

# How to Configure the DS320PR810 Using SigCon Architect

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## ABSTRACT

Welcome to the Falcon SigCon Architect User's Guide. This document explains how to configure your DS320PR810 redriver using the user-friendly GUI.

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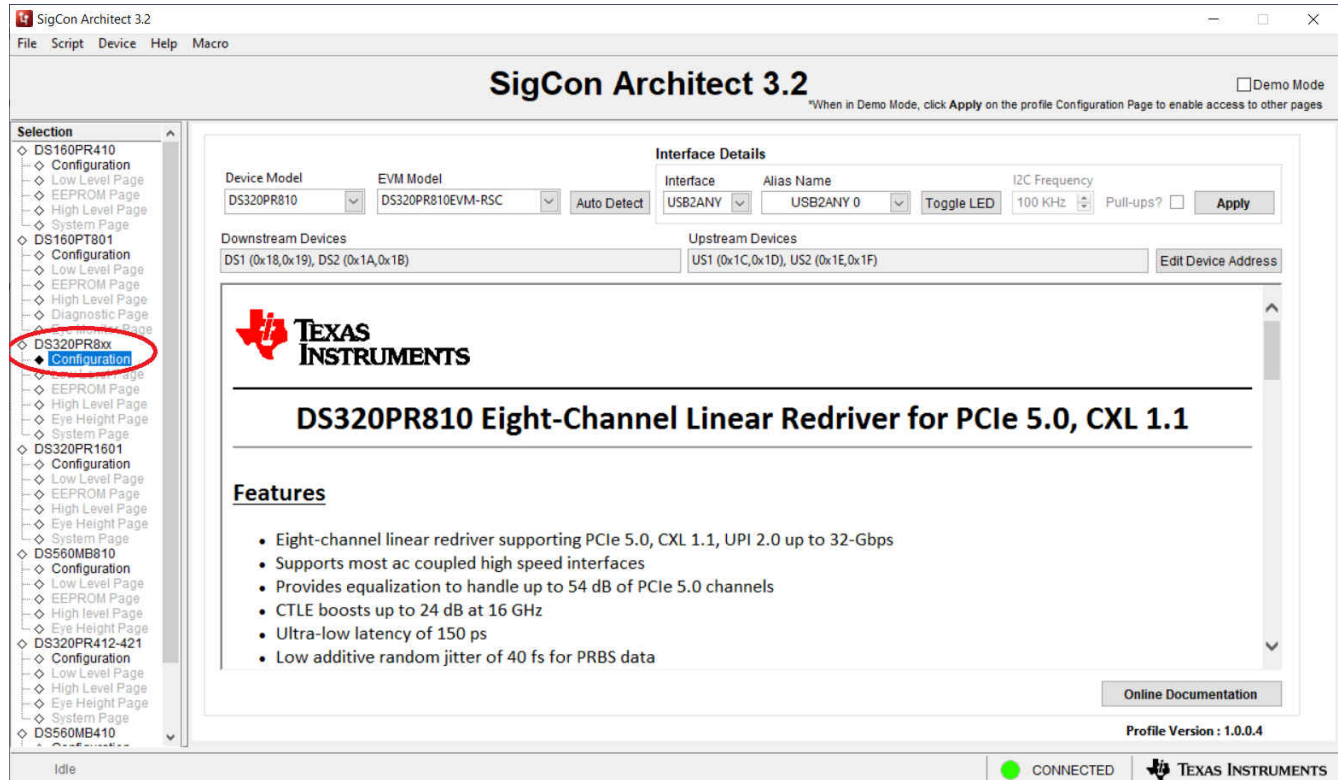
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## Trademarks

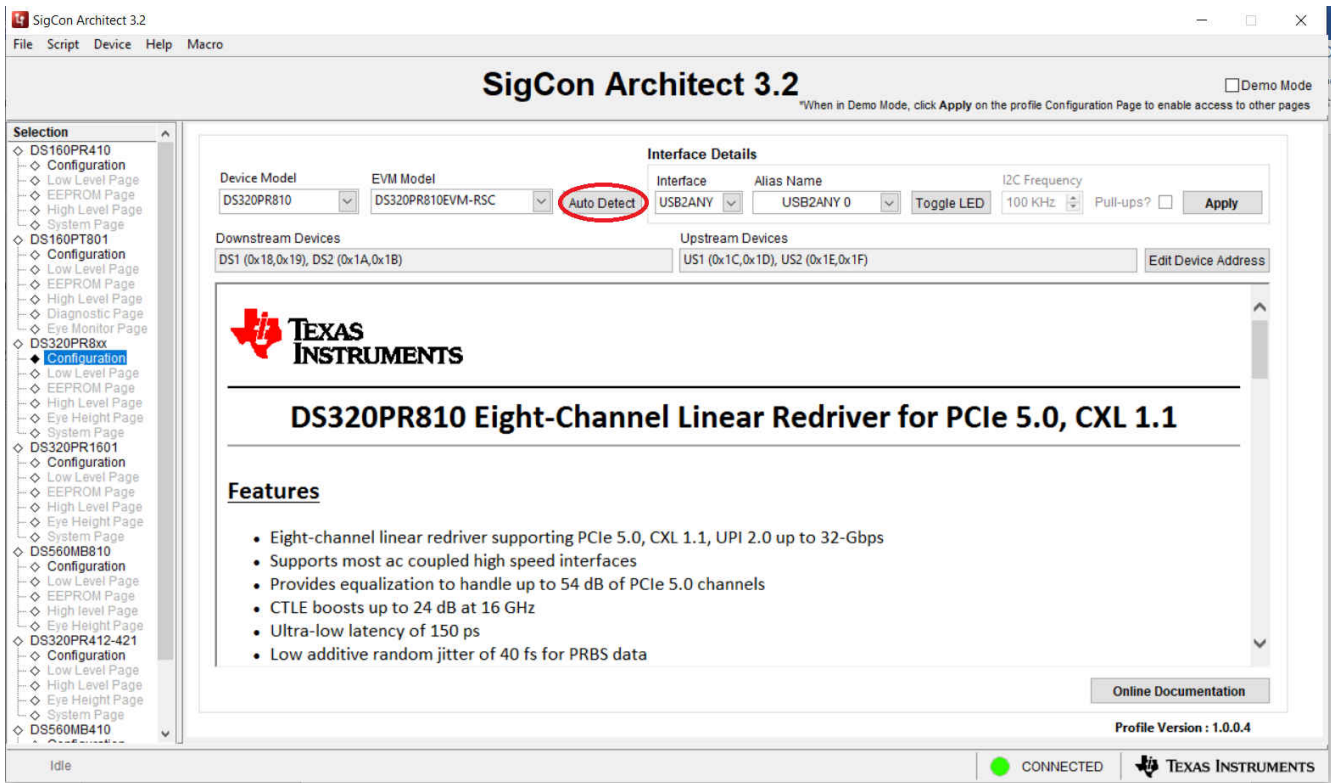
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## 1 Getting Started

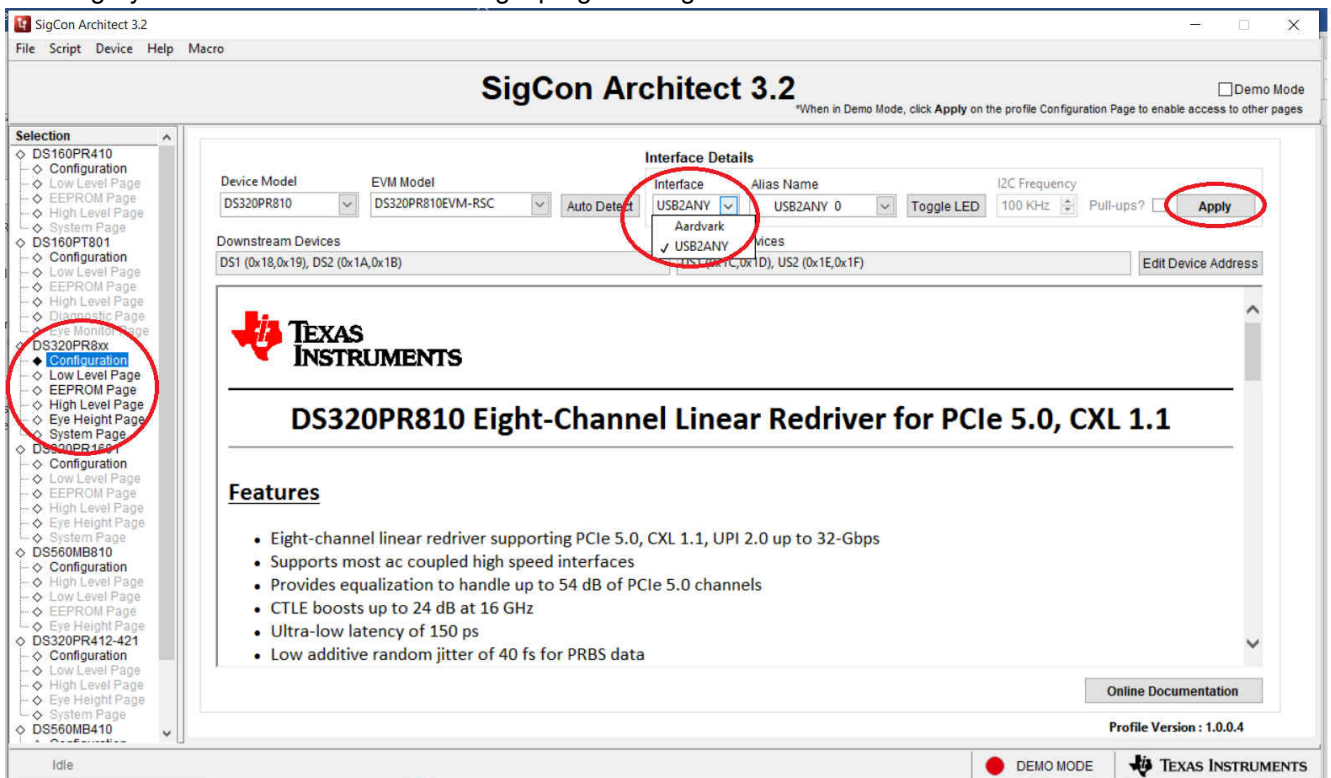
1. Download and install SigCon Architect. Follow the steps in the [SigCon Architect: Installation and Starter's Guide](#) for detailed instructions.
2. Download and install the DS320PR810 Profile Updater.
3. Connect a USB2ANY Interface Adapter or Aardvark I2C Host Adapter to the desired DS320PR810 and PC.
4. Open SigCon Architect and click the *Configuration* tab below the DS320PR8xx profile on the left, as shown below.



5. Click the *Auto Detect* button to detect the device and SMBus addresses.



6. Ensure the correct interface adapter is selected below the interface drop-down menu (USB2ANY or Aardvark). Then click *Apply*. The user will see the other tabs under the DS320PR8xx profile become un-greyled. Click the desired tab to begin programming the device.

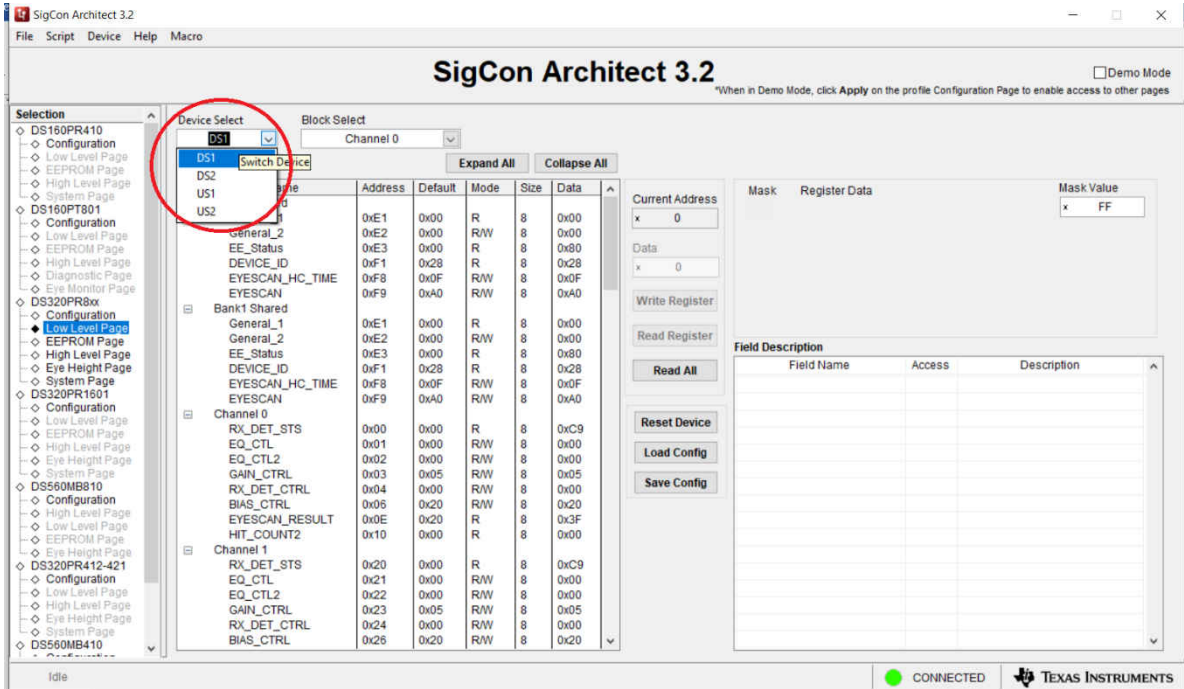


7. Descriptions of each tab is listed below:
  - a. Low Level Page: Individual register access to the lowest level of the device. Can be used to change specific settings, or to verify changes from the high-level page have taken effect.

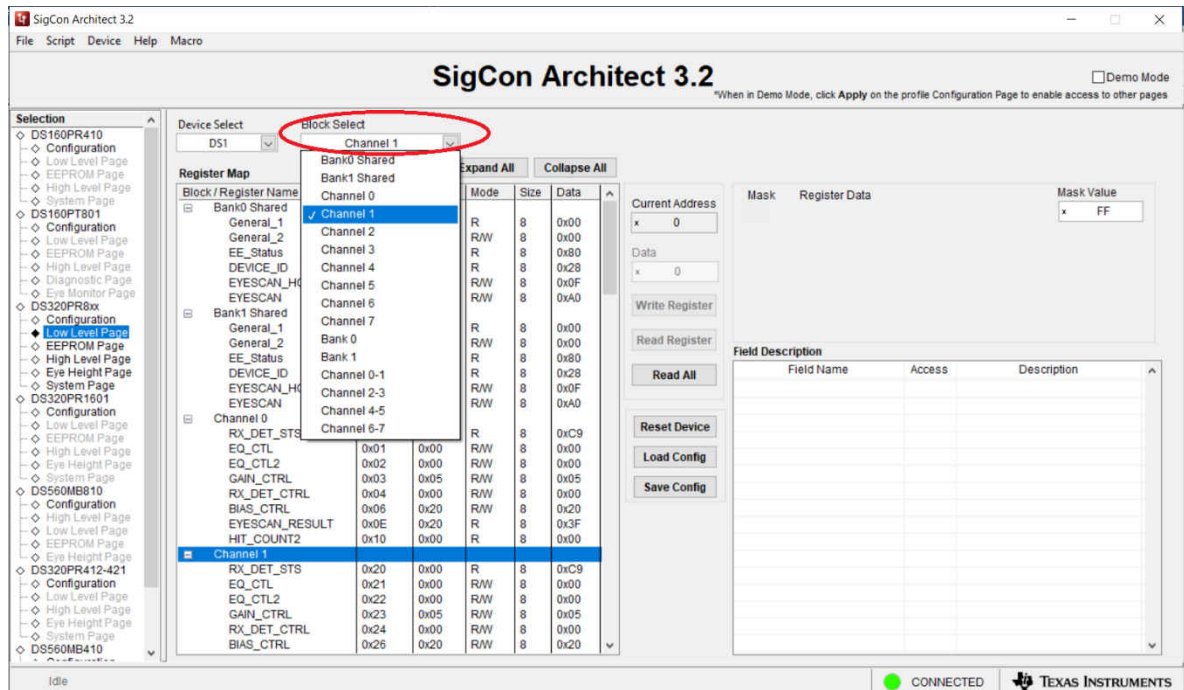
- b. EEPROM Page: When in I2C primary mode, upon boot up the redriver will load the settings stored in its EEPROM. The user can configure those settings here.
- c. High Level Page: Main page used to change EQ settings of the device and to see the active status of each channel
- d. Eye Height Page: Performs a sweep of all CTLE settings for the desired channel and displays eye height for each settings. This can assist in choosing an optimal CTLE setting for your system.
- e. System Page: Allows the user to input pre and post channel losses of their system, and provides a recommended CTLE index value for each PCIe transmitter preset.

## 2 Low Level Page

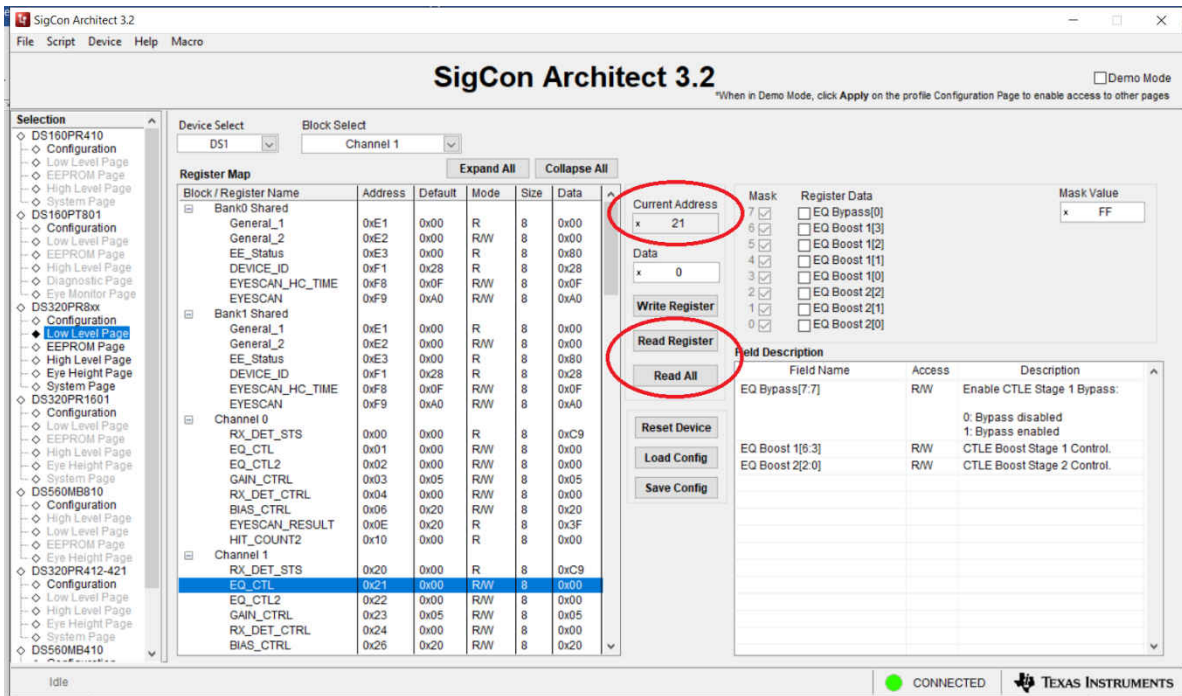
- Use the *Device Select* drop-down menu to select which device you want to read or write to. The DS320PR810EVM includes two upstream and two downstream devices.



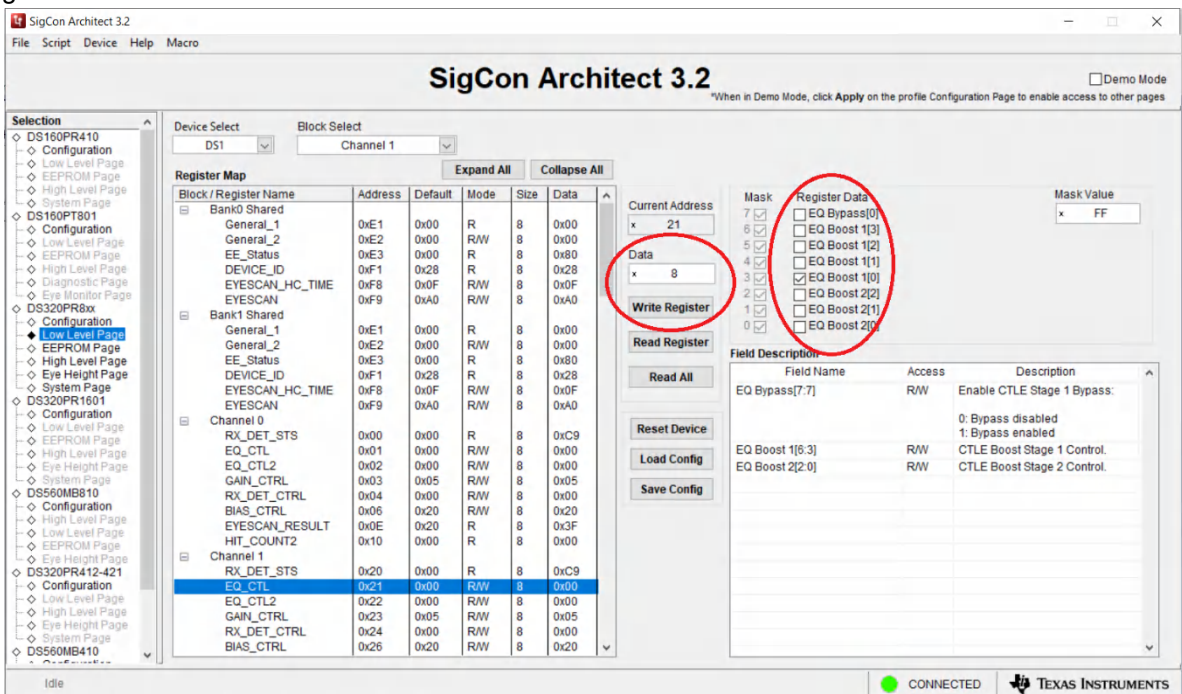
- Once the device is selected, the complete register map appears in the table below. Use the *Block Select* drop-down menu to jump to the desired part of the table to view specific channels. Bank 0 includes channels 0-3 and Bank 1 includes channels 4-7.



- Click the *Read All* button to read the configuration of the entire device. Alternately, click on a specific register, and click the *Read Register* device to update the target register quicker. The current address field will automatically update with the highlighted register.



- To write to the selected register, check or deselect the boxes in the *Register Data* field, or manually enter a hex value into the *Data* field. Then, click the *Write Register* button. To verify the change was made, click the *Read Register* button. Note the *Field Description* table describes the function of each bit in the highlighted register.



- Use the *Save Config* and *Load Config* buttons to save the current configuration in a .cfg file, and load it back as needed. Click the *Reset Device* button to reset every setting to the default.

SigCon Architect 3.2

File Script Device Help Macro

## SigCon Architect 3.2

Demo Mode  
\*When in Demo Mode, click Apply on the profile Configuration Page to enable access to other pages

**Selection**

- DS160PR410
  - Configuration
  - Low Level Page
  - EEPROM Page
  - High Level Page
  - System Page
- DS160PT801
  - Configuration
  - Low Level Page
  - EEPROM Page
  - High Level Page
  - Diagnostic Page
  - Eye Monitor Page
- DS320PR8xx
  - Configuration
  - Low Level Page**
  - EEPROM Page
  - High Level Page
  - Eye Height Page
  - System Page
- DS320PR1501
  - Configuration
  - Low Level Page
  - EEPROM Page
  - High Level Page
  - Eye Height Page
  - System Page
- DS560MB810
  - Configuration
  - High Level Page
  - Low Level Page
  - EEPROM Page
  - Eye Height Page
  - System Page
- DS320PR412-421
  - Configuration
  - Low Level Page
  - High Level Page
  - Eye Height Page
  - System Page
- DS560MB410
  - Configuration

Device Select: DS1    Block Select: Channel 1

Block / Register Name	Address	Default	Mode	Size	Data
Bank0 Shared					
General_1	0xE1	0x00	R	8	0x00
General_2	0xE2	0x00	R/W	8	0x00
EE_Status	0xE3	0x00	R	8	0x80
DEVICE_ID	0xF1	0x28	R	8	0x28
EYESCAN_HC_TIME	0xF8	0x0F	R/W	8	0x0F
EYESCAN	0xF9	0xA0	R/W	8	0xA0
Bank1 Shared					
General_1	0xE1	0x00	R	8	0x00
General_2	0xE2	0x00	R/W	8	0x00
EE_Status	0xE3	0x00	R	8	0x80
DEVICE_ID	0xF1	0x28	R	8	0x28
EYESCAN_HC_TIME	0xF8	0x0F	R/W	8	0x0F
EYESCAN	0xF9	0xA0	R/W	8	0xA0
Channel 0					
RX_DET_STS	0x00	0x00	R	8	0xC9
EQ_CTL	0x01	0x00	R/W	8	0x00
EQ_CTL2	0x02	0x00	R/W	8	0x00
GAIN_CTRL	0x03	0x05	R/W	8	0x05
RX_DET_CTRL	0x04	0x00	R/W	8	0x00
BIAS_CTRL	0x06	0x20	R/W	8	0x20
EYESCAN_RESULT	0x0E	0x20	R	8	0x3F
HIT_COUNT2	0x10	0x00	R	8	0x00
Channel 1					
RX_DET_STS	0x20	0x00	R	8	0xC9
EQ_CTL	0x21	0x00	R/W	8	0x00
EQ_CTL2	0x22	0x00	R/W	8	0x00
GAIN_CTRL	0x23	0x05	R/W	8	0x05
RX_DET_CTRL	0x24	0x00	R/W	8	0x00
BIAS_CTRL	0x26	0x20	R/W	8	0x20

Current Address: \* 21

Data: \* 8

Mask: 7  EQ Bypass[0], 6  EQ Boost 1[3], 5  EQ Boost 1[2], 4  EQ Boost 1[1], 3  EQ Boost 1[0], 2  EQ Boost 2[2], 1  EQ Boost 2[1], 0  EQ Boost 2[0]

Mask Value: \* FF

Field Name	Access	Description
EQ Bypass[7:7]	R/W	Enable CTLE Stage 1 Bypass:
		0: Bypass disabled
		1: Bypass enabled
EQ Boost 1[6:3]	R/W	CTLE Boost Stage 1 Control.
EQ Boost 2[2:0]	R/W	CTLE Boost Stage 2 Control.

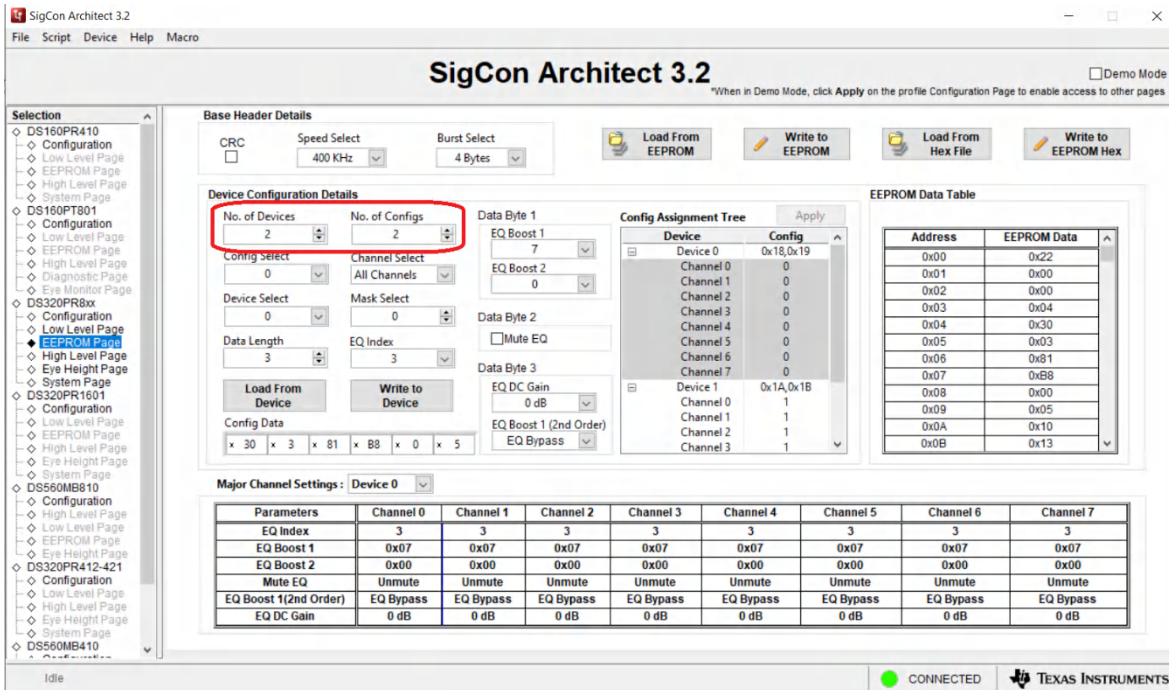
Idle
● CONNECTED
 TEXAS INSTRUMENTS

### 3 EEPROM Programming Page

SigCon Architect can be used to generate an EEPROM file for a single redriver or multiple DS320PR810 redriivers. The below images provide an example.

In this example, two redriivers are present with different EQ index values (CTLE index 3 for device at address 0x18, 0x19 and CTLE index 7 for device at address 0x1A, 0x1B), for each device, the same value is used for every channel. For programming additional devices, increase the number of devices and configs as needed.

- Multiple devices can be programmed at once. Select the number of devices and the number of configurations. Up to 16 different configurations can be created and assigned to each device and channel as needed.



The screenshot shows the SigCon Architect 3.2 software interface. The 'Device Configuration Details' section is highlighted with a red box, showing 'No. of Devices' set to 2 and 'No. of Configs' set to 2. The 'Config Assignment Tree' shows two devices: Device 0 (0x18, 0x19) and Device 1 (0x1A, 0x1B). The 'EEPROM Data Table' shows the data for each device and channel.

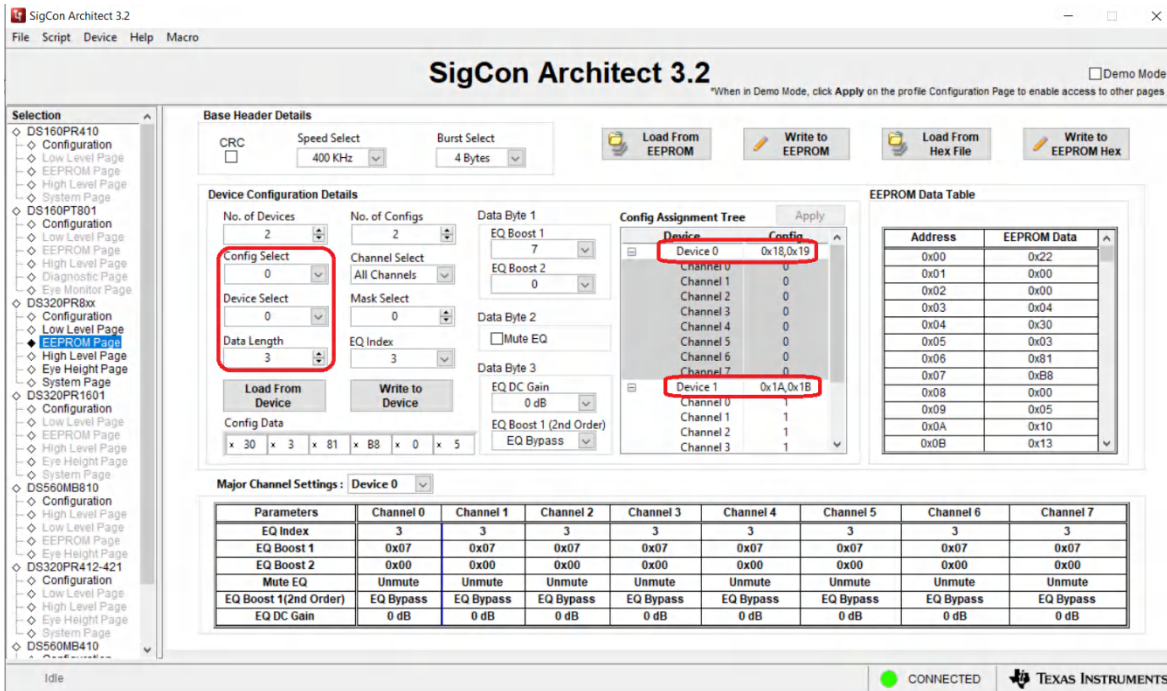
Address	EEPROM Data
0x00	0x22
0x01	0x00
0x02	0x00
0x03	0x04
0x04	0x30
0x05	0x03
0x06	0x81
0x07	0xB8
0x08	0x00
0x09	0x05
0x0A	0x10
0x0B	0x13

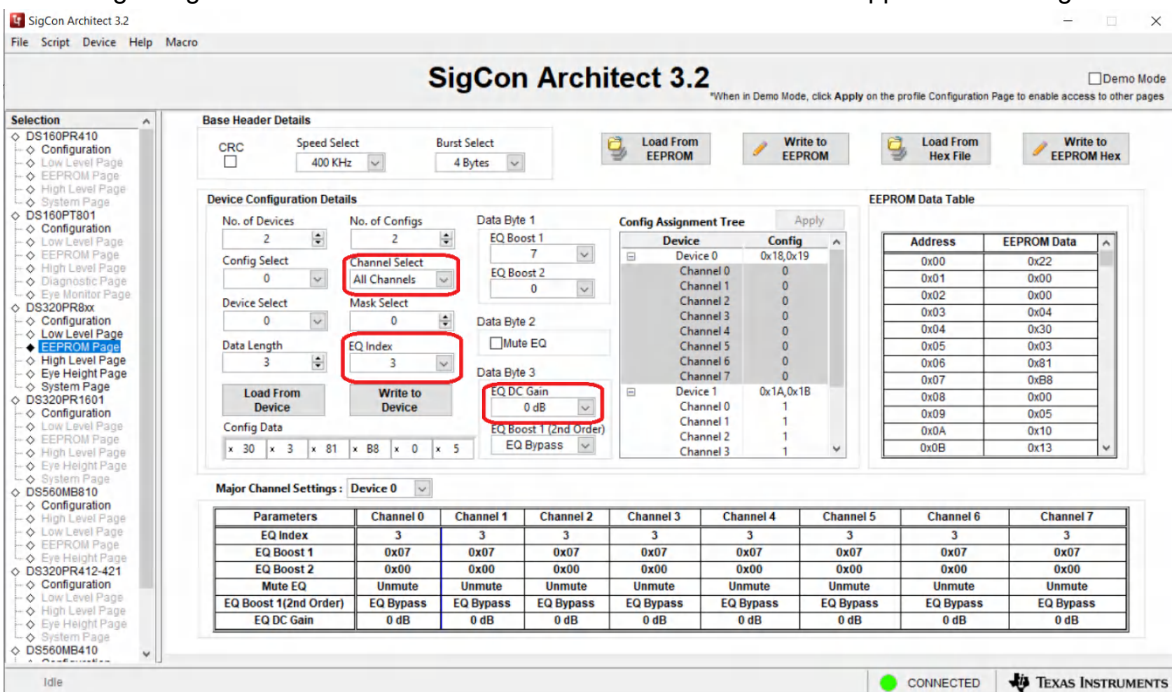
Parameters	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
EQ Index	3	3	3	3	3	3	3	3
EQ Boost 1	0x07	0x07	0x07	0x07	0x07	0x07	0x07	0x07
EQ Boost 2	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Mute EQ	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute
EQ Boost 1(2nd Order)	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass
EQ DC Gain	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB

- To program the first device, select configuration 0 and device 0 from the drop-down menu. Note the Config Assignment Tree shows the hex address of each device (0x18, 0x19 for device 0). Set the data length to 3 since 3 bytes are needed to program the DS320PR810.

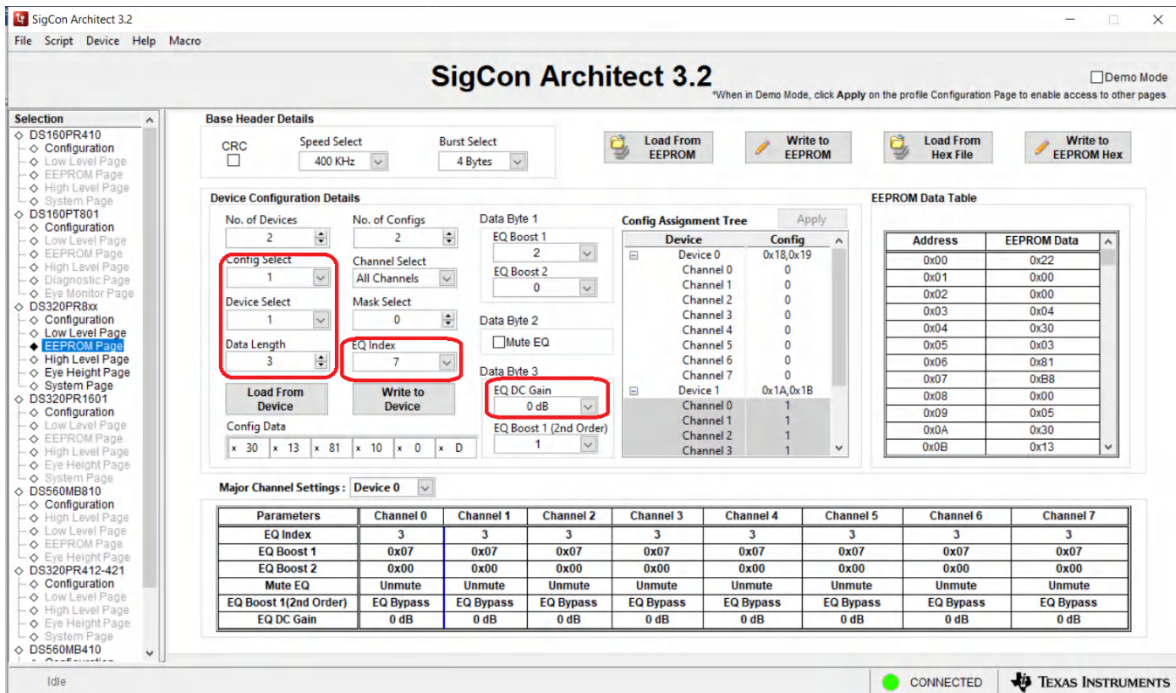




3. Select the desired channel, then choose an *EQ Index* from the drop-down menu. This will automatically adjust the EQ boost 1, EQ boost 2, and EQ Boost 1 (2nd Order) fields. Select the desired EQ DC gain. Note in the Config Assignment Tree that the desired channel of device 0 will be applied with configuration 0.



4. Switch to configuration 1 and device 1 in the drop-down menu, set the data length back to 3, and select the new EQ index, and DC gain. Notice the config assignment tree will update the device 1 channels as config 1.



**Base Header Details**

CRC  Speed Select: 400 KHz Burst Select: 4 Bytes

**Device Configuration Details**

No. of Devices: 2 No. of Configs: 2

Config Select: 1 Channel Select: All Channels

Device Select: 1 Mask Select: 0

Data Length: 3 EQ Index: 7

EQ DC Gain: 0 dB

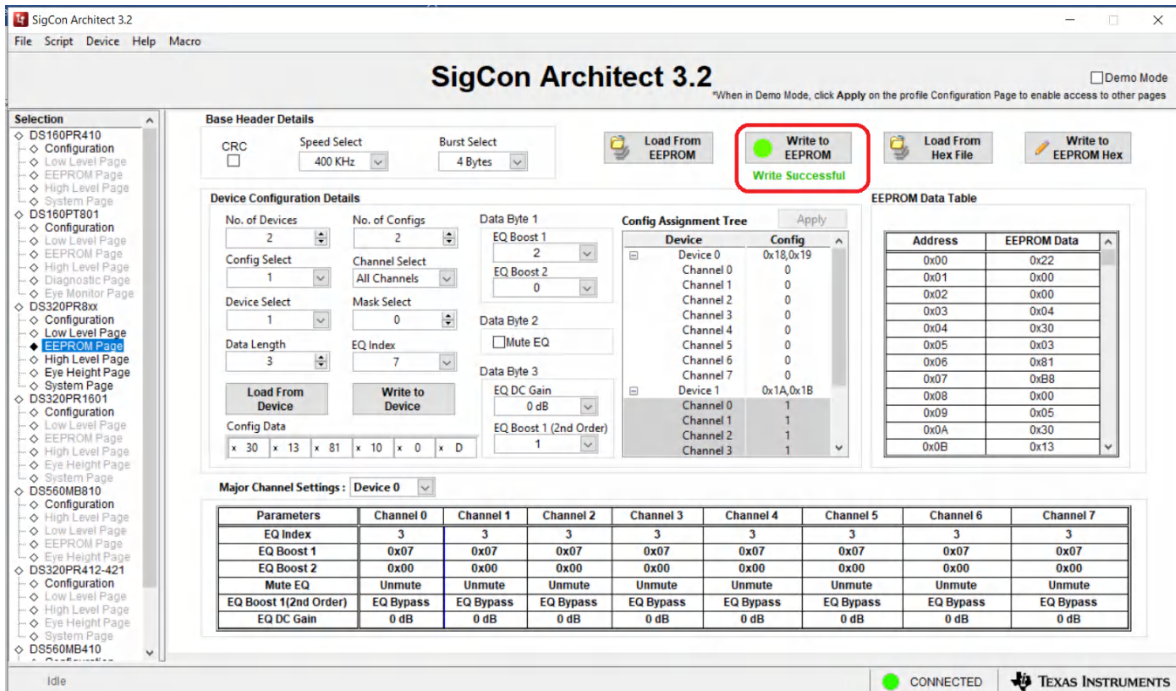
**EEPROM Data Table**

Address	EEPROM Data
0x00	0x22
0x01	0x00
0x02	0x00
0x03	0x04
0x04	0x30
0x05	0x03
0x06	0xB1
0x07	0xB8
0x08	0x00
0x09	0x05
0x0A	0x30
0x0B	0x13

**Major Channel Settings: Device 0**

Parameters	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
EQ Index	3	3	3	3	3	3	3	3
EQ Boost 1	0x07	0x07	0x07	0x07	0x07	0x07	0x07	0x07
EQ Boost 2	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Mute EQ	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute
EQ Boost 1(2nd Order)	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass
EQ DC Gain	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB

5. Once all devices have been configured, click the *Write to EEPROM* button to load the EEPROM with the new settings. The button will turn green when the write is completed.



**Base Header Details**

CRC  Speed Select: 400 KHz Burst Select: 4 Bytes

**Device Configuration Details**

No. of Devices: 2 No. of Configs: 2

Config Select: 1 Channel Select: All Channels

Device Select: 1 Mask Select: 0

Data Length: 3 EQ Index: 7

EQ DC Gain: 0 dB

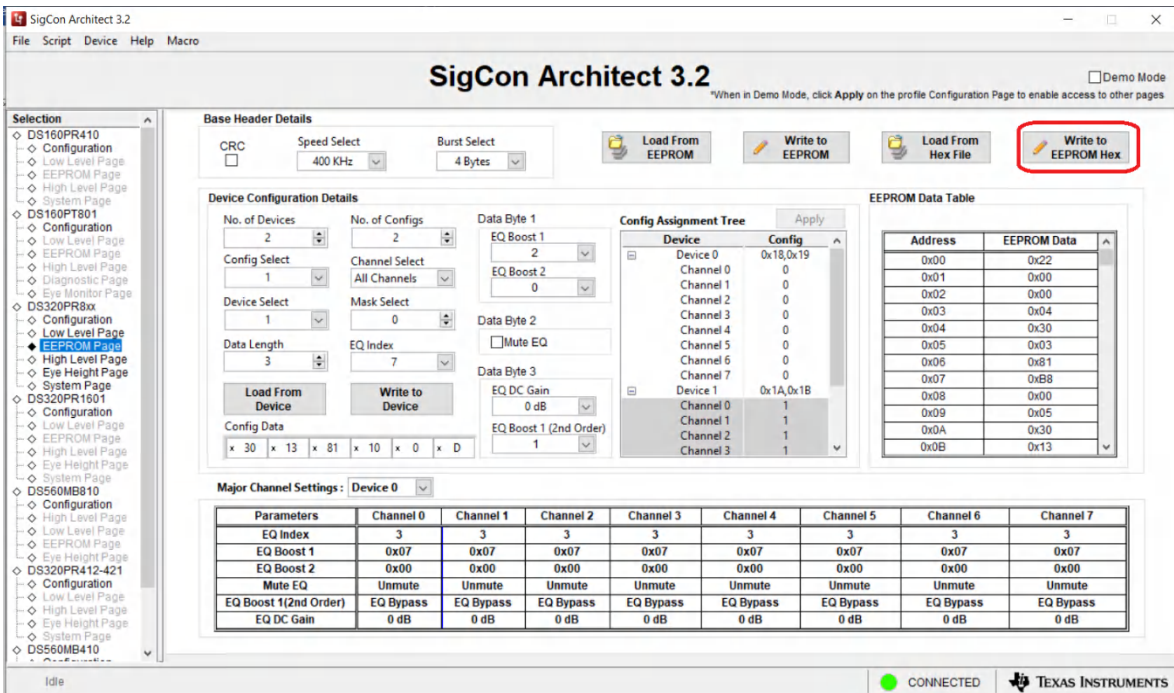
**EEPROM Data Table**

Address	EEPROM Data
0x00	0x22
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0x03	0x04
0x04	0x30
0x05	0x03
0x06	0xB1
0x07	0xB8
0x08	0x00
0x09	0x05
0x0A	0x30
0x0B	0x13

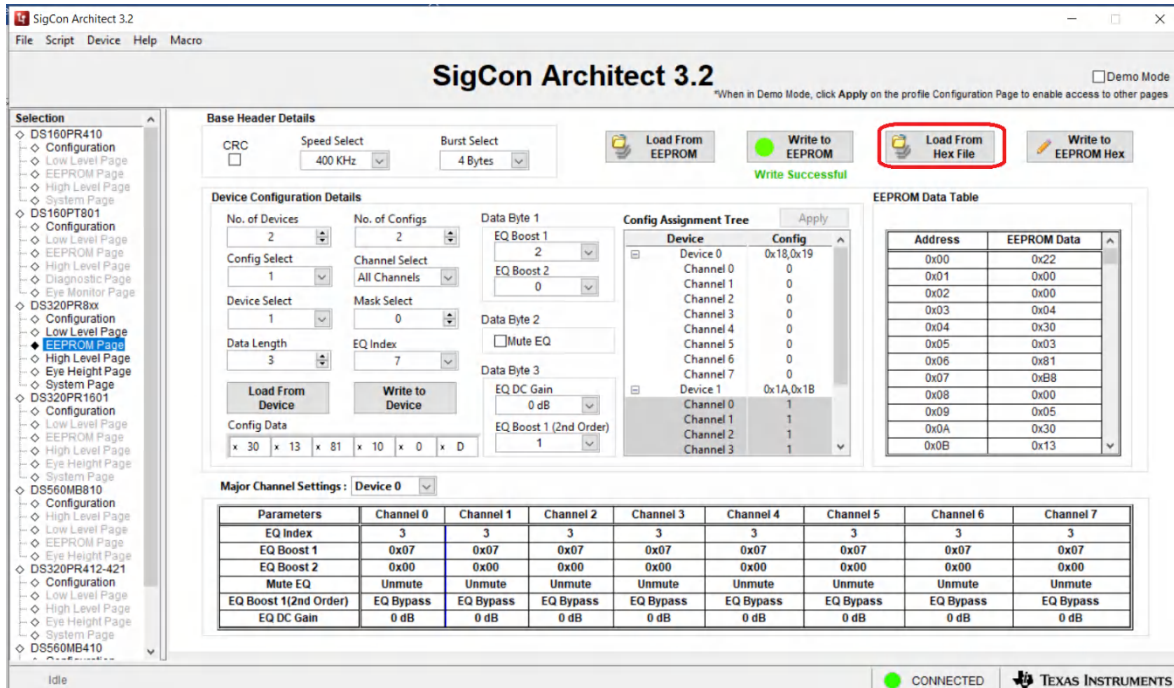
**Major Channel Settings: Device 0**

Parameters	Channel 0	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6	Channel 7
EQ Index	3	3	3	3	3	3	3	3
EQ Boost 1	0x07	0x07	0x07	0x07	0x07	0x07	0x07	0x07
EQ Boost 2	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
Mute EQ	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute	Unmute
EQ Boost 1(2nd Order)	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass	EQ Bypass
EQ DC Gain	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB	0 dB

6. To save these current EEPROM settings for later, click the *Write to EEPROM Hex* button to create a hex file with these settings. Save the hex file to the desired location.



- To load the EEPROM settings back from the hex file, click the *Load from Hex File* button, select the hex file you saved, then click the *Write to EEPROM* button and wait for the green dot.



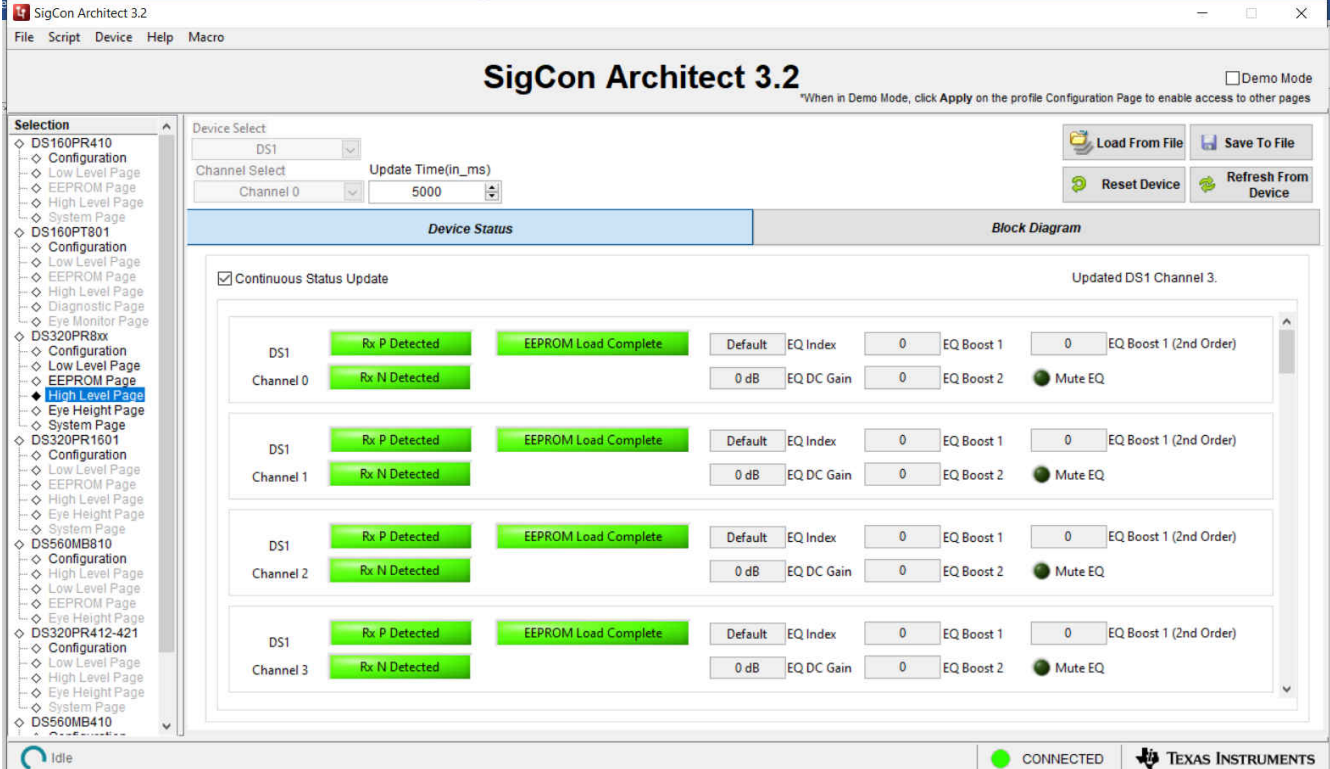
## 4 High Level Page

The DS320PR810 redriver features a continuous-time linear equalizer (CTLE) that applies high-frequency boost and low-frequency attenuation to help equalize the frequency-dependent insertion loss effects of a passive channel.

This page is used to quickly and easily adjust the CTLE settings as needed for your specific application. A further description of this feature is described in Section 7.3 of the DS320PR810 data sheet.

The high level page also contains a device status page which shows which channels are detecting a signal.

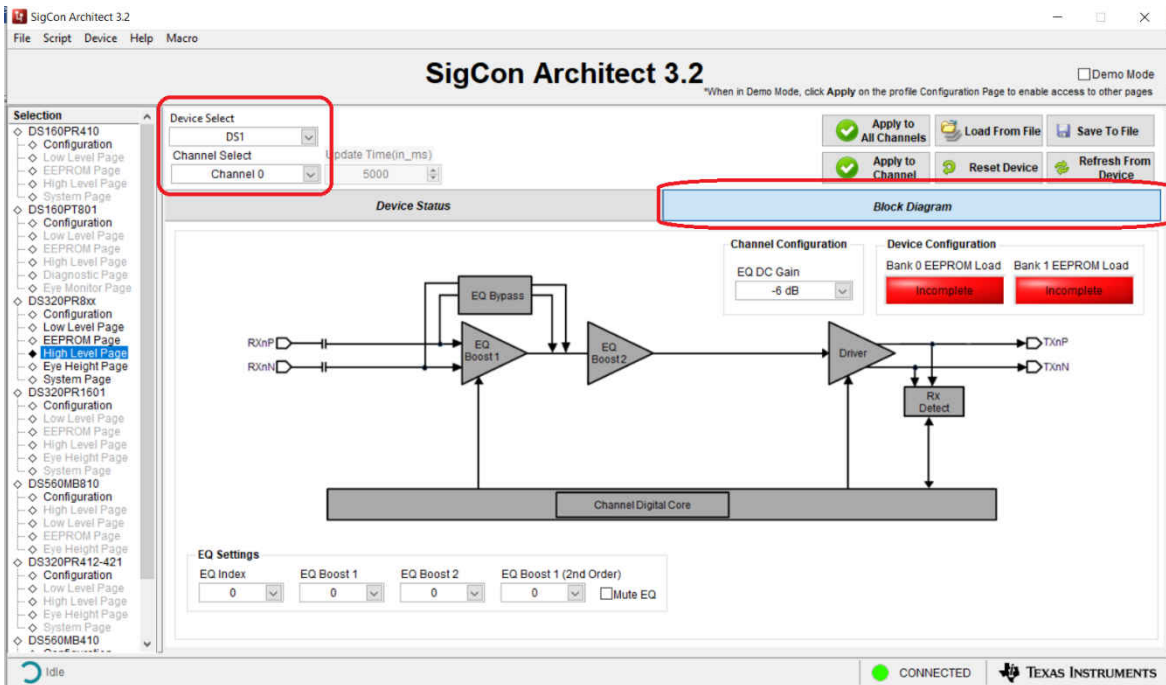
1. After clicking on the high level tab, the device status page will be shown. Each channel status will be updated sequentially, and appear green if a signal is detected and red if a signal is not detected. The current EQ settings will also be shown next to each channel.



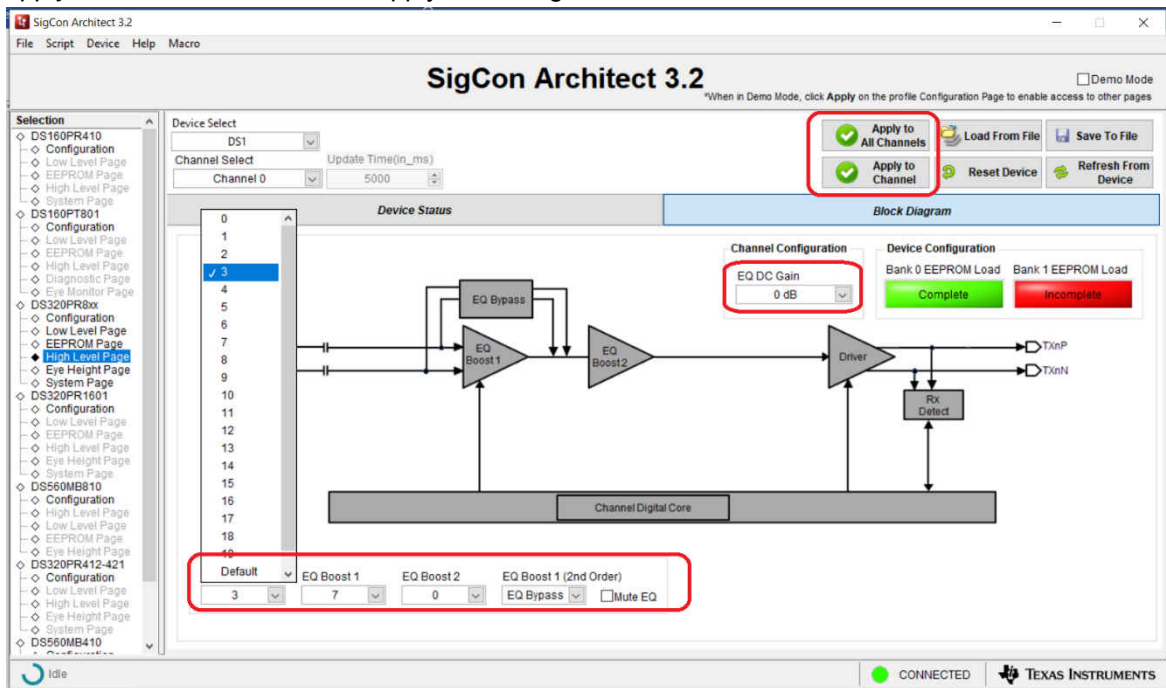
The screenshot displays the SigCon Architect 3.2 software interface. The main window is titled "SigCon Architect 3.2" and includes a "Demo Mode" checkbox. The interface is divided into several sections:

- Selection:** A tree view on the left side showing the configuration hierarchy for various devices, including DS160PR410, DS160PT801, DS320PR8xx, DS320PR1601, DS560MB810, DS320PR412-421, and DS560MB410.
- Device Select:** A dropdown menu set to "DS1" and a "Channel Select" dropdown set to "Channel 0". An "Update Time(in\_ms)" field is set to "5000".
- Buttons:** "Load From File", "Save To File", "Reset Device", and "Refresh From Device".
- Device Status:** The active tab, showing a list of channels (Channel 0 to Channel 3) for device DS1. Each channel has a "Continuous Status Update" checkbox checked. The status for each channel is shown as "Rx P Detected" (green) and "Rx N Detected" (green). Below the status indicators are EQ settings: EQ Index (0), EQ DC Gain (0 dB), EQ Boost 1 (0), EQ Boost 2 (0), and EQ Boost 1 (2nd Order) (0). A "Mute EQ" button is also present for each channel.
- Status Bar:** Shows "Idle" and "CONNECTED" with a green indicator, along with the Texas Instruments logo.

2. Click on the *Block Diagram* tab to show the following screen. Here, we can adjust the EQ values for each channel. Select a device and channel from the drop-down menu.



- Select the desired EQ settings and DC gain. The *EQ Index* drop-down menu is the easiest way to quickly adjust the amount of equalization applied. After selecting an Index value, the Boost 1, Boost2, and Boost 1 (second order) fields will automatically populate. The user can adjust each boost value for finer tuning as needed. Refer to table 7-1 of the DS320PR810 data sheet for more information. Click the *Apply to Channel* or *Apply to All Channels* button to apply the changes.



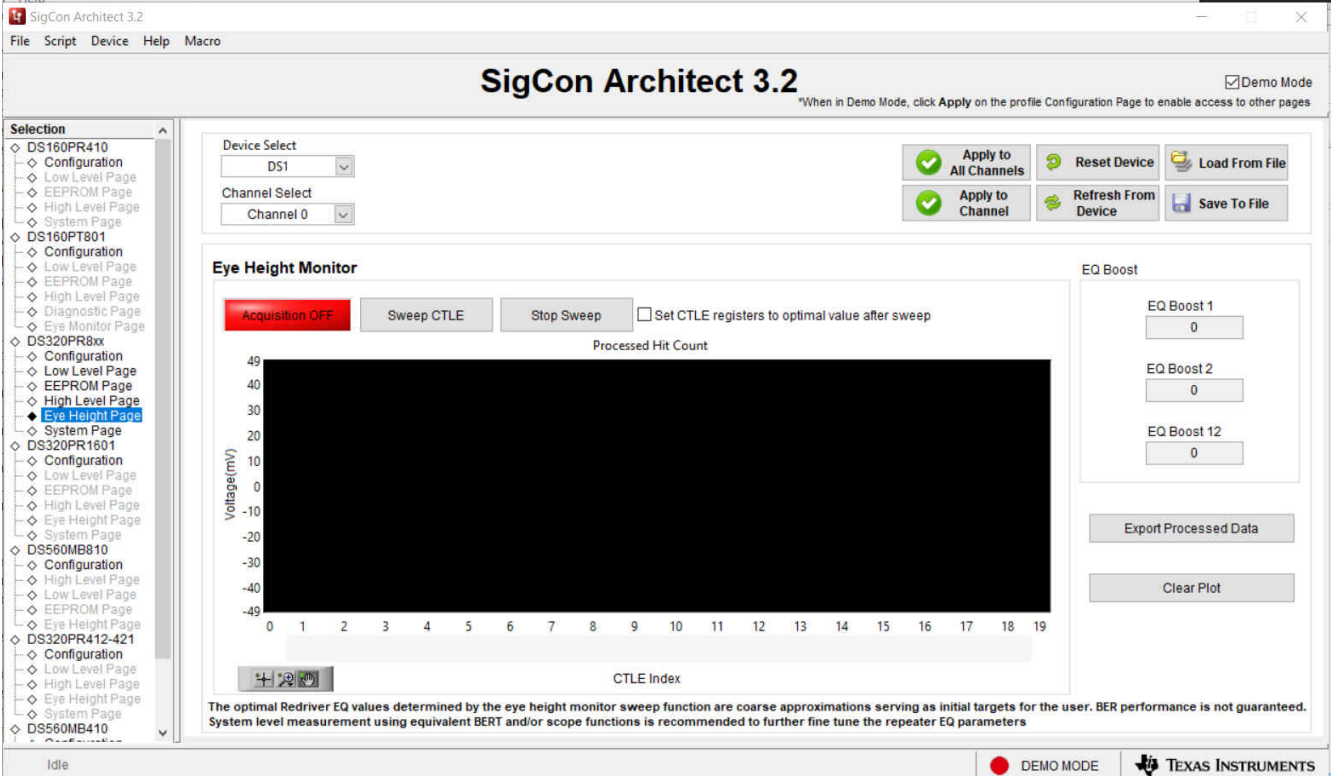
## 5 Eye Height Page

### Note

This page is currently under development and the provided results might not be accurate

This page can assist the user in tuning the CTLE settings to best match their system. Use it to display the eye height of the signal passing through the redriver, for all 20 CTLE index settings. Select the channel you would like to test, and click the *Sweep CTLE* button. The redriver will automatically detect the eye height with each index setting and display it in the plot below.

Note that this plot displays the eye heights directly at the output pins of the redriver. It is recommended to also use other lane margining tools to monitor signal quality at each end of the link. This tool should only be used as a reference and cannot guarantee optimal system performance based on this plot alone.



The screenshot shows the SigCon Architect 3.2 software interface. The main window is titled "SigCon Architect 3.2" and includes a "Demo Mode" checkbox. The interface is divided into several sections:

- Selection:** A tree view on the left side showing various device configurations, including DS160PR410, DS160PT801, DS320PR8xx, DS320PR1801, DS560MB810, DS320PR412-421, and DS560MB410.
- Device Select:** A dropdown menu currently set to "DS1".
- Channel Select:** A dropdown menu currently set to "Channel 0".
- Control Buttons:** A set of buttons including "Apply to All Channels", "Reset Device", "Load From File", "Apply to Channel", "Refresh From Device", and "Save To File".
- Eye Height Monitor:** The central section containing:
  - Buttons for "Acquisition OFF" (highlighted in red), "Sweep CTLE", and "Stop Sweep".
  - A checkbox labeled "Set CTLE registers to optimal value after sweep".
  - A plot titled "Processed Hit Count" showing "Voltage(mV)" on the y-axis (ranging from -49 to 49) and "CTLE Index" on the x-axis (ranging from 0 to 19). The plot area is currently black.
  - Buttons for "Export Processed Data" and "Clear Plot".
- EQ Boost:** A section on the right with three input fields for "EQ Boost 1", "EQ Boost 2", and "EQ Boost 12", all currently set to "0".

At the bottom of the interface, there is a status bar showing "Idle", "DEMO MODE", and the Texas Instruments logo.

## 6 System Page

This page allows users to estimate optimal CTLE settings for their application, based on known pre and post channel losses. This feature is also available in Demo Mode.

1. Enter the known Pre and Post-channel losses into each of the boxes. The GUI will show whether the losses are within the limit of the redriver or not.

The screenshot shows the SigCon Architect 3.2 software interface. The main window displays a signal flow diagram for a PCIe Root Complex and a PCIe Endpoint. The Root Complex includes a PCIe Tx, a Pre-channel Loss of 10.5 dB, and a Redriver. The Endpoint includes a Post-channel Loss of 5.5 dB and a PCIe Rx. The total downstream loss is 16 dB. Below the diagram is a table for selecting CTLE Index and Boost values.

**Estimate Loss:** Downstream

**Pre-channel Loss:** 10.5 dB

**Total Downstream Loss:** 16 dB

**Post-channel Loss:** 5.5 dB

**Select Boost:**

PCle Tx	PCle Tx Tx EQ	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
P4	0.00	0.00	1.20	2.40	3.60	4.80	5.60	6.20	6.90	7.50	8.10	8.70	9.10	9.40	10.00	10.80	11.20	12.00	12.80	13.20	14.00
P5	1.90	1.90	3.10	4.30	5.50	6.70	7.50	8.10	8.80	9.40	10.00	10.60	11.00	11.30	11.90	12.70	13.10	13.90	14.70	15.10	15.90
P3,P6	2.50	2.50	3.70	4.90	6.10	7.30	8.10	8.70	9.40	10.00	10.60	11.20	11.60	11.90	12.50	13.30	13.70	14.50	15.30	15.70	16.50
P1,P9	3.50	3.50	4.70	5.90	7.10	8.30	9.10	9.70	10.40	11.00	11.60	12.20	12.60	12.90	13.50	14.30	14.70	15.50	16.30	16.70	17.50
P2	4.40	4.40	5.60	6.80	8.00	9.20	10.00	10.60	11.30	11.90	12.50	13.10	13.50	13.80	14.40	15.20	15.60	16.40	17.20	17.60	18.40
P0,P8	6.00	6.00	7.20	8.40	9.60	10.80	11.60	12.20	12.90	13.50	14.10	14.70	15.10	15.40	16.00	16.80	17.20	18.00	18.80	19.20	20.00
P7	8.00	8.00	9.20	10.40	11.60	12.80	13.60	14.20	14.90	15.50	16.10	16.70	17.10	17.40	18.00	18.80	19.20	20.00	20.80	21.20	22.00
P10	9.50	9.50	10.70	11.90	13.10	14.30	15.10	15.70	16.40	17.00	17.60	18.20	18.60	18.90	19.50	20.30	20.70	21.50	22.30	22.70	23.50

**EQ Settings:** CTLE Index: 3, EQ Boost 1: 7, EQ Boost 2: 0, EQ Boost 1(2nd Order): EQ Bypass

**Apply Settings:** Device Select: DS1, Channel Select: Channel 0, Apply to Channel, Apply to All Channels

2. Click the calculator button next to the transmission lines to calculate loss for PCB traces. Enter the trace material, width, length, and so on, and then click the *Apply* button.

**Transport Layer Loss Calculator**

Material: Typical FR4  
 df: 0.02  
 dk: 4  
 Frequency: 8 GHz  
 Width: 5 mils  
 Constant: 2.3  
 Loss per inch: 1.3 dB/in  
 Length: 5 inch  
**Total Loss: 6.51 dB**

Attenuation (dB/in) =  $\frac{1}{\text{Width(mils)} \cdot \sqrt{\text{Freq(GHz)} + \text{Constant} \cdot \text{Freq(GHz)}}} \cdot df + \sqrt{dk}$

PCle Tx Presets	Boost (dB)	0	1	2	3
P4	0.00	0.00	1.20	2.40	3.60
P5	1.90	1.90	3.10	4.30	5.50
P3,P6	2.50	2.50	3.70	4.90	6.10
P1,P9	3.50	3.50	4.70	5.90	7.10
P2	4.40	4.40	5.60	6.80	8.00
P0,P8	6.00	6.00	7.20	8.40	9.60
P7	8.00	8.00	9.20	10.40	11.60
P10	9.50	9.50	10.70	11.90	13.10

- The table will highlight suggested CTLE values for each PCIe Tx Preset, based on the losses you entered. You can use the lowest part of the screen to apply these CTLE settings, or do it from the high-level page. Note that these are only estimated values and are not guaranteed to be the best settings. Further IBIS model simulation, or bit error rate testing can be used to further determine the optimal redriver settings.

**Select Boost:**

PCle Tx Presets	Tx EQ Boost (dB)	CTLE Index & Boost (dB)																			
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
P4	0.00	0.00	1.20	2.40	3.60	4.80	5.60	6.20	6.90	7.50	8.10	8.70	9.10	9.40	10.00	10.80	11.20	12.00	12.80	13.20	14.00
P5	1.90	1.90	3.10	4.30	5.50	6.70	7.50	8.10	8.80	9.40	10.00	10.60	11.00	11.30	11.90	12.70	13.10	13.90	14.70	15.10	15.90
P3,P6	2.50	2.50	3.70	4.90	6.10	7.30	8.10	8.70	9.40	10.00	10.60	11.20	11.60	11.90	12.50	13.30	13.70	14.50	15.30	15.70	16.50
P1,P9	3.50	3.50	4.70	5.90	7.10	8.30	9.10	9.70	10.40	11.00	11.60	12.20	12.60	12.90	13.50	14.30	14.70	15.50	16.30	16.70	17.50
P2	4.40	4.40	5.60	6.80	8.00	9.20	10.00	10.60	11.30	11.90	12.50	13.10	13.50	13.80	14.40	15.20	15.60	16.40	17.20	17.60	18.40
P0,P8	6.00	6.00	7.20	8.40	9.60	10.80	11.60	12.20	12.90	13.50	14.10	14.70	15.10	15.40	16.00	16.80	17.20	18.00	18.80	19.20	20.00
P7	8.00	8.00	9.20	10.40	11.60	12.80	13.60	14.20	14.90	15.50	16.10	16.70	17.10	17.40	18.00	18.80	19.20	20.00	20.80	21.20	22.00
P10	9.50	9.50	10.70	11.90	13.10	14.30	15.10	15.70	16.40	17.00	17.60	18.20	18.60	18.90	19.50	20.30	20.70	21.50	22.30	22.70	23.50

EQ Settings: CTLE Index: 17, EQ Boost 1: 13, EQ Boost 2: 5, EQ Boost 1(2nd Order): 15

Apply Settings: Device Select: DS1, Channel Select: Channel 0



## 7 References

- Texas Instruments, [DS320PR810 Eight-Channel Linear Redriver for PCIe 5.0, CXL 1.1](#) data sheet.

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