



## APPLICATION NOTES

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GPIO

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All Powersoft rack-mountable installation amplifiers feature a GPIO section. The feature set differs from model to model, and so this document is divided by amplifier family initially (Sections 1 through 4), and then the families are grouped together with the Dynamic Music Distribution GPIO implementation (Section 5) and examples of common combinations of models are provided at the end (Section 6). Methods for implementing the most common applications are detailed in this document as both electrical wiring schematics and implementation examples. The implementation examples utilize DIN rail terminal blocks to aid with real-world implementation of the proposed electrical wiring schematic.

For those unfamiliar with DIN rail terminal blocks - they are available from many different manufacturers, in many different formfactors, and with many different feature sets. The examples provided in this document are based on the WAGO 2002-12 as this is an extremely common variety with a very basic feature set. They have a straight-through connection and two jumper-pin locations that are utilized to link two or more terminal blocks together.

For example, the Normally-Open Emergency Mute example for the Mezzo shown in Figure 1 would be implemented using one 5-pin jumper across 5 terminals as shown in the rendering in Figure 2.

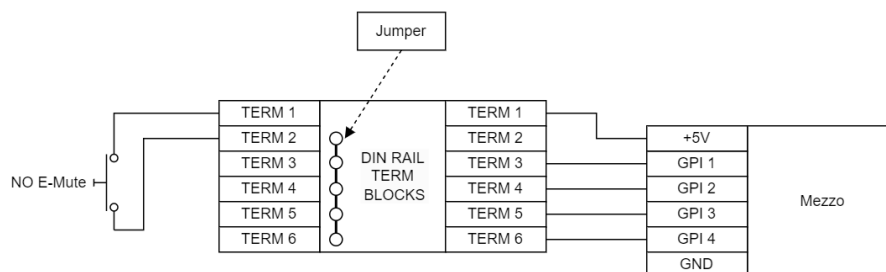


Figure 1 – Mezzo Normally-Open Emergency Mute

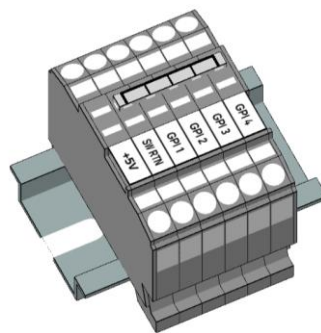


Figure 2 – Mezzo Normally-Open Emergency Mute DIN-Rail Block

Many other suppliers of DIN rail terminal blocks are available – please use the version most suitable for your project. Powersoft does not require the use of DIN-rail terminal blocks for implementation of GPIO functionality. The examples provided here are designed to help make your installation and planning process quicker and simpler.

It is also useful to note that a number of different methods for incorporating resistors into the signal path are demonstrated, including terminal blocks with built-in resistors such as the WAGO 2002-1211/1000-737.

# 1 PRIMA

## 1.1 Overview

The PRIMA GPIO provides the minimal GPIO required for fault monitoring and integration into control systems. A fault contact closure provides input to a control system for fault monitoring, and a remote On/Off connection allows the control system to power on or off the system.

### 1.1.1 Allowable Voltage Ranges

Prima GPI is designed for 0-12VDC only.

The contact closure is rated for up to 30VDC.

### 1.1.2 Status Contact Closure

The pins labelled with a switch icon connect to a contact closure that closes in the event of an amplifier or channel fault (including pilot tone monitoring faults). This is used to report amplifier status to a control system that does not implement the control and monitoring over the network.



Figure 3 – Prima contact closure connection

This is a normally closed connection. Under normal operation the relay is closed and will open upon a fault condition such as:

- No AC Mains
- Over temperature
- Amplifier in standby
- Loss of Pilot Tone
- Output monitoring fault
- Channel Faults

### 1.1.3 Remote On/Off (Standby)

Applying  $\geq 5\text{VDC}$  to the Remote Off pin will cause the amplifier to enter standby mode. Removing this Voltage will cause the amplifier to turn back on.

## 1.2 Generic Integration With Emergency-Mute Contact Closures

The integration of Prima with Emergency-Mute triggers is achieved using the Remote On/Off Connection. Please note that the resistor value is for demonstration only, the true value should be calculated based on the cable length and the input impedance of the GPI (15K $\Omega$ ).

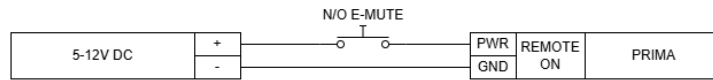


Figure 4 – PRIMA Normally Open E-Mute Circuit

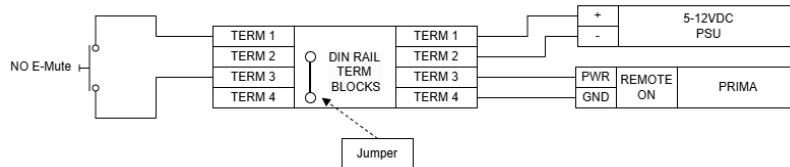


Figure 5 – PRIMA Normally Open E-Mute Implementation Example

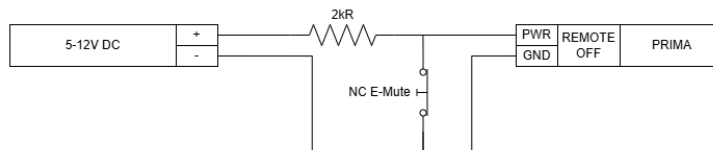


Figure 6 – PRIMA Normally Closed E-Mute Circuit

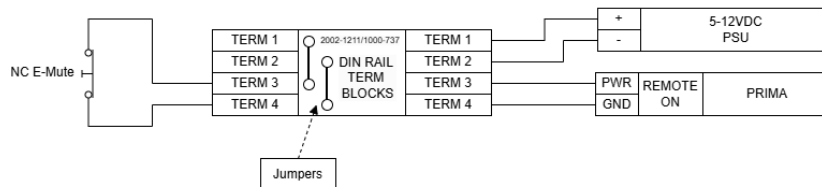


Figure 7 – PRIMA Normally Closed E-Mute Application Example V1

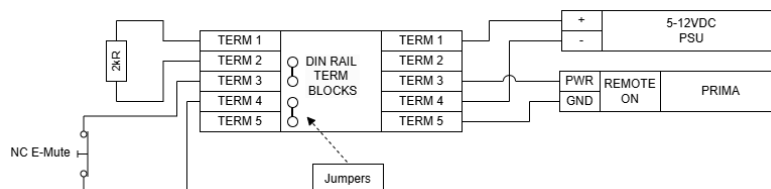


Figure 8 – PRIMA Normally Closed E-Mute Application Example V2

## 2 MEZZO



Figure 9 – Mezzo 602 AD GPIO Section

### 2.1 Overview

The Mezzo GPIO is split into two sections, the right-hand side features a symbol of a switch. This is a contact closure that closes in the event of an amplifier or channel fault (including pilot tone monitoring faults). The left-hand side features pins for GPI use. Ground and +5V surround the main GPI pins.

#### 2.1.1 Allowable Voltage Ranges

Mezzo GPI is designed for 0-5VDC only.

The contact closure is rated for up to 48V.

#### 2.1.2 Status Contact Closure

The pins labelled with a switch icon connect to a contact closure that closes in the event of an amplifier or channel fault (including pilot tone monitoring faults). This is used to report amplifier status to a control system that does not implement the control and monitoring over the network.



Figure 10 – Mezzo contact closure connection

This is a normally closed connection. Under normal operation the relay is closed and will open upon a fault condition such as:

- No AC Mains
- Over temperature
- Amplifier in standby
- Loss of Pilot Tone
- Output monitoring fault
- Channel Faults

## 2.1.3 VCA Control

In the most basic default state of the amplifier, the GPI pins operate as VCA controls for the channel output levels. For more flexible GPI features with a Mezzo please see Section 5 for details on GPI integration with a DMD system.

Figure 11 shows the basic circuit diagram of a potentiometer controlling the VCA of Channel A of a Mezzo. +5V on the input pin results in the channel fully off, 0V on the input pin is fully open.

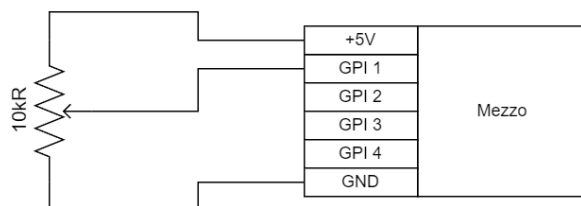


Figure 11 – Mezzo VCA Circuit

Figure 12 expands on this circuit diagram with an application example showing 3 potentiometers connected to a bank of terminal blocks utilizing jumpers to link the +5V and GND connections. Potentiometers 1 and 2 control the output levels of channels A and B respectively, but the third potentiometer controls the level of both channels C and D.

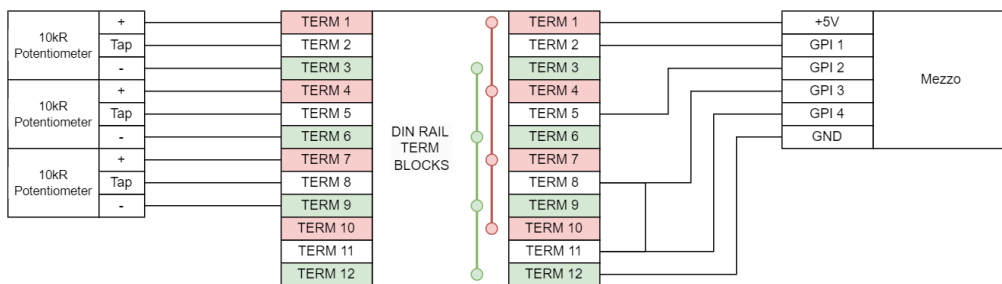


Figure 12 – Mezzo VCA Schematic Implementation Example

Figure 13 contains a rendering with the WAGO Configurator of the Mezzo VCA schematic shown in Figure 12.

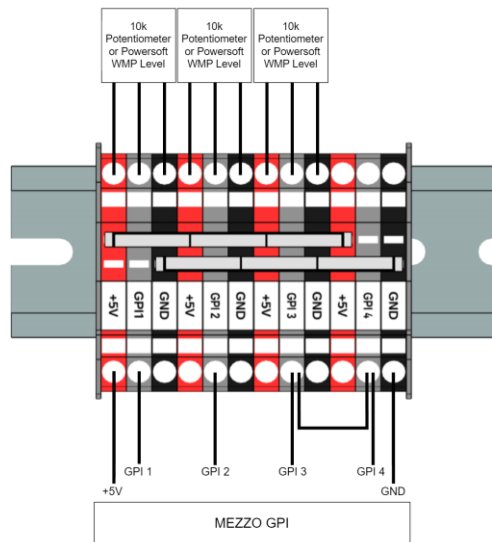


Figure 13 – Mezzo VCA Physical Implementation Example

## 2.2 Generic Integration With Emergency-Mute Contact Closures

The integration of Mezzo with Emergency-Mute triggers outside of a DMD system is achieved by utilizing the VCA channel level controls. By holding them to +5V the channel output level is set to negative infinity as shown in Figure 14.



Figure 14 – +5V applied to GPI1 has muted channel 1, nothing applied to GPI2 means that channel 2 gain is unaffected.

This can be achieved with Normally Open connections as shown in Figure 15 and implemented in an installation as detailed in Figure 16. A Normally Closed configuration can be supported using a separate pull-up resistor as shown in Figure 17, this can be neatly implemented as shown in Figure 18.

NOTE: Where multiple connections are required to a single pin on the amplifier it is recommended that the integrator should run these connections through terminal blocks and not attempt to make multiple connections in the phoenix connector on the back of the amplifier as this can be prone to faulty connections, loose strands, and is difficult to troubleshoot.

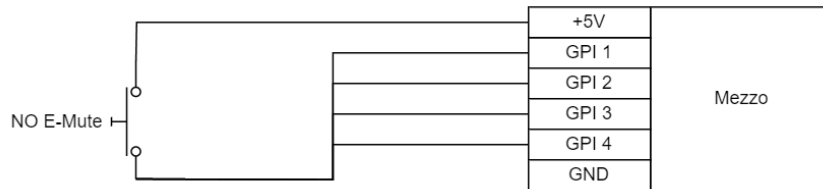


Figure 15 – Mezzo Normally Open E-Mute Circuit

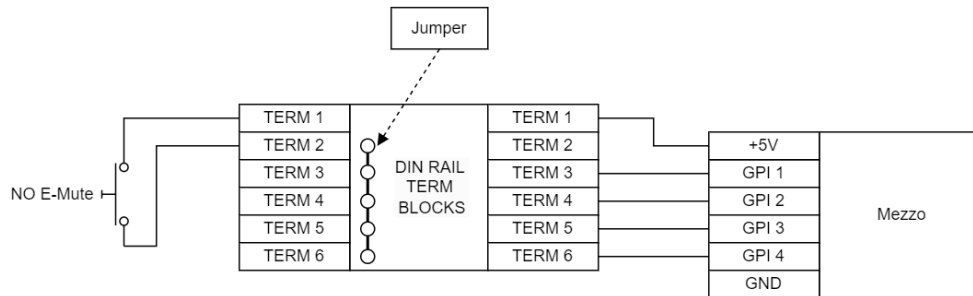


Figure 16 – Mezzo Normally Open E-Mute Implementation Example

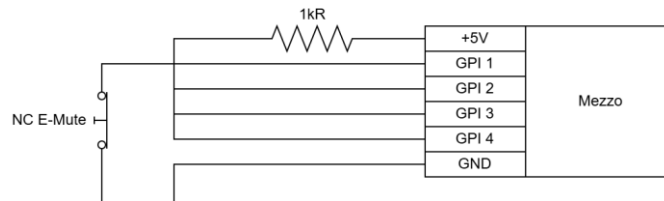


Figure 17 – Mezzo Normally Closed E-Mute Circuit

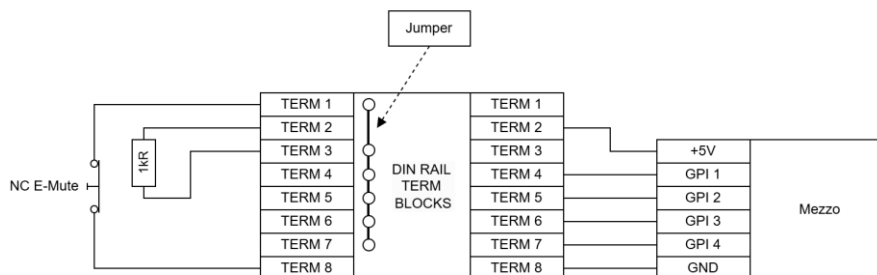


Figure 18 – Mezzo Normally Closed E-Mute Implementation Example

## 3 CANALI



Figure 19 – Canali GPIO Section

### 3.1 Overview

The Canali GPIO section features the most fixed-function connections in the amplifier range with dedicated VCA, Remote On/Off, and Alarm sections.

#### 3.1.1 Allowable Voltage Ranges

The Canali Level controls are designed to operate using the supply either side of them, not an external supply, this is 0-5VDC.

The remote on/off GPI is designed to operate within 0-24VDC.

The alarm contact closures are rated for up to 48V.

#### 3.1.2 Alarm

A pair of output relays per channel are available for alarm monitoring. Each channel has a normally closed and a normally open connection as shown in Figure 20. When the amplifier is under normal operation the NO contact is closed and the NC contact is open.

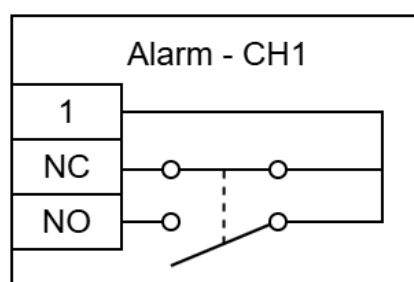


Figure 20 – Canali alarm output schematic (in an alarm state)

The alarm output is triggered by any potentially dangerous faults such as:

- No AC Mains
- Over temperature
- Amplifier is in standby
- Loss of Pilot Tone

- Output monitoring fault
- Channel Faults

### 3.1.3 VCA Control

The left-hand side features four potentiometer level connections, they provide VCA control of the output level of each channel. A dip-switch is available to enable input 1 to control all four channels. This is especially useful in emergency-mute application as detailed in section 3.2. In the application example shown in Figure 22, the first two potentiometers control channels 1 and 2 respectively, but the third potentiometer is linked to both channel 3 and channel 4 and so will control the output level of both channels.

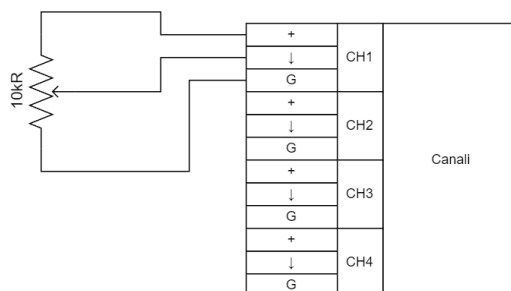


Figure 21 – Canali VCA Circuit

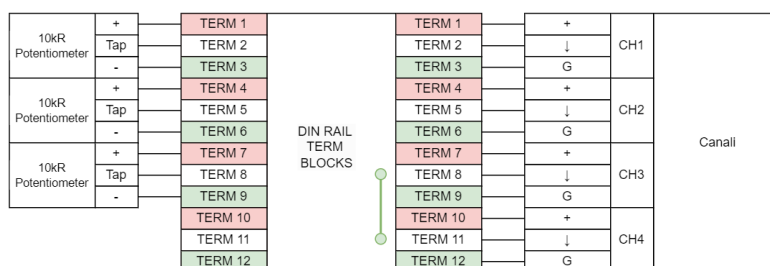


Figure 22 – Canali VCA Application Example

### 3.1.4 Remote On/Off (Standby)

Applying  $\geq 5VDC$  to the Remote On pin will cause the amplifier to turn on. Removing this Voltage will cause the amplifier to return to the state that was previously set by A+ or the webapp.

Applying  $\geq 5\text{VDC}$  to the Remote Off pin will cause the amplifier to enter standby mode. Removing this Voltage will cause the amplifier to return to the state that it was previously set by A+ or the webapp.

Applying  $\geq 5\text{VDC}$  to the Remote On will override any setting of the Remote Off pin. The remote on must be  $< 5\text{VDC}$  for the Remote Off pin to function.

# 3.2 Generic Integration With Emergency-Mute Contact Closures

The integration of Canali with Emergency-Mute triggers outside of a DMD system can be achieved either with the VCA connections or utilising the remote-off/on connections. Examples of integrating this with Normally Closed E-MUTE relays through both methods is shown in sections 3.2.2 and 3.2.1.

NOTE: Where multiple connections are required to a single pin on the amplifier it is recommended that the integrator should run these connections through terminal blocks and not attempt to make multiple connections in the phoenix connector on the back of the amplifier as this can be prone to faulty connections, loose strands, and is difficult to troubleshoot.

## 3.2.1 Utilising Remote On/Off

For a normally closed operation the amplifier should be placed into standby via A+ or the web app. 24VDC  $\geq$  5VDC should be applied to the Remote On connection. Upon removing this DC Voltage, the amplifier will enter standby mode.

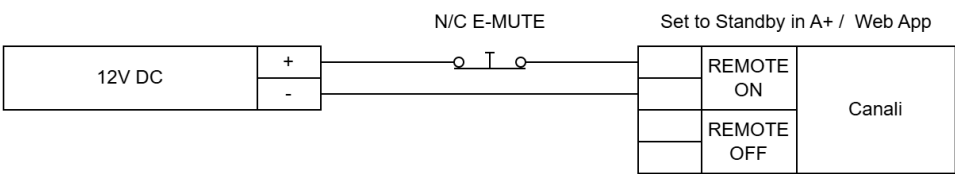


Figure 23 – Canali Normally Closed E-Mute Circuit using Remote ON

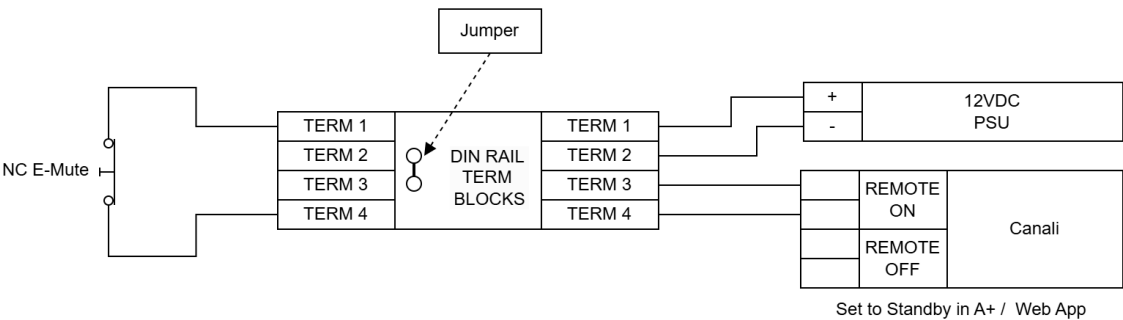


Figure 24 – Canali Normally Closed E-Mute Circuit using Remote ON Application Example

For a normally open operation the amplifier should be taken out of standby by A+ 24VDC  $\geq$  5VDC should be applied to the Remote Off connection. Upon applying the Voltage, the amplifier will enter standby mode.

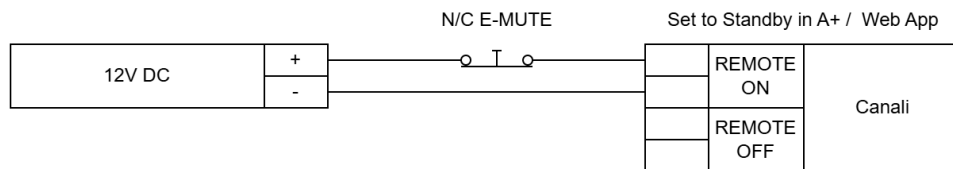


Figure 25 – Canali Normally Open E-Mute Circuit using Remote ON

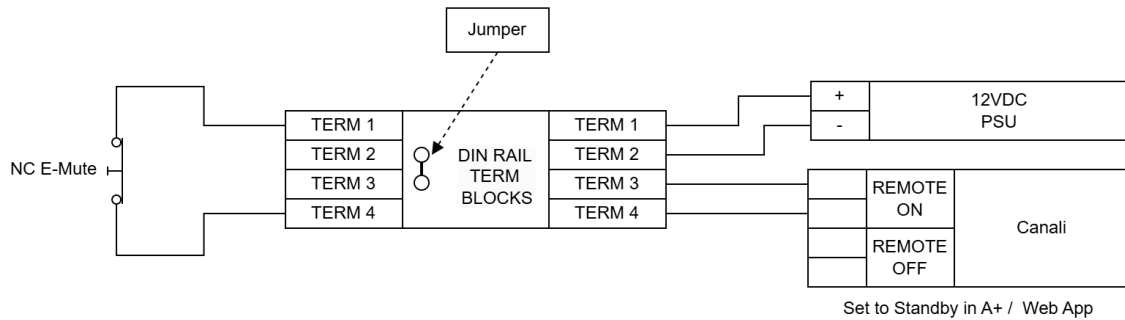


Figure 26 – Canali Normally Open E-Mute Circuit using Remote ON Application Example

### 3.2.2 Utilising VCA

To utilise the VCA to mute the system, the CH1 MSTR dipswitch should be set so that CH1 is a master VCA for the amplifier.

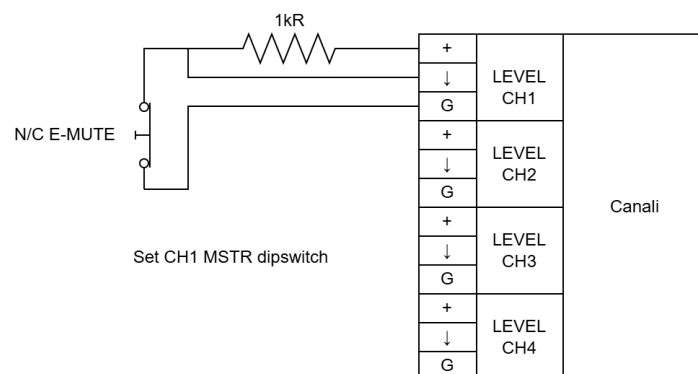


Figure 27 – Canali Normally Closed E-Mute Circuit using VCA

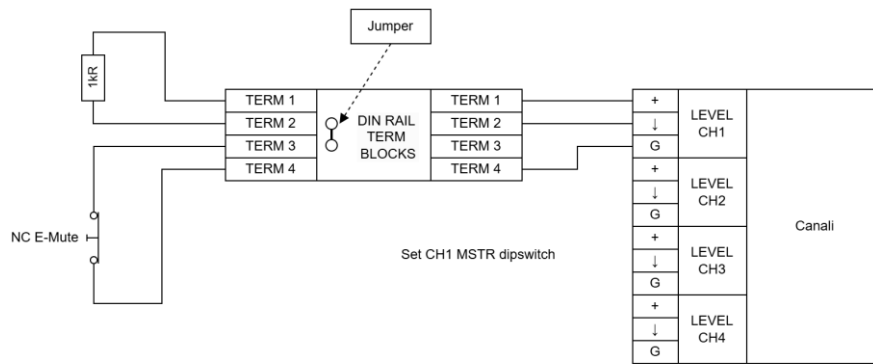


Figure 28 – Canali Normally Closed E-Mute Circuit using VCA Application Example

## 4 UNICA



Figure 29 – Unica GPIO

### 4.1 Overview

The Unica GPIO is split into four sections, the left-hand side features a symbol of a switch and is labelled “STS” (for status). Next to this is a stand-by input which puts the amplifier into standby when +5V is present. Next to this is an input labelled “Level”; this acts as a master VCA for the output levels of the amplifier. The right-hand side of the GPIO section is a true General Purpose Input Output (GPIO).

#### 4.1.1 Allowable Voltage Ranges

The Unica GPIO, Level, and Standby Controls are designed for 0-5VDC only.

The contact closure is rated for up to 48V.

#### 4.1.2 Status Contact Closure

The pins labelled “STS” connect to a contact closure which works as normally closed. Under normal operation the relay is open and will close upon a fault condition such as:

- No AC Mains
- Over temperature
- Amplifier in standby
- Loss of Pilot Tone
- Output monitoring fault
- Channel Faults

Please see section 4.1.5.1 for an example of replicating this behaviour as normally-closed.

#### 4.1.3 Stand-by

The stand-by input puts the amplifier into standby when +5V is present. The default implementation of this is as a normally-open circuit. This means that the amplifier will enter standby mode when 5V is applied to the input pin. This configuration is shown in Figure 30.

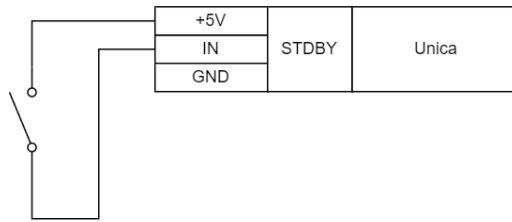


Figure 30 – Unica normally-open standby circuit

A normally-closed configuration can be achieved with the circuit shown in Figure 31, in the state shown in Figure 31 the amplifier would be powered off.

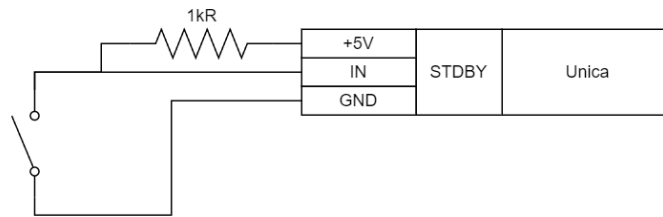


Figure 31 – Unica normally-closed standby circuit

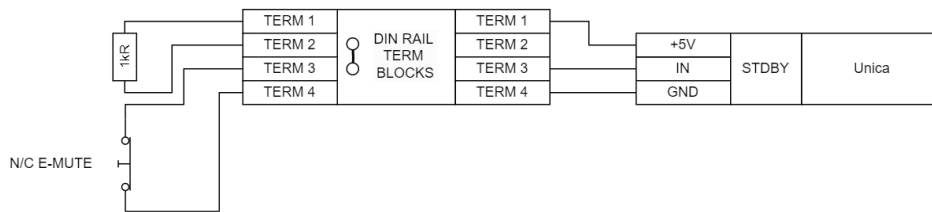


Figure 32 – Unica normally-closed standby implementation example

## 4.1.4 Master VCA

The input labelled “Level” acts as a master VCA for the output levels of the amplifier. Applying +5V to the level GPI sets the output levels to negative infinity, 0V means that the channel levels are unaffected.

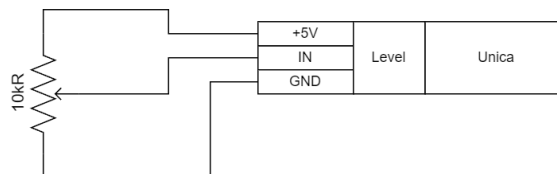


Figure 33 – Unica master VCA Circuit

## 4.1.5 Configurable GPIO

The GPIO section is a true General Purpose Input Output (GPIO). Each of the 6 pins (labelled X1 through X6) can be assigned one of the following functions:

- No Function (None)
- Ground
- +5V
- VCA Control (for any combination of output channels)
- Mute (for any combination of output channels)
- Device Fault indication
- Input Monitoring Status (for any combination of input channels)
- Load Monitoring Status (for any combination of output channels)

Configuring the GPIO of the Unica is done on an amplifier-by-amplifier basis in the amplifier Options menu as shown in Figure 34 and Figure 35.

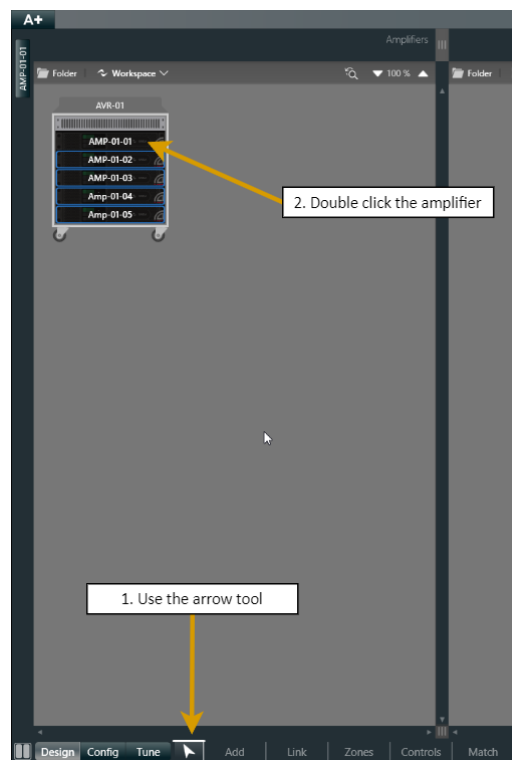


Figure 34 – Configuring Unica GPIO (part 1 – navigating to the amplifier options)

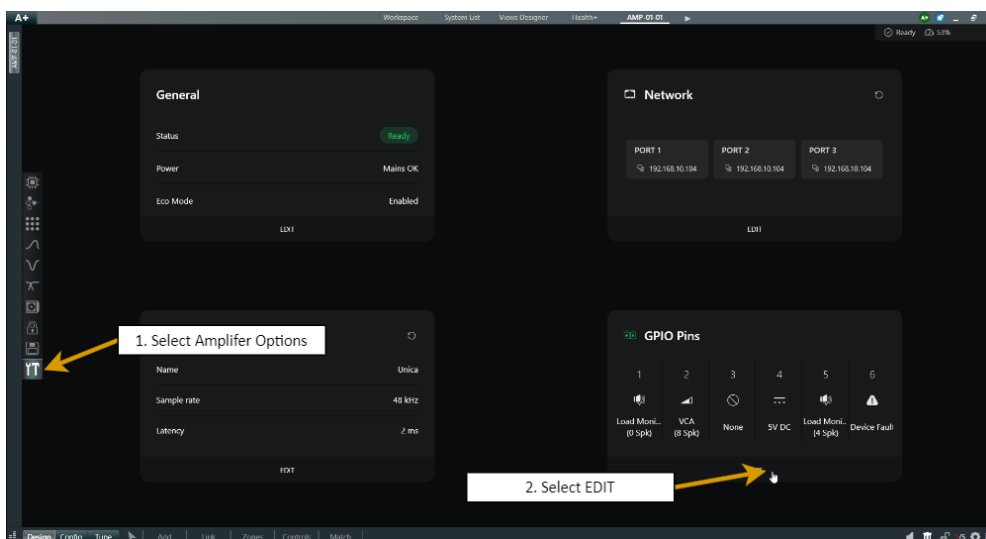


Figure 35 – Configuring Unica GPIO (part 2 – navigating to the GPIO options)

Through the use of these customizable GPIO pins, complex reporting and system control can be achieved.

#### 4.1.5.1 Fault Monitoring Example

The Unica configurable GPIO can be used to report amplifier health to a control system in a manner that replicates a normally closed version of the STS contact closure. An example of the GPIO configuration to achieve this is shown in Figure 36, with the wiring showing in Figure 37.

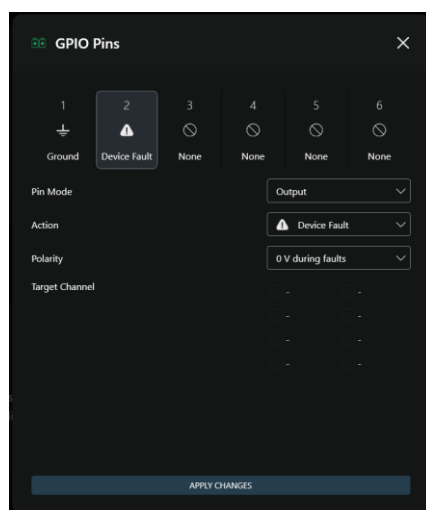


Figure 36 – Unica GPIO Configuration for Fault Reporting

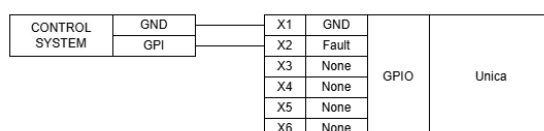


Figure 37 – Unica GPIO Configuration for Fault Reporting Application Example

## 4.2 Generic Integration with Emergency-Mute Contact Closures

The integration of Unica with Emergency-Mute triggers outside of a DMD system is achieved by utilizing the GPX configured as Input to Mute all outputs.

NOTE: When used with a contact closure, a 120Ω resistor must be included on the +5V line to protect the GPX configured as input.

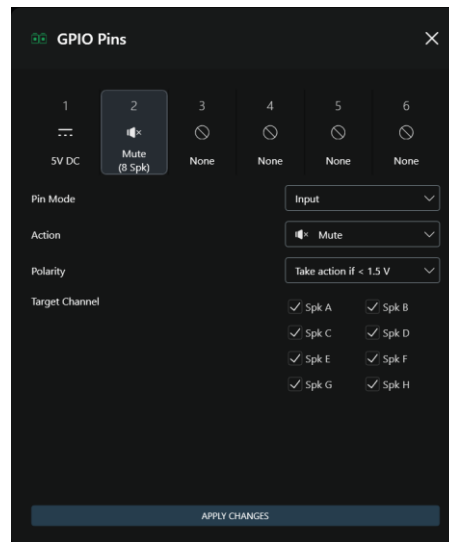


Figure 38 – Unica GPIO configuration for all-mute

The “Polarity” option allows the mute to be triggered with either a normally open or a normally closed input.

NOTE: when testing this, the amplifier will not display a muted status. Instead, the output level will show negative infinity. This is so that the output cannot be un-muted by any API calls from Armonia+ or third-party control systems until the control signal has been removed/restored.



Figure 39 – +5V applied to the Level input has muted the output.

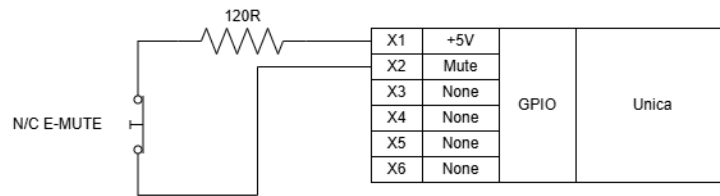


Figure 40 – Unica Normally Closed E-Mute Circuit

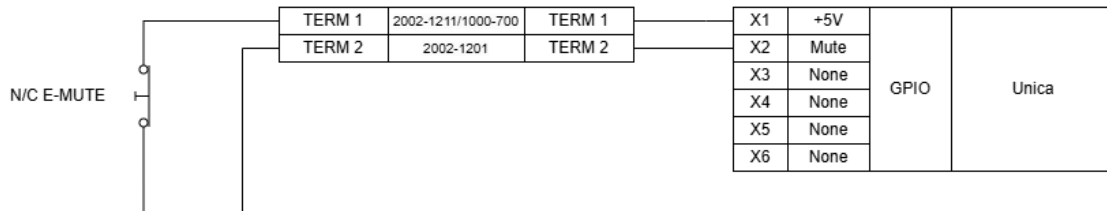


Figure 41 – Unica Normally Closed E-Mute Application Example

## 5 INTEGRATION WITH DYNAMIC MUSIC DISTRIBUTION

GPI wiring is significantly simplified when used as part of a DMD system. Any GPI of any amplifier in a DMD system can act as:

- a VCA control for any zone within the DMD system (see section 5.1)
- a source selection control from any zone within the DMD system (see section 5.1)
- an emergency source selection to apply to all zones within the DMD system (see section 5.2)
- a standby control for the entire DMD system (see section 5.2)

### 5.1 Zone Level and Source Select Application Examples

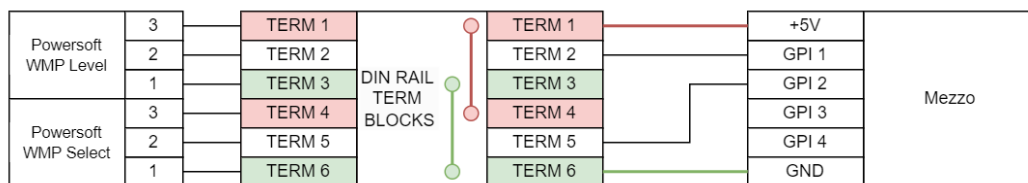


Figure 42 – DMD Zone Level & Source Select with Mezzo GPI

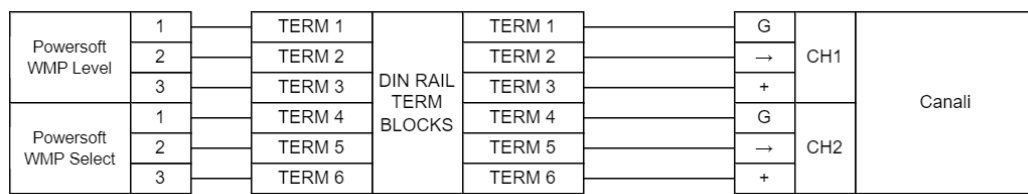


Figure 43 – DMD Zone Level & Source Select with Canali GPI

## 5.1.1 Implementation in Armonia+

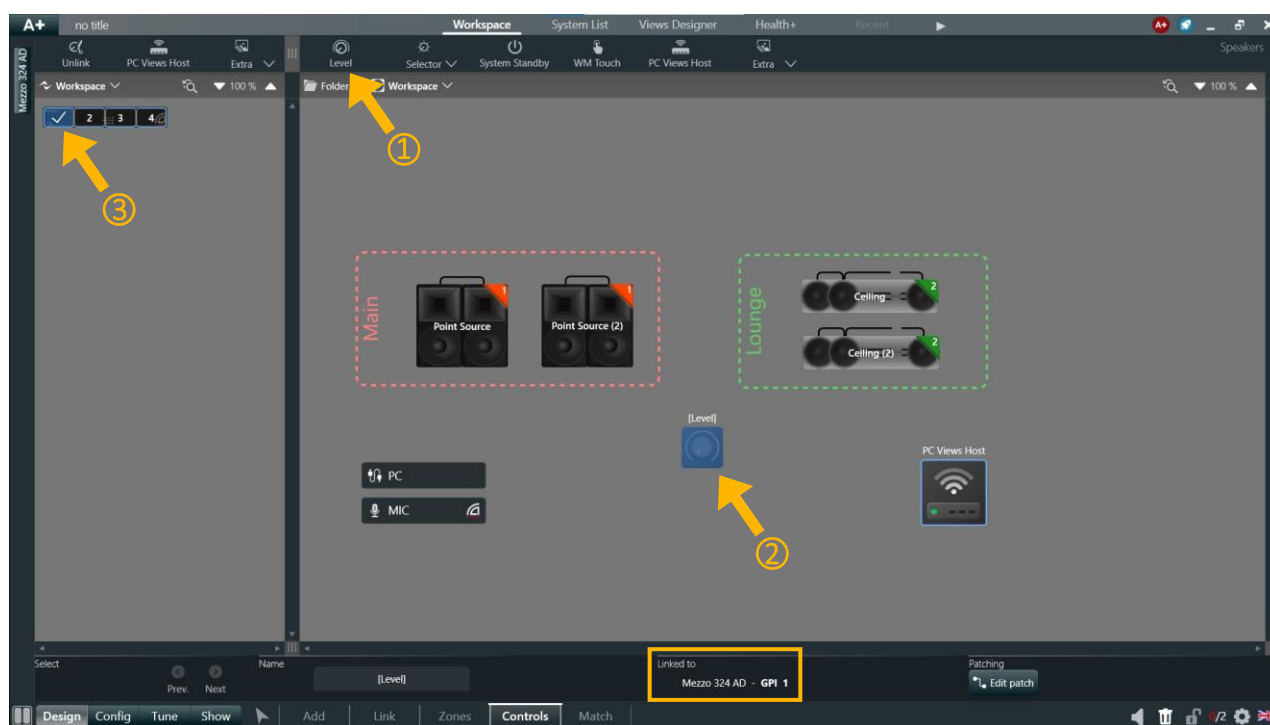


Figure 44 – Linking a WMP Level Controller to a GPI Input of an Amplifier

1. Click on 'Level' icon to add a 'Level' control
2. Click on 'Level' control added to link to a GPI input
3. Click on the desired GPI input to complete the link

## 5.2 Stand-by and Priority Source Select Application Examples

A DMD system provides the option to put the entire system into stand-by or to switch every zone to a specific input source when a trigger is received. The implementation of this is very simple, as shown in Figure 45.

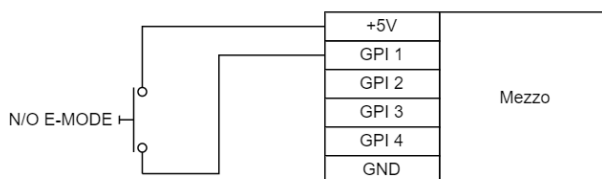


Figure 45 – DMD Normally Open Emergency Mode Trigger Circuit

This can be modified for Normally Closed operation in the same way as was shown for a Mezzo in Section 2.2.

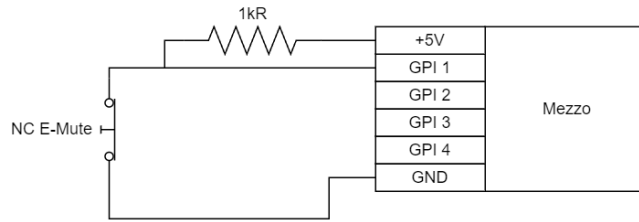


Figure 46 – DMD Normally Closed Emergency Mode Trigger Circuit

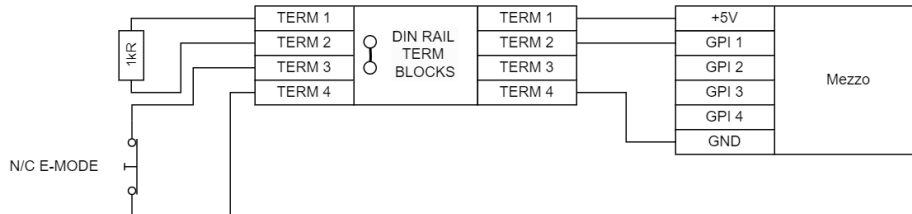


Figure 47 – DMD Normally Closed Emergency Mode Trigger Implementation Example

Linking the system stand-by to a GPI is a great way of implementing a quick “system mute” for integration with emergency systems.

## 5.2.1 Implementation in Armonia+

System standby can be implemented in Armonia+ in “Design → Controls” mode as shown in Figure 48 and Figure 49.

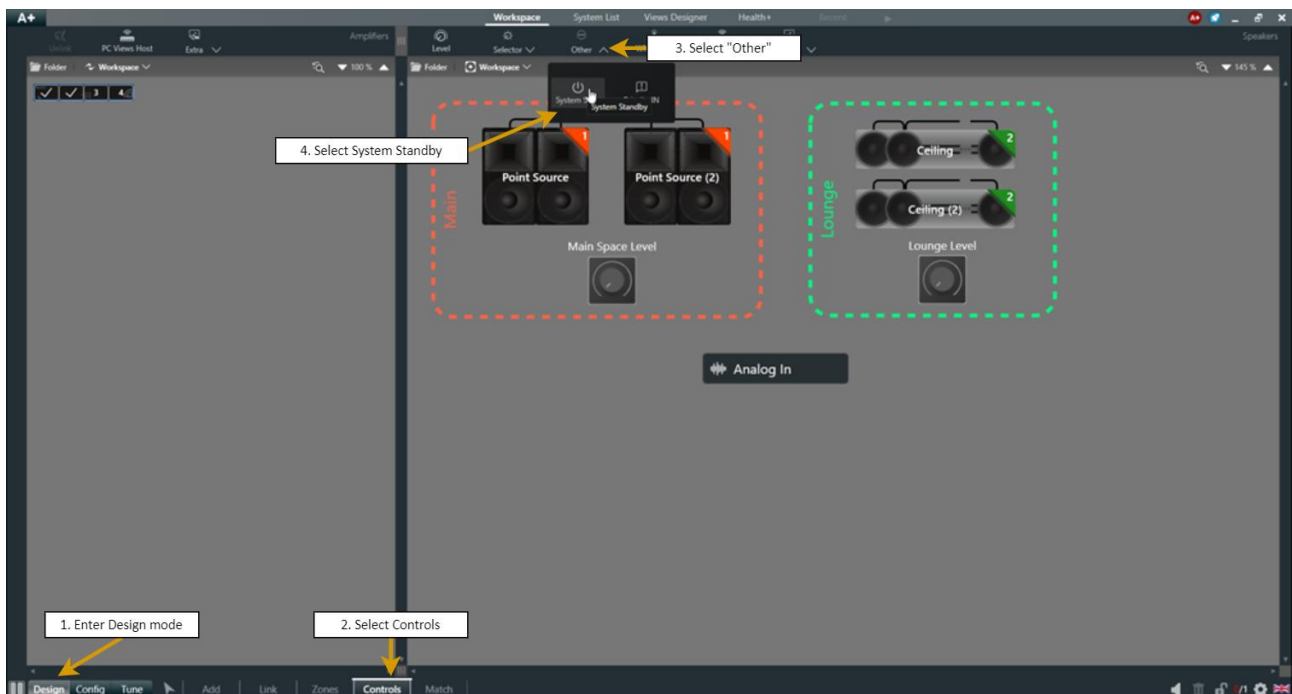


Figure 48 – Adding system standby GPI (part 1 – adding the object)

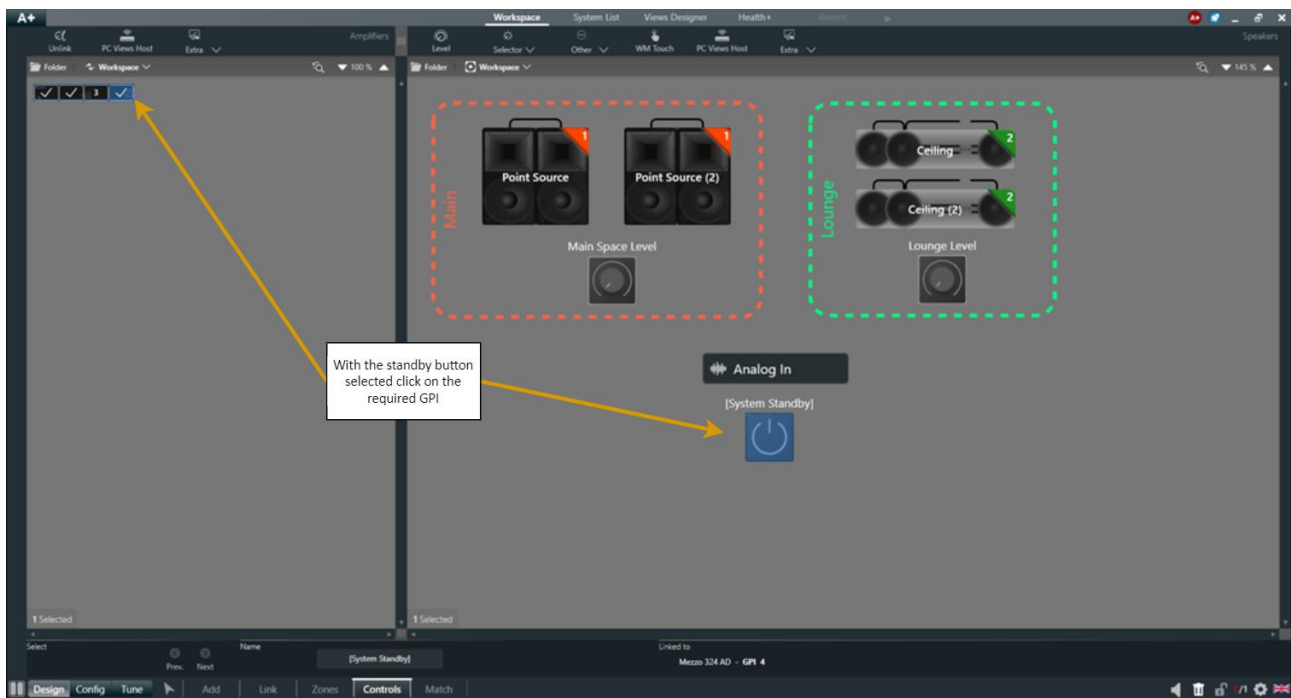


Figure 49 – Adding system standby GPI (part 2 – linking the object to the GPI)

Note: when this is added to a project, the standby options on the WM Touch, SYS Control App, and Web Views are all disabled when the GPI is active.

The implementation of a priority source selection follows the same process.

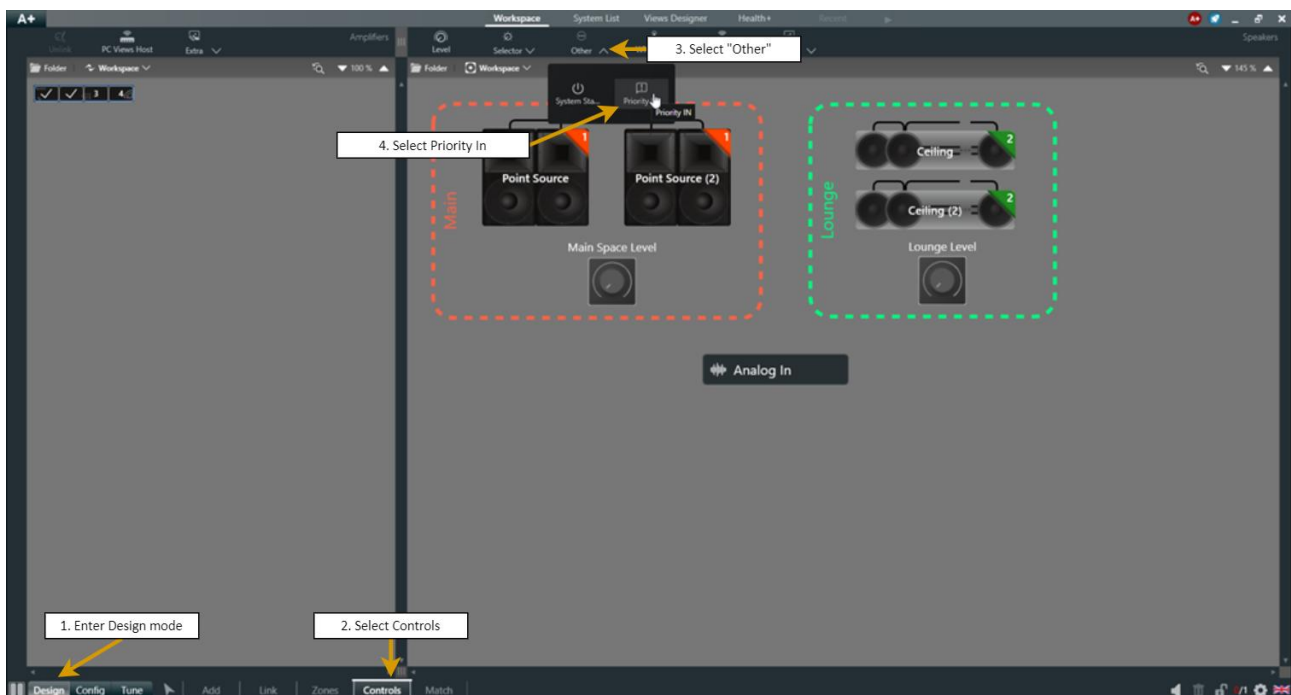


Figure 50 – Adding a GPI triggered priority input (part 1 – adding the object)

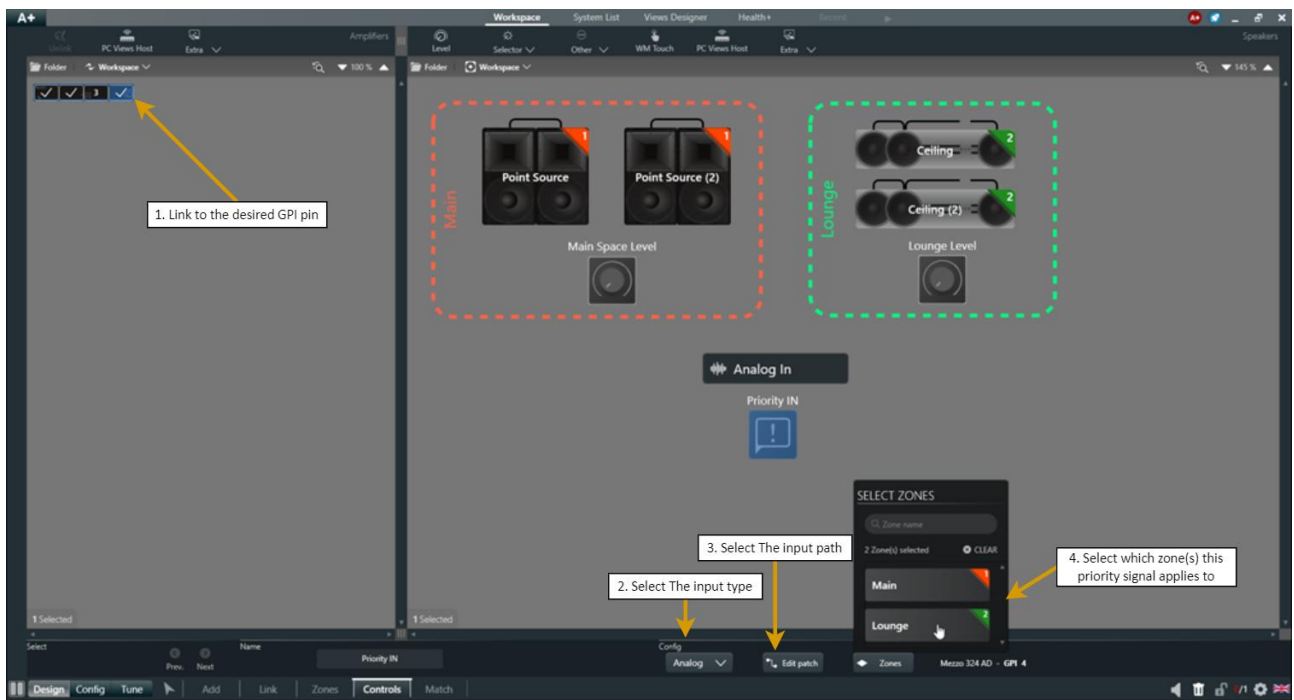


Figure 51 – Adding a GPI triggered priority input (part 2 – linking the object to the GPI)

6 APPLICATION EXAMPLES FOR COMMON COMBINATIONS

6.1 Canali + Mezzo N/C Emergency Mute

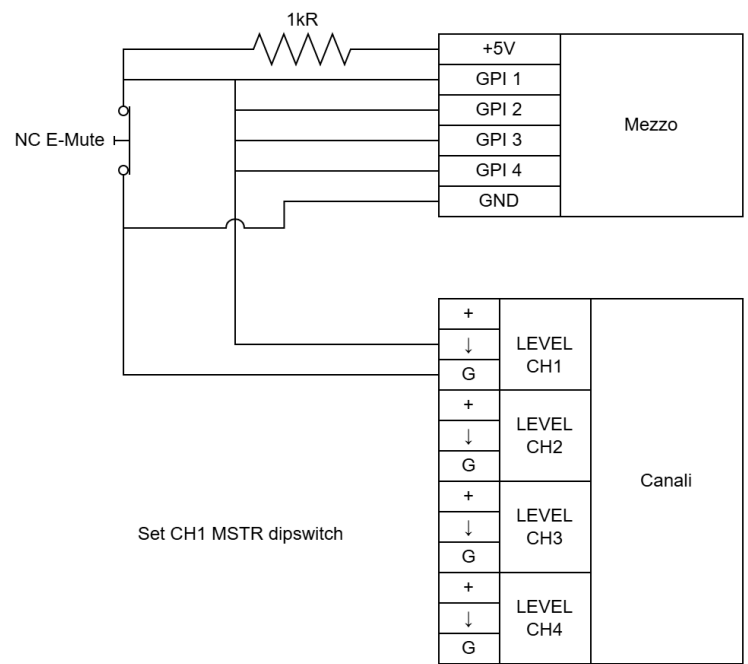


Figure 52 – Mezzo & Canali Normally Closed E-Mute Circuit

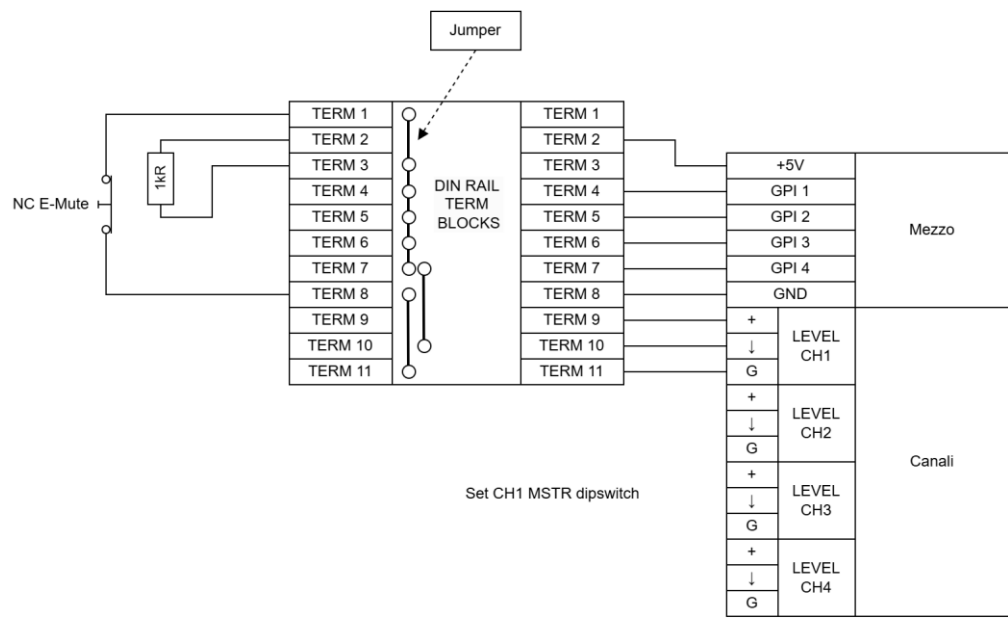


Figure 53 – Mezzo & Canali Normally Closed E-Mute Circuit Application Example

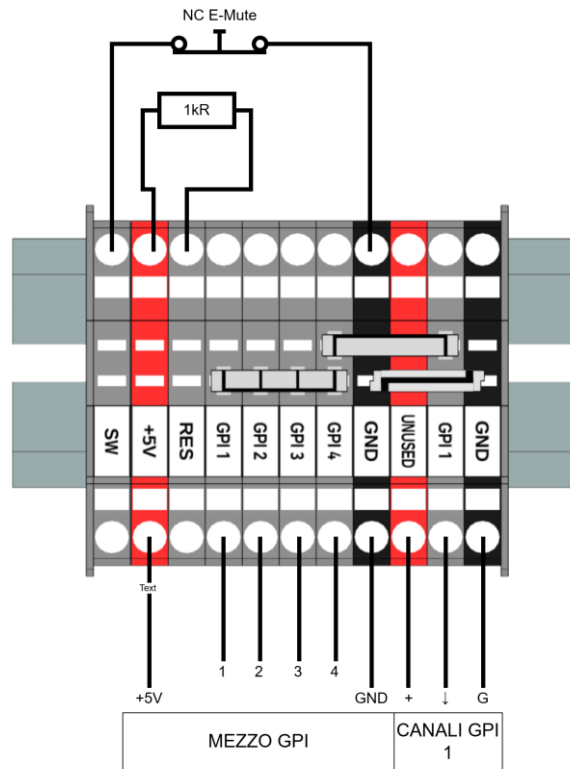


Figure 54 – Mezzo & Canali Normally Closed E-Mute Physical Implementation Example

Document Title: GPIO

**Reference:** DO000345.02 REV.00

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