

# *Audio Precision Technical Training*

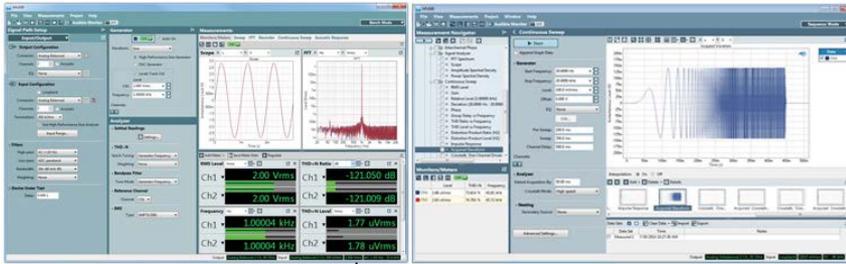
**LabVIEW Drivers for  
APx Instruments**

LABVIEW  
APX  
.NET

LABVIEW  
APX  
DAQ

APX API

APX LIB



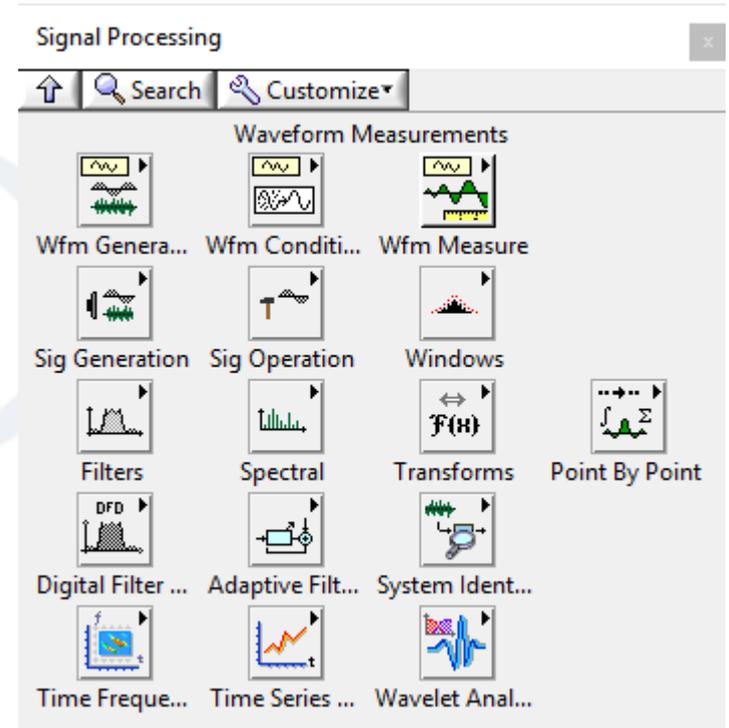
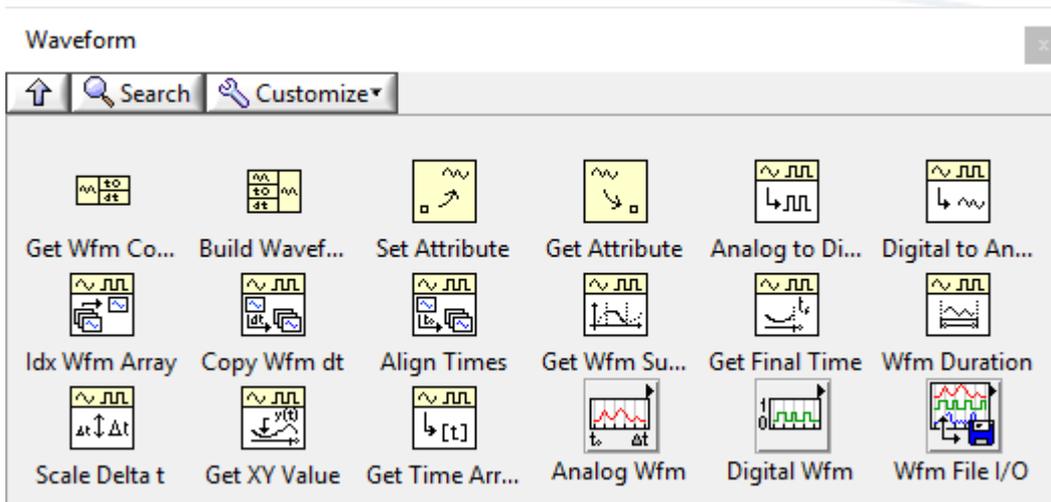
# APx LabVIEW .NET versus DAQ Driver

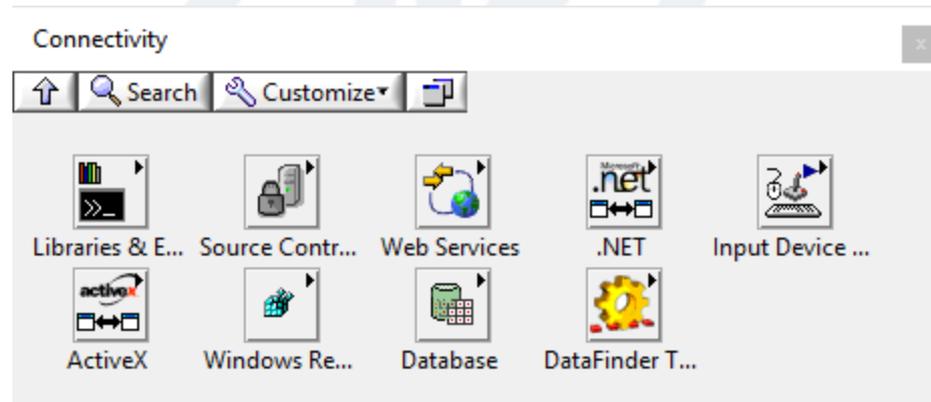
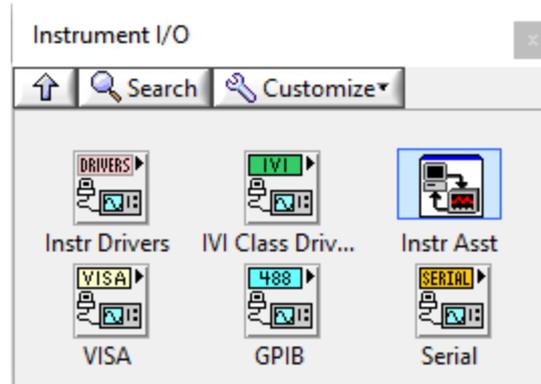
APx LabVIEW .NET Driver	APx LabVIEW DAQ Driver
Requires APx500 software	Independent of APx500 software
Requires Microsoft .NET	Based on low level C++ functions
LabVIEW framework and wrapper for APx500 API	True instrument driver
Complex	Simple
Any APx Audio Analyzer	APx515 only

# APx LabVIEW .NET Driver

1. **Why LabVIEW**
2. Driver Structure
3. Signal Path
4. Measurements
5. Other VIs
6. Examples
7. Constructing LV Projects
8. Constructing LV VIs

# LabVIEW Waveforms and Signal Processing





[Home](#) > [Support](#) > [Downloads](#) > [Drivers](#) > [3rd Party Instrument Drivers](#)

Search Entire Site

Search Within

[Drivers](#)

[NI Drivers](#)

[Instrument Drivers](#)

Narrow by

▼ **Manufacturer**

[A \(2059\)](#)

[B-C \(607\)](#)

[D-E \(216\)](#)

[F-H \(441\)](#)

[I-K \(1760\)](#)

## Instrument Driver Network (IDNet)

Find, download, or submit a driver to communicate with third-party Drivers.

Instrument Drivers | ▼

### Popular Drivers

[Tektronix TDS 200 1000 2000 Series](#)

[Agilent 34970A](#)

[Agilent 34401](#)

[Keithley 2400 Series](#)

[Agilent 33XXX Series](#)

[Agilent E363XA Series](#)

[Tektronix TDS 3000 series](#)

[Tektronix MDO MSO DPO 2000 3000 4000 Series](#)

[Ocean Optics 2000 4000 Series](#)

[Agilent MXA Series](#)

3D Graph Properties

↑ Search Customize







3D Surface.vi 3D Parametri... 3D Curve.vi Convert OLE ... Set Plots.vi






Basic Propert... Axes Properti... Grid Properti... Projection Pr...

Graph

↑ Search Customize






Waveform C... Waveform G... XY Graph Ex XY Graph






Intensity Chart Intensity Gra... Digital Wave... Mixed Signal...






Compass Plot Error Bar Plot Feather Plot XY Plot Matrix





Controls 3D Picture 3D Graph

3D Graph

↑ Search Customize






Scatter Bar Pie Stem






Ribbon Contour Quiver Comet





Surface Mesh Waterfall





Surface Graph Parametric G... Line Graph

Picture Plots

↑ Search Customize






Polar Plot.vi Smith Plot.vi Smith Multi ... Normalize S...







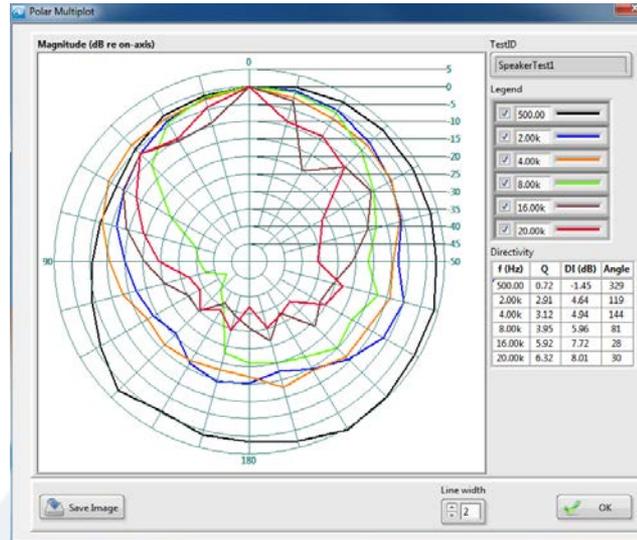
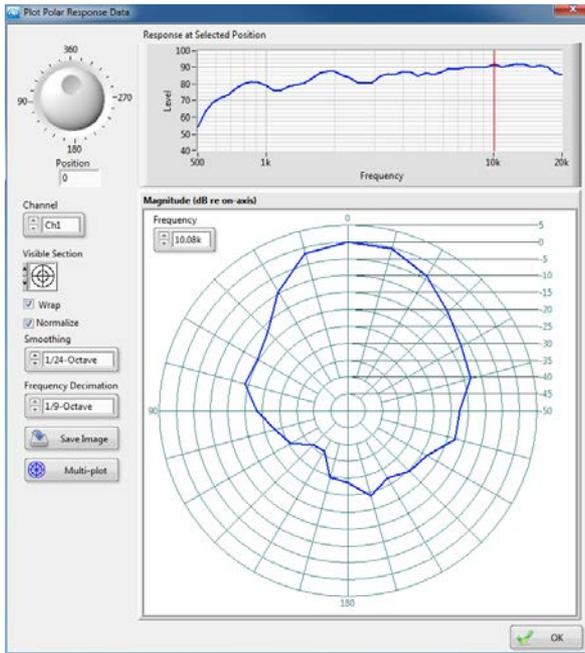
Plot XY.vi Plot Multi-X... Plot Wavefor... Radar Plot.vi Draw Legend...





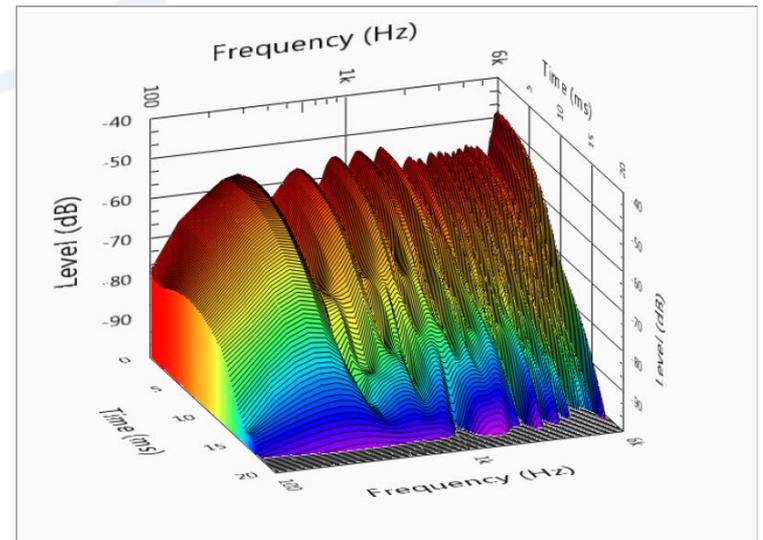


Calc Scale Sp... Draw Scale.vi Map Setup.vi Map Value t... Map Pixel to ...



APx Polar Plot Utility

APx CSD Utility



Numeric

↑ Search Customize

Add	Subtract	Multiply	Divide	Quotient & ...
Conversion	Increment	Decrement	Add Array El...	Multiply Arra...
Compound ...	Data Manipu...	Absolute Val...	Round To N...	Round Towa...
Round Towa...	Scale By Pow...	Complex	Square Root	Square
Negate	Reciprocal	Sign	Scaling	Numeric Co...
Enum Const...	Ring Constant	Random Nu...	Expression N...	Fixed-Point
DBL Numeri...	+Inf	-Inf	Machine Eps...	Math Consta...

Array

↑ Search Customize

Array Size	Index Array	Replace Subs...	Insert Into Ar...	Delete From ...
Initialize Array	Build Array	Array Subset	Max & Min	Reshape Array
Sort 1D Array	Search 1D Ar...	Split 1D Array	Reverse 1D A...	Rotate 1D Ar...
Interpolate 1...	Threshold 1...	Interleave 1D...	Decimate 1D...	Transpose 2...
Array Consta...	Array To Clu...	Cluster To Ar...	Array to Matrix	Matrix to Array

Matrix

Mathematics

↑ Search Customize

Numeric	Elementary	Linear Algebra	Fitting
Interp & Extr...	Integ & Diff	Prob & Stat	Optimization
Differential E...	Geometry	Polynomial	Script & For...

# APx LabVIEW .NET Driver

1. Why LabVIEW
2. **Driver Structure**
3. Signal Path
4. Measurements
5. Other VIs
6. Examples
7. Constructing LV Projects
8. Constructing LV VIs

The image displays a multi-level software palette. The top-level menu is titled "Functions" and includes a search bar. It is organized into several categories:

- Programming:** Contains icons for Structures, Array, Cluster, Clas..., Numeric, Boolean, String, Comparison, Timing, Dialog & Use..., File I/O, Waveform, Application..., Synchronizat..., Graphics & S..., Report Gener..., VI Analyzer, Unit Test Fra..., and GPower.
- Instrument I/O:** This category is highlighted in blue and contains:
  - Connectivity
  - Control & Simulation
  - Express
  - Addons
  - Favorites
  - User Libraries
  - Select a VI...
  - JKI Toolkits
  - OpenG

Below the main palette, three overlapping windows are shown, illustrating the hierarchy:

- Instrument I/O:** Shows sub-categories like "Instrument Drivers" and "Instr Drivers".
- Instrument Drivers:** Lists specific drivers such as "VISA", "Agilent 34401", and "APx500".
- APx500:** This window is the most detailed, showing a grid of actions for the APx500 driver:
  - VI Tree
  - Data
  - Open
  - Utility
  - Close
  - Examples
  - Configure
  - Bench
  - Action/Status

APx500 VI Tree.vi Block Diagram

File Edit View Project Operate Tools Window Help

15pt Application Font

Search

**SIGNAL PATH**  
Polymorphic Bench/Sequence  
Input - Output

- Connector Type
- Analog Balanced
- Analog Unbalanced
- Analog
- ASIO
- Bluetooth
- Digital Balanced
- Digital Unbalanced
- Digital Optical
- Digital Serial
- File Analog
- File Digital
- HDMI
- HDMI-ARC
- PDM
- S/PDIF Output Metadata
- Switchers
- Filters
- Delay

**MEASUREMENTS**  
Sequence mode  
All - Generator - Acquisition & Analysis

- Acoustic Response
- Bandpass Frequency Sweep
- Bandpass Level
- Bandpass Level Sweep
- CMRR
- CMRR-IEC
- Compare Encoded Bitstream
- Continuous Sweep
- Crosstalk Custom
- Crosstalk One Channel Driven
- Crosstalk One Channel Undriven
- CT Sweep Custom
- CT Sweep One Channel Driven
- CT Sweep One Channel Undriven
- DC Level
- DC Level (DCX)
- DC Level Sweep
- Digital Error Rate
- DIM
- DIM Level Sweep
- Dynamic Range AES17
- Frequency
- Frequency Response
- IMD
- Jitter Level Sweep
- Level and Gain
- Level Ratio
- Loudspeaker Production Test
- Maximum Output
- Maximum Output (CEA-2006) (Burst)
- Measurement Recorder
- Metadata Recorder
- Modulated Noise
- Multitone Analysis
- Nested Sweep
- Noise (RMS)
- Noise (Q-peak)
- Noise Recorder (RMS)
- PESQ
- PESQ (Averaged)
- POLQA
- POLQA (Averaged)
- PSR
- PSR Frequency Sweep
- Regulated Frequency Sweep
- Resistance (DCX)
- Signal Acquisition
- Signal Analyzer

**MISCELLANEOUS**  
Bench and/or Sequence mode

- Initialize
- Action/Status
- Data
- Utility
- Examples
- Close

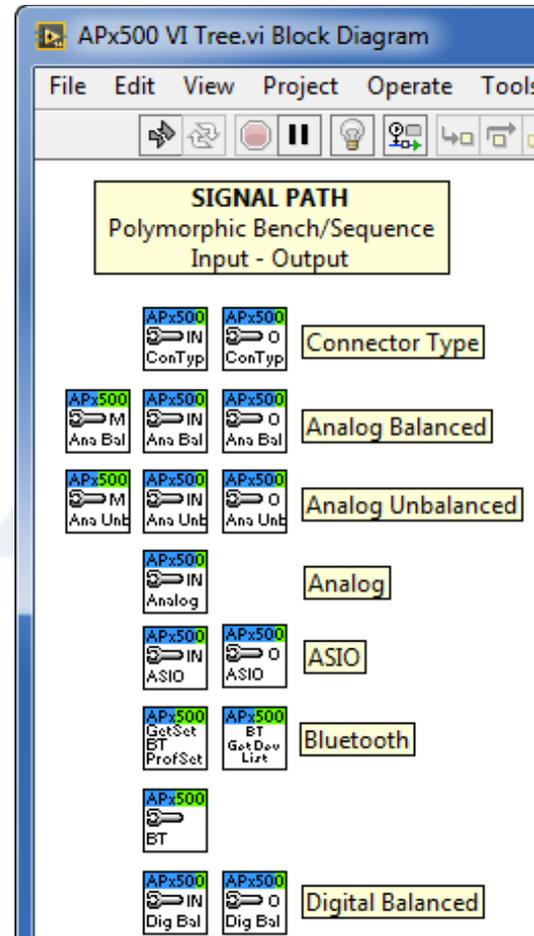
**BENCH MODE**  
(only)

- Generator/Analyzer
- Measurements
- Recorder
- Sweep
- Nested Sweep

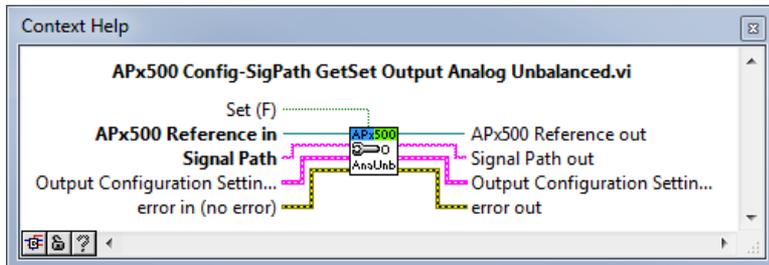
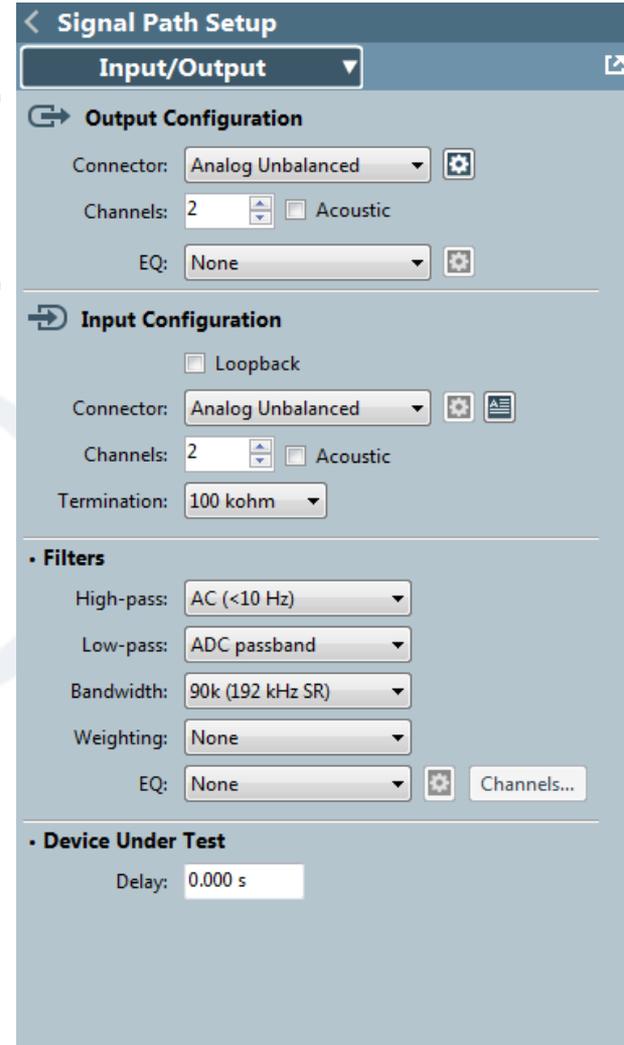
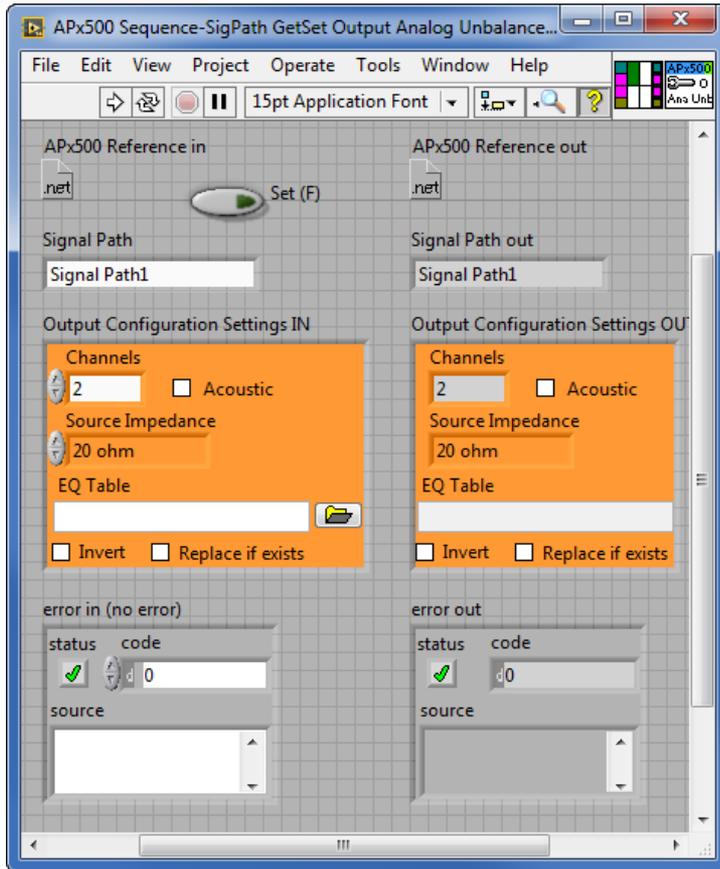
See SIGNAL PATH section for connectors, metadata, switchers, filters, and DUT delay.

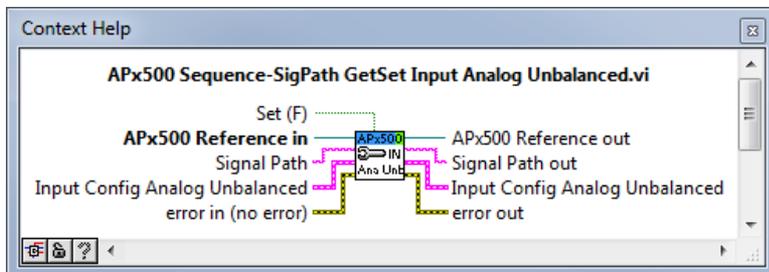
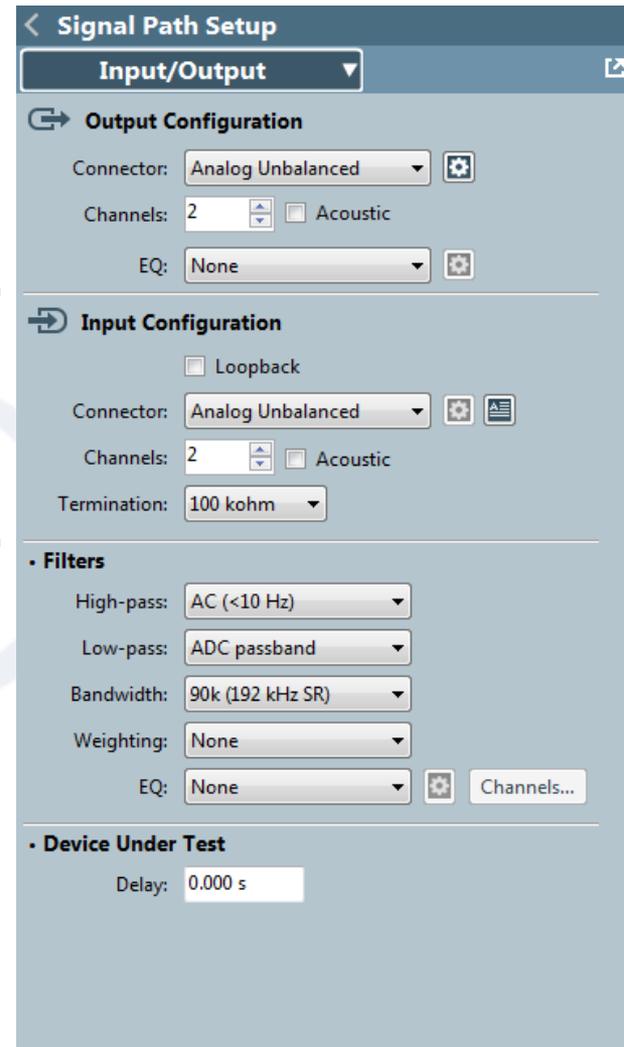
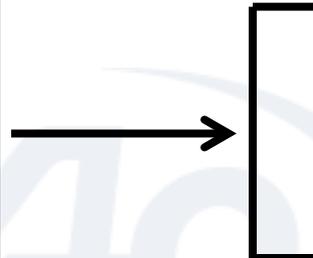
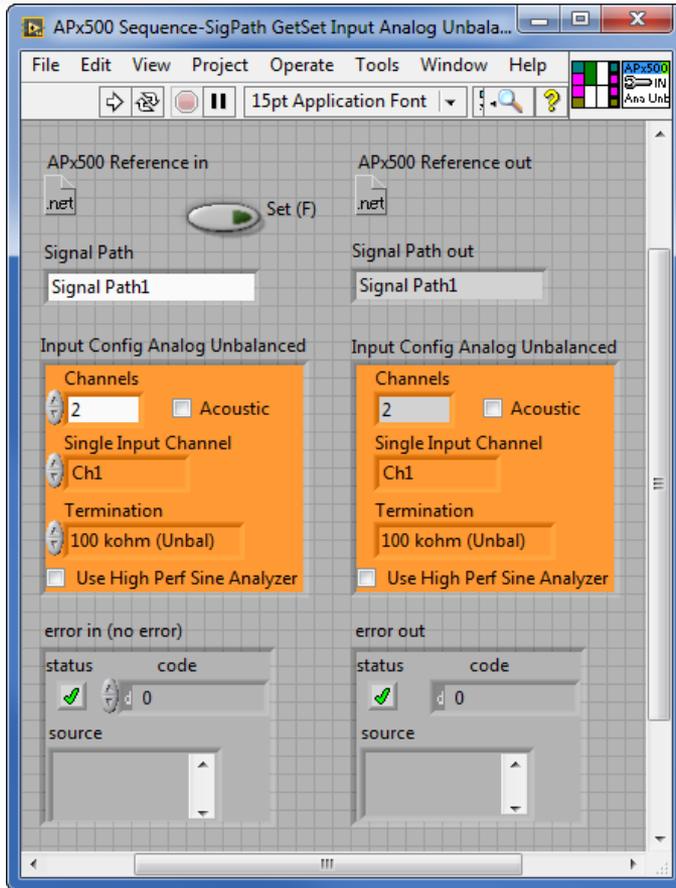
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# SPS – Output Config





APx500 Sequence-SigPath GetSet Filters Analog.vi Front Panel

File Edit View Project Operate Tools Window Help

APx500 Reference in .net Set (F) APx500 Reference out .net

Filters

High-pass Filter HP Freq (custom)  
AC 0

Low-pass Filter LP Freq (custom)  
ADC passband 0

Bandwidth  
90k (192 kHz SR)

Weighting Filter  
None

Input EQ  
EQ Table

Invert  Replace if exists

error in status code source

error out status code source

Context Help

APx500 Config-SigPath GetSet Filters Analog.vi

APx500 Reference in

APx500 Reference out

Filters

FiltersA

error in

error out

Signal Path Setup

Input/Output

Output Configuration

Connector: Analog Unbalanced

Channels: 2  Acoustic

EQ: None

Input Configuration

Loopback

Connector: Analog Unbalanced

Channels: 2  Acoustic

Termination: 100 kohm

Filters

High-pass: AC (<10 Hz)

Low-pass: ADC passband

Bandwidth: 90k (192 kHz SR)

Weighting: None

EQ: None Channels...

Device Under Test

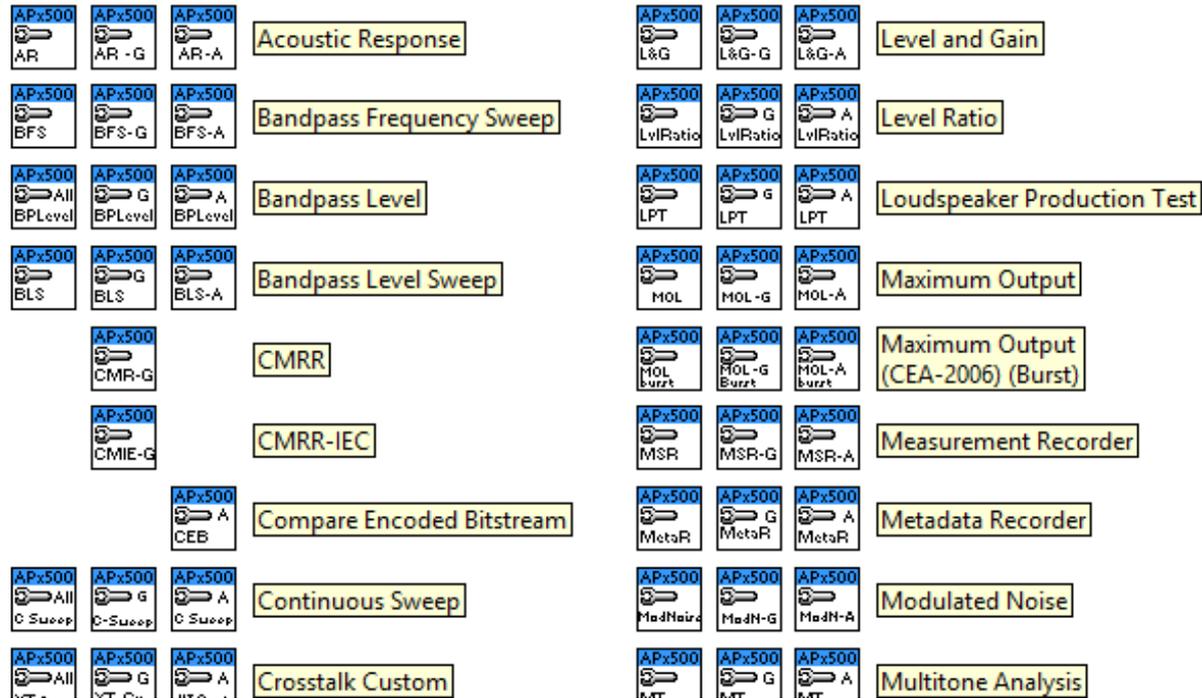
Delay: 0.000 s



# APx LabVIEW .NET Driver

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**MEASUREMENTS**  
Sequence mode  
All - Generator - Acquisition & Analysis





Context Help

**APx500 Config-Continuous Sweep GetSet Generator.vi**

error in (no error)  
status code  
source



APx500 Config-Continuous Sweep GetSet Acq&Analysis.vi Front Panel

File Edit View Project Operate Tools Window Help

15pt Application Font

APx500 Reference in (Set F) APx500 Reference out

Signal Path & Measurement in Signal Path & Measurement out

Path Name: Signal Path1

Selected measurement Index: 0

Measurements: Name, Checked, MeasurementType, SignalPathSetup

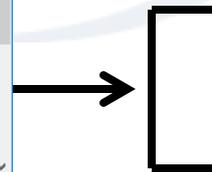
Signal AcqAnalysis Settings (Cont Sweep) in Signal AcqAnalysis Settings (Cont Sweep) out

Extend Acquisition By: 0.05

CrosstalkMode: None

error in (no error) error out

status code source



### Continuous Sweep

**Start**

Append Graph Data

**Generator**

Start Frequency: 20.0000 Hz

Stop Frequency: 20.0000 kHz

Level: 100.0 mVrms

Offset: 0.000 V

EQ: None

Edit...

Pre-Sweep: 100.0 ms

Sweep: 350.0 ms

Channel Delay: 500.0 ms

Channels: 1 2

**Analyzer**

Extend Acquisition By: 50.00 ms

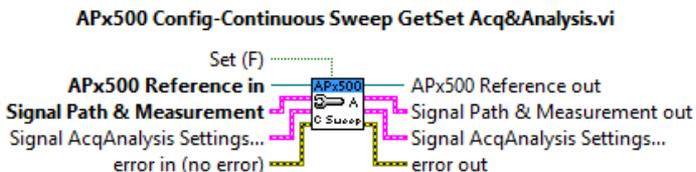
Crosstalk Mode: High speed

**Nesting**

Secondary Source: None

Advanced Settings...

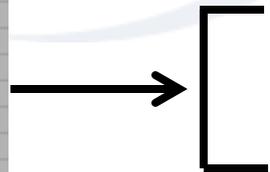
Context Help



Signal AcqAnalysis Settings (Cont Sweep) in

Extend Acquisition By: 0.05  Append

CrosstalkMode: None



< Continuous Sweep

**Start**

Append Graph Data

**• Generator**

Start Frequency: 20.0000 Hz

Stop Frequency: 20.0000 kHz

Level: 100.0 mVrms

Offset: 0.000 V

EQ: None

Edit...

Pre-Sweep: 100.0 ms

Sweep: 350.0 ms

Channel Delay: 500.0 ms

Channels: 1 2

**• Analyzer**

Extend Acquisition By: 50.00 ms

Crosstalk Mode: High speed

**• Nesting**

Secondary Source: None

Advanced Settings...

Context Help

APx500 Config-Continuous Sweep GetSet Acq&Analysis.vi

Set (F)

APx500 Reference in

APx500 Reference out

Signal Path & Measurement

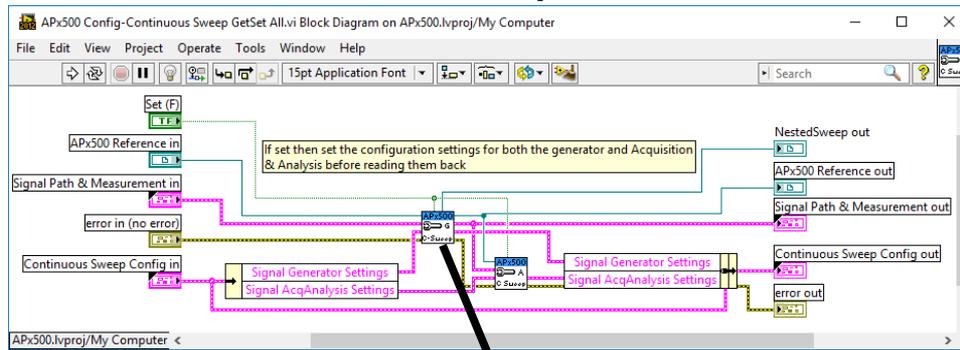
Signal Path & Measurement out

Signal AcqAnalysis Settings...

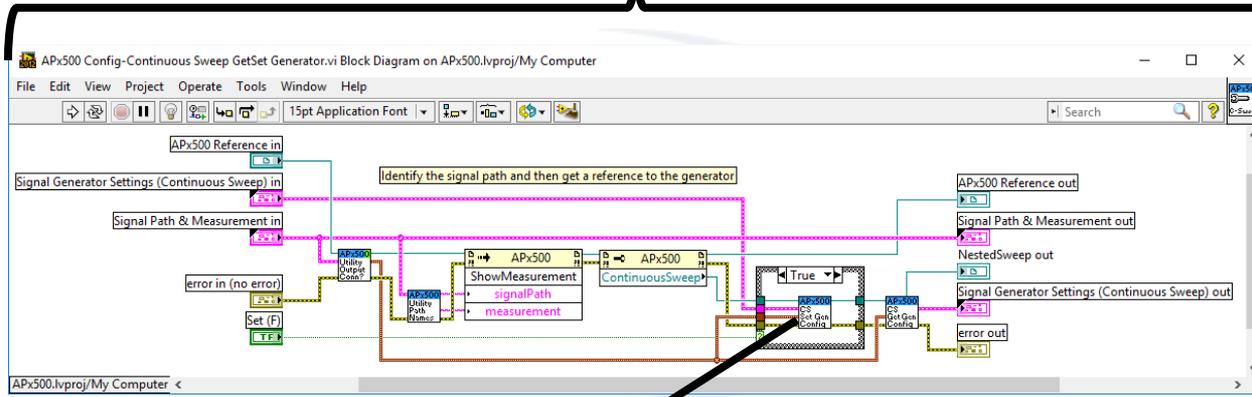
Signal AcqAnalysis Settings...

error in (no error)

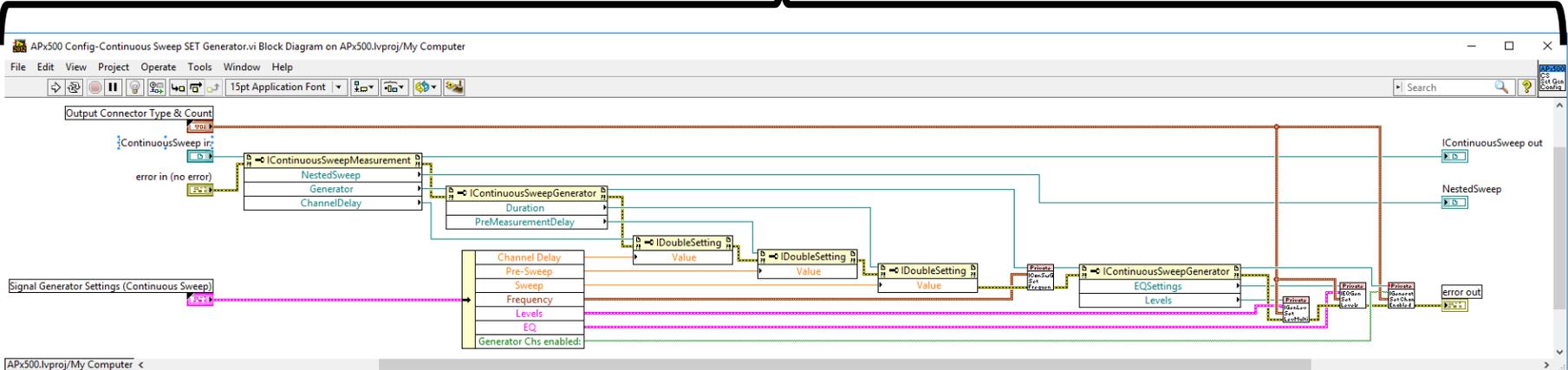
error out



## Continuous Sweep GetSet Generator



## Continuous Sweep Set Generator

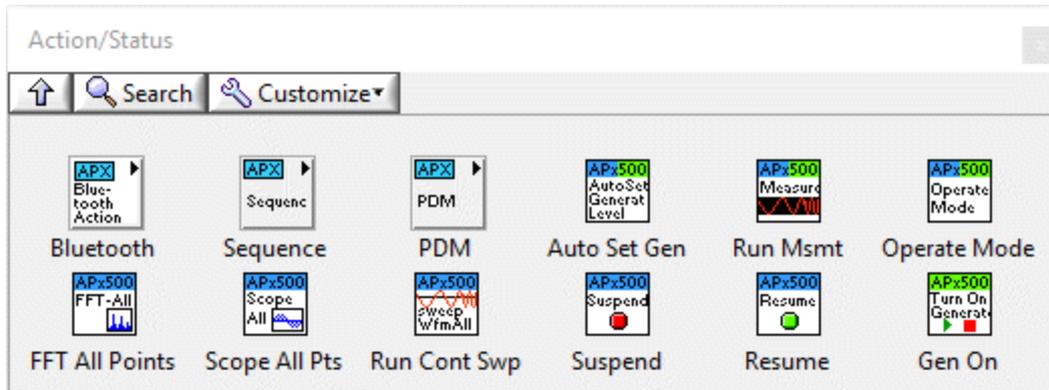


# APx LabVIEW .NET Driver

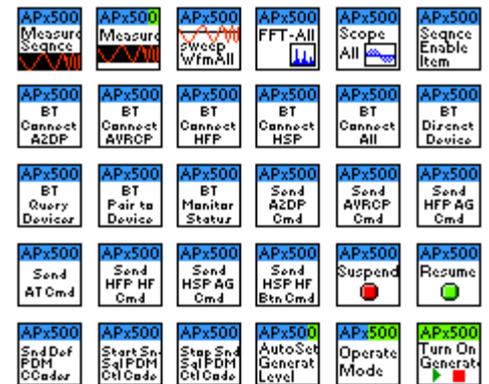
1. Why LabVIEW
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Palette:

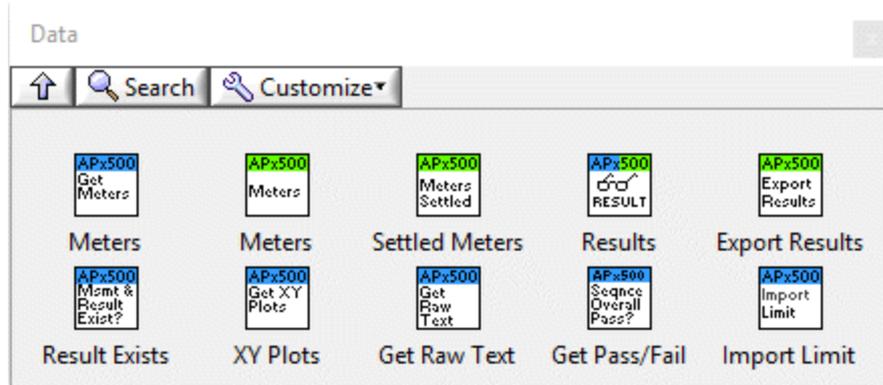
Tree:



Action/Status



Palette:



Tree:



APx500 Sequence - Get Measurement Results.vi Front Panel

File Edit View Project Operate Tools Window Help

15pt Application Font

APx500 Reference .net

APx500 Reference out .net

Signal Path & Measurement in

Signal Path & Measurement out

Path Name: Signal Path1

Selected measurement Index: 0  Path Enabled

Measurements

0 Name: \_\_\_\_\_ Checked

MeasurementType: \_\_\_\_\_

SignalPathSetup: \_\_\_\_\_

Measurement Data Set

XY Results

XY Result Name: \_\_\_\_\_

XY Unit: \_\_\_\_\_

YUnit: \_\_\_\_\_

Channel Readings

XY Values

0

Passed Upper Limit

Passed Lower Limit

XXY Results

XXY Result Name: \_\_\_\_\_

XXY Unit: \_\_\_\_\_

Left Unit: \_\_\_\_\_

Right Unit: \_\_\_\_\_

Channel Readings

XY Values Left: \_\_\_\_\_

XY Values Right: \_\_\_\_\_

0

Passed Upper Limit

Passed Lower Limit

Meter Results

Meter Result Name: \_\_\_\_\_

MeterUnit: \_\_\_\_\_

Readings

Value: \_\_\_\_\_

0

Passed Upper Limit

Passed Lower Limit

Raw Text Results

Raw Text Result Name: \_\_\_\_\_

Text Results Array

0

0

Thiele Small Results

T/S Result Name: \_\_\_\_\_

Readings

Parameter: \_\_\_\_\_

Unit: \_\_\_\_\_

Value: \_\_\_\_\_

0

Passed Upper Limit

Passed Lower Limit

error in (no error)

status code: 0

source: \_\_\_\_\_

error out

status code: 0

source: \_\_\_\_\_

APx500 Bench - Get Measurement Results.vi Front Panel

File Edit View Project Operate Tools Window Help

15pt Application Font

APx500 RESULT

APx500 Reference in .net

APx500 Reference out .net

BenchTestFunction Sweep

Bench Measurement Data Set

**XY Results**

0

XY Result Name   Passed Upper Limit

XUnit   Passed Lower Limit

YUnit

Channel Readings

0

XY Values

4 Y 0

X 0

Passed Upper Limit

Passed Lower Limit

**Meter Results**

0

Meter Result Name   All Passed Upper Limit

MeterUnit   All Passed Lower Limit

Readings

0

Value

0

Passed Upper Limit

Passed Lower Limit

error in (no error)

status  code 0

source

error out

status  code 0

source

## Palette:

Utility

↑ Search Customize

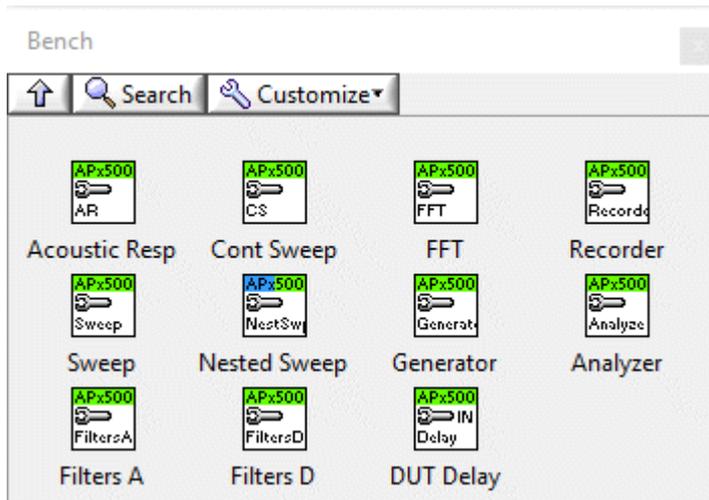
Utility Get SigPath	Utility Signal& Meas	Utility Parse SP&M	Utility SP&M Index	Utility Str > SP&M	Utility Active SP&M
Get Sig Paths	Sel Path Info	Parse Sig Path	SP&M Index	Strings>SP&M	Active Msmt
Utility Path Names	Utility Add Sig Path	Utility Add Meas	Utility Get Meas Checked	Utility Set Meas Checked	Utility Find MsNam
SP&M> Strings	Add Sig Path	Add Meas	Get Checked	Set Checked	Find Msmt
Utility Search Wave Name	Utility Get wav Scale Factors	Utility Load wav	Utility Exp MT Wav	Utility Get MT Def	Utility Exp MT Def
Wav Name	Wav Scale Fact	Load wav	Exp MT Wav	Get MT Def	Exp MT Def
Utility Export Sig Def	Utility Export Sig Wav	Utility IO Conn?	Utility Input Labels	Utility Channel Col...	Utility Channel Col...
Ex Sig Def	Ex wav	IO Connector?	Input Labels	Channel Col...	Channel Col...
Utility Get	Utility Load	Utility GetSet REFS	Utility GetSet Rep	Utility Aux Ctl Out	Utility Aux Ctl In
Get Proj Name	Open Proj File	Ref Levels	Report?	Aux Ctl Out	Aux Ctl In
Utility GetSet Audible Monitor	Utility Signal Monit...	Utility Check Attachd ProjItem	Utility Delete MsRec Wav	Utility Delete wav if found	Utility APx Error
Audible Mon	Signal Monit...	Attached Item	Del MR Wave	Del Proj Wave	APx Error
Utility Version OK?	Utility Version OK?	Utility APx Visible?	Utility Util Get Set UserVar	Utility Util Get All Variable	Utility Util Get Set Sequenc
APx Running?	APx Version?	APx Visible?	User Variables	All Variables	Sequence

## Tree:

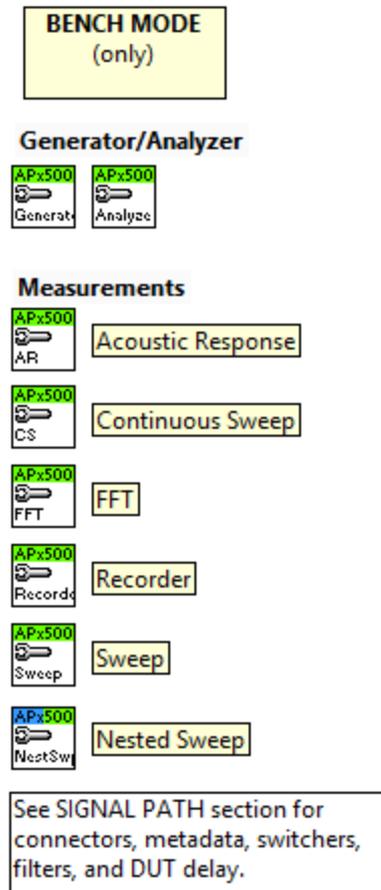
Utility

Utility Get SigPath	Utility Signal& Meas	Utility Parse SP&M	Utility SP&M Index	Utility Str > SP&M	Utility Active SP&M
Utility Path Names	Utility Add Sig Path	Utility Add Meas	Utility Get Meas Checked	Utility Set Meas Checked	Utility Find MsNam
Utility Search Wave Name	Utility Get wav Scale Factors	Utility Load wav	Utility Exp MT Wav	Utility Get MT Def	Utility Exp MT Def
Utility Export Sig Def	Utility Export Sig Wav	Utility IO Conn?	Utility Input Labels	Utility Channel Col...	Utility Channel Col...
Utility Get	Utility Load	Utility GetSet REFS	Utility GetSet Rep	Utility Aux Ctl Out	Utility Aux Ctl In
Utility GetSet Audible Monitor	Utility Signal Monit...	Utility Check Attachd ProjItem	Utility Delete MsRec Wav	Utility Delete wav if found	Utility APx Error
Utility Version OK?	Utility Version OK?	Utility APx Visible?	Utility Util Get Set UserVar	Utility Util Get All Variable	Utility Util Get Set Sequenc

## Palette:



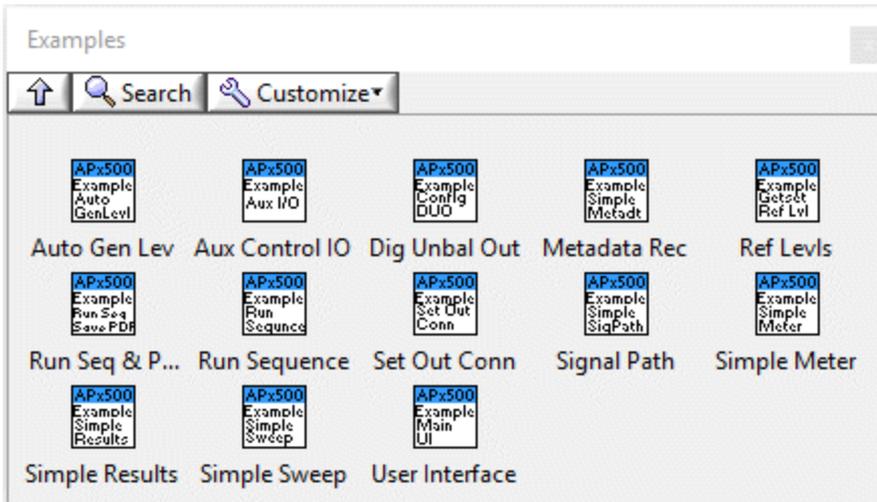
## Tree:



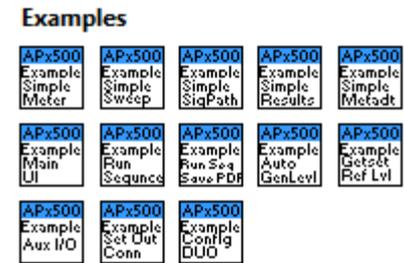
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Palette:



Tree:



APx500 Example - Reference Levels Au...

File Edit View Project Operate Tools Window

15pt Application Font

Regulation Configuration

Regulate

GeneratorLevel

To

Minimum

Target Value

Target Unit

2

On

HighestMeasuredValue

Channel

Ch1

Send Values to APx

Get Values from APx

Auto Gen Level Button

Set Generator Level

Clear error

stop

STOP

Adjust

RmsLevel

Start Value

Start Unit

1

Stop Value

Stop Unit

2

Initial Steps

1

ToleranceType

Auto

Abs Tol Value

Abs Tol Unit

0

Rel Tol Value

Rel Tol Unit

0

APx500.lvproj/My Computer

APx500 Example - Aux Control ...

File Edit View Project Operate Tools W

15pt Applica

APx500 Example Aux I/O

APx500 Example to illustrate setting the Aux Control Out port and reading the Aux Control In port. To use this VI, select the Aux Control monitor view in the APx500 application. To set the Aux Control Out bits, click on one of the buttons in the Aux Control Out control, or change the value of the Hex Out control. Each time the Aux Control Out value is changed, the VI reads the Aux Control In port.

To see the Aux Control In values change, you can simply loop the Aux Control Out connector back to the Aux Control in connector using a straight-through DB9 cable

Aux Control Out

Hex Out:

0 0 0 0 0 0 0 0

Aux Control In

Hex In:

0

APx500.lvproj/My Computer

APx500 Example - Configure Digital Unbalanced Outp...

File Edit View Project Operate Tools Window Help

15pt Application Font

APx500 Example Config DUO

Signal Path

Signal Path1

Output Config Digital Unbalanced

Note: Channels fixed at 2

Sample Rate

SR Units

48.0000k

Hz

Scale Freq By

OutputSampleRate

Fixed Rate

48000

Bit Depth

24

Enable Dither (T)

Output Mode Professional (F)

Set

stop

STOP

APx500.lvproj/My Computer

APx500 Example to illustrate configuring the Digital Unbalanced Output Connector Settings (accessed from the Settings... button in the Output Configuration box of the Signal Path Setup in APx).

Each time the Set button is clicked, the VI Sets the configuration settings in the APX application accordingly. If an error is thrown, it displays the Simple Error Dialog, clears the error and then Gets the configuration settings.

APx500 Example - Set Output Connector Type.vi ...

File Edit View Project Operate Tools Window Help

15pt Application Font

APx500 Example Set Out Conn

Signal Path

Signal Path1

Output Connector Type in

AnalogUnbalanced

Set

stop

STOP

APx500.lvproj/My Computer

APx500 Example to illustrate setting the Output Connector Type. Each time the value of the Output Connector Type is changed, the VI sets the Output Connector in the APX application accordingly. If an error is thrown (e.g., if a Connector Type that does not exist in the instrument is selected), it displays the Simple Error Dialog, clears the error and then Gets the Output ConnectorType.

# APx LabVIEW .NET Driver

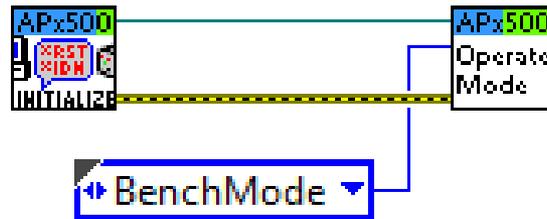
1. Why LabVIEW
2. Driver Structure
3. Signal Path
4. Measurements
5. Other VIs
6. Examples
7. **Constructing LV Projects**
8. Constructing LV VIs



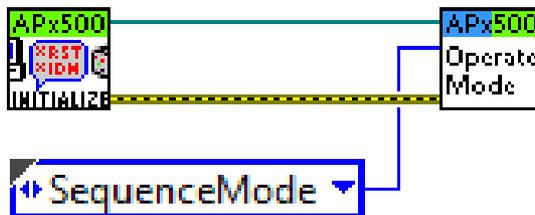
Sequence mode



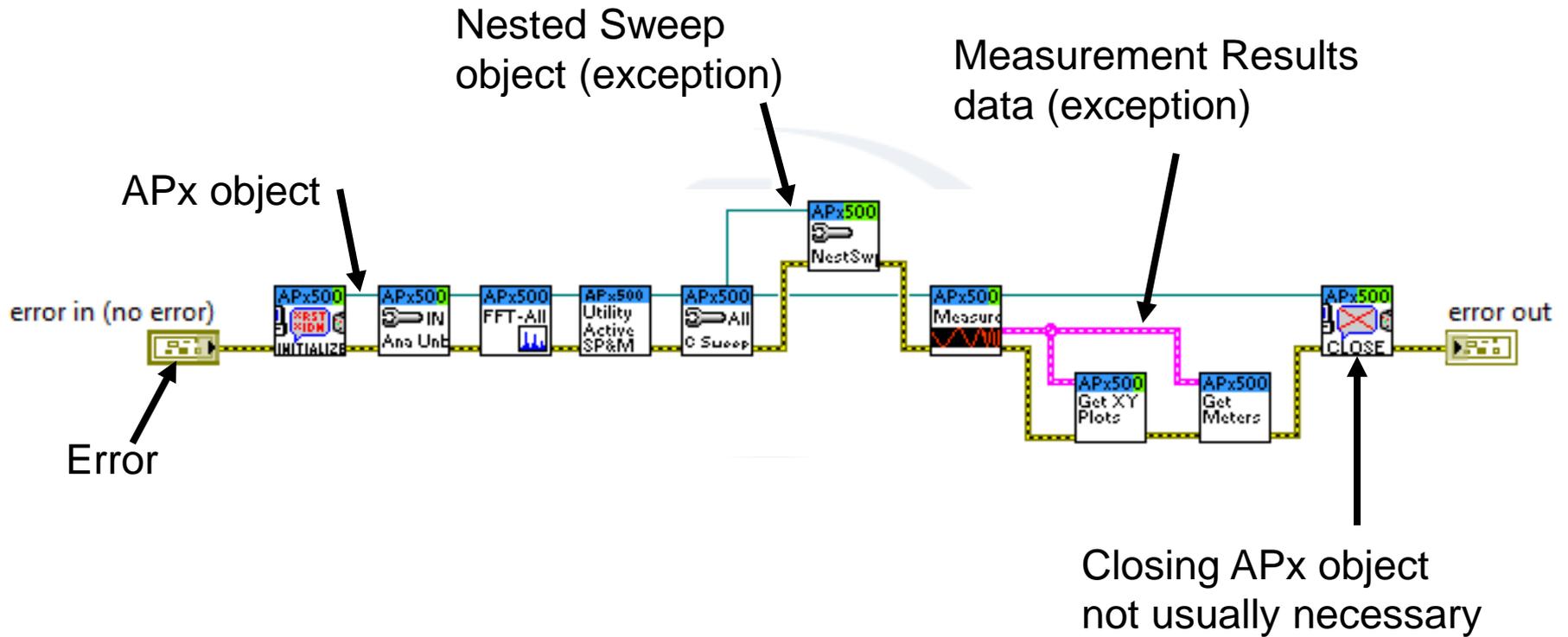
Bench mode



Sequence mode,  
switch to Bench mode



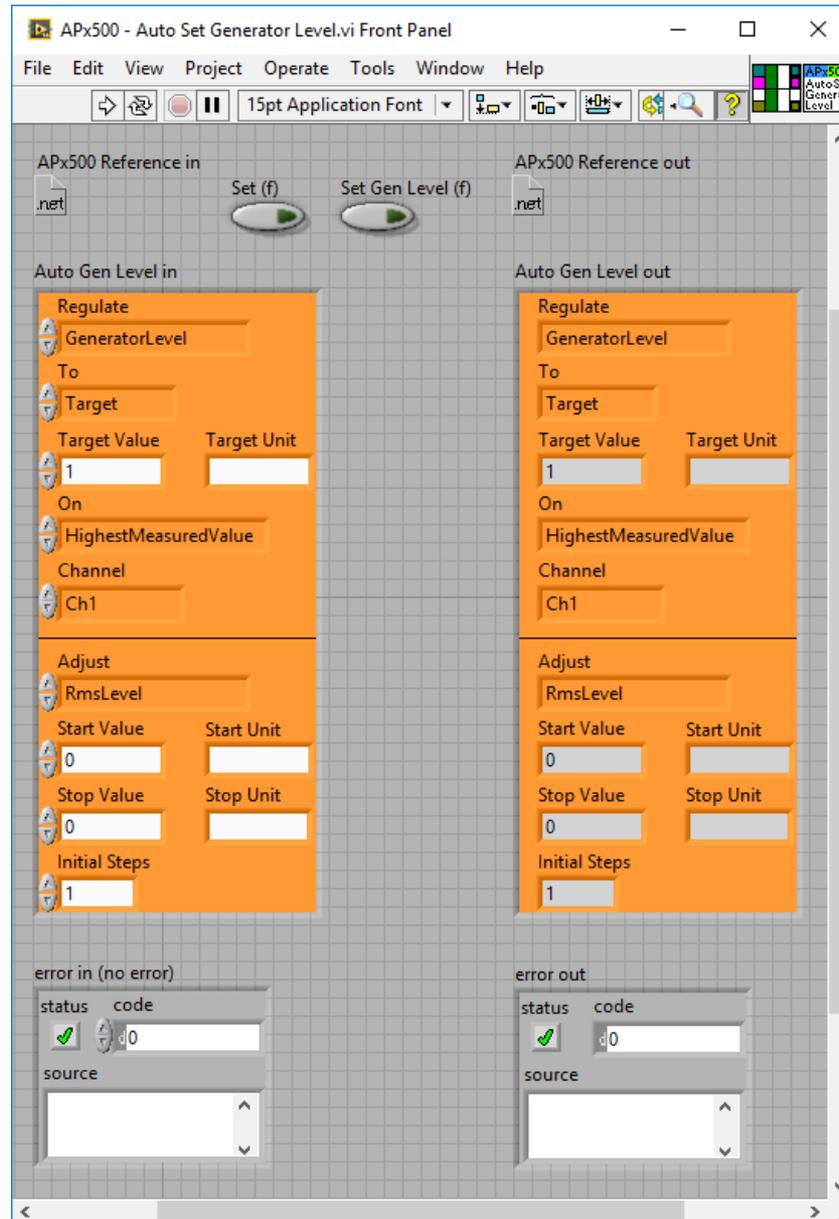
Bench mode, switch  
to Sequence mode



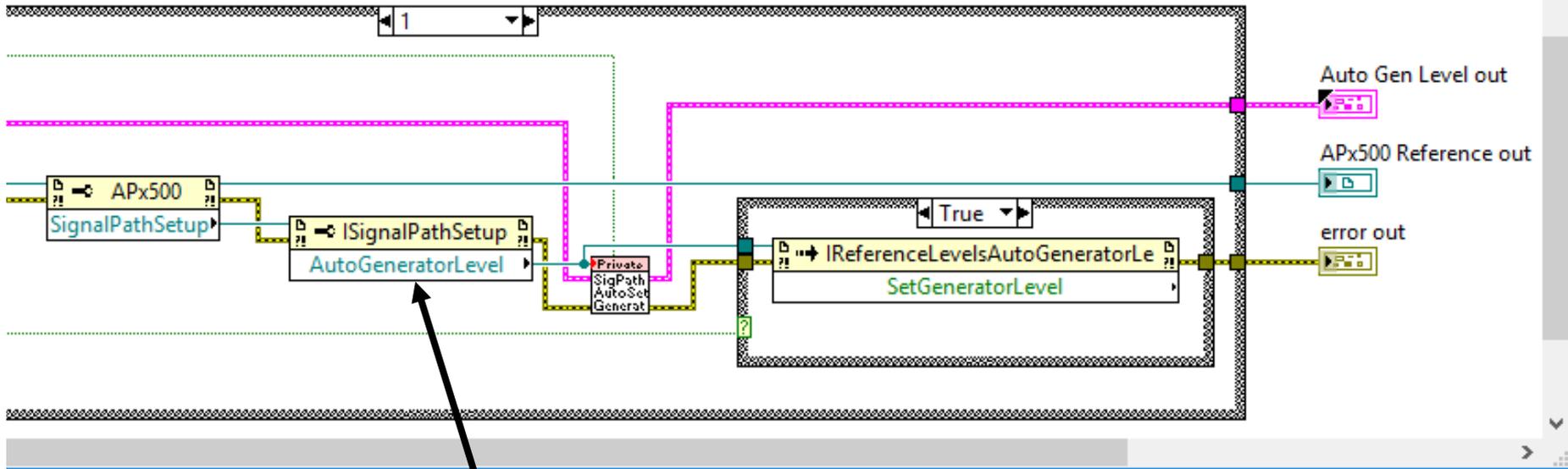
# APx LabVIEW .NET Driver

1. Why LabVIEW
2. Driver Structure
3. Signal Path
4. Measurements
5. Other VIs
6. Examples
7. Constructing LV Projects
8. **Constructing LV VIs**

# VI Structure – Auto Set Gen Panel



# VI Structure – Auto Set Gen Block



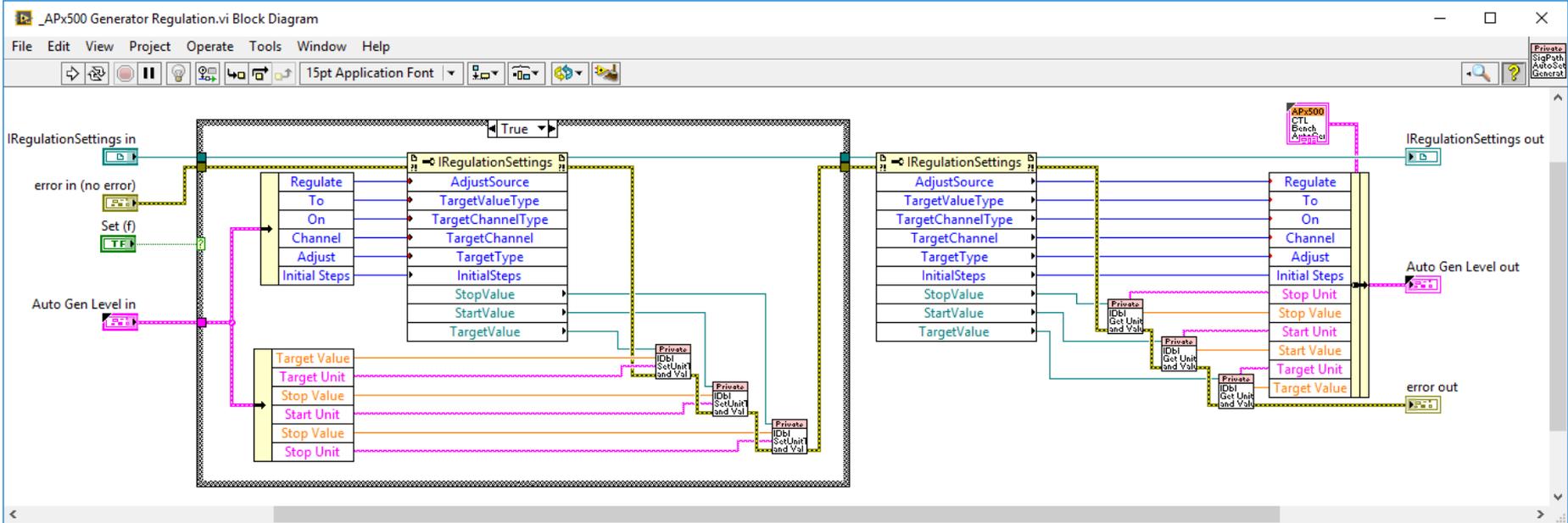
Asio

**AutoGeneratorLevel**

- AbsoluteTolerance
- AdjustSource
- InitialSteps
- MaximumGeneratorAmplitude

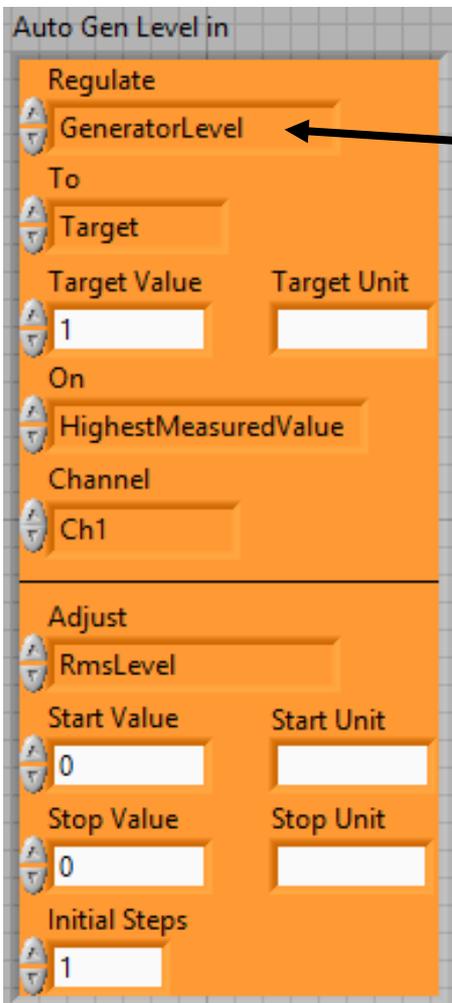
Sample Code: `APx.SignalPathSetup.AutoGeneratorLevel`

APx API Browser

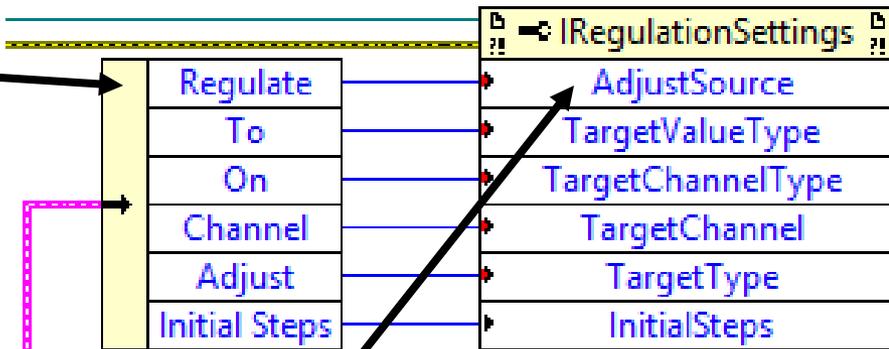


# VI Structure – Write Settings

Front panel control cluster



Unbundle cluster .NET property node (write)



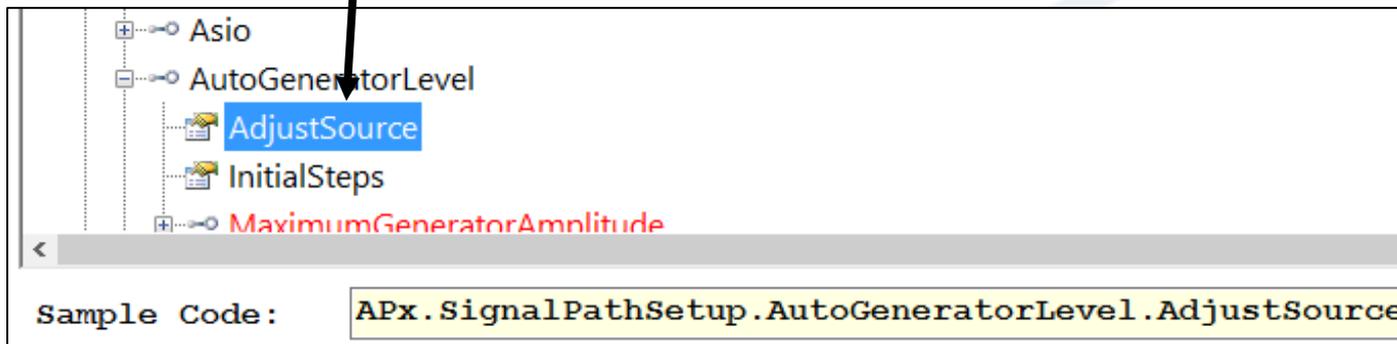
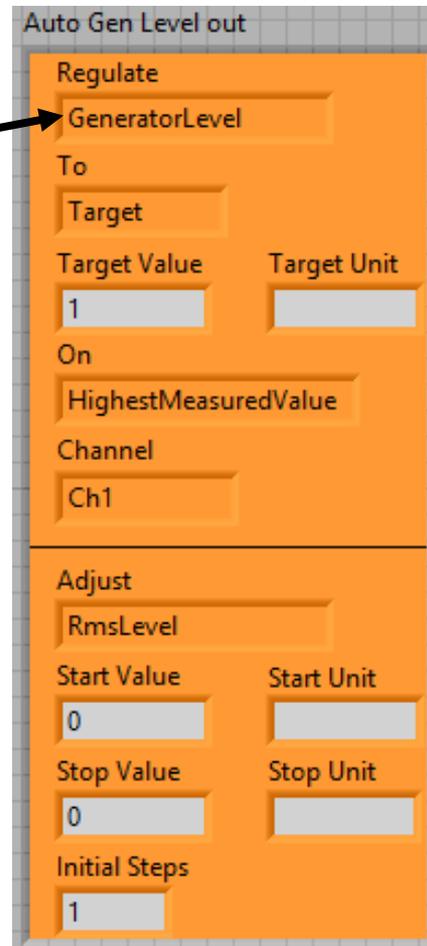
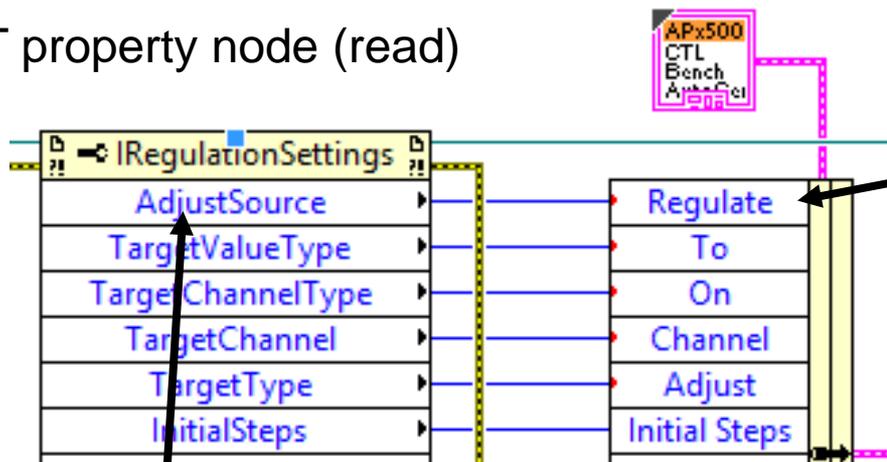
APx API Browser

# VI Structure – Read Settings

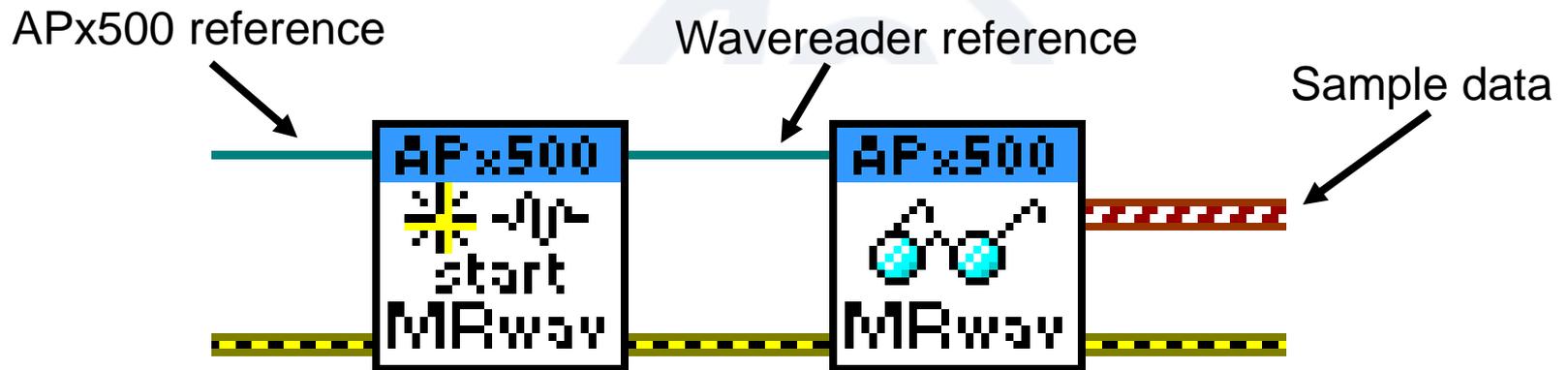
Front panel indicator cluster

Unbundle cluster

.NET property node (read)



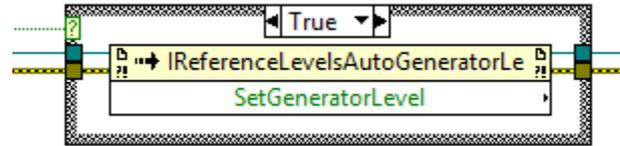
APx API Browser



Front panel control



.NET invoke node (method)



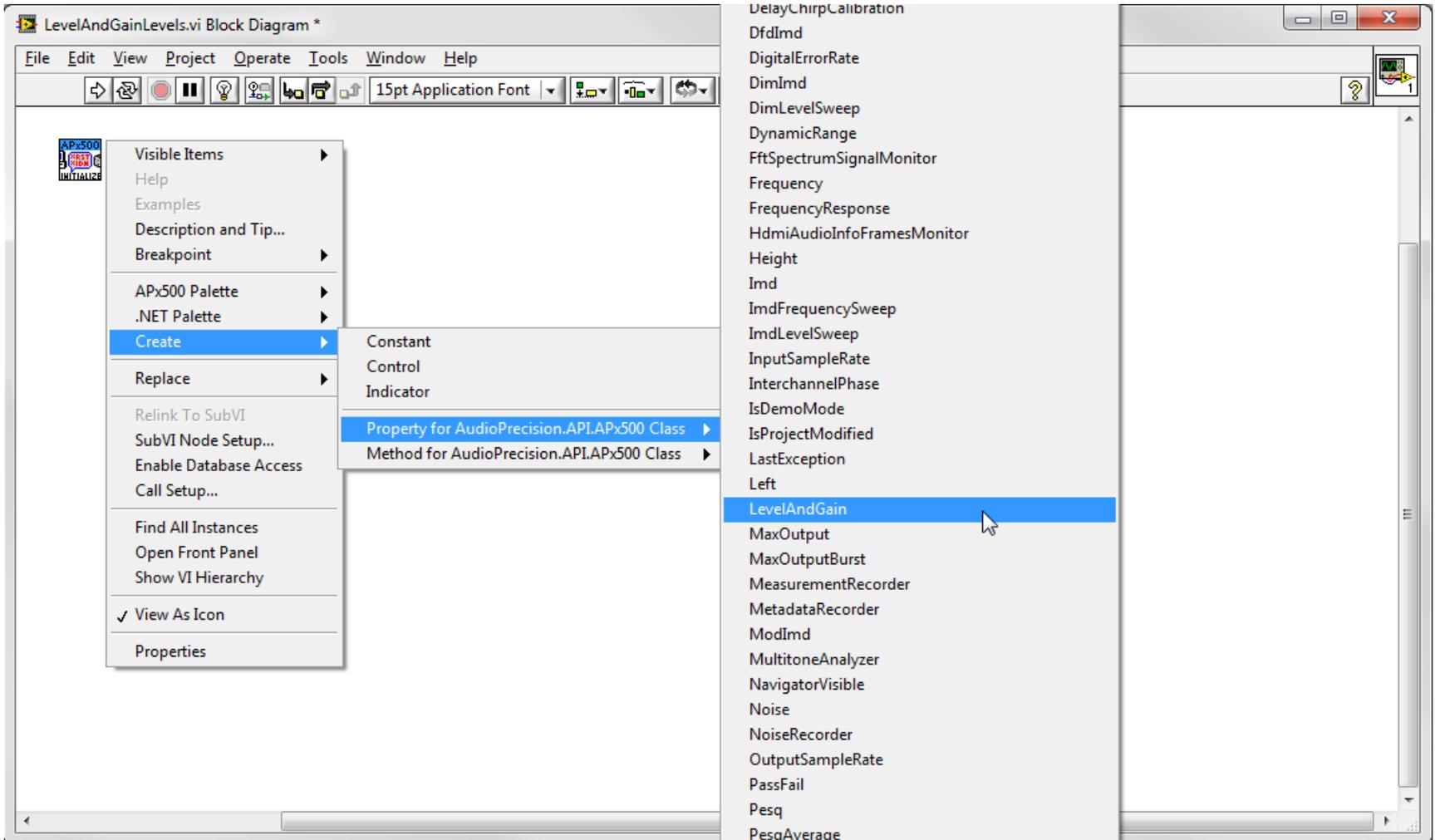
Asio

- AutoGeneratorLevel
  - AdjustSource
  - InitialSteps
  - MaximumGeneratorAmplitude
  - MeasuredChannel
  - MeasureWorstChannel
  - SetGeneratorLevel()**
  - SourceMaxValue

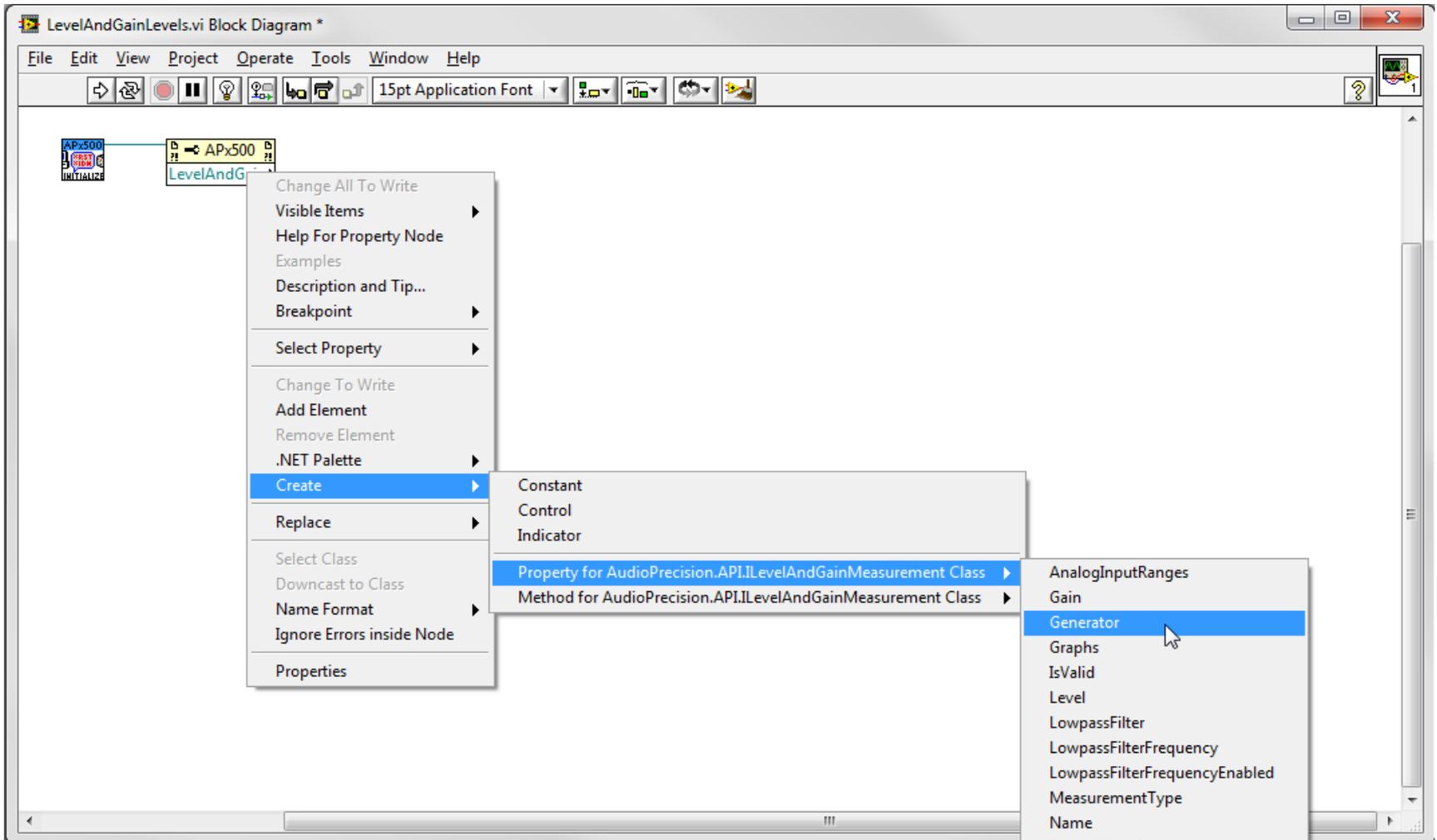
Sample Code: `APx.SignalPathSetup.AutoGeneratorLevel.SetGeneratorLevel()`

APx API Browser

# Adding Properties and Methods



# Adding Properties and Methods



# Adding Properties and Methods

LevelAndGainLevels.vi Block Diagram \*

File Edit View Project Operate Tools Window Help

15pt Application Font

The block diagram shows the following components and connections:

- APx500** (Initializes) is connected to **LevelAndGain**.
- LevelAndGain** is connected to **ILevelAndGainMeasurement Generator**.
- ILevelAndGainMeasurement Generator** is connected to **ILevelAndGainGenerator AnalogLevels**.

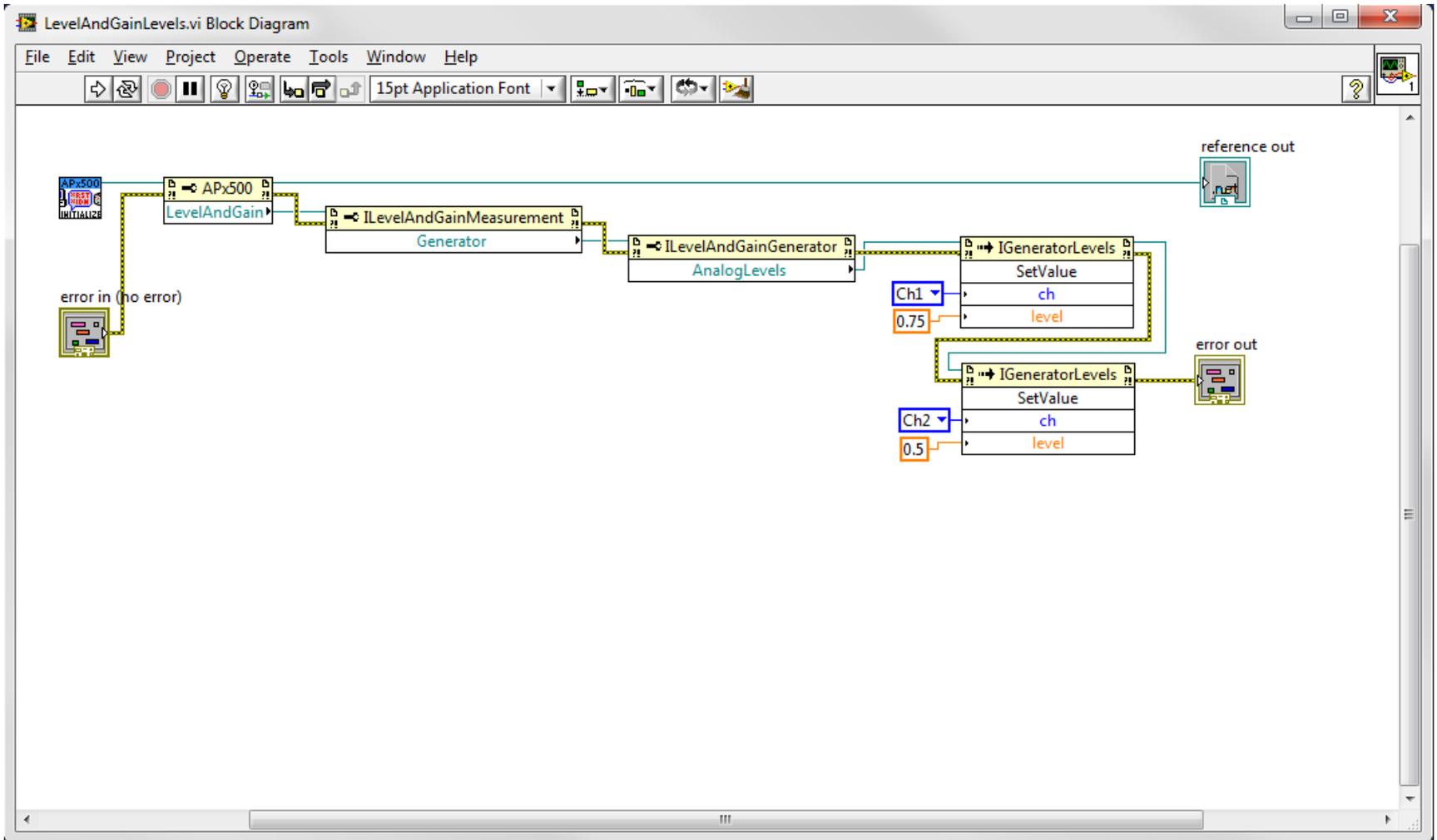
The context menu for **ILevelAndGainGenerator AnalogLevels** includes the following options:

- Change All To Write
- Visible Items
- Help For Property Node
- Examples
- Description and Tip...
- Breakpoint
- Select Property
- Change To Write
- Add Element
- Remove Element
- .NET Palette
- Create**
  - Constant
  - Control
  - Indicator
  - Property for AudioPrecision.API.IGeneratorL
  - Method for AudioPrecision.API.IGeneratorL**
- Replace
- Select Class
- Remove the Class

The 'Create' submenu also lists the following methods:

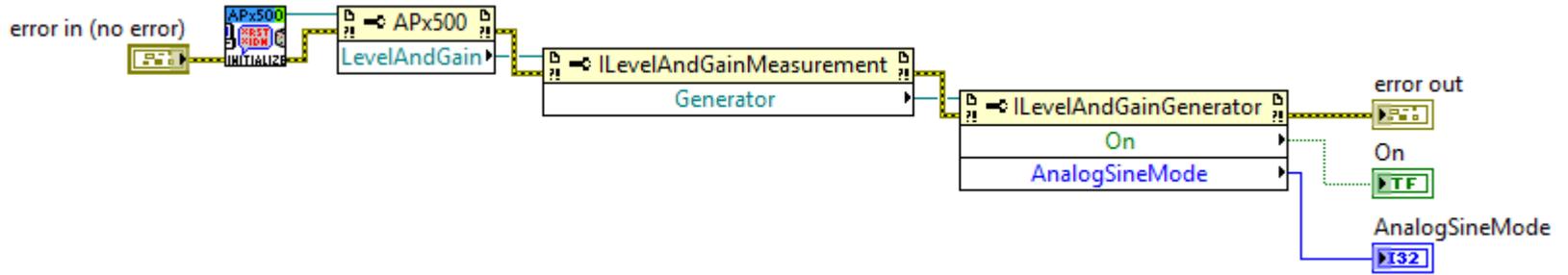
- GetOffsetText(OutputChannelIndex ch)
- GetOffsetText(OutputChannelIndex ch, String unit)
- GetOffsetValue(OutputChannelIndex ch)
- GetOffsetValue(OutputChannelIndex ch, String unit)
- GetText(OutputChannelIndex ch)
- GetText(OutputChannelIndex ch, String unit)
- GetValue(OutputChannelIndex ch)
- GetValue(OutputChannelIndex ch, String unit)

# Adding Properties and Methods

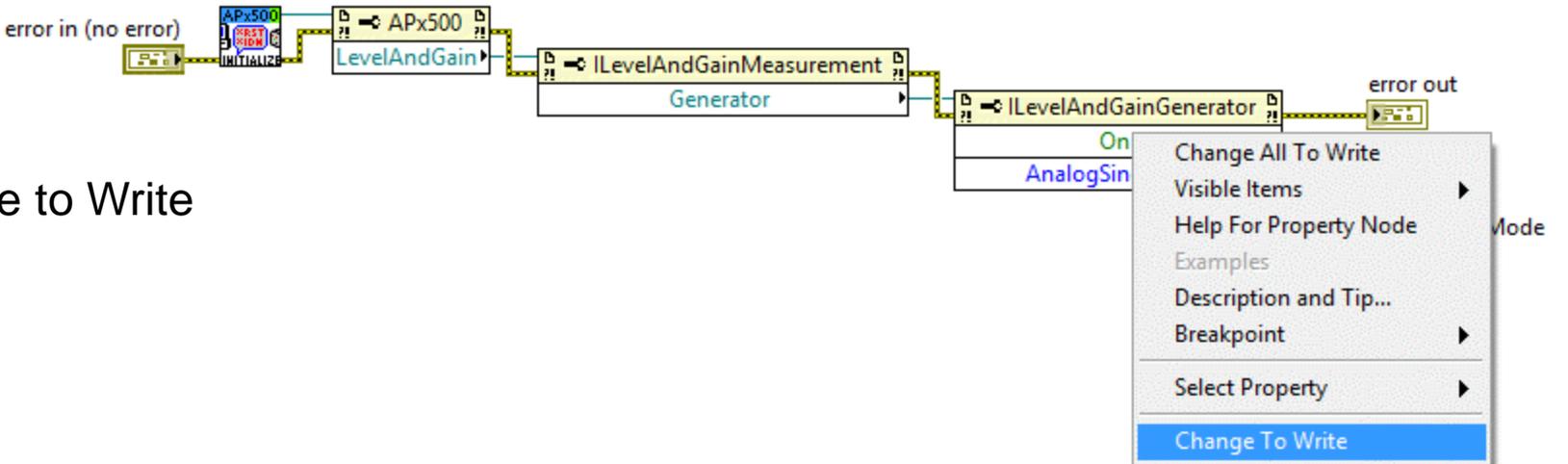


# Changing Property from Read to Write

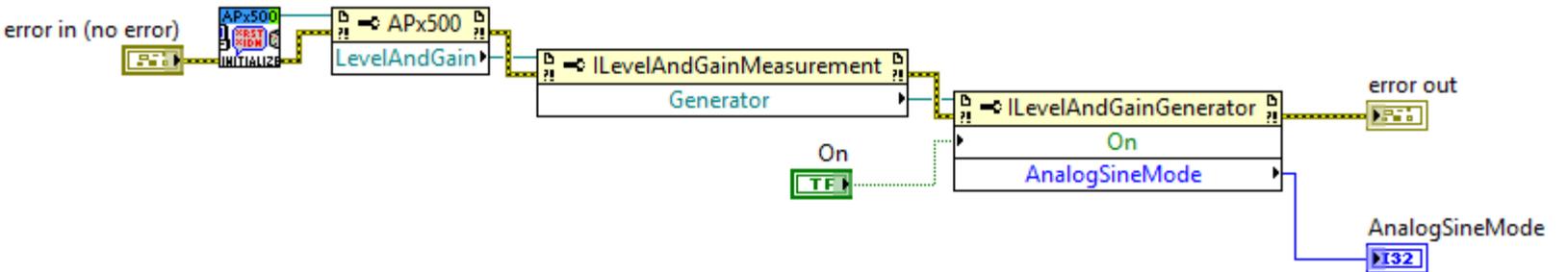
Read



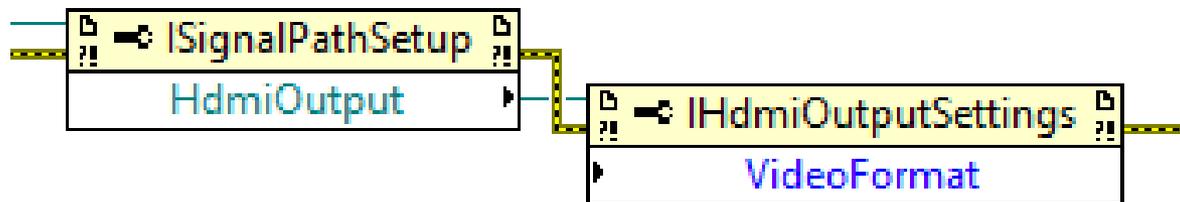
Change to Write



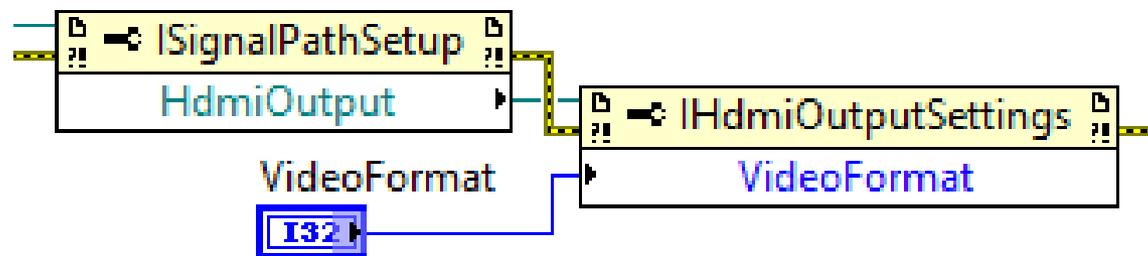
Write



Add the property.

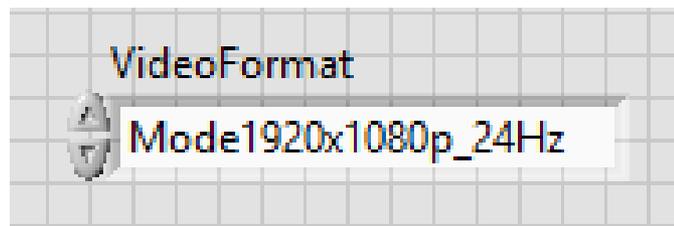


Add a control.



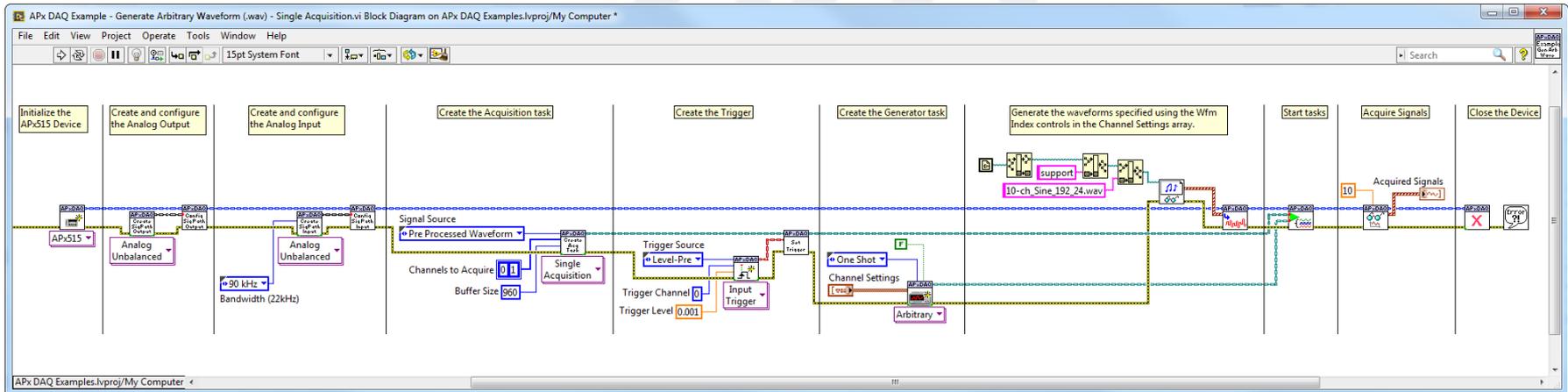
Replace the Ring with an Enum.

Save as a Type Def if desired.

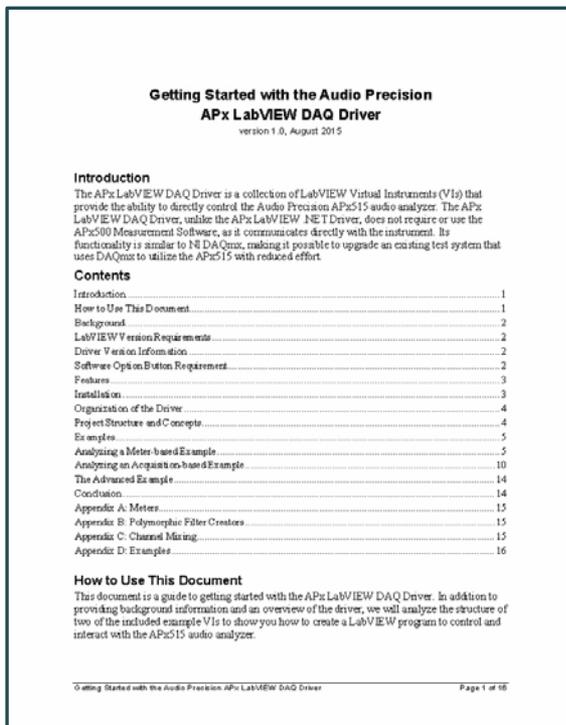
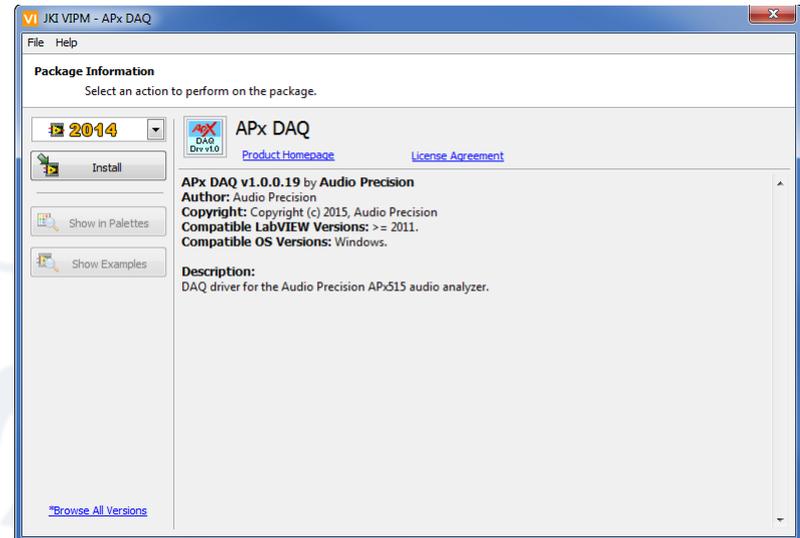


# APx LabVIEW DAQ Driver

- **LabVIEW Data Acquisition (DAQ) Driver for the APx515 Audio Analyzer**
- **Similar to NI DAQmx™**
  - Easy conversion of LabVIEW VIs from DAQmx

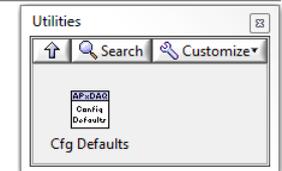
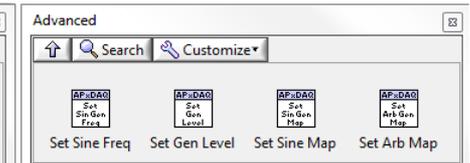
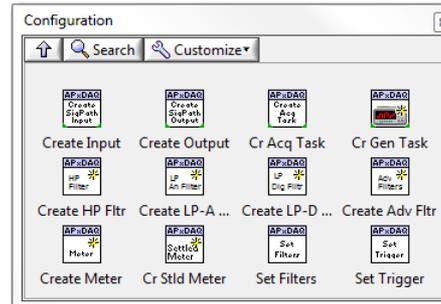
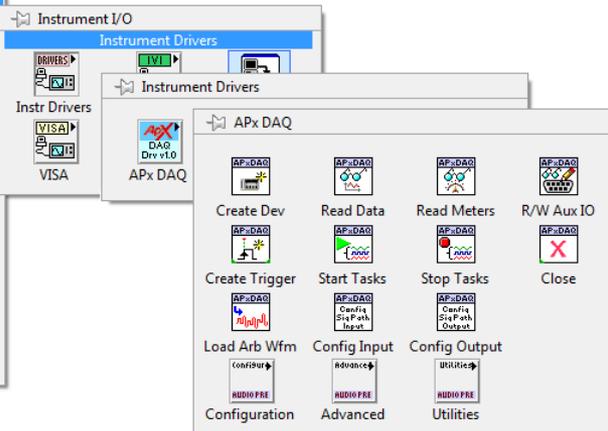
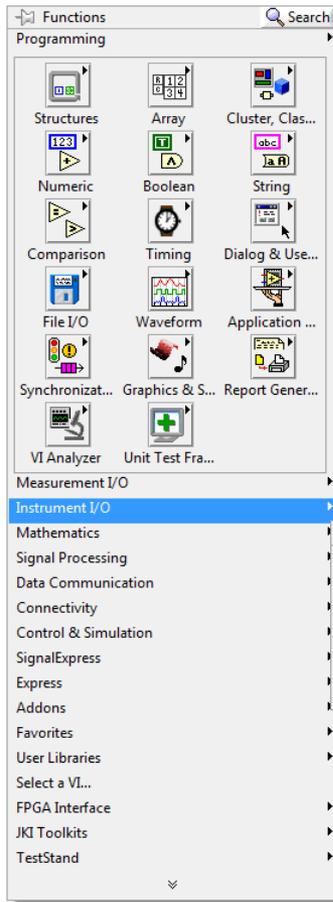


- **DAQ Driver package available for download from AP.com includes:**
  - VI Package file
  - User Guide

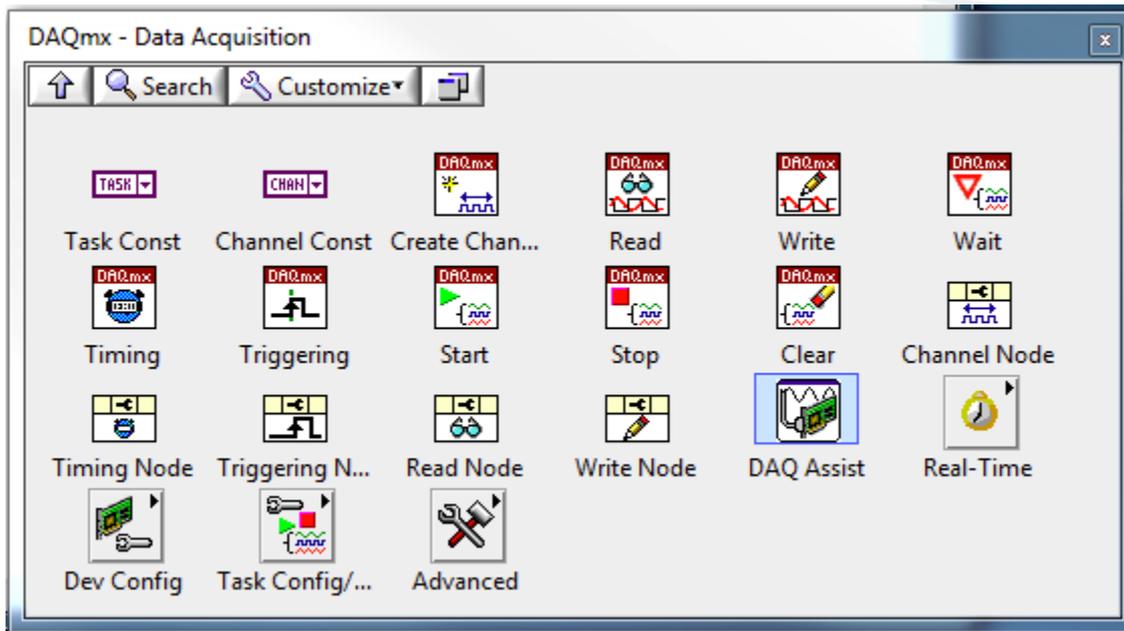


- **Uses VI Package Manager from JKI**
  - Free download
- **Can be installed in LabVIEW 2012 or later.**

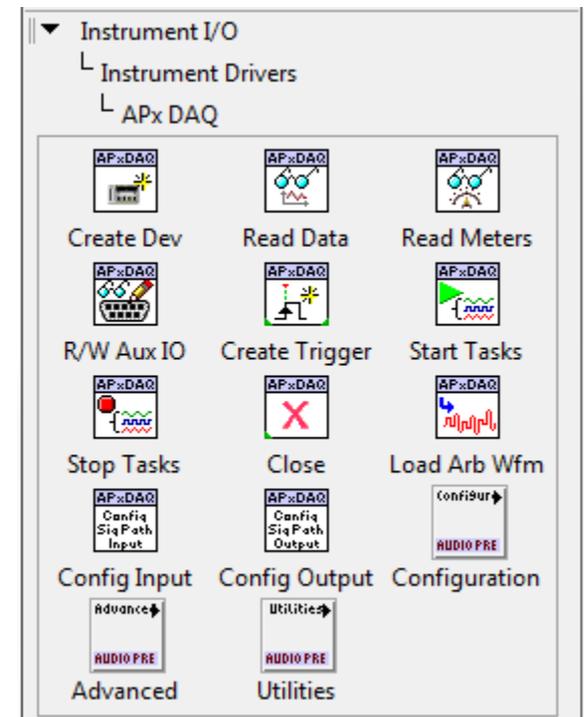
- Installs a set of menu palettes on the Instrument Drivers palette, under Instrument I/O



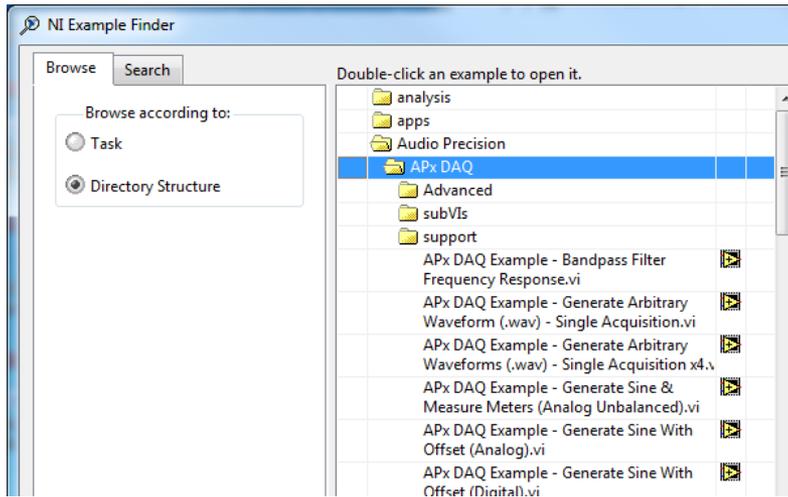
## NI-DAQmx



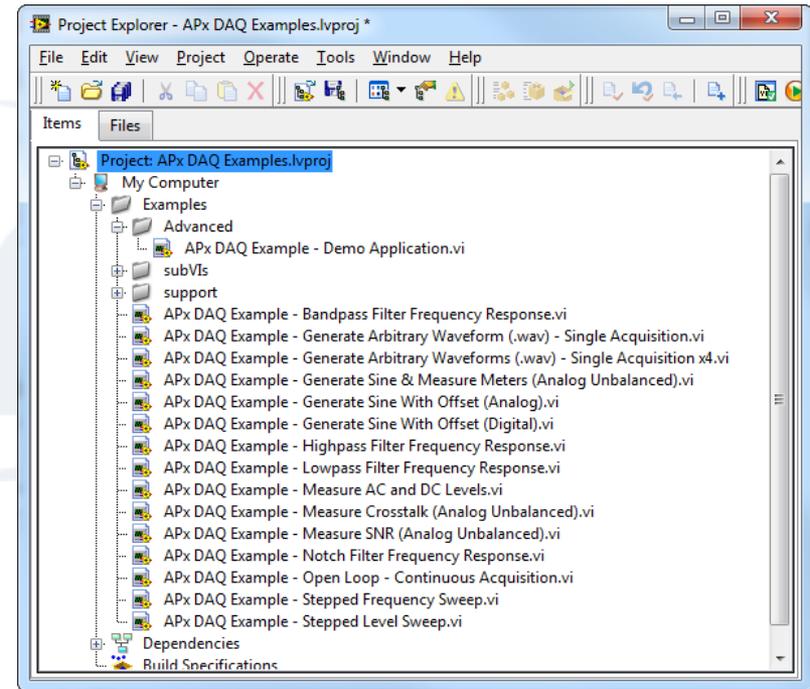
## APx DAQ



## NI Example Finder



## Examples Project



## **All Instrument Drivers have:**

- **Arbitrary Waveform Generator**
- **Waveform Acquisition**
- **LabVIEW waveform data type**

- **Built-in sine wave generator**

- 2 independent channels
- Dither (optional)

- **Input Filters**

- High Pass
- Low Pass
  - Butterworth & Elliptic
  - User specified corner frequencies
- Weighting Filters
  - A, B, C, CCIR, C-Message, ... etc.

- **Built-in meters for audio metrics**

- RMS Level
- Peak Level
- DC Level
- Frequency
- Phase
- THD+N Ratio
- THD+N Level
- SINAD
- Bandpass Level
- DC Level
- Input Sample Rate

## Generator Performance

- Sine Frequency Range: 2 Hz to 80.1 kHz
- Frequency Accuracy: 3 ppm
- Maximum Amplitude (balanced): 16.00 Vrms
- Amplitude Accuracy:  $\pm 0.05$  dB
- Flatness (5 Hz–20 kHz):  $\pm 0.010$  dB
- Digital Output Sampling Rate: 22 – 216 kHz

## Analyzer Performance

- Maximum Rated Input Voltage: 125 Vpk
- Residual Input Noise (20 kHz BW):  $\leq 1.4$   $\mu$ V
- Maximum Bandwidth: > 90 kHz
- Amplitude Accuracy (1 kHz):  $\pm 0.05$  dB
- Amplitude Flatness (10 Hz - 20 kHz):  $\pm 0.010$  dB
- DC Voltage Measurement: Yes



## System Performance

- Residual THD+N (20 kHz BW): -102 dB + 1.4  $\mu$ V
- Typical: < -106 dB (1 kHz, 2.0 V)

**Base Price: \$6,450**  
*(including APx500 SW)*

# Closest NI DAQ module



**NI PCI-4461**      **\$4,300**  
PCI card



**NI PXI-4461**      **\$4,200**  
**NI PXIe-4463 + NI PXIe-4464** **\$6,000**

PXI Chassis + controller extra (> \$5k)



# Quick Comparison APx515 versus NI 4461

	APx515	NI 4461
Analog I/O channels	2 In / 2 Out, 24 bit	2 In / 2 Out, 24 bit
Maximum Sample Rate (2 channels)	192 kHz	102 kHz <i>(204 kHz on 1 channel)</i>
Maximum Input Voltage	125 Vp	42 Vp
Maximum Output Voltage	22.6 Vp (16 Vrms)	10 Vp
Output THD (typical)	-110 dB*	-95 dB
Input THD (typical)	-110 dB*	-107 dB
Digital I/O	AES3, S/PDIF, TOSLINK	None
Warranty	3 years	1 year
Additional Features	<ul style="list-style-type: none"> <li>Built in weighting, high-pass &amp; low-pass filters and audio meters</li> <li>APx500 SW available free</li> </ul>	<ul style="list-style-type: none"> <li>Inputs support IEPE (CCP)</li> </ul>

\* Measured on an APx515 demo unit (AP specifies THD+N, not THD).

APx DAQ Example - Demo Application.vi

File Edit View Project Operate Tools Window Help

Connector Acquisition Filters Generator Triggers

Generator Channels: Ch1 [Enable] Ch2 [Enable]

Generator Settings: Ch1 [0.1] Level [0.2] Level [0.0] Offset [0.0] Offset

Generator Frequency: [1020] [400]

Meters Chart Scope FFT

FFT

Level (dB)

Frequency

Ch1 [Waveform] Ch2 [Waveform]

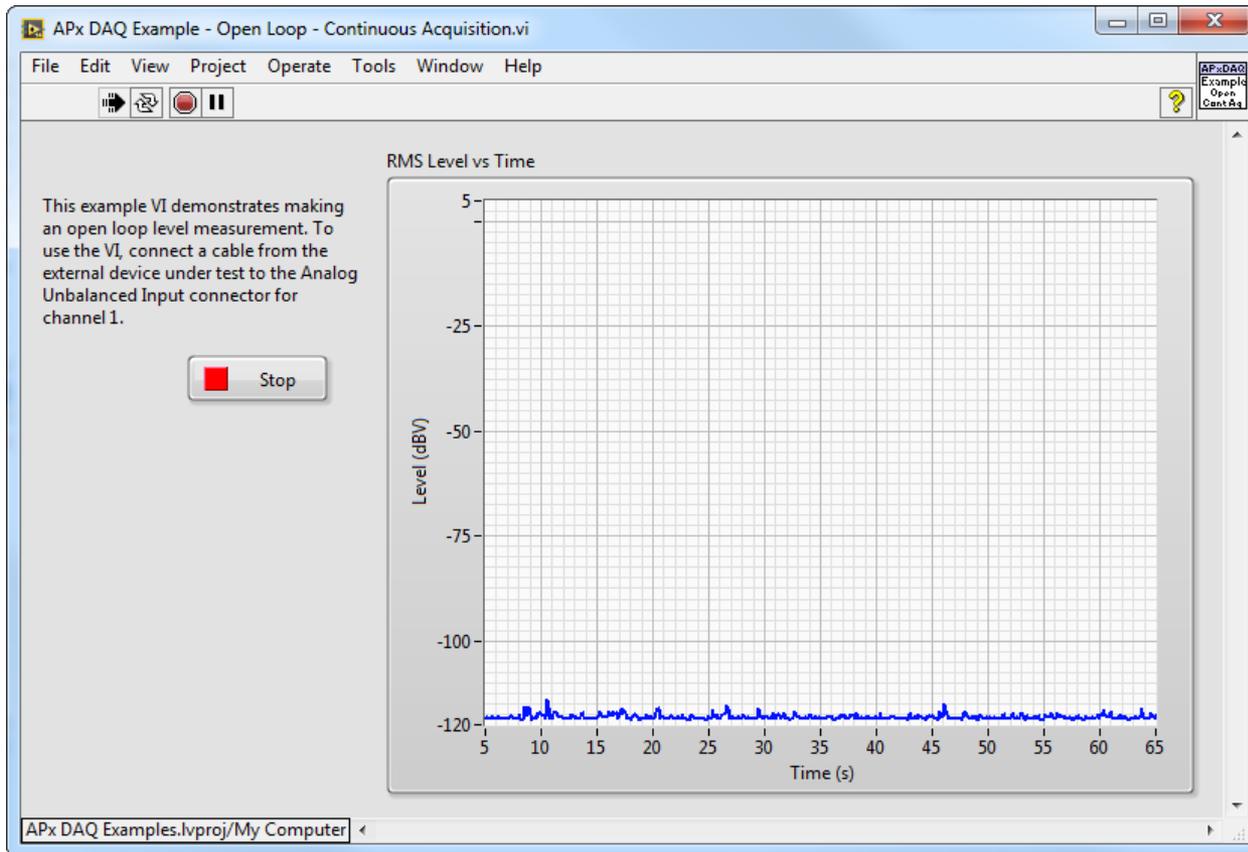
7 Term B-Harris [Autoscale Level]

Initialized? [Stop]

APx DAQ Examples.lvproj/My Computer

This example VI demonstrates many of the instrument configuration options and measurements available through the APx DAQ driver. The left-side tabs allow you to set up the instrument configuration as desired. The right-hand tabs show the measurement results in various formats.

To use the VI, connect a loopback cable(s) between the output and input connectors for channels 1 and 2 for the connector type selected on the Connector tab (default Analog Unbalanced). You should set the controls as required before running the VI, although many of the settings can be changed while it is running. The VI will run continuously until the Stop button is pushed.



# Examples – Generation only (Analog & Digital)

APx DAQ Example - Generate Sine With Offset (Analog).vi

File Edit View Project Operate Tools Window Help

This example VI will generate sine signals on 2 channels of the specified Analog output connector. To use the VI, set the controls as required before running the VI. The VI will generate sine signals as specified until the Stop button is clicked. To change the settings or frequencies, stop the VI and run it again.

Analog Output: Unbalanced

Initialized?

Elapsed Time (s): 5.9

Generator Channel Settings

0	Channel	1	Channel
1	Level	1	Level
0.5	Offset	0.5	Offset
A	Generator	B	Generator
1	Mix	0	Mix

Frequency A: 200.0      Frequency B: 1.000k

STOP

APx DAQ Examples.lvproj/My Computer

APx DAQ Example - Generate Sine With Offset (Digital).vi

File Edit View Project Operate Tools Window Help

This example VI will generate sine signals on 2 channels of the specified Digital output connector. To use the VI, set the controls as required before running the VI. The VI will generate sine signals as specified until the Stop button is clicked. To change the settings or frequencies, stop the VI and run it again.

Digital Output: Unbalanced

Initialized?

Elapsed Time (s): 2.2

Sample Rate: 48000      Bit Depth: 24       Dither (T)

Generator Channel Settings

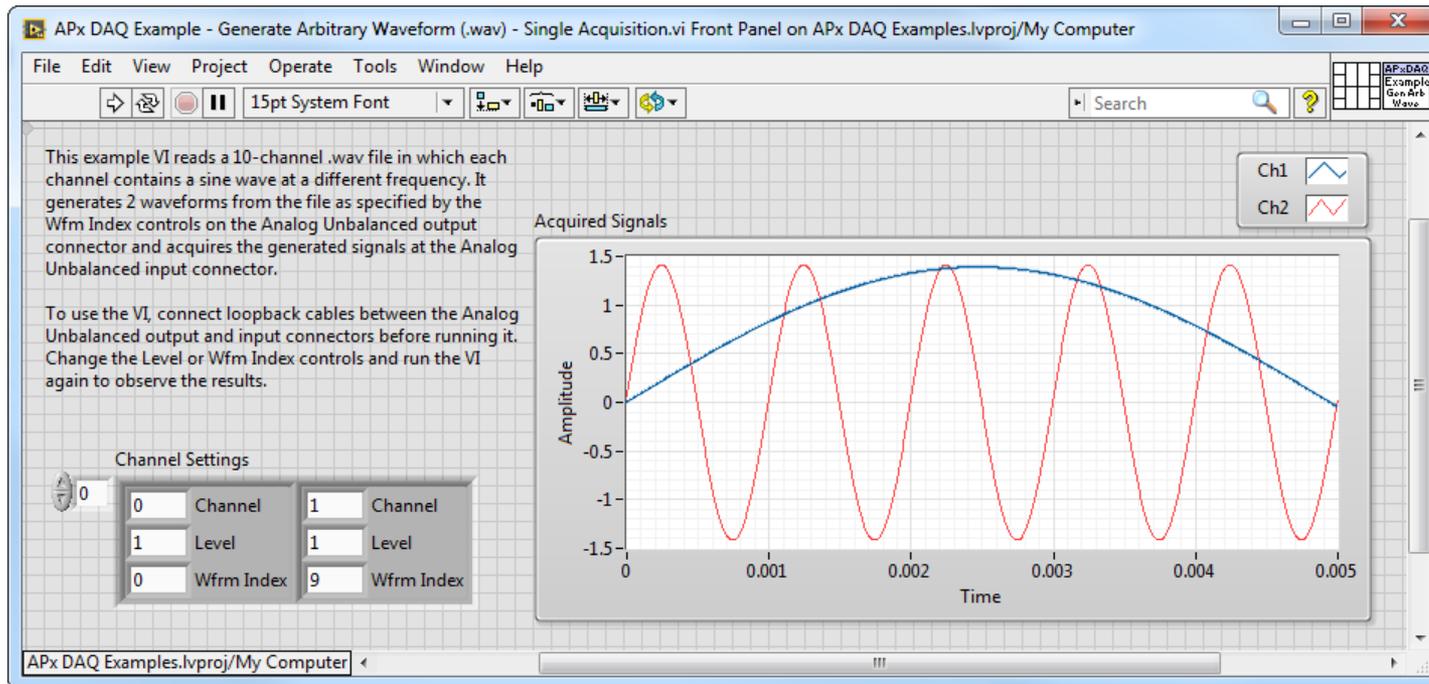
0	Channel	1	Channel
0.5	Level	0.5	Level
0.2	Offset	0.2	Offset
A	Generator	B	Generator
1	Mix	0	Mix

Frequency A: 200.0      Frequency B: 1.000k

STOP

APx DAQ Examples.lvproj/My Computer

# Example – Waveform Generation & Acquisition (multi-channel wav)



# Example – Waveform Generation & Acquisition (multiple files)

APx DAQ Example - Generate Arbitrary Waveforms (.wav) - Single Acquisition x4.vi

File Edit View Project Operate Tools Window Help

▶ ||

This example VI reads one of 4 single-channel .wav files sequentially in a loop, generates the signal on the Digital Unbalanced Output Connector and acquires the same number of samples at the Digital Unbalanced input connector.

To use the VI, connect loopback cables between the Digital Unbalanced output and input connectors before running it. Click the Next button to generate and acquire the next waveform in the sequence.

Next  Loop Continuously

Trigger Source: Level-Pre    Trigger Level: 0.001

.wav file name: file2.wav    #samples: 16384

Stop

APx DAQ Examples.lvproj/My Computer

The graph displays the acquired signal over time. The y-axis is labeled 'Amplitude' and ranges from -1.5 to 1.5. The x-axis is labeled 'Time' and ranges from 0 to 0.35. The signal begins with a low-frequency sine wave (approximately 0.05 Hz) and then transitions to a high-frequency sine wave (approximately 1000 Hz) starting around 0.15 seconds.

# Example – Generate Sine & Measure Meters (Analog)

APx DAQ Example - Generate Sine & Measure Meters (Analog).vi

File Edit View Project Operate Tools Window Help

This example VI will generate sine signals on 2 channels of the Analog Unbalanced output connector and display meter data for the signals on the Analog Unbalanced input connector.

To use the VI, connect loopback cables between the Analog Unbalanced output and input connectors. Set the controls as required before running the VI. The VI will generate sine signals as specified until the Stop button is clicked. To change the settings or frequencies, stop the VI and run it again.

**Channel Settings**

0	Channel	1	Channel
0.5	Level	0.5	Level
0	Offset	0.2	Offset
A	Generator	B	Generator
1	Mix	0	Mix

Highpass Filter 20.000  
Lowpass Filter 20.000k

Frequency A 200.0      Frequency B 1.000k

Initialized?
   
 Settled Meters
   
 Levels in dB
   
 Timeout (1) 1

**Meters**

	1	2	IsSettled?
RMS Level	-6.037	-5.379	<input checked="" type="radio"/>
Frequency	200.0	1.000k	
Phase	0.000	-73.60	
DC Level	-1.931u	200.3m	
Peak Level	-3.027	-854.2m	
Bandpass Level	-6.037	-6.026	
THD+N Level	-113.5	-113.3	
THD+N Ratio	-107.5	-107.3	
SINAD	107.5	107.3	
IMD Ratio	NaN	NaN	
Sample Rate	48.00k	48.00k	

APx DAQ Examples.lvproj/My Computer

# Example – Generate Sine & Measure Meters (Digital)

APx DAQ Example - Generate Sine & Measure Meters (Digital).vi

File Edit View Project Operate Tools Window Help

This example VI will generate sine signals on 2 channels of the Digital Unbalanced output connector and display meter data for the signals on the Digital Unbalanced input connector.

To use the VI, connect loopback cables between the Digital Unbalanced output and input connectors. Set the controls as required before running the VI. The VI will generate sine signals as specified until the Stop button is clicked. To change the settings or frequencies, stop the VI and run it again.

Channel Settings

0	Channel	1	Channel
0.5	Level	0.5	Level
0	Offset	0.2	Offset
A	Generator	B	Generator
1	Mix	0	Mix

Highpass Filter 20.000

Lowpass Filter 20.000k

Frequency A 200.0

Frequency B 1.000k

Stop

Initialized?

Timeout (1) 1

Settled Meters

Levels in dB

Meters

		IsSettled?
RMS Level	-6.020 -4.815	<input checked="" type="checkbox"/>
Frequency	200.0 1.000k	
Phase	0.000 70.84	
DC Level	1.393u 200.0m	
Peak Level	-6.020 -3.103	
Bandpass Level	-6.020 -6.021	
THD+N Level	-142.3 -142.6	
THD+N Ratio	-136.3 -136.6	
SINAD	136.3 136.6	
IMD Ratio	NaN NaN	
Sample Rate	48.00k 48.00k	

APx DAQ Examples.lvproj/My Computer

# Examples – AC & DC Level + Crosstalk

APx DAQ Example - Measure AC and DC Levels.vi

File Edit View Project Operate Tools Window Help

This example VI demonstrates measuring RMS, DC, and True AC Level. To use the VI, connect loopback cables between the Analog Unbalanced output and input connectors. Set the controls as required before running the VI.

Frequency (Hz) 1.000k

RMS Level Meter (Vrms) 0 141.1m 100.0m Settled?

DC Level Meter (V) 0 99.72m 210.6u Settled?

True AC Level (Vrms) 0 99.87m 100.0m

APx DAQ Examples.lvproj/My Computer

APx DAQ Example - Measure Crosstalk.vi

File Edit View Project Operate Tools Window Help

This example VI demonstrates measuring Crosstalk using two Analog Unbalanced channels. To use the VI, connect loopback cables between the Analog Unbalanced output and input connectors. Set the controls as required before running the VI.

This VI conducts two measurements: In the first, Channel 1 is driven at the specified Level and Channel 2 is undriven (generator level = zero). In the second measurement, the driven and undriven channels are swapped. For each measurement, the Bandpass Level is measured with the bandpass filter auto-tuned to the frequency of the driven channel. Crosstalk is calculated as the ratio of the level in the undriven channel to the generator level of the driven channel.

Frequency (Hz) 10.00k Level (Vrms) 1.000

Measurement #1 (Vrms) 999.9m 279.5n Settled?

Measurement #2 (Vrms) 384.6n 999.8m

Crosstalk (dB) -128.30 -131.07

R > L L > R

APx DAQ Examples.lvproj/My Computer

APx DAQ Example - Measure SNR.vi

File Edit View Project Operate Tools Window Help

This example VI demonstrates measuring Signal to Noise Ratio (SNR) using two Analog Unbalanced channels. To use the VI, connect loopback cables between the Analog Unbalanced output and input connectors. Set the controls as required before running the VI. The VI will first measure the Signal level. It will then set the generator off (Level = 0) and measure the Noise. Finally it will calculate the ratio of signal to noise and express it in dB.

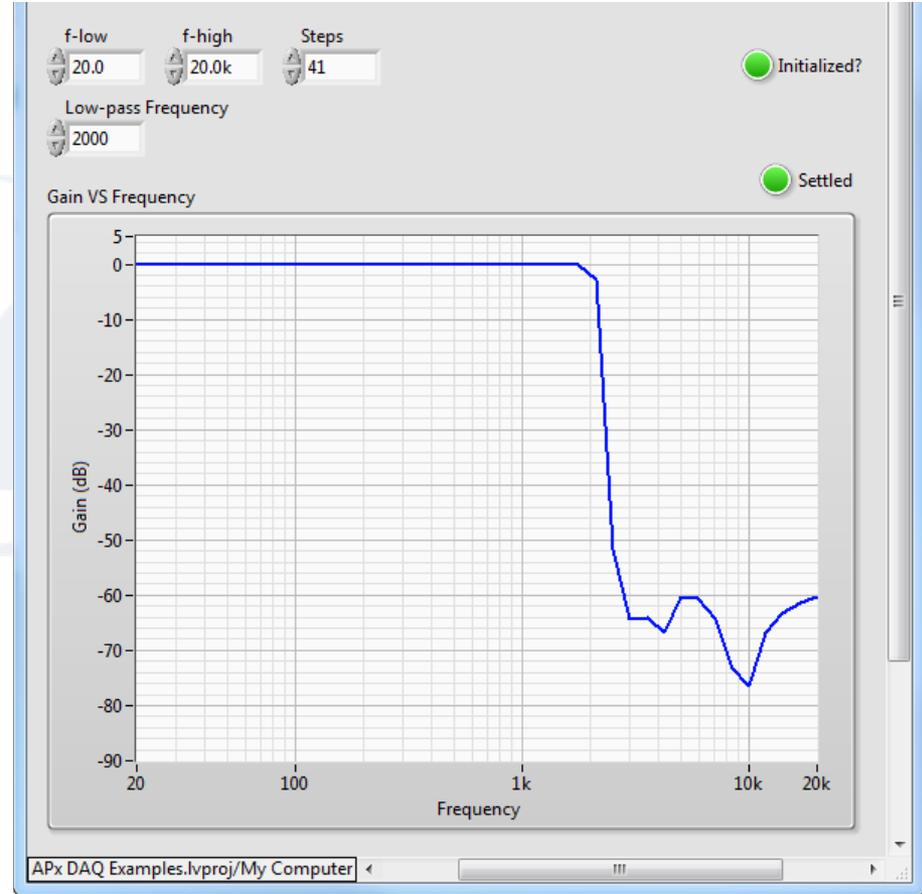
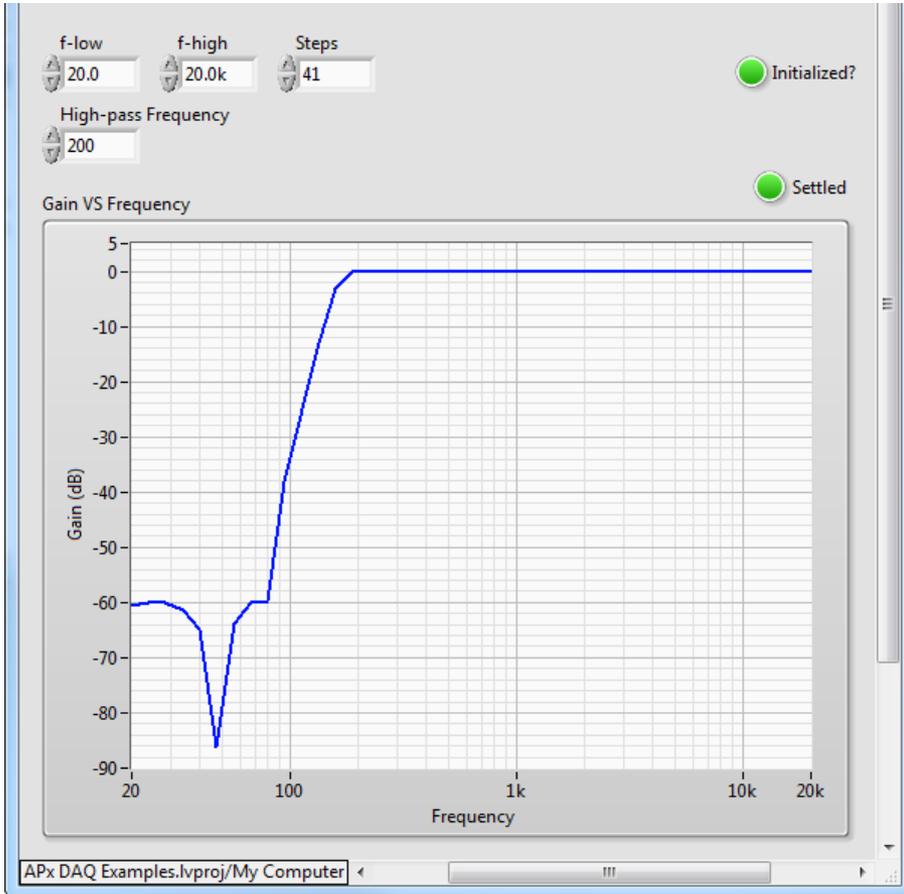
Frequency (Hz): 1.000k  
 Level (Vrms): 1.000  
 Level (Vrms): 0 1.000 1.000  Settled?

Noise (Vrms): 0 1.069u 1.052u

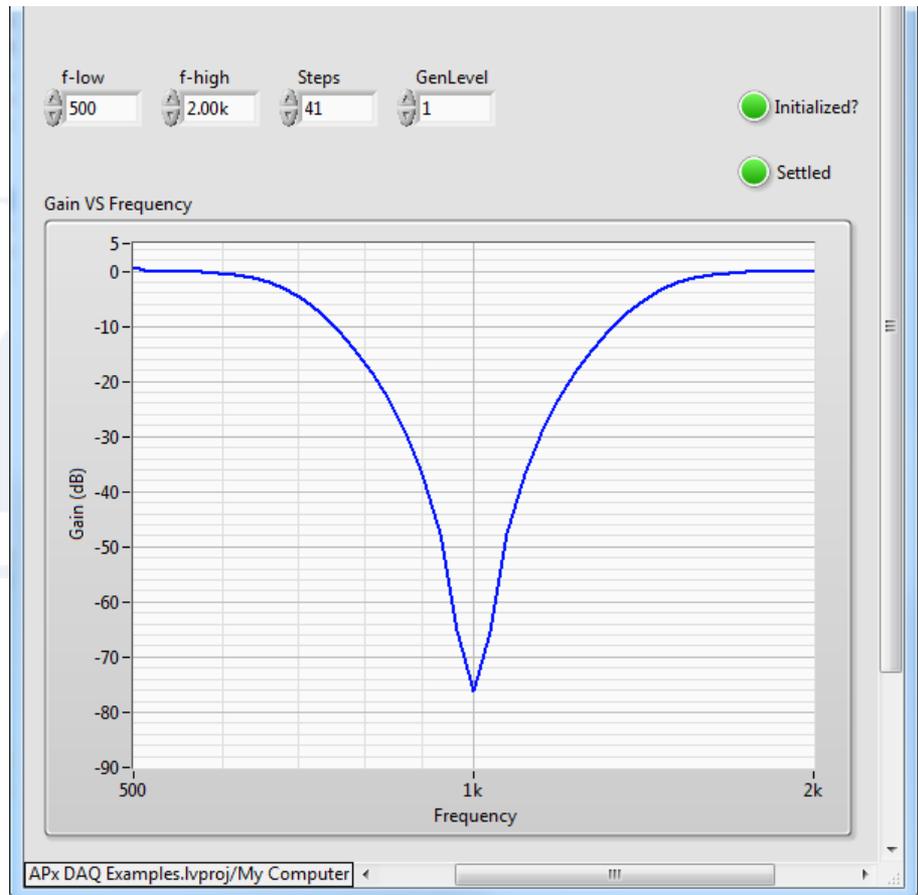
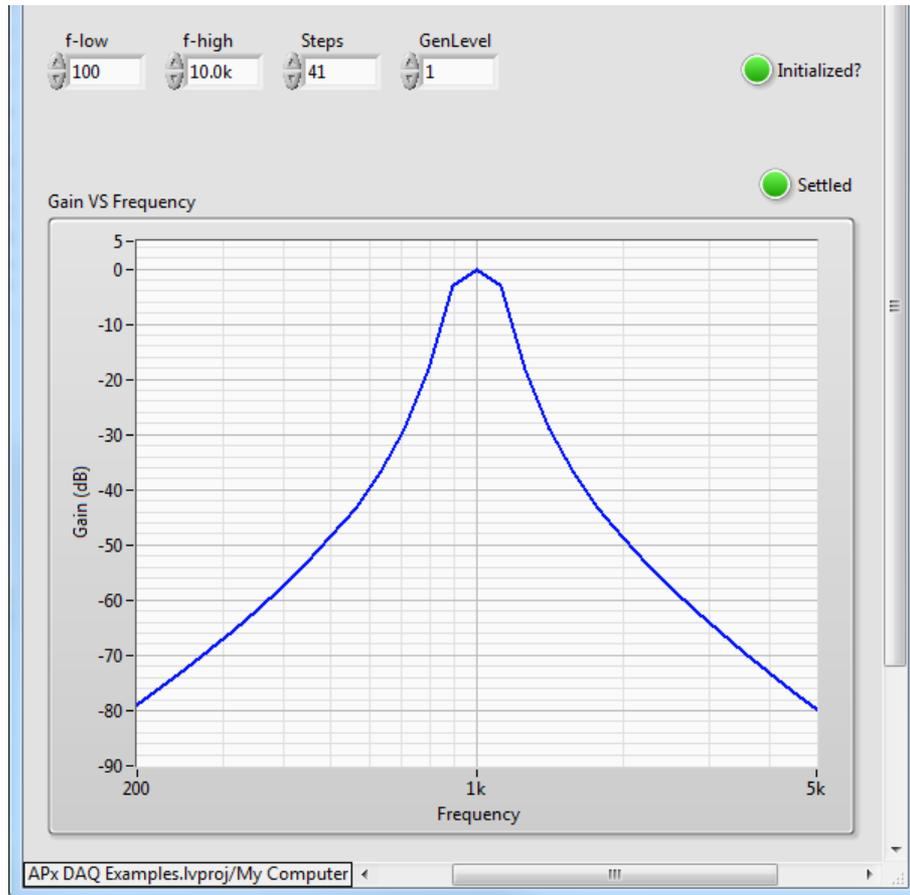
SNR (dB): 0 119.42 119.56

APx DAQ Examples.lvproj/My Computer

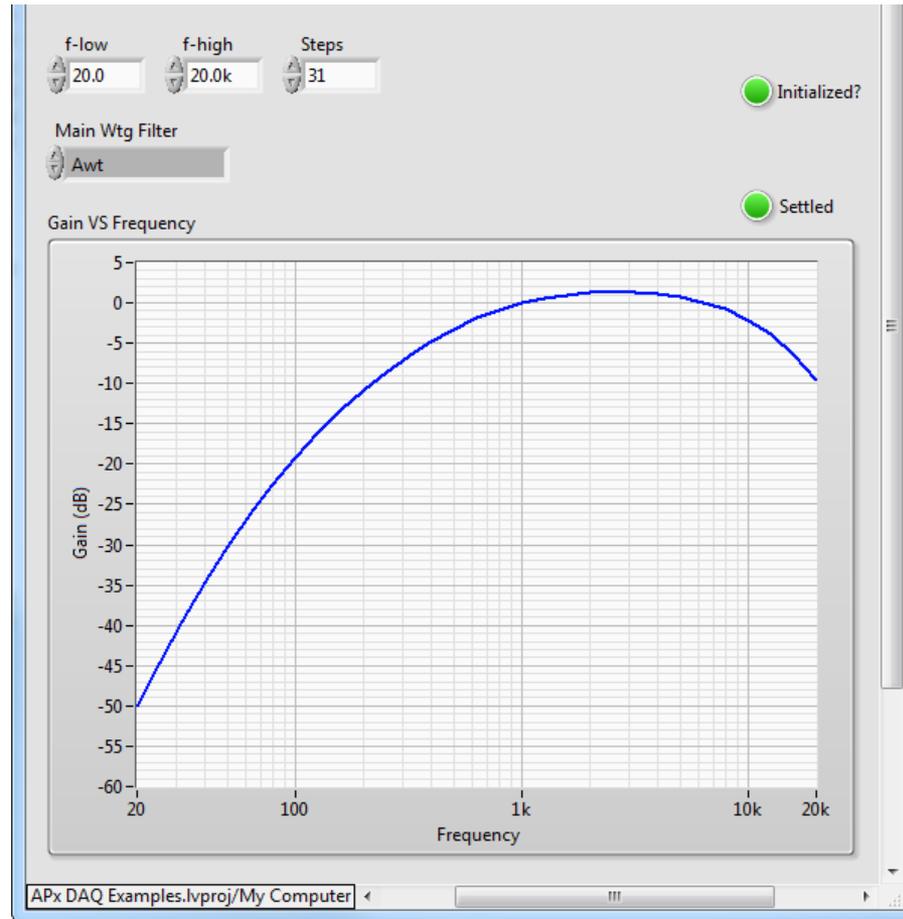
# Examples - High-pass & Low-pass filters



# Examples – Bandpass & Notch Filters



# Example – Weighting Filter



# Example – Stepped Level Sweep

