

Visualization Tuning Tool

ACPWorkbench

User Manual

V3.9.0

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1. General Description

ACPWorkbench, the visualization tuning tool, is a real-time audio effect flow plotting and tuning tool. Compared to version 2, this version has undergone significant visual and functional changes. Whether you're a seasoned user of the MVsilicon SDK or a newcomer, you'll benefit from its intuitive operation and rapid customization of audio effect streams. Its main features include:

- ✧ **Intuitive Interface:** Presents the description of audio effect flow in a graphical format, allowing users to visually see the effects and specific data flow on each channel.
- ✧ **Real-time Preview:** Users can dynamically zoom in to view the overall flowchart as needed, or zoom in to examine specific details of individual audio effects.
- ✧ **Rapid Customization:** Supports offline editing of audio effect flowcharts. For DU series, after editing, it supports one-click download; for SDK series, after editing, it supports one-click export of .c and .h files, which can be imported for compilation and download via the SDK to showcase the effects.
- ✧ **Real-time Tuning:** Once connected successfully with the firmware, ACPWorkbench allows real-time online adjustment of parameters for each audio effect and immediate listening to the effects.
- ✧ **Sound Library Refresh:** When connected to the firmware, ACPWorkbench automatically updates to the current firmware's audio library. When disconnected from the firmware, users can manually refresh it to the desired audio library according to their needs, enabling audio effect flowchart editing.
- ✧ **Automatic Parameter Saving:** Supports automatic saving of audio effect flow and parameters at regular intervals, with the option to disable this feature.
- ✧ **Parameter Import and Export:** Supports manual import and export of audio effect parameters and hardware parameters, making it easy to quickly present the parameters adjusted by the user.

2. Getting Started

ACPWorkbench contains the following files:

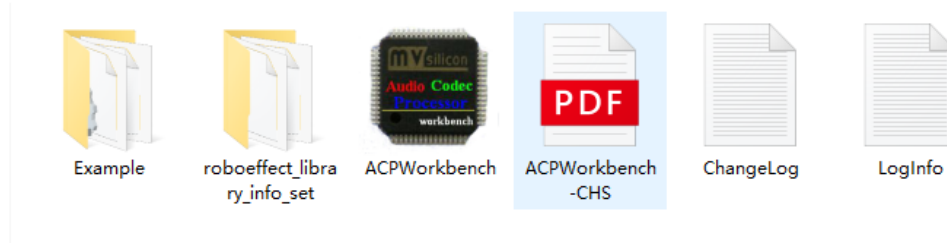


Figure 1 ACPWorkbench files

- ✧ ACPWorkbench.exe is the main executable.
- ✧ ACPWorkbench-ENG.pdf is the help document in English.
- ✧ ACPWorkbench-CHS.pdf is the help document in Chinese.
- ✧ ChangeLog is the change logs file.
- ✧ Roboeffect_library_info_set folder contains binary files of different audio engine libraries. By default, when ACPWorkbench boots up, it will search for the highest version of the audio engine library binary file in this folder and then refresh the offline library.
- ✧ LogInfo is an interactive log file.
- ✧ Example contains examples of sound effect flows.

When ACPWorkbench is launched, it will automatically find and connect the demo board via the connected UART (serial) or USB (HID) port. Once connected, ACPWorkbench will read all the configurations in chip and update its GUI controls accordingly. Please ensure the demo board is connected to PC and powered on. Whenever the demo board is powered on/off, ACPWorkbench will always try to re-connect it

- ✧ **Offline Editing:** When ACPWorkbench is not connected to the firmware, it is in offline editing mode. The title displays "ACPWorkbench_Disconnect – [Offline Editing]", and the parameters in the status bar have no background color. When ACPWorkbench is connected to the firmware and manual changes are made to the audio effect flow, causing inconsistency between the interface's audio effect flow and the firmware's audio effect flow, the firmware is online but in editing mode. The title displays "ACPWorkbench_for_XXXX – [Offline Editing]", and the background color of the parameters in the status bar is yellow.
- ✧ **Online Tuning:** When ACPWorkbench is connected to the firmware and the audio effect flow is consistent with the firmware's, it is in online tuning mode. The title displays "ACPWorkbench_for_XXXX—[Online Tuning]", and the background color of the parameters in the status bar is green.

Below are two different scenarios, each illustrating the online tuning state and the

offline editing state:

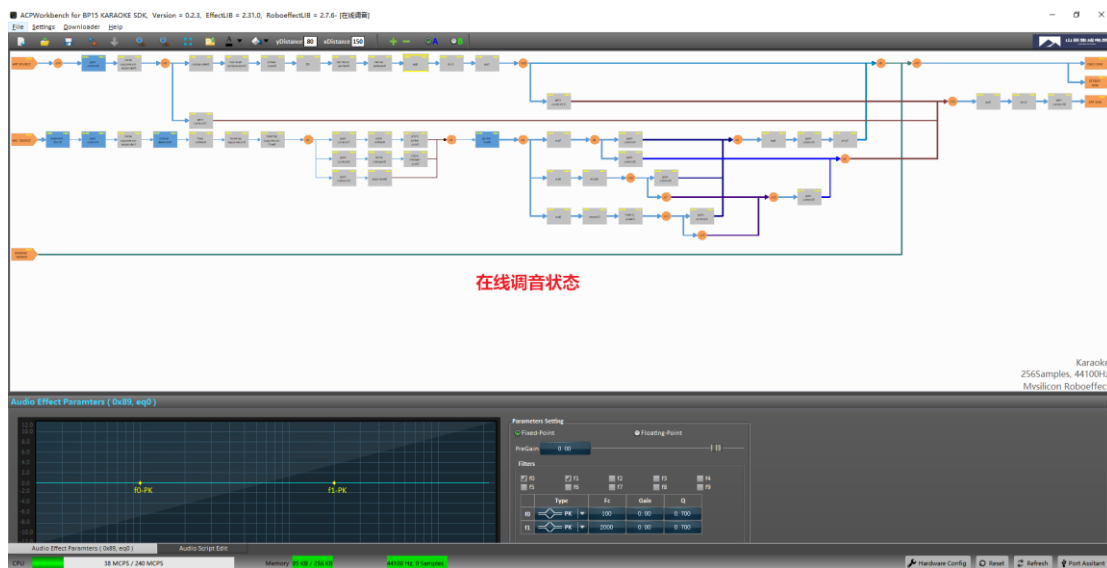


Figure 2 Online Editing

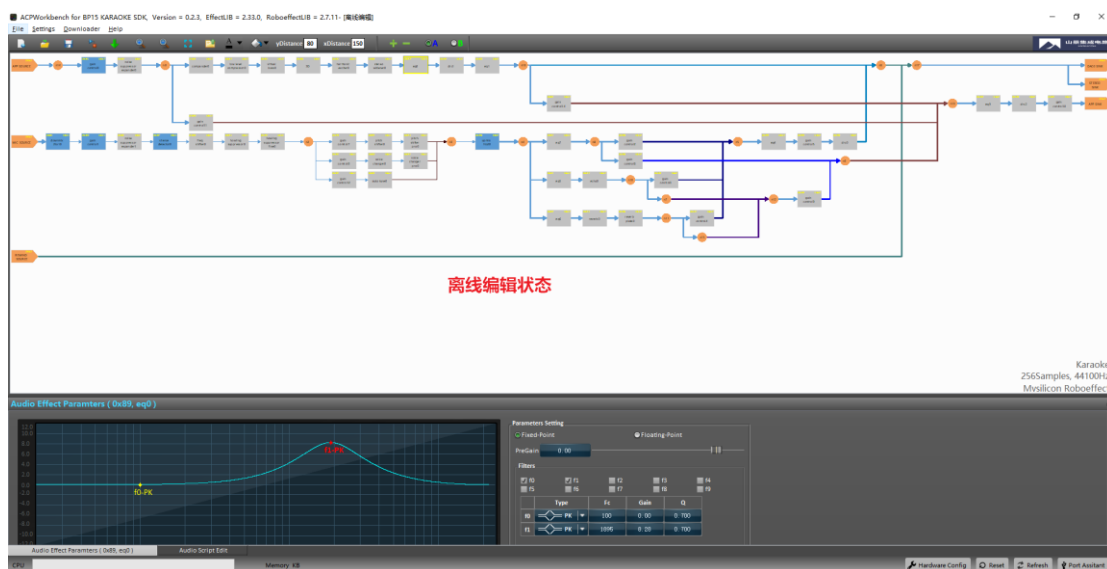


Figure 3 Offline Editing

3. Interface

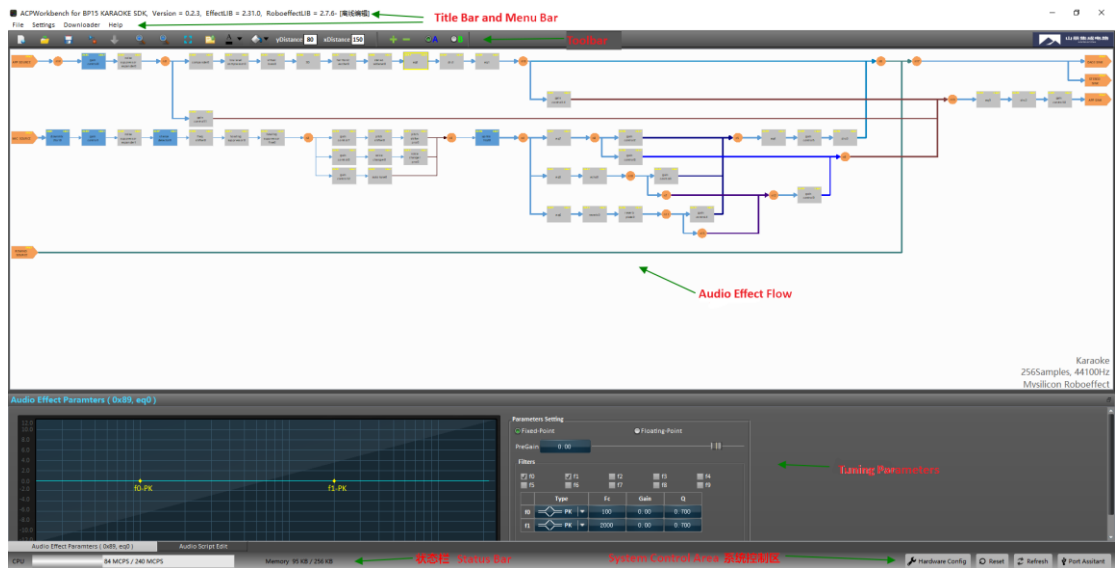


Figure 4 ACPWorkbench UI

- ✧ **Title Bar:** Displaying the current firmware information.
- ✧ **Menu Bar:** Includes File, Settings, Downloader and help menu options.
- ✧ **Tool Bar:** General operation tools for the flowchart area, including new, open file, save, run, download, zoom in, zoom out, full image, export image, set font color, set background color, customize the height and width of the connecting line, and multiple sets of parameters for real-time comparison operations;
- ✧ **Flow Chart Area:** Shows a flowchart of the firmware upload or a flowchart drawn with a user-defined description;
- ✧ **Tuning Section:** Used to adjust sound parameters;
- ✧ **Status Bar and System Control Area:** In this area, if there is a firmware online, it will display the current firmware's CPU consumption and other information in real time. Meanwhile, hardware parameter configuration, reset, refresh and debug assistant are also supported in the status bar;

4. Menu Bar

4.1 File

The file contains: New Audio Flow File, Import Audio Flow from, Export Audio Flow to, Export Audio Parameters to, Refresh Offline Audio Effect Library and Exit;

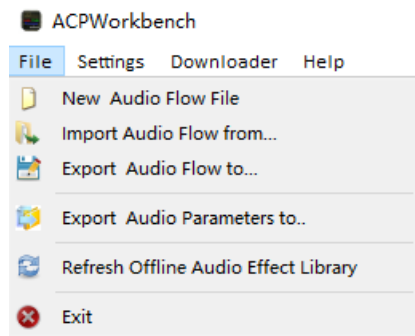


Figure 5 File Menu

4.1.1 New Audio Flow File

Click File→New Audio Flow File to recreate a new audio flow file, if there is a previous audio flow architecture file, a dialog box will pop up whether to save or not, according to the needs of the choice to save or not to save.

4.1.2 Import Audio Flow from

Click File→Import Audio Flow from... and the file path selection will pop up, select the file to import the audio flow file. If the audio flow contains parameters, refresh the parameters at the same time. If the file import fails, you can pay attention to the following points:

- ✧ Whether the imported file is a audio flow architecture file;
- ✧ Whether the current ACPWorkbench audio effect library supports all the audio effects in the imported file; if the audio effect library of the tuning tool is of a lower version, refresh the offline library.

4.1.3 Export Audio Flow to

Click File→Export Audio Flow to... and the export file screen will pop up:

1. For the SDK that supports effect mode interaction protocol, as shown in the figure below, it contains: file type, engine version, effect mode, parameter group, and name of the exported file, in which the default effect modes are all selected, which means that the exported file contains not only the content of the audio flow, but also the parameters of the selected modes; if the user does not want to put audio flow and effect mode parameters into one file, he can cancel the selection status of all modes, so that the exported file contains only the content of the audio flow, and the export of effect parameters needs to use the "Export audio Parameters" function to export parameters of the corresponding modes in turn. If you don't want to put the audio flow and parameters into one file, you can uncheck all the modes, so the exported file will only contain the sound stream, and the parameters of the corresponding modes need to be exported through the "Export Audio Parameters" function;



Figure 6 Export Flow UI for case1

2. For SDKs that do not support audio effect mode interaction, this part only supports the data export of audio flow, and the parameters need to be exported through the "Export Audio Parameters Wizard" function with the following interface:



Figure 7 Export Flow UI for case2

3. Users can choose different export methods according to their needs.
 - ✧ **文件类型:** Includes ini files, c/h files and exports all supported types at the same time.;
 - ✧ **引擎版本:** Enumerates all engine library versions available to the user in the roboeffect_library_info_set folder of ACPWorkbench;
 - ✧ **文件名称:** Select the export file path and name;

4.1.4 Export Audio Parameters

Clicking File→Export Audio Parameters to... will bring up the selection of the file path, this function supports the export of audio parameters in the current mode.



Figure 8 Export Audio Parameters UI

4.1.5 Refresh Offline Audio Effect Library

Click File→Refresh Offline Audio Effect Library, a file selection pops up, select the audio effect library file (bin format) and click input to refresh the offline audio effect library. effect_libs_info_x.x.x.x.bin file is synchronized with the release of the engine library, please look for it in the engine library package. ACPWorkbench will search for effect_libs_info_x.x.x.x.bin in the current path by default when it starts, if it exists, it will refresh the parameters of the current bin.

4.1.6 Exit

Click the Exit button to exit the ACPWorkbench.exe program immediately!

4.2 Settings

The setup menu contains: Communication Type, Offline Chip Type, Sample Rate, MCLK Source, Frame Size, Heartbeat Time, Tag Config and AutoSave Audio Script.

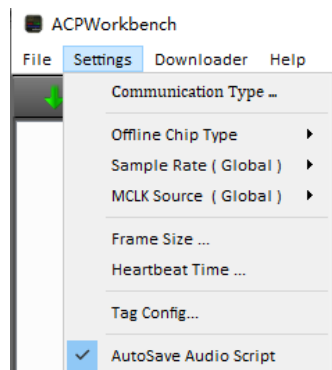


Figure 9 Settings

4.2.1 Communication Type

Supports two communication modes: USB and UART.

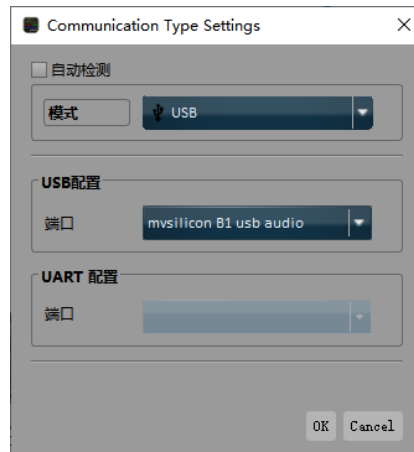


Figure 10 Communication Type

4.2.2 Offline Chip Type

If the device is in online mode, ACPWorkbench will automatically recognize the chip type; if the device is in offline editing mode, the chip type can be selected as needed so that the hardware can be switched to the corresponding series of parameters.

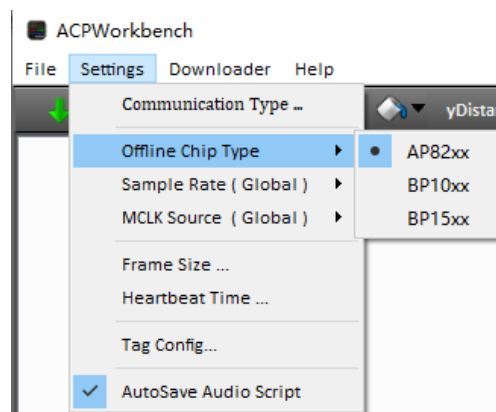


Figure 11 Offline Chip Type

4.2.3 Sample Rate

Inactive and 13 sample rates (8000-192000Hz) are included. When 13 sample rates are selected, the global sample rate is enabled and all hardware modules are configured according to the current sample rate; when Inactive is selected, the global sample rate is not enabled and each hardware module is configured according to the local sample rate parameters.

The sample rate of the audio effect module comes from the sample rate in the

chart information;

4.2.4 MCLK Source

Inactive and 5 MCLK source selections are included. Select 5 MCLK sources: PLL Clock1, PLL Clock2, OSC IN, MCLK IN0, MCLK IN1, and global MCLK Inactive; when selecting the 5 sources, the local MCLK source does not work; when selecting Inactive, the global MCLK source does not work, and each module is configured according to the local MCLK source.

4.2.5 Frame Size

Click Settings→Frame Size... The following window will pop up, select the desired frame size and click Apply to download it to the firmware;

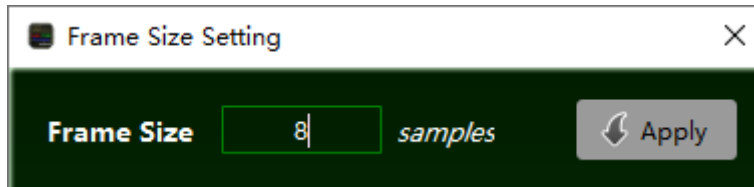


Figure 12 Frame Size

4.2.6 HeartBeat Time

Click Settings→HeartBeat Time... will pop up the following window, enable or disable the heartbeat packet function according to your need, and if enabled, it also supports the heartbeat packet interval time setting.

If heartbeat packet is enabled, ACPWorkbench will read all the status information of the firmware according to the set interval.

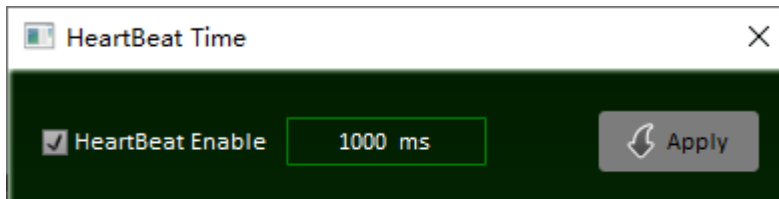


Figure 13 HeartBeat Time

4.2.7 Tag Config

Communication protocol 0xFC provides a custom label function, the user can use the function according to the actual needs; support for character and HEX two editing formats, as follows

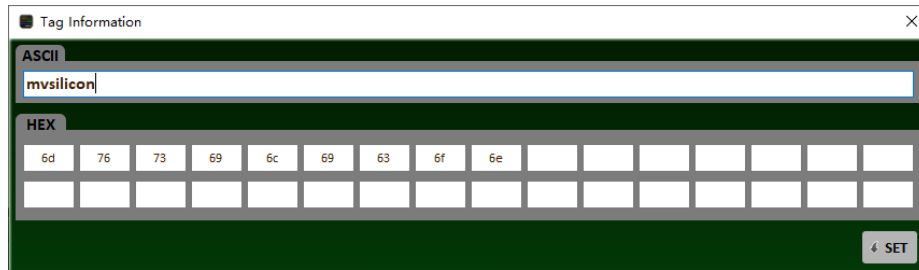


Figure 14 Tag Config

4.2.8 AutoSave Audio Script

The default checkbox of the tuning tool is AutoSave, which will save the audio parameters and audio flow files on a regular basis; if the user cancels this function, just remove the checkbox.

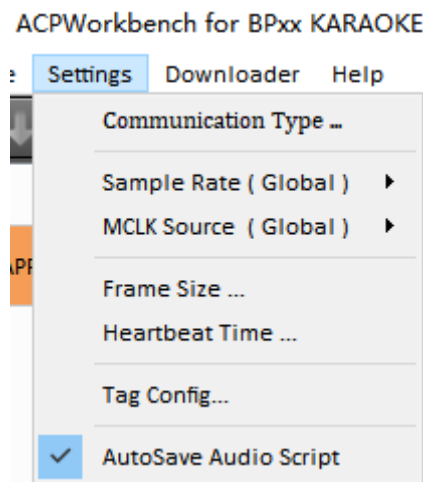


Figure 15 AutoSave Audio Script

4.3 Downloader

The download menu contains the firmware upgrade and save parameters to flash functions;

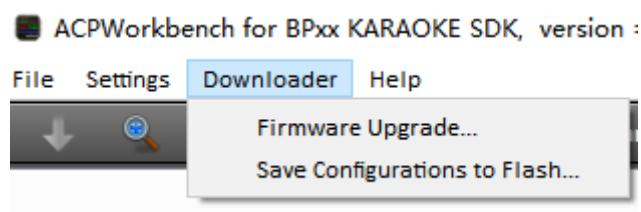


Figure 16 Downloader

4.3.1 Firmware Upgrade

ACPWorkbench.exe supports online firmware upgrading, by clicking the "Downloader" menu, the "Firmware Upgrader" window will pop up. Then select the downloaded mva file and click the download button to upgrade it. And the upgrade

process is displayed in the status bar of the upgrade window in real time.

Currently, firmware upgrade only supports USB communication. There are two kinds of upgrade methods: application layer upgrade and BOOT upgrade (check Firmware is in boot).

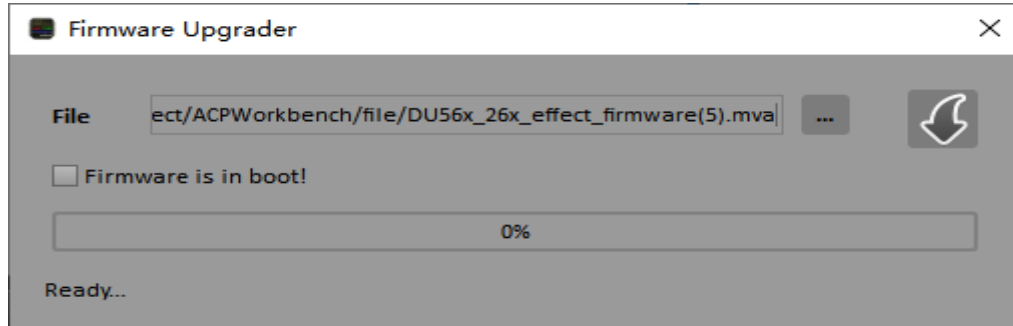


Figure 17 Firmware Upgrade

4.3.2 Save Configurations to Flash

The download menu supports saving parameters to flash online. After saving the parameters, the firmware will read the parameters from the flash when powering up next time. Supports various commands to save flash parameters for compatibility with various chip types.

4.4 Help

Content-Chinese: Click this menu to open the Chinese help file of ACPWorkbench.exe.

Content-English: Click this menu to open the English help file of ACPWorkbench.exe.

Key: When the firmware or SDK is encrypted, you can enter the key to get the audio parameters by clicking on this menu.

About: Clicking on this menu displays information about the software.


5. Audio Effect Flow Chat Area

5.1 Tool Bar

In the toolbar from left to right are New, Open, Save, Compile, Download, Settings, Zoom In, Zoom Out, Global Spread, Export Image, Font Color Settings, Background Color Settings, Horizontal Spacing of Sound Modules, Vertical Spacing of Sound Modules, effect Modes, and A/B Comparison for each group of effect modes. As shown in the picture below:



Figure 18 Tool Bar

- ✧ **New:** Create a new diagram;
- ✧ **Open:** Open file;
- ✧ **Save:** Saves the current sound stream file;
- ✧ **Compile:** Compile the current audio flow graph;
- ✧ **Download:** When ACPWorkbench is connected to the DU firmware, this button is enabled, i.e., it allows the drawing to be downloaded to the firmware with a single click after it is finished; when connected to the SDK, this button is disabled, and the finished drawing is exported to the SDK with all the information of the drawing through the button Export Sound Parameters in the File menu;
- ✧ **Settings:** Some system configurations;
- ✧ **Zoom In / Out:** Clicking on the buttons will zoom in and out of the flowchart.
- ✧ **Global Spread:** Clicking this button causes the tuning tool to display the graphic spread globally at the current tool size;
- ✧ **Export Image:** Clicking on it will automatically take a screenshot of the image in the current flowchart area and save it to a path of the user's choice;
- ✧ **Font Color Settings:** Support for changing font colors in flowcharts;
- ✧ **Background Color Settings:** Support flowchart background color changes, such as the following figure were selected standard white, Dark dark for the effect of the demonstration;
- ✧ **Parameter Group:** Effect Mode, compared with 3.8.X and previous versions, 3.9.0 has added the effect mode function. Each effect mode also supports A/B comparison; when creating or modifying a effect mode, click the button  on the right to customize the effect mode according to your needs.

5.2 Editing Flowcharts

Flowchart area can be realized to draw flowcharts and control flowcharts, as shown in the following figure. In the flowchart area you can use the mouse to complete some operations.

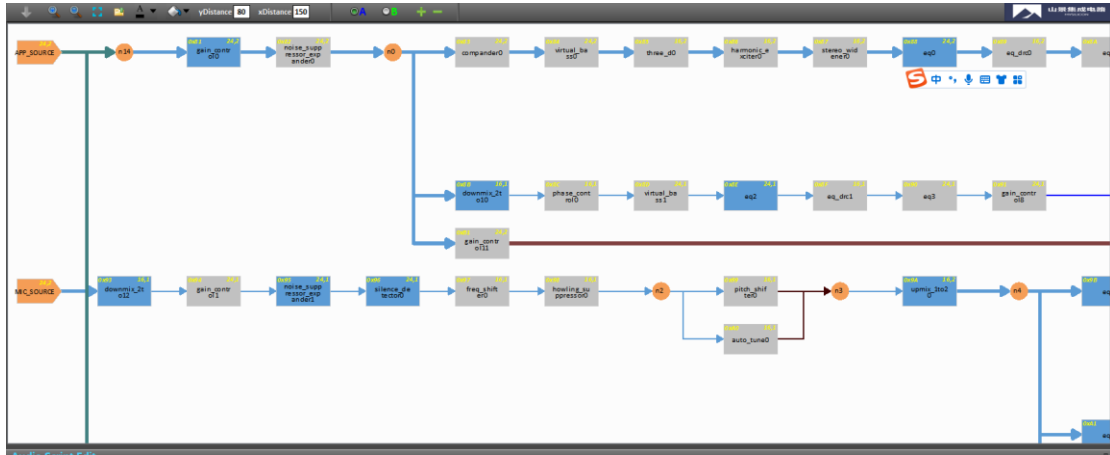


Figure 19 Editing Flowcharts

5.2.1 New Source

Right-click on any position in the flowchart area to bring up a pop-up menu, select "新建 Source 输入" to bring up the "新建 source 源" window, enter the name, select the bit width and the number of channels.



Figure 20 New Source

5.2.2 New Effect

If you want to add a audio effect after a audio effect, you can right-click on the module, in the pop-up menu, select "新建音效于后", and then it will pop up all the current support for the audio effect, select the audio effect will be automatically compiled, if the compilation is successful, it will be automatically added to the chart.

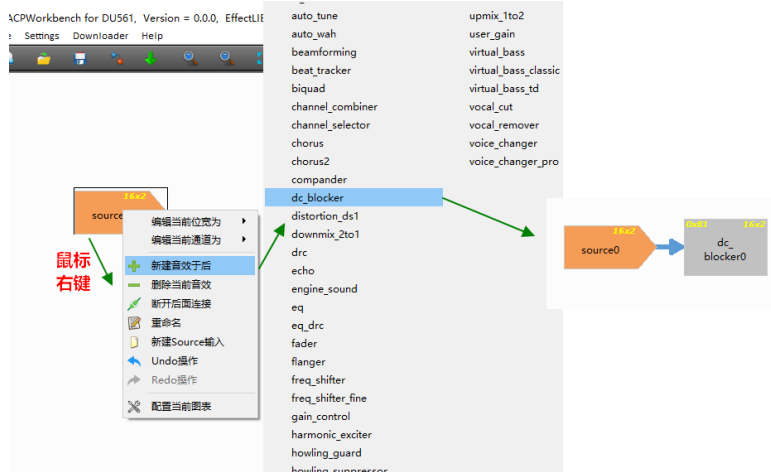


Figure 21 New Effect

5.2.3 Connecting Existing Effect

Multiple input source audio effects (e.g. AEC) or Node nodes allow multiple inputs, if the audio effect has already been drawn on the graph and other audio effects want to connect to it, you can select "连接已有音效", as shown in the following figure.

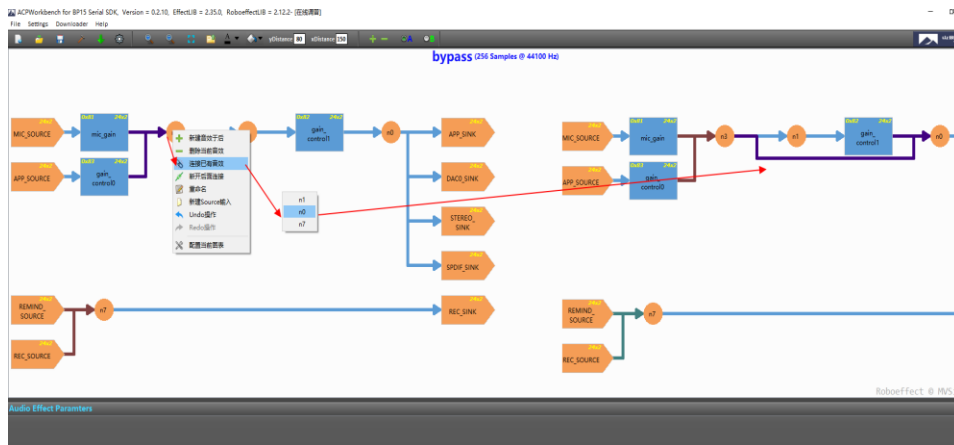


Figure 22 Connecting Existing Effect

5.2.4 Delete Effect

1. For normal audio effects, right-click on the module to be deleted, and then select "删除当前音效" to delete it, as shown in the following figure.

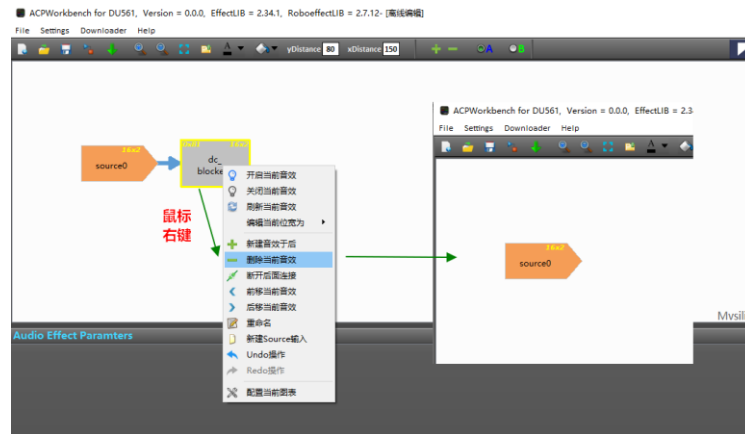


Figure 23 Delete Effect

- If you want to delete a node effect that has multiple branches, you need to reduce the branch to a single branch before you can delete the node effect.

5.2.5 Disconnect Effect

If the current effect is followed by a multi-input effect, and disconnecting the current connection will not affect the normal flow of the subsequent effects, then this effect can be disconnected from the subsequent effects, as shown in the following figure.

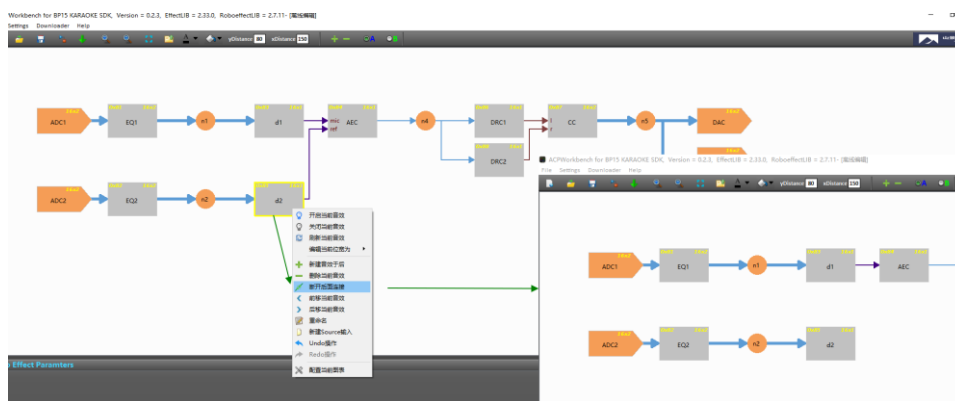


Figure 24 Disconnect Effect

5.2.6 Move Effect

Normal effects allow forward and backward operations between them, as shown below:

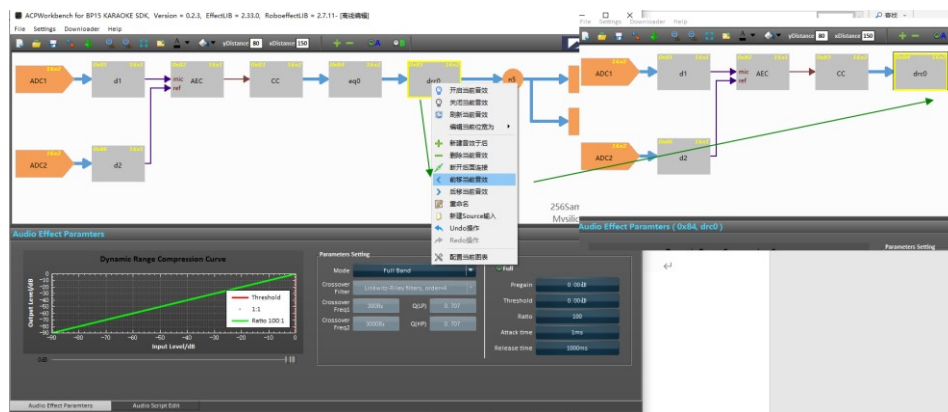


Figure 25 Move Effect

5.2.7 Rename Effect

Select the effects that need to be renamed, right mouse button, in the pop-up menu, select "重命名", and then modified in accordance with the requirements can be, as shown in the figure below.

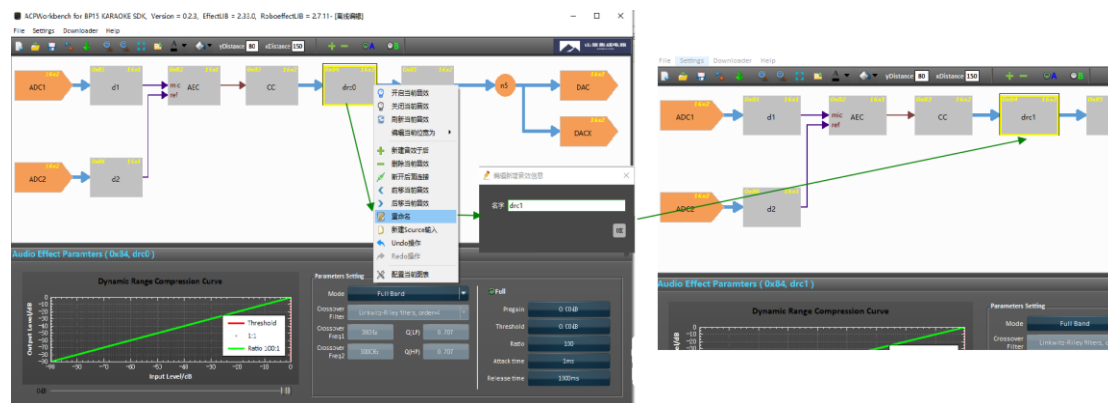


Figure 26 Rename Effect

5.2.8 Undo/Redo

Supports undo/redo operations within 5 operations.

5.2.9 Configuring Read-only

If you want to design a flowchart in which some specific modules are not allowed to be deleted or renamed, you can lock them by setting them to read-only, as shown in the following figure, there will be a lock flag in the "mic_gain" module, so that the "mic_gain" module will have a lock symbol, so that the mic_gain sound effect will be set to read-only, and the user will not be able to delete or rename it.

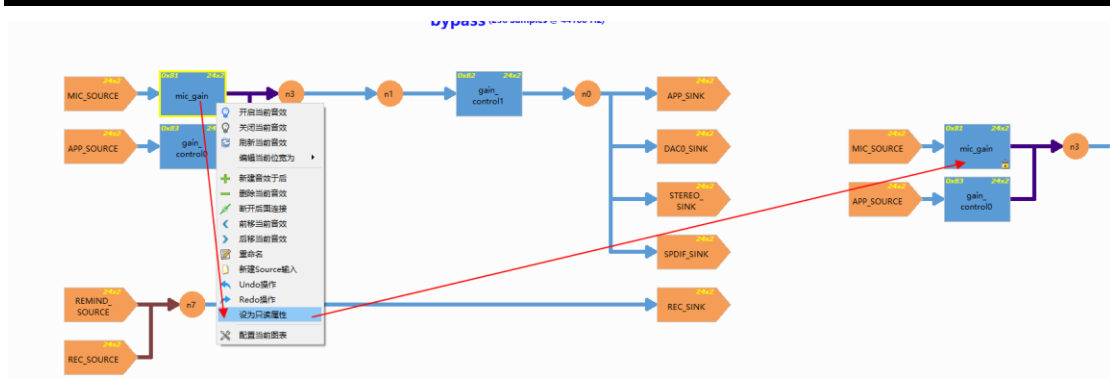


Figure 27 Configuring Read-only

5.2.10 Sequential Operation of Multi-input Effects

General multi-input effects on the input order has certain requirements, if the design flow chart and the demand for the order of the difference, you can right mouse button, in the pop-up menu, select "配置输入源顺序", in the pop-up window, select the order of the need to complete the switch.

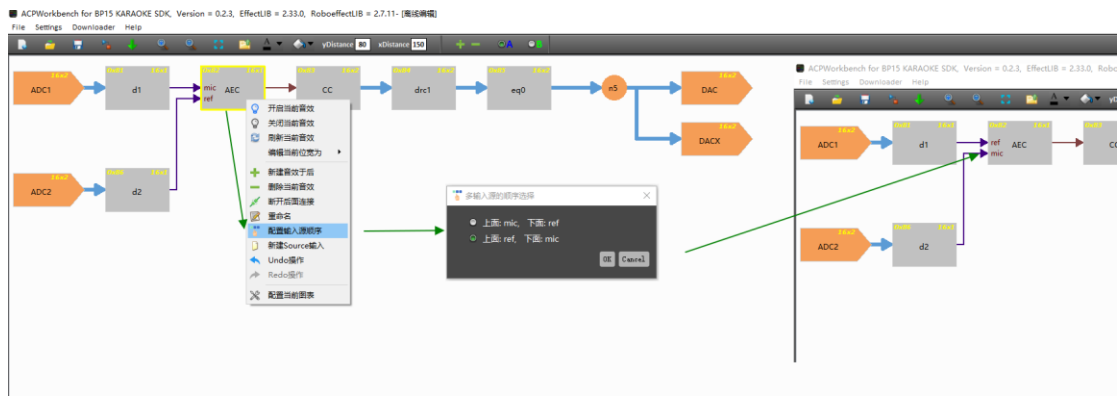


Figure 28 Sequential Operation of Multi-input Effects

5.3 Control Flow Chart

5.3.1 Drag

Drag the mouse anywhere in the flowchart area and the drawing will move with the mouse;

5.3.2 Zoom In / Out

After left-clicking anywhere in the process, scrolling the mouse wheel will enlarge the diagram display, and scrolling the mouse wheel in the opposite direction will reduce the diagram display;

5.3.3 Enable / Disable Current Effect

In the position of the effect module, right-click the mouse, the following menu will pop up, click "开启当前音效", it will notify the firmware to turn on the current effect, click "关闭当前音效", the tuning tool will notify the firmware to turn off the current sound. If you right click on a non-effect module to bring up the menu, "Turn on current effect" and "Turn off current effect" are disabled;

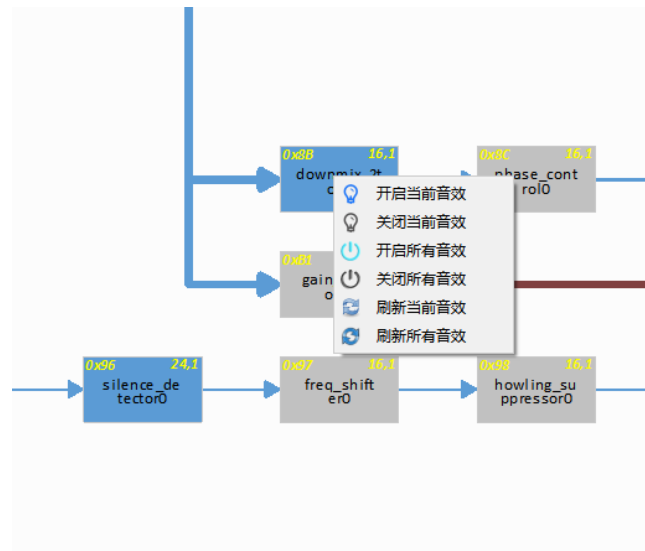


Figure 29 Enable / Disable Current Effect

5.3.4 Enable / Disable All Effects

Unlike turning on/off the current effect, turning on/off the display of all effect functions does not require selecting a location, just right mouse click anywhere in the flowchart area as shown below. Clicking on it will notify the firmware to turn on or off all effect modules;



Figure 30 Enable / Disable All Effects

5.3.5 Refresh Current Effect

Right click on the effect module that needs to be refreshed, a pop-up menu will appear, select "刷新当前音效" and the tuning tool will immediately read all the parameters of the current effect module;

5.3.6 Refresh All Effect

Right click anywhere in the flowchart area (not limited to the sound module) to bring up the menu and select "刷新所有音效", the tuning tool will immediately read all the effect parameters in the current chart;

6. Online Tuning

6.1 Select Effect

If you left-click on the effect module in the flowchart area, all the parameters of the selected effect will be displayed in the online tuning area. As shown in the figure below, eq0 in the flowchart is selected by left clicking on the mouse, and then all the parameter information of eq0 is automatically switched to the tuning area, and each parameter can be adjusted at this time.

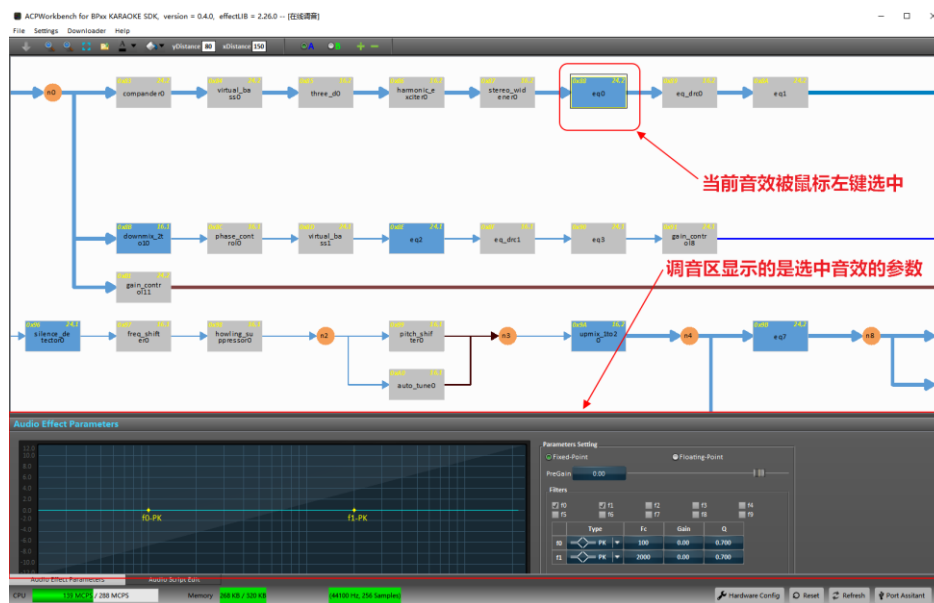


Figure 31 Select Effect

7. System Control

There are several system controls on the status bar: Hardware Config, Reset, System, and Port Assistant.

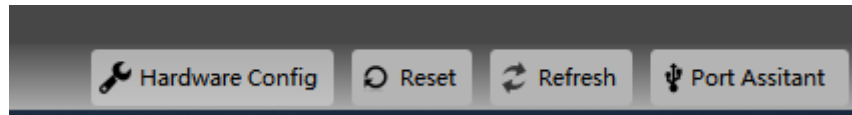


Figure 32 System Control

7.1 Hardware Config

Click the Hardware Config button on the status bar, the hardware parameter interface of the corresponding model will pop up, as shown in the figure below, and you can adjust the corresponding parameters according to your needs:

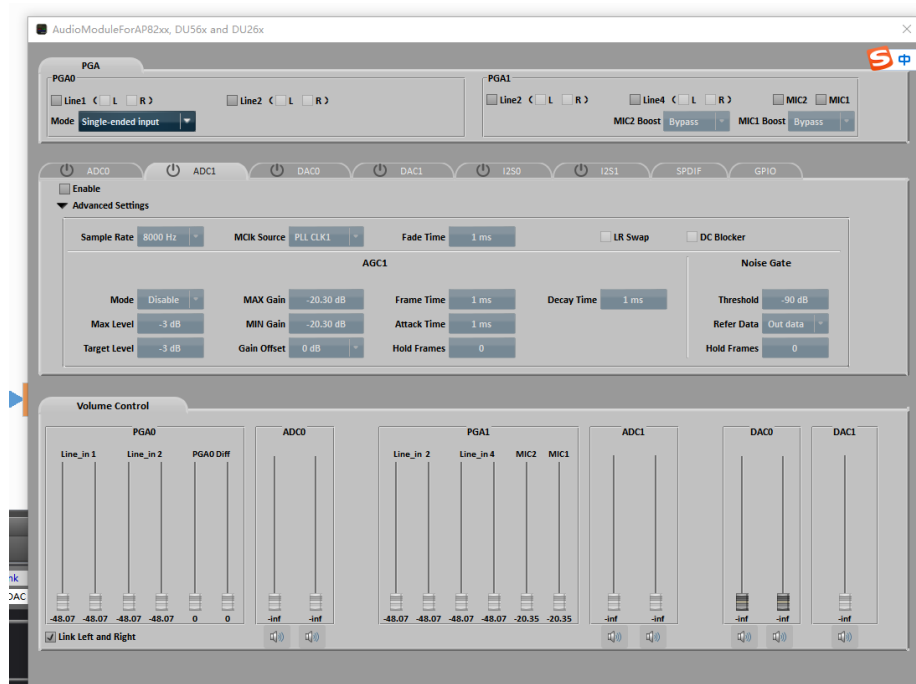


Figure 33 Hardware Config

7.2 Reset

After clicking the "Reset" button on the status bar, the reset options will pop up: system reset or factory reset.

- ✧ **System Reset:** It just resets the firmware successfully without changing the parameters;
- ✧ **Factory Reset:** While resetting the firmware, the parameters are restored to

the factory parameters;

7.3 Refresh

By clicking "Refresh" on the status bar, the tuning tool will re-read all the parameters of the device.

7.4 Port Assistant

After clicking "Port Assistant" on the status bar, the window of debugging assistant will pop up, you can manually send commands or read certain commands, as shown in the following figure:



Figure 34 Port Assistant

9. CPU AND MEMORY USAGE

ACPWorkbench can read and display the CPU and memory usage of the chip in real time after it has connected to the demo board successfully.

9.1 CPU Usage

ACPWorkbench displays CPU usage in real time on the bottom progress bar. The unit MCPS means mega cycles per second. When CPU usage exceeds that maximum limit, the process bar's color will turn red to give a warning. In this case, the chip is not able to work in real time, and certain delays can be heard in output as a result.

9.2 Memory Usage

Memory usage will be displayed in digital form.

10. CONTACT INFORMATION

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