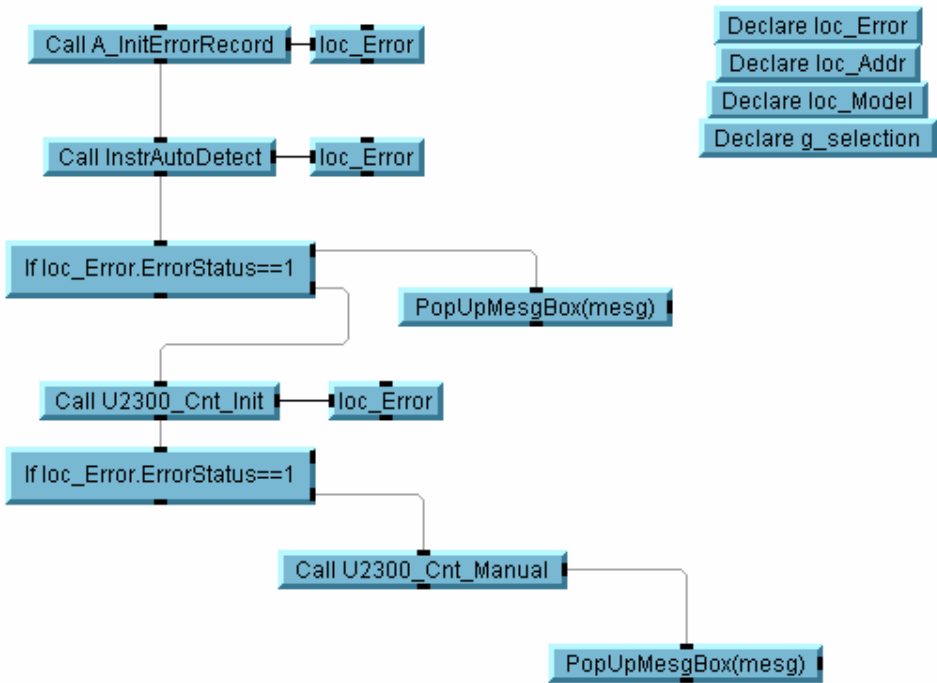
15	InstrAutoDetect ()	Function that automatically detects any instrument that is connected to the pc via GPIB, USB or LAN interface.
16	InstrInterfaceType (str)	Function that distinguish between a GPIB or USB interface.
17	InstSearch_MsgBox ()	Function that displays a message "Please wait... Searching for instrument"
18	Int_ExtractStepRec (iniFile)	Internal function to extract the digital output steps from a given "ini" file. It formats the data to be displayed on the step editor.
19	Load_Pattern ()	Function that loads the digital output pattern from a selected "ini" file. Uses the Button_OnClick () function.
20	PopUpMesgBox (mesg)	Multipurpose display message box.
21	PopUpMesgBoxDec (mesg)	Display message box with a "YES" and "NO" button.
22	String_IndexChar (string,char)	Finds the all the indices of the char in the string. Returns array of indices. If char doesn't exist in the string, this function returns -1. Limited to 100 indices
23	U2300_Ch501_ADO (Select) --> U2300_Ch504_ADO (Select)	This function is called when the digital output pattern generation is executed. It will display the state (ON or OFF) of each bit for that particular channel. Channel 501 and 502 are 8 bits whereas channel 503 and 504 are 4 bits.
24	U2300_Ch501_DI (Select) --> U2300_Ch504_DI (Select)	This function is called when the channel is set to input direction. It will show you the state of each bit of that particular channel.
25	U2300_Ch501_DO (Select) --> U2300_Ch504_DO (Select)	This function is called when the channel is set to output direction. You can manually click on each bit to enable or disable the bit of that channel.
26	U2300_DIO_Control (Select)	This function is the control screen for the user to view all the channels on selected DAQ.
27	U2300_DIO_Init ()	This function must be called first to establish communication with the U2300 unit. It obtains the model and serial number.
28	U2300_DIO_InitVar ()	This function initializes all the variables used in this program.
29	U2300_GetDI (Select, Ch)	Get the state of all the bits of the given channel (Ch) and selected DAQ.
30	U2300_GetModel ()	Get the model of the attached U2300.
31	U2300_GetSerial ()	Get the serial number of the attached U2300.
32	U2300_Init ()	Perform a "Reset" and "Clear" the event registry and error queues of the U2300. Dynamically sets the interface address.

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33	U2300_SetDir (Select, Ch, Dir)	Configures the given channel for either input ("INP") or output ("OUTP") direction on the selected DAQ.
34	U2300_SetDO (Select, Ch, Value)	Sets the given channel (Ch) to output the state based on the integer value given on the selected DAQ.

Counter (U2300_CNT.vee)

The "U2300_CNT.vee" is a standalone application that provides control for the counter of the U2300A Series DAQ devices. The user can control up to a maximum of six units of DAQ within the cardcage or via any USB port. The application will automatically detect the DAQ when it is connected to the pc via USB port. The main workspace is as shown below.



Users have control over the gate source and polarity, clock source and polarity, the ability to measure the totalizer, frequency, period and pulse width.

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Counter control

Model : U2351A

Serial : TW46400017

Unit Selection
2

☒ Channel 301

Gate Source
Internal

Gate Polarity
Active High

Clock Source
Internal

Clock Polarity
Active High

Mode
Totalizer

Direction
Increment

Initial Value
0

Start Meas

Stop Totalizer

Totalizer
56106332

Frequency (kHz)

Period (ms)

Pulse Width (ms)

☒ Channel 302

Gate Source
Internal

Gate Polarity
Active High

Clock Source
Internal

Clock Polarity
Active High

Mode
Totalizer

Direction
Increment

Initial Value
0

Start Meas

Stop Totalizer

Totalizer

Frequency (kHz)

Period (ms)

Pulse Width (ms)

Stop

Exit

Counter control

Model : U2351A

Serial : TW46400017

Unit Selection
2

☒ Channel 301

Gate Source
Internal

Gate Polarity
Active High

Clock Source
External

Clock Polarity
Active High

Mode
Measurement

Direction
Increment

Initial Value
0

Start Meas

Stop Totalizer

Totalizer

Frequency (kHz)
5.002

Period (ms)
0.199

Pulse Width (ms)
0.099

☒ Channel 302

Gate Source
Internal

Gate Polarity
Active High

Clock Source
Internal

Clock Polarity
Active High

Mode
Totalizer

Direction
Increment

Initial Value
0

Start Meas

Stop Totalizer

Totalizer

Frequency (kHz)

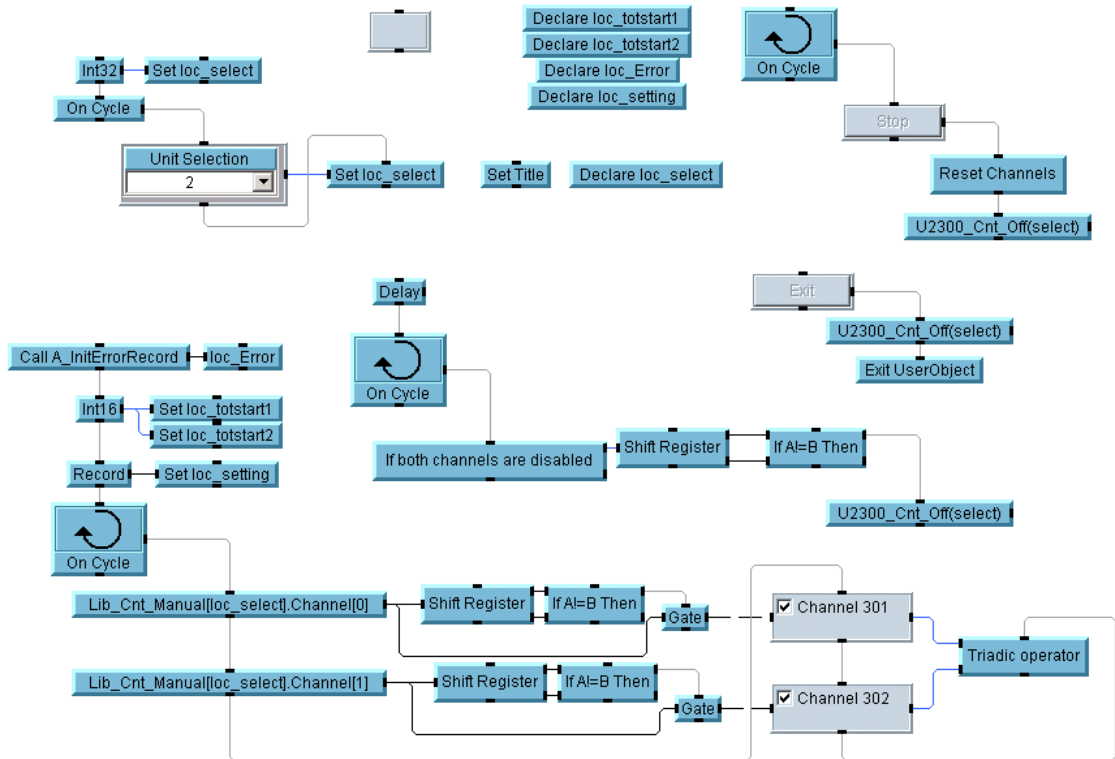
Period (ms)

Pulse Width (ms)

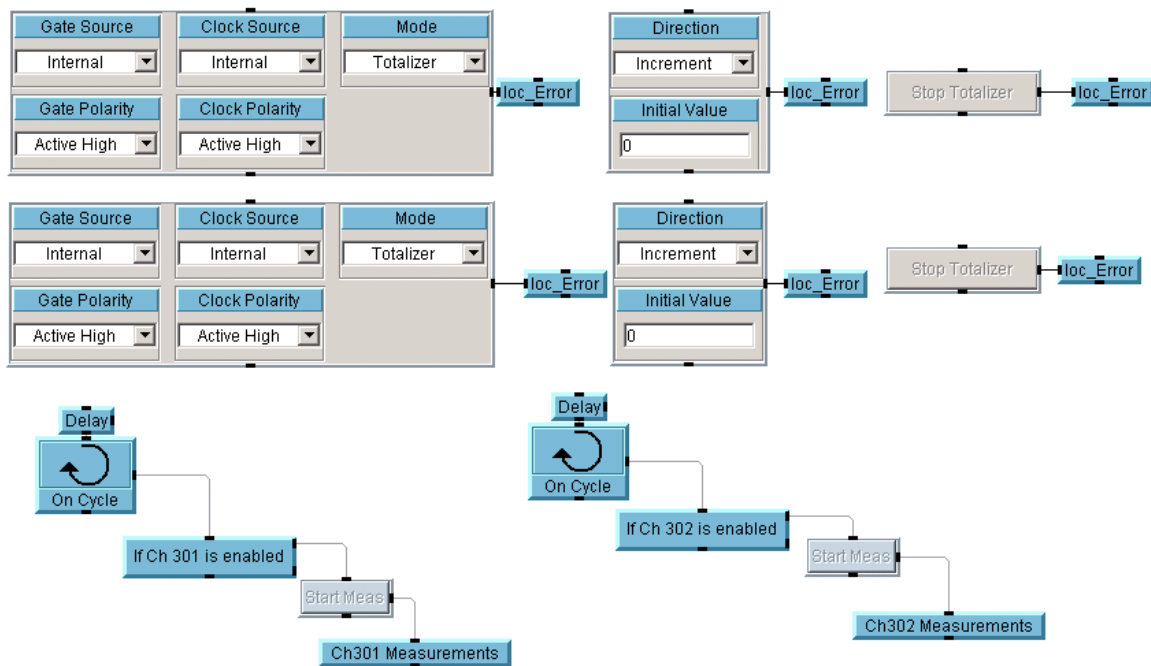
Stop

Exit

The detailed view of the control is made up from several user- objects running in separate threads. The unit selection control allows the user to choose the DAQ unit they want to control. This will set the "loc_select" variable. Once there is a changed in this variable, the controls will be directed to that particular DAQ.

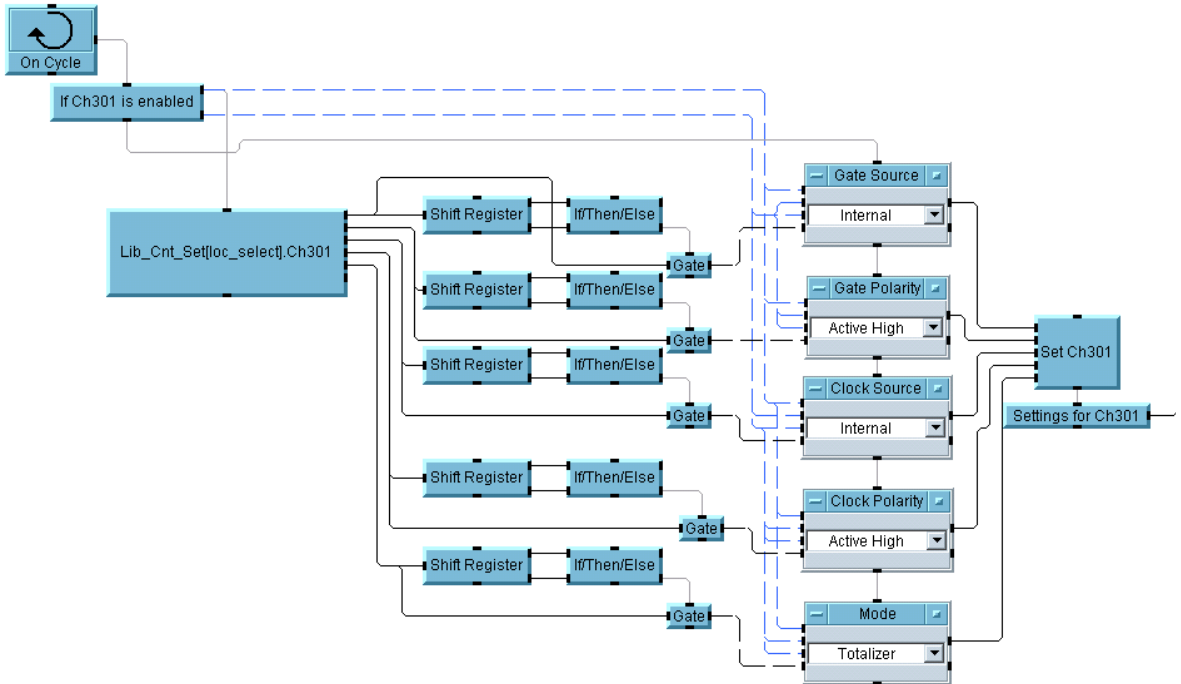


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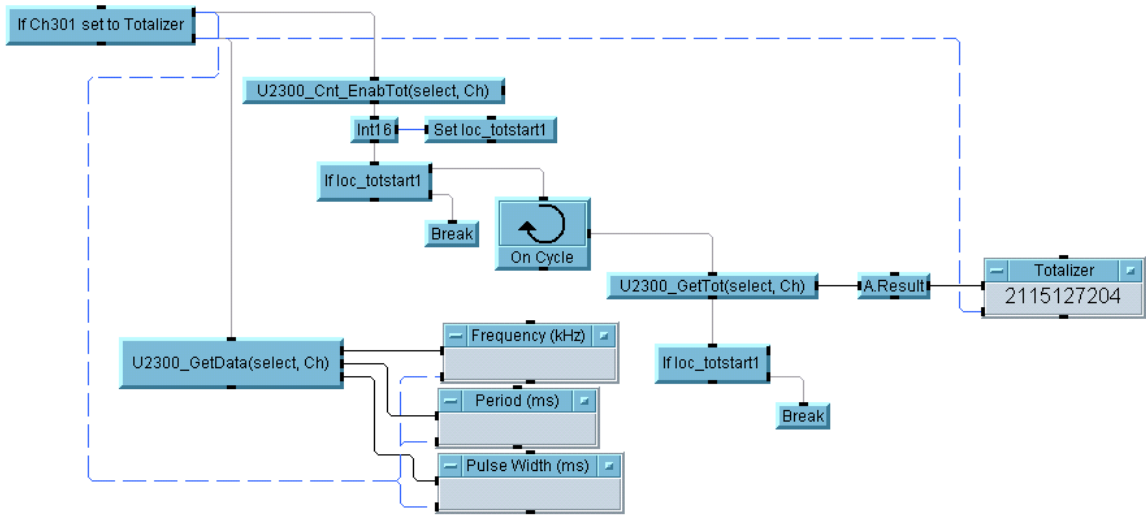
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Channel 301 counter settings are controlled by another user- object called "Ch301 controls". Within this user- object, it is running on an individual loop, it will update the variable and update the DAQ once there is a change in the setting.



The measurement portion is made up of another user- object on a separate thread.

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A list of all the userfunctions in the "U2300_CNT.vee" application is as given below.

No	Userfunction	Description
1	A_InitErrorRecord ()	Initializes the error handling variable record (loc_Error). Used for the functions that only sets the DAQ.
2	A_InitOutputRecord ()	Initializes the error handling variable of 6 records (loc_Output). Used for the functions that queries the DAQ.
3	A_InitSngOutputRecord()	Initializes the error handling variable of 1 record (loc_Output). Used for the functions that queries the DAQ.
4	EnumerateVisaAddresses ()	Function that uses "visa32.dll" to detect all instruments that are connected to the pc.
5	HandleVisaReturnCode ()	Function that handles error codes generated by "visa32.dll" while searching for instruments
6	InstrAutoDetect ()	Function that automatically detects any instrument that is connected to the pc via GPIB, USB or LAN interface.
7	InstrInterfaceType (str)	Function that distinguish between a GPIB or USB interface.
8	InstSearch_MsgBox ()	Function that displays a message "Please wait... Searching for instrument"
9	PopUpMesgBox (mesg)	Multipurpose display message box.
10	PopUpMesgBoxDec (mesg)	Display message box with a "YES" and "NO" button.
11	String_IndexChar (string,char)	Finds the all the indices of the char in the string. Returns array of indices. If char doesn't exist in the string, this function returns -1. Limited to 100 indices
12	U2300_Cnt_ClkPol (Select, Polarity, Channel)	Sets the counter's input clock polarity for the given channel and selected DAQ.
13	U2300_Cnt_ClkSour (Select, Source, Channel)	Sets the counter's input clock source for the given channel and selected DAQ.
14	U2300_Cnt_EnabTot (Select, Channel)	Enables the counter's totalizer for the given channel and selected DAQ.
15	U2300_Cnt_GatePol (Select, Polarity, Channel)	Sets the counter's input gate polarity for the given channel and selected DAQ.
16	U2300_Cnt_GateSour (Select, Source, Channel)	Sets the counter's input gate source for the given channel and selected DAQ.

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17	U2300_Cnt_Init ()	This function must be called first to establish communication with the U2300 unit. It obtains the model and serial number.
18	U2300_Cnt_InitVar ()	This function initializes all the variables used in this program.
19	U2300_Cnt_Manual ()	This function holds the main controls to the counter application.
20	U2300_Cnt_Off (Select)	Function to abort counter measurements on selected DAQ.
21	U2300_Cnt_SetTot (Select, Channel)	Start totalizer measurement for the given channel and selected DAQ.
22	U2300_Cnt_SetTotDir (Select, Direction, Channel)	Sets the direction of the totalizer for the given channel and selected DAQ.
23	U2300_Cnt_SetTotlVal (Select, Value, Channel)	Sets the initial value of the totalizer for the given channel and selected DAQ.
24	U2300_CntStopTot (Select, Ch)	Stop totalizer measurement for the given channel and selected DAQ.
25	U2300_GetFreq (Select, Channel)	Get the frequency measurement for the given channel and selected DAQ.
26	U2300_GetModel ()	Get the model of the attached U2300.
27	U2300_GetPeriod (Select, Channel)	Get the period measurement for the given channel and selected DAQ.
28	U2300_GetPWidth (Select, Channel)	Get the pulse width measurement for the given channel and selected DAQ.
29	U2300_GetSerial ()	Get the serial number of the attached U2300.
30	U2300_GetTot (Select, Channel)	Get the totalizer value for the given channel and selected DAQ.
31	U2300_Init ()	Perform a "Reset" and "Clear" the event registry and error queues of the U2300. Dynamically sets the interface address.

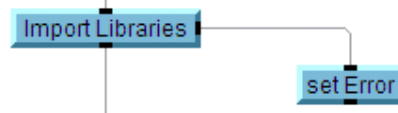
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Temperature Monitoring Application (U2300_TempMonitor.vee)

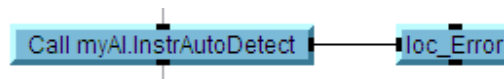
This application continuously monitor up to six analog input channels, mainly channel 101 to channel 106. The polarity of these channels are fixed as bipolar and 10 V range. It can support any U2300A Series models. The DAQ can either be on a USB port or in a cardcage. However, the present program can only support one DAQ at a time. The application uses the temperature coefficients for LM19 and LM60 temperature sensor from National Semiconductor.

The user can also set either one or both the analog output channels (201 and 202) to output from 2.4 V to 10 V. The application also plots the graphs of all the six channels that can be enabled or disabled at any time. This program uses the userfunctions imported from "Simple U2300_AI.vee" and "Simple U2300_AO.vee". It does not use "U2300_AI.vee" and "U2300_AO.vee" as these programs have complex variable constants that have the same declaration.

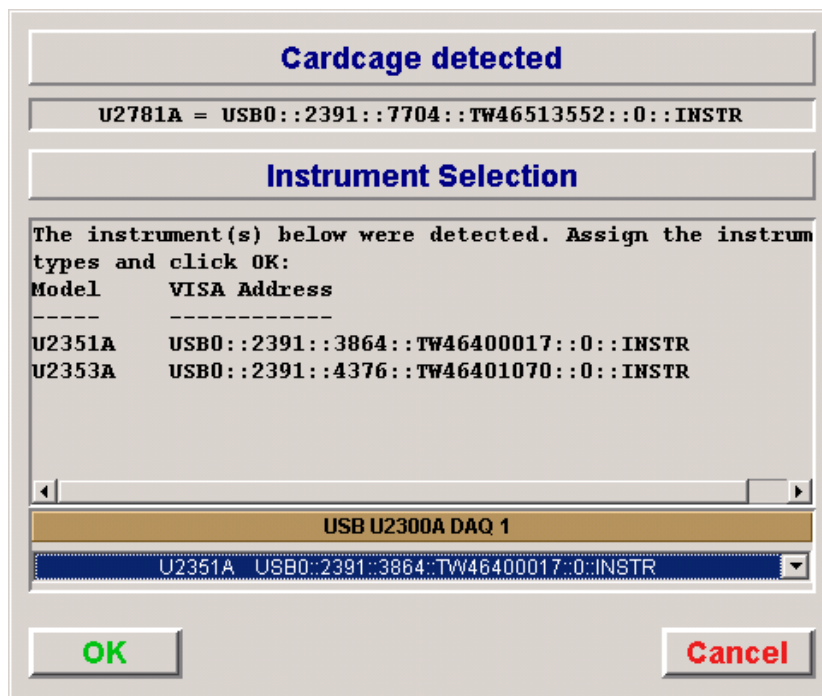
The application starts by importing in the userfunctions from the two VEE files. The object is located in "Main" workspace called "Import Libraries"



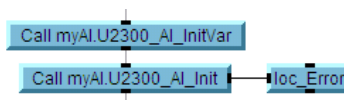
Once the userfunctions are imported, it will do an auto- detection for any instrument that is connected to the computer. The function "InstrAutoDetect ()" will display the identification and the addresses of the instrument(s) and prompt the user to select it.



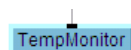
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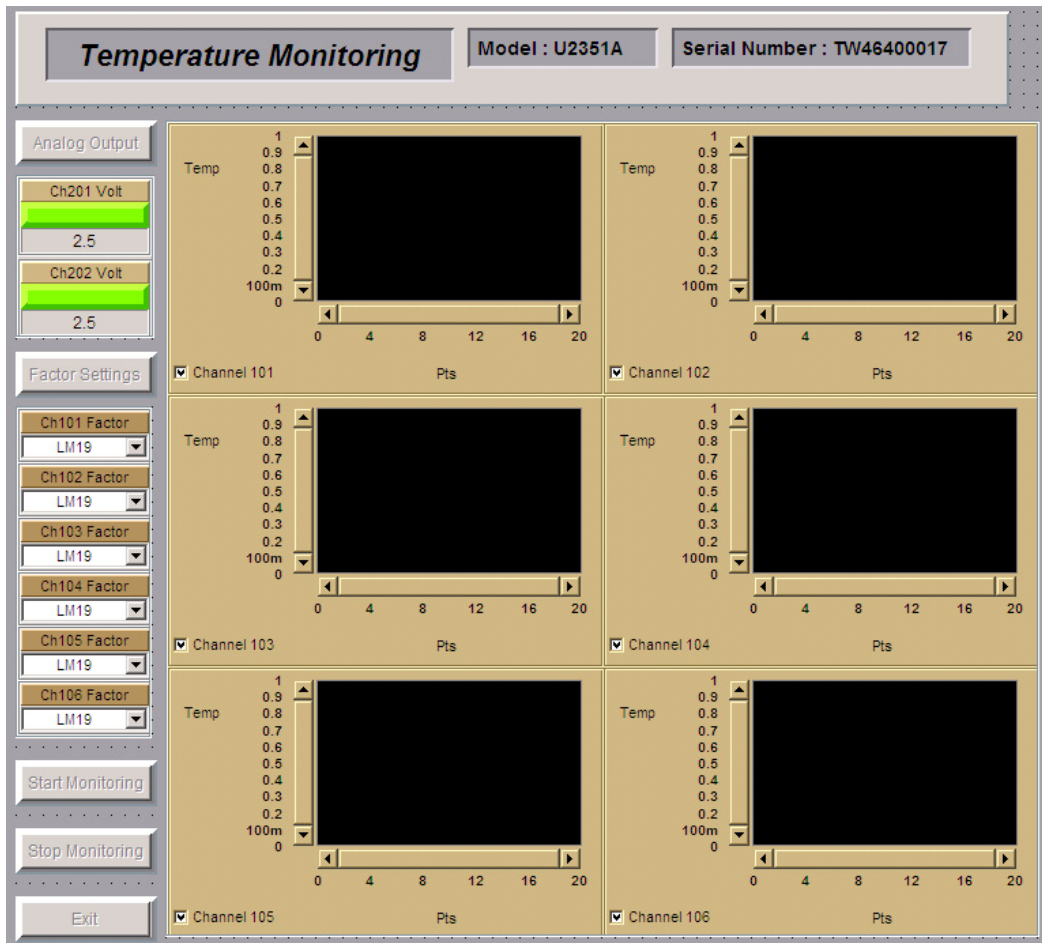


If no instrument is detected, it will give an error message and then terminate the program. The following action is used to initialize all the variables used in the program, start communicating with the instrument and obtain its model and serial number. It also determines the maximum sampling rate that is settable depending on model.



The main collection of functions that controls the temperature monitoring are contained within the object called "TempMonitor".

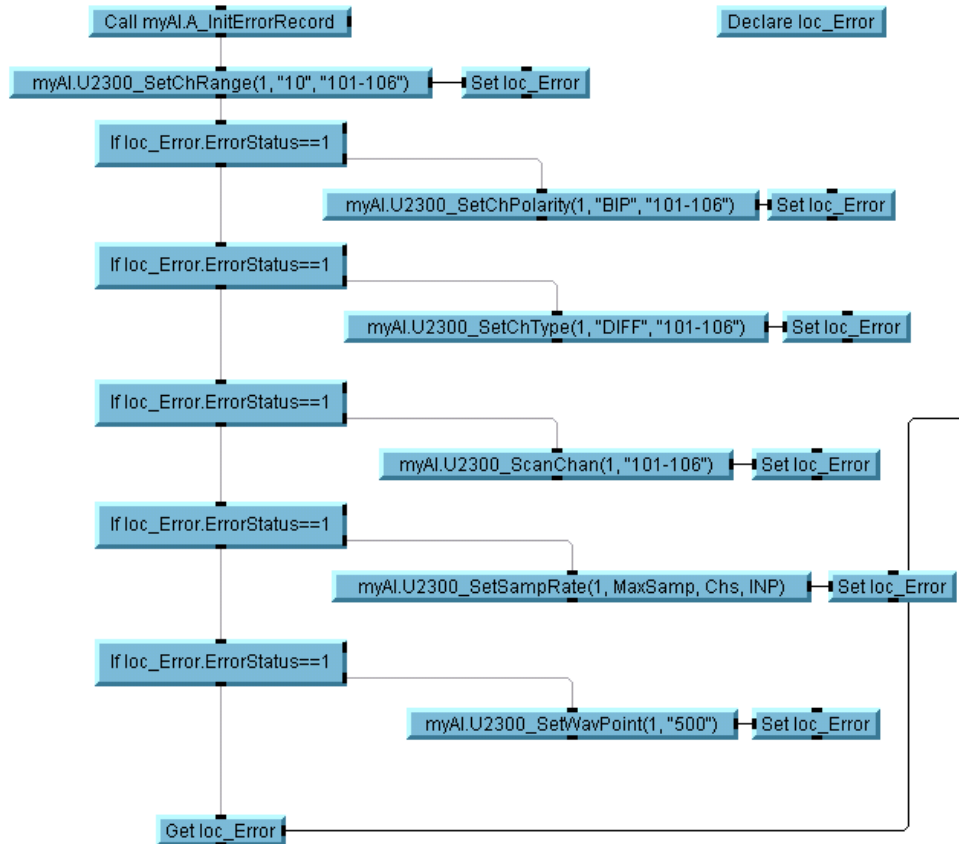




When the temperature monitoring is activated, the user can see the above screen. User is able to view the six channels, set the analog output voltage, set the temperature coefficient factors, select the temperature sensor that is connected to each channel and activate the monitoring itself.

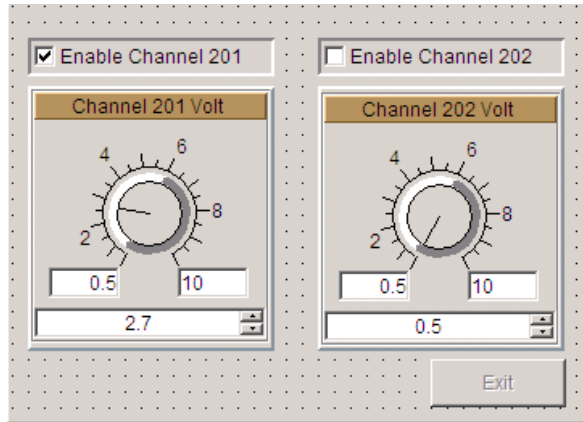
Before any monitoring can be initiated, the channels have to be properly configured. The object "Setup for measurement" makes use of functions from "Simple U2300_AI.vee". The functions are "U2300_SetChRanges (Select, Range, Channels)",

"U2300_SetChPolarity (Select, Polarity, Channels)",
 "U2300_SetChType (Select, Type, Channels)", "U2300_ScanChan
 (Select, Channels)", "U2300_SetSampRate (Select, Maximum
 Rate, Channels, Rate)" and "U2300_SetWavPoint (Select, No of
 Points)".

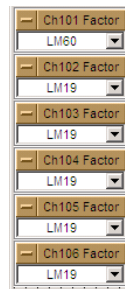
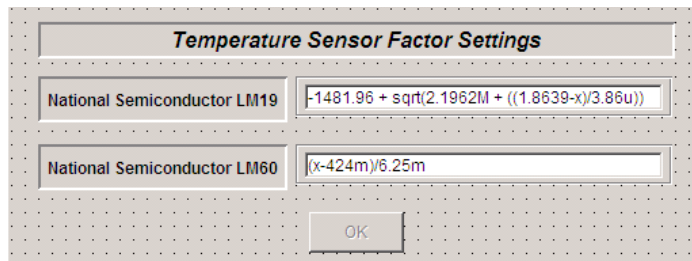


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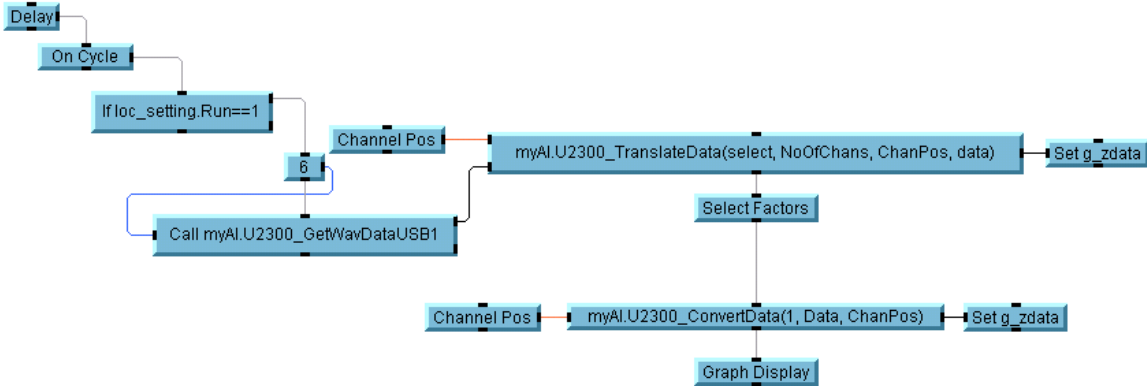
The "Analog Output" button allows the user to set the output voltage for channel 201 and 202. It makes use of functions imported from "Simple U2300_AO.vee" like "U2300_SetVolt (Select, Volt, Channel)", "U2300_AO_Off (Select)" and "U2300_GetError (Select)". These functions are used to set the voltage of the particular channel, switch it off and also read any errors generated by the U2300A units.



Users can change the factor settings for the temperature sensor via the "Factor Settings" button. Currently the sensor factors that are programmed in are of LM19 and LM60 from National Semiconductor. Users can also determine the sensors that are connected to each respective channel.



Functions that are used in getting the waveform, converting it from binary to decimal and applying the coefficient factors are "U2300_GetWavData (Select)", "U2300_TranslateData (Select, Chan#, Channel Position, Data)" and "U2300_ConvertData (Select, Data, Channel Position)" from the imported userfunctions from "Simple U2300_AI.vee".



To start and stop the monitoring, the "U2300_RunUSB1 ()" and "U2300_StopUSB1 ()" functions are called. These are accessible via the "OK" buttons on the userobjects called "Start Monitoring" and "Stop Monitoring" respectively. These functions are from the file "Simple U2300_AI.vee". The "Exit" user-object calls the "U2300_StopUSB1 ()" function while the application is still monitoring before it ensures that the analog outputs are switched off using the function "U2300_AO_Off (Select)" from "Simple U2300_AO.vee".

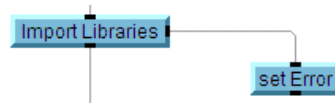
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Simple Test Application (U2300 Auto Prog Tool.vee)

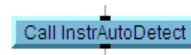
This application allows the user to test three devices via the analog input of the U2300A Series DAQ devices. The program also allows the user to control a SCPI- based power supply. The DAQ can either be on a USB port or in a cardcage. However, the present program can only support one DAQ at a time. Digital outputs from the U2300A are used to supposedly switch the DUTs. All the test results will be displayed and also the user can determine the sequence of the test, settings on the power supply and also the test limits.

The analog input channels used are channel 101, 102 and 103. Polarity of these channels are fixed as bipolar and 10 V ranges which is the default settings. It can support any U2300A models. The digital output channel used is channel 501 with only three bits being utilized, mainly Bit 0,1 and 2 for each DUT. The application uses the userfunctions imported from "Simple U2300_AI.vee" and "Simple U2300_DIO.vee". It does not use "U2300_AI.vee" and "U2300_DIO.vee" as these programs have complex variable constant that have the same declaration.

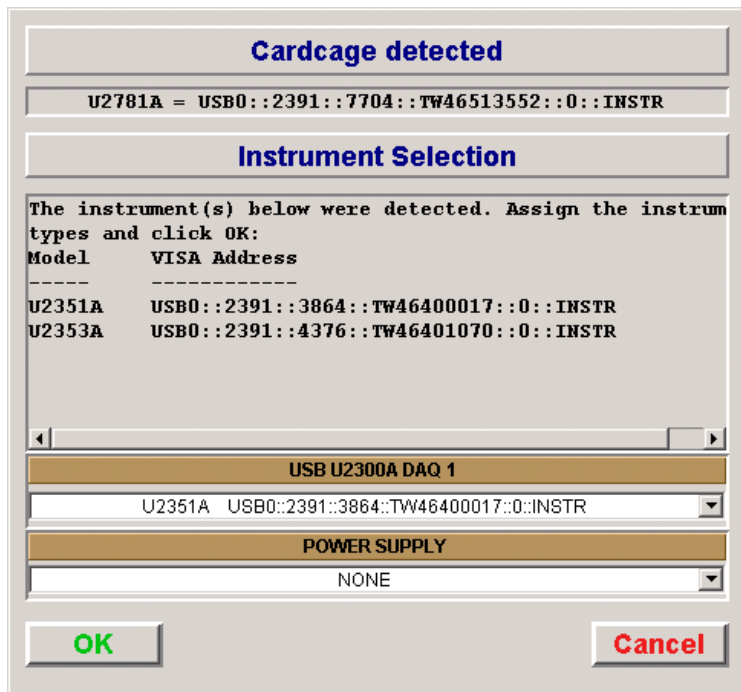
The application start by importing in the userfunctions from the two VEE files. The object is located in "Main" workspace called "Import Libraries".



Once the userfunctions are imported, it does an auto- detection for any instrument that is connected to the computer. The function "InstrAutoDetect ()" will display the identification and the address of the detected instrument and prompt the user to select it.

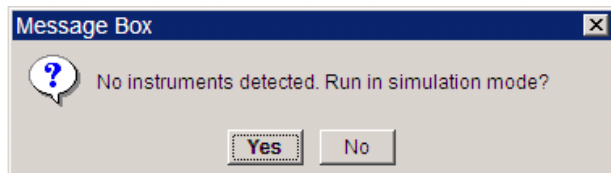


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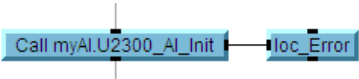
After that step, if no instruments can be detected, it will prompt the user to run in simulation mode or quit the program.

Since the emphasis on this application is on the U2300A, the user can still proceed to use it even a programmable power supply is not present. Put the selection for power supply as "NONE".

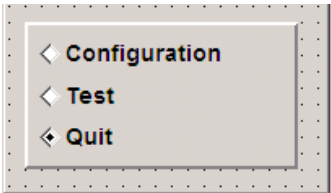


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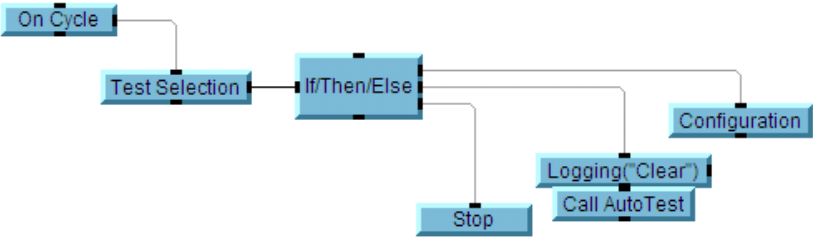
The following object is used to start communicating with the instrument and obtain its model and serial number. It also determines the maximum sampling rate that is settable depending on model.



The following step will request the user to select and configure the tests or proceed to test.



The test selection will branch out to an "If/Then/Else" object to determine which object to call based on the users selection.



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Within the configuration screen, the user can determine the voltage and current setting of the power supply. They can also set the sequence of the tests and the limits.

Test Configuration

Power Supply Setup

PS Voltage: 3.5 PS Current: 0.5

Test Sequence

Test # 1: DUT1 Test # 1 Hi: 2 Test # 1 Lo: 0.5

Test # 2: DUT2 Test # 2 Hi: 2 Test # 2 Lo: 0.5

Test # 3: DUT3 Test # 3 Hi: 2 Test # 3 Lo: 0.5

OK

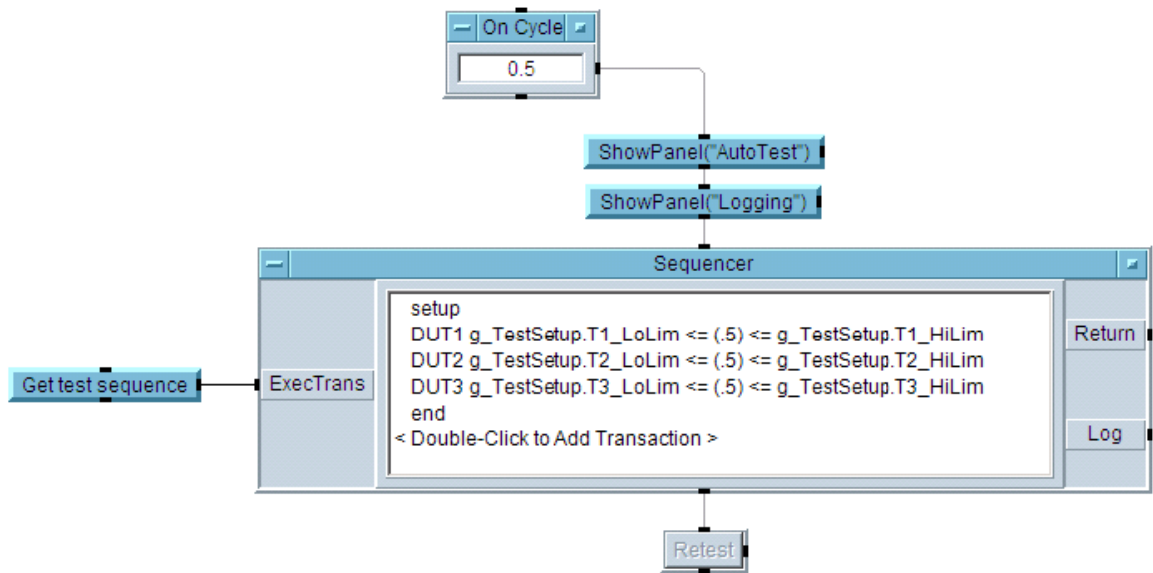
The "AutoTest" userobject uses a sequencer to handle all the tests and it passes the results to a userfunction called "Logging ()". Prior to running the "AutoTest" object, the test log is cleared. The "AutoTest" graphical user interface (GUI) allows the user to retest and save the data to a text file. It also shows the model and serial number of the DAQ currently attached to the PC.

Automated Test Model: U2351A Serial Number: TW04000017

TestName	Result	High Limit	Low Limit	Status
DUT1	0.314	2	0.5	FAIL
DUT2	0.504	2	0.5	PASS
DUT3	0.851	2	0.5	PASS

Retest Close Save Data

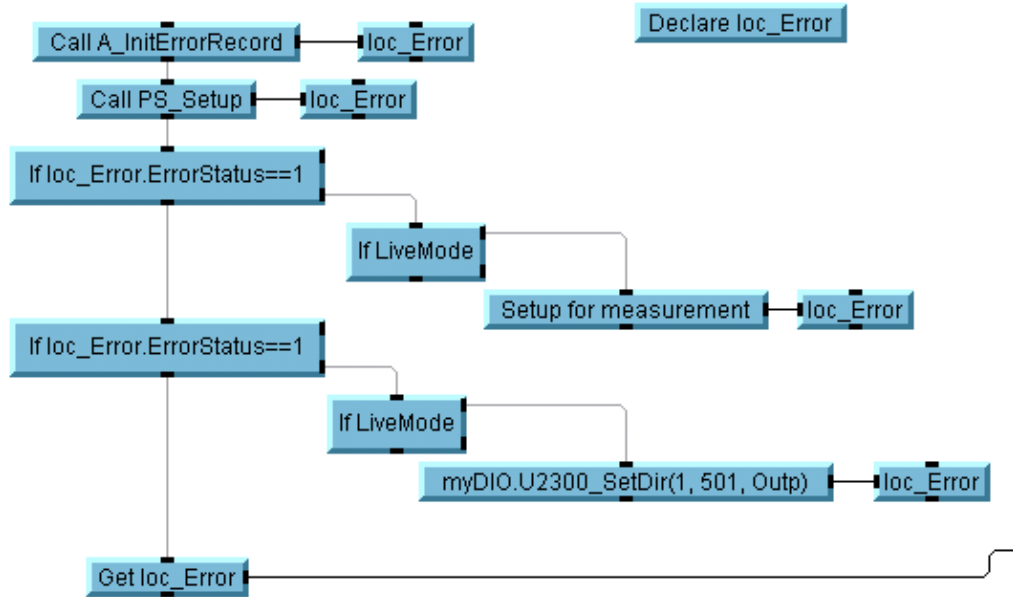
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Before any test starts, the "setup" routine is called to set up the power supply. When all the tests is completed, the "end" sequence will ensure that the power supply is switched off. The sequence of testing for DUT1 to DUT3 is determined by the user.

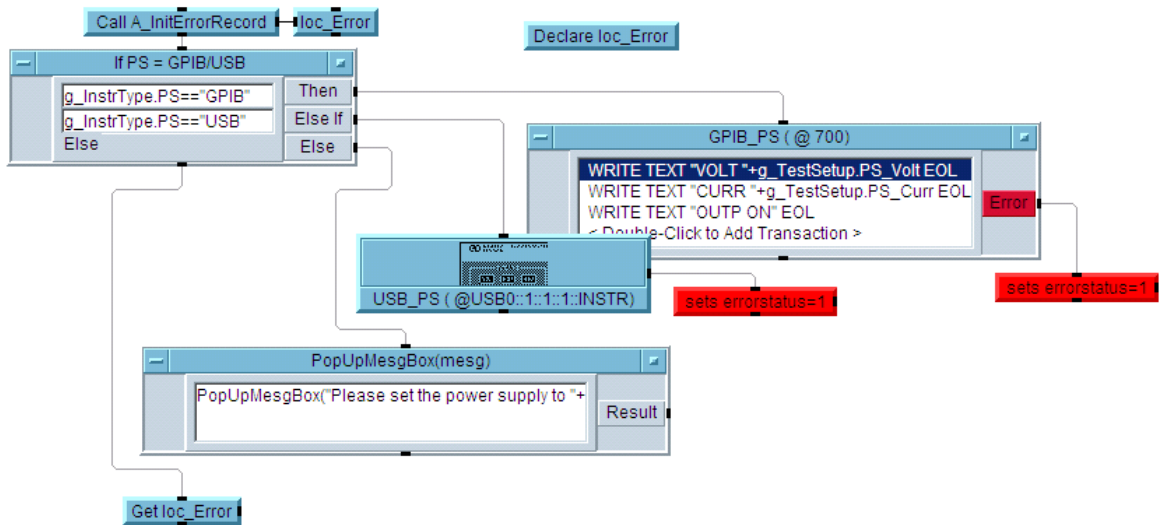
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All the test results are passed to a userfunction called "Logging ()". The "setup" routine calls the "T_Start ()" userfunction that prepares all the instruments for measurement.



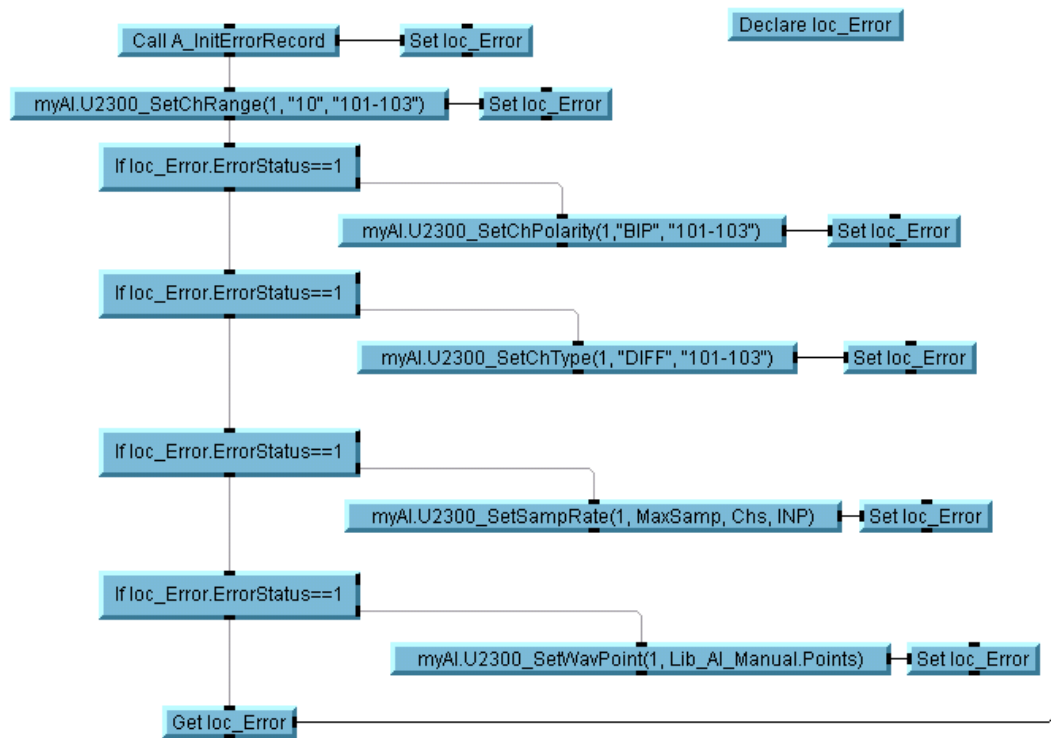
Within the "T_Start ()" userfunction, it calls upon the "PS_Setup ()" userfunction that setup the power supply. It also determines that if it is not operating in simulation mode, it will setup the DAQ for analog input in "Setup in measurement" object and the digital port "501" for output mode. "U2300_SetDir (Select, Channel, Mode)" function from "Simple U2300_DIO.vee" is use to configure channel 501 to output mode.

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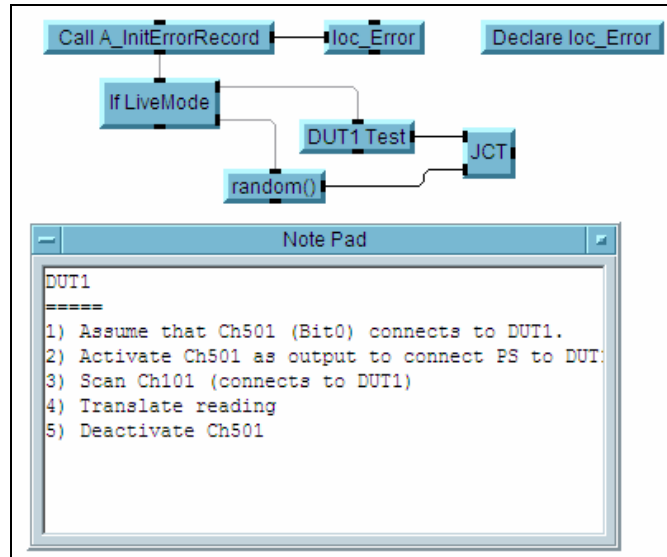
In the "PS_Setup ()" userfunction, the program determines which interface to use. In this case, only "GPIB" or "USB" based power supply is considered. If the power supply is other than the covered interfaces or without any interfaces, a message box will appear instructing the user what to do manually. The program also assumes that any programmable power supply used will have to be SCPI- based.

Before any monitoring can be initiated, the channels have to be properly configured. The object "Setup for measurement" makes use of the functions from "Simple U2300_AI.vee". The functions are "U2300_SetChRanges (Select, Range, Channels)", "U2300_SetChPolarity (Select, Polarity, Channels)", "U2300_SetChType (Select, Type, Channels)", "U2300_ScanChan (Select, Channels)", "U2300_SetSampRate (Select, Maximum Rate, Channels, Rate)" and "U2300_SetWavPoint (Select, No of Points)".



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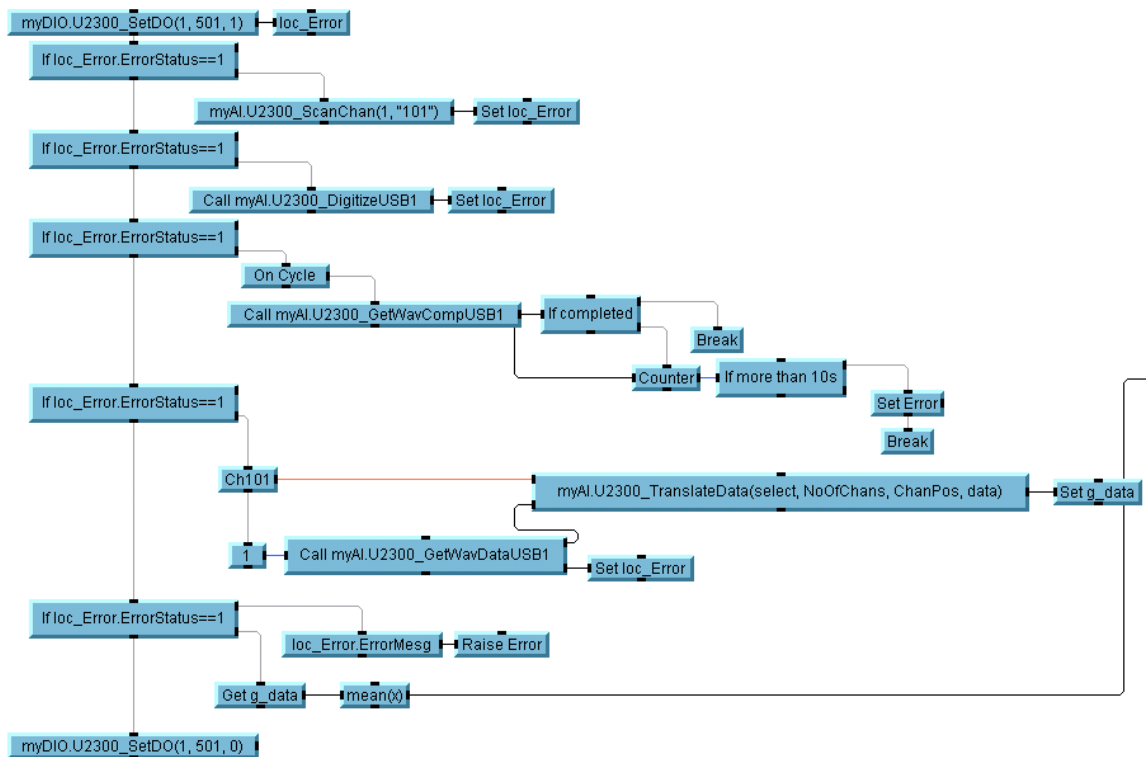
Test function "T_DUT1 ()" checks if it is live mode before actually running the measurement, else it will generate a random number for the simulation mode.



Inside the "DUT1 Test" object, it calls upon userfunctions from "Simple U2300_AI.vee" and "Simple U2300_DIO.vee". It will set digital channel "501" bit 0 to high to signify that a connection is made between the device. Then it will scan channel "101" and set it to digitize mode for a single shot mode. This is made by the userfunctions "U2300_ScanChan (Select, Channel)" and "U2300_DigitizeUSB1 ()". The program will then monitor for the completion of the signal via "U2300_GetWavCompUSB1 ()".

Once the data is available, the userfunction "U2300_GetWavDataUSB1 ()" will read out the data in binary format and "U2300_TranslateData (Select, No of channels, Channel number, Data)" will convert the data to numerical format. It will then output the average reading and disconnect the DUT by setting bit 0 of channel 501 to low.

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Test functions "T_DUT2 ()" and "T_DUT3 ()" are similar to "T_DUT1 ()" except it controls different channels. "T_End ()" is called to complete the tests by switching off the power supply and resetting the digital output of the DAQ.

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