



Mandala Lightserve

Model MWJB190A

Operating Manual

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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 the particular date. It turns the lights on before sunset, and turns them off after sunrise.

An operator can override the Lightserve by commanding it to turn on the lights at any time of the day. The lights will remain on until the next sunrise; the Lightserve will then return to automatic operation.

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 a setpoint. This allows plant maintenance staff to replace all lamps at the same time, reducing maintenance costs.

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 rated for operation in Class 1 Division 2/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.

WARNINGS

WHEN OPERATING IN A HAZARDOUS AREA, DO NOT MAKE OR BREAK ANY CONNECTIONS WHILE THE LIGHTSERVE CONTROLLER IS ENERGIZED UNLESS THE AREA IS KNOWN TO BE FREE OF EXPLOSIVE GAS.

THE HANDHELD PROGRAMMER FOR THE LIGHTSERVE CONTROLLER IS NOT RATED FOR USE IN HAZARDOUS AREAS. DO NOT ENERGIZE THE HANDHELD PROGRAMMER IN A HAZARDOUS AREA UNLESS THE AREA IS KNOWN TO BE FREE OF EXPLOSIVE GAS.

THE LIGHTSERVE CONTROLLER IS TO BE MOUNTED WITHIN A WEATHERPROOF ENCLOSURE THAT PROVIDES CONDUIT AND/OR CABLE ENTRIES.

Lightserve Operation

The Mandala Lightserve automatically turns the lights on before sunset, and turns them 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.

Some light fixtures do not restart well in cold temperatures. A thermostat can be connected to the Lightserve to turn the lights on and keep them on until the ambient temperature goes above the thermostat setpoint. (Software version 1.12 or higher only.)

Two diagnostic lights on the Lightserve help the operator to determine that the unit is operating normally. The green “Heartbeat” light on top flashes when the Lightserve is operating correctly. If this Heartbeat signal stops, either with the light steadily on or steadily off, the controller has failed. Refer to the Troubleshooting section of this document if this occurs. The red “Relay” light on the bottom 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 be on. If the output relay is not energized, the plant lights should be off, and the Relay light will also be off.

Lightserve Installation

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

Terminal 1: 120 VAC +/- 10%
Terminal 2: Neutral
Terminal 3: Ground
Terminal 4: Main relay output. This terminal will be at 120 VAC 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.

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 120 VAC when the lamp hours have exceeded the relamp setpoint and at 0 VAC when the lamp hours are less than the relamp setpoint. Connect the other side of the Relamp Alarm lamp to Neutral.

To connect the Bypass pushbutton switch, make the following connection to the Digital Input/Output connector TB2:

Terminal 10: Connect to one side of the pushbutton.
Connect the other side of the pushbutton to 120 VAC.

To connect the Thermostat, make the following connection to the Digital Input/Output connector TB2. If the Thermostat feature will not be used, the input terminal can be left open.

Terminal 9: Connect to one side of the thermostat.
Connect the other side of the thermostat to 120 VAC.

Lightserve Setup and Handheld Programmer Operation

WARNING: The handheld programmer is NOT approved for use in hazardous locations. Before connecting, disconnecting, or using the handheld programmer in a hazardous area, ensure that no explosive gasses are present.

To set up the operating parameters of the Lightserve, connect the handheld programmer to the Lightserve. Plug the serial cable into the programmer. Plug the other end of the serial cable into the serial port on the Lightserve.

Start the Lightserve program on the handheld computer. Click on the “Start” icon in the top left corner of the screen, then choose “Lightserve” from the list. The Lightserve program displays the Main screen at startup. If a good connection has been established between the Lightserve controller and the programmer, the date and time, as retrieved from the Lightserve clock, will be displayed. If the connection is not good, the programmer will display the message “Unable to locate Lightserve on any comm port.” Most connection errors can be corrected by tightening the connections on the serial cables and by terminating, then restarting the program on the handheld programmer. Please refer to the Troubleshooting section of this document if these attempts are not successful.

Main Screen

All calculations in the Lightserve controller are based on the local time. It is very important that the internal clock of the Lightserve is set to the correct local time. Before setting the clock on the Lightserve, ensure that the time displayed on the handheld programmer is correct. To adjust the time on the programmer, double-click the pointer on the clock icon in the lower right corner of the screen. Set the clock to the correct date and time, and click on “Apply”. Once the programmer clock is correct, set the Lightserve clock by clicking on the box labeled “Sync Lightserve to this PC”. The correct time should appear on the Main screen within 5 seconds.

The Main screen also displays the number of hours that the lights have been turned on since installation. When the plant is relamped, this hour counter should be reset to zero by clicking on “Reset Hour Counter”.

The main screen also shows the setpoint for the Relamp Alarm. If the On hours exceed the value displayed in the “Alarm if Hours Exceed...” box, the Relamp Alarm relay will become energized. The manufacturer of the lamps should recommend the correct value to be entered into this box. It should correspond to the expected life of the lamps, in hours. If a question mark appears in the setpoint box when the program is first started, move to a different screen (for example, the Solstices screen), then return to the Main screen. The correct setpoint should now appear in the box.

Solstice Screen

The Lightserve is programmed for a particular geographical location by way of the Solstice screen.

Normally, the operator needs only to select the location from the list of preprogrammed locations. Click on the arrow beside the location selection to see the expanded list. If there is an entry on the list that is within approximately 30 km of the plant site, select that location, and click on Send.

If none of the preprogrammed locations is near the plant site, the solstice data will have to be manually entered. Contact Mandala Controls for the correct values to enter, or refer to the section of this document entitled “Selection of Solstice Data” for the procedure for determining the solstice values for the plant location.

Amps Screen

The Amps screen allows the operator to set an Underload setpoint for the Lightserve controller. If the total current on all three phases is less than the setpoint, the controller activates an alarm relay. This alarm indicates that an excessive number of lamps have burned out.

This feature is available only in plants where current transformers have been installed on the lighting bus. Not all Lightserve controllers support this feature. Please contact Mandala Controls for further details.

Comm Screen

The Communication screen will not normally be used by the operator. It indicates whether good communication has been established between the Lightserve controller and the handheld programmer. Normally, the Messages Sent and Messages received counts should increment at the same rate. If this is not the case, there is an error in the connection. Most connection errors can be corrected by tightening the connections on the serial cables or by terminating, then restarting the program on the handheld programmer. Please refer to the Troubleshooting section of this document if these attempts are not successful.

Lights Screen

The Lights screen allows the operator to set the time interval before sunset that the lights are turned on and the time interval after sunset that the lights are turned off. The default value for these setpoints is 40 minutes. If a new value is entered for either setpoint, click on the Send button to send the new value to the Lightserve controller.

Maintenance Screen

The Maintenance screen will not normally be used by the operator. It shows the software versions of the Lightserve controller and the Handheld Programmer. It also shows the total hours that the lights have been turned on. Even if the Hours on the Main screen are reset, the counter on the Maintenance screen continues to increment. If the hour counter on the main screen is reset in error, the value on the Maintenance screen can be used to recover from the error. The date that the counter was reset is also recorded on the Maintenance screen.

The Maintenance screen also shows the number of times that the bypass pushbutton switch has been activated. This count might indicate that the area is too dark, since the operator is often turning the lights on during daylight hours. The counter is reset when the hour counter on the main screen is reset. (Software version 1.12 or higher only.)

Modbus Communication

The Lightserve controller supports the Modbus Binary communication protocol. The Lightserve controller acts as a Modbus slave device. Communication parameters on the host computer should be set to 9600 baud; no parity, 8 data bits, and one stop bit. All registers are located in one contiguous block, as shown in the table below.

Register Name	Read Address	Write Address	Register Offset
LightsOnResettable_KHours,	30001	N/A	0
LightsOnResettable_Hours,	30002	N/A	1
ResetTotalHoursNow,	30003	40003	2
RunKHrsSetpt,	30004	40004	3
Amps_A,	30005	40005	4
Amps_B,	30006	40006	5
Amps_C,	30007	40007	6
AmpSumLoSetpt,	30008	40008	7
DateAndTime.SetClockNow,	30009	40009	8
DateAndTime.Year,	30010	40010	9
DateAndTime.Month,	30011	40011	10
DateAndTime.DayOfMonth,	30012	40012	11
DateAndTime.Hour,	30013	40013	12
DateAndTime.Minute,	30014	40014	13
DateAndTime.Second,	30015	40015	14
DateAndTime.DaylightSavNow,	30016	40016	15
SumSolSunriseHour,	30017	40017	16
SumSolSunriseMinute,	30018	40018	17
SumSolSunsetHour,	30019	40019	18
SumSolSunsetMinute,	30020	40020	19
SumSolDaylightSaving,	30021	40021	20
WinSolSunriseHour,	30022	40022	21
WinSolSunriseMinute,	30023	40023	22
WinSolSunsetHour,	30024	40024	23
WinSolSunsetMinute,	30025	40025	24
LightsOffsetBeforeSunset,	30026	40026	25
LightsOffsetAfterSunrise,	30027	40027	26
LightsOnTotal_ThousandHours,	30028	N/A	27
LightsOnTotal_Hours,	30029	N/A	28
LastResetDate_Year,	30030	N/A	29
LastResetDate_Month,	30031	N/A	30
LastResetDate_Day,	30032	N/A	31
SoftwareVersion	30033	N/A	32
BypassCount	30034	N/A	33
DegreesC	30035	N/A	34
DegreesC_Offset	30036	40036	35
DegreesC_LoSetpt	30037	40037	36

A host computer can read Modbus registers from the Lightserve by issuing Modbus command 04 (Read Input Registers). A maximum of nine registers can be read using a single command.

A host computer can write Modbus registers by issuing Modbus Command 16 (Set Multiple Registers). A maximum of nine registers can be written using a single command. Data written to addresses marked "N/A" in the table will be ignored, as these are Read Only registers.

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.

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://geonames.nrcan.gc.ca/search/search_e.php 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.

To enter the data on the Solstice screen on the handheld programmer, click on the Manual Entry box, then enter the solstice data determined above into the appropriate boxes. Click on the Daylight Saving box if the summer solstice data is given in Daylight Saving Time. After sunrise and sunset data have been entered for both the Summer and Winter Solstices, click on the Send button to update the Lightserve controller.

Troubleshooting Guide

Symptom

Solution

Heartbeat light not flashing.

Check power supply fuse.

Turn power to Lightserve off, then on.

NOTE: This condition normally indicates a catastrophic failure. It is recommended that the Lightserve be removed from service unless the cause of the failure is known.

No communication to handheld programmer.

Tighten all connections on the serial cable.

Terminate, then restart the Lightserve program on the handheld programmer.

Check the COMM screen on the Lightserve program on the handheld programmer. Ensure that the Messages Sent count is incrementing. Check whether the Messages Received count is incrementing at the same rate; if so, good communication has been established.

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 handheld programmer to check the time on the Lightserve controller. Ensure that the daylight savings flag is set correctly.

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.

Specifications

Main Relay

- Maximum 2 Amps continuous at 240 VAC
- Maximum 25 Amps Inrush for 16.6 ms
- Minimum holding current 100 mA
- Zero-voltage switching
- Fused on circuit board

Alarm Relay #1 (Ralamp)

- Maximum 1 Amp continuous at 240 VAC
- Maximum 4 Amps Inrush for 16.6 ms
- Minimum holding current 100 mA
- Fused on circuit board

Alarm Relay #2

- Maximum 300 mA continuous at 120 VAC
- Maximum 2 Amps Inrush for 16.6 ms
- Minimum holding current 25 mA
- Fused on circuit board

Power Supply

- 120 VAC +/- 10% continuous
- 100 mA maximum
- Rides through 15 electrical cycles of power loss without failure
- Fuse: 1/8 Amp Slow-Blow, 5x20 mm size

Hazardous Area Classification

- CSA Approved as a component suitable for use in:
 - Class 1 Division 2 Groups A,B,C,D
 - Class 1 Zone 2 Groups IIC (AEX n IIC)
- when installed within an enclosure providing mechanical protection and conduit/cable entries.

Temperature

- 40 to +70 Degrees C

Wire size for external connections:

- 22 AWG to 12 AWG

Modbus communications:

- RS-232 protocol, 9600 baud, No parity, 8 data bits, 1 stop bit
- Read registers via Modbus command 04, maximum of 9 registers per message
- Set registers via Modbus command 16, maximum of 9 registers per message
- Lightserve has DB-9 male connector