SoundOff Signal®

# bluePRINT®

TRAINING

CERTIFICATION

# manual

This Page Is Intentionally Blank

# OVERVIEW

Today's vehicles are increasingly complex, using sophisticated communication networks that render traditional warning system installation methods obsolete. Simultaneously, today's roadway environment requires first responders to compete for the attention of motorists, challenging their safety in many ways. One solution is to use automated, intelligent warning systems for safer responses.

SoundOff Signal® has responded by developing the industry's most complete, most capable Intelligent Control System. Introduced in 2014, bluePRINT® is a networked, programmable, logic-driven input/output hub that adapts to vehicle and environmental conditions. bluePRINT enhances safety by automating emergency lighting, siren functions, and other features to allow first responders to focus on the roadway environment. With bluePRINT, performance is planned, prioritized, and predictable.

A bluePRINT-equipped emergency vehicle is state-of-the-art. The vehicle communicates transmission, braking, headlamp, and door states, speed, and other information to the Central Controller, causing lighting and siren functions to change according to pre-programmed parameters. Agencies benefit with improved policy and law compliance, situation-specific warning profiles, automatic dimming and flash rate adjustments, and cost-saving load management features.

SoundOff's bluePRINT provides many benefits for installers as well. Upfits become more standardized, wiring is greatly simplified, and accessories like relays, diodes, timers, and fuse blocks are often eliminated. Importantly, bluePRINT's Link® feature provides a plug-n-play CANbus interface that protects vehicle circuit integrity by eliminating the need to splice into OEM wiring. Once a pilot vehicle is completed, additional vehicles can be more rapidly built and programmed.

# THINKING in "bluePRINT"

With bluePRINT, complex vehicle layouts are now easier to accomplish than ever before. The system offers up to 82 outputs, 96 inputs, and 450 amps of power distribution to handle any task. More than 50 vehicle data and status signals are available to work with. Up to five Remote Nodes can be used to simplify and consolidate wiring. bluePRINT can even run two control heads for added flexibility.

A successful bluePRINT build begins with planning and customer input. First, you'll need a solid grasp of the host vehicle's design and specifications. Next, you need to know what bluePRINT can do, and also what your customer's needs and expectations are. A review of current vehicle capabilities, common scenarios, recurring issues or maintenance problems, and department policies can be helpful.

When discussing how the bluePRINT system will be configured, consider the four functions of emergency vehicle warning systems:

1. Identification / Presence
2. Warn others of hazards
3. Request the right of way
4. Signal violators to stop

These provide a basis for developing situation-appropriate lighting profiles which can be further configured to change based on park status, door status, speed, ambient lighting, and so forth. You can also configure task or scene lighting, arrow and siren functions, cruise modes and more. In this way, the system can be setup to react to a variety of scenarios

When planning lighting profiles, consider the 360-degree safety(1) needs of all roadway users. A compromise must be found between effective signals which gain attention, and excessive signals which distract and disorient. bluePRINT is capable of much more than just flashing lights; it can address tactical considerations to enhance officer safety, providing an advantage in chaotic, stressful situations.

bluePRINT improves how warning systems communicate, offering consistent, clear, and intuitive messages. Slow-moving vehicles can have slow flash patterns, fast-moving vehicles can have rapid patterns and flashing white lights. Parked vehicles can have fewer lights flashing. Brake lamps can be prioritized over warning lights. Low power can activate based on ambient lighting but turn off if the siren is active. All without the vehicle operator having to make decisions under stress.

The number and types of lights and peripheral devices that bluePRINT will control is another important consideration. SoundOff lightbars integrate directly and easily into the system. Secondary lights become remote units, as the system will control their functions. Multi-color lights are perfect for bluePRINT, which can control all colors. Accessories, like cameras, radios, and radars, can be powered through bluePRINT to eliminate parasitic drains.

Successful upfitting has always been a matter of planning ahead, and a successful bluePRINT upfit is no different. However, the end results will be worthwhile and redefine what you think emergency vehicle warning systems are capable of. SoundOff Signal's bluePRINT will help you take upfitting to the next level, one where control systems are not just installed, but integrated and intelligent. Once again, thank you for choosing to be our partner. SoundOff Signal is excited to add you to our Certified Installer list!

*(1) 360-Degree Safety accounts for all components of the environment an emergency vehicle is operating in at a given time, including the vehicle, operator, other roadway users, weather, ambient lighting, geography, & roadway design.*

# Table of Contents

## System Setup



## Siren Setup



## Lightbar Programming



## Diagnostics



## Appendix






**bluePRINT Training Certification Manual  © SoundOff Signal 2019**

**bluePRINT Programming Manual - 4th Edition - October 2019 v4.3 - Printed February 2020**

# bluePRINT Components & Connectivity

bluePRINT is a System consisting of several different components that can be utilized and customized to suit any vehicle's needs.

Throughout this chapter, the capabilities of each component is covered.

## The Central Controller

The main component of the bluePRINT system, and what makes everything possible is the Central Controller. The Central Controller functions much like a vehicle's Body Control Module (BCM), acting as a centralized data signal processor. The Central Controller manages all flashing, timers, load management, and logic processing.

It controls additional components of the bluePRINT system through various data buses, which will be covered later in this chapter.

The Central Controller has twenty-four individual outputs, twenty of which can be configured as a flashing or for steady-on output, the remaining four supplying constant steady output (fused at up to 10 amps).

Four of the twenty configurable outputs are in-rush capable, meaning they can momentarily handle over 10 amps of current. Two outputs are additionally capable of diode isolation. The following table lists each output, its current rating, and any specialized functionality:

| Output | Amp Rating | Additional Info |
|---|---|---|
| 1 | 5 | |
| 2 | 10 | Xenon Inrush |
| 3 | 5 | |
| 4 | 10 | |
| 5 | 5 | |
| 6 | 5 | |
| 7 | 10 | Xenon Inrush |
| 8 | 5 | |
| 9 | 10 | |
| 10 | 5 | |
| 11 | 10 | Constant Power |
| 12 | 10 | Constant Power |
| 13 | 10 | Constant Power |
| 14 | 10 | Constant Power |
| 15 | 5 | Diode Isolated |
| 16 | 10 | Xenon Inrush |
| 17 | 5 | |
| 18 | 10 | |
| 19 | 5 | |
| 20 | 5 | |
| 21 | 10 | Xenon Inrush |
| 22 | 5 | |
| 23 | 10 | |
| 24 | 5 | Diode Isolated |

In the above table there are four groups of five outputs separated in the middle by the four constant outputs. Each of these groups of 5 outputs is referred to as a switch.

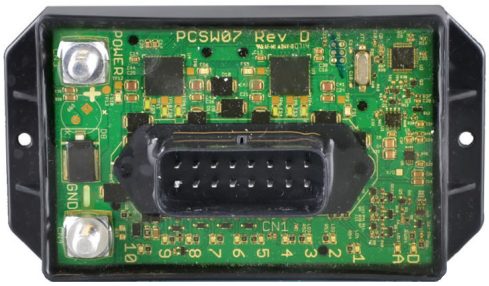
Looking closer at each switch, there are three 5 amp outputs and two 10 amp outputs. You will notice that there is a consistent pattern to the layout of each switches outputs and current capabilities.

The Central Controller communicates to the different components of the bluePRINT system using 4 data buses: **Control Panel Bus, Lightbar Data Bus, Siren Data Bus,** and **LIN Data Bus.**

Each of these data buses and the associated connectivity will be covered in the section “Component Connectivity” on page four.

The Central Controller is rated up to 100 amps of output current.

## Remote Nodes




The primary expansion to bluePRINT is the Remote Node. Each remote node adds 10 outputs to the bluePRINT system, as well as 4 inputs that are selectable between a high (positive) or low (ground) signal.

bluePRINT supports up to 5 Remote Nodes, allowing for an additional 50 outputs!

The output layout of the Remote Node is identical to the first 10 outputs, or the first two switches, of the Central Controller.

Each Remote Node connects to the bluePRINT Central Controller using a single wire, connected to the **LIN Data Bus**.

Each Remote Node rated up to 50 amps of current capability to bluePRINT.

## Input Node

Next in line is the Input Node. The Input Node provides 20 discrete wire inputs for the bluePRINT system. 13 of these inputs are high or low selectable, and the remaining 7 respond to a high only signal.

This component is also connected to the **LIN Data Bus**.


As an added feature, any nFORCE® or mpower® lightbar Break Out Box (B.O.B.) can be used as the Input Node. When doing this, the number of discrete wire inputs is reduced to 19 (13 are high or low selectable, 6 are high signal only).

*Please note*: when using a lightbar B.O.B. it is also connected slightly different. Instead of connecting this to the LIN Bus, it is connected to the **Lightbar Data Bus**.

There are configuration options that need to be programmed for the Input node, which is described on page 55, and additionally on page 70 for Break Out Boxes.

## bluePRINT Link®


bluePRINT Link utilizes vehicle data harvested from the Controller Area Network Bus, otherwise known as the CAN-BUS.

bluePRINT Link provides 24 CAN-BUS inputs to be utilized with bluePRINT. Each input can be

configured to use one of more than 50 signals provided by the vehicle.

Each bluePRINT Link kit includes a CAN-BUS T-Harness, Central Controller connectivity cable, and bluePRINT Link module.

Depending on the make and model of the vehicle application, the CAN-BUS T-Harness may be a standard OBD-II data link connector, or a more vehicle specific gateway connector.

bluePRINT Link is connected to the **Control Panel Bus**.

400 Series Siren

## 400 Series Siren Amplifiers

bluePRINT will work with any 400 series bluePRINT or nERGY Siren amplifier, including console and remote mount versions.

The functionality of these amplifiers is improved significantly when using bluePRINT.

In a traditional installation, all the different controls are directly mapped to specific outputs on the 400 series amplifier.

Now, with bluePRINT each of these outputs can be utilized in a more effective way allowing equipment like a modem, computer, or power port to be wired directly to the unit.

bluePRINT turns each of these outputs on or off based on a fully customizable configuration.

Each 400 amplifier adds 12 relay controlled outputs to bluePRINT, and provide 100 amps of power.

There are options for a 100 watt and 200 watt siren amplifier. When utilizing a 200 watt amplifier, a true dual tone function is provided, allowing different tones to play on each speaker.

400 series amplifiers connect to the **Siren Data Bus.**

A siren amplifier adds 100 amps of output power to the bluePRINT system.

## 200 Series Siren Amplifiers

An alternative to the 400 series amplifier is the 200 series amplifier. The 200 series is a weatherproof amplifier that can be mounted in most environments, including under the hood of the vehicle.

Utilizing this type of amplifier allows an installer to be even more flexible in how the vehicle is laid out.

An 200 Series amplifier provides 100 watts of output power to a single speaker. bluePRINT supports up to two amplifiers, which can be used with a different tone on each, or in unison.

## bluePRINT Sync®

bluePRINT Sync is the newest component to the bluePRINT family. With bluePRINT Sync installed, bluePRINT synchronizes displayed patterns between vehicles that are commonly equipped with bluePRINT Sync utilizing GPS technology. Any time two or more vehicles are

displaying the same pattern, they will be synchronized.

bluePRINT Sync adds the most functionality when paired with bluePRINT Link. Using this pair together allows for additional functionality by using vehicle data to further enhance bluePRINT's function. Factors such as speed or ambient light can help control patterns, which lights are active, and how bright they are while keeping two or more vehicles in perfect synchronization.

For more information on programming bluePRINT Sync, please refer to the section in the appendix on page 101.

Just like bluePRINT Link, bluePRINT Sync is connected on the **Control Panel Bus**.

## Control Panels

bluePRINT supports up to two different control panels on the system.

Each panel can provide up to 22 of 30 available control panel inputs to the bluePRINT system, depending on panel type and programming. This allows some functions to be shared between two panels, and other functions to be independent.

bluePRINT Sync

Any of the bluePRINT or nERGY control panels can be used with bluePRINT, regardless if it is a remote type or console mount type panel.

Please read the next section, "Component Connectivity" for detailed instructions on how to connect the different control panels.

## Component Connectivity

**Power & Ground:** Source power for each of the bluePRINT components from the closest constant power location. Keep in mind the requirements and capacity of each component when hooking them up to power. Be sure to fuse accordingly.

**System Ignition Sources:** bluePRINT requires a vehicle ignition source input to wake the system up. This ignition input can be connected at either the Central Controller (pink wire), Input Node (Input #12), any Remote Node (Input #1), or the 480 Siren Amplifier (orange/black). There is no need to provide more than one ignition input to the system.

*Please note, a Breakout Box or 200r Amplifier cannot be used to source ignition for the bluePRINT system.*

## The Central Controller Data Bus Connectivity Overview

**LIN Data Bus:** The LIN bus is a one wire communication bus located on the 4 pin Molex connector next to the ground stud. Pin #2 (yellow wire).

Remote Nodes, Input Nodes, & 200r Siren Amplifiers utilize this data bus for communication.

When using a lightbar B.O.B. as the system Input Node, *do not* connect it to this wire.

**Lightbar Data Bus:** All lightbar data between the lightbar B.O.B. and the Central Controller are connected through the RJ-45 modular port labeled LB on the Central Controller.

When using a lightbar B.O.B. as an Input Node, it gets connected using a standard Ethernet cable to this port.

**Control Panel Bus:** Any SoundOff Signal remote style control panel can be hooked up to the RJ-45 modular port labeled CP on the Central Controller using a standard Ethernet cable.

This includes remote push button, remote rotary, and handheld control panels.

When using bluePRINT Link with the system, it is also hooked up to this port through the supplied Ethernet cable.

**Siren Data Bus:** When using a 400 series siren amplifier with bluePRINT, it is connected to the RJ-45 modular port labeled SIREN.

This is also where a console mount (one piece) siren, or secondary remote control panel is connected.

Any of the remote panels as well as console mounted sirens are supported on this port.

When using a remote control panel on the siren port, a 400 series amplifier is required for operation.

**bluePRINT Tip:**

bluePRINT should not be run through any device that controls the power supply. bluePRINT has it's own built in timers and load shed.

**Ethernet Splitters:** In some installations, two or more pieces of equipment may need to share a Data Bus. In these cases, an Ethernet splitter may be used.

Please do not confuse an Ethernet splitter with an Ethernet switch or router.

Ethernet splitters can be used at either end of a data bus connection. For example, bluePRINT Link can be plugged into the **Control Panel Bus** either at the Central Controller, or at the Control Panel itself.

SoundOff Signal typically provides splitters with lightbars when specified, and they are also available for purchase separately.

## Schematics

All schematics for bluePRINT, as well as example layouts are in the appendix on pages 84-86.

This includes a visual connectivity chart for bluePRINT.

# Vehicle Layout

## Decentralization

What makes bluePRINT unique is decentralization of its core components. By decentralizing, components can be placed closer to whatever they are controlling.

This allows for shorter wire lengths to each individual light or object being controlled. Only a single wire interconnects each component to the Central Controller.

*For example*: if a vehicle has 4 lights on a push bumper, 6 lights in the center area of the vehicle, and 4 more lights in the tailgate, the lights in the front could be connected to a Remote Node in the front. Lights in the center of the vehicle can be controlled by the Central Controller. And finally, rear mounted lights can be controlled by a Remote Node in the tailgate.

The siren amplifier could be mounted where it was most convenient, or if using the 200 amplifier, it could be mounted under the hood, close to the siren speakers themselves.

A system can be as simple or complex as the installer needs it to be, depending on the requirements of the end user.

## How Many Outputs?

When planning out the number of components for a bluePRINT installation, there are factors that need to be considered.

First, how many lights are going to be connected to the bluePRINT system?

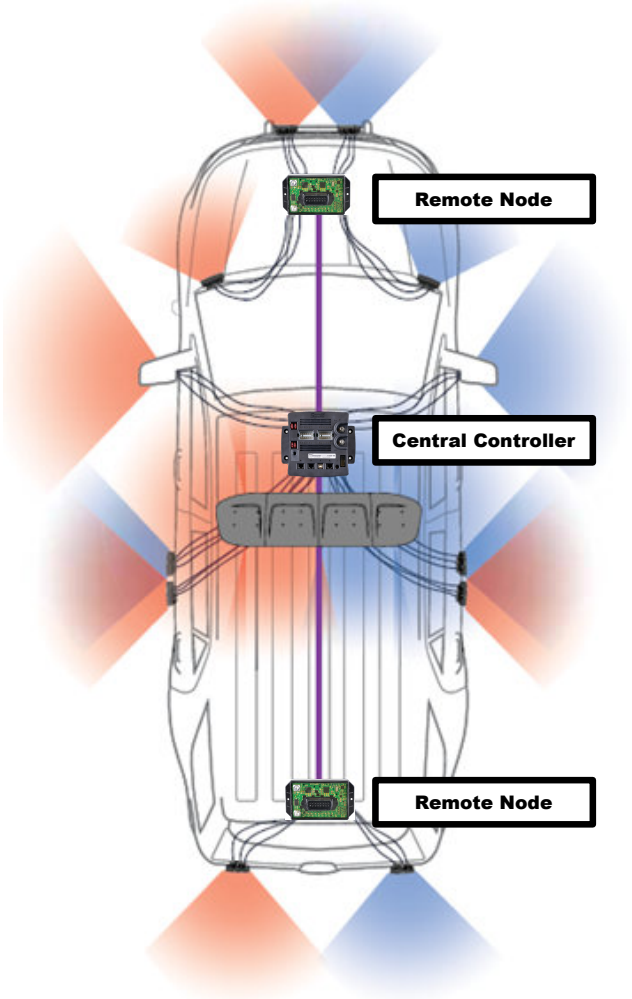
Second, of those lights, how many are single, dual or triple color?

Third, is there anything that needs a special output, like an in-rush or diode isolated output?

Fourth, with the lights aside, is there other equipment that bluePRINT can provide controlled power for?

Once those questions are answered, it is time to calculate outputs.

The basic calculation: for each single color SoundOff light, one output is needed. If a light is dual or triple colored, it will need two outputs.




Example of Decentralization

This gives you the minimum number of flash-able outputs, allowing full control over every single light independent of all others.

Other equipment, like computer docks, modems, USB power, and other accessories, don't need a flash-able output. For equipment like this, we recommend utilizing the 400 series siren amplifier. The 12 outputs that are provided can cover most accessory equipment used in a vehicle installation.

Using the example from the previous section, "Decentralization," there were 4 lights in the front end, 6 in the middle, and 4 in the tailgate.

If all of these lights were dual or triple color, 28 outputs would be recommended, allowing independent control of each light.

That could be done with the Central Controller (20 flash-able outputs) and a single remote node (10 flash-able outputs).

When setup like this, it is typical to have a remote node under the hood control the 4 lights in the front end, and the Central Controller to control the remaining 10 lights.

In this scenario, a second remote node is not needed to meet our output needs. However adding a second remote node provides greater flexibility and the installation would be faster and cleaner, using less wire and connections.

Why? Remember the 4 lights that were in the tailgate of the vehicle. If they were all dual color, that will mean they require 8 outputs. That is 8 wires that have to run from the tailgate, through the passage boot, into the vehicle, and from there to wherever the Central Controller is located.

That is a lot of wire, and time.

If the additional node was there, the only wire running from the node to the Central Controller is the data wire.

## Inputs

With bluePRINT, inputs are just as important as outputs for realizing the system's capabilities. System inputs allow bluePRINT to determine what the vehicle is doing and to prioritize what is going on with the system.

The more connected inputs, the more bluePRINT can be controlled and customized. Each input makes the system more intelligent.

Some inputs may be provided via the CAN-BUS using bluePRINT Link, others may need to be discretely tied into electrical signals from the vehicle, like at a Body Control Module (BCM) connector. Another possibility could be upfitter added switches or buttons.

A discrete signal is one that has a wire hooked up to bluePRINT.

When discretely tying into Original Equipment Manufacturer (OEM) wiring, it is best to review and follow the vehicle manufacturer's best practices. In the appendix of this manual on page 103, are instructions and web-links for best practices.

Each discrete signal can be connected to bluePRINT using the closest component. For example, if the manufacturer provided an upfitter harness in the console, any signals that were located there could be tied to input node, which typically is located there.

If a discrete headlight or high beam signal was required, those signals could be connected to the remote node under the hood of the vehicle.

Certain input signals are going to be common to the majority of bluePRINT installations.

First, and foremost is the ignition input. Ignition is the input that signals bluePRINT to "wake up" and turn on. Depending on the system setup, ignition can be connected to the Central Controller, any remote node, the input node (but not the B.O.B.), or the 400 series amplifier.

Whichever component that is used, can be selected under “Ignition Input Source” which is covered on page 54.

The next input that is typical to all installations is the horn ring input. It is recommended to always use a low current signal between the horn button and the horn relay, which is usually a low (ground) signal when active.

The horn ring is typically wired in series with the 200 or 400 series amplifier with the signal coming from the horn button connected to the horn ring input on the siren, and the signal between the siren and the horn connected to the horn output.

bluePRINT Link provides input signals for bluePRINT without the need of splicing into factory wiring. Additionally, bluePRINT Link allows access to signals that couldn’t be utilized when discretely wired, like vehicle speed, or brake torque. For more information on bluePRINT Link, see page 34.

**bluePRINT Tip:**

However the system is setup, it is important to provide constant power to any bluePRINT component. They were all designed to run with a constant power supply, and will shut themselves down as needed.

The average draw of a bluePRINT component in standby mode is around 350 micro amps. That is one hundred times less than the parasitic draw of a vehicle BCM!

## Power & Ground

Because bluePRINT is decentralized, not all power needs to be routed from the same source. This means that if there is a vehicle power source near a bluePRINT component, power can be taken there for that component.

*For example*: the Chevrolet Tahoe police package or special service package has a battery in the front end, an upfitter power source in the console area, and a secondary fuse panel in the rear end.

When sourcing power locally be sure to protect the bluePRINT components with a fuse, and to also keep in mind the limitations of the power source. bluePRINT components should be fused at 125% of the current requirement.

System grounds should be kept as short as possible while still connecting to a factory ground point.

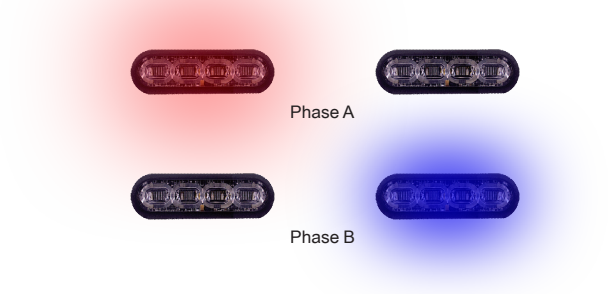
For more information on best practices, see page 103 in the appendix.

## Odd vs Even Outputs / Phasing

With bluePRINT, all perimeter lights on a vehicle flash in two phases, A or B. These phases alternate with one another.

In a default setup, phases A and B correspond to odd (A) and even (B) outputs system-wide.

That means that an odd output on one component, like a remote node under the hood, will alternate with an even output on another component, like the Central Controller.




Phasing can be changed for a given input within the bluePRINT software at any time, to allow more flexibility with pattern control. This is covered on page 30.

When laying a vehicle out, this is something that should be taken into consideration, since it can help limit the amount of phase programming in later steps.

There is also a global phasing change, which modifies all instances of an output's phase. This is typically used when multiple alternating lights were connected on the same phase. This allows for corrections to be made. For more information, please refer to global phase changes on page 58.

Keep in mind, when making a global phase change, this is a change that should occur on all vehicles in a bluePRINT installation. It is not recommended to "fix" one vehicle through software programming in a multi car installation, when that vehicle has a light on the wrong phase. This creates a situation where there are now two different programs involved with that multi car installation.

## SoundOff Signal Lights and bluePRINT

Most SoundOff Signal lights have built in functionality to allow them to flash without using bluePRINT.

These lights can be used with bluePRINT by grounding the Green (Sync) wire. When this is done, the light is now in "bluePRINT Mode."

In bluePRINT mode, the light will no longer flash on its own and requires an external source to control when it flashes.

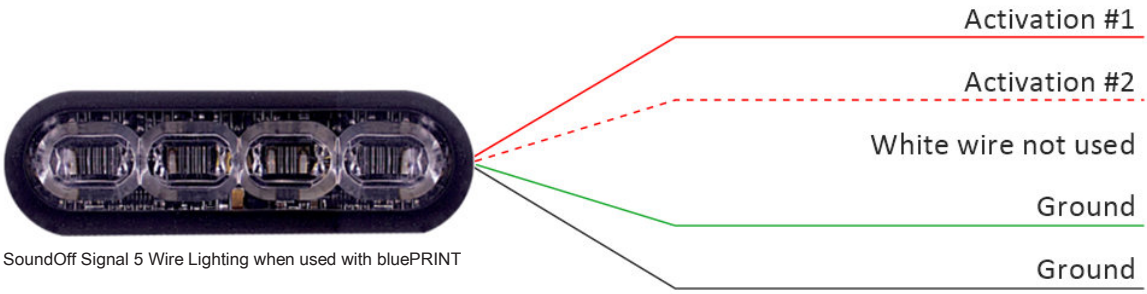
In the case of a multi-colored light, the two activation wires on the light determine what color the light produces.

The primary activation wire, which is red will activate the first color of the light, steady on.

If the light is a dual or triple color, the secondary activation, which is red/white, will activate the second color of the light, steady on.

In the case of a triple color light, to activate the third color, energize both the red and red/white wires.

SoundOff lights come with different wire configurations as well. Older lights have 3 or 4 wires to control them, and newer lights have 5 wires. bluePRINT was designed to work with the 5 wire lights and can possibly damage older 3 and 4 wire lights when flashing.




SoundOff Signal 5 Wire Lighting when used with bluePRINT

Those older lights can still be used, but it is recommended for bluePRINT to supply steady power and let the light flash using it's own flasher.

## Additional Notes

To aid in vehicle layout, the use of standardized forms is recommended. On the SoundOff Signal website, as well as in the appendix on page 103, are "Live Forms."

There is a form for each of the following components. Central Controller, Remote Nodes, Input Nodes (or B.O.B.), and 400 series amplifiers.

Each of these forms can be printed out blank or completed. It is recommended that they are filled out prior to printing, so they can be saved for future reference. The following pages show examples of the live forms.

Central Controller Live Form

bluePRINT automatic logic

**CENTRAL CONTROLLER INSTALL TEMPLATE**

Department: _____
Vehicle: _____
Installer / Date: _____
Mounting Location: _____

(Power) + AUTOMOTIVE 100 AMP MAX FUSE OR BREAKER

(Ground) −

NOT USED
Ignition _____
Remotes/200R/Input Data _____
External Reset _____

Wire Color

| | | | |
|---|---|---|---|
| _____ | 5A, Output 1, Pin 11 | Pin 12, Output 24, 5A | _____ |
| _____ | 10A, Output 2, Pin 9 | Pin 10, Output 23, 10A | _____ |
| _____ | 5A , Output 3, Pin 7 | Pin 8, Output 22, 5A | _____ |
| _____ | 10A, Output 4, Pin 5 | Pin 6, Output 21, 10A | _____ |
| _____ | 5A , Output 5, Pin 3 | Pin 4, Output 20, 5A | _____ |
| _____ | 5A, Output6, Pin 1 | Pin 2, Output 19, 5A | _____ |
| _____ | 10A,Output 7, Pin 11 | Pin 12, Output 18, 10A | _____ |
| _____ | 5A , Output 8, Pin 9 | Pin 10, Output 17, 5A | _____ |
| _____ | 10A , Output 9, Pin 7 | Pin 8, Output 16, 10A | _____ |
| _____ | 5A, Output 10, Pin 5 | Pin 6, Output 15, 5A | _____ |
| _____ | 10A,Output 11, Pin 3 ON | ON Pin 4, Output 14, 10A | _____ |
| _____ | 10A,Output 12, Pin 1 ON | ON Pin 2, Output 13, 10A | _____ |

Always On, Output 11, 10A
Always On, Output 12, 10A

Always On, Output 14, 10A
Always On, Output 13, 10A

RESET
SIREN
USB — USB for configuration & diagnostics only
CP — Serial: Control Panel #1 bluePRINT Link
LB — Serial: Lightbar
Serial: 400 Amplifier Control Panel #2

⋈ = Backfeed Protection ◇ = Xenon Inrush

Remote Node Live Form

bluePRINT automatic logic

**REMOTE NODE INSTALL TEMPLATE**

Department: _____
Vehicle: _____
Installer / Date: _____
Mounting Location: _____

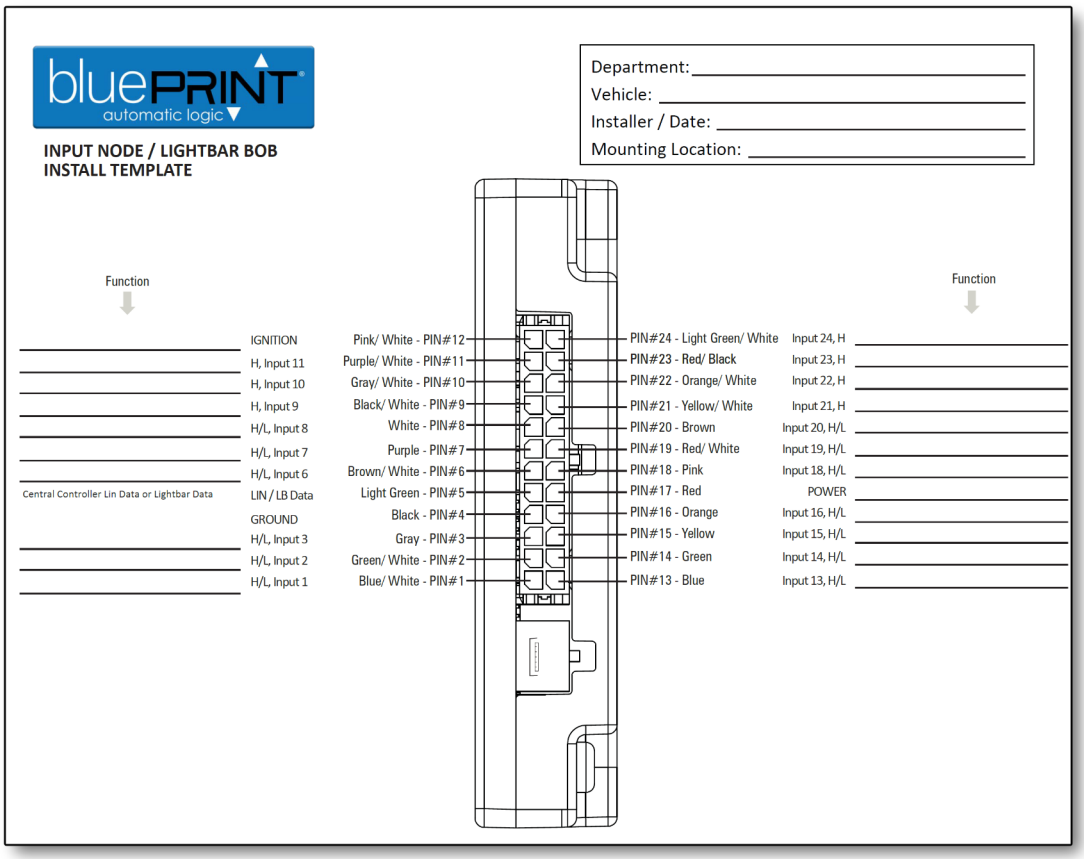
(Ground) −

(Power) + AUTOMOTIVE 50A MAX FUSE OR BREAKER

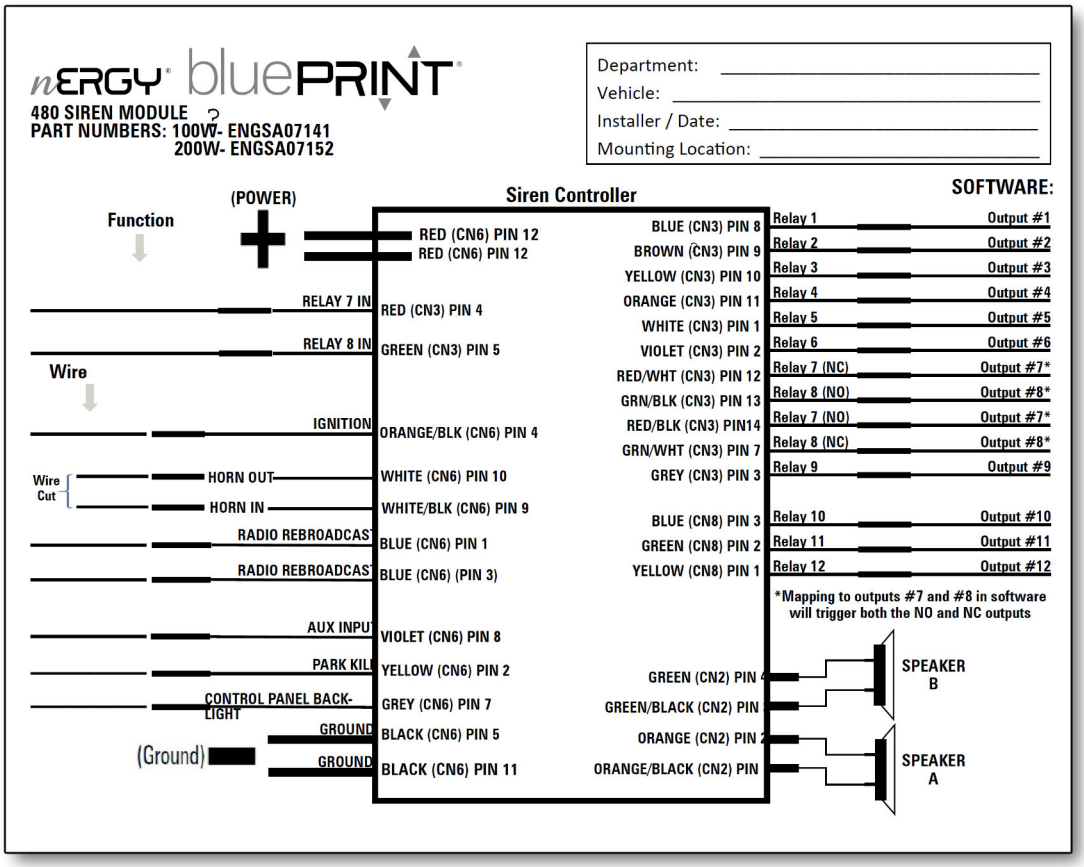
| Wire Color | Function | | Function | Wire Color |
|---|---|---|---|---|
| _____ | _____ | 5A, Output 10, Pin 9 | Pin 1, Output 9, 10A _____ | _____ |
| _____ | _____ | Input 1, Pin 10 | Pin 2, Output 8, 5A _____ | _____ |
| _____ | _____ | Input 2, Pin 11 | Pin 3, Output 7, 10A◇ _____ | _____ |
| _____ | _____ | Input 3, Pin 12 | Pin 4, Output 6, 5A _____ | _____ |
| _____ | _____ | Input 4, Pin 13 | Pin 5, Output 5, 5A _____ | _____ |
| | ID # _____ | ID Select, Pin 14 | Pin 6, Output 4, 10A _____ | _____ |
| _____ | Central Controller LIN Data | DATA, Pin 15 | Pin 7, Output 3, 5A _____ | _____ |
| _____ | _____ | 5A, Output 1, Pin 16 | Pin 8, Output 2, 10A◇ _____ | _____ |

◇ = Xenon Inrush

Input Node Live Form




480 Amplifier Live Form



# Software Downloading & Installation

bluePRINT 3 installation consists of three different pieces of software.

The first and most obvious software is the bluePRINT 3 program. The second piece of software is the SoundOff Signal Lightbar Configurator. Finally, the FTDI Drivers will need to be downloaded

The minimum requirements for bluePRINT to run are as follows:

*Processor:* 1Ghz

*RAM:* 512MB / 4GB Recommended

*OS:* Windows 7

*Resolution:* Any will work, but High Definition resolutions are recommended.

An internet connection is required during the installation of any bluePRINT software component..

There is a specific recommended order for installing the software components to avoid any error messages. Installing things out of this order will not result in harm, just a bit more clicking to close communication error messages.

## Windows Driver Installation

The first software component that should be downloaded is the Windows drivers package for the FTDI chip. This is the main communication driver Windows uses to talk to bluePRINT or lightbars.

If the computer has been used previously to program SoundOff Signal lightbars, this step can be skipped.

**Installation Tip:**

All of the software listed in this section can be installed in any order.

We recommend installation in this specific order to prevent any error messages from coming up during installation. Most installation error messages are because the FTDI Drivers have not been fully installed.

To download drivers, navigate to the following webpage:

“https://www.soundoffsignal.com/resources/software/”

Look for the download link for the FTDI (USB Driver) and click on it. This will open a new browser page with the FTDI chip website download page.

Once here, scroll down to the table labeled:

“Currently Supported D2XX Drivers:”

The first row is for Windows drivers. Here the driver can be downloaded for either 32-bit or 64-bit systems. Alternately, there is a setup executable link in the comments column that auto detects which type of driver to install.

USB A to Mini B

USB A to B Cable

Once downloaded, go ahead and click on the installation file. It may be inside of a compressed file, in which case, you will need to extract that file to a location of your choosing.

Following installation of the FTDI drivers, connect to a B.O.B. or currently powered Central Controller with the applicable USB cable to allow Windows to complete the drivers installation.

USB cables required:

| | |
|---|---|
| *B.O.B.* | USB A to Mini B |
| *Central Controller:* | USB A to B |

## Lightbar Configurator

To download the SoundOff Signal Lightbar Configurator, close the web page for the FTDI drivers. The SoundOff Signal software page should still be open. If not, here's the link:

“https://www.soundoffsignal.com/resources/software/”

Click on the download link for the nFORCE Lightbar Configuration Utility, otherwise known as the SoundOff Lightbar Configurator.

Once, downloaded, install the program and let it run for the first time. When this step is done, close the program.

## bluePRINT 3

To access bluePRINT 3 software, you must have a Dealer Showroom account with bluePRINT access. This usually is provided during a bluePRINT training event. Please contact your SoundOff Signal territory representative for further instruction.

To access the software, please go to:

“https://www.soundoffsignal.com/dealer-portal/”

This will bring you to the login page. Go ahead and fill in any login information to access the Dealer Showroom.

Once in the Dealer Showroom, look for the bluePRINT section badge:


Click on that badge to navigate to the bluePRINT section of the showroom.

Then click “Downloads” to get to the download links for both bluePRINT 2 and 3. This manual is specifically covering bluePRINT 3, but there is quite a bit of information that will work for bluePRINT 2 as well.

There is additional information in this section as well, ranging from Live Forms, to hardware instruction manuals and articles, to training videos.

Once the software is downloaded, installation is just like the Lightbar Configurator.

## Final Notes

Once all software components are installed, bluePRINT will run the Lightbar Configurator as needed, inside the bluePRINT software.

In some cases, when there is an older version of Lightbar software, installing the current version creates a second folder on the computer which can cause issues with bluePRINT. To prevent this from occurring, we recommend uninstalling any previous versions from the Windows computer, and then reinstalling the newer versions.

Although we do not support installation of software on other operating systems, like Linux or OS X, many people have been able to get bluePRINT working using a Windows emulator or Virtual Machine.

# Software Navigation

SoundOff Signal's bluePRINT software is powerful and feature-laden. Navigating it can be challenging at first, but it will get easier with familiarization.

bluePRINT navigation is broken into three sections. The upper menu, the navigation tabs, and any sub tabs within each navigation tab.

Each section is detailed in this chapter.

## The Upper Menu

Below is an image of bluePRINT's upper navigation menu. From left to right they are:

**Close Program:** This will do exactly that, close the bluePRINT program and any open lightbar tabs. If the file is unsaved, bluePRINT will show a dialog box allowing the user to save their file.

**New File:** This creates a new file, allowing the user to discard any progress on the current file.

**Load File:** Clicking this icon will allow the user to load a new file.

**Save File:** This will save the current file. If it is the first time being saved, a dialog box will pop-up allowing the user to save the file under a specified name.

**Save As:** Like the above function, but saves the file as a new file each time this is clicked, not overwriting the current file. A dialog box will pop-up allowing the user to save the file under a specified name.

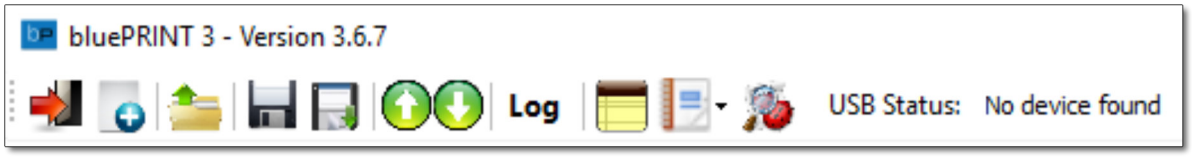
**Upload:** The green circle with the white up arrow is upload. This uploads software settings and configuration to the hardware overwriting any current program. Also known as pushing.

**Download:** The green circle with the white down arrow is download. This downloads settings and configuration from the hardware overwriting anything in the software. Also known as pulling.

**Hardware Log:** The hardware log provides specific information about firmware and hardware errors should it ever be requested during a technical support case.

**Notes:** This notepad icon opens up a new menu allowing the user to provide any pertinent information to the program or vehicle. There are fields for the Organization Name, Car Make and Model, and information that is included in the bluePRINT report (see the next icon), or information that is excluded from that report.

This information is stored in the bluePRINT file when it is saved on the computer hard drive.




bluePRINT Upper Menu

**Report:** This button allows the user to create either a bluePRINT or Lightbar Configuration report. This will generate an HTML file that can be viewed in any web browser.

The information in this report provides all input and output functions of the currently loaded program.

**Diagnostics:** This button starts bluePRINT diagnostics. This is covered in depth on page 72.

**Control Simulator:** The Control Simulator is only present when focused on a lightbar tab (see Lightbar later in this chapter). When activated, it provides functionality to do quick tests of a B.OB.'s discretely wired inputs.

**USB Status:** Current connection status is shown here. The most common messages are "No device found," or "EV System Connected."

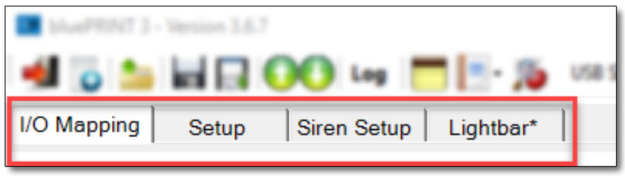
## The Upper Menu - Lightbar vs bluePRINT Tabs

It is worth noting that bluePRINT and Lightbar configuration files are not conjoined, meaning each one is saved separately.

This affects many of the bluePRINT upper menu buttons. Depending on the Navigation Tab selected (discussed next), the upper menu buttons may be referring to a bluePRINT file or a Lightbar file.

As a rule of thumb, if a Lightbar navigation tab is currently selected, then the upper menu functions are referring to the Lightbar file. If a Lightbar navigation tab is not currently selected, the upper menu functions are now referring to the bluePRINT file.

## Navigation Tab I/O Mapping




As shown in the above image, there are 4 main navigation tabs. On the very left is I/O Mapping.

I/O Mapping is broken into six Input sub tabs, and six output sub tabs.

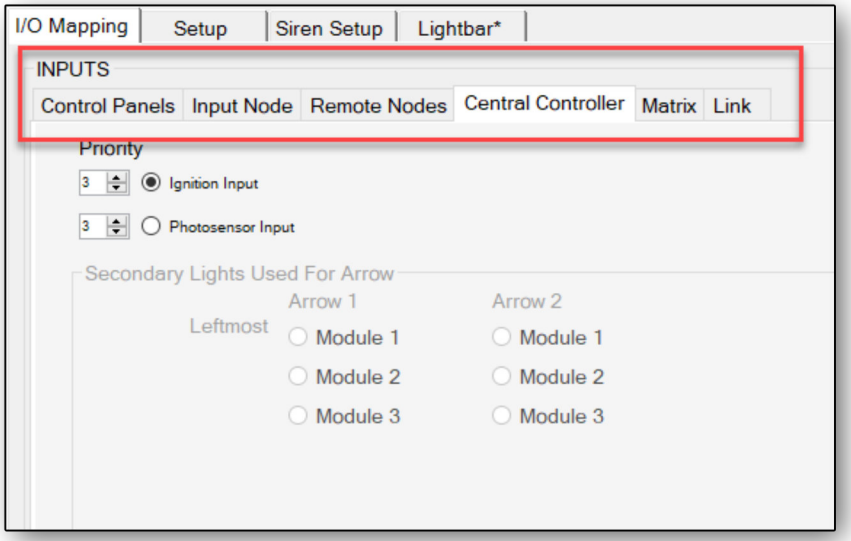
The input sub tabs cover all inputs in bluePRINT, not just the inputs that are connected. This is a key point to note, since a program can be written without equipment connected.

***Input Tabs***

**Control Panel:** The Control Panel sub tab displays the programmed type of control panel and available inputs to each panel type, which is covered in the next chapter. Remember, that bluePRINT can support two different control panels.

**Input Node:** The Input Node sub tab provides a numeric location for each of the discrete wired inputs on either an Input Node, or Breakout Box. When using a Breakout Box for inputs, bluePRINT needs to be told to do so, which is covered on page 55.

**Remote Node:** The Remote Node input sub tab provides access to the discrete wired inputs on each of the Remote Nodes. There is a selection box to determine which Remote Node's inputs are being selected, based on the ID number for the Remote Node. Please refer to the hardware installation manual for Remote Nodes for information about programming ID numbers.




I/O Mapping Input Sub Tabs

***Output Tabs***

The six output tabs are covered below. Each tab lists all outputs on the bluePRINT system. Please remember, this is listing all output tabs, not just connected hardware.

**Lightbar Control:** This output sub tab lists all output mappings for serial connected lightbars. Serial connected refers to any lightbar currently connected to bluePRINT via an Ethernet cable.

**Central Controller:** The Central Controller input sub tab provides access for programming the system ignition and photosensor inputs.

Additionally, mapping outputs to create lights in an arrow group is done on this tab. This is covered on pages 43-45.

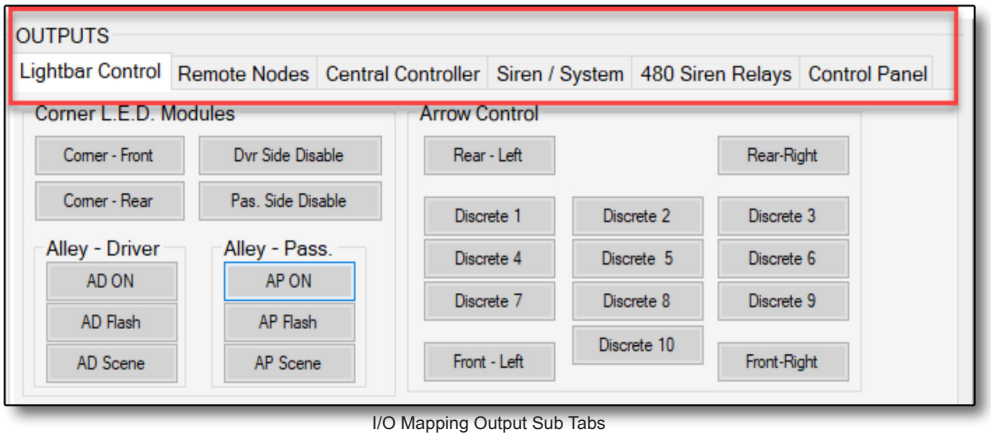
Please note, whichever ignition source is being used will show up here. Refer to the System Setup chapter on page 52 for more information on this.

**Matrix:** The Matrix sub tab includes all virtual/ conditional inputs within bluePRINT. This is covered on pages 46-53.

**Link:** The last of the input sub tabs is bluePRINT Link. Each of these inputs can be programmed to respond to CAN-BUS events. bluePRINT Link is covered on pages 34-35.

**Remote Nodes:** Just like the Remote Node input sub tabs, there is an output sub tab. All outputs are listed for each Remote Node. Again, there is a selection box for the specific Remote Node each output belongs to. Remote Node outputs are broken into groups of five, otherwise known as a switch. For more information on Switches, please see page one.

**Central Controller:** All twenty of the Central Controller outputs are listed in the Central Controller output sub tab. These outputs are also broken into groups of five.




I/O Mapping Output Sub Tabs

**Siren/System:** This sub tab has all the special output scenarios for things like backlighting or cruise modes. It is covered more in depth on pages 39-42.

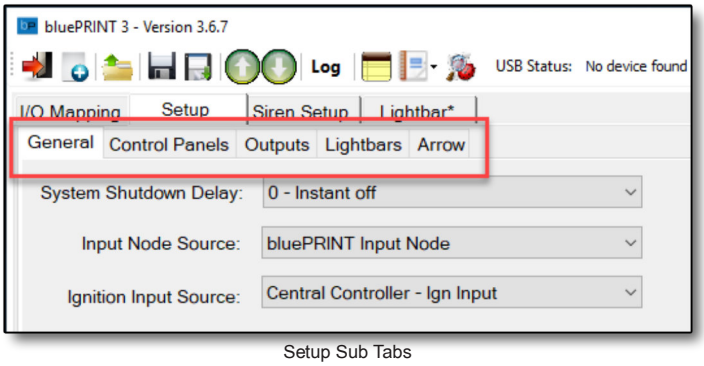
**480 Siren Relays:** The outputs associated with the 480 siren amplifier are covered in this output sub tab. They are broken down by the physical connector that they are located on.

Plug CN3 has all nine of the 10amp outputs and plug CN8 has the three 20amp outputs.

There are also two check boxes concerning ground switching, refer to page 42.

**Control Panel:** The last tab covered in this section is the Control Panel output sub tab. This tab shows the control panel buttons as outputs within the bluePRINT system.

Although they are not actual outputs, they can be turned on and off by other inputs.



Setup Sub Tabs

**Outputs:** Special output settings for all flash-able outputs are covered in this sub tab. For more information, please refer to page 39.

**Lightbar:** Settings for photocell, lightbar type and syncing are all located here.

**Arrow:** Lastly, part of the arrow group programming process is completed here. For more information on arrow groups, please go to page 43.

## Navigation Tab Setup

The next main navigation tab is Setup. It is located just to the right of I/O Mapping.

Most of the global settings for bluePRINT are under this navigation tab. Each of the sub tabs are detailed below:

**General:** The first sub tab covers the most basic system settings, those with the highest level of control.

**Control Panels:** The Control Panel sub tab is where the different control panels' button functions are programmed. This is covered in the next chapter.

## Navigation Tab Siren Setup

Siren functions are programmed under the next main navigation tab. This whole section is covered on page 61.

**bluePRINT Tip:**

Throughout this manual, navigation to different tabs will be referred to by the main Navigation tab, followed with a "/" and the any sub-tab.

*For example*, "I/O Mapping / Input Node input sub-tab" or "Setup / General sub-tab"

## Navigation Tab Lightbar

The last of the main navigation tabs is the lightbar tab.

When clicked, bluePRINT opens a session of the SoundOff Lightbar Configurator, allowing for programming of the lightbars.

Each time the Lightbar tab is clicked, another session opens. This allows multiple lightbars to be opened inside of bluePRINT, for cases where different types of lightbars are connected to bluePRINT.

Please note, this means that each session has a specific lightbar file, and must be saved separately.

For information on lightbar programming, please see page 66. Additionally, there are programming videos for lightbars in the bluePRINT Training Videos section on the Dealer Portal.

## Other Notes

When it comes to saving files, regardless of bluePRINT or Lightbar, we recommend using Save As each time and creating a revised file.

By doing this, any mistakes that may be discovered could possibly be isolated to the last revision. Going back a revision can sometimes be quicker than correcting any programming mistakes.

One final note for this chapter, be certain when clicking upload or download. It is possible to click upload when meaning to click download and overwrite a file that is currently stored in a Central Controller.

This most commonly occurs when starting bluePRINT (so the file is blank), and mistakenly clicking upload instead of download, accidentally wiping everything from the Central Controller.

Lightbar Programming Tab

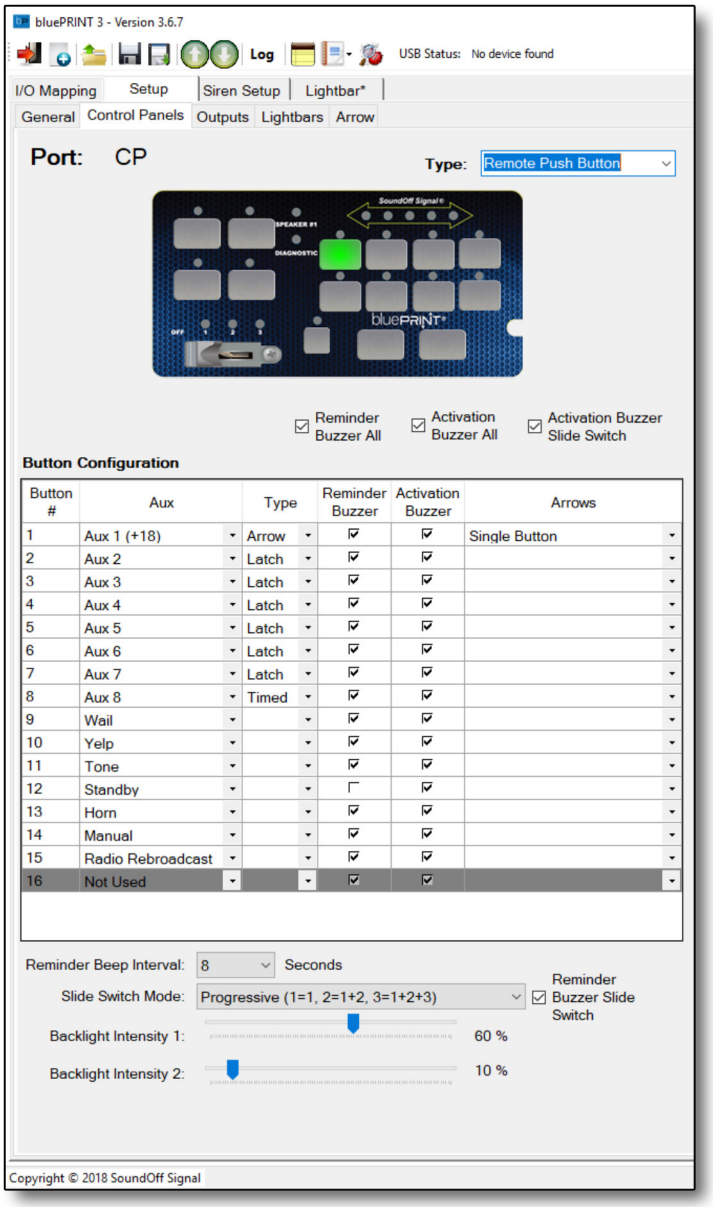
# Adding Control Panels

Now that basic software navigation is covered, it is time to start building a program.

In most cases, the control panel is the first part of a new program that is setup, since it is the primary means for the end user to communicate with bluePRINT.

This chapter covers how to configure the functionality of the control panel. Each button can be independently set to function in any of several ways, meaning one button can be set to turn on and off with each press, and another can be set to turn on only while pressed (momentary function).

Once the control panels are setup, they are programmed just like any other input, which is covered on page 26.




Control Panel Setup Menu

## Control Panel Setup Menu

The first step in setting up control panels is to access the Control Panel Setup menu by navigating to Setup / Control Panels sub-tab.

If working with a new program, this will bring up a screen that is mostly empty. This is the Control Panel Setup screen.

The next step is to determine which port the control panel will be plugged into.

## Which Port? Control Panel Types

Control panels can be plugged into either the Control Panel port (CP) or the Siren Port (SIREN) on the Central Controller.

bluePRINT needs to know which port a component is connected to in order to process information from that port.

Each port is setup to work with specific panel types. When connecting a panel to the Control Panel port (CP), the following panel types are supported:

**Remote Push Button:** This type of panel has eight auxiliary control buttons, seven siren speaker control buttons, and a standard four position slide switch.

**Remote Rotary Knob:** Similar to the above panel, this panel has eight auxiliary control buttons, a five position rotary knob for siren speaker control, three buttons for siren speaker control, and a standard four position slide switch.

**Handheld Control:** The handheld control panel uses less space than a standard remote panel and is intended to be held in the hand during use. It has six buttons for auxiliary controls, five siren speaker control buttons, and four buttons in place of a standard slide switch.

If connecting the control panel to the Siren port (SIREN) on the Central Controller, the following panels are supported:

**Remote Panels:** All the panels that are listed above are supported on the SIREN port, with one requirement. There must be a 400 series amplifier also connected on the port. bluePRINT uses the 400 series amplifier to provide power on this port when needed.

**Console Mounted Push Button:** An integrated siren and control panel. All control buttons on this panel are the same as the Remote Push Button panel listed previously.

**Console Mounted Rotary Knob:** An integrated siren and control panel. Button functions are the same as the Remote Rotary Knob.

Once a control panel type is selected, it will be displayed on the screen.

## Changing Button Functions

Once the control panels are added to the program, it is time to configure how each button functions. The easiest way to do this is to click on a button

Each time a button is clicked it will highlight the associated function line in the lower part of the screen. For example, if you clicked on the very top left button of a remote push button panel, it would highlight the row for button #12 in the lower table.

Once that row is highlighted, each of the following can be changed to suit the user needs.

**Aux Column:** The Aux column determines the primary functionality of that button. Choices for button types are AUX 1 through AUX 18, and siren tone buttons.

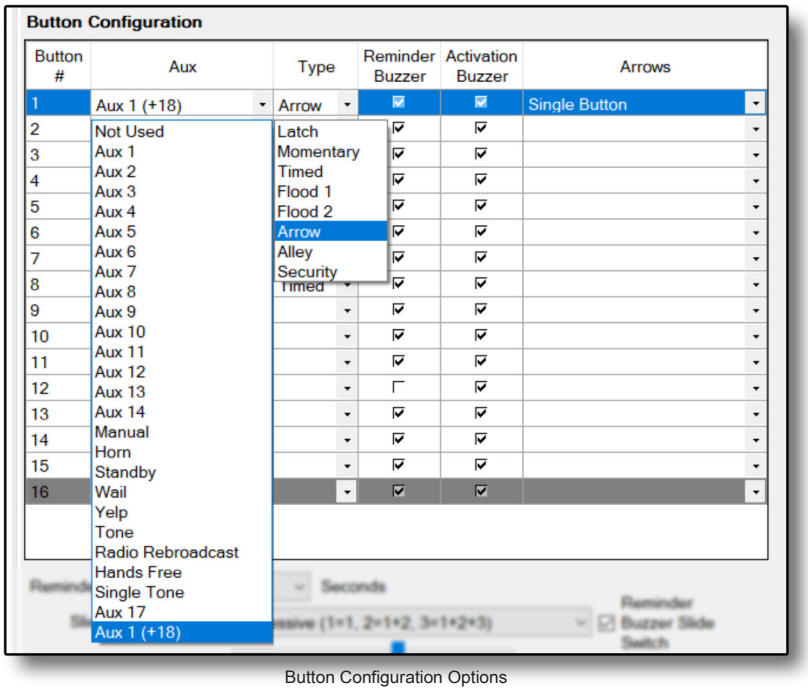
If using AUX 1 – 18, the button is setup as a standard unmapped input. This means the button will do only what is mapped to it when activated. This is covered in the next chapter.

If two buttons have the same AUX number, they will function the same.

When using a button as a siren tone button, the button has built-in functionality. If the button is programmed as Wail, it will activate siren tones that are programmed for Wail.

Siren tones can still have additional functions mapped to them in addition to the built-in ones.

Sometimes there will be two AUX numbers in this column. For example, the default setting for Button #1, lists AUX1 (+18). This means that




Button Configuration Options

the button is setup to use more than one state. Each state can be mapped as needed.

**Type Column:** This column determines how each button is activated. Options include:

*Latch* – When the button is set to Latch, the first press of the button turns it on, and the second press turns it off.

*Momentary* – The button is active only while pressed.

*Timed* – The button activates and stays active for a configurable amount of time, each time it is pressed.

*Security* – A special type of button which requires a press of the button followed by another input to activate. See page 42 for more information.

*Arrow* – When active, the arrow button will cause the arrow indicator on the control panel to go a specific direction. When this button is selected, another column on the far right of the table will populate allowing the user to select Left, Right, or Single Button. Single button will cycle through Left, Right, and Center Out displays. Although this button can be used on all control panel types, it has no display effect on the handheld controller. Each state of the button can be mapped as needed.

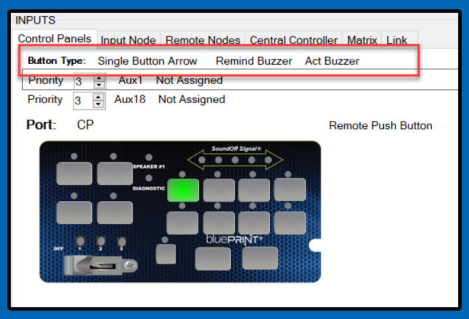
*Alley* – This works just like above with the same options and turns on indicator lights to show that the Left or Right alley lights are active. This button can be used on any control panel, but only has display effects on the handheld controller.

*Flood 1 / 2* – This is a multi-state function which allows you to map functions to each state of the button. When selected, a column on the very right will populate for setting how the different states are activated with each press of the button.

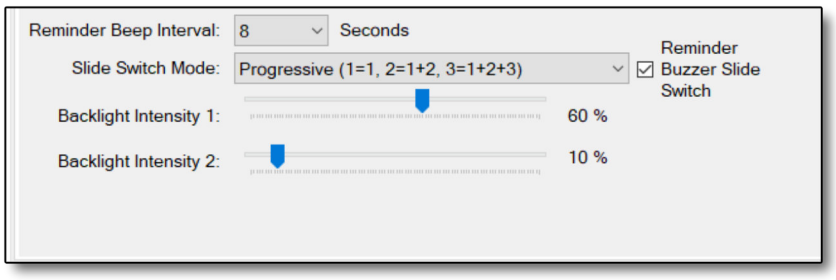
Arrow, Alley, Flood 1 and Flood 2 can each be selected once in a program.

**bluePRINT Tip:**

All button configuration information is also displayed at the top of the Control Panel Input sub-tab, when each button is selected!



## Alert Buzzers




Slide Switch Modes / Backlight Adjustments

Buzzers can be programmed as needed for each button. This means one button can have an activation buzzer while another may not. Alert buzzers are setup into two categories:

**Reminder Buzzer:** This buzzer continues to beep when the button is active. It will follow the timing set within the Reminder Beep Interval drop down, below the Button Configuration table. The interval can be set to beep from 1 – 30 seconds.

**Activation Buzzer:** The activation buzzer makes a beep each time the button is pressed.

Just above the Button Configuration table are check boxes to turn the buzzers on or off for all reminders or all activations.

There are also check boxes for the slide switch activation buzzer, and the slide switch reminder buzzer.

## Slide Switch Modes

Below the Button Configuration table is a drop-down menu titled Slide Switch Mode. This drop-down allows control over how the slide switch functions. Mode options are:

**Progressive:** Each slide switch mode is activated in addition to the previous. This means when slide switch position 2 is active, position 1 is also active. The same goes for slide switch position 3 keeping positions 1 and 2 active.

**Single:** When this mode is selected, each slide switch mode is independent of others. For example, if slide switch position 2 is active, positions 1 and 3 are inactive. This works for all panels but the handheld.

**Mode 3:** This is a hybrid between single and progressive. Slide switch positions 1 and 2 are independent of one another, but when position 3 is activated, all positions turn on as if they were progressive.

**Progressive with the option to turn off lower levels:** This is a specialty mode which is only able to be utilized with the handheld controller. It functions as progressive when turning modes on, but lower levels can be turned on and off as needed. For example, if level 3 is turned on, it also turns on levels 1 and 2. While level 3 is active, the user can turn off functions on level 1 by pressing the button associated with level 1.

**Individual Control:** The functionality of this mode is identical to Single, but it is made specifically to work with the handheld controller.

## Backlight Intensity

bluePRINT has three levels of backlight intensity. The first level is 100% intensity and not adjustable. The second and third intensities are labeled Backlight Intensity 1 and Intensity 2. These intensities are fully adjustable from 1 to 100%. Activating backlighting is covered on page 41.

# Input and Output Basics

Inputs control outputs. In the simplest form, when an input is active, regardless if it is a control panel button, discretely wired input, or a bluePRINT Link input, any associated output mapping is being controlled by that input.

When configuring bluePRINT, there are criteria that needs to be set for this to occur.

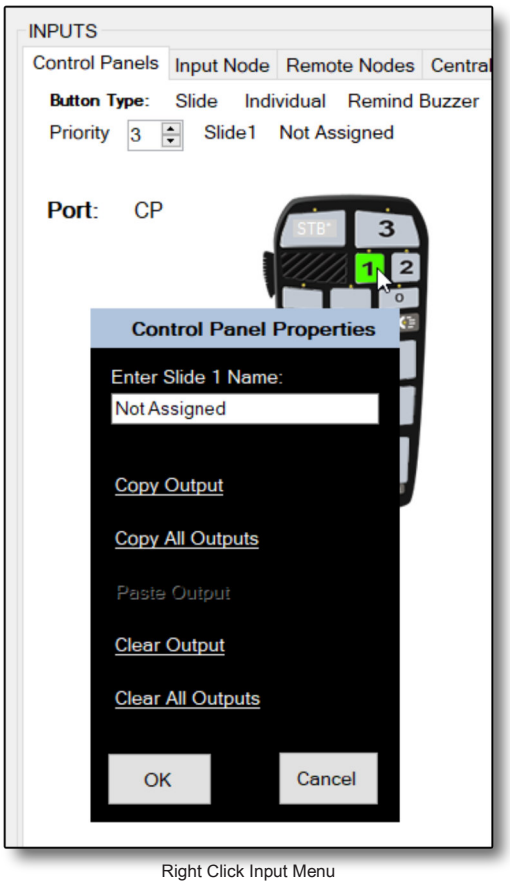
## Naming Inputs and Outputs

In the previous chapter, adding control panels to the system was covered. The next step needing to be done is naming inputs and outputs.

Adding names is important; without them, everything is named “Not Assigned.” This can quickly get confusing.

More importantly, when an input or output is not named, it is filtered from any type of reference list. This was purposely done, to limit information to what is relevant to a program. Remember, there are potentially 82 outputs and 96 inputs in bluePRINT. That would be a nightmare to go through if everything had the same “Not Assigned” name.

To name an input or output, simply click the right mouse button while hovering over the input or output. The right click menu will pop up with an area to type a name.




Right Click Input Menu

Names can be up to 16 characters in length, including spaces. Some abbreviation of what each input or output’s intended function may be required.

**bluePRINT Tip:**

Don’t forget to name the remote nodes, and slide switches. Both are commonly forgotten!

## Discrete Input Polarity & Logic

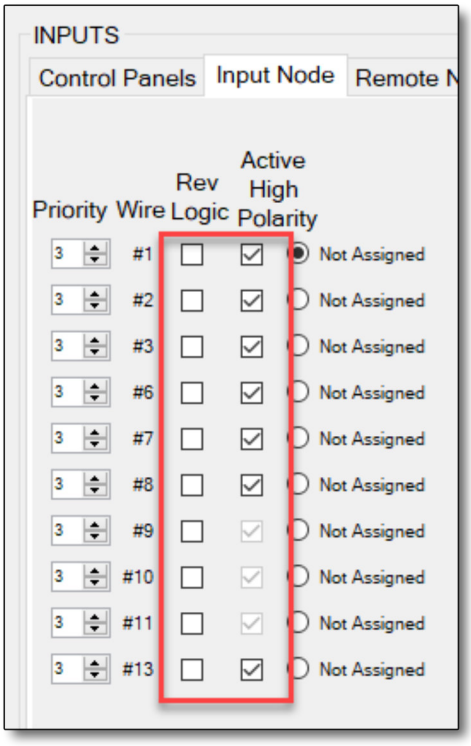
When discretely connecting to a vehicle signal using a wire, bluePRINT needs to know how the signal works, and if it is positive (high) or negative (low).

This only affects discrete (physically wired) inputs connected to the Input Node or any Remote node.

Remember, programming these discretely connected wires is done on the Input Node and Remote Node input sub- tabs in the I/O Mapping section.

Next to each input in those sections are two columns of check boxes.

The right check boxes determines input polarity. If checked, bluePRINT is expecting a positive (high) signal from the wire when active. If unchecked, bluePRINT looks for the opposite polarity, or ground.




Input Polarity / Reverse Logic

The left of the check boxes is for Reverse Logic. This is used when the signal is active, but the function providing the signal is inactive.

An example of this are the doors on a Ford Explorer. The door signal is a ground signal, but it is grounded when closed. By checking reverse logic, bluePRINT will process the input as active when the signal is no longer present.

In the case of the Ford, when the door is opened, the ground signal is no longer present, and bluePRINT can process the door as open.

## Mapping Output States

Once all inputs have been named, and input polarity determined, a program is ready to be mapped.

The process is started by clicking on an input. Once selected, output functions can be mapped to the input.

Each input can set an output to one of these states:

**Turn Output On:** This turns an output active. The output is now providing steady power to the attached device. When selected, the output will turn green to indicate this state.

Lightbars are the exception to this rule. When a lightbar function is turned on (green) it will follow functions that were programmed to the specific lightbar output, in the SoundOff Signal Lightbar Configurator.

**Turn Output Off:** When this state is selected the output is turned off. The output will turn red to indicate this state.

**Flash Output:** This output state starts flashing the output, in a specific pattern. See the next chapter "Flash Patterns & Priority" for more information. When selected, the output turns yellow.

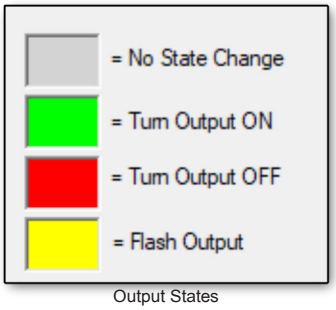
The Flash option is only available to outputs on the Central Controller or the Remote Node.

**bluePRINT Tip:**

Hold down the control button on the keyboard and hover the mouse over any input. This will bring up a screen showing outputs mapped to that input!

Everything will be color coded to match flashing, on, or off.

**No State Change:** All outputs are in this state unless they are changed specifically to the other listed states. These show in the standard gray color.



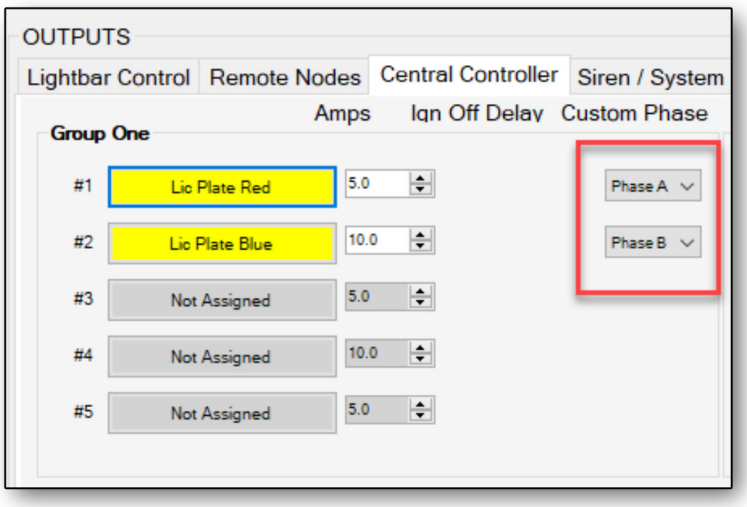
Output States

To change the output state for each input, just click on the output with the left mouse button.

## Output Phasing

bluePRINT flashes outputs on the Central Controller or Remote Nodes using two phases. If you remember back in the chapter "Vehicle Layout" on page nine, odd and even outputs alternate by default with one another. In bluePRINT, this corresponds to phase A and B.

When an output on the Central Controller or a Remote Node is set to flash, a drop-down box will appear to the right of the output allowing the user to select phase A, phase B, or "both." This is shown in the image below.



Output Phasing / Input Specific

The "both" phase is used to make an output flash on "both" phases.

Here is an example use for the "both" phase, with a little bit of information up front:

SoundOff Signal lights either use one or two wires to activate the colors, depending on if the light is single, dual, or triple color.

When using a triple color light, there are only two outputs flashing that light. Output 1 is flashing the first activation wire on the light, and the first color. Output 2 is flashing the second activation wire, and the second color. In order to flash the third color, both outputs 1 and 2 are both activated at the same time.

Back to the "both" phase:

If a vehicle was setup with a Red/Blue/White light, slide switch level 2 could flash the above-mentioned light between red and blue by keeping one output on phase a and the other output on phase b.

Slide switch level 3 could flash that same light between red and white by setting the output associated with the red light to "both" phases.

This type of phase change is specific to selected input.

There are options for "global" phase changing on page 58.

## Copying and Pasting

As a program is built, there will be situations where one input is similar to another input regarding which outputs are being mapped.

An example of this would be outputs that flash one pattern on slide switch position 1 and another pattern on slide switch position 2.

As the program for each input grows, it can be time consuming to remap everything from input to input.

Fortunately bluePRINT includes a feature to copy from one input and paste on another.

Simply right click on an input, just like you would if you were going to name it. When the right click menu opens, there will be options to copy the output.

**Copy Output:** This copies output data from the output tab that is currently visible to the bluePRINT clipboard.

**Copy All Outputs:** When clicking this option, all output data for a specific input is copied to the bluePRINT clipboard.

Once data is copied, right click on the input that will be pasted to and choose the option “Paste Output.”

## Clearing an Input

Just like copy and paste, an input can be cleared using the right click menu. There are options to clear the output and clear all outputs. These work in a similar fashion to copying outputs described above.

**bluePRINT Tip:**

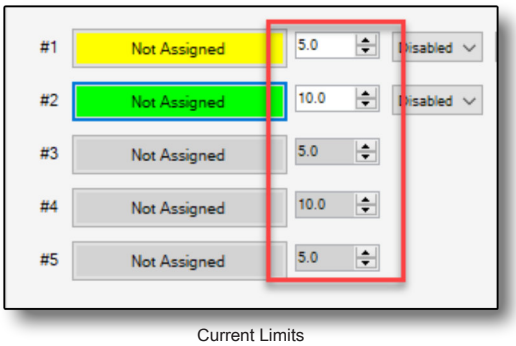
Use a mouse! When programming bluePRINT, there are frequently situations where clicking an object happens over and over.

Using a laptop touch-pad to do this can be tedious and time consuming.

## Current Limits

Every output on the Central Controller and Remote Nodes has a current limit that is displayed directly to the right of the output.

The default limits are the maximum for each output. These can be tailored to the individual requirements of the output buy clicking the up or down arrow. Alternately, a number can be typed into the output.



Current Limits

Active current shows the maximum current that can ever be drawn through the component, based on all outputs that have an on or flashing activation throughout the program. We recommend you do set appropriate and realistic current limits for outputs. Doing so helps prevent exceeding a component's max current load and also aids in diagnostics.

# Flash Patterns and Priority

In the previous chapter, we discussed how to map outputs to a specific input. As a program is built and becomes more complex, there *will* be multiple inputs trying to control an output.

In order to determine when an input "wins" control over an output, a priority system must be implemented.

## Priority

bluePRINT processes all input commands based on the input priority. Every input has an assigned priority, shown to the left of the input, except for the control panel inputs. Control Panel inputs are displayed just above the control panel, where the input configuration information is located.

Priority is measured from 1 to 10. The higher the priority, the more control an input will have over any mapped outputs.

*For example*, if we had a triple color mpower light on outputs 1 and 2, and it was alternating between red and blue with slide switch #1 active, button #1 would require a higher priority than slide switch #1 to make both outputs turn on steady to create a scene light.

When a new program is created, all inputs default to priority 3. From there the programmer can adjust the priority setting for each input up and down.

**bluePRINT Tip:**

Hold down the Control button on your keyboard and hover the mouse over an output.

This will bring up a screen showing all inputs that are trying to control that output.

The list is in order from lowest priority showing at the top, to highest priority showing at the bottom.

When multiple inputs have the same priority, the list shows how bluePRINT processes which one wins.

## Sub-Priority

With potential for 96 inputs in bluePRINT and only 10 levels of priority, at some point there will be two or more inputs mapped to the same output that have the same priority.

In those cases, bluePRINT processes input control based on two considerations:

**Input #:** The input number on the input sub tab is considered when processing sub-priority. The higher the input number, the more control.

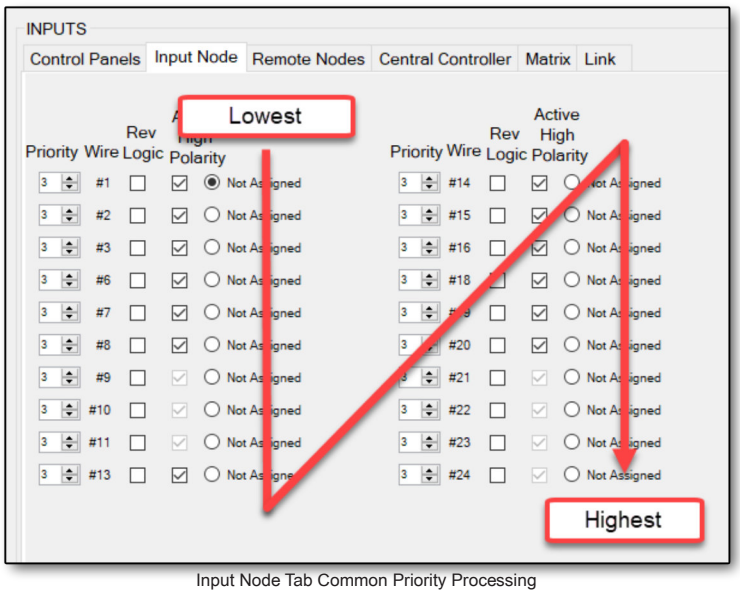
*For example*, on the Input Node sub tab input #3 is set to priority 4, input #6 is set to priority 4, and input #7 is set to priority 4. bluePRINT would process control over these as follows:

Input 7 (Highest), Input 6, Input 3

In the above example, if input #1 was set to priority 5, bluePRINT would process all the inputs in this order:

Input 1 (Highest), Input 7, Input 6, Input 3

# Flash Patterns




Input Node Tab Common Priority Processing

When an input is mapped to flash outputs, the pattern that the output flashes is set at the bottom of the I/O Mapping screen.

There is a drop-down box for each level of priority, allowing up to 10 different patterns in a bluePRINT program.

In a typical police vehicle, as the slide switch progresses from position #1 to #2 and then to #3, the pattern becomes more aggressive.

**Input Sub-tab:** When there is common priority between inputs on two different sub tabs, bluePRINT likewise processes the inputs in a certain order:

Remote Node Inputs (lowest), Input Node, Control Panel, Central Controller Inputs, Matrix, Link (highest).

Continuing the previous example, if slide switch #1 was set to priority 4, and Matrix #2 was set to priority 4, the processing will look like this:

Input 1 (highest), Matrix 2, Input 7,
Input 6, Input 3, Slide Switch 1

Don't forget that Input #1 was set to priority 5 in the previous examples.

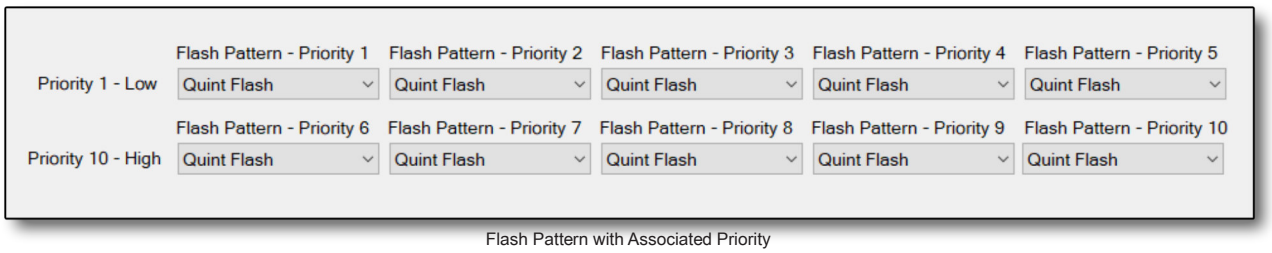
That means each slide switch position will need to be on a different priority, so that two things happen.

1. Control of any lights is overridden when the slide switch is moved from position #1 to position #2, and again from position #2 to #3.

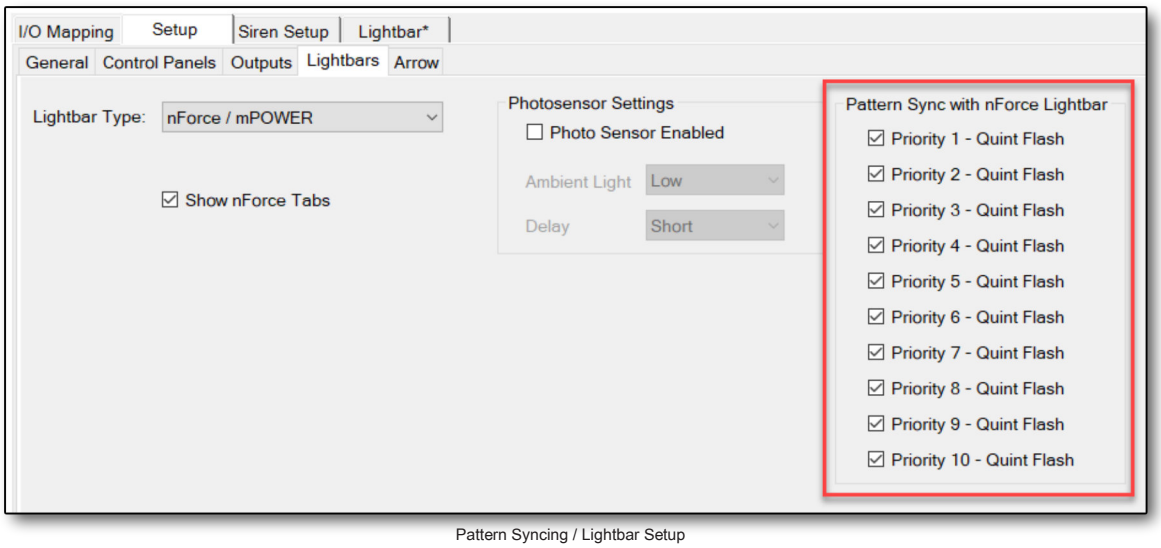
2. The pattern shifts with each position of the slide switch.

Flash patterns can be setup as simple or complex as the programmer needs. Not all outputs need to be flashed on the same pattern at any given time.

*For example*, if a vehicle had a pair of license plate lights, spoiler lights, and undercover inserts, these could be flashed on different patterns at the same time. With a control panel that is setup as progressive, slide switch #1




Flash Pattern with Associated Priority




Pattern Syncing / Lightbar Setup

could be set to flash all the lights on the Slow Runner pattern, with slide switch #2 changing the pattern to Power Pulse on the license plate and spoiler lights only.

Because the control panel is setup as progressive, any lights that were not specifically mapped with slide switch #2 on, would continue to flash in the pattern determined with slide switch #1.

**bluePRINT Tip:**

Remember, ground the green wire on any SoundOff Signal 5 wire light to put the light into bluePRINT Mode.

Once again, this means there will be times where multiple inputs are being mapped to the same output. Each of these inputs could be at the same or different priorities depending on the desired effect or flash pattern. This happens frequently with bluePRINT.

## Syncing Lights and Lightbars

bluePRINT can sync lightbar patterns with perimeter lighting to create emphasis with any light pattern. In fact, bluePRINT will do this by default, unless specifically programmed not to.

There are criteria for this function to work.

First, the lightbar pattern must have the same name as the perimeter light pattern. Single, dual, or triple color pattern names on the lightbar do not matter in this case, just the name. This means lightbar pattern “DC3: Quint Dual” will sync with “Quint” in the flash pattern/priority drop-down.

The second criteria apply only to nFORCE lightbars. The breakout box must have firmware version 2.1 or newer installed. The current version at the time this manual was written is 3.0.

Third, the priority / flash pattern is checked under the section titled “Pattern Sync with nFORCE Lightbar.”

This is in the Setup / Lightbar sub-tab. For more information, please refer to page 59.

## Final Thoughts

When a program grows, it is bound to have many features implemented. Sometimes it is nice to be able to see all inputs and their priorities at a glance.

Once again, you can use the software's Control + hover feature here. Hold the Control key down and hover over the flash pattern / priority menu.

This will display a screen showing all priorities and inputs. The list is filtered to remove inputs that have nothing mapped to them.

For best results, practice keeping input priority low (starting with priority 3) and think things through. By doing this, adding to a program later will be easier because there is available priority if needed.

# Priority Worksheet

bluePRINT allows users to set priority levels for user-defined inputs, changing from the default setting of 3. By doing so, programmers can provide override functionality for feature sets and de-conflict their program.

Below are recommendations for setting priorities for certain functions or features. These recommendations are designed to reduce conflicts in common programming scenarios. Please consider these guidelines for your own programs. Remember that the higher the number, the more powerful the priority.

**Don't Forget "Control Hover!"**

Holding the Control (Ctrl) key while hovering the mouse cursor over an input, priority, or output provides additional information necessary for determining what priority to set an input at. It's a very useful time saver!

---

**1** **2**

Priorities 1 & 2 are recommended for functions like Cruise and Low Power. By setting these low to begin with they are easy to overriding by things like response modes and scene lighting.

Additionally, low priority flash patterns can be used here. These are flash patterns that will be overridden by almost every other function in a program.

**3** **4** **5** **6**

Priorities in the 3 - 6 range are recommended for the primary flash patterns. As patterns change in a vehicle (with slide switch, or possibly vehicle speed changes) we recommend going up one priority at a time in this range.

When additional patterns beyond the four in this range are needed, consider priority 2 and priority 7.

**7** **8**

Priorities 7 & 8 are recommended for steady scene lighting. Alley lights, take-downs, work lights, and front and rear scene are examples of this. Reverse lights are generally excluded from this range.

If additional higher priority flash patterns are needed, locate them here.

**9** **10**

Priorities 9 & 10 are reserved for your highest priority functions. These are usually reserved for features like brake and reverse, as well as alarm or panic modes.

*Don't forget that there is a priority within a priority built into bluePRINT's processing order. For more information, check out the bluePRINT Instruction Manual's section on Priority.*

This Page Is Intentionally Blank

# Specialized Inputs & Outputs

Now that we have covered inputs, outputs, flash patterns and priority, it is time to cover some of the special input and output scenarios.

Not all these inputs will be needed in every program, but they are all worth discussion, as they have specific functions that can affect a program.

## bluePRINT Link

bluePRINT Link connects to the vehicle's OBD-II or Gateway interface, adding CAN-BUS functionality to bluePRINT.

With bluePRINT Link, bluePRINT receives information directly from the vehicle computer systems. More importantly, this means all the information is obtained without the need to cut any wires on the vehicle.

This manual does not cover the hardware installation of bluePRINT Link. For up to date hardware instructions, please go to the following location at our website:

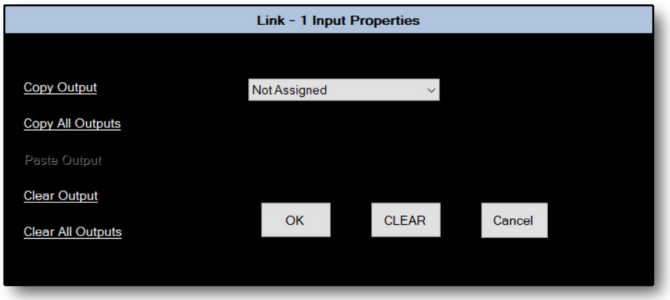
“https://www.soundoffsignal.com/products/blueprint-link”

Before designating any signals as an input in bluePRINT, be sure to select a vehicle. This is done on the bluePRINT Link Input Tab. At the top of that section is a drop-down menu which contains all the different vehicles that are currently supported.

Each vehicle has specific signals that bluePRINT Link recognizes. By selecting a vehicle, the signal list is filtered for a specific type of vehicle.

Once a vehicle is selected, signals can be tied to one of the 24 Link inputs within bluePRINT. Just like before, each can have unique output mapping.

To select a signal, right click on an input to bring up the relevant menu. All the normal functions will be there except for the name. In its place, is a drop-down menu with a list of vehicle signals.




bluePRINT Link Right Click Menu

Once a signal is chosen, there is usually a sub menu that appears, allowing for additional parameters for that signal. For example, clicking on Transmission, will produce another menu with options for Park, Reverse, Neutral, Drive, and the Manual positions.

Some signals will create a sub menu that looks like this:


In these cases, there is additional information that bluePRINT requires to determine when the signal is true. From left to right:

**"1" –** The first drop-down is referred to as the "operator." This tells bluePRINT how to process the signal to determine when the input becomes active. There are options for:

| | |
|---|---|
| "<" | Less Than |
| "<=" | Less than or Equal To |
| ">" | Greater Than |
| ">=" | Greater than or Equal to |
| "=" | Equal to |
| "!=" | Not Equal To |

**"2" –** The second drop-down is just a number or "target." Depending on the signal type, this could represent percentage, or miles per hour.

*For example*, if the signal that was being utilized was Vehicle Speed, this could be represented by inserting ">=" in the first drop-down and "66" in the second.

bluePRINT would now activate this input anytime the vehicle was at 66 miles per hour or higher.

**"3" –** The third drop-down is only required if there are going to be additional conditions to determine when the signal is true.

If it is left blank, there will be no further conditions or processing.

If changed to AND, all the information that is given in the first and second drop-down menus is required, as well as information in the fourth and fifth drop down menus for the input to become active.

Finally, if it is changed to OR, either the information given in the first and second drop down menus, or the information given in the fourth and fifth drop down menus makes this input active.

**bluePRINT Tip:**

When using Greater Than and Less Than, don't forget to include a target number.

If input 1 is vehicle speed less than (<) 30, and input 2 is vehicle speed greater than (>) 30, we forgot to include 30 itself!

**"4 & 5" –** These are only required when either "AND" or "OR" is given in the third drop down. The information that is provided in these two drop-down menus is identical in format to the first two menus.

Vehicle signals from the vehicle can be assigned to more than one input. This means that the same signal can be used to do different things (at different levels of priority if needed). An example of this, is using vehicle speed under 30, and then vehicle speed of 30 or greater.

Another feature of bluePRINT Link is the ability to retrofit older vehicles to incorporate the new features that are provided.

The hardware used with older versions of bluePRINT is compatible with bluePRINT 3, with a simple firmware update.

For more information on firmware updates, please see page 80. Additionally, look at page 90 for information regarding importing older bluePRINT Programs.

## Other Specialized Inputs

There are a couple other inputs to go over. These are inputs typically used in a traditional non-bluePRINT installation. These inputs may be utilized differently or not at all with bluePRINT.

**Park Kill Input / 400 Series Amplifier:** This input is located on the CN6 plug of the 400 series amplifier and it is yellow colored.

We don’t recommend using this input with bluePRINT since it is not a controlled input. Output mapping is limited with this input, and it does not follow priority rules within bluePRINT.

Instead of connecting a discrete park signal here, we instead recommend connecting it to an input on either the Input Node or a Remote Node.

If using bluePRINT Link, a discrete wired input for Park Kill should not be required, as you can simply use the CAN-BUS Park signal instead.

**Aux Tone / 400 Series Amplifier:** This input is located on the CN6 plug of the 400 series amplifier, and it is violet colored.

Once again, we do not recommend using this input with bluePRINT for the same reasons as stated above.

Any discrete wire trigger that needs to activate the Aux tone should be connected to either the Input Node or Remote Node inputs. Common applications are K9 heat alarms or anti-theft alarms which are used to activate the siren.

**Backlight Input / 400 Series Amplifier:** Also located on the CN6 plug of the 400 series amplifier is the Backlight Input. This input is gray in color.

Again, this input is not recommended for use with bluePRINT because it is not a controlled input.

If a discrete wire trigger needs to activate the backlighting, it is best done through the Input Node or Remote Node.

In all three of the above situations, utilizing the inputs at the siren override all bluePRINT commands. This means that bluePRINT cannot control these inputs when they are active.

## Inputs & Control Panel Activation

Any input in bluePRINT can be programmed to activate or deactivate a control panel button or slide switch.

To do this, navigate to the Control Panel Buttons output tab. A green box will appear next to each input.

The green box represents the “ON” or active state for that input. Clicking on the green box turns it red. The red box represents the “OFF” or inactive state for that input.

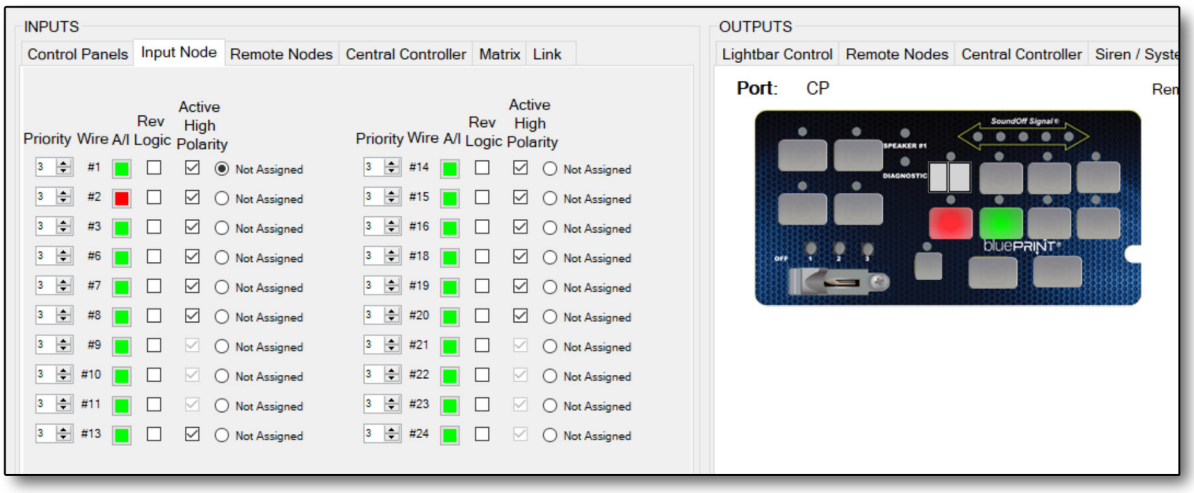
Each input state can be mapped to turn a control panel button on or off just like it was an output. Just click on the “output” to the control panel button to make it go active or inactive. See the example images on the next page.

Control Panel buttons can be mapped to turn on or off when the input deactivates as well.

There are a couple considerations when using this feature:

First, bluePRINT is looking at the moment the input changes state. When that input changes state, it activates or deactivates Control Panel buttons immediately.

*For example*, if a vehicle has steering wheel switch #1 set to virtually activate slide switch position #1, it does so the moment the steering wheel switch is activated. After that, the slide switch can be deactivated, either by shutting off the steering wheel control (if that state is programmed), or by manually switching the slide switch to the off position. This would require the operator to cycle the switch "on" then "off."




Inputs activating Control Panel buttons

In this case, it is possible for the steering wheel switch to be active while the slide switch has manually been turned off.

The second item to consider:

When having an input virtually turn a control panel button on, does that same input also turn the control panel button off when the input becomes inactive?

With bluePRINT, either situation can be used, based on the requirements of the programmer.

## Cruise Mode & Low Power

With bluePRINT, the programmer has the option to put lights into a cruise mode or a low power state as needed. These are activated independently between the lightbar and the perimeter lights.

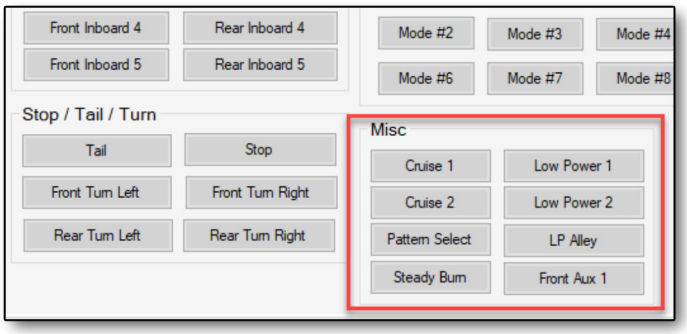
Cruise modes create a steady on light, traditionally set at a lower intensity similar to a marker light. Low power allows a light to flash at a lower than normal intensity.

Lightbars have a one or two cruise modes, determined by their type, and two low power modes. This means that certain modules can be active in low power, and others still in full intensity.

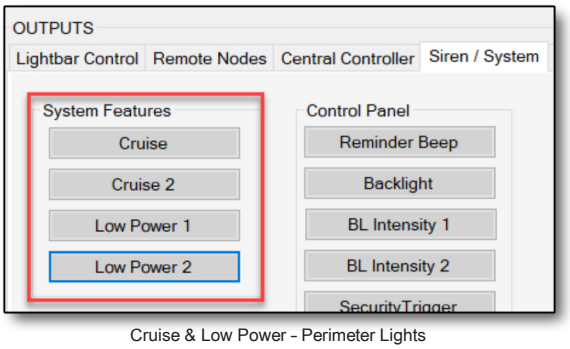
Perimeter or secondary lighting have options for two different cruise modes as well as two different low power modes, which allows for even more flexibility.

Activating either cruise or low power is done in two different areas, depending if the intended function is being sent to the lightbar or to the perimeter lights. To activate these functions with the lightbar, go to the Lightbar Control output tab. Activation for the perimeter lights is on the Siren/System output tab.

Once the cruise or low power modes are set to activate, it is time to determine which outputs are going to be affected.




Cruise & Low Power - Lightbars
At the bottom of the lightbar tab

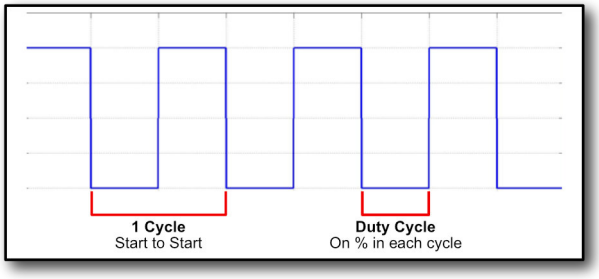



Cruise & Low Power - Perimeter Lights

For the lightbar, refer to lightbar programming on page 66.

To set perimeter lights to cruise or low power, go to the Setup / Outputs sub-tab. This opens output settings screen shown below.

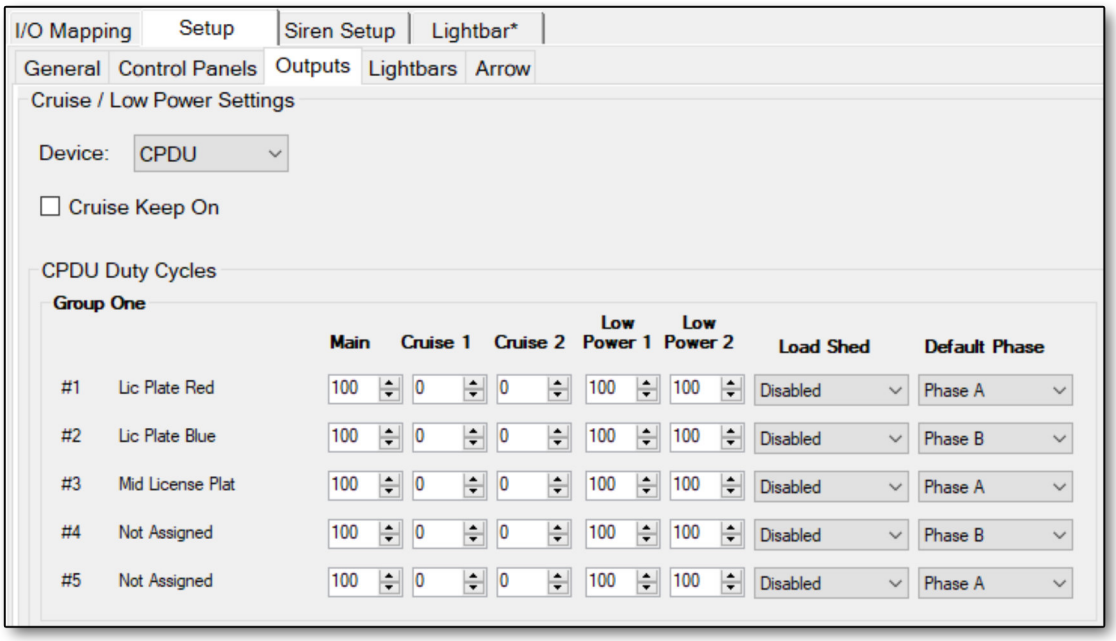
Cruise and low power work by manipulating the duty cycle of an output. Normally, bluePRINT flashes each output on the Central Controller and Remote Nodes 100 times per second, or 100 Hz. The duty cycle is the percentage of time for *each cycle* that power is being applied to an output. Although you can't see it with your naked eye, bluePRINT is cycling lights on and off constantly when the light's assigned output is active, even when the light is "steady-on."




If an output was tied to a LED light, and we lowered the duty cycle, we would perceive the light as dimmer.

Each cruise and low power mode has a field where the duty cycle can be set for each output. This allows the programmer to set up to two different cruise modes on a single output; the same goes for low power.

Outputs that are displayed on this screen are based on the component that is currently selected. To change to a different component, simply click the drop-down menu at the top left




Output Setting Screen

of this setup screen and select it. The hardware components are displayed as:

| | |
|---|---|
| CPDU | Central Controller |
| RPDU #1 - #5 | Remote Node #1 - #5 |

When an output has a number other than zero in the cruise mode column, it will respond when the corresponding cruise mode is activated.

If an output has a number other than one hundred in the low power mode column, it will respond when the corresponding low power mode is activated.

In either case, SoundOff Signal does not recommend a duty cycle on SoundOff Signal lights lower than 60%. There may be unexpected results.

With cruise, it is common to see cruise mode 1 activate all lights in either red or blue throughout the vehicle (or a combination of the two), while cruise mode 2 only activates rear-facing lights.

Another common cruise mode setup is to have an upper and lower division of cruise lights where cruise mode 1 activates all lights below the vehicle windows, and cruise 2 activates all light above the vehicle windows.

Keep in mind the effect of cruising two outputs tied to the same light. In some cases, the light may not produce desired results.

With low power modes, using low power 1 for forward facing lights and low power 2 for rear facing lights is common. This allows forward facing lights to be in high power while rear facing lights are in low power.

In cases where the same output is cruising at one intensity on cruise 1, and another intensity on cruise 2, cruise 2 will override cruise 1. The same goes for low power 1 and 2.

One last option with cruise mode is "Cruise Keep On." When this checkbox is checked, the cruise function will continue to run in the background when an output flashes. This can create a flashing effect, where the light never really turns off.

Keep in mind how this might affect a dual or tri color light, where one output is cruising and the other is flashing, possibly producing a third color.

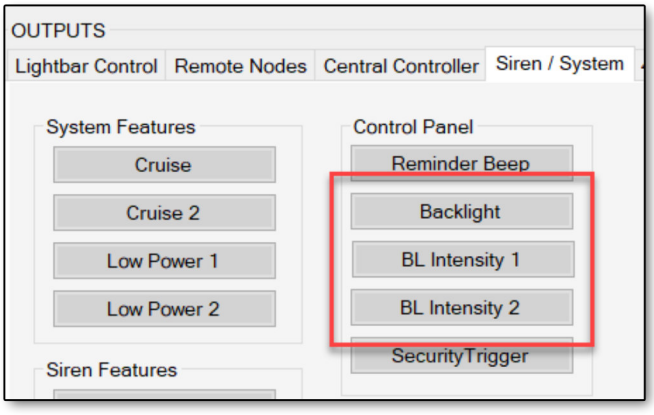
**bluePRINT Tip:**

The main duty cycle can be set here as well. This allows dimming of an output when cruise modes and low power modes are not active.

## Backlighting Activation

With bluePRINT, backlighting can be controlled using any system input. This allows the system flexibility in handling when backlighting is at full intensity, low intensity, or even off.

*For example*, if using bluePRINT with bluePRINT Link, backlighting can be controlled simply by rolling the vehicle's dashboard dimmer up or down. Simply map the different backlighting activations to different dimmer settings.




Backlight Activation Outputs

To activate backlighting, navigate to I/O Mapping and then to the Siren/System output tab. Here you can choose options for the different variations of backlighting.

Backlight by itself turns on the control panel backlighting at 100% intensity. BL Intensity 1 and 2 are user configurable. Please refer to page 25 for more information on how to configure the different intensities.

bluePRINT automatically overrides the different backlighting settings in this order:

Backlight (lowest) < BL Intensity 1 < BL Intensity 2 (highest)

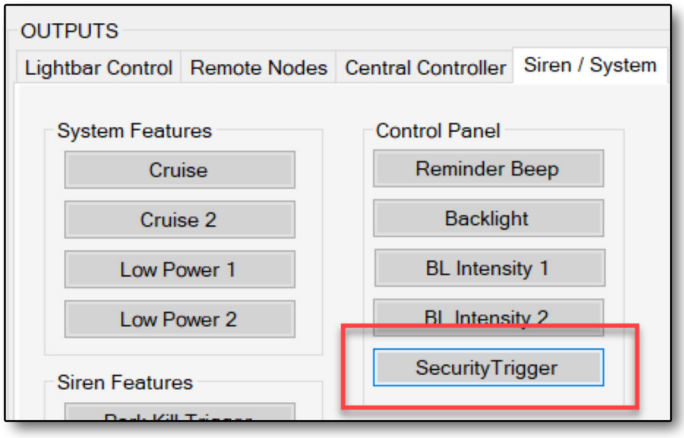
## Security Timers

Back on page 23 we covered how to select a button as a security button. When a button is configured this way, it requires a secondary input, called the security trigger, within one second to allow it to activate.

A common use for this is for a gun lock release. For example, you could configure the "stand by" button to provide the second input. In that case, pressing the gun lock button and then pressing the stand by button within the one second window will release the gunlock.

Any input can be used as the security trigger, including a Matrix input. Additionally, there can be more than one security trigger allowing activation of a security timer button.

To designate an input as a security trigger, navigate to the Siren/System output tab and map that input to activate the Security trigger output.




Security Trigger Activation

## Ground Outputs

Occasionally, a ground side output is required to activate hardware like a tail light flasher or low frequency siren amplifier. bluePRINT offers two ground side outputs, both located on the optional 400 series amplifier.

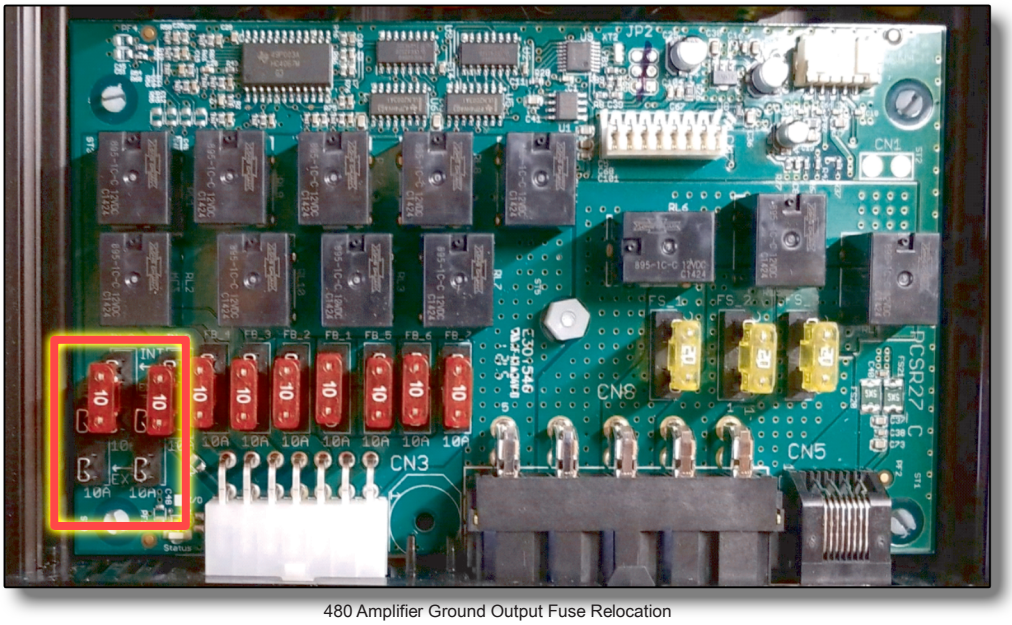
To use these outputs as ground side requires the following steps:

**Step 1:** Open the top flip lid on the 400 series amplifier. Inside are two fuses that have two different positions that they can be in. These are for relay outputs 7 and 8.

Each of the two positions represents where the fuse is receiving its source of power. The default position, in line with all the other fuses, is internal power.

The other position is the setting for external source. This source can be power or ground. There is an input wire for each of these relays that is used when the source is setup as external.

Supply ground to that input wire. When the relay is activated, it will now output ground. This process is the same for relay 7 or 8.




480 Amplifier Ground Output Fuse Relocation

**Step 2:** Navigate to I/O Mapping and then to the 480 Siren Relays output tab. There are check boxes available to ignore faults for relays 7 or 8.

This will bypass the normal fault reporting that an output does when it is in a faulted state. For more information, see diagnostics on page 72, and also refer to the 400 series installation guide for additional details.

## Perimeter Arrow

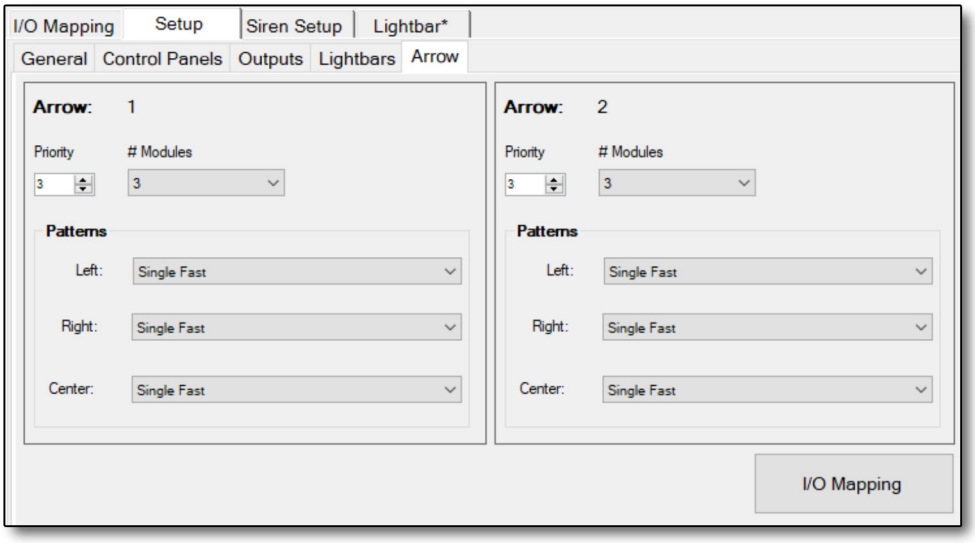
bluePRINT can utilize 2 groups of perimeter lights to create traffic arrow functionality. This is in addition to the arrow function provided by a lightbar. Each group independently supports up to 12 modules.

This allows a vehicle to utilize traffic control functions on multiple sides of the vehicle or create a traffic arrow with different colors when needed.

*For example*, a police vehicle could use an amber arrow to route traffic in normal circumstances, and then opt for a blue or red arrow for routing traffic at emergency scenes. This allows for clear identification of police presence without confusing motorists with multiple colors flashing together.

Creating a traffic arrow requires three steps:

**Initial setup:** First, navigate to the Setup / Arrow sub-tab to bring up the Arrow setup screen.




Arrow Setup Screen

For each arrow group, you'll set the following:

1. The number of modules in the group.

2. The pattern that each group will be using.

3. The priority of the individual modules when active. Typically, this priority is set higher than any other flash pattern in bluePRINT, so the traffic function overrides when needed. Default priorty in bluePRINT for arrow modules is 10.

Once the above settings are determined, navigate to the I/O Mapping / Central Controller input sub-tab. Alternatively, press the I/O Mapping jump button just to the bottom and left of the setup screen.

**Mapping modules to outputs:** The next step is to start mapping each module position to an output.

Just under the photosensor input is a box labeled “Secondary Lights Used For Arrow.” Each module in an arrow grouping can be mapped to outputs, just as if it was another input. The leftmost module in a group is at the top and the rightmost is at the bottom.

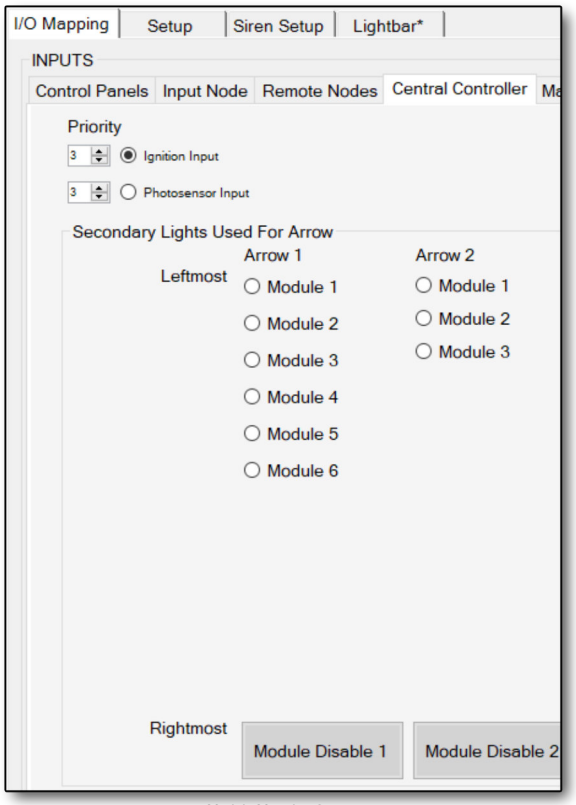
To clarify, a module position is just the position in order from left to right. In an 8-module traffic arrow, module 4 would be the 4$^{th}$ one to turn on when the arrow was diverting traffic to the right (left to right).

Each module can have one or more outputs mapped to it. This could mean mapping two outputs to create a third color, for a Red/Blue/Amber light, or possibly turning on two different lights on a vehicle to create a more noticeable traffic arrow.

Below each arrow group is a button for Module Disable. When this is activated, it allows certain outputs to be turned off when the arrow function is running. This is useful when there is a flash pattern that the arrow must override.

When configured properly, lights that are flashing will stop and turn off, and the arrow will fill in the blank space. If Module Disable is not configured, the arrow will run over the flash pattern, which can be confusing in appearance.

**Activation of the arrow group:** The final step is activating the arrow group. This is done by mapping the input to trigger the arrow group to




Module Mapping Screen

turn on. These outputs are listed on the Siren/ System output tab in the section titled “Arrow.”

Priority for the input is set as normal.

Between the initial setup, and the activation of the arrow group, there are two different priority settings.

Each of these priorities is specific to a part of the arrow group:

The Module Priority is what we set during the initial setup. This priority setting is what we are typically modifying to make sure the modules is overriding or being overridden when the arrow is active.

The Input Priority is the priority associated with the input that turns the arrow function on.

# Final Thoughts

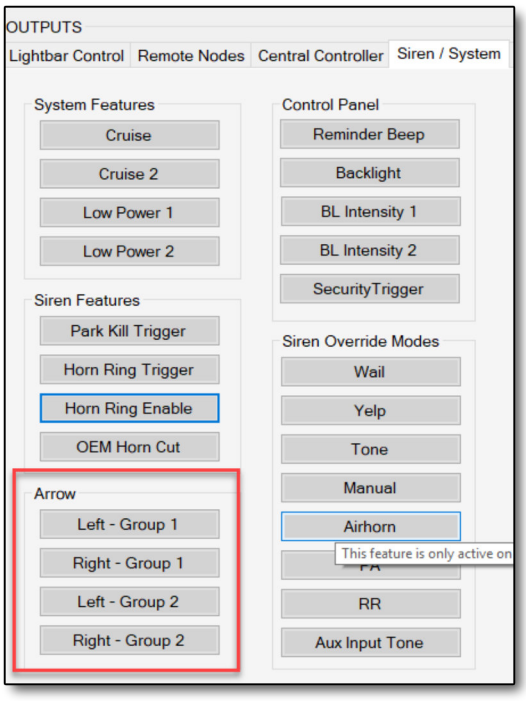
With so many different specialized inputs and outputs, bluePRINT can be a very powerful programming tool.

To minimize confusion while learning how to program, we suggest testing programs after each configured function, at least until you develop a better understanding of the different ways that bluePRINT can be programmed.

A couple other things to remember, from previous chapters:

1. Use the Control hover functions! Hold down control and hover over an input, output or priority list. These help immensely during the initial programming and when troubleshooting a program.

2. Don’t forget, control panel buttons are inputs! We use the word input fairly loosely in this manual, because there are so many different ways to provide input to bluePRINT.




Arrow Activation Outputs

# Matrices

A Matrix is what really makes bluePRINT stand apart from the others. From a technical standpoint, a Matrix is a conditional virtual input, with timer delay options, that is active when logical combinations of other inputs (including other matrices and system states) are met.

In simpler terms, a Matrix is input that only works when certain conditions are met. That statement barely scratches the surface of possibilities.

Matrices truly allow for out of the box thinking. Need a car to continue running after the key has been removed? Check. How about a warning light that only activates when the door is open, and the emergency lights are on? What about a pattern change every couple of seconds? Check. Check.

## When does an input need to be a Matrix?

Any time more than one condition is required, to manipulate an output function, it is a Matrix. We use the word condition and not input in this case, because a Matrix can include more than just an input.

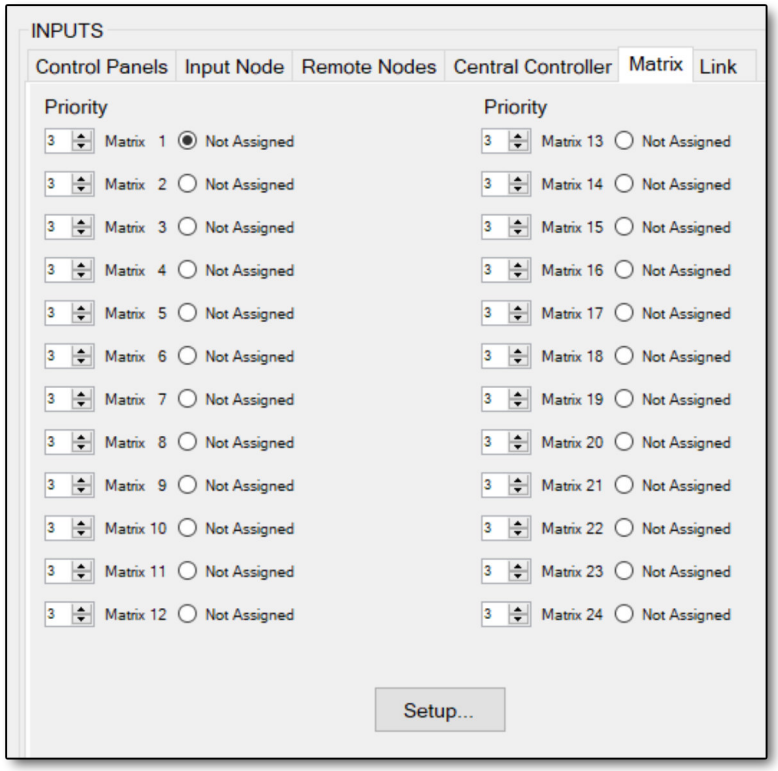
The easiest way to determine if a desired function needs to be a Matrix, is to say it out loud. In most cases, saying AND or OR between the different conditions indicates it probably will require a Matrix.

*For example*, if we wanted to change bluePRINT behavior when (condition a) the slide switch is in position #3 AND (condition b) the vehicle transmission is not in park, we have a Matrix requirement. The key here is (a) AND (b), which is a logic function.

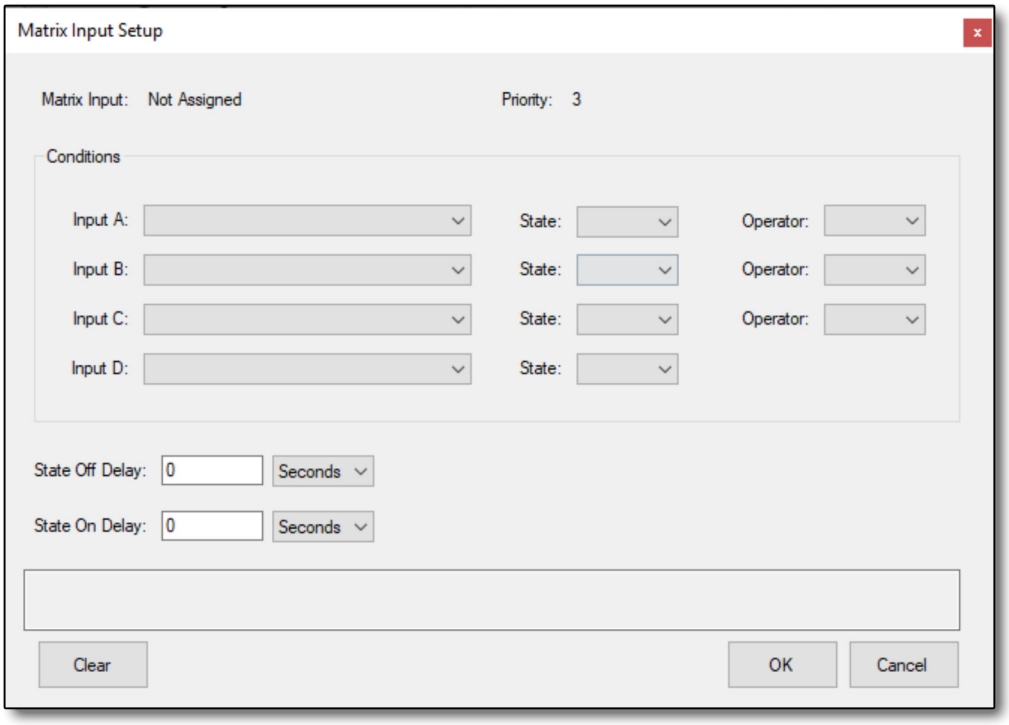
## Creating a Matrix

Creating a Matrix involves a few steps. Start by navigating to the I/O Mapping / Matrix input sub tab. This brings up the Matrix input screen.

From this screen a Matrix can be selected to program. When a Matrix is selected, and Setup is clicked, the Matrix Input Setup screen appears. This screen allows for Matrix




Matrix Input Screen




Matrix Setup Screen

Programming. It is broken down into five parts: conditions, state, operator delays, and Matrix disablers.

**Matrix Input Conditions:** Any of the following can be used as an input condition for a Matrix:

1. Inputs that have been named. This includes discretely wired inputs, control panel inputs, and bluePRINT Link inputs.

2. Outputs that have been named.

3. Any siren function, including Push to Talk.

4. Voltages

5. Other Matrices can be referenced as an input condition provided the Matrix has been named.

Up to four input conditions can be added to a Matrix. They are designated Input A through D.

To select an input, click the drop-down menu and look for the desired input in the list. The list is sorted by component, not alphabetically. Inputs are listed at the top of the list, outputs are towards the middle. Siren and voltages are at the bottom.

**State:** The state refers to if the input condition is currently ON or OFF.

**Operator:** The operator is used when there are two or more conditions in a Matrix. There are options for AND or OR.

For each condition beyond the first, the operator is required to tell bluePRINT how to process that Matrix.

If a Matrix was written with the following conditions:

| Condition | State | Operator |
|---|---|---|
| Slide Switch 1 | ON | AND |
| Tailgate Open | ON | |
| | | |
| | | |

bluePRINT would activate this Matrix when both slide switch position #1 was on and the Tailgate was open.

Another scenario:

| Condition | State | Operator |
|---|---|---|
| Slide Switch 3 | ON | AND |
| Brakes | ON | OR |
| Brake Torque > 80% | | |

In this scenario, bluePRINT would activate this Matrix when (condition a) Slide Switch was in position #3 AND (condition b) the brakes were pressed, OR (condition c) the vehicle was braking extremely hard.

In the above scenario, there are three conditions at work, but only two are interdependent, (a) and (b). Condition (c) is stand alone, but will similarly activate the Matrix to effect the same bluePRINT behavior.

Think of it like this: An input also uses logic in a sense, as it has a condition ("on") that results in an action. If "on" is true, then the mapping is true, or active. This is simple "if / then" logic, which has always been used in upfitting, even if you were not thinking of it that way.

With a matrix, which is a virtual input, the same thing happens, except that it is modified by needing multiple things to be true, and flexible enough to have different conditions for what's making it's mapping active. This is slightly more complex "if/and/or/then" logic.

**bluePRINT Tip:**

Matrices are just like any other input in bluePRINT, except for the conditional functionality.

That means a Matrix is mapped to outputs as if it were just another input.

Don't forget to give it a name!!

The OR operator plays a significant part in how a Matrix is processed. We will cover that shortly in the Logic Line section.

**Delay Timers:** The fourth part of a Matrix are the delay timers. bluePRINT can process a timer in two different ways:

*State Off Delay*: This timer starts running the moment the Matrix is no longer true. During this time, the output mapping of the Matrix will continue to run.

*State On Delay:* This timer has the opposite function. It prevents the Matrix from activating when all conditions are met, for the designated amount of time. Once the Matrix has been true for the specified time, bluePRINT will activate any output mappings.

Timers are measured intervals of 100ms, seconds, minutes, or hours.

Sometimes delays are used to enhance functions, and other times they are used to prevent functions from being activated.

*For example*, some vehicle manufacturers use Pulse Width Modulation on their headlights to control voltage to the light. Essentially, that is the same as Duty Cycle, which we talked about on page 40, allowing the vehicle to change the pulse width ("on time" of the duty cycle) on the fly to account for voltage fluctuations in the vehicle.

This can affect bluePRINT operation, because bluePRINT sees these fluctuations on any given input.

If bluePRINT had a vehicle's high beams as an input, and that input was set to turn on push bumper lights as well, the lights could possibly flicker from the pulse width modulation since bluePRINT is seeing the signal turn on and then off.

In order to combat this, a State Off Delay could be added to a Matrix that prevents the lights from turning off during that dip in signal. In most cases, 100 to 200 ms is all that is required. When the signal comes back on, the timer resets. The result is that the matrix doesn't react to the duty cycle change, allowing the bumper lights in this example to stay on so long as the high beam input was active.

**Disable Matrix:** The final part of a Matrix is the disable Matrix Output check box. These check boxes are only available when there is more than one condition in the Matrix.

When checked for a specific condition, the Matrix can be disabled when that condition is no longer true.

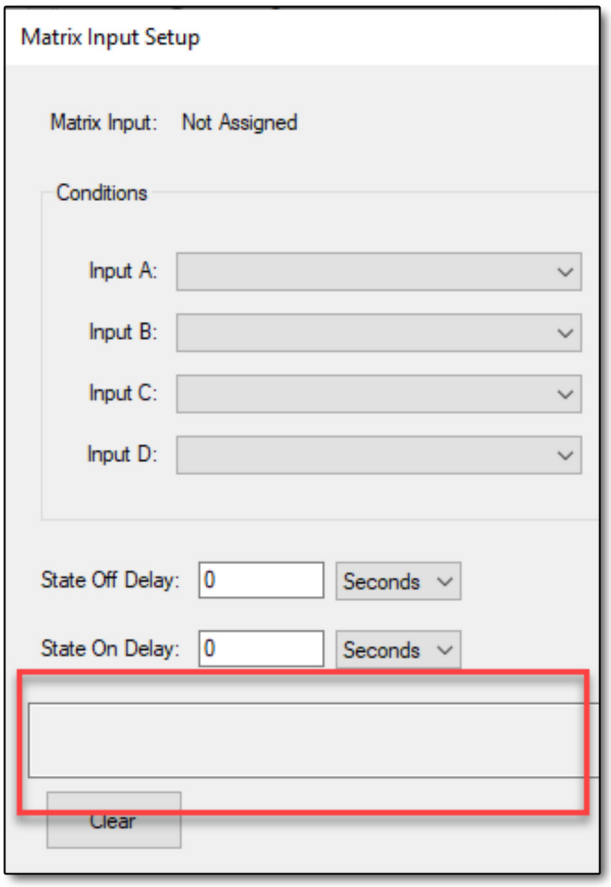
This will only apply in two situations: The matrix has a State Off Delay, or the matrix is looping.

## The Logic Line

They key to effective Matrix authoring is how the AND and OR operators are placed in a Matrix.

*For example*, if there were four different conditions in a Matrix written like this:

Condition A is ON AND
Condition B is ON OR
Condition C is ON AND
Condition D is ON




The Logic Line

This would be processed differently than this example:

Condition A is ON AND
Condition D is ON AND
Condition B is ON OR
Condition C is ON

In both examples, Condition B or C are next to one another.

To aid in processing, at the bottom of the Matrix Setup screen is the Logic Line. This line is broken down into groups depending on how many conditions are part of the Matrix.

The first group, called the primary group is a combination of the first two conditions. Going back to our earlier example Matrix for slide

switch position #1 is ON and the Tailgate is ON, it would look like this in the Logic Line:

( CPSlide1 - Slide 1 is On **And** BBIN1 - Hatch is On )

Everything written inside of that parenthesis is the primary group. This means for this Matrix to be true, both of those conditions need to be met, which makes the primary group true.

Now if we added a button in the rear of the vehicle that could cause the same effect when pressed, regardless of the tailgate being open or the slide switch, the Matrix conditions would look like this:

| Condition | State | Operator |
|---|---|---|
| Slide Switch 1 | ON | AND |
| Tailgate Open | ON | OR |
| Tailgate Button | ON | |

The Logic line would look familiar but different:

( ( CPSlide1 - Slide 1 is On **And** BBIN1 - Hatch is On) **Or** RP1IN2 - Tailgate Button is On)

As shown in the above example, the primary group is still there, but it is inside a second group of parentheses, called the secondary group. bluePRINT starts processing from the inside out, and it processes each group one at a time.

Being that there is a primary and secondary group, bluePRINT first processes the primary group. It is either true or it is not. Then the secondary group is processed, which includes the first group. Again, that group is either true or it is not.

In the previous example, the first group is slide switch position #1 is ON AND the Hatch is ON (open). The second group is the results of the first group OR the tailgate button is on.

This is repeated when there is a fourth condition in a Matrix. Below is another example:

| Condition | State | Operator |
|---|---|---|
| Slide Switch 3 | ON | AND |
| Photosensor | ON | AND |
| Brake | ON | OR |
| Brake Torque > 80% | ON | |

( ( ( CPSlide3 - Slide 3 is On **And** CPDUIN - Photosensor Input is On) **And** BBIN2 - Brake is On) **Or** Link - 2 - (Brake Torque > 80 %) is On)

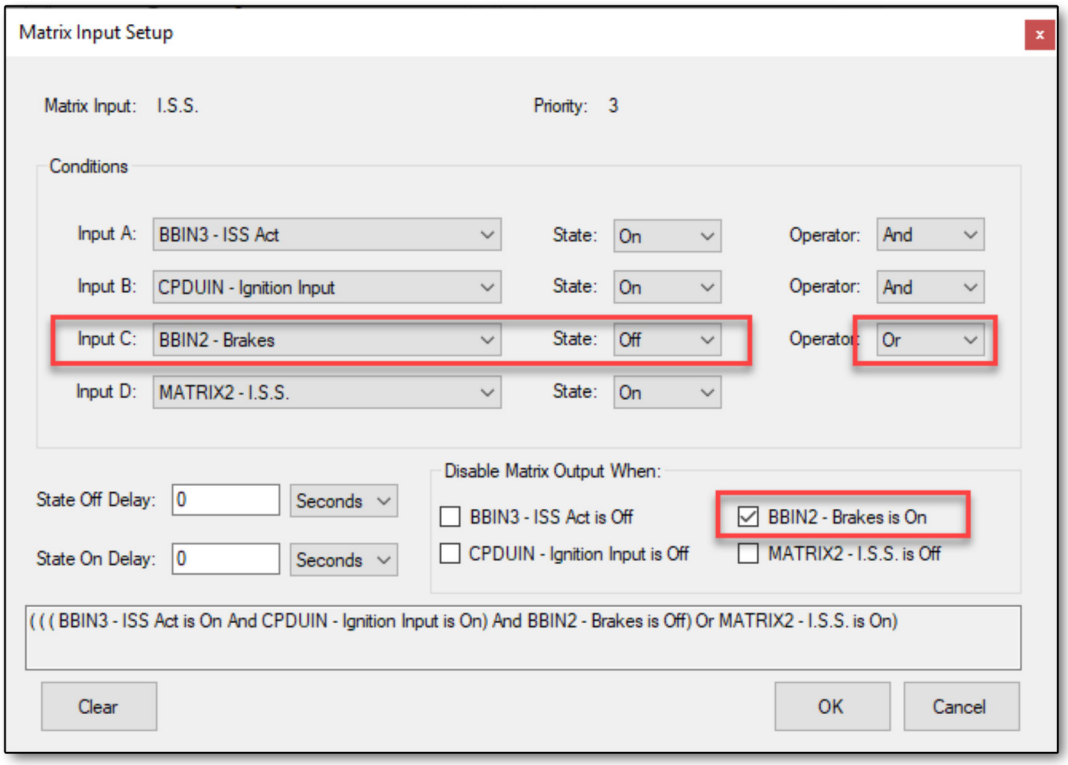
In this case the combination of slide switch position #3, the photosensor, and brakes being on would activate the Matrix, as would the Brake Torque if it exceeded 80%.

**Looping Matrix:** Sometimes an input may need to be able to run with only an initial trigger condition. To do this, reference the Matrix itself with the OR operator *at the end of the Matrix.*

Don't forget to put a condition in that can cancel the Matrix, and use the disable Matrix checkbox for that condition. See the example Ignition Security System Matrix on the next page.

*For example*, a vehicle could be setup to run with no key by referencing the Ignition is on, and a momentary trigger is activated. By having the Matrix reference, itself at the end it will continue to run, if the Matrix was outputting power to the vehicle's ignition and accessory wires.

In order to allow the Matrix to disable, add a condition for the brake is off, at the time the Matrix is activated. Check the disable Matrix box for when brakes are on, and it is all set to go, and you just eliminated the need for adding an ignition security device as would have been needed in the past!



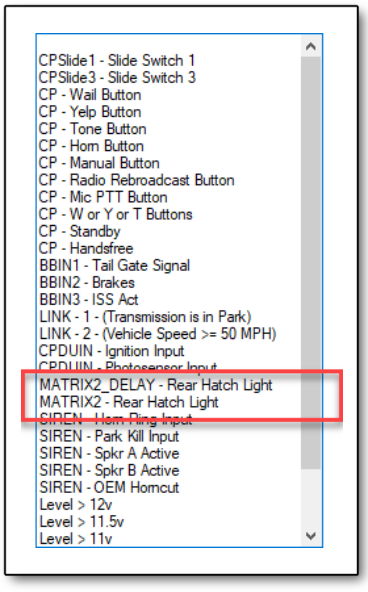

Looping Matrix / Ignition Security System

## Stacking Matrices

Matrix stacking is used when all the conditions of one Matrix are necessary for another. In the example shown on the next page, all the conditions of the first Matrix are present in the second matrix, which will reference it first.

In theory, the upper Matrix, SS3 OOP, or Slide Switch 3 Out of Park, activates all the lights on a police vehicle in an aggressive pattern when the slide switch is in position 3, and the vehicle is not in park.

The lower Matrix, SS3 OOP 50+, is set to start reducing lights to the rear automatically when the vehicle exceeds 50 miles per hour. This allows a pursuing vehicle to see the brake lights of the lead vehicle more effectively at higher speeds, in an effort to reduce the potential for a rear-end collision.



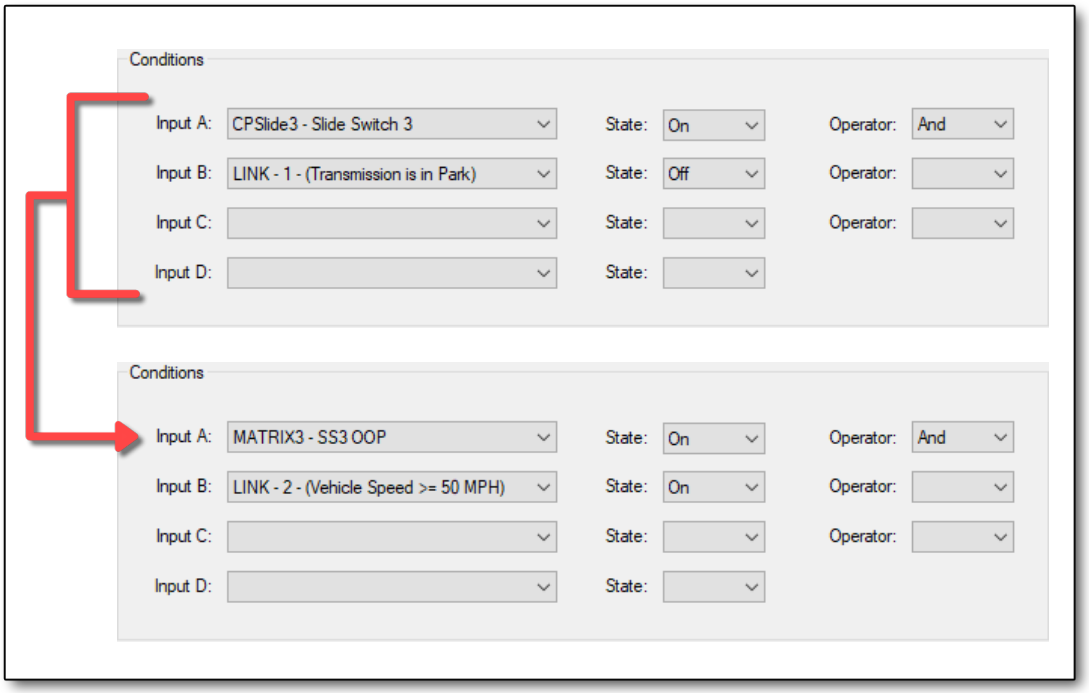

Matrix vs Matrix Delay

When referencing a second Matrix, there will be two options for each Matrix. See the example image to the left.

There is an option for Matrix 2 – Rear Hatch Light as well as Matrix 2 Delay – Rear Hatch light. What's the difference?

Matrix 2 – Rear Hatch is referring to when the hatch is open.

Matrix 2 Delay – Rear Hatch is referring to when the hatch is




Matrix Stacking

open, plus any State Off Delay timers that may be active.

Matrices can also be used to cause a cycling or canceling effect between two different Matrices. For example, Matrix 1 can be deactivated by Matrix 2. Matrix 2 can be activated 2 seconds after Matrix 1. By using a State on Delay and State Off delay, the two matrices can cycle back and forth.

## Final Thoughts

Writing a Matrix lets you practically re-code the bluePRINT software so it performs they way you want. You are limited only by your imagination and the available number of Matrices.

To help you get started, we have included several matrix examples in the appendix, starting on page 91. These are commonly used Matrices, but are by no means the limit to what can be done with bluePRINT Matrices.

We encourage out of the box thinking with bluePRINT. Ideas are always appreciated, and we recommend communicating your ideas on a forum like Facebook, or Discord in one of the SoundOff Signal private groups.

For more information on these groups, contact any of the SoundOff Signal bluePRINT Trainers at 800-338-7337, extension 4.

**bluePRINT Tip:**

If you want to learn more about the type of logic used in Matrix building, web search "Boolean Logic."

# Matrix Ideas

Below are a list of commonly used Matrices with bluePRINT.

- Takedowns + High Beams = Full Scene
- High Beam + Park = Full Scene
- Takedowns or Park + High Beams = Full Scene
- Ignition Security System
- Slide Switch 3 + Park off = Pursuit Pattern
- Slide Switch 3 + Park off + Brakes = Slow flash pattern + extra red lighting
- Slide Switch 3 + Air Horn = Intersection Wall of White light
- Intersection Wall of White followed by Intersection Crazy Lights (2 Matrices)
- Slide Switch 3 + Photosensor active = Auto rear cut / dim
- Day vs Night patterns
- Tailgate Open + Emergency Lights = Rear Warning - 5 second on delay
- Passenger Door + emergency lights = Kill end cap lights with an off delay
- Driver door + emergency lights = Like passenger + activate left traffic arrow
- Photosensor + Rear doors = Prisoner dome light
- Turn signals + emergency lights off
- Slide Switch 3 + Photosensor active = Kill rear lights turn on rear cruise
- Horn button + park + emergency lights = Panic followed by scene (2 Matrices)
- 12v remote input + ISS active = Turn lights on
- Pattern Flip Flop (2+ Matrices)
- Gunlock release
- Latching a momentary signal / cancelling a latched signal
- Slide Switch 3 + Park + Photosensor = Automatic Takedown
- Augmenting K9 alarms
- Augmenting vehicle alarms
- Turn signal + park = Traffic Arrow (frees up a button!)

# System Setup

This chapter focuses on the different basic setup functions that can affect the overall operation of bluePRINT.

## Selecting Ignition Source

In most typical installations, a vehicle ignition source is connected to the Central Controller, providing 12 volts of power to it's ignition circuit, which wakes bluePRINT up. This also activates the ignition input on the I/O Mapping / Central Controller input sub-tab.

The system doesn't have to be setup this way, however. With the Central Controller aside, the following additional components can be used to provide an ignition input signal:

1. Any remote node, using input #1.

2. The input node, using pin #12. This is specific to the input node. A breakout box cannot be used for this function.

3. The ignition input on the 480 amplifier.

Thus, if one of those components was located closer to the vehicle's ignition source, you could input ignition to it and save the time and cost of a longer wire run.

A common example of this is installing the Central Controller in the rear end of an SUV, and the 480 amplifier in the console. Either component could be used to wake the system up, but the 480 amplifier would most likely be closer to the vehicle's ignition circuit.

If this alternate ignition source configuration is going to be used, there are two steps that need to occur.

**Step 1:** bluePRINT must be told where to look for the ignition source. This is done on the Setup Navigation tab, under the General sub-tab. Look for the "Ignition Input Source" drop-down box.

This drop-down has all the different ignition source input options for bluePRINT listed.

**Step 2:** When a Central Controller is new in the box, its default ignition source input location is the Central Controller. In order to change the ignition source through programming, the Central Controller needs to be awake. To do this, provide 12 volts to the Central Controller ignition wire. This power needs to stay constant, until the change to the ignition input has been made to the program and uploaded to the Central Controller.

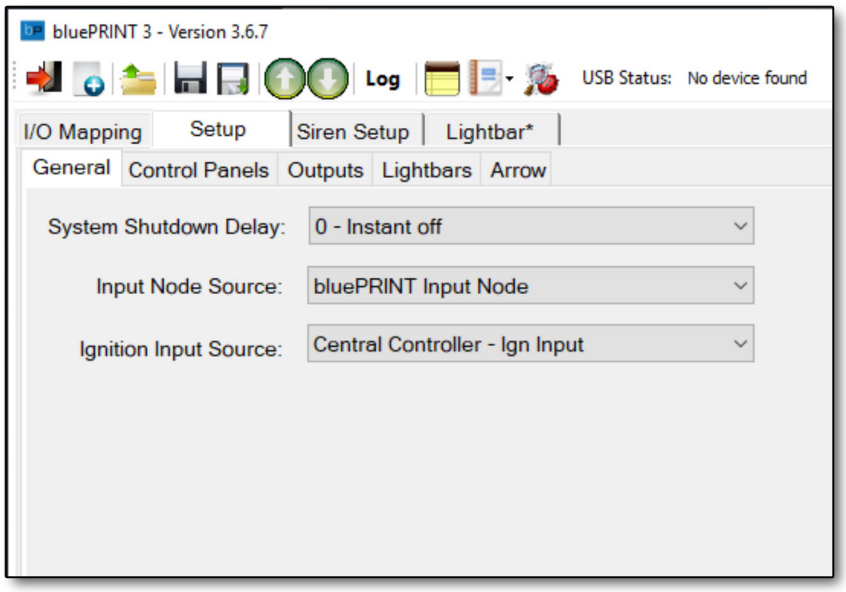
This can be done on a bench before installing the Central Controller, or in the vehicle, once everything has been installed.

Regardless of which source is selected for ignition, bluePRINT still reports ignition is present on the Ignition Input, located under the I/O Mapping / Central Controller sub-tab. This means any ignition input mapping always occurs there.

**bluePRINT Tip:**

When an Ignition input other than the default is being used, bluePRINT will note "(alternate inputs enabled)" next to the ignition input.

The ignition input on the Central Controller will always wake up bluePRINT. This was done intentionally for diagnostics, in the case where the ignition component stopped communicating with bluePRINT.




System Shutdown Delay / Ignition Source / Input Node Source

## Selecting Input Node Type

On the same screen as the Ignition Input Source, is the Input Node Source.

This drop-down menu instructs bluePRINT to communicate with a specific type of hardware for status of discrete wired inputs. The selected component becomes the Input node that all inputs on the I/O Mapping Input Node sub-tab refer to.

The default selection is the bluePRINT Input Node. Alternate selections allow for different types of lightbar breakout boxes.

When a breakout box is used, be sure to select "Controlled by bluePRINT" so that the breakout box sends commands directly to bluePRINT for processing. See page 70 for more information.

Only one breakout box on a system is "Controlled by bluePRINT." There is no need to select that function on multiple breakout boxes. In fact, this can cause issues with connectivity.

**bluePRINT Tip:**

Control Panels count as inputs towards the System Shutdown Delay.

## System Delays

The last option on the Setup / General sub-tab, is for System Shutdown Delay.

This drop-down is the time frame after ignition is removed that bluePRINT will still respond to inputs.

Settings range from instant off up to 4 hours. There is also an option titled "Max Ignition Off Delay," which keeps bluePRINT awake until all Ignition Off delays have expired, explained next.

## Ignition Off Delays

Any output can have an ignition off delay. This is an option when mapping an output to the Ignition Input on the I/O Mapping / Central Controller input sub-tab.

Any time an output is mapped to ignition, a drop-down menu appears. This drop-down menu provides a timer ranging from 10 seconds to 18 hours for each output.

When there is a time selected in the drop-down, each output will continue whatever it was mapped to do by ignition for the duration of the timer.

Each output can have its own timer setting.

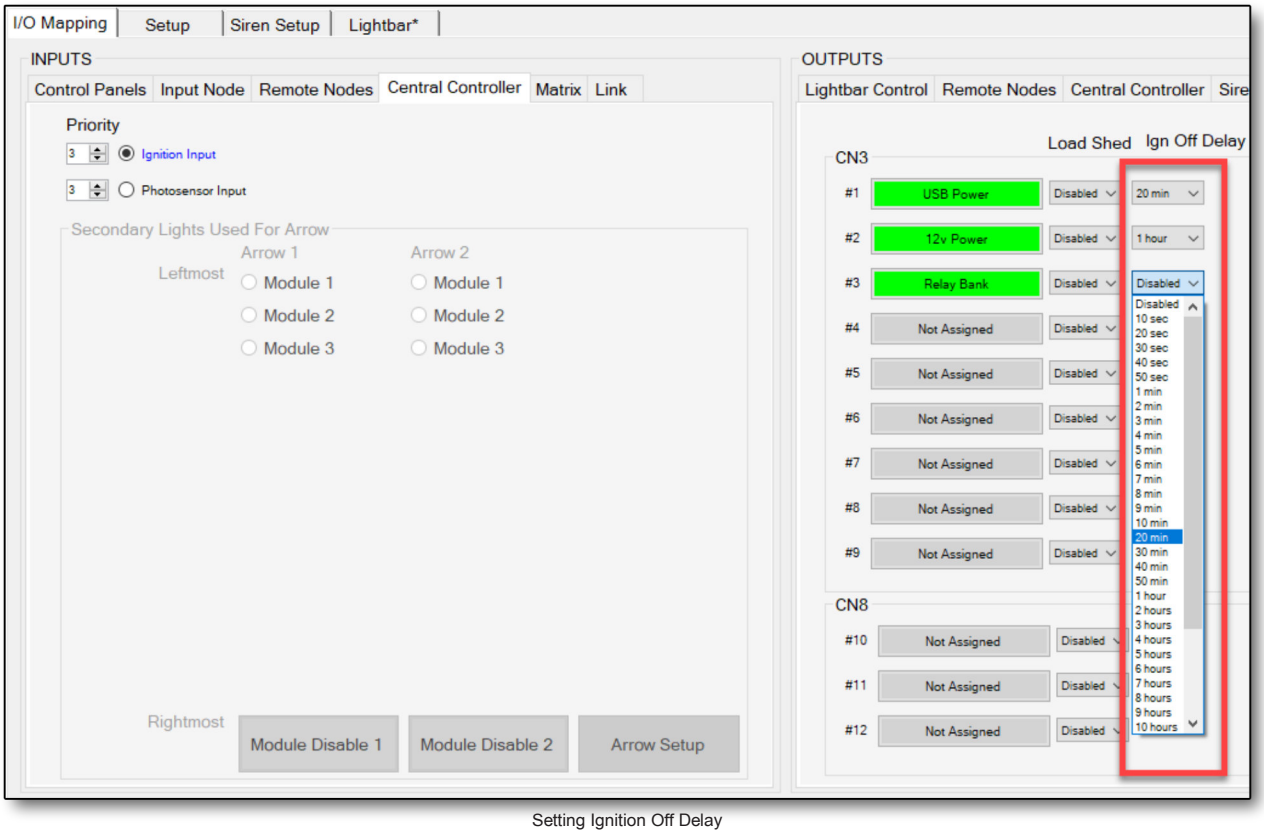
*For example*, ignition can be mapped to turn on output #1 on the 480. The delay can be set to continue running for 20 minutes after ignition is removed. If you used that output to power a flashlight charger or other device, this option lets it continue charging for a time without risk of draining the vehicle battery.

On the same system, ignition can be mapped to flash output #4 on the Central Controller, with a 5 minute off delay.

After ignition was removed on the vehicle, Central Controller output #4 will flash for 5 minutes and then stop. Output #1 on the 480 will continue to run for an additional 15 minutes.

**bluePRINT Tip:**

System Off Delays and Ignition Off Delays are completely independent of one another. A System Off Delay can be shorter or longer than any Ignition Off Delay.




Setting Ignition Off Delay

# Load Shedding

The Load Shed feature built into bluePRINT allows a system to shut outputs down based on current voltages.

This is set per output, allowing the programmer to shut down outputs in a prioritized fashion.

Before going into programming each of these functions here are a few considerations:

**Vehicle Startup Voltage –** Always consider the voltage requirements for a modern vehicle. In many cases, the BCM controls whether or not the vehicle can start. In many cases, a vehicle will not start once the voltage has crossed under a manufacturer-set minimum voltage. These minimum voltages are frequently higher than we might think, and are designed to protect the vehicle battery from excessive strain, prolonging its life.

**Battery condition / age –** A 12 volt battery is fully charged at above 12.7 volts. 12.4 volts is considered 75% charged. 12 volts is considered 25% charged and 11.9 volts is considered discharged.

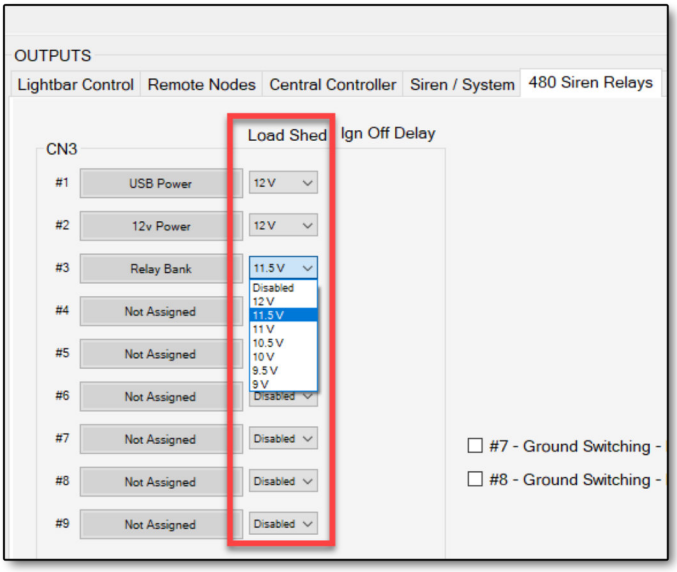
When a vehicle is running, it is typical to see 14.5 volts or more at the battery.

As a battery ages, the time it takes to go down in voltage shrinks. The cranking and cold cranking capacity of a battery is also affected in that time. By considering this when setting load shed, dead battery scenarios can be avoided.

**Lightbars –** Since lightbars are not a physical output on bluePRINT they cannot be load shed like a normal output. To create a lightbar load shed, create a Matrix with voltage as a condition, and map the Matrix to turn off lightbar functions.

**Voltage Spike –** When using the load shed feature on a vehicle, it is suggested not to shed all outputs at the same voltage.

In cases like this, the vehicle sheds all loads, and then the voltage comes back up suddenly, allowing all loads to turn back on. This process can become cyclical and can damage electronic components.



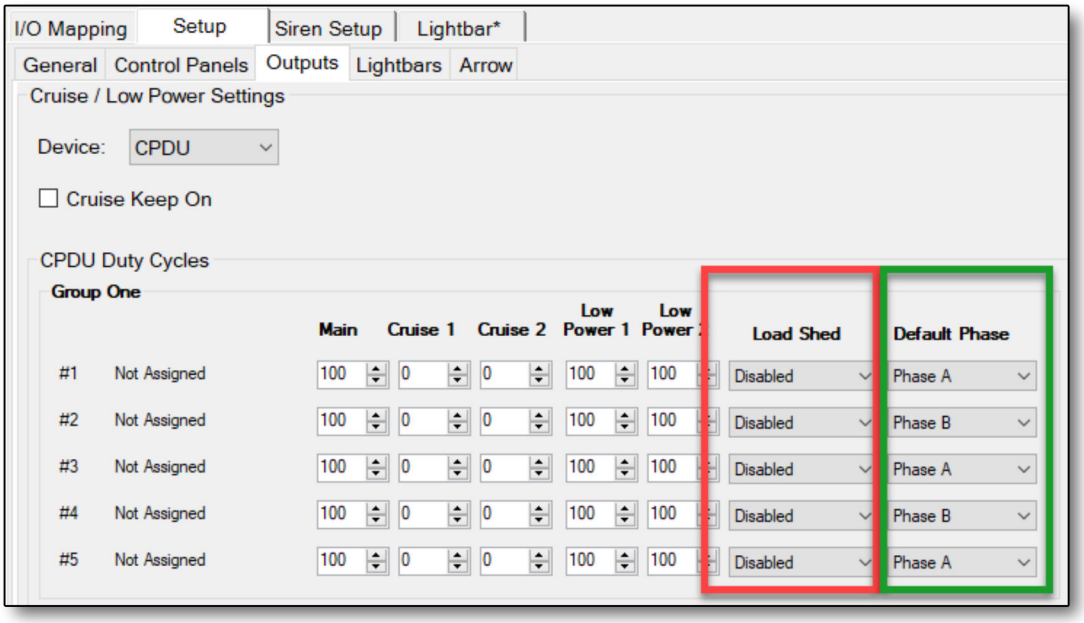

Load Shed - 480 Amplifier

**Recommended Values –** Each vehicle manufacturer has specific requirements for a vehicle to run. As a result, there is no exact voltage setting for load shed. Most vehicles can benefit with settings between 12 volts and 11.5 volts. Dipping into 11.0 volts can sometimes be problematic on older batteries.

Load shed is set in two different places depending on the output type being shed.

For the 480 amplifier, there is a drop-down always showing next to each output. Just click on the drop-down and set the shed threshold.

Any outputs that are on the Central Controller or Remote Nodes are set on the Output




Load Shed - Central Controller / Remote Nodes (Red) - Default Phase (Green)

Settings Screen. Navigate to the Setup / Output sub-tab.

At the far right of each output, is a drop-down for load shed allowing for customized settings. See the above image. Load shed for the Central Controller and Remote Nodes is noted with the red box.

bluePRINT will shed an output when the system voltage is below the threshold for more than 5 seconds. Once the output is shed, it will stay off until voltage comes back up above the threshold for more than 1 second.

In many cases a vehicle has a System Off Delay of Instant Off, meaning that when the key is removed all the equipment shuts down. We still recommend setting load shed for unlikely events such as:

Alternator Failure

Key On / Engine Off

In the case of an Ignition Off Delay on a specific output, we always recommend setting load shed. These types of outputs are typically used for higher current draw components like modems, radios, power outlets.

## Global Phase Change

Global Phase changes allow the user to make changes to the standard output phasing. By default, odd outputs flash on phase A, and even outputs flash on phase B.

This is commonly used when a vehicle layout didn't follow the normal odd/even alternating setup.

To access the global phase settings, navigate to the Setup / Outputs sub-tab. To the far right of each input is a drop-down to change the default phase, shown above, in the green box.

Making changes here modifies ALL current mappings, so it is advised to make these changes before any specialized output mapping is completed.

We do not recommend these changes to correct a mis-wired vehicle in a multi vehicle installation. Instead, we recommend correcting any mis-wiring. If all vehicle's were similarly mis-wired, due to a schematic change or planning error, then a global change would be appropriate.

## Misc. Lightbar Settings

There are a handful of miscellaneous lightbar settings that can be set on the Setup / Lightbar sub-tab. From left to right each of these settings are covered.

**Lightbar Type:** This drop-down determines which type of lightbar bluePRINT is controlling. The default setting, nFORCE or mpower, works for most installations. If using a legacy type lightbar select the second option, EPL9000, ETL5000, Apex or Magnum.

This allows bluePRINT to send commands to the lightbar directly, instead of using the older breakout box discrete wires.

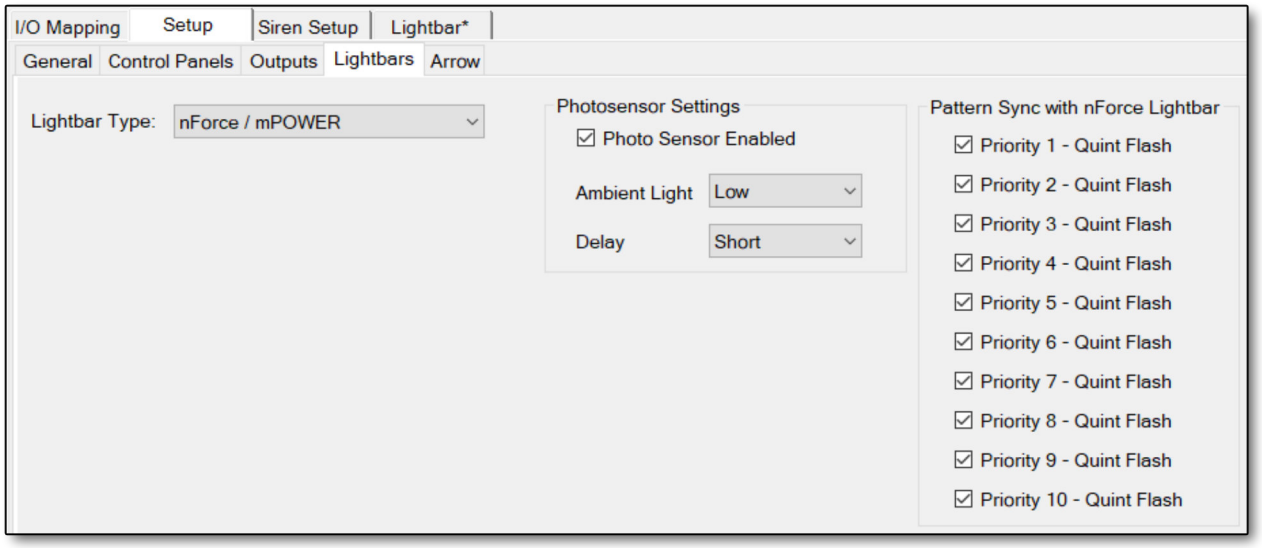
**Photosensor Settings:** mpower and nFORCE Exterior lightbars come with photo sensors by default. In order to utilize the photo sensor, bluePRINT must be told to recognize the input. By checking the box “Photo Sensor Enabled” bluePRINT will activate the photo sensor input based on the Ambient Light and delay settings.

For the ambient light settings, each are displayed below. The “Activation” rating is the lux value for the photo sensor to become active. The “Clear” rating is the upper threshold for the photosensor to deactivate.

In either case, the lux value must be under or over threshold for a designated time.

| Ambient Light | Activation | Clear |
|---|---|---|
| Low | 20 Lux | 200 Lux |
| Medium | 50 Lux | 300 Lux |
| High | 70 Lux | 500 Lux |

| Delay | Time |
|---|---|
| Short | 5 Seconds |
| Medium | 15 Seconds |
| Long | 30 Seconds |




Miscellaneous Lightbar Settings

**Pattern Sync:** bluePRINT can sync lightbar patterns with perimeter lighting to create emphasis with any light pattern. In fact, bluePRINT will do this by default, unless it is specifically programmed not to.

This function can allow a pattern to sync on one priority and the same pattern not to sync on another priority.

By un-checking these boxes, bluePRINT will no longer sync on the specific priority.

# Siren Setup

This chapter covers how to setup siren functionality within bluePRINT. For most installations, the default configuration can be used.

## Global Settings

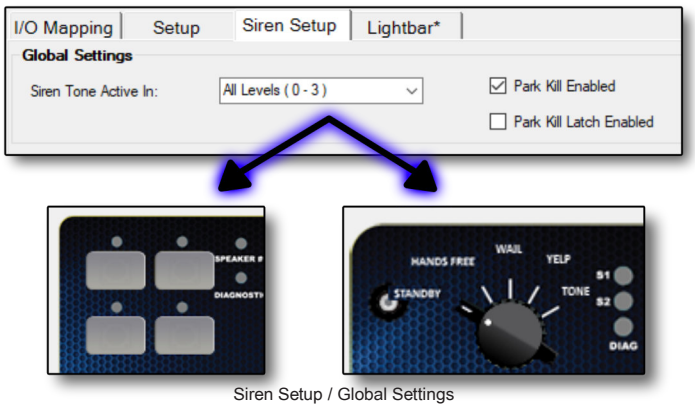
The global settings at the top of the siren setup page is broken into two parts.

**Siren Tone Active In:** The first part determines when siren tones can be activated using the Control Panel buttons. This affects any button set to Wail, Yelp or Tone Functions.

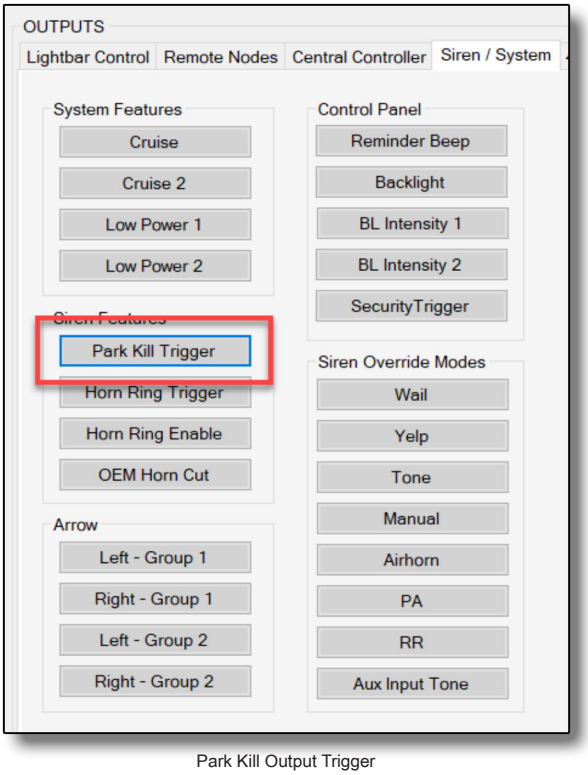
This is based on slide switch positions. The drop-down allows the siren buttons to be active in any level, or to be restricted to higher levels.

**Park Kill Function:** The two check boxes within the Global Settings are specific to how Park Kill functions.

When Park Kill Enabled is checked, Park Kill is set to respond to the Park Kill output trigger in the I/O Mapping / Siren System sub-tab.




Siren Setup / Global Settings



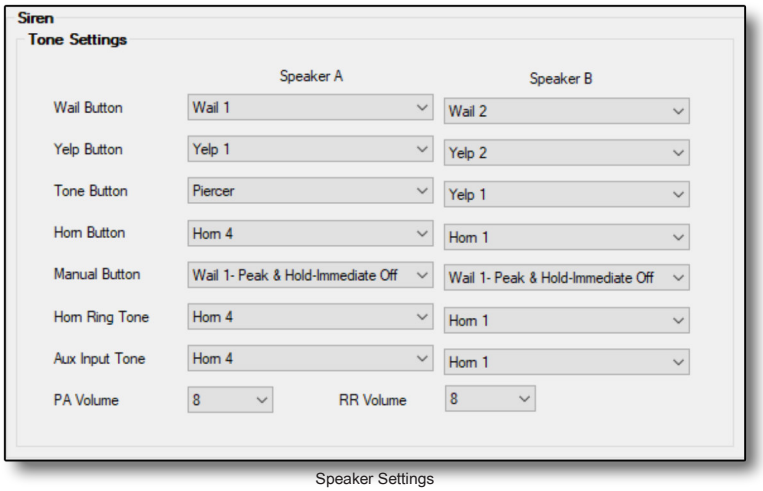

Park Kill Output Trigger

When Park Kill Latch is enabled, the siren goes into standby once the vehicle enters park. The siren will stay in the standby position, regardless of knob or push button position, when the vehicle exits park. The user must manually activate the siren tone once again or use the horn ring functions to activate it (provided horn ring is programmed to activate the siren).

With this feature not active, the siren is essentially muted while the vehicle is in park. Once the vehicle exits park, the siren tone will resume. This forces the operator to physically turn the siren function off when no longer needed.

## Siren Tone Settings

Siren Tone Settings allow the programmer to determine which tone



Speaker Settings

will play from the speaker. Speaker A is the primary speaker, and speaker B is the secondary when utilizing a 200-watt system.

bluePRINT can be programmed to play two different emergency tones at any given time. This can create a perception that there is more than one emergency vehicle approaching.

On the 400 series amplifier, speaker A is wired to the Orange & Orange/Black pair of wires. Speaker B is wired to the Green & Green/Black pair.

If installing the 100-watt, 200 series siren, two will be needed, each powering a separate speaker. Provide 12 volts of power to the tan wire on the second 200 amplifier to make it the Speaker B tone source.

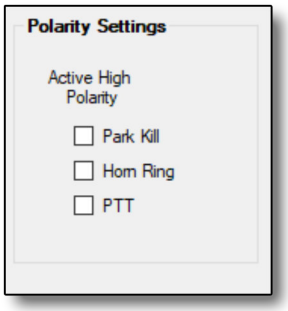
PA and Radio Rebroadcast volumes are adjusted at the bottom of this section.

**Park Kill:** On page 37, we talked about special inputs for bluePRINT. Park Kill at the siren amplifier was one of them.

We recommend not using this input since it cannot be overridden with bluePRINT. Anytime a discrete wire is to be used for Park Kill, we recommend connecting it as an input on the Input Node or a Remote Node.

**Horn Ring:** This check box allows the programmer to set the polarity of the horn ring. In most vehicles the horn ring is a negative signal from the horn switch to the BCM.

Regardless of positive or negative, we recommend connecting the horn ring before the vehicle's horn ring relay, where it is still low current. Driving the horn directly can blow internal fuses on the siren amplifier.

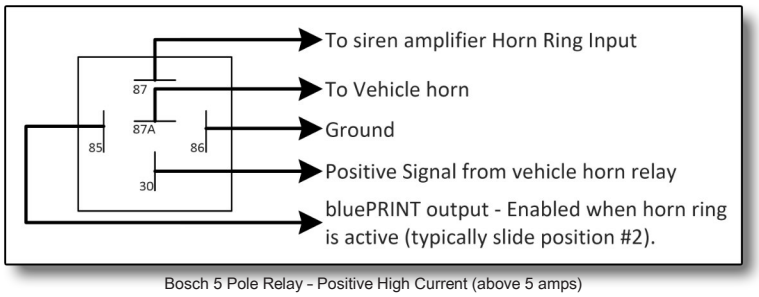


Siren Polarity Settings

If it is necessary to connect the horn ring to the higher current, we recommend using a standard Bosch relay to isolate the amplifier. With this setup, an activation output will be needed to energize the relay when the Horn

## Polarity Settings

The specific polarity settings for the siren amplifier inputs are set here. Remember Active High polarity is referring to a positive signal.



Bosch 5 Pole Relay - Positive High Current (above 5 amps)

Ring is to become active. This is typically in slide switch position two, vehicle out of park.

**PTT:** The polarity needed to activate the PA when the Push to Talk (PTT) feature is activated. This is typically used with the 200 series amplifier.

## Advanced Horn Ring Settings

Advanced horn ring settings allow the programmer to set different horn ring functions for each level of the slide switch.

These horn ring settings are specific to when the siren is on or off. Configuring advanced settings is broken down into 4 sections.

**Slide Level:** Settings are completed for each slide level. This allows one level to have horn ring functions and another not to, based on the requirements of the end user.

For each level, the transfer functions will need to be set, as covered below.

**Horn Transfer Check Boxes:** Each check box allows the horn ring transfer to be active when the siren is on or off. Siren on means a siren button (or knob) on the control panel is active.

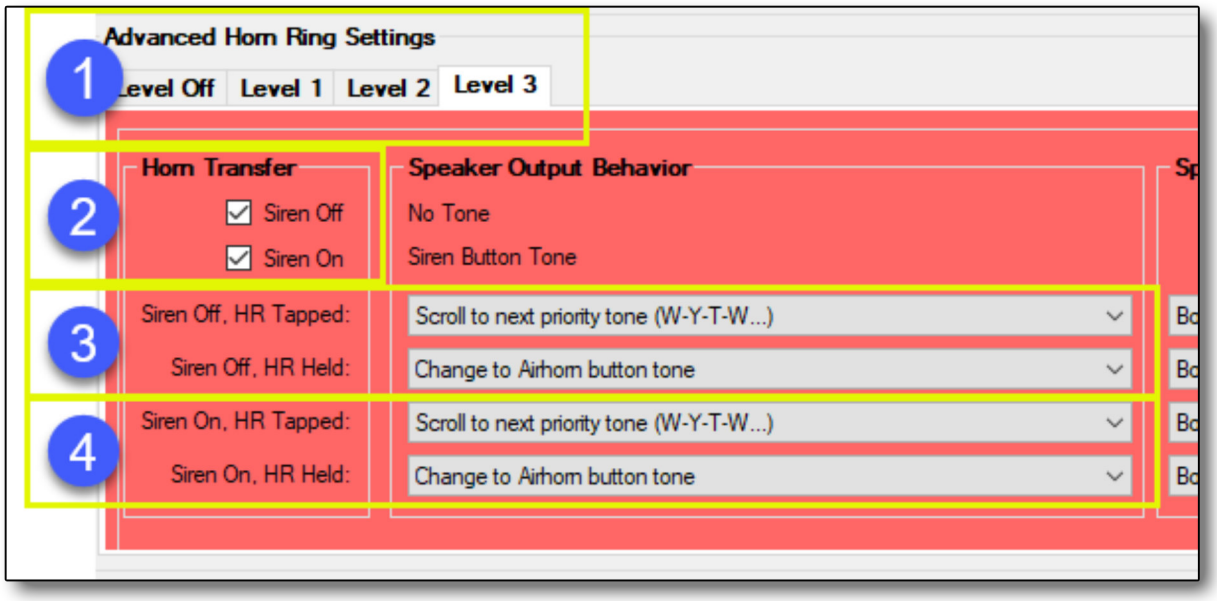
This allows the horn ring to be programmed based on when the siren buttons are active or not. The horn ring can be configured differently for each state.

**Horn Transfer / Siren Off:** This sets the horn ring functions for when the siren buttons or knob are off. This is done per level.

The speaker can be set to play different tones, based on tapping the horn ring, vs holding down the horn ring.

First, pick a behavior. This can be playing a specific tone, scrolling to the next tone, or toggling between two different tones.

Next, pick which speaker this tone will play out of. This allows one tone to play out of one or both speakers in a 200-watt system. This means that the horn ring can affect one or both speakers based on the user needs.




Advanced Horn Ring Settings

Finally, the duration is set. There are 4 different options for the duration.

*Latch until control panel button change* - The tone will continue playing until the operator changes it, either buy shutting the siren off, or pressing the horn ring again. If the siren was not active and this feature was enabled while pressing the horn button, the siren tone would activate and continue until the operator turned it off or the vehicle was put into park.

*Horn Ring Duration* - The tone will play for the Horn Ring duration and then return to the previous tone. Horn ring duration refers to a timer setting at the very top of the Advanced Horn Ring Settings section.

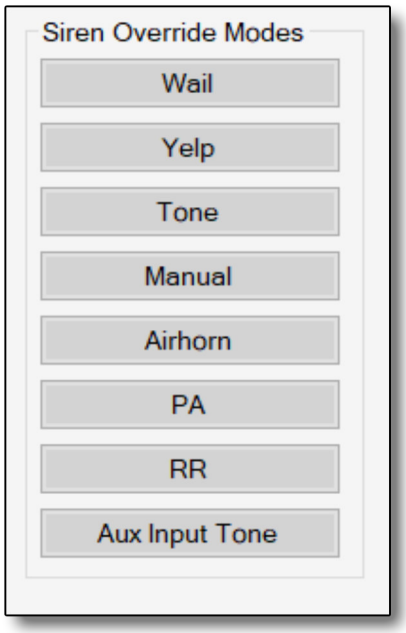
*While pressed then revert to previous tone* - The tone will change with the horn ring input, while the horn button is pressed. When released, the tone will go back to the tone it was playing. This momentary activation type is typically used for sounding the airhorn while another siren tone is active.

*While pressed then turn off* - Like the above, the tone changes while pressed, and the siren turns off when released. This slightly different momentary activation type is also typically used for the airhorn, or for "manual" siren functions such as ramp up or peak and hold.

The last option, only available for the Siren Off setting, "Latched until control panel button change," is “Allow double tap to cancel." When checked, this allows a quick double tap within one half second to turn the siren off. This function ONLY works with a siren tone that was activated using the horn ring, and not siren tones activated using the siren buttons or knob.

**Horn Transfer / Siren On:** This sets horn ring functions for when the siren buttons or knob are on.

Programming is the same as for "Siren Off."



Siren Override Tones

## Siren Override Outputs

Siren override tones allow activation of specific tones without the use of a control panel.

These tones are activated and deactivated as an output in bluePRINT, and are located on the I/O Mapping / Siren System output sub-tab.

Typically these outputs are utilized with a discretely wired input, like from a hidden switch.

Because these are overrides, keep in mind they will override all other siren functions including Park Kill. If Park Kill is to be used, map the input trigger to turn the Siren Override output off (red).

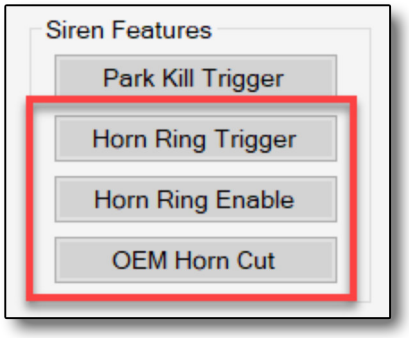
## Horn Ring Outputs

There are a couple horn ring outputs that are worth mentioning in this manual. All of these are located on the I/O Mapping / Siren System sub-tab.

**Horn Ring Trigger:** When active, this output instructs bluePRINT to follow horn ring functions. This should be mapped to a momentary trigger, which allows for a quick press, or a long press.

**Horn Ring Enable:** When this output is active, bluePRINT enables the Advanced Horn Ring Settings. It is on by default with ignition in a new program.

**OEM Horn Cut:** By activating this function, bluePRINT opens the horn ring circuit. This allows for the OEM horn to not see the horn signal each time the horn is pressed.




Horn Ring Outputs

# Lightbar Programming

With bluePRINT, lightbars can be programmed directly through the bluePRINT application, or by running the SoundOff Lightbar Configurator as a second program.

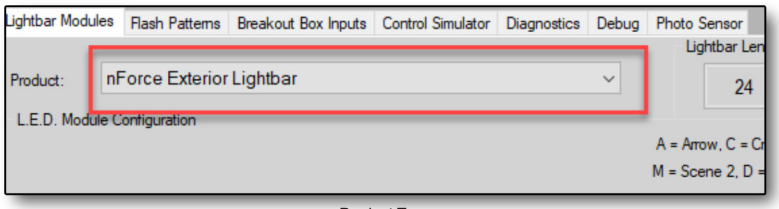
When programming a lightbar with bluePRINT, all programming for the lightbar and bluePRINT itself is transferred using a USB A to B cable, connected to the Central Controller.

Remember, the top menu bar commands are specific to the lightbar when a lightbar tab is currently selected.

Programming a lightbar directly, without using bluePRINT, involves a direct connection between the lightbar breakout box and the SoundOff Lightbar Configurator. This requires a USB A to Mini B cable.

This chapter covers programming as it relates to bluePRINT. Some features are excluded, due to how bluePRINT processes lightbar commands.

There are sub-tabs within each Lightbar Navigation tab. We will be concentrating on Lightbar Modules, Flash Patterns, and Diagnostics.




Product Type

USB A to B Cable

USB A to Mini B

## Product Types & Breakout Boxes

For each type of SoundOff Signal lightbar, there are different breakout boxes. Typically, the label on top of the breakout box determines which type of lightbar it is setup for.

There are internal differences between each lightbar type, which means swapping one type in for another will not work.

Each breakout box type corresponds with a lightbar type in the software, selected using the Product drop-down menu at the top left.

As a lightbar type is selected, additional parameters may be requested. For example,

selecting a mpower Lightbar prompts for bar size, and module size.

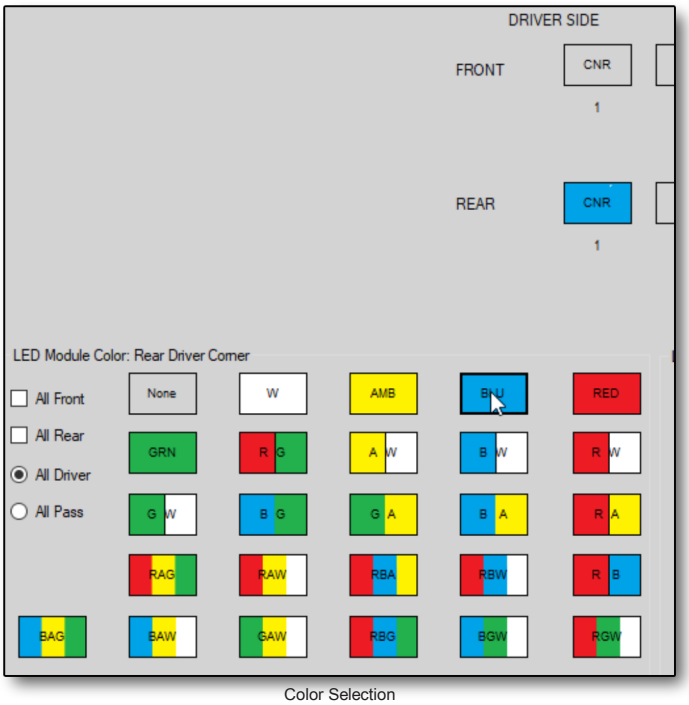
When connecting to a system that has the lightbar already programmed, selecting the proper bar type is required to allow communication between bluePRINT and the lightbar.

## Selecting Module Colors

Once the bar type, length, and module type are selected, each module position can be assigned a specific color, or combination of colors.

Simply click on a module, and then click on the required color or colors for that module.

To the left of the color swatches, are selection boxes for All Driver or Passenger, and All Front or Rear. This allows rapid assignment of lightbar modules.



Color Selection

**bluePRINT Tip:**

When programming lightbars, there is a check box titled “Select Multiple”.

When activated, multiple modules can be selected allowing functions to be assigned at the same time.

When using any of the mpower type of lightbars, clicking the Identify Modules button will scan the lightbar and report back each module and associated colors. For this to work, the lightbar and breakout box must have power, ground, and data connectivity.

## Configuring Module Functions

bluePRINT sends lightbar commands out in a stream of data. Breakout boxes respond to this data when programmed by activating the lightbars.

Think of it this way, when at baggage claim at the airport, the bags just keep coming out the conveyor lift, and onto the carousel. Those bags are the data stream being sent from bluePRINT.

When we pick up our bag off the carousel, we are responding to the data in front of us.

As different modules are set to different functions, they respond when bluePRINT sends the command out.

Each command is being sent to all connected lightbar breakout boxes, but only the breakout boxes that are programmed to respond do. Going back to the analogy above, each person at the airport carousel is a lightbar module. They can see all the data, but respond only to a particular piece (their own luggage).

Once all lightbar module colors are set, the functions for each can be programmed. Just like before, click on the module, and then set the functions.

Functions are set on the drop-down menus. Within each drop-down a color can be selected. In the case of a multi-colored light, all color options for the specific light module will be presented.

If for some reason, a function is not needed on a specific light module, set that function to "None."

When a function is added to a module, a letter will appear beneath the module, notifying which functions it is programmed to respond to. There is also a legend above all the modules.

Each of these functions is activated in bluePRINT on the I/O Mapping / Lightbar output sub-tab.

STT, or Stop/Tail/Turn, and Alley scene automatically respond to the side of the lightbar that they are on.

Don't forget, there are cruise and low power modes specific to the lightbar functions as well as vehicle perimeter lights.

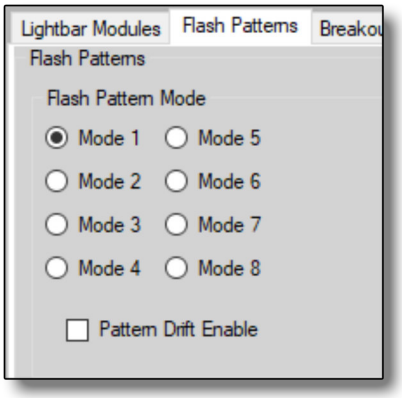
| Code | Function |
|---|---|
| A | Arrow |
| C | Cruise Mode 1 |
| D | Steady On |
| L | Alley Scene |
| M | Scene 2 |
| N | Scene 1 |
| R | Cruise Mode 2 |
| S | Stop / Tail / Turn |
| T | Takedown |
| 1 | Low Power 1 |
| 2 | Low Power 2 |

Lightbar Function Legend

# Flash Patterns & Modes

Flash patterns are set on the Flash Pattern sub-tab. This tab is broken down into 3 selections.

**Mode Selection:** Each mode of the lightbar allows different flash pattern programming for each module. These modes correspond to the mode selection on the I/O Mapping / Lightbar output sub-tab.




Lightbar Modes

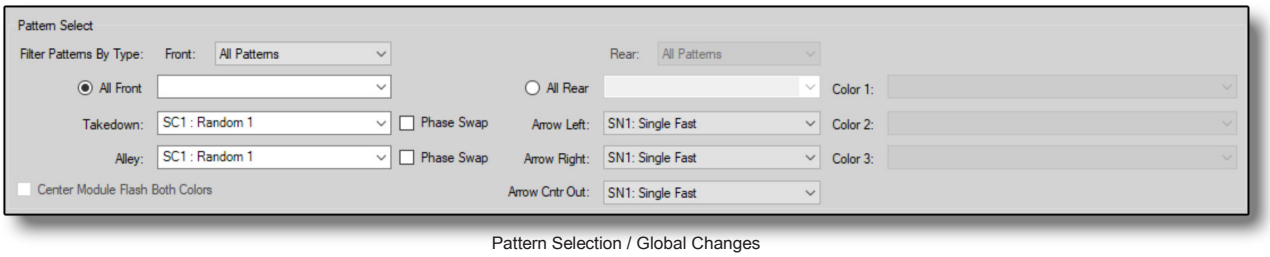
As a mode changes, so do the patterns associated with the mode, when programmed to do so.

The modes have built in priority. This needs to be considered when activating them using bluePRINT. Mode 1 is the lowest and mode 8 is the highest.

Pattern drift allows synchronized lightbar patterns to un-sync. For this function to work, make sure that the pattern is also unchecked on the on the Setup / Lightbar sub-tab. See page 59 more more information.

**Pattern Select Section:** In this section, drop-down menus allow all front or all rear modules to be set to the same pattern, along with which color activates first, second, or third in a multi-colored pattern.

Arrow warning patterns are also set in this section. Each direction can have a different arrow pattern if needed. The same goes for Flashing Takedown patterns.




Pattern Selection / Global Changes

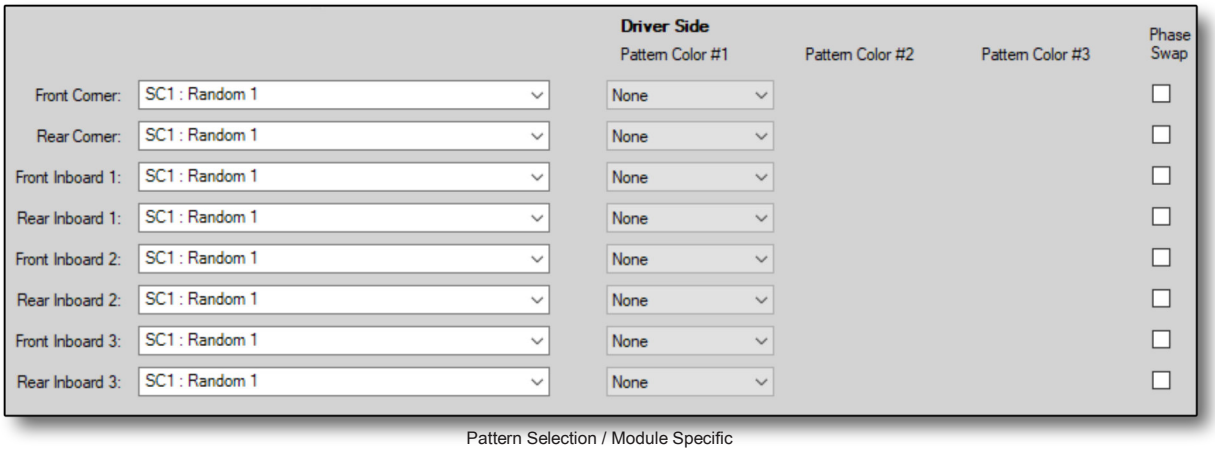
Arrow and Takedown patterns can be different with each lightbar mode.

**Module Specific Patterns:** When needed, lightbar modules can have different patterns, just by selecting the module and changing the pattern.

This allows modules to be setup on different patterns and different color combinations for each lightbar mode.

There is a check box option for each mode titled “Phase Swap.” This allows for variation in the lightbar pattern from the default side to side.

With this feature active, side to side flash patterns can be modified so that they flash every other module, or inside / outside patterns.




Pattern Selection / Module Specific

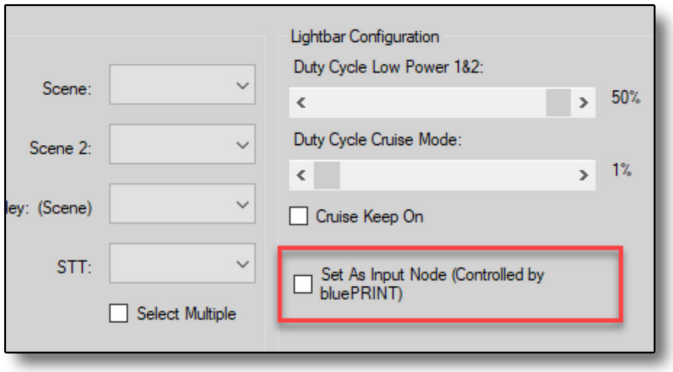
## Set as Input Node

**Formerly "Controlled by bluePRINT"**

When using a breakout box to replace a bluePRINT Input Node, a few steps must be followed. First, the input node type must be configured in bluePRINT so that the Central Controller knows where to look for inputs (covered on page 55).

The same must be done for the breakout box that is going to be used for inputs. This instructs the breakout box to send the input signals directly to bluePRINT instead of processing them internally.

To do this, check the box "Set as Input Node." *There should only ever be one breakout box that is "Set as Input Node" on a system.*




Controlled by bluePRINT

**Input Node:**

Input Nodes are connected to the LIN Data bus. Pin #5, light green, is connected directly to LIN Data.

No Ethernet connection is needed.

See the images at the end of this chapter.

## Connectivity Review

**Lightbar Breakout Box:**

When connecting a breakout box to bluePRINT, be sure it is connected to the Lightbar Data Bus with an Ethernet cable. This is regardless of whether it is "Controlled by bluePRINT" or not.

Pin #5 which is light green is for lightbar data communication and should only be connected to the lightbar data wire.

Do not under any circumstances connect Pin #5 to the LIN Data Bus. This is an easy mistake to make, as B.O.B.s and Input Nodes are similar in appearance and have similar wire harnesses.

## Firmware Updates

When connecting to a breakout box, a message may popup requesting a firmware update of either the breakout box, or in the case of mpower lightbars, the modules themselves.

This is done on the Diagnostics tab.

There will be different update options depending on the bar type that is connected/ selected.

**NOTE:** Firmware updates must be done while connected directly to the breakout box using a USB A to Mini B connector.

Firmware updates should always be done with a new installation to allow for the newest features as well as stability.

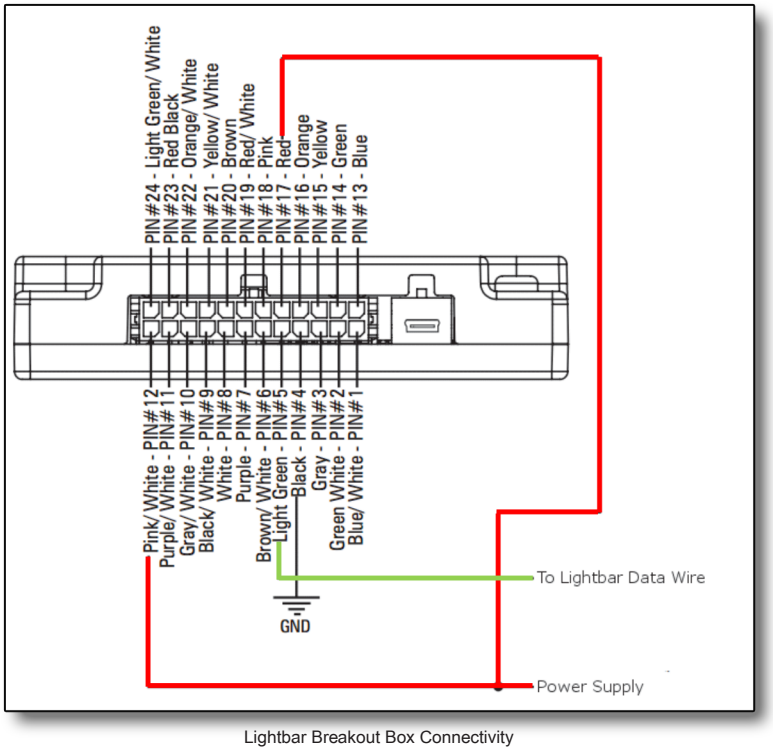
# Final Notes

With some installations, there may be multiple lightbars of the same type connected to bluePRINT. Although we do not offer technical support for installations like this, there are guidelines to avoid problems:

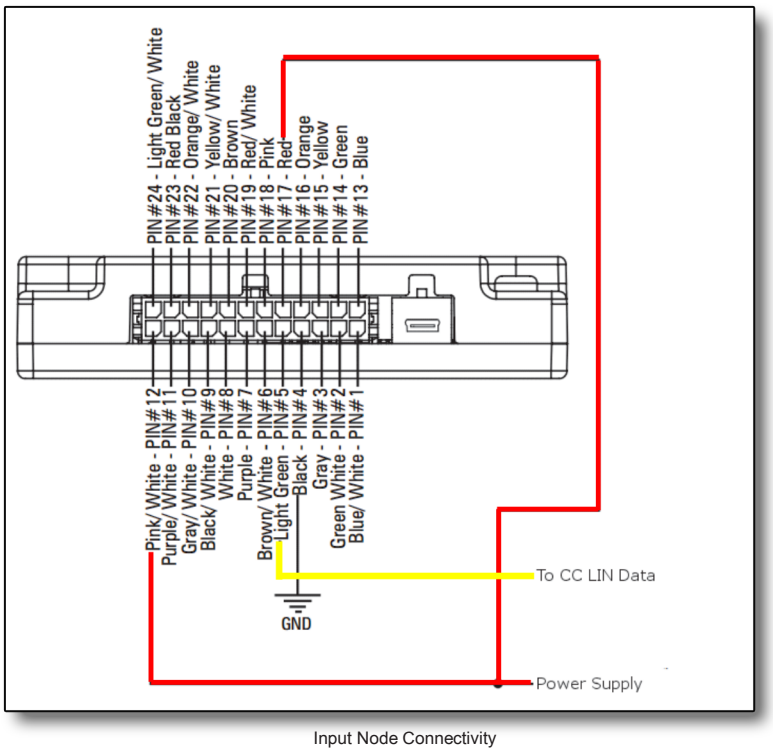
1. Make sure all breakout boxes and modules of the same type are up to date on firmware.

2. Programming should be done directly to the breakout box. Attempting to program breakout boxes through bluePRINT will most likely produce unexpected results.

3. bluePRINT will communicate and sync with the Ford Interceptor equipped with OEM SoundOff Signal interior or spoiler lights. Additional programming to the breakout box requires Dip Switch #2 to be moved from the OEM position.




Lightbar Breakout Box Connectivity




Input Node Connectivity

# Diagnostics

At some point in a vehicle's service life, things may go wrong with bluePRINT. This could be something simple, like a light doesn't work, or something more serious, such as when a whole input or Matrix does not perform its function.

This chapter covers bluePRINT's advanced diagnostics, a powerful set of tools to aid a technician in determining the root cause of a problem.

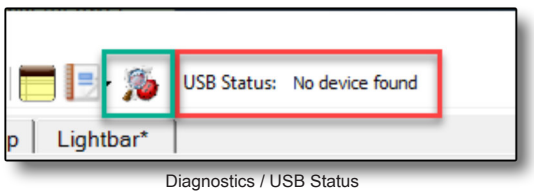
## Output Faults

The first sign that something is wrong can vary. In some cases, a light may no longer be flashing, or a complete function is activating when it should not be. In others, a control panel LED indicator may be flashing.

Regardless of the sign, bluePRINT has different diagnostic tools to help resolve the problem.

The first step in diagnosis, is to make sure bluePRINT is up and running on the vehicle. The ignition should be on, and computer connected. Remember to look for the "EV System Connected" at the USB Status indicator at the top of the bluePRINT screen.

Once all that has been checked, click on the Diagnostics button in the upper menu. This will open the diagnostics screen. Then hit "Start Diagnostics." This turns all diagnostic reporting on, and bluePRINT immediately starts updating the computer with real-time data.

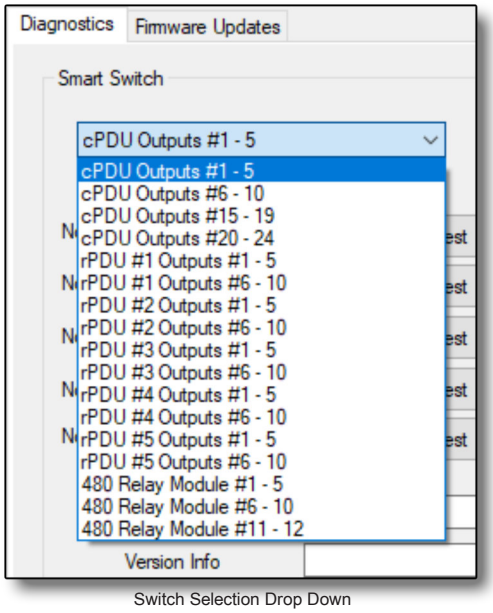


Diagnostics / USB Status

Most features require bluePRINT Diagnostics to be active, so please consider that when performing any diagnostic work.

The screen is divided into three parts: Smart Switch Status, Fault Logs, and Firmware updates. We will start with Smart Switch Status.

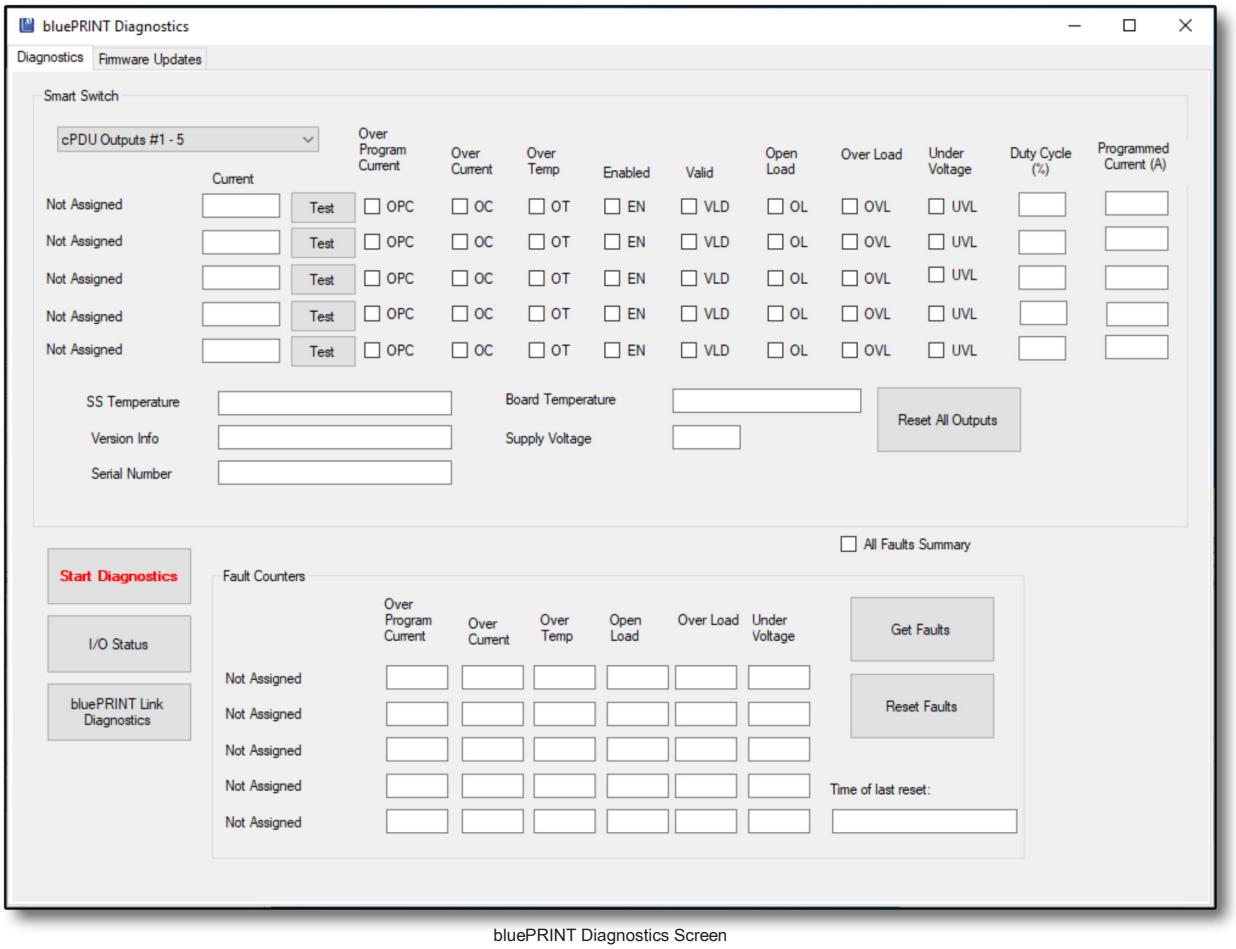
Smart Switch Status is the main fault report tool in bluePRINT. Each switch utilizes solid state electronics and monitor themselves for proper health. Because of this, there are no fuses on these outputs. They will shut themselves down in any over-current or fault situation.



Switch Selection Drop Down

**Switch Selection:** At the top left of the Smart Switch area is a drop-down, which allows the technician to select which switch is being shown on the screen.

The component is listed before the outputs to ease the technician in locating a faulted output. CPDU refers to the Central Controller and




bluePRINT Diagnostics Screen

RPDU, followed by a number, refers to a specific Remote Node.

Once selected, a group of 5 outputs will be displayed, each on its own row. Remember, 5 outputs make up a switch. For each row, are several columns of information, which are described from left to right:

**Output Name:** Each output's name will be displayed here.

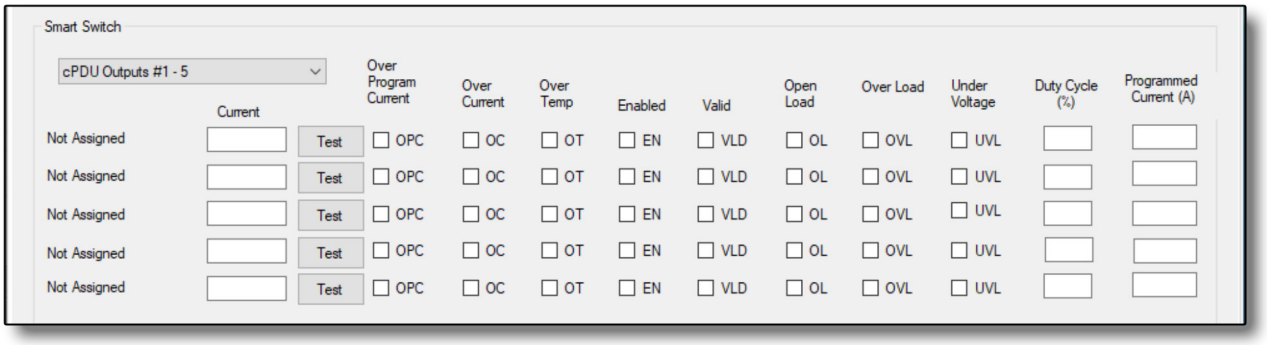
**Current:** The first column displays the current being drawn from bluePRINT by each output. Current is displayed here any time the output is being utilized, either by testing or activation through a program function. Keep in mind, current measurements when flashing are more likely to be an average current.

**Over Program Current:** The first of the check box columns. When this is checked, bluePRINT is indicating this output went over the programmed current limit. This typically happens when the current limit was set just above the specified draw of a light. When the vehicle is not running, and the voltage starts to drop, the current will increase based on Ohms Law.

Amps = Watts / Volts

Once faulted, the output will continue to stay off until it has been inspected and reset by the technician.

**Over Current:** When checked, the output has exceeded the maximum current rating for the output itself. Remember, each switch has three




Smart Switch Faults

outputs rated at 5 amps, and two at 10 amps. One of the 10-amp outputs is always Xenon Inrush capable. See page one.

Once faulted, the output will continue to stay off until it has been inspected and reset by the technician.

**Over Temperature:** When this occurs, it is indicating that the output temperature has exceeded its safe limit and shut down. This may plague more than one output on the same switch, considering they are all connected.

This is likely caused by too many high amperage loads on the same switch. Another possibility is that the affected piece of equipment is in a hot un-vented area.

When this fault occurs, the output or outputs will continue to stay off until it has been reset by the technician.

This is a very rare fault, even in hot climates. An over temp fault should merit serious inspection, as you may have a bad connection or inadequate wire size on that circuit.

**Enabled:** This will be checked anytime bluePRINT is trying to activate an output, regardless of the fault state of that output.

**Valid:** When checked, the output is working normally. If any other fault condition is checked, aside from enabled, Valid will not have a check mark in it.

**Open Load:** This indicates that the output is not seeing a load when active. There are several potential situations that can cause this, but most commonly: a bad connection, or the piece of equipment connected to the output is no longer working.

Open load can also provide a false positive with an extreme low amperage device connected. There are some lights, like the SoundOff Signal Fusion light, that have such a low draw, bluePRINT considers the light not there.

When an output has an open load fault, it will continue to run as normal.

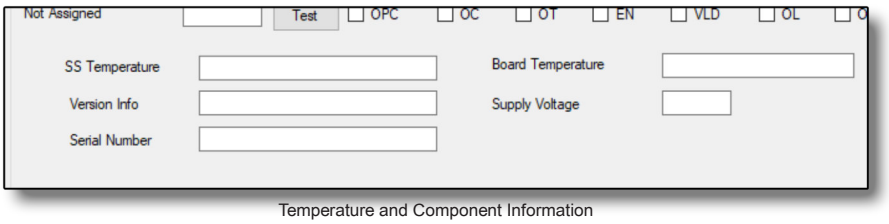
**Over Load:** When checked, the output has detected an overload condition. This is typically a short circuit. Most common causes are a malfunctioned component, bad splice, or possibly a pinched wire.

Once faulted, the output will continue to stay off until it has been inspected and reset by the technician.

**Under Voltage:** If this box is checked, it is indicating that the selected switch has inadequate power supplied to it. This typically is due to an undercharged battery, undersized wire or a malfunctioning component.

When an output has the under-voltage fault, it will continue to run as normal.

**Duty Cycle:** The main duty cycle for the output is displayed here.



Temperature and Component Information

**Programmed Current:** The output current limit that was previously programmed will be displayed here.

Below the current faults section is more information for the currently selected Smart Switch.

**SS Temperature:** This will display the current Smart Switch temperature. Typically ranges from 25-50 Celsius are shown. Temps should not get above 100 Celsius.

**Board Temperature:** Just like the Smart Switch temp, but for the components circuit board.

**Version Info:** The currently selected components firmware will be displayed here.

**Supply Voltage:** This displays the supply voltage for the currently selected Smart Switch. The voltages from switch to switch and component to component should be fairly close one another.

When there is a significant variation in voltage from one component to another, this can indicate a supply problem.

*For example*, if the Central Controller is showing 12.9 volts on all four of it's switches, and the front Remote Node is showing 10.2 volts on both of it's switches, there is a definite supply issue.

When there is a significant variation in voltage from switch to switch on the same component, this can indicate a faulty component.

Another example, if the Central Controller is showing 12.9 volts on switches 1-5, 6-10, and 15-19, but showing 11.2 volts on 20-24, there can be a potential issue with the Central Controller.

**Serial Number:** This displays the serial number for the currently selected component.

## Control Panel Fault Indicators

Sometimes, when a fault occurs, there may be a LED light blinking on the control panel. This happens when there is a direct fault on a control panel input.

*For example*, if slide switch position #2 is blinking, this is indicating that something in the output mapping for that specific input has faulted.

With a progressive control panel, it is possible to see multiple faults on multiple levels. For example, if slide positions #1 - #3 are all blinking, that indicates that an output on each position is faulted. This could be the same output, if it is mapped multiple times at different priorities/flash patterns.

In some cases, a control panel input is only activating a Matrix and has no output mapping. With situations like this there will be no fault indicator on the control panel.

## Resetting Current Faults

Once an output is faulted, it will remain that way until reset.

This most important reason for this is to protect the components involved, including any wiring. Secondly, it allows the diagnosing technician to see the fault as it has happened.

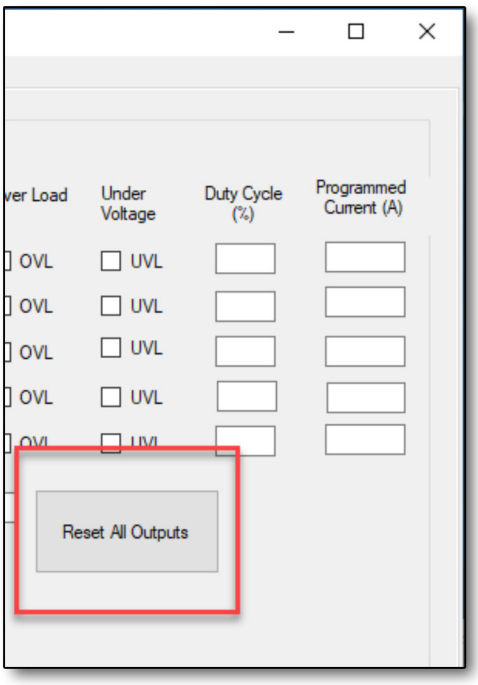
There are three different ways to clear current faults. All three require bluePRINT to be up and running with ignition power.

**Option 1:** Clear the fault using bluePRINT Diagnostics. On the diagnostic screen, is a button to "Reset All Outputs." Clicking resets all faults to the ready state.

Hardware Reset

**Option 2:** On the Central Controller, there is a button next to the Siren Data Bus modular jack. It is labeled "Reset." Using a small screwdriver, or pen, press the button to reset outputs to the ready state.

**Option 3:** If using a SoundOff Signal Central Controller harness, the violet wire will reset all outputs when grounded. Although this is a valid method of resetting, we discourage it since it can be abused.




Software Reset

## Fault Logs

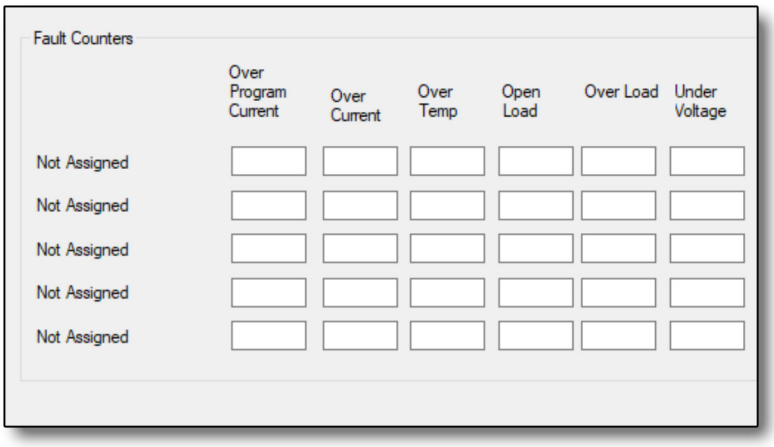
At the bottom of the bluePRINT Diagnostics screen is the Fault Counters section. This section logs faults and number of occurrences.

To start, click on "Get Faults." This command has bluePRINT poll the currently selected Smart Switch for a history of events. In each column are listings of the number of times each type of fault has occurred.

Remember, some faults need to be reset to allow the output to continue functioning. These types of faults ***should*** have relatively low fault counts.

Sometimes the fault count will be high on a re-settable condition. This usually indicates that the operator has been manually resetting the output, either by the reset button, or the wire reset option.

During a typical bluePRINT installation, it is very likely to create faults while testing functions



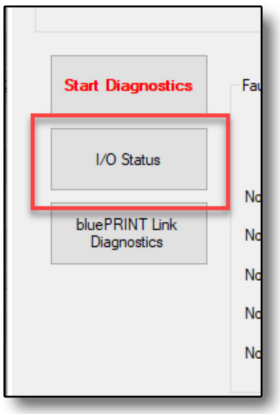

Fault Counters

and building a program. We recommend resetting the fault counter when the vehicle is complete and ready to use in the field. By doing this, faults from the installation and assembly processes are not included in the log. This will avoid confusion later should the vehicle come back for service.

We also recommend clearing the logs each time a vehicle has been serviced.

To do this, simply click "Reset Faults." The fault logs will be cleared out, and a date and time stamp will be included at the bottom.

## Input / Output Status




Input Output Status

The I/O Status screen is the backbone of bluePRINT. This screen allows the technician to see all inputs and all outputs in real-time as they are activated or deactivated.

Click on "I/O Status" to open the display window.

This page is broken into two sections, components and status.

**Components:** The left side of the screen will show a list of all the different bluePRINT components on the system. The color that the component shows up in determines if the component is being seen by bluePRINT.

If a component is listed in green, bluePRINT actively sees that component. If it is show up in red, bluePRINT does not see the component. In the case of bluePRINT Link, there is a third state, which is yellow. This means the BCM of the vehicle has gone to sleep.

**Status:** All the different check-boxes represent inputs or outputs on the system. As they activate, the box will check. When not active, the box clears itself.

**bluePRINT Tip:**

Don't forget to ID Remote Nodes when there are more than one on the system. Otherwise they may not show up at all!

Hovering over a box displays the name for that input or output.

This feature allows the technician to see an input go active, and any associated output mapping go active (or inactive) from the input. The same can be done with a Matrix. Each condition can be monitored allowing you to see if the Matrix goes active or not.

To aid in diagnostics, any input or output can be right clicked to activate it. This is especially helpful when testing the function of a Matrix. Without being in the vehicle, each condition can be made active or inactive one at a time.

This is also helpful for initial testing of each output.

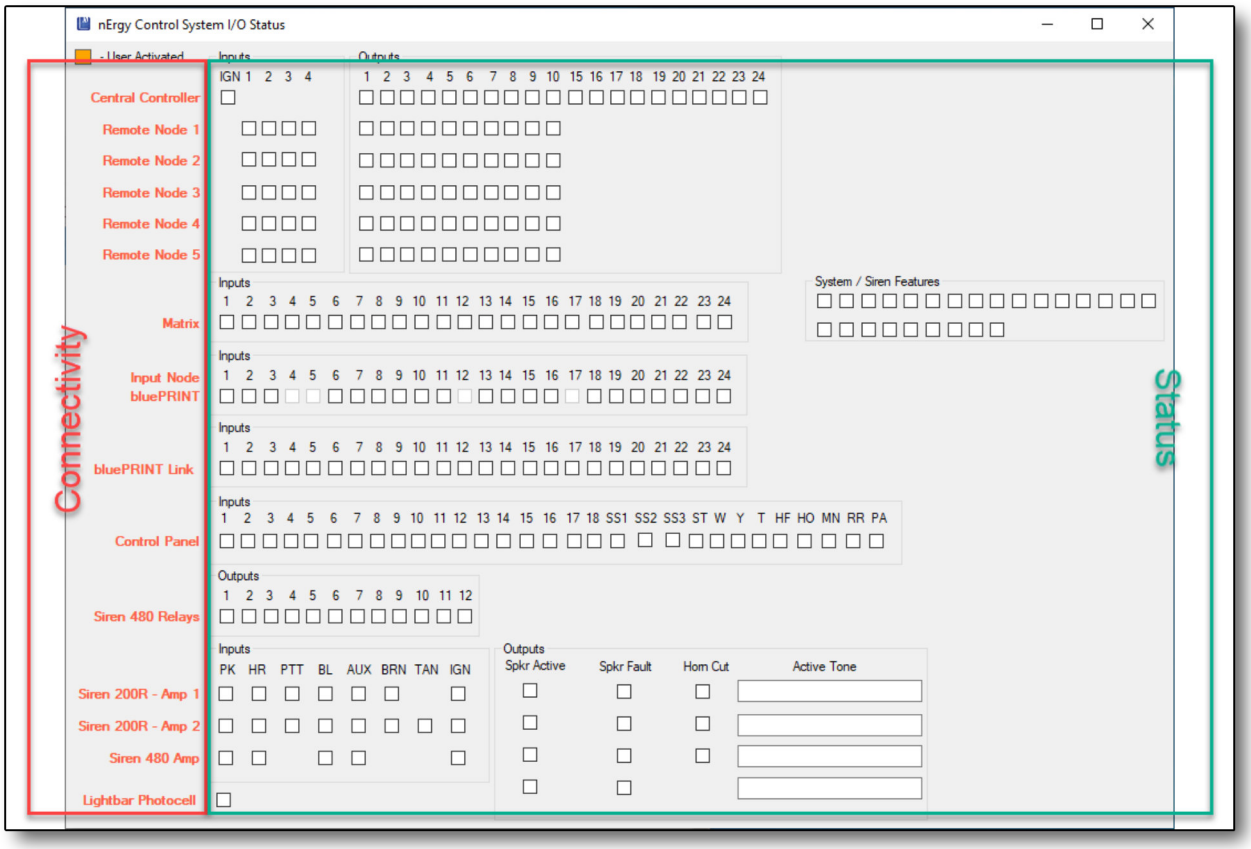
When an input or output is “User Activated” it will be highlighted in a yellow color. To deactivate the output, right click on it one more time.

Outputs that are already active by an actual input trigger cannot be deactivated using this method, except for the control panels.

If a discretely wired input is not working properly, double check the polarity and logic on that input. See page 26. Once changes have been made to the program, they must be uploaded for the system to show any response.

**bluePRINT Tip:**

The Input Node line may show up as a breakout box, if the system has been set to look for inputs there. Look on page 55 and 70 for using a lightbar breakout box as the input node.




I/O Status Screen

# bluePRINT Link Diagnostics

Just below the I/O Status screen button, is a button to activate bluePRINT Link Diagnostics.

Clicking it will bring up another screen displaying all the bluePRINT Link inputs. Inputs will either be written in black, or a barely visible gray.

Inputs displayed in black are the inputs that bluePRINT Link currently sees. Some of these are on/off inputs, in which case, they can be activated using the right click method. Other inputs are just reporting information.

The signals in the left column are variable readings. The right side check boxes are all on or off.

For clarification, the left column abbreviations are:

Speed – Miles per hour

RPM – Engine Revolutions per minute

APP – Accelerator Pedal Position in %

Brake Torque – Displays brake pressure in %

TR – Transmission Range Position

Key Position – Displays the current key position

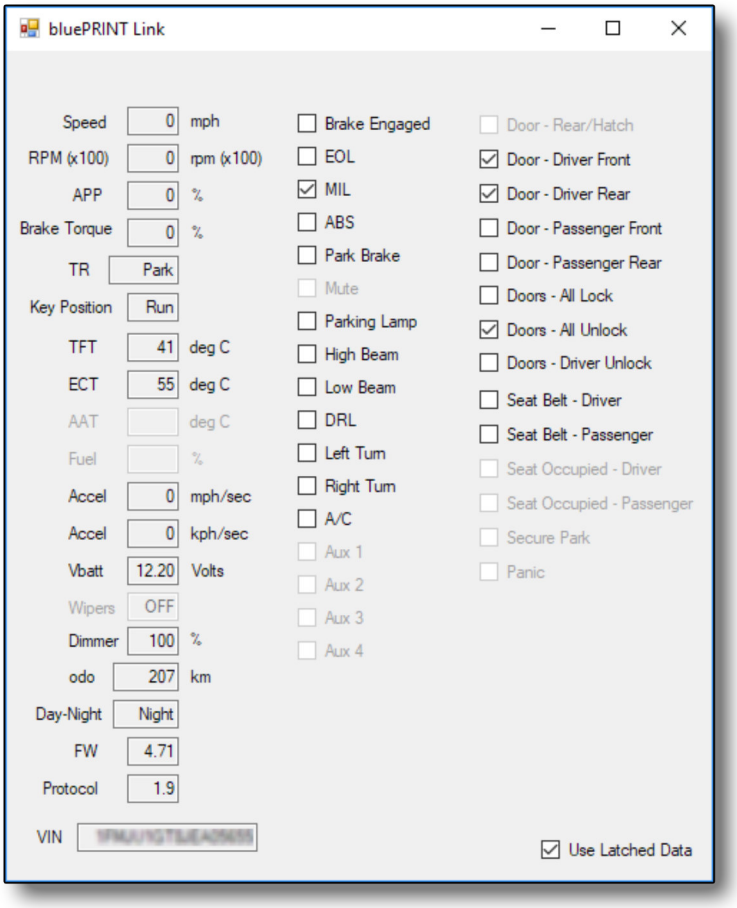
TFT – Transmission Fluid Temp, in Celsius

ECT – Engine Coolant Temp, in Celsius

AAT – Ambient Air Temp (outside), in Celsius

Fuel – Level in %

Accel – Miles per hour increase/decrease per second




bluePRINT Link Status

Accel – Kilometers per hour increase/decrease per second

Vbatt – Battery Voltage

Wipers – Current Wiper Position

Dimmer – Dashboard dimmer %

Odo – Odometer in Kilometers

Day-Night – OEM Photosensor Status

FW – Currently loaded Link Firmware

Protocol – SoundOff Signal software version

VIN – Vehicle Identification Number

The last feature of bluePRINT Link is the “Use Latched Data” function. This is active by default. When active, if the BCM goes to sleep

after reporting a state, bluePRINT will continue to function as if the state was still being reported.

*For example*, when the door is open on a police vehicle, it may be setup to shut lights off the lightbar, to prevent night blindness. If the vehicle wasn't running during this time frame, the BCM will eventually go to sleep. When this happens, bluePRINT will continue to keep that light off. The moment the door is closed, the BCM will wake back up and report the closing to bluePRINT.

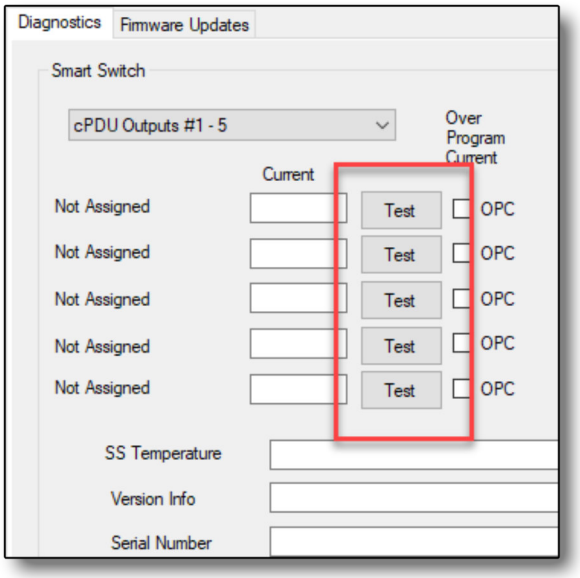
If this feature was disabled, the input would deactivate the moment the BCM went to sleep.

## Other Test Modes

Aside from testing in the bluePRINT Diagnostics I/O Status screen, there are two other ways to test an output.

The first one is also in bluePRINT Diagnostics, in the Smart Switch Status section. Just to the right of each outputs current display is a test button. Clicking on this button will test the output for approximately five seconds. Only one output can be tested at a time with this method. Clicking a second output while the first one is active, will turn off the first output.

The second method for testing outputs, is on the I/O Mapping Navigation tabs. To the right of the priority / flash pattern list is a check-box to "Test Outputs." When activated, any output can be tested right from this screen.




Test Outputs / Diagnostics

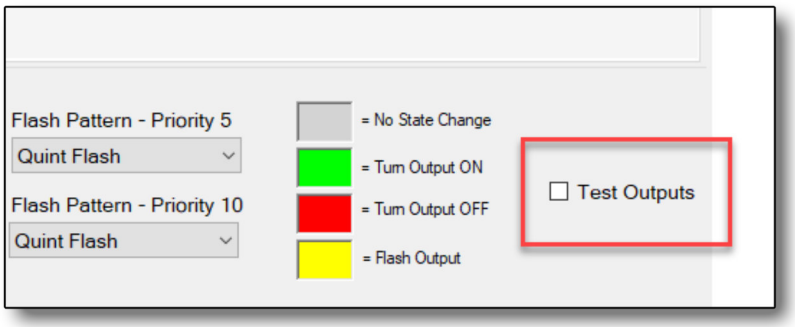
As an output is turned on, it changes to blue. Turning it off again turns it back to gray. Un-checking Test Outputs turns all outputs off.

## Firmware Updates

bluePRINT software sometimes comes with pre-installed firmware for the system's different components. In some cases, the software will detect that it has newer firmware than the equipment being connected to.

When this occurs, bluePRINT will display a prompt alerting the technician what, if any, components are out of date.

To access firmware updates, open bluePRINT Diagnostics. At the top of the screen, are two sub-tabs. Diagnostics and Firmware Updates.




Test Outputs / I/O Mapping

*Prior to doing any firmware updates,* make sure all the components are currently active with ignition power. DO NOT attempt an update while bluePRINT is in a System Off Delay.

To update a component, click on the Device drop-down and select the component. Once selected, click "One-Click Update."

That's it. Let the update finish, and the component is ready to go.

To determine what firmware is currently loaded in a device, make sure it is selected. Click on "Show Advanced Options." Another drop-down menu will display as well as the Send Command button. Click the drop-down and find "Get Version Info."

Send the command, and bluePRINT will report back the installed firmware for the currently selected component.

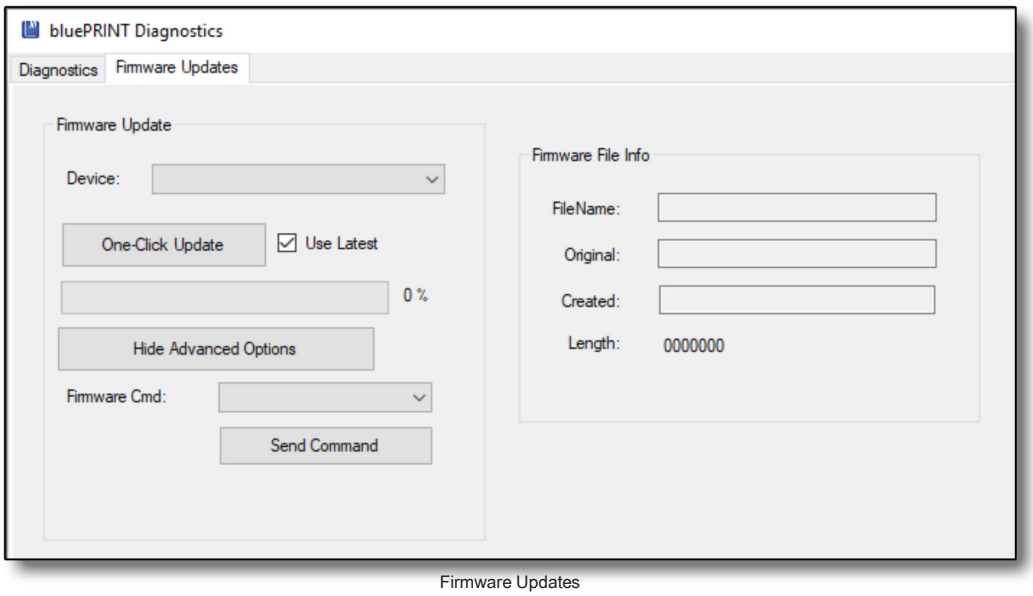
The other advanced commands should be left alone, unless told to use by SoundOff Technical Support.

In some cases, we may send out a beta test firmware for a hardware problem that has recently been discovered. To use this, un check "Use Latest" and then click on the One-Click Update button. This will open a prompt asking for a file. Select the file and press OK.

There are a couple special scenario updates that need to be mentioned:

*Control Panels:* When selecting a control panel for an update, an additional drop-down box will be displayed asking which port the panel is connected to.

*Console Mount Sirens:* When updating a console mount siren, it is technically two different updates. One for the siren amplifier itself, the other for the control panel on the siren port. These do not always need to be done at the same time.




Firmware Updates

# Appendix

# Connectivity Cheat Sheet

| Component | Connected To: |
|---|---|
| Remote Node LIN Data Wire (Pin #15) | Central Controller LIN Data<br>Single Wire |
| Input Node LIN Data Wire | Central Controller LIN Data<br>Single Wire |
| 200 Series Siren Amplifier | Central Controller LIN Data<br>Single Wire |
| Breakout Box as an Input Node | Central Controller LB Port<br>Cat 5 Ethernet * |
| Breakout Box | Central Controller LB Port<br>Cat 5 Ethernet * |
| 400 Series Siren Amplifier | Central Controller Siren Port<br>Cat 5 Ethernet |
| Console Mounted Siren Amplifier | Central Controller Siren Port<br>Cat 5 Ethernet |
| Secondary Remote Control Panel | Central Controller Siren Port<br>Cat 5 Ethernet ** |
| Primary Remote Control Panel | Central Controller CP Port<br>Cat 5 Ethernet |
| bluePRINT Link | Central Controller CP Port<br>Cat 5 Ethernet |

* Pin 5 (Light Green) on a breakout box is lightbar data. Do not confuse with LIN data.

** When using a secondary remote control panel on the SIREN port, be sure to supply power to the port with a 400 series siren amplifier.

# bluePRINT System Schematics

| Wire Pin # | Wire Function | Amp |
|---|---|---|
| 1 | OUTPUT 9 | 10 Amp |
| 2 | OUTPUT 8 | 5 Amp |
| 3 | OUTPUT 7 | 10 Amp |
| 4 | OUTPUT 6 | 5 Amp |
| 5 | OUTPUT 5 | 5 Amp |
| 6 | OUTPUT 4 | 10 Amp |
| 7 | OUTPUT 3 | 5 Amp |
| 8 | OUTPUT 2 | 10 Amp |
| 9 | OUTPUT 10 | 5 Amp |
| 10 | INPUT 1 | |
| 11 | INPUT 2 | |
| 12 | INPUT 3 | |
| 13 | INPUT 4 | |
| 14 | ADDRESS SELECT | |
| 15 | DATA | |
| 16 | OUTPUT 1 | 5 Amp |

Table 1

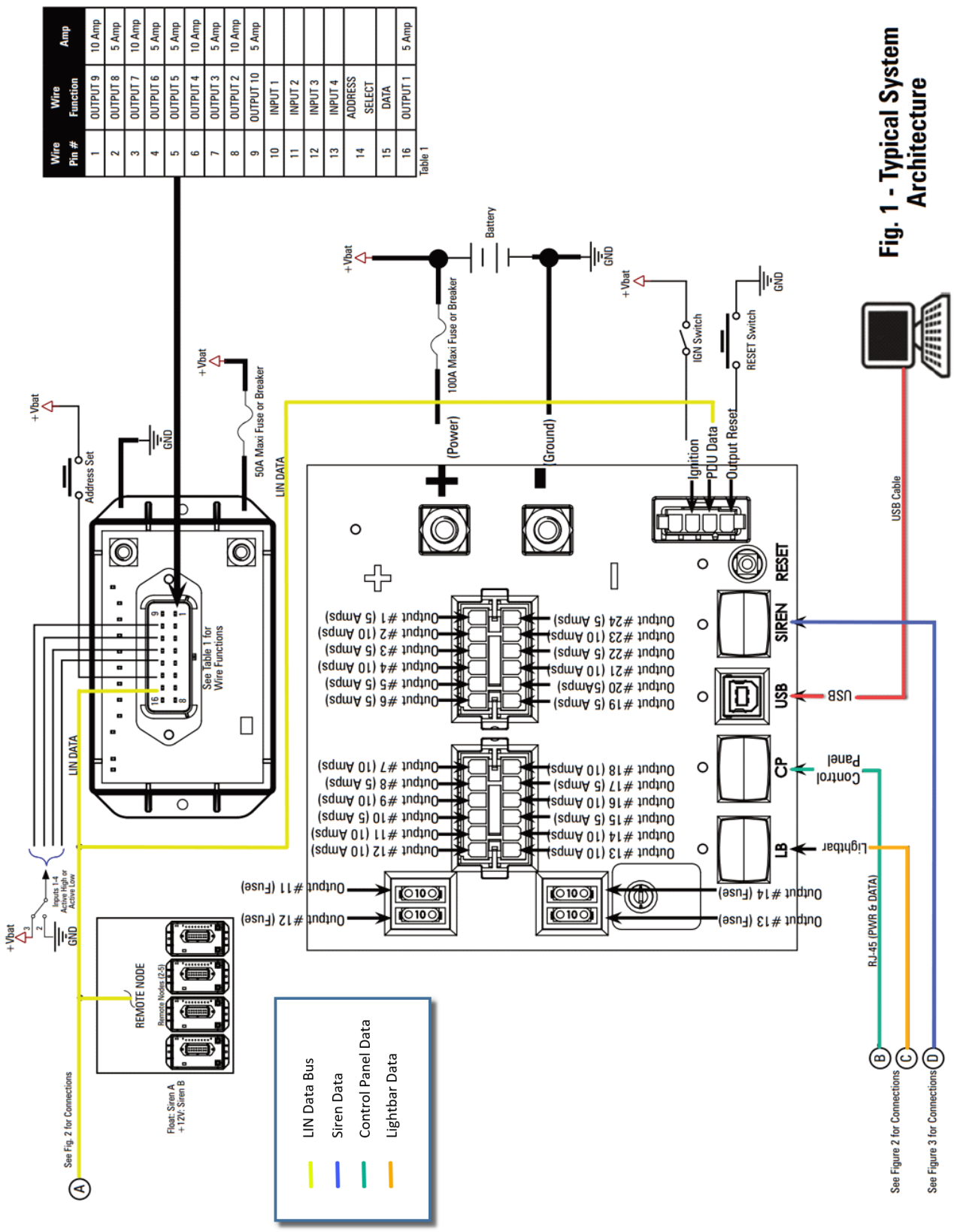
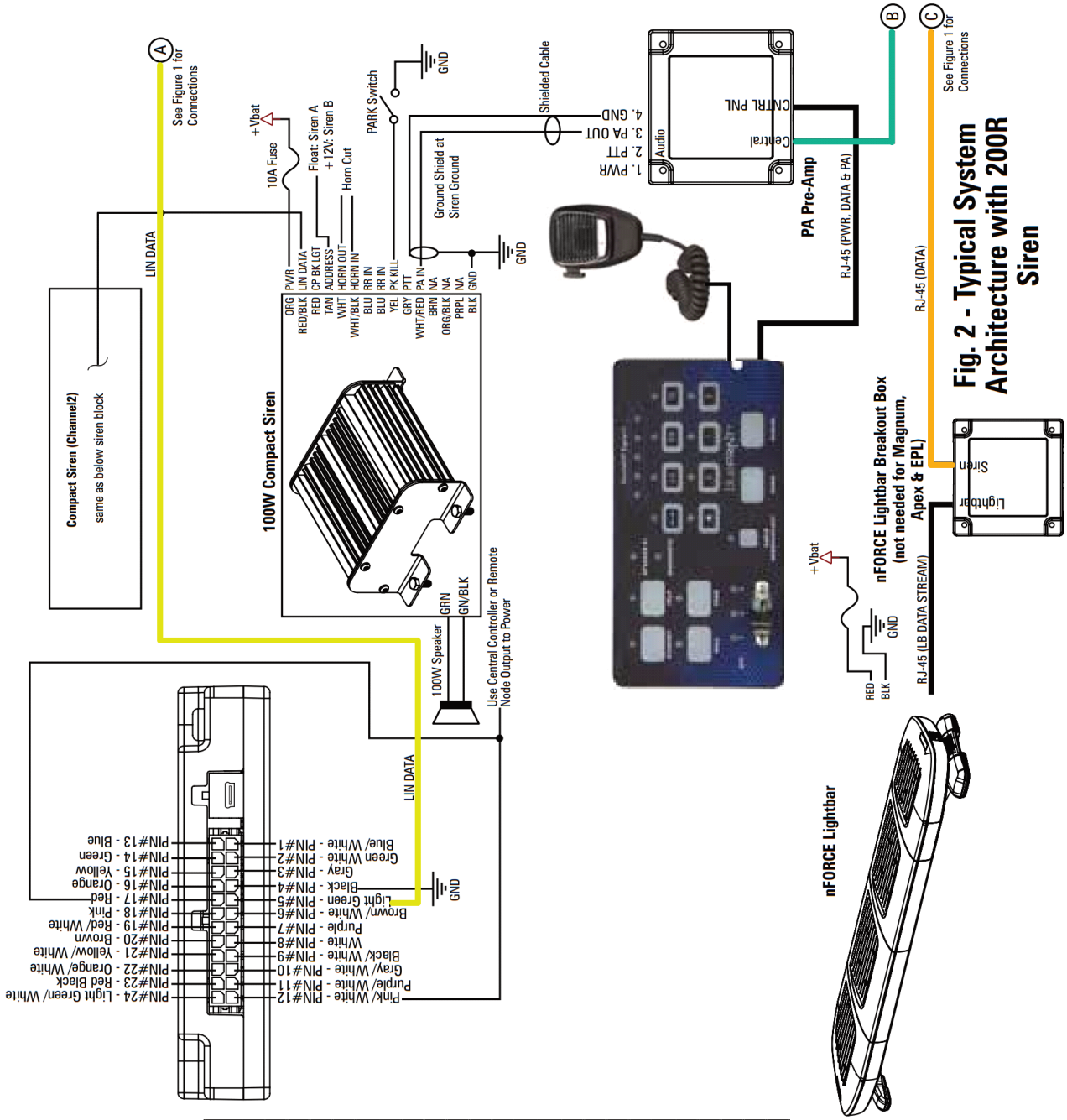



Fig. 1 - Typical System Architecture

# bluePRINT System Schematics




| Input Node | | |
|---|---|---|
| Function | Wire Pin # | Wire Color |
| Input 1 | 1 | Blue/White |
| Input 2 | 2 | Green/White |
| Input 3 | 3 | Gray |
| Ground | 4 | Black |
| LIN Data | 5 | Light Green |
| Input 6 | 6 | Brown/White |
| Input 7 | 7 | Purple |
| Input 8 | 8 | White |
| Input 9 | 9 | Black/White |
| Input 10 | 10 | Gray/White |
| Input 11 | 11 | Purple/White |
| Ignition | 12 | Pink/White |
| Input 13 | 13 | Blue |
| Input 14 | 14 | Green |
| Input 15 | 15 | Yellow |
| Input 16 | 16 | Orange |
| Power | 17 | Red |
| Input 18 | 18 | Pink |
| Input 19 | 19 | Red/White |
| Input 20 | 20 | Brown |
| Input 21 | 21 | Yellow/White |
| Input 22 | 22 | Orange/White |
| Input 23 | 23 | Red/Black |
| No Used | 24 | Light Green/White |

# bluePRINT System Schematics

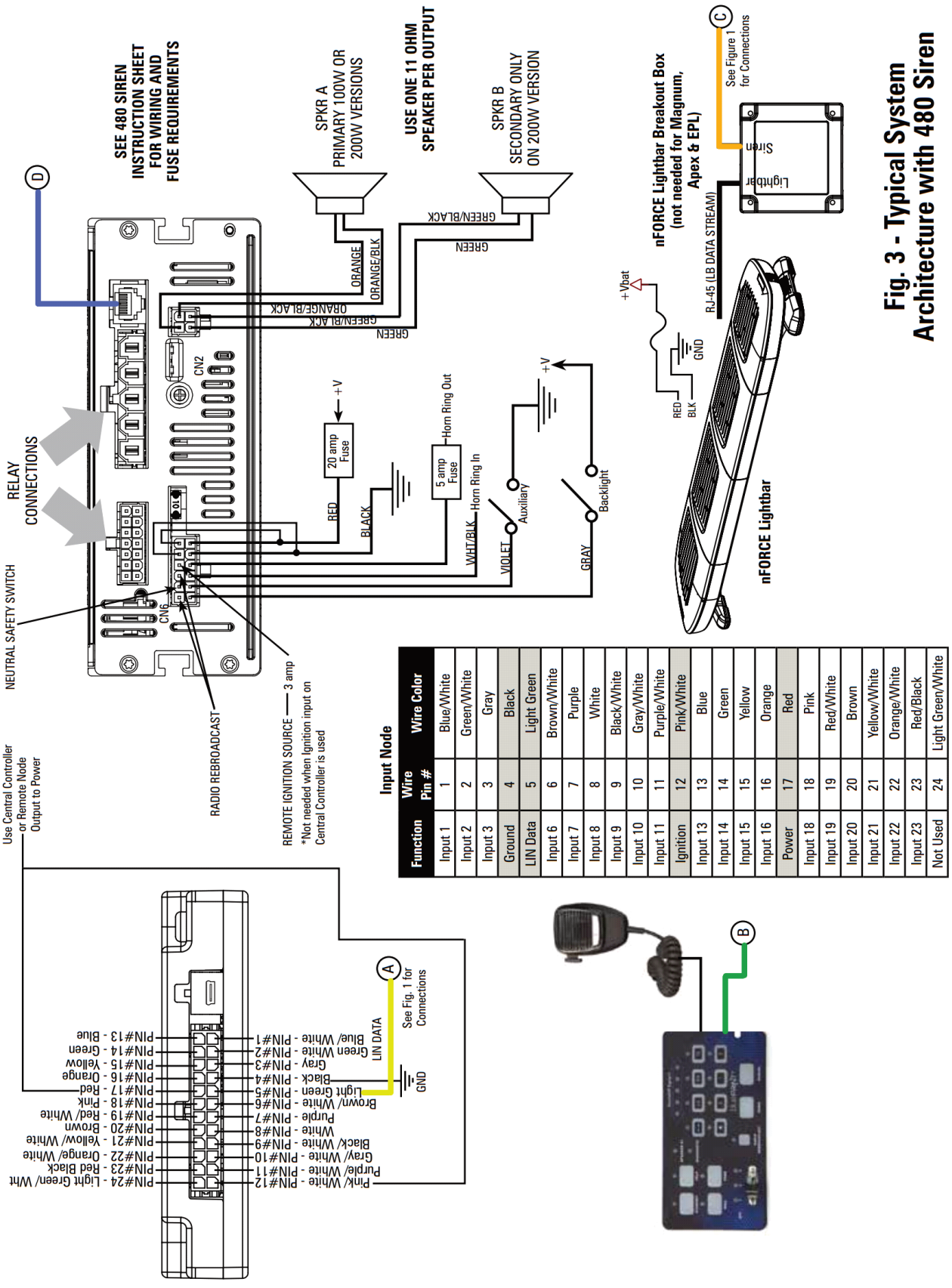



**Fig. 3 - Typical System Architecture with 480 Siren**

**Input Node**

| Function | Wire Pin # | Wire Color |
|---|---|---|
| Input 1 | 1 | Blue/White |
| Input 2 | 2 | Green/White |
| Input 3 | 3 | Gray |
| Ground | 4 | Black |
| LIN Data | 5 | Light Green |
| Input 6 | 6 | Brown/White |
| Input 7 | 7 | Purple |
| Input 8 | 8 | White |
| Input 9 | 9 | Black/White |
| Input 10 | 10 | Gray/White |
| Input 11 | 11 | Purple/White |
| Ignition | 12 | Pink/White |
| Input 13 | 13 | Blue |
| Input 14 | 14 | Green |
| Input 15 | 15 | Yellow |
| Input 16 | 16 | Orange |
| Power | 17 | Red |
| Input 18 | 18 | Pink |
| Input 19 | 19 | Red/White |
| Input 20 | 20 | Brown |
| Input 21 | 21 | Yellow/White |
| Input 22 | 22 | Orange/White |
| Input 23 | 23 | Red/Black |
| Not Used | 24 | Light Green/White |

# bluePRINT Reports

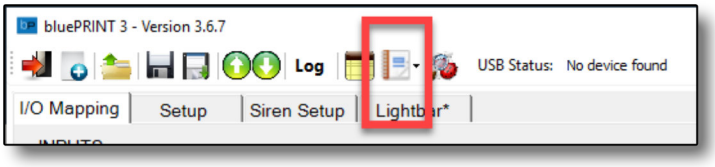
bluePRINT has built in reporting functions that provide in depth reports for each program.

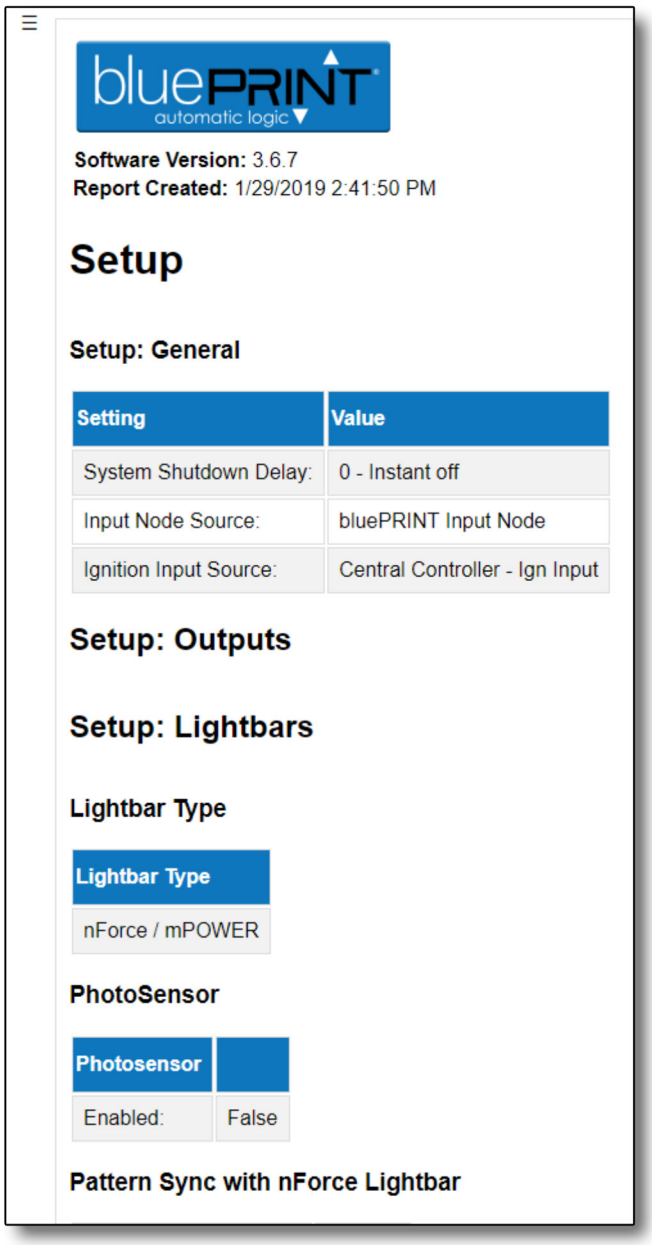
To access the report features, simply click on the report button. A menu will open, which provides report options for the bluePRINT or Lightbar programs.

Once selected, a save file dialog box will open allowing the report to be saved. Reports are saved in HTML format. They are view able in any web browser.

Depending on the report type, different information will be provided.

Comments that were previously saved in the notes feature, will be displayed at the bottom of the report.



bluePRINT automatic logic

**Software Version:** 3.6.7
**Report Created:** 1/29/2019 2:41:50 PM

## Setup

### Setup: General

| Setting | Value |
|---|---|
| System Shutdown Delay: | 0 - Instant off |
| Input Node Source: | bluePRINT Input Node |
| Ignition Input Source: | Central Controller - Ign Input |

### Setup: Outputs

### Setup: Lightbars

#### Lightbar Type

| Lightbar Type |
|---|
| nForce / mPOWER |

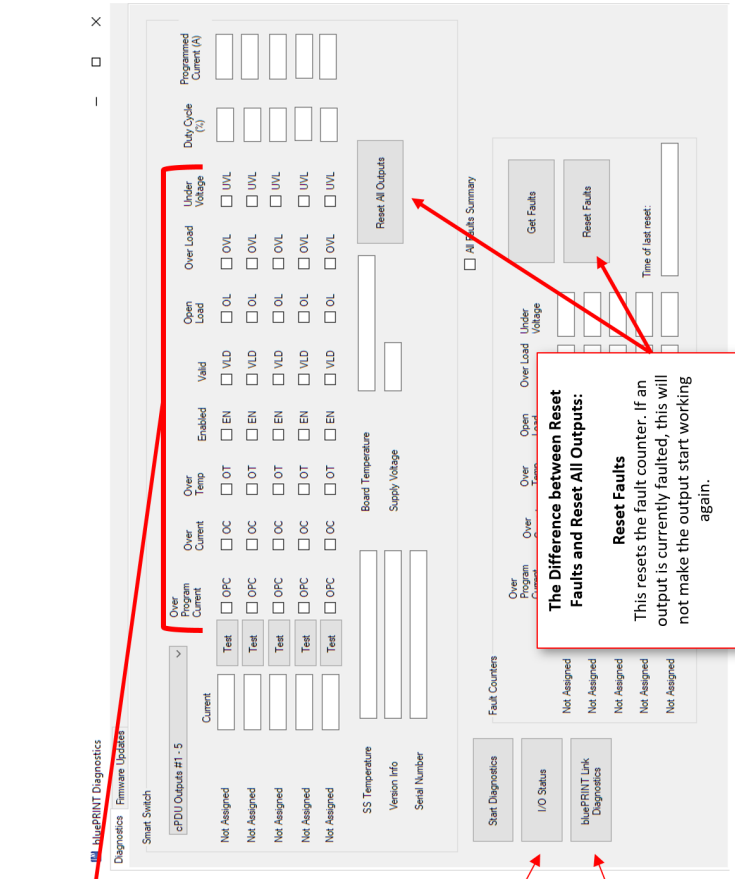
#### PhotoSensor

| Photosensor | |
|---|---|
| Enabled: | False |

#### Pattern Sync with nForce Lightbar

# bluePRINT Diagnostics Cheat Sheet

# bluePRINT Diagnostics Cheat Sheet




This area shows any conditions that are currently going on with each output.

- **Enabled –** This means that output is currently active. This could be through a current program, or test mode.
- **Valid –** This means that the output is working properly
- **Over Program Current –** This would be checked if a light had turned off because of a current limit that the user set (see the text box to the right).
- **Over Current –** This would be checked if an output was trying to pull more current than the switch is rated for.
- **Over Temp –** This will be checked if the switch that is running that output is starting to overheat.
- **Open Load –** This is typically indicative of a bad connection or the component has malfunctioned.
- **Over Load –** This is typical of a short circuit, pinched wire, or the component has malfunctioned.
- **Under Voltage –** If this box is checked, it is indicating that the selected switch has inadequate power supplied to it. This typically is due to a undercharged battery, undersized wire or a malfunctioning component.

The Input & Output status of every input and output on the whole bluePRINT system are displayed on this menu.

The Input status of the bluePRINT Link module are displayed here.

**The Difference between Reset Faults and Reset All Outputs:**

**Reset Faults**
This resets the fault counter. If an output is currently faulted, this will not make the output start working again.

**Reset All Outputs**
This resets any faulted outputs into their enabled state. This has no effect on the fault counter.

## Upgrading to bluePRINT 3

At some point, it is likely that a vehicle will be upgraded from bluePRINT 2 to bluePRINT 3. There are several reasons for this.

1. bluePRINT Link requires bluePRINT 3.

2. bluePRINT 3 Has additional Matrix and Priority capabilities than version 2

3. Older fleets are sometimes retrofitted with newer technology, allowing the whole fleet to operate the same.

When this happens, there is a suggested procedure:

**Step 1:** Go through all the functions of the bluePRINT 2 vehicle. Check what each control panel button or slide switch does. Take notes, they will be needed later.

**Step 2:** Download bluePRINT 2 from the SoundOff Signal Dealer Showroom. This allows access to the older files that may be stored.

**Step 3:** Extract the bluePRINT 2 file from the Central Controller and save the file. This is extremely important, especially if this is the only accessible file. This should be done before ANYTHING else. Steps 1 through 3 and step 7 are only required when extracting a file from a bluePRINT 2 vehicle. It is a good idea to extract the lightbar files as well. For this, we recommend using the SoundOff Signal Lightbar Configurator.

**Step 4:** Close bluePRINT 2 and open bluePRINT 3. Upgrade the vehicle hardware to bluePRINT 3. This is actually an easy step that requires nothing but firmware upgrades. Starting with the Central Controller, upgrade every piece of equipment. Don't forget to upgrade any lightbar breakout boxes, since newer bluePRINT 3 features were written to utilize the newer breakout box firmware. Breakout box upgrades require plugging directly into the breakout box using the USB A to Mini B plug.

**Step 5:** Using bluePRINT 3, open the bluePRINT 2 file. Save the file. This converts the file to bluePRINT 3. It will have a new file extension. For example, if it was bluePRINT2File.dat, it will now be bluePRINT2File.bp.

**Step 6:** Upload the new file to the Central Controller.

**Step 7:** Check operation of the file. Compare all the functions against the notes taken earlier. Pay special attention to the traffic arrow function. If it isn't working properly, go to the Setup / Control Panel sub-tab and verify that the control panel buttons are setup the way they used to be.

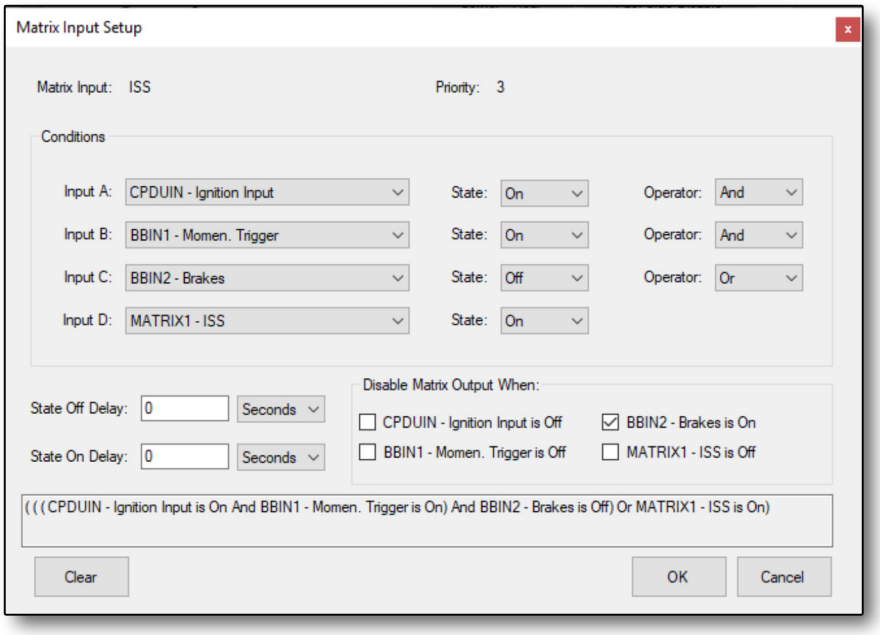
**Step 8:** Once the file has been verified to work as it used to, start adding bluePRINT 3 features!

# Matrix Examples

The following pages show different examples of Matrices. Remember, the sky is the limit when it comes to Matrices. Feel free to use any or all of these in each program.

We like good Matrix ideas! Be sure to submit yours to techgroup@soundoffsignal.com. If we end up using one in a future instruction manual, there could be a reward!

## Ignition Security System




There are two key points in this Matrix.

1. Notice the Disable Matrix when the brakes are on. This allows the brakes to shut down the I.S.S.

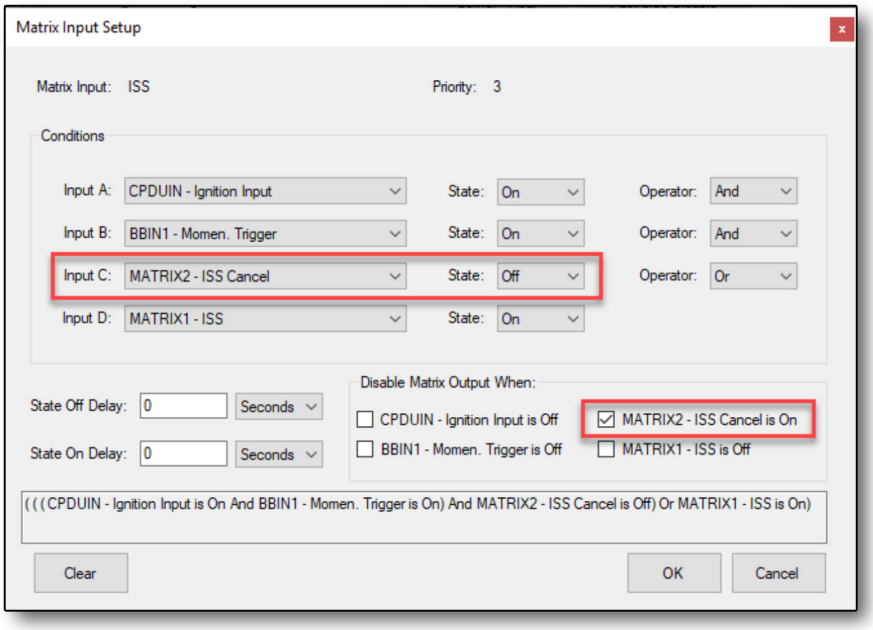
2. The fourth condition is the ISS Matrix itself. This Matrix is referencing itself at the end using the OR operator. Once this Matrix is active, it will remain active.

The Matrix needs to be mapped to whichever outputs are tied to the vehicle ignition so that the key can be removed and the engine continues to run. We recommend using either the 400 Series siren amplifier outputs, or outputs #15 and #24 on the Central Controller.

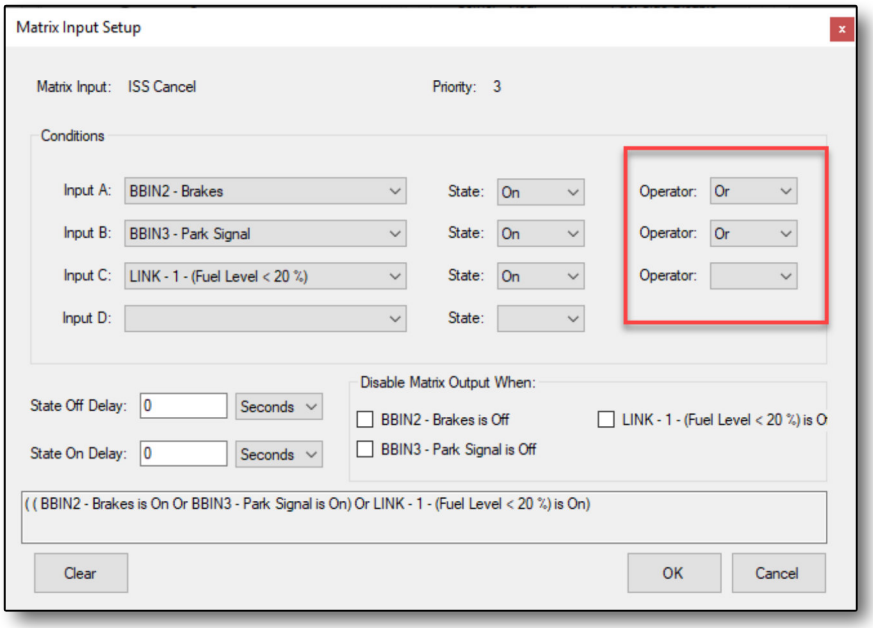
See the next Matrix for cancellation options other than brake.

# I.S.S Cancellation Matrix

Instead of using just one Matrix with brake as the only cancellation option, a second Matrix can be created allowing multiple cancellations. In the first example below, the original ISS has been modified to reflect the new condition. All outputs continue to be mapped to the first Matrix (ISS).




The second example below, has three different conditions that can make this Matrix active. Notice the use of OR with this Matrix. This means any of the conditions make this Matrix true (or activated) which disables the first.



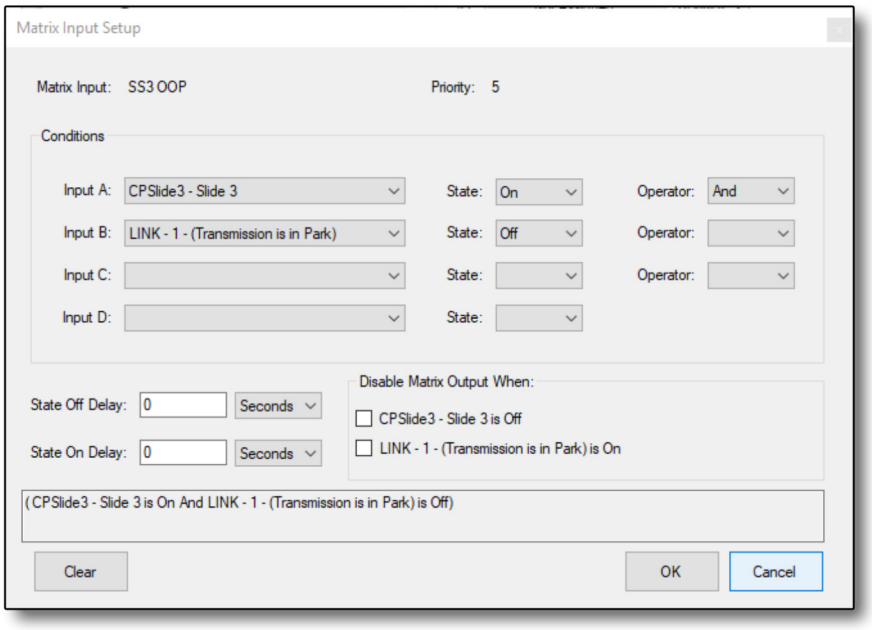
## Slide Switch 3 - Out of Park

Many times with emergency response vehicles, as the slide switch progresses, so do the patterns. This usually includes white lights flashing when the slide switch is in position #3.

In these cases, a Matrix can be used to process how slide switch position 3 operates, in and out of park.

In this example, there is a Matrix that is activated when the vehicle is in slide switch position 3, and out of park. Any white lights, or aggressive patterns can be mapped to this Matrix, while more calm patterns are mapped directly to slide switch position 3.

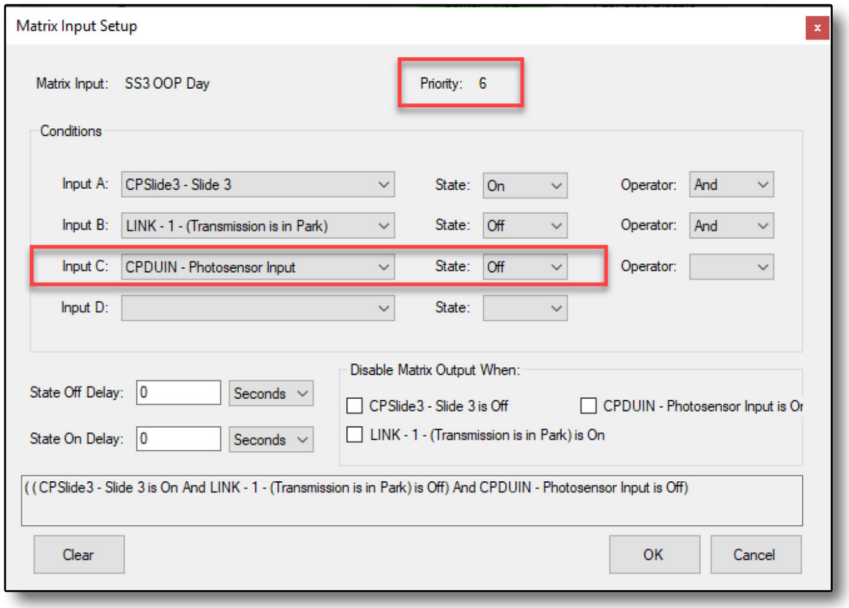
See the below example:

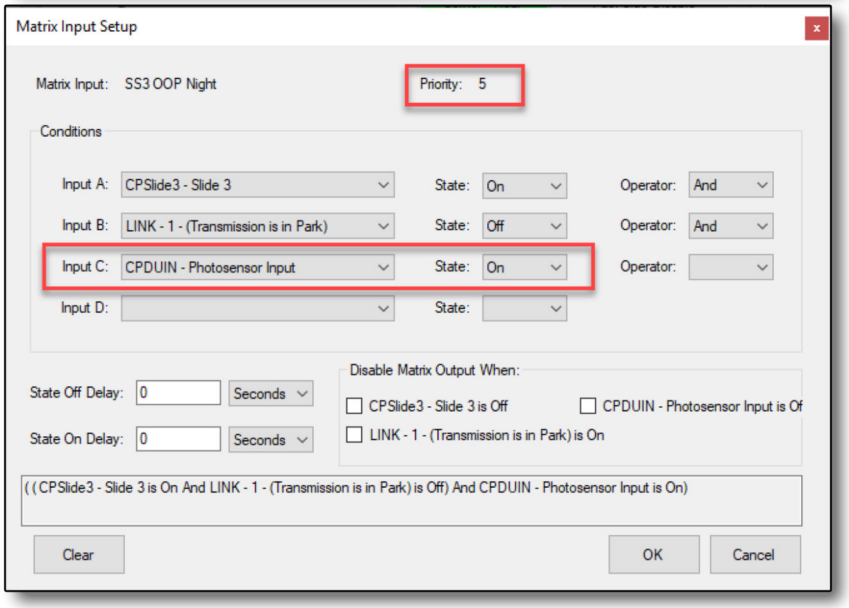



This Matrix adds lights when the vehicle is not in park, as opposed to restricting lights. This is an effective use of bluePRINT priority, since it does not require additional priority unless a flash pattern change was required.

## Slide Switch 3 - Out of Park (Day / Night Variation)

A variation of the Slide Switch 3 - Out of Park Matrix is to create a day and night version, using two different matrices. By doing this, different patterns and light combinations can be activated during the day or at night. The first example shows a daytime Matrix and the second, a nighttime Matrix.



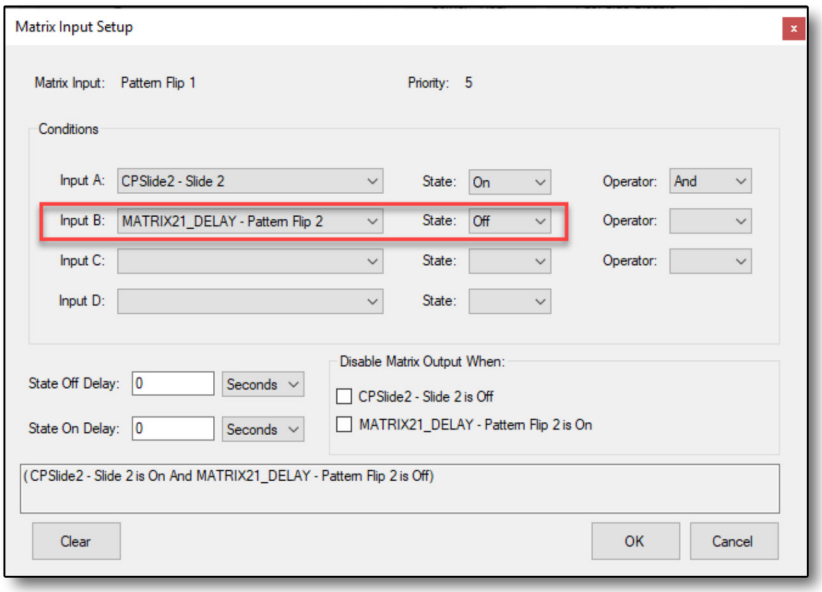

Looking at the above matrices, there are two differences.

First, priority. The night Matrix is at priority 5, and the day Matrix is at priority 6. Second, the day Matrix references the photosensor off, while the night Matrix references it on.

Since both matrices cannot be on at the same time, they could both have unique mappings that make them appear and function differently.

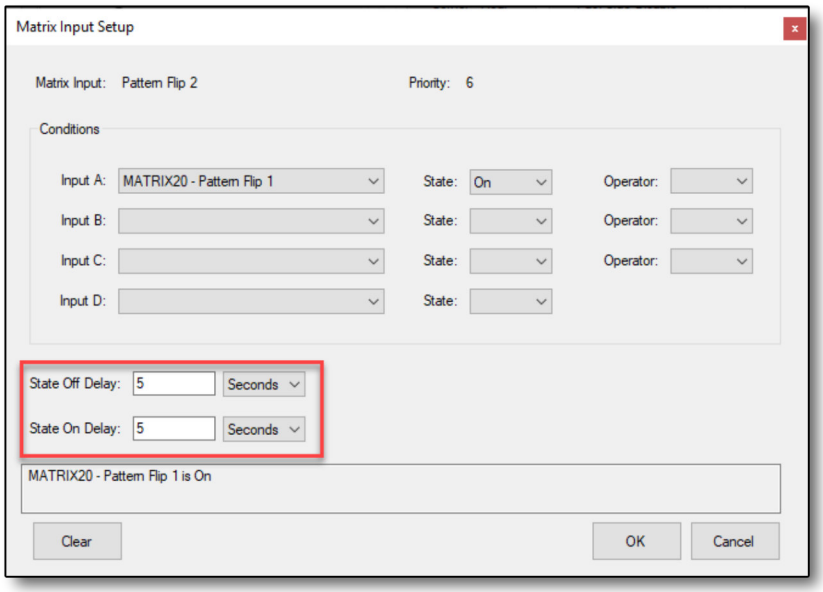
# Pattern Flip

Sometimes an end user may want a slide switch activation to flip flop between two different patterns. This is relatively easy to do.




First, create two matrices. The below are called Pattern Flip 1 and Pattern Flip 2.

Second, map any lights that are going to change patterns during the flip. If every light on the vehicle is going to change, copy all outputs from one Matrix to the other. Dont forget there may be a lightbar mode change.




The sole condition of the second Matrix is when the first is active.

To make this work requires on and off delays. In the example to the right, this Matrix has a State On Delay and waits 5 Seconds before activating. When it activates, the first Matrix deactivates.

At that moment, the second Matrix becomes invalid because the first is invalid, and starts counting down the State Off Delay.

Adjusting the on and off delays can change how this matrix works. The on delay adjusts how long the first Matrix runs for, and the off delay controls the second Matrix run time.

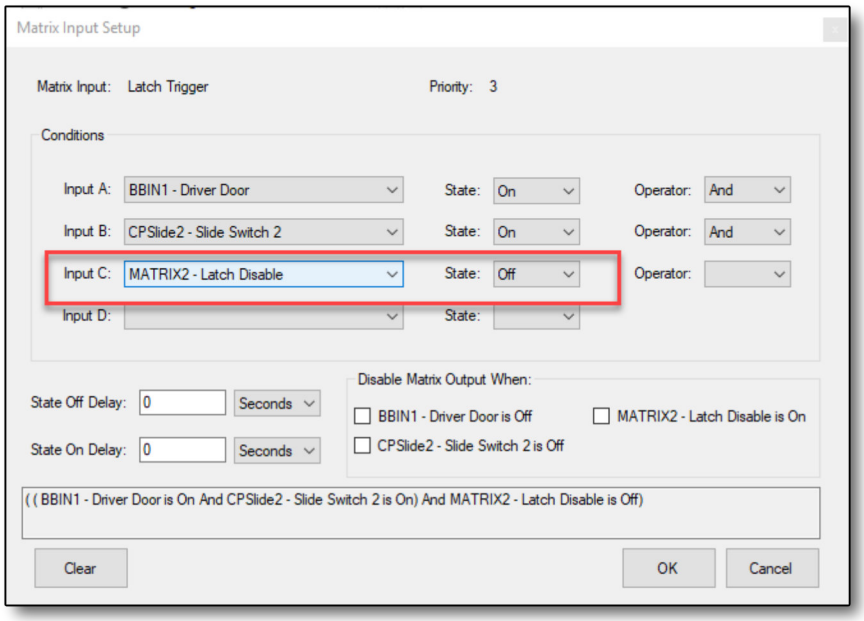
# Turning a Latched Signal into a Pulse or Timed Output

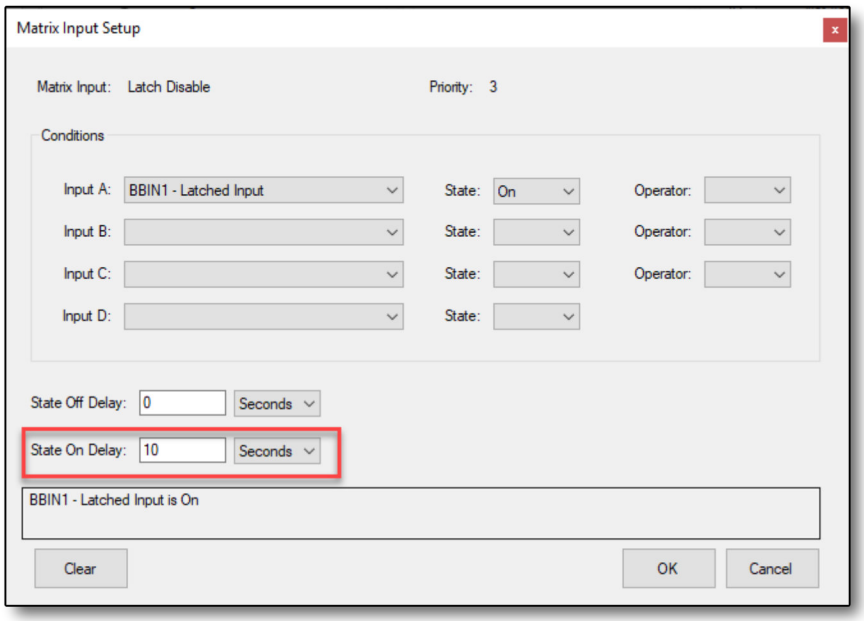
Occasionally, a latched signal needs to be turned into a timed signal or even a short pulse. This can be done with creative matrix writing.

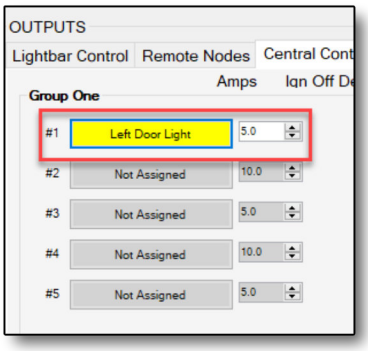
This will require using two different Matrices. The first turns on the output, and the second Matrix disables the first.

In the below example, when the emergency lights are on, and the driver door opens, the left door lights start flashing.

After 10 seconds, they stop flashing.



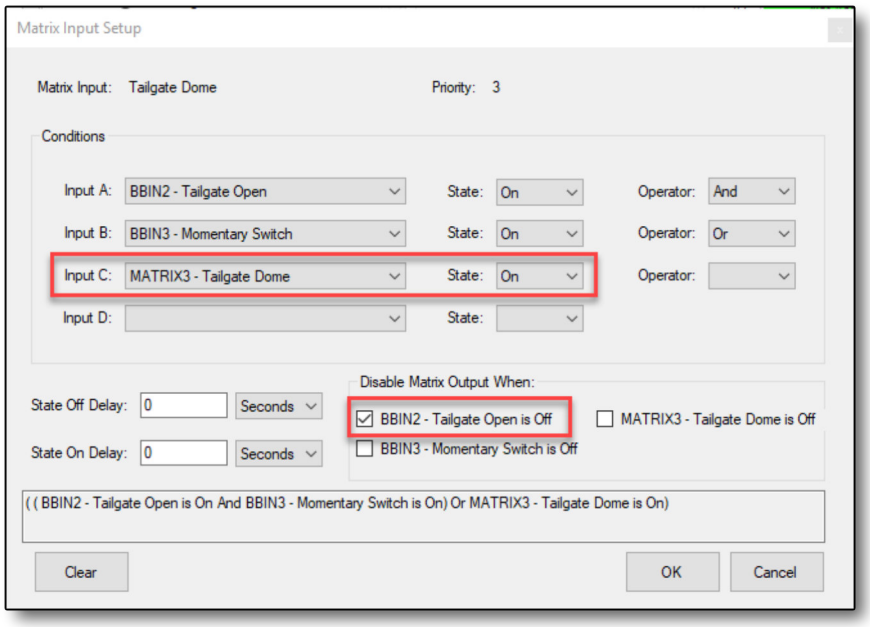




In this example, the first Matrix, "Latch Trigger" activates an output to start flashing when the driver door is open, and Slide Switch position #2 is off. There is a third condition, which references a second Matrix, "Latch Disable," as off.

The moment the door opens, the second Matrix starts counting. In this example, when the door has been open for 10 seconds, this Matrix activates.

As long as the door remains open, the second Matrix continues to run, cancelling out the first.

# Turning a Momentary Signal into a Latched Output




Many times a momentary signal is all that is provided to activate an output.

If the momentary button was activating a control panel button, no Matrix would be needed, since the control panel button can be pressed again to turn off.

If the momentary signal was to create a output that stays on, a looping Matrix will be required.

In the below example, we have a vehicle with a tailgate mounted dome light. For tactical reasons, the tailgate mounted dome light does not automatically turn on with the tailgate.

It requires the press of a momentary button to turn on.

This matrix activates when the tailgate is open, and the momentary button is turned on. The third condition, is the Matrix referencing itself.

This is called looping. Once this Matrix is activated, it will start looping indefinately. In order to allow this Matrix to cancel, we need to include a Matrix disabler.

In this case, when the tailgate is closed the loop is disabled.

# Using a momentary button to turn an output on and then off

In this example, we are going to build on the previous page. As the Matrix stands, closing the tailgate disables the Matrix and breaks the loop.

If we wanted to be able to turn the light back off, by either pressing the button or closing the tailgate, we will need to use a second Matrix.

The first Matrix receives a new condition, referencing the second Matrix, "TG Dome Off."

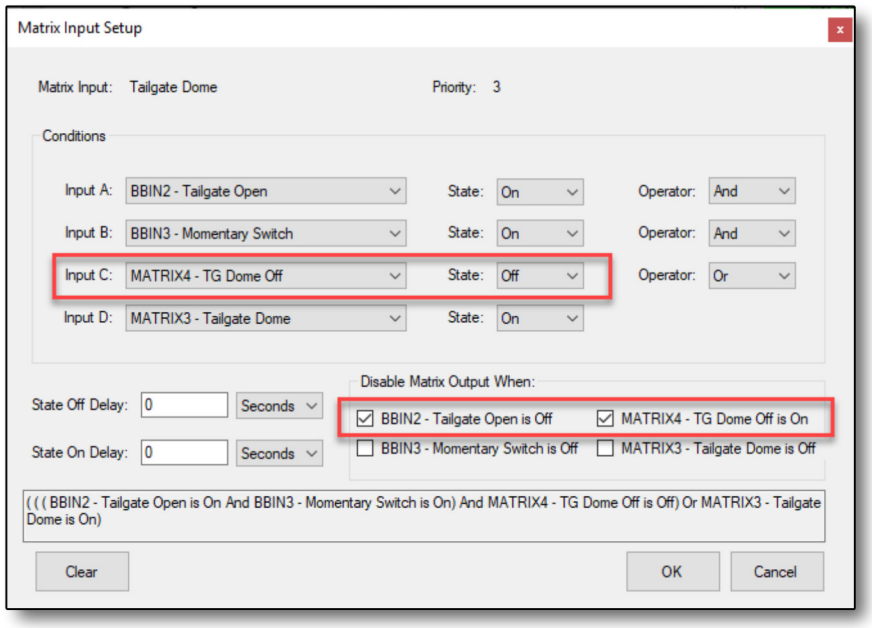
This condition is in the off state.

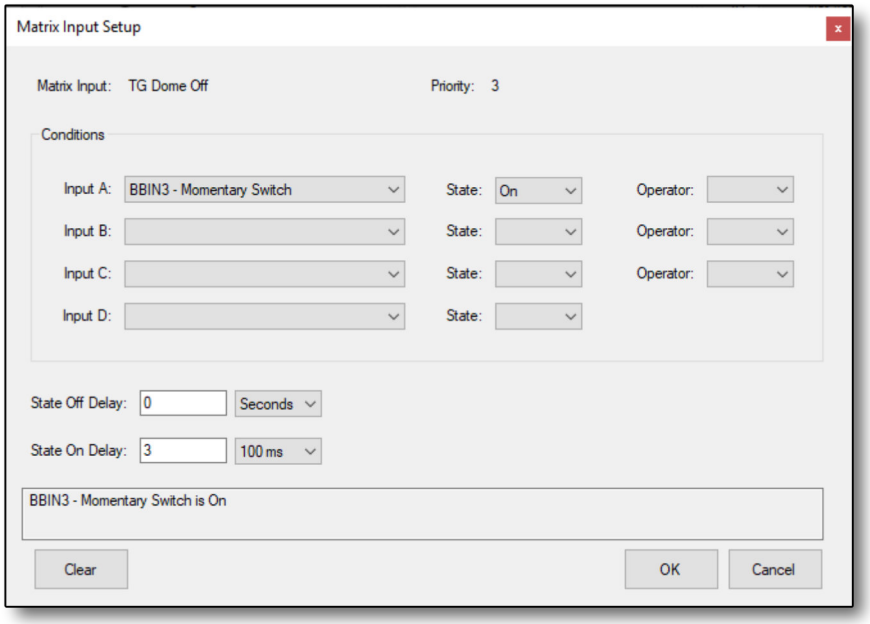
The second Matrix, is only looking at the switch itself. This is the same switch that turns on the Tailgate Dome Matrix.

If the switch is active for more than 100 ms (State On Delay), this Matrix activates, cancelling the first Matrix.

The State On Delay can be played with, for different timings.

*For example*, a quick press could activate the Tailgate dome, and a long 1 second press of the button could be used to turn it off.



# bluePRINT Best Practices: Ignition Security System (ISS)

Theft of public safety vehicles is far too common and poses a significant risk to the public. Almost every public safety vehicle theft results in damage to multiple vehicles and many of these incidents result in serious injury and even death to innocent motorists. On August 26, 2019, in Dayton, Ohio, a stolen police car crashed into a family's mini-van. Two 6 year-old girls were killed and several other family members were injured.

Tragically, these incidents are largely preventable. A good prevention strategy includes use of an anti-theft device. SoundOff Signal's bluePRINT Intelligent Control System has a unique capability to be configured to provide an Ignition Security System (ISS) feature. This feature is easily wired into most police vehicles at no extra cost. Many departments are using bluePRINT's ISS capability to protect their fleet every day.

bluePRINT's ISS function generally works as follows (configuration-dependent):

- If the vehicle is in park and the operator activates a momentary input trigger, such as an accessory switch, then the key can be removed from the ignition switch and bluePRINT will continue to provide power to the ignition & accessory circuits, allowing the vehicle to continue running.
- bluePRINT "kills" power to the ignition & accessory circuits if the brake pedal is pressed, causing the vehicle to stall. This prevents theft by turning the vehicle off before the vehicle can be shifted out of park, as well as keeping the steering wheel lock engaged.

When configuring bluePRINT for ISS, we recommend technicians consider the following:

- Connect only to the host vehicle's ignition and accessory wires located in the wire harness for the key switch. Use proper connection techniques. No Scotch-Loks!
- Use the Central Controller's diode-isolated outputs #15 & #24, or any two relay outputs on the 480 siren amplifier for the ignition and accessory wire connections.
- We strongly recommend that ISS be configured so that it is activated only when the vehicle's parking or emergency brake is set. This adds additional anti-theft security, eliminates the need to add a switch, and requires a deliberate act by the officer to engage and disengage. Also, this prevents the vehicle from rolling in the unlikely event a person was able to press the brake and shift quickly before the ISS stalled.
- You will have to locate a + or - signal that is active when the parking brake is set. This is most easily done using bluePRINT Link, which captures CAN Bus data from the vehicle.
- For added protection from theft attempts technicians should consider interrupting the shift interlock circuit, disabling it entirely when ISS is active. This requires discreet wire connections to the circuit and a relay or other interrupt device being added.

- Because ISS allows the vehicle to continue running unattended, you must protect the vehicle against overheating or running out of fuel. bluePRINT Link makes this easy, allowing you to write your ISS matrix so it cancels under the following circumstances:

  a. Brake pedal is engaged.

  b. Engine coolant temperature is greater than 113°C*.

  c. Engine oil lamp is on.

  d. Fuel level is 10% or less.

- Consideration must be given and agency executives should be consulted on what other vehicle functions or features they might want to enable or disable when ISS is active, such as gunlock release buttons.

It is important to note that bluePRINT's ISS must be enabled or activated each time the feature is needed. Should the vehicle operator forget to activate ISS, the system would not provide theft protection. SoundOff Signal believes it is a good practice to configure the ISS to activate through a process the operator routinely uses and that operators be trained on how the system works, as well as when it should be used.

For additional safety and to prevent carbon monoxide poisoning, ISS should NEVER be used in an indoors setting, such as a garage or parking structure. Finally, use of ISS is at the discretion of the technician, the agency, and the individual officer. SoundOff Signal makes no guaranties, implied or otherwise, as to the security of vehicles using bluePRINT's ISS feature.

If you need additional information or assistance in configuring your fleet's bluePRINT solution to provide Ignition Security System functionality, please contact:

**If you need additional information or assistance in configuring your fleets bluePRINT solution to provide Ignition Security System Functionality, please contact:**

**Damon Mirate**
Lead Product Trainer - West
dmirate@soundoffsignal.com

**-Or-**

**Matthew Ayers**
Lead Product Trainer - East
mayers@soundoffsignal.com

# bluePRINT Best Practices: Sync Programming Considerations

bluePRINT Sync is SoundOff Signal's proprietary, subscription-free technology which allows for same pattern synchronization and coordinated visual warning messages amongst similarly-equipped vehicles. bluePRINT Sync enhances bluePRINT's ability to manage patterns, colors, and flash-rates, helping to reduce the distracting, overpowering effects of today's high-intensity, LED warning lights.

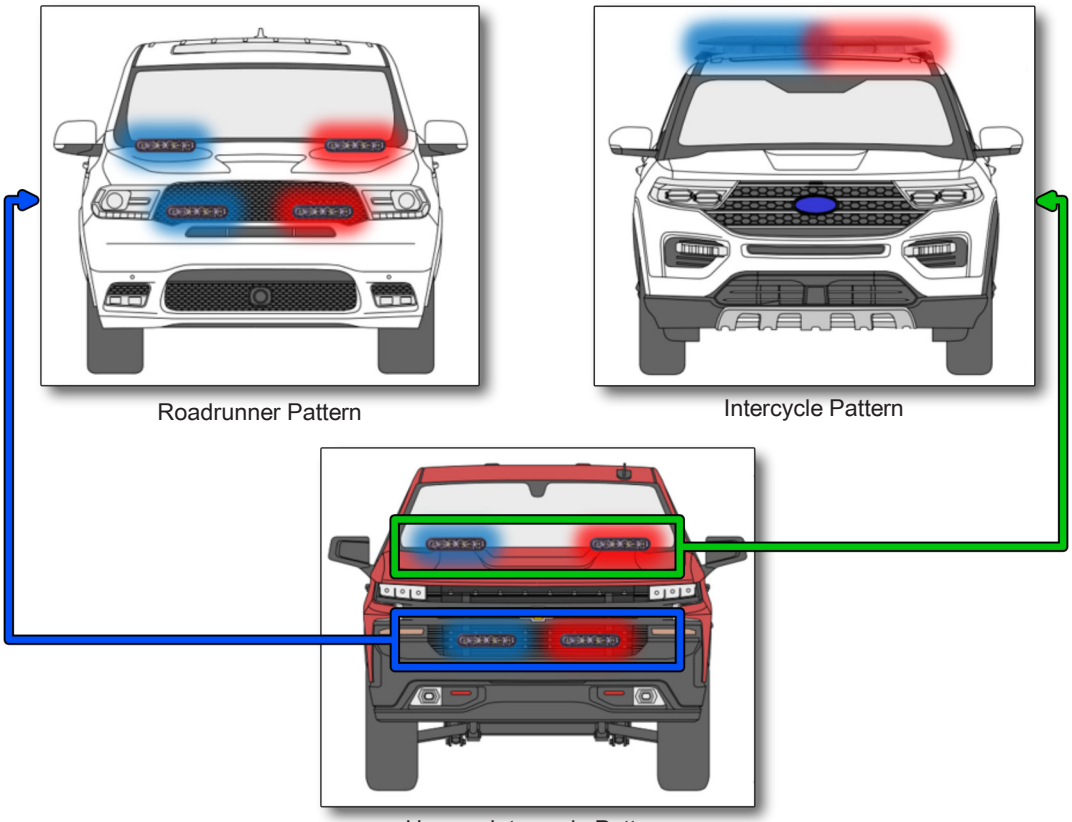
Simple to install, bluePRINT Sync utilizes a universal timing convention to ensure lights flash in phase with no car-to-car communication. Anytime two or more vehicles are on the same pattern they will be synchronized, regardless of range.

Because bluePRINT Sync uses pattern specific synchronization, it is possible for vehicles with two or more active patterns to be in sync with one another. For example, fleets could use different patterns on their lightbars and secondary lights and vehicles would sync those patterns respectively.

In the illustration below, the red Silverado truck synchronizes with both the Durango and the Police Interceptor using two different patterns.

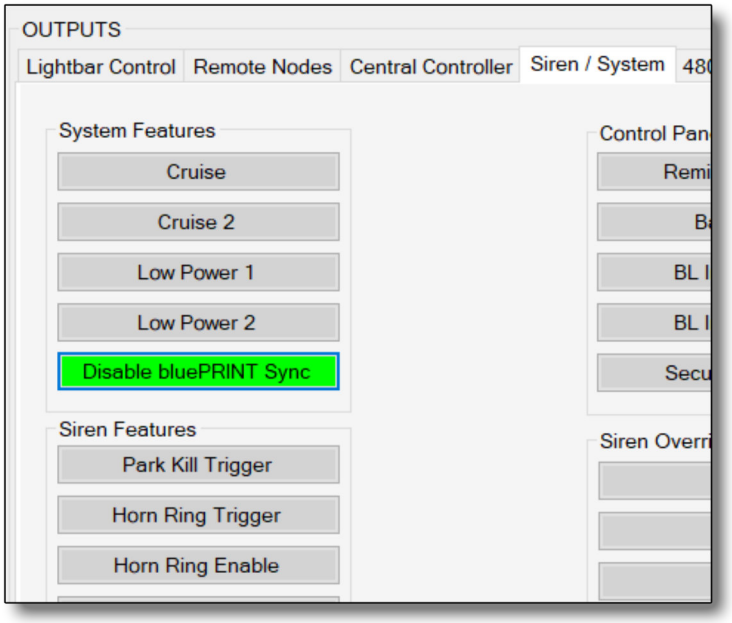
To maximize bluePRINT Sync's advantages, it is necessary that the vehicle warning systems have the same flash pattern priority programing and active priority (flash patterns) should primarily be dependent on vehicle inputs (or virtual inputs), versus button or slide switch inputs.

Consider a traditional bluePRINT setup where each subsequent slide switch introduces faster flash patterns. In a bluePRINT Sync build, this might create a situation where two or more vehicles are on scene with different active patterns because of operator switch selection. In such a case, the vehicles will not be in synchronization.



Instead, consider using factors other than the slide switch to dictate the active pattern. With bluePRINT Sync this would be far more important and useful to ensure vehicles performing similar tasks in similar circumstances used similar patterns. Factors like vehicle speed, ambient lighting, brakes, and more be used to specify which pattern is active.

Here's an example: Vehicle speed can be used to create scenarios (matrices) where at a certain speed range the pattern is the same regardless of the slide switch position. Perhaps all vehicles below 10mph use a default Road Runner pattern. Then if above 10mph in slide switch position #2, the pattern switches to Intercycle. Then, if the vehicle is traveling more than 60mph, a more aggressive pattern might activate.



Disabling bluePRINT Sync

In that way, vehicles on a traffic stop would be synchronized and vehicles responding would be synchronized, but each would be visually different with patterns that help others distinguish their speed and urgency when needed. Likewise, vehicles parked on scene could all be associated visually, while providing calming effects through slower, coordinated patterns.

Ambient light can be used to further modify patterns as situationally appropriate, with a different patterns during the day and during the night, also speed-dictated. Patterns like Flicker Cruise, or slow patterns with cruise lights running in the background can provide a powerful nighttime advantage.

Lastly, there are benefits when using bluePRINT Sync for:

- Organized movements
- VIP details
- Crowd control
- Special events
- Multi-agency scene management

The enhanced visual presence offered by bluePRINT Sync helps project a more uniform appearance at all times to improve department image. Consistent patterning directly related to scene intensity and vehicle activity stands to improve public response to emergency vehicles over time. bluePRINT Sync provides a less-chaotic viewing experience for other roadway users, improving on-scene safety for first responders.

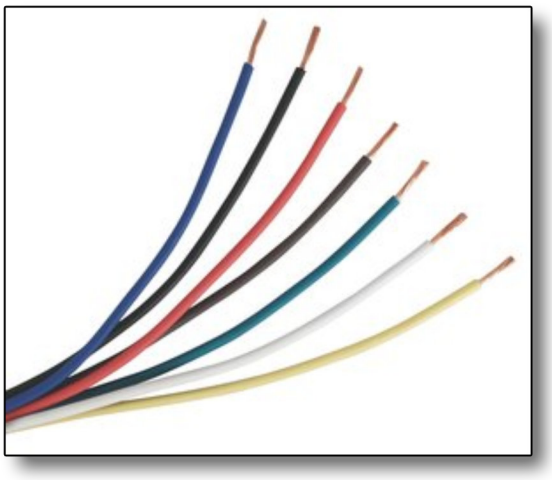
# Best Practices: Wiring Guidlines

When upfitting a vehicle, it is in the interest of the upfitter and the end user that the vehicle be built to the highest standards of quality and performance. Most aftermarket upfitting results in modifications to the vehicle's OEM specifications, and all require some level of disassembly and reassembly. This is a very serious responsibility to assume; following OEM recommended guidelines and best practices is essential.

Here are some very basic best practice guidelines as applicable to bluePRINT installation. We have also included several links to the best practice guides of the major police vehicle manufacturers. Additional information can be obtained by consulting the OEM electrical and body reference manuals for a particular vehicle, which can be obtained through your local dealer. Finally, we encourage you to seek and maintain Emergency Vehicle Technician certification.

**Amperage and wire considerations:** Wire selection plays a critical part to keeping electrical systems reliable. Not only is the type of wire you select important, it's also important to choose the best wire gauge size based on your application's current draw, potential electrical resistance, and voltage drop.

SoundOff Signal recommends automotive cross link wire, with the GXL, SXL, or TXL specifications. Cross link wire can be used in very harsh under-hood applications because it withstands oil, heat, abrasion, gasoline, and many other chemicals. It meets all OEM requirements and in general offers much better performance than GPT primary wire. In no circumstance should solid (household) wiring be used.



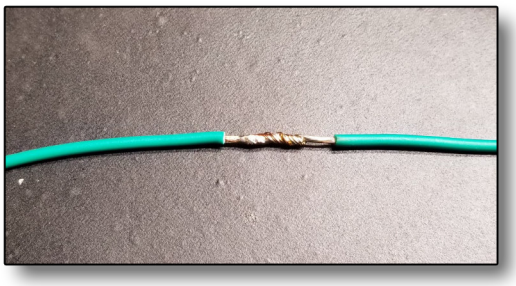
SXL Cross Link Wire

| Wire Gauge | Current Draw in Amps (12 Volt System, 2% Drop) | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 7.5 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 150 | 200 | 250 | |
| 22 | 14.4 | 7.2 | 4.8 | 3.6 | 2.9 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 20 | 23.0 | 11.5 | 7.5 | 5.5 | 4.5 | 3.0 | 2.0 | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 18 | 36.5 | 18.3 | 12.2 | 9.1 | 7.3 | 4.9 | 3.7 | 2.4 | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| 16 | 57.5 | 28.8 | 19.2 | 14.4 | 11.5 | 7.7 | 5.8 | 3.8 | 2.9 | x | x | x | x | x | x | x | x | x | x | x | x | |
| 14 | 92.0 | 46.0 | 30.7 | 23.0 | 18.4 | 12.3 | 9.2 | 6.1 | 4.6 | 3.7 | 3.1 | x | x | x | x | x | x | x | x | x | x | |
| 12 | x | 73.5 | 49.0 | 36.8 | 29.4 | 19.6 | 14.7 | 9.8 | 7.4 | 5.9 | 4.9 | 3.7 | x | x | x | x | x | x | x | x | x | |
| 10 | x | x | 78.0 | 58.5 | 46.8 | 31.2 | 23.4 | 15.6 | 11.7 | 9.4 | 7.8 | 5.9 | 4.7 | x | x | x | x | x | x | x | x | |
| 8 | x | x | x | 93.0 | 74.4 | 49.6 | 37.2 | 24.8 | 18.6 | 14.9 | 12.4 | 9.3 | 7.4 | 6.2 | 5.3 | x | x | x | x | x | x | Max Length |
| 6 | x | x | x | x | x | 78.7 | 59.0 | 39.3 | 29.5 | 23.6 | 19.7 | 14.8 | 11.8 | 9.8 | 8.4 | 7.4 | 6.6 | 5.9 | x | x | x | of Wire in |
| 4 | x | x | x | x | x | x | 94.0 | 62.7 | 47.0 | 37.6 | 31.3 | 23.5 | 18.8 | 15.7 | 13.4 | 11.8 | 10.4 | 9.4 | x | x | x | Feet |
| 2 | x | x | x | x | x | x | x | 99.5 | 74.6 | 59.7 | 49.7 | 37.3 | 29.8 | 24.9 | 21.3 | 18.7 | 16.6 | 14.9 | 9.9 | x | x | |
| 1 | x | x | x | x | x | x | x | x | 94.3 | 75.4 | 62.8 | 47.1 | 37.7 | 31.4 | 26.9 | 23.6 | 20.9 | 18.9 | 12.6 | 9.4 | x | |
| 1/0 | x | x | x | x | x | x | x | x | x | 95.2 | 79.3 | 59.5 | 47.6 | 39.7 | 34.0 | 29.8 | 26.4 | 23.8 | 15.9 | 11.9 | x | |
| 2/0 | x | x | x | x | x | x | x | x | x | x | 100.0 | 75.0 | 60.0 | 50.0 | 42.9 | 37.5 | 33.3 | 30.0 | 20.0 | 15.0 | 12.0 | |
| 3/0 | x | x | x | x | x | x | x | x | x | x | x | 94.5 | 75.6 | 63.0 | 54.0 | 47.3 | 42.0 | 37.8 | 25.2 | 18.9 | 15.1 | |
| 4/0 | x | x | x | x | x | x | x | x | x | x | x | x | 95.2 | 79.3 | 68.0 | 59.5 | 52.9 | 47.6 | 31.7 | 23.8 | 19.0 | |

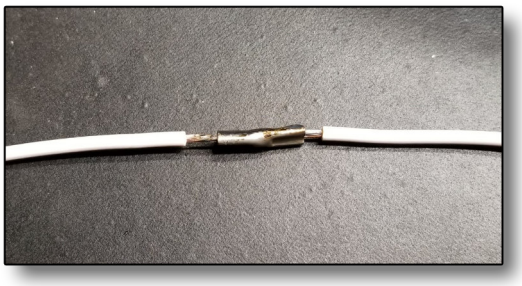
Current Draw Table - www.info.WAYTEKWire.com

Always make sure the wire being used is the same size or larger than the device wiring. The wire should be capable of 125% of the load being placed onto it. When considering this, also consider the length of the wire. See the chart on page 103 for general sizing guidelines.

**Circuit Protection and Fusing:** Follow all aftermarket equipment manufacturer's recommendations for fusing. In some applications, the vehicle manufacturer may have provided upfitter circuits for use in your installation. We encourage the use of these circuits as they have been engineered to work with the vehicle's electrical system. All fuses should be rated for 125% of the load. Be sure to use automotive grade cartridge or blade-type fuses. SoundOff Signal does not recommend using circuit breakers or glass fuses in their place.

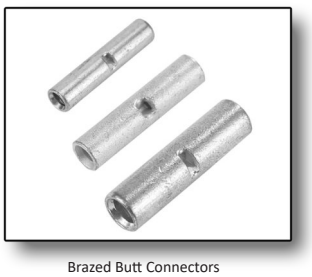


Soldered Connection



Crimped & Soldered Connection

**Connections & Crimps:** Ideally, all connections should be properly soldered and insulated with adhesive-lined heat shrink tubing. Electrical tape is not recommended as an insulator since it can come apart over time and does not adequately protect against moisture and corrosion.



Brazed Butt Connectors

If electing to crimp your connections, it is important to use butted, brazed-seam connectors and the correct crimping tool. Always perform a pull test on the wiring when done. While nylon or vinyl-insulated connectors are commonly available, we recommend using uninsulated connectors and protecting them with adhesive-lined heatshrink tubing.

Whether soldered or crimped (or crimped and soldered!), ensure that your wiring is slack enough to resist vibration and strain. Securing wire on both sides of a connection adds strength as well.

Braided Loom

Split Loom

**Wire Protection:** Wire and harnesses should always be neatly secured. Stray wires risk potential damage from chafing and rubbing.

It is good practice to use wire loom to protect wiring used in the engine compartment or vehicle exterior, and we recommend nylon or polypropylene types for their higher heat ratings. For interior wiring we also recommend loom or expandable, braided sleeving be used, and that you follow factory wire routing were possible. Be sure to secure your wires with zip-ties to add strain relief.

Tesa Tape

Another good option for protecting wire, creating harnesses, and keeping things neat, is Tessa tape. This high-quality tape is commonly used in OEM wiring applications. Interior (fuzzy) and exterior (hard cloth) versions are inexpensive and very handy to have around.

Wire should always be protected when passing through metal surfaces. Rubberized and hard plastic grommets are perfect for this. Be sure to seal any holes created for this purpose, to protect the vehicle against rust and corrosion. Automotive grade silicone sealant or strip caulk (dum-dum) works well.

**Equipment Mounting:** Even though equipment may be waterproof or resistant, common sense must always be used when placing it. Mounting a plug for an electrical connector in an area that always sees water or moisture, is usually not a great idea, regardless of its resistance characteristics.

All connections should be above water level and protected from water spray. When mounting equipment in a high heat area, make sure there is adequate air flow and ventilation

Use caution when drilling and fastening, and always be sure what is behind the mounting surface. We recommend stainless hardware for most applications. Finally, always consider airbag deployment zones as well.

**Final Thoughts:** The best, best practice is having a solid plan at the start of your upfit. Know the vehicle, know the equipment, and know your limitations. Increase your knowledge of this important topic by visiting the links below. Finally, regardless of what practices SoundOff Signal recommends, manufacturer specifications and guidelines take precedence.

**General Motors Best Practice Manual:**
https://www.gmupfitter.com/pages/best-practice-manuals

**Ford Motor Company Body Builder Guides:**
https://fordbbas.com/publications

**Dodge Charger Police Upfitter Guide:**
https://www.fcausfleet.com/dodge/charger-pursuit.html

**WAYTEK Wire's Blog:**
http://info.waytekwire.com/blog

**Emergency Vehicle Technician Certification:**
http://www.evtcc.org/faq

# Password Protection

Any bluePRINT file can be password protected when it is uploaded to the Central Controller. It is a very simple task to do.

While clicking on the upload icon, hold down the Control button on the keyboard.

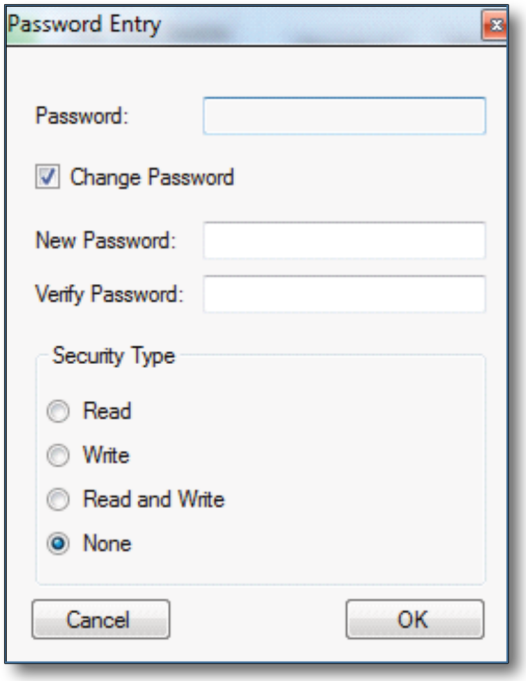
bluePRINT will open the Password Entry dialog box allowing the user to add or change the password associated with a file.

Based on the security type, there are different types of protection.

**Read:** With this type selected, a password will be required to view the program currently stored in the Central Controller. This only prevents a user from viewing the program, and does not protect the Central Controller in the case when a new program is uploaded.

**Write:** Write protection prevents any changes from being made to the current program in the Central Controller. Without a password, the user can see the program, but not make modifications.

**Read and Write:** The ultimate protection for a Central Controller. With this type selected, the installed program cannot be read or written over without the password.




Password Protection

bluePRINT automatic logic

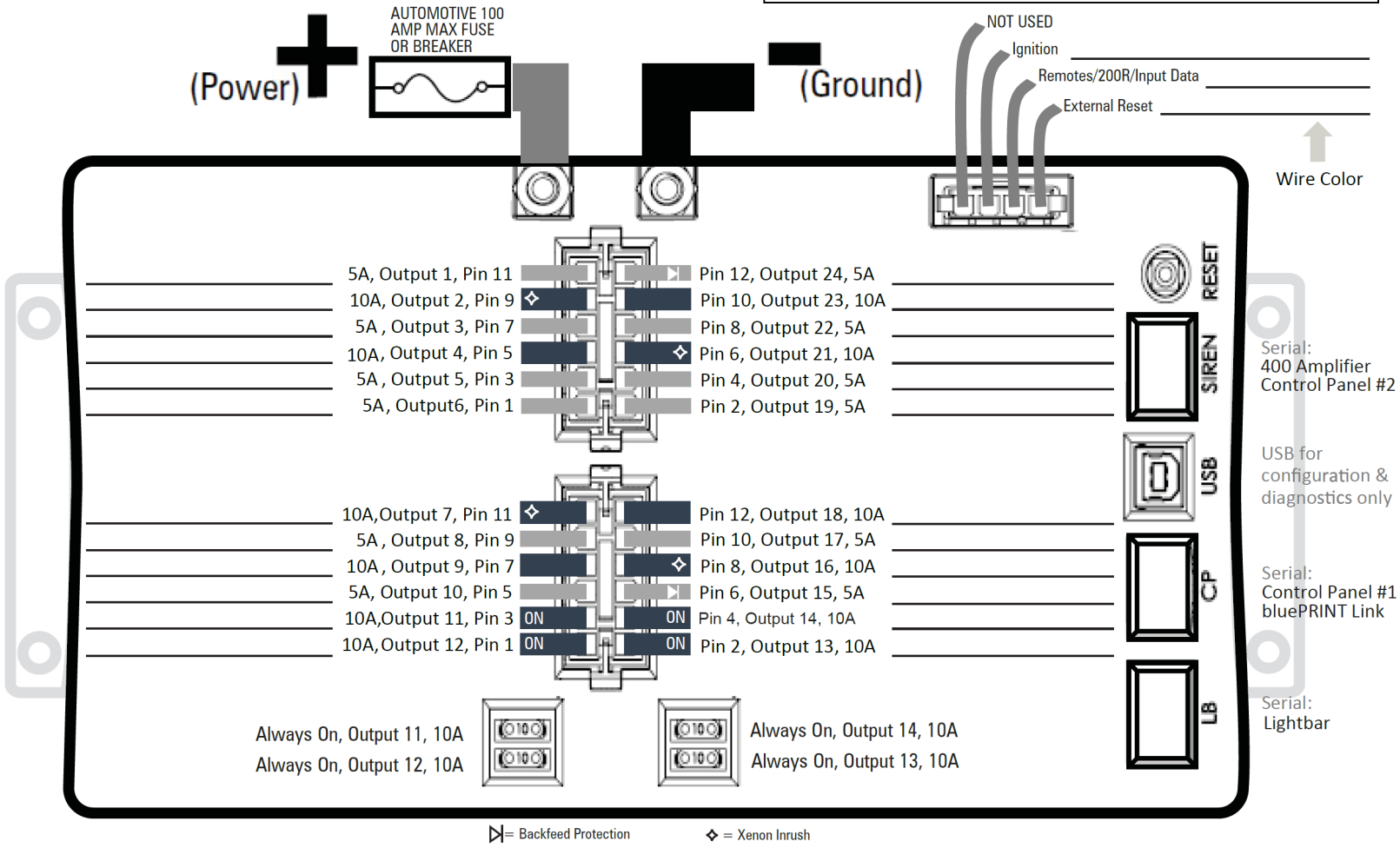
# CENTRAL CONTROLLER INSTALL TEMPLATE

Department: _____

Vehicle: _____

Installer / Date: _____

Mounting Location: _____




1.800.338.7337 / www.soundoffsignal.com

EVCS_Central Controller 2.16

bluePRINT automatic logic

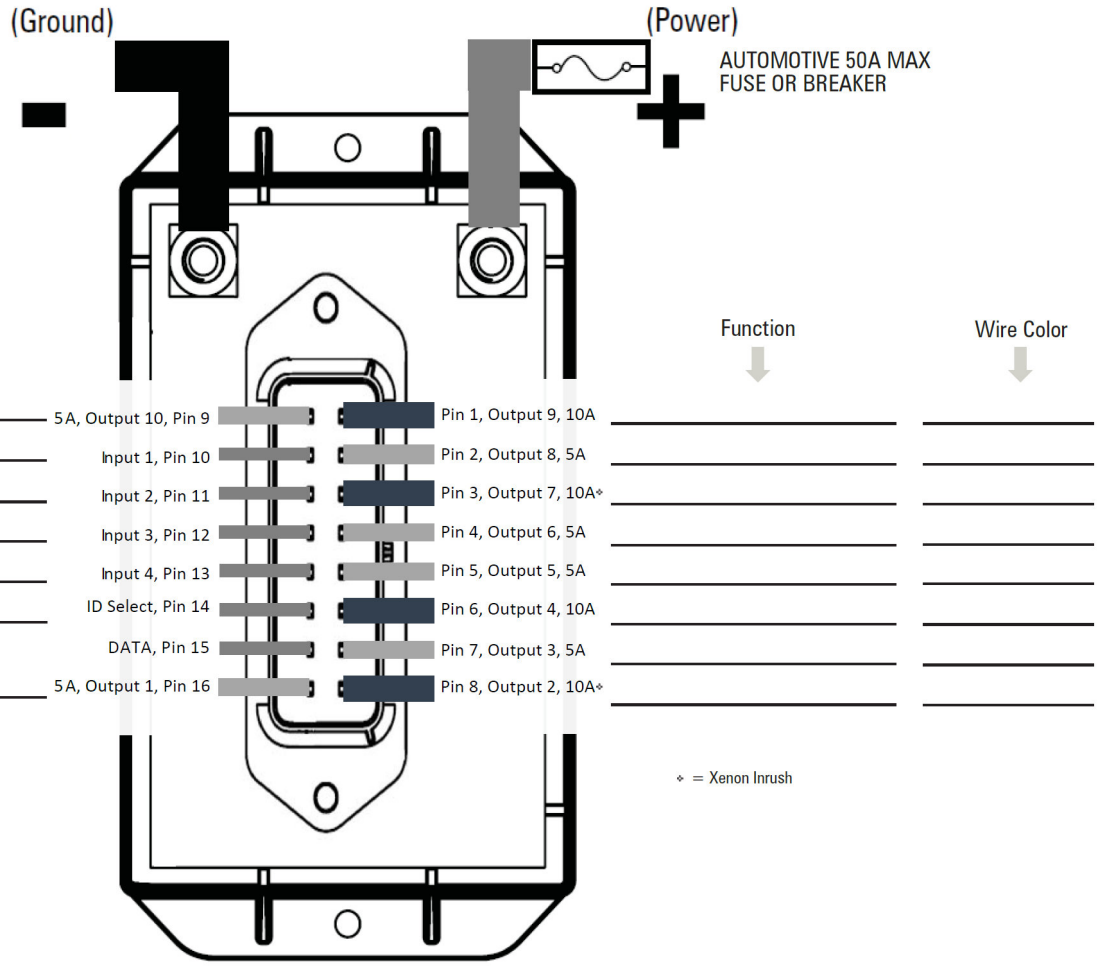
# REMOTE NODE INSTALL TEMPLATE

Department: _____

Vehicle: _____

Installer / Date: _____

Mounting Location: _____




1.800.338.7337 / www.soundoffsignal.com

EVCS_Remote Node 1.2

# INPUT NODE / LIGHTBAR BOB INSTALL TEMPLATE

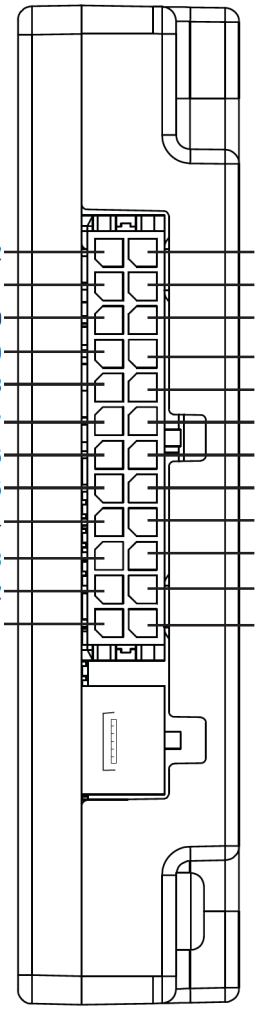
Department: _____

Vehicle: _____

Installer / Date: _____

Mounting Location: _____

| Function | |
|---|---|
| _____ | IGNITION |
| _____ | H, Input 11 |
| _____ | H, Input 10 |
| _____ | H, Input 9 |
| _____ | H/L, Input 8 |
| _____ | H/L, Input 7 |
| _____ | H/L, Input 6 |
| Central Controller Lin Data or Lightbar Data | LIN / LB Data |
| | GROUND |
| _____ | H/L, Input 3 |
| _____ | H/L, Input 2 |
| _____ | H/L, Input 1 |

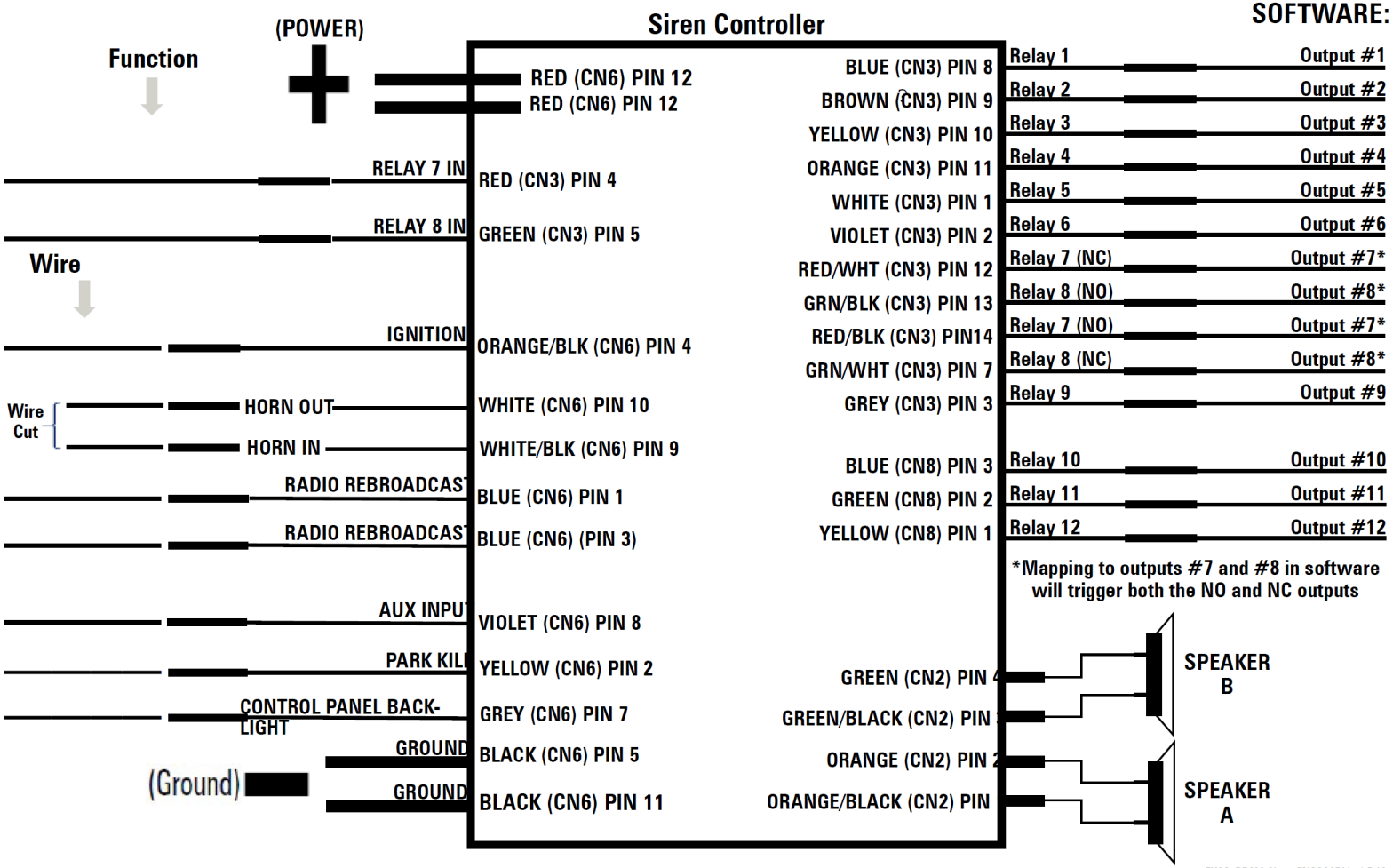


| | | Function | |
|---|---|---|---|
| Pink/ White - PIN#12 | PIN#24 - Light Green/ White | Input 24, H | _____ |
| Purple/ White - PIN#11 | PIN#23 - Red/ Black | Input 23, H | _____ |
| Gray/ White - PIN#10 | PIN#22 - Orange/ White | Input 22, H | _____ |
| Black/ White - PIN#9 | PIN#21 - Yellow/ White | Input 21, H | _____ |
| White - PIN#8 | PIN#20 - Brown | Input 20, H/L | _____ |
| Purple - PIN#7 | PIN#19 - Red/ White | Input 19, H/L | _____ |
| Brown/ White - PIN#6 | PIN#18 - Pink | Input 18, H/L | _____ |
| Light Green - PIN#5 | PIN#17 - Red | POWER | _____ |
| Black - PIN#4 | PIN#16 - Orange | Input 16, H/L | _____ |
| Gray - PIN#3 | PIN#15 - Yellow | Input 15, H/L | _____ |
| Green/ White - PIN#2 | PIN#14 - Green | Input 14, H/L | _____ |
| Blue/ White - PIN#1 | PIN#13 - Blue | Input 13, H/L | _____ |

nERGY® bluePRINT®

**480 SIREN MODULE ?**
**PART NUMBERS: 100W- ENGSA07141**
**200W- ENGSA07152**

Department: _____
Vehicle: _____
Installer / Date: _____
Mounting Location: _____






EVCS_BP480 Siren_ENGSA071(xx) 5.16

# Troubleshooting & Tips

**Erratic Lightbar Operation**

- Make sure the lightbar data wire (Pin 5 on the BOB) is not connected to LIN data on the Central Controller (4 pin plug, yellow)
- Check that the lightbar data wire is not shorted to ground or hot.
- Control Panel doesn't work
- Make sure the program matches the control panel type and is using the matching data port (Control Panel or Siren).
- If using a control panel on the siren port, make sure there is a 400 series siren on the port to provide power to the control panel.

**bluePRINT Link doesn't work**

- Verify with SoundOff Signal Technical Support that the proper firmware is loaded for the vehicle type.
- Make sure bluePRINT Link is connected to the Control Panel port. Since control panels can be connected to either the Siren or Control Panel ports, it is common to mistakenly connect bluePRINT Link to the control panel on the Siren port.
- bluePRINT Link doesn't work with bluePRINT 2.

**bluePRINT Sync doesn't work**

- Verify that both vehicles are on the same pattern.
- Check the hardware troubleshooting tips in the Sync instructions; make sure bluePRINT Sync has received GPS lock.
- Make sure bluePRINT Sync is connected to the Control Panel port. Since control panels can be connected to either the Siren or Control Panel ports, it is common to mistakenly connect bluePRINT Sync to the control panel on the Siren port.
- bluePRINT Sync doesn't work with bluePRINT 2.

**BOB as an input node not working**

- Verify "Set BOB as Input Node (Controlled by bluePRINT)" is checked on the BOB file. See page 70 for more.
- Make sure only one BOB file has this checked.
- Make sure the input node type is set to BOB. See page 70 for more information.

**Park Kill Tips**

- Park Kill must be mapped when using an input from the input node, remote node, or bluePRINT Link.
- We recommend not using the Park Kill wire on the siren amplifier. This overrides any programmed bluePRINT functionality.
- If no siren tones are being produced check the following: wired input for park kill polarity, other inputs that may have mappings to park kill, or a microphone that is keyed up.
- If the siren will not shut down check the following: Siren override tones are mapped, park kill polarity, an input with higher priority is deactivating park kill.

**Horn Ring Tips**

- Horn ring wired through the amplifier can be setup as positive or negative polarity on the Siren Setup main tab. Most vehicles use

negative horn ring between the horn switch and the BCM.

- We do not recommend connecting the horn ring between the BCM and the horn itself. The amperage requirements may blow the fuse in the siren.
- A discrete input and a 10a output can be used to control the horn if needed. This will require mapping when “Horn Ring Enable” is active.
- Horn ring cannot be by bluePRINT when park kill is active. If there is a requirement to see horn ring while in park, run a redundant input from the horn ring input to an input on the Input Node/BOB or Remote Node.

**Custom Harness Tips**

- Custom harnesses can pose issues when they are pinned incorrectly. If using a harness that was custom pinned be sure to check all wires are pinned correctly.

**Service Loop Tips**

- Always leave some service loop with any electronic components. This allows components to be serviced later comfortably and also reduces stress on any wiring.

## SoundOff Signal Technical Support

## (800) 338-7337
## Extension 4

## techgroup@soundoffsignal.com

# bluePRINT® TRAINING CERTIFICATION manual


www.soundoffsignal.com

3900 Central Parkway
PO Box 206
Hudsonville, MI 49426

OFFICE DIRECT
616.896.7100

TOLL FREE
800.338.7337
*Customer Services, press 5*
*Technical Services, press 4*

ORDER FAX
616.896.1286


**CA Proposition 65 Warning**
**What is CA Proposition 65?**

In November 1986, California voters approved a ballot initiative to address concerns about exposures to toxic chemicals. That initiative became The Safe Drinking Water and Toxic Enforcement Act of 1986, better known by its original name, Proposition 65.

**Our posted warning is as follows:**

WARNING: Chemicals known to the state of California to cause cancer, or birth defects, or other reproductive harm may be present in products sold by SoundOff Signal® or SoundOff Commerical Vehicle Solutions®.