BACnet IP Interface

SENSORVIEW TO BACNET IP SOFTWARE PLUG-IN MODULE

SPECIFICATIONS

FEATURES

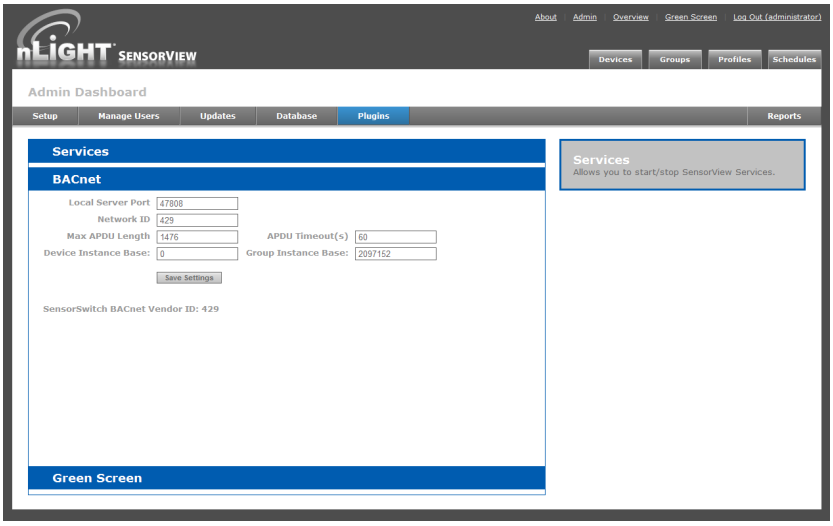
Software Interface to BMS/BAS Systems over BACnet IP
Change of Value Reporting
Network Data Collection

BACNET PICS INFORMATION

VENDOR NAME: Sensor Switch
PRODUCT NAME: nLight BACnet Interface
SOFTWARE VERSION: SensorView 2.5
DATA LINK LAYER: BACnet IP, (Annex J)
CHARACTER SET SUPPORTED: ANSI X3.4
SEGMENTATION: Not Supported
CONFIGURABLE PARAMETERS:
- APDU Timeout
- Device Base Instance
- Group Base Instance
- Local Server BACnet Port
- Max APDU Length
- Max String Length (for description field)
- Network ID

OVERVIEW

The nLight SensorView **BACnet IP Software Plug-in** module allows a Building Management System (BMS) to communicate to an nLight system. This plug-in module functions as a software gateway to the nLight network, receiving and translating BACnet IP messages from any BMS system and then transmitting them over the nLight network. Response messages from the nLight network are then similarly translated and communicated back via BACnet IP to the BMS system. Additionally this software gateway will allow BMS systems to subscribe for change of value notification for devices or for zone groups (not including user created groups).



This interface is a BACnet/IP software solution that requires the SensorView application to run at all times. The SensorView host server must be permantently connected to the network of nLight hardware devices. BACnet is not resident on nLight hardware devices, SensorView manages all BACnet communication on behalf of the hardware. The following requests for nLight network and device information are supported:

- Model #
- User Label
- Firmware Revision
- Changes in the value of occupancy state and/or relay state
- Read zone relay state (open/closed). If any relay is closed, state = closed; If ALL relays are open, state = open
- Read zone occupancy state (occupied/vacant). If any sensor has occupancy, state = occupied; If ALL sensors unoccupied, state = vacant
- Read measured light level and dimming input level
- Run profile
- Read list of profiles currently in the SensorView database

All individual devices and zone groups are enumerated automatically and are made available for reading via the BMS controller. SensorView itself is present as the first instance number in the specified sequence and contains objects that allow all profiles in the system to be run or disabled from the BMS system. The instance numbers for all devices are configurable in the Plug-ins screen of the Admin page in SensorView (see above). The network number that all devices report under is also configurable in the same Plug-in tab as the instance numbers.

DETAILED IMPLEMENTATION DESCRIPTION

Change of Value with Device Management
If any object specified for change of value reporting cannot be polled then all the registered change of value properties for the object will enter a fault state and be reported to the BMS controller. Once the faulting device can be polled again the object will report the change of value notices for all properties after the current value has been determined again (this is because the object could be faulting for an indeterminate length of time and the current value must be determined rather than reporting an old value). For example, if a zone being monitored for relay and occupancy state has an occupancy sensor go offline while all relay devices still remain online, both occupancy and relay properties will enter fault states. If a single device becomes unreachable, then all monitored properties of the device will enter the fault state. It is important to note that any device being added, removed, or replaced will only become visible to the BACnet subsystem once it has been discovered by SensorView. It is also important to note that for device management related to removal or replacement, the individual device/zone will already be in a fault state since the candidate device must be offline for these actions to be possible.

Device Removal
Removing an offline device via SensorView has different effects whether the removed device was monitored as a single device or as a zone. If the device is individually being monitored then all monitored properties will enter the fault state. Since only offline devices are eligible for removal, once it is removed it will again send fault notices. Additionally, if the device is reconnected in single device monitoring mode it *WILL NOT* be monitored since the removal of the device via SensorView will delete any preexisting change of value registrations. If the device being removed is part of a zone being monitored (and assuming there is no other faults in the zone), the zone will report the new resulting property values once each has been redetermined by polling all remaining devices. If there are any properties in the zone that were *ONLY* present in the removed device, then that property will enter a fault state.

Device Addition
Adding a device has no effect on individual device monitoring since the device would have to be present before change of value can be registered for it. If a device is connected to a zone that is being monitored then it will inherit monitoring on all properties that were currently being monitored for the zone. Once the device has been polled, any necessary change of value notices will be reported if the property value causes the current average value to cross the configured threshold.

Device Replace
If a device being replaced is being monitored individually, then the new device will inherit its place. Once it is polled it will then report the current value. If the device being replaced is part of a zone being monitored (and assuming there is no other faults in the zone), the zone will report the new resulting property values once each has been redetermined by incorporating the new devices values.

Data Collection
The data collection algorithm for the nLight BACnet interface works to reduce the time between when an event occurs (i.e. a relay or occupancy state change) and when the change is reported to the BMS. This algorithm is necessary because there may be other SensorView plugin applications (such as the GreenScreen plug-in) polling the nLight network simultaneously. When just the nLight BACnet plug-in is enabled, data is monitored by polling each zone a single device at a time. Once a single device in every zone has been polled, a second device in each zone is polled. This algorithm is possible because devices in a zone intercommunicate. If a change of state of a single device (for example an occupancy sensor) is observed, changes in the states of other devices (for example relays) can be anticipated. This triggers more immediate polling of the zone. For example, if the occupancy state of a monitored sensor in a zone has changed, the rest of the devices in the zone are polled to determine if their states also changed. In general, if a state change for a given device is detected, the additional devices in the zone will be polled until either: all devices have been polled, it is determined that additional properties have changed, or it is determined that all other properties did not change. The extra polling of devices in a zone does not affect the regular polling schedule for devices in other zones. This algorithm is preferred to polling every device in a given zone and then moving to the next zone because, on average, it reduces the average delay for an event to be reported across the network. The worse case performance for the algorithm is equivalent to a straight linear poll.

Combined BACnet and GreenScreen Data Collection
If an end user wishes to run the nLight BACnet plug-in and the GreenScreen plug-in simultaneously, all devices in a zone will be polled before moving onto the next zone. This may slow the BACnet change of value notification. The polling schedule will automatically switch to the algorithm described previously if the GreenScreen plug-in is stopped.

PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (PICS)

The following BACnet service requests are supported:

- Confirmed Request
  - ReadProperty
  - ReadPropertyMultiple
  - ConfirmedCOVNotification
- Subscribe COV
- SubscribeCOVProperty – for purpose of changing COV Increment only
- Unconfirmed Request
  - Who-Is
  - I-Am
  - Who-Has
  - I-Have
  - UnconfirmedCOVNotification
- Complex ACK
- Simple ACK

BACnet Interoperability Building Blocks (Annex J)

DS-RP-A	Read Property
DS-RP-B	Read Property
DS-RPM-A	Read Property Multiple
DS-RPM-B	Read Property Multiple

A SensorView device object exists and is represented as a BACnet device object with an instance number of BACnet Base Device Instance + 1. The points/objects under the SensorView device object are the profiles that have been created and are stored in SensorView. The profiles are represented by binary value objects with instance numbers starting at 100 + the profile ID. Each nLight device, excluding the nGWY is represented as a BACnet device object with instance numbers starting at BACnet Base Device Instance + 2

OBJECT TYPE:

nLight Object	Access	Zone Derived	BACnet Object Type	Instance number
SensorView object	R		Device (8)	BACnet Device Base + 1
Sensor, Power Pack, Slave Pack, nIO	R		Device (8)	BACnet Device Base + (2+N)
Zone object	R		Device (8)	BACnet Group Base + 1
Measured Light Level	R/COV	average	Analog Input (0)	1
Dimming Input Level	R/COV	average	Analog Input (0)	2
Dimming Output Level (P1)	R/COV	average	Analog Value (2)	1
Dimming Output Level P2	R/COV	average	Analog Value (2)	2
Time Delay Remaining (P1)	R/COV	maximum	Analog Value (2)	3
Time Delay Remaining P2	R/COV	maximum	Analog Value (2)	4
Photocell Inhibit Timer (P1)	R/COV	maximum	Analog Value (2)	9
Photocell Inhibit Timer P2	R/COV	maximum	Analog Value (2)	10
Active Load	R/COV	average	Analog Value (2)	28
Active Load (P1)	R/COV	average	Analog Value (2)	29
Active Load (P2)	R/COV	average	Analog Value (2)	30
Occupied (P1/P2 combined)	R/COV	see below	Binary Value (5)	1
Occupied (P1)	R/COV	see below	Binary Value (5)	2
Occupied P2	R/COV	see below	Binary Value (5)	3
Relays (P1/P2 combined)	R/COV	see below	Binary Value (5)	4
Relay State (P1)	R/COV	see below	Binary Value (5)	5
Relay State P2	R/COV	see below	Binary Value (5)	6
Photocell Inhibiting (P1)	R/COV	see below	Binary Value (5)	7
Photocell Inhibiting P2	R/COV	see below	Binary Value (5)	8
Heartbeat	R		Binary Value	33

Access:
R – read only access R/W – read and write access COV – Supports Change of Value Notification

DERIVED OBJECTS (ZONE AND INDIVIDUAL)

Occupied – derived from time delay remaining status value

Individual devices:

- If time delay is not zero, occupied is true
- If time delay is zero, occupied is false

Zone groups:

- If the time delay of any device in a zone is not zero, occupied is true
- If all time delays within zone are zero, occupied is false

Relays – derived from relay state of devices within zone

- If at least one relay in zone is closed, relays is true (lights are on)
- If all relays in zone are open, relays is false (lights are off)

Photocell inhibiting – derived from photocell inhibit and non inhibit timers

- If the photocell inhibit timer is not zero, photocell inhibiting is true
- If the photocell non-inhibit timer is not zero, photocell inhibiting is false

Maximum – value returned will be the maximum of all like objects in zone

Average – value returned will be the average of all like objects in zone

INSTANCE NUMBERS

BACnet Device Objects are used to represent the SensorView object, therefore nLight devices, nLight zones/groups, and BACnet instance numbers do not map directly to SensorSwitch IDs. Furthermore, there are two configurable base numbers stored in the SensorView database. One base (device base number) is used to assign unique instance numbers to the SensorView object and to each nLight Device. The other base number (group base number) is used to assign unique instance numbers to nLight zones/groups. nLight zone/group IDs are offset by the group base number to create a unique BACnet instance number. Instance numbers of BACnet Objects other than devices are fixed values, see table on reverse.

PROFILES

Profiles are represented as Binary Value objects under the SensorView device object. Their instance numbers begin at 100 offset by the profile ID. Profiles can be run by writing a 1 to the BV object and Disabled by writing 0.

DEVICE OBJECT:

Property Identifier	Property Data Type	Access
Object_Identifier (75)	BACnetObjectIdentifier	Read
Object_Name (77)	CharacterString	Read
Object_Type (79)	BACnetObjectType	Read
System_Status (112)	BACnetDeviceStatus	Read
Vendor_Name (121)	CharacterString	Read
Vendor_Identifier (120)	Unsigned 16	Read
Model_Name (70)	CharacterString	Read
Firmware_Revision(44)	CharacterString	Read
Description (28)	CharacterString	Read/Optional
Protocol_Version (98)	Unsigned	Read
Protocol_Revision (139)	Unsigned	Read
Protocol_Services_Supported (97)	BACnetServicesSupported	Read
Protocol_Object_Types_Supported (96)	BACnetObjectTypesSupported	Read
Object_List (76)	BACnetARRAY[n]ofBACnetObjectIdentifier	Read
Max_APDU_Length_Accepted (62)	Unsigned	Read
Segmentation_Supported (107)	BACnetSegmentation	Read
APDU_Timeout (11)	Unsigned	Read
Number_Of_APDU_Retries (73)	Unsigned	Read
Device_Address_Binding (30)	List of BACnetAddressBinding	Read
Database_Revision (155)	Unsigned	Read
Active_COV_Subscriptions (152)	List of BACnetCOVSubscription	Read/Write

ANALOG INPUT OBJECT:

Property Identifier	Property Data Type	Access
Object_Identifier	BACnetObjectIdentifier	Read
Object_Name	CharacterString	Read
Object_Type	BACnetObjectType	Read
Present_Value	REAL	Read
Description	CharacterString	Read/Optional
Status_Flags	BACnetStatusFlags	Read
Event_State	BACnetEventState	Read
Out_Of_Service	BOOLEAN	Read
Units	BACnetEngineeringUnits	Read
COV_Increment	REAL	Read

ANALOG VALUE OBJECT:

Property Identifier	Property Data Type	Access
Object_Identifier	BACnetObjectIdentifier	Read
Object_Name	CharacterString	Read
Object_Type	BACnetObjectType	Read
Present_Value	REAL	Read/Write* (non commandable)
Description	CharacterString	Read/Optional
Status_Flags	BACnetStatusFlags	Read
Event_State	BACnetEventState	Read
Out_Of_Service	BOOLEAN	Read
Units	BACnetEngineeringUnits	Read
COV_Increment	REAL	Read

*Not all values are Writable, see Object Type table

BINARY VALUE OBJECT:

Property Identifier	Property Data Type	Access
Object_Identifier	BACnetObjectIdentifier	Read
Object_Name	CharacterString	Read
Object_Type	BACnetObjectType	Read
Present_Value	REAL	Read
Description	CharacterString	Read/Optional
Status_Flags	BACnetStatusFlags	Read
Event_State	BACnetEventState	Read
Out_Of_Service	BOOLEAN	Read
Inactive_Text	CharacterString	Read
Active_Text	CharacterString	Read

Please refer to the ASHRAE BACnet Protocol document for a description of each BACnet property.