# DigitalSynth

## USER'S MANUAL

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# Hardware requirements

- Digilent Nexys FPGA Board
- Digilent PMOD DA1
- Digilent SPKR1
- Digilent PS/2 Module
- PS/2 keyboard
- USB cable

# Hardware connection

Do not touch the integrated circuits!
They are sensitive to electrostatic discharges.

Do not connect or disconnect the components while power is on
and/or the USB cable is connected to the board!

1. Connect the PS/2 keyboard to the Digilent PS/2 Module.
2. Connect the Digilent PS/2 Module to the expansion port A of the FPGA board.
3. Connect the Digilent SPKR1 to the Digilent PMOD DA1.
4. Connect the Digilent PMOD DA1 to the expansion port D of the FPGA board.
5. Connect the USB cable to the USB connector of the FPGA board and to the PC.

A representation of the board with all the components can be found in figure 2, at the end of the document.

Instead of using the Digilent Speaker, the user can build a very simple connector that allows using other speakers. The following figure presents the connector.
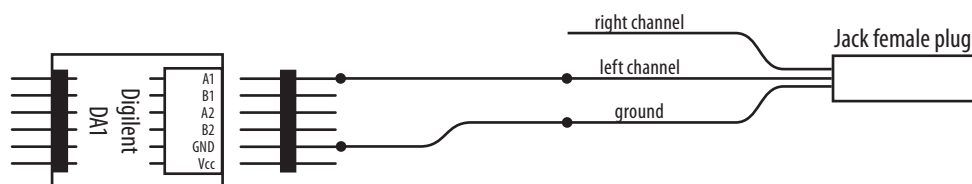


**Figure 1.** The speaker connector.

# Board programming

1. Turn on the power switch of the FPGA board.
2. Open the Digilent Adept ExPort application.
3. Configure and select the proper USB communication module.
4. Initialize the communication.

5. Select the "digitalsynth.bit" file.

6. Program the board.

7. Close the Digilent Adept ExPort application.

The board is now programmed. The user can start playing notes on the PS/2 keyboard, which will be rendered by the speaker. Other features of the design are accessible only to the software application.


# Software requirements

- Microsoft Windows XP
- Digilent Adept ExPort
- Microsoft .NET Framework 2.0


# Software installing and running

The "DigitalSynth" installer contains both the Microsoft .NET Framework 2.0 and the DigitalSynth application.

Before using the application, Digilent ExPort must be closed, as DigitalSynth doesn't share the "dpcutil.dll" dynamic library with other programs.


# Software usage

1. Initialize and start the USB communication with the FPGA board by selecting "USB Communication…" in the menu of the application.

2. Select "Audio Console…" in the menu of the application and apply effects on the sounds generated by the board or select a different voice.

3. Select "Open…" in the menu of the application, select a MIDI file and view its music sheet in the main window.

4. Click the "Play" button in the toolbar of the application and play the opened MIDI file on the FPGA board.

5. Click the "Record" button in the toolbar of the application and record a MIDI file from the FPGA board.

**Note.** Closing the application will automatically trigger closing the USB communication, without the user's intervention.
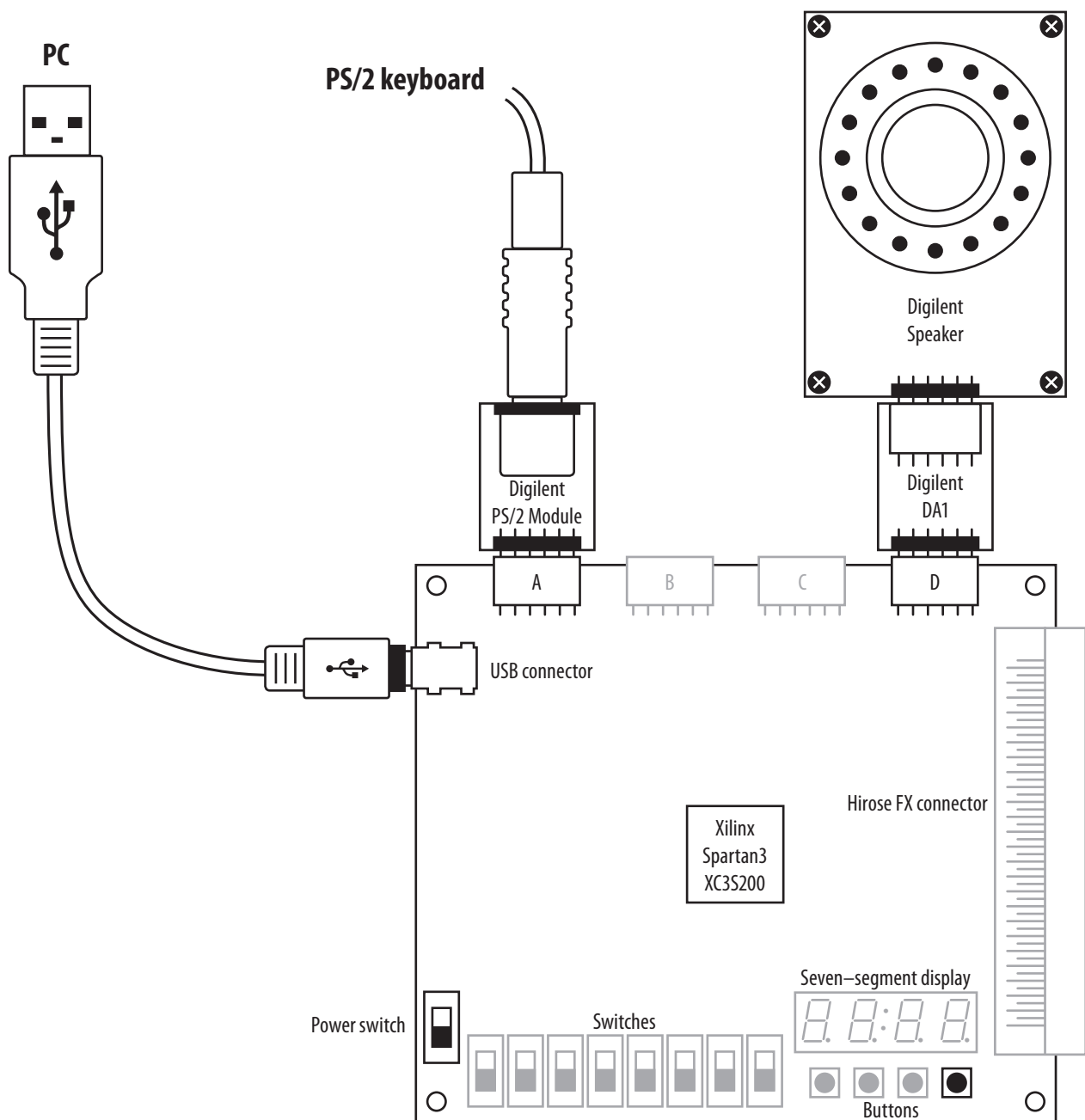
**Figure 2.** The hardware components. The gray elements are not used by the design.