

Mandala Lightserve MWJB190B Hazardous Area Lighting Controller Operating Manual



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Table of Contents

Overview, Benefits	Page 2
Warnings, Operation	Page 3
Installation	
Mounting, Retrofitting, Wiring Diagram	Page 4
Wiring Input Power, Relamp Alarm Lamp	Page 5
Wiring Bypass Pushbutton, Thermostat	Page 6
Wiring Short Time On Pushbutton	Page 6
Wiring Additional Delayed Contactors	Pages 6-7
Setup Using Display	Pages 8-9
Selection of Solstice Data	Page 9
Battery Replacement	Page 10
Troubleshooting	Page 11
Specifications	Page 12
Wiring Diagram, large version	Page 13

Overview

The Mandala Lightserve automates the control of lights in an industrial plant. It performs an astronomical calculation to determine sunrise and sunset times at the plant's location on every date. It turns the lights on before sunset and turns them off after sunrise. Even as the length of the day changes throughout the year, the lights are energized through the night and off through the day.

An operator can override the Lightserve by commanding it to turn on the lights at any time of the day. Normally, the lights will remain on until the next sunrise. The Lightserve will then return to automatic operation. Alternately, the operator can turn the lights on for only an hour or two before automatic operation resumes.

The Lightserve logs the total time that the lights have been turned on since installation. A Relamp Alarm can be configured to indicate to the operator when the total lamp time has exceeded the life expectancy of the lamps. This allows plant maintenance staff to replace all lamps at the same time. This group relamping strategy reduces maintenance costs, increases safety, and avoids chasing the failed lamp.

An optional sensor monitors the ambient temperature to ensure that the lamps will light correctly when energized. If the ambient temperature approaches the low temperature limit of the lamps, the Lightserve turns the lamps on to prevent starting problems.

The Lightserve is certified for operation in Class 1 Division 2 and Zone 2 hazardous locations.

Benefits

Reduced energy consumption: lights are on only when needed.

Longer lamp life: lights are off during daylight hours.

Reduced maintenance costs: all lamps can be replaced at end of life, without waiting for failures.

Improved safety: Longer lamp life and group relamping mean less risk of reduced light in the area.

Easy programming and setup: Display and human interface allow setup in hazardous locations without a laptop computer and without additional equipment.

Certified for use in Class 1 Div 2 Group ABCD T5 and Zone 2 IIC T5 Gc areas.

Warnings

WARNING - EXPLOSION HAZARD.

- BATTERIES MUST ONLY BE CHANGED IN AN AREA FREE OF IGNITABLE CONCENTRATIONS.
- DO NOT REMOVE OR REPLACE FUSE WHEN ENERGIZED.
- DO NOT CONNECT OR DISCONNECT CONNECTORS WHEN ENERGIZED.
- DO NOT CONNECT OR DISCONNECT A USB CABLE UNLESS THE AREA IS FREE OF IGNITABLE CONCENTRATIONS.
- A LAPTOP COMPUTER USED TO PROGRAM THE LIGHTSERVE CONTROLLER IS NOT RATED FOR USE IN HAZARDOUS AREAS. DO NOT ENERGIZE A LAPTOP COMPUTER OR CONNECT A USB CABLE FROM A LAPTOP COMPUTER TO A LIGHTSERVE CONTROLLER IN A HAZARDOUS AREA UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITABLE CONCENTRATIONS.
- THE LIGHTSERVE CONTROLLER IS TO BE MOUNTED WITHIN A WEATHERPROOF ENCLOSURE THAT PROVIDES CONDUIT AND/OR CABLE ENTRIES AND MECHANICAL PROTECTION.

Lightserve Operation

The Mandala Lightserve automatically turns the lights on before sunset, and off after sunrise. To turn the lights on during daylight hours, press the Bypass pushbutton. The lights will be turned on, and they will remain on until they are automatically turned off after the next sunrise.

To turn the lights on for a short time only, a One Hour Bypass pushbutton can be installed. During the day, the lights will remain on for one hour. If sunset occurs before the one hour timer expires, the lights will stay on until after the next sunrise.

Some light fixtures do not restart well in cold temperatures. A thermostat can be connected to the Lightserve to keep the lights on until the ambient temperature goes above the thermostat setpoint.



Two diagnostic lights on the Lightserve help the operator to determine that the unit is operating normally. The green “Heartbeat” light flashes when the Lightserve is operating correctly. The red “Relay” light follows the state of the Lightserve output relay. If the output relay is energized, the plant lights should be on, and the Relay light will also flash. If the output



relay is not energized, the plant lights should be off, and the Relay light will not flash.

A display and a human interface allow an operator to configure the Lightserve operation. Three pushbuttons allow the operator to scroll through the different setup screens, as well as edit various readings and setpoints.

When the human interface has not been used for several minutes, it enters Sleep mode. This reduces power consumption and extends the life of the display. In Sleep mode, the controller continues to operate normally, but the display intermittently flashes “Any button to wake”. When any pushbutton on the display is pressed, the Lightserve display wakes up to show the introduction page.

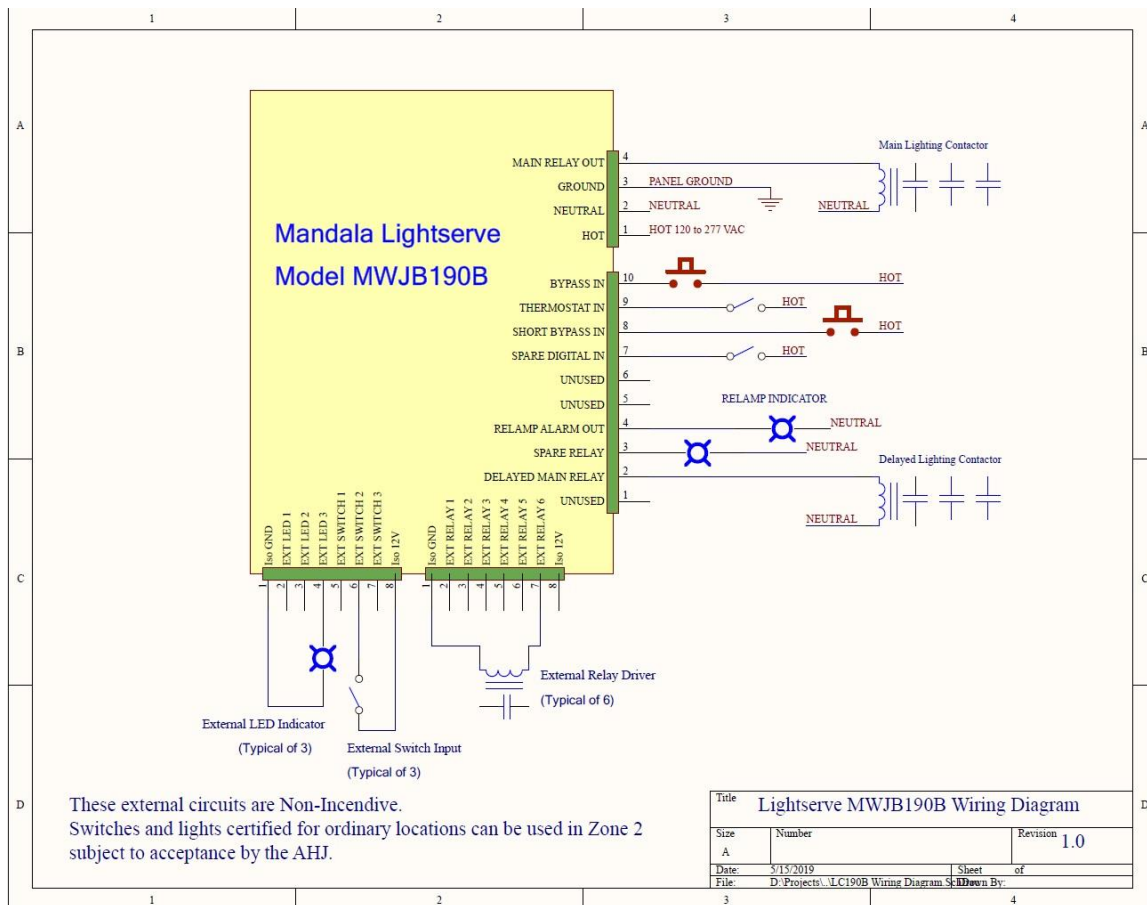
Lightserve Installation

Mounting: Mount the Mandala Lightserve controller inside a weatherproof enclosure that provides mechanical protection and conduit/cable entries. For proper cooling, the controller must be installed with its door toward the door of the weatherproof enclosure, with the hinge on the left. Do not install any other equipment within 7 cm of the top or bottom of the controller. This will allow proper air flow through it.

Mounting hole pattern for normal installation is 4.75” wide by 6.87” high (121 cm x 175 cm). The mounting tabs on the enclosure can be rotated 90 degrees to accommodate different panel layouts while keeping the controller in the proper orientation.

Retrofitting: If the Model MWJB190B controller is to be installed as a retrofit for an older-generation Model MWJB190A, a mounting adapter kit, part number LC190AB-ADAPT, is recommended. The adapter allows the new Lightserve controller to be installed in the original holes used by the old controller, without the need to drill new holes in the back pan. Terminal blocks used on the older MWJB190A are fully compatible with those on the new model. There is no need to rewire the terminal blocks unless it is desired to use the additional features of the new model.

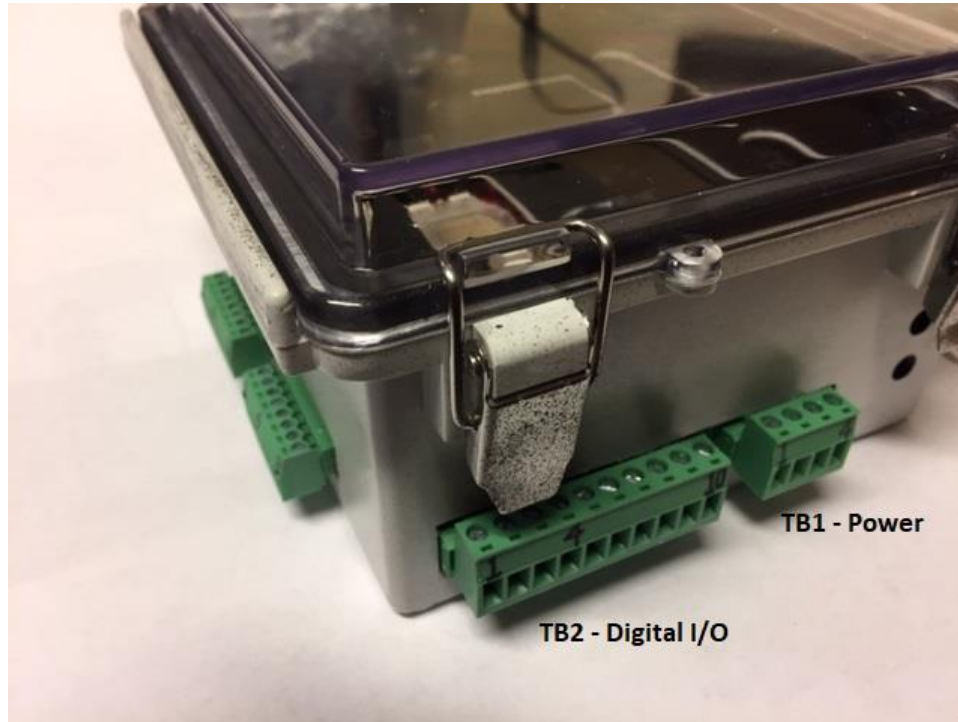
Wiring:



Mandala Lightserve MWJB190B Wiring Diagram. For a larger version, see the back page of this manual.

Lightserve Installation (continued)

Wiring:



Input Power and Main Relay: For proper operation of the Lightserve controller, make the following connections to the Power Supply connector TB1:

- Terminal 1: 120 to 277 VAC +/- 10% (referred to as “Power Supply Voltage” below)
- Terminal 2: Neutral
- Terminal 3: Ground
- Terminal 4: Main relay output. This terminal will be at the Power Supply Voltage when the contactor is to be energized and at 0 VAC when the contactor is not energized. Connect this terminal to one side of the lighting contactor coil. Connect the other side of the lighting contactor coil to Neutral.

A **Relamp Alarm** lamp can be connected to illuminate when the lights have been On for more than their rated lifetime. To connect the Relamp Alarm, make the following connections to the Digital Input/Output connector TB2:

- Terminal 4: Relamp relay output. This terminal will be at the Power Supply Voltage when the lamp hours have exceeded the relamp setpoint and at 0 VAC when the lamp hours are less than the relamp setpoint. Connect this terminal to the Hot side of a 120 VAC alarm lamp. Connect the other side of the Relamp Alarm lamp to Neutral.

The **Bypass Pushbutton** input allows an operator to bypass automatic operation of the Lightserve controller for the remainder of the day. When the Bypass pushbutton is pressed, the lights will turn On. They will remain on until just after sunrise of the following day. Automatic operation will then resume. This configuration allows the operator to force the lights On, without the risk that the system might remain under manual control over the long term. To connect the Bypass pushbutton switch, make the following connection to the Digital Input/Output connector TB2:

TB2, Terminal 10: Connect to one side of the pushbutton.
Connect the other side of the pushbutton to the Power Supply Voltage.

The **Thermostat input** is useful if the lighting panel is indoors, while the lamps are installed outdoors and will not start reliably at low temperatures. This is often the case with high pressure sodium lamps. It is not normally a problem with LED lamps. The Lightserve controller has an internal temperature sensor, so the Thermostat input is not used if the lighting panel is installed outdoors. If the controller is installed in a heated indoor location while the lights are outdoors, a thermostat should be installed outdoors to measure ambient temperature. The Low Temperature setpoint is configured via the display. If either the ambient temperature of the controller is below the Low Temperature setpoint or the thermostat closes, the lights will remain On even during daylight hours. To connect the Thermostat, make the following connection to the Digital Input/Output connector TB2. If the Thermostat feature is not used, the input terminal should be left open.

TB2, Terminal 9: Connect to one side of the thermostat.
Connect the other side of the thermostat to the Power Supply Voltage.

Short Time ON Input: In some installations it is preferable to turn the lights on for only a short period, not until the next sunrise. A pushbutton switch can be configured to turn the lights on for only one hour. After the hour has expired, automatic operation will resume. To connect a One Hour Bypass pushbutton, make the following connection to the Digital Input/Output connector TB2. If the One Hour Bypass feature will not be used, the input terminal should be left open.

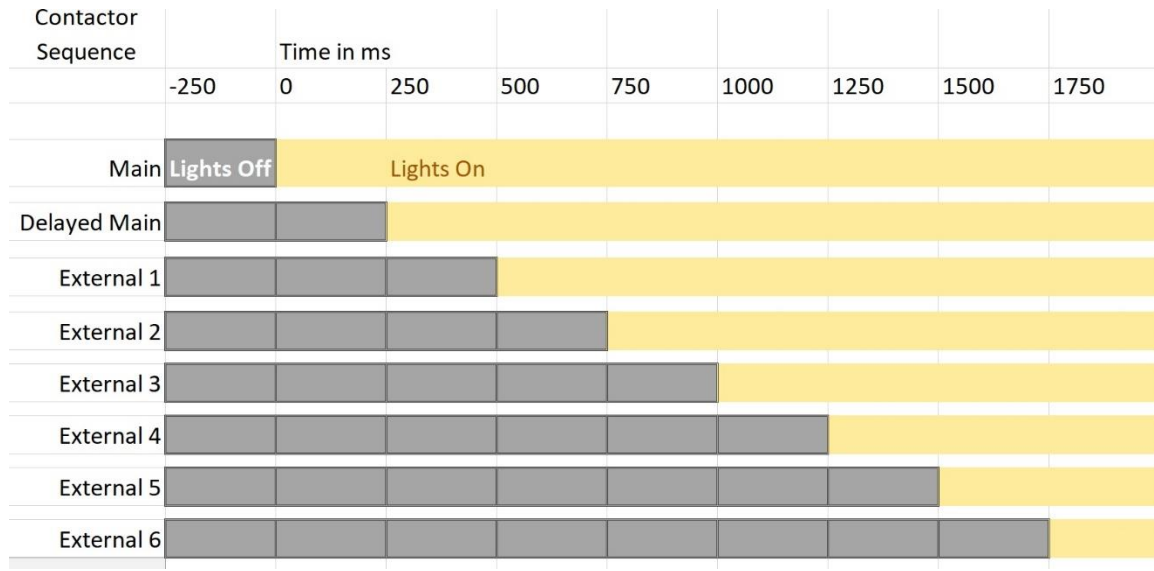
TB2, Terminal 8: Connect to the One Hour Bypass pushbutton.
Connect the other side of the pushbutton to the Power Supply Voltage.

Delayed Main Relay Output: To reduce inrush current on the lighting transformer, it may be desirable to delay the turn-on of some lighting circuits. A second lighting contactor can be connected to Digital Input/Output connector TB2. This lighting contactor will be energized 250 ms after the Main contactor.

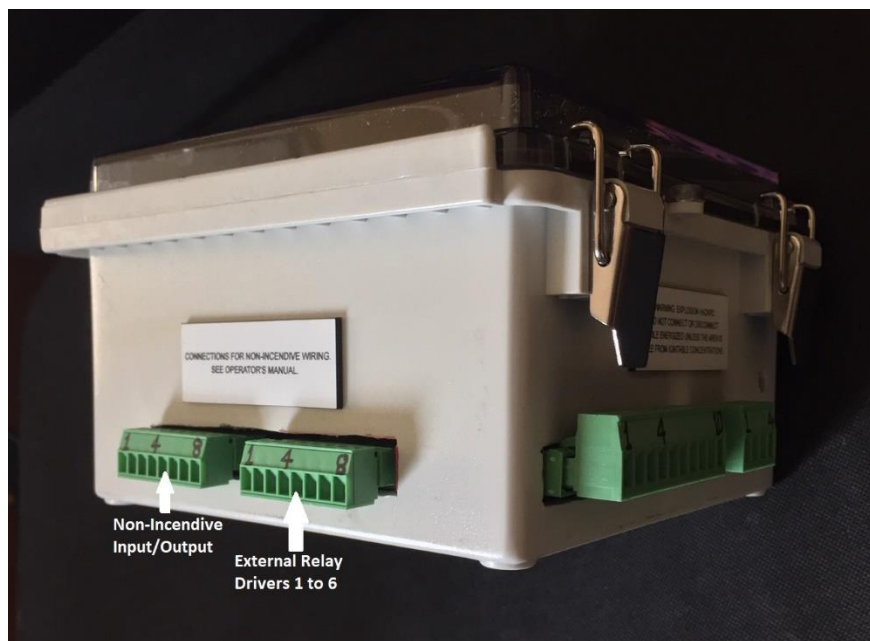
TB2, Terminal 2: Delayed Main relay output. This terminal will be at the Power Supply Voltage 250 ms after the main contactor is energized and at 0 VAC when the contactor is not energized.
Connect this terminal to one side of the lighting contactor coil.
Connect the other side of the lighting contactor coil to Neutral.

External Relay Drivers (6): These outputs function in the same way as the Delayed Main Relay output. However, these 6 outputs require an interposing relay in order to control a lighting contactor. Each output can drive an external relay at 12 VDC and 25 mA continuous. The drive current is internally limited, and the outputs are non-incendive. For operation in a hazardous area, each of these outputs can be connected to a solid-state relay that in turn controls a hazardous-area lighting contactor. External Relay Driver #1 is

energized 250 ms after the Delayed Main Relay output (or 500 ms after the Main Relay Output), External Relay Driver #2 is energized 250 ms after #1, and so on until #6 is energized.



If the Main Relay Output, Delayed Main Relay Output, and the 6 external relay drivers are all connected to separate lighting contactors, the lighting load can be energized in 8 stages over 2 seconds. This gradual turn-on greatly reduces inrush current on the lighting transformer.

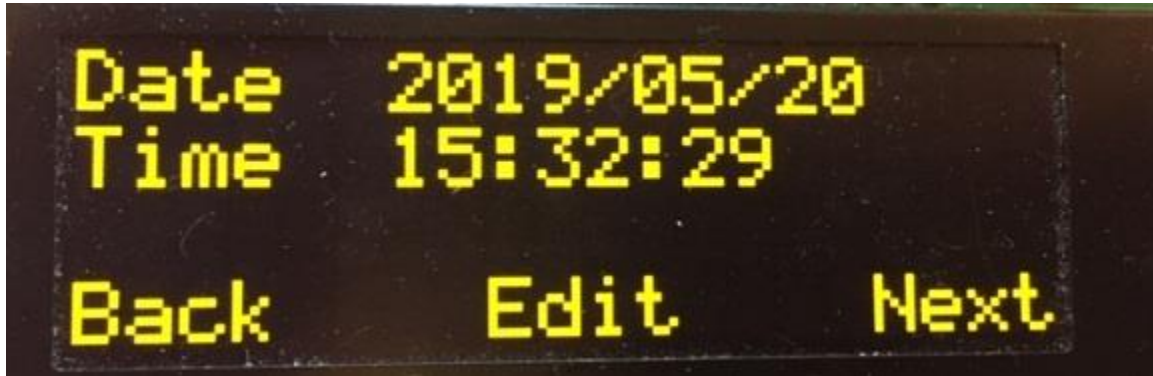


Connect external relay coils 1 to 6 to Terminals 2 to 7 of the External Relay Driver terminal block. Connect the other side of each relay coil to Terminal 1, Isolated Ground. Refer to the wiring diagram for details.

The two terminal blocks for non-incandive I/O are keyed. This prevents plugging a terminal block into the wrong socket.

Lightserve Setup Using the Display

The easiest way to set up the operating parameters of the Lightserve is via the built-in display and human interface. To navigate from a display page to the next one, press the pushbutton labeled “NEXT”. To move to the previous page, press the pushbutton labeled “BACK”. To change the values on the page, press “EDIT”.



The display will proceed forward and backward through the following pages as the Back and Next buttons are pressed:

Introduction Page. Make, model, and version

Technical Support contact information

Date and Time (can be edited)

Lights On X minutes before Sunset (can be edited)

Lights Off X minutes after Sunrise (can be edited)

Ambient Temperature measured at the controller (can be edited)

Low Temperature Setpoint (can be edited). Lights will remain On if ambient is colder than this setpoint.

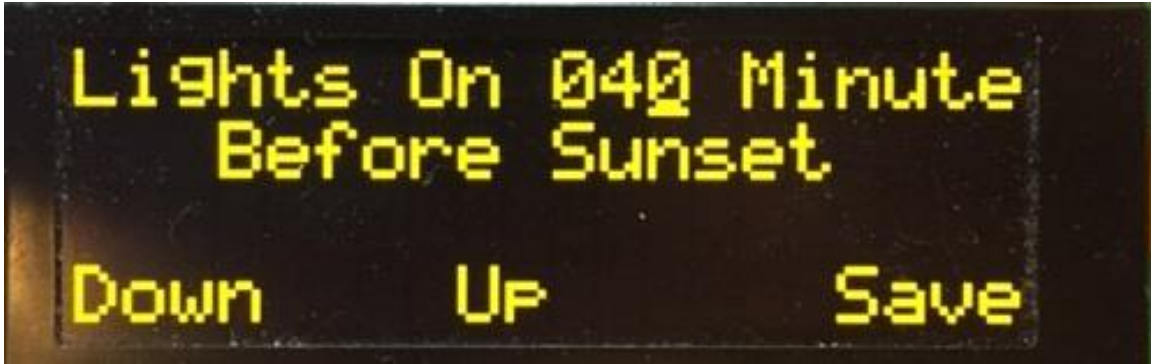
Relamp Alarm Hours (can be edited). Normally set to the life expectancy of the lamps in hours.

Location setpoint (can be edited). Set to the geographical location nearest to where the panel is installed.

Bypass Pushbutton Counter (can be reset to zero only). A high count indicates that an area may be dark during the day, causing the operator to bypass automatic operation frequently.



For example, the photo above shows the Sunset Offset page. To edit this setpoint, press the center button. The screen changes to the following:



To increase the setpoint value, press Up. To decrease the setpoint value, press Down. When the setpoint reaches the desired value, press Save. Then resume navigating between pages using the Next and Back buttons.

Not all pages can be edited. If the Edit selection is not offered, the page is read-only.

Selection of Solstice Data

It will not normally be necessary to manually enter solstice data into the Lightserve controller. It will only be required if the controller is installed in a location not anticipated by Mandala Controls. We suggest that if the controller does not offer a location near the site of the installation, contact Mandala Controls at www.mandalacontrols.com and we will provide the solstice data required for your site.

If you prefer to find the solstice data for the install location yourself, please follow these steps.

The first step in determining the solstice data is to determine the latitude and longitude of the location. If this information is not known, it can be determined as follows.

For locations in Canada, go to the website <http://www4.rncan.gc.ca/search-place-names/search?lang=en> and follow the instructions there to determine the latitude and longitude of the town nearest the plant location. Then go to the website http://aa.usno.navy.mil/data/docs/RS_OneDay.html, select Form B (Locations Worldwide) and enter the latitude and longitude to determine sunrise and sunset data for the location.

For locations in the United States, go to the website http://aa.usno.navy.mil/data/docs/RS_OneDay.html, select Form A (U.S. Cities and Towns) and enter the name of the nearest town to determine sunrise and sunset data for the location.

Get the sunrise and sunset data for June 21, 2000 (summer solstice) and December 21, 2000 (winter solstice). Be sure to note whether the summer solstice data are given in Daylight Saving Time or Standard Time.

Battery Replacement

The backup battery allows the Lightserve controller to maintain its timekeeping functions even if the main AC power fails. The battery also allows all setpoints to be retained during a power failure.

The life expectancy of the backup battery is 5 years. Before the end of the expected life, the battery should be changed using the following procedure.

WARNING - EXPLOSION HAZARD- BATTERIES MUST ONLY BE CHANGED IN AN AREA FREE OF IGNITABLE CONCENTRATIONS.



Step 1: Remove screw and battery cover.

Step 2: Pry out battery holder with a screwdriver.

Step 3: Pop the battery out of the holder.

Step 4: Insert a new CR2032 battery in holder. The positive side of the battery should be away from the controller.

Step 5: Snap the battery and holder back into the circuit board.

Step 6: Replace the battery cover and screw removed in Step 1.

Step 7: Power up the controller. Scroll to the Time and Date screen. Set today's time and date, adjusted for Daylight Saving Time.

Step 8: Schedule the next battery replacement in 5 years or less.

Troubleshooting Guide

Symptom

Solution

Heartbeat light not flashing.

Before troubleshooting, confirm that the area is free from ignitable concentrations.
Check power supply fuse.
Turn power to Lightserve off, then on.
Replace backup battery.
Confirm voltage between TB1 terminals 1 and 2 is > 110V.
Contact Technical Support for further troubleshooting advice.

Main relay does not properly switch a latching contactor.

Use of a latching contactor is not supported. Minimum hold current for the main relay is 100 mA. Replace the contactor with an electrically-held contactor.

Lights remain on after dawn.

Use the display to check the time on the Lightserve controller. Ensure that the “Lights Offset After Sunrise” setpoint is set correctly. The lights will remain on for the selected number of minutes after dawn.

Check the Thermostat by reading the voltage at Terminal 9 on TB2. If this terminal reads 120 VAC, the thermostat is preventing the lights from turning off. This is correct operation.

If the bypass switch has been pressed, the lights will remain on until the following morning. If it is important to turn the lights off before then, cycle power to the Lightserve controller.

Check the battery voltage. Open the cover on the Lightserve controller. Use a voltmeter to read the voltage on the backup battery. The voltage should read between 2.8 VDC and 3.4 VDC.

Contact Technical Support at www.MandalaControls.com for further troubleshooting advice.

Specifications – Mandala Lightserve MWJB190B

Main Relay and Delayed Main Relay

Maximum Switching Voltage 277 VAC

Maximum Current 4 Amps continuous, 7.5 Amps for 1 minute, 20 Amps for 50 ms

Minimum holding current 100 mA

Zero-voltage switching

Fuse: 8 A Slow Blow

Delayed Main Relay energized 250 ms after Main Relay

Alarm Relay #1 (Relamp) and Alarm Relay #2 (Spare)

Maximum 200 mA continuous at 277 VAC

Maximum 500 mA Inrush for 50 ms

Zero-voltage switching

Fuse: 250 mA Slow Blow

Power Supply

277 VAC +/- 10% continuous, 60 Hz,

1 Phase. Input Current 190 mA at 277 VAC;

250 mA at 120 VAC.

Rides through 6 electrical cycles of power loss without dropping out relays.

Fuse: 1 Amp Slow Blow

Hazardous Area Classification:

Certified as a component suitable for use in Class 1 Division 2 Group ABCD T5 when installed within an enclosure providing mechanical protection and conduit/cable entries. Can be installed in Zone 2 IIC T5 Gc hazardous locations.

Ambient Temperature -40 to +40 Degrees C

Mounting orientation: enclosure door vertical, with hinge on the left.

Wire size for external connections on Power Terminal Block and I/O Terminal Block: 22 AWG to 12 AWG

Non-Incendive Outputs for External LED Indicators: 12 VDC supplied internally, 20 mA each, 3 outputs provided. Wire size 24-16 AWG.

Non-Incendive Inputs for External Switches: 12 VDC supplied internally, 10 mA each, 3 inputs provided. Wire size 24-16 AWG.

Non-Incendive Outputs for External Relay Coils: 12 VDC supplied internally, 25 mA each, 6 outputs provided. Energized at 250 ms intervals after Delayed Main Relay. Wire size 24-16 AWG.

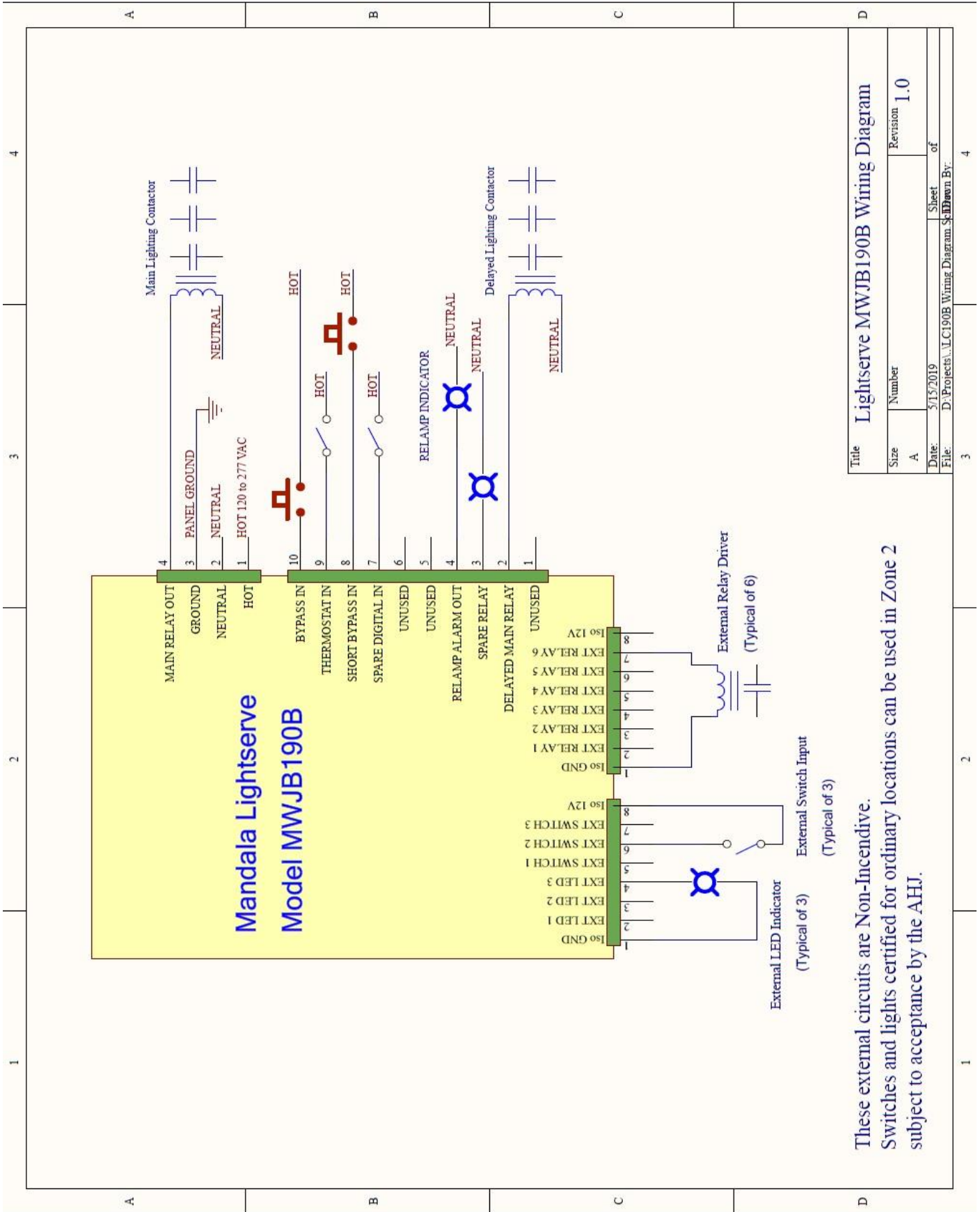
Backup battery: Type CR2032 Primary Lithium, 3 VDC. Life expectancy 5 years.

Real Time Clock: Accurate within 0.5 seconds per day from -40 to +40 Degrees C.

Dimensions: Controller body: 6.5" wide by 6.25" high. Mounting holes 4.75" wide by 6.87" high.



Mandala Lightserve MWJB190B Installation Schematic



These external circuits are Non-Incendive. Switches and lights certified for ordinary locations can be used in Zone 2 subject to acceptance by the AHJ.

Title		Lightserve MWJB190B Wiring Diagram	
Size	Number	Revision	1.0
A			
Date:	5/15/2019	Sheet	of
File:	D:\Projects\ALC190B Wiring Diagram	Sketch	By: