EMERGENCY LIGHTING
WITH AVI-ON CONTROLS

Making it Simple and Easy Regardless of the Application

This white paper covers background on the various methods of deploying emergency lighting with Avi-on controls, how to specify and install each type, and some unique cost and labor saving opportunities in emergency lighting recently made possible by changes to UL 924 requirements in 2022, and Avi-on's specific UL Approval for UL 924.

OVERVIEW

All buildings beyond a certain minimum size require exit pathway lights to be on at 100% during emergency conditions.

This is typically accomplished by having a local backup power source, such as batteries or a generator that can be connected to a dedicated emergency lighting circuit, or increasingly scenarios with individual fixture control, by installing emergency specific fixtures with integrated backup batteries. On a loss of utility power, or trigger from a life safety or building control system, A UL 1008 listed transfer switch disconnects the circuit from utility power and connects the backup source. Battery based emergency fixtures simply switch to their battery power on loss of normal power (and also block any lighting control signals from reaching the fixture output.)

With the release of the May 2022 update to UL 924, UL has changed how emergency lighting works in significant ways. In the past, a circuit level device would detect turn-on of emergency power and trigger the lights to stay on at full for 90 minutes, non bypassable.

Now, UL 924 requires active and continuous detection of normal power. Emergency mode is now triggered by the loss of normal power, just for the duration of that loss, vs a specified time frame. Devices that passively detect either the presence of emergency power, or the interruption of normal power to trigger emergency mode are no longer allowed.

IMPLICATIONS OF **UL 924 2022 UPDATE**

BENEFITS:

1. Emergency fixtures will now turn on anytime there is a loss of light due to loss of normal power. In the past, sensing power interruptions or emergency power were used as a proxy for measuring the loss of normal power to lighting, but there are cases where that signal might not be accurate.
2. The mandatory 90 minute on period has been removed (though the emergency power system must be capable of keeping the lights on for at least 90 minutes if needed), so a short interruption will no longer override all lighting controls for longer than the actual duration of the emergency condition.
3. The changes open up significant simplification and cost saving opportunities by allowing the integration of fixture control and emergency bypass functionality in a single device.
4. The standard applies a consistent approach regardless of controls or wiring design so that a common approach transcends different methods of emergency and fixture wiring.

CHALLENGES:

The big change in the new standard is that now there must be a device that continuously detects the presence or absence of normal power and then informs any emergency fixture control devices to turn on and to override any dimming commands until normal power is restored.

The challenge is, unless emergency control is being accomplished with Branch Circuit Emergency Lighting Transfer Switch, or BCELTS, the two devices (sensor and control device) may be long distances apart, and connecting them with wire could involve long and difficult wiring runs, and/or a lot of duplicate equipment, raising the cost and complexity of a lighting installation. It also means conventional power-interruption based shunt relays are no longer usable unless they are able to directly detect the loss of normal power, and provide the needed lighting control override.

AVI-ON WITH **UL 924 2022**

Avi-on is one of the only providers in the market that has a fully wireless UL 924 approval that allows the normal power sensor to send wireless messages to the emergency fixture control devices, and a single, combined fixture control/emergency device can be mounted either at the circuit level, or individual fixture level. A single normal power detector can be installed for up to an entire building, and Shunt Relays are no longer required anywhere. The wireless message from the normal power detector simply enables the emergency mode for each individual emergency fixture (or circuit). This avoids complicated and potentially untenable wiring challenges, and saves on expensive duplicated equipment.

The Avi-on AVI-XFAC-16A combines wireless normal power fixture controls with a UL 924 listed control override capability in a single package. Using an emergency enabled AVI-XFAC-16A on a wired 0-10V emergency circuit control, or mounted on individual fixtures, and a single AVI-SEN-XFAC-UL924 Normal Power Sensor per transfer switch creates a qualifying emergency solution with no additional components.

Further, with an Avi-on UL 924 XFAC-EM fixture control device mounted at each fixture, it is also not necessary to specifically UL list the fixture as emergency capable.

To use Avi-on controls with dedicated emergency wiring, simply follow these simple steps:

1. Install an AVI-SEN-SIM-UL924-OA normal power sensor downstream of the transfer switch powered by the EMERGENCY power circuit and upstream of any fixtures. Choose a location where emergency power and normal power are located close together and that has an open air space to the rest of the building (outside a concrete electrical room). Wire into the EMERGENCY power line using an AVI-PSS-277-12-150 power supply
2. Connect the normal power to the detector sensor input. Use an AVI-PSS-277-12-150 power supply to the NORMAL power source and connect to the contact closure inputs of the detector
3. Install AVI-XFAC-16A (Any model) as the fixture control device on the emergency circuits or individual emergency fixtures
4. Put your emergency Fixture/Circuit XFACs into a dedicated group that matches the coverage of the transfer switch. You need one detector per transfer switch if you want each emergency circuit to be able to operate independently of the others.
5. Enable UL 924 mode on the selected AVI-XFAC-16A's if not already done before shipping
6. Done!

PROGRAMMING MULTIPLE LIGHT LEVELS DURING EMERGENCY CONDITIONS

In some UPS based emergency scenarios, all lights are continuously connected through the UPS power source, but there is not necessarily enough battery power to run all lights at full for the required 90 minutes.

With Avi-on, simply configure additional Sensor Input Modules (SIM's) on the UPS emergency trigger contact closures to reduce the non-emergency lighting during an emergency condition to not exceed a specified level.

WHEN TO USE AVI-ON UL 924 SOLUTIONS FOR EMERGENCY POWER

Use Avi-on when you encounter these emergency wiring approaches:

- Anytime the emergency power transfer switch controls more than one circuit
- UPS based continuous power with or without separated emergency wiring
- Any project using individual fixture controls

WHEN AVI-ON UL 924 IS NOT NEEDED FOR EMERGENCY POWER

1. UL 924 listed battery backup emergency fixtures are used as the exclusive emergency lighting method
2. When Branch Circuit Emergency Lighting Transfer Switch, or BCELTS, is used on every branch circuit.

In these cases Avi-on can still provide controls, but the UL 924 capabilities are not needed because they are fully provided by the battery emergency driver or BCELTS, so further sensors or controls are not needed

TESTING

Another important change with the 2022 standard relates to testing. In the past, testing modes and test requirements primarily applied to the fixture control devices under UL 924. While they could be tested on a more central basis at the transfer switch level under UL1008, UL 924 devices that manage the fixture emergency controls overrides also needed their own test buttons or modes.

With UL 924 2022, the testing can be accomplished at the transfer switch level only under UL 1008, and the downstream devices (normal power test sensor and fixture emergency controls) can simply exhibit proper behavior during the test, and do not specifically need their own test modes within UL 924.

Another big change was the requirement for indicator lights in spaces that identify whether the lights are running on emergency power or normal modes, and those lights must be visible in the occupied space. This has been a confusing requirement, because the emergency devices and controls can often be located far from the spaces they control. Avi-on clarified this with UL in the process of its approval and has the following guidance:

- BCELTs's must have a visible emergency power mode indicator light in the space they control
- Battery backup UL 924 fixtures must have an emergency power indicator light mounted on the fixture and visible to the occupants.
- UL 1008 Transfer switches must have an emergency power indicator light and test modes, but a light does not need to be visible in every individual room downstream of the transfer switch

NOTE ON NETWORK COVERAGE

Since the loss of normal power will mean the loss of many lighting devices in the system, it is possible that the wireless mesh network will have too few devices to reach all emergency control enabled fixtures. On rare occasions, it may be necessary to either add a few additional Avi-on devices powered from the emergency circuit, or move a few additional lights from normal power to emergency power. This condition can be easily anticipated and avoided during the initial layout process for the quote and tested during installation to validate reliable performance.

USING AVI-ON IN SPECIFIC WIRING APPLICATIONS

Below are a set of wiring diagrams for the most common emergency lighting approaches using Avi-on UL 924 devices. They all follow the same principles:

- Install and configure a normal power sensor
- Configure the Avi-on UL 924 devices for either enable on or enable off
- Verify that the transfer switch is UL 1008 listed and will provide the necessary test functions

If Avi-on emergency capabilities are not required, it is still critical that the Avi-on lighting control devices be properly wired into battery emergency fixtures or BCELT's. Diagrams follow on how to properly wire them.

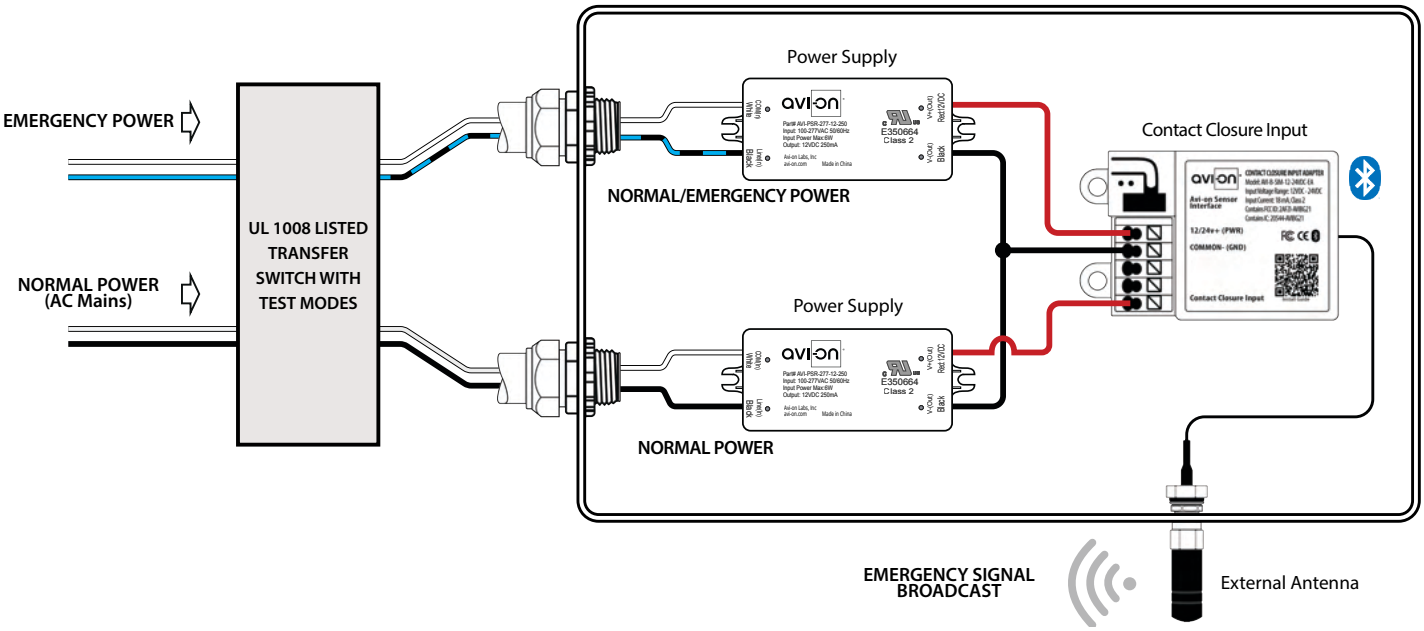
EMERGENCY LIGHTING **WIRING DIAGRAMS**

WIRING NORMAL POWER SENSORS

Wiring the normal power sensor is easy and is the same regardless of the downstream fixture configuration.

Normal Power Sensor Wiring Diagram

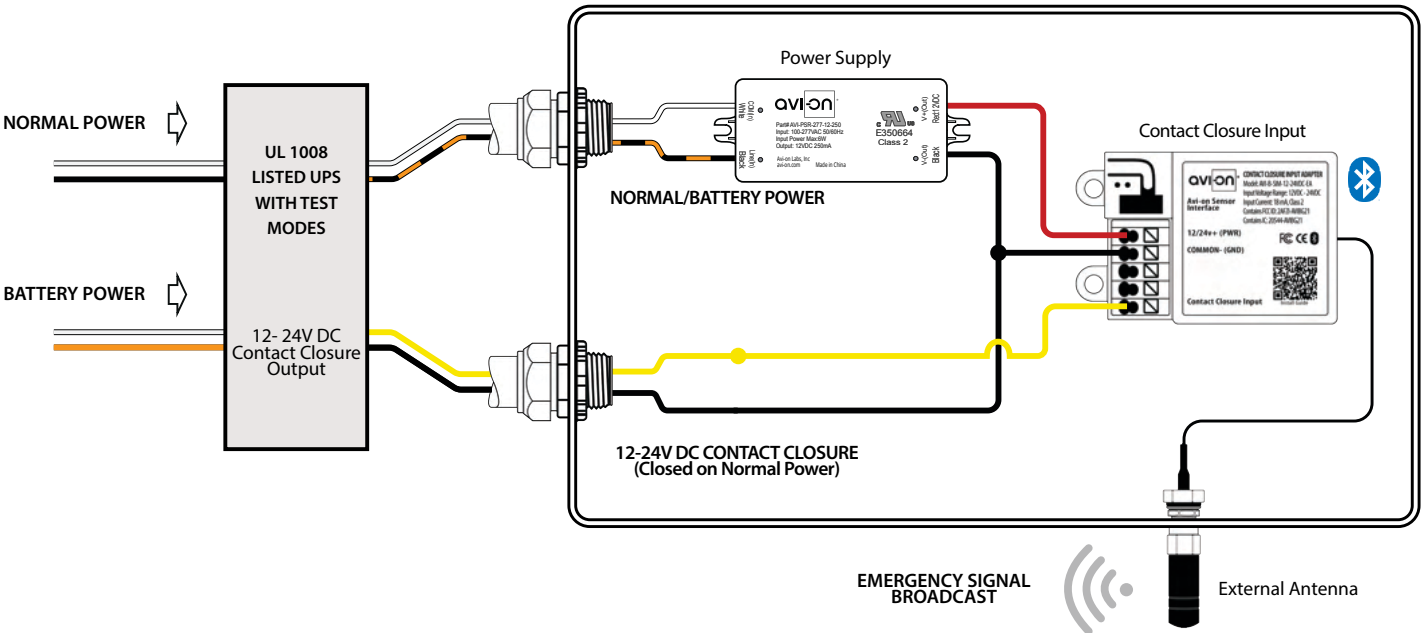
Transfer Switch



1. Install in a normal 4x4 Junction box in a location with good airspace visibility to the emergency fixtures
2. Power the Normal Power Sensor using EMERGENCY power through the supplied 12VDC power supply
3. Connect the Power Sensor input using the supplied power supply connected to NORMAL power, making sure to connect both Power Supply Grounds together. Be sure not to connect the Sensor input directly to AC power
4. Drill a ¼" hole in the top or side and mount the supplied antenna, being sure not to crimp or cut the antenna cable

Normal Power Sensor Wiring Diagram

Uninterruptible Power Supply (UPS)

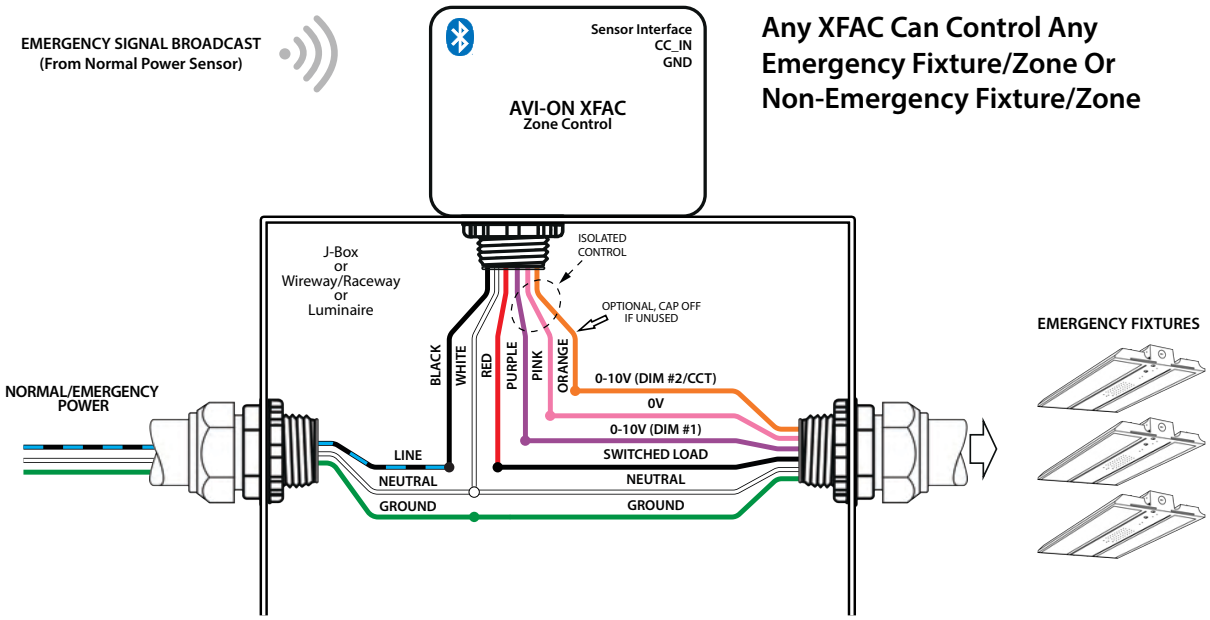


1. Install in a normal 4x4 Junction box in a location with good airspace visibility to the emergency fixtures
2. Power the Normal Power Sensor using EMERGENCY power through the supplied 12VDC power supply, making sure to connect the Power Supply Ground to the Contact Closure Ground
3. Connect the Power Sensor input to the UPS emergency contact trigger. The Sensor can sense 12-24V contact closures. If the UPS contact trigger is not powered, introduce 12V DC power using the included power supply wired to the EMERGENCY AC power line.
4. Drill a ¼" hole in the top or side and mount the supplied antenna, being sure not to crimp or cut the antenna cable

INSTALLING CIRCUIT BASED EMERGENCY FIXTURES

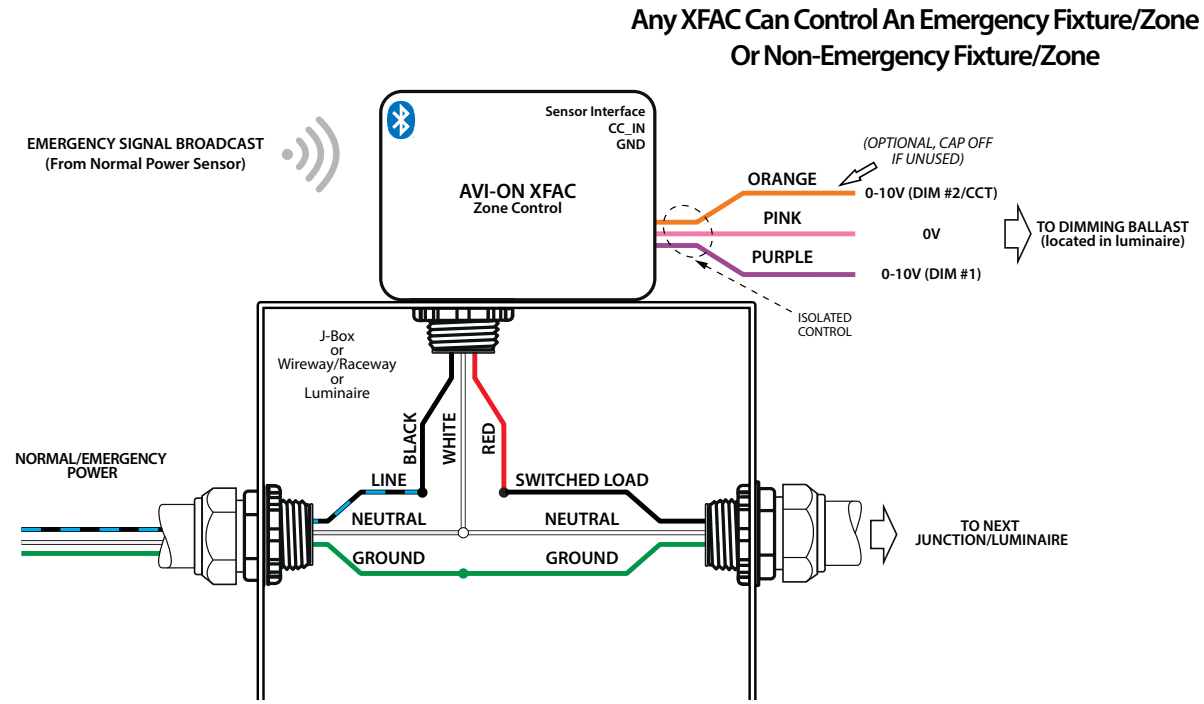
Emergency Zone Controller Wiring Diagram

(Class 1)



Emergency Zone Controller Wiring Diagram

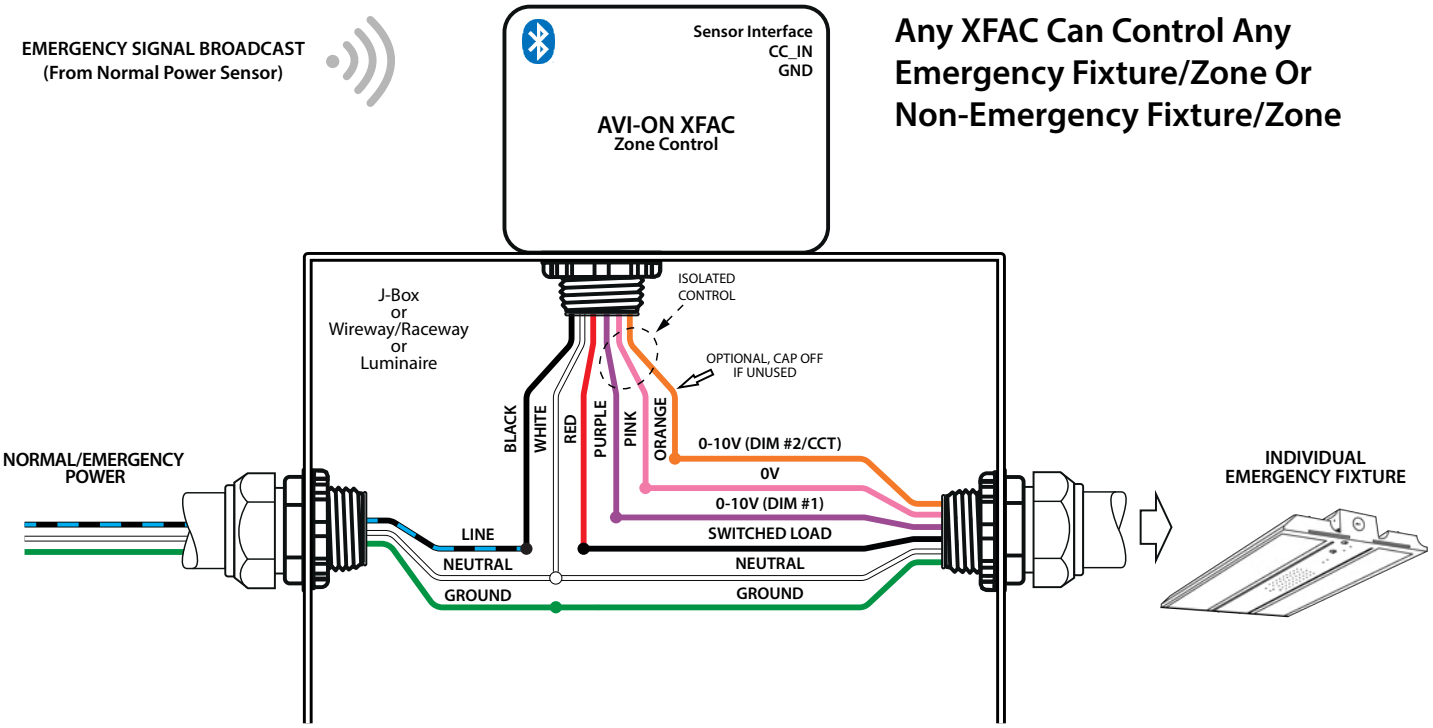
(Class 2)



INDIVIDUAL FIXTURE EMERGENCY LIGHTS ON A DEDICATED EMERGENCY CIRCUIT

Emergency Control Wiring Diagram

(Individual Fixture)

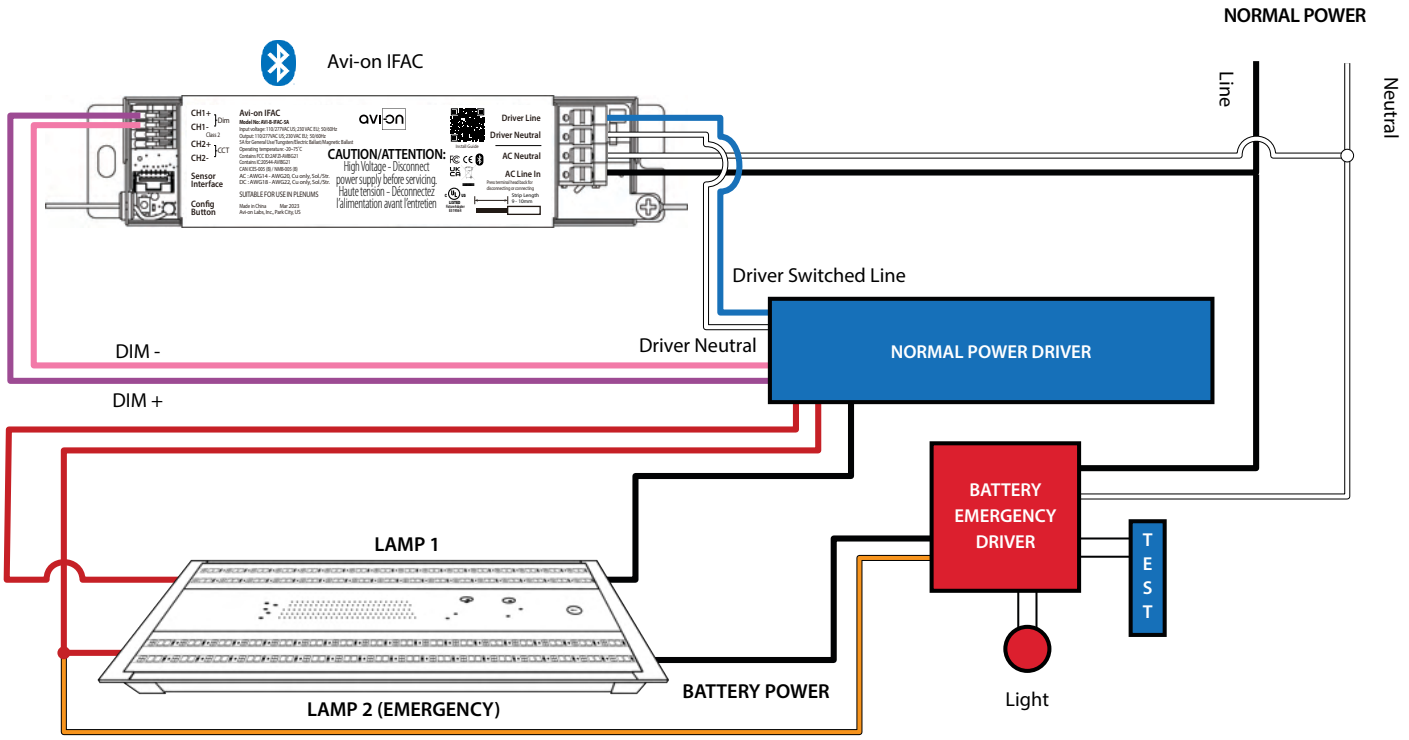


BATTERY POWERED EMERGENCY LIGHTS

In this case, there are no special emergency requirements to be fulfilled by Avi-on as long as the battery lights are connected to normal power and are UL 924 2022 certified. Note the wiring diagrams below are illustrative for typical situations. Consult the wiring diagrams for the LED drivers for any specific instructions.

IFAC Fixture Wiring Diagram

(With Emergency Battery)

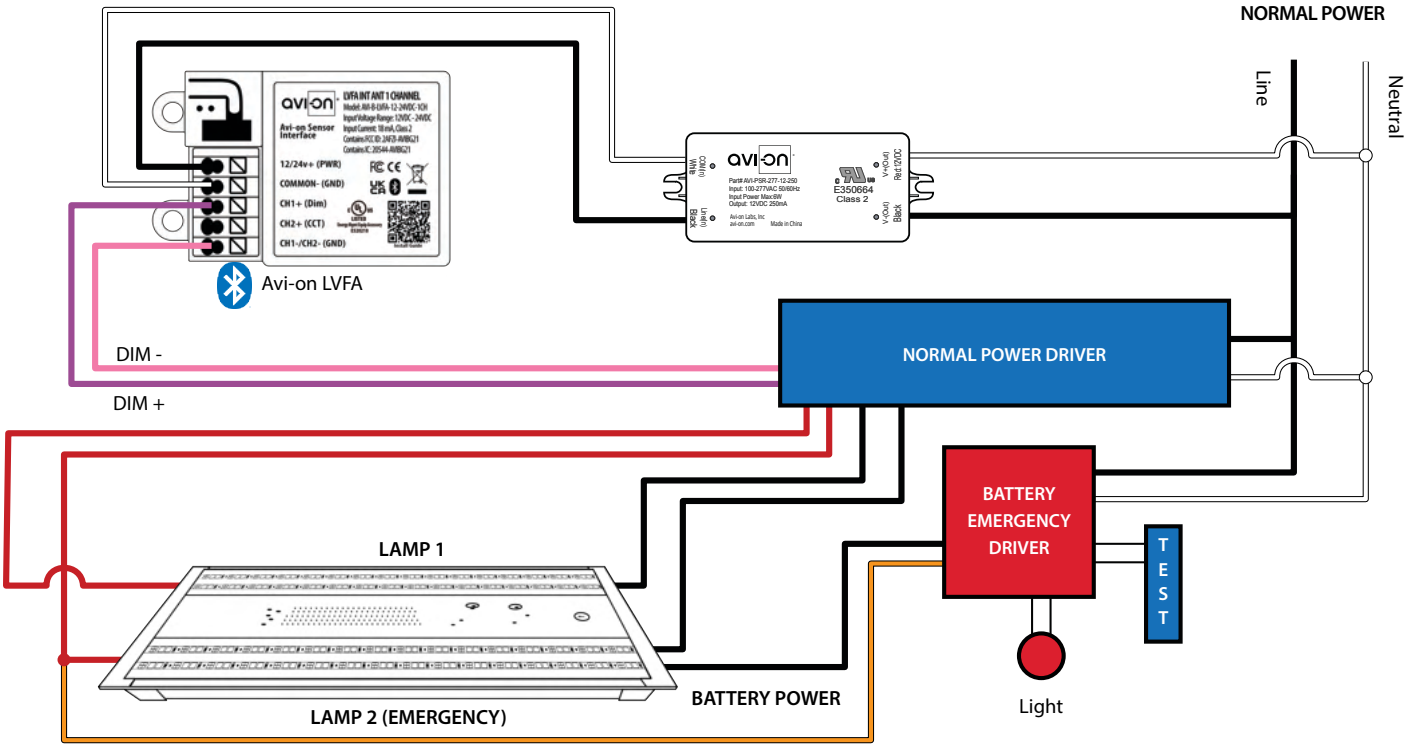


Connect the Battery Emergency Driver AC and Avi-on IFAC AC inputs to line and neutral of the normal power circuit. Connect the Normal Power Driver AC inputs to the AC driver outputs of the IFAC. Connect the IFAC Dim+ and Dim- wires to the driver as normal.

Wire the selected emergency LED strings to the Plus and Minus connections of both drivers. Connect LED strings not used for emergency to the Normal Power Driver only. Connect the test and indicate light buttons as indicated by the Emergency Driver manufacturers instructions.

LVFA Fixture Wiring Diagram

(With Emergency Battery)



Connect the Normal Power Driver AC, Battery Emergency Driver AC and 110-277v -12VDC power adaptor to the Normal Power AC. Connect the low voltage outputs from the power supply to the Avi-on LVAC power Plus and Minus Inputs. Connect the LVFA Dim+ and Dim- wires to the driver as normal.

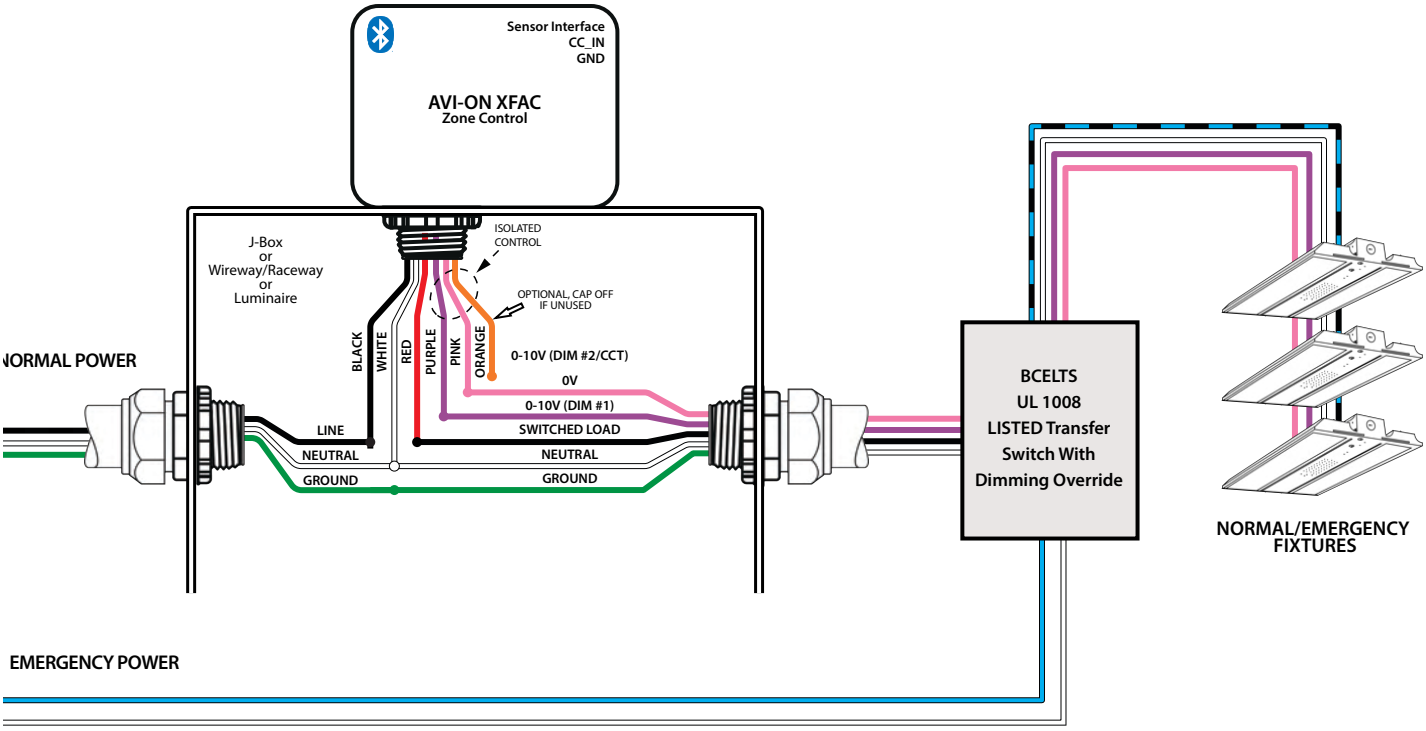
Wire the selected emergency LED strings to the Plus and Minus connections of Both drivers. Connect LED strings not used for emergency to the Normal Power Driver only. Connect the test and indicate light buttons as indicated by the Emergency Driver manufacturers instructions.

BRANCH CIRCUIT EMERGENCY LIGHTING TRANSFER SWITCH (BCELTS)

In this case, there are also no special emergency requirements to be fulfilled by Avi-on. The only key requirements for wiring are:

Zone Controller Wiring Diagram

Branch Circuit Emergency Lighting Transfer Switch (BCELTS)



- Wire the Avi-on fixture control device to NORMAL POWER, UPSTREAM of the BCELTS. This assures the fixture control will not override the emergency power AC power source to the signal.
- Wire the 0-10V Dimming and AC Power from the Avi-on fixture control device into the NORMAL power and dimming inputs of the BCELTS. This will assure that the BCELTS is able to make sure the lights are on and sent to full brightness during an emergency condition