ENERGY SAVING LIGHTING CONTROLS

Intelligent Lighting Controls, Inc.

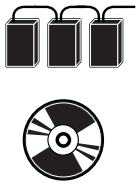
Works with LightMaster Pro Lighting Control Software and LightMaster Panels in Extended Network Applications

LIGHTMaster USER GUIDE

Includes setup, installation, programming, and application information for the ILC LightMaster lighting controller in ILC Extended Network applications

www.ilc-usa.com

Works with LightMaster Pro Lighting Control Software and LightMaster Panels in Extended Network Applications



LIGHTMaster

USER GUIDE

Version 1C-EN
1/1/05

Extended Network Version

Class A FCC Device Statement

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

INTELLIGENT LIGHTING CONTROLS, INC.

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Introduction

The LightMaster Extended Network System consists of a Extended Network Manager and LightMaster control panels (microprocessor-based programmable controllers with LightSync™ network cabability). The Extended Network Manager is programmed via a PC and LightMaster Pro ENET software, and links up to 128 individual LightMaster controllers and up to 254 LightSync devices. The local area network (LAN) functions as a facility-wide lightng control system. The LightMaster Extended Network Manager is UL and FCC approved for commercial applications.

Structure

The major components making up the Network Manager are:

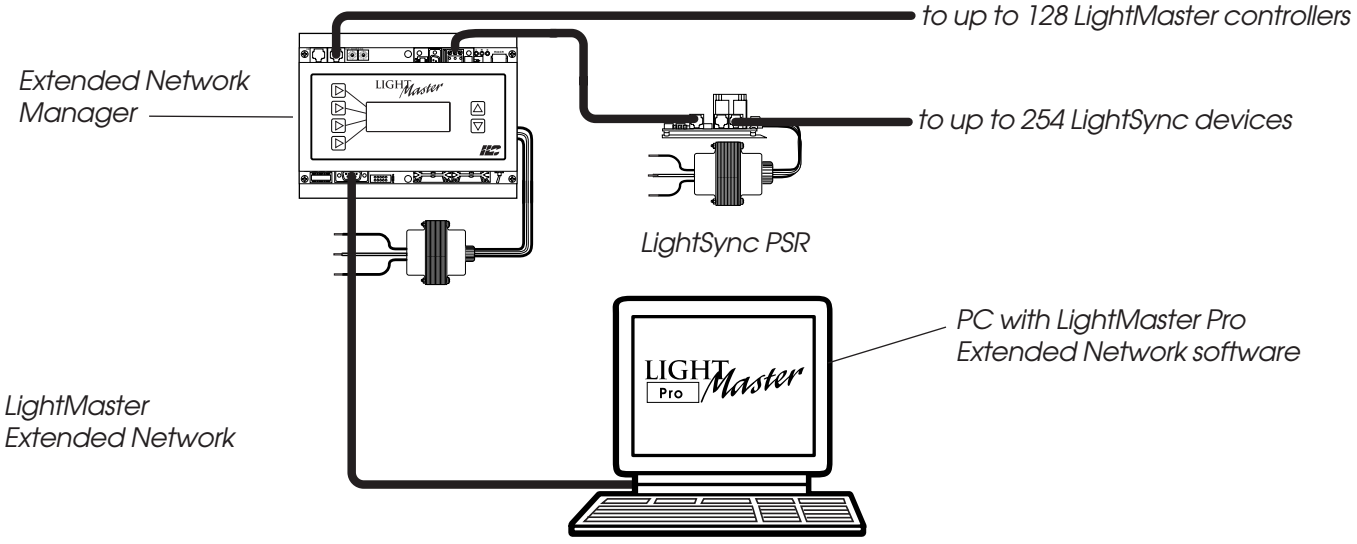
- enclosure
- control transformer
- CPU board
- keypad/display
- RJ45 connnectors for LightSync data line
- RS232 port for PC programming
- LightSync Scanner card

Enclosure – The enclosure is rated NEMA 1. It is divided into a line voltage section and a low voltage section. The line voltage section uses a voltage divider and contains the line voltage side of the control transformer. The low voltage section contains the LightMaster Extended Network Manager's CPU board and keypad display.

Transformer – A 40 VA multi-tap control transformer (120 or 277/24 VAC) provides the 24 VAC input to power the controller electronics,

CPU Board – The CPU board provides the controller's intelligence and memory. Major components include:

- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all controller electronics.
- *Communications* – RS-232 port, LightSync™ RJ-45 data line connectors, LightSync Scanner card.
- *Microprocessor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *PROM Chip* – contains the controller operating system and basic tasks.
- the *NVRAM Chips* – store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.



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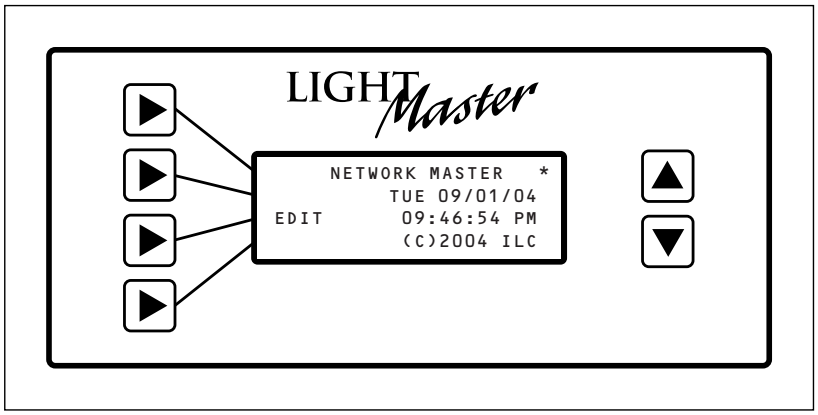
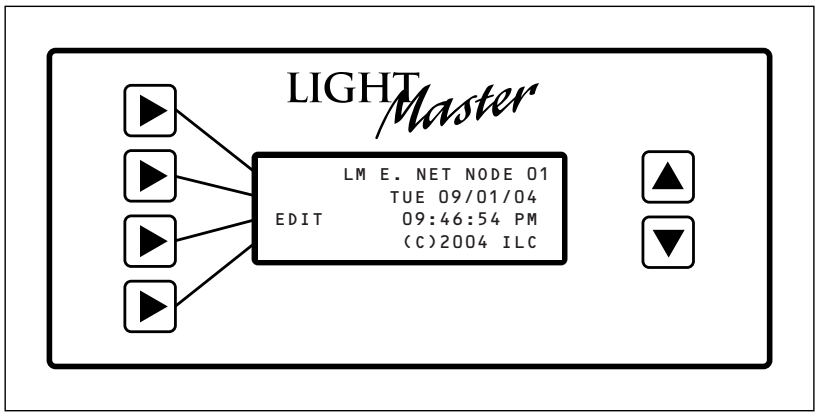
LIGHTMaster

Section 1
Controller Description



Network Manager



LightMaster Node

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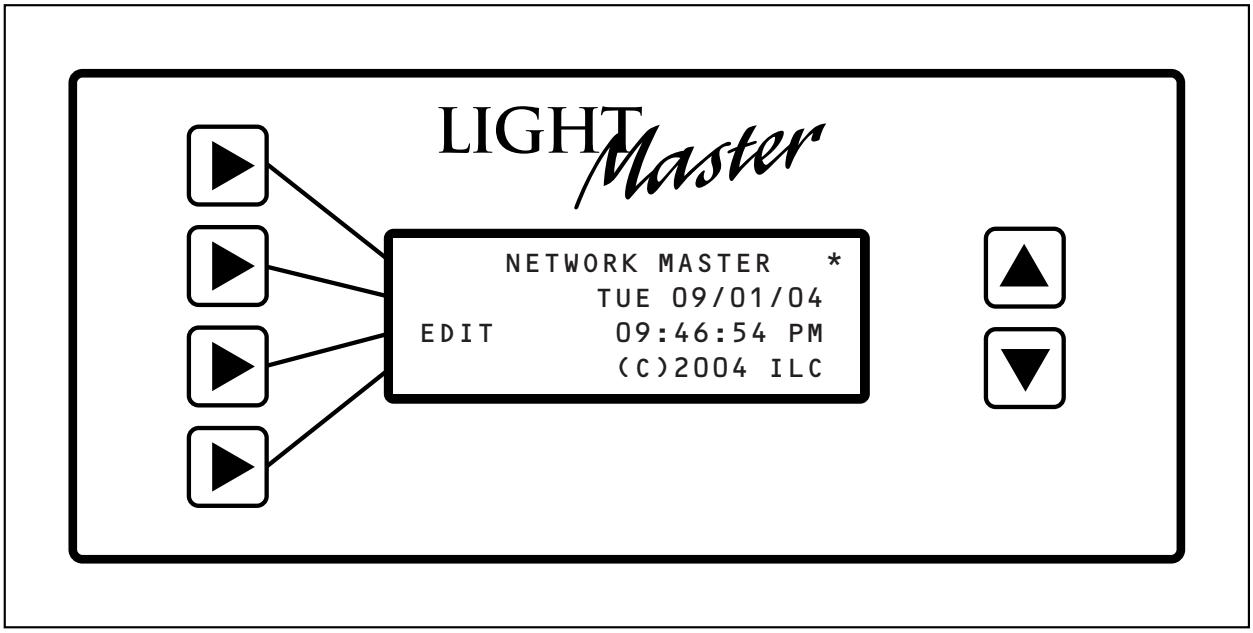
Network Manager Controller



Objectives

In this Section you will learn about the structure and configuration of the LightMaster Extended Network Manager and how the individual LightMaster controllers may be linked together to form a facility-wide integrated lighting control system.

Overview

The LightMaster Extended Network Manager efficiently controls all of the LightMaster panels and all the LightSync™ devices. Although the Extended Network Manager is required for networks with more than 32 panels or 127 Lightsync devices, it is aslo a great solution for smaller, more complex networks which utilize many LightSync devices. This product efficiently syncs time, date and other data on the entire network, ensuring that times and clock functions operate uniformly as well as providing access to system programming of all the panels in the LightSync network. The Extended Network Manager can be mounted in a facility control office, or anywhere on the network. Supplied in a standard enclosure or a custom enclosure with Gateways, Power and Data Management devices or other ILC devices as needed for your particular installation.

1.1 Controller Architecture

The major components making up the controller are: (See Figure 1.1.)

- enclosure
- control transformer
- CPU board
- keypad/display
- RJ45 connnectors for LightSync data line
- RS232 port for PC programming
- LightSync Scanner card

1.1.1 Enclosure - The enclosure is rated NEMA 1. It is divided into a line voltage section and a low voltage section. The line voltage section uses a voltage divider and contains the line voltage side of the control transformer. The low voltage section contains the LightMaster Extended Network Manager's CPU board and keypad display.

1.1.2 Transformer - A 40 VA multi-tap control transformer (120 or 277/24 VAC) provides the 24 VAC input to power the controller electronics,

1.1.3 CPU Board – (See Figure 1.2.) The CPU board provides the controller's intelligence and memory. Major components include:

- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all controller electronics.
- *Communications* – RS232 port, LightSync™ RJ45 data line connectors, LightSync Scanner card
- *Microprocessor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *PROM Chip* – contains the controller operating system and basic tasks.
- the *NVRAM Chips* – store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.

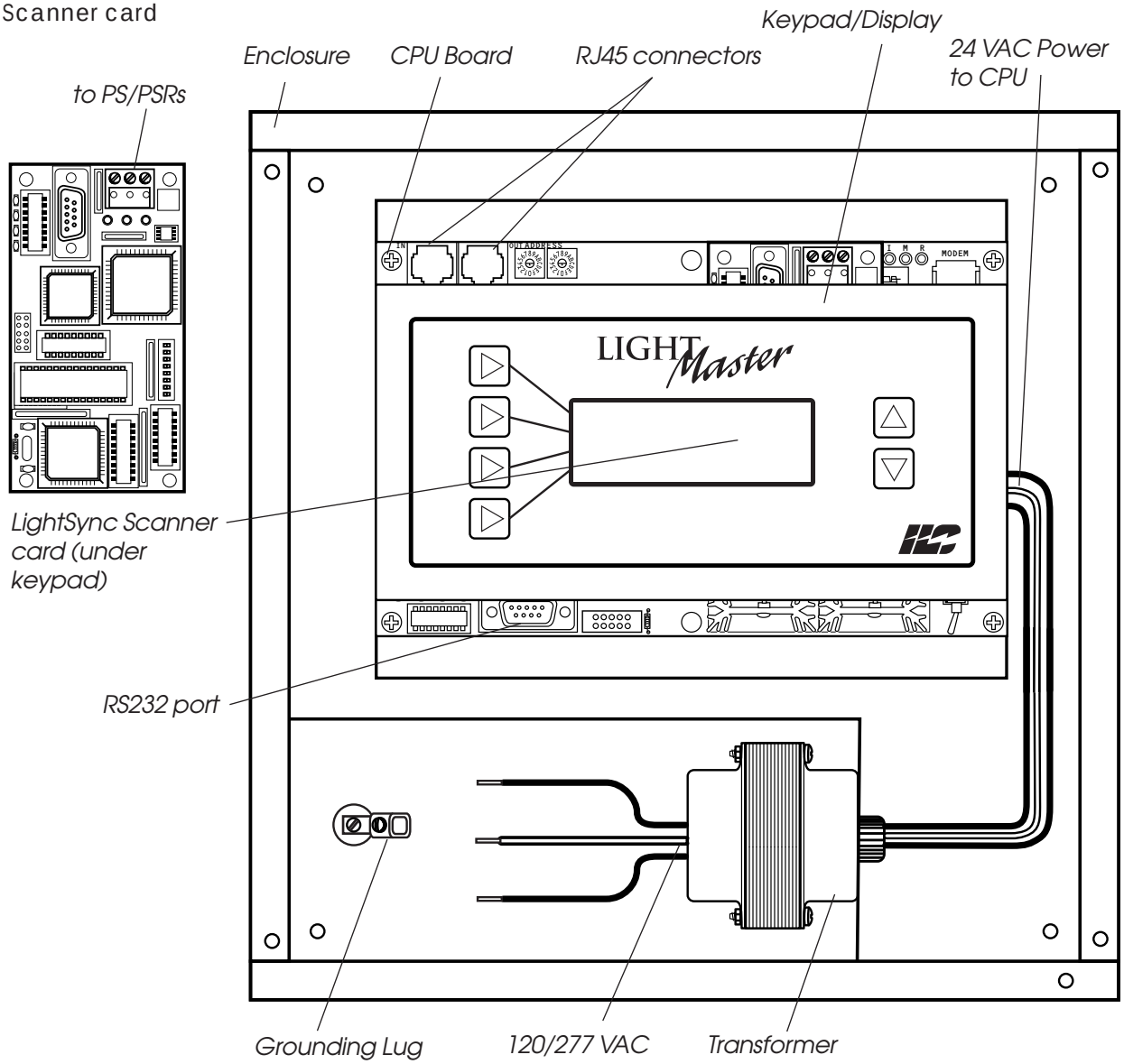


Figure 1.1 – LightMaster Extended Network Manager

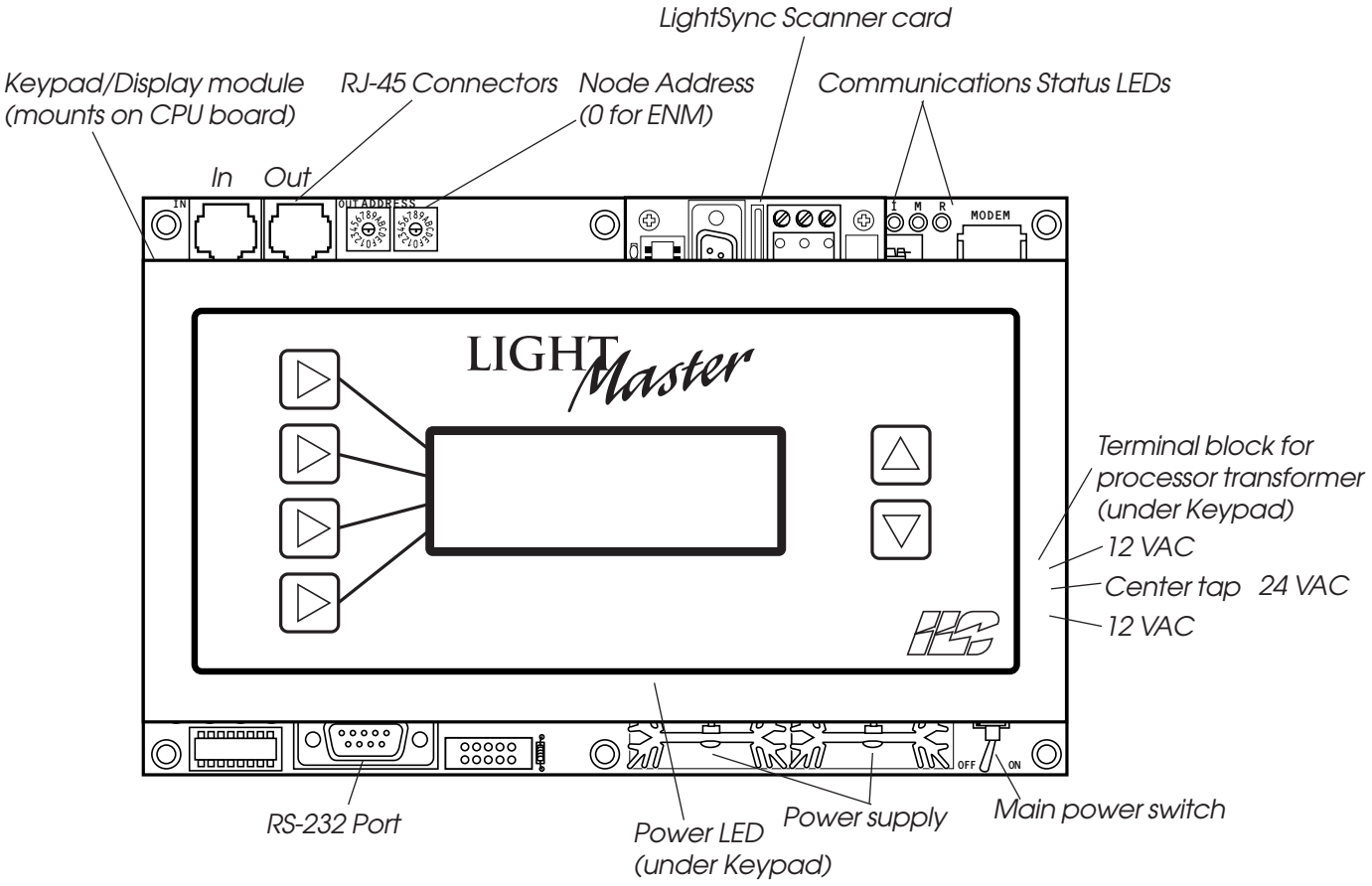


Figure 1.2 – CPU Board

1.1.4 Keypad/Display Module - (See Figure 1.3.) The keypad/display module provides you with an on-board means to view controller data. It consists of a tactile response keypad and screen. The module is mounted to the CPU board.

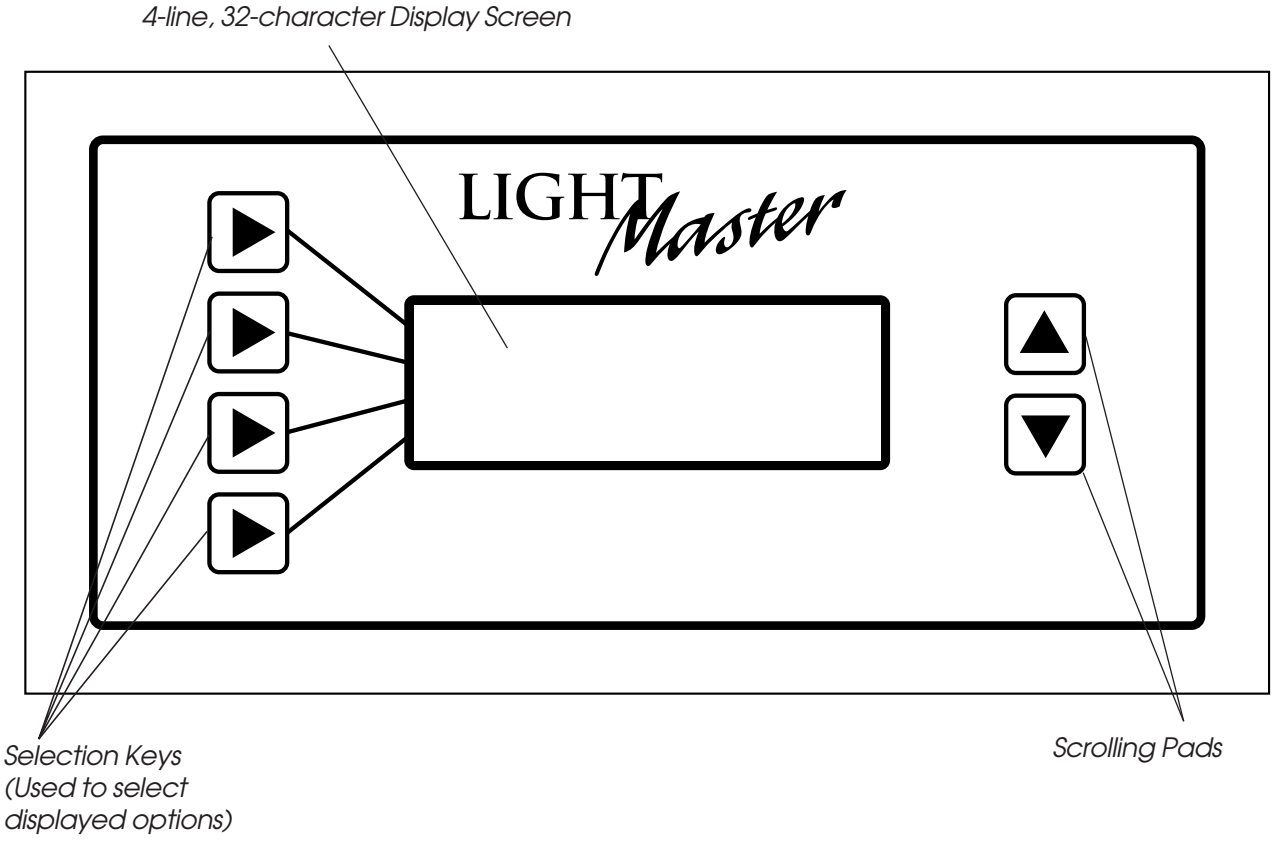
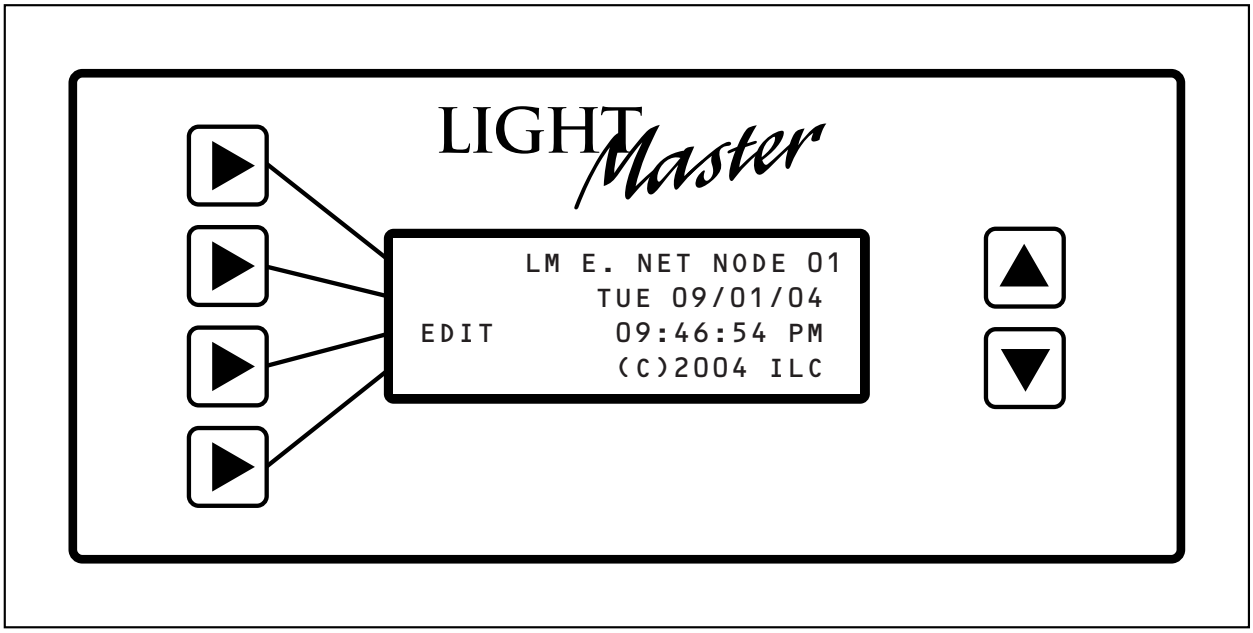


Figure 1.3 – LightMaster Keypad/Display

LightMaster Controller Nodes



Introduction

The LightMaster Programmable Lighting Controller is a microprocessor-based programmable lighting controller with LightSync™ network cabability. You can program each of the controller inputs to control any or all of the relay outputs. Individual controllers are linked together along with the Extended Network Manager to form a local area network (LAN) and function as a facility-wide lightng control system. The LightMaster is UL and FCC approved for commercial applications.

Structure

The major components making up the controller are:

- enclosure
- control transformers
- CPU board
- I/O board(s)
- keypad/display
- lighting relays

Enclosure – The enclosure is rated NEMA 1. It is divided into a line voltage section and a low voltage section. The line voltage section contains the line voltage side of the control transformers and lighting relays. The low voltage section contains the Class 2 side of the lighting relays, transformer secondaries and electronic components. Enclosures are available in 5 sizes to accommodate 4, 8, 16, 24, 32, 40 and 48 inputs, outputs, and lighting relays.

Transformers – A 40 VA multi-tap control transformer (120 or 277/24 VAC) provides the 24 VAC input to power the controller electronics, a second 40 VA transformer supplies power for lighting relay switching.

CPU Board – The CPU board provides the controller's intelligence and memory. Major components include:

- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all controller electronics.
- *Communications* – on-board modem connection (if equipped), RS-232 port, LightSync™ RJ-45 data line connectors, add-on card expansion socket.
- *Microprocessor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *PROM Chip* – contains the controller operating system and basic tasks.
- the *NVRAM Chips* – store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.

I/O Board(s) – Each I/O board provides eight (8) switch inputs and relay outputs, status pilots and override switches (16 outputs only on double sided I/O board). Major components include:

- *Switch Inputs* – can accept input from either 2- or 3-wire momentary or maintained dry contact devices. Each input has three associated LEDs (light emitting diodes). The ON LED lights when a closure is sensed between the ON and COMMON terminals. The OFF LED lights when a closure is sensed between the OFF and COMMON terminals. The Pilot LED lights when the remote mounted pilot associated with that switch input is activated. A remote pilot can be programmed to track the state of a single relay, relay group or preset. The inputs are optically isolated, noise- and surge-resistant. A switch and pilot may be located up to 1500 feet from the controller, provided you use a minimum of 18 gauge wire. As an alternative to hardwired switching, relays may be controlled by signals transmitted via a LightSync network. (See Section 4 for details.)
- *Relay Outputs* – Each optically isolated output switches its associated lighting relay ON and OFF. Each output has an associated LED. The LED lights when the output switches the relay ON, reflecting the relay's true status.
- *Relays* – 20A at 120, 277 or 347 VAC magnetically latching relays maintain their state without power.
- *Override Switches* – Each relay output is equipped with an ON and an OFF override switch. These switches allow you to turn the associated lighting relay ON or OFF independent of any programming.

1.1.5 CPU Board – (See Figure 1.5.) The CPU board provides the controller's intelligence, memory, and communications capabilities. Major components include:

- *Power Supply* – converts the 24 VAC input to the +5, -5 and +12 VDC required by the controller logic and communications circuits. A power switch provides the means of energizing/de-energizing all CPU electronics.
- *Communications* – on-board modem (if equipped), , RS-232 port, LightSync™ RJ-45 connectors, add-on card expansion socket.

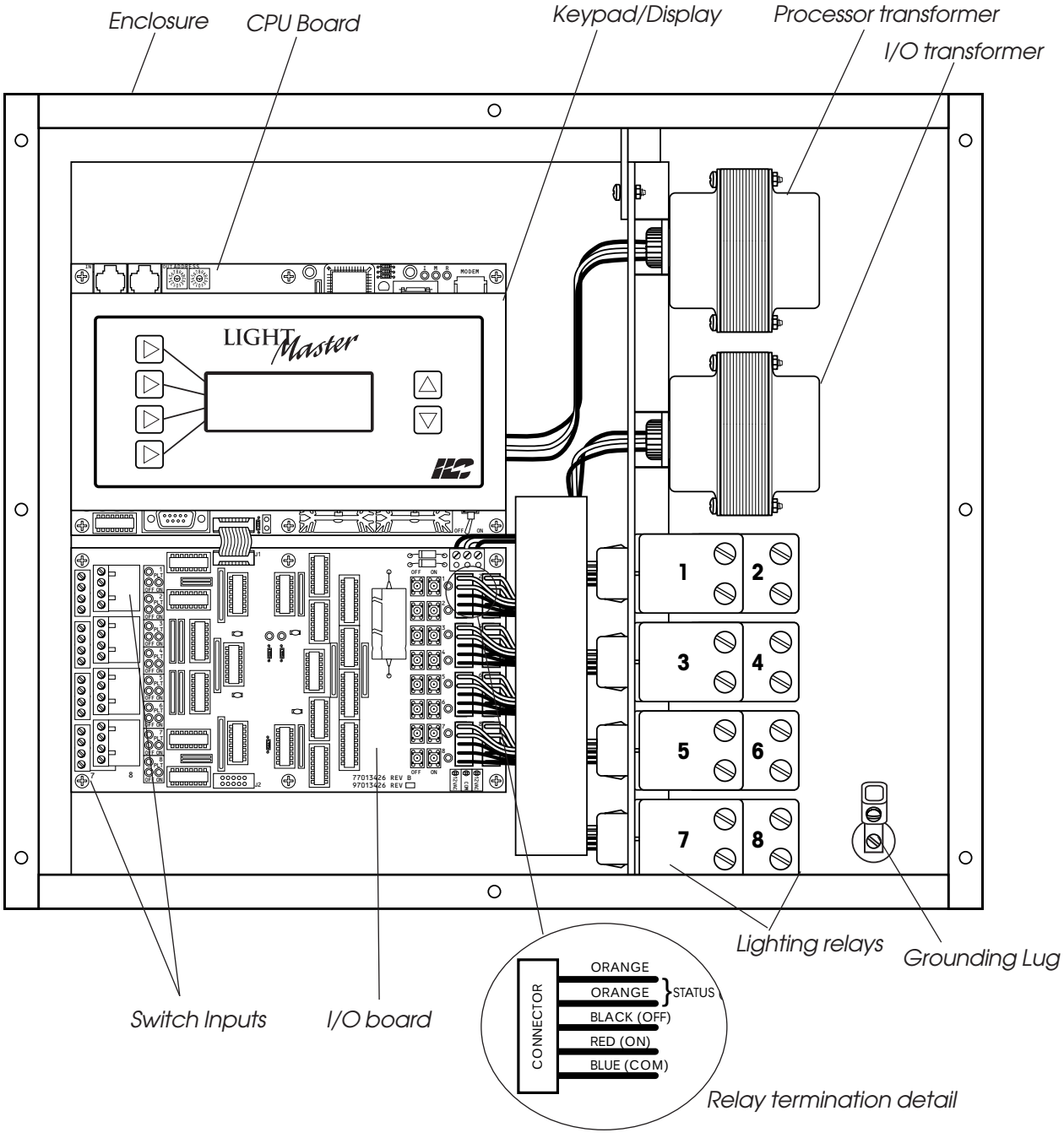


Figure 1.4 – LightMaster 8 Controller

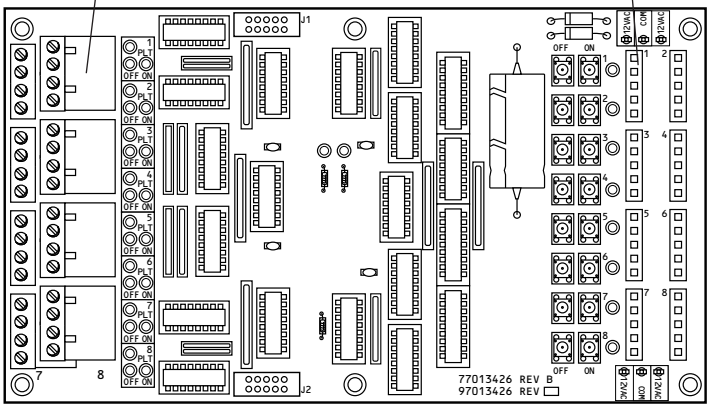
- *Micro-Processor* – executes the computer code and coordinates all controller functions including the controller real time clock.
- *PROM Chip* – contains the controller operating system and basic tasks.
- the *NVRAM Chips* – store the user-entered operating parameters.
- *Real time clock* – maintains time and date for up to 30 days without power.

1.1.4 I/O Board(s) – Each I/O board adds eight (8) switch inputs and relay outputs. The LightMaster double-sided version has 16 relay outputs per board and no switch inputs. Both inputs and outputs are optically isolated. Additional boards can be added to the appropriate size enclosure to provide a controller capacity of up to 48 switch inputs and 48 switch relay outputs. (See Figure 1.6, which illustrates a LightMaster 32.) Major components include:

- *Switch Inputs* – The LightMaster is designed to accomplish a wide variety of switch input types. Each switch input features an ON/OFF status pilot LED to indicate contact closure between ON and Common and OFF and Common. In addition, each switch input has an associated switch pilot LED which can be programmed to track the state of a selected relay, relay group, or preset. See the Table 1.1 (next page)for a description of switch input types. As an alternative to hardwiring switches to the switch inputs, you can control relays via signals transmitted over the LightSync™ data line. (See Section 4 for details.)
- *Relay Outputs* - each output switches its associated lighting relay ON and OFF. Each output has an associated LED (light emitting diode). The LED lites when the output switches the relay ON.
- *Relays* – 20A at 120, 277 or 347 VAC magnetically latching relays maintain their state without power.
- *Override Switches* – Each relay output is equipped with an ON and an OFF override switch. These switches allow you to turn the associated lighting relay ON or OFF independent of programming parameters.

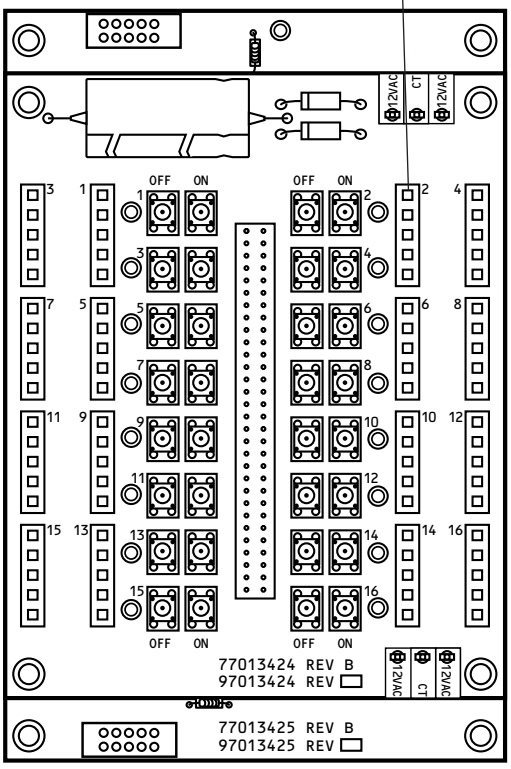
Switch inputs and pilot outputs (8 per board)

Relay outputs (8 per board)

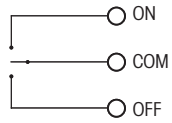
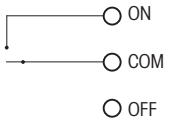
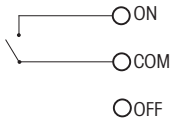
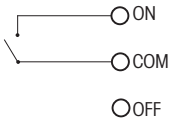
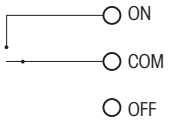
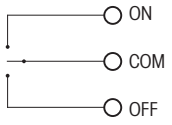
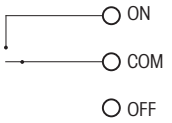
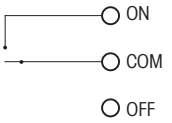
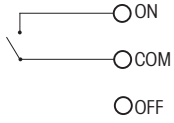
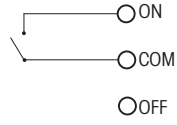
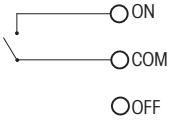
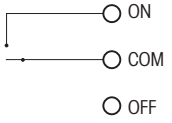
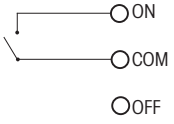
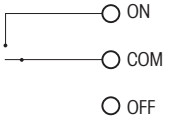
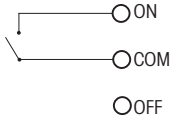
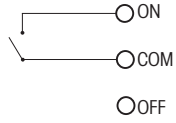
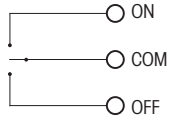


LightMaster Standard I/O board

Relay outputs (16 per board)



LightMaster Double sided I/O board

Momentary ON/OFF: When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM relay outputs controlled by this input are turned OFF.  MOMENTARY	***Momentary Push- Button:*** When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON and OFF alternately each time contact is made.  MOMENTARY	***Maintained ON/OFF:*** When contact is made between ON and COM relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.  MAINTAINED	***Maintained Multi-Way:*** When contact is either made or broken between the ON and COM, relay outputs controlled by this input will be toggled between ON and OFF conditions. This function is similar to that of standard 3- and 4-way switches.  MAINTAINED	***Set Preset:*** When momentary contact is made between ON and COM, the selected preset will be activated.  MOMENTARY	***Timed ON/Cleaning Switch:*** When momentary contact is made between COM and ON, relay outputs are turned ON. When contact is broken, a timed ON duration is started from 5-999 minutes. Contact between OFF and COM will turn relays OFF.  MOMENTARY
Two-Step Group: When the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. When the input is activated again, group A turn OFF and group B turn ON. The pattern repeats with successive switch activations.  MOMENTARY	***Four-Step Group:*** The first time the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. The second time the switch is activated, group A turn OFF and group B turn ON. The third time, both groups turn ON. The fourth time, both groups turn OFF. The fifth actuation begins a repeat of the 4 steps.  MOMENTARY	***Input Disable:*** When contact is made between ON and COM, selected input or inputs will be ignored.  MAINTAINED	***Timer Disable:*** While contact is made between ON and COM, selected timer or timers will be ignored.  MAINTAINED	***Network Disable:*** While contact is made between ON and COM, all network commands will be ignored (used in special applications only).  MAINTAINED	***Output Override:*** While contact is made between ON and COM, relay outputs controlled by this input are turned ON, OFF or held in their current state and all other control commands are ignored. **All inputs/timers are ignored for controlled relay outputs.**  MAINTAINED
Photo Sensor Inputs: LightMaster controllers can be connected to either momentary or maintained output photo sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"	***Motion Sensor Inputs:*** LightMaster controllers can be connected to either momentary or maintained output motion sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"	***Fire Alarm System Inputs:*** LightMaster controllers can be easily connected to building Fire Alarm Systems to force selected controlled lighting circuits to the ON, OFF or HOLD state and lock out all other forms of control when a Fire Alarm signal is present (contacts CLOSED).  MAINTAINED Programmed as "Output Override input"	***Dry Contact Interface:*** Virtually any control system or device can be interfaced to a LightMaster controller through the use of a simple dry contact interface utilizing any of the available switch types. Please consult factory for any special requirements.	***Force Timer:*** A switch input can be mapped to force a LightMaster Timer activation.  MAINTAINED	***HID Bi-Level:*** Operation of Bi-level HID Ballasts. First contact between COM and ON will turn ON power and High/Low relay. (High/Low relay is locked ON for 15 minutes for warm up period) Additional activations of ON terminal will toggle High/Low relay. Contact between OFF and COM will turn relays OFF.  MOMENTARY

NOTE: Switch Enable-Disable: Inputs may be enabled or disabled based on Time of day

Table 1.1 – LightMaster Switch Input Types

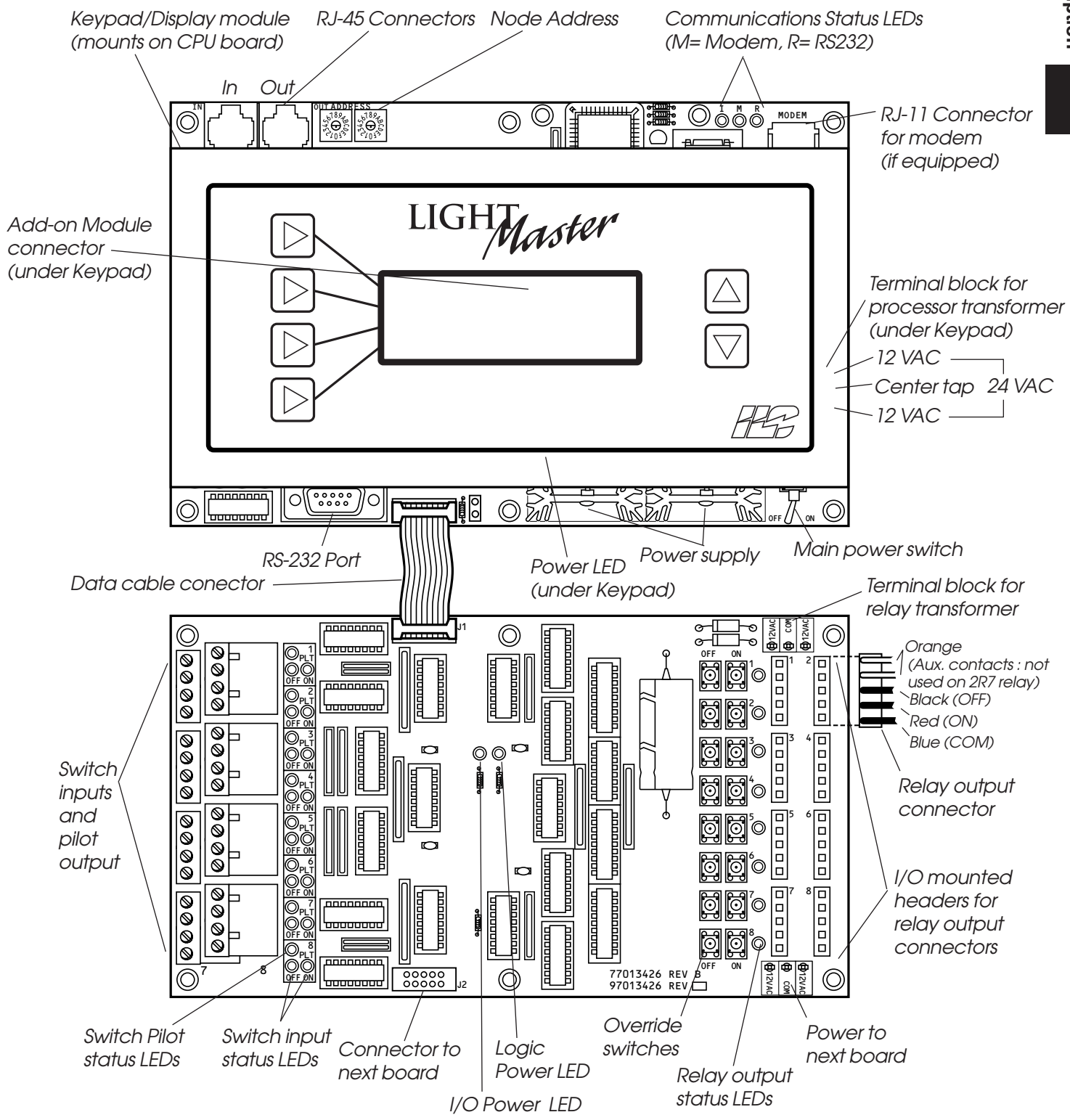


Figure 1.5 – LightMaster CPU Board and I/O

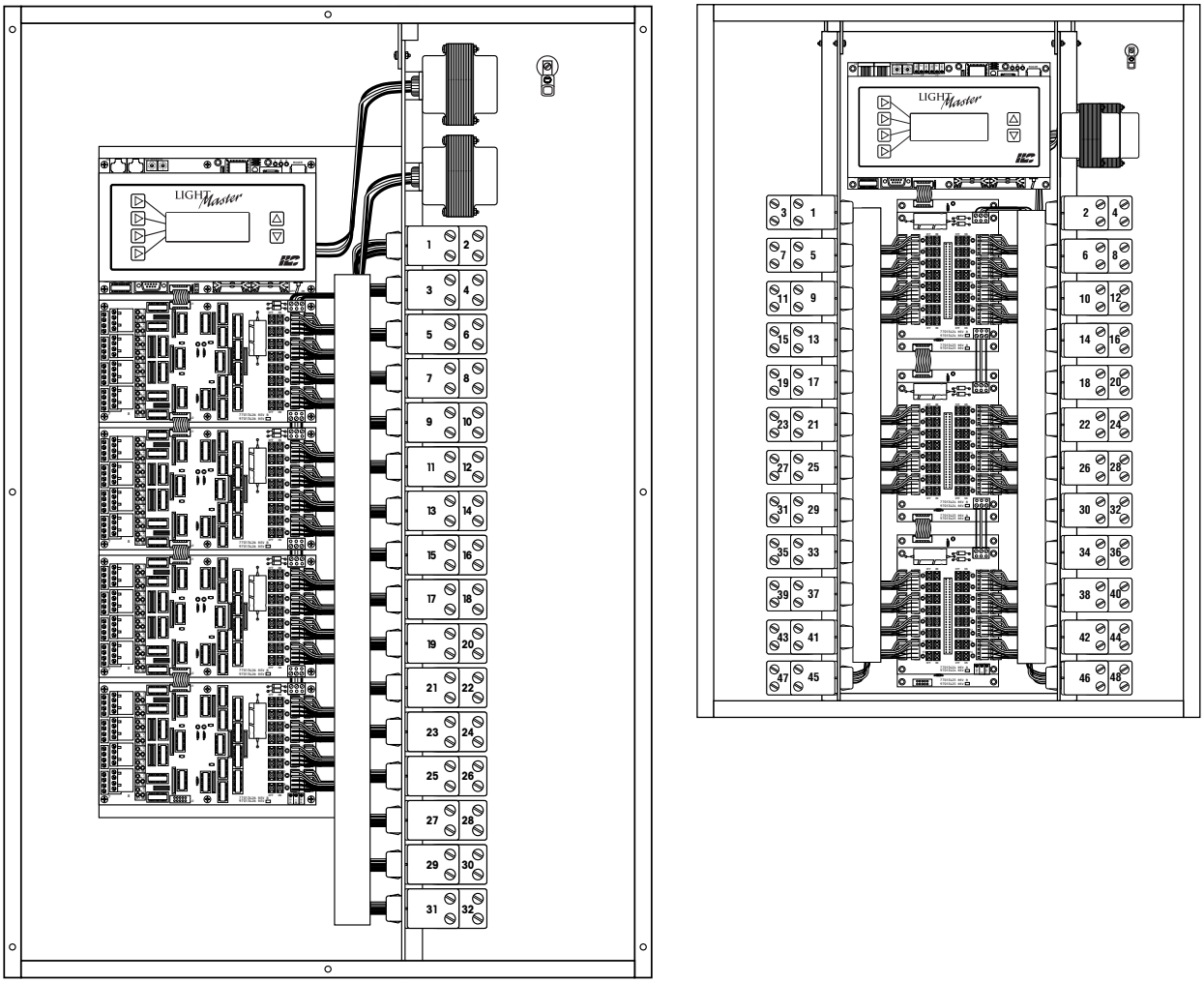


Figure 1.6 – LightMaster 32 and LightMaster 48DS

1.2 Lighting Controller Network

LightMaster controllers must be networked together to create a Local Area Network (LAN) and form a comprehensive lighting control system for an entire facility.

1.2.1 Communications Protocol And Transmission Media – Devices that operate on ILC's LightSync CAT-5 data line include LightMaster panels, LightSync switches, photocells, and interfaces like the LightSync D-6 and SIB-4. A standard 24 gauge CAT-5 cable is used for the data line and provides both data and power to these devices. See Figure 1.7 which details cable specifications. The cable terminates to ports on each Lightmaster controller and LightSync device as shown in Figure 1.5. The total data line end to end distance may not exceed 3000 feet without the addition of a Power Supply Repeater (PSR) (See Figure 1.8) to the data line. Only a PSR will extend the data line. A PSR has one incoming and two outgoing RJ45 ports to split the line into two different directions. See Figure 1.10 for an example of possible project layout.

1.2.2 Network Architecture
A network of LightMaster controllers equipped with a LightMaster Extended Network Manager can have of up to 128 Lightmaster controller nodes. Each controller in the network receives a unique controller node address. This is done via the address dials on the controller CPU board. (See Figure 1.9) The possible addresses range from 01-80.

The Extended Network Manager, which coordinates communications and data transmission and serves as the system programming mechanism must be addressed as Node 00.

It is necessary that programming be done from a personal computer (PC) equipped with LightMaster Pro Extended Network software.

1.2.3 Network Architecture- Expansion – A Power Supply Repeater (PSR) is required to extend the data for each 32 LightMaster controller nodes/3000 feet of Cat-5 network data cable and provide an additional OUT port to the CAT-5 network in the event a T-split is required in the cable run. See Data Cable Requirement and LightSync Cable Run Distance Detail charts of the following pages(Figs. 1.7, 1.8).

1.2.4 Device Nodes – Extended Networks also feature LightSync Device Nodes. These are data switches, photocells and other I/O devices connected to the CAT-5 data line. (See Figure 1.10). There can be a maximum of 254 Device Nodes in a extended network.

There are limitations to the distance data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see Figure 1.6), depending on the application. The specific use of these devices depends on the project layout.

Each device node is addressed via address dials that are part of the device. *Possible addresses for device nodes are 01-FE. These are a different set of addresses from the controller node addresses.*

If your project features Device Nodes, consult Section 4 for details.

Data Cable Requirements

Definitions:

Category 5 Cable (UTP-Unshielded Twisted Pair)- A 4 pair high performance cable that consists of twisted pair conductors, used mainly for data transmission. Basic CAT-5 cable was designed for characteristics of up to 100 MHz. NOTE: The twisting of the pairs gives the cable a certain amount of immunity from the infiltration of unwanted interference.

Category 5E Cable (Enhanced)- Same as Category 5, except that it is made to somewhat more stringent standards (see comparison chart below). The Category 5E standard is now officially part of the 568A standard. Category 5 E is recommended for all new installations, and was designed for transmission speeds of up to 1 gigabit per second.

Below you will find a list of the required properties your selected cable must meet. You will also find a list of cables, which meet these criteria from several different manufacturers. At your option you may utilize one of the below-suggested cables or have your cable supplier provide you with a suitable alternative, which meets the listed criteria.

Category 6 Cable- Same as Category 5E, except that it is made to a higher standard (see comparison chart below). Category 6 is now part of the 568A standard.

Standard 24-gauge Data Cable Performance Specification Chart:

Parameter	Category 5	Category 5E	Category 6
Specified frequency range	1-100 MHz	1-100 MHz	1-250 MHz
Attenuation	24 dB	24 dB	36 dB
NEXT	27.1 dB	30.1 dB	33.1 dB
Power-sum NEXT	N/A	27.1 dB	30.2 dB
ACR	3.1 dB	6.1 dB	-2.9 dB
Power-sum ACR	N/A	3.1 dB	-5.8 dB
ELFEXT	17 dB	17.4 dB	15.3 dB
Power-sum ELFEXT	14.4 dB	14.4 dB	12.3 dB
Return loss	8 dB	10 dB	8 dB
Propagation delay	548 nsec	548 nsec	546 nsec
Delay Skew	50 nsec	50 nsec	50 nsec

Suggested Manufacturers and Data Cables:

Manufacturer	Part Number	Cable Type	Phone
Belden	7854A	CAT-5 non-plenum	800 235 3361
	1583A	CAT-5E non-plenum	
	7811A	CAT-5 plenum	
	1585A	CAT-5E plenum	Contact Cassidey Technolgies (800 464 9473), manufacturer, or local distributor
General	2137113	CAT-5 non-plenum	
	5133299E	CAT-5E non-plenum	
	5131413	CAT-5 plenum	
	6131278	CAT-5E plenum	
Hitachi	38696-8	CAT-5 non-plenum	
	38993-8	CAT-5E non-plenum	
	39419-8	CAT-5 plenum	
	38891-8	CAT-5E plenum	

If you have any questions or would like our engineers to approve your cable selection please feel free to contact our applications department at 1-800-922-8004.

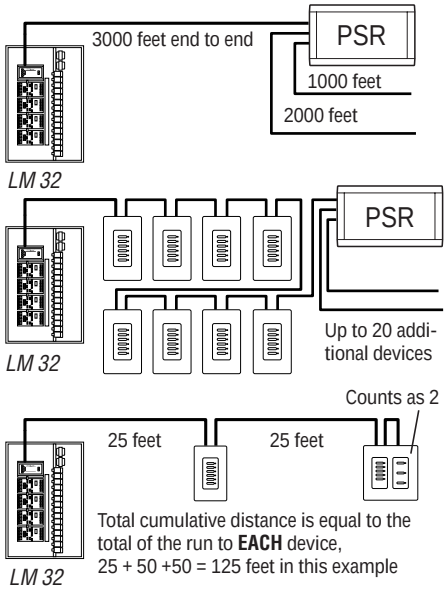
Figure 1.7 – Data Cable Requirements

LightSync™ Network Cable Run Distance Detail

Devices that operate on ILC's LightSync CAT-5 data line include LightSync switches, photocells, and interfaces like the LightSync D-6 and SIB-4. A standard CAT-5 cable is used for the data line and provides both data and power to these devices. There are limitations to the distance data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see chart), depending on the application. The specific use of these devices depends on the project layout.

There are four main areas of limitation to be addressed:

1. **Total Data Line Overall Distance:** The total data line end to end distance may not exceed 3000 feet without the addition of a PSR to the data line. Only a PSR will extend the data line.
2. **Total number devices (Lightmaster panels and LightSync devices):** Total number of devices without a PSR is 32. A PSR will add 31 more devices (PSRs are counted as a device).
3. **Total number of LightSync devices powered:** No Lightmaster controller panel can power more than eight (8) LightSync devices on the data line without a PS, PSR or LightSync Hub (each can power up to 20 additional LightSync devices).
4. **Total Power Cumulative Distance:** The cumulative distance from each device to its power supply may not exceed 2000 feet if powered by a Lightmaster panel, or 3000 feet if powered by a PS, PSR or LightSync Hub.



ILC Power and Data Repeating Device	Total Data (end to end) Distance	No. of LightSync Devices Powered	Cumulative Power Distance
LightMaster Panel	3000 feet	8	2000 feet
Power Suppy (PS)	N/A	20	3000 feet
Power Supply Repeater (PSR)	3000 feet (combined)	20	3000 feet
LightSync Hub (HUB)	1500 feet per port	20 total	1500 feet per port

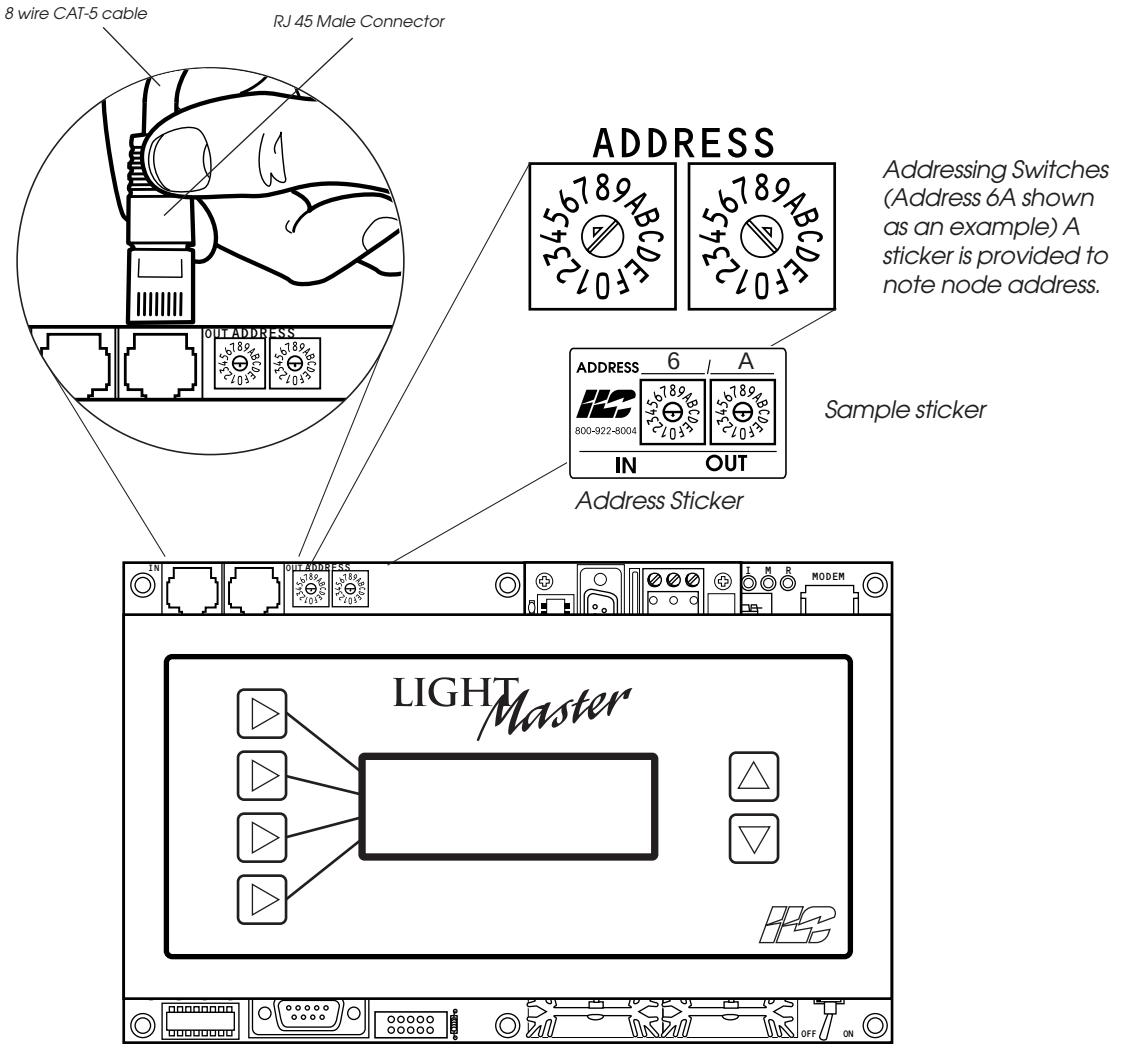
ILC Power and Data Repeating Devices

A **Power Supply Repeater** (PSR) is both a power supply and data repeater and its primary purpose is to repeat data and provide a bridge to another data line capable of 3000 feet end to end. This device also has one incoming and two outgoing RJ45 ports to split the line into two different directions. The PSR also adds power to LightSync devices for an additional 3000 cumulative feet.

A **Power Supply** (PS) provides additional power as needed to the LightSync data line. This is the most efficient option to compensate for voltage drop from multiple LightSync devices on the data line. Note that a PS provides power only and does not repeat data.

A **LightSync Hub** (HUB) is a device that allows a home run configuration by providing RJ45 ports for up to 20 LightSync devices, supplying power and data up to 1500 feet per each port.

Figure 1.8 – LightSync Network Cable Run Distance Detail



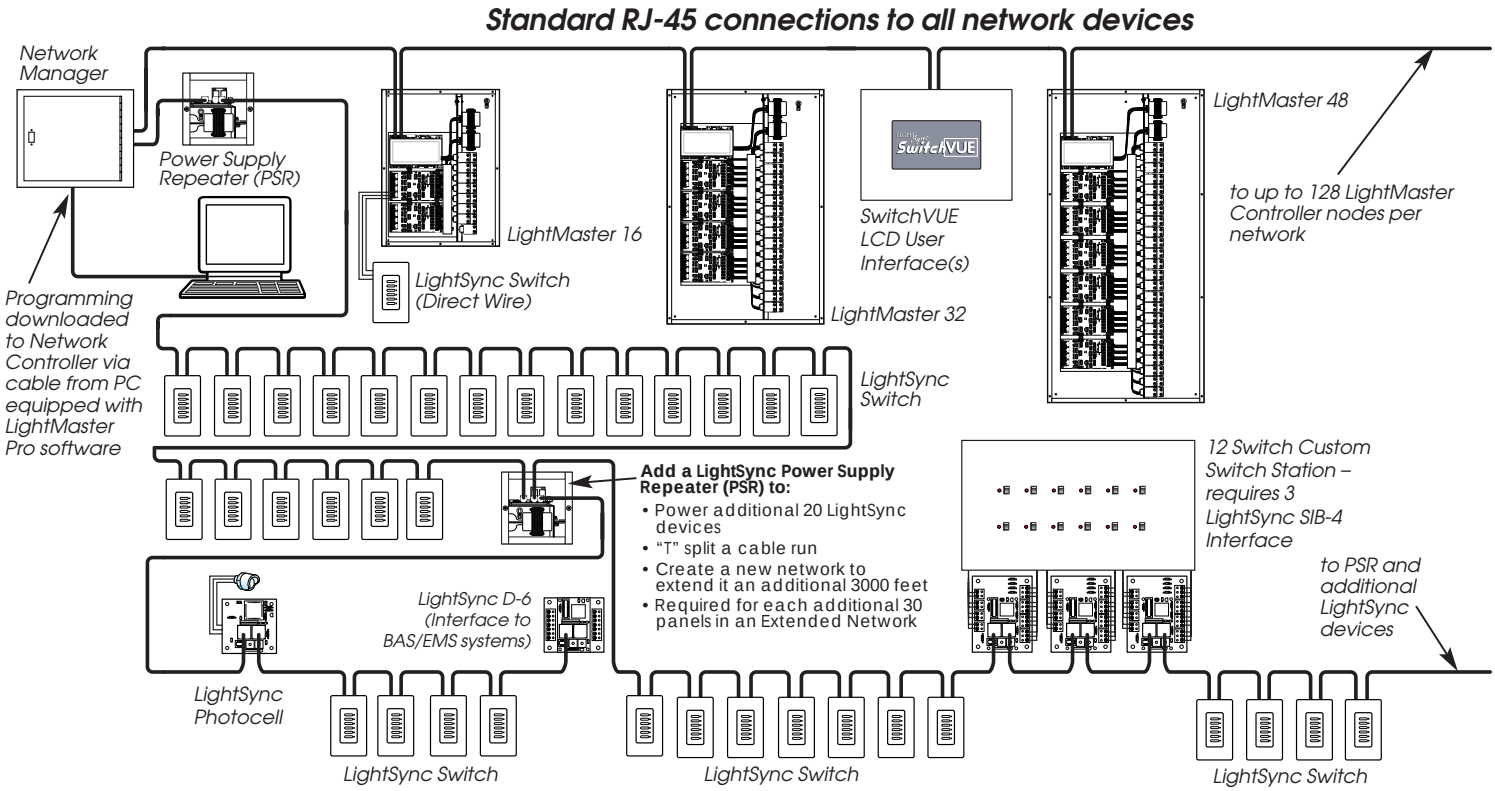
- Each networked LightMaster relay control panel must be given a unique 2-digit node address using the addressing switches noted above. Settings from 01 to 80 can be used to address up to 128 panels in a network.
- This 2-digit address code system is also used with LightSync data line devices.
- LightMaster panels and LightSync device addresses are unique.
- Document and record all node addresses on the supplied sticker for future reference (they will be needed for programming).

Figure 1.7 – CAT-5 Termination and Node Address Detail

Extended Network Overview

Extended Network

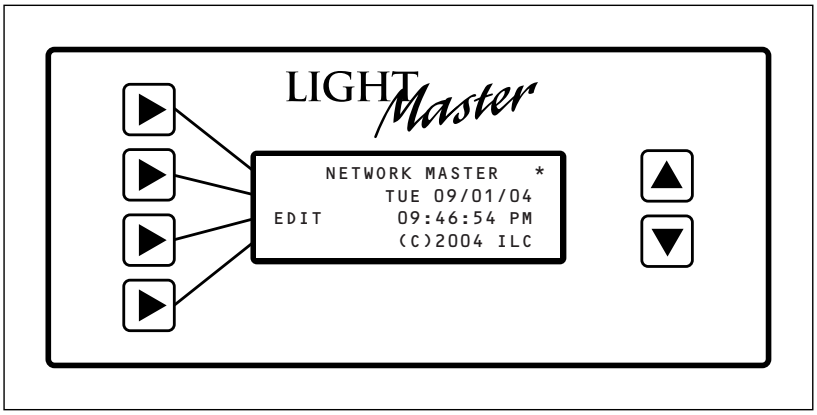
- 128 panel capability (Power Supply Repeater required for each additional 30 panels in Extended Network)
- 254 LightSync devices per network
- 3000 feet maximum run without LightSync Power Supply Repeater (PSR) (see manual for specifications)



- *Observe all ILC cable and cable run requirements (Fig. 1.7 and 1.8)*
- *128 panel nodes per extended network*
- *Each panel can support up to 8 LightSync devices*
- *Each PSR powers up to 20 additional devices and adds 3000 ft. cumulative power, 1500 ft. per data port (2)*
- *Extended network system supports 254 LightSync device addresses*
- *Keep all Class 2 wiring separated from high voltage*

Figure 1.10 – Extended Network Riser Example

Section 2
Installation



Section 2 Installation

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Objectives

This section shows you how to install the LightMaster Extended Network Manager, LightMaster controllers, and LightMaster Pro ENET software. Also covered is how to set up a LAN composed of multiple controllers and control the LAN via a PC.

NOTE: Consult Section 4 for information for installation of LightSync™ device nodes.

Overview

This section covers the following topics:

- Hardware pre-installation checks
- Mounting the controller
- Wiring the controller
- Network installation issues
- Pre-power-up checks
- Power-up and checkout
- Hardware Troubleshooting
- Install LightMaster Pro Software
- Linking to LightMaster network

2.1 Hardware Pre-Installation Checks

Do the following before beginning the installation:

1. Verify that you have received the proper equipment. Check the packing slip against the materials you ordered and verify that the material is appropriate for the project. Check to ensure that the voltages of the controller(s) transformers match the available power. Report any discrepancies or visible damage at once.
2. Review electrical prints and other relevant project documentation. Determine the optimum network data cable routing and the number of controller device nodes. Observe all ILC cable and cable run distance requirements. See Section 1 for details.
3. Ensure that you have a digital multi-meter, CAT-5 crimp tool and CAT-5 cable tester.

2.2 Mounting the Controller Hardware

Consider the following when selecting a site for the LightMaster Extended Network Manager controller and LightMaster slaves.

2.2.1 Network Manager Location – Typically, the LightMaster Extended Network Manager controller is mounted near the maintenance or control room. The enclosure is manufactured with pre-drilled mounting holes located near the four corners of the rear wall of the enclosure. Secure the enclosure to the mounting surface with hardware appropriate for the application.

2.2.2 LightMaster Network Controller Location – Typically, LightMaster controller(s) are mounted near the lighting panel containing the circuits to be controlled by the lighting relays. The enclosure is manufactured with pre-drilled mounting holes located near the four corners of the rear wall of the enclosure. Secure the enclosure to the mounting surface with hardware appropriate for the application.

CAUTION: LIGHTMASTER CONTROLLERS ARE HOUSED IN A NEMA 1 ENCLOSURES. DO NOT INSTALL IN SITUATIONS REQUIRING SPECIAL PURPOSE ENCLOSURES OR IN AREAS WHERE THE CONTROLLER WILL BE SUBJECT TO CONDITIONS OUTSIDE ITS DESIGNED OPERATING RANGES.

2.2.3 Environmental Considerations – The LightMaster Extended Network Manager and network controllers are designed to operate in temperatures between 0 and 50 degrees C (32°-112°F) and10%-90% humidity non-condensing.

2.2.4 Distance From Control Devices – See Sections 1 and 4 for LightSync requirements. Direct wired switches may be located up to 1500 ft. from a controller using 18GA wire.

2.3 Wiring the Controllers

Perform the following procedures to wire the line circuits of the LightMaster Extended Network Manager and the line and control circuits of LightMaster network controllers. Do ***NOT*** apply power to any circuits until instructed to do so. Document all terminations.

2.3.1 Wire the Extended Network Manager Control Transformer

Run a dedicated 120 or 277 VAC circuit, including grounding conductor, and terminate it to the primaries and ground lug of the LightMaster Extended Network Manager. Cap all unused leads. (See Figure 2.1.)

2.3.2 Wire the LightMaster Network Controller(s)

Run a dedicated 120 or 277 VAC circuit, including grounding conductor, and terminate it to the primaries and ground lug of the LightMaster processor and I/O transformers. (See Figure 2.2.) Cap unused leads. Then connect line and load wires of the line voltage circuits to the Lighting Relays. If required, wire the Class 2 Switch Circuits. (See Figure 2.3.) NOTE: If the project requires LightSync™ switching, consult Section 4.

1. Run the required wiring between the controller and the field-installed switches. NOTE: Do **NOT** mix with high voltage wiring. Consult project documentation to determine the type and quantity of required switch circuits. Check each switch run to ensure that there are no shorts between conductors or to ground. Also verify that there are no opens.
2. Make the connections at the switch end.
3. Make the connections to the controller switch input terminals.

2.4 Install Network Cable

1. Run the cable between nodes. If PSRs are required, ensure they are powered.
2. Install RJ-45 male connectors to the cable ends for each node run. See Figure 2.1a.
3. Verify the integrity of each run with the CAT-5 cable tester.
4. Set the node address for each controller in the network. (See Figure 1.7)

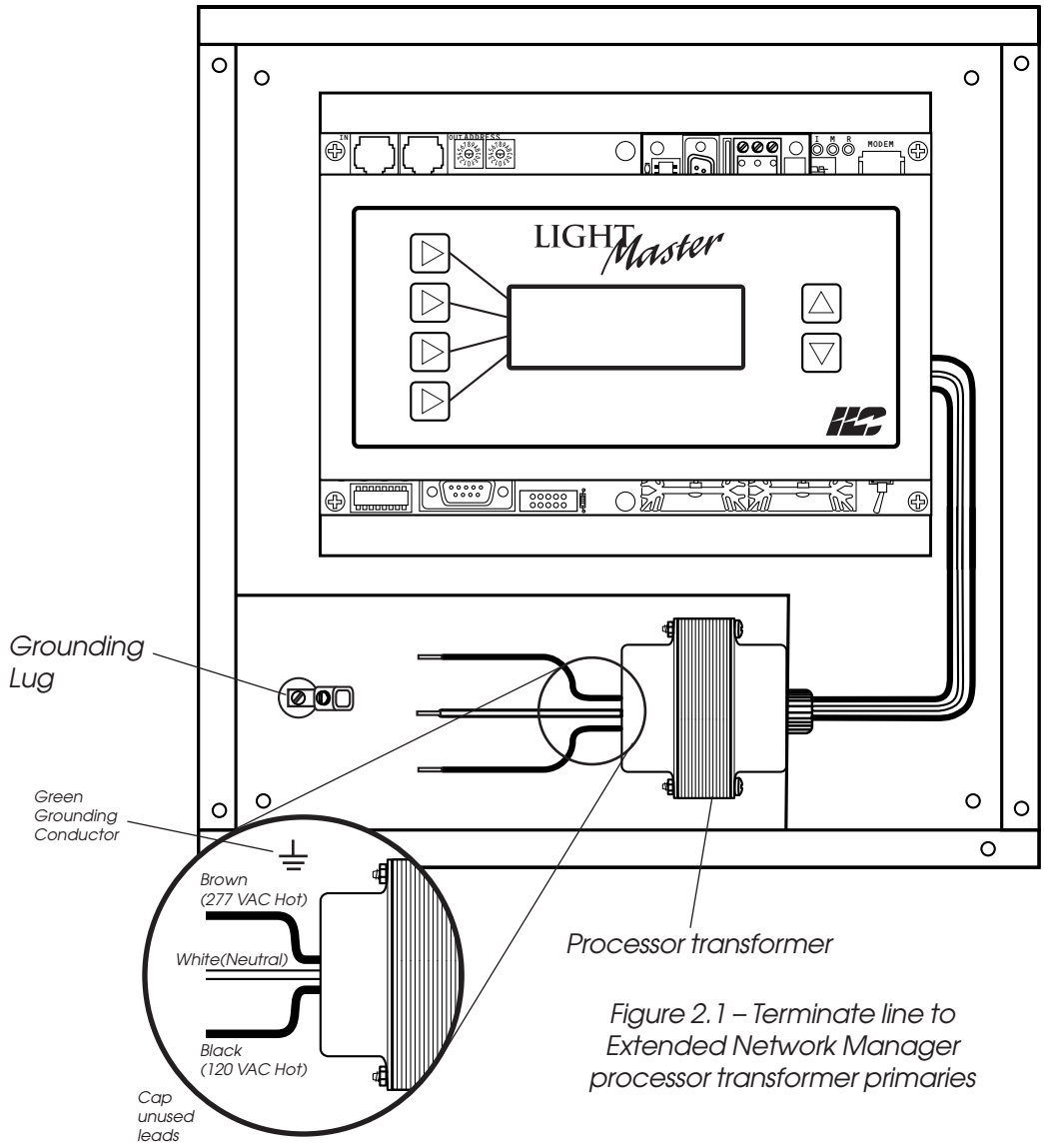
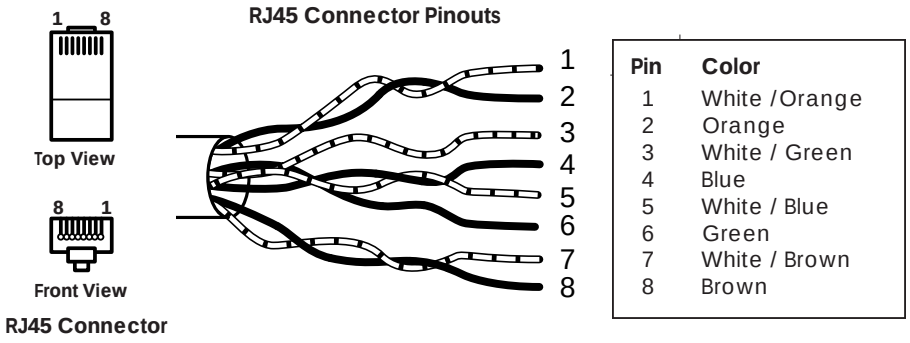


Figure 2.1 – Terminate line to Extended Network Manager processor transformer primaries



Pin	Color
1	White /Orange
2	Orange
3	White / Green
4	Blue
5	White / Blue
6	Green
7	White / Brown
8	Brown

Figure 2.1a – Data Cable Termination Detail

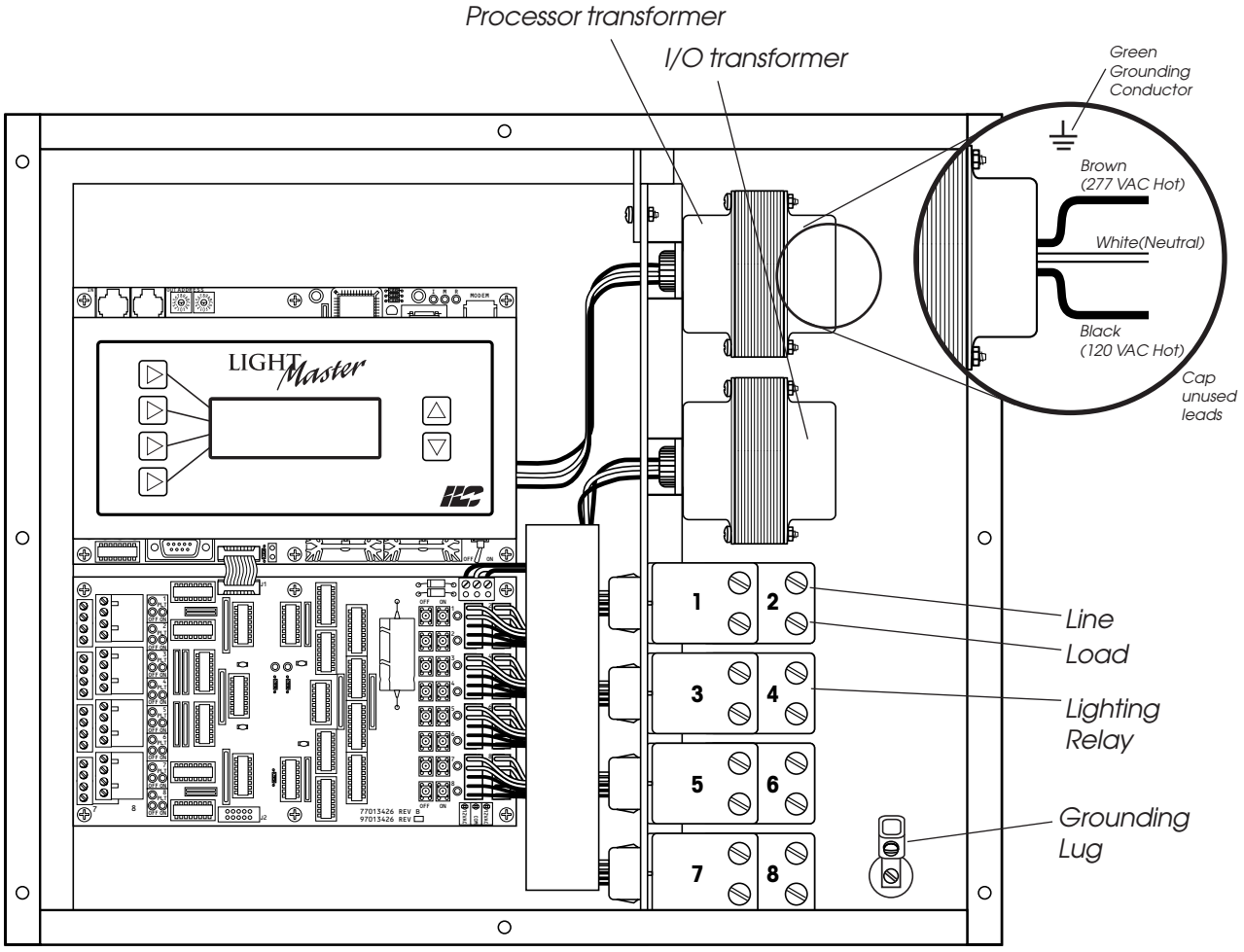
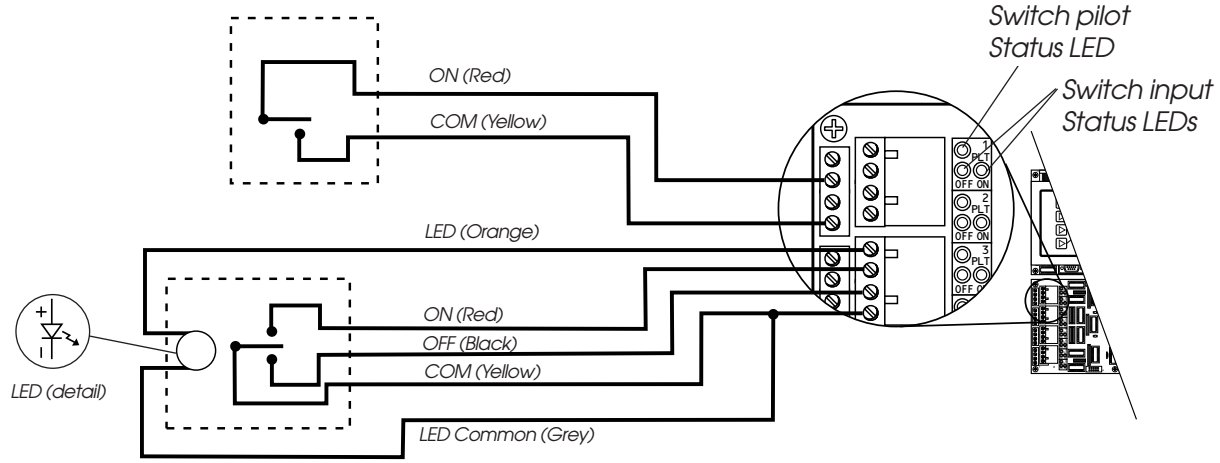


Figure 2.2 – Terminate line to LightMaster slave controller(s) I/O and processor transformer primaries

Typical maintained switch



Typical momentary switch with LED

Figure 2.3 – Wire Class 2 Switch Circuits (if required)

2.5 Pre-Power Checks

Complete the following checks BEFORE applying power to the LightMaster Extended Network Manager and LightMaster networked controllers.

2.5.1 Check Controller Power Input

1. Verify that the controller power switch is OFF.
2. After verifying that the processor and I/O transformers source voltage is 120 or 277 VAC (whichever is appropriate), power-up the circuit.
3. Verify correct line voltage on the primary of the transformer.

2.5.2 Verify Controller's Supply Voltage

Verify that there is 24 VAC on processor transformer secondary and 12 VAC between each leg and the center tap. (See Figure 1.5.)

2.5.3 Double-Check Connections

1. Verify integrity of power connections.
2. Verify integrity of all internal and external wire/cabling.

2.5.4 External Monitoring and Control

LightMaster Extended Network is designed to work with LightMaster Pro Extended Network software installed on a PC. Installation and set up follows hardware installation.

2.6 Power-Up and Check Out

Complete the following procedures to power-up and check out the LightMaster Extended Network Manager controller and LightMaster networked controllers.

2.6.1 Power-Up the Networked Controller(s)

1. Turn the power switch located on each controller CPU board ON. (See Figure 1.5.) NOTE: Power-up the LightMaster Extended Network Manager (Node 00) last.
2. Verify that the controller keypad screen displays the default time and date.
3. Verify that power LED lights on the CPU board.

2.6.2 Clear memory in all panels from the Network Manager Keypad

1. Clear memory in all network panels. This removes all of the programming in all of the panels, but does not clear time and date information. From the Network Manager home screen, press EDIT, then FIRMWARE REVISIONS, then press the up and down arrows at the same time to access the CLEAR MEMORY system wide screen.

2.7 Hardware Troubleshooting

In the event of trouble, use the following procedures to identify the problem.

2.7.1 Controller(s) Will Not Power-Up (All controllers)

1. Verify that there is 120/277 VAC on the primary and 24 VAC on the secondary of all control transformer(s).
2. Verify that all the power LEDs on the CPU and I/O boards (where applicable)are lit.
3. If there is proper primary and secondary voltage on the transformer but the power LED is not lit and the keypad screen does not come up, consult the factory.

2.7.2 Lighting Relay(s) Will Not Function (LightMaster networked controllers)

1. Verify that there is 24 VAC on I/O transformer secondary.(See Figure 1.5.)
2. Make sure that lighting control wiring is landed properly on the relay output of the I/O board(s). (Blue is common, red is ON, black is OFF, orange is status.) (See Figure 1.5.)
3. Override the affected relay ON/OFF with the override switches located on the I/O board. (See Figure 1.5.)
4. If the relay does not respond, consult the factory.

2.7.3 Switch Input Will Not Function (LightMaster networked controllers)

1. Check your programming.
2. Verify proper connections at field and controller end.
3. Verify that there is only one maintained switch connected per input.
4. Unhook field connections from affected input. Connect test switch of same type as field switch.
5. Work the test switch. Observe whether the switch input status LED lights when it senses a switch closure.
6. If the switch input LED lights and the relays function properly, there is probably a problem with the field wiring.

7 Verify that the CPU is seeing the switch input by viewing the current switch status. This can be done with the keypad by going to the *Switch Status* screen and scrolling to the individual input or scanning all of the inputs to verify that a switch closure is being seen by the controller. Also the outputs of the I/O board(s)s can be tested through the keypad by going to thr RELAY STATUS screen. Relays can be forced individually or all swept ON or OFF using the keypad.

8. If the switch input or affected relay does not respond (or no response is viewed through the keypad), consult the factory.

2.7.4 Timers Will Not Function Properly (LightMaster networked controllers)

1. Check your programming.

2.7.5 Entire I/O Board(s) Doesn't Work (LightMaster networked controllers)

1. Check to ensure that the data and power cables linking the I/O boards are connected properly and are free of opens and shorts.
2. Check to ensure that both of the power LEDs on each I/O board are lit.
3. Verify that the CPU sees the expansion I/O boards using the keypad. This can be done by going to the Relay Status screen and scrolling through the outputs to see if the CPU sees all of the outputs.
4. If the I/O board is not recognized by the CPU, consult the factory.

2.7.6 Network Communication Problems (All controllers)

1. Verify the affected node is powered up.
2. Check that the node address is properly set. (From the keypad, press EDIT. Scroll to FIRMWARE REVISIONS. The node address will be displayed in this window.)
3. Verify the integrity of the CAT-5 cable and connections with a CAT-5 cable tester.
4. Verify that the network does not exceed the maximum run distance (See Fig. 1.8).
5. Break the network down to a few nodes. Check status from the computer. Continue to add nodes until the problem recurs. Address problem at failure point.

2.8 Install LightMaster Pro Software

Programmming the LightMaster Extended Network Manager and LightMaster networked controller(s) requires connection to a PC equipped with LightMaster Pro Extended Network software.

2.8.1 LightMaster Pro Requirements

The following are the minimum requirements for your PC to run LightMaster Pro ENET software:

- Pentium 4 – 1.6 GHZ or greater
- 1 RS232 Port
- CD drive
- Windows 2000 or XP
- 512 MB RAM
- 100 MB free space
- SVGA monitor, 1024 x 768 recommended
- Mouse & keypad or touch screen

2.8.2 Software Installation

1. Insert the LightMaster Pro ENET CD into your PC's CD drive
2. Exit any open applications and temporarily disable virus protection software
3. Point & click on START
4. Select RUN
5. Then Browse to the CD.
6. Select Setup ILC LightMaster ENET.exe on the CD
7. Click OK and follow the directions on the screen.

2.8.3 Troubleshooting

If LightMaster Pro ENET installation fails, reboot and reinstall the software. If further assistance is required, call ILC Technical Support at 1-800-922-8004.

2.9 Link Your PC to the Network

To link a PC to the network, connect the factory supplied cable (consult factory for alterate cable) between a COM port on your computer and the RS 232 port on the Network Manager CPU board. (See Figure 2.4) If the distance between the PC and the LightMaster Extended Network Manager is greater than 25 feet, a LightMaster PAK (Programming Access Kit) is required. (See Fig. 2.5.) This will allow communication up to 3000 feet.

2.10 Back Up Programming

Be sure to back up all programming to the removable media of your choice and store in a safe location. From the FILE menu, you may SAVE and name the data files, or choose SAVE AS to rename or save to a different location.

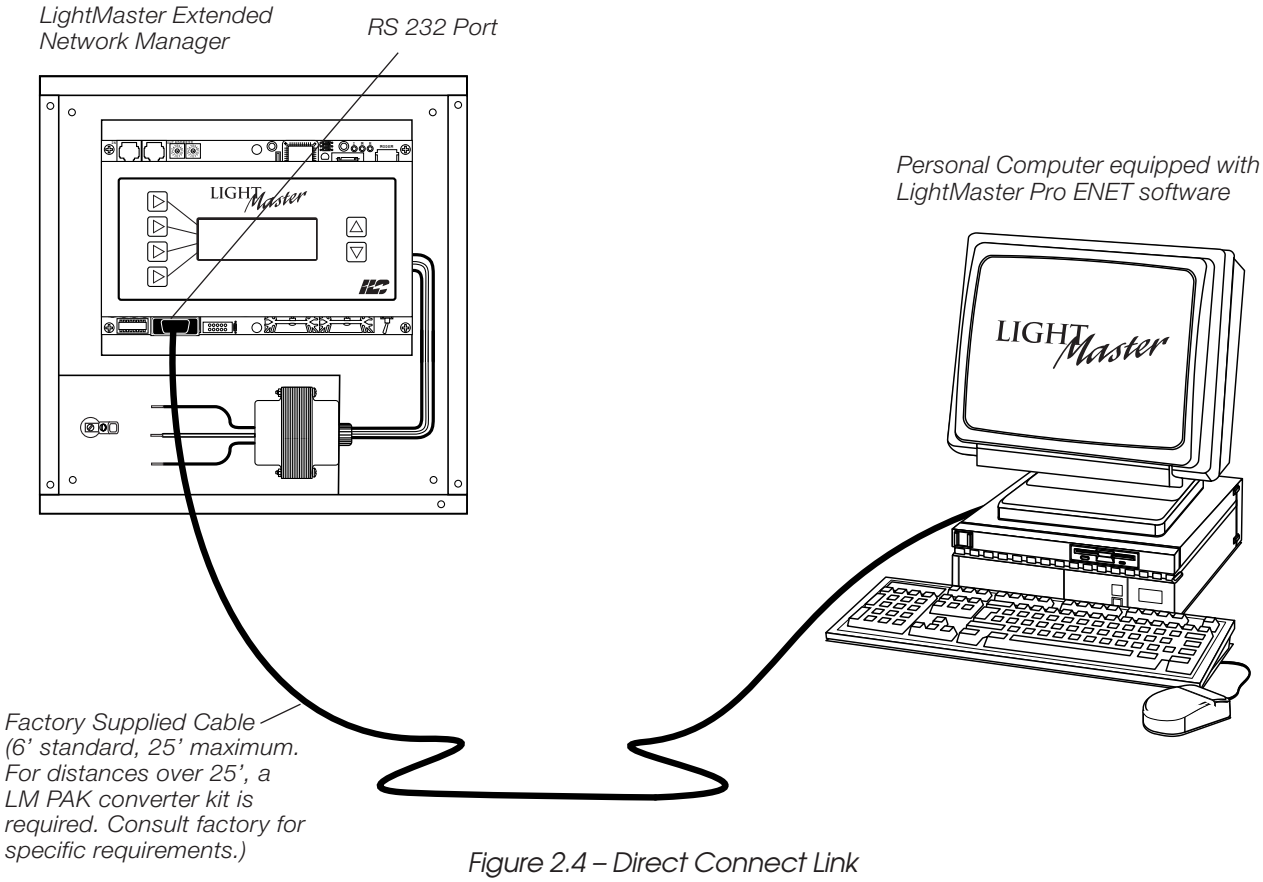
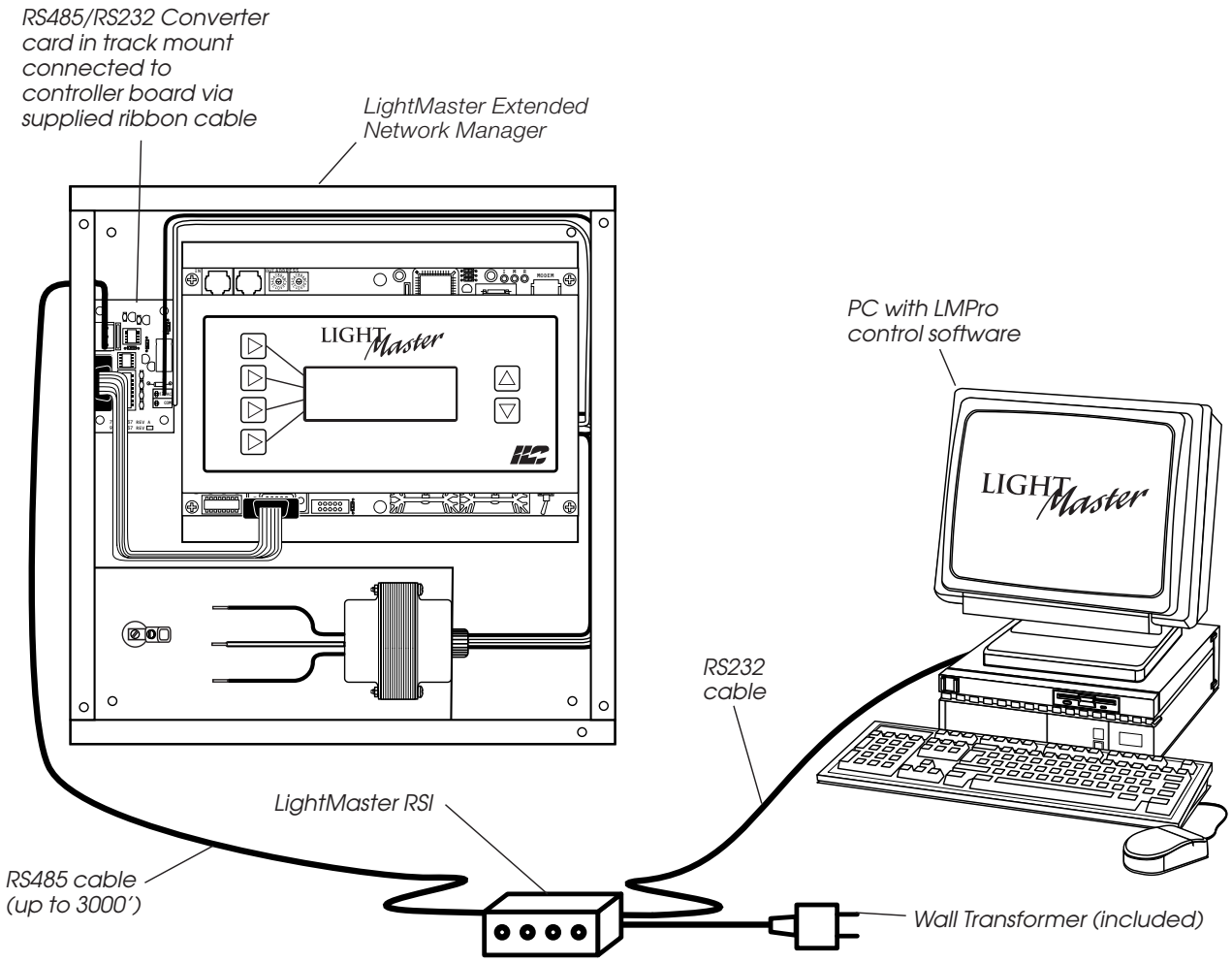


Figure 2.4 – Direct Connect Link



LightMaster PAK Sample Installation (for distances over 25 feet)

Figure 2.5 – Remote Connect Link

Section 3
Programming Features

Section 3 Programming Features

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3.0 Overview

Lightmaster Pro Extended Network software is an ILC Corp. proprietary software package designed for use with the extended (up to 128 controller node lighting controller and 254 LightSync™ devices) network. Using this Windows-based software you can program the lighting controller nodes, retrieve data from and issue commands to the controllers. You can develop the programming parameters off-line, save them to a file and then download them from your PC.

See Section 2.8 in this manual for minimum PC requirements and installation instructions.

3.1 Starting LightMaster Pro Extended Network

To start the program point and click on the ILC LightMaster ENET icon on your desktop. The Home screen will appear. See page 3-3. A menu tree overview of the programming flow is shown in Figure 3.3. A chart of available switch input types is shown in Table 3.2, and a chart of available relay output operations is shown on page 3 - 8.

3.2 Home Screen Menu Bar Choices

- **File** - Use FILE to create a new file, open, save current system entries/parameters to your hard drive, and to exit the program.
- **Connect** – Use to connect your PC to the lighting control network. You can set the system clock, retrieve data, issue commands and program parameters on-line via Connect.
- **Edit System** – Use Edit System to enter the system level parameters for the network. Generally node-based, time based, group and lightsync device parameters are entered at the system level.
- **Select Node** – Use Select Node to choose the node you want to program with the node level parameters.
- **Edit Node** – You use this choice to enter the node level parameters of the node you have selected. Generally speaking, individual relay, hardwired switch, LightSync/relay, pilot, timer and preset input parameters are entered at the node level.
- **Document** - This feature allows you to organize and manipulate data for exporting into other data based and spreadsheet programs.
- **About** – displays the Home screen and the software revision level and the ILC Corp. 800 number.

3.3 Edit System Options

The edit system options offered from the home screen are:

- **Configure Nodes** - use this option to configure the number of inputs, outputs and any optional add-on modules for the network nodes.
- **Group Control** – use this option to check relay status and to force relay groups ON and OFF.
- **LightSync Settings** – use this option to view LightSync device status, configure LightSync devices and pilots.
- **Timer Settings**- use this option to define normal, astro, and open/close timers. Then map each timer to the relay group or preset it controls and define its response.
- **Set Times** - use this option to enable/disable daylight savings and define astro clock, open/close, OFF sweep.
- **Capture Presets** – use this option to capture, and set presets from your PC.
- **Special Functions**- use this option to customize names of timers, presets and LightSync devices and change the Photocell Filter.

Basic Concepts

To program a network of Lightmaster controllers you must enter parameters at both the system and the individual node level. See Figure 3.3 to view the screen flow and top level menu choices for these levels. Generally speaking, you enter time dependent and group parameters at the system level and individual input/output parameters at the individual node level.

In some cases to achieve a functional objective (for example) controlling a relay with a timer you will need to enter parameters at both the system and individual node level.(See Table 3.3 for a quick reference on the level required to implement control objectives.)

NOTE: All extended network programming must be done from a PC connected to the Network Manager (node 00).

3.4 Sequence of Programming

1. Beginning with controller node 01, enter the node level parameters. Start first by defining the node type (number of controller I/O points, and any add-on modules)

LightMaster Pro Extended Network Home Screen

3.5 Connect to the Network

From the Home Screen, select the **Connect** menu choice. Select the appropriate communications port and click on **Connect to LightMaster**. You are now ready to begin programming. (Figure 3.1) You may also perform programming offline and download the saved file. Note: You may also reset the LightMaster Clock from this screen.

3.6 Configure Nodes

1. Point and click on **Edit System** to access the system pull down menu, select **Configure Nodes**
2. Point & click on the Node 01 **Node Type/I-O Count** box; then point & click on the box arrow and select the number of I/O points the controller is equipped with.
3. If so equipped, Point and click on **Add-On Module Type** to select card type
4. Repeat step 2 to configure Node 02, etc..

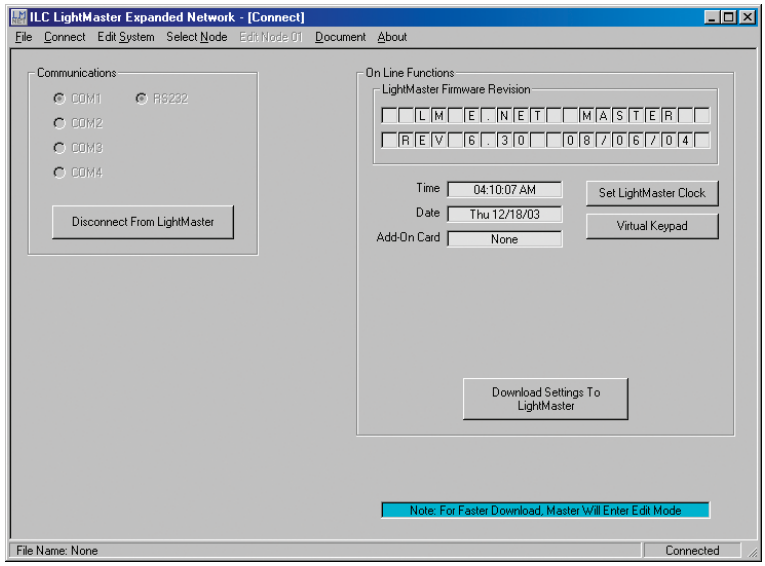


Figure 3.1 – Connect menu choice

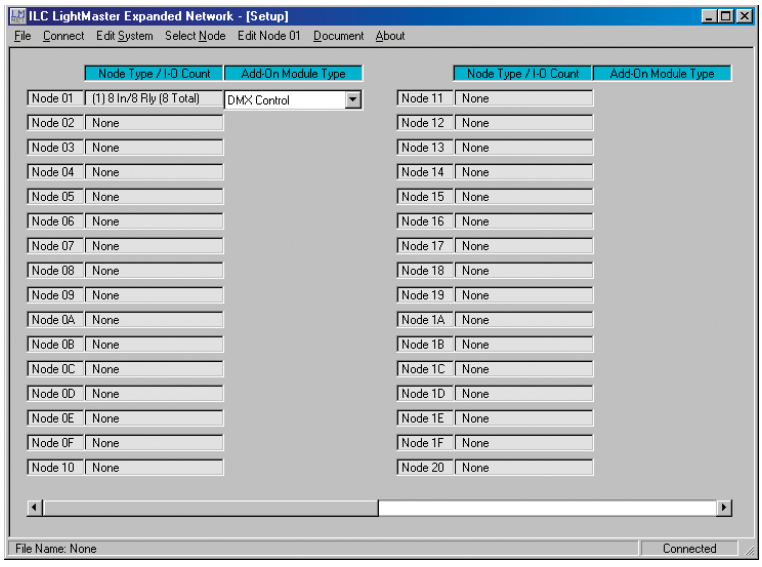


Figure 3.2 – Configure Nodes screen

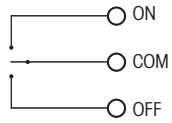
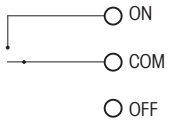
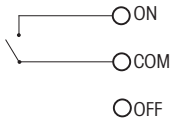
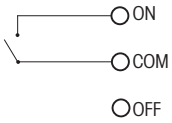
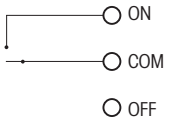
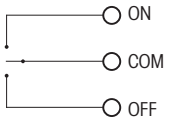
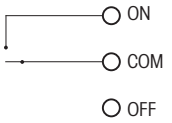
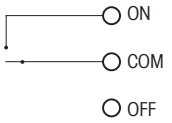
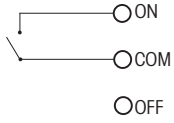
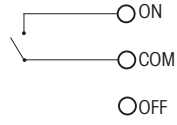
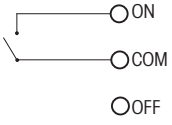
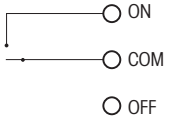
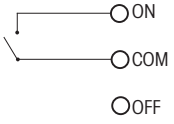
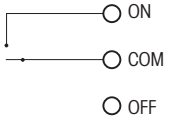
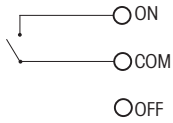
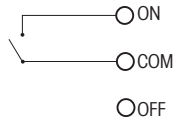
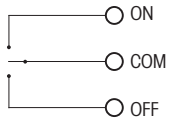
LightMaster Pro ENET Menu Tree

File	Connect	Edit System	Select Node, then Edit Node	Document
• New • Open • Save • Save As • Exit	Communications Port Connect to Lightmaster	• Configure Nodes • Group Control • LS Settings • Timer Settings • Set Times • Capture Presets • Special Functions	• Relay Outputs • Switch Inputs • Switch Pilots • Timers • Set Times • Presets • Add-on Modules • Special Functions	Output customized system wide programming settings to a text file.
New • Clears all data and Open • Opens a previously saved LightMaster Save • Save settings to Save As • Rename data file and/or save to another location Exit • Quit LightMaster Pro Extended Network	Firmware Revision Time Date Add-on Card Set LM Clock Virtual Keypad Download Settings to LightMaster	Configure Nodes • Define I/O Group Control • Turn Defined Relay Groups ON or OFF LightSync Settings • View LightSync Node Status • Configure LightSync Node Characteristics • Define LightSync Pilot Timer Settings • Configure Timers • Define Timer/Relay Group Control • Define Timer/Preset Control Set Times • Daylight Savings • Astro Clock • Open/Close Times - Normal and Single Date • Off Hours Sweeps • Capture and Set Presets and Get Special Functions • Edit Group, Timer, Preset & LightSync Names • Change Photocell	Relay Outputs • Control Relay(s) • View Relay Status • Configure Relay Options (Blink, Switch Inputs • Local (Hardwired) Inputs: Status, Switch Type Definition, Input/Relay Control, Input/Group Control Switch Pilots • Hardwired Switch Pilot Configuration Timers • Define Timer/Relay Set Times • OFF Hour Sweeps/Relays • Input Active Times Presets • Edit Presets Add-on Module • Used with optional Special Functions • EDIT: - Panel, Relay, Input Names - Relay Drive	

Figure 3.3

Operation	Programming Level
Control a Relay Group or Preset w/ a Timer	Configure timer and timer to group or preset control at the system level. Define the relay group or edit the preset at the node level
Control a Relay w/ a Timer	Configure timer at system level. Define timer to relay control at the node level
Control a Relay with a hardwired switch	Configure the input and input/relay control at the node level
Control a Relay with a Lightsync switch	Configure the Lightsync node at the system level. Program input/relay control at the node level
Control a Relay Group with a hardwired switch	Configure the input, input to relay control, and relay group at the node level
Control a Relay Group with a Lightsync Switch	Configure the Lightsync node and input/group control at the system level. Define the relay group at the node level.
Work w/Presets	Capture and set presets at the system level. Edit presets at the node level
Program Astro Clock	Configure Astro parameters at the system level
Program Open/Close Times	Configure open/close times at the system level
Program Off Hours Group Sweeps	Configure Off hrs. relay group sweeps at system level
Program Off Hours Relay Sweeps	Configure Off hours individual relay sweeps at the node level
Program Lightsync Switch Pilots	Configure Lightsync switch pilots at the system level
Program hardwired switch pilots	Configure hardwired switch pilots at the node level
Program Input Active Times	Configure Input active times at the node level
Program blink alert, override, and alarm times	Configure these parameters at the system level
Program relay option parameters	Configure blink, HID delay, power up state etc. at the node level
Control relay groups ON/OFF from the Master Controller keypad	Perform this operation at the system level.
Control or Sweep Individual relays ON/OFF from the Master controller keypad	Perform this function at the node level
Edit Names of Groups, Presets, Timers & Lightsync Nodes	Configure names of these entities at the system level
Edit Names of Panels, Relays, and Inputs	Configure names of these entities at the node level
Change the Photocell Filter	Configure this operation at the system level
Define the Controller Type (number of I/O Points)	Configure this operation at the system level
View Controller Firmware Revision and gain access to "Hidden Functions" (Cear Memory, COM Monitor, Relay Drive)	Access these features at the node level (from the Keypad ONLY)
View Lightsync Node Status	Perform at the system level
View hardwired inputs, relays	Perform at the node level

Table 3.1 – Quick Reference Programming Level for Major Operations

Momentary ON/OFF: When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON. When momentary contact is made between OFF and COM relay outputs controlled by this input are turned OFF.  MOMENTARY	***Momentary Push- Button:*** When momentary contact is made between ON and COM, relay outputs controlled by this input are turned ON and OFF alternately each time contact is made.  MOMENTARY	***Maintained ON/OFF:*** When contact is made between ON and COM relay outputs controlled by this input are turned ON. When contact is broken between ON and COM, relay outputs controlled by this input are turned OFF.  MAINTAINED	***Maintained Multi-Way:*** When contact is either made or broken between the ON and COM, relay outputs controlled by this input will be toggled between ON and OFF conditions. This function is similar to that of standard 3- and 4-way switches.  MAINTAINED	***Set Preset:*** When momentary contact is made between ON and COM, the selected preset will be activated.  MOMENTARY	***Timed ON/Cleaning Switch:*** When momentary contact is made between COM and ON, relay outputs are turned ON. When contact is broken, a timed ON duration is started from 5-999 minutes. Contact between OFF and COM will turn relays OFF.  MOMENTARY
Two-Step Group: When the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. When the input is activated again, group A turn OFF and group B turn ON. The pattern repeats with successive switch activations.  MOMENTARY	***Four-Step Group:*** The first time the switch is activated, group A (relay outputs) turn ON and group B (relay outputs) turn OFF. The second time the switch is activated, group A turn OFF and group B turn ON. The third time, both groups turn ON. The fourth time, both groups turn OFF. The fifth actuation begins a repeat of the 4 steps.  MOMENTARY	***Input Disable:*** When contact is made between ON and COM, selected input or inputs will be ignored.  MAINTAINED	***Timer Disable:*** While contact is made between ON and COM, selected timer or timers will be ignored.  MAINTAINED	***Network Disable:*** While contact is made between ON and COM, all network commands will be ignored. (Used in special applications only.)  MAINTAINED	***Output Override:*** While contact is made between ON and COM, relay outputs controlled by this input are turned ON, OFF or held in their current state and all other control commands are ignored. **All inputs/timers are ignored for controlled relay outputs.**  MAINTAINED
Photo Sensor Inputs: LightMaster controllers can be connected to either momentary or maintained output photo sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"	***Motion Sensor Inputs:*** LightMaster controllers can be connected to either momentary or maintained output motion sensors as shown below.  MOMENTARY Programmed as "Momentary"  MAINTAINED Programmed as "Maintained ON/OFF input"	***Fire Alarm System Inputs:*** LightMaster controllers can be easily connected to building Fire Alarm Systems to force selected controlled lighting circuits to the ON, OFF or HOLD state and lock out all other forms of control when a Fire Alarm signal is present (contacts CLOSED).  MAINTAINED Programmed as "Output Override input"	***Dry Contact Interface:*** Virtually any control system or device can be interfaced to a LightMaster controller through the use of a simple dry contact interface utilizing any of the available switch types. Please consult factory for any special requirements.	***Force Timer:*** A switch input can be mapped to force a LightMaster Timer activation.  MAINTAINED	***HID Bi-Level:*** Operation of Bi-level HID Ballasts. First contact between COM and ON will turn ON power and High/Low relay. (High/Low relay is locked ON for 15 minutes for warm up period) Additional activations of ON terminal will toggle High/Low relay. Contact between OFF and COM will turn relays OFF.  MOMENTARY

NOTE: Switch Enable-Disable: Inputs may be enabled or disabled based on Time of day

Table 3.2 – LightMaster Switch Input Types

3.7 Relay Output Operations

You can use RELAY OUTPUTS to view the current ON/OFF Status of the relay outputs. You also have the option of switching individual relays, user defined relay groups or all the controller relay outputs ON/OFF. In addition you can define certain relay output parameters (See Tables 3.3, 3.4) and form relay groups.

Table 3.3

TIMERS Choice	Definition
NO BLINK (default)	The relay will not blink prior to an OFF Timer
BLINK	The relay output blinks and postpones the OFF timer for a user defined time (2-99 minutes) The default alert time is 5 minutes. If a switch controlling the relays is turned ON during this time, the OFF Timer is again postponed for a user defined period (5-999 minutes) or until the switch is turned OFF. The default override is 120 minutes.
HID DELAY	Same as BLINK (the OFF timer is postponed) except that there is NO blink warning.
ALARM ON PLS	During the ON pulse period (1-99 seconds programmable) the relay is cycled ON and OFF at 1 second intervals. The relay returns to OFF when complete. Used to alarm or buzzer signal applications
ALARM OFF PLS	During the OFF pulse period (1-99 seconds programmable) the relay is cycled OFF and ON at 1 second intervals. The relay returns to ON when complete . Used in settable blink alert applications.
ALARM ON	Relay will turn ON for a programmed duration (1-99 seconds) and then return to the OFF state. Used for mechanically latching contactor control.
ALARM OFF	Relay will turn OFF for a programmed duration (1-99 seconds) and then return to the ON state. Used with controllable H.V. switches.
Note: *How to change blink alert, override, and alarm pulse times defaults is done by selecting BLINK ALERT/ALARMS from the TIMER SETTINGS menu.*	

Table 3.4

PWR-UP Choices	Definition
NO ACTION (default)	The relay output holds its pre-existing state when power is applied or re-applied to the controller
TURN ON	The relay output switches ON when power is applied or reapplied to the controller.
TURN OFF	The relay output switches OFF when power is applied or reapplied to the controller
ON/IN:1	The relay output switches ON when power is applied or reapplied to the controller if Input 1 is closed at the time of power-up.
OFF/IN:1	The relay output switches OFF when power is applied or reapplied to the controller if Input 1 is closed at the time of power-up.

Type	Physical	Operation
Momentary ON/OFF (default type)	3-wire momentary	Momentary contact between ON and Common turns controlled relay outputs ON. Momentary contact between OFF and Common turns controlled relay outputs OFF.
Momentary Pushbutton	2-wire momentary	Momentary contact between ON and Common turns controlled relays ON and OFF alternately each time contact is made.
Maintained ON/OFF	2-wire maintained	When contact between ON and Common are made, controlled relays turn ON. When contact is broken, controlled relays turn OFF.
Maintained Multi-way	2-wire maintained	When contact is made or broken between ON and Common, the controlled relays will toggle from ON to OFF or OFF to ON; similar to conventional 3-way switching.
Set Preset	2-wire Momentary	When momentary contact between ON and Common is made, the controlled relay outputs will go to their programmed states.
Timed ON	2 or 3 wire momentary	Contact between ON and Common will turn relay outputs on for a programmed time. At the end of this time the controlled relays will turn OFF. Contact between OFF and Common will turn relays OFF.
HID BI-LEVEL	3 wire momentary	The first contact between ON and Common, turns the ON/OFF ballast relay ON and the HIGH/LOW ballast relay HIGH (NC default) or Low (NO default) and locks them in this position for a 15 minute warm up period. Subsequent contact closures between ON and Common toggle between HIGH and LOW. Contact between OFF and COMMON locks both the ON/OFF and HIGH/LOW ballast relays OFF for 15 minutes.
Two-Step Group	2-wire momentary	Upon switch activation, Group A relays turn ON and Group B turn OFF. The following activation causes Group A to turn OFF and Group B to turn ON. The pattern repeats with each switch activation.
Four-Step Group	2-wire momentary	On the first activation, Group A relays turn ON and Group B turn OFF. On the second activation, Group A turns OFF and B turns ON. The third activation causes both A and B to go ON. On the fourth activation, both A and B go OFF. Then the pattern repeats.
Input Disable	2-wire maintained	As long as the switch is closed, other selected inputs are disabled.
Timer Disable	2-wire maintained	As long as the switch is closed, selected timers are disabled.
Network Disable	2 wire maintained	As long as the switch is closed, all network commands are disabled (Used in special applications only.)
Output Override	2-wire maintained	When the switch is closed, selected relay(s) will go to the programmed ON, OFF, or Hold status, other signals are ignored until the switch is open.
FORCE TIMER	2 wire maintained	The switch closure will trigger the selected timer.

Table 3.5 – LightMaster Switch Types

3.8 Complete System Programming

After completing node configuration from the Edit System drop down menu, you may also access Group Control, LightSync Settings, Timer Settings, Set Times, Capture Presets and Special Functions menus.

Group Control (See Figure 3.4)

Use this screen to manage groups of relays, see status, and force ON or OFF.

LightSync Settings (See Figure 3.5)

You must first configure connected (see Section 4) LightSync devices and download in order to check status. Select Configure LightSync Devices, then choose the node address assigned to the device you wish to configure and choose its type (switch, photo-cell, D-6, SIB-4, etc.) You may then choose its characteristics. Repeat for all connected LightSync devices.

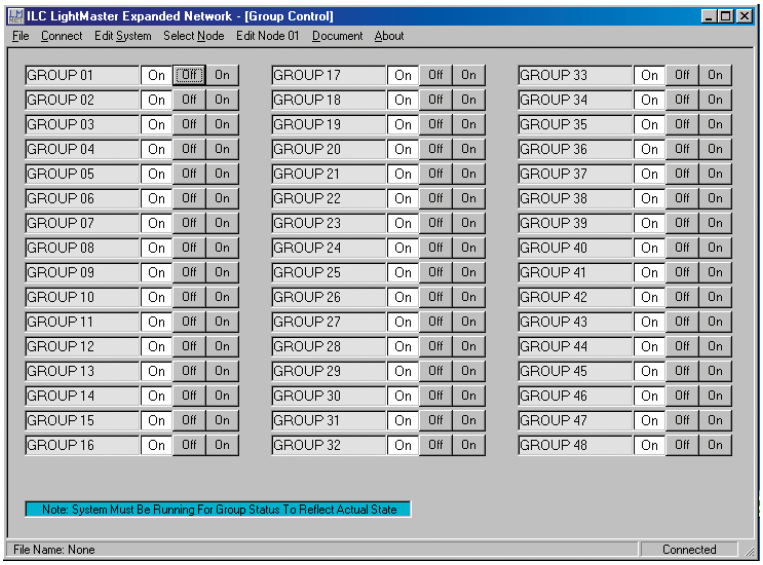


Figure 3.4 – Group Status and Control Screen

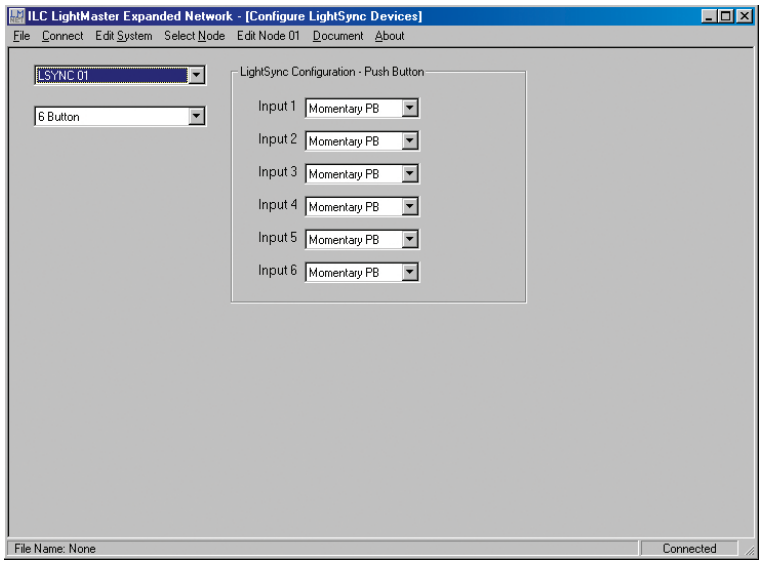


Figure 3.5 – Configure LightSync Devices Screen

3.8 System Programming, continued

Timer Settings (See Figure 3.6)

You may use this menu choice to configure up to 48 individual timers. Set timers based on normal days of the week or holidays, Astro time based on sunrise and sunset or set timers based on store open and close times. You may also set Timer to Group Control, Timer to Preset Control, adjust Blink Alerts, Overrides and Alarm Setting from this menu.

Set Times (See Figure 3.7)

This menu choice allows you to set daylight savings time preferences, astro clock settings, open and close settings (normal days and single dates), and off-hours sweeps (intervals or groups).

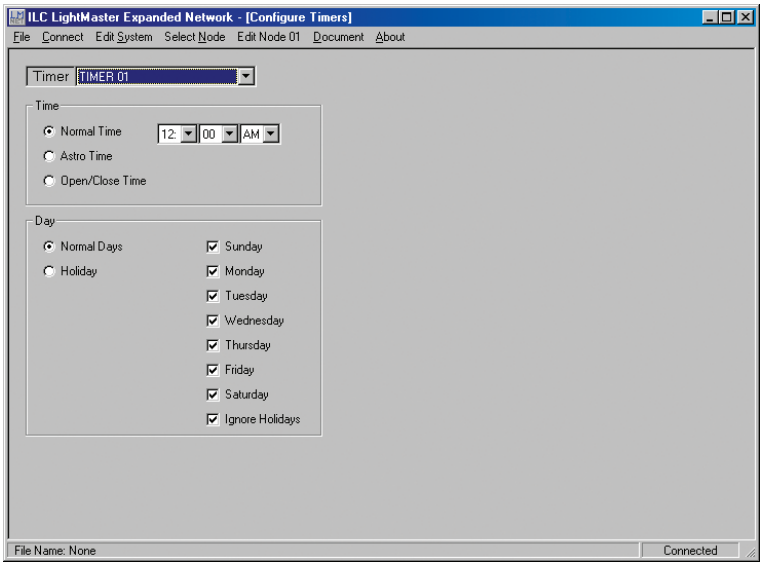


Figure 3.6 – Configure Timers Screen (Timer Settings)

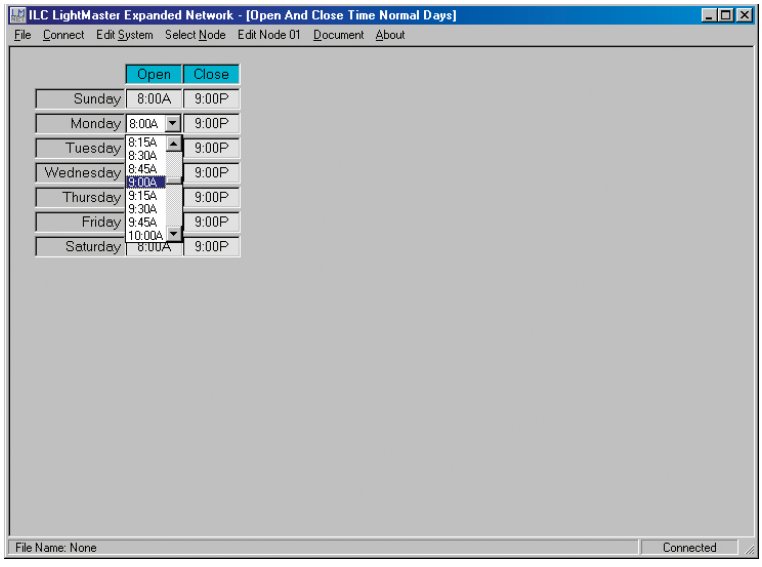


Figure 3.7 – Daily Open and Close Times Screen (Set Times)

3.8 System Programming, continued

Capture Presets (See Figure 3.8)

Use Capture Presets to capture and set any of the previously defined and saved preset relay output patterns (48 possible).

Special Functions (See Figure 3.9)

This menu choice allows custom naming of Groups, Timers, Presets, and LightSync devices. You may also change the Photocell Filter rate from the default 30 second average to a 2 second average.

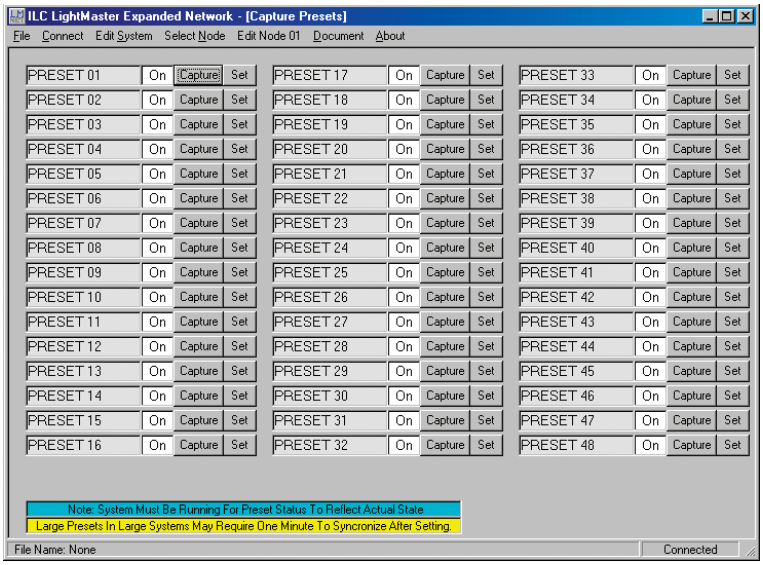


Figure 3.8 – Status and Capture Presets Screen

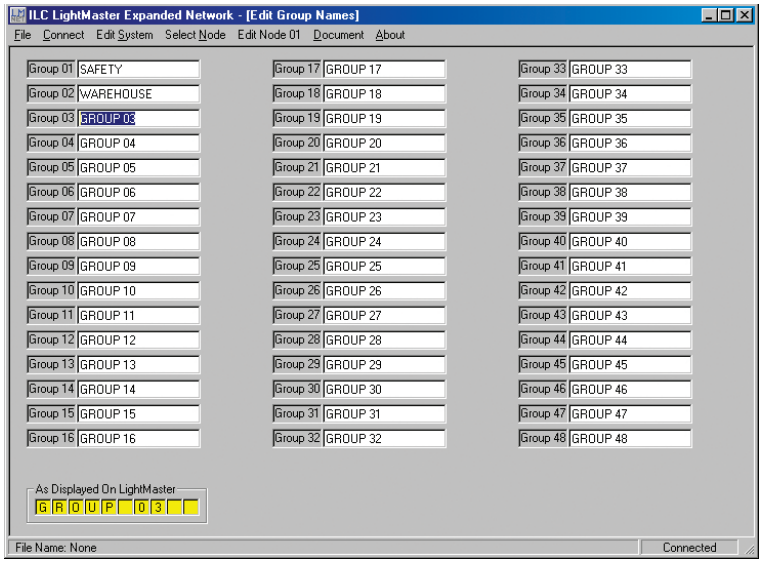


Figure 3.9 – Edit Group Names Screen

3.9 Individual Node Programming

Use Select Node to specify the controller to be programmed, then click on the Edit Node menu to see the drop down choices. From the Edit Node drop down menu, you may program settings for Relay Outputs, Switch Inputs, Switch Pilots, Timers, Set Times, Presets, Add-on Modules, and access Special Functions

Relay Outputs (See Figure 3.10)
Use this option to to check Relay Status, Relay Output Options, or configure Relay Grouping.

Switch Inputs (See Figure 3.11)
This menu allows access to Status, Options, Input to Relay and Input to Group Control for Local Inputs as well as Input to relay Control for Network Inputs, and Input to Relay or Input to Group Control for LightSync Inputs.

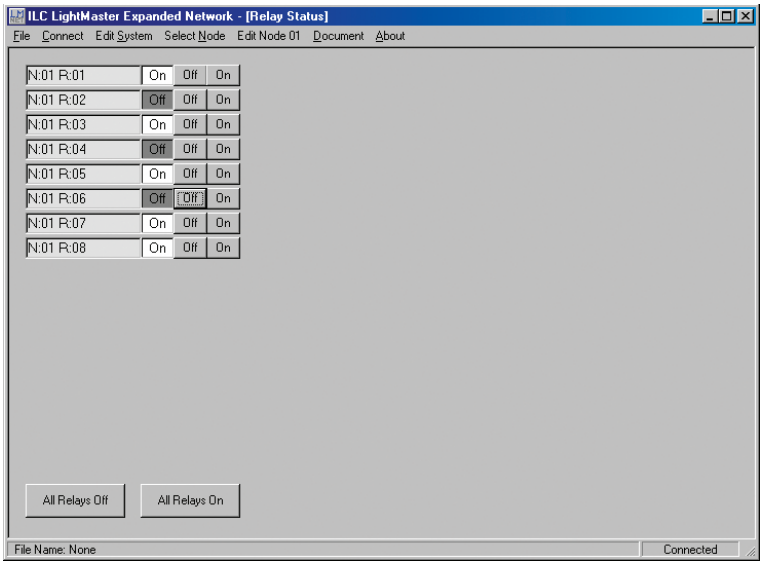


Figure 3.10 – Relay Status Screen

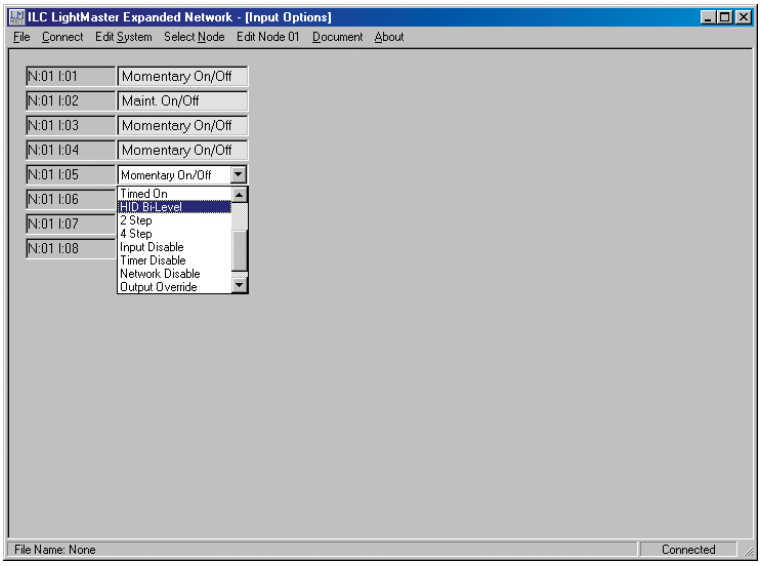


Figure 3.11 – Switch Input Local Options Screen

3.9 Node Programming, continued

Switch Pilots (See Figure 3.12)

This feature allows configuration of Local Input Pilots (LightSync Pilots are configured at the Edit System level under LightSync Settings).

Timers (See Figure 3.13)

Use this to assign or map previously defined Timers to individual relays in a specific controller.

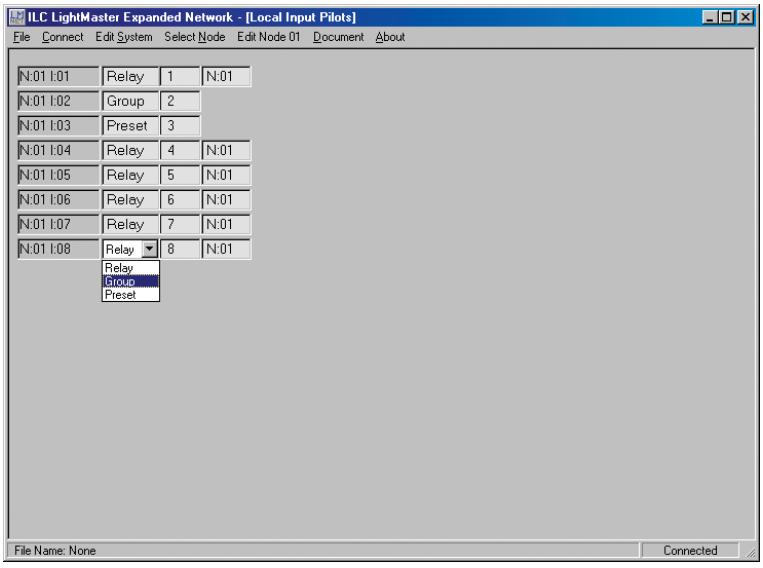


Figure 3.12 – Local Input Pilots Screen

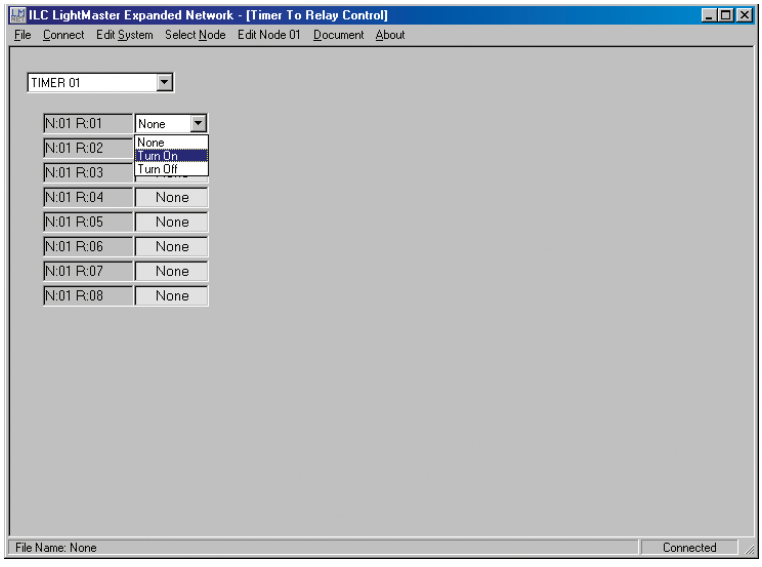


Figure 3.13– Timer to Relay Control Screen

3.9 Node Programming, continued

Set Times (See Figure 3.14)
Configure times for relay control of Off Hours Sweeps, and to Input Active Times for each relay in the affected panel.

Presets (See Figure 3.15)
Allows you to Edit Presets assigned to the relays in the controller.

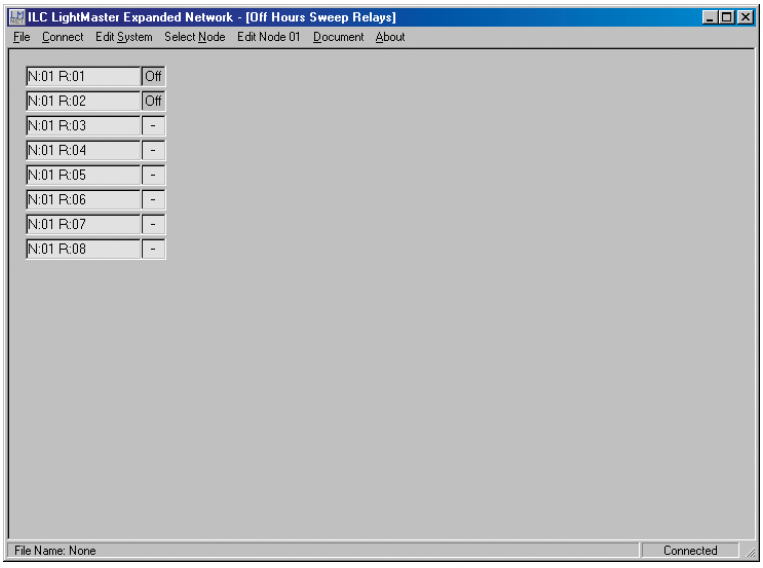


Figure 3.14 – Off Hours Sweep Relay Screen

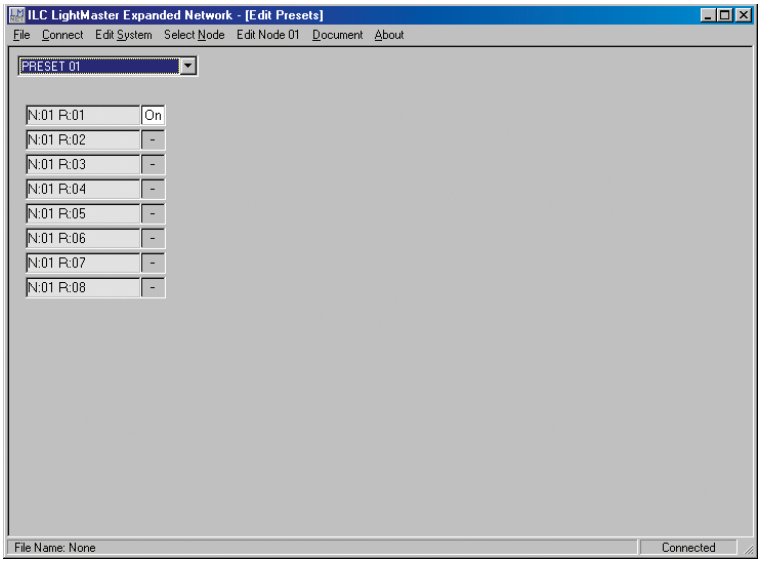


Figure 3.15 – Edit Presets Screen

3.9 Node Programming, continued

Add On Modules (See Figure 3.16)

Use this screen to manage any add-on cards installed in the controller at this node (DMX card shown in this example).

Special Functions (See Figure 3.17)

This menu choice allows node level custom naming of Panel, Relay, and Inputs for this controller. You may also change the Relay Drive rate from the default 17 millisecond average setting to a 50 millisecond, sweep or instant setting.

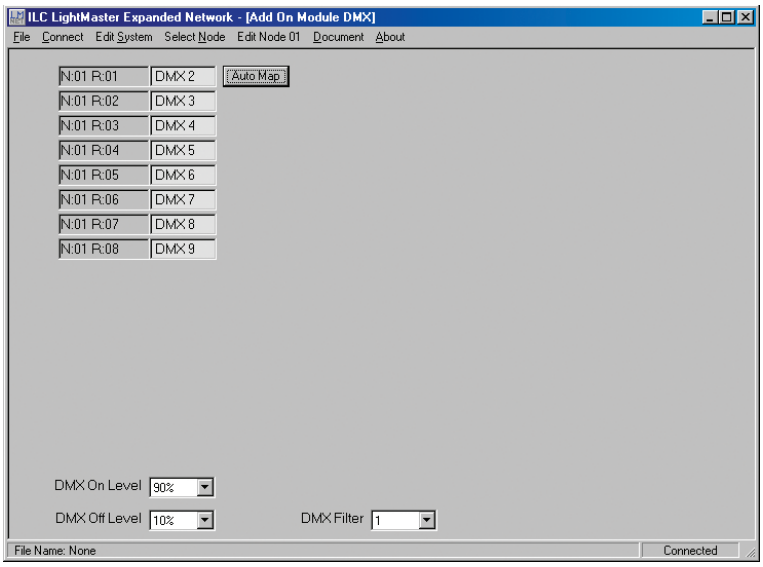


Figure 3.16 – DMX Add On Module Screen

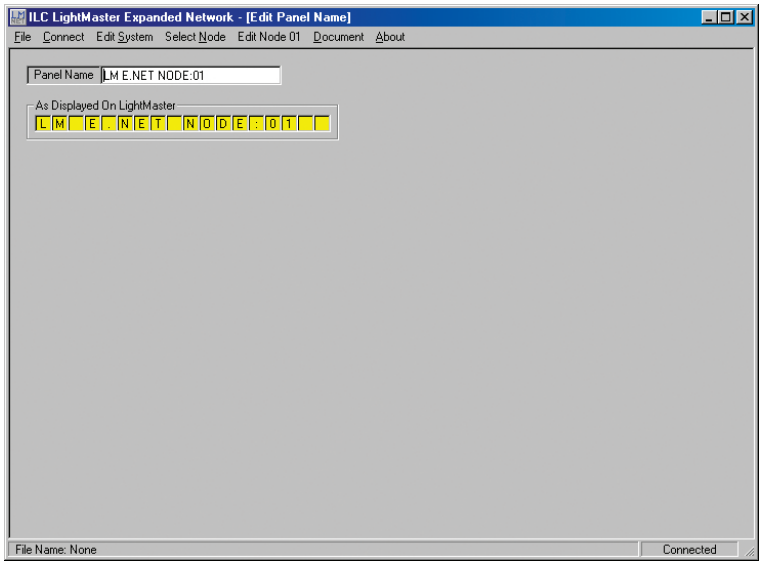


Figure 3.17 – Edit Panel Name Screen

3.10 Programming Examples

Controlling a relay output(s) with a local switch

This operation is programmed at the node level.

Define the switch input and select the relay that you want the switch to control.

1. From the title bar push **Select Node** and click on the node desired to be programmed.
2. From the title bar click on **Edit Node xx** and select **Switch Inputs** then **Local Inputs** then **Input Options**.
3. From here select the switch type being used for each switch.(see Table 3.5)
4. From the Local input menu select Input to relay control.
5. Select the switch input from the pull down menu.
6. Then select the relay(s) to control and change the action line to the desire operation.
7. Do this operation for each input used.

Controlling a relay output(s) with a timer

Defining a normal timer at the system level and programming relay control in a specific node.

1. From the title bar click on **Edit System** then **Timer Settings** than **Configure Timers**.
2. On the timer screen select the timer you want to program.
3. Select **Normal Time** and select the time desired.
4. Under **Normal Days** select the days of the week that this timer will function. Also select **Ignore Holidays** if desired.
5. From the title bar push **Select Node** and click on the node desired to be programmed.
6. From the title bar click on **Edit Node xx** and select **Timers** then **Timer to Relay Control**.
7. From that screen select the timer that you want to program.
8. Than select the relay(s) to control and change the action line to the desired operation.

TIME BASED OPERATIONS OVERVIEW

CONCEPTS AND PARAMETERS

You can program the controller to control a single relay output, a relay group, or a preset according to a time based schedule. (A preset is user defined group of relays programmed to assume a pre-determined ON/OFF pattern when invoked.)

Time based control involves:

1. Defining the timer and any associated parameters.
2. Programming how the timer impacts the selected relay, relay group, or preset.

NOTE: You will need the latitude and longitude for your location in order to define an Astro Timer. A listing of latitudes and longitudes for many major US cities is provided in the Appendix P.

Parameter Key:

TIMER = 1 of up to 48 time based events that impact relays, relay groups, or presets. A NORMAL timer executes its function according to standard AM/PM time. This is the default timer type. An ASTRO timer operates in relation to sunrise or sunset. An OPEN/CLOSE timer is keyed to user entered facility open and close times. (Both ASTRO and OPEN/CLOSE timers can be programmed to occur at exactly sunrise/sunset open/close or offset either before or after these times.) Open/Close Timers can be keyed to different open/close times. For example weekday hours as opposed to weekend hours. An Open/Close timer can also be programmed to execute on a specific date.

RELAY = one of 48 available relay outputs impacted by the timers

RELAY GROUP = one of 48 available user defined groups of relay outputs that respond as a group to a timer

PRESET = one of 48 available user defined ON/OFF relay output patterns activated by a timer.

ACTION = How the timer will impact the relay output, relay group, or preset. The default is NO ACTION (The timer has no effect on the relay, relay group, or preset.) Other possible entries are:

TURN ON (used with relays and relay groups)
TURN OFF (used with relays and relay groups)
ACTIVATE (used with presets)

3.10 Programming Examples, cont.

Controlling a relay output(s) with a LightSync switch

Define how to configure a LightSync switch at the system level and program relay control in a specific node.

1. From the title bar click on **Edit System** than **Configure LightSync Devices**.
2. From that screen select the device node number and the device type. (This number is set with rotary switches on the devices.)
3. Select the **Input Type** for the device.
4. From the title bar push **Select Node** and click on the node desired to be programmed.
5. From the title bar click on **Edit Node xx** and select **Switch Inputs** then **LightSync Inputs** then **LightSync to Relay Control**.
6. Select the device from that screen
7. Select the **Switch Input** from the pull down menu.
8. Then select the relay(s) to control and change the action line to the desire operation.

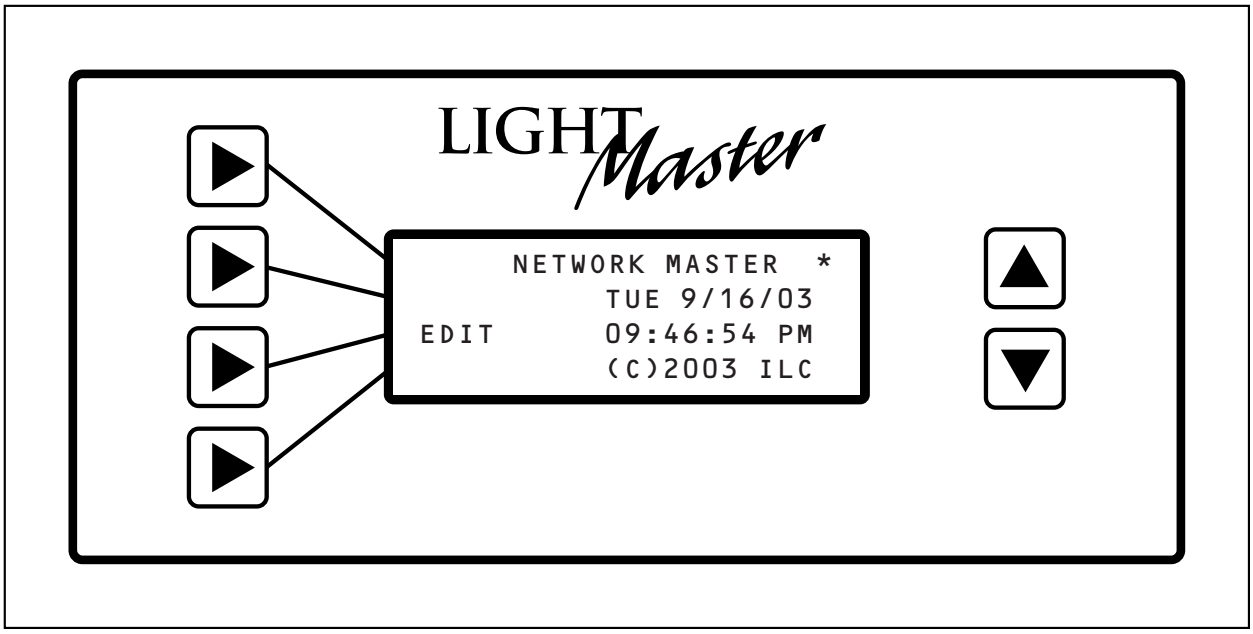
Controlling relay groups with a local switch input.

Define how to add relays into a group and program a local switch input to control them.

1. From the title bar push **Select Node** and click to select the node to be programmed.
2. From the title bar click on **Edit Node xx** and select **Relay Outputs** than **Relay Grouping**.
3. Select the desired group.
4. Select the relay(s) to be added to the group and click on "no" to change to yes.
5. Do this to each relay to be included in the group. This must be done in each node.
6. From the title bar click on **Edit Node xx** and select **Switch Inputs** then **Local Inputs** then **Input to Group Control**.
7. From this screen select the input that will control the group.
8. Then select the group that that switch will control and change the action to the desired operation.

Section 4

LightSync™ Device Switching



Section 4 LightSync Device Switching

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4.1 Installation 4-4
4.2 Verifying Communications 4-5
4.3 Solving Problems 4-5

IMPORTANT
Please read before installing LightSync™ devices

There are cable distance limitations for both data and power that need to be addressed for proper LightSync CAT-5 data line operation.

For the system to operate correctly, it is critical that the data line cumulative distance restrictions are observed.

Additional ILC power or data repeating devices may be necessary for proper system operation, based on the actual number and distance of LightSync devices to be installed on the CAT-5 data line.

Please review the LightSync Cable Run Distance Detail technical bulletin (TB-1408) on the next page for details. Contact ILC Technical Support at (800) 922-8004 for further assistance.

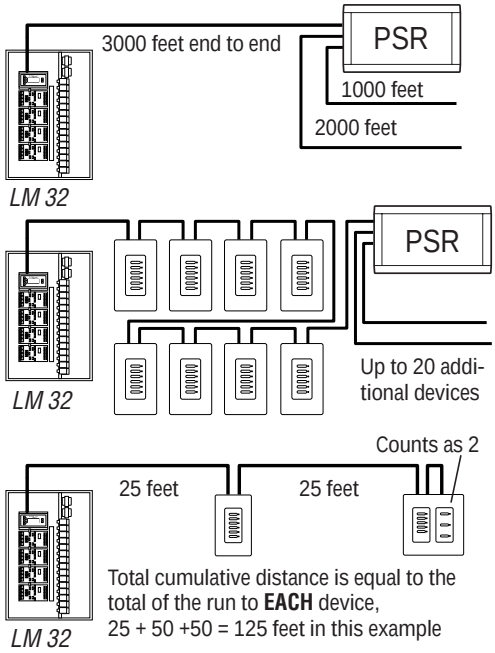
Also refer to the installation instructions enclosed with the specific LightSync device being installed.

LightSync™ Network Cable Run Distance Detail

Devices that operate on ILC's LightSync CAT-5 data line include LightSync switches, photocells, and interfaces like the LightSync D-6 and SIB-4. A standard 24 gauge CAT-5 cable is used for the data line and provides both data and power to these devices. There are limitations to the distance data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. These limitations are addressed by the addition of a Power Supply Repeater, Power Supply or LightSync Hub (see chart), depending on the application. The specific use of these devices depends on the project layout.

There are four main areas of limitation to be addressed:

1. **Total Data Line Overall Distance:** The total data line end to end distance may not exceed 3000 feet without the addition of a PSR to the data line. Only a PSR will extend the data line.
2. **Total number devices (Lightmaster panels and LightSync devices):** Total number of devices without a PSR is 32. A PSR will add 31 more devices (PSRs are counted as a device).
3. **Total number of LightSync devices powered:** No Lightmaster controller panel can power more than eight (8) LightSync devices on the data line without a PS, PSR or LightSync Hub (each can power up to 20 additional LightSync devices).
4. **Total Power Cumulative Distance:** The cumulative distance from each device to its power supply may not exceed 2000 feet if powered by a Lightmaster panel, or 3000 feet if powered by a PS, PSR or LightSync Hub.



ILC Power and Data Repeating Device	Total Data (end to end) Distance	No. of LightSync Devices Powered	Cumulative Power Distance
LightMaster Panel	3000 feet	8	2000 feet
Power Suppy (PS)	N/A	20	3000 feet
Power Supply Repeater (PSR)	3000 feet (combined)	20	3000 feet
LightSync Hub (HUB)	1500 feet per port	20 total	1500 feet per port

ILC Power and Data Repeating Devices Overview

A **Power Supply Repeater** (PSR) is both a power supply and data repeater and its primary purpose is to repeat data and provide a bridge to another data line capable of 3000 feet end to end. This device also has one incoming and two outgoing RJ45 ports to split the line into two different directions. The PSR also adds power to LightSync devices for an additional 3000 cumulative feet.

A **Power Supply** (PS) provides additional power as needed to the LightSync data line. This is the most efficient option to compensate for voltage drop from multiple LightSync devices on the data line. Note that a PS provides power only and does not repeat data.

A **LightSync Hub** (HUB) is a device that allows a home run configuration by providing RJ45 ports for up to 20 LightSync devices, supplying power and data up to 1500 feet.

CAT-5 Data Cable and Class 2 Switch Wiring Installation Guidelines

- Observe all ILC Data Cable Requirements and LightSync Cable Run Distance requirements as they pertain to your project in laying out the cable runs.
- Maintain the twists of the pairs all the way to the point of termination, or no more than 1" untwisted.
- Make gradual bends of the cable, where necessary. No sharper than a 1" radius.
- Dress the cables neatly with cable ties. Use low to moderate pressure.
- Use low to moderate force when pulling cable.
- Use cable pulling lubricant for cable runs that may otherwise require great force to install.
- Keep cables away from potential sources of EMI (electrical cables, transformers, light fixtures, etc.).
- Install proper cable supports, spaced no more than 5 feet apart.
- Always label every termination point. Use a unique number for each cable segment. This will make moves, adds, changes and troubleshooting as simple as possible. Document these onto a riser.
- Always test every installed segment with a CAT-5 cable tester.
- Always leave extra slack in the cable run, neatly coiled up in the ceiling or nearest concealed place.
- Always use grommets to protect the cable when passing through metal studs or anything that can possibly cause damage to them.
- Always follow all local and national building and fire codes. Be sure to "firestop" all cables that penetrate a firewall. Use plenum rated cable where it is mandated.
- Do not pull ANY data cable or switch wires with high voltage wires.
- Keep all low voltage totally separate from ALL high voltage. Failure to do so will void the ILC warranty.
- Always contact ILC on installations between buildings or cable pulled underground. Special considerations may be needed.

4.0 Overview

This section covers installation and programming procedures required to implement LightSync switching. You should be equipped with the following tools (available from ILC):
CAT-5 Terminal Crimping Tool –
ILC Part No. (1 ea): 93000801
LanRover CAT-5 Tester –
ILC Part No. (1 ea): 93000802

System Overview/Guidelines

You can control relay outputs and monitor switch and switch pilot status over the LightSync network. Most switch functions available via hard-wired connection to the switch inputs are also available for LightSync switching (see Section 3). The LightMaster Extended Network Manager supports up to 254 LightSync switch nodes. ***Note:*** *These addresses are a separate set of addresses from the 128 Lightmaster Controller node addresses.*

The communications media is an 8 wire 24 gauge CAT-5 cable terminated at the Network Manager's LightSync Scanner card and routed to a LightSync Power Supply (PS) or Power Supply Repeater (PSR), then out to the LightSync device CAT-5 cable run. Run the CAT-5 cable between LightSync devices installed throughout the facility. (See Figure 4.2). There are limitations to the distance data can travel over CAT-5 cable without loss, and distance limitations due to voltage drop associated with cable length and number of devices on the LightSync data line. (See Page 4-1 for detail). The devices are equipped with two RJ45 connectors. Each switch must have a unique node address (01-FE). (See Figure 4-3a). NOTE: LightSync switch node addresses are pre set at the factory. Be sure to document switch locations at installation.

LightSync devices are available in either momentary push button, maintained, or key switch configurations. Switches are available with up to 6 push buttons mounted on a single gang plate. Key switch nodes are limited to one per gang. In addition to the switches, a LightSync photocell node (Figure 4.3b), a 4-input switch station (SIB-4) (Figure 4.3c), and a 6-Input/Output module (D-6) (Figure 4.3d) are also available. Depending on the installation, one or more Power Supply (PS), Power Supply Repeater (PSR) or LightSync Hub (each will power up to 20 additional LightSync devices) may be required. (See ILC Power and Data Repeating Devices Overview on preceding page). PSRs are also required if the installation layout requires a "T" connections (one incoming and two outgoing lines). See Figure 4.2.

4.1 Installation

1. Check the electrical prints and other job documentation to determine the most efficient way to route the CAT-5 cable as well as the number and location of any required Power Supplies or Power Supply Repeaters. Be certain to observe cable distance limitations and wiring guidelines set forth in the LightSync Cable Run Distance Detail and CAT-5 Wiring Guidelines on pages 4-1 and 4-2 in this section.
2. Always check all CAT-5 cables between each device. Refer to Figure 3 to ensure correct connector pinouts. Use a CAT-5 cable tester to verify the connections are free from shorts, opens, and that the needed twisted pairs are together.
3. Verify that each LightSync device on the network has a unique node address. (Your device is pre-addressed at the factory: in the event another address is required, see Figure 1 to set a unique node address.) Note address on switch label.

Note: The controller and device node address are separate sets. Therefore it is possible for example to have controller node 03 and a device node 03.

4. Run the cable between the all of the LightSync node locations. Plug the RJ-45 connector to the IN port on the back of the switch or other LightSync device. If you are connecting multiple LightSync devices, run cable from the OUT port to the next device. Verify that all Power Supply or Power Supply Repeaters are powered up and connected to the data line.

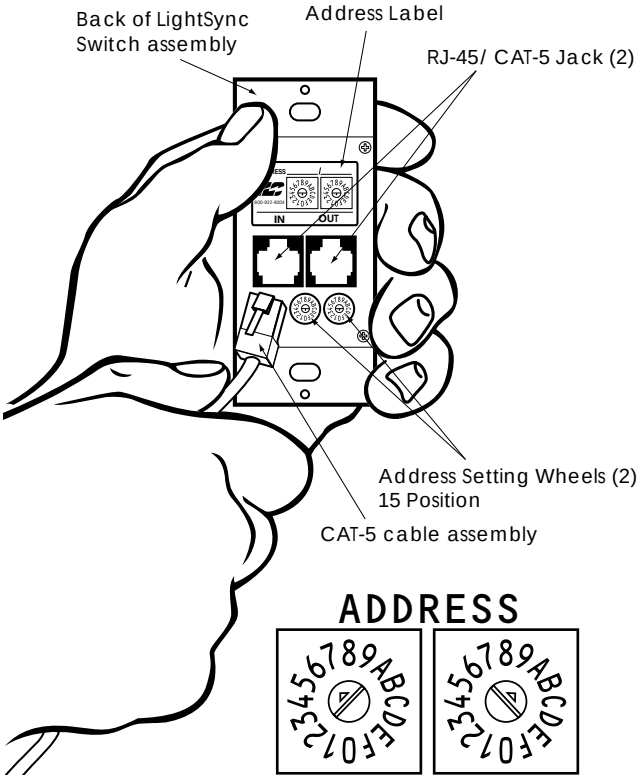


Figure 2

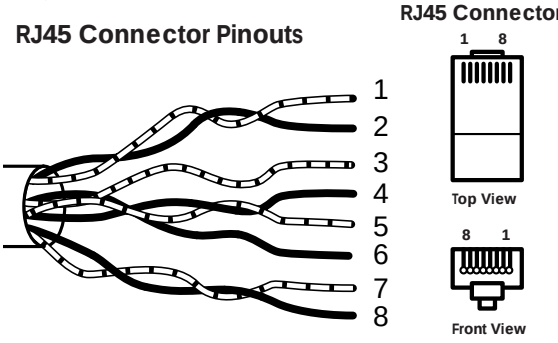
Connect LightSync device to CAT-5 network

Figure 1

Addressing Switches (Address 6A shown as an example) A sticker is provided to note node address.

Figure 3

RJ45 Connector Pinouts



Pin	Color	Pin	Color
1	White /Orange	5	White / Blue
2	Orange	6	Green
3	White / Green	7	White / Brown
4	Blue	8	Brown

4.2 Verifying Communications and Operations

1. Launch LightMaster ENET Extended Network software and go to CONFIGURE LIGHTSYNC DEVICES under EDIT SYSTEM. Define LightSync devices (type, number of buttons, etc.). Download settings when completed. After setting up the devices, click on LIGHTSYNC STATUS under the EDIT SYSTEM menu.
2. Select the node address of the device.
3. Verify the LightSync device status. It should show the device is connected. No response indicated the device is not communicating. See the installation section on the previous page.
4. Have someone at the switch location push and release each button. The status will show a closure if the device is working properly.

4.3 Solving Problems

1. LightSync switches that have LEDs flashing on and off indicated a low power situation on the data line. Disconnect devices from the end of the problem line until flashing stops and LEDs burn steady. Place a Power Supply (PS) or Power Supply Repeater (PSR) ahead of the problem to add power to the data line. Reconnect devices to the output of the PS or PSR and retest.
2. A switch can be placed directly after the Power Supply Repeater out of the Network Manager with a known good patch cable to verify switch integrity.

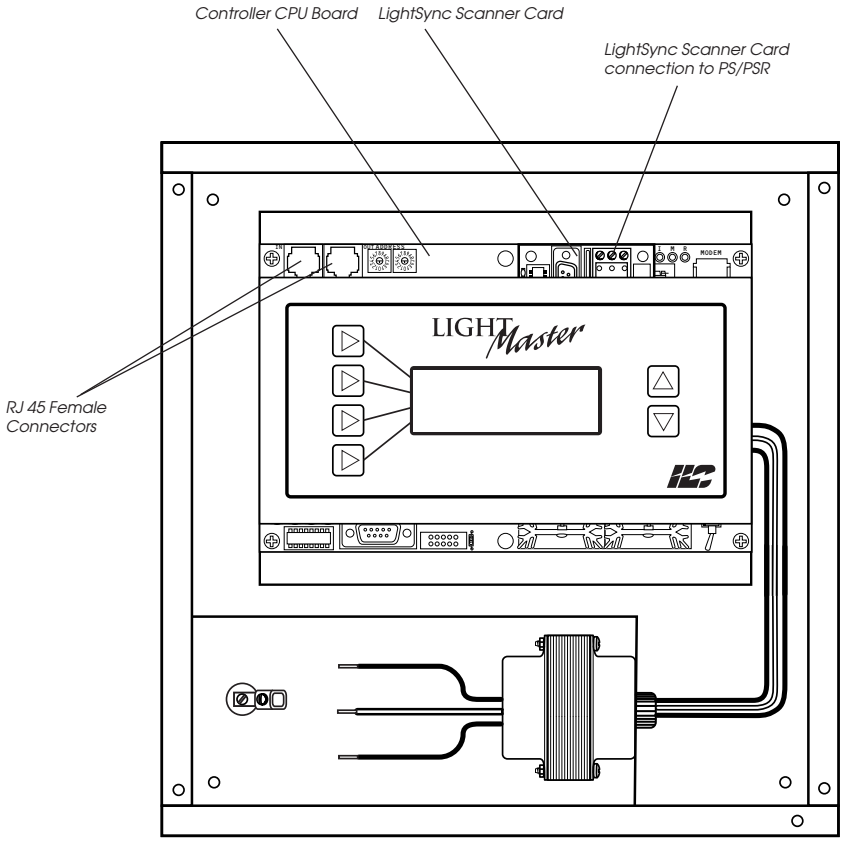


Figure 4.1 – CPU Board LightSync Connection Detail

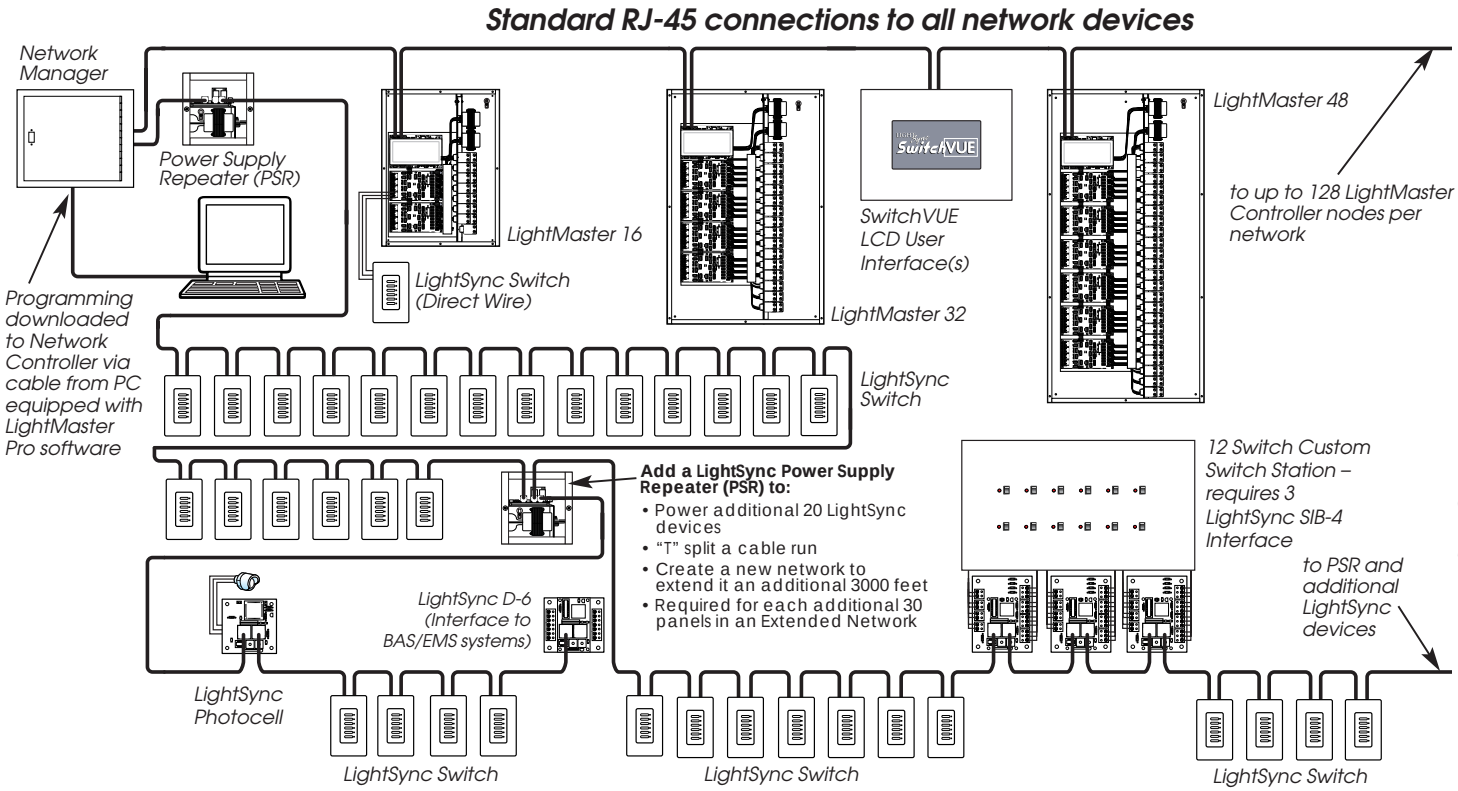


Figure 4.2 – Sample Extended Network LightSync Switching Layout

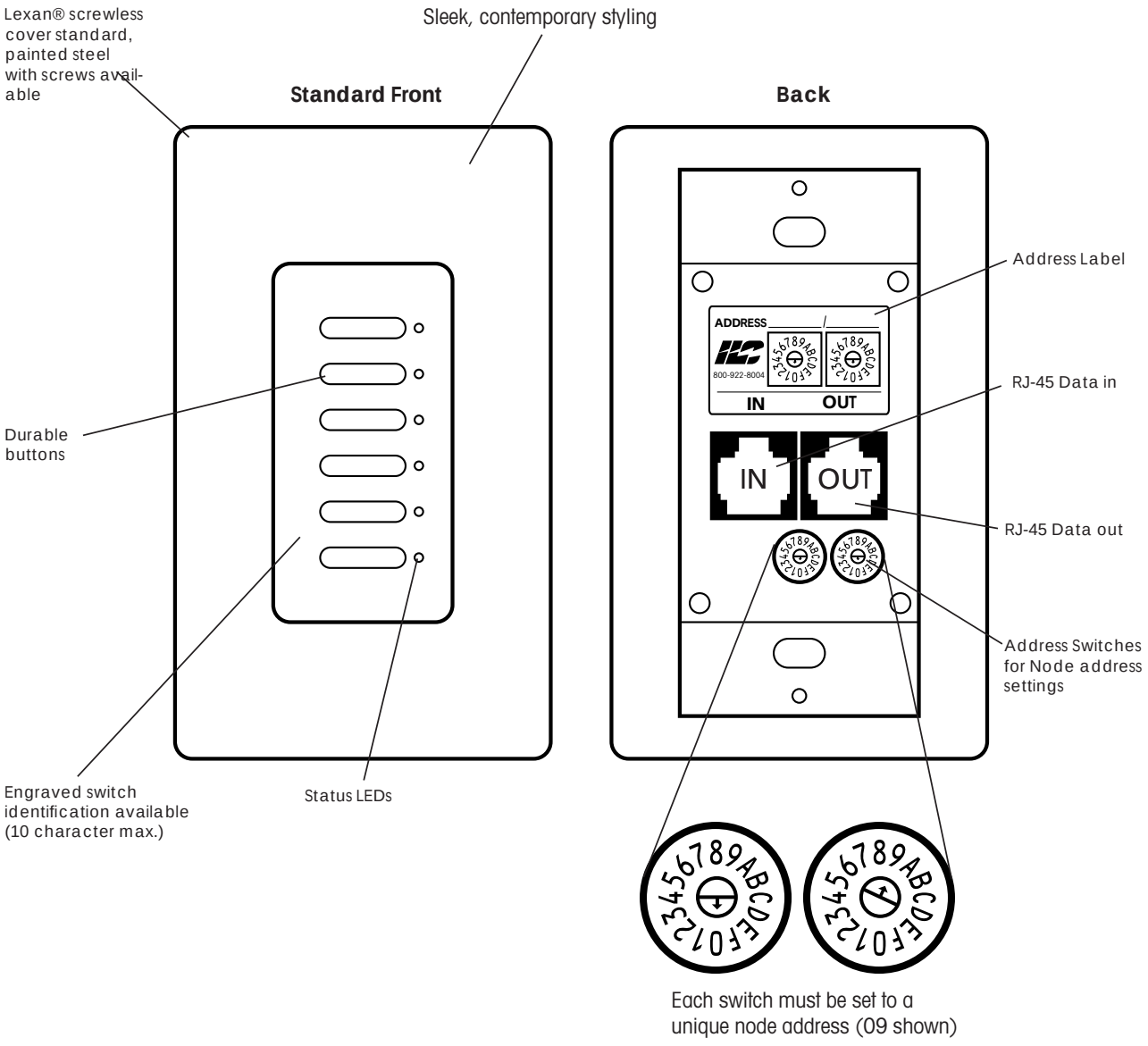


Figure 4.3a – LightSync Switch Detail

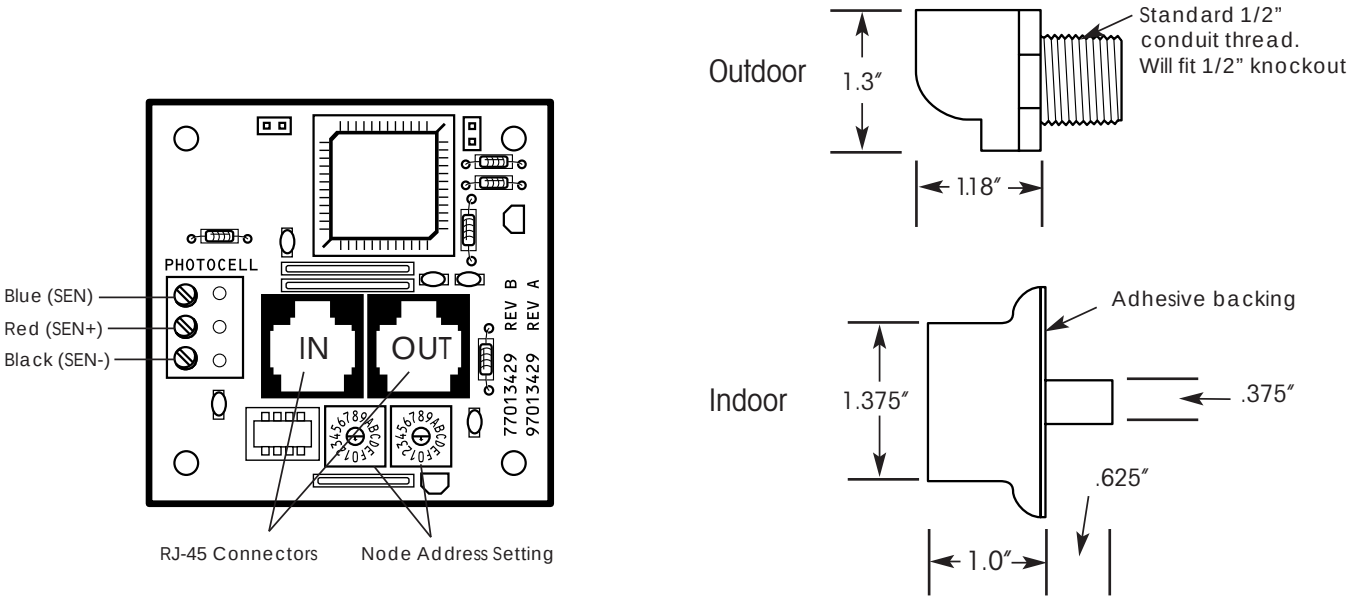


Figure 4.3b– LightSync Photocell Controller and Heads Detail

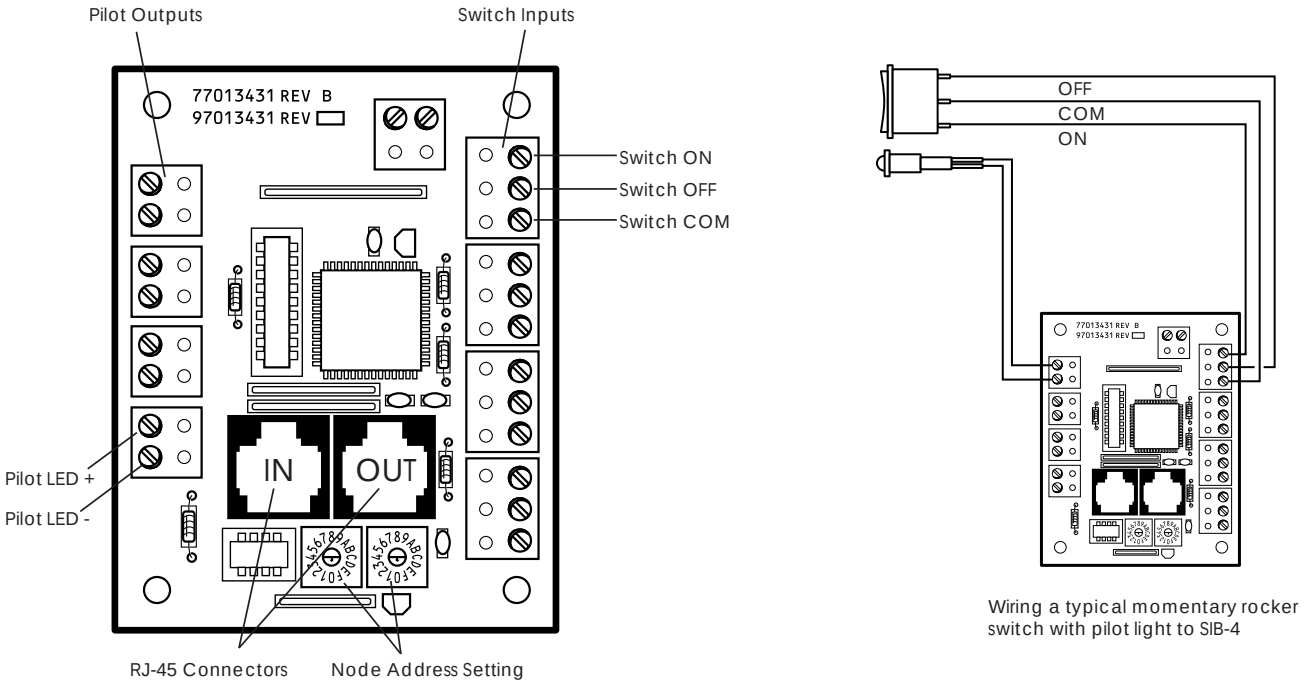
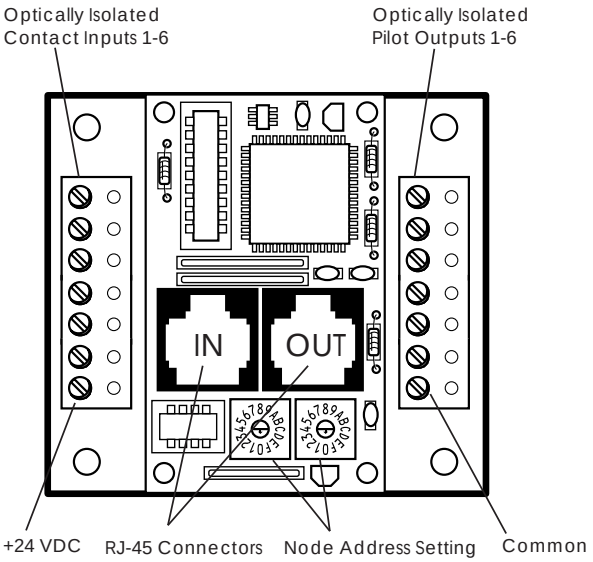
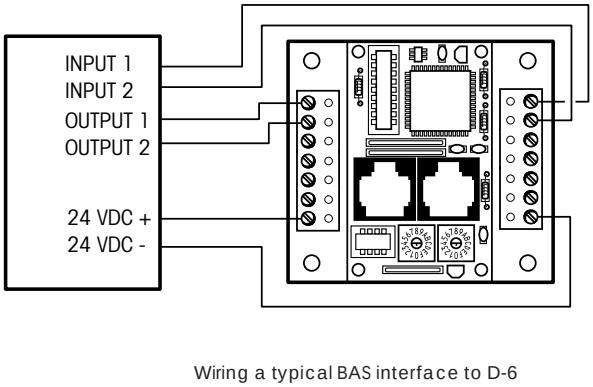


Figure 4.3c – LightSync SIB-4 Switch Interface





Wiring a typical BAS interface to D-6

Figure 4.3d – LightSync D-6 Network Contact Interface

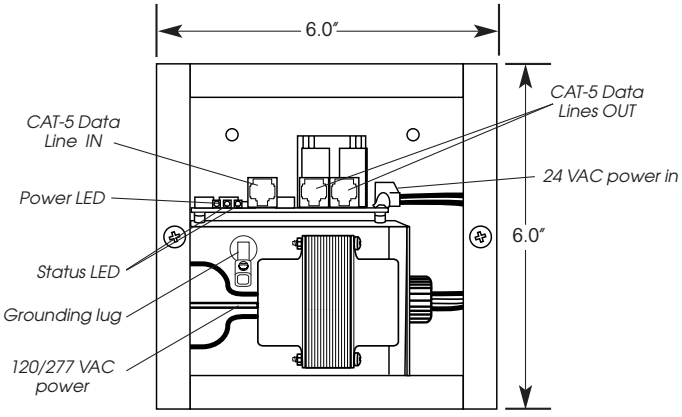


Figure 4.4 – LightSync Power Supply Repeater (PSR) Detail

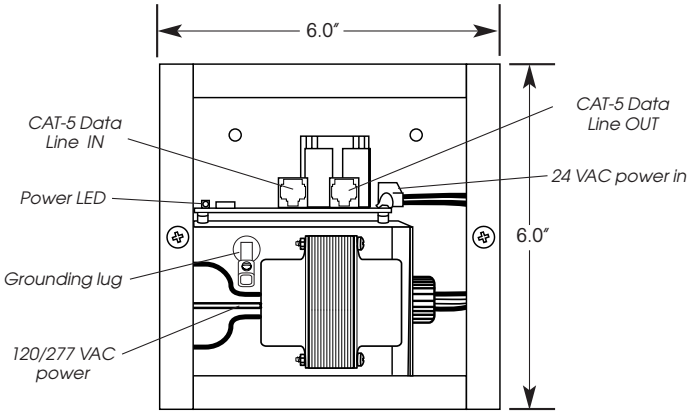
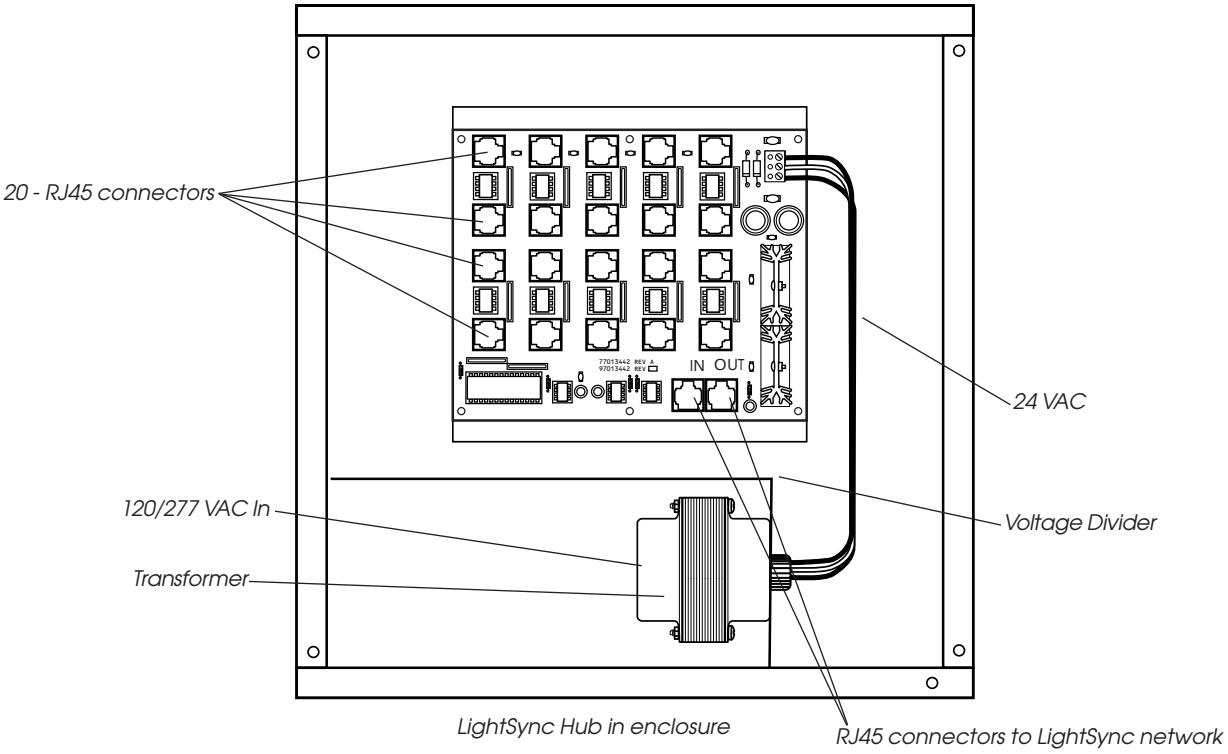


Figure 4.4a – LightSync Power Supply (PS) Detail



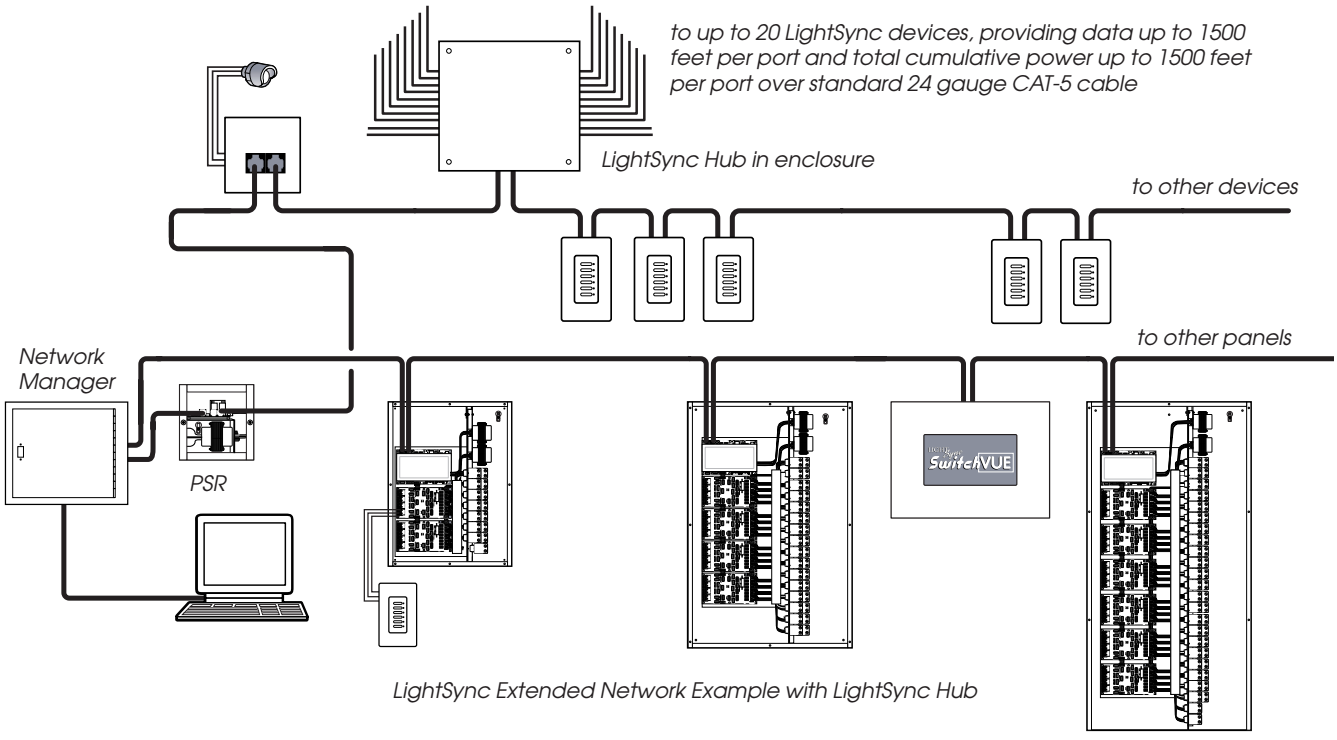
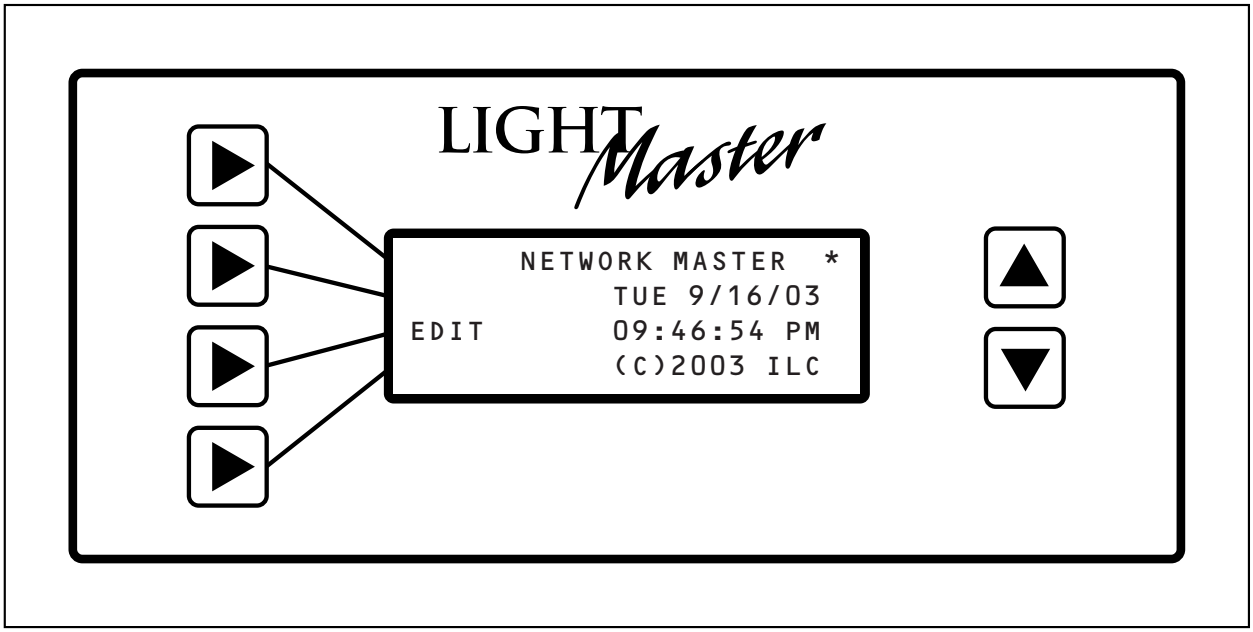


Figure 1.9 – LightSync Hub Option

Section 5
Appendix



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The FCC requires that the following statement be included in this manual.
FCC Registration #6TP USA-35522-DM-N
Ringer Equivalence 0.4B

Connecting to the telephone company

This equipment complies with Part 68 of the FCC rules. On the back plate near the RJ 11 jack of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence (REN) for this equipment. If requested, provide this information to your telephone company.

The REN is useful to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in devices not ringing in response to an incoming call. In most, but not all areas, the sum of RENs of all devices should not exceed five (5). To be certain of the number of devices that may be connected to a line, as determined by the total RENs, contact the local telephone company.

If your telephone equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC if you believe it is necessary.

Your telephone company may make changes in your facilities, equipment, operations, or procedures that could affect he operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with this telephone equipment, please contact: Intelligent Lighting Controls, Inc./Reliant Relay Co., Technical Support Department at 1-800-922-8004 for repair and warranty information. If your equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

This equipment may not be used on public coin service provided by the telephone company. Connection to party lines is subject to state tariffs. (Contact your local state public utility commission or corporation commission for information.)

NOTICE: The Industry Canada label identifies certain equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local t elecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line of individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designed by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

A.1 Overview

Panel Level Connection: The DTMF Add-On Module is an one line optional board that easily plugs in the expansion port provided on the LightMaster controller CPU board. The module supports dual-tone multi-frequency (DTMF) touchtone telephone control allowing panel level relay control, or to check input status in that panel. (See Figures A.1 and A.3.)

Single to Four Line Gateway Connection: The LightMaster 4-line DTMF Gateway module can easily be added to any LightSync data line network application to provide multi-line Voice Prompted DTMF touch-tone telephone control and monitoring. (See Figure A.2)

Both devices support the use of the DTMF control signals allowing the user to command relays, groups of relays, or activate preset scenes from the convenience of any touch-tone telephone, including cellular phones. Clear voice prompts are built in to make navigating command menus easy and straightforward.

A.2 Voice/DTMF Control Features

This Add-On Modules support the following touchtone telephone control features:

- Get the current status of the controller's relay outputs (panel level only)
- Turn ON or OFF single relays, groups of relays or presets
- Get the current status of the controller's switch inputs (panel level only)

DTMF commands and control functions are supported by voice prompts that guide you through operational commands and give you instructions on how to use the system.

A.3 Panel LevelVoice/DTMF Control Setup

1. If you are field-installing the module, power-down the controller and plug the module into the expansion port on the controller CPU board. (See Figure A.3.)
2. Connect a phone cord to the module's RJ11 jack and connect the other end to the telephone outlet. **The telephone line must be an analog line and have its own phone number. The line must be direct and not switched through a PBX or any type of extension system.**
3. Dial the telephone number of the controller.
4. When the controller answers, follow the voice prompts that will guide you through the operations you can perform. See A.4 for prompts and codes.

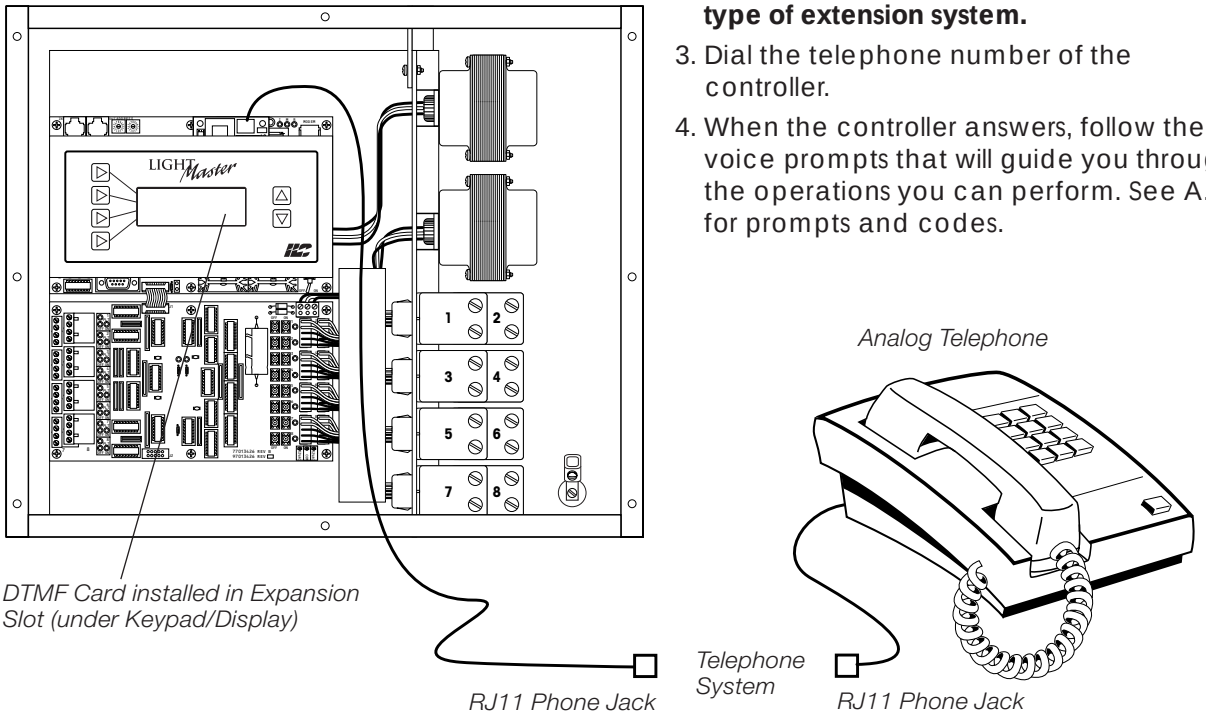
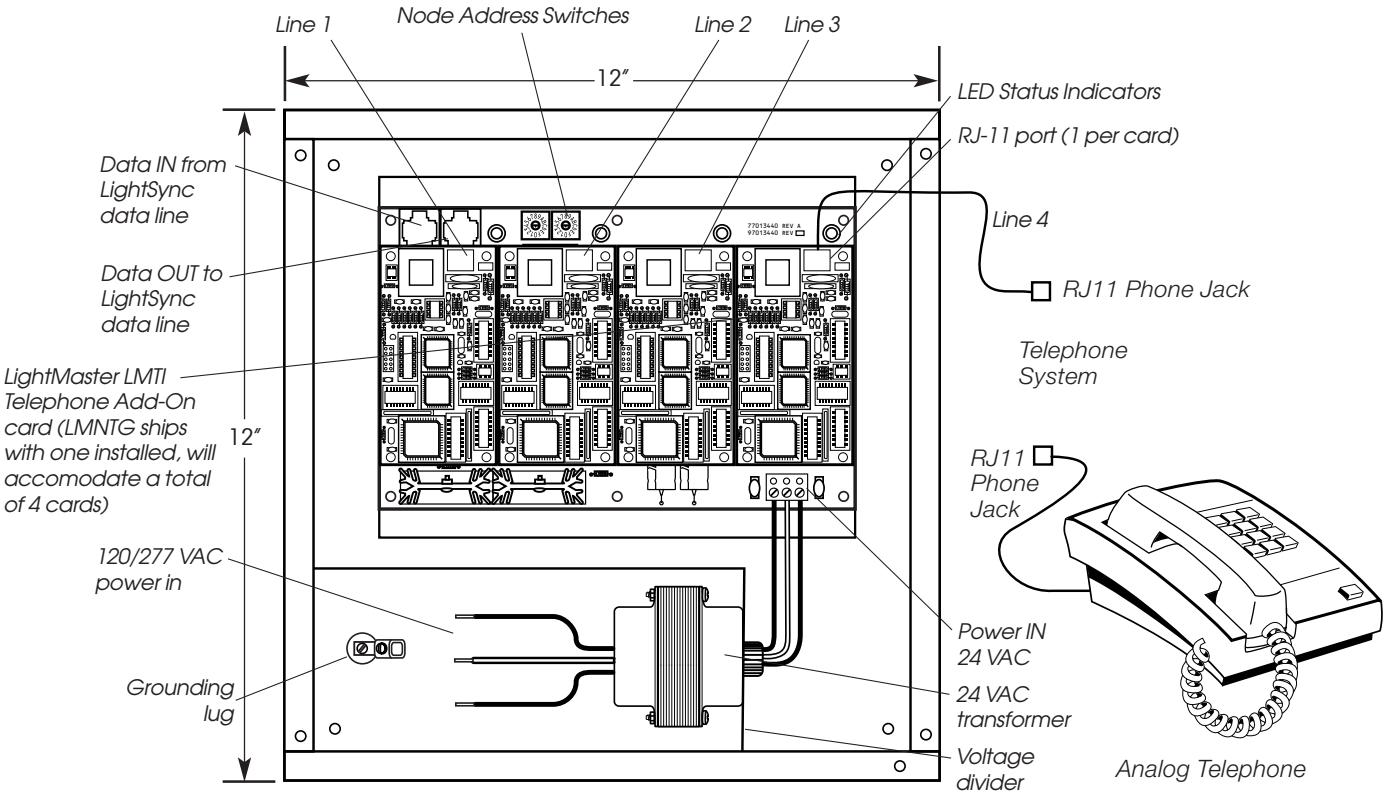


Figure A.1 – Panel Level DTMF Phone Control



LightMaster 4-line DTMF Gateway (shown in NEMA-type enclosure with transformer)

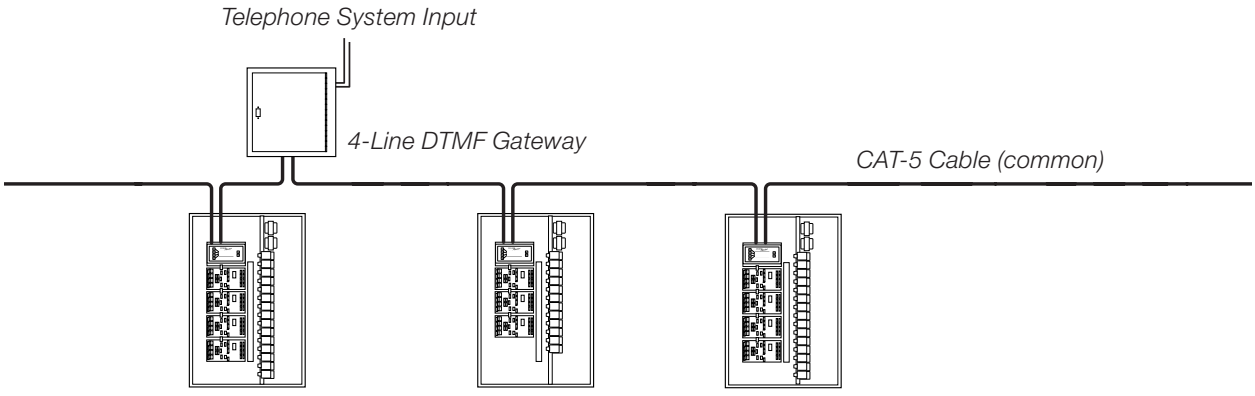


Figure A.2 – 4-Line DTMF Gateway Connection to LightMaster network

A.4.1 Panel Level Control Codes

Use the telephone keypad to enter the following control codes:

- Relay Codes (2 digits)
  The digits designate which relay in that panel (01-48)
- Preset codes (2 digit)
  01-48
  Sample: Enter code 31 to set Preset 31
- Group codes (2 digit)
  01-48
  Sample: Enter code 22: you will be prompted to push 1 to turn ON Group 22 or push 2 to turn OFF group 22

A.4.2 Gateway Level Control Codes

Due to the potential for very large numbers of relays controlled in an extended network, a code is needed for specific relays. This code consists of 4 digits. The formula for this code is: (Node # x 48)+ relay number. NOTE: The Node # must be converted to decimal first. (See conversion chart).
Sample: Node 1C (decimal 28), Relay 17 is code (28 x 48) + 17 = 1361

Hexadecimal Conversion Chart

No.	Hex	No.	Hex	No.	Hex	No.	Hex
0	00	32	20	65	41	97	61
1	01	34	22	66	42	98	62
2	02	35	23	67	43	99	63
3	03	36	24	68	44	100	64
4	04	37	25	69	45	101	65
5	05	38	26	70	46	102	66
6	06	39	27	71	47	103	67
7	07	40	28	72	48	104	68
8	08	41	29	73	49	105	69
9	09	42	2A	74	4A	106	6A
10	0A	43	2B	75	4B	107	6B
11	0B	44	2C	76	4C	108	6C
12	0C	45	2D	77	4D	109	6D
13	0D	46	2E	78	4E	110	6E
14	0E	47	2F	79	4F	111	6F
15	0F	48	30	80	50	112	70
16	10	49	31	81	51	113	71
17	11	50	32	82	52	114	72
18	12	51	33	83	53	115	73
19	13	52	34	84	54	116	74
20	14	53	35	85	55	117	75
21	15	54	36	86	56	118	76
22	16	55	37	87	57	119	77
23	17	56	38	88	58	120	78
24	18	57	39	89	59	121	79
25	19	58	3A	90	5A	122	7A
26	1A	59	3B	91	5B	123	7B
27	1B	60	3C	92	5C	124	7C
28	1C	61	3D	93	5D	125	7D
29	1D	62	3E	94	5E	126	7E
30	1E	63	3F	95	5F	127	7F
31	1F	64	40	96	60	128	80

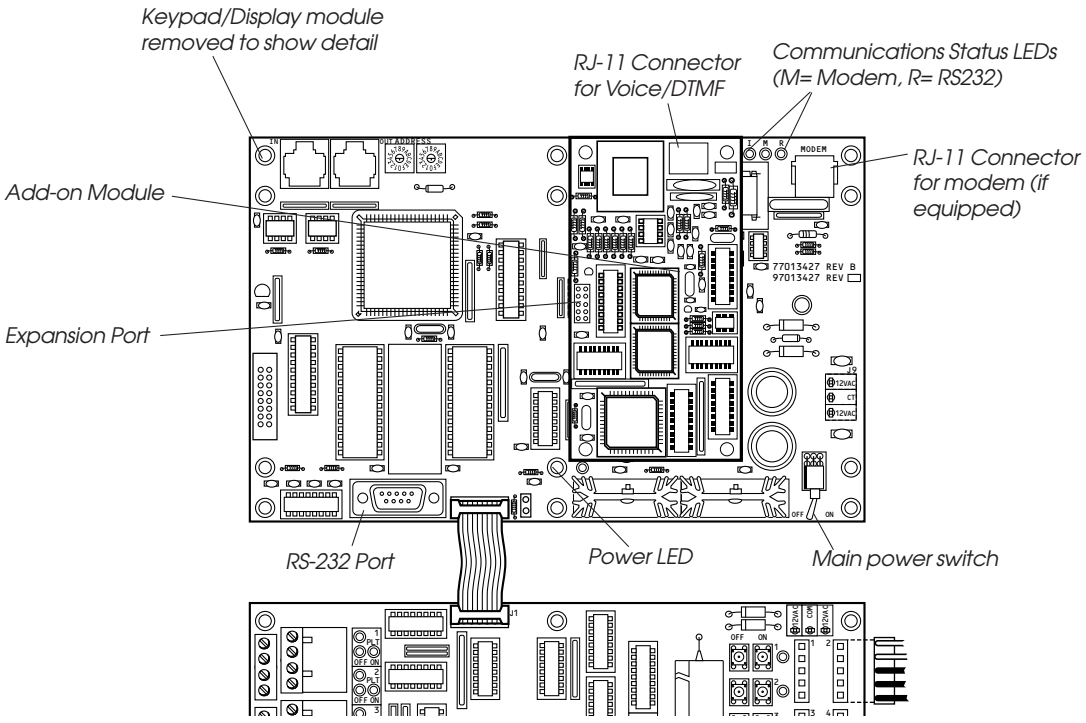


Figure A.3 – Voice/DTMF Module Installation (panel level)

E.1 Overview

- With the addition of a DMX 512 interface card, the LightMaster controller supports the control of non-dimmed loads via standard USITT DMX 512 communications protocol.

- The physical link is a standard USITT DMX 512 control cable (18 gauge, shielded twisted pair) that runs from the DMX output of the theatrical lighting controller to the LightMaster DMX communications port. The DMX 512 interface mounts on the LightMaster CPU board. (See Figure D-1.)

- You can program the LightMaster with desired ON and OFF DMX signal levels and then select how the LightMaster relay outputs will respond.

- You set common ON and OFF DMX signal levels for all DMX 512 channels (1 to 512 channels). However, you can program relay action on an individual channel basis.

DMX ON and DMX OFF Levels:
Any time a DMX channel is at or above the ON level, the relay(s) mapped to that channel will be forced ON regardless of any switch input or timer control. Any time a DMX channel is at or below the OFF level, the relay(s) mapped to that channel will be forced OFF regardless of any switch input or timer control. While a DMX channel is below the ON level and above the OFF level, the relay(s) mapped to that channel are able to be controlled by switch inputs and timers.

EXAMPLE 1: To lock out all control other than DMX, set the DMX ON level to 90% and the OFF level to 10%. By setting the DMX signal level to 100% or 0%, the relay(s) will turn ON or OFF and also revert to the desired position after any change due to a switch input or timer.

EXAMPLE 2: To control relays via DMX and also allow switch inputs or timers to change the position, set the DMX ON level to 90% and the OFF level to 10%. By momentarily setting the DMX signal level to 100% and then setting it to 50%, the relay(s) will be turned ON and local control will return. By momentarily setting the DMX signal level to 0% and then setting it to 50%, the relay(s) will be turned OFF and local control will return.

DMX Filter:
The Filter setting determines the number of times the ILC Apprentice must receive a constant value on a DMX channel prior to performing the control mapped to that channel. The Filter may be set from 1 to 16. Lower Filter settings make the ILC Apprentice respond faster to DMX commands. Higher Filter settings prevent undesired relay control due to momentary zero levels on DMX channels. The Filter setting does not directly correspond to DMX frame counts due to the ILC Apprentice not reading each frame.

E.2 Objectives

After reading Appendix E, you will be able to program the LightMaster to implement DMX control.

E.3 Panel Level Connection

In applications where signal timing is critical, (Example: Theatrical Applications) a separate out cable is daisy-chained to each of the DMX device nodes. See Figure D.2

E.4 Single Point Gateway Connection

In applications where signal timing is less critical, a special DMX Gateway node may be installed on the network. This provides the advantage of eliminating the installation of dedicated cable runs and DMX modules to each controller. See Figure D.3

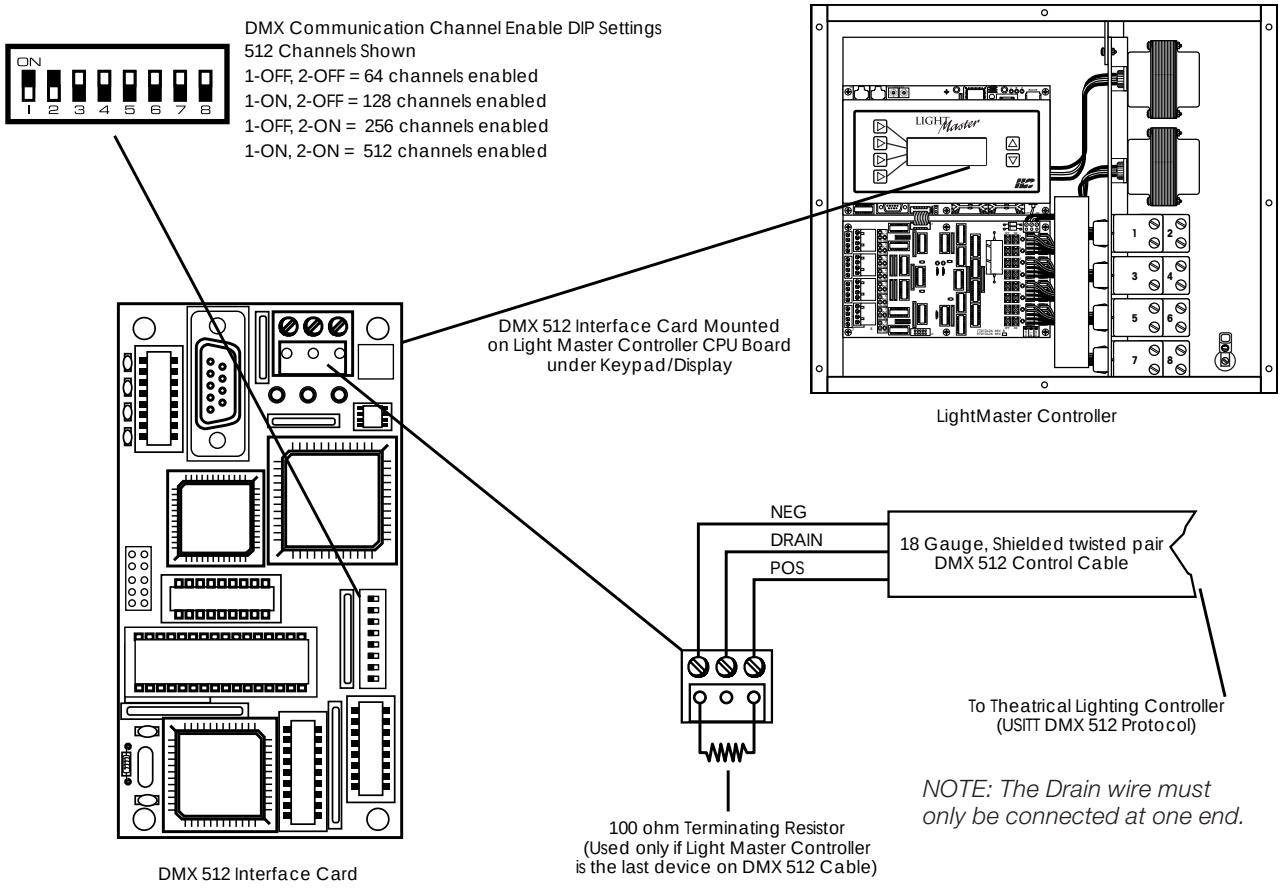


Figure D.1 – Panel Level DMX Interface Hardware Features

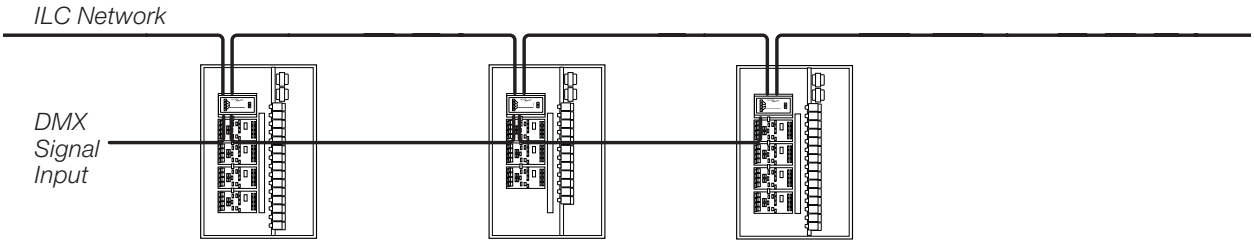
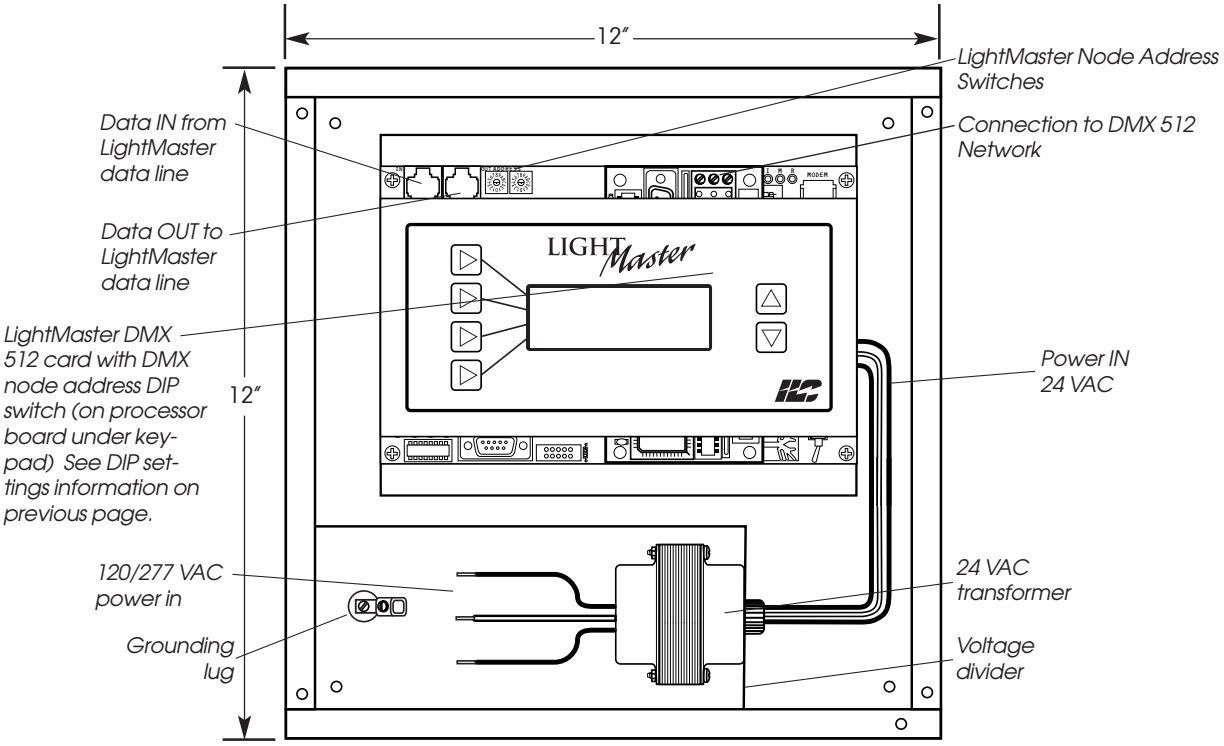


Figure D.2 – Panel lLevel DMX Connection



LightMaster DMX 512 Gateway (shown in NEMA-type enclosure with transformer)

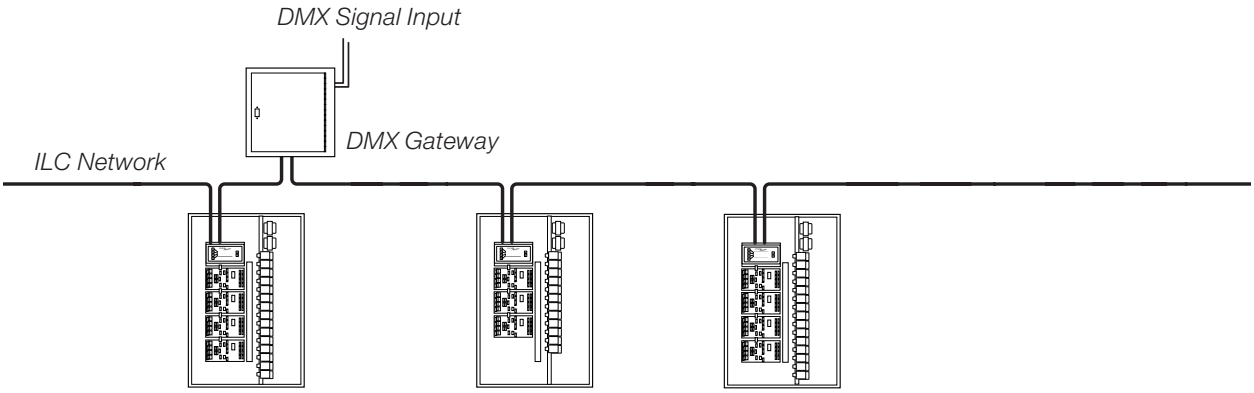


Figure D.3 – Gateway Level DMX Connection

E.5 Programming

Panel Level Installation: From the software or from the Network Manager's keypad, select the node containing the controller with the DMX module installed. Click on ADD ON MODULES. The DMX screen will appear. Map the first relay to the desired DMX channel. Press AUTOMAP to map DMX channels to relays. (You may also manually assign channels to relays). From this screen you can set DMX ON/OFF levels and DMX filter.

Gatway Installation: Configure the Gateway Node from the software and download. (See Section 3.6.) From the Network Manager's keypad, select NODE STATUS, then select the node number assigned to the DMX Gateway. Press EDIT, then press EDIT again. Select DMX/RELAY MAPPING. Select controller node. Press EDIT CONTROL. Select the relay in that controller node to be controlled. Select the DMX channel, or press Automap to automatically assign DMX channels to the relays in that panel. From the previous screen you may also set ON/OFF levels, filter levels and clear all settings.

NOTE: DMX Gateway may also be programmed using ILC LightMaster DMX Gateway configuration software.

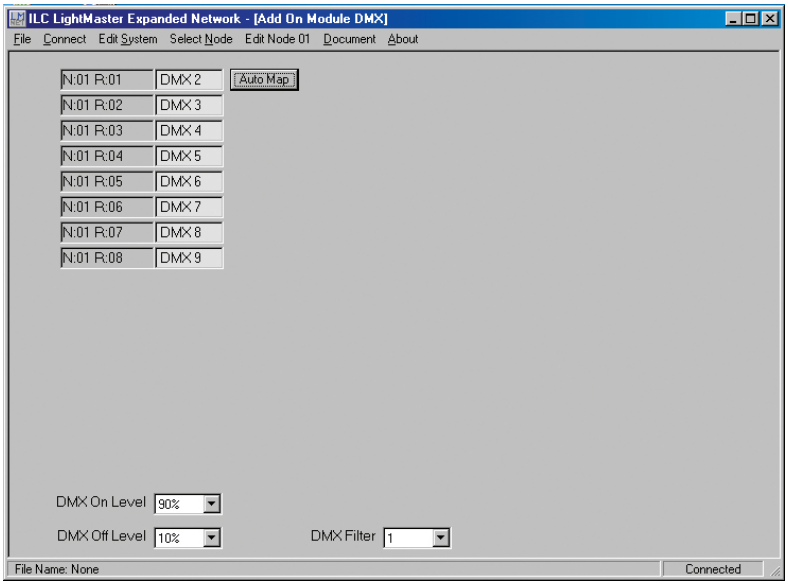


Figure D.4 – LightMaster Pro ENET DMX Screen

M.1 Overview

MODBUS protocol is an industrial communications and distributive control system developed by Gould-Modicon to integrate programmable logic controllers (PLCs), computers, terminals and other monitoring, sensing, and control devices. By setting a unique address via the address DIP switches, a LightMaster lighting controller can become a Slave NODE on the MODBUS Network. (See Figure M-1.)

M.2 Structure

MODBUS is a Master/Slave communications protocol. One device (the Master) controls all serial activity by selectively polling one or more of the slave devices. The maximum number of slave devices is 247 per network. Each device (node) is assigned a unique address to distinguish it from all the other nodes.

Only the Master initiates a transaction. Transactions are either a query/response (only a single slave is addressed), or a broadcast/no response (all slaves are addressed). A transaction comprises a single query and single response frame or a single broadcast frame.

Certain characteristics of the MODBUS protocol are fixed: frame format, frame sequences, communications error handling, exception conditions, and the functions performed. Other characteristics are selectable: transmission media, baud rate, character parity, number of stop bits, communications error handling, exception conditions, and functions performed.

M.3 Panel Level Connection

In applications where signal timing is critical, a separate out cable is daisy-chained to each of the MODBUS device nodes. See Figure M.2

M.4 Single Point Gateway Connection

In applications where signal timing is less critical, a special MODBUS Gateway node may be installed on the network. This provides the advantage of eliminating the installation of dedicated cable runs and MODBUS modules to each controller. See Figure M.3

M.5 Transmission Modes

The transmission mode is the structure of the individual units of information within a message, and the numbering system used to transmit the data. Two transmission modes are available. Both provide the same communication capabilities. The mode selected depends on the equipment used as the MODBUS master. Only one transmission mode may be selected per network. Mixing modes on a single network is not allowed. The two available transmission modes are ASCII (American Standard Code For Information Interchange) and RTU (Remote Terminal Unit)

M.5.1 ASCII

Coding System – ASCII (7 Bit); hexadecimal uses ASCII printable characters (0-9, A-F)
Start Bits – 1
Data Bits (least significant first) – 7
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2 (1 for even or odd parity, 2 for no parity)
Error Checking – LRC (Longitudinal Redundancy Check)

M.5.2 RTU

Coding System – 8 Bit Binary
Start Bits – 1
Data Bits (least significant first) – 8
Parity (optional) – 1 (1 Bit set for even or odd, no Bits for no parity)
Stop Bits – 1 or 2 (1 for even or odd parity, 2 for no parity)
Error Checking – CRC (Cyclical Redundancy Check)

M.6 Transmission Mode Characteristics

ASCII printable characters are easy to view when trouble shooting and this mode is suited to PLC masters and computer masters programmed in a high level language, such as VISCOM BASIC.

In RTU mode, data is sent in 8-bit binary characters. In ASCII mode, data is divided into two 4 bit parts and then represented by the hexadecimal equivalent. ASCII mode uses twice as many characters as RTU mode but decoding is easier.

In RTU mode data must be transmitted in a continuous stream. In ASCII mode breaks of up to one second can occur between characters to allow for a relatively slow master.

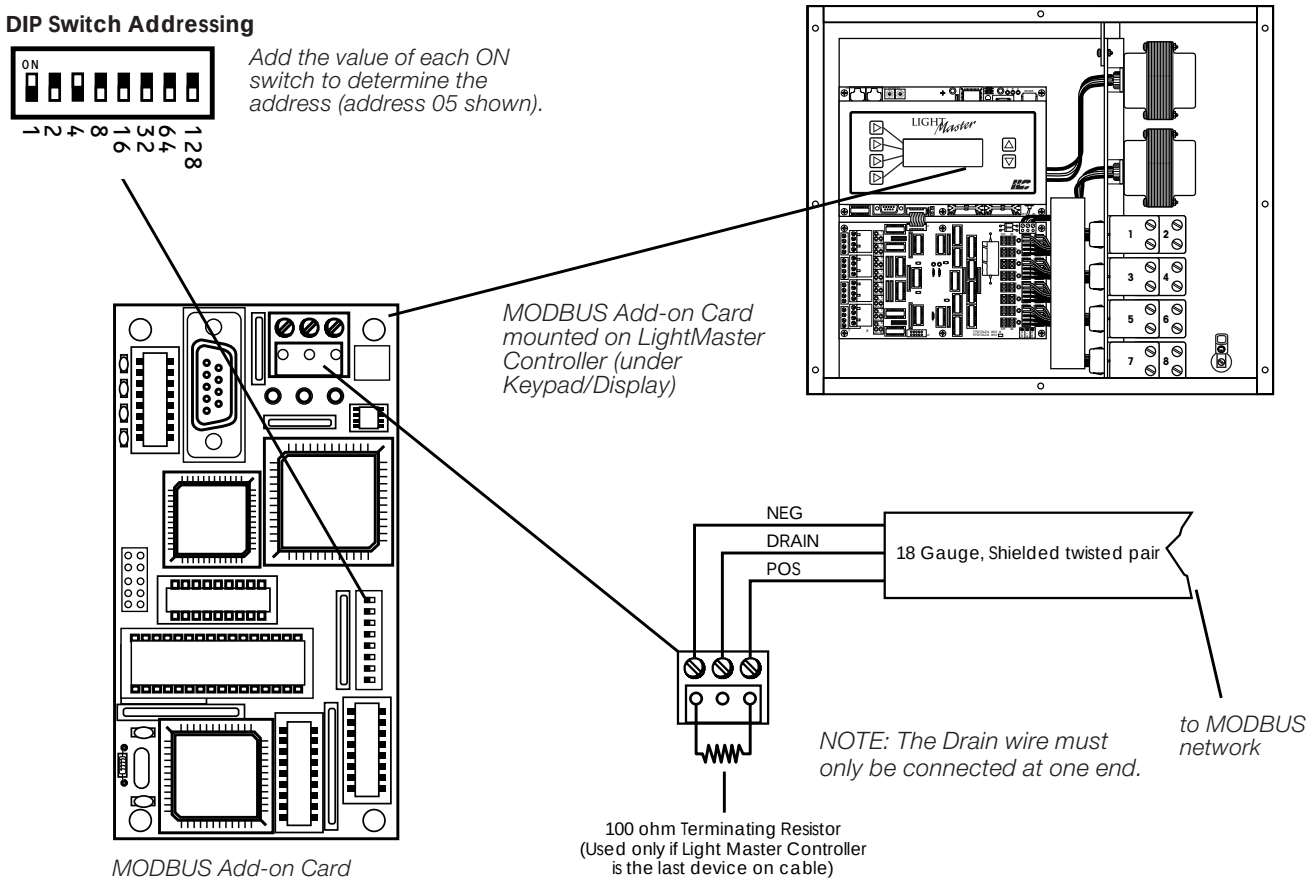


Figure M-1 Panel Level MODBUS Set-Up

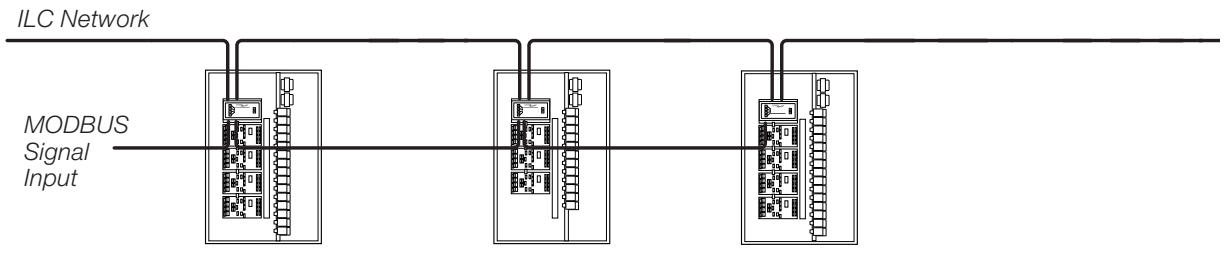
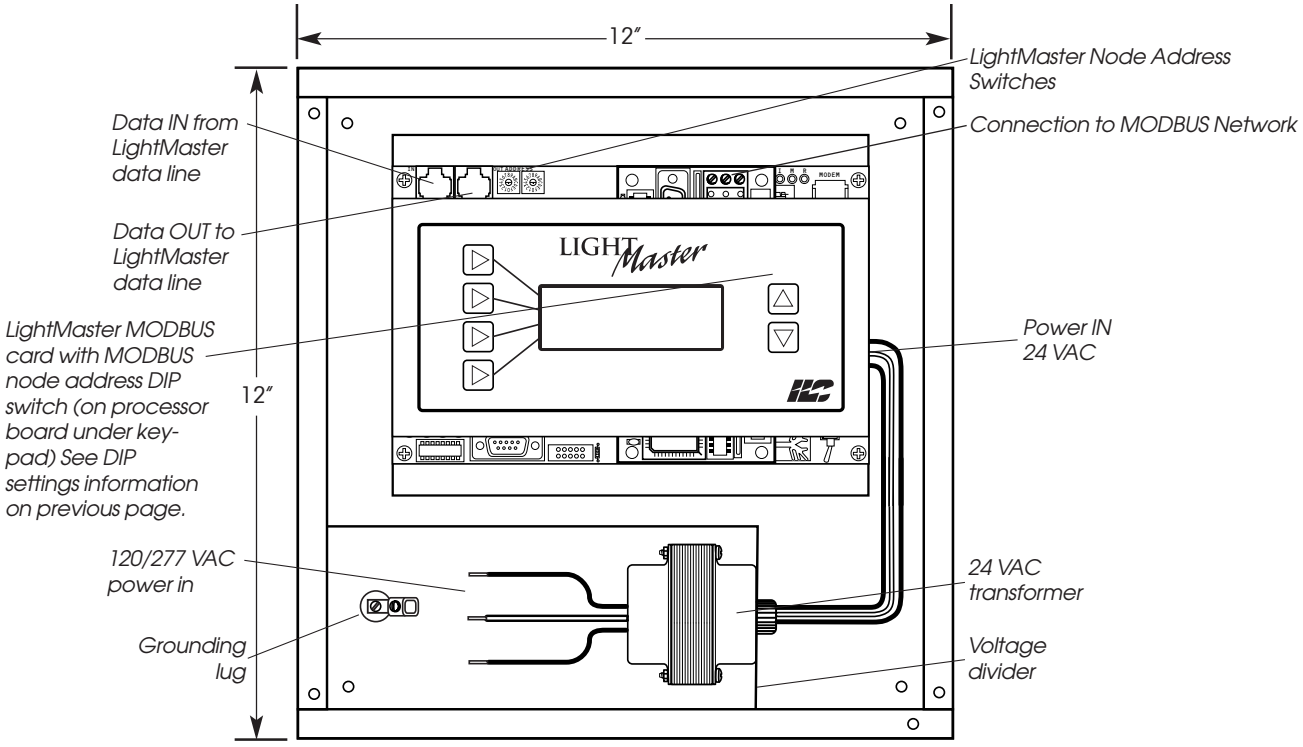


Figure M.2 – Panel lLevel MODBUS Connection



LightMaster MODBUS Gateway (shown in NEMA-type enclosure with transformer)

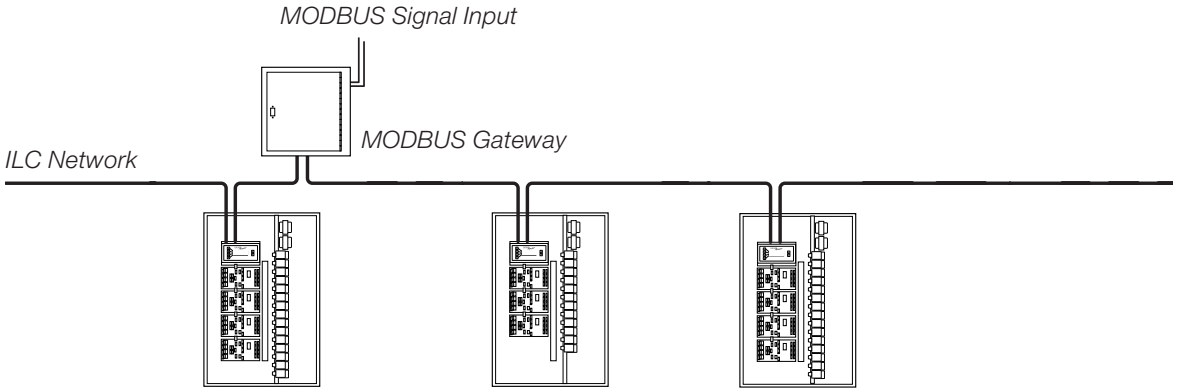


Figure M.3 – Gateway Level MODBUS Connection

M.7 Hardware Setup

The LightMaster must be equipped with a MODBUS add-on card and addressed with a unique node address (See Figure M-1). The network cable is a two wire shielded twisted pair. Consult the Automation system provider for the exact specifications. Terminate the cable as shown in Figure M.1.

M.8 Required Parameter Entries

After setting the MODBUS card address DIP switches, you must power up the LightMaster controller and define certain operational parameters for MODBUS communication.

M.9 Framing

Both ASCII and RTU transmission modes feature mechanisms to indicate the beginning and end of a frame, the node address, a function code (the type of information sought/command signal), a data field indicating the particular point or register accessed. See Table M-1 for data field I/O point designators for a LightMaster node.

M.10 Supported Commands

01 Read coil status

02 Read input status

05 Force singe coil

15 Force multiple coils

M.11 Additional Information

Contact Modicon Inc. if you would like more detailed information on MODBUS protocol.

M.12 Additional Functions

- ON/OFF with Time options (Blink/Alarm) See Table M.1.2

M.13 Programming

Panel Level Installation: From the software or from the Network Manager's keypad, select the node containing the controller with the MODBUS module installed. From the EDIT NODE menu choice (software) or NODE STATUS (keypad), click on ADD ON MODULES. The MODBUS screen will appear. Select communications mode (ASCII or RTU), baud rate, and Parity from this screen. See Tables M.1 and M.1.1 for panel level point addresses.

Gatway Installation: From the Network Manager's keypad, press EDIT. Press NODE STATUS, then select the node number assigned to the MODBUS Gateway. Press EDIT, then press EDIT again. Select communications mode (ASCII or RTU), baud rate, and Parity.See Tables M.2.1, M.2.2 and M.2.3 for Gateway level point addresses.

NOTE: DMX Gateway may also be programmed using ILC LightMaster DMX Gateway configuration software.

M.14 Gateway Point Address

The address is a four-digit Hex number. The upper two digits are the node number and the lower digits are the input, relay or group numbers. Example: Node 2D/Relay 23 is MODBUS number 2D17H. For commands 01 and 05, node FF controls groups. See table below.

Hexadecimal Conversion Chart

No.	Hex	No.	Hex	No.	Hex	No.	Hex
0	00	32	20	65	41	97	61
1	01	34	22	66	42	98	62
2	02	35	23	67	43	99	63
3	03	36	24	68	44	100	64
4	04	37	25	69	45	101	65
5	05	38	26	70	46	102	66
6	06	39	27	71	47	103	67
7	07	40	28	72	48	104	68
8	08	41	29	73	49	105	69
9	09	42	2A	74	4A	106	6A
10	0A	43	2B	75	4B	107	6B
11	0B	44	2C	76	4C	108	6C
12	0C	45	2D	77	4D	109	6D
13	0D	46	2E	78	4E	110	6E
14	0E	47	2F	79	4F	111	6F
15	0F	48	30	80	50	112	70
16	10	49	31	81	51	113	71
17	11	50	32	82	52	114	72
18	12	51	33	83	53	115	73
19	13	52	34	84	54	116	74
20	14	53	35	85	55	117	75
21	15	54	36	86	56	118	76
22	16	55	37	87	57	119	77
23	17	56	38	88	58	120	78
24	18	57	39	89	59	121	79
25	19	58	3A	90	5A	122	7A
26	1A	59	3B	91	5B	123	7B
27	1B	60	3C	92	5C	124	7C
28	1C	61	3D	93	5D	125	7D
29	1D	62	3E	94	5E	126	7E
30	1E	63	3F	95	5F	127	7F
31	1F	64	40	96	60	128	80

LightMaster Input	ON	OFF	Closed	Open
1	1	49	1 = Input Closed	0= Input Open
2	2	50	1 = Input Closed	0= Input Open
3	3	51	1 = Input Closed	0= Input Open
4	4	52	1 = Input Closed	0= Input Open
5	5	53	1 = Input Closed	0= Input Open
6	6	54	1 = Input Closed	0= Input Open
7	7	55	1 = Input Closed	0= Input Open
8	8	56	1 = Input Closed	0= Input Open
9	9	57	1 = Input Closed	0= Input Open
10	10	58	1 = Input Closed	0= Input Open
11	11	59	1 = Input Closed	0= Input Open
12	12	60	1 = Input Closed	0= Input Open
13	13	61	1 = Input Closed	0= Input Open
14	14	62	1 = Input Closed	0= Input Open
15	15	63	1 = Input Closed	0= Input Open
16	16	64	1 = Input Closed	0= Input Open
17	17	65	1 = Input Closed	0= Input Open
18	18	66	1 = Input Closed	0= Input Open
19	19	67	1 = Input Closed	0= Input Open
20	20	68	1 = Input Closed	0= Input Open
21	21	69	1 = Input Closed	0= Input Open
22	22	70	1 = Input Closed	0= Input Open
23	23	71	1 = Input Closed	0= Input Open
24	24	72	1 = Input Closed	0= Input Open
25	25	73	1 = Input Closed	0= Input Open
26	26	74	1 = Input Closed	0= Input Open
27	27	75	1 = Input Closed	0= Input Open
28	28	76	1 = Input Closed	0= Input Open
29	29	77	1 = Input Closed	0= Input Open
30	30	78	1 = Input Closed	0= Input Open
31	31	79	1 = Input Closed	0= Input Open
32	32	80	1 = Input Closed	0= Input Open
33	33	81	1 = Input Closed	0= Input Open
34	34	82	1 = Input Closed	0= Input Open
35	35	83	1 = Input Closed	0= Input Open
36	36	84	1 = Input Closed	0= Input Open
37	37	85	1 = Input Closed	0= Input Open
38	38	86	1 = Input Closed	0= Input Open
39	39	87	1 = Input Closed	0= Input Open
40	40	88	1 = Input Closed	0= Input Open
41	41	89	1 = Input Closed	0= Input Open
42	42	90	1 = Input Closed	0= Input Open
43	43	91	1 = Input Closed	0= Input Open
44	44	92	1 = Input Closed	0= Input Open
45	45	93	1 = Input Closed	0= Input Open
46	46	94	1 = Input Closed	0= Input Open
47	47	95	1 = Input Closed	0= Input Open
48	48	96	1 = Input Closed	0= Input Open

Table M.1 – Panel Level LightMaster Data Field Input Point Designators

LightMaster Output	Closed	Open
1	1=Output Closed	0=Output Open
2	1=Output Closed	0=Output Open
3	1=Output Closed	0=Output Open
4	1=Output Closed	0=Output Open
5	1=Output Closed	0=Output Open
6	1=Output Closed	0=Output Open
7	1=Output Closed	0=Output Open
8	1=Output Closed	0=Output Open
9	1=Output Closed	0=Output Open
10	1=Output Closed	0=Output Open
11	1=Output Closed	0=Output Open
12	1=Output Closed	0=Output Open
13	1=Output Closed	0=Output Open
14	1=Output Closed	0=Output Open
15	1=Output Closed	0=Output Open
16	1=Output Closed	0=Output Open
17	1=Output Closed	0=Output Open
18	1=Output Closed	0=Output Open
19	1=Output Closed	0=Output Open
20	1=Output Closed	0=Output Open
21	1=Output Closed	0=Output Open
22	1=Output Closed	0=Output Open
23	1=Output Closed	0=Output Open
24	1=Output Closed	0=Output Open
25	1=Output Closed	0=Output Open
26	1=Output Closed	0=Output Open
27	1=Output Closed	0=Output Open
28	1=Output Closed	0=Output Open
29	1=Output Closed	0=Output Open
30	1=Output Closed	0=Output Open
31	1=Output Closed	0=Output Open
32	1=Output Closed	0=Output Open
33	1=Output Closed	0=Output Open
34	1=Output Closed	0=Output Open
35	1=Output Closed	0=Output Open
36	1=Output Closed	0=Output Open
37	1=Output Closed	0=Output Open
38	1=Output Closed	0=Output Open
39	1=Output Closed	0=Output Open
40	1=Output Closed	0=Output Open
41	1=Output Closed	0=Output Open
42	1=Output Closed	0=Output Open
43	1=Output Closed	0=Output Open
44	1=Output Closed	0=Output Open
45	1=Output Closed	0=Output Open
46	1=Output Closed	0=Output Open
47	1=Output Closed	0=Output Open
48	1=Output Closed	0=Output Open

Table M.1.1 – Panel Level LightMaster Data Field Output Point Designators

LightMaster Output	Coil Point	Closed	Open
1	101	1=Output Closed/Timer Option	0=Output Open/Timer Option
2	102	1=Output Closed/Timer Option	0=Output Open/Timer Option
3	103	1=Output Closed/Timer Option	0=Output Open/Timer Option
4	104	1=Output Closed/Timer Option	0=Output Open/Timer Option
5	105	1=Output Closed/Timer Option	0=Output Open/Timer Option
6	106	1=Output Closed/Timer Option	0=Output Open/Timer Option
7	107	1=Output Closed/Timer Option	0=Output Open/Timer Option
8	108	1=Output Closed/Timer Option	0=Output Open/Timer Option
9	109	1=Output Closed/Timer Option	0=Output Open/Timer Option
10	110	1=Output Closed/Timer Option	0=Output Open/Timer Option
11	111	1=Output Closed/Timer Option	0=Output Open/Timer Option
12	112	1=Output Closed/Timer Option	0=Output Open/Timer Option
13	113	1=Output Closed/Timer Option	0=Output Open/Timer Option
14	114	1=Output Closed/Timer Option	0=Output Open/Timer Option
15	115	1=Output Closed/Timer Option	0=Output Open/Timer Option
16	116	1=Output Closed/Timer Option	0=Output Open/Timer Option
17	117	1=Output Closed/Timer Option	0=Output Open/Timer Option
18	118	1=Output Closed/Timer Option	0=Output Open/Timer Option
19	119	1=Output Closed/Timer Option	0=Output Open/Timer Option
20	120	1=Output Closed/Timer Option	0=Output Open/Timer Option
21	121	1=Output Closed/Timer Option	0=Output Open/Timer Option
22	122	1=Output Closed/Timer Option	0=Output Open/Timer Option
23	123	1=Output Closed/Timer Option	0=Output Open/Timer Option
24	124	1=Output Closed/Timer Option	0=Output Open/Timer Option
25	125	1=Output Closed/Timer Option	0=Output Open/Timer Option
26	126	1=Output Closed/Timer Option	0=Output Open/Timer Option
27	127	1=Output Closed/Timer Option	0=Output Open/Timer Option
28	128	1=Output Closed/Timer Option	0=Output Open/Timer Option
29	129	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	130	1=Output Closed/Timer Option	0=Output Open/Timer Option
31	131	1=Output Closed/Timer Option	0=Output Open/Timer Option
32	132	1=Output Closed/Timer Option	0=Output Open/Timer Option
33	133	1=Output Closed/Timer Option	0=Output Open/Timer Option
34	134	1=Output Closed/Timer Option	0=Output Open/Timer Option
35	135	1=Output Closed/Timer Option	0=Output Open/Timer Option
36	136	1=Output Closed/Timer Option	0=Output Open/Timer Option
37	137	1=Output Closed/Timer Option	0=Output Open/Timer Option
38	138	1=Output Closed/Timer Option	0=Output Open/Timer Option
30	139	1=Output Closed/Timer Option	0=Output Open/Timer Option
40	140	1=Output Closed/Timer Option	0=Output Open/Timer Option
41	141	1=Output Closed/Timer Option	0=Output Open/Timer Option
42	142	1=Output Closed/Timer Option	0=Output Open/Timer Option
43	143	1=Output Closed/Timer Option	0=Output Open/Timer Option
44	144	1=Output Closed/Timer Option	0=Output Open/Timer Option
45	145	1=Output Closed/Timer Option	0=Output Open/Timer Option
46	146	1=Output Closed/Timer Option	0=Output Open/Timer Option
47	147	1=Output Closed/Timer Option	0=Output Open/Timer Option
48	148	1=Output Closed/Timer Option	0=Output Open/Timer Option

Table M.1.2 – Panel Level with a Timer Option (Blink/Alarm) Output Point Designators

LightMaster Input	ON Point	OFF Point	Closed	Open
1	01	31	1 = Input Closed	0= Input Open
2	02	32	1 = Input Closed	0= Input Open
3	03	33	1 = Input Closed	0= Input Open
4	04	34	1 = Input Closed	0= Input Open
5	05	35	1 = Input Closed	0= Input Open
6	06	36	1 = Input Closed	0= Input Open
7	07	37	1 = Input Closed	0= Input Open
8	08	38	1 = Input Closed	0= Input Open
9	09	39	1 = Input Closed	0= Input Open
10	0A	3A	1 = Input Closed	0= Input Open
11	0B	3B	1 = Input Closed	0= Input Open
12	0C	3C	1 = Input Closed	0= Input Open
13	0D	3D	1 = Input Closed	0= Input Open
14	0E	3E	1 = Input Closed	0= Input Open
15	0F	3F	1 = Input Closed	0= Input Open
16	10	40	1 = Input Closed	0= Input Open
17	11	41	1 = Input Closed	0= Input Open
18	12	42	1 = Input Closed	0= Input Open
19	13	43	1 = Input Closed	0= Input Open
20	14	44	1 = Input Closed	0= Input Open
21	15	45	1 = Input Closed	0= Input Open
22	16	46	1 = Input Closed	0= Input Open
23	17	47	1 = Input Closed	0= Input Open
24	18	48	1 = Input Closed	0= Input Open
25	19	49	1 = Input Closed	0= Input Open
26	1A	4A	1 = Input Closed	0= Input Open
27	1B	4B	1 = Input Closed	0= Input Open
28	1C	4C	1 = Input Closed	0= Input Open
29	1D	4D	1 = Input Closed	0= Input Open
30	1E	4E	1 = Input Closed	0= Input Open
31	1F	4F	1 = Input Closed	0= Input Open
32	20	50	1 = Input Closed	0= Input Open
33	21	51	1 = Input Closed	0= Input Open
34	22	52	1 = Input Closed	0= Input Open
35	23	53	1 = Input Closed	0= Input Open
36	24	54	1 = Input Closed	0= Input Open
37	25	55	1 = Input Closed	0= Input Open
38	26	56	1 = Input Closed	0= Input Open
39	27	57	1 = Input Closed	0= Input Open
40	28	58	1 = Input Closed	0= Input Open
41	29	59	1 = Input Closed	0= Input Open
42	2A	5A	1 = Input Closed	0= Input Open
43	2B	5B	1 = Input Closed	0= Input Open
44	2C	5C	1 = Input Closed	0= Input Open
45	2D	5D	1 = Input Closed	0= Input Open
46	2E	5E	1 = Input Closed	0= Input Open
47	2F	5F	1 = Input Closed	0= Input Open
48	30	60	1 = Input Closed	0= Input Open

Table M.2.1 – Gateway Level LightMaster Data Field Input Point Designators

LightMaster Output	Point	Closed (ON)	Open (OFF)
1	01	1=Output Closed	0=Output Open
2	02	1=Output Closed	0=Output Open
3	03	1=Output Closed	0=Output Open
4	04	1=Output Closed	0=Output Open
5	05	1=Output Closed	0=Output Open
6	06	1=Output Closed	0=Output Open
7	07	1=Output Closed	0=Output Open
8	08	1=Output Closed	0=Output Open
9	09	1=Output Closed	0=Output Open
10	0A	1=Output Closed	0=Output Open
11	0B	1=Output Closed	0=Output Open
12	0C	1=Output Closed	0=Output Open
13	0D	1=Output Closed	0=Output Open
14	0E	1=Output Closed	0=Output Open
15	0F	1=Output Closed	0=Output Open
16	10	1=Output Closed	0=Output Open
17	11	1=Output Closed	0=Output Open
18	12	1=Output Closed	0=Output Open
19	13	1=Output Closed	0=Output Open
20	14	1=Output Closed	0=Output Open
21	15	1=Output Closed	0=Output Open
22	16	1=Output Closed	0=Output Open
23	17	1=Output Closed	0=Output Open
24	18	1=Output Closed	0=Output Open
25	19	1=Output Closed	0=Output Open
26	1A	1=Output Closed	0=Output Open
27	1B	1=Output Closed	0=Output Open
28	1C	1=Output Closed	0=Output Open
29	1D	1=Output Closed	0=Output Open
30	1E	1=Output Closed	0=Output Open
31	1F	1=Output Closed	0=Output Open
32	20	1=Output Closed	0=Output Open
33	21	1=Output Closed	0=Output Open
34	22	1=Output Closed	0=Output Open
35	23	1=Output Closed	0=Output Open
36	24	1=Output Closed	0=Output Open
37	25	1=Output Closed	0=Output Open
38	26	1=Output Closed	0=Output Open
30	27	1=Output Closed	0=Output Open
40	28	1=Output Closed	0=Output Open
41	29	1=Output Closed	0=Output Open
42	2A	1=Output Closed	0=Output Open
43	2B	1=Output Closed	0=Output Open
44	2C	1=Output Closed	0=Output Open
45	2D	1=Output Closed	0=Output Open
46	2E	1=Output Closed	0=Output Open
47	2F	1=Output Closed	0=Output Open
48	30	1=Output Closed	0=Output Open

Table M.2.2 – Gateway Level LightMaster Data Field Output Point Designators (Nodes 01-80)

LightMaster Group	Point	Closed (True)	Open (False)
1	01	1=Group Closed	0=Group Open
2	02	1=Group Closed	0=Group Open
3	03	1=Group Closed	0=Group Open
4	04	1=Group Closed	0=Group Open
5	05	1=Group Closed	0=Group Open
6	06	1=Group Closed	0=Group Open
7	07	1=Group Closed	0=Group Open
8	08	1=Group Closed	0=Group Open
9	09	1=Group Closed	0=Group Open
10	0A	1=Group Closed	0=Group Open
11	0B	1=Group Closed	0=Group Open
12	0C	1=Group Closed	0=Group Open
13	0D	1=Group Closed	0=Group Open
14	0E	1=Group Closed	0=Group Open
15	0F	1=Group Closed	0=Group Open
16	10	1=Group Closed	0=Group Open
17	11	1=Group Closed	0=Group Open
18	12	1=Group Closed	0=Group Open
19	13	1=Group Closed	0=Group Open
20	14	1=Group Closed	0=Group Open
21	15	1=Group Closed	0=Group Open
22	16	1=Group Closed	0=Group Open
23	17	1=Group Closed	0=Group Open
24	18	1=Group Closed	0=Group Open
25	19	1=Group Closed	0=Group Open
26	1A	1=Group Closed	0=Group Open
27	1B	1=Group Closed	0=Group Open
28	1C	1=Group Closed	0=Group Open
29	1D	1=Group Closed	0=Group Open
30	1E	1=Group Closed	0=Group Open
31	1F	1=Group Closed	0=Group Open
32	20	1=Group Closed	0=Group Open
33	21	1=Group Closed	0=Group Open
34	22	1=Group Closed	0=Group Open
35	23	1=Group Closed	0=Group Open
36	24	1=Group Closed	0=Group Open
37	25	1=Group Closed	0=Group Open
38	26	1=Group Closed	0=Group Open
39	27	1=Group Closed	0=Group Open
40	28	1=Group Closed	0=Group Open
41	29	1=Group Closed	0=Group Open
42	2A	1=Group Closed	0=Group Open
43	2B	1=Group Closed	0=Group Open
44	2C	1=Group Closed	0=Group Open
45	2D	1=Group Closed	0=Group Open
46	2E	1=Group Closed	0=Group Open
47	2F	1=Group Closed	0=Group Open
48	30	1=Group Closed	0=Group Open

Table M.2.3 – Gateway Level LightMaster Data Field Group Point Designators (Node FF)

N.1 Overview

The LightMaster Controller(s) can be integrated into a Building Automation System (BAS) that uses the N2 communications protocol. The host system can then poll the status of the LightMaster Controller inputs and outputs and issue ON/OFF commands to the LightMaster's relay outputs.

N.2 Panel Level Connection

In applications where signal timing is critical, (a separate out cable is daisy-chained to each of the N2 device nodes. See Figure N.2

N.3 Single Point Gateway Connection

In applications where signal timing is less critical, a special N2 Gateway node may be installed on the network. This provides the advantage of eliminating the installation of dedicated cable runs and N2 modules to each controller. See Figure N.3

N.4 Point Map

Fill out the appropriate point map (Panel Level or Gateway communication) Note that only BI and BO point types are used. The completed point map will serve as the control schedule used to determine how LightMaster relay outputs will be controlled.

ILC LightMaster N2 Rev 1 Unsupported Attributes

All attributes in the following regions

Analog Input
Analog Output
Internal Float
Internal Integer
Internal Byte

Binary Input Unsupported Attributes

Attribute 1		
Bit 0	COS _enabled	Always 1 (COS is always enabled)
Bit 1	Normal state	Always 0
Bit 3	Alarm_enabled	Always 0 (disabled)
Attribute 2		
Bit 0	Always reliable (0)	
Bit 1	Override active	Always 0 (not active)
Bit 4	Normal (0)	
Bit 5	JCI use only	
Attribute 3	JCI use only	
Attribute 4	JCI use only	

Binary Output Unsupported Attributes

Attribute 1		
Bit 0	COS _enabled	Always 0 (COS is always enabled)
Bit 1	Normal state	Always 0
Attribute 2		
Bit 0	Always reliable (0)	
Bit 1	Override active	Always 0 (not active)
Bit 4	JCI use only	
Bit 5	JCI use only	
Attribute 3	Minimum ON time	Always 0
Attribute 4	Minimum OFF time	Always 0
Attribute 5	Maximum Cycles/Hour	Always 0
Attribute 6	JCI use only	
Attribute 7	JCI use only	

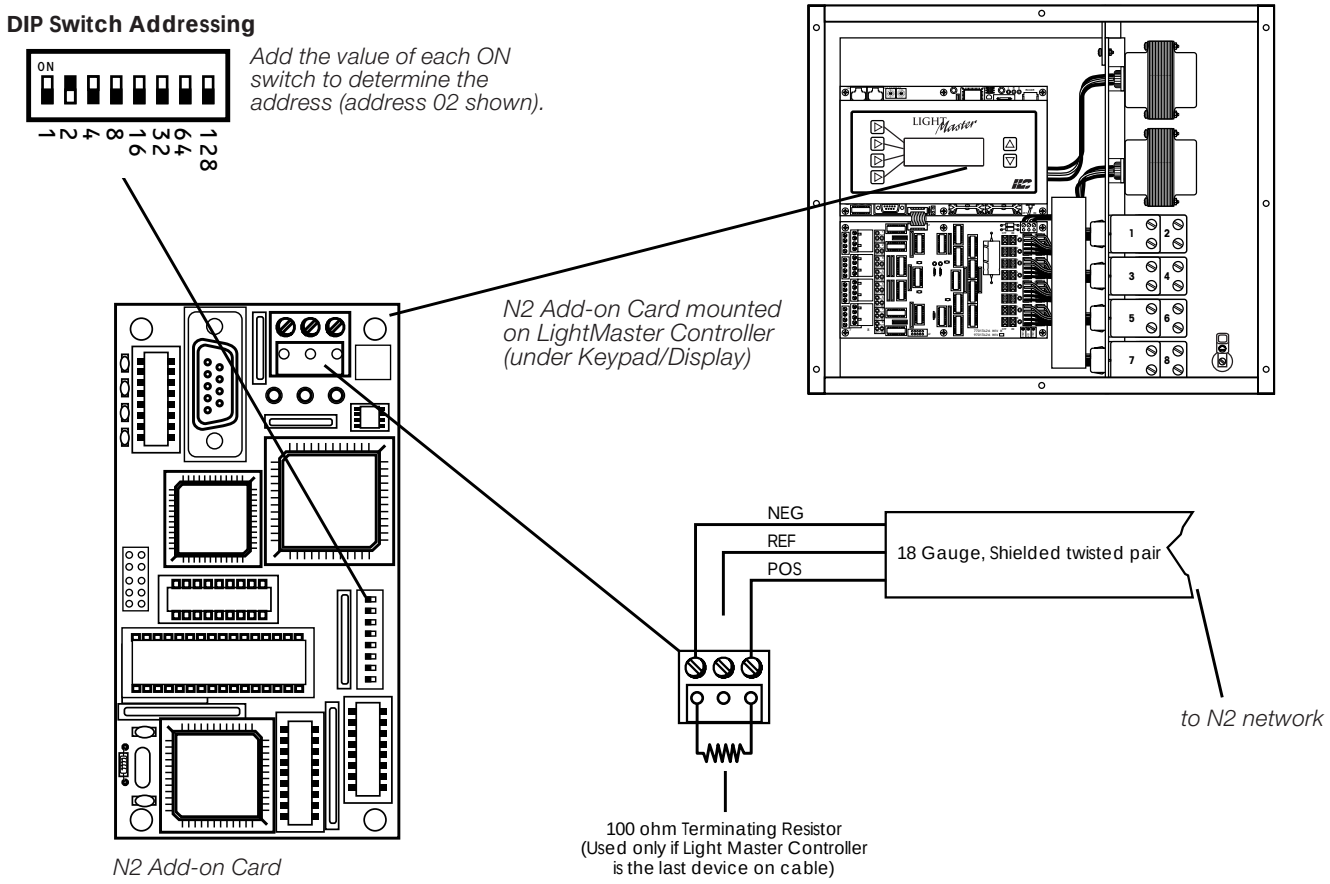


Figure N.1 Panel Level N2 Set-Up

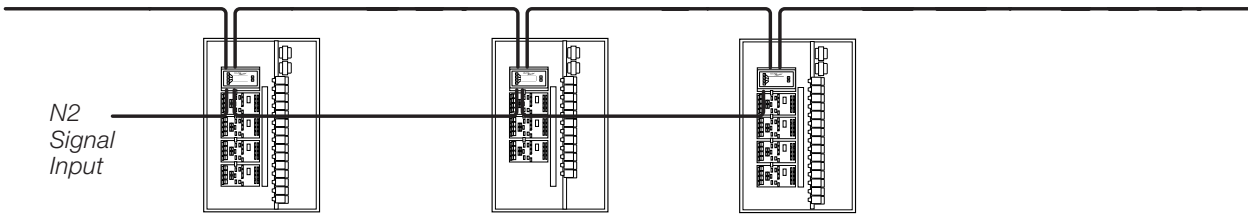
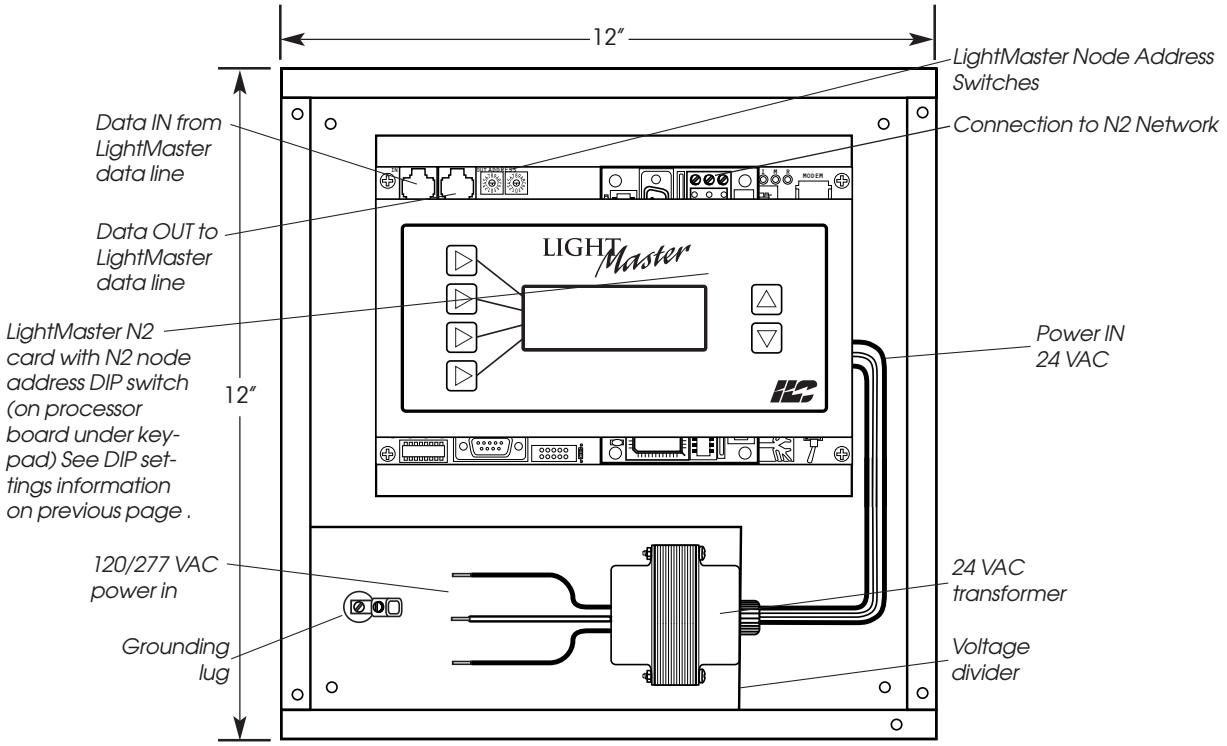


Figure N.2 – Panel Level N2 Connection



LightMaster N2 Gateway (shown in NEMA-type enclosure with transformer)

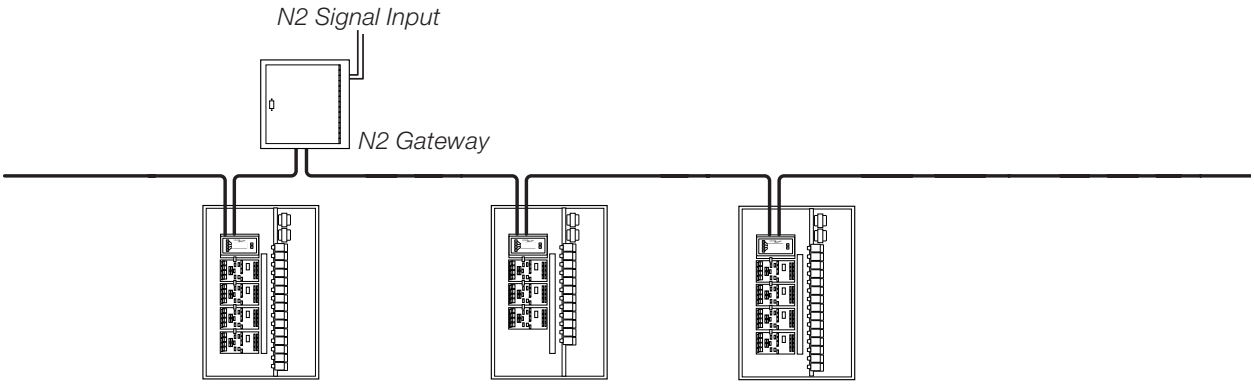


Figure N.3 – Gateway Level N2 Connection

N.4 Programming

No configuration is required.

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	1		SWITCH INPUT #1 OFF	0-OPEN 1-CLOSED	
BI	2		SWITCH INPUT #1 ON	0-OPEN 1-CLOSED	
BI	3		SWITCH INPUT #2 OFF	0-OPEN 1-CLOSED	
BI	4		SWITCH INPUT #2 ON	0-OPEN 1-CLOSED	
BI	5		SWITCH INPUT #3 OFF	0-OPEN 1-CLOSED	
BI	6		SWITCH INPUT #3 ON	0-OPEN 1-CLOSED	
BI	7		SWITCH INPUT #4 OFF	0-OPEN 1-CLOSED	
BI	8		SWITCH INPUT #4 ON	0-OPEN 1-CLOSED	
BI	9		SWITCH INPUT #5 OFF	0-OPEN 1-CLOSED	
BI	10		SWITCH INPUT #5 ON	0-OPEN 1-CLOSED	
BI	11		SWITCH INPUT #6 OFF	0-OPEN 1-CLOSED	
BI	12		SWITCH INPUT #6 ON	0-OPEN 1-CLOSED	
BI	13		SWITCH INPUT #7 OFF	0-OPEN 1-CLOSED	
BI	14		SWITCH INPUT #7 ON	0-OPEN 1-CLOSED	
BI	15		SWITCH INPUT #8 OFF	0-OPEN 1-CLOSED	
BI	16		SWITCH INPUT #8 ON	0-OPEN 1-CLOSED	
BI	17		SWITCH INPUT #9 OFF	0-OPEN 1-CLOSED	
BI	18		SWITCH INPUT #9 ON	0-OPEN 1-CLOSED	
BI	19		SWITCH INPUT #10 OFF	0-OPEN 1-CLOSED	
BI	20		SWITCH INPUT #10 ON	0-OPEN 1-CLOSED	
BI	21		SWITCH INPUT #11 OFF	0-OPEN 1-CLOSED	
BI	22		SWITCH INPUT #11 ON	0-OPEN 1-CLOSED	
BI	23		SWITCH INPUT #12 OFF	0-OPEN 1-CLOSED	
BI	24		SWITCH INPUT #12 ON	0-OPEN 1-CLOSED	

Table N.1 – LightMaster N2 Panel Level Point Map

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	25		SWITCH INPUT #13 OFF	0-OPEN 1-CLOSED	
BI	26		SWITCH INPUT #13 ON	0-OPEN 1-CLOSED	
BI	27		SWITCH INPUT #14 OFF	0-OPEN 1-CLOSED	
BI	28		SWITCH INPUT #14 ON	0-OPEN 1-CLOSED	
BI	29		SWITCH INPUT #15 OFF	0-OPEN 1-CLOSED	
BI	30		SWITCH INPUT #15 ON	0-OPEN 1-CLOSED	
BI	31		SWITCH INPUT #16 OFF	0-OPEN 1-CLOSED	
BI	32		SWITCH INPUT #16 ON	0-OPEN 1-CLOSED	
BI	33		SWITCH INPUT #17 OFF	0-OPEN 1-CLOSED	
BI	34		SWITCH INPUT #17 ON	0-OPEN 1-CLOSED	
BI	35		SWITCH INPUT #18 OFF	0-OPEN 1-CLOSED	
BI	36		SWITCH INPUT #18 ON	0-OPEN 1-CLOSED	
BI	37		SWITCH INPUT #19 OFF	0-OPEN 1-CLOSED	
BI	38		SWITCH INPUT #19 ON	0-OPEN 1-CLOSED	
BI	39		SWITCH INPUT #20 OFF	0-OPEN 1-CLOSED	
BI	40		SWITCH INPUT #20 ON	0-OPEN 1-CLOSED	
BI	41		SWITCH INPUT #21 OFF	0-OPEN 1-CLOSED	
BI	42		SWITCH INPUT #21 ON	0-OPEN 1-CLOSED	
BI	43		SWITCH INPUT #22 OFF	0-OPEN 1-CLOSED	
BI	44		SWITCH INPUT #22 ON	0-OPEN 1-CLOSED	
BI	45		SWITCH INPUT #23 OFF	0-OPEN 1-CLOSED	
BI	46		SWITCH INPUT #23 ON	0-OPEN 1-CLOSED	
BI	47		SWITCH INPUT #24 OFF	0-OPEN 1-CLOSED	
BI	48		SWITCH INPUT #24 ON	0-OPEN 1-CLOSED	
BI	49		SWITCH INPUT #25 OFF	0-OPEN 1-CLOSED	

Table N.1 – LightMaster N2 Panel Level Point Map

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	50		SWITCH INPUT #25 ON	0-OPEN 1-CLOSED	
BI	51		SWITCH INPUT #26 OFF	0-OPEN 1-CLOSED	
BI	52		SWITCH INPUT #26 ON	0-OPEN 1-CLOSED	
BI	53		SWITCH INPUT #27 OFF	0-OPEN 1-CLOSED	
BI	54		SWITCH INPUT #27 ON	0-OPEN 1-CLOSED	
BI	55		SWITCH INPUT #28 OFF	0-OPEN 1-CLOSED	
BI	56		SWITCH INPUT #28 ON	0-OPEN 1-CLOSED	
BI	57		SWITCH INPUT #29 OFF	0-OPEN 1-CLOSED	
BI	58		SWITCH INPUT #29 ON	0-OPEN 1-CLOSED	
BI	59		SWITCH INPUT #30 OFF	0-OPEN 1-CLOSED	
BI	60		SWITCH INPUT #30 ON	0-OPEN 1-CLOSED	
BI	61		SWITCH INPUT #31 OFF	0-OPEN 1-CLOSED	
BI	62		SWITCH INPUT #31 ON	0-OPEN 1-CLOSED	
BI	63		SWITCH INPUT #32 OFF	0-OPEN 1-CLOSED	
BI	64		SWITCH INPUT #32 ON	0-OPEN 1-CLOSED	
BI	65		SWITCH INPUT #33 OFF	0-OPEN 1-CLOSED	
BI	66		SWITCH INPUT #33 ON	0-OPEN 1-CLOSED	
BI	67		SWITCH INPUT #34 OFF	0-OPEN 1-CLOSED	
BI	68		SWITCH INPUT #34 ON	0-OPEN 1-CLOSED	
BI	69		SWITCH INPUT #35 OFF	0-OPEN 1-CLOSED	
BI	70		SWITCH INPUT #35 ON	0-OPEN 1-CLOSED	
BI	71		SWITCH INPUT #36 OFF	0-OPEN 1-CLOSED	
BI	72		SWITCH INPUT #36 ON	0-OPEN 1-CLOSED	
BI	73		SWITCH INPUT #37 OFF	0-OPEN 1-CLOSED	

Table N.1 – LightMaster N2 Panel Level Point Map

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	74		SWITCH INPUT #37 ON	0-OPEN 1-CLOSED	
BI	75		SWITCH INPUT #38 OFF	0-OPEN 1-CLOSED	
BI	76		SWITCH INPUT #38 ON	0-OPEN 1-CLOSED	
BI	77		SWITCH INPUT #39 OFF	0-OPEN 1-CLOSED	
BI	78		SWITCH INPUT #39 ON	0-OPEN 1-CLOSED	
BI	79		SWITCH INPUT #40 OFF	0-OPEN 1-CLOSED	
BI	80		SWITCH INPUT #40 ON	0-OPEN 1-CLOSED	
BI	81		SWITCH INPUT #41 OFF	0-OPEN 1-CLOSED	
BI	82		SWITCH INPUT #41 ON	0-OPEN 1-CLOSED	
BI	83		SWITCH INPUT #42 OFF	0-OPEN 1-CLOSED	
BI	84		SWITCH INPUT #42 ON	0-OPEN 1-CLOSED	
BI	85		SWITCH INPUT #43 OFF	0-OPEN 1-CLOSED	
BI	86		SWITCH INPUT #43 ON	0-OPEN 1-CLOSED	
BI	87		SWITCH INPUT #44 OFF	0-OPEN 1-CLOSED	
BI	88		SWITCH INPUT #44 ON	0-OPEN 1-CLOSED	
BI	89		SWITCH INPUT #45 OFF	0-OPEN 1-CLOSED	
BI	90		SWITCH INPUT #45 ON	0-OPEN 1-CLOSED	
BI	91		SWITCH INPUT #46 OFF	0-OPEN 1-CLOSED	
BI	92		SWITCH INPUT #46 ON	0-OPEN 1-CLOSED	
BI	93		SWITCH INPUT #47 OFF	0-OPEN 1-CLOSED	
BI	94		SWITCH INPUT #47 ON	0-OPEN 1-CLOSED	
BI	95		SWITCH INPUT #48 OFF	0-OPEN 1-CLOSED	
BI	96		SWITCH INPUT #48 ON	0-OPEN 1-CLOSED	

Table N.1 – LightMaster N2 Panel Level Point Map

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE
BO	1		RELAY OUTPUT #1	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	2		RELAY OUTPUT #2	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	3		RELAY OUTPUT #3	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	4		RELAY OUTPUT #4	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	5		RELAY OUTPUT #5	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	6		RELAY OUTPUT #6	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	7		RELAY OUTPUT #7	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	8		RELAY OUTPUT #8	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	9		RELAY OUTPUT #9	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	10		RELAY OUTPUT #10	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	11		RELAY OUTPUT #11	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	12		RELAY OUTPUT #12	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	13		RELAY OUTPUT #13	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	14		RELAY OUTPUT #14	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	15		RELAY OUTPUT #15	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	16		RELAY OUTPUT #16	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	17		RELAY OUTPUT #17	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	18		RELAY OUTPUT #18	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	19		RELAY OUTPUT #19	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	20		RELAY OUTPUT #20	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	21		RELAY OUTPUT #21	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	22		RELAY OUTPUT #22	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	23		RELAY OUTPUT #23	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	24		RELAY OUTPUT #24	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option

Table N.1 – LightMaster N2 Panel Level Point Map

Panel Level Communication

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE
BO	25		RELAY OUTPUT #25	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	26		RELAY OUTPUT #26	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	27		RELAY OUTPUT #27	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	28		RELAY OUTPUT #28	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	29		RELAY OUTPUT #29	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	30		RELAY OUTPUT #30	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	31		RELAY OUTPUT #31	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	32		RELAY OUTPUT #32	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	33		RELAY OUTPUT #33	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	34		RELAY OUTPUT #34	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	35		RELAY OUTPUT #35	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	36		RELAY OUTPUT #36	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	37		RELAY OUTPUT #37	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	38		RELAY OUTPUT #38	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	39		RELAY OUTPUT #39	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	40		RELAY OUTPUT #40	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	41		RELAY OUTPUT #41	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	42		RELAY OUTPUT #42	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	43		RELAY OUTPUT #43	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	44		RELAY OUTPUT #44	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	45		RELAY OUTPUT #45	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	46		RELAY OUTPUT #46	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	47		RELAY OUTPUT #47	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option
BO	48		RELAY OUTPUT #48	0-OFF (Open) 1-ON (Closed) 2-OFF w/Timer Option

Table N.1 – LightMaster N2 Panel Level Point Map

Gateway Level Communication: Controller Node #1

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	1		SWITCH INPUT #1 OFF	0-OPEN 1-CLOSED	
BI	2		SWITCH INPUT #1 ON	0-OPEN 1-CLOSED	
BI	3		SWITCH INPUT #2 OFF	0-OPEN 1-CLOSED	
BI	4		SWITCH INPUT #2 ON	0-OPEN 1-CLOSED	
BI	5		SWITCH INPUT #3 OFF	0-OPEN 1-CLOSED	
BI	6		SWITCH INPUT #3 ON	0-OPEN 1-CLOSED	
BI	7		SWITCH INPUT #4 OFF	0-OPEN 1-CLOSED	
BI	8		SWITCH INPUT #4 ON	0-OPEN 1-CLOSED	
BI	9		SWITCH INPUT #5 OFF	0-OPEN 1-CLOSED	
BI	10		SWITCH INPUT #5 ON	0-OPEN 1-CLOSED	
BI	11		SWITCH INPUT #6 OFF	0-OPEN 1-CLOSED	
BI	12		SWITCH INPUT #6 ON	0-OPEN 1-CLOSED	
BI	13		SWITCH INPUT #7 OFF	0-OPEN 1-CLOSED	
BI	14		SWITCH INPUT #7 ON	0-OPEN 1-CLOSED	
BI	15		SWITCH INPUT #8 OFF	0-OPEN 1-CLOSED	
BI	16		SWITCH INPUT #8 ON	0-OPEN 1-CLOSED	
BI	17		SWITCH INPUT #9 OFF	0-OPEN 1-CLOSED	
BI	18		SWITCH INPUT #9 ON	0-OPEN 1-CLOSED	
BI	19		SWITCH INPUT #10 OFF	0-OPEN 1-CLOSED	
BI	20		SWITCH INPUT #10 ON	0-OPEN 1-CLOSED	
BI	21		SWITCH INPUT #11 OFF	0-OPEN 1-CLOSED	
BI	22		SWITCH INPUT #11 ON	0-OPEN 1-CLOSED	
BI	23		SWITCH INPUT #12 OFF	0-OPEN 1-CLOSED	
BI	24		SWITCH INPUT #12 ON	0-OPEN 1-CLOSED	

Table N.2 – LightMaster N2 Gateway Point Map

Gateway Level Communication: Controller Node #1

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	25		SWITCH INPUT #13 OFF	0-OPEN 1-CLOSED	
BI	26		SWITCH INPUT #13 ON	0-OPEN 1-CLOSED	
BI	27		SWITCH INPUT #14 OFF	0-OPEN 1-CLOSED	
BI	28		SWITCH INPUT #14 ON	0-OPEN 1-CLOSED	
BI	29		SWITCH INPUT #15 OFF	0-OPEN 1-CLOSED	
BI	30		SWITCH INPUT #15 ON	0-OPEN 1-CLOSED	
BI	31		SWITCH INPUT #16 OFF	0-OPEN 1-CLOSED	
BI	32		SWITCH INPUT #16 ON	0-OPEN 1-CLOSED	
BI	33		SWITCH INPUT #17 OFF	0-OPEN 1-CLOSED	
BI	34		SWITCH INPUT #17 ON	0-OPEN 1-CLOSED	
BI	35		SWITCH INPUT #18 OFF	0-OPEN 1-CLOSED	
BI	36		SWITCH INPUT #18 ON	0-OPEN 1-CLOSED	
BI	37		SWITCH INPUT #19 OFF	0-OPEN 1-CLOSED	
BI	38		SWITCH INPUT #19 ON	0-OPEN 1-CLOSED	
BI	39		SWITCH INPUT #20 OFF	0-OPEN 1-CLOSED	
BI	40		SWITCH INPUT #20 ON	0-OPEN 1-CLOSED	
BI	41		SWITCH INPUT #21 OFF	0-OPEN 1-CLOSED	
BI	42		SWITCH INPUT #21 ON	0-OPEN 1-CLOSED	
BI	43		SWITCH INPUT #22 OFF	0-OPEN 1-CLOSED	
BI	44		SWITCH INPUT #22 ON	0-OPEN 1-CLOSED	
BI	45		SWITCH INPUT #23 OFF	0-OPEN 1-CLOSED	
BI	46		SWITCH INPUT #23 ON	0-OPEN 1-CLOSED	
BI	47		SWITCH INPUT #24 OFF	0-OPEN 1-CLOSED	
BI	48		SWITCH INPUT #24 ON	0-OPEN 1-CLOSED	
BI	49		SWITCH INPUT #25 OFF	0-OPEN 1-CLOSED	

Table N.2 – LightMaster N2 Gateway Point Map

Gateway Level Communication: Controller Node #1

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	50		SWITCH INPUT #25 ON	0-OPEN 1-CLOSED	
BI	51		SWITCH INPUT #26 OFF	0-OPEN 1-CLOSED	
BI	52		SWITCH INPUT #26 ON	0-OPEN 1-CLOSED	
BI	53		SWITCH INPUT #27 OFF	0-OPEN 1-CLOSED	
BI	54		SWITCH INPUT #27 ON	0-OPEN 1-CLOSED	
BI	55		SWITCH INPUT #28 OFF	0-OPEN 1-CLOSED	
BI	56		SWITCH INPUT #28 ON	0-OPEN 1-CLOSED	
BI	57		SWITCH INPUT #29 OFF	0-OPEN 1-CLOSED	
BI	58		SWITCH INPUT #29 ON	0-OPEN 1-CLOSED	
BI	59		SWITCH INPUT #30 OFF	0-OPEN 1-CLOSED	
BI	60		SWITCH INPUT #30 ON	0-OPEN 1-CLOSED	
BI	61		SWITCH INPUT #31 OFF	0-OPEN 1-CLOSED	
BI	62		SWITCH INPUT #31 ON	0-OPEN 1-CLOSED	
BI	63		SWITCH INPUT #32 OFF	0-OPEN 1-CLOSED	
BI	64		SWITCH INPUT #32 ON	0-OPEN 1-CLOSED	
BI	65		SWITCH INPUT #33 OFF	0-OPEN 1-CLOSED	
BI	66		SWITCH INPUT #33 ON	0-OPEN 1-CLOSED	
BI	67		SWITCH INPUT #34 OFF	0-OPEN 1-CLOSED	
BI	68		SWITCH INPUT #34 ON	0-OPEN 1-CLOSED	
BI	69		SWITCH INPUT #35 OFF	0-OPEN 1-CLOSED	
BI	70		SWITCH INPUT #35 ON	0-OPEN 1-CLOSED	
BI	71		SWITCH INPUT #36 OFF	0-OPEN 1-CLOSED	
BI	72		SWITCH INPUT #36 ON	0-OPEN 1-CLOSED	
BI	73		SWITCH INPUT #37 OFF	0-OPEN 1-CLOSED	

Table N.2 – LightMaster N2 Gateway Point Map

Gateway Level Communication: Controller Node #1

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BI	74		SWITCH INPUT #37 ON	0-OPEN 1-CLOSED	
BI	75		SWITCH INPUT #38 OFF	0-OPEN 1-CLOSED	
BI	76		SWITCH INPUT #38 ON	0-OPEN 1-CLOSED	
BI	77		SWITCH INPUT #39 OFF	0-OPEN 1-CLOSED	
BI	78		SWITCH INPUT #39 ON	0-OPEN 1-CLOSED	
BI	79		SWITCH INPUT #40 OFF	0-OPEN 1-CLOSED	
BI	80		SWITCH INPUT #40 ON	0-OPEN 1-CLOSED	
BI	81		SWITCH INPUT #41 OFF	0-OPEN 1-CLOSED	
BI	82		SWITCH INPUT #41 ON	0-OPEN 1-CLOSED	
BI	83		SWITCH INPUT #42 OFF	0-OPEN 1-CLOSED	
BI	84		SWITCH INPUT #42 ON	0-OPEN 1-CLOSED	
BI	85		SWITCH INPUT #43 OFF	0-OPEN 1-CLOSED	
BI	86		SWITCH INPUT #43 ON	0-OPEN 1-CLOSED	
BI	87		SWITCH INPUT #44 OFF	0-OPEN 1-CLOSED	
BI	88		SWITCH INPUT #44 ON	0-OPEN 1-CLOSED	
BI	89		SWITCH INPUT #45 OFF	0-OPEN 1-CLOSED	
BI	90		SWITCH INPUT #45 ON	0-OPEN 1-CLOSED	
BI	91		SWITCH INPUT #46 OFF	0-OPEN 1-CLOSED	
BI	92		SWITCH INPUT #46 ON	0-OPEN 1-CLOSED	
BI	93		SWITCH INPUT #47 OFF	0-OPEN 1-CLOSED	
BI	94		SWITCH INPUT #47 ON	0-OPEN 1-CLOSED	
BI	95		SWITCH INPUT #48 OFF	0-OPEN 1-CLOSED	
BI	96		SWITCH INPUT #48 ON	0-OPEN 1-CLOSED	

Table N.2 – LightMaster N2 Gateway Point Map

Gateway Level Communication: System Wide

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BO	1		RELAY GROUP #1	0-OFF (Open) 1-ON (Closed)	
BO	2		RELAY GROUP #2	0-OFF (Open) 1-ON (Closed)	
BO	3		RELAY GROUP #3	0-OFF (Open) 1-ON (Closed)	
BO	4		RELAY GROUP #4	0-OFF (Open) 1-ON (Closed)	
BO	5		RELAY GROUP #5	0-OFF (Open) 1-ON (Closed)	
BO	6		RELAY GROUP #6	0-OFF (Open) 1-ON (Closed)	
BO	7		RELAY GROUP #7	0-OFF (Open) 1-ON (Closed)	
BO	8		RELAY GROUP #8	0-OFF (Open) 1-ON (Closed)	
BO	9		RELAY GROUP #9	0-OFF (Open) 1-ON (Closed)	
BO	10		RELAY GROUP #10	0-OFF (Open) 1-ON (Closed)	
BO	11		RELAY GROUP #11	0-OFF (Open) 1-ON (Closed)	
BO	12		RELAY GROUP #12	0-OFF (Open) 1-ON (Closed)	
BO	13		RELAY GROUP #13	0-OFF (Open) 1-ON (Closed)	
BO	14		RELAY GROUP #14	0-OFF (Open) 1-ON (Closed)	
BO	15		RELAY GROUP #15	0-OFF (Open) 1-ON (Closed)	
BO	16		RELAY GROUP #16	0-OFF (Open) 1-ON (Closed)	
BO	17		RELAY GROUP #17	0-OFF (Open) 1-ON (Closed)	
BO	18		RELAY GROUP #18	0-OFF (Open) 1-ON (Closed)	
BO	19		RELAY GROUP #19	0-OFF (Open) 1-ON (Closed)	
BO	20		RELAY GROUP #20	0-OFF (Open) 1-ON (Closed)	
BO	21		RELAY GROUP #21	0-OFF (Open) 1-ON (Closed)	
BO	22		RELAY GROUP #22	0-OFF (Open) 1-ON (Closed)	
BO	23		RELAY GROUP #23	0-OFF (Open) 1-ON (Closed)	
BO	24		RELAY GROUP #24	0-OFF (Open) 1-ON (Closed)	

Table N.2 – LightMaster N2 Gateway Point Map

Gateway Level Communication: System Wide

NETWORK POINT TYPE	NETWORK POINT ADDRESS	UNITS	POINT DESCRIPTION	RANGE/VALUE	NOTES
BO	25		RELAY GROUP #25	0-OFF (Open) 1-ON (Closed)	
BO	26		RELAY GROUP #26	0-OFF (Open) 1-ON (Closed)	
BO	27		RELAY GROUP #27	0-OFF (Open) 1-ON (Closed)	
BO	28		RELAY GROUP #28	0-OFF (Open) 1-ON (Closed)	
BO	29		RELAY GROUP #29	0-OFF (Open) 1-ON (Closed)	
BO	30		RELAY GROUP #30	0-OFF (Open) 1-ON (Closed)	
BO	31		RELAY GROUP #31	0-OFF (Open) 1-ON (Closed)	
BO	32		RELAY GROUP #32	0-OFF (Open) 1-ON (Closed)	
BO	33		RELAY GROUP #33	0-OFF (Open) 1-ON (Closed)	
BO	34		RELAY GROUP #34	0-OFF (Open) 1-ON (Closed)	
BO	35		RELAY GROUP #35	0-OFF (Open) 1-ON (Closed)	
BO	36		RELAY GROUP #36	0-OFF (Open) 1-ON (Closed)	
BO	37		RELAY GROUP #37	0-OFF (Open) 1-ON (Closed)	
BO	38		RELAY GROUP #38	0-OFF (Open) 1-ON (Closed)	
BO	39		RELAY GROUP #39	0-OFF (Open) 1-ON (Closed)	
BO	40		RELAY GROUP #40	0-OFF (Open) 1-ON (Closed)	
BO	41		RELAY GROUP #41	0-OFF (Open) 1-ON (Closed)	
BO	42		RELAY GROUP #42	0-OFF (Open) 1-ON (Closed)	
BO	43		RELAY GROUP #43	0-OFF (Open) 1-ON (Closed)	
BO	44		RELAY GROUP #44	0-OFF (Open) 1-ON (Closed)	
BO	45		RELAY GROUP #45	0-OFF (Open) 1-ON (Closed)	
BO	46		RELAY GROUP #46	0-OFF (Open) 1-ON (Closed)	
BO	47		RELAY GROUP #47	0-OFF (Open) 1-ON (Closed)	
BO	48		RELAY GROUP #48	0-OFF (Open) 1-ON (Closed)	

Table N.2 – LightMaster N2 Gateway Point Map

Alabama,Birmingham,33,87
Alabama,Gadsden,34,86
Alabama,Huntsville,34,86
Alabama,Mobile,30,88
Alabama,Montgomery,32,86
Alaska, Anchorage, 61,150
Alaska, Fairbanks, 65,148
Alaska, Juneau, 58,135
Arizona,Flagstaff,35,111
Arizona,Phoenix,33,112
Arizona,Tucson,32,111
Arizona,Yums,32,114
Arkansas,Fort Smith,35,94
Arkansas,Little Rock,34,92
California,Bakersfield,35,119
California,Berkeley,38,122
California,Eureka,41,124
California,Fresno,36,120
California,Los Angeles,34,118
California,Oakland,37,122
California,Pasadena,34,118
California,Sacramento,38,121
California,San Bernandio,34,117
California,San Diego,32,117
California,San Francisco,38,122
California,San Jose,37,122
California,Santa Barbara,34,119
California,Santa Cruz,37,122
California,Stockton,38,121
Colorado,Colorado Springs,39,105
Colorado,Denver,39,105
Colorado,Grand Junction,39,108
Colorado,Pueblo,38,104
Connecticut,Bridgeport,41,73
Connecticut,Hartford,42,72
Connecticut,Meriden,41,73
Connecticut,New Britain,41,73
Connecticut,New Haven,41,73
Connecticut,Stanford,41,73
Delaware,Wilmington,39,75
District of Columbia,
Washington,39,77
Florida,Daytona Beach,29,81
Florida,Gainesville,29,82
Florida,Jacksonville,30,81
Florida,Key West,24,82
Florida,Miami,26,80
Florida,Orlando,28,81
Florida,Penescola,30,87
Florida,Sarasota,27,82
Florida,St. Petersburgh,28,82
Florida,Tallahassee,30,84
Florida,Tampa,28,82
Florida,West Palm Beach,26,80
Georgia,Atlanta,34,84
Georgia,Augusta,33,82
Georgia,Columbus,32,85
Georgia,Macon,33,83
Georgia,Savannah,32,81
Idaho,Boise,43,116
Idaho,Pocatello,43,112
Illinois,Bloomington,40,89
Illinois,Champaign,40,88
Illinois,Chicago,42,87
Illinois,Decatur,40,89
Illinois,Peoria,40,89
Illinois,Rockford,42,89
Illinois,Springfield,40,89
Illinois,Urbana,40,86
Indiana,Evansville,38,87
Indiana,Ft. Wayne,41,85
Indiana,Gary,41,87
Indiana,Indianapolis,40,86
Indiana,Lafayette,40,87
Indiana,Muncie,40,85
Indiana,South Bend,41,86
Indiana,Terre Haute,39,87
Iowa,Cedar Rapids,42,91
Iowa,Des Moines,41,93
Iowa,Dubuque,42,90
Iowa,Iowa City,41,91
Iowa,Sioux City,43,96
Iowa,Waterloo,42,92
Kansas,Dodge City,38,100
Kansas,Kansas City,39,94
Kansas,Salina,39,97
Kansas,Topeka,39,95
Kansas,Wichita,37,97
Kentucky,Ashland,38,82
Kentucky,Bowling Green,37,86
Kentucky,Lexington,38,84
Kentucky,Louisville,38,86
Kentucky,Paducah,37,88
Louisiana,Baton Rouge,30,91
Louisiana,New Orleans,30,90
Louisiana,Shreveport,32,93
Maine,Augusta,44,70
Maine,Bangor,45,69
Maine,Lowell,42,71
Maine,Portland,43,70
Maryland,Baltimore,39,76
Maryland,Springfield,42,72
Massachusetts,Boston,42,71
Massachusetts,Brockton,42,71
Massachusetts,Cambridge,42,71
Massachusetts,Fall River,41,71
Massachusetts,Lawrence,42,71
Massachusetts,Plainfield,42,73
Massachusetts,Worcester,42,72
Michigan,Ann Arbor,42,83
Michigan,Battle Creek,42,85
Michigan,Bay City,43,84
Michigan,Detroit,42,83
Michigan,Flint,43,83
Michigan,Grand Rapids,43,85
Michigan,Jackson,42,84
Michigan,Kalamazoo,42,85
Michigan,Lansing,42,84
Michigan,Saginaw,43,84
Minnesota,Duluth,47,92
Minnesota,Minneapolis,45,93
Minnesota,Rochester,44,92
Minnesota,St. Cloud,45,94
Minnesota,St. Paul,45,93
Mississippi,Biloxi,30,89
Mississippi,Gulfport,30,89
Mississippi,Jackson,32,90
Mississippi,Natchez,31,91
Missouri,Columbia,38,92
Missouri,Joplin,37,94
Missouri,Kansas City,39,94
Missouri,Springfield,37,93
Missouri,St. Joseph,40,95
Missouri,St. Louis,38,90
Montana,Billings,46,108
Montana,Butte,46,112
Montana,Great Falls,47,111
Montana,Helena,46,112
Nebraska,Lincoln,41,96
Nebraska,Omaha,41,96
Nevada,Carson City,39,120
Nevada,Las Vegas,36,115
Nevada,Reno,39,120
New Hampshire,Concord,43,71
New Hampshire,Manchester,43,71
New Hampshire,Portsmouth,43,71
New Jersey,Atlantic City,39,74
New Jersey,Elizabeth,40,74
New Jersey,Jersey City,40,74
New Jersey,Newark,40,74
New Jersey,Peterson,41,74
New Jersey,Trenton,40,75
New Mexico,Albuquerque,35,106
New Mexico,Gallup,35,108
New Mexico,Santa Fe,35,106
New York,Albany,42,74
New York,Binghamton,42,76
New York,Buffalo,43,79
New York,Central Islip,41,73
New York,New York,41,74
New York,Rochester,43,77
New York,Schenectady,43,74
New York,Syracuse,43,76
New York,Troy,42,73
New York,Utica,43,75
New York,White Plains,41,74
North Carolina,Asheville,35,82
North Carolina,Charlotte,35,81
North Carolina,Durham,36,79
North Carolina,Greensboro,35,80
North Carolina,Raleigh,36,78
North Carolina,Wilmington,34,78
North Carolina,Winston-
Salem,36,80
North Dakota,Bismarck,47,101
North Dakota,Fargo,37,97
North Dakota,Minot,48,101
Ohio,Akron,41,81
Ohio,Canton,41,81
Ohio,Cincinnati,39,84
Ohio,Cleveland,41,81
Ohio,Columbus,40,83
Ohio,Dayton,40,84
Ohio,Hamilton,39,84
Ohio,Lima,40,84
Ohio,Springfield,40,84
Ohio,Staubenville,40,80
Ohio,Toledo,41,83
Ohio,Youngstown,41,80
Ohio,Zanesville,40,82
Oklahoma,Enid,36,98
Oklahoma,Oklahoma City,35,97
Oklahoma,Tulsa,38,96
Oregon,Salem,45,123
Oregon,Eugene,44,123
Oregon,Portland,45,122
Pennsylvania,Allentown,40,75
Pennsylvania,Erie,42,80
Pennsylvania,Harrisburg,40,77
Pennsylvania,Johnstown,40,79
Pennsylvania,Lancester,40,76
Pennsylvania,Philadelphia,40,75
Pennsylvania,Pittsburgh,40,80
Pennsylvania,Reading,40,76
Pennsylvania,Wilkes-Barre,41,76
Rhode Island,Providence,42,71
South Carolina,Charleston,33,80
South Carolina,Columbia,34,81
South Carolina,Greenville,35,82
South Carolina,Spartanburg,35,82
South Dakota,Pierre,44,100
South Dakota,Rapid City,44,103
South Dakota,Sioux Falls,43,96
Tennessee,Chattanooga,35,85
Tennessee,Knoxville,36,84
Tennessee,Memphis,35,90
Tennessee,Nashville,36,87
Texas,Abilene,32,99
Texas,Amerillo,35,102
Texas,Austin,30,97
Texas,Beaumont,30,94
Texas,Corpus Christi,28,97
Texas,Dallas,33,97
Texas,El Paso,32,106
Texas,Port Arthur,30,94
Texas,Fort Worth,32,97
Texas,Galveston,29,95
Texas,Houston,30,95
Texas,Laredo,27,99
Texas,Lubbock,33,102
Texas,Marshall,32,94
Texas,San Antonio,29,95
Texas,Texakana,33,94
Texas,Waco,31,97
Utah,Opden,41,112
Utah,Provo,40,111
Utah,Salt Lake City,41,112
Vermont,Brattleboro,43,72
Vermont,Burlington,44,73
Vermont,Montpellier,44,72
Virginia,Norfolk,37,76
Virginia,Portsmouth,37,76
Virginia,Richmond,37,77
Virginia,Roanoke,37,80
Washington,Bellingham,49,122
Washington,Seattle,47,122
Washington,Spokane,47,117
Washington,Tacoma,47,122
Washington,Walla Walla,46,118
Washington,Yakima,46,120
West Virginia,Charleston,38,81
West Virginia,Wheeling,40,80
Wisconsin,Eau Claire,45,91
Wisconsin,Green Bay,44,88
Wisconsin,Kenosha,42,88
Wisconsin,Madison,43,89
Wisconsin,Milwaukee,43,88
Wisconsin,Racine,42,88
Wisconsin,Sheboygan,44,87
Wisconsin,Superior,46,92
Wyoming,Cheyenne,41,105
Wyoming,Sheridan,45,107

P.1 Overview

ILC Corporation manufactures photo control systems specially designed to work with the LightMaster Controller. One model is hardwired to the LightMaster Controller. The other model is installed as a LightSync™ device node on and communicates with the LightMaster via a standard CAT-5 data cable network.

P.2 Hardwired Model

The hardwired photo-controller system features two main components: the controller board and the photo sensor. Both indoor and outdoor sensors are available. The photo control features an indoor range of 1-100 foot candles (fc) and an outdoor range of 1-1000 foot candles. The photo controller supports 10 individually selectable ON/OFF set points. There is also a time delay feature to prevent nuisance switching. The photo control board is powered by either a 12 VAC or 12 VDC power supply. See Figures P.1 and P.2 for detailed set-up and installation instructions.

P.3 Programming

1. Program the LightMaster switch input that the photo-controller is wired to as a MAINTAINED ON/OFF switch TYPE.
2. Program the Input/Relay control of the relay or relay group that the switch controls.

Consult Section 3 of this manual (The LightMaster User Guide) for detailed programming information.

P.4 LightSync™ Model

If you are not familiar with Lightsync data line concepts and installation procedures consult Section 4 of this manual (LightMaster User Guide).
The LightSync photo controller is installed on the RS485 data network and communicates with the LightMaster Controller over the CAT-5 data cable. The LightSync photo controller features 8 sets of independently adjustable ON/OFF set points each with 256 possible set point steps. Each step equates on average to the foot candle Levels shown in Table P.1 (Component and environmental variables may require adjustments from these settings to attain a desired foot candle level.) Either an indoor or outdoor photo eye is available. The photo eye may be installed up to 5000 ft. from the photo controller using 18 gauge wire. The settings are programmed at the LightMaster controller.

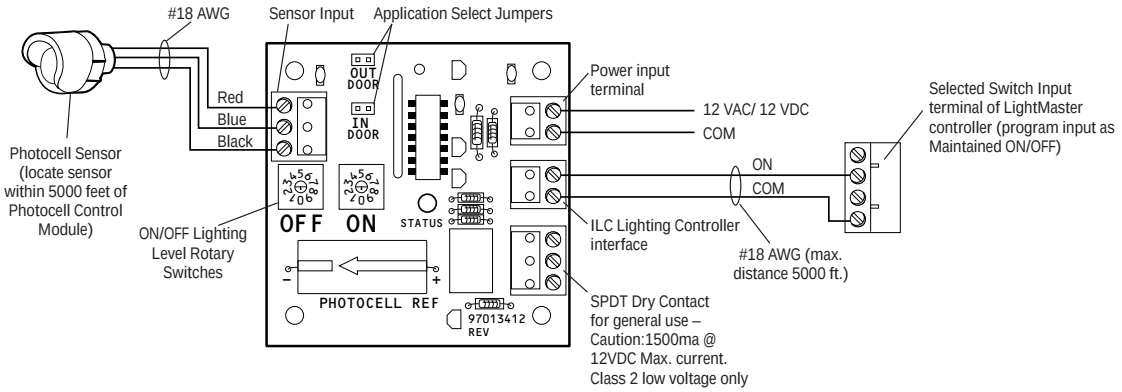
Table P.1– LightSync Photocell Set Points

.....Foot Candle	Avg. Settings
1	18
2	27
3	37
4	47
5	56
6	61
7	65
8	71
9	74
10	80
11	84
12	87
13	90
14	93
15	96
20	108
30	112
40	115
50	126
60	131
70	135
80	139
90	146
100	167
150	179
200	192
300	202
400	207
500	213
600	216
700	220
800	223
900	226
1000	229
1200	231
1400	233
1600	235
1800	236

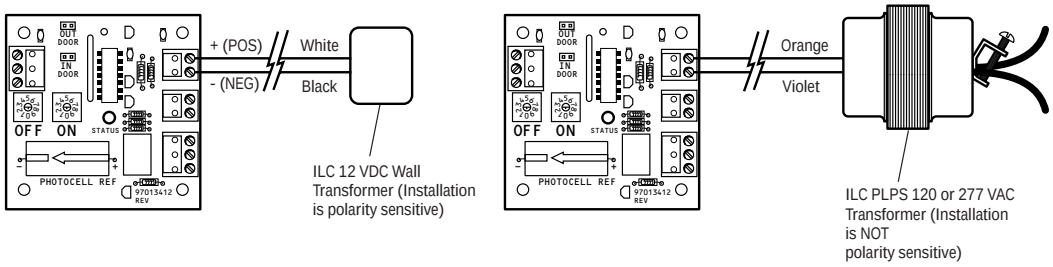
Note: Typical ON/OFF set points for an outdoor application are 25 fc (110) ON and 75 fc (137) OFF.

Photocell Controller Board Installation Guide

Wiring Overview



Power Supply Termination



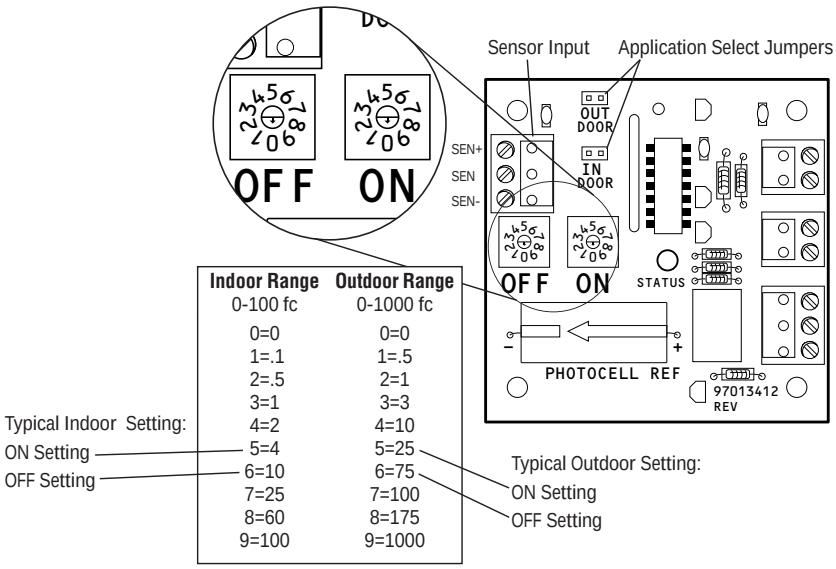
Installation

1. Mount the control module either in, or remote from, the lighting control device. When interfacing with a LightMaster controller, it is usually easiest to mount the photocell control module in the low voltage section of the controller. If choosing to mount the control module remotely, do not exceed a distance of 5000 feet from the control module to the ILC lighting controller. Use 18 gauge conductors. If the photocell controller is used to interface with non-ILC manufactured equipment, consult the manufacturer's literature for guidance.
2. Install the sensor and terminate it to the sensor inputs on the photocell control module. Use 18 gauge wire and keep the distance under 5000 feet. If the sensor is for an outdoor application, mount it on a roof or equal facing north with its hood on top and facing away from any night time light sources. Indoor sensors should be installed 6-8 feet from windows, with the sensing eye pointed down and away from any direct lighting.
3. Depending on the application, wire the photocell control module output to the input of the lighting control device. Use 18 gauge conductors. Use a dedicated output when interfacing with an ILC controller. (Program the selected lighting controller switch input as Maintained ON/OFF.) Use the SPDT dry contact output when interfacing with other devices. **Caution: Do not exceed 1500ma @ 30 VDC.**
4. Wire the 12 VAC or VDC power source to the photocell control module power input terminals.

Figure P.1– Hardwired Photocell Installation

Photocell Controller Board Setup Guide

ON and OFF Set Point Selectors



Indoor Range 0-100 fc	Outdoor Range 0-1000 fc
0=0	0=0
1=.1	1=.5
2=.5	2=1
3=1	3=3
4=2	4=10
5=4	5=25
6=10	6=75
7=25	7=100
8=60	8=175
9=100	9=1000

Description

The ILC Photocell is an electronic device which supports the ON/OFF control of lighting circuits. The lighting circuits are controlled indirectly by means of the photocell controller module maintained contact closure signals sensed by the switch inputs of LightMaster lighting controllers or by dry contact inputs to other devices which control line voltage loads via low voltage (Class 2) signals. The photocell control module can be mounted either on the manufacturer provided plastic channel for installation in the control section of the LightMaster lighting controller, or in an enclosure suitable for remote mounting. The photocell control module requires either a 12 VAC or 12 VDC power source to operate. It is recommended that the power source feature a disconnecting means to facilitate service.

The photocell control module outputs respond when the photocell sensor detects the user selected ON and OFF foot candle level. Both outdoor and indoor sensors are available depending on the required application.

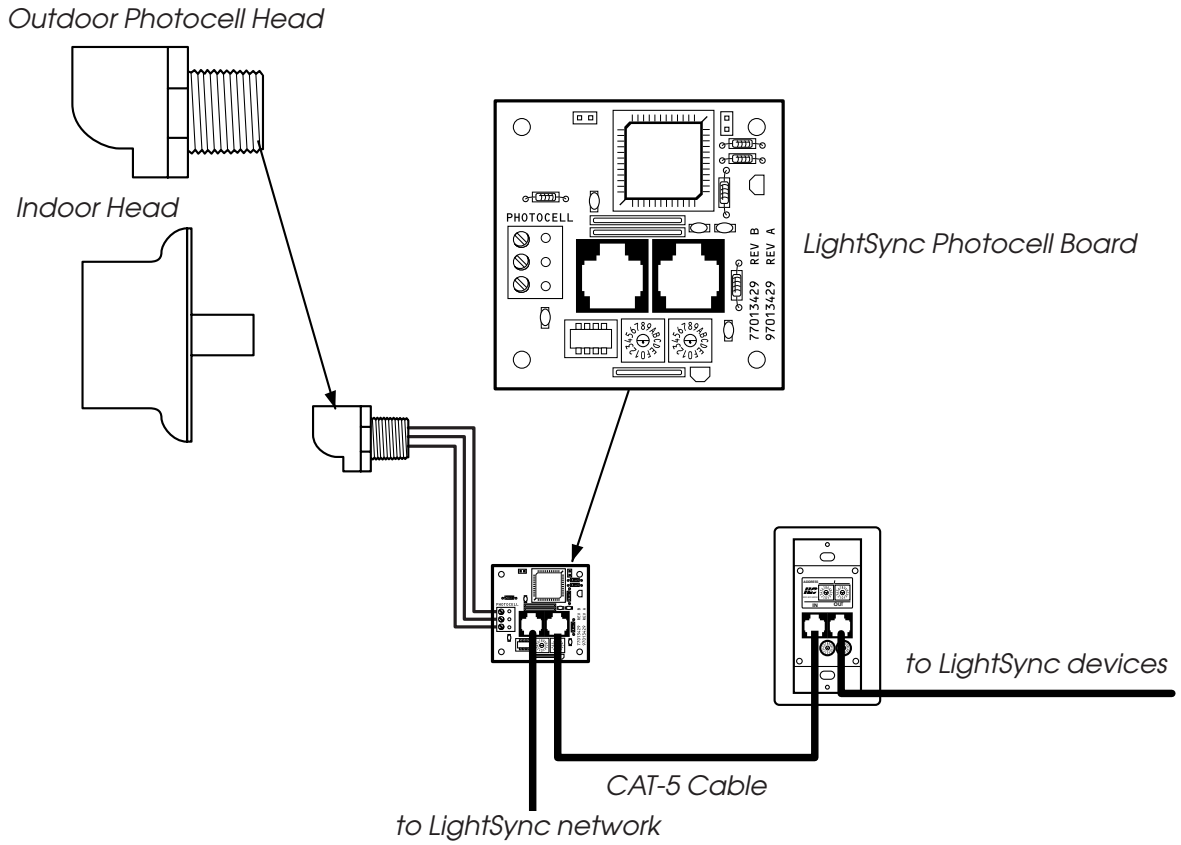
Setup (See above example)

1. Jumper the photocell control module for either outdoor or indoor depending on your application.
2. Set the desired ON and OFF foot candle levels by turning the rotary switches to the desired settings.
   Typical settings: outdoor – ON at 25fc, OFF at 75fc; indoor – ON at 4fc, OFF at 10fc.
3. Energize the 12 VAC or 12 VDC power.
4. Simulate dark and light conditions at the sensor and make any required adjustments on the rotary switches. Note: On power up there is a 15-25 minute setup period during which the controller will react instantly. After the setup time has expired, there is an 8-12 second time delay to prevent nuisance switching during normal operation.

Figure P.2– Hardwired Photocell Setup

P.5 Installation

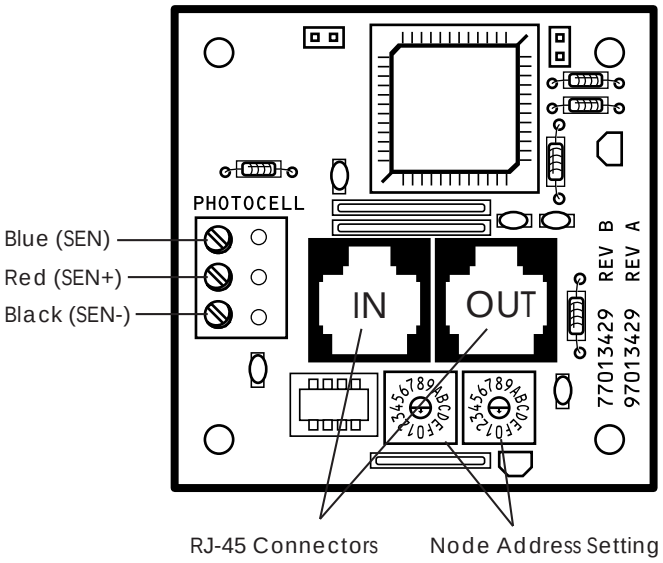
1. Route the CAT-5 cable to the photo controller from the nearest LightSync™ device node.
2. Crimp male ends on the cable and check the cable integrity with a CAT-5 cable tester.
3. Install the photo sensor and terminate the conductors to the controller board.
4. Set the node address.
5. Plug the incoming CAT-5 cable into the "IN" photo-controller RJ-45 connector . Plug the other end of the CAT-5 into the "OUT" connector on the upstream LightSync node.



The LightSync Photo Sensor provides 256 light to dark levels, allowing the user to select 8 individual set points for OFF and ON. Each set point features a selectable range of deadband and is programmable to individual relays or groups of relays. The LightSync Photo Sensor is configured from any LightMaster programming device and allows the indoor or outdoor photocell to operate as a fully programmable global switch on the LightSync network.

Figure P.3– LightSync Photocell Installation Overview

LightSync Photocell Controller Board



LightSync Photocell Controller Board Mounting Options

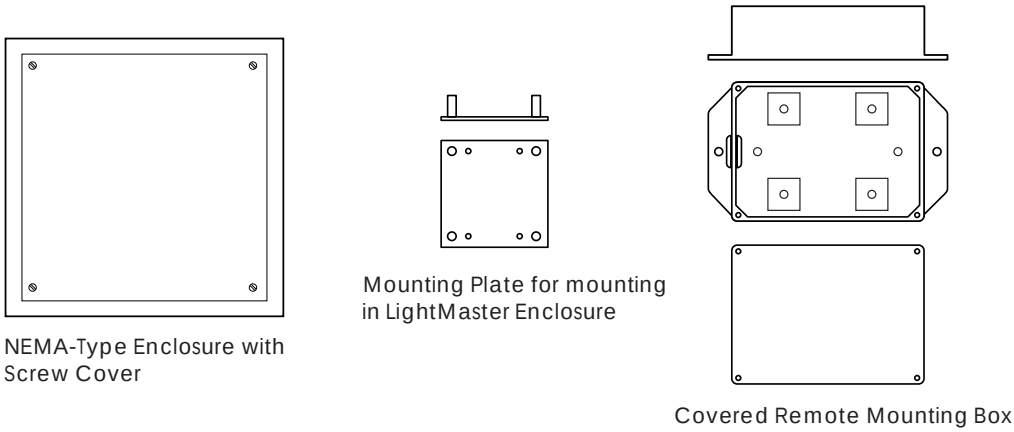


Figure P.4– LightSync Photocell Controller Board Detail and Mounting options

P.6 Programming Example

How to Program a LightSync™ Photocell to Control Relay Outputs

You have to perform two essential and possibly one optional tasks to control relays from a LightSync photocell.

- Define the photocell operational parameters
- Select the relays to be controlled and define how they will react
- If desired, change the photocell filter rate from its default of 30 seconds to 2 seconds. The filter is a delay period applied to the photocell controller to prevent nuisance switching (30 is generally used.)

Define the photocell node:
(This operation is performed at the System level)

1. Launch LightMaster ENET and go to CONFIGURE LIGHTSYNC DEVICES under EDIT SYSTEM. Select Photocell from the list of devices. Define the photocell's operational parameters.

Select the relays that the photocell will control
(This operation is performed at the Node level)

1. Select the node address of the desired controller from the SELECT NODE menu, then EDIT NODE.
2. Select SWITCH INPUTS, then LIGHTSYNC INPUTS, then LightSync input to Relay Control. Select the LightSync node you have assigned to the photocell.
3. Select the input number.
4. Select the action of the relays being controlled. (ON only, OFF only, On & OFF, and Blink Alert).

Change the Photocell Filter
(This operation is performed at the System level)

1. Select SPECIAL FUNCTIONS from the EDIT SYSTEM menu.
2. Select PHOTOCELL FILTER, then select either a 30 second or 2 second average (30 sec. is the default).