Lutron/Johnson Controls® BACnet Integration

Johnson Controls

Quantum Integration Overview

Quantum server

Quantum Vue client

JCI Controller

Building Ethernet BACnet/IP

Quantum Lighting Hub (floor 1)

Quantum Lighting Hub (floor 1)
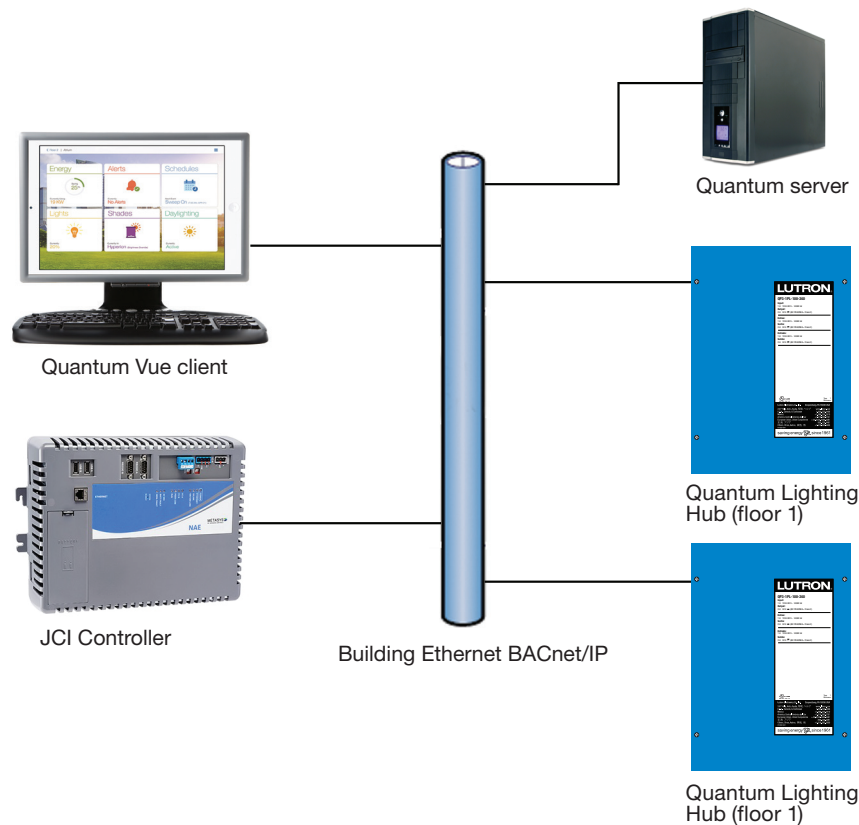
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The Lutron Quantum lighting control system is a total light management system that incorporates digital LED drivers and fluorescent ballast controllers, analog dimming and switching lighting controllers, motorized window treatments, keypads, occupancy sensors, light level sensors and web browser based control software, all under one programmable software system.
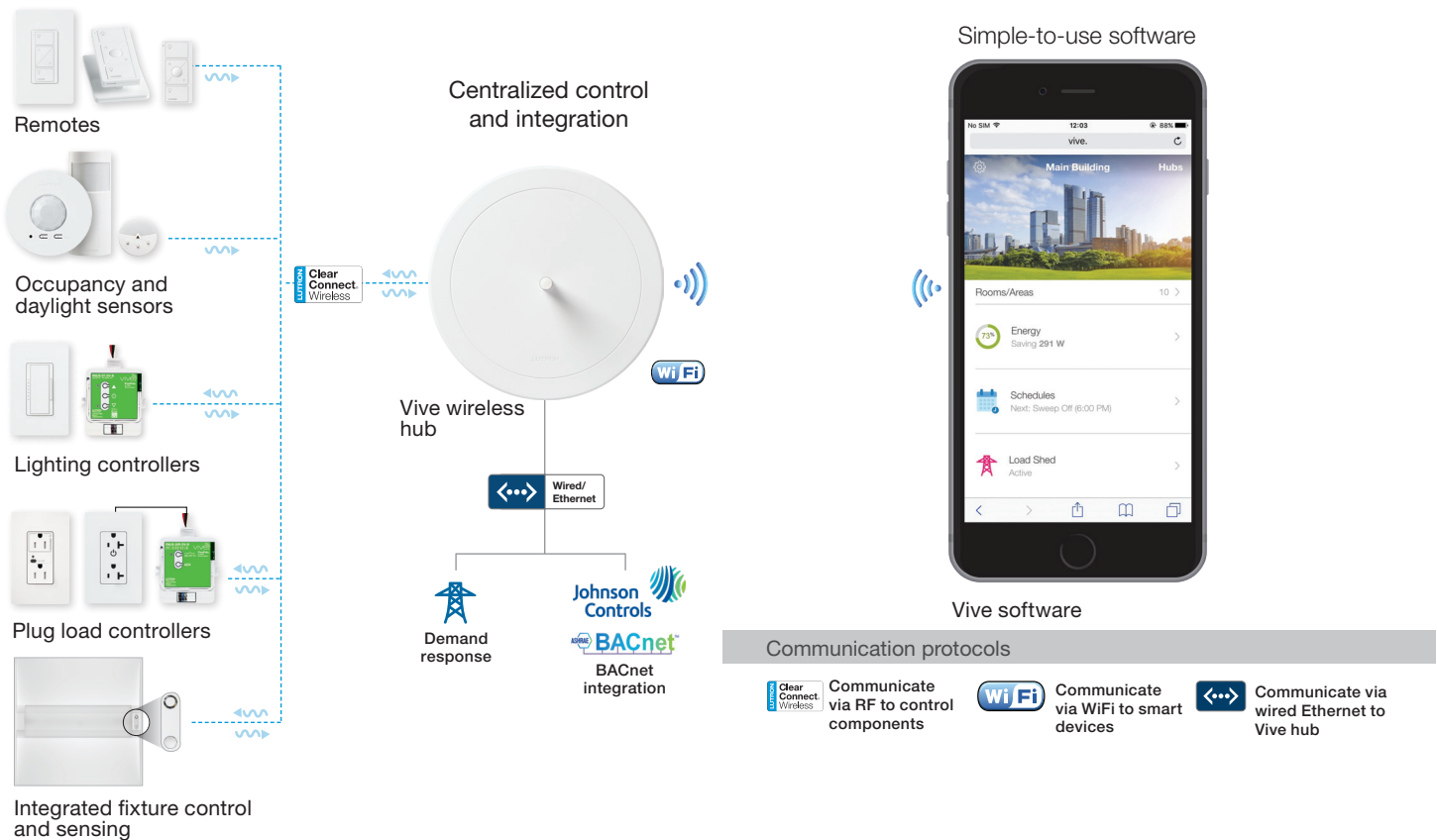
A typical building will contain at least one Quantum Lighting Hub per floor which are connected together as a system over an Ethernet network. The Quantum system can seamlessly and reliably integrate with other building management systems over the Ethernet network using an industry standard protocol known as BACnet/IP.

The BACnet/IP protocol is embedded in the Quantum Lighting Hubs, which means that no external interfaces or gateways are required for integration. The diagram above shows an optional Quantum server which is used to provide a central software user interface for the Quantum system and for historical data logging and reporting.

The Quantum system has been tested by BACnet Testing Laboratories (BTL) and is certified to comply with all of their necessary interoperability requirements.
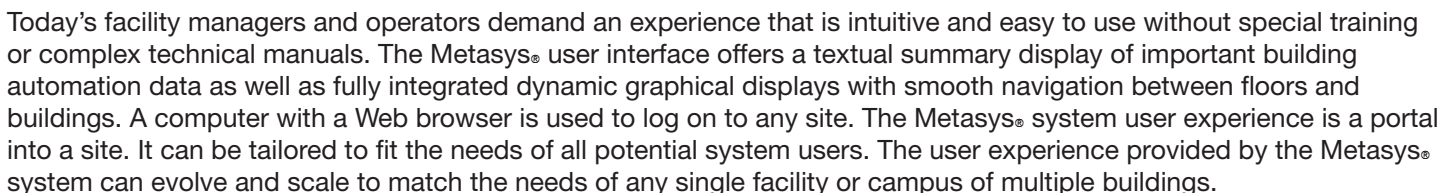
Vive System Overview

Wireless controls and sensors

Remotes

Occupancy and daylight sensors

Lighting controllers

Plug load controllers

Integrated fixture control and sensing

Centralized control and integration

Clear Connect Wireless

Wi Fi

Vive wireless hub

Wired/ Ethernet

Demand response

Johnson Controls

ASHRAE BACnet

BACnet integration

Simple-to-use software

Vive software

Communication protocols

Clear Connect Wireless — Communicate via RF to control components

Wi Fi — Communicate via WiFi to smart devices

— Communicate via wired Ethernet to Vive hub

The Lutron Vive system is the premier simple and scalable retrofit lighting control solution for commercial buildings. The system consists of: a centralized main controller called the Vive wireless hub; wireless load controllers for lighting loads throughout the space; wireless wall controls, occupancy sensors, and daylight sensors; and intuitive programming and monitoring software to tie the solution together. The individual load controllers communicate directly with remotes and sensors, but also communicate back to the Vive wireless hub via Lutron Clear Connect wireless technology. This allows for energy monitoring, timeclock events, and demand response functionality. In a typical building, you will have at least one Vive wireless hub per floor (or more depending on size and coverage requirements) connected over the building network.

The Vive system can seamlessly integrate with other systems in the building via BACnet/IP protocol. BACnet is embedded or native in the Vive wireless hub. Connection is required to each of the Vive wireless hub(s) for control of the Vive system.
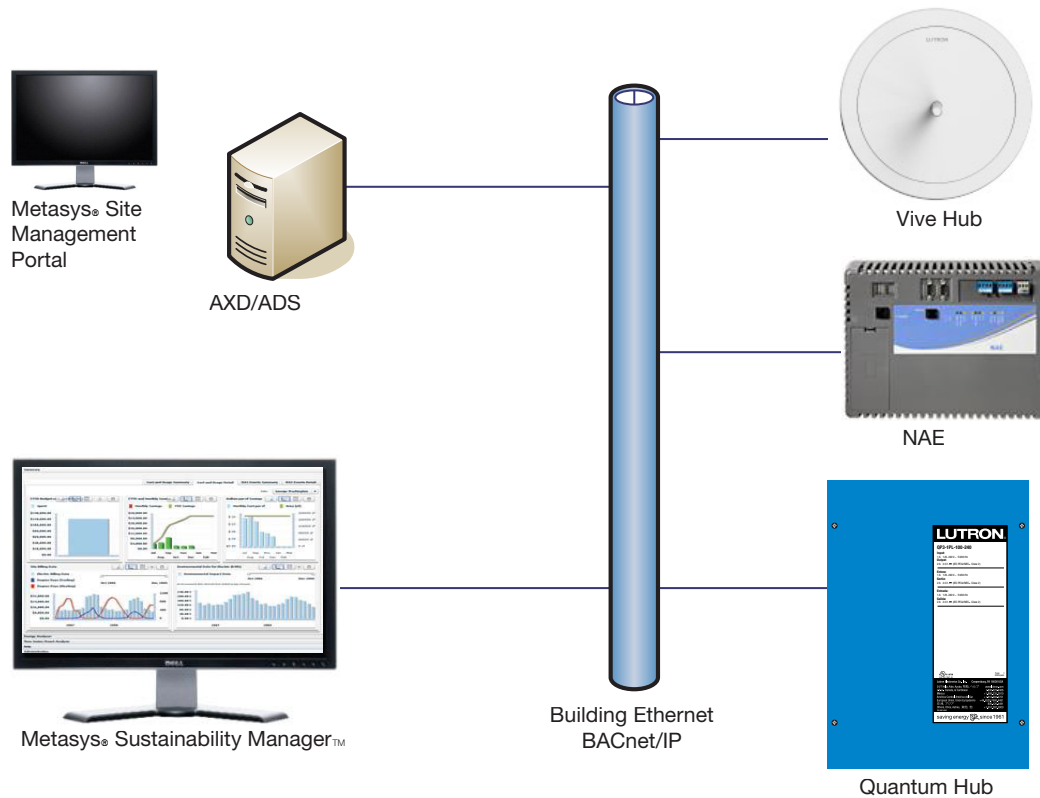
The Vive system has been tested by BACnet Testing Laboratories (BTL) and is certified to comply with all of their necessary interoperability requirements.

Metasys® Extended Architecture Overview

The Metasys® architecture has evolved to bring the benefits of the latest computing and communication technologies into building automation and facility management. At the same time, it preserves and enhances existing investments in building control systems and technology in your facilities. While maintaining all the basic features of a building automation system, the Metasys® system embraces the standard and open technologies of the IT and Internet age, enabling the system to be fully integrated into the information and networking infrastructure of buildings and enterprises. The management of information and its electronic distribution provide extra value to the building owner and operator, along with more efficient day-to-day operation. Enhanced access to data is available for performance analyses and financial planning. The integration of systems and devices from other manufacturers has always been a major feature of the Metasys® system. The Web-based generation of the Metasys® system continues in this tradition, making extensive use of open protocols and standards in the design. The system is able to integrate BACnet, N2, and LONWORKS devices in a single cohesive system. Although the Metasys® system extended architecture is based on leading edge software and hardware technology, it fully integrates Metasys® N1 networks to protect existing investments and provide a path for the continuous upgrade of the systems installed in your building.

Today's facility managers and operators demand an experience that is intuitive and easy to use without special training or complex technical manuals. The Metasys® user interface offers a textual summary display of important building automation data as well as fully integrated dynamic graphical displays with smooth navigation between floors and buildings. A computer with a Web browser is used to log on to any site. The Metasys® system user experience is a portal into a site. It can be tailored to fit the needs of all potential system users. The user experience provided by the Metasys® system can evolve and scale to match the needs of any single facility or campus of multiple buildings.

Integration Overview

The Johnson Controls® Metasys® solution can be used to monitor and control the Lutron Quantum or Vive system using the BACnet protocol. The BACnet protocol is a non-proprietary open communication software standard published by ASHRAE.

Lutron and Johnson Controls

Metasys® Site
Management
Portal

AXD/ADS

Vive Hub

NAE

Metasys® Sustainability Manager™

Building Ethernet
BACnet/IP

Quantum Hub

Communication Protocol

- Communication between Johnson Controls® and Lutron is BACnet/IP Annex J
- BACnet/IP uses Broadcast UDP and Peer-to-Peer UDP on any standard Ethernet network
- Johnson Controls BACnet controllers are compatible with 10/100 Mb/s, half-duplex or full duplex

BACnet Testing Laboratories Listing

Johnson Controls® and Lutron devices are BTL Listed:

- Johnson Controls® NAE is BTL-Listed a BACnet Building Controller (B-BC)
- Lutron Quantum and Vive Lighting Control Systems are BTL-Listed as a BACnet Application Specific Controller (B-ASC)

How to Set Up Integration:

What needs to be done in the Lutron Quantum system?

1. BACnet is native to the Quantum processor. However, in order to enable this capability, a BACnet software license must be purchased for each processor in the system.

2. With the BACnet software license, the Lutron service representative must enable BACnet and set the Device IDs and BACnet network IDs.

3. If the Quantum processor and Metasys® systems are not on the same subnet, a BACnet Broadcast Management Device (BBMD) is required by the integrator. Quantum processor supports foreign device registration to a BBMD. IP address of the BBMD should be given to the Lutron Field service representative at setup if required. BBMD functionality should only be enabled if the BBMD exists on a different subnet than the Quantum processors.

4. Limit the design so that each Quantum subsystem should be limited to a maximum of 50 areas per subsystem. Each area in the Quantum system equates to 1 BACnet virtual device. The more areas per Quantum subsystem, the longer it will take for the Quantum system to respond to the Metasys® system.

5. Ensure that COV is enabled on all Lutron systems before integrating to Metasys®. If the integration to Metasys® occurs before enabling COV, the Metasys® processors need to be reset in order to enable.

6. Use the most lightly loaded Quantum processor as the BACnet processor that will communicate for the subsystem. This would be the processor with the least number of links used and the least amount of devices per link in each subsystem.

7. Before integrating, have an agreed plan with the integrator of what BACnet Device IDs and BACnet network IDs the Lutron system should use to ensure that all IDs are unique for all devices and routers.

What needs to be done in the Lutron Vive system?

1. BACnet is native to the Premium Vive wireless hub (model HJS-2) and can be enabled on other hubs (model HJS-0 and HJS-1) by purchasing a BACnet license.

2. BACnet is disabled by default in the Vive hub, and must be enabled and configured. The BACnet programming menu can be accessed from the main Vive Vue Dashboard > Gear Icon > Hub Details > BACnet Programming.

3. If the Vive and Johnson Controls systems are not on the same subnet, a BACnet Broadcast Management Device (BBMD) is required by the integrator. The Vive wireless hub supports foreign device registration of BBMD. The IP address and port of the BBMD should be given to the Vive programmer during setup (if required). The Johnson Controls Metasys® System supports BBMD functionality.

4. All BACnet enabled Vive hubs are BACnet routers. Metasys® controllers are BACnet routers as well. All BACnet routers on a network must have unique BACnet virtual network IDs. So, if there are 5 Vive Hubs and 2 Metasys® controllers on the network, 7 unique IDs are required. The "Network number" in the "BACnet Programming" screen in the Vive software is the virtual network number and can be modified here. Coordinate with the Johnson Controls representative on-site to make sure all router IDs are unique.

5. The Lutron Vive system's device instance numbers must be set uniquely on the network. The IDs must be unique across all Vive hubs as well as across all BACnet devices on the network. Coordinate with the Johnson Controls representative on-site. They will typically assign a range of device IDs to each manufacturer on the network.

What needs to be done in Metasys® System?

1. Quantum and Vive communicates to the Metasys® system via BACnet IP. Make sure that BACnet IP is enabled in all Metasys® processors.

2. Quantum and Vive are tied into Metasys® through an NAE using the BACnet/IP Integration object. This can be defined and configured either on-line (using the Site Management Portal - SMP), or off-line (using our System Configuration Tool – SCT).

3. Metasys® uses the Who-Is service to initially discover and bind to BACnet devices. Normally there is about one Who-Is per off-line device each minute. Do not use unbounded Who-Is commands for discovery. Discover within the range specified for the Lutron system.

4. ADPU timeout should be set to the maximum (30 seconds) on all Metasys® processors.

5. Metasys® default values for all Lutron devices should be set to unaffected so that power cycles of the Metasys® controller will not inadvertently change the level of the lights.

6. Enable COV in the system. Make sure that the systems are communicating via COV.

7. Increase the space between all polls to at least 50mS for all non-COV commands.

8. Have no more than 1 Metasys® controller per Lutron subsystem. You can have multiple subsystems per Metasys® controller.

9. Router busy should be enabled for all Metasys® controllers (for Quantum systems only). Note that the Router busy feature was released in Quantum 3.2 and in Metasys® version 9.

What to Integrate:

Data sharing

Lutron exposes lighting and shading objects as Analog Value objects, Binary Value objects as Multi-State Value objects. This will allows Johnson Controls applications like Metasys® site Management Portal to use BACnet services to monitor and command the lighting objects.

Most devices in the Lutron system are virtual BACnet devices. Virtual devices are area-based so they correspond to a geographical area of the building (e.g., conference room, private office 101, etc.). Virtual device names are job specific and created at the time of Lutron database creation, which is done in-house at Lutron's HQ just prior to startup. To simplify the integration process, it is recommended that the integrator and Lutron field service representative coordinate on area naming conventions. For a summary of Lutron BACnet objects, naming convention, and functionality, reference the additional tables located in the Lutron BACnet PICS statement. To get the latest PICS statement, contact any Lutron representative or find them at www.lutron.com/quantum or www.lutron.com/vive under the "Product Specification Submittals" section.

BACnet Scheduling

Lutron does not currently support the BACnet Schedule Object. There are 2 approaches that can be employed for scheduling the lighting system.

Approach 1: The Metasys® controllers support the Schedule which can be used to directly command the Lutron lighting objects. The Schedule can be viewed and modified using Metasys® Site Management Portal.

Approach 2: The Lutron system can support the schedule and the Quantum or Vive software can be used to view and modify events. The Metasys® system can enable/disable a specific timeclock through BACnet binary objects (Quantum only).

BACnet Trending

Lutron does not support the BACnet Trend Log object. However, Lutron's system does share live time information (power usage, occupancy, etc.) through binary, analog, and multi-state objects, which can be used for trending. The Metasys® Site Management Portal supports the Trend Log object which can trend the Lutron lighting objects. The Trend Log object data can be archived at Metasys® ADX/ADS. The reporting module within Lutron's Quantum Vue and Vive Vue software can also be used to view historical trends of these objects.

BACnet Alarming

Lutron does not support the alarming object. However, Lutron's system does share asset and maintenance data appropriate for alarms (lamp failure, ballast failures, low battery failures on wireless devices, etc.) through binary, analog, and multi-state objects. The Johnson Controls® Metasys® Site Management Portal supports the Event Enrollment object which can be used to alarm the Lutron lighting objects to display in the Alarm Status. The alerts module within Lutron's Quantum Vue software can also be used to configure and view alerts.

Common Integration Examples

- A BMS system can trigger load-shed events in a Quantum and Vive system.
- Occupancy sensor status can be shared with the HVAC system to set back temperatures when areas become unoccupied.
- Energy usage information can be shared with the BMS to eliminate the need to add costly energy meters.

Important Integration Notes:

- Use BACnet/IP to integrate to Lutron. Do not use BACnet MS/TP.
- To simplify the integration process, it is recommended that the integrator and Lutron field service representative or project manager assigned to the job coordinate on area/point naming convention when designing the job, not during installation.
- Coordinate with Lutron to disable the Lutron schedule if BACnet schedules are used.
- The Quantum Processor has a limit of 20 BACnet messages per second. This includes all BACnet messages not just messages from the NxE. More frequent requests may cause communication issues due to the number of points available in the Lutron system through a single IP address. BACnet Broadcast traffic on the entire network should be minimized regardless of the Source of that traffic. All unbound references in the Metasys® equipment must be resolved. Periods of high volume (greater than 500 per second) BACnet broadcasts can trigger short duration offline events between the JCI and Lutron systems.
- Whenever it is possible, a dedicated NAE should be used for the Lutron Integration. The special setting outlined below could have an impact on integrations with other types of BACnet equipment.
- The Quantum Processor(s) should be running release 3.2 or newer. A patch is also available upon request for systems running 3.1 if they will be integrated with JCI. The latest Vive hub software can be downloaded from www.lutron.com/vive.
- NAE 55-2, 55-3, will need to be patched at release 8.0. Patch is available from the FSC. Release 9.0 includes the BACnet Performance Enhancements from this Patch. NAE8500 will need to use Release 9 no patch is available for this platform.
- Recommended APDU Timeout for BACnet/IP configuration in Metasys® is 30,000 ms. Use this value for both the APDU and APDU Segment Timeouts. These can be configured under the Eth IP Datalink object of the NAE.
- Retries can also be modified if needed. When adjusting the Retries consider the allowable amount of time before a Lutron device that is actually offline is flagged offline. Use the formula [(retries +1) x APDU Timeout] to determine the length of time before an offline event is captured. For example if the retries are set to 3 it will take 2 minutes for an offline to be detected (3+1=4 4 x 30,000 ms=120,000 ms 120 seconds)
- The NAE can be configured to perform the "online" poll messages less frequently. The default is once every 40 seconds. These messages are given some priority within the NAE transmit buffers. This should be given some consideration however it is not the primary method of determining an offline event. Official parameter for this is called Internode Comm Timer, to achieve a period of 60 seconds between cycles a value of 30 should be used. Value of Internode timer multiplied by 2 is the number of seconds between poll cycles. When determining this value give consideration to the amount of time allowed by the combination of APDU and Retries as well. If 2 or more minutes for an offline is acceptable to the customer for an offline these online poll cycles can be extended.
- If Binary or Multistate objects are to be trended consideration should be given to using COV trends (sample interval of 0 seconds) as this will spread out the renewal of these BACnet COV subscriptions across an hour instead of every 5 minutes.

Key contacts if you need assistance on a job:

Pre-Sale Support: systemsalesengineers@lutron.com
Post-Sale Support: 1.844.588.7661; systemsupport@lutron.com

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