How to Integrate External Control Inputs on Symetrix DSP Hardware

This tech tip will explain how to properly integrate the External Control Inputs of Symetrix DSP units (Radius/Edge, xControl, Jupiter, 761). Both the physical hardware connections and programming setup will be covered.

Each External Control Input, also known as an Analog Control Input or GPIO, can be configured in one of two modes: as a dual switch closure or a potentiometer.

Dual Switch Closure mode is most commonly used with PTT/PTM (Push To Talk/Push To Mute) buttons on microphones, for an Emergency System/fire alarm relay connection that will mute or override the audio system, and for Room Combining that use switches on moveable wall partitions.

The potentiometer mode is typically used to create an inexpensive, volume control for an input, source, zone, or output.

Jupiter, Zone Mix 761

Note: The Jupiter or the Zone Mix 761 supports a combination of up to 2 potentiometers or 4 switch closures.

Using standard shielded twisted pair terminated with a terminal block on one end, External Control Inputs may be freely assigned to parameters in the Symetrix DSP hardware. The operational mode (switch closure vs. potentiometer) must first be configured while on-line or off-line using the Configure External Control Inputs dialog.

While on-line with the DSP using the Symetrix software, a potentiometer can be calibrated for maximum travel or scaled as described later in this document.

Radius/Edge, xControl

Note: Edge, Radius, or Radius AEC supports a combination of up to 4 potentiometers or 8 switch closures. xControl supports a combination of up to 8 potentiometers or 16 contact closures.
Configuring External Control Inputs in a Jupiter or Zone Mix 761: Example 1: Switch Closure

This example will step through the setup of an Emergency System fire alarm mute in the Zone Mix 761 where the fire alarm relay connects to External Control Input 1A. The process is virtually identical for the Jupiter software/hardware.

First, make the physical connections using the above picture as a guide.

Then, once the Zone Mix 761 software is online with the hardware, launch the External Controller Wizard. It should be noted that configuring the External Control Inputs on a Jupiter or Zone Mix 761 is straightforward since the External Controller Wizard simplifies the process.

Choose Add New External Controller, select Switch or Control Voltage and then click Next.

Now give the switch a descriptive name based on where in the venue it is located or based on what function it will provide. For example, the name could be as simple as “Switch” or as descriptive as “Fire Alarm relay”. Select the “Emergency” option for the Switch Function and click Next.
On the next page choose the desired function that will trigger based on the state of the input connection provided by the emergency fire alarm system. The two options are: Mute All Outputs or Route Input 3 to Specified Outputs at a Pre-Determined Volume Level. Select the appropriate function and click Next.

For an Emergency Fire Alarm Mute select the “Mute All Outputs” option and click Next.
On the next page, remember to select the correct physical External Control Input that the emergency system relay will connect to. This example uses Switch Closure 1A.

Once the correct input is selected, click Next.

Now, select the emergency route logic based upon how the Emergency relay functions. For reference, the software presents a few practical examples: Normally Open/Active Low and Normally Closed/Active High. Click Finish to close the External Controller Wizard or Next to return to the first page and setup another ARC remote.

Example 2: Potentiometer

This example will step through the setup of a potentiometer in the Zone Mix 761 where the RC-3 connects to the External Control Input 1. The process is virtually identical for the Jupiter software/hardware.

Once connected, you can launch the External Controller Wizard and add it to your configuration.

Choose Add New External Controller, select Potentiometer (RC-3) and then click Next.
The RC-3 can control any of the twelve input volumes, the two program volumes per zone, the six zone volumes, the six output volumes, or sets of linked volumes. The particular gain stage the RC-3 will control is selected with the Parameter drop-down menu.

It may be a good idea to give the RC-3 a descriptive name based on where in the venue it is located or based on what function it will provide, especially if both External Control Inputs have a potentiometer or RC-3 connected.

Click Next when done.
On the calibrate page, the range of the controller fader can be restricted or scaled by typing the value in Upper and Lower Limits. When finished, click Next.

In this step, calibrate the potentiometer to the 761’s External Control Input to ensure the full travel of the pot is utilized. The Zone Mix 761 software must be on-line for the calibration function to work. Rotate the pot fully counterclockwise (CCW) and click the Set Minimum Position button. Now, rotate the pot fully clockwise (CW) and click the Set Maximum Position button.

Once completed, click Next and the software will return to the External Controller Wizard’s opening screen. Continue to add controllers or edit existing ones if needed.

If finished, click the Finish button to exit the External Controller Wizard.
After making the physical connections, while in Schematic Edit Mode, configure the External Control Inputs by right-clicking on the unit in Design View and select “Configure External Control Inputs...”:

Remember to select “Dual Switch Closure for the input the Fire Alarm relay connects to.

Now that the External Control Inputs are configured, here is one example of control logic programming for an emergency mute/unmute function in SymNet Composer 2.0 software.

*Note:* Alternative logic programming examples are located at the end of this section.

Double click the “1 Button Latched” module to open its user interface. Then assign the selected Analog Control Input to the “On” button by right-clicking directly on the “On” button and selecting “Set Up Remote Control.”
Click the drop down arrow under Remote control device and select “Remote Analog Input - ‘xControl’” to assign an External Control Input from the xControl. For assigning an External Control Input from an Edge or Radius choose the “Local Analog Input –“Radius12x8-9” or whatever “Remote Analog Input” is appropriate.

Click the drop down arrow under Select Analog Control and choose the switch input that matches the physical wiring on the External Control Input. This example uses Switch 1A. Select OK when finished.
Once the External Control Input is assigned to a fader or button an A1 “Highlighted Assigned Control Indicator” appears super imposed on the “On” button.

Note 1: Alt+M or Tools->Super Impose Assigned Controllers must be checked.

Note 2: If the system mute performance is inverted set the Off Level to 100% and On Level to 0.0%.

Double click the “2 Input Logic” module and select “OR”. When the button is triggered, it will set the output signal to True or False when the button is On or Off, respectively.

Double click the “Preset Trigger 1” module and assign Preset #999. SymNet Composer 2.0 automatically creates Preset#999 to mute the hardware without affecting the individual output mute states. This will mute all hardware when the latched button is triggered by the fire alarm relay.

Double click the “Preset Trigger 2” module and assign Preset #1000. SymNet Composer 2.0 automatically creates Preset#1000 to unmute the hardware without affecting the individual output mutes states. This will unmute all hardware when the fire alarm relay is reset.
Note: In the Preset Manager for SymNet Composer 2.0 Preset #999 and #1000 are pre-configured for the emergency mute/unmute function, equivalent to the F2 button in SymNet Composer. 

#999 = Mute All Hardware. #1000 = Unmute All Hardware.

Alternative Methods:

In this example an “Inverter” module is used in place of the “2 Input Logic” module and will perform the same function as the “False” output of the 2 Input Logic (11) module from the previous example.

Here, a Super Module from Tools->Super-Module Library Manager is used for the Emergency System Mute.

Once completed, Push the file to the SymNet system.
Example 2: Potentiometer
This example will step through the setup of a potentiometer in a SymNet system using SymNet Composer 2.0 software, where the RC-3 connects to the External Control Input 1 on an xControl. The process is identical for setup and assigning External Control Inputs on an Edge, Radius or Radius AEC.

Note: In potentiometer mode, A is the +V output and B is the voltage input.

After making the physical connection, configure the External Control Inputs by right-clicking on the unit in Design View and select “Configure External Control Inputs...”: 
To configure the input for use with a potentiometer, select the appropriate input tab, and then select the “Pot - Connect a variable voltage input (0-5V)” radio button. Select “OK” when finished.

### Pot Calibration:

**Note:** SymNet Composer must be connected to the DSP hardware with the input configured as a “Pot” in order to calibrate the input. The potentiometer must be physically wired to the External Control Input as well.

Calibrating the External Control Input determines the way the 0-5V potentiometer affects SymNet Composer parameters. There are two separate areas that can be altered:

1. Compensation for pots that don’t get all the way down to 0V or all the way up to 5V. This could happen because of characteristics of the pot itself, or resistance in the connection between the pot and the unit, especially with long wire runs. This is referred to as Calibrating Pot Range below.

2. Limiting the range of parameters controlled by an analog input. This is referred to as Calibrating Control Range or scaling the range.
This setting should match the control input of the pot being calibrated. If a pot is connected and the settings are correct, turning the pot should move the small indicator along the Current input position line. The value of the pot (0-255) is also updated to show the current level generated by the pot. Zero represents GND or 0V, 255 represents 5V, and the range is linear.

**Calibrating Pot Range:**
To compensate for a pot that does not cause its assigned fader in software to travel the entire range when the physical pot is turned to its lowest and highest position, make sure the pot is connected to one of the 8 External Control Inputs and the correct input tab is selected in the Config External Control Inputs Window of SymNet Composer 2.0. Turn the pot to its minimum value (usually all the way counterclockwise). Click the “Set Minimum Position” button. Next, turn the pot to its maximum value (usually all the way clockwise). Click the “Set Maximum Position” button.

Note: These settings can be used to compensate for a reverse-wired pot. To reset the calibration, click the Reset Min/Max Positions and they will be returned to their defaults.

**Calibrating Control Range:**
It may be desirable to limit the end user range of a potentiometer connected to an External Control Input and its effect on a gain stage. For example, if a pot is controlling a volume fader, it may be preferred to limit the fader range the end user can access from -30dB to 0dB rather than the full -72dB to +12dB range allowed in the software.

To limit the upper range of a control, enter a value less than 100% for the maximum level. To limit the lower range of a control, enter a value greater than 0% for the minimum level. When set to 100% and 0%, the control is allowed to travel the entire range shown in the SymNet Composer GUI. Other values reduce this range accordingly. Some experimentation may be required to find the percentage values that limit a range appropriate to the current application.

As an example, for a fader with ranges -72db to +12db, 84% is equal to 0dB.

**Important Notes:**
By setting the minimum value to a number larger than the maximum value, it is possible to reverse the operation of the pot or compensate for a reverse-wired pot. To reset the calibration, enter 100% for the maximum level and 0% for the minimum level.

If it is desired to reset all analog calibration data for a unit, use the Erase Memory command found under Hardware->Upgrade Firmware. Select only Analog Calibration Settings and hit ERASE.

All settings made using this dialog box are stored in the hardware, not in the site file. Changes made take effect immediately without the need to download the entire site.

**Assigning a Parameter:**
Right-click directly on the parameter and select “Set Up Remote Control.”
Click the drop down arrow under Remote control device and select “Remote Analog Input - 'xControl'” to assign an External Control Input from the xControl. For assigning an External Control Input from an Edge or Radius choose the “Local Analog Input –“Radius12x8-9” or whatever “Remote Analog Input” is appropriate.

Click the drop down arrow under Select Analog Control and choose the pot that matches the physical wiring on the External Control Input. Select OK when finished.
Once the External Control Input is assigned to a fader a P1 “Highlighted Assigned Control Indicator” appears super imposed on the GUI. Note: Alt+M or Tools->Super Impose Assigned Controllers must be checked.

Once completed, Push the file to the SymNet system.