SigmaStudio

User Manual

CONTENT

The **DF**-series with **DSP** amplifiers are equipped with digital signal processor based on chip from the **Analog Devices** company. The processor has 2 analog inputs and 4 outputs, and implements a lot of advanced signal processing algorithms. **SigmaStudio** software from **Analog Devices** is used as the management tool.

SigmaStudio™ is a graphical development tool, designed by **Analog Devices** to programming **SigmaDSP®** audio processors. The program has a freely configurable signal path. This means, that you can create your own path of signal processing, composed of filters (including FIR filters), crossovers, dynamics processing blocks, and blocks of complex algorithms (dynamic bass, synthesizers subharmonics, etc.).

All the signal processing algorithms are presented as circuit blocks and can be connected in any order.

The installation package of the **SigmaStudio** ver.3.10 can be found on the CD, supplied with the amplifier. It can also be downloaded from the download sections of our site.

32-bit and 64-bit version of the software are available.

1. USING SigmaStudio PRESET TEMPLATES

The **SigmaStudio** software allows to build unique signal processing path. This is its advantage, compared with specialized programs with fixed signal processing structure.

On the other hand, it requires more skills of the program usage. Therefore, a lot of predefined templates were prepared.

SigmaStudio Templates are designed for fast and easy development of custom presets. Templates include a set of connected blocks (crossovers, equalizers, limiters ...), required for the speaker setup.

The user has only to set the parameters according to the project requirements and specifications, as well as a starting point to develop a custom preset by modifying, adding or deleting parts of the template.

The installation package of the software, user manuals, video tutorial and other infomation materials can be found on the CD, attached to the amplifier. All the materials can also be downloaded from the download sections of the corresponding amp models of our website.

Note: *Our equipment was designed and tested with the version 3.10 of the* ***SigmaStudio*** *software. The next version of the program does not work correctly with the* ***Park Audio*** *equipment.*

1.1. Finding and Downloading the SigmaStudio Project Templates

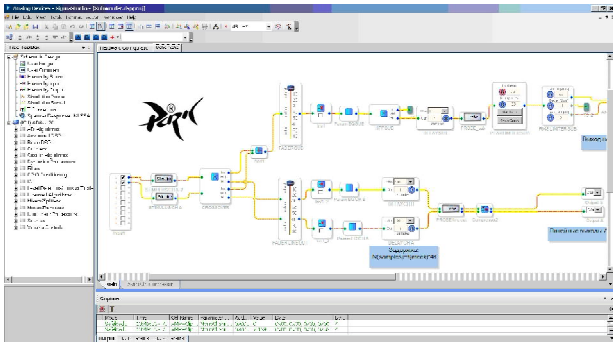
Templates can be found on the CD, attached to the amplifier, or can be downloaded from the download sections of the corresponding amp models of our website.

Templates are packed in a zip archive files. Initially template must be written to the hard disk and extracted from the archive. After that start the program by double-clicking on the project name.

You can always contact us for help in writing the templates by e-mail: support@parkaudio2.com.

1.2. Arranging the Workspace

Workspace will look the following way:



On the left there is **Tree ToolBox** area, where you can find the basic “building” blocks to design your project.

The actual Workspace is in the center. It shows different information depending on the mode, selected in the tabs in the top left corner of the workspace.

The workspace scale can be changed.

Note: *Circuit blocks parameters can be changed only when the zoom is set to 100%. In other zoom level you can only edit the schematics without possibility of changing the circuit blocks parameters.*

The current scale is displayed on the tab in the lower right corner.

Hardware Configuration Tab is used to set up communication between the software and DSP board.

Schematic Tab is used to create your DSP design by dragging block from the Toolbox window.

1.2.1. Status Bars

Placed below the workspace, the schematic status bar displays the state of the schematic. Consider the 2 most important status states:

Design Mode indicates, that the schematic design has been modified, and recompile is required to validate the current design.

Active: Downloaded Mode indicates, that the schematic design was successfully compiled, and that the program data was successfully downloaded to hardware

1.3. Description of the SigmaStudio Preset Templates

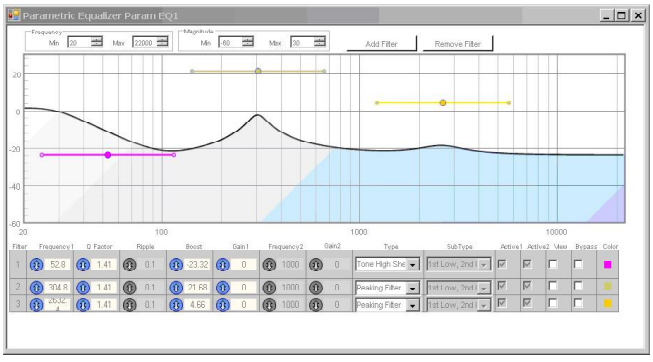
All Project Templates share the same structure:

> **Input Section**;
> **Input EQ**;
> **Crossover**;
> **Fader**;
> **Digital Volume Control** (block, working with level controls, located on the front panel of the amplifier);
> **Inv** (Output signal polarity switch);
> **Output EQ**;
> **Delay**;
> **Peak Limiter**;
> **RMS Limiter**;
> **Output**;
> **Limiter Indicator** (block, working with LEDs, located on the front panel of the amplifier).

1.3.1. Input Section

It is signed on the rear pannel as **Input CH 1-2** (input 0 from circuit block) and **Input CH 3-4**(input 1 from circuit block)

1.3.2. Input / Output EQ

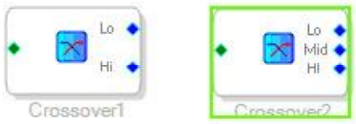


The EQ control window can be opened by clicking the blue icon button. Control window allows to select the filter type. Usually only the first 3 filter types are used:

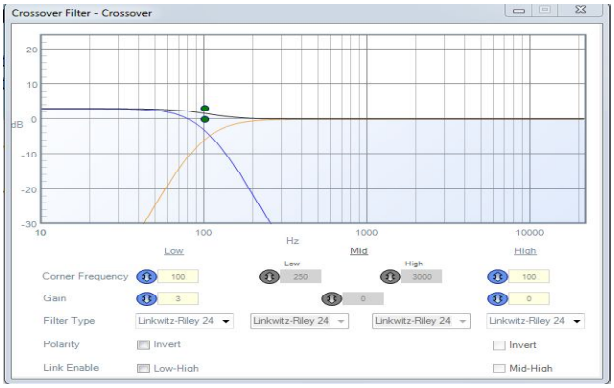
> Peaking filter;
> Tone Low shelf;
> Tone High shelf.

You can set the parameters for each filter type. You can also set the desired frequency response graphically. The number of filters can easily be increased / decreased via **Add/Remove Filter** buttons. Each filter can be independently turned on/off via **Bypass** button.

1.3.3. Crossover



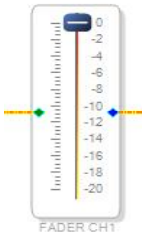
The crossover control window can be opened by clicking the blue icon button.



The following settings are available:

> **Crossover frequencies**;
> **Crossover types**: Linkwitz-Riley, Butterworth, Bessel;
> **Filter orders**: 2nd, 3rd, 4th, 6th, and 8th;
> **Gain**;
> **Polarity**.

1.3.4. Level Controls

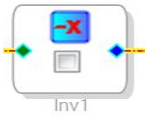


The block is used to change the signal level. Right-click on a block to bring up the level pop-up menu.

1.3.5. Digital Volume Control

This block is used to work with level controls, located on the front panel of the amplifier. The block needn"t any settings.

1.3.6. Polarity



The block is used to change the polarity of the output signal.

1.3.7. Delay

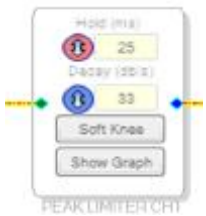
This block is intended to be used for speaker alignment purposes. The input signal is delayed by the amount of samples, reflected in the **Cur** numeric text box. The top dropdown menu, labeled **Max**,represents the largest amount of delay, that could be applied to the input signal, since it is the size of the data delay buffer being stored.

Since the sampling rate is 48 kHz (corresponding to 48000 samples per second, that is 48 samples per millisecond), the amount of delay needed in ms can be easily converted in samples by using the formula:

Delay (in samples) = 48 X **Delay** (in ms)

Setting the **Max** control's value allocates memory on the DSP, reserving that memory for use by this particular block only and reducing the available memory for all other delay blocks in the design. In order to avoid any waste of memory, it is recommended to set the Max with the same value used in **Cur** numeric text box.

1.3.8. Peak Limiter

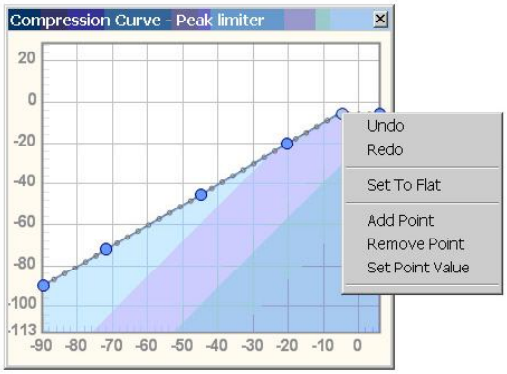


Is used for instant limiting peak power of the amplifier.

The following settings are available:

> **Hold** (ms) - hold time;

> **Decay** (dB/sec) - release speed.

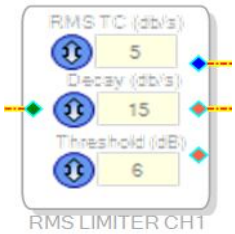


Click **Show Graph** in the Peak Limiter block to open the Compression Curve window. Right-click along the curve to add or remove control points according to your needs.

More detailed method of setting the limiter parameters, depending on the specifications of the speakers used, can be found in the download section of the corresponding amp model on our website **parkaudio.ua** (item **Limiter User Manual**).

To calculate the parameters of the limiter we recommend to use calculation table **Limiters_calculation.xls** (item **Limiter's Settings Calculation**).

1.3.9. RMS Limiter



The block is used for limiting the average power of the amplifier.

The following settings are available:

>**RMS TC** (dB/sec) - attack speed

>**Decay** (dB/sec) - release speed

>**Threshold** (dB)

More detailed method of setting the limiter parameters, depending on the specifications of the speakers used, can be found in the download section of the corresponding amp model on our website **parkaudio.ua** (item **Limiter User Manual**).

To calculate the parameters of the limiter we recommend to use calculation table **Limiters_calculation.xls** (item **Limiter's Settings Calculation**).

1.3.10. Output Block

Is used to send the signal to the input of the amplifier.

DSP board has 4 outputs, designated as DAC0 - DAC3. They are connected to a power amplifier CH1 - CH4.

1.3.11. Limiter Indicator

Is used to indicate limiters status. Upon actuation PEAK or RMS limiters in some of the channels, corresponding **CLIP** LED lights up. The block needn't any settings.

1.3.12. Simulation

The **Simulation Probe** is used in conjunction with the **Simulation Stimulus** to plot the frequency and phaze response of the system you configure.

The **Simulation Stimulus** is used to send a virtual signal. The signal is generated upon clicking the button **Stimulus**.

Simulation Probe is used to display the response to the virtual signal, generated by the **Stimulus** and processed by the algorithms, belonging to the path from the Stimulus to the Probe. Clicking the Probe icon will open the Simulated Frequency and phase responce.

2. SETTING and STORING PRESETS

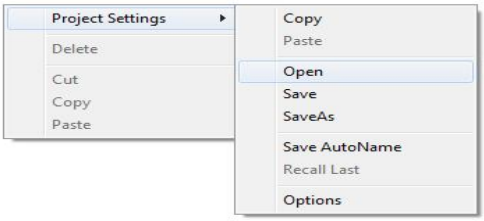
2.1. Working with Presets

In the non-volatile memory of the processor can be written up to 8 different presets. To select the desired preset, use the **DIP**-switch, located on the rear panel of the amplifier. The amplifier is supplied with the stored presets, which correspond to the basic operation modes. Detailed description of the stored presets can be found in the download section of the corresponding amp model on our website **parkaudio.ua** (item **DF-series factory DSP presets**). There can be also found templates, corresponding to the stored presets (item **Project Templates)**.

The downloaded file should be unzipped to the hard disk of your computer. After that, the corresponding template (file with extension **.dspproj)** can be opened using **SigmaStudio.**

You can save several different presets (project settings) within one project. The settings for all blocks within this project are saved as the preset (project settings). For example, you can save some settings of EQ, delays, limiters for the same speakers system in different presets (project settings).

For opening/saving presets to disk you need to call the menu by right-clicking in the workspace project:



You can assign the name for generated preset and save it on a disk.

For reading a stored preset you can choose the **Open** item of the same menu. You can form several desired presets with settings for different acoustic conditions. After the presets are prepared, they can be stored in non-volatile memory of the **DSP** Board.

An important feature of the SigmaStudio software is that the stored preset cannot be read from the **DSP** board memory. Therefore, a copy of a stored preset should always should be saved on the hard disk.

2.2. The Preset Storing to the DSP Board Memory

The USB connector, which is used to connect the control computer, is located on the rear panel of the amplifier. The SigmaStudio software uses High-speed USB protocol. Therefore, you should use high-quality, not very long USB cable to connect to the amplifier. Periodic failures of communication and clicks may be a result the poor quality of the cable.

To store the prepared preset to the DSP board, you should use command Link Compile Download (or press F7).

Once the project has been downloaded to the DSP, the system will be responsive to any real-time changes of controls (sliders, knobs, etc.) in the schematic workspace, allowing to adjust parameters in real time.

The current status is displayed in the status bar in the lower right corner of the screen.

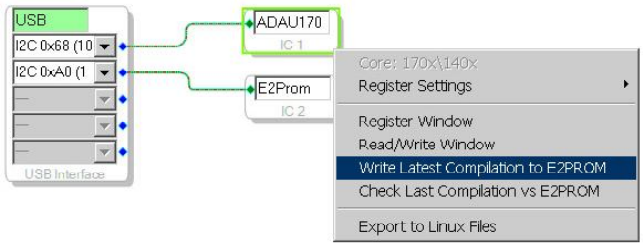
Active Downloaded Mode indicates, that the schematic design was successfully compiled, and that the program data was successfully downloaded to hardware.

Design Mode indicates, that the schematic design has been modified, and recompile is required to validate the current design.

2.3. Storing Presets in Nonvolatile Memory

Once the DSP project has been downloaded into the DSP, the program can be stored into nonvolatile memory.

To do this you should go into the **Hardware** configuration tab section 1.2.). Right-clicking on the icon ADAU1701, select **Write Latest Compilation to E2PROM** from the menu.



In the non-volatile memory of the processor can be stored up to 8 different presets. To select the desired preset, use the DIP-switch, located on the rear panel of the amplifier.

The current SigmaStudio project is written to the memory bank, that corresponds to the current switch position.

After setting the switches in other position, you get access to another memory bank.

Please note, that it is impossible to read the stored preset from the DSP memory. Therefore, in the case of overwriting presets, you must save the project on your computer's hard drive for future editing.

3. EDITING PRESETS

On the basis of templates you can create your own project by adding new or removing algorithms, which is not used. This section describes basic principles of editing **SigmaStudio** projects. Full description of all signal processing algorithms, available in **SigmaStudio**, can be found in **Help** menu.

3.1. Circuit Blocks

Circuit blocks are shown in the left panel **Tree ToolBox** and can be dragged to the workspace.Each block represents one or more algorithms.

3.1.1. The Circuit Blocks Renaming

To change the name of a circuit block, double-click on its name and type a new name. Note, that within each project, all block names must be unique. When attempting to use a name, which is already present in the current project, an error window appears.

3.1.2. Choise

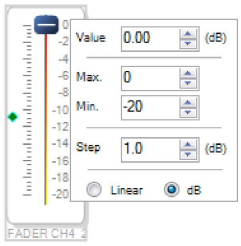
To select a block, click on its frame or label. To select several blocks, select them, pressing **Shift**. You can also highlight the circuit fragment by selecting it, using frame selection. The selected blocks are indicated by a light green outline.

3.1.3. Deleting

To remove a block from schematics, select the block and press the Delete key. You can also delete the selected blocks by choosing Edit – Cut from the main menu or by pressing Ctrl+X.

3.1.4. Action Menu

The pop-up menu can be opened by right-clicking to the block.



3.2. Controls

Blocks can contain a variety of controls for editing the algorithm parameters.

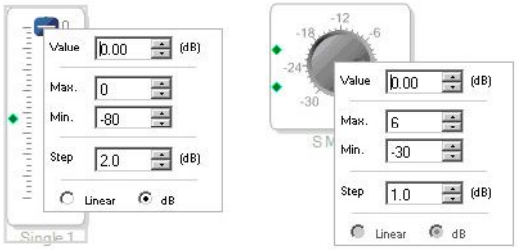
3.2.1. Numeric Input Box

It allows you to enter data directly in the edit box or by clicking the arrow. You can left-click the arrow and hold the button moving it down or up in order to change the parameters data smoothly.

3.2.2. Knobs and Sliders

To change the knobs or sliders control, left-click and hold the button to control the movement and set the desired value.

You can also opened pop-up Numeric Input Menu by right-click the mouse.



3.2.3. Pop-up Controls

Some units have an additional pop-up control window, which contains additional settings. To open this window, right-click on the icon button.

3.3. Pins

Each circuit block may contain one or more pins, used to connect the blocks to each other.

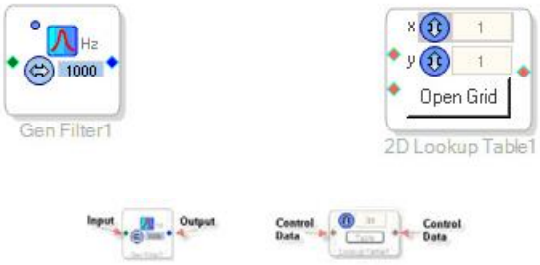
There are 3 different type of pins:

> Input pin (green);

> Output pin (blue);

> Control pin (orange).

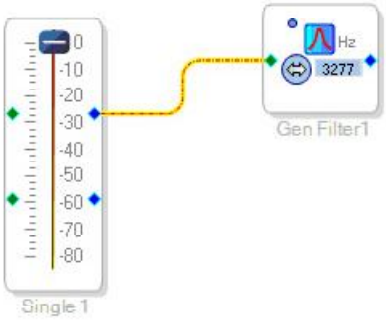
The output pins can be connected only to input pins and vice versa. As a rule, control pins are connected only with other control pins, but you can optionally connect audio pins to the control pins and vice versa.



If you place the cursor on the pin, will display its description.

3.4. Connection

The **SigmaStudio** project consists of blocks, connected by wires.



To create the wire you should move the cursor to the icon pin, to open the drop-down menu with the name of the output. Then, pressing and holding the left mouse button, move the cursor to the pin of another block. Remember, that the output pins can be connected only to input pins and vice versa.

3.5. Checking amount of resources used

The DSP has a limited amount of program and data memories. These resources may not be enough for creating too big projects.

You can monitor the amount of resources, used in the project, by opening the 'compiler_output.txt' file, automatically created when a **Link Compile Download** operation is performed. The file is located inside the folder: projectfolder / I C_1_projectname/ net_list_out / compiler_output.txt, where projectfolder is the folder of the .dspproj file, and projectname is the filename.

For example, for a project named "Mysub": projectfolder/ IC_1_Mysub/ net_list_out2/compiler_output.txt. At the end of the opened file you will see information: Number of instructions used (out of a possible 1024) = 16; Data RAM used (out of a possible 2048) = 10; Parameter RAM used (out of a possible 1024) = 5.

In case the program will display a message about lack of resources while project compiling, you need to remove some of the unused blocks. After removing the blocks, be sure to restore brocken wires.