Catalog Number:	Date:	Project:

OVERVIEW

The nLight nIO X is a small inline wired device that digitally interfaces an nLight-enabled zone with a non-nLight device with RS-232 or RS-485 outputs (such as a 3rd party touch panel). This allows rooms with non-nLight touch panels (often for controlling HVAC or A/V) to also individually turn controlled lighting loads on/off and to raise/lower their light level. Additionally, the nIO X enables one of four local/global scenes to be run upon request.

FEATUR ES

- Digitally Interfaces an nLight Zone with a non-nLight Device (e.g. 3rd Party Touch Panel)
- Enables On/Off/Dim Commands
- Provides Relay and Dimming Level Status to Touch Screen when polled
- Toggles Local Relays On/Off
- Stores and runs up to 4 local or global scenes
- Remotely configurable/upgradeable
- Communication indicator via LED per RJ-45 port

Warranty
Five-year limited warranty. Complete warranty terms located at:
www.acuitybrands.com/CustomerResources/Terms_and_conditions.aspx

Note: Actual performance may differ as a result of end-user environment and application. Specifications subject to change without notice.

A+ Capable

This item is an A+ capable component, which has been designed and tested to provide out-of-the-box luminaire compatibility with simple commissioning, when included as part of an A+ Certified™ Solution.

To learn more about A+, visit www.acuitybrands.com/aplus.

nLIGHT

nIO X

External Third Party Interface Device

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ORDERING INFORMATION

nIO X			Example: nIO X Kit
Series		**Temp/Humidity (nIO X CTRL only)**	
nIO X Kit	nLight RS-232 Interface Kit (includes controller & RS232 Isolator)	[blank]	Standard
nIO X CTRL	nLight RS-232 Interface Controller (replacement only)	LT	Low Temp
RS232 ISO	RS-232 Isolator (replacement only)		
nIO X 485	nLight RS-485 Interface Controller (isolator not required for RS-485 version)		

Rev. 10/17/17

SPECIFICATIONS

nIO X CTRL / nIO X 485:

Size:	2.54" H x 1.98" W x 1.00" D (6.45 cm x 5.03 cm x 2.54 cm)
Mounting:	Predrilled screw hole
Weight:	nIO X CTRL or nIO X 485: 2 oz nIO X Kit: 16 oz
Serial Ports:	nIO X CTRL- 1 RS-485 Native nLight (RJ-45), 1 RS-232 External Interface (RJ-45) nIO X 485- 1 RS-485 Native nLight (RJ-45), 1 RS-485 External Interface (RJ-45)
Provided Accessories:	1 DB9F to RJ-45F adapter & 6" CAT-5 patch cable
nLight Bus Power Consumption:	< 3mA

RoHS Compliant

RS232 ISO (not including power supply):

Size:	4.38" H x 2.13" W x 1.00" D (11.13 cm x 5.41 cm x 2.54 cm)
Serial Ports:	2 RS-232 Interface Ports (DB9M)
Provided Accessories:	2 DB9 Patch Cables, AC Adapter (120-240V, 50/60 Hz)

RS-232 Comm.:

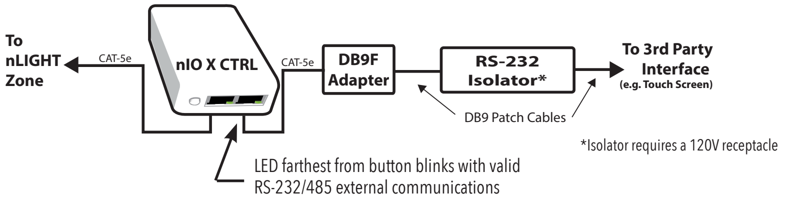
Baud Rate:	115,200 bps
Data Bits:	8
Parity:	None
Start Bit(s):	1
Stop Bit(s):	1

OPERATION

Using the protocol commands specified, a 3rd party interface would send commands (via status packets) to the nIO X. The nIO X will translate the received command into the corresponding nLight status packet and then retransmit over the nLight port. All nLight devices in that zone then execute the command (i.e. transfer relays, dim, or run a scene). If a scene is to be executed, it must first be setup using the normal nLight SensorView interface. When a user initiates a scene, the touch panel sends a special scene command which the nIO X executes by sending all the scene's settings to the necessary nLight devices. A touch panel can also periodically poll the nIO X in order to determine the status of the zone's relays and/or dimming levels.

WIRING / PINOUT

Physically, the nIO X has two RJ-45 ports. The first is an nLight port that is wired using CAT-5e cable to any nLight-enabled device within the zone to be controlled. The second is a port that communicates to the touch screen using the digital protocol specified within this document. Both RS-232 and RS-485 electrical interfaces are supported (see pin-out tables on page 2). The serial data format consists of 8 data bits, no parity, one start bit, and one stop bit at 115,200 bps. Included with the nIO X is a DB9F to RJ-45 adapter (see image on below) and a 6 in CAT-5e cable. The nIO X KIT also includes an RS-232 Isolator that is required when interfacing RS-232 equipment.



*Isolator requires a 120V receptacle

LED farthest from button blinks with valid RS-232/485 external communications

DB9F to RJ-45F Adapter

RS-232 Isolator

NIO X PIN-OUT DESCRIPTION

RS-232 Pin-out (DB9 Female)			
PIN	**DESCRIPTION**	**PIN**	**DESCRIPTION**
1	No Connection	6	No Connection
2	(TXD) RS-232 Transmit Data	7	No Connection
3	(RXD) RS-232 Receive Data	8	No Connection
4	No Connection	9	No Connection
5	Ground (RS-232 Common)		

RS-485 Pin-out (DB9 Female) - *nIO X 485 unit only*		
PIN	**DIRECTION**	**DESCRIPTION**
Tie Pins 1 &9 together	Bi-Directional	RS485 -
Tie Pins 4 & 6 together	Bi-Directional	RS485 +
Pin 5	Ground	Ground
Pins 2, 3, 7, 8		No Connection

NIO X COMMUNICATION PROTOCOL DESCRIPTION

To assist in the encoding of specific instructions for the nIO X into the binary values that must be sent by the non-nLight device (e.g. touch screen), refer to our online encoder tool.

The technical documentation for the protocol is described further below. Consult the non-nLight device's documentation and/or manufacturer for technical support related to programming.

PACKET FORMAT

Sync Byte (0xA5)	Length	Subject	Data	Checksum
1-byte	**1-byte**	**1-byte**	**Variable**	**2-bytes**
(8-bits)	**(8-bits)**	**(8-bits)**	**(Variable)**	**(16-bits)**

Min. Size: 5-bytes (No-data field)
Max Size: 50 bytes

Sync Byte (1 byte long):
The header is a single byte (8 bits). This byte is always 0xA5. It signifies the beginning of a new packet. Its bit pattern, 10100101, may also be used to synchronize to the exact baud rate by measuring the bit widths.

Length (1 byte long):
The length value includes every byte in the packet from the Sync byte to the checksum bytes.
Valid packet lengths: 5-50

Subject (1 byte long):
1-253 Commands and Responses

Data (0 to 45 bytes long)

CheckSum (2 bytes long):
The 16-bit (2 bytes) checksum is calculated over all received/transmitted bytes B1...Bn in the data frame except the checksum bytes themselves by XORing odd bytes and even bytes separately and inverting the result.

Formula:
CK1 = INV [B1 XOR B3 XOR … XOR Bn–1]
CK2 = INV [B2 XOR B4 XOR … XOR Bn]

For example:
To send the packet: A5 08 7A 01 04 05 CK1 CK2, the sender must calculate CK1 and CK2 and attach them to the end of the packet.

CK1 = INV[A5 ^ 7A ^ 04] = 24
CK2 = INV[08 ^ 01 ^ 05] = F3

TRANSMISSION CODES

Acknowledgement - ACK (0x04):
An ACK indicates that the command was received. The Data Field holds the command which is being acknowledged (ACK'd).

Example:	**Sync Byte**	**Length**	**Subject**	**Data**	**Checksum**
	0xA5	**0xXX**	**0x04**	**0xXX**	**0xFFFF**

Poll - (0x0C):
Used to request status of nLight Zone.

Example:	**Sync Byte**	**Length**	**Subject**	**Checksum**
	0xA5	**0xXX**	**0x0C**	**0xFFFF**

Poll Response (0x0D):
Contains information regarding status of nLight Zone.

Example:	**Sync Byte**	**Length**	**Subject**	**Data**	**Checksum**
	0xA5	**0xXX**	**0x0D**	**0xXXXX**	**0xFFFF**

The Data Field holds the status of relays in the zone (as follows on following pages):

<u>Poll Response Data Field</u> (0xXXXX):

Byte 0:

Bit 7 = Set if any relays tracking switches on channel 16 are closed.
Bit 6 = Set if any relays tracking switches on channel 15 are closed.
Bit 5 = Set if any relays tracking switches on channel 14 are closed.
Bit 4 = Set if any relays tracking switches on channel 13 are closed.
Bit 3 = Set if any relays tracking switches on channel 12 are closed.
Bit 2 = Set if any relays tracking switches on channel 11 are closed.
Bit 1 = Set if any relays tracking switches on channel 10 are closed.
Bit 0 = Set if any relays tracking switches on channel 9 are closed.

Byte 1:

Bit 7 = Set if any relays tracking switches on channel 8 are closed.
Bit 6 = Set if any relays tracking switches on channel 7 are closed.
Bit 5 = Set if any relays tracking switches on channel 6 are closed.
Bit 4 = Set if any relays tracking switches on channel 5 are closed.
Bit 3 = Set if any relays tracking switches on channel 4 are closed.
Bit 2 = Set if any relays tracking switches on channel 3 are closed.
Bit 1 = Set if any relays tracking switches on channel 2 are closed.
Bit 0 = Set if any relays tracking switches on channel 1 are closed.

Byte 2: Maximum Dim Level of any device tracking switches on channel 1
Byte 3: Maximum Dim Level of any device tracking switches on channel 2
Byte 4: Maximum Dim Level of any device tracking switches on channel 3
Byte 5: Maximum Dim Level of any device tracking switches on channel 4
Byte 6: Maximum Dim Level of any device tracking switches on channel 5
Byte 7: Maximum Dim Level of any device tracking switches on channel 6
Byte 8: Maximum Dim Level of any device tracking switches on channel 7
Byte 9: Maximum Dim Level of any device tracking switches on channel 8
Byte 10: Maximum Dim Level of any device tracking switches on channel 9
Byte 11: Maximum Dim Level of any device tracking switches on channel 10
Byte 12: Maximum Dim Level of any device tracking switches on channel 11
Byte 13: Maximum Dim Level of any device tracking switches on channel 12
Byte 14: Maximum Dim Level of any device tracking switches on channel 13
Byte 15: Maximum Dim Level of any device tracking switches on channel 14
Byte 16: Maximum Dim Level of any device tracking switches on channel 15
Byte 17: Maximum Dim Level of any device tracking switches on channel 16

Byte 18:

Bits 0-3: Pole 2 Scene Status (see codes below)
Bits 4-7: Pole 1 Scene Status (see codes below)

Byte 19:

Bits 0-3: Pole 4 Scene Status (see codes below)
Bits 4-7: Pole 3 Scene Status (see codes below)

Status Codes	Hex Value	Description
Scene Control Disable	0x00	Scene control is disabled, this overrides control button action
Scene Control Active	0x01	Scene control is active, button has been pressed from the scene selector and settings were sent successfully
Scene Control Idle	0x02	Scene Control is enabled, waiting for execution from button press or remote execution command
Scene Control Error	0x03	Scene control error, the execution was initiated and an error occurred during transmission of settings to the list of devices

Channel Exert (0x7A):

Command to perform one of the following actions:

Exert On, Exert Off, Dim Up, Dim Down, and Go To Dim Level

This command will respond immediately with an Acknowledge packet.

Sync Byte	Length	Subject	Payload	Checksum
0xA5	0xXX	0x7A	(see below)	0xFFFF

Payload Format:

byte0	byte1	byte2
Channel	Action	Dim Amount

Channel (1 byte): The switch broadcast channel of the switch being pressed.
Channel 1 = 0x01, Channel 2 = 0x02, … , Channel 16 = 0x10.

Action (1 byte)

Exert On = 0x01
Exert Off = 0x02
Dim Up = 0x03
Dim Down = 0x04
Go To Dim Level = 0x05

Dim Amount (1 byte)

1. **For Exert On and Exert Off: (don't care)**
2. **For Dim Up and Dim Down: 5, 10, 15, 20, or 25 => The percentage (in hex) the dim level will change by with each button press**
3. **For Go To Dim Level: 0-100 => The percentage (in hex) of full brightness desired**

Examples:

Exert On Channel 1 =	A5 08 7A 01 01 00 21 F6
Ack =	A5 07 04 7A 01 5F 82
Exert On Channel 2 =	A5 08 7A 02 01 00 21 F5
Ack =	A5 07 04 7A 01 5F 82
Exert Off Channel 3 =	A5 08 7A 03 02 00 22 F4
Ack =	A5 07 04 7A 02 5C 82
Exert Up 5% on Channel 4 =	A5 08 7A 04 03 05 23 F6
Ack =	A5 07 04 7A 03 5D 82
Exert Down 5% on Channel 1 =	A5 08 7A 01 04 05 24 F3
Ack =	A5 07 04 7A 04 5A 82
Go To 78% on Channel 8 =	A5 08 7A 08 05 4E 25 B1
Ack =	A5 07 04 7A 05 5B

Execute Scene (0x85)

This command will execute all settings from the respective scene control button and will respond immediately with an Acknowledge packet. The specific actions (settings) associated with the scene will be setup using nLight Sensorview software.

Sync Byte	Length	Subject	Payload	Checksum
0xA5	0xXX	0x85	(see below)	0xFFFF

Payload:

0x01 = Scene 1
0x02 = Scene 2
0x03 = Scene 3
0x04 = Scene 4