Introduction

Some L-Acoustics products offer GPIO connectivity, for the purpose of triggering commands on the equipment or monitoring its state from third-party devices or via simple contact closure.

This Technical Bulletin describes how GPIO work on L-Acoustics products, and provides all information needed to connect and use them with third-party devices.

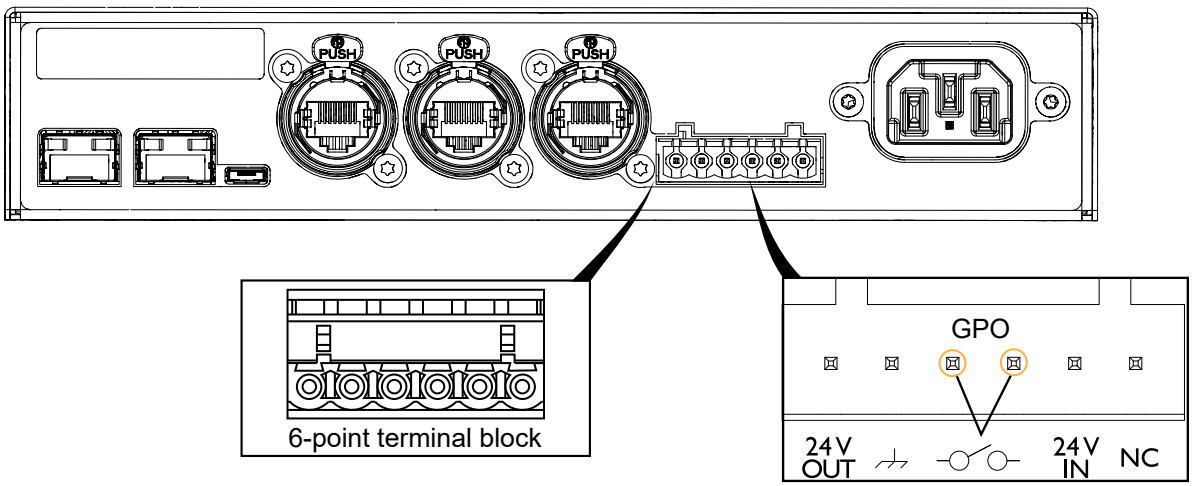
L-Acoustics products supporting GPIO

Product	Device type	GPI	GPO	GPIO*
LS10	Avnu™-certified AVB Network Switch	—	1	—
P1	Networked AVB Audio Processor	1 + 1**	2	—
LA2Xi	Install-specific Amplified Controller	—	—	4
LA7.16i	Install-specific Amplified Controller	—	—	3

* Pin that can be configured as GPI or GPO.
** One isolated GPI, and one non-isolated GPI.

LS10

LS10 features a 6-point terminal block on the rear panel that includes a configurable GPO. It can be connected using the included 6-point terminal block connector.



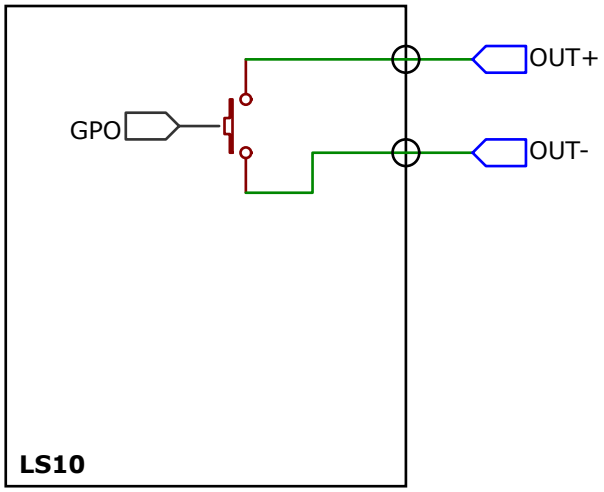
Pinout

Pin	Function	Description
3	OUT+	Fully isolated, relay contact, normally open
4	OUT–	Fully isolated, relay contact, normally open

Electrical specifications

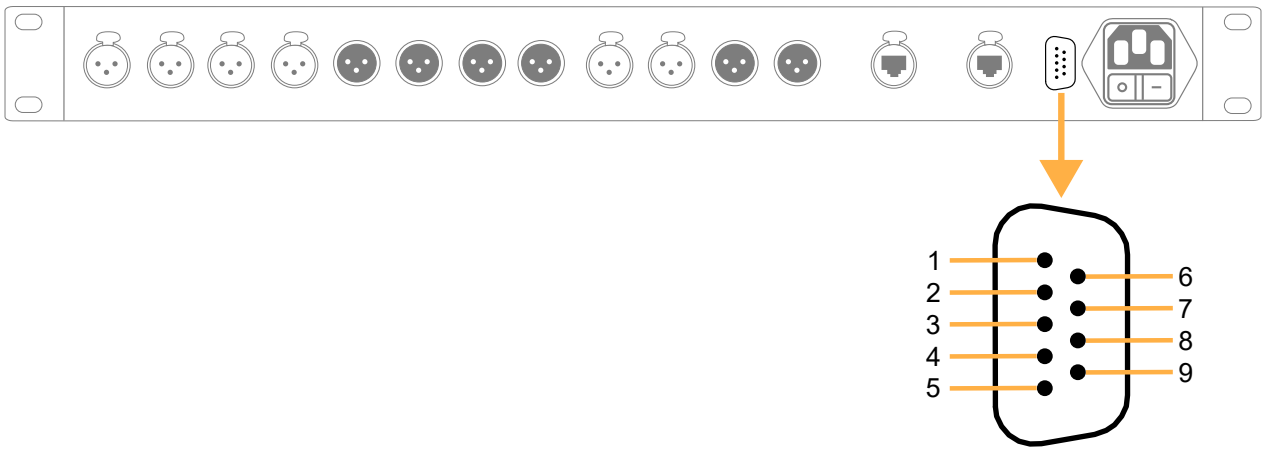
	GPI	GPO
Galvanic isolation (200 V)	—	Yes
Logic LOW voltage	—	—
Logic HIGH voltage	—	—
Maximum voltage	—	—
Rated current	—	—
Maximum current	—	500 mA
Contact rating (resistive)	—	1 A / 30 V DC

Schematic diagram



P1

P1 features a female DB9 connector on the rear panel which exposes two isolated output relays, one isolated digital input, one digital input referenced to chassis ground, and one 5 V DC power supply.



Pinout

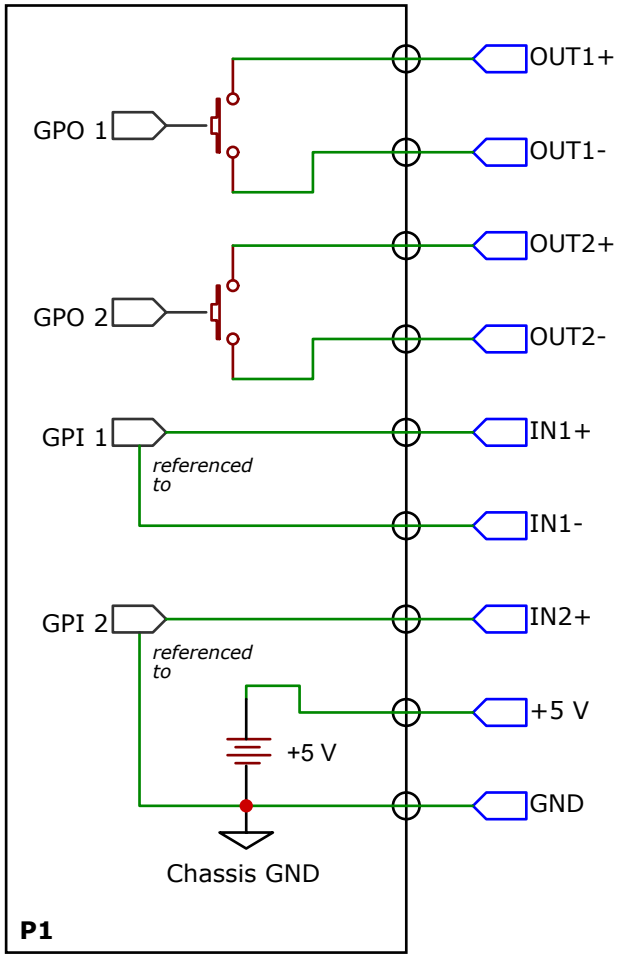
Pin	Function	Description
1	OUT1+	Fully isolated, relay contact, normally open
2	OUT1–	Fully isolated, relay contact, normally open
3	OUT2+	Fully isolated, relay contact, normally open

Pin	Function	Description
4	OUT2–	Fully isolated, relay contact, normally open
5	IN1+	Fully isolated digital input
6	IN1–	Fully isolated digital input
7	IN2	Input referenced to chassis ground
8	+5 V / 50 mA power	Power supply referenced to chassis ground
9	CHGND	Chassis ground

Electrical specifications

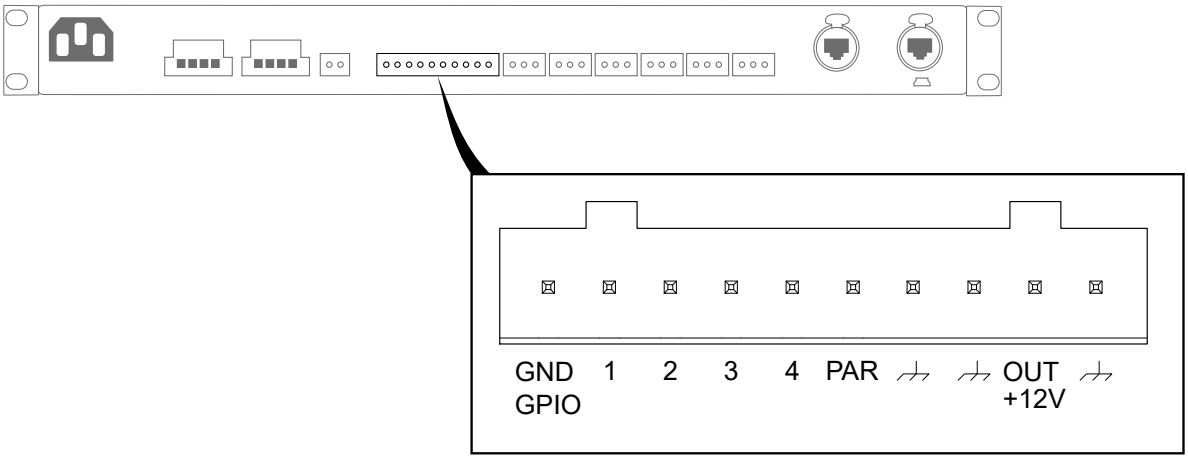
	GPI	GPO
Galvanic isolation (200 V)	Yes (IN1) / No (IN2)	Yes
Logic LOW voltage	0 V to 3 V	—
Logic HIGH voltage	4 V to 24 V	—
Maximum voltage	27 V	—
Rated current	4 mA (@5 V)	—
Maximum current	10.5 mA (@27 V)	500 mA
Contact rating (resistive)	—	1 A / 30 V DC

Schematic diagram



LA2Xi

LA2Xi features a 10-point terminal block on the rear panel that includes four configurable GPIO. It can be connected using the included 10-point terminal block connector.



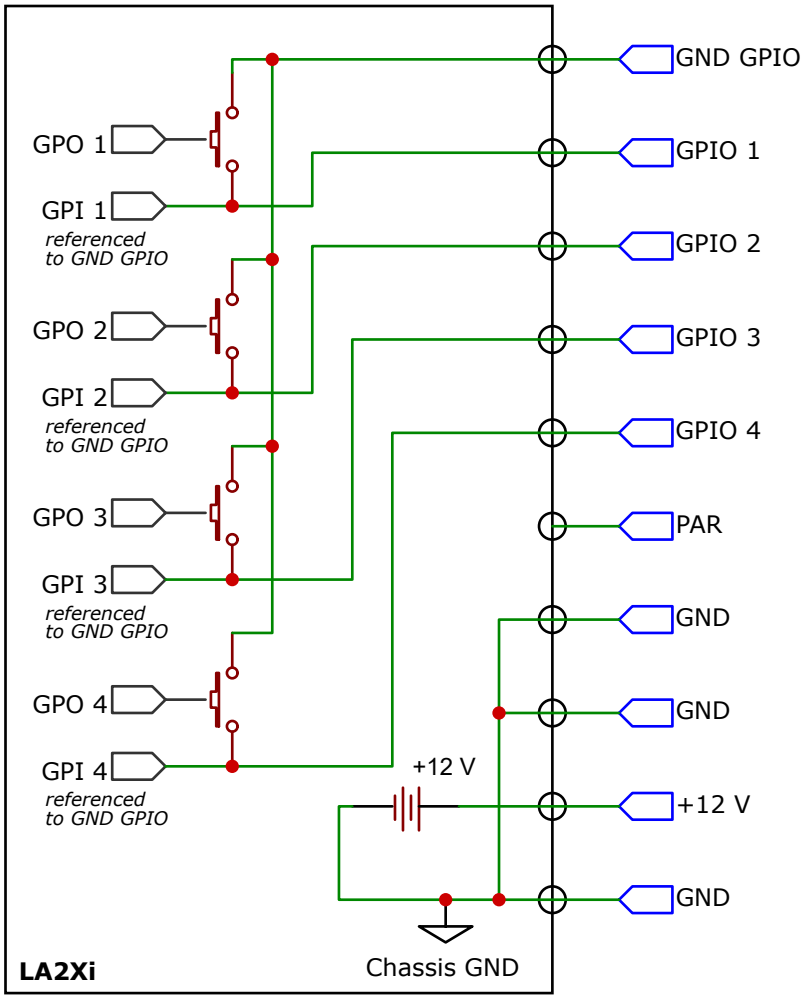
Pinout

Pin	Function	Description
1	GND GPIO	Fully isolated ground for GPIO
2	GPIO 1	Fully isolated, digital input or relay contact, normally open
3	GPIO 2	Fully isolated, digital input or relay contact, normally open
4	GPIO 3	Fully isolated, digital input or relay contact, normally open
5	GPIO 4	Fully isolated, digital input or relay contact, normally open
6	PAR	Connect to a ground pin for PBTL bridging. Refer to the LA2Xi owner's manual.
7	GND	Chassis ground
8	GND	Chassis ground
9	OUT +12 V / 45 mA	Power supply referenced to chassis ground
10	GND	Chassis ground

Electrical specifications

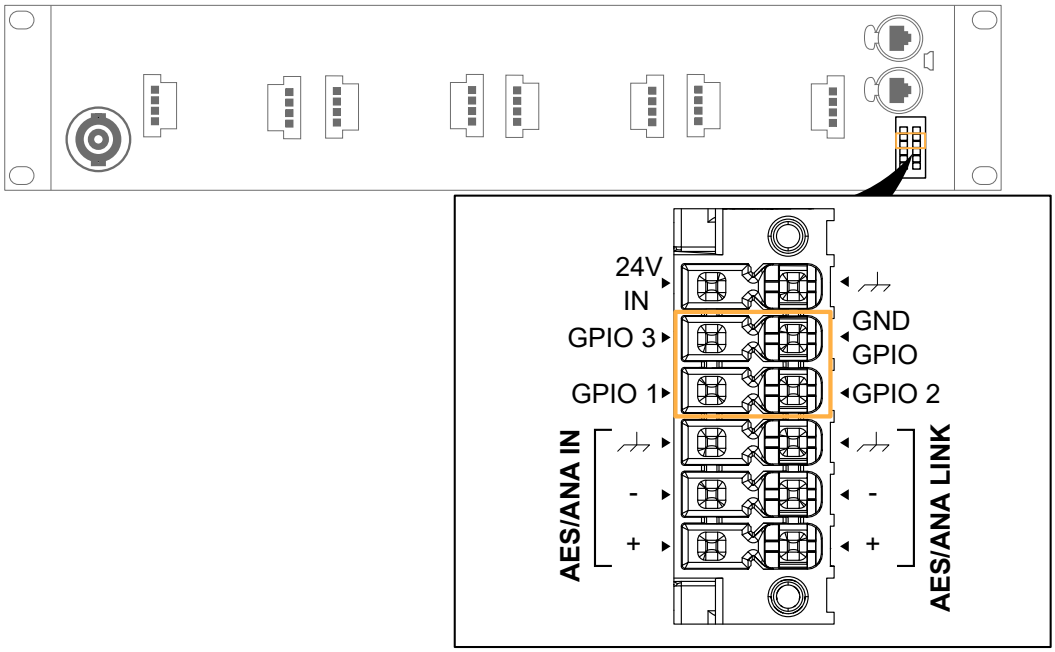
	GPI	GPO
Galvanic isolation (200 V)	Yes	Yes
Logic LOW voltage	0 V to 1 V	—
Logic HIGH voltage	2 V to 24 V	—
Maximum voltage	28 V	—
Rated current	4 mA (@5 V)	—
Maximum current	8.8 mA (@28 V)	500 mA
Contact rating (resistive)	—	1 A / 30 V DC

Schematic diagram



LA7.16i

LA7.16i features a 12-point terminal block on the rear panel that includes three configurable GPIO. It can be connected using the included 12-point terminal block connector.



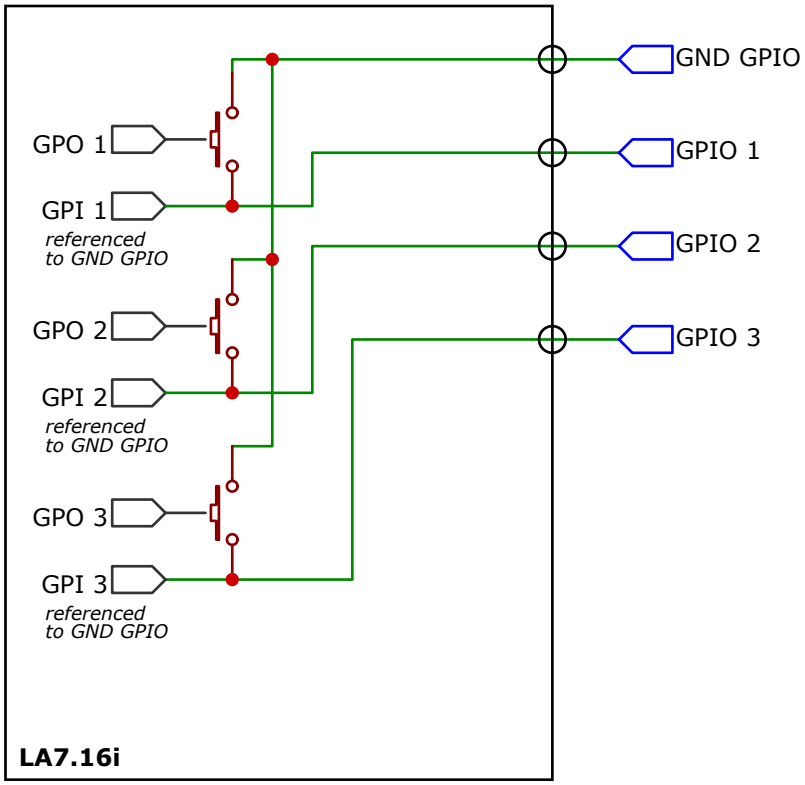
Pinout

Pin function	Description
GND GPIO	Fully isolated ground for GPIO
GPIO 1	Fully isolated, digital input or relay contact, normally open
GPIO 2	Fully isolated, digital input or relay contact, normally open
GPIO 3	Fully isolated, digital input or relay contact, normally open

Electrical specifications

	GPI	GPO
Galvanic isolation (200 V)	Yes	Yes
Logic LOW voltage	0 V to 1 V	—
Logic HIGH voltage	2 V to 24 V	—
Maximum voltage	28 V	—
Rated current	1.2 mA (@5 V)	—
Maximum current	2.3 mA (@28 V)	1 A
Contact rating (resistive)	—	1 A / 30 V DC

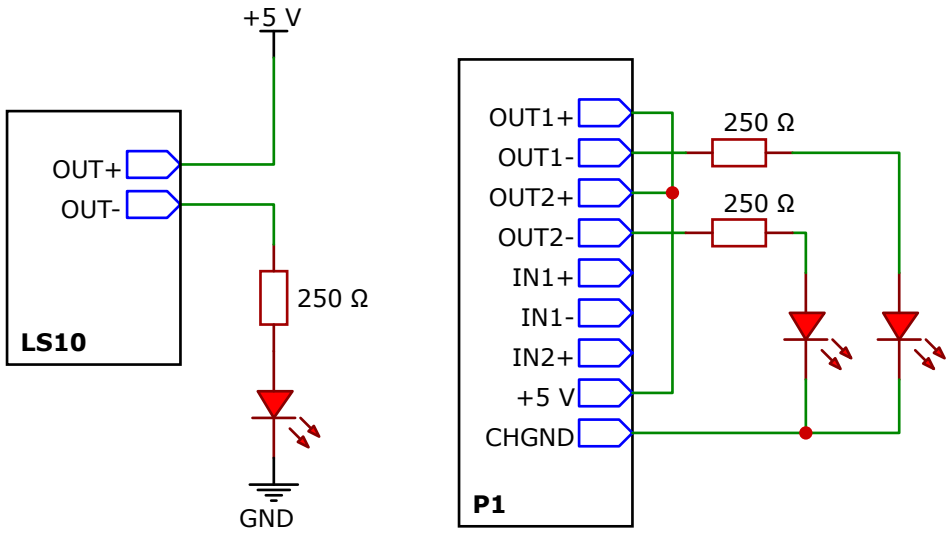
Schematic diagram



Connecting the GPIO

Connecting a GPO

Example 1: lighting an LED (forward logic)

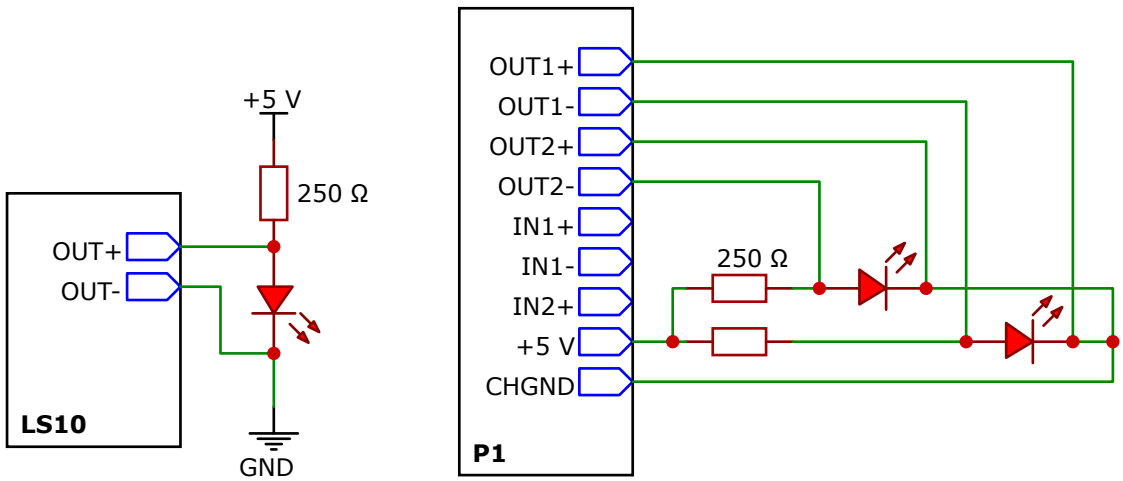


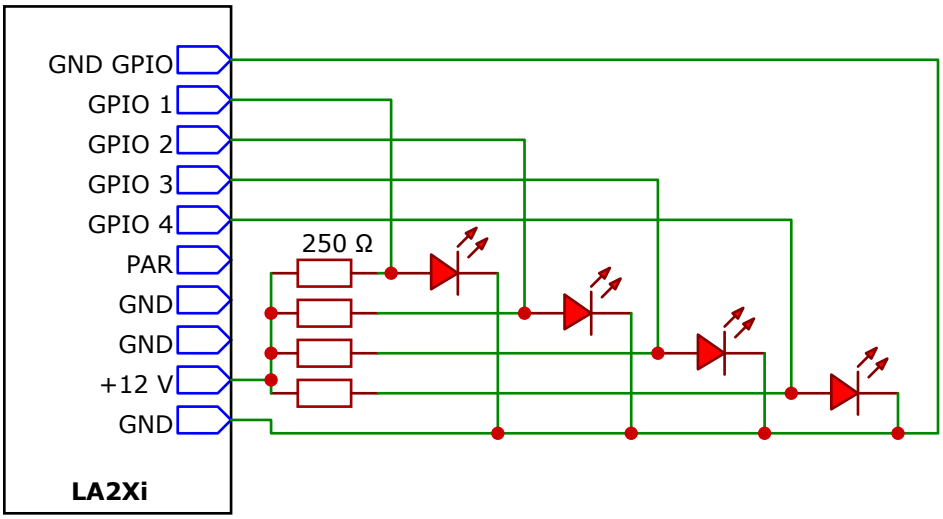
When the GPO is **closed**, the LED is **turned on**.

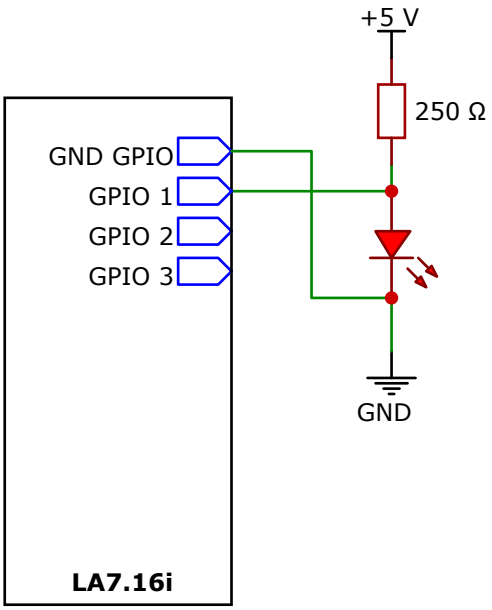
When the GPO is **open**, the LED is **turned off**.

i This scenario is not possible with LA2Xi or LA7.16i. The current drawn by the GPI circuit is too high for the LED to turn off when the relay is open.

Example 2: lighting an LED (reverse logic)



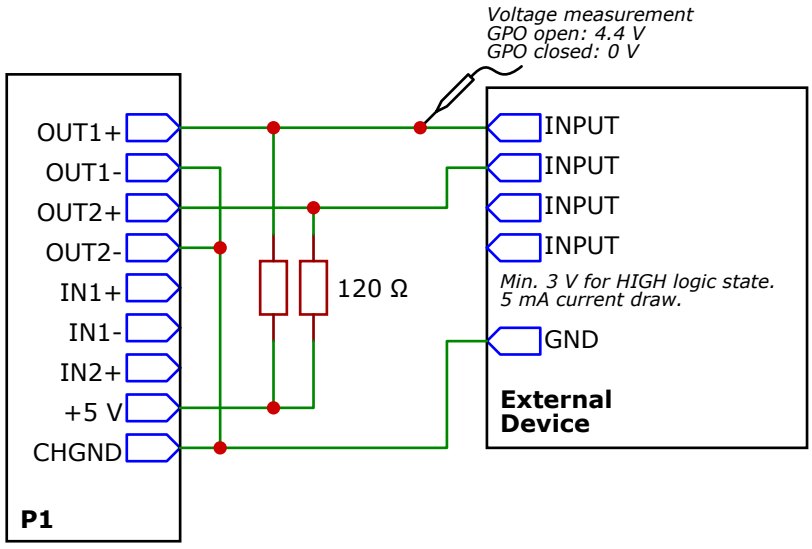


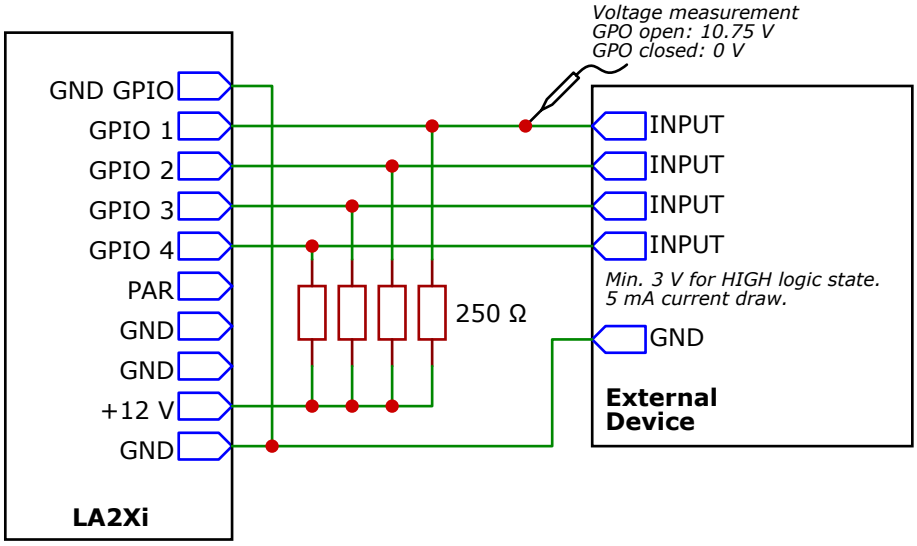


When the GPO is **closed**, the LED is **turned off** (the LED is short-circuited by the contact relay).

When the GPO is **open**, the LED is **turned on**.

Example 3: triggering an external GPI with internal voltage source



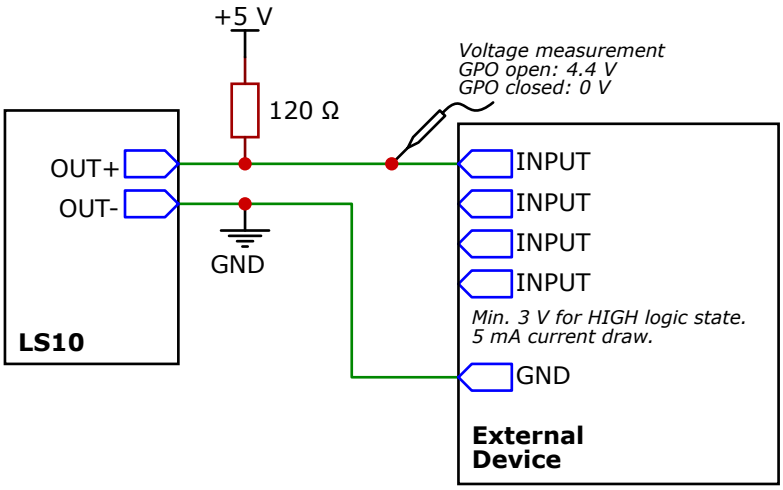


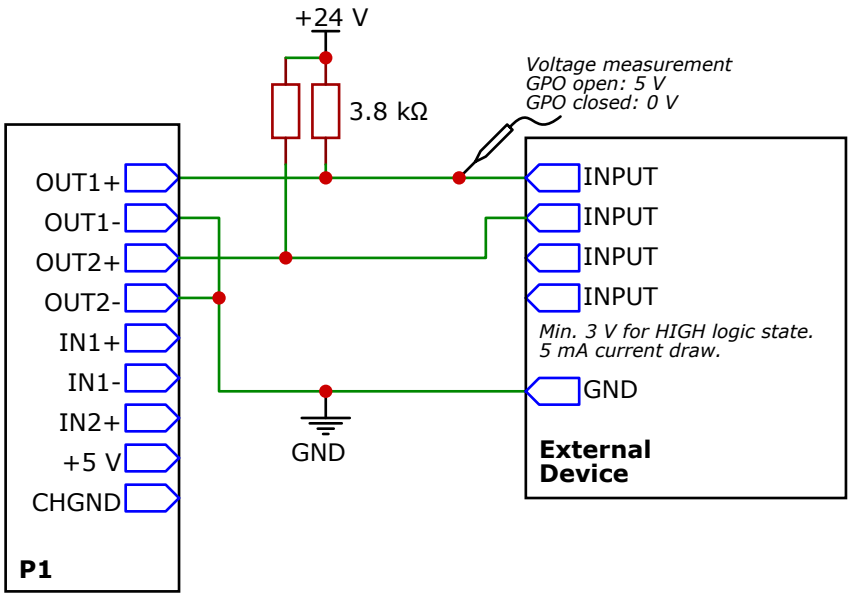
When the GPO is **closed**, the GPI of the external device is set to **LOW** logic state.

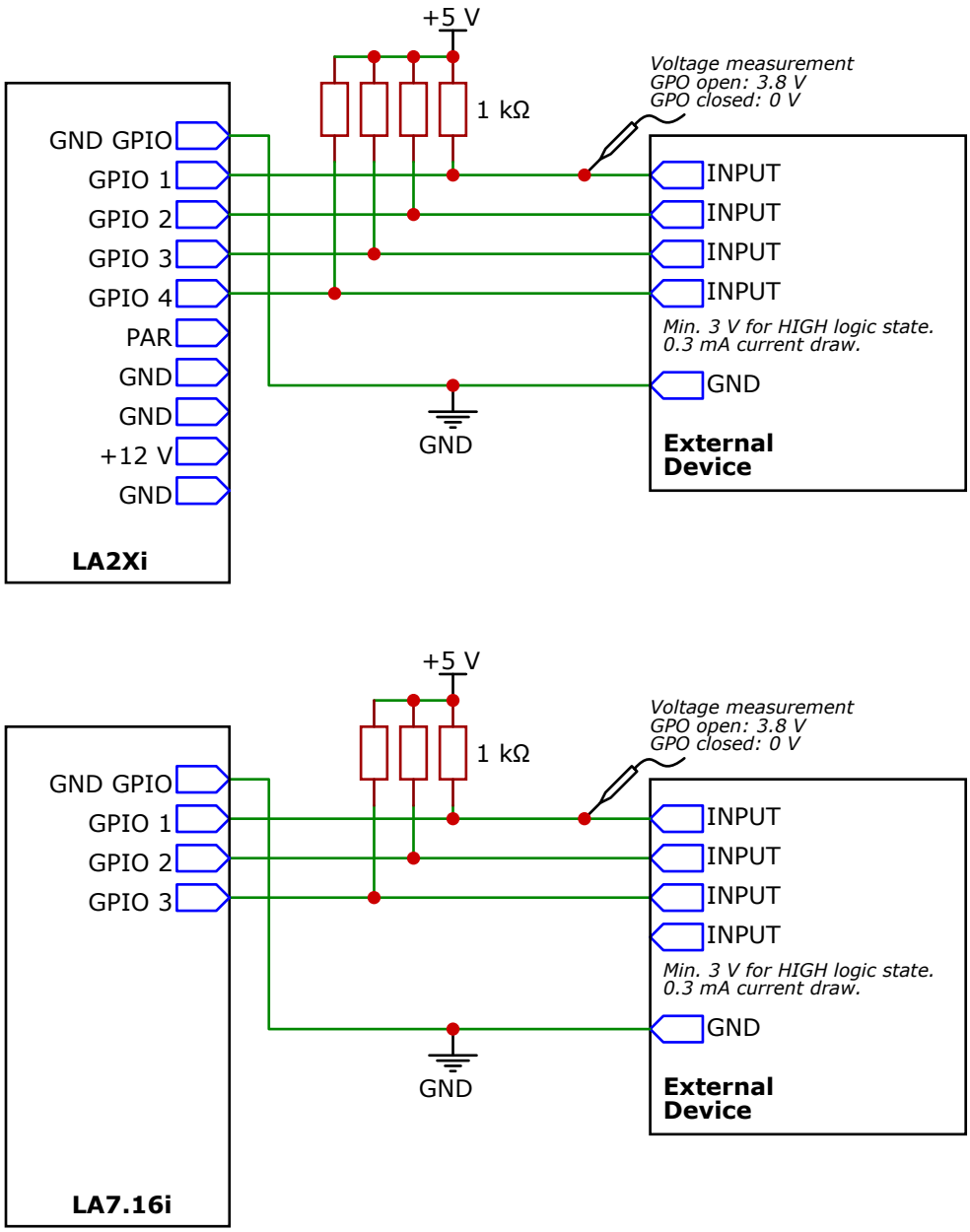
When the GPO is **open**, the GPI of the external device is set to **HIGH** logic state.

The resistor value choice depends on the voltage source and the current drawn by the external device when the GPO is open.

Example 4: triggering an external GPI with external voltage source





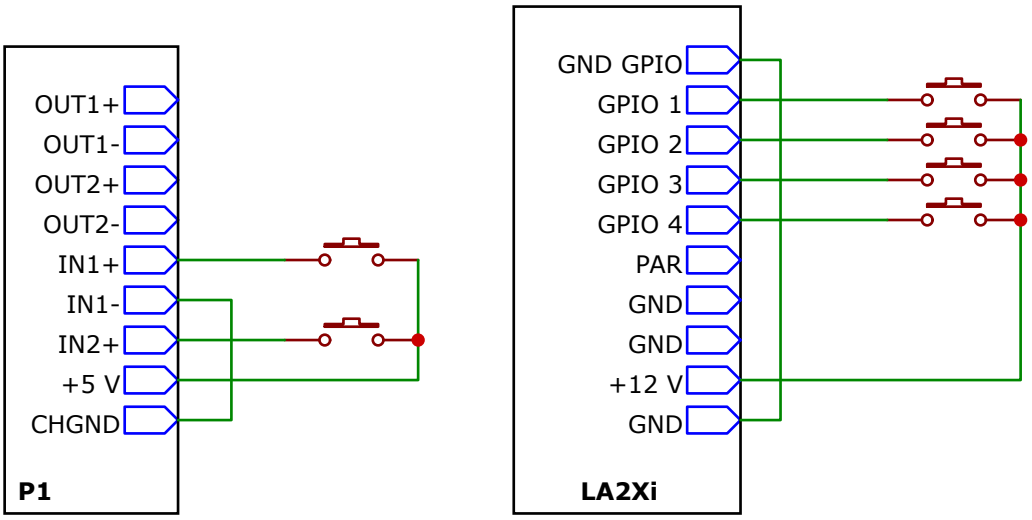


When the GPO is **closed**, the GPI of the external device is set to **LOW** logic state.

When the GPO is **open**, the GPI of the external device is set to **HIGH** logic state.

Connecting a GPI

Example 5: triggering GPI with a push button

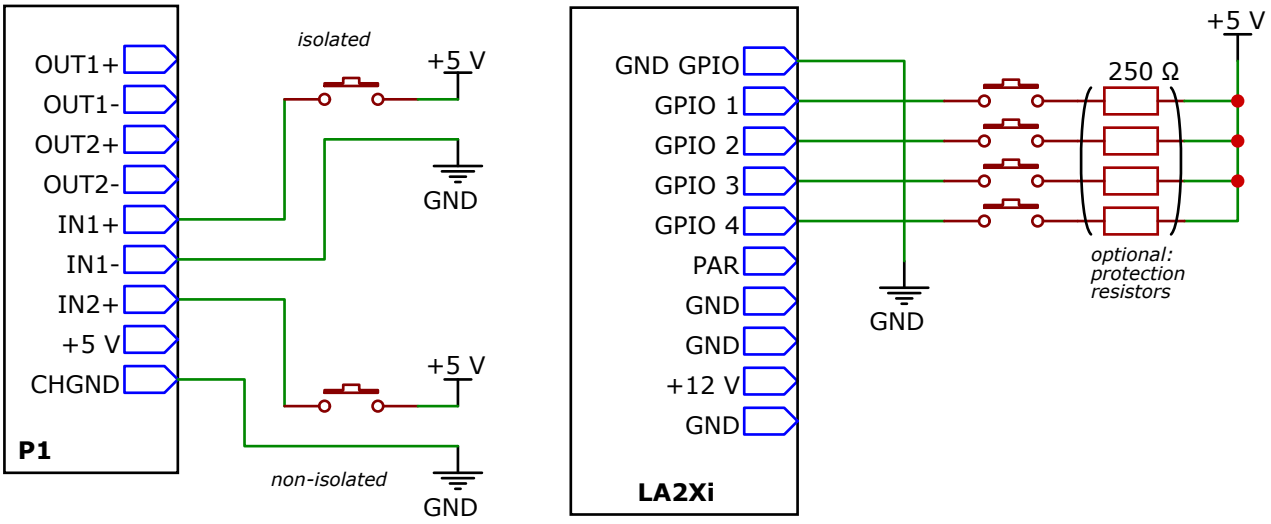


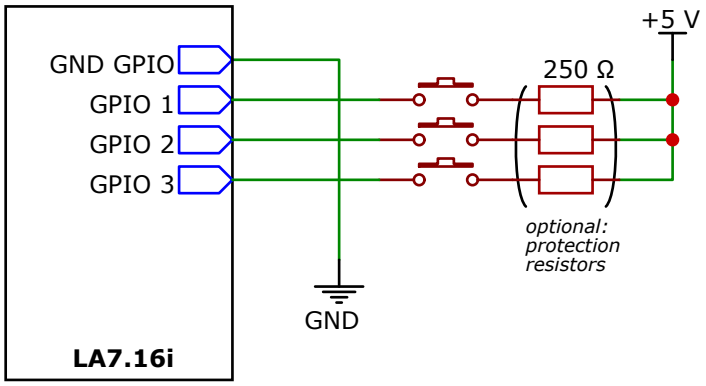
When the push button is closed, the GPI logic state is **HIGH**.

When the push button is open, the GPI logic state is **LOW**.

i In the case of LA2Xi, the GPIO used as inputs must be configured as GPI to prevent the internal contact relay from closing. Closing the internal contact relay by mistake could lead to connecting the +12 V voltage supply to ground. This is not a problem for the voltage supply, which is short-circuit tolerant, but the voltage would drop to 0 V and prevent GPI from receiving **HIGH** logic state.

Example 6: triggering GPI with a push button and external power supply



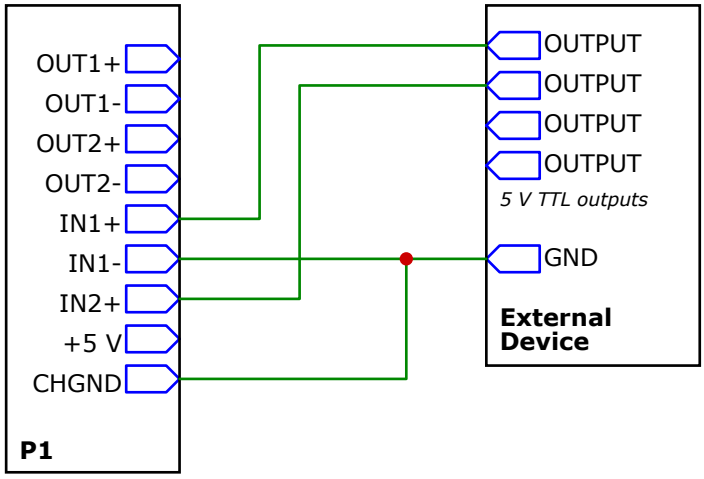


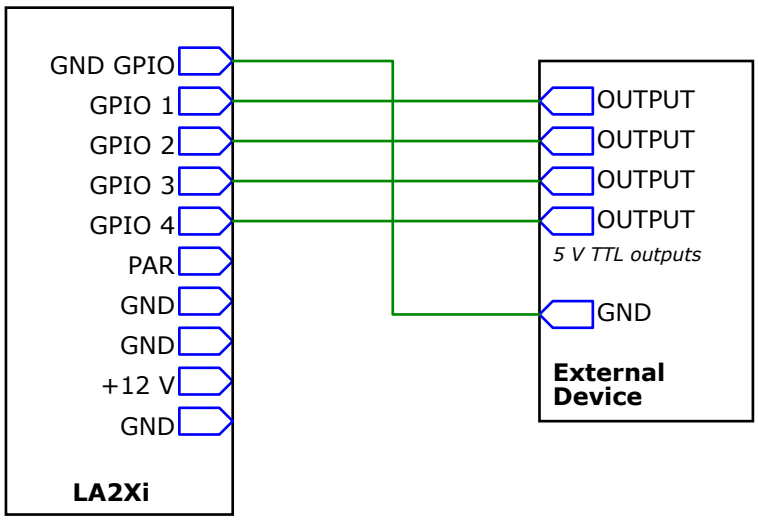
When the push button is closed, the GPI logic state is **HIGH**.

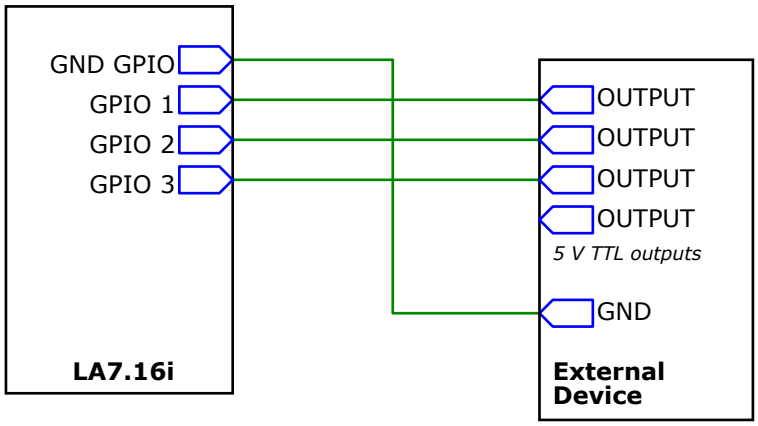
When the push button is open, the GPI logic state is **LOW**.

In the case of LA2Xi or LA7.16i, the GPIO used as inputs must be configured as GPI to prevent the internal contact relay from closing. Closing the internal contact relay by mistake could lead to connecting the voltage supply to ground. In case the voltage supply is not protected against short-circuit, this can lead to an over-current. Protection resistors can be inserted to protect from over-current.

Example 7: triggering GPI from an external device (TTL outputs)

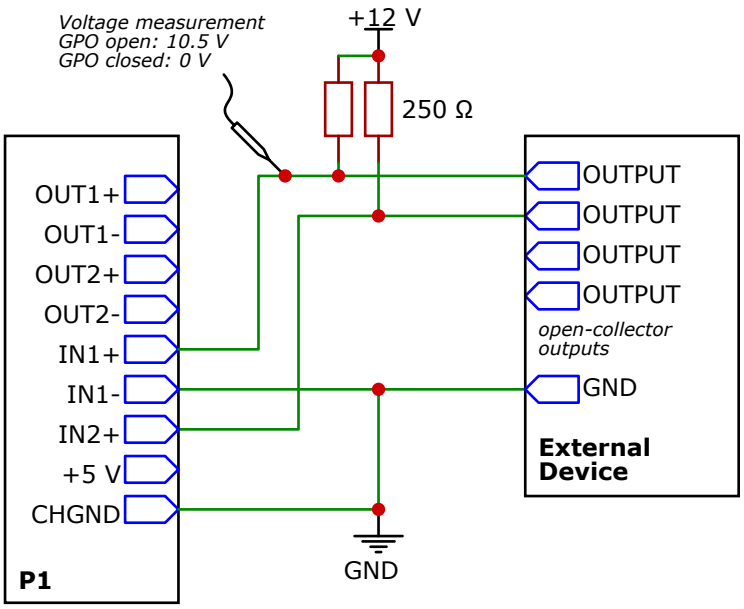


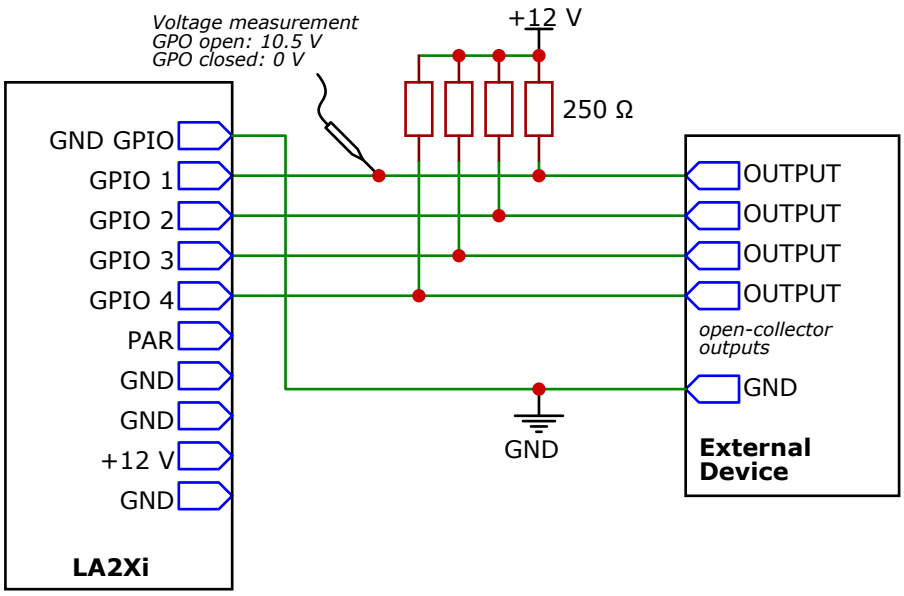


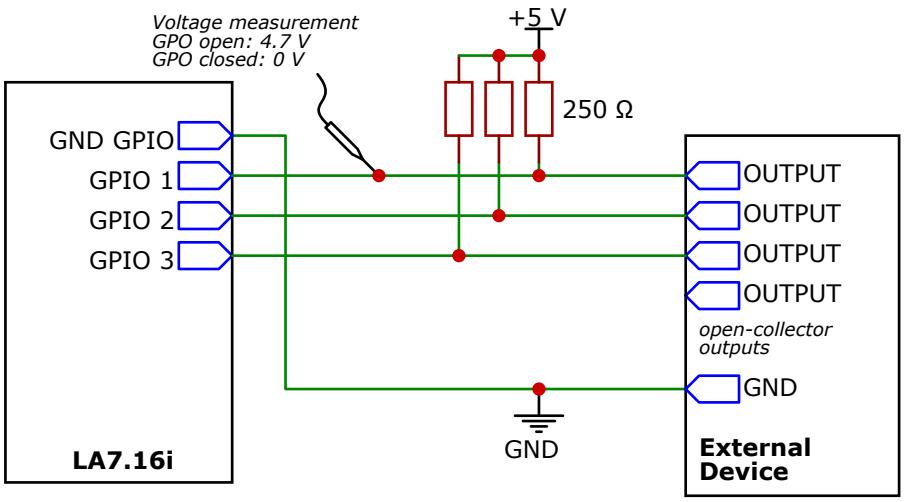


The TTL output of the external device can switch between +5 V and 0 V potentials, and is directly connected to the GPI port.

Example 8: triggering GPI from an external device (open-collector outputs)







The open-collector output is either floating or connected to ground. Pull-up resistors are used to force the **HIGH** logic state when the output is open.

Choose a pull-up resistor value to keep a **HIGH** logic state voltage high enough for the GPI of the device (because the current drawn by the GPI circuit creates a voltage drop on the pull-up resistor).

LS10 GPIO functions

Outputs

When LS10 is not powered, its GPO is in the OPEN state.

List of functions

List of GPO functions available with firmware 2.12.0.43. This list may evolve in future firmware releases.

Function name	Description	Options
None	The GPO is not used.	n/a
State	Manually set the GPO state.	Pin State
Fault	Report a selection of possible faults.	• Link Fault • Mains Loss • 24 V input Loss • 24 V Output Error
Alive	Periodically switch between OPEN and CLOSED states.	Alive Period (1 to 60 seconds)

State

GPO state	Condition
OPEN	Pin State = OPEN
CLOSED	Pin State = CLOSED

Fault

Multiple selection is possible among the available fault options. If any of the selected options is reporting a fault, then the GPO reports a fault.

A fault is reported by the GPO state OPEN. In case of no fault detected, the GPO state is CLOSED.

GPO state	Condition
OPEN	At least one of the selected options is reporting a fault.
CLOSED	All the selected options are not reporting any fault.

Link Fault

The Link Fault option has a set of sub-options: each network port of LS10 can be selected to be included in the fault reporting.

Typically select the network parts that are known to be used, and unselect the network ports that are supposed to be unplugged.

Link Fault	Condition
YES	At least one of the selected network ports is DOWN.
NO	All the selected network ports are UP.

Mains Loss

Mains Loss Fault	Condition
YES	LS10 lost its mains power (the unit might still be powered up thanks to the backup power).
NO	LS10 mains power is present and correct.

24 V Input Loss

24 V Input Loss Fault	Condition
YES	LS10 is not detecting any +24 V backup power.
NO	LS10 is detecting +24 V backup power.

24 V Output Error

24 V Output Error	Condition
YES	LS10 is not able to provide +24 V on its backup power output.
NO	LS10 is providing +24 V on its backup power output.

Alive

The GPO state is alternating between OPEN and CLOSED states every time the Alive Period duration is elapsed.

P1 GPIO functions

Inputs

Every GPI can have two functions:

- one function when its state changes from LOW to HIGH,
- one function when its state changes from HIGH to LOW.

This allows the GPI to adapt to the type of device used for triggering the functions (push button, two-state switch, dry contact relay, etc.).

List of functions

List of GPI functions available with firmware 2.12.0.43. This list may evolve in future firmware releases.

Function name	Description	Options
None	The GPI is not used	n/a
Mute	Set all the outputs of the P1 to mute.	n/a
Unmute	Set all the outputs of the P1 to unmute.	n/a
Toggle Mute	Toggle between mute and unmute for all P1 outputs.	n/a
Load Configuration A	Load the configuration in selected memory slot A.	Configuration slot A (1 to 30)
Load Configuration B	Load the configuration in selected memory slot B.	Configuration slot B (1 to 30)
Load Next Configuration	Load the next available configuration.	n/a
Load Previous Configuration	Load the previously available configuration.	n/a

Toggle Mute

The manual mutes and unmutes that can happen between two toggles are not taken into account.

The GPI Toggle Mute logic remains internal to the last GPI action (mute or unmute).

Load A / B / Next / Previous Configuration

The Load Configuration functions cannot be used when LA Network Manager is controlling the P1. In this case, the command is discarded and an error is displayed on the P1 front panel.

Load Configuration A / B

If a Configuration slot is empty when trying to load it, then the command is discarded, and an error message appears on the P1 front panel.

Each GPI has its own A and B options for Configuration slot selection, allowing to load up to four different configuration slots from the two GPI of P1.

Load Next / Previous configuration

The next/previous configuration ignores empty configuration slots, and is circular (the next configuration slot after 30 is the slot 1, and vice-versa). If all configuration slots are empty, then the command is discarded, and an error message appears on the P1 front panel.

Outputs

When P1 is not powered, all its GPO are in the OPEN state.

List of functions

List of GPO functions available with firmware 2.12.0.43. This list may evolve in future firmware releases.

Function name	Description	Options
None	The GPO is not used.	n/a
State	Manually set the GPO state.	State Select
Power	Report a power failure.	n/a
Alive	Periodically switch between OPEN and CLOSED states.	Alive Period (1 to 60 seconds)
Ethernet Links	Report a failing or disconnected Ethernet network port.	• Ethernet Port 1 • Ethernet Port 2
Error	Report a global error of P1.	n/a
AES/EBU Lock	Report an AES/EBU lock issue on one or both AES/EBU inputs.	• AES/EBU input 1-2 • AES/EBU input 3-4
AVB Lock	Report an AVB lock issue on the AVB input streams.	• AVB input stream 1 • AVB input stream 2

State

GPO state	Condition
OPEN	Pin State = OPEN
CLOSED	Pin State = CLOSED

Power

GPO state	Condition
OPEN	The P1 lost its mains power or is turned off.
CLOSED	The P1 is correctly powered and is turned on.

Alive

The GPO state is alternating between OPEN and CLOSED states every time the Alive Period duration (set in seconds, from 1 to 60) is elapsed.

Ethernet Links

GPO state	Condition
OPEN	At least one of the selected Ethernet ports is DOWN, or there are no Ethernet ports selected for this function.
CLOSED	All selected Ethernet ports are UP.

Error

GPO state	Condition
OPEN	The P1 encountered an internal error.
CLOSED	The P1 is working correctly.

AES/EBU Lock

GPO state	Condition
OPEN	At least one of the selected AES/EBU inputs is not locked, or there are no AES/EBU inputs selected for this function.
CLOSED	All selected AES/EBU inputs are locked.

AVB Lock

In Normal Network mode, the P1 has two independent AVB input streams. Select one of them or both of them using the **AVB input stream 1** and **AVB input stream 2** options.

Network Mode = Normal	
GPO state	**Condition**
OPEN	At least one of the selected AVB input streams is not locked, or there are no AVB input streams selected for this function.
CLOSED	All selected AVB input streams are locked.

In Redundancy Network mode, the P1 has one single AVB redundant input stream (primary and secondary), which can be selected with the **AVB input stream 1** option. The second option **AVB input stream 2** is ignored.

Network Mode = Redundancy	
GPO state	**Condition**
OPEN	The primary input stream is not locked AND the secondary input stream is not locked, OR the redundant AVB input stream (AVB input stream 1) is not selected for this function.
CLOSED	The primary input stream is locked OR the secondary input stream is locked.

LA2Xi / LA7.16i GPIO functions

Each of the GPIO pins available on the LA2Xi or LA7.16i can be used either as an input (GPI) or as an output (GPO).

Inputs

When set as input, a GPI can have two functions:

- one function when its state changes from LOW to HIGH,
- one function when its state changes from HIGH to LOW.

This allows the GPI to adapt to the type of device used for triggering the functions (push button, two-state switch, dry contact relay, etc.).

List of functions

List of GPI functions available with firmware 2.12.0.43. This list may evolve in future firmware releases.

Function name	Description	Options
None	The GPI is not used	n/a
Mute	Set all the outputs of the amplified controller to mute.	n/a
Unmute	Set all the outputs of the amplified controller to unmute.	n/a
Toggle Mute	Toggle between mute and unmute for all amplified controller outputs.	n/a
Standby	Set the amplified controller to Standby mode.	n/a
Wakeup	Set the amplified controller to Online mode.	n/a
Toggle Standby / Wakeup	Toggle between Standby and Online modes.	n/a
Gain Up	Increase the gain of all outputs by +3 dB.	n/a
Gain Down	Decrease the gain of all outputs by –3 dB.	n/a
Load Configuration A*	Load the configuration in selected memory slot A.	Configuration slot A (1 to 8)
Load Configuration B*	Load the configuration in selected memory slot B.	Configuration slot B (1 to 8)
Load Next Configuration*	Load the next available configuration.	n/a
Load Previous Configuration*	Load the previously available configuration.	n/a

* For more information about Configurations and usage with L-Acoustics amplified controllers, contact avcontrol@l-acoustics.com.

Toggle Mute

If all outputs are already muted, then this command unmutes all outputs. In other cases, it mutes all outputs.

Gain Up / Down

The gain of all outputs is increased/decreased by 3 dB, unless one of the channels cannot follow this gain change because the upper or lower gain boundary is exceeded. In such case, the gain step is adjusted for all channels so that the limiting channel(s) stop(s) at the minimum/maximum allowed value.

Load A / B / Next / Previous Configuration

The Load Configuration functions cannot be used when LA Network Manager is controlling the amplified controller. In this case, the command is discarded.

Load Configuration A / B

If a Configuration slot is empty when trying to load it, then the command is discarded.

Each GPI has its own A and B options for Configuration slot selection, allowing to load up to eight different configuration slots from the four GPIO of LA2Xi, or up to six different configuration slots from the three GPIO of LA7.16i.

Load Next / Previous configuration

The next/previous configuration ignores empty configuration slots, and is circular (the next configuration slot after 8 is the slot 1, and vice-versa). If all configuration slots are empty, then the command is discarded.

Outputs

When LA2Xi or LA7.16i is not powered, all its GPO are in the OPEN state.

List of functions

List of GPO functions available with firmware 2.12.0.43. This list may evolve in future firmware releases.

Function name	Description	Options
None	The GPO is not used.	n/a
State	Manually set the GPO state.	State Select
Fault	Report a selection of possible faults.	• Amplifier state • Output temperature • Output error • Ethernet Links • AES/EBU Lock • AVB Lock
Alive	Periodically switch between OPEN and CLOSED states.	Alive Period (1 to 60 seconds)
Ethernet Links	Report a failing or disconnected Ethernet network port.	• Ethernet Port 1 • Ethernet Port 2
PA/VA	Report a PA/VA fault (input signal monitoring, loudspeaker load monitoring).	n/a
AES/EBU Lock	Report an AES/EBU lock issue on a selection of AES/EBU inputs.	LA2Xi: • AES/EBU input 1-2 • AES/EBU input 3-4 LA7.16i: • AES/EBU input
AVB Lock	Report an AVB lock issue on a selection of AVB input streams.	LA2Xi: • AVB input stream 1 LA7.16i: • AVB input stream 1 to 16

Fault

Multiple selection is possible among the available fault options. If any of the selected options is reporting a fault, then the GPO reports a fault. A fault is reported by the GPO state OPEN. In case of no fault detected, the GPO state is CLOSED.

GPO state	Condition
OPEN	At least one of the selected options is reporting a fault.
CLOSED	All the selected options are not reporting any fault.

Ethernet Links fault option

The Ethernet Link option has a set of sub-options: each network port of the amplified controller (port 1 and port 2) can be selected to be included in the fault reporting.

Typically select the network parts that are known to be used, and unselect the network ports that are supposed to be unplugged.

Ethernet Link Fault	Condition
YES	At least one of the selected Ethernet ports is DOWN, or there are no Ethernet ports selected for this function.
NO	All selected Ethernet ports are UP.

AES/EBU Lock fault option

The AES/EBU Lock option has a set of sub-options: each AES/EBU stereo input can be selected to be included in the fault reporting.

AES/EBU Lock Fault	Condition
YES	At least one of the selected AES/EBU inputs is not locked, or there are no AES/EBU inputs selected for this function.
NO	All selected AES/EBU inputs are locked.

AVB Lock fault option

The AVB Lock option has a set of sub-options depending on the amplified controller type: each AVB input stream can be selected to be included in the fault reporting.

LA2Xi has only one AVB input stream, which is redundant in case of Redundancy Network mode. This sub-option is present for compatibility with devices that have more than one AVB input streams (for instance LA7.16i or P1).

This sub-option must be selected for the reporting of the AVB input stream of LA2Xi to work in this situation.

Network Mode = Normal	
AVB Lock Fault	**Condition**
YES	At least one of the selected AVB input streams is not locked, or there is no AVB input stream selected for this function.
NO	All selected AVB input streams are locked.

Network Mode = Redundancy	
AVB Lock Fault	**Condition**
YES	At least one of the selected redundant AVB input streams has its primary OR its secondary stream not locked, OR there is no AVB input stream selected for this function.
NO	All selected redundant AVB input streams have their primary AND secondary streams locked.

Alive

The GPO state is alternating between OPEN and CLOSED states every time the Alive Period duration (set in seconds, from 1 to 60) is elapsed.

Ethernet Links

GPO state	Condition
OPEN	At least one of the selected Ethernet ports is DOWN, or there are no Ethernet ports selected for this function.
CLOSED	All selected Ethernet ports are UP.

AES/EBU Lock

GPO state	Condition
OPEN	At least one of the selected AES/EBU inputs is not locked, or there are no AES/EBU inputs selected for this function.
CLOSED	All selected AES/EBU inputs are locked.

AVB Lock

Network Mode = Normal	
GPO state	**Condition**
OPEN	At least one of the selected AVB input streams is not locked, or there is no AVB input stream selected for this function.
CLOSED	All selected AVB input streams are locked.

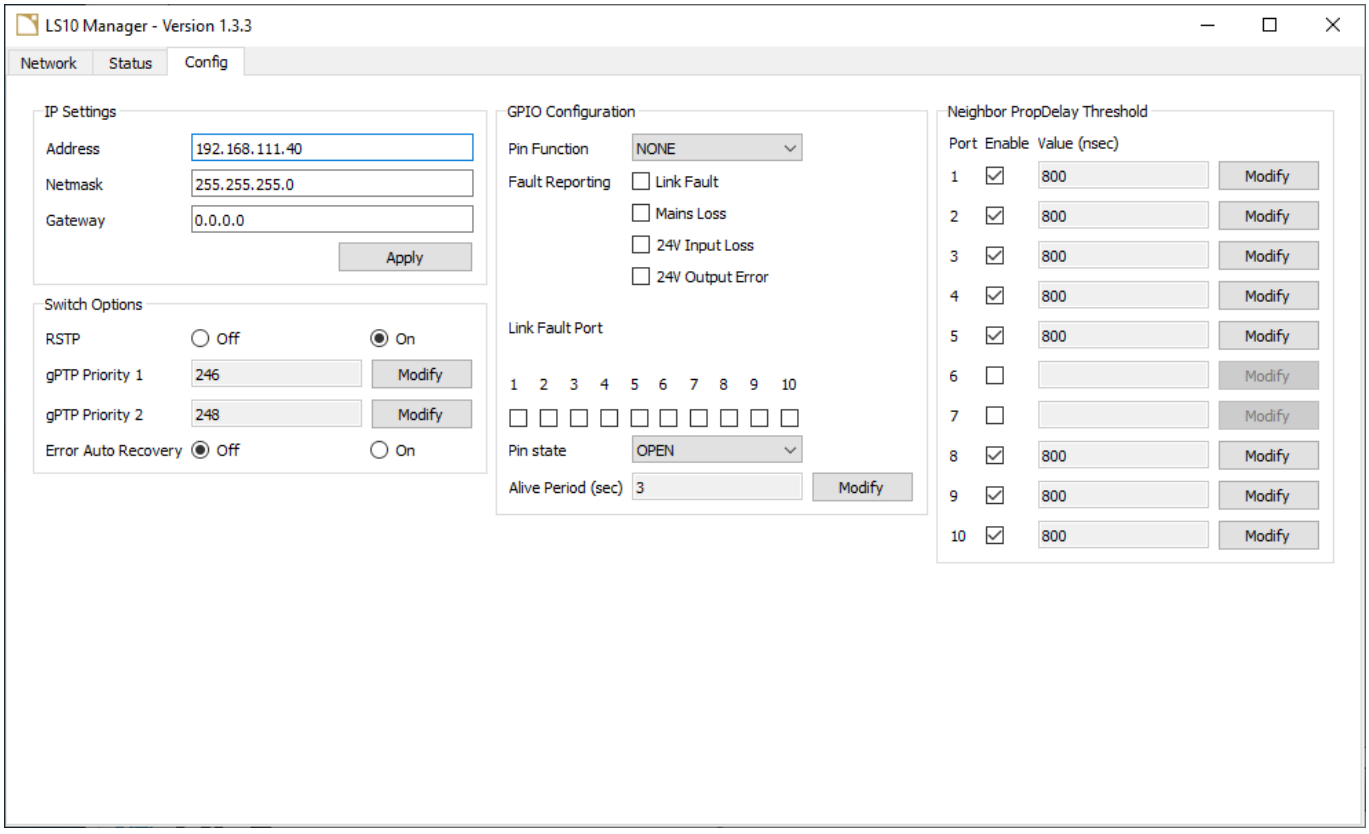
Network Mode = Redundancy	
GPO state	**Condition**
OPEN	At least one of the selected redundant AVB input streams has its primary AND its secondary stream not locked, OR there is no AVB input stream selected for this function.
CLOSED	All selected redundant AVB input streams have their primary OR secondary streams locked.

Configuration tools

The GPIO parameters of the L-Acoustics devices can be configured through the network thanks to L-Acoustics software tools or third-party control applications.

Device	GPIO setup tools	GPIO settings preserved at:		
		reboot	firmware update	reset to factory
LS10	• LS10 Manager (LA Network Manager)	Yes	Yes	No
P1	• LA Network Manager • Q-SYS plug-in for Networked Audio Processors • CRESTRON module for P1	Yes	Yes	Yes
LA2Xi	• LA Network Manager • Q-SYS plug-in for Amplified Controllers	Yes	Yes	No
LA7.16i	• LA Network Manager • Q-SYS plug-in for 16-channel Amplified Controllers • CRESTRON module for 16-channel Amplified Controllers	Yes	Yes	No

LS10 Manager



LS10 Manager is available in LA Network Manager main menu.

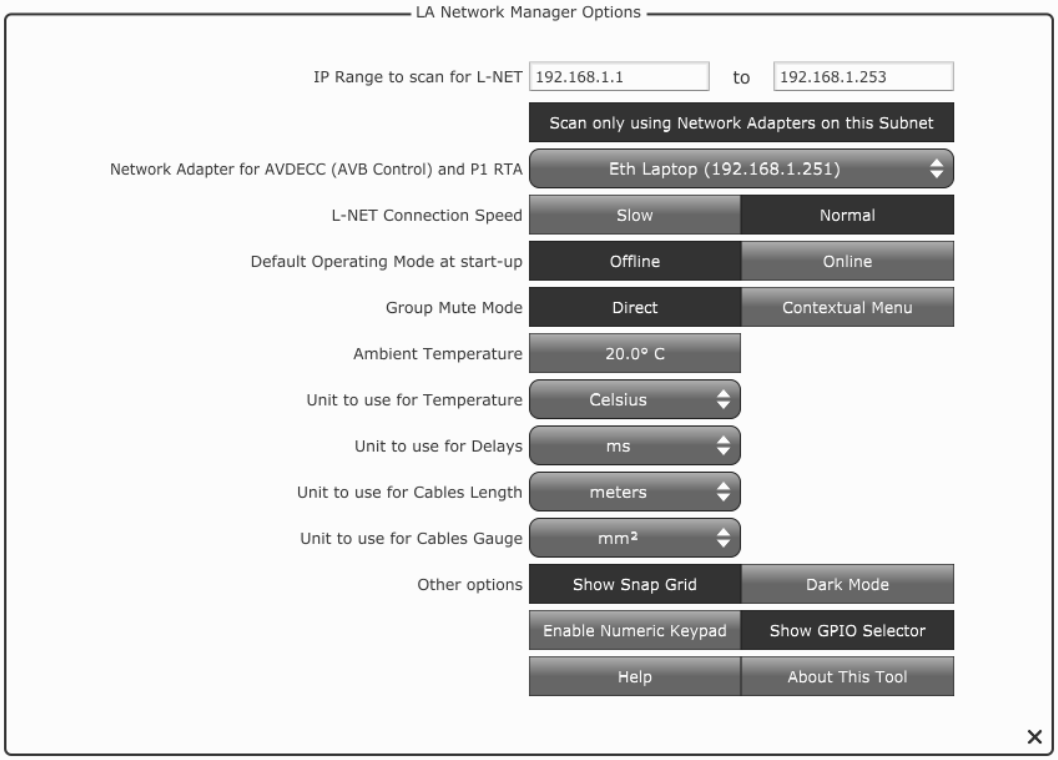
To configure the GPO of LS10:

- scan network for LS10 devices,
- connect to chosen LS10 unit,
- under the **Config** tab, select the requested options inside the **GPIO Configuration** section.

The current state of the GPO is displayed under the **Status** tab, inside the **Device Status / GPIO Status** section.

LA Network Manager

LA Network Manager Setup page is used to configure the GPIO parameters for P1, LA2Xi, and LA7.16i online devices. The GPIO configuration section of the Operating Mode panel can be enabled in the application's options.



To configure the GPIO of one or multiple online devices:

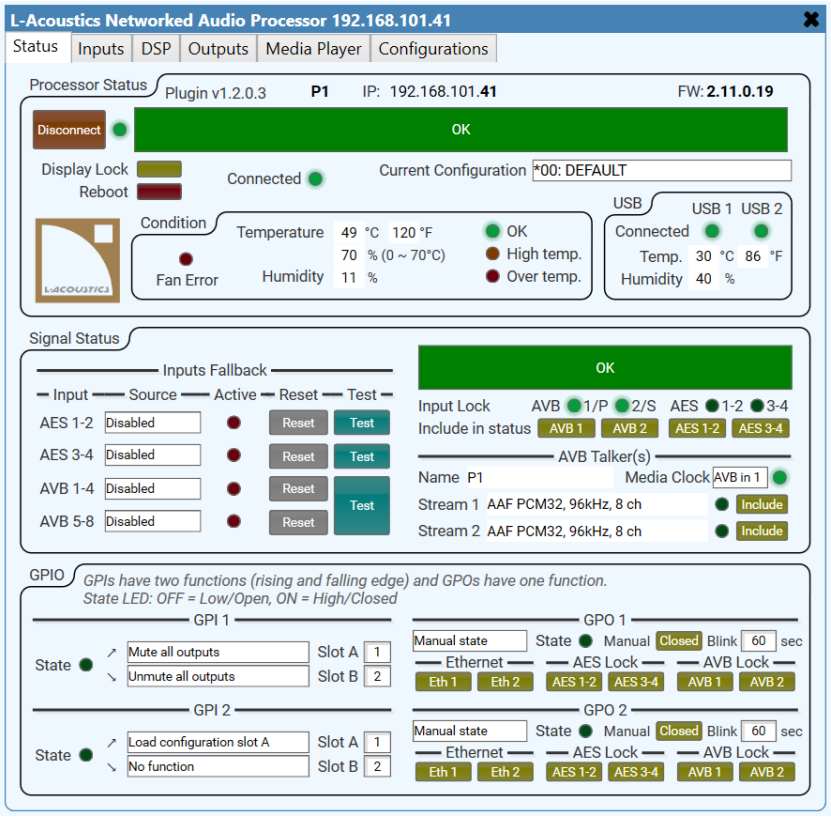
1. In the Setup page, select one or more online devices of the same type.
2. Open the Operating Mode Selector and select the requested GPIO options.

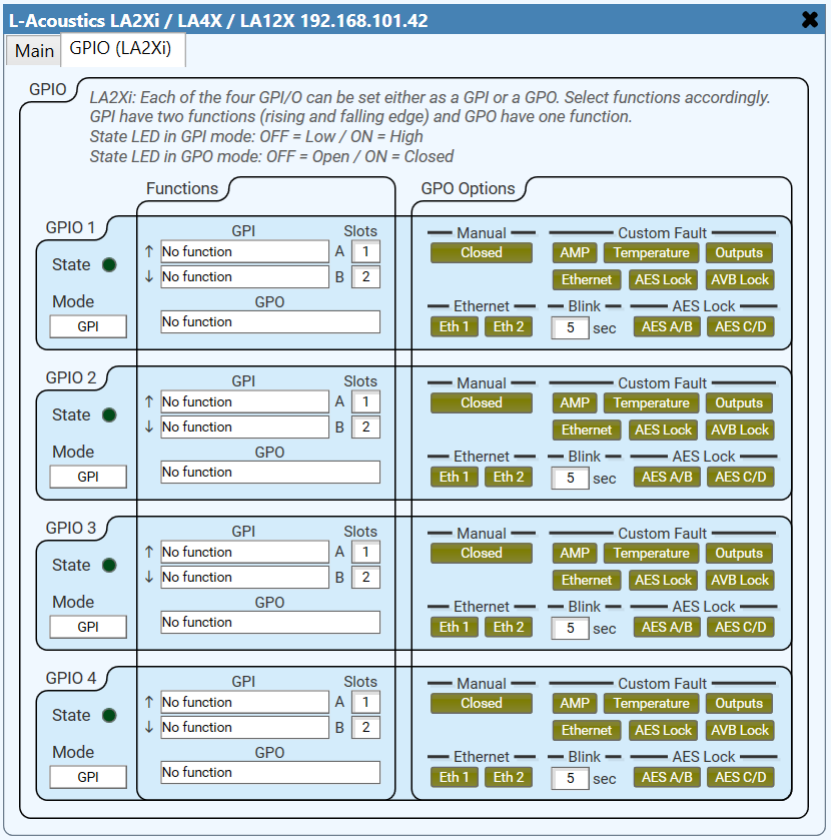
Q-SYS plug-ins

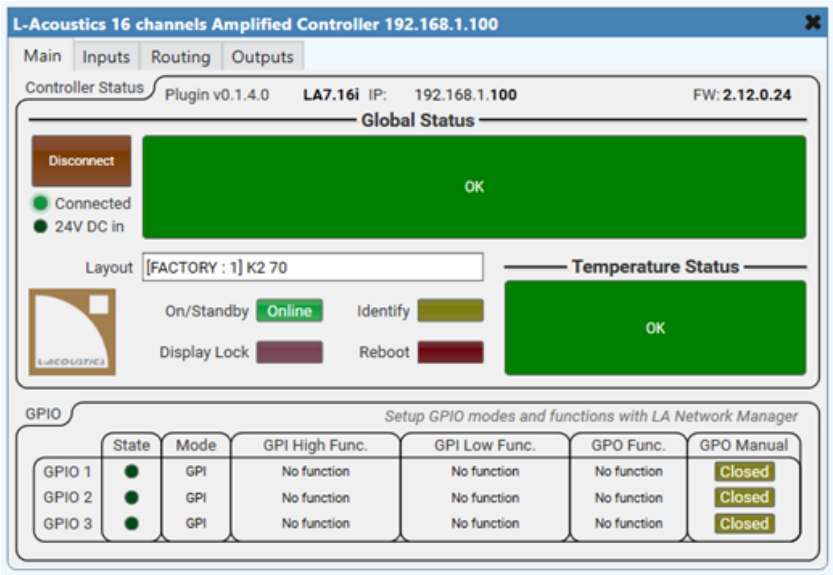
The controls available in the Q-SYS plug-ins allow to configure the GPIO for P1, LA2Xi, and LA7.16i devices.

When the Q-SYS plug-in connects to the device, it overwrites the device's GPIO settings with the plug-in's GPIO settings. Except for the first time the plug-in gets connected to the device: it reads the GPIO settings from the device because it does not have any settings stored yet.

This behavior allows the third-party system to restore GPIO settings in case of device maintenance or replacement leading to GPIO settings being lost on the device.






L-Acoustics 16 channels Amplified Controller 192.168.1.100
Main
Inputs
Routing
Outputs
Controller Status
Plugin v0.1.4.0
LA7.16i IP: 192.168.1.100
FW: 2.12.0.24
Global Status
Disconnect
Connected
24V DC in
OK
Layout
[FACTORY : 1] K2 70
On/Standby
Online
Identify
Display Lock
Reboot
Temperature Status
OK
GPIO
Setup GPIO modes and functions with LA Network Manager
State
Mode
GPI High Func.
GPI Low Func.
GPO Func.
GPO Manual
GPIO 1
GPIO 2
GPIO 3
GPI
No function
Closed

CRESTRON modules

The CRESTRON modules for P1 and LA7.16i do not offer full GPIO configuration.

The module allows for monitoring the GPI inputs state and use the State function of the GPO (see State (p.19)).