

# **MXE5-64 DSP Matrix Mix Engine**

## **Crestron Control Modules**



## Release Notes

Release Date	Version	Changes
02/2021	V1.0.0	<ul style="list-style-type: none"> <li>First release. Compatible with Crestron 3-Series processors. Can also be used for 4-Series hardware but not fully optimised for these processors.</li> </ul>
09/2023	V1.1.0	<ul style="list-style-type: none"> <li>Updated to work with SONICUE 1.3.1 and MXE5 firmware 1.4.3161 (supports fixed DSP config mode only).</li> <li>Fixed a bug where adding multiple MXE5 Mix Engine modules to a Crestron program may not work correctly when going online to the MXE5's.</li> <li>Added discrete Connect &amp; Disconnect signals to the MXE5 Mix Engine module. These can be used instead of the ToggleConnect signal and have been added as a customer request.</li> <li>Improved handling if the Crestron control system is left online to an MXE5 during firmware updates and/or sample rate changes. Previously, the control system may have needed to be restarted following these changes.</li> <li>Can be used with 4-Series hardware but it is recommended to use version 2.0 (or greater) of the Crestron Control Modules as they have been fully optimised for 4-Series processors and VC-4, and SONICUE 1.3 in both fixed and flexible DSP config modes. Please note Crestron modules v2.0 do not support 3-Series hardware.</li> <li>Corrections to some control signal descriptions in the reference section of the user guide. The toggle operation of some signals had been incorrectly described in v1.0 of the guide.</li> <li>Note: Crestron Control Modules v1.1.0 is a separate package with its own user guide. This package and user guide is for Crestron Control Modules v2.0 only. Please download and use both versions if you are working with both 3-Series and 4-Series hardware.</li> </ul>
07/2023	V2.0.1	<ul style="list-style-type: none"> <li>Major update fully optimised for Crestron 4-Series and VC-4 control processors.</li> <li>Modular approach allows you to select only the control elements you require for each program.</li> <li>Requires SONICUE V1.3 or greater, and MXE5 firmware V1.4 or greater, for flexible DSP configuration.</li> <li>Requires SONICUE V1.2.4 or greater, and MXE5 firmware V1.3 or greater, for fixed DSP configuration.</li> <li>Built using Crestron.SimplSharp.SDK.Library version 2.19.63</li> </ul>

		<ul style="list-style-type: none"> <li>This version is no longer compatible with Crestron 3-Series processors. Please continue to use V1.1.0 for all 3-Series projects.</li> </ul>
09/2023	V2.0.2	<ul style="list-style-type: none"> <li>Compatibility update to support SONICUE 1.3.1, and MXE5 firmware V1.4.3161 or greater.</li> <li>Built using Crestron.SimplSharp.SDK.Library version 2.19.71</li> <li>It is recommended to use this package for all SONICUE versions from 1.2.4 onwards on Crestron 4-Series and VC-4 control processors.</li> </ul>
06/2024	V2.1.0	<ul style="list-style-type: none"> <li>Added fixed IP address capability to the MXE5 Mix Engine Module. You can now choose between device discovery through the device name (for systems where all the hardware is on the same subnet), and static IP address for the MXE5 (where there is a requirement to route control data between subnets).</li> <li>Built using: <ul style="list-style-type: none"> <li>Crestron.SimplSharp.SDK.Library version 2.20.66</li> <li>.NET Framework 4.7.2</li> <li>Crestron Database 225.5.001.00</li> <li>Device Database 200.350.00100.0</li> <li>SIMPL Windows 4.3000.01.01</li> <li>Vision Tool Pro-e 6.2.02.08</li> </ul> </li> </ul>

# Introduction

The Dynacord MXE5 DSP Matrix Mix Engine is designed to control, mix, and route audio signals through professional audio systems in fixed installations and live audio applications. Its key features are;

- Up to 128 x 128 mixing matrix
- 12 mic/line inputs and 8 x line outputs
- Up to 64 x 64 Dante IO, and AES70 remote control, via the OMNEO networking interface
- 8 x GPIO control ports
- 48 kHz and 96 kHz sample rates

OMNEO is a media networking architecture that combines studio-quality multi-channel audio and a common control system over standard IT networks. OMNEO's media transport uses Dante, while the control system uses Open Control Architecture (OCA). OCA is an open public standard, also known as AES70, for control and monitoring of professional media networks.

The MXE5 Crestron user modules allow the MXE5 to be fully integrated into a Crestron 4-Series or VC-4 control system. This enables a Crestron processor to control many common functions of the device, such as its central matrix zone mixer, input and output channel gains and mutes, power, preset recall, and error/fault supervision. The modules make full use of the Crestron SIMPL# programming environment to take care of all the heavy lifting for device communication and control. The resulting SIMPL# and SIMPL+ projects have been integrated into feature rich SIMPL Windows user modules that can be added to your control system project without needing any former knowledge of the AES70 control protocol. The modules are simply connected to other Crestron SIMPL symbols using traditional digital, analog, and serial signal joins that a Crestron programmer will already be familiar with.

The MXE5 should initially be setup with Dynacord's SONICUE software. This is used to configure DSP processing, zone mixing and loudspeaker settings, create presets, and set up the required error notifications. Once this is done the Crestron control system can operate simultaneously with SONICUE, or completely standalone, if SONICUE is not required for routine operation.

To simplify connecting to the MXE5 the 'Dynacord MXE5 Mix Engine' user module incorporates full device discovery, allowing you to discover and connect to your MXE5 by name, without having to worry about IP addressing or TCP/IP port numbers.

This guide explains how to integrate the MXE5 user modules into the Crestron SIMPL software. The module software package also includes two fully functioning demo projects which can be referred to for further information on how the modules can be used.

More information about the Dynacord MXE5 can be found on the Dynacord website at;  
<https://products.dynacord.com/na/en/mxe5/>

# 1. Installing the SIMPL user modules

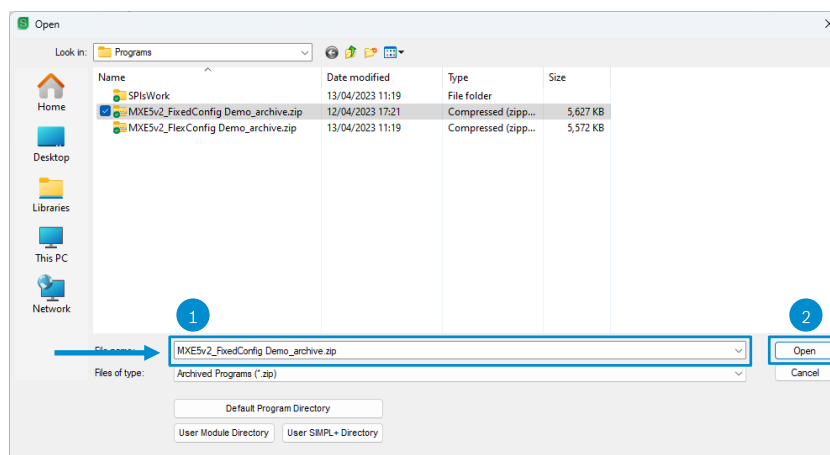
The module package contains the following components;

- **MXE5v2.1.0\_FixedConfig Demo\_archive.zip** - A SIMPL Windows archived demo project showing how the modules can be used in a typical project where the MXE5 is in fixed DSP configuration mode.
- **MXE5v2.1.0\_FlexConfig Demo\_archive.zip** - A SIMPL Windows archived demo project showing how the modules can be used in a typical project where the MXE5 is in flexible DSP configuration mode.
- **MXE5v2\_FixedConfig Demo UI.vtp** - VisionTools Pro-e project file for the fixed DSP configuration demo XPanel user interface file. There is a corresponding MXE5v2\_FixedConfig Demo UI.xexe folder containing the compiled XPanel user interface that can run on a Windows PC. Allows use of the demo project without needing a dedicated Crestron touch panel.
- **MXE5v2\_FlexConfig Demo UI.vtp** - VisionTools Pro-e project file for the flexible DSP configuration demo XPanel user interface file. As for the fixed config demo, there is a corresponding MXE5v2\_FlexConfig Demo UI.xexe folder containing the compiled XPanel user interface.
- **MXE5v2\_FixedConfig Demo.snc** - SONICUE project file.
- **MXE5v2\_FlexConfig Demo.snc** - SONICUE project file.

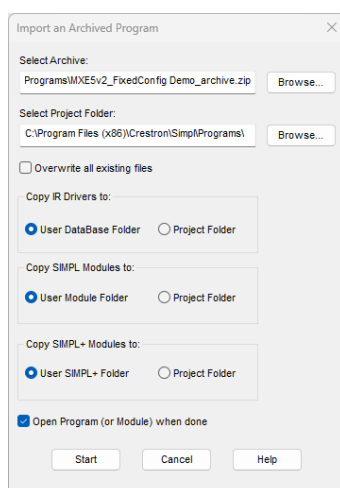
To install and use the demo project and user modules you will need Crestron SIMPL Windows and Dynacord SONICUE software installed on your PC, and suitable Crestron 4-Series hardware. Crestron Toolbox™, and VisionTools Pro-e™ are also recommended.

To install the modules:

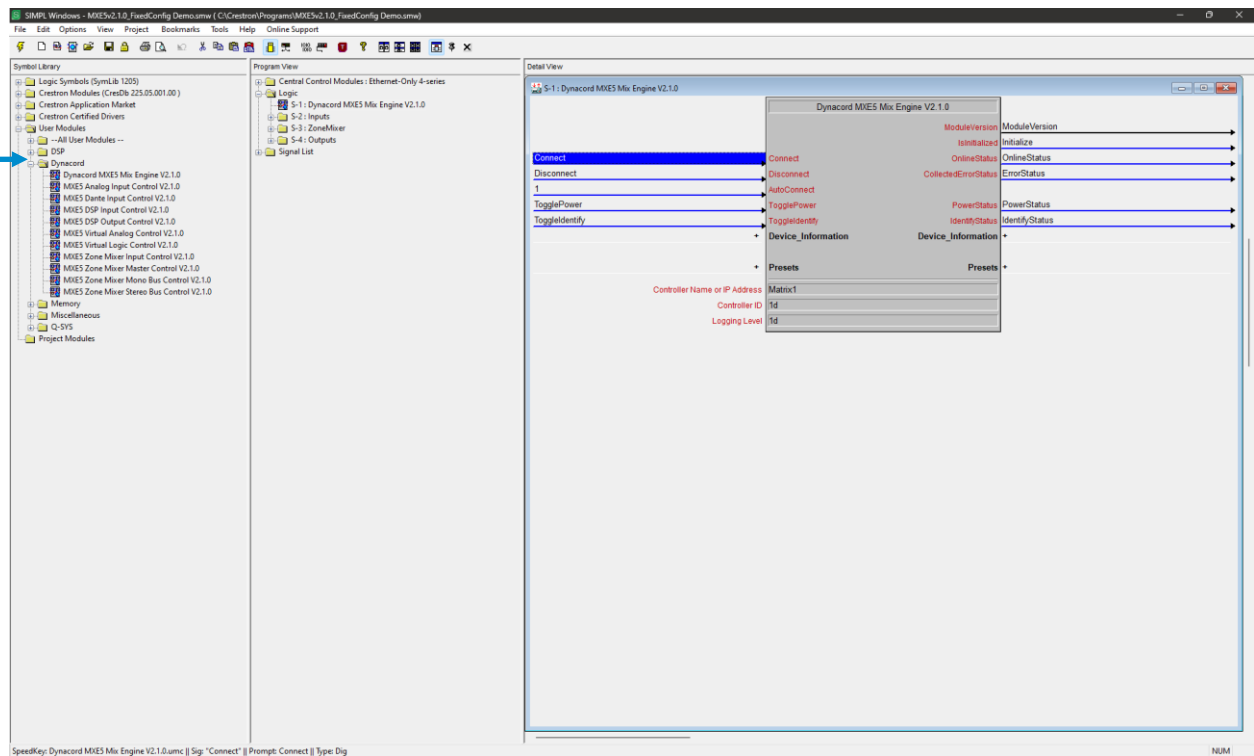
1. The most straightforward way to install the modules is to open the archived demo project files from within SIMPL Windows.
2. Open SIMPL Windows, then click menu item 'File > Open...'. The Windows File Explorer window appears.
3. Navigate to the location where you saved the MXE5 user module software package, select one of the demo programs and click 'Open'. If the demo programs do not show up in the window change the 'Files of type:' dropdown box to 'Archived Programs (\*.zip)'.



4. The 'Import an Archived Program' window appears.



5. Browse to the folder where you want the project to be installed. The default is usually your SIMPL Windows Project folder, but you can change this if desired.
6. To make the SIMPL and SIMPL+ modules packaged in the demo project available for other projects, make sure that the 'Copy SIMPL Modules' and 'Copy SIMPL+ Modules' radio buttons are both set to the 'User Folder' option, not the Project Folder.
7. Click 'Start' to import the demo project and user modules. Once the import is complete the project will open in SIMPL Windows.
8. The modules should now also be installed under the 'User Modules > Dynacord' folder in the Symbol Library pane.
9. A different set of user modules is included in each demo project. If you plan to use the MXE5 in both fixed DSP configuration and flexible DSP configuration we recommend you import both demo projects to SIMPL first to install all of the available modules.



## 2. Removing the SIMPL user modules

If you need to remove the modules you can do so by deleting them from the folder locations shown in your SIMPL Windows 'Preferences' dialog.

**Note:** This will not remove the modules from any of your archived projects. If you need to remove them from an existing project you will need to manually delete each module added to the project.

## 3. Updating the SIMPL user modules

If a newer version of an MXE5 module becomes available you can update it by following the procedure to install the modules above. Multiple different versions can be installed at the same time; therefore, you may also want to consider removing older versions by following the procedure to remove the modules above.

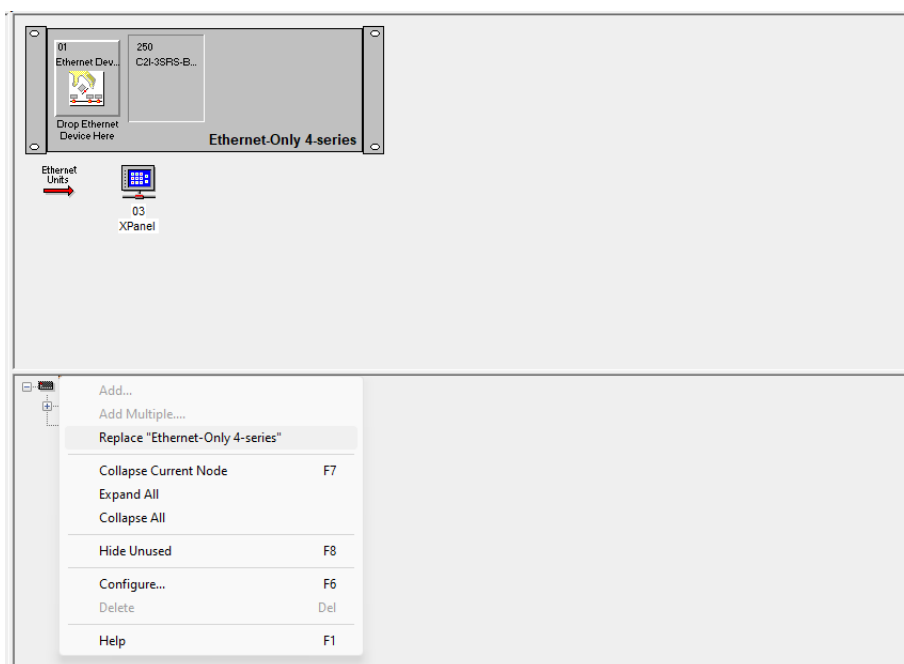
**Note:** Installing an update will not update any of your existing projects. Should you wish to make use of an update in an existing project, you will need to manually delete the older version from the project and replace it with the newer update.

**Tip:** As removing a module from a project may result in numerous signal joins also being removed, you may wish to consider first saving a backup of the current project, opening this backup version and the version to be updated side by side (in two instances of SIMPL Windows), then, after replacing the module, copy/paste the signal joins from the backup copy back into the updated version. This will save you having to re-enter each signal join manually.

## 4. Demo project overview

The two demo projects illustrate how each type of MXE5 user module might be integrated into a typical control program. Although not every available input and output signal has been connected, at least one of each control type has been fully implemented to show how it could be used. The demo projects also include fully functional XPanel user interfaces allowing you to set up a small test and development system with very little effort.

The projects have been configured for an Ethernet-Only 4-Series device to enable support for all 4-Series hardware and VC-4. If you want to use a specific processor, in SIMPL Windows, select 'Project menu > Configure System', right click on the 'Ethernet-Only 4-series' icon in the lower pane and select Replace "Ethernet-Only 4-series". Select your controller from the popup dialog that appears.



1. The **Dynacord MXE5 Mix Engine** module provides all the functionality for communicating with a remote MXE5 device using the AES70 protocol over TCP/IP. The Mix Engine module must always be added to a project where you want to control an MXE5. In addition to general communications, it offers the following functions:
  - Automatic device discovery using DNS-SD. You enter the name of the MXE5 in the 'Controller Name or IP Address' parameter and discovery will locate the device and obtain its IP address and TCP/IP port.
  - Static IP addressing. If you want to connect to a device using a specific IP address, rather than through device name discovery, simply enter the required IP address in the 'Controller Name or IP Address' parameter instead.
  - Online status and collected error/fault indicators.
  - AutoConnect digital input. If this input is high the control system can automatically reconnect to the MXE5 whenever the program is restarted.



- Basic information about the connected MXE5 including the device name, model, serial number and status.
- Power/standby switching.
- Identify function to locate a physical MXE5 device on a network (causes the front panel LCD display of the MXE5 to illuminate and show its ID information).
- Recall of all available user presets (U01 – U60) and the factory preset (F01).

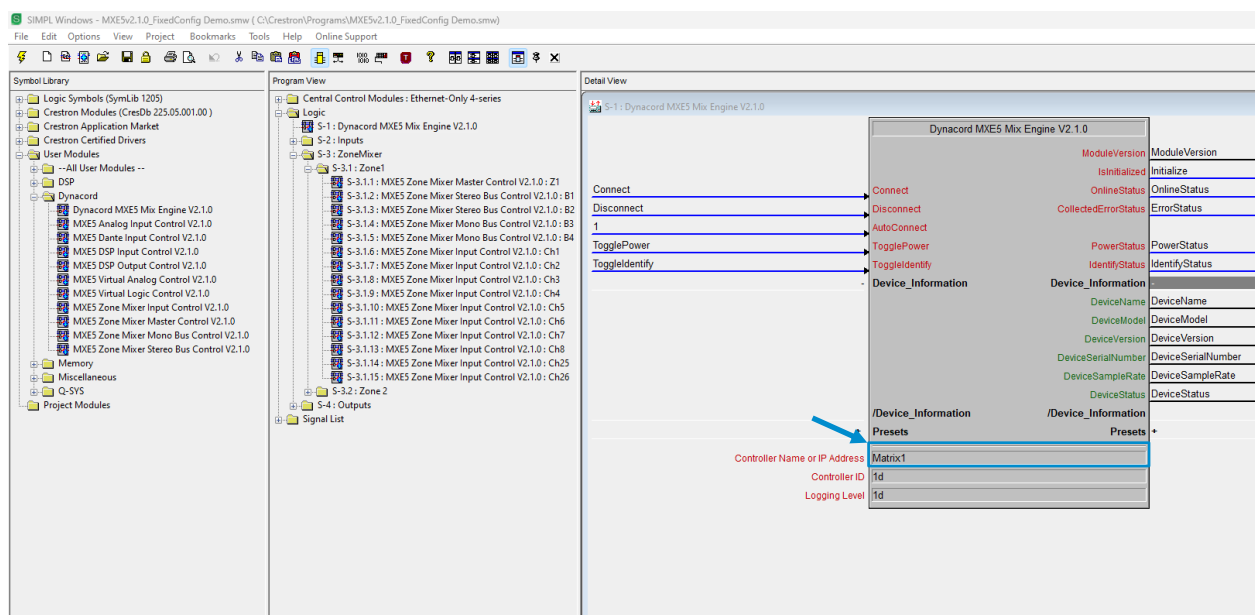
2. The **MXE5 Control** modules provide controls for several of the most useful DSP blocks typically needed in a control system program including:

- Control of the zone mixer input channels, buses and master outputs.
- Control of the input and output DSP levels for each of the 24 available I/O channels.
- Pilot tone supervision status for all analog and Dante input sources.
- Refer to the control module reference section of this guide for a complete overview of each control.

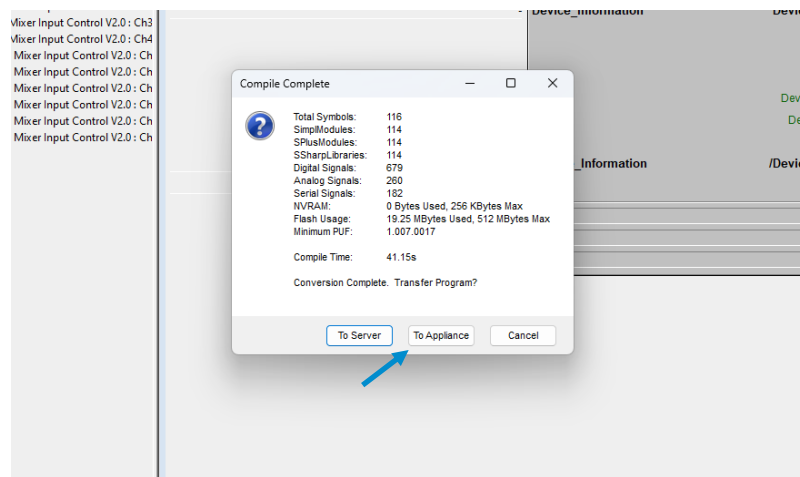
**Note:** SONICUE offers flexible dynamic patching and routing of audio signals through the MXE5, allowing you to change the number of DSP inputs and outputs in use, the number of inputs and buses for each zone of the zone mixer, and the overall number of zones in use. If you attempt to control an element that has not been enabled in SONICUE first, it will not cause problems, although it might waste processing resources on your Crestron system that could be used for other tasks as it will make no audible changes on the MXE5. When you create real-world projects make sure to setup the SONICUE design appropriately first.

## Running the demo project

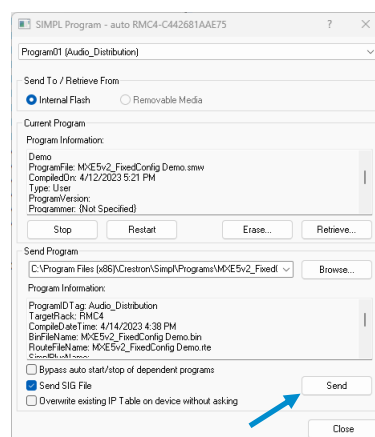
To run one of the demo projects, you may need to set the name of your MXE5 in the ‘Controller Name or IP Address’ parameter on the Mix Engine module.



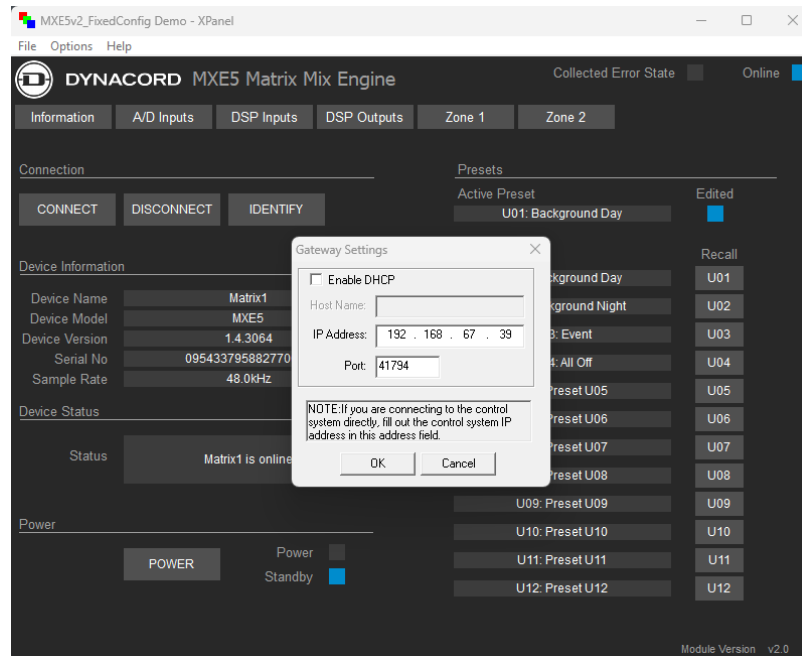
1. Set the 'Controller Name or IP Address' parameter to match the name of your MXE5. The default name when adding a single MXE5 to a SONICUE project is 'Matrix1' so this step is usually only necessary if you have changed its name, or you have more than one MXE5 on your network. Note that the controller name is case sensitive and must exactly match the name configured on the MXE5 device.
2. Alternatively, to connect to the MXE5 using a specific IP address (for example, when a static IP address has been assigned so you can connect to a device in a different subnet) enter the IP address in the 'Controller Name or IP Address' box instead. The address must be in the standard IPv4 format XXX.XXX.XXX.XXX -> for example, 192.168.1.100
3. Click the 'Convert/Compile' icon on the SIMPL tool bar, or press F12.
4. When compile has completed, transfer the project to your control processor. Select 'To Server' for VC-4, or 'To Appliance' for 4-Series hardware.
5. For 4-Series hardware, select your processor and enter the correct IP address (or Hostname) in the Address Book window that appears.



6. Transfer the project.



7. For VC-4 use the web interface to add the program and activate it in the room of your choosing.
8. Use Windows Explorer to locate the XPanel project in the module software package, then double click 'LaunchXPanel.exe' to launch the demo UI.
9. Select 'Options > Settings...', the Gateway Settings dialog appears. Change the IP Address to match your processor or VC-4 server and click 'OK'.



10. Click 'Connect' on the XPanel UI to discover and connect to your MXE5.

**Note:** It is important that both the Crestron control processor and the MXE5 Mix Engine have IP addresses that are in the same range, on the same subnet, otherwise discovery for the MXE5 will fail. This is usually satisfied if all your network devices are set to obtain an IP address from a DHCP service, and an active server is available on the network. If you are using a link local address for your MXE5 (169.254.X.X) your Crestron processor must also be assigned an address in this range.

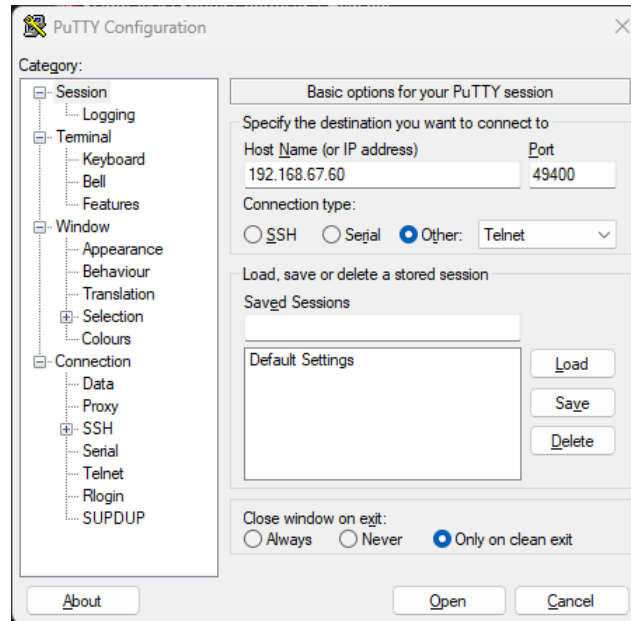
Link local is an addressing system that automatically assigns an IP address to a device (in the link local range), if a DHCP server is not enabled on the network, and it has not been configured with a static IP address.

**Important:** Discovery uses UDP on port 5353. If your control system is a VC-4 you will need to specifically allow this port in the VC-4 firewall settings as it will be blocked by default.

Alternatively, configure the MXE5 with a static IP address and use that same address for the 'Controller Name or IP Address' parameter to bypass the discovery process and connect to the MXE5 directly. If you are connecting to an MXE5 in a different subnet or VLAN to your control system, additional network configuration and routing will be required. If you are unsure of how to configure a routable network please consult an IT specialist.



13. VC-4 does not output to the Toolbox Text Console but you can still view debug messages using a telnet client such as PuTTY. Connect the telnet client to your VC-4 using the VC-4's IP address, the TCP port 49400, and the Telnet connection type. You MUST also enable TCP port 49400 on the VC-4 host operating systems firewall settings, otherwise logging will not work.
14. Advanced users can edit the SIMPL+ file '**Dynacord MXE5 Controller V2.1.0.usp**' to change the TCP port if required. The file is usually found in your '\Creston\Usrplus' folder. Edit the file with SIMPL+, scroll down to 'Function Main()' and edit the line 'mxe5.VirtualConsolePort = 49400;' to the port you require. Recompile and upload the updated program to the VC-4. Remember to allow the new port in the VC-4 host firewall settings too.



15. The connection to the virtual console is not authenticated and not secure. Although the host operating system cannot be accessed through the virtual console, if security is paramount for your project, you should remove the logging port from the host firewall settings before handing the system over to your customer. You can also disable the virtual console entirely by editing the '**Dynacord MXE5 Controller V2.1.0.usp**' and changing the virtual console port to 0 (zero) 'mxe5.VirtualConsolePort = 0;'. Don't forget to recompile and update the program on the VC-4 if you do edit the SIMPL+ file.

## 5. Dynacord MXE5 Mix Engine - Module Reference

This module is used for handling device discovery, remote control of the device using the AES70 protocol over TCP/IP, and some control elements on the MXE5. It also acts as a gateway for other MXE5 modules to communicate with the device, therefore your control system program must always have at least one Mix Engine module, otherwise the other control modules will not work.

Multiple modules can be used in the same program when you want to control more than one MXE5 using the same Crestron control processor. A separate instance of the module is required for each device you want to control. The total number of devices that can be supported on a single control processor will be determined by the speed of its CPU, and the number of other tasks it is handling in your overall control system project. An undesirable slowdown may require processing tasks to be split over more than one control processor.

The module is supported on 4-Series hardware and VC-4 only, and uses the Ethernet control port. 3-Series processors are no longer supported with V2.X of these Crestron modules. Please continue to use V1.0 of the modules for 3-Series hardware.

It incorporates automatic reconnect if it loses connectivity to the MXE5 while it is online to the device. It will send discovery messages using multicast DNS once every 10 seconds until either the device responds again, or the connection is aborted by the user. As the discovery process sends, and needs to receive, multicast ethernet packets, there may be additional requirements (such as configuring IGMP snooping and firewalls) where your network is utilizing managed network switches. Both the Crestron control processor (and any associated touch panels, and other networked hardware it may be controlling), and the MXE5 must have IP addresses in the same range, on the same subnet. These can be assigned using a DHCP server, link local addressing (where a DHCP server is not available), or static user configured IP addresses. Correct setup of the network is beyond the scope of this guide as there are many different variables to consider, especially when integrating the control system into a corporate network. However, it is an essential step for reliable operation. If necessary, the knowledge of an IT professional may be required.

Discovery uses UDP on port 5353. If your control system is a VC-4 you will need to specifically allow this port in the VC-4 firewall settings as it will be blocked by default.

Alternatively, you can enter the MXE5 IP Address in place of the device name to establish a direct connection that will bypass the discovery process.

Input and output signals on the module are grouped into categories of related parameters. Each parameter group can be expanded, or contracted, by clicking the '+' or '-' icons to the left or right of the symbol graphic. There is no requirement for every available input or output signal to be used (only the signals you need for a specific project need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

MXE5 control parameters on the module are fully synchronized with the device, and other controlling software such as SONICUE. This means any changes to a control value in one software

will automatically populate to the other. There is no need to constantly poll the MXE5 for the latest status information. All parameter subscriptions and notifications are handled by the module.

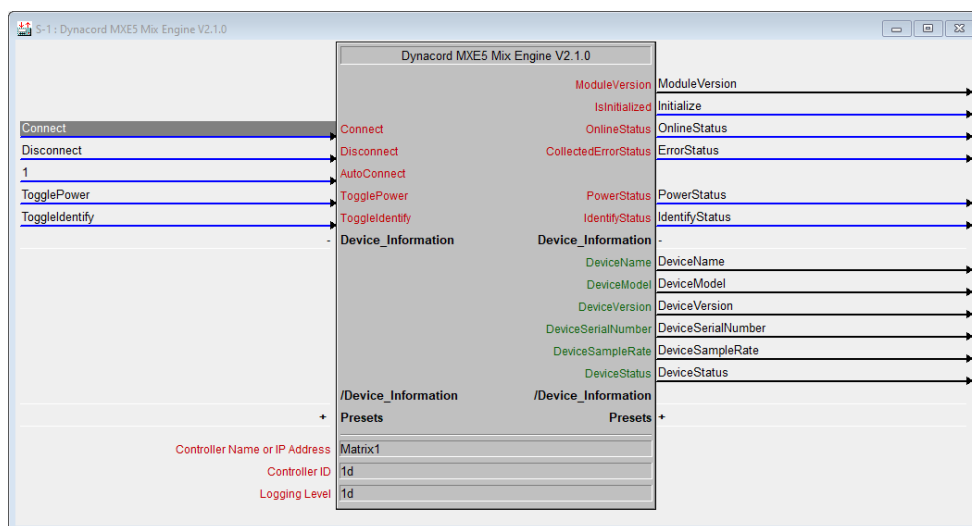
To achieve this, the Crestron control system must synchronize the control parameters each time it connects to the MXE5, which may take several seconds depending on the speed of the control system in use. It is recommended that minimal other processing is being carried out until synchronization is complete i.e., you may need to stagger initial connection to multiple devices in a more complex control project.

## Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



## Control (Input) signals:

Signal name	Type	Description
Connect	D	Connects to the MXE5 when the signal input is pulsed high. The input does not need to remain high once the connection has been initiated.
Disconnect	D	Disconnects from the MXE5 when the signal input is pulsed high. The input does not need to remain high once the disconnection has been initiated.
AutoConnect	D	If this input is high when the control system is restarted (for example following a reboot, power cycle, or restart of the running program) the control system will automatically connect to the MXE5 without needing to pulse the Connect input. The input can be configured through some programmer specified logic, or by using '1' as the signal input as shown in the demo programs.
TogglePower	D	Switches the MXE5 between standby and powered up each time the signal input is pulsed high.
ToggleIdentify	D	Turns the MXE5 Identify function on or off each time the signal input is pulsed high. When Identify is on this causes the LCD front panel of the connected MXE5 device to light up and display IP address information, as well as flashing the blue OMNEO LED. It is used to help physically locate a device in an installation.  Note: The control system must be connected (online) to the MXE5 for the locate function to work.
RecallPreset_U01 to RecallPreset_U60	D	Pulse the respective signal input high to recall the corresponding preset on the MXE5.  Note: Presets must be created first using SONICUE. Recalling a preset that has not previously been saved will cause a DSP error on the device.
RecallPreset_F01	D	Pulse the signal input high to recall the MXE5 factory preset.

## Feedback (Output) signals:

Signal name	Type	Description
ModuleVersion	S	Indicates the version number of this module.
IsInitialized	D	Latches high to indicate that this module has been initialized. Used to signal to other MXE5 modules that they can register with their corresponding MXE5 Mix Engine module, as this



Signal name	Type	Description
		must only be done <i>after</i> the Mix Engine module has initialized.
OnlineStatus	D	Latches high to Indicate when the module is online to the MXE5 it is controlling. Latches low when it is offline or the control system has lost communication with the MXE5 device.
CollectedErrorStatus	D	Latches high to indicate that the connected MXE5 is reporting an error, or fault, condition. Latches low when the MXE5 is reporting 'OK'.  Note: The fault conditions that trigger a collected error are set up using SONICUE.
PowerStatus	D	Latches high to indicate that the MXE5 is in its powered-up state. Latches low to indicate that the MXE5 is in its standby state.  This signal output will change state when either the 'TogglePower' signal input pulses high, or the connected MXE5 notifies the module that its power state has been changed by another source.
IdentifyStatus	D	Latches high to indicate that the MXE5 locate function is active. Latches low to indicate that it is not active.  This signal output will change state when either the 'ToggleIdentify' signal input pulses high, or the connected MXE5 notifies the module that its identify function has been changed by another source.
DeviceName	S	String output with the device name returned by the MXE5 during parameter synchronization while connecting to the device.
DeviceModel	S	String output with the model name returned by the MXE5 during parameter synchronization while connecting to the device.
DeviceVersion	S	String output with the firmware version returned by the MXE5 during parameter synchronization while connecting to the device.
DeviceSerialNumber	S	String output with the manufacturer assigned serial number returned by the MXE5 during parameter synchronization while connecting to the device.
DeviceSampleRate		String output with the current sample rate (48 or 96 kHz) returned by the MXE5 during parameter synchronization while connecting to the device.

Signal name	Type	Description
DeviceStatus	S	String output indicating the current connection status to the MXE5. Whether it is online, or offline, the module is attempting to discover the device, the module is busy synchronizing parameters with the device, or the connection to the device has been lost.  It will output a warning message if you attempt to use control modules that are only intending for use with an MXE5 in fixed DSP mode but the MXE5 is configured for flexible DSP mode.
ActivePresetNumber	A*	The value at the output signal identifies the preset that is currently active on the connected MXE5.  1 -> 60 = user presets U01 to U60 61 = Factory preset
ActivePresetDescription	S*	String output with the textual description of the currently active preset. This is the name the preset was given by the user when it was stored.
ActivePresetEdited	D*	Latches high whenever a change has been made to the currently active preset. This means one or more controls (e.g. a mute, or a level) are in a state that is different to when the preset was last stored. When the state of all the controls are identical to the stored preset the signal output latches low.
PresetDescription[U01] to PresetDescription[U60]	S	String output with the textual description of the corresponding preset. This is the name given to the preset when it was stored by the user. Presets that have not previously been stored will return just the preset number (e.g. "U01") without any further descriptive text.
PresetDescription[F01]	S	String output with the textual description of the factory preset.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

Parameters:		
Parameter name	Type	Description
Controller Name or IP Address	S	Name assigned to the MXE5 to identify it on the network and to Dante Controller. The name entered in this parameter must match the name assigned to the MXE5 exactly (case sensitive).  The default is 'Matrix1'.  If necessary, the MXE5's name can be changed using SONICUE, it must be unique on the network and follow Dante naming rules.

Parameter name	Type	Description
		<p>Naming rules;</p> <ul style="list-style-type: none"> <li>• Cannot start, or end, with a hyphen (-).</li> <li>• Cannot contain only numbers. At least one letter, or hyphen, is also required.</li> <li>• Can only contain numbers, uppercase and lowercase letters, and hyphens. Spaces and other characters are not allowed.</li> <li>• Can have up to 31 characters.</li> </ul> <p>Alternatively, enter the IP address of the MXE5 to bypass the discovery process and connect to the device directly. The IP address must be an IPv4 address in the format XXX.XXX.XXX.XXX (for example, 192.168.1.100)</p>
Controller ID	Dec	<p>Arbitrary value used to pair an MXE5 Mix Engine module with other MXE5 control modules. It is used when multiple MXE5's are being controlled by the same Crestron control processor. Other control modules that need to communicate with a particular device should have the same Controller ID as their parent Mix Engine module.</p> <p>The allowed range is between 1 and 1024, and the default value is 1.</p>
LoggingLevel	Dec	<p>Specifies the severity of debugging messages that are sent to the Crestron Toolbox Text Console window.</p> <p>The allowed range is between 0 and 7, and the default value is 4.</p> <p>When setting the logging level all messages equal or greater than the selected level will be sent to the Console.</p> <p>0 = None (logging disabled, no messages will be sent to the Console)</p> <p>1 = Verbose (useful for initial program debugging but can result in a large amount of messages being generated)</p> <p>2 = Debug</p> <p>3 = Information</p> <p>4 = Warning</p> <p>5 = Error</p> <p>6 = Exception</p> <p>7 = Fatal</p>

## 6. MXE5 Analog Input Control - Module Reference

This module controls a single analog input on an MXE5, providing access to the input gain, phantom power, and pilot tone supervision properties on the device. The input gain can be ramped up or down automatically by holding the IncreaseGain/DecreaseGain input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each of the 12 available analog inputs you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for each analog input enabled in SONICUE to have a corresponding Analog Input Control, and gaps can be left between inputs that do not require Crestron control. For example, if a project requires four analog inputs (1 -> 4) but only inputs 2 and 4 require Crestron control, you can add two Analog Input Control modules to your SIMPL project, setting their 'Block ID' parameter to 2 and 4 respectively.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

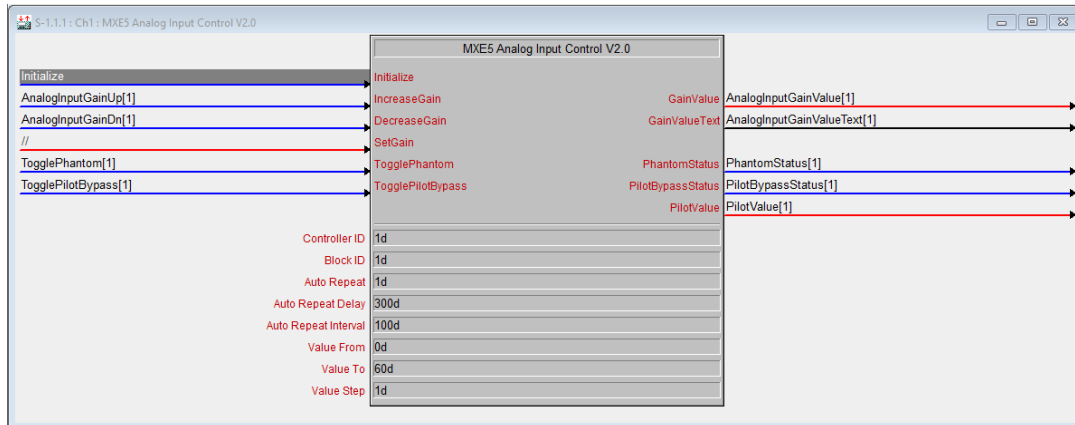
SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



## Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>must</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseGain	D	<p>Increments the analog input gain by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the gain up by 'Value Step' every 100 ms until the maximum gain of +60 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseGain	D	<p>Decrements the analog input gain by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the gain down by 'Value Step' every 100 ms until the minimum gain of 0 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>

Signal name	Type	Description
SetGain	A	Sets the analog input gain to the value at the signal input. If the value is less than, or greater than, the allowed range (0 -> 60) it will be set to the minimum or maximum accordingly.
TogglePhantomPower	D	Turns the analog inputs phantom power on or off each time the signal input is pulsed high.
TogglePilotBypass	D	Turns the analog inputs pilot tone supervision detection on or off each time the signal input is pulsed high.

### Feedback (Output) signals:

Signal name	Type	Description
GainValue	A*	The value at the output indicates the current gain setting for the analog input returned from the MXE5.
GainValueText	S*	String representation of the GainValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the analog input gain setting on a user interface in a more user-friendly style.
PhantomStatus	D	Latches high to indicate that phantom power is on. Latches low to indicate that it is off.  This output will change state when either the 'TogglePhantom' signal input pulses high, or the connected MXE5 notifies the module that the phantom power state has been changed by another source.
PilotBypassStatus	D	Latches high to indicate that pilot tone supervision is bypassed. Latches low to indicate that it is active.  This signal output will change state when either the 'TogglePilotBypass' signal input pulses high, or the connected MXE5 notifies the module that the pilot bypass state has been changed by another source.
PilotValue	A*	The value at the output indicates the current state for the analog input pilot tone supervision returned from the MXE5.  0 = pilot tone supervision for the input is bypassed  1 = pilot tone supervision is active and the pilot signal is being received  2 = there is a pilot tone supervision fault, the pilot signal is not being received

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

## Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.  The allowed range is between 1 and 1024, and the default value is 1.
Block ID	Dec	The analog input number this module refers to. That is, the analog input in SONICUE that this module will control  The allowed range is between 1 and 12, and the default value is 1.
Auto Repeat	Dec	Specifies whether holding the IncreaseGain and DecreaseGain inputs high will automatically repeat incrementing or decrementing the input gain.  0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.
Auto Repeat Delay	Dec	The time, in milliseconds, to wait before automatic repeating will begin.  The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.  This parameter has no effect if Auto Repeat is disabled.
Auto Repeat Interval	Dec	The time, in milliseconds, to wait between repeats. The analog input gain will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.  The allowed range is 0 (don't repeat) to 10,000. The default value is 100.  This parameter has no effect if Auto Repeat is disabled.
Value From	Dec	Specifies the minimum value repeating will ramp down to.  The allowed range is 0 to 60. The default value is 0.
Value To	Dec	Specifies the maximum value repeating will ramp up to.  The allowed range is 0 to 60. The default value is 60.
Value Step	Dec	Specifies the amount (in dB) by which the gain will be ramped on each repeat interval.

Parameter name	Type	Description
		The allowed range is 1 to 60. The default value is 1.



## 7. MXE5 Dante Input Control - Module Reference

This module controls a single Dante input on an MXE5, providing access to the inputs pilot tone supervision properties on the device. A separate instance of the module should be added to your SIMPL program for each of the 24 available Dante inputs you want to supervise. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for each Dante input enabled in SONICUE to have a corresponding Dante Input Control, and gaps can be left between inputs that do not require Crestron control. For example, if a project requires four Dante inputs (1 -> 4) but only inputs 2 and 4 require Crestron control, you can add two Dante Input Control modules to your SIMPL project, setting their 'Block ID' parameter to 2 and 4 respectively.

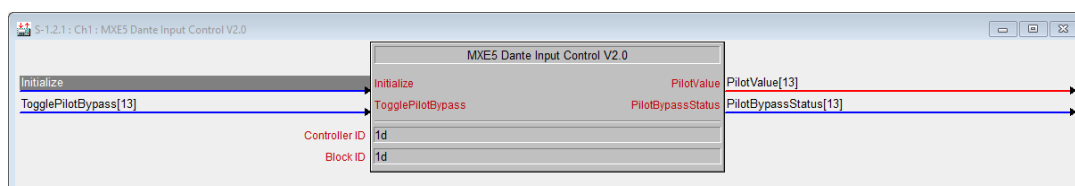
SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



### Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>must</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
TogglePilotBypass	D	Turns the Dante inputs pilot tone supervision detection on or off each time the signal input is pulsed high.

### Feedback (Output) signals:

Signal name	Type	Description
PilotBypassStatus	D	<p>Latches high to indicate that pilot tone supervision is bypassed. Latches low to indicate that it is active.</p> <p>This signal output will change state when either the 'TogglePilotBypass' signal input pulses high, or the connected MXE5 notifies the module that the pilot bypass state has been changed by another source.</p>
PilotValue	A*	<p>The value at the output indicates the current state for the Dante input pilot tone supervision returned from the MXE5.</p> <p>0 = pilot tone supervision for the input is bypassed</p> <p>1 = pilot tone supervision is active and the pilot signal is being received</p> <p>2 = there is a pilot tone supervision fault, the pilot signal is not being received</p>

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

### Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular

Parameter name	Type	Description
		<p>MXE5 should have the same Controller ID value as the required Mix Engine parent module.</p> <p>The allowed range is between 1 and 1024, and the default value is 1.</p>
Block ID	Dec	<p>The analog input number this module refers to. That is, the Dante input in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>

## 8. MXE5 DSP Input Control - Module Reference

This module controls a 'Trim' DSP block on an MXE5, providing access to the input trim level, mute, and phase reverse properties. The input trim can be ramped up or down automatically by holding the IncreaseLevel/DecreaseLevel signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each of the 24 available Trim DSP blocks you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for each Trim block enabled in SONICUE to have a corresponding DSP Input Control, and gaps can be left between blocks that do not require Crestron control. For example, if a project requires four Trim inputs (1 -> 4) but only inputs 2 and 4 require Crestron control, you can add two DSP Input Control modules to your SIMPL project, setting their 'Block ID' parameter to 2 and 4 respectively.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

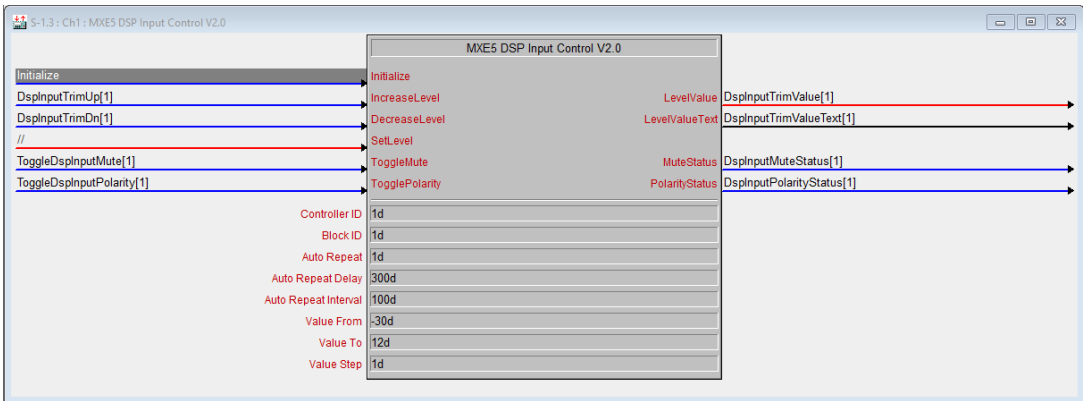
SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevel	D	<p>Increments the Trim input level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 'Value Step' every 100 ms until the maximum level of +12 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevel	D	<p>Decrements the Trim input level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level down by 'Value Step' every 100 ms until the minimum level of -30 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>

Signal name	Type	Description
SetLevel	A	Sets the Trim input level to the value at the signal input. If the value is less than, or greater than, the allowed range (-30 -> 12) it will be set to the minimum or maximum accordingly.
ToggleMute	D	Toggles the Trim blocks mute on or off each time the signal input is pulsed high.
TogglePolarity	D	Toggles the Trim blocks polarity (phase invert) between normal and inverted each time the signal input is pulsed high.

### Feedback (Output) signals:

Signal name	Type	Description
LevelValue	A*	The value at the output indicates the current setting for the Trim level returned from the MXE5.
LevelValueText	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the Trim level setting on a user interface in a more user-friendly style.
MuteStatus	D	Latches high to indicate that the Trim block is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMute' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.
PolarityStatus	D	Latches high to indicate that polarity is inverted. Latches low to indicate that it is normal.  This signal output will change state when either the 'TogglePolarity' signal input pulses high, or the connected MXE5 notifies the module that the polarity state has been changed by another source.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

### Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are

Parameter name	Type	Description
		<p>being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.</p> <p>The allowed range is between 1 and 1024, and the default value is 1.</p>
Block ID	Dec	<p>The Trim DSP block number this module refers to. That is, the Trim block in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the Trim level.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The Trim level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -30 to 12. The default value is -30.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -30 to 12. The default value is 12.</p>
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 42. The default value is 1.</p>

## 9. MXE5 DSP Output Control - Module Reference

This module controls an output ‘Level’ DSP block on an MXE5, providing access to the level, mute, and phase reverse properties. The output level can be ramped up or down automatically by holding the IncreaseLevel/DecreaseLevel signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each of the 24 available output Level DSP blocks you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for each Level block enabled in SONICUE to have a corresponding DSP Output Control, and gaps can be left between blocks that do not require Crestron control. For example, if a project requires four outputs (1 -> 4) but only outputs 2 and 4 require Crestron control, you can add two DSP Output Control modules to your SIMPL project, setting their ‘Block ID’ parameter to 2 and 4 respectively.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using ‘Make Symbol Complete’ (Ctrl + I) in SIMPL Windows to avoid compiler errors.

SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

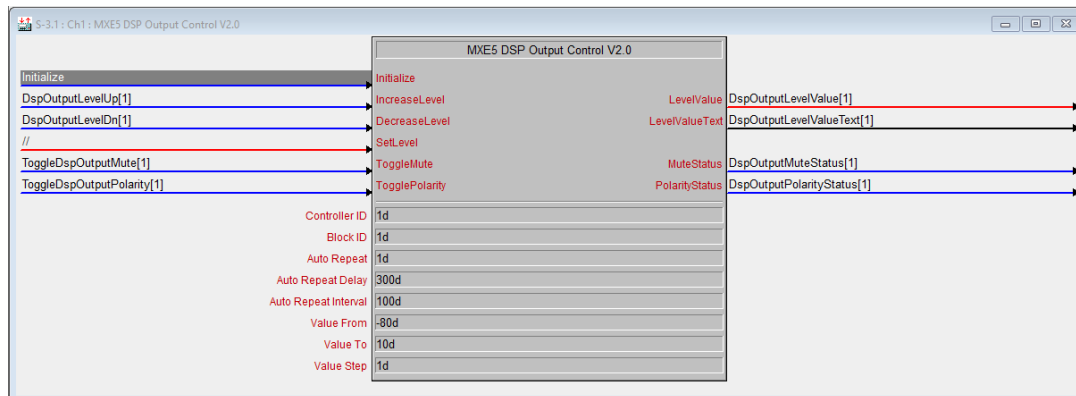
### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)



**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



### Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>must</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevel	D	<p>Increments the DSP output level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 'Value Step' every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevel	D	<p>Decrements the DSP output level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level down by 'Value Step' every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
SetLevel	A	<p>Sets the DSP output level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -&gt; 10) it will be set to the minimum or maximum accordingly.</p>

Signal name	Type	Description
ToggleMute	D	Toggles the Level blocks mute on or off each time the signal input is pulsed high.
TogglePolarity	D	Toggles the Level blocks polarity (phase invert) between normal and inverted each time the signal input is pulsed high.

#### Feedback (Output) signals:

Signal name	Type	Description
LevelValue	A*	The value at the output indicates the current setting for the Level blocks volume level returned from the MXE5.
LevelValueText	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the Level blocks volume level setting on a user interface in a more user-friendly style.
MuteStatus	D	Latches high to indicate that the Level block is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMute' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.
PolarityStatus	D	Latches high to indicate that polarity is inverted. Latches low to indicate that it is normal.  This signal output will change state when either the 'TogglePolarity' signal input pulses high, or the connected MXE5 notifies the module that the polarity state has been changed by another source.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

#### Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.

Parameter name	Type	Description
		The allowed range is between 1 and 1024, and the default value is 1.
Block ID	Dec	<p>The Level DSP block number this module refers to. That is, the Level block in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the DSP output level.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The DSP output level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -80 to 10. The default value is -80.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -80 to 10. The default value is 10.</p>
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 90. The default value is 1.</p>

## 10. MXE5 Zone Mixer Input Control - Module Reference

This module controls a single input channel of the 'Zone Mixer' DSP block on an MXE5, providing access to the input level, mute, and pan/balance properties. The input level can be ramped up or down automatically by holding the IncreaseLevel/DecreaseLevel signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. An interlock parameter allows you to group several inputs to make their channel mute controls behave like a source selection, where only one channel can be selected (live) at a time. All other members of the interlock group will get muted whenever a new input is selected. A separate instance of the module should be added to your SIMPL program for each of the 26 available input channels available on each zone you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for every input channel for a zone enabled in SONICUE to have a corresponding Zone Mixer Input Control, and gaps can be left between inputs that do not require Crestron control. For example, if a project requires 10 mixer channels (1 -> 10) but only inputs 2 and 4 require Crestron control, you can add two Zone Mixer Input Control modules to your SIMPL project, setting their 'Input ID' parameter to 2 and 4 respectively.

The Zone ID parameter refers to the zone number the module relates to. In the above example, if the zone mixer had been configured with two zones, where each zone required Crestron control for input channels 2 and 4, you would add four Zone Mixer Input Control modules to your SIMPL program. The first two would have Zone ID = 1 (assuming you wanted to control the inputs for Zone 1 of course), while the second two would have Zone ID = 2.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

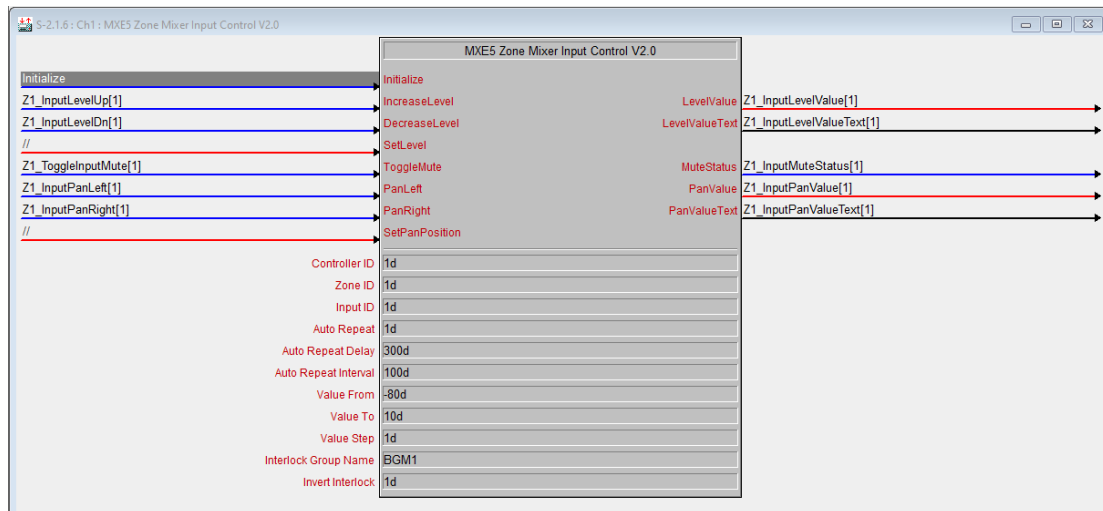
### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal

- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



### Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevel	D	<p>Increments the zone input channel level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 'Value Step' every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevel	D	<p>Decrements the zone input channel level by 'Value Step', on the rising edge each time the input is pulsed. If the input</p>

Signal name	Type	Description
		<p>remains high for greater than 300 ms it will continue to ramp the level down by 'Value Step' every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
SetLevel	A	Sets the zone input channel level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -> 10) it will be set to the minimum or maximum accordingly.
ToggleMute	D	Toggles the zone input channel mute on or off each time the signal input is pulsed high.
PanLeft	D	<p>Moves the zone input channel pan position left by 1, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp left by 1 every 100 ms until the maximum of 100 L is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any pan ramping will stop immediately.</p> <p>Note: the auto repeat parameters for the pan control are preset and cannot be changed. The auto repeat parameters on the module only affect the input level control.</p>
PanRight	D	<p>Moves the zone input channel pan position right by 1, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp right by 1 every 100 ms until the maximum of 100 R is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any pan ramping will stop immediately.</p> <p>Note: the auto repeat parameters for the pan control are preset and cannot be changed. The auto repeat parameters on the module only affect the input level control.</p>
SetPan	A	Sets the zone input channel pan position to the value at the signal input. If the value is less than, or greater than, the allowed range (-100 -> 100) it will be set to the minimum or maximum accordingly (negative values pan towards the left, positive values pan towards the right, 0 (zero) positions the pan in the centre.

## Feedback (Output) signals:

Signal name	Type	Description
LevelValue	A*	The value at the output indicates the current setting for the zone input channel volume level returned from the MXE5.
LevelValueText	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate zone input channels volume level setting on a user interface in a more user-friendly style.
MuteStatus	D	Latches high to indicate that the zone input channel is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMute' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.
PanValue	A*	The value at the output indicates the current setting for the zone input channel pan position returned from the MXE5.
PanValueText	S*	String representation of the PanValue. For example, if the value is '100', the text will be the formatted string '100 R'. If the pan is in the central position the text will be the formatted string 'C', while the value -38 would produce the formatted string '38 L'.  This output can be used to indicate the zone input channels pan position setting on a user interface in a more user-friendly style.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

## Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.  The allowed range is between 1 and 1024, and the default value is 1.

Parameter name	Type	Description
Zone ID	Dec	<p>The zone number on the Zone Mixer block this module refers to. That is, the zone number for the input channel in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>
Input ID	Dec	<p>The input channel number for the zone on the Zone Mixer block this module refers to. Remember to activate all the Zone Inputs you want to use on the Zone Mixer flyout (using the Routing tab) in SONICUE too.</p> <p>The allowed range is between 1 and 26, and the default value is 1.</p> <p>Input 25 is for the noise generator and input 26 is for the Sine generator.</p>
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the input channel level.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The input channel level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -80 to 10. The default value is -80.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -80 to 10. The default value is 10.</p>
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 90. The default value is 1.</p>
Interlock Group Name	S	Arbitrary text string used to create an interlock group.



Parameter name	Type	Description
		<p>The interlock is a very similar concept to the SIMPL Interlock symbol where activating one member of the group will deactivate all other members. The interlock function for this module operates on the channel mute property and provides a convenient way to repurpose the mute as a source selection. For example, if you had 4 background music sources available to a zone it is likely you would only want one of them to be active at any one time. Selecting a new background music source should also turn off the previous selection. By entering the same Interlock Group Name into each Zone Mixer Input Control module in your group, the mute controls will operate in this way.</p> <p>You can create as many interlock groups as you want but each module can only be a member of one group. Also, keep in mind, if you want to create interlock groups for several zones you should create different groups for each zone. If you name them all using the same name they will function as one large group, which is most likely not what you would want.</p> <p>The interlock groups are common to this particular control system only. This means you could still enable/disable grouped channels in SONICUE, or some other control system, leading to undesirable results where more than one channel could be unmuted. If your system has multiple control points, from Crestron and Dynacord TPC-1 touch panels say, you should program similar interlocks on the other control system too.</p> <p>See the MXE5 demo projects for examples of how to implement these interlocks in your own programs.</p>
Invert Interlock	Dec	<p>Specifies whether the mute controls in the group should be inverted. It usually makes sense that you would want to invert them for source selection. When a channel is muted the modules MuteStatus output is high, this would mean the channel is off in a source selection group. Inverting the interlock would make the MuteStatus high when the channel is on (i.e. when the channel is unmuted). This will make feedback signals to UI source selection controls much more intuitive when programming the control system.</p> <p>Enter 0 to not invert the interlock (for a set of mute controls in a group only one can be muted at a time), or 1 to invert the interlock (for the same set of mute controls only one can be unmuted at a time). The default value is 1.</p> <p>Note: All members of an interlock group should set this parameter to the same value, otherwise unpredictable states may occur.</p>

## 11. MXE5 Zone Mixer Stereo Bus Control - Module Reference

There are two versions of this module, one for a stereo bus and one for a mono bus. They both provide the same control features but the mono bus module would only control the left channel if it was inadvertently used for a stereo bus.

The module controls a single stereo zone output bus of the 'Zone Mixer' DSP block on an MXE5, providing access to the left and right bus levels, and the left and right bus mutes. The bus levels can be ramped up or down automatically by holding the IncreaseLevel/DecreaseLevel signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each of the eight output buses available on a zone that you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for every bus of a zone enabled in SONICUE to have a corresponding Zone Mixer (Mono or Stereo) Bus Control, and gaps can be left between buses that do not require Crestron control. For example, if a project requires 4 buses (1 -> 4) but only buses 2 and 4 require Crestron control, you can add two Zone Mixer Bus Control modules to your SIMPL project, setting their 'Bus ID' parameter to 2 and 4 respectively.

The Zone ID parameter refers to the zone number the module relates to. In the above example, if the zone mixer had been configured with two zones, where each zone required Crestron control for buses 2 and 4, you would add four Zone Mixer (Mono or Stereo) Bus Control modules to your SIMPL program. The first two would have Zone ID = 1 (assuming you wanted to control the buses for Zone 1 of course), while the second two would have Zone ID = 2.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

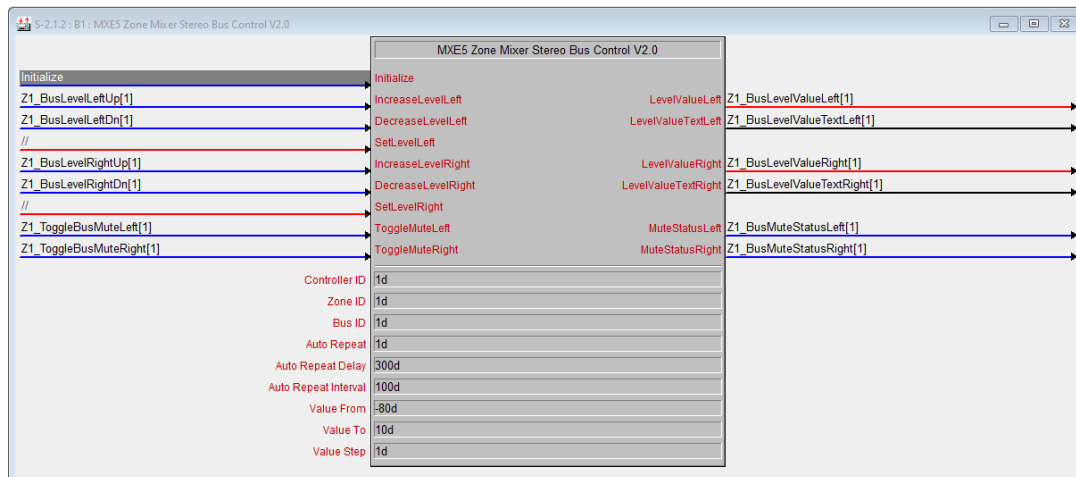
SONICUE V1.3 introduced a new mode for DSP configuration -> Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



### Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevelLeft	D	<p>Increments the zone bus left channel level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 'Value Step' every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevelLeft	D	<p>Decrements the zone bus left channel level by 'Value Step', on the rising edge each time the input is pulsed. If the input</p>

Signal name	Type	Description
		<p>remains high for greater than 300 ms it will continue to ramp the level down by 'Value Step' every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
SetLevelLeft	A	Sets the zone bus left channel level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -> 10) it will be set to the minimum or maximum accordingly.
IncreaseLevelRight	D	<p>Increments the zone bus right channel level by 1 dB, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 1 dB every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevelRight	D	<p>Decrements the zone bus right channel level by 1 dB, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level down by 1 dB every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
SetLevelRight	A	Sets the zone bus right channel level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -> 10) it will be set to the minimum or maximum accordingly.
ToggleMuteLeft	D	Toggles the zone bus left channel mute on or off each time the signal input is pulsed high.
ToggleMuteRight	D	Toggles the zone bus right channel mute on or off each time the signal input is pulsed high.

## Feedback (Output) signals:

Signal name	Type	Description
LevelValueLeft	A*	The value at the output indicates the current setting for the zone bus left channel level returned from the MXE5.
LevelValueTextLeft	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the zone bus volume level setting on a user interface in a more user-friendly style.
LevelValueRight	A*	The value at the output indicates the current setting for the zone bus right channel level returned from the MXE5.
LevelValueTextRight	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the zone bus volume level setting on a user interface in a more user-friendly style.
MuteStatusLeft	D	Latches high to indicate that the zone bus left channel is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMuteLeft' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.
MuteStatusRight	D	Latches high to indicate that the zone bus right channel is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMuteRight' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

## Parameters:

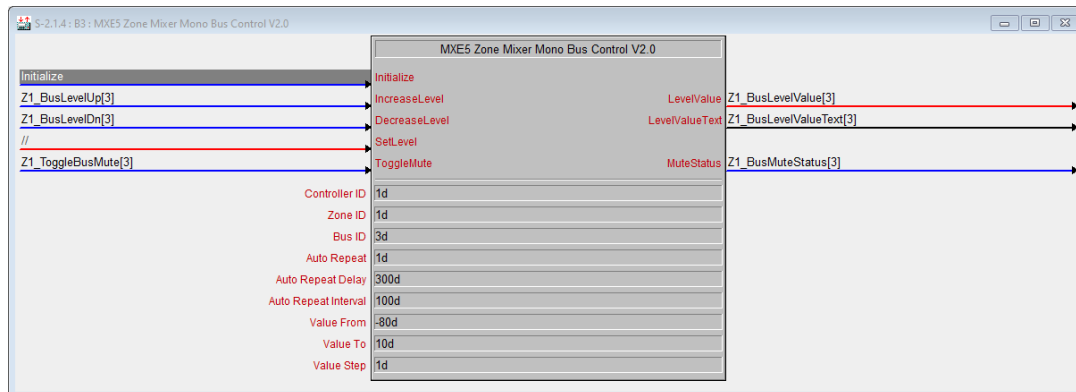
Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.

Parameter name	Type	Description
		The allowed range is between 1 and 1024, and the default value is 1.
Zone ID	Dec	<p>The zone number on the Zone Mixer block this module refers to. That is, the zone number for the bus in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>
Bus ID	Dec	<p>The bus number for the zone on the Zone Mixer block this module refers to. Remember to activate all the Zone Outputs you want to use on the Zone Mixer flyout (using the Routing tab) in SONICUE too.</p> <p>The allowed range is between 1 and 8, and the default value is 1.</p>
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the bus level. Applies to both the left and right channels.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin. Applies to both the left and right channels.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The bus level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses. Applies to both the left and right channels.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to. Applies to both the left and right channels.</p> <p>The allowed range is -80 to 10. The default value is -80.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to. Applies to both the left and right channels.</p> <p>The allowed range is -80 to 10. The default value is 10.</p>

Parameter name	Type	Description
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval. Applies to both the left and right channels.</p> <p>The allowed range is 1 to 90. The default value is 1.</p>

## 12. MXE5 Zone Mixer Mono Bus Control - Module Reference

This module controls a single mono zone output bus of the ‘Zone Mixer’ DSP block on an MXE5, providing access to the bus level and bus mute. Other features are identical to the Stereo Bus Control.



Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>must</i> initialize first, it is highly recommended that this input is driven from the ‘IsInitialized’ output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevel	D	<p>Increments the zone bus level by ‘Value Step’, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by ‘Value Step’ every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevel	D	<p>Decrements the zone level by ‘Value Step’, on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level down by ‘Value Step’ every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p>



Signal name	Type	Description
		When the signal input goes low any level ramping will stop immediately.
SetLevel	A	Sets the zone bus level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -> 10) it will be set to the minimum or maximum accordingly.
ToggleMute	D	Toggles the zone bus mute on or off each time the signal input is pulsed high.

#### Feedback (Output) signals:

Signal name	Type	Description
LevelValue	A*	The value at the output indicates the current setting for the zone bus level returned from the MXE5.
LevelValueText	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the zone bus volume level setting on a user interface in a more user-friendly style.
MuteStatus	D	Latches high to indicate that the zone bus is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMute' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

#### Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.  The allowed range is between 1 and 1024, and the default value is 1.

Parameter name	Type	Description
Zone ID	Dec	<p>The zone number on the Zone Mixer block this module refers to. That is, the zone number for bus in SONICUE that this module will control.</p> <p>The allowed range is between 1 and 24, and the default value is 1.</p>
Bus ID	Dec	<p>The bus number for the zone on the Zone Mixer block this module refers to. Remember to activate all the Zone Outputs you want to use on the Zone Mixer flyout (using the Routing tab) in SONICUE too.</p> <p>The allowed range is between 1 and 8, and the default value is 1.</p>
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the bus level.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The bus level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -80 to 10. The default value is -80.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -80 to 10. The default value is 10.</p>
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 90. The default value is 1.</p>

## 13. MXE5 Zone Mixer Master Control - Module Reference

This module controls the master output of the 'Zone Mixer' DSP block on an MXE5, providing access to overall output level and mute. The output level can be ramped up or down automatically by holding the IncreaseLevel/ DecreaseLevel signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each zone that you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too.

**Tip:** There is no requirement for every zone enabled in SONICUE to have a corresponding Zone Mixer Master Control.

There is also no requirement for every available signal input or output to be used (only the signals you need for a specific program need be assigned), but any unused signals should be commented out using 'Make Symbol Complete' (Ctrl + I) in SIMPL Windows to avoid compiler errors.

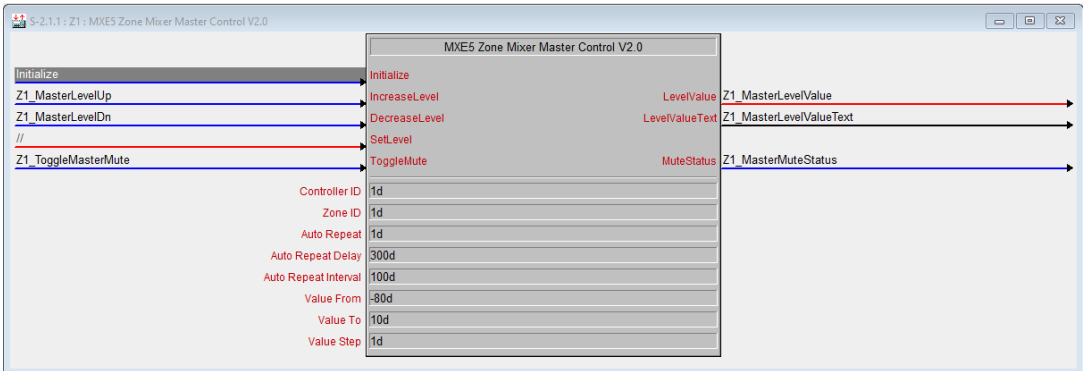
SONICUE V1.3 introduced a new mode for DSP configuration → Flexible, allowing the system programmer to layout and connect their DSP blocks however they wish. Fixed DSP configuration is still available for both new and legacy SONICUE projects. **This module will only work for Fixed DSP configurations.** Refer to the reference guides for MXE5 Virtual Analog Control and MXE5 Virtual Logic Control for the possibilities to control flexible DSP configurations with Crestron control systems.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



Control (Input) signals:		
Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseLevel	D	<p>Increments the zone master level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level up by 'Value Step' every 100 ms until the maximum level of +10 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>
DecreaseLevel	D	<p>Decrements the zone master level by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the level down by 'Value Step' every 100 ms until the minimum level of -80 dB is reached, after which, any further activation of the input will have no effect.</p> <p>When the signal input goes low any level ramping will stop immediately.</p>

Signal name	Type	Description
SetLevel	A	Sets the zone master level to the value at the signal input. If the value is less than, or greater than, the allowed range (-80 -> 10) it will be set to the minimum or maximum accordingly.
ToggleMute	D	Toggles the zone master mute on or off each time the signal input is pulsed high.

#### Feedback (Output) signals:

Signal name	Type	Description
LevelValue	A*	The value at the output indicates the current setting for the zone master level returned from the MXE5.
LevelValueText	S*	String representation of the LevelValue. For example, if the value is '6', the text will be the formatted string '6 dB'.  This output can be used to indicate the zone master level setting on a user interface in a more user-friendly style.
MuteStatus	D	Latches high to indicate that the zone master is muted. Latches low to indicate that it is unmuted.  This output will change state when either the 'ToggleMute' signal input pulses high, or the connected MXE5 notifies the module that the mute state has been changed by another source.

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

#### Parameters:

Parameter name	Type	Description
Controller ID	Dec	Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.  The allowed range is between 1 and 1024, and the default value is 1.
Zone ID	Dec	The zone number on the Zone Mixer block this module refers to. That is, the zone number in SONICUE that this module will control.

Parameter name	Type	Description
		The allowed range is between 1 and 24, and the default value is 1.
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseLevel and DecreaseLevel inputs high will automatically repeat incrementing or decrementing the master level.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The bus level will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -80 to 10. The default value is -80.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -80 to 10. The default value is 10.</p>
Value Step	Dec	<p>Specifies the amount (in dB) by which the level will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 90. The default value is 1.</p>

## 14. MXE5 Virtual Analog Control - Module Reference

Virtual Analog blocks on an MXE5 allow you to store a numerical value to a memory location on the device that can then be linked to a control through Logic programming, or, with the release of SONICUE V1.3, the new Task Engine. The MXE5 supports 100 virtual analog blocks.

The Virtual Analog Control module allows you to read and write values to these Virtual Analog blocks from your Crestron control system. After linking the block to a control of your choice in the Task Engine, you have the flexibility to control pretty much any property with a variable value from your control system. For example, you could control an EQ frequency or a compressor threshold. This is something that would not be possible using the general MXE5 control modules as they only target specific controls related to that module.

SONICUE V1.3 also introduced flexible DSP configurations allowing the system programmer to layout and connect their DSP blocks however they wish. As there is no way for the Crestron control system to know how the programmer has configured the MXE5, control of flexible DSP configurations *must* be done using Virtual Analog and Virtual Logic blocks instead.

**This module will work with both Fixed DSP configurations and Flexible DSP configurations.**

As the saying goes, a picture paints a thousand words, so it is highly recommended that you refer to the FlexConfig demo projects to learn how to set up Virtual blocks on the MXE5 (see the SONICUE project) and how to interact with them from the Crestron control system (see the Crestron SIMPL program).

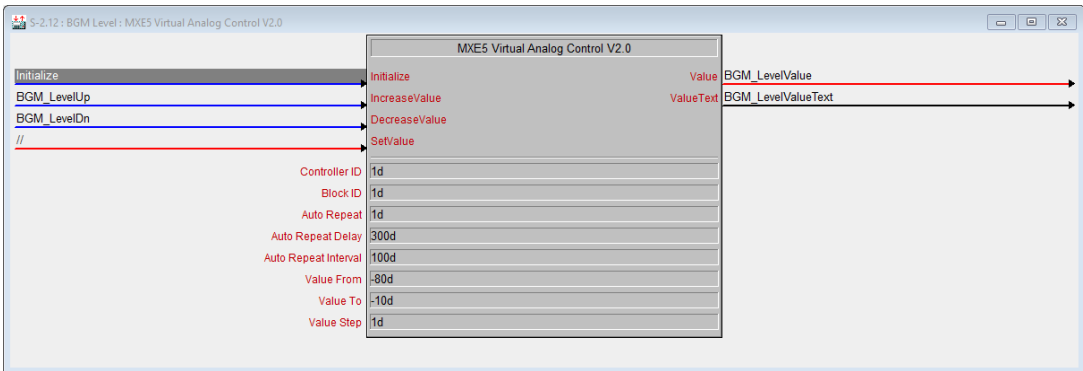
The 'Value' parameter of the Virtual Analog Control module can be ramped up or down automatically by holding the IncreaseValue/DecreaseValue signal input high. Ramping will stop when the minimum or maximum limit is reached, or the signal input goes low. Settings for the ramping repeat interval and min/max limits can be assigned by the programmer using the parameter options available on the module. A separate instance of the module should be added to your SIMPL program for each MXE5 Virtual Analog block that you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too. Each Virtual Analog block should also be linked to an actual control on the MXE5 through the Task Engine. This link is programmed in SONICUE.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



Control (Input) signals:		
Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
IncreaseValue	D	<p>Increments the virtual analog value by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the value up by 'Value Step' every 100 ms until the maximum value of 32767 is reached, after which, any further activation of the input will have no effect.</p> <p>This range can be restricted using the 'Value To' parameter.</p> <p>When the signal input goes low any value ramping will stop immediately.</p>
DecreaseValue	D	<p>Decrements the virtual analog value by 'Value Step', on the rising edge each time the input is pulsed. If the input remains high for greater than 300 ms it will continue to ramp the value down by 'Value Step' every 100 ms until the minimum gain of -32768 dB is reached, after which, any further activation of the input will have no effect.</p> <p>This range can be restricted using the 'Value From' parameter.</p>



Signal name	Type	Description
		When the signal input goes low any value ramping will stop immediately.
SetValue	A	<p>Sets the virtual analog value to the value at the signal input. If the value is less than, or greater than, the allowed range (-32768 -&gt; 32767) it will be set to the minimum or maximum accordingly.</p> <p>This range should be restricted using the 'Value From' and 'Value To' parameters.</p>

#### Feedback (Output) signals:

Signal name	Type	Description
Value	A*	The value at the output indicates the current setting for the virtual analog value returned from the MXE5.
ValueText	S*	<p>String representation of the LevelValue.</p> <p>This output can be used to indicate the virtual analog value setting on a user interface in a more user-friendly style.</p>

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

#### Parameters:

Parameter name	Type	Description
Controller ID	Dec	<p>Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.</p> <p>The allowed range is between 1 and 1024, and the default value is 1.</p>
Block ID	Dec	<p>The Virtual Analog block this module refers to. That is, the Virtual Analog block number in the SONICUE Task Engine that this module will control.</p> <p>The allowed range is between 1 and 100, and the default value is 1.</p>

Parameter name	Type	Description
Auto Repeat	Dec	<p>Specifies whether holding the IncreaseValue and DecreaseValue inputs high will automatically repeat incrementing or decrementing the virtual analog value.</p> <p>0 to disable auto repeat (ramping), or 1 to enable. The default value is 1.</p>
Auto Repeat Delay	Dec	<p>The time, in milliseconds, to wait before automatic repeating will begin.</p> <p>The allowed range is 0 (start auto repeating immediately) to 10,000. The default value is 300.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Auto Repeat Interval	Dec	<p>The time, in milliseconds, to wait between repeats. The virtual analog value will be ramped by the amount of the 'Value Step' parameter each time the repeat interval elapses.</p> <p>The allowed range is 0 (don't repeat) to 10,000. The default value is 100.</p> <p>This parameter has no effect if Auto Repeat is disabled.</p>
Value From	Dec	<p>Specifies the minimum value repeating will ramp down to.</p> <p>The allowed range is -32768 to 32767. The default value is -80.</p> <p>As good programming practice, this value should be set so that it is within the range of the control it is linked to.</p>
Value To	Dec	<p>Specifies the maximum value repeating will ramp up to.</p> <p>The allowed range is -32768 to 32767. The default value is 10.</p> <p>As good programming practice, this value should be set so that it is within the range of the control it is linked to.</p>
Value Step	Dec	<p>Specifies the amount by which the virtual analog value will be ramped on each repeat interval.</p> <p>The allowed range is 1 to 65535. The default value is 1.</p> <p>As good programming practice, this value should be set so that it is within the range of the control it is linked to.</p>

## 15. MXE5 Virtual Logic Control - Module Reference

Virtual Logic blocks on an MXE5 allow you to store a Boolean (true/false, or on/off) value to a memory location on the device that can then be linked to a control through Logic programming, or, with the release of SONICUE V1.3, the new Task Engine. The MXE5 supports 100 virtual logic blocks.

The Virtual Logic Control module allows you to toggle the state of Virtual Logic blocks from your Crestron control system. After linking the Virtual Logic block to a control of your choice in the Task Engine, you have the flexibility to control pretty much any parameter with an on/off style value from your control system. For example, you could control an EQ bypass or a matrix mixer crosspoint. This is something that would not be possible using the general MXE5 control modules as they only target specific controls related to that module.

SONICUE V1.3 also introduced flexible DSP configurations allowing the system programmer to layout and connect their DSP blocks however they wish. As there is no way for the Crestron control system to know how the programmer has configured the MXE5, control of flexible DSP configurations must be done using Virtual Analog and Virtual Logic blocks instead.

**This module will work with both Fixed DSP configurations and Flexible DSP configurations.**

As the saying goes, a picture paints a thousand words, so it is highly recommended that you refer to the FlexConfig demo projects to learn how to set up Virtual blocks on the MXE5 (see the SONICUE project) and how to interact with them from the Crestron control system (see the Crestron SIMPL program).

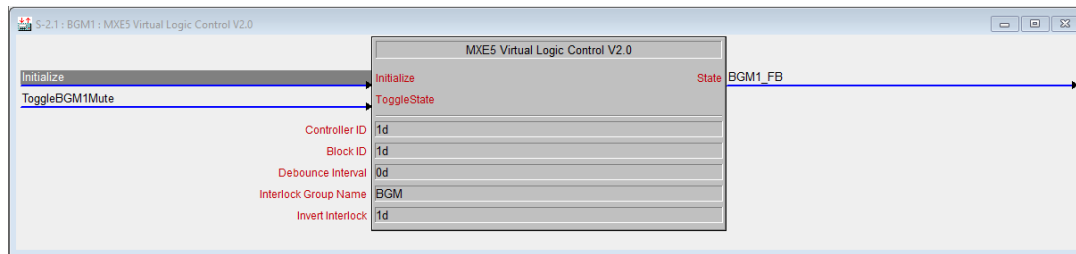
An interlock parameter allows you to group several related inputs to make their on/off controls behave like a source selection, where only one source can be selected (on) at a time. All other members of the interlock group will get turned off whenever a new source is selected. A separate instance of the module should be added to your SIMPL program for each MXE5 Virtual Logic block that you want to control. The module(s) must be paired with an MXE5 Mix Engine module, so a program must also include at least one instance of the Mix Engine module too. Each Virtual Logic block should also be linked to an actual control on the MXE5 through the Task Engine. This link is programmed in SONICUE.

### Module Signal I/O and Properties

The module exposes numerous signals for control and feedback, and several parameters to configure it. These are discussed in detail in the following sections. Signal types use the following abbreviations;

- D – Digital signal
- A – Analog signal
- S – Serial (string) signal
- Dec – Numerical value (to be entered for a parameter)

**Note:** Most Control (Input) signals will only become operational once you are connected to the MXE5. Activating them without a valid connection will only provide a visual effect. Some feedback signals will also only be updated while the control system is connected to the MXE5.



### Control (Input) signals:

Signal name	Type	Description
Initialize	D	<p>Initializes the module, and registers it with its MXE5 Mix Engine parent module when the input goes high.</p> <p>As the Mix Engine parent module <i>*must*</i> initialize first, it is highly recommended that this input is driven from the 'IsInitialized' output of the corresponding MXE5 Mix Engine parent module. This module and its parent are paired by setting the same Controller ID value to both.</p>
ToggleState	D	Toggles the virtual logic state on or off each time the signal input is pulsed high.

### Feedback (Output) signals:

Signal name	Type	Description
State	D	<p>Latches high to indicate that the virtual logic state is on. Latches low to indicate that it is off.</p> <p>This output will change state when either the 'ToggleState' signal input pulses high, or the connected MXE5 notifies the module that the virtual logic state has been changed by another source.</p>

\* Data for this signal is sent from the MXE5 itself and will only be updated while connected to the device.

## Parameters:

Parameter name	Type	Description
Controller ID	Dec	<p>Arbitrary value used to pair this module with an MXE5 Mix Engine parent module. It is used when multiple MXE5's are being controlled by the same Crestron control processor. All control modules that need to communicate with a particular MXE5 should have the same Controller ID value as the required Mix Engine parent module.</p> <p>The allowed range is between 1 and 1024, and the default value is 1.</p>
Block ID	Dec	<p>The Virtual Logic block this module refers to. That is, the Virtual Logic block in the SONICUE Task Engine that this module will control.</p> <p>The allowed range is between 1 and 100, and the default value is 1.</p>
Debounce Interval	Dec	<p>Specifies the time, in milliseconds, to wait, once the state has been toggled, before it can be toggled again. It can be used to prevent a user from rapidly pressing a button on a UI causing the control to be toggled too frequently.</p> <p>The allowed range is between 0 and 10,000, and the default value is 0 (= debounce disabled).</p>
Interlock Group Name	S	<p>Arbitrary text string used to create an interlock group.</p> <p>The interlock is a very similar concept to the SIMPL Interlock symbol, where activating one member of the group will deactivate all other members. The interlock function for this module operates on the state property and provides a convenient way to repurpose on/off style controls as a source selection. For example, if you had 4 background music sources available it is likely you would only want one of them to be activate at any one time. Selecting a new background music source should also turn off the previous selection. By entering the same Interlock Group Name into each Virtual Logic Control module in your group, the on/off controls will operate in this way.</p> <p>You can create as many interlock groups as you want but each module can only be a member of one group.</p> <p>The interlock groups are common to this particular control system only. This means you could still enable/disable grouped logic blocks in SONICUE, or some other control system, leading to undesirable results. If your entire system has multiple control points, from Crestron and Dynacord TPC-1 touch panels say, you should program similar interlocks on the other control system too.</p>

Parameter name	Type	Description
		See the MXE5 FlexConfig demo projects for examples of how to implement these interlocks in your own programs.
Invert Interlock	Dec	<p>Specifies whether the State parameters in the group should be inverted.</p> <p>Enter 0 to not invert the interlock or 1 to invert it. The default value is 1.</p> <p>Note: All members of an interlock group should set this parameter to the same value, otherwise unpredictable states may occur.</p>

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