Ezairo® 7160 SL Pre Suite Getting Started Guide

M-20867-008
October 2024

© SCILLC, 2024
Previous Edition © 2023
"All Rights Reserved"

Table of Contents

Page

Table of Contents 2
1. Introduction 4
2. Product Overview 5
  2.1 Hardware Setup 5
  2.2 Hybrid Module 5
  2.3 Firmware Bundle 5
  2.4 Sound Designer Software 10
  2.5 Hybrid Demonstrator Board 11
  2.6 Programming Box 11
3. Initial Setup 13
  3.1 Prerequisites and Software Downloads 13
  3.2 Installation Instructions 13
    3.2.1 Updating the RSL10 Dongle Driver 14
      3.2.1.1 RSL10 Dongle Driver 14
      3.2.1.2 RSL10 Dongle Firmware Update 14
    3.2.2 Additional Sound Designer Software Features, Locations, and Installation 15
      3.2.2.1 Documentation 15
      3.2.2.2 Sample Code 15
      3.2.2.3 iOS and Android App Development Tools 15
  3.3 Configuring the Hybrid Demonstrator Board 16
  3.4 Connecting the Programming Box 17
4. Working with the Sound Designer SDK 19
  4.1 Working with the SDK 19
    4.1.1 Connect to Device 19

- 4.2 Example Operations 24
  - 4.2.1 Audio Path Configuration 24
    - 4.2.1.1 What You Need 24
    - 4.2.1.2 Enable the Sound Generator 25
  - 4.2.2 Basic Wireless Configuration 26
    - 4.2.2.1 What You Need 26
    - 4.2.2.2 Enable Wireless Operation and Change the Device Name 26

5. Further Reading 27

CHAPTER 1

Introduction

Sound Designer Software Development Kit (SDK) Pre Suite is a comprehensive turnkey solution for Bluetooth® Low Energy-enabled hearing aids. Using the various tools described in this document, Ezairo 7160 SL Pre Suite greatly simplifies the development of wireless hearing-aid products. This document provides a guide for getting started with Ezairo 7160 SL Pre Suite, illustrating interaction of the system components and required tools.

CHAPTER 2

Product Overview

Ezairo 7160 SL Pre Suite is comprised of the Ezairo 7160 SL hybrid module and the Ezairo 7160 SL Firmware Bundle. The product is configured using Sound Designer Software, the Ezairo 7160 SL Hybrid Demonstrator Board, and a programming box that provides PC-to-device communications. This group of topics provides a brief overview of each component.

2.1 HARDWARE SETUP

The "Typical Evaluation and Development Setup" figure (Figure 1) illustrates a typical evaluation and development setup.

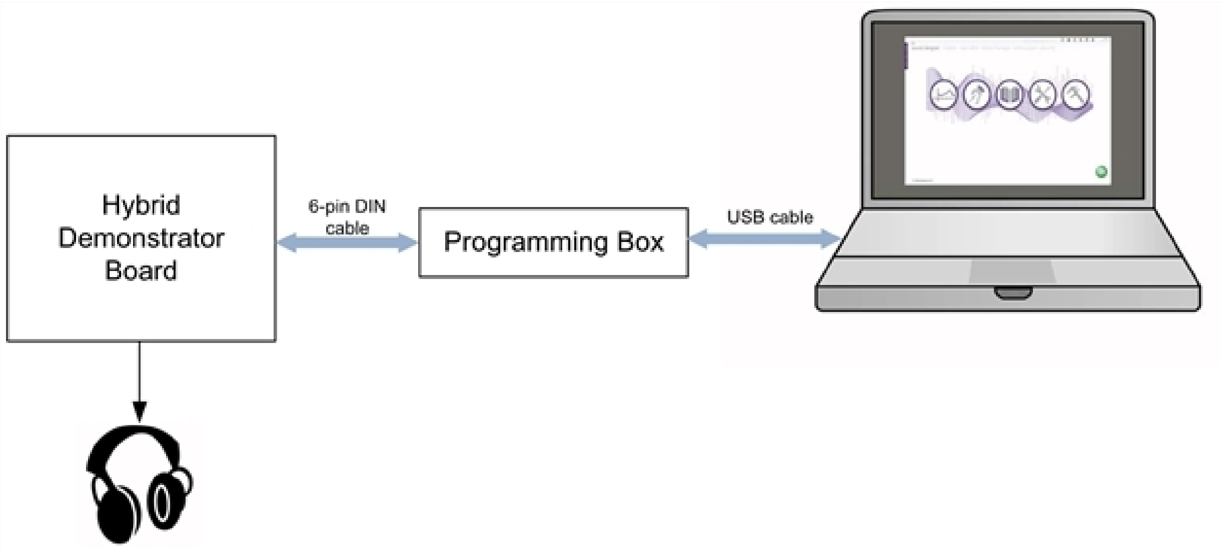


Figure 1. Typical Evaluation and Development Setup

2.2 HYBRID MODULE

Ezairo 7160 SL is an open-programmable DSP-based hybrid module specifically designed for wireless enabled, high-performance hearing aids. The Ezairo 7160 SL hybrid is comprised of: the Ezairo 7100SL System-on-Chip (SoC) audiology processor; RSL10, the industry's lowest power Bluetooth® 5 radio SoC; EA2M, a 2 Mb EEPROM; and all necessary passive components for operating the sub-system and interfacing with hearing aid transducers.

Full details for the Ezairo 7160 SL hybrid module (including a hearing-aid connection diagram) can be found in the Ezairo 7160 SL data sheet.

2.3 FIRMWARE BUNDLE

The Ezairo 7160 SL Firmware Bundle implements all the features required for an advanced, Bluetooth Low Energy enabled wireless hearing aid. These are listed in the "Firmware Features" table (Table 1), below.

Table 1. Firmware Features

Feature	Description
Control over Bluetooth Low Energy	Volume control and program memory selection can be performed over the Bluetooth Low Energy interface. Both remote-control functions as well as the hearing-aid battery status are provided as discoverable, Bluetooth Low Energy-compliant services.
Multi-protocol wireless audio streaming	The device can also receive wireless audio streams, either from certain proprietary devices (when capacity and licensing permit this), or via a custom protocol. The received audio stream is mixed with the microphone audio signal using an adjustable gain that can be configured wirelessly.
Andorid audio streaming support for hearing aids.	Ezairo 7160 SL supports the Android accessibility feature Audio Streaming for Hearing Aids (ASHA), which uses Bluetooth Low Energy to stream audio from ASHA-enabled Android mobile devices to connected hearing aids.
Wireless binaural synchronization	Operation of the user controls is synchronized between the left and right hearing aids in a binaural pair. Pushing a button on one ear automatically causes a corresponding change in the opposite ear. Synchronization of the environment classifier state further ensures that the left and right hearing aids are always in the same environment.
Firmware Over The Air (FOTA) support	Ezairo 7160 SL supports Firmware Over-The-Air (FOTA) updates for the radio application only.
Audio bandwidth	All features in the audio path, from microphone inputs to the receiver output, operate at a sample frequency of 24 kHz, providing an audio bandwidth of 12 kHz. Wireless audio streaming operates at a sample frequency of 16 kHz with a built-in conversion to 24 kHz for local audio mixing.
16-channel WDRC with in-channel limiting	Fully adjustable WDRC that provides independent compression in up to 16 channels. Each channel provides a compression curve with four separate knee points: expansion, low-level gain, high-level gain, and output limiting. Dynamic behavior covers a wide range through adjustable time constants.
Impulse Noise Reduction (INR)	Hearing aids are designed to amplify soft sounds to a level that is above the patient’s elevated threshold of hearing. On average, this leads to improved audibility of speech sounds. In real life, however, desired speech sounds are often accompanied by short-duration sounds that, when amplified, lead to listener discomfort. Such impulsive sounds include doors slamming and clatter from dishes and cutlery. This algorithm reduces the over-amplification for this type of impulsive sound.
Wideband limiter (AGCo)	Adjustable wideband gain with integrated fast-acting compression limiting.
48-band graphic Equalizer (EQ)	A graphic EQ provides an independent gain adjustment in each of the 48 separate frequency bands. Gains can be adjusted from -18 to +18 dB.
Adaptive Feedback Canceller Second Generation	Advanced, multiband feedback canceller with independent operation in each frequency band. A rich set of controls are provided to allow tuning over a wide range of acoustic conditions. An optional gain management feature further augments the canceller to minimize the occurrence of feedback events.
Adaptive noise reduction	Attenuates noise independently in 48 frequency bands. Maximum attenuation is adjustable in each frequency band up to a maximum of 15 dB.

Table 1. Firmware Features (Continued)

Feature	Description
Adaptive Directional Microphone	Synthesizes a directional microphone pattern from two omnidirectional microphones (front and rear). Automatically steers/adjusts the microphone pattern to minimize interfering noise sources. The directional block includes an optional low-frequency boost to equalize the directional microphone response.
Telecoil and Direct Audio Inputs (DAI)	An additional auxiliary input can be configured as telecoil, DAI, or wireless audio.
Environment Classification	Automatically classifies the acoustic environment and activates the appropriate program memory. Detection characteristics are adjustable, and the behavior of the device in each environment is completely flexible. Supports quiet, speech in quiet, noise, speech in noise, wind, and music.
8 Program Memories	The device supports up to 8 program memories with independent parameters. Selection of the active memory can be performed over Bluetooth Low Energy, by using push-button controls, or via the environment classifier feature.
General Purpose Filters	Eight general-purpose digital filters are provided for fine tuning the audio path. Each of the eight filters are second-order, Infinite Impulse Response (IIR) filters (also called biquads). Four filters (pre-biquads) are placed near the input stage, ahead of the WDRC processing; and four filters are placed near the output stage, after the WDRC processing. Filter coefficients are completely programmable via Sound Designer Software.
Datalogging	A short-term data log periodically records device status and system events into a circular buffer. A total of 512 events can be logged in the buffer which, assuming a log interval of 1 hour, covers a total time period of over 4 weeks. A separate long-term data log keeps track of how much time has been spent in each program memory.
Automatic Receiver Detection (ARD)	The ARD feature is intended for detachable RIC-style hearing aids. It provides a means of automatically detecting the type of attached receiver link. ARD operates in real time and provides rapid detection of the connected receiver link with no audible artifacts.
Firmware updates	The Pre Suite framework supports field upgradeable firmware.
Sound Generator for Tinnitus Treatment	Consists of a random noise generator with adjustable frequency shaping and randomized time modulation for tinnitus treatment.
Configurable Man-Machine Interface (MMI)	The MMI feature supports a push-button style volume control (up/down presses), an 8-program memory select function, and an automatic telecoil activation feature. Operation of the MMI is fully configurable, and the IO pins used for the MMI functions are selectable through the Sound Designer Software Windows application. Twenty-one different system events are signaled through an acoustic indicator feature that supports both tone-based and pre-recorded alert signals.
Fitting	All device parameters can be accessed over both the wired and wireless interfaces via the Sound Designer SDK. Wireless fitting is supported for Windows, via NoahLINK wireless or the RSL10 dongle, Android, and iOS. By providing a consistent API across multiple platforms, the Software Development Kit simplifies the development of fitting software.
Diagnostics	The Ezairo 7160 SL firmware bundle also provides numerous features designed to simplify hearing-aid design and manufacturing. These features include battery management, live display data, tone generation, and feedback-path measurement.

The main features are illustrated by the block diagram shown in the "Ezairo 7160 SL Firmware Bundle Block Diagram" figure (Figure 2).

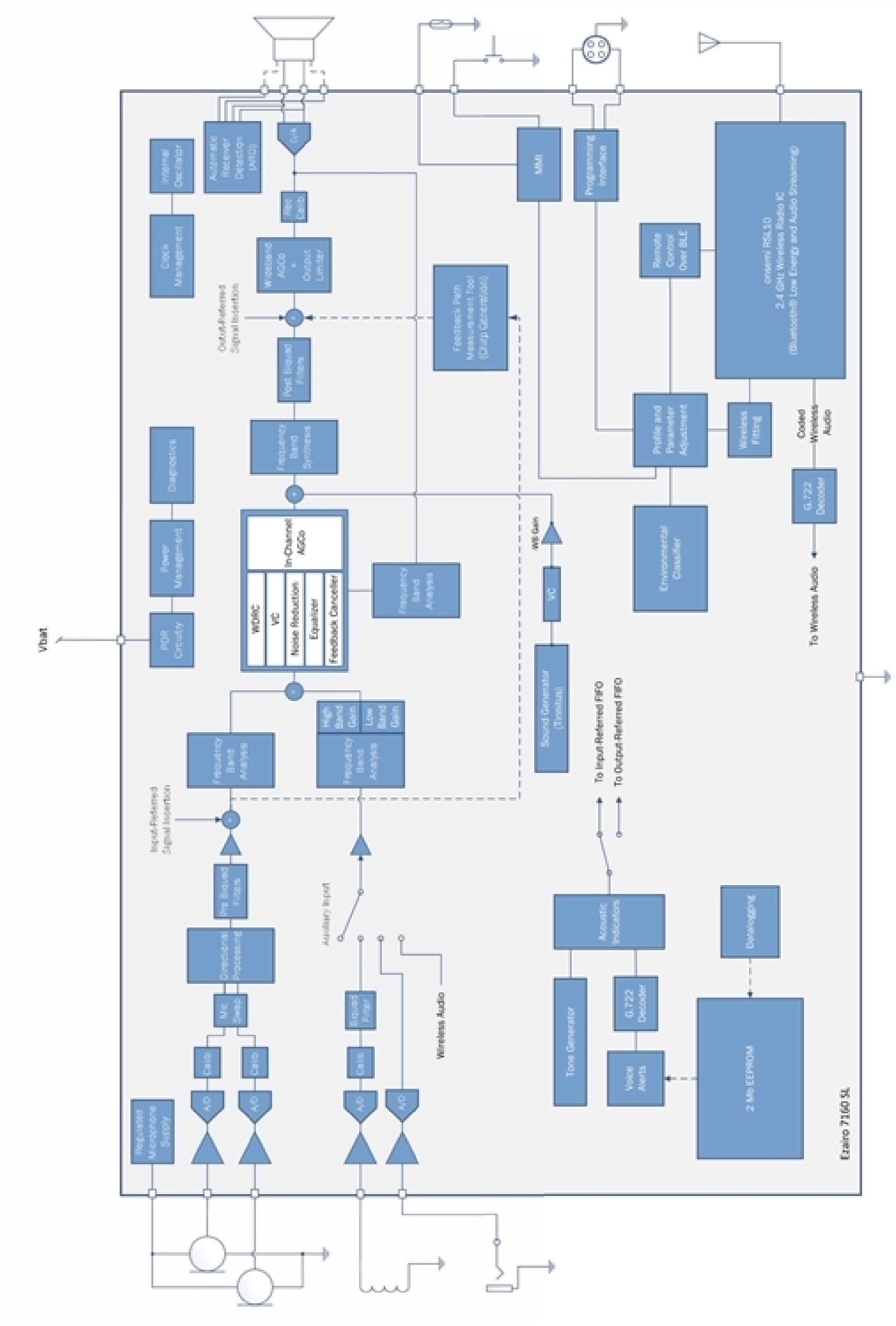

Internal Oscillator
Automatic Receiver Detection (ARD)
D/A
Rec Calib
Clock Management
Wideband AGCo + Output Limiter
Output-Referred Signal Insertion
Post Biquad Filters
Feedback Path Measurement Tool (Chirp Correlation)
MMI
Programming Interface
Remote Control Over BLE
onsemi RSL10 2.4 GHz Wireless Radio IC (Bluetooth® Low Energy and Audio Streaming)
Profile and Parameter Adjustment
Wireless Fitting
Coded Wireless Audio
G.722 Decoder
To Wireless Audio
Environmental Classifier
Frequency Band Synthesis
Diagnostics
Power Management
POR Circuitry
Vbat
In-Channel AGCo
WDRC
VC
Noise Reduction
Equalizer
Feedback Canceller
Frequency Band Analysis
WB Gain
VC
Sound Generator (Tinnitus)
High Band Gain
Low Band Gain
Frequency Band Analysis
Frequency Band Analysis
Input-Referred Signal Insertion
To Input-Referred FIFO
To Output-Referred FIFO
Auxiliary Input
Pre Biquad Filters
Directional Processing
Mic Swap
Calib
Calib
Biquad Filter
Calib
Wireless Audio
A/D
A/D
A/D
A/D
Regulated Microphone Supply
Acoustic Indicators
Tone Generator
G.722 Decoder
Voice Alerts
Datalogging
2 Mb EEPROM
Ezairo 7160 SL

Figure 2. Ezairo 7160 SL Firmware Bundle Block Diagram

Full product information is provided in the *Ezairo 7160 SL Firmware Bundle User's Guide*, which is included with the Sound Designer Software Windows Application.

2.4 SOUND DESIGNER SOFTWARE

The Ezairo Sound Designer Software Application is an engineering tool that allows Hearing Aid manufacturers to configure any Pre Suite Firmware bundle and derive several different Hearing Aid end products. Sound Designer Software consists of the Sound Designer Software Windows Application and the Sound Designer Software Development Kit (SDK).

The Sound Designer Software Application provides a complete desktop environment for hearing aid design. It integrates a device modeler, parameter map editor, product library manager, device control panel, and a calibration and configuration utility. This allows hearing aid manufacturers to create, configure, and test hearing aids more efficiently, with less time spent on repetitive tasks. The application's menu is shown in the "Application Opening Menu" figure (Figure 3).

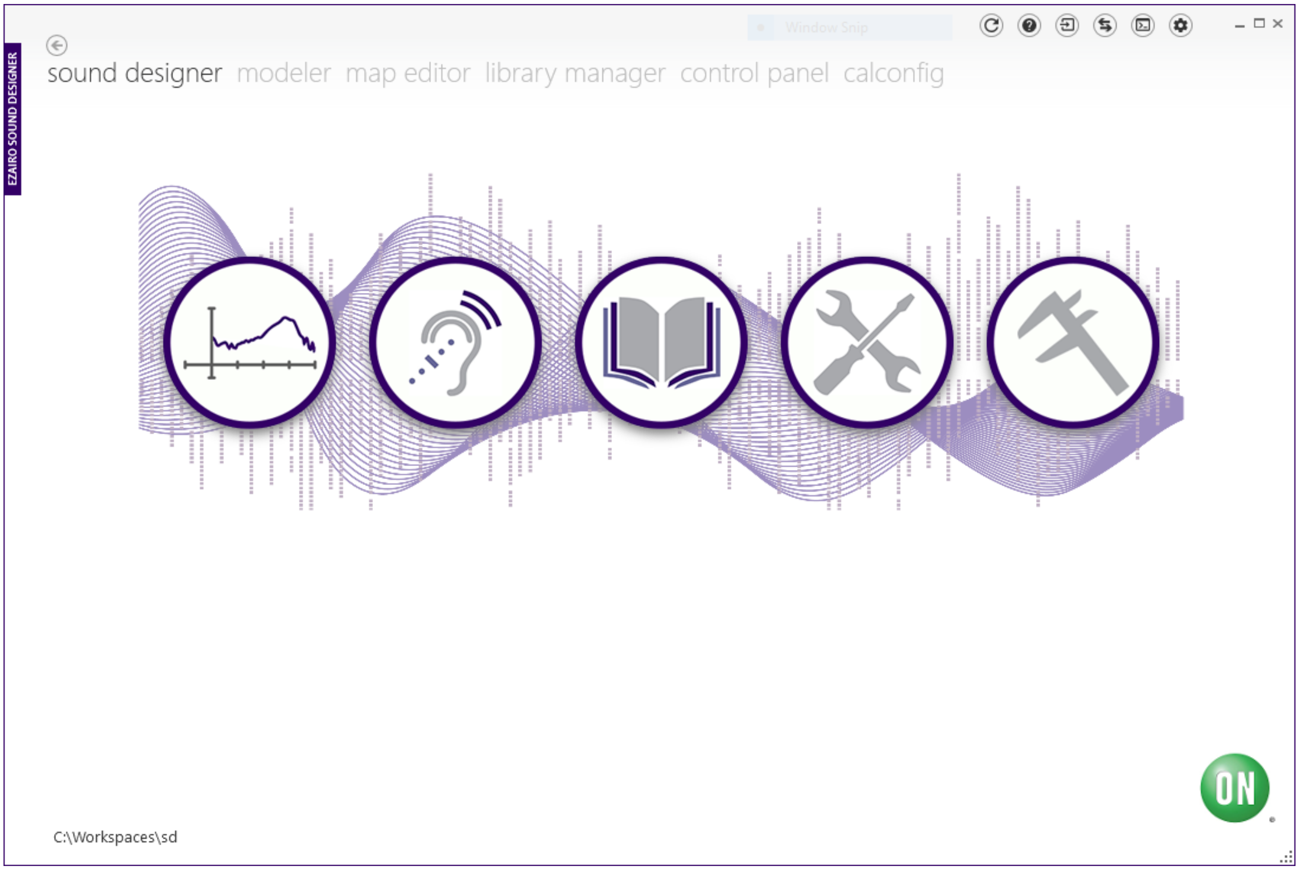


Figure 3. Application Opening Menu

The Sound Designer SDK is a cross-platform library that provides an interface to the hearing aid modeling and control functions. By providing a consistent API across multiple platforms, it simplifies the development of fitting software targeting the Ezairo 7160 SL Pre Suite product. The SDK distribution file also contains sample mobile applications for iOS, Android and Xamarin, to facilitate the development of mobile applications that work with the Ezairo 7160 SL Pre Suite and Windows sample code.

A complete reference guide for the Sound Designer Software Windows Application is provided upon installation of the software (see below for installation instructions). An SDK reference guide is included with the SDK distribution package.

2.5 HYBRID DEMONSTRATOR BOARD

The Hybrid Demonstrator Board is designed to be used with the Ezairo 7160 SL Pre Suite firmware bundle to develop wireless-enabled hearing aids based on Ezairo 7160 SL. The board includes an antenna and matching filter, and it features many configuration options available via standard 0.1 inch header pins. Two versions of the Ezairo 7160 SL demonstrator board are available but the descriptions in this document pertain to one version only: the socketed version (E7160SL-001GEVB). This version of the board is recommended for development, testing and debug purposes since the Ezairo 7160 SL hybrid module can be easily replaced.

The picture and the configuration options are described in Section 3.3 “Configuring the Hybrid Demonstrator Board” on page 16.

2.6 PROGRAMMING BOX

When using the Ezairo 7160 SL Hybrid Demonstrator Board, a programming box interface is provided through a 6-pin DIN connector that is mounted on the board. A 6-pin DIN to 6-pin DIN cable is also provided, allowing direct connection to the programming box. This connector is compatible with the connections provided on most of the programming boxes listed in the "Supported Communication Interfaces and Protocols" table (Table 2), with the exception of the Promira. When using the Promira, use the 6-pin DIN to 34-pin header adapter, provided with the Ezairo 7160 SL Hybrid Demonstrator Board.

Communicating with a device requires an I^2C connection between the Windows PC and Ezairo 7160 SL. The I^2C interface is provided by one of a number of different programming boxes that are compatible with Sound Designer Software. Supported devices are listed in "Supported Communication Interfaces and Protocols" table (Table 2).

Table 2. Supported Communication Interfaces and Protocols

Interface	I^2C	Wireless
Communication Accelerator Adaptor (CAA)	X	
HiPro	X	
DSP3	X	
Promira Serial Platform	X	
NOAHlink	X	
NOAHlink Wireless (versions 1 and 2)		X
RSL10 Dongle		X

Sound Designer Software works with any of the programming boxes listed above, but before using a wireless programmer or any other wireless feature, Ezairo 7160 SL must first be configured for wireless operation using a wired programming box. In addition, you must ensure that the Windows drivers provided by the manufacturer have been installed prior to using Sound Designer Software. Windows drivers for the various programming boxes are available from the manufacturers listed below in the "Windows Programmer Drivers and Their Manufacturers" table (Table 3).

Table 3. Windows Programmer Drivers and Their Manufacturers

Inferface	Manufacturers of Drivers
HiPro2	Otometrics
Noahlink/Noahlink Wireless	HIMSA
RSL10 Dongle	onsemi
Promira	TotalPhase Inc.
CAA	onsemi
DSP3	onsemi

CHAPTER 3

Initial Setup

This section describes the initial setup for evaluating the Ezairo 7160 SL Pre Suite. This includes downloading and installing the Sound Designer Software Windows application, configuring the Ezairo 7160 SL Hybrid Demonstrator Board, and connecting the programming box. The description is intended for first-time users. If you have already completed the initial setup, you can proceed to Section 4.2.1 “Audio Path Configuration” on page 24.

3.1 PREREQUISITES AND SOFTWARE DOWNLOADS

Before attempting to install Sound Designer Software, ensure that the computer meets the following minimum requirements:

- Hardware
    - Processor: 1 GHz
    - Memory: 512 MB RAM
    - Display: 16-bit color, 1024x768 screen resolution
    - Hard Drive: 150 MB of free space
    - Peripherals: communications interface for connecting to the Hybrid Demo Board (typically a serial or USB port - see below)

- One of the following versions of Microsoft® Windows®:
    - Windows 7 with Service Pack 1 (32-bit or 64-bit)
    - Windows 8.1 (32-bit or 64-bit)
    - Windows 10 (32-bit or 64-bit)

- For running the code samples:
    - CTK: This package is installed automatically as part of the Sound Designer Software installation and needs to be installed if you are using any programmer other than the Noahlink™ Wireless or the RSL10 dongle. The Noahlink Wireless programmer and RSL10 dongle do not require the CTK package to be installed.
        i. Microsoft® Visual C++ 2010 SP1 Redistributable Package (x86) (vcredist_x86.exe) available here: SoundDesignerSDK/redistribution/MS VC++ 2010 Redist (x86). The installation of this redistributable is required for CTK.
        ii. CTK installer: SoundDesignerSDK/redistribution/CTK
    - Microsoft Visual C++ 2015 Redistributable Update 2 for 32-bit operating systems (vc_redist.x86.exe), available here: SoundDesignerSDK/redistribution/MS VC++ 2015 Redist (x86). Installation of this package is required for the SDK.
    - The prerequisites listed in the *README* files contained in the individual code samples’ sub-directories. For example, to run the C# sample you need the Dot Net Core runtime (as indicated in the *README* file of that sample), in addition to the Visual Studio 2015 C++ redistributable.

To download Sound Designer Software, you require a MyON login account. If you do not have a MyON account, please contact your local onsemi sales representative.

To download the Sound Designer Software package, log into your MyON account and select the **Software** hyperlink from the main Ezairo 7160 SL landing page. From the **Design Tools** tab, select **E7160SL Firmware, Sound Designer and SDK** to download the main *.ZIP* file. Unzip the file contents to a local directory and then follow the instructions below.

3.2 INSTALLATION INSTRUCTIONS

To install Sound Designer Software, follow these steps:

1. Double-click **sounddesigner_setup.exe**. Follow the prompts for installing the software on your computer. When installation is complete, the Sound Designer Software can be launched from the **Start** menu under **onsemi** > **Sound Designer** > **Sound Designer**.
2. Select the appropriate programming box installation procedure from the following list:
    a. If you are using a DSP3 (from manufacturer onsemi), install the DSP3 Programmer driver version 2.1.71 (included in redistribution/DSP3).
    b. If you are using a HI-PRO (from manufacturer Otometrics), install the latest HI-PRO driver (currently version 4.02) from Otometrics®; add the following to your system path (found in the environment variables) to complete the HI-PRO programmer installation:

```
C:\Program Files (x86)\HI-PRO;
```

    c. If you are using a Promira™ Serial Platform (from manufacturer Total Phase), ensure that you are running firmware version 1.35 or later. Ensure also that your Promira is registered in the Device Manager under **Network Devices**, not under **Other Devices**. It might appear as **Remote NDIS Compatible Device**. When you plug in the Promira Serial Platform for the first time on a particular USB port, you need to wait for about two minutes to allow it to register before using Sound Designer Software. During registration, the blue light comes on, which normally indicates that the device is ready for use; however, if the registration is incomplete, Sound Designer Software cannot use Promira. See the *Promira Serial Platform System User Manual* from TotalPhase™ for more information.
    d. If you are using Noahlink Wireless (from manufacturer HIMSA), the driver is a simple plug-and-play setup. If it is not automatically installed, see https://www.himsa.com/himsa_download/noahlink-wireless-downloads/. You also must have the appropriate NOAHLink Wireless "Nibelung" DLLs available on your computer (version 1.x.x). The path to these files is configurable in the Sound Designer Software and via an API call in the Sound Designer SDK. All required DLLs need to be in a flat list in the specified directory. Both version 1 and 2 of the Noahlink Wireless are supported, as Version 2 of the Noahlink is backwards compatible with the Version 1 driver. The "Nibelung2" version of the driver is not yet supported.
    e. If you are using the RSL10 dongle, the driver is installed automatically when the dongle is plugged into the PC. For more information about the driver, see Section 3.2.1 "Updating the RSL10 Dongle Driver" on page 14.

3.2.1 Updating the RSL10 Dongle Driver

3.2.1.1 RSL10 Dongle Driver

To determine if you need to install the driver, open the Windows **Control Panel > Device Manager > Ports (COM & LPT)**. If it is working correctly, it is identified as **onsemi RSL10 USB dongle USB to UART Bridge**. If the dongle is not shown under this category in the Device Manager, or it shows up under **Other Devices** as **CP2102N USB to UART Bridge Controller**, then the driver needs to be installed. You need the listed COM port when configuring Sound Designer Software to use the dongle.

The driver installation files are provided in the *redistribution* folder under *RSL10/Driver*. Check the RSL10 USB Dongle version number printed on it to determine whether it is RSL10 v1.02 or RSL10 v1.02B. Unzip the archive corresponding to the RSL10 USB Dongle version, and install the appropriate *.exe* file.

3.2.1.2 RSL10 Dongle Firmware Update

The version information can be obtained when you connect to a device with the dongle via Sound Designer (in the console) and is shown as follows:

```
RSL10 Dongle Information:
App ID = DONG_R
App Version = 1.1.1
```

If the version shown is less than 1.1.1 then the software will not connect to the device and you must update the dongle firmware. To update the dongle firmware to the latest version, follow the instructions in *redistribution/RSL10/Firmware/README.TXT*.

3.2.2 Additional Sound Designer Software Features, Locations, and Installation

3.2.2.1 Documentation

Once the Sound Designer Software has been installed, you also have access to all the detailed technical documentation, such as the *Ezairo 7160 SL Firmware Bundle User's Guide* and the *Ezairo Sound Designer Software User's Guide*. See the *Documentation* directory under the SD installation directory; and the Firmware Bundle documentation is also located in the SDK documentation folder. This documentation is not required at this stage, but is useful for more advanced device configuration.

3.2.2.2 Sample Code

As part of the Sound Designer Software Development Kit (SDK), you have access to an archive containing sample code for all operating systems supported by the Sound Designer Software API. The "Code Sample Types and Locations" table (Table 4) shows the types of code samples available and where to find them in the archive.

Table 4. Code Sample Types and Locations

Code Sample Type	Location
C# samples using .NET Core and .NET Framework	*samples/win/cs*
COM samples in the form of API tests and a Win32 application	*samples/win/COM*
Python samples in the form of tests	*samples/win/python*
Xamarin for iOS sample app	*samples/ios/xamarin*
Swift for iOS sample app	*samples/ios/sdmobile*
Android sample app	*samples/android*

3.2.2.3 iOS and Android App Development Tools

Unzipping the Sound Designer Software Development Kit (SDK) gives you access to frameworks and libraries for developing iOS and Android apps, as described below in the "App Development Tools in the Sound Designer SDK" table (Table 5).

Table 5. App Development Tools in the Sound Designer SDK

Tool	Description	Location	More Information
iOS Sound Designer Software Frameworks	XCode app	*samples/ios/sdmobile*	*samples/ios/sdmobile/sdmobile/README.TXT*
	Xamarin app	*samples/ios/xamarin/Framework*	*samples/ios/xamarin/README.TXT*
Android Sound Designer Software Libraries	Android software libraries and a demonstration app	*samples/android*	*samples/android/E7150SL_SDK_Demo/README.TXT*

More details on the Sound Designer SDK and its features can be found in the *SDK Readme.html* file, located at the top level of the main *.ZIP* file.

3.3 CONFIGURING THE HYBRID DEMONSTRATOR BOARD

The description below assumes use of the socketed version of the Ezairo 7160 SL Hybrid Demonstrator Board (E7160SL-001GEVB) can be used for rapid evaluation of the Ezairo 7160 SL Pre Suite. The non-socketed version (E7160SL-002GEVB) can also be used.

Before connecting the Ezairo 7160 SL Hybrid Demonstrator Board to the programming box, ensure that a functioning Ezairo 7160 SL hybrid is installed. Refer to the *Ezairo 7160 SL Hybrid Demo Board User's Manual* (EVBUM2581) for detailed instructions on how to install the hybrid. Once the hybrid is installed, ensure that the jumpers and power switch are configured as listed in the "Jumper Configurations for the Hybrid Demonstrator Board" table (Table 6). If you are planning to work on wireless features, you also need to ensure that an appropriate antenna is connected to the threaded connector J1. Full information on the jumper settings and other board options can be found in the *Ezairo 7160 SL Hybrid Demo Board User's Manual* (EVBUM2581).

Table 6. Jumper Configurations for the Hybrid Demonstrator Board

Jumper/Switch	Required Setting	Description
PSU-SEL	Short pins 1&2	Draws power from 6-pin DIN connector
VBAT-I	Short pins together	Not measuring current
RCVR-EN	Short pins 1&2	Enable 7160SL output drivers
RCVR-BAT	Leave open	Using onboard power
ON-OFF	Set to ON	Power switch for 7160SL

A properly configured Hybrid Demonstrator Board looks like the one shown in the "Properly Configured Ezairo 7160 SL Hybrid Demonstrator Board " figure (Figure 4). The correct settings are indicated by red rectangles.

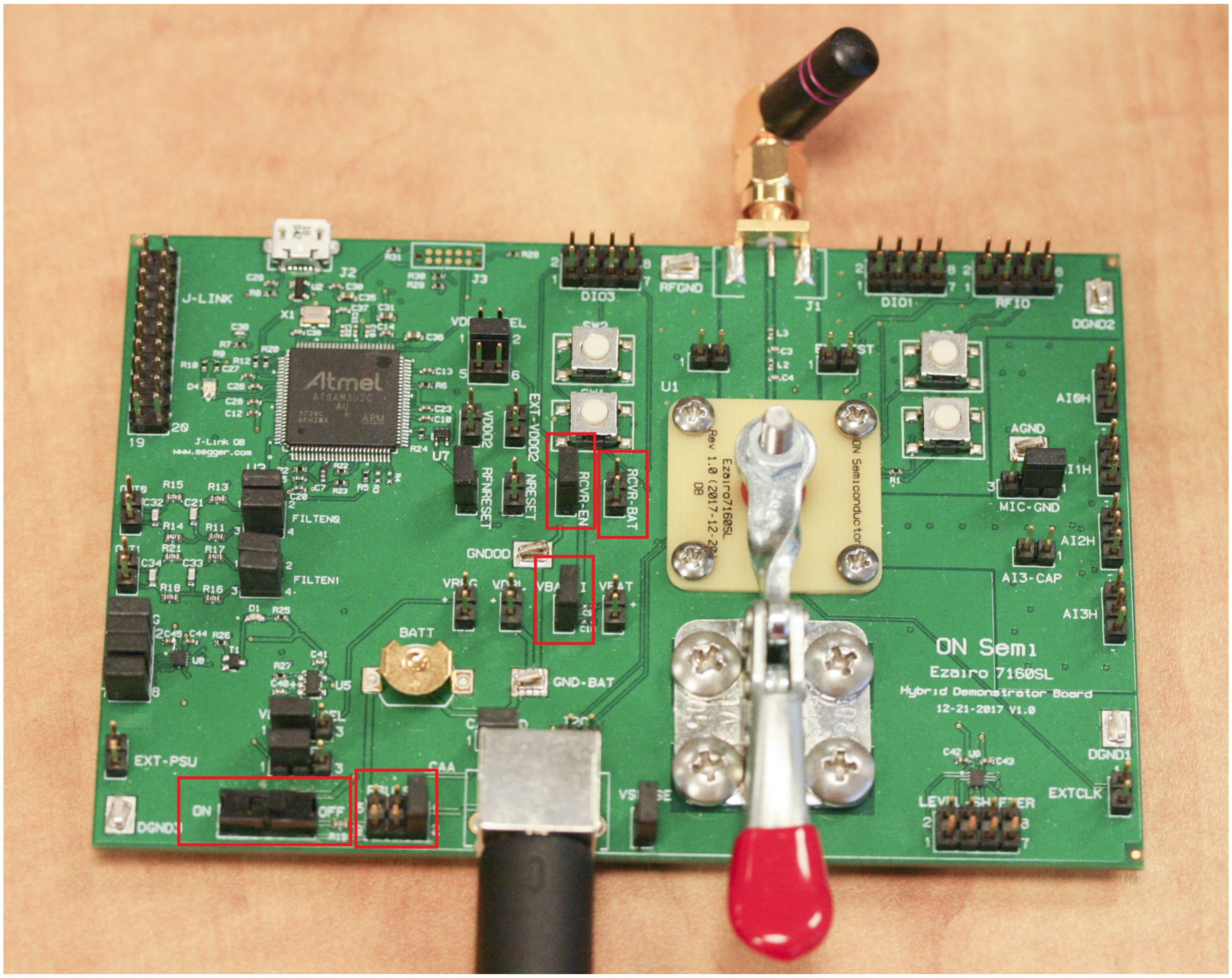


Figure 4. Properly Configured Ezairo 7160 SL Hybrid Demonstrator Board

3.4 CONNECTING THE PROGRAMMING BOX

The programming box is connected to the Hybrid Demonstrator Board via the 6-pin DIN connector provided on the Hybrid Demonstrator Board. The programming box connection is either a similar 6-pin DIN connector, or in the case of the Promira, a 34-pin header adapter.

Next, connect the programming box to the PC using a USB cable. The fully connected system appears as shown in the "Connected Ezairo 7160 SL Hybrid Demonstrator Board, Windows PC, and Programming Box " figure (Figure 5).

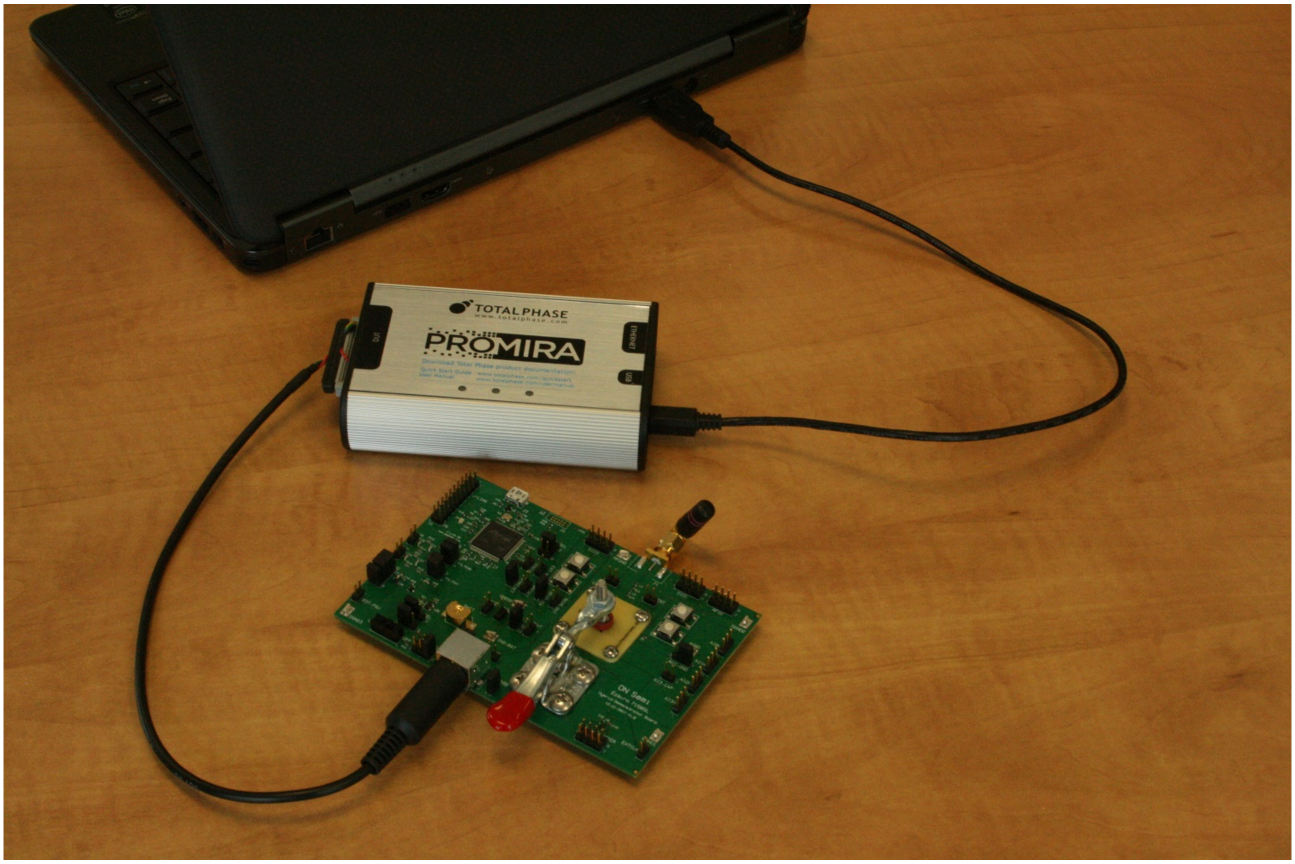

TOTAL PHASE
www.totalphase.com
PROMIRA

Figure 5. Connected Ezairo 7160 SL Hybrid Demonstrator Board, Windows PC, and Programming Box

Once the system is connected, you can perform the initial communication from the PC to Ezairo 7160 SL (device connection).

CHAPTER 4

Working with the Sound Designer SDK

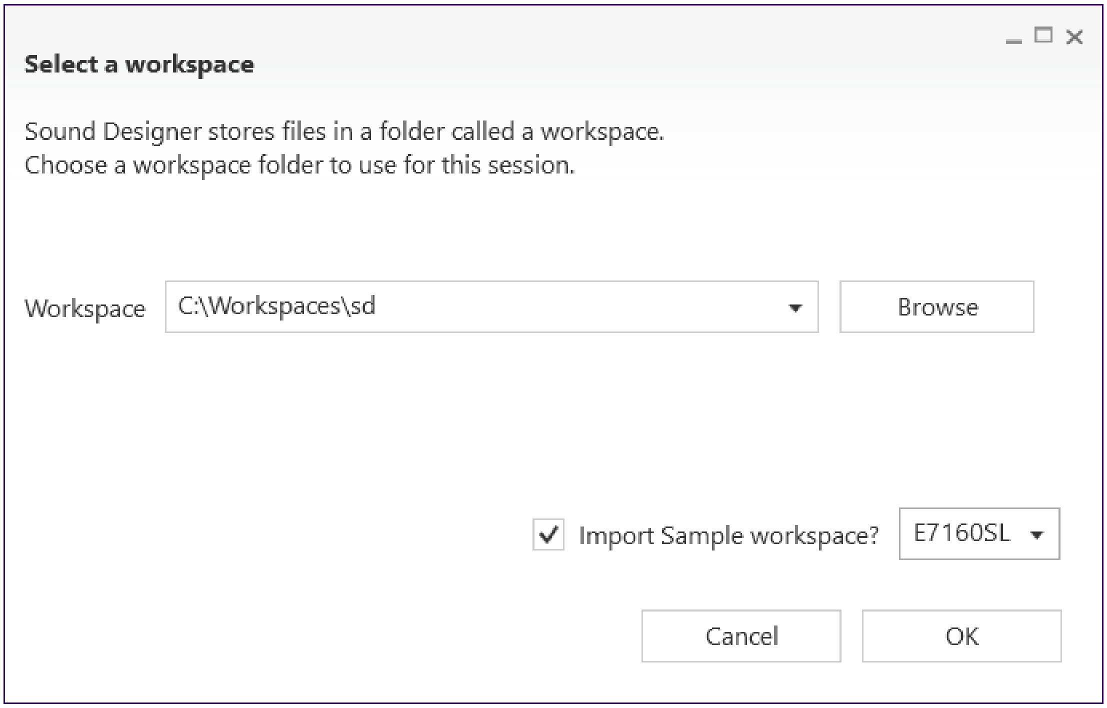
4.1 WORKING WITH THE SDK

4.1.1 Connect to Device

NOTE: The Ezairo Pre Suite firmware bundles are embedded within the Sound Designer Software. Options for selecting the appropriate firmware are provided upon initial connection to a device.

To establish a connection with the device, follow these steps:

1. Power on your device by plugging in the programming box and moving the Hybrid Demonstrator Board ON-OFF switch to the ON position (if not already done).
2. Start Sound Designer Software by clicking on the **Sound Designer** link under the **onsemi** tab on the Windows **Start** menu.
3. When the **Select a Workspace** dialog box appears, you need to choose a workspace to for Sound Designer Software. For new installations, we highly recommend selecting an empty directory for the workspace. Errors might occur if opening a workspace created using an earlier version of the Sound Designer Software Application. To create a workspace, click **Browse** and the software allows you to create one. If you click **Browse** and select a pre-existing directory for your workspace, make sure it is empty. To begin working with the Ezairo 7160 SL, check **Import Sample Workspace**, and select **E7160SL** from the drop-down list. Click **OK**. (See the "Selecting a Workspace" figure (Figure 6).)



Select a workspace

Sound Designer stores files in a folder called a workspace.
Choose a workspace folder to use for this session.

Workspace: C:\Workspaces\sd

☑ Import Sample workspace? E7160SL

Figure 6. Selecting a Workspace

IMPORTANT: If you experience problems, such as an error opening a map file, when you use a workspace that has been created for an older version of Sound Designer Software, try creating a new workspace.

4. Optionally, open the console window by clicking the Show Console icon (shown in the "Opening the Control Panel and the Console Window" figure (Figure 7)). The console window displays error and status messages accumulated in this session. We recommend having the console viewable at all times while using Sound Designer Software, to get immediate status information.

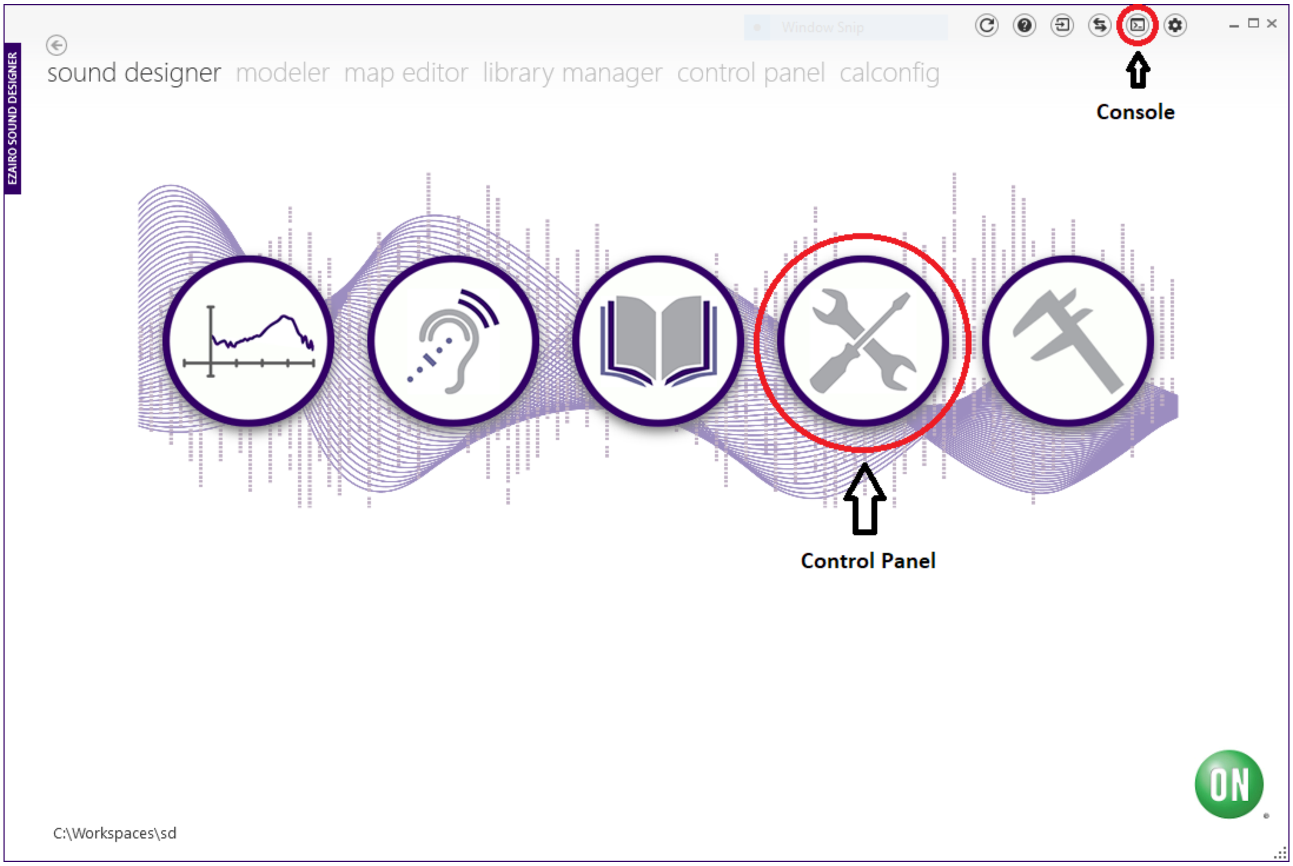
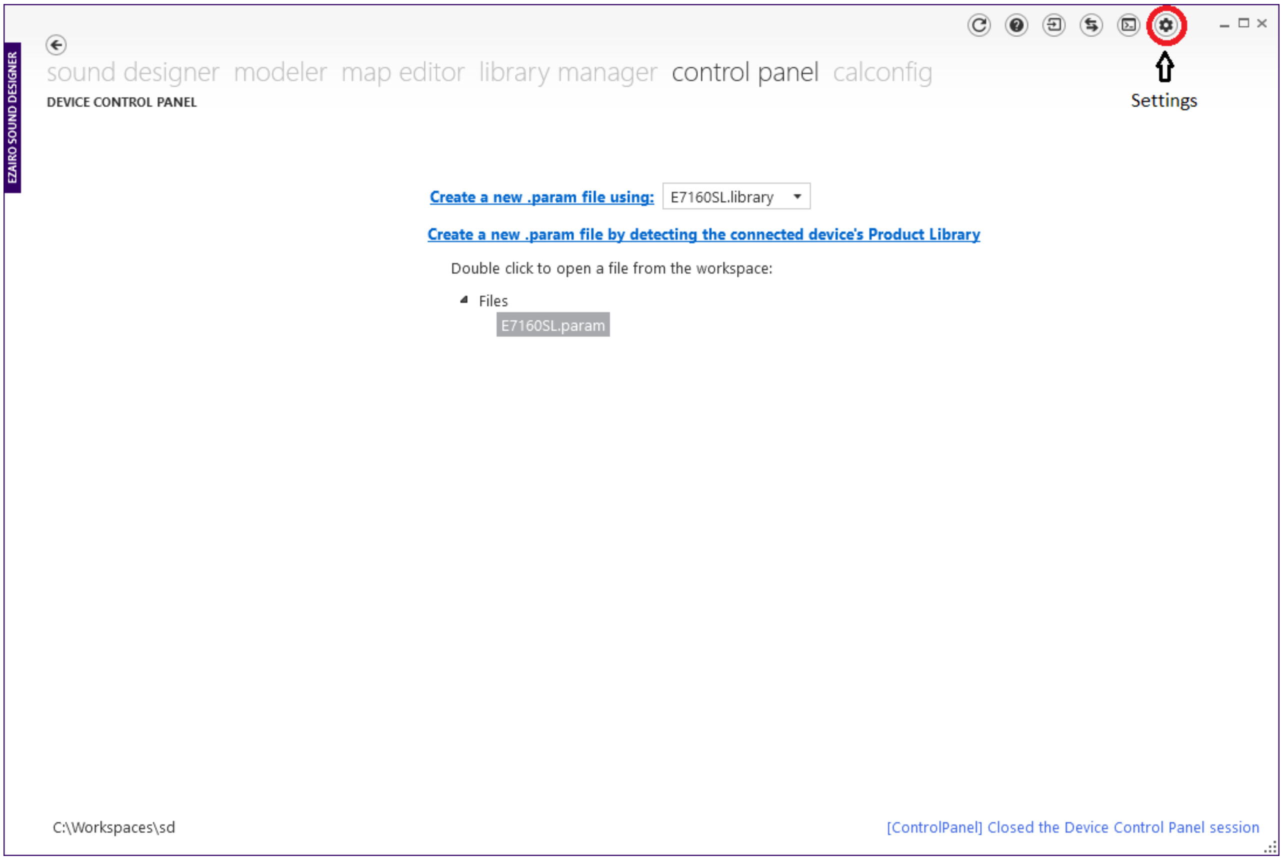

EZAIRO SOUND DESIGNER
sound designer
modeler
map editor
library manager
control panel
calconfig
Console
Control Panel
C:\Workspaces\sd

Figure 7. Opening the Control Panel and the Console Window

5. To configure device parameters, click on the **Control Panel** icon (circled in red in the "Opening the Control Panel and the Console Window" figure (Figure 7)) and, when prompted, double-click the **Ezairo7160SL.param** sample parameter file to open the demo product library, as shown below in the "Selecting the Parameter File" figure (Figure 8).


EZAIRO SOUND DESIGNER
sound designer
modeler
map editor
library manager
control panel
calconfig
DEVICE CONTROL PANEL
Settings
Create a new .param file using:
E7160SL.library
Create a new .param file by detecting the connected device's Product Library
Files
E7160SL.param

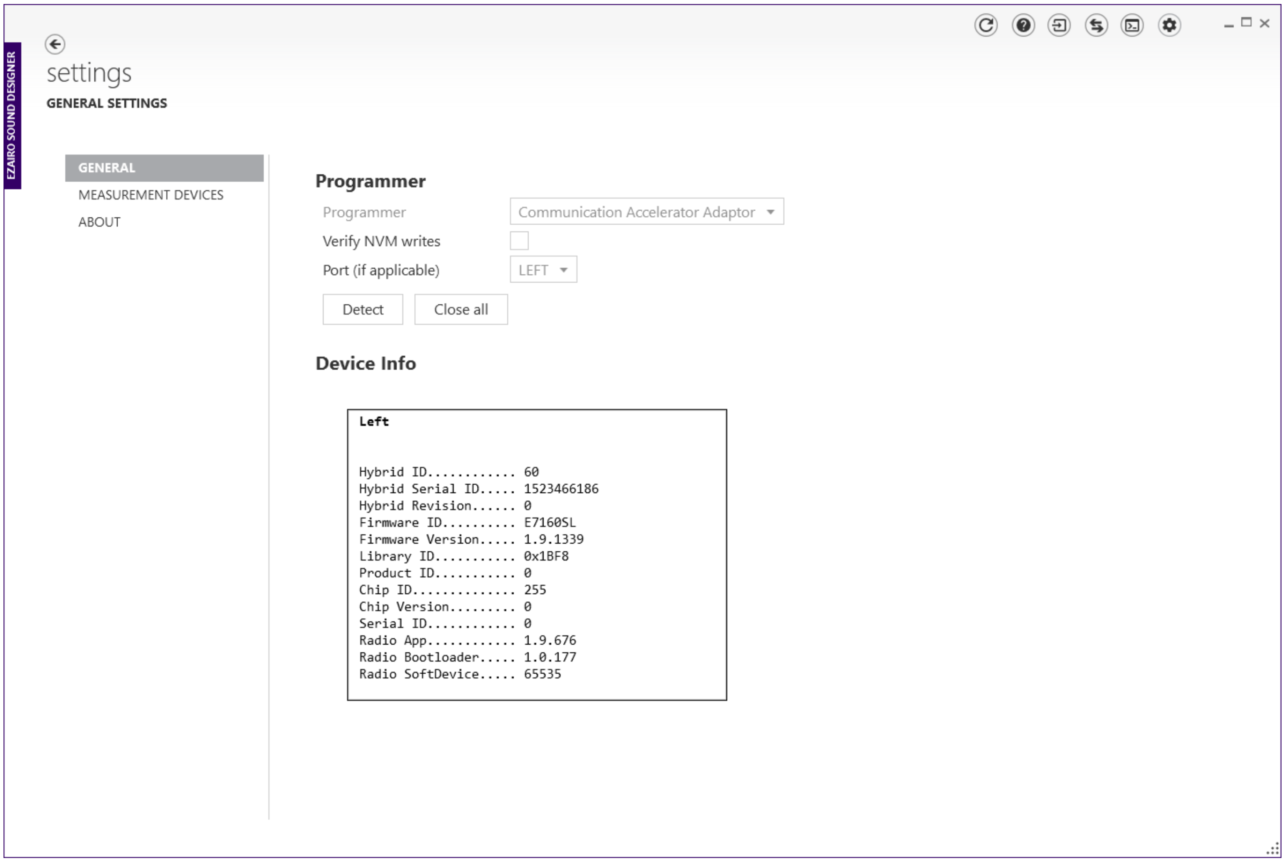
Double click to open a file from the workspace:

C:\Workspaces\sd

[ControlPanel] Closed the Device Control Panel session

Figure 8. Selecting the Parameter File

6. To connect to the device, go to the **Settings** screen. Select the correct **Programmer**, and **Port** if applicable. Next, click **Detect**. A successful detection populates the device information in the **Device Info** box, as shown in the "Detecting the Device" figure (Figure 9).



Programmer

Programmer: Communication Accelerator Adaptor

Verify NVM writes ☐

Port (if applicable): LEFT

Device Info

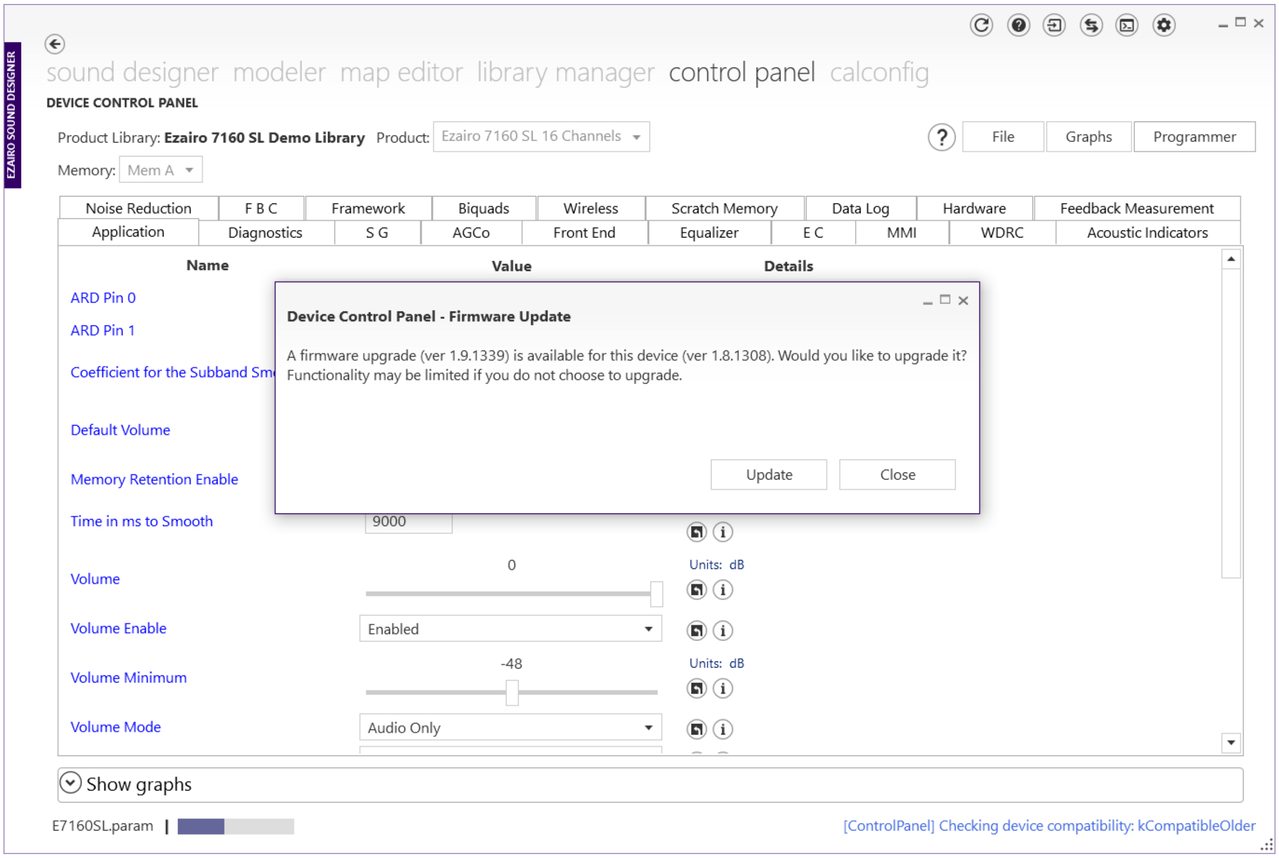
```
Left


Hybrid ID............ 60
Hybrid Serial ID..... 1523466186
Hybrid Revision...... 0
Firmware ID.......... E7160SL
Firmware Version..... 1.9.1339
Library ID........... 0x1BF8
Product ID........... 0
Chip ID.............. 255
Chip Version......... 0
Serial ID............ 0
Radio App............ 1.9.676
Radio Bootloader..... 1.0.177
Radio SoftDevice..... 65535
```

Figure 9. Detecting the Device

NOTE: Selecting **NOAHlink Wireless** or **RSL10 Dongle** displays a **Scan** button and a text field. The text field accepts the name of a device. Alternatively, using the **Scan** button opens a window that would allow the NOAHlink Wireless or RSL10 Dongle to scan for available devices so that you can choose one.

7. Use the back button—the arrow in the top left corner—to return to the Control Panel.
8. To connect to the device, click **Programmer** > **Connect**. You might get a popup warning you that the device is configured with another library. If you see this pop-up, click **OK**.
9. Before communicating any parameter information, Sound Designer Software checks the device to determine the firmware version currently residing in NVM. If the current version (contained within Sound Designer Software) is not the same as that currently in the device, you are prompted to upgrade the firmware. The prompt screen looks similar to that shown in the "Upgrading the Firmware" figure (Figure 10).


EZAIRO SOUND DESIGNER
sound designer
modeler
map editor
library manager
control panel
calconfig
DEVICE CONTROL PANEL
File
Graphs
Programmer
Noise Reduction
F B C
Framework
Biquads
Wireless
Scratch Memory
Data Log
Hardware
Feedback Measurement
Application
Diagnostics
S G
AGCo
Front End
Equalizer
E C
MMI
WDRC
Acoustic Indicators
Name
Value
Details
ARD Pin 0
ARD Pin 1
Coefficient for the Subband Sm
Default Volume
Memory Retention Enable
Update
Close
Show graphs

Product Library: **Ezairo 7160 SL Demo Library** Product: Ezairo 7160 SL 16 Channels

Memory: Mem A

Device Control Panel - Firmware Update

A firmware upgrade (ver 1.9.1339) is available for this device (ver 1.8.1308). Would you like to upgrade it? Functionality may be limited if you do not choose to upgrade.

Time in ms to Smooth: 9000

Volume: 0 Units: dB

Volume Enable: Enabled

Volume Minimum: -48 Units: dB

Volume Mode: Audio Only

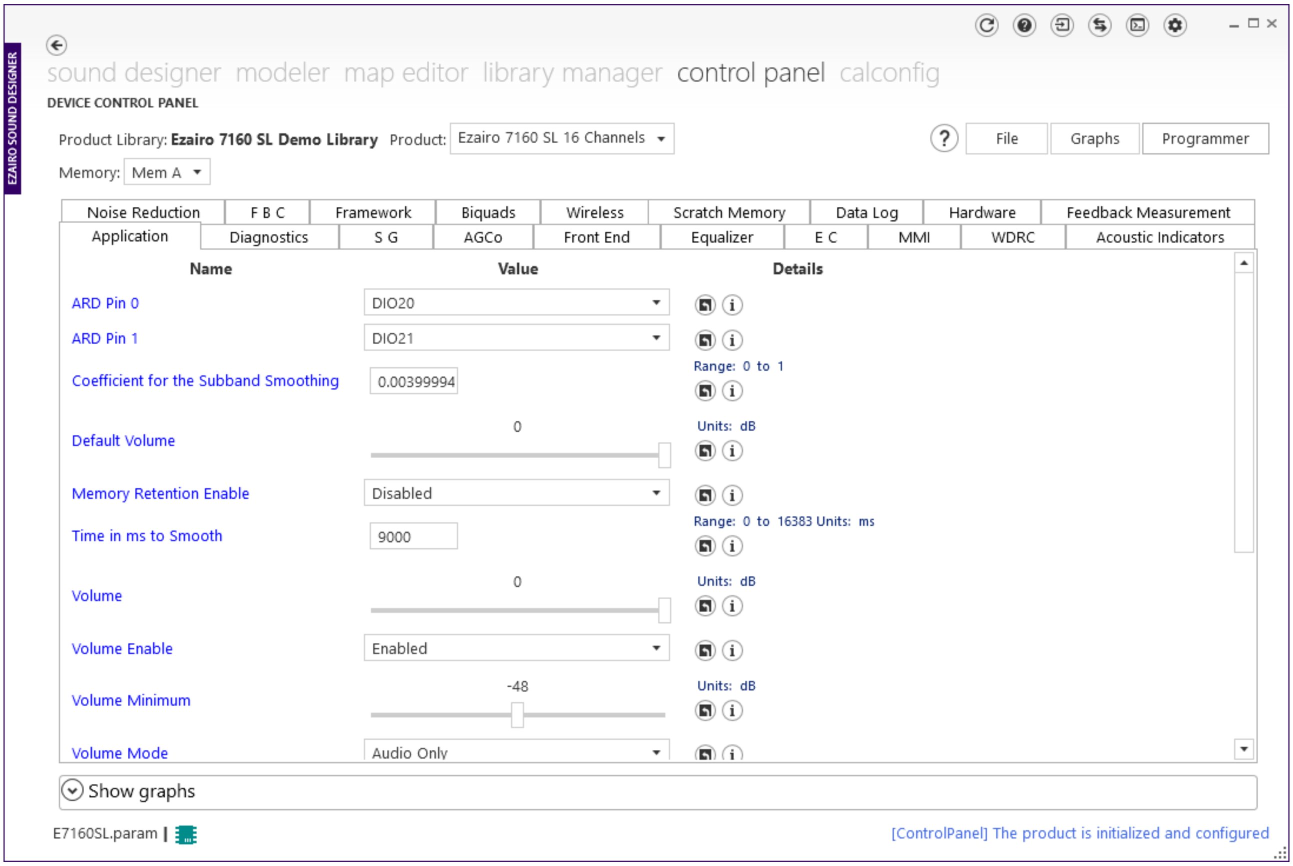
E7160SL.param

[ControlPanel] Checking device compatibility: kCompatibleOlder

Figure 10. Upgrading the Firmware

NOTE: Firmware cannot be updated over the wireless interface. When using a wireless programmer, you are notified of the firmware version but you will not be able to update the device. This requires a wired programmer.

10. Once the connection succeeds, the connection status symbol appears to the right of the file name, as shown below in the "Successful Connection" figure (Figure 11). You can hover over this symbol to view the programmer name and the firmware ID of the device. It is now possible to configure the device parameters.


EZAIRO SOUND DESIGNER
sound designer
modeler
map editor
library manager
control panel
calconfig
DEVICE CONTROL PANEL
?
File
Graphs
Programmer
Noise Reduction
F B C
Framework
Biquads
Wireless
Scratch Memory
Data Log
Hardware
Feedback Measurement
Application
Diagnostics
S G
AGCo
Front End
Equalizer
E C
MMI
WDRC
Acoustic Indicators
Show graphs

Product Library: **Ezairo 7160 SL Demo Library** Product: Ezairo 7160 SL 16 Channels
Memory: Mem A

Name	Value	Details
ARD Pin 0	DIO20	
ARD Pin 1	DIO21	
Coefficient for the Subband Smoothing	0.00399994	Range: 0 to 1
Default Volume	0	Units: dB
Memory Retention Enable	Disabled	
Time in ms to Smooth	9000	Range: 0 to 16383 Units: ms
Volume	0	Units: dB
Volume Enable	Enabled	
Volume Minimum	-48	Units: dB
Volume Mode	Audio Only	

E7160SL.param |

[ControlPanel] The product is initialized and configured

Figure 11. Successful Connection

4.2 EXAMPLE OPERATIONS

4.2.1 Audio Path Configuration

Once connected to a device, it is possible to read, write and burn parameters to the Ezairo 7160 SL internal NVM. The steps below illustrate how to configure the built-in sound generator to generate an audio signal from the Ezairo 7160 SL.

4.2.1.1 What You Need

Before beginning, you need to connect headphones or some other audio equipment to the output of the Ezairo 7160 SL Hybrid Demonstrator Board. Please refer to the *Ezairo 7160 SL Hybrid Demo Board User's Manual* for details.

The direct audio output from Ezairo 7160 SL is a pulse density modulated signal that can be used to directly drive hearing aid receivers or high impedance headphones. It is available on pins 2 and 4 of the header pins labelled `FILTEN0`.

The Demonstrator Board also provides a low-pass filtered output that is more appropriate for connection to sound cards and other audio equipment. The filtered output is enabled by connecting jumpers across pins 1 and 2 and 3 and 4 of header pin connector labelled `FILTEN0`. The filtered audio output is then available across pins labelled `OUT0`.

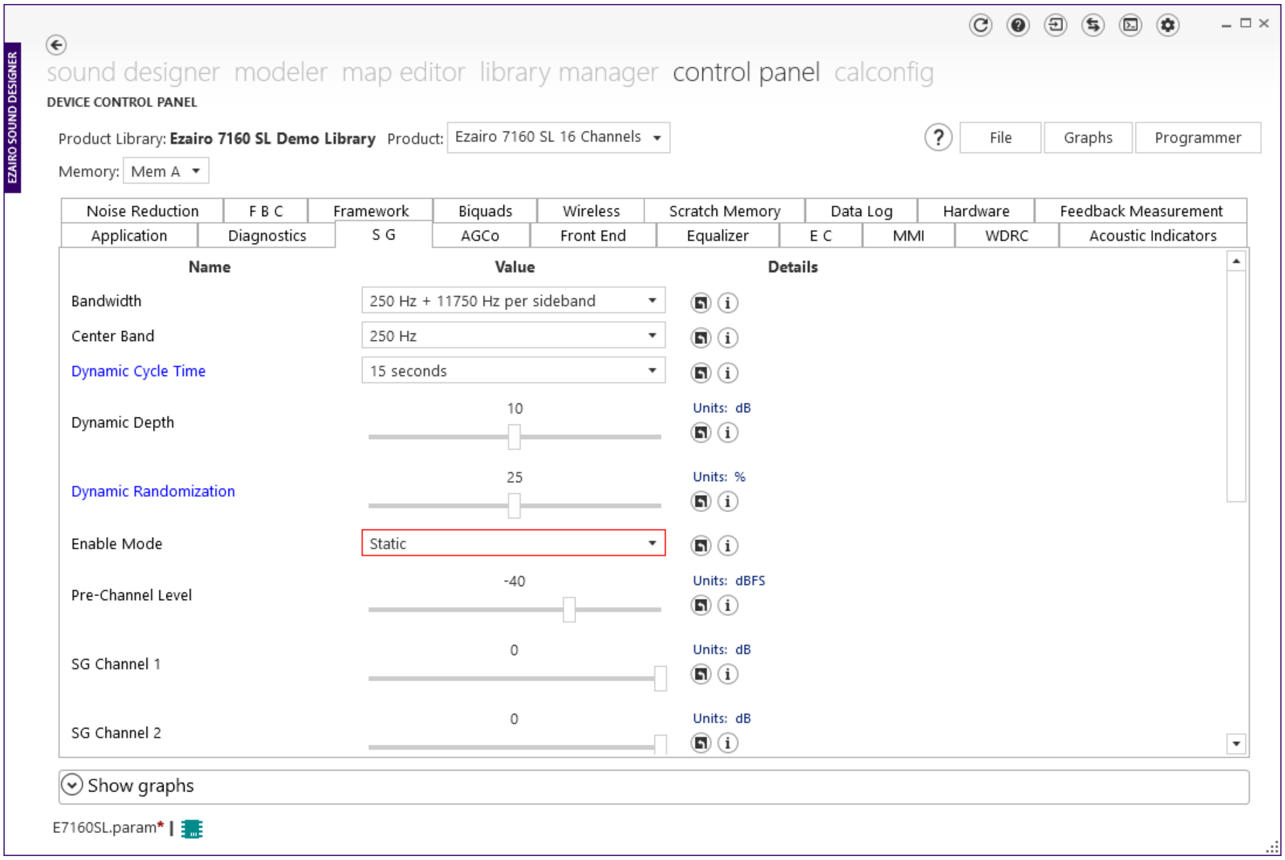
4.2.1.2 Enable the Sound Generator

If you are using a new device for the first time, all parameters need to be set to their default settings, as shown in the *E7160SL.param* file. If you are uncertain of the device state, or to ensure that the Sound Designer Software parameters are consistent with those stored in the device, you can perform a **Burn All to NVM** operation. This operation burns all default parameters from the current parameter file into NVM on the device, ensuring consistency with Sound Designer Software.

In the default configuration, only a basic audio path is configured. The front microphone input is enabled but the preamplifier gain is set to 0 dB. All advanced features are disabled. At this point, no audio signal is observed at the device output.

To generate an audio signal, follow these steps:

1. Select the **SG** tab in the Control Panel window.
2. Ensure that the **SG Bandwidth** parameter is set to 250 Hz + 11750 Hz per sideband.
3. Ensure the **Pre-Channel Level** is set to -40 dB.
4. Enable the sound generator by selecting **Static** from the drop-down menu for the **Enable Mode** parameter. The Control Panel screen needs to look like the "Enabling the Sound Generator " figure (Figure 12).


EZAIRO SOUND DESIGNER
sound designer
modeler
map editor
library manager
control panel
calconfig
DEVICE CONTROL PANEL
File
Graphs
Programmer
Noise Reduction
F B C
Framework
Biquads
Wireless
Scratch Memory
Data Log
Hardware
Feedback Measurement
Application
Diagnostics
S G
AGCo
Front End
Equalizer
E C
MMI
WDRC
Acoustic Indicators
Name
Value
Details
Show graphs

Product Library: **Ezairo 7160 SL Demo Library** Product: Ezairo 7160 SL 16 Channels

Memory: Mem A

Name	Value	Details
Bandwidth	250 Hz + 11750 Hz per sideband	
Center Band	250 Hz	
Dynamic Cycle Time	15 seconds	
Dynamic Depth	10	Units: dB
Dynamic Randomization	25	Units: %
Enable Mode	Static	
Pre-Channel Level	-40	Units: dBFS
SG Channel 1	0	Units: dB
SG Channel 2	0	Units: dB

E7160SL.param* |

Figure 12. Enabling the Sound Generator

5. Click the **Programmer** button and select **Write to RAM**.

6. A white noise signal is now observable at the output of the device.
7. To disable the sound generator, select **Disabled** from the drop-down menu for the **Enable Mode** parameter and write that to RAM. The noise signal is now off.

If you can hear an audio signal from your device, then your system has been configured correctly. You can now use a similar procedure to modify other device parameters. For full details on the various features, refer to the *Ezairo 7160 SL Firmware Bundle User's Guide*.

4.2.2 Basic Wireless Configuration

This section demonstrates basic wireless configuration of the Ezairo 7160 SL. The simplest way to demonstrate wireless operation is to change the displayed device name. The device name is a string of ASCII text that is transmitted from the device to enable correct identification during pairing operations. It is typically used to advertise a manufacturer or model name of the wireless hearing aid.

4.2.2.1 What You Need

In order to observe the wireless operation of the Ezairo 7160 SL, you will need the following:

1. A suitable antenna connected to the Ezairo 7160 SL Hybrid Demonstrator Board
2. A mobile phone or other Bluetooth wireless-enabled device that is capable of operating as a Bluetooth central device. The central device will be used to scan for and display the names of currently advertising Bluetooth devices.

4.2.2.2 Enable Wireless Operation and Change the Device Name

To configure the device name, follow these steps:

1. From the Sound Designer Software Control Panel, select the **Wireless** tab.
2. Enter a unique and recognizable device name into the edit box labelled **Device name (ASCII text)**.
3. Enable the wireless system by selecting **Enabled** from the drop-down menu for the **Wireless Enable** parameter.
4. Select **Programmer** > **Burn to NVM**.
5. Power cycle the EVB.
6. Go to the settings menu of your mobile device and select the Bluetooth option.
7. Under the Bluetooth settings, you can find a way to show a list of nearby devices available for connections. Check the list to see the device name entered under step 2, above.

For complete details of configuring the wireless system, refer to the *Ezairo 7160 SL Firmware Bundle User's Guide*.

CHAPTER 5

Further Reading

For additional technical details and more information regarding firmware bundle algorithm parameters, refer to the following resources:

- *Ezairo 7160 SL Firmware Bundle User's Guide*
- *Ezairo Sound Designer Software Development Kit (SDK) Programmer's Guide*

These documents can be requested through your local onsemi representative or authorized distributor:

- The Ezairo 7160 SL Datasheet
- *Ezairo 7160 SL Hybrid Demo Board User's Manual*
- *AND9838/D: Bluetooth Certification Guidelines for Sound Designer Software Development Kit (SDK)-based products*

onsemi and the onsemi logo are registered trademarks of Semiconductor Components Industries, LLC (onsemi). All other brand names and product names appearing in this document are trademarks of their respective holders.

Copyright 2023 Semiconductor Components Industries, LLC (“onsemi”). All rights reserved. Unless agreed to differently in a separate onsemi license agreement, onsemi is providing this “Technology” (e.g. reference design kit, development product, prototype, sample, any other non-production product, software, design-IP, evaluation board, etc.) “AS IS” and does not assume any liability arising from its use; nor does onsemi convey any license to its or any third party’s intellectual property rights. This Technology is provided only to assist users in evaluation of the Technology and the recipient assumes all liability and risk associated with its use, including, but not limited to, compliance with all regulatory standards. onsemi reserves the right to make changes without further notice to any of the Technology.

The Technology is not a finished product and is as such not available for sale to consumers. Unless agreed otherwise in a separate agreement, the Technology is only intended for research, development, demonstration and evaluation purposes and should only be used in laboratory or development areas by persons with technical training and familiarity with the risks associated with handling electrical/mechanical components, systems and subsystems. The user assumes full responsibility/liability for proper and safe handling. Any other use, resale or redistribution for any other purpose is strictly prohibited.

The Technology is not designed, intended, or authorized for use in life support systems, or any FDA Class 3 medical devices or medical devices with a similar or equivalent classification in a foreign jurisdiction, or any devices intended for implantation in the human body. Should you purchase or use the Technology for any such unintended or unauthorized application, you shall indemnify and hold onsemi and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that onsemi was negligent regarding the design or manufacture of the board.

The Technology does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the technical requirements of these or other related directives.

THE TECHNOLOGY IS NOT WARRANTED AND PROVIDED ON AN “AS IS” BASIS ONLY. ANY WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT, ARE HEREBY EXPRESSLY DISCLAIMED.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL ONSEMI BE LIABLE TO CUSTOMER OR ANY THIRD PARTY. IN NO EVENT SHALL ONSEMI BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE WHATSOEVER (INCLUDING, BUT NOT LIMITED TO, LOSS OR DISGORGEMENT OF PROFITS, LOSS OF USE AND LOSS OF GOODWILL), REGARDLESS OF WHETHER ONSEMI HAS BEEN GIVEN NOTICE OF ANY SUCH ALLEGED DAMAGES, AND REGARDLESS OF WHETHER SUCH ALLEGED DAMAGES ARE SOUGHT UNDER CONTRACT, TORT OR OTHER THEORIES OF LAW.

Do not use this Technology unless you have carefully read and agree to these limited terms and conditions. By using this Technology, you expressly agree to the limited terms and conditions. All source code is onsemi proprietary and confidential information.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for onsemi
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support:
800-282-9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support: Phone: 421 33 790 2910

onsemi Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

M-20867-008