

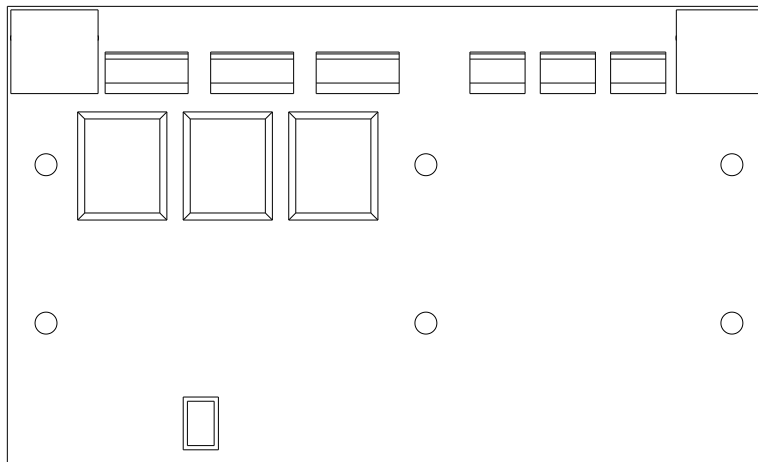


I/O OPTION MANUAL

175W - 1100W SINGLE PHASE

Series LV

EMERGENCY LIGHTING CENTRAL INVERTER



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Table of Contents

SECTION 1	2
Connecting the I/O Board	2
Output Connections:	3
Input Connections:	3
SECTION 2	3
Navigating the I/O Board settings	3
To ensure that an I/O option is present:	3
To set an input function:	3
To set an output function:	4
To view the status of inputs and outputs:	4
Default settings:	4
SECTION 3	5
Input functions defined	5
Indicator (IND):	5
Charger Disabled (CHD):	5
Switched Output (SWO):	5
Transfer to Battery (TTB):	5
Normally Off Relay (NOR):	5
SECTION 4	6
Output functions defined	6
Output Set Point Functions:	6
Status/Alarm Functions:	7
Other Output Functions:	8
SECTION 5	9
Switched Outputs	9
Switched output without the I/O Board option:	9
Non-isolated switched output with the I/O Board option:	10
SECTION 6	12
LED Dimmer Application with Switch	12
0-10 LED Dimmer Application (Full Brightness)	13
0-10 LED Dimmer Application (Minimum Brightness)	14
SECTION 7	15
Combination of output contacts	15
In parallel:	15
In series:	16
Mixed series and parallel:	16
SECTION 8	17
Zone Monitor	17

SECTION 1

Connecting the I/O Board

The I/O Board options for the Series LV Emergency Lighting Central Inverter can have a varying amount of input and output connections. The two most common versions are a version with 3 inputs and 3 outputs, and another version with 6 outputs. The following section outlines how to connect this version.

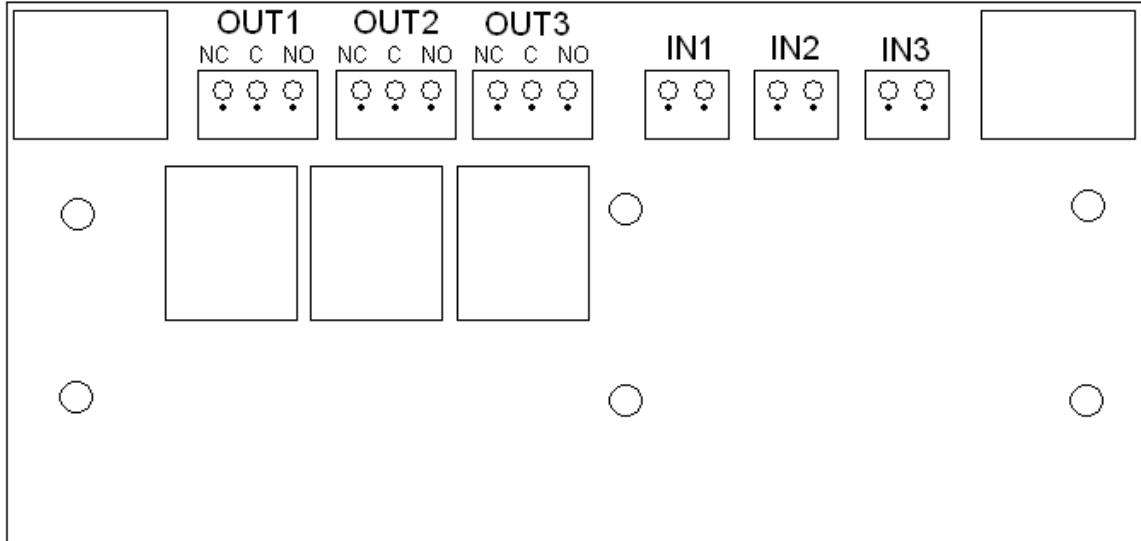


Figure 1.1 - Basic structure of I/O Board with three inputs and three outputs.

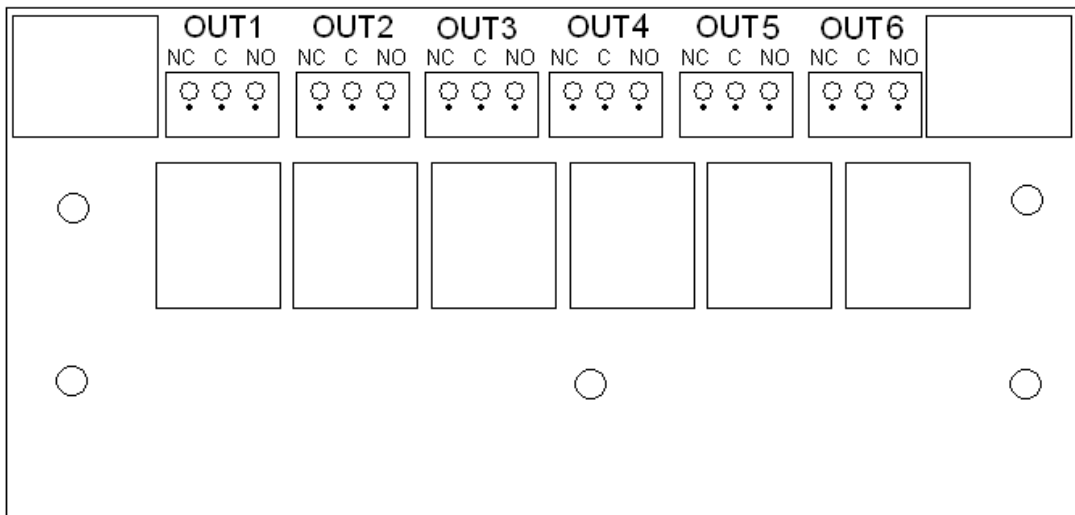


Figure 1.2 - Basic structure of I/O Board with 6 outputs.

Output Connections:

The output connections of the I/O Board option are dry contacts. These contacts are rated for up to 277Vac at **10A** and are isolated from the rest of the Series LV system, so sources of a different phase can be controlled without damaging components. The connection marked **C** on the I/O Board is the common connection of the relay. This connection is mechanically connected to **NC** when not powered, and **NO** when powered.

Input Connections:

The input connections of the I/O Board option detect a 90-277Vac voltage. These inputs are isolated, so multiple sources, of various phase and voltage, can be detected with one I/O Board. The polarity of these input connections is not important to the function. If at least 90VAC is applied across these connections, a logic high will be detected. Each input can be programmed as **Active Open** or **Active Closed**. Active Open is active when there is less than 50Vac across the input. Active Closed is active when there is more than 90Vac across the input. A voltage of between 50-90Vac across the input may cause the input to toggle. The input is not intended to be used between 50-90Vac.

SECTION 2

Navigating the I/O Board settings

The inputs and outputs of the I/O Board are programmable through the display panel of the Series LV system, which is featured on advanced systems. The following section outlines how to set input and output functions through the LV display panel. See the 115107 LV Series Manual for further instructions on the display operation of the LV system.

To ensure that an I/O option is present:

Hold down the power button on the display for five seconds to power it on.
Using the arrow keys, navigate to **Unit Info** in the display menu.
Using the arrow keys, navigate to **I/O Module** in the System Setup menu.
This menu will say **PRESENT** if the I/O Board option is available.
This menu will say **NOT PRESENT** if the I/O Board option is not available.*

**If an IO board has been installed, but this menu says that it is not present, ensure that the RJ45 connectors are seated properly.*

To set an input function:

Ensure that the Series LV unit is fully powered and contains an I/O Board option.
Hold down the power button on the display to power it on.
Using the arrow keys, navigate to **System Setup** in the display menu.
Using the arrow keys, navigate to **I/O Settings** in the System Setup menu.
Using the arrow keys, choose the desired input, and press the enter button.

Using the arrow keys, choose the desired function, and press enter.
 Using the arrow keys, choose the appropriate Active state, and press enter.
 Using the arrow keys, choose the appropriate label, and press enter.
 Press escape to leave the **I/O Settings** menu and the changes will be updated.

To set an output function:

Ensure that the Series LV unit is fully powered and contains an I/O Board option.
 Hold down the power button on the display to power it on.
 Using the arrow keys, navigate to **System Setup** in the display menu.
 Using the arrow keys, navigate to **I/O Settings** in the System Setup menu.
 Using the arrow keys, choose the appropriate output, and press the enter button.
 Using the arrow keys, choose the desired function, and press enter.
 Using the arrow keys, set the required range if needed, and press enter.
 Press escape to leave the **I/O Settings** menu and the changes will be updated.

To view the status of inputs and outputs:

Ensure that the Series LV unit is fully powered and contains an I/O Board option.
 Hold down the power button on the display to power it on.
 Using the arrow keys, navigate to **Contact Status** in the display menu.
 Using the arrow keys, navigate to through the I/O in the Contact Status menu.
 The menu displays the state of the contacts as well as the function they are set too.

Default settings:

The following table outlines the default settings for different versions of the LV series I/O Option board.

Table 2.1: Default settings

6 Output Option		3 Output / 3 Input Option	
I/O	Default Setting	I/O	Default Setting
OUT1	Advanced: VAC In (Function) (Utility VAC Nominal +14% / -15%)	IN1	Isolated Power Input
	Basic: AC Present (Status) (AC Utility above 60VAC)		
OUT2	Input Fuse Failed (Alarm)	IN2	Isolated Power Input
OUT3	On Battery (Status) (Inverter On)	IN3	Isolated Power Input
OUT4	Overload (Alarm) (AC Output Turns Off if On Battery)	OUT1	Active when IN1 Power Present or when On Battery
OUT5	Battery Voltage (Function) (Near Low Battery = 1.85V / Cell)	OUT2	Active when IN2 Power Present or when On Battery
OUT6	Test Failed (Alarm)	OUT3	Active when IN3 Power Present or when On Battery

- Default settings are factory programmed.
- Basic LV System I/O boards are not adjustable.

SECTION 3

Input functions defined

Indicator (IND):

The indicator function displays a specific indicator in the Contact Status menu of the display and is passed through as data in the BACnet communication option. This function does not change any parameters, nor does it perform any other task.

Charger Disabled (CHD):

The charger disabled function stops the unit from charging the batteries. Leaving the unit in this state will eventually cause the batteries to go into low voltage disconnect, which will result in a power down of the unit and lose of backup power. For this reason, this function is only intended for emergency use.

Switched Output (SWO):

The switched output function binds the selected input to the output of the same number and creates a switched output. Whenever the selected input is active, the output of the same number will go active. The same output will also go active if the unit goes into emergency power. For example, if **IN1** is set to the switched output function, **OUT2** will toggle active whenever **IN2** goes active. **OUT2** will also go active if the unit goes into emergency power.

Transfer to Battery (TTB):

The transfer to battery function forces the unit to switch to emergency power regardless of the utility power and return from emergency power once the unit goes into low voltage disconnect or the selected input becomes inactive. If the unit goes into low voltage disconnect because of this function the unit will be locked out of transferring to inverter because of this function until the selected input goes inactive, making this effectively an edge triggered function. This protects the batteries from a deep discharge in the case where the transfer to battery function is left active.

Normally Off Relay (NOR):

The normally off relay function powers the normally off relay when the selected input is active. The contacts for this relay are labeled **N.Off**, **N.On**, and **Switched**. This function works with the normally off relay controls that are standard with a LV series emergency lighting system. If the loadshed feature of the LV series unit is enabled, it will disable the normally off relay after a set amount of time regardless of the active state of an input set to the normally off relay function. Multiple inputs can be set to this function at the same time, allowing different utility zones to control the same lighting load.

SECTION 4

Output functions defined

Output function can be broken into three categories, status/alarms, set points, and other.

Output Set Point Functions:

Set point outputs are output functions that require the user to set limits. **Input Voltage, Input Frequency, Output Voltage, Output Current, Battery Voltage, Battery Temperature, Ambient Temperature, and On Inverter Timer** are all set point outputs. For all of these set point functions, except **On Inverter Timer**, the user defines a top limit and a bottom limit. When the value of the selected set point falls out of the defined ranged, the output relay is powered. For example, if an output is set to **Input Voltage**, and the user has defined the input voltage range to be 102Vac-130Vac, the output contact will be powered if the input voltage falls below 102Vac or rises above 130Vac. The **On Inverter Timer** function requires that the user set a specific amount of time, rather than a range. When the Series LV unit goes into emergency power for this specified amount of time, the output relay is activated.

Table 4.1 Output Set Point Functions

	Unit Size	Low Setting	High Setting
Input Voltage	120Vac	102Vac-115Vac	125Vac-137Vac
	277Vac	235Vac-263Vac	290Vac-318Vac
Input Frequency	All	55Hz-59Hz	61Hz-65Hz
Output Voltage	120Vac	80Vac-115Vac	125Vac-150Vac
	277Vac	185Vac-263Vac	290Vac-346Vac
Output Current	175W	0Amps-1.45Amps	XAmps-1.82Amps*
	350W	0Amps-2.91Amps	XAmps-3.64Amps*
	550W	0Amps-4.58Amps	XAmps-5.72Amps*
	750W	0Amps-6.25Amps	XAmps-7.81Amps*
	1100W	0Amps-9.17Amps	XAmps-11.46Amps*
Battery Voltage	175W	10.5Vdc-12Vdc	13.5Vdc-15Vdc
	350W	21Vdc-24Vdc	27Vdc-30Vdc
	550W	31.5Vdc-36Vdc	40.5Vdc-45Vdc
	750W,1100W	42Vdc-48Vc	54Vdc-60Vdc
Battery Temp	All	-20°C to 10°C	40°C to 120°C
Ambient Temp	All	-20°C to 10°C	35°C to 800°C
On Inverter Timer	All	1min-255mins	**

*The range starts one increment above the lower setting

**On Inverter Timer only has one setting

Special considerations:

If multiple outputs are set to the same set point function, they must share the same set points. Changing the set points for one output will change the set points for any other outputs that are set to the same function.

Status/Alarm Functions:

Status/Alarm outputs are powered when the selected status or alarm is triggered. **Powered, Charging, On Battery, Test Active**, and **Norm Off Active** are available status functions. An output set to the **Powered** function will be powered as long as the unit is on. If the Series LV unit is bulk, absorption, or float charging, an output set to **Charging** will be powered. If the Series LV unit is in manual test, monthly test, or a yearly test, an output set to **Test Active** will be powered. If the unit is in emergency backup, any output set to **On Battery** will be powered. **Normally Off Active** functions similarly to On Battery, except there are options in the **Normally Off Relay** section of the **System Setup** menu that keep the normally off load powered for a varying amount of time after the Series LV unit returns from emergency backup. **Charger, Summary, Over current, Overload, Test Failed, Load Red, Heat sink temperature, Input Fuse Failed** are all available alarm functions. If an output is set to one of these alarms, and the Series LV unit has this alarm, the output relay is powered.

Table 4.2 Status Functions

Status Function	Description
Powered	Engages the output relay when the LV Series unit is powered.
Charging	Engages the output relay when the LV Series unit is charging.
On Battery	Engages the output relay when the LV Series unit is in emergency backup.
Test	Engages the output relay when the LV Series unit is conducting an inverter test.
Norm Off Active	Engages the output relay when the normally off relay is powered.
AC Present	Engages the output relay when AC is greater than 60Vac

Table 4.3 Alarm Functions

Alarm Function	Description
Charger	Engages the output relay when the LV Series fails to charge correctly
Summary	Disengages the output relay when LV Series summary contact is Disengaged*
Over current	Engages the output relay when the LV Series unit is in over current.
Overload	Engages the output relay when the LV Series unit is overloaded.
Test Failed	Engages the output relay when a monthly, yearly, or manual test has failed.
Load Red	Engages the output relay when the load falls below the load reduction set point.
Heat Sink	Engages the output relay when the heat sink temperature goes about 90°C
Input Fuse Failed	Engages the output relay when the unit has an input fuse failed alarm

*Summary alarms activates the relays when the unit has no alarms, and deactivates them when there is an alarm

Other Output Functions:

Input Active, Switched Output, and Transfer Delay are other functions available for the output contacts. If an output is set to **Input Active**, it will be powered as long as the same number input is powered. For example, if input 1 is powered with a 90-277Vac signal, output 1 will be powered.

An output set to **Switched Output** will be powered when the corresponding input is powered, or when the Series LV unit goes into emergency backup.

Note: *The output is automatically set to **Switched Output** when an input is defined with the **Switched Output** function.*

Transfer Delay operates as a normally on output and will force a time delay off of 6 seconds each time the unit transfers to battery. After the delay, the relay will go back to a normally on state. This function is used with certain lighting controls that require a break in power for several seconds between normal power and battery power to detect that the inverter is in emergency mode.

SECTION 5

Switched Outputs

There are multiple ways to accomplish a switched output function with the Series LV Emergency lighting inverter. The following section will outline three of the most common solutions.

Switched output without the I/O Board option:

Without an I/O Board option, the normally off feature of the unit can be used for the switched output function.

To wire this switched output solution:

Connect the neutral wires to either of the two **NEU** connections.

Connect the load to the **N.OFF** connection.

Connect the switched line to the **SWITCHED** connection.

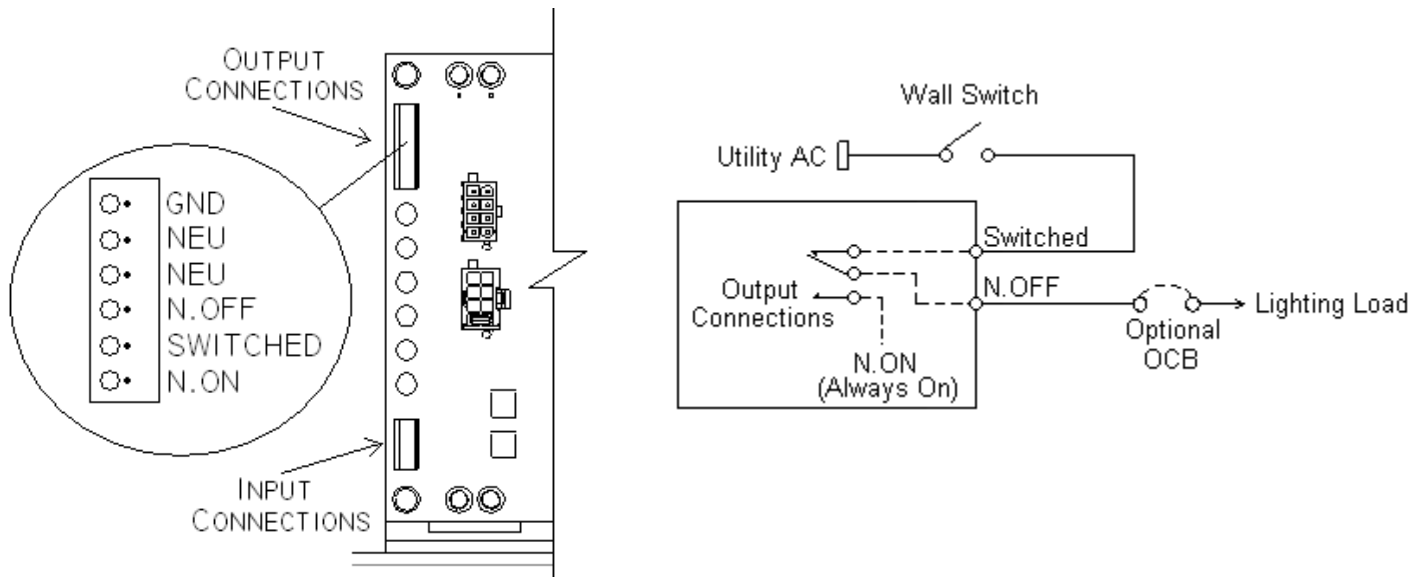


Figure 5.1 - Series LV Output Connections

Special considerations:

This switched output solution requires that the switched line mentioned is the same phase as the input to the LV Series unit. This solution can not be accomplished with voltages of different phases or magnitudes without damaging the LV system.

If the LV system has a display, this switched output solution can have an optional extended timer that is controlled by the normally off timer in the set points menu of the display. This time extension will keep the switched output powered for a specified amount of time after the unit returns from battery, shed the normally off load after a specified amount of time on emergency, or set the normally off relay dependent on the time of day.

A dimmer switch can be used in place of the switch to dim the output until the unit goes into emergency backup. While in backup, the lighting will be full brightness.

Non-isolated switched output with the I/O Board option:

This solution uses an I/O Board option to wire one of the I/O Board outputs almost the same way as using the normally off relay.

To wire this switched output solution with only one output of the I/O Board:

Connect the load for the switched output to the **C** connection of the I/O Board Output.

Connect the switched line to the **NC** connection of the I/O Board Output.

Connect the emergency backup line to the **NO** connection of the I/O Board Output.

After wiring is completed, the output needs to be set to **On Battery** in the I/O settings menu in the display. This causes the output contact to switch whenever the unit goes into emergency backup for any reason, causing the power to bypass the wall switch.

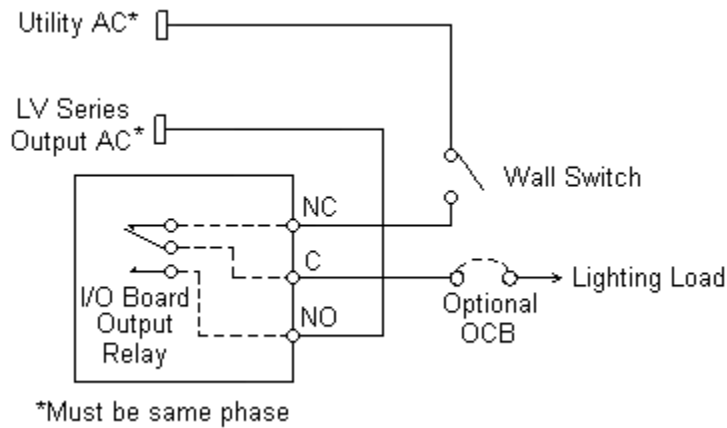


Figure 5.2

Special considerations:

This switched output solution requires that the switched line mentioned is the same phase as the input to the LV Series unit. This solution can not be accomplished with voltages of different phases or magnitudes without damaging the LV system.

A resistive dimmer switch can be used in place of the switch to dim the output until the unit goes into emergency backup. While in backup, the lighting will be full brightness.

If the utility AC used to power the wall switch loses power, and the utility source for the LV Emergency Lighting Inverter does not lose power, there may be a loss of power for a lighting load that uses this switched output solution.

Isolated switched output with the I/O Board option:

This solution uses an I/O Board option to wire one of the I/O Board outputs with an isolated input to detect the wall switch.

To wire this switched output solution with only one output of the I/O Board:

Connect the load for the switched output to the **C** connection.

Connect the **emergency backup line** to the **NO** connection.

Connect the switched utility line to an input of the I/O Board.

Connect the switched utility neutral to the same input of the I/O Board.

After wiring is completed, the input needs to be set to **Switched Input** in the I/O settings menu in the display. This causes the output contact to switch whenever there is a 90-277Vac voltage across the input connection of the I/O Board, or the LV Series unit goes into emergency backup.

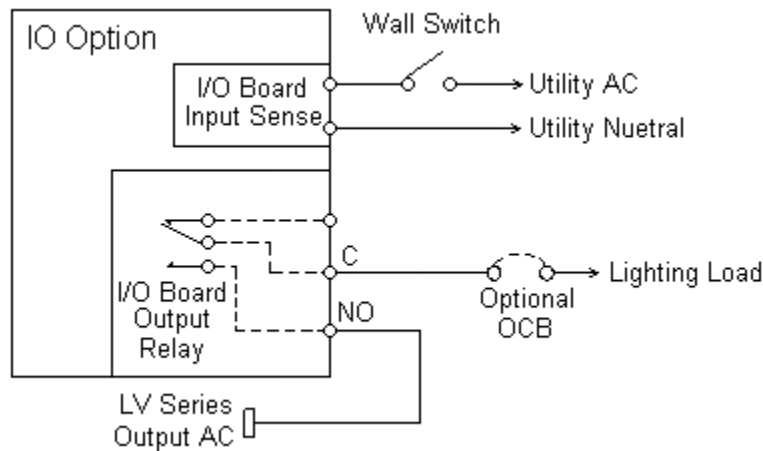


Figure 5.3

Special considerations:

This switched output solution is completely isolated. Any 90-277Vac signal, regardless of phase, can be used to toggle the switched output without damaging the LV Series unit.

A resistive dimmer can not be used to replace the wall switch with this solution. The input detects either an on or off situation and a resistive dimmer may cause the output contact to pulsate rather than dim.

When selecting **Switched Input** for the input I/O setting, the output function of the corresponding output I/O is tied directly to the corresponding input. This output will be locked, and it will be impossible to change this output function without first changing the input setting to something other than **Switched Input**. For example, setting input 1 of the I/O board to **Switched Input** locks output 1.

SECTION 6

LED Dimmer Application with Switch

Certain LED ballasts offer a dimmer feature that is controlled with a 0-10dc voltage. The following section outlines an effective solution for returning the LED lighting load to full brightness without having to purchase an external emergency power dimmer control.

To wire a dimmed ballast so that it is full brightness when on emergency backup:

Connect the load for the switched output to the **C** connection of **OUT1**.

Connect the **emergency backup line** to the **NO** connection of **OUT1**.

Connect the switched utility to the **NC** connection of **OUT1**.

Connect the ballast dimming signal in series with **NC** and **C** of **OUT2**.

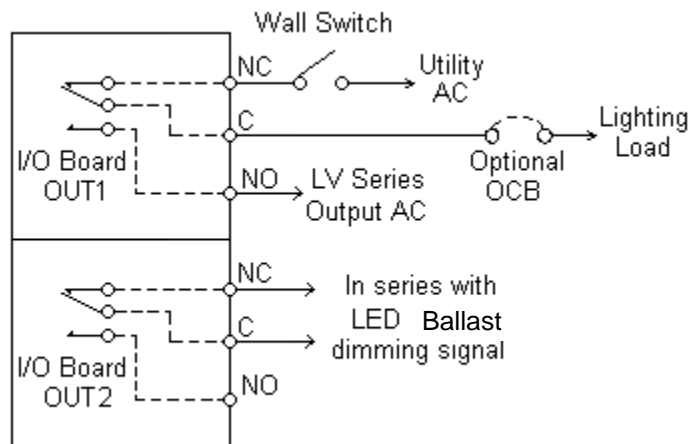


Figure 6.1

After wiring is completed, both **OUT1** and **OUT2** need to be set to **On Battery** in the I/O settings menu in the display. This causes the output contacts to switch whenever the LV Series unit goes into emergency backup. During an emergency, **OUT1** switches the load source from utility AC to the output of the LV Series unit and **OUT2** opens the dimmer signal, causing the ballast control to switch to full brightness.

Special considerations:

Some LED ballasts may not default to full brightness when the dimmer signal is broken. Refer to the LED ballast manual for further details of its functionality.

A second DC voltage can be applied to the NO contact of **OUT2** if full brightness of the LED ballast is not required. During an emergency, **OUT2** will switch to this signal voltage, dimming the ballast accordingly.

0-10 LED Dimmer Application (Full Brightness)

Certain LED ballasts offer a dimmer feature that is controlled with a 0-10dc voltage. The following section outlines an effective solution for returning the LED lighting load to full brightness without having to purchase an external emergency power dimmer control.

To wire a dimmed ballast so that it is full brightness when on emergency backup:
Connect the ballast dimming signal in series with **NC** and **C** of **OUT1**.

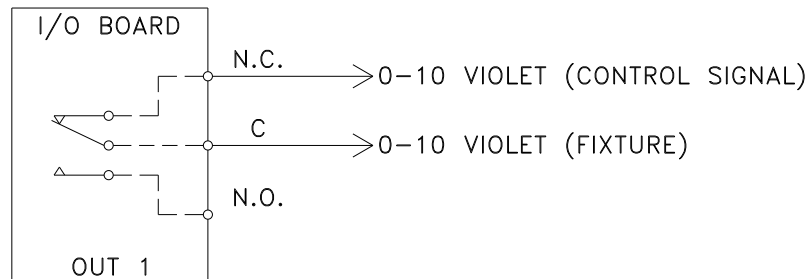


Figure 6.2

After wiring is completed, set **OUT1** to **On Battery** in the I/O settings menu in the display. This causes the output contacts to switch whenever the LV Series unit goes into emergency backup. During an emergency, **OUT1** opens the dimmer signal, causing the ballast control to switch to full brightness.

Special considerations:

Some LED ballasts may not default to full brightness when the dimmer signal is broken. Refer to the LED ballast manual for further details of its functionality.

A second DC voltage can be applied to the NO contact of **OUT1** if full brightness of the LED ballast is not required. During an emergency, **OUT1** will switch to this signal voltage, dimming the ballast accordingly.

0-10 LED Dimmer Application (Minimum Brightness)

Certain LED ballasts offer a dimmer feature that is controlled with a 0-10dc voltage. The following section outlines an effective solution for returning the LED lighting load to minimum brightness without having to purchase an external emergency power dimmer control.

To wire a dimmed ballast so that it is minimum brightness when on emergency backup:

Connect the ballast dimming signal in parallel with **NO** and **C** of **OUT1**.

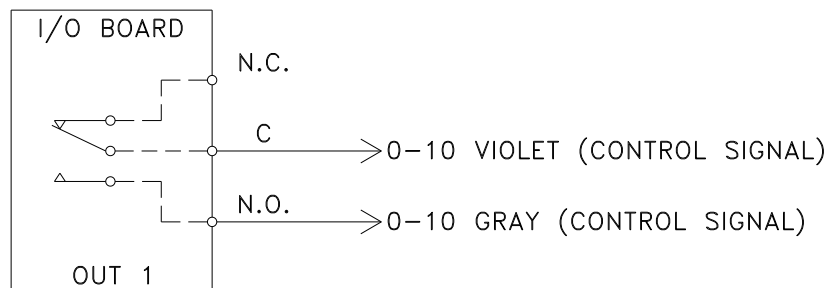


Figure 6.3

After wiring is completed, set **OUT1** to **On Battery** in the I/O settings menu in the display. This causes the output contacts to switch whenever the LV Series unit goes into emergency backup. During an emergency, **OUT1** shorts the dimmer signal, causing the ballast control to switch to minimum brightness.

Special considerations:

Some LED ballasts may not default to minimum brightness when the dimmer signal is shorted. Refer to the LED ballast manual for further details of its functionality.

SECTION 7

Combination of output contacts

If multiple outputs of the I/O Board are used, a combination of logic can be accomplished. The outputs can be connected in parallel, series, or a combination of both.

Application example #1:

Want to have a light turn on when the utility fails and when the battery temperature is too high?

Solution example #1:

Wire the light to the normally open (NO) of an output set to **Input Voltage** in series with the normally closed (NO) of an output set to **Battery Temperature**. The light will only be powered if both outputs are active.

Applications example #2:

Want to have a light turn on when the batteries are charging, and also turn on if a light switch is toggled?

Solution example #2:

Wire the normally open (NO) of an output set to **Charging** in parallel with the normally open (NO) of an output set to **Input Active**. The light will be powered as long as either output is active.

In parallel:

The following picture illustrates how to wire any number of outputs in parallel. If wired as shown in the picture, the load will receive power as long as any output is in the powered state. If one of the outputs is wired to the **NC** position, instead of the **NO** position, the load will receive power as long as that output is not powered.

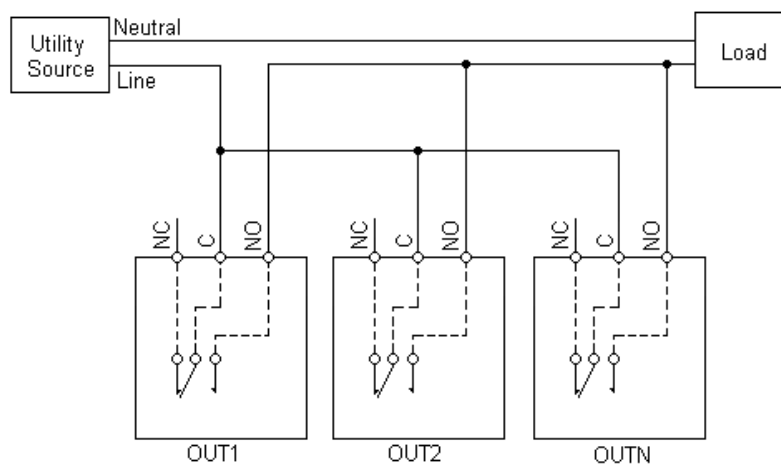


Figure 7.1 - Wiring the I/O Board outputs in parallel

In series:

The following picture illustrates how to wire any number of outputs in series. If wired as shown in the picture, the load will receive utility voltage only if every output is powered. If one of the outputs is wired to the **NC** position, instead of the **NO** position, the load will receive power as long as all of the outputs are powered except that specific output.

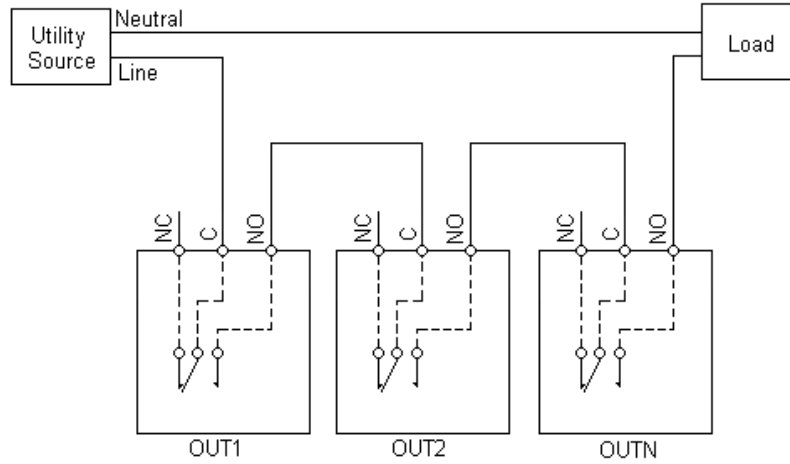


Figure 7.2 - Wiring the I/O Board outputs in series (OR function)

Mixed series and parallel:

The following picture illustrates how to wire the outputs of the IO board in a combination of series and parallel. In this illustration, the load receives utility voltage when Out1 is powered or when Out2 and Outn are powered at the same time.

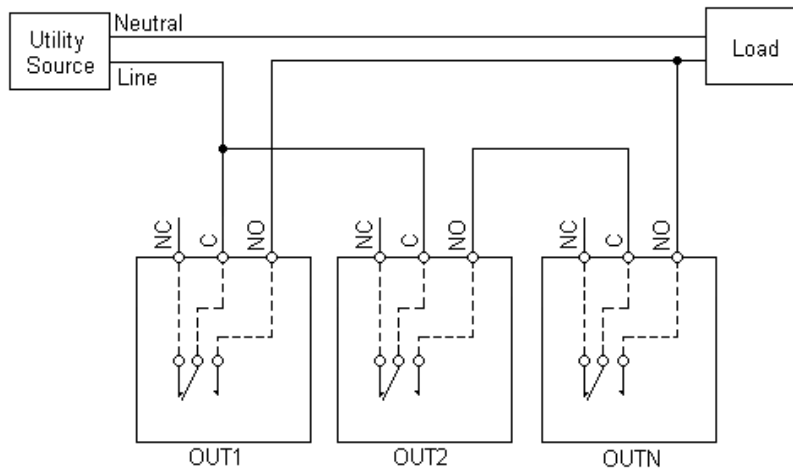


Figure 7.3 - Wiring the I/O Board outputs with a mix of parallel and series (AND function)

SECTION 8

Zone Monitor

Figure 8 illustrates a zone monitor application where a separate zone and/or fire alarm panel can force the Emergency Lighting Inverter into an emergency state even if its AC power is within acceptable limits. The AC input that is feeding the room lighting is connected directly to the Isolated I/O Board Input Sense or in the case of a fire alarm panel connected through a normally closed dry contact from the fire alarm panel as shown.

Note: The fire alarm contact must be rated for the input voltage and be able to switch 100 mA. The voltage range for the I/O Board Input Sense is 100-300 VAC or VDC.

The lighting load is connected to the optional output circuit breaker, if supplied, or the common terminal of the I/O Board Output Relay.

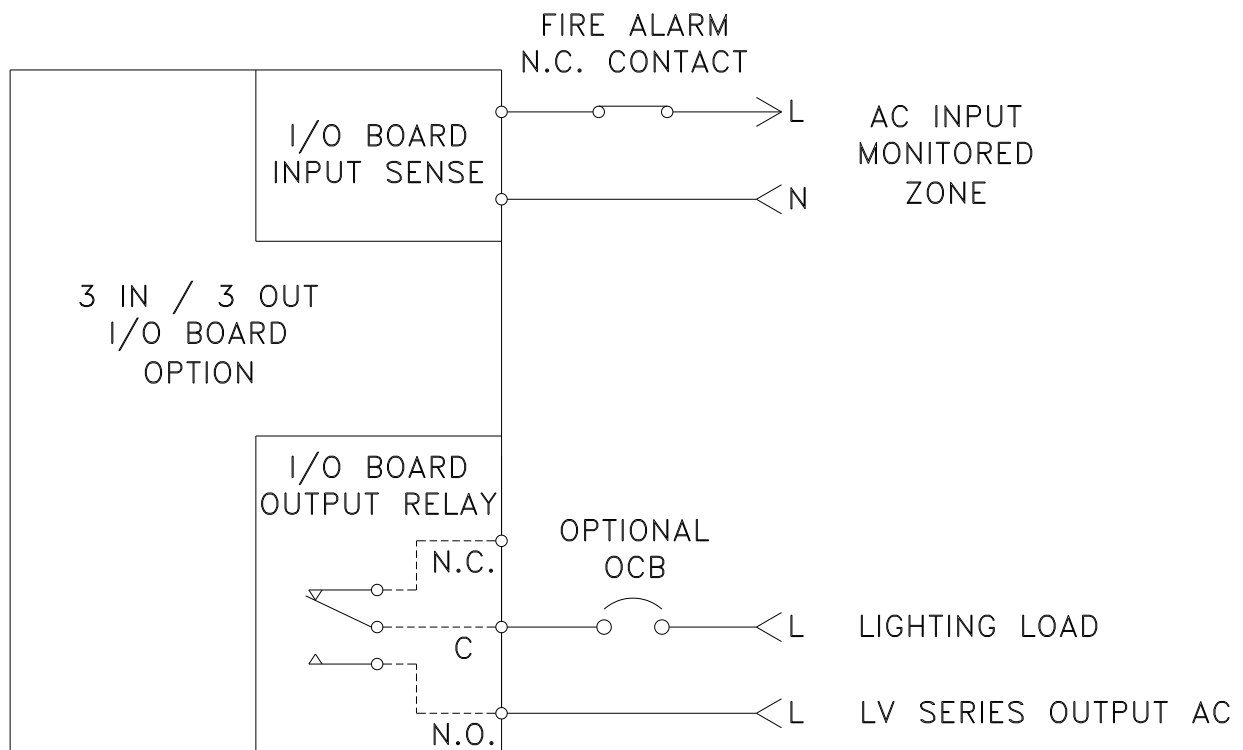


FIGURE 8

Notes: