Chapter 3: Build a ControlSpace ESP-88 system

This chapter covers how to build a sound system design in ControlSpace Designer software.

Build a system design

The first step toward creating a ControlSpace ESP-88 system design in Designer software is to specify the hardware components that make up your system.

Project files

Your system design is stored in a project file with the file extension **.csp**. When you launch ControlSpace Designer software, a new project is automatically created and named “Untitled”. When you first save the project, you will be prompted to rename it.

Note: The system configuration that is stored in the ESP-88 can be downloaded to a project file at any time. This is helpful if you are working on a system that you did not create, or if you do not have the original .csp file. You can connect to the ESP-88 and download the configuration. See *Downloading settings: connecting to an existing ControlSpace ESP-88 system* at the end of this chapter.

Project View

Project View is a workspace where you add and connect the hardware components in your system design. These components are dragged from the **Device List** on the left and dropped into **Project View** on the right.

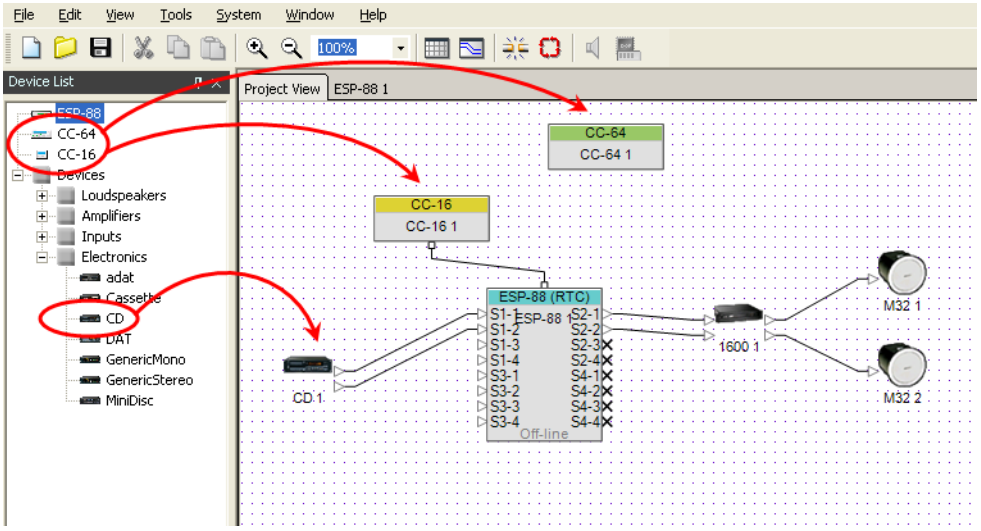


*Figure 3.1 - Drag and Drop devices into **Project View***

Project View allows you to graphically lay out the system design. The only required components are the ESP-88 and any CC-64s and CC-16s that are part of your design. Other devices, such as microphones and loudspeakers, can be added for your reference only, they do not perform any function in ControlSpace Designer software.

Note: You must wire any CC-16s in your design to an ESP-88 in Project View. All other wiring is technically optional, but can be added as a graphical reference.

Any ESP-88, CC-64 and CC-16 in your design can be renamed. Select the icon and press **F2**, or right click and choose **Rename**.

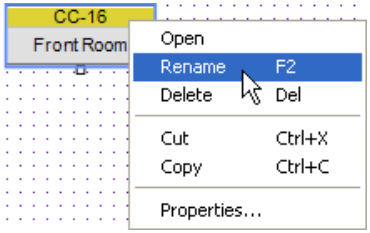
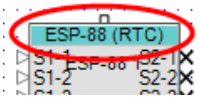


Figure 3.2 - Renaming a CC-16

Tip: **The first ESP-88 that you place acts as the Real Time Clock (RTC) for the system. This is indicated in the ESP-88 icon title bar. Go to Tools > Set Main ESP... to change which ESP-88 is the RTC in your design.**



Devices are wired together by dragging and dropping wires from output nodes to input nodes, as shown in Figure 3.3.

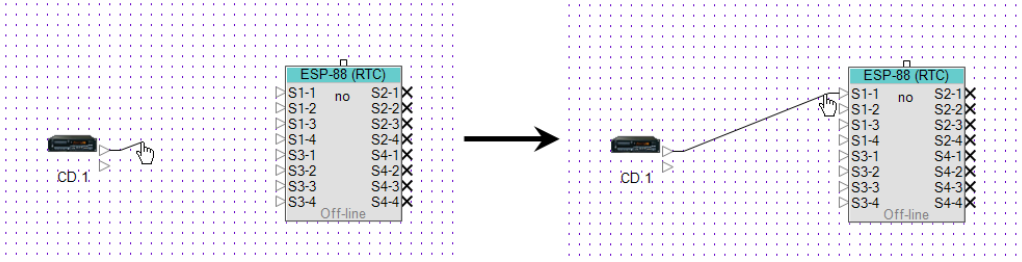


Figure 3.3 - Click and drag a wire from output to input.

To delete a wire, select the wire and press the **Delete** key, or right click and choose **Delete**.

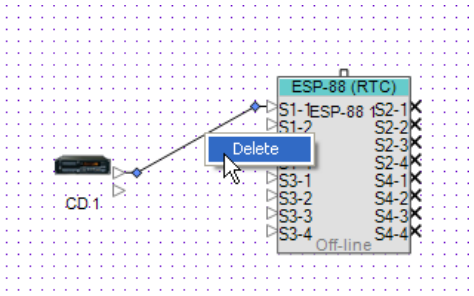


Figure 3.4 - Delete a wire

To move a wire, select the wire by clicking anywhere on the wire, then click and drag the blue node to the new location.

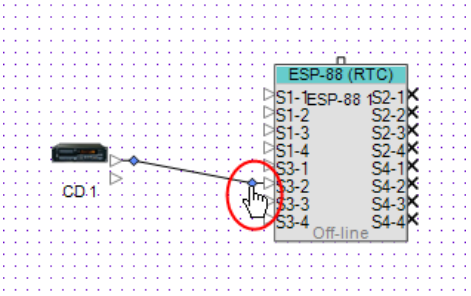


Figure 3.5 - Drag the blue node to move a wire

ESP-88 properties

ESP-88 properties, including the input/output card configuration, can be accessed by right clicking on the ESP-88 in **Project View**, and choosing **Properties...**.

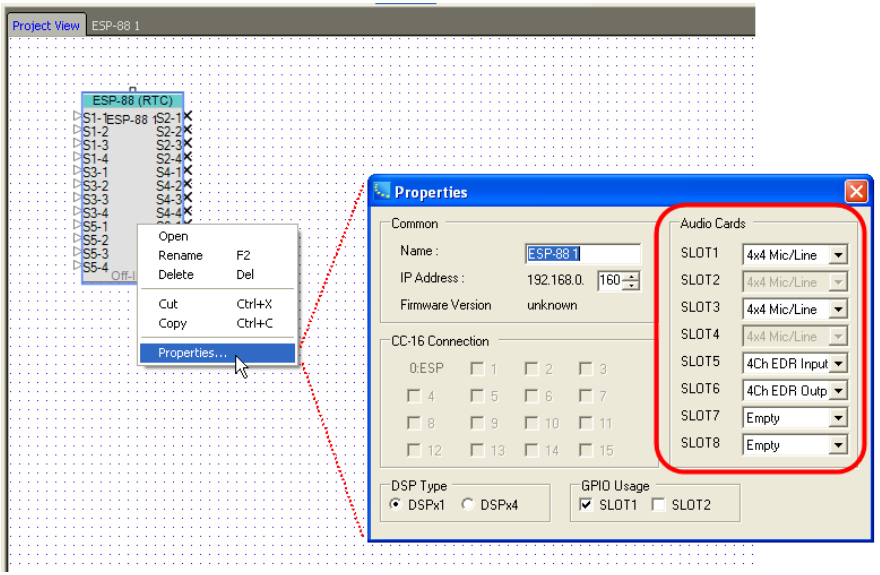


Figure 3.6 - Setting the input/output card configuration for an ESP-88

The slots in the **Audio Cards** section correspond to the slots on the back of the ESP-88. Choose a card from the dropdown menu to change the slot configuration. When you are connected to the ESP-88, running a Scan will automatically set the ESP-88 card configuration to the hardware that you are using.

Note: **The ESP-88 comes with 8 analog inputs (mic or line-level), and 8 analog line level outputs. These cards occupy the first four slots in the ESP-88. You can expand the number of inputs and outputs by adding cards to the remaining 4 slots in the ESP-88. This allows you to use up to 16 more analog audio channels (any combination of input or output), or up to 32 more digital audio channels using AES3 cards.**

Note: Available audio cards may differ from those shown in the Audio Cards dropdown menus.

You can also expand the functionality of the ESP-88 by installing an additional General Purpose Input/Output card, or the DSP expansion card. Specify the DSP card and GPI/O card configuration at the bottom of the **Properties** window.

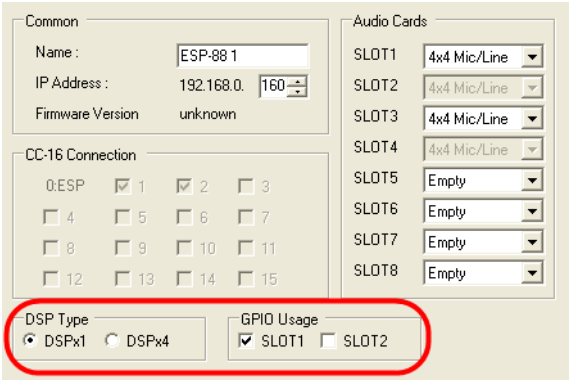


Figure 3.7 - DSP and GPI/O card configurations

ESP-88 window

Signal processing is configured in the **ESP-88** window. The **ESP-88** window is accessed by clicking on an **ESP-88** tab at the top of the window or by double-clicking on an ESP-88 in **Project View**. If you have more than one ESP-88 in your design each will have a separate tab. The **ESP-88** window is a block diagram display of the processing inside the selected ESP-88 unit, including inputs, outputs, signal processing blocks, and the GPI/O and Serial Inputs/Outputs.

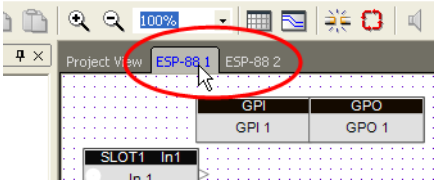


Figure 3.8 - ESP tabs

Card inputs

The column of blocks to the left side of the window represent the card inputs on the ESP-88. The inputs are named by which slot they are physically located in, for example **SLOT1**, or **SLOT3**.

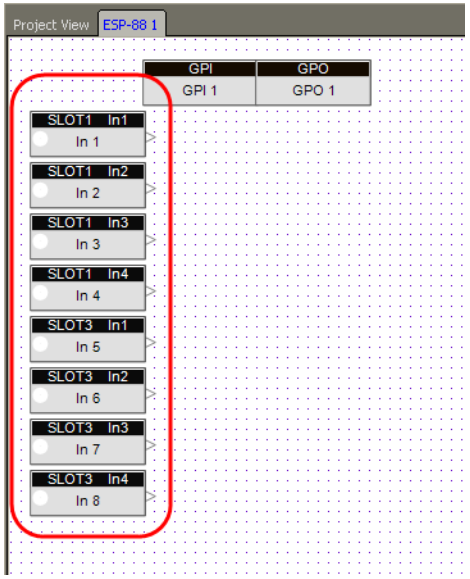


Figure 3.9 - Card inputs

To help organize your design, you can rename any signal processing, input, or output block by clicking on the block and pressing **F2**, or by right clicking and choosing **Rename**.

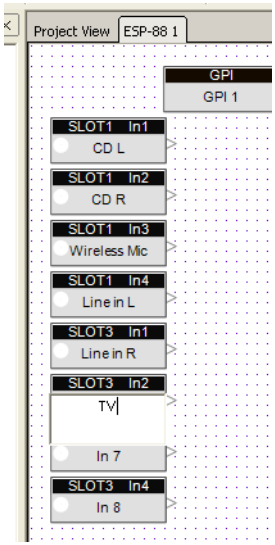
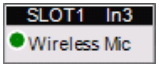


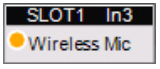
Figure 3.10 - Renaming a input blocks

When the ESP-88 is online and a signal is present at the input, the audio input indicator lights up green, yellow, or red. These lights represent the following levels:

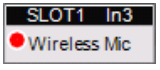
- Green - signal is greater than -36 dBu/-60 dBFS



- Yellow - signal is greater than or equal to +4 dBu/-20 dBFS



- Red - near clipping, signal is greater than or equal to +18 dBu/-6 dBFS



These indicators are mirrored in the LEDs on the front panel of the ESP-88.

Double-click on an input block to open the input control panel. Here you can adjust the input level, and set the input type and input gain. You can also turn on phantom power and mute the input.

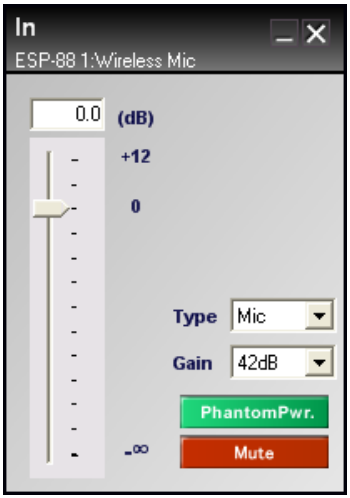


Figure 3.11 - 4X4 Mic/Line card input control panel

Tip: **To copy the settings from one input to another, right click on the input block and choose Copy Parameters (or press Ctrl + G). Then paste the settings to other inputs by selecting one or more inputs, right clicking, and choosing Paste Parameters (or press Ctrl + R)**

When an input is muted, the block output node turns red in the **ESP-88** window and in **Project View**:

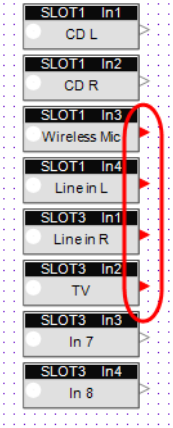


Figure 3.12 - Muted input blocks

Card Outputs

The column of blocks to the right side of the ESP-88 window represent the card outputs on the ESP-88. The outputs are named by which slot they are physically located in, for example **SLOT2**, or **SLOT4**.

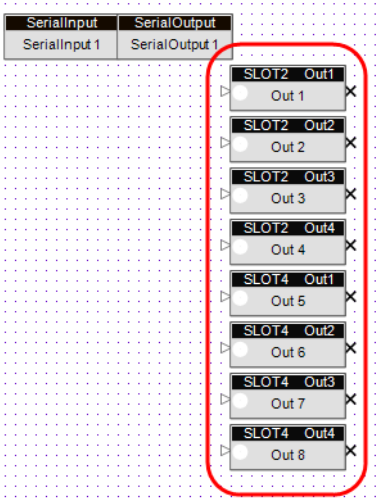


Figure 3.13 - Output blocks

The output node on an output block cannot be wired to as it represents the hardware output of the audio signal. An output node has three different icons and two different colors, as shown in the following figures:

Figure 3.14 - Output is not connected

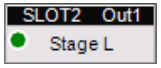
Figure 3.15 - Output is connected

Figure 3.16 - Output is connect and polarity is reversed

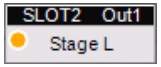
Figure 3.17 - Output is muted

As with any block in the ESP-88 window, you can rename outputs by pressing **F2**, or by right clicking and choosing **Rename**. The output blocks also have audio level indicators, which display a green, yellow, or red light in the same manner as the input blocks.

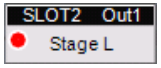
- Green - signal is greater than -36 dBu/-60 dBFS



- Yellow - signal is greater than or equal to +4 dBu/-20 dBFS



- Red - near clipping, signal is greater than or equal to +18 dBu/-6 dBFS



Double-click on an output block to open the output control panel. Use this control panel to adjust the output level. You can also change the polarity of the output signal, and mute the output.

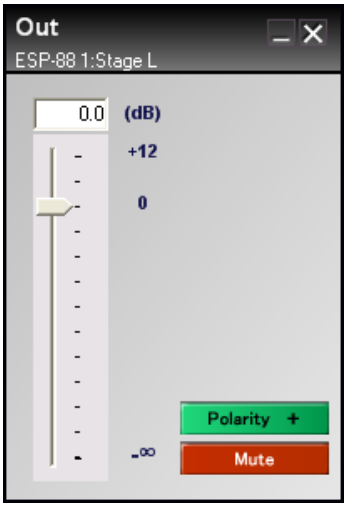


Figure 3.18 - Output control panel

General Purpose Inputs (GPI) and General Purpose Outputs (GPO)

The blocks in the upper left corner of the **ESP-88** window are used to program the General Purpose Inputs (**GPI**) and General Purpose Outputs (**GPO**). General purpose inputs to the ESP-88 allow you to control the system using devices such as switches and potentiometers. For example, a simple on/off switch could be used to switch between presets. General Purpose Outputs allow you to generate contact closure outputs from the ESP-88. See *Chapter 6: Program GPI/O and Serial Input/Output* for more information on programming General Purpose Inputs and Outputs.

Serial Inputs, Serial Outputs

The ESP-88 has a serial port that can be used to send or receive serial strings or commands.The blocks in the upper right corner of the **ESP-88** window are used to program the Serial Inputs (**SerialInput**) and Serial Outputs (**SerialOutput**). Serial inputs can be programmed to invoke an action in the ControlSpace ESP-88 system when a serial command is

received from an external device. Serial Outputs can be programmed to send a serial command to an external device when a parameter set is invoked, or when a timer expires. See *Chapter 6: Program GPI/O and Serial Input/Output* for more information on programming Serial Inputs and Serial Outputs.

Add signal processing

The **Signal Processing (SP) Tool Kit** window is visible when you are working in the **ESP-88** window. The **SP Tool Kit** contains signal processing blocks that can be used in your design. Simply drag a block from the **SP Tool Kit** window into the **ESP-88** window.

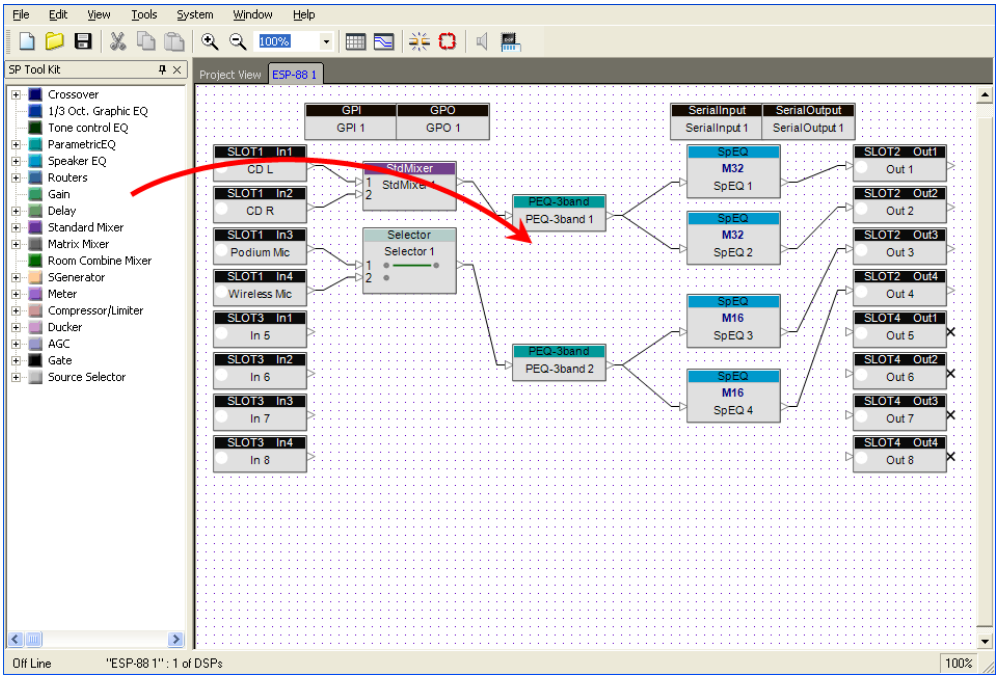


Figure 3.19 - Adding signal processing

The signal processing blocks are grouped by type. Click on the “+” next to a group to view the signal processing blocks. To open the control panel for any signal processing block, simply double-click on the block after you have added it to the **ESP-88** window.

Working with signal processing blocks

After placing signal processing blocks into the **ESP-88** window, you can move one or more blocks around by selecting and dragging them with the mouse. You can also use the arrow keys on your keyboard to nudge the blocks into position. To line up blocks, use the options in the **Edit** menu. For example, to vertically align the left borders of a group of blocks, select all the blocks and choose **Edit** > **Align Left Sides**:

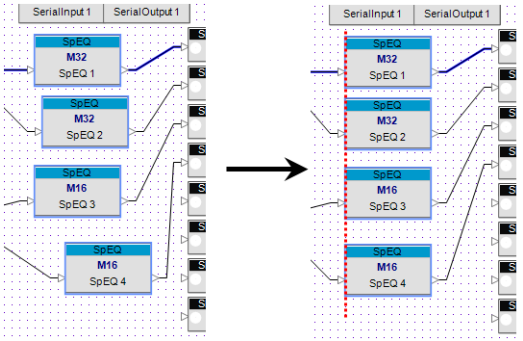
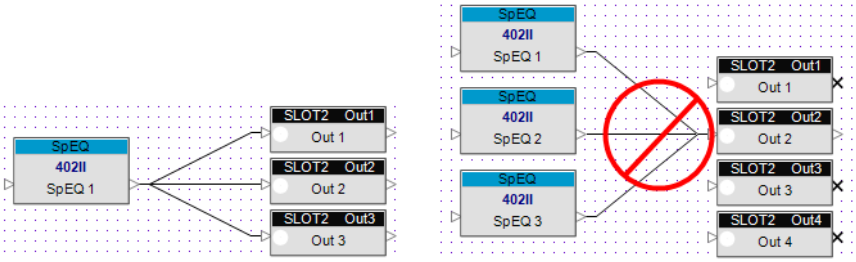


Figure 3.20 - Align Left Sides

Note: **The output of a signal processing block can be wired to more than one input, but a signal processing block can only accept one input wire.**



Rename any signal processing block by right clicking and selecting **Rename**, or by pressing **F2**.

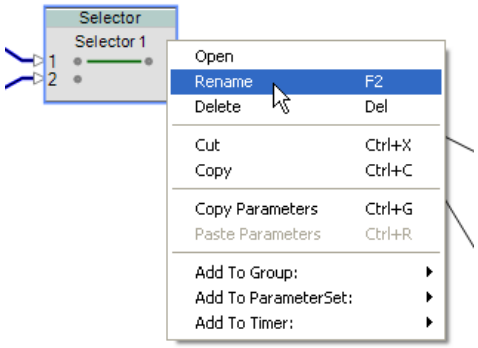


Figure 3.21 - Rename a signal processing block

To copy the settings in one signal processing block to another signal processing block of the same kind, right click on the block and select **Copy Parameters**. To paste these settings to another signal processing block of the same kind, select the signal processing block, right click and select **Paste Parameters**.

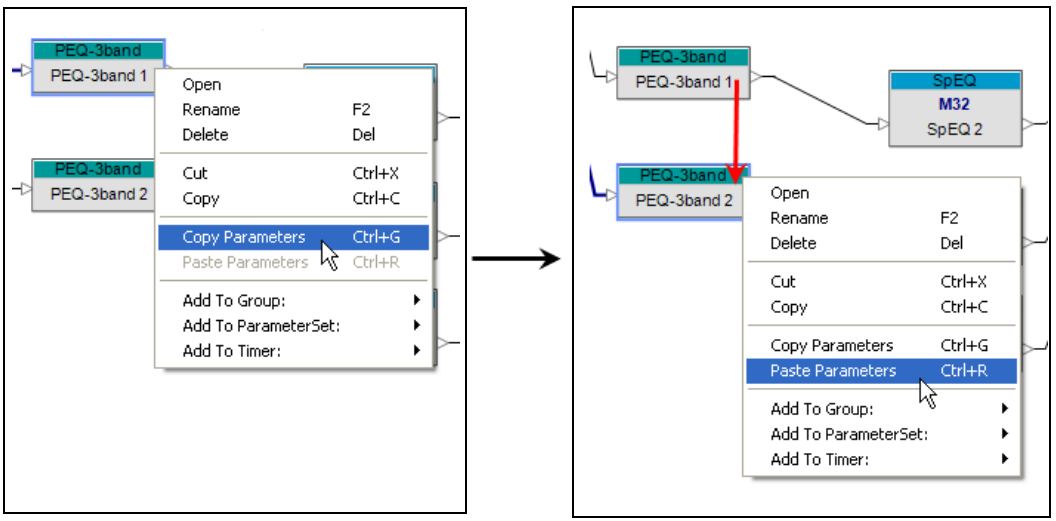


Figure 3.22 - Copy and paste parameters between two signal processing blocks of the same kind

DSP Resources

As you design your ControlSpace ESP-88 system, use the **DSP Resources** window to monitor the signal processing and delay usage for the ESP-88. To open the **DSP Resources** window, first select the **ESP-88** window, then choose **Tools** > **DSP Resources**, or press the **DSP Resources** button:

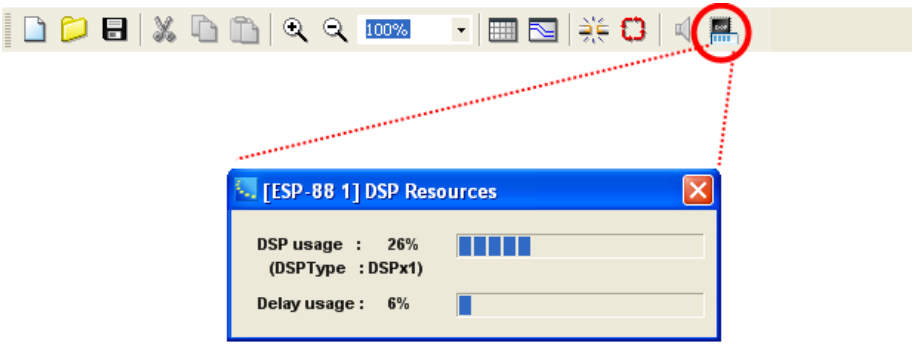


Figure 3.23 - DSP Resources

The **DSP Resources** window shows the percent capacity used for signal processing (DSP) and delay in the selected ESP-88.

Connecting to the ControlSpace ESP-88 system

After you have finished your system design, you need to connect to the ControlSpace ESP-88 system to upload the design into the ESP-88(s). If you have not already done so, you must first make the proper hardware connections to establish the local network for your ControlSpace ESP-88 system. For more information on hardware connections and network settings, see *Chapter 1: Configure the ControlSpace Designer network*.

There are two methods by which you can go on-line: download and upload. Most often, you will make changes to, or create a design in ControlSpace Designer software, and then upload the design to the ESP-88. Alternately, you can use the download option as a way to see the currently running configuration in a ControlSpace ESP-88 system.

Go on-line

Uploading to the ESP-88

Once you have created your system, you can upload the design from ControlSpace Designer software to any ESP-88s, CC-64s and CC-16s in your system. Once you are connected to the hardware, press the **Go on-line** button to upload your settings to the Flash memory in the ESP-88:

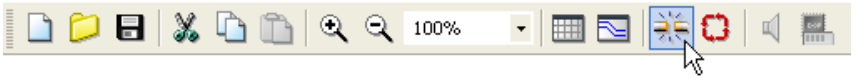


*Figure 3.24 - **Go on-line** button*

The **Go Online** window opens if the configuration in the ESP-88 Flash memory is different than the configuration in your design. Press the **Upload** button to load your design into the ESP-88.

Figure 3.25 - Go Online window

Once the settings are uploaded, the background in **Project View** and the **ESP-88** window turns blue to indicate that you are now working online.

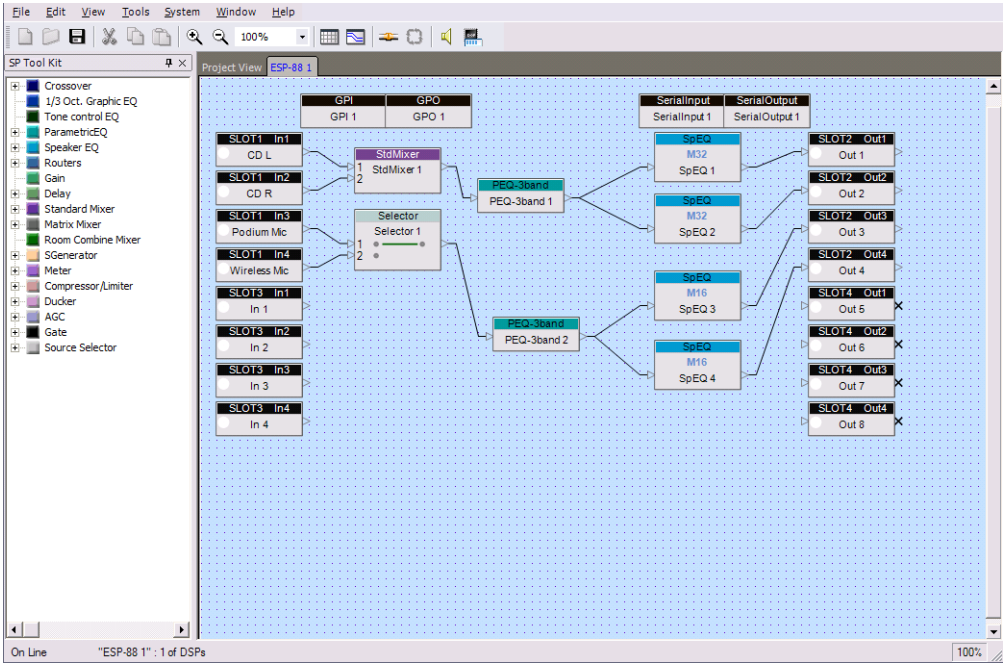


Figure 3.26 - Working online

Real-time controls

You can make adjustments to parameters in your system while online. For example, you may want to adjust the equalization of your system while you are listening to it. The following is a partial list of actions that are allowed when the system is online:

- Open and modify many signal processing block settings, such as EQs, Gains, Delays, and Compressors
- Copy and paste parameters from one signal processing block to another
- Use the CC-64 and CC-16 Smart Simulators to simulate user controls.

In general, signal flow and connections cannot be changed when the system is online. The following is a partial list of actions that are **NOT** allowed when the system is online:

- Changes in wiring between signal processing blocks and devices
- Adding or removing signal processing blocks and devices

Note: You must go off-line before disconnecting your computer from the local network.

Downloading settings: connecting to an existing ControlSpace ESP-88 system

You also have the option to download the system configuration from the hardware to ControlSpace Designer software. This is useful if you are connecting to an existing ControlSpace ESP-88 system and you do not have the original .csp project file. Follow these steps to download an existing configuration to ControlSpace Designer software:

1. Connect to the ControlSpace local hardware network.
2. Launch ControlSpace Designer software and create a new project file.
3. Press the **Scan** button to identify what hardware exists on the local network. This is necessary for ControlSpace Designer software to recognize the hardware components that it will upload to or download from.

*Figure 3.27 - **Scan** button*

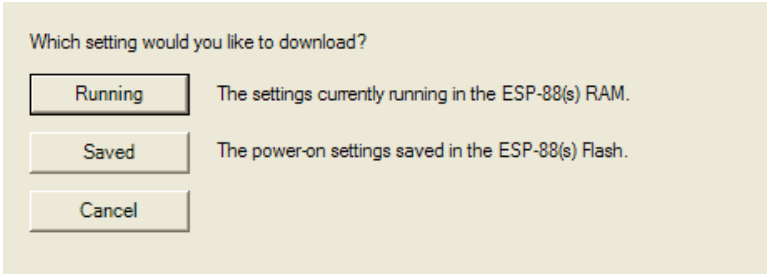
4. Press the **Go on-line** button.

*Figure 3.28 - **Go on-line** button*

5. Press the **Download** button in the **Go Online** window.

*Figure 3.29 - **Go Online** window*

Choose which settings you would like to download:



Running - Download the settings as they currently exist in the ControlSpace ESP-88 system. This *includes* any settings that have been changed in the system since the configuration was last loaded (or since the last time the system was powered on). For example, if you just changed the gain of an output from 0 dB to 7dB, the running settings will be downloaded with the gain at 7 dB.

Saved - Download the settings as they were last loaded into the ESP-88 Flash memory. This *does not include* any settings that have been changed in the system since the configuration was last loaded.

Cancel - Cancel the download.

After downloading the settings, the system will be on-line with the existing configuration in your ControlSpace project file.

Go off-line

To disconnect from the ControlSpace ESP-88 system while on-line, press the **Go off-line** button.

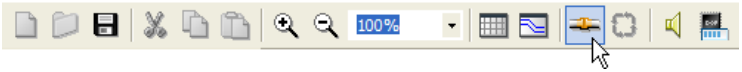


*Figure 3.30 - **Go off-line** button*

You are asked whether or not you want to save the currently running settings to the Flash memory in the ESP-88. The currently running settings include any settings that have been changed in the system since going on-line, for example any EQ adjustments you made while on-line.

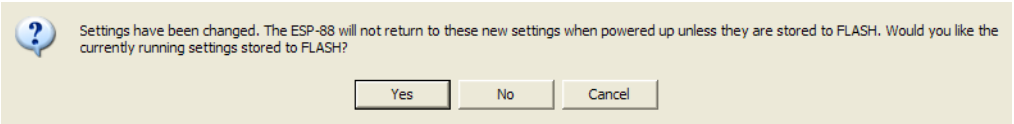


Figure 3.31 - Save settings when going off-line