Quantum

Total Light Management System
IT Implementation Guide

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LUTRON

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Lutron Quantum Security Statement

Lutron takes the security of our Lighting Control Systems very seriously. The Quantum Lighting Control System can be configured to meet reasonable standards for security. Lutron has engaged security experts and independent testing firms to review the systems architectures and Lutron is committed to security and continuous improvement throughout the product lifecycles.

Lutron's Security Architecture Includes:

1. Isolation of the wired Ethernet processor network, the wired QS device links, and the wireless Clear Connect device from each other, which strictly limits the possibility of using the Lutron device links or wireless communication to gain access to the Ethernet network.
2. A web browser user interface protected using TLS and capable of accepting a customer-supplied certificate.
3. Vue user account password storage using NIST-recommended salt and hashing protection. Integration with LDAP is optional.
4. Authenticated firmware upgrades, such that processors only accept firmware validated and signed by Lutron.

System Network Deployment

The Quantum processors must be connected via Ethernet to allow the processors to communicate with each other, to access certain features such as BACnet® for BMS integration and to communicate with the optional system server. Lutron advises following best practices in this instance, including separating the business information network and the building infrastructure network. Use of a VLAN or physically separated networks is recommended for secure deployment. Lutron Services Company Engineers or Lutron Certified Installers can aid in the design and implementation of the Quantum system to meet your specific IT security needs.

The devices on the network can be deployed in one of two ways:

Dedicated Lutron Network Deployment

In this deployment, the Quantum processors are not connected to the building IT network. Dedicated Ethernet cables and switches are used to interconnect the processors with the system server.

Integrated as Part of the Managed IT Network

The Quantum processors communicate with each other, with the system server and with other building management systems via the building IT network. Integration with other building management systems may require ports to be opened between the systems VLANs. It is strongly recommended that local IT security professionals be involved with the system design and the network configuration to ensure the installation meets their security needs. A Lutron representative is available to meet with the security team and IT team to discuss their particular security strategy, networking configuration, VLANs, firewalls, network settings, third-party integration, etc., and to recommend Lutron best practices for a secure deployment of the system.

Glossary and Abbreviations

Hop – Lutron extends the network definition of a hop that traditionally refers to the number of intermediate devices through which data packets must pass between source and destination to include layer 3 and layer 2 devices. This includes any device that will delay the data packets from a source processor to a destination processor. **Note:** This rule is only applicable when using an unmanaged network to interconnect the devices of a Quantum system.

Hop Limit – A hop is one portion of the path that a packet takes from source to destination. Traditionally, the hop limit refers to the time to live (TTL) of that packet before it is discarded. With a Lutron Quantum system, the hop limit is not concerned with TTL. Rather it is a guideline so that latency of Quantum system commands is kept to a minimum. **Note:** This rule is only applicable when using an unmanaged network to interconnect the devices of a Quantum system.

Q-Admin – Thick Client UI for setup, monitor and control of the Quantum system. Primary software for all Quantum software versions from 1.5 through 2.7. Primarily used for setup in Quantum software version 3.0 and 3.1. This application has been replaced by Quantum Vue in Quantum version 3.2 and later.

Q-Control + App – For limited monitor and control of the Quantum system via an *iPad*. Refer to page 17 for information on Quantum version availability. Note that Q-Control+ requires a separate server per system. Multiple systems cannot be installed on the same server when Q-Control+ is required.

Quantum Hub – Metal enclosure containing the Quantum processor(s). Wall-mounted vertically, predominantly in electrical closets. The QP3 is a smaller enclosure to house a single Quantum processor and the QP2 is a larger enclosure to house one or two Quantum processors. The QP2 also houses a 5 port unmanaged layer 2 network switch for connectivity.

Quantum Processor – This is the basic Quantum controller supporting an expanded MicroC/OS operating system and will be the main Quantum component connected to any network. Each Quantum processor has two RJ45 female connectors, one for the Quantum LAN/VLAN connection and the other for serviceability.

Quantum Subsystem – A group of Quantum processors that share events, overrides, BACnet and Telnet integration, sensor controls, or any other system functionality, (normally relegated to a single floor). The inter-processor communication is UDP multicast. A Quantum subsystem is also a multicast group and shares the same Class D multicast address.

Quantum Vue – Browser based UI for setup, monitor and control of the Quantum system. Available on Quantum software version 3.0 and higher.

Master Processor – The processor in a unicast subsystem that communicates to the other processors in the subsystem via multicast. This processor is designated by selecting its IP in Q-Design on the activate screen.

Network and IT Considerations

Network Architecture Overview

What is on the traditional network IP architecture? – The Quantum processors, Quantum server, and client devices (e.g. PC, laptop, tablet, etc).

What is NOT on the traditional network IP architecture? – The lighting actuators, sensors, and load controllers are not on the network architecture. This includes keypads, wired and wireless daylight sensors, wired and wireless occupancy sensors, load controllers, dimmers, switches, lighting panels, fluorescent lamp ballasts, or LED drivers. These devices communicate on a Lutron proprietary wired or wireless communication network.

Note that AV integration with the processor can be achieved in 1 of 2 ways:

Option 1 – Telnet integration over Ethernet directly to the processor. Telnet is disabled by default in version 3.4.

Option 2 – Using a Lutron model QSE-CI-NWK-E AV integration interface which allows an AV system to integrate via RS232 or via a Telnet connection over Ethernet that is separated from the processor network.

Physical Medium

IEEE 802.3 Ethernet – Is the physical medium standard for the network between Quantum processors and the Quantum server. Each Quantum processor has 2 female RJ45 connectors. One port is used to connect the processor to the network. The other port is for diagnostics and troubleshooting by a Lutron service technician. The ports are interchangeable.

CAT5e – The minimum network wire specification of the Quantum LAN/VLAN.

IP Addressing

IPv4 – The addressing scheme used for the Quantum system. The IPv4 address should be static but a DHCP reservation system can also be used. Standard DHCP lease is not allowed. DNS Hostname is not supported. The IPv4 address can be field set to any range, Class A, B, or C. Static will be assumed. IPv6 is not supported.

Class D Addressing

Quantum Subsystem – A Quantum subsystem is a multicast group of Quantum processors sharing a unique and common class D address that need to share events. Maximum 16 Quantum processors on a Quantum subsystem. Minimum one Quantum processor on a Quantum subsystem.

Multicast communications – Basic communication to share events between Quantum processors and the Quantum server is based on UDP multicast groups. Below are details on how the Quantum system deploys this communication scheme.

- Each group of Quantum processors that need to share events will need a unique and common class D address. The class D multicast address can be field set and specified by the customer. Processors needing to share events are normally limited to a single floor.
- Any source multicast is used because any Quantum processor may be enacting the event.
- Multicast communication in the Quantum system is primarily event based (e.g. system trigger or change in state for monitoring). Polling is not a basis of communications in Quantum.
- Prior to software version 3.0, the Quantum server needed to join every multicast group to communicate to the Quantum processors. Quantum servers hosting software version 3.0 and newer can either communicate to the Quantum processors by joining every multicast group or can be setup as TCP unicast communication. This can be setup during system startup at the customer's discretion.

  Note: Unicast or multicast communication option is configured on site by a Lutron field engineer and at the customer's discretion. System will default to multicast if not specified.

Network and IT Considerations *(continued)*

Feature Dependent Ports

Source	Source Application	Destination	Port	Protocol	Destination Application	Description
Quantum Vue Server	Q-Design	Outside Network	2647 and 2660	UDP	Quantum Processor	Quantum processor configuration and detection software • Only required while performing intial commissioning or maintenance.
Outside Network	BACnet Client	Outside Network	47808	UDP	Quantum Processor	Quantum processor BACnet/IP • Only required if the Quantum system is intergrating with a BMS through BACnet/IP. • UDP port 47808 may be **CHANGED** at the customer's discretion at any time during system startup by a field service engineer.
Quantum Vue Server or Outside Network	Telnet	Outside Network	23	TCP	Quantum Processor	Quantum processor Telnet • Only required if the Quantum system is integrating with AV equipment through Serial/IP. • This part is open by default in versions 3.3 and earlier. • The port number is also configurable if desired.
Quantum Vue Server	FTP	Outside Network	21	TCP	Quantum Processor	Quantum processor additional port (FTP) • This port is open by default in Quantum versions 3.3 and earlier. • This port is closed in Quantum version 4.4 and later.
Quantum Vue Server	Q-Design	Outside Network	123	TCP	NTP Cloud Server	NTPServerPort (used to connect to NTP server IP).
Quantum Vue Server	Local RabbitMQ Server Service	Quantum Vue Server	15672	TCP IPv4	Local RabbitMQ Server Service	RabbitMQ Admin Panel • Used for diagnostics and troubleshooting in Quantum version 3.4.321 and below.
Quantum Vue Server	Local RabbitMQ Server Service	Quantum Vue Server	15671	TCP IPv4	Local RabbitMQ Server Service	RabbitMQ Admin Panel • Used for diagnostics and troubleshooting in Quantum version 3.4.403 and above.
Quantum Vue Server	LSM	Enterprise Vue Server IP	36000–36030	TCP	CSM	Enterprise Vue CSM to Quantum Vue LSM communication • Only required if Enterprise Vue is being used.
Enterprise Vue Server IP	CSM	Enterprise Vue Server IP	6666	TCP	CSM	Enterprise Vue CSM internal process • Only required if Enterprise Vue is being used.

Ports (REQUIRED)

Note: Unicast or multicast communication option is configured on site by a Lutron field engineer and at the customer's discretion. System will default to multicast if not specified.

Source	Source Application	Destination	Port	Protocol	Destination Application	Description
Quantum Vue Server	IIS	Quantum Vue Server	15672	TCP IPv4	Local RabbitMQ Server Service	RabbitMQ management console - HTTP API client, management UI and rabbitmqadmin, (only if the management plug-in is enabled)
Quantum Vue Server	IIS	Quantum Vue Server	15671	TCP IPv4	Local RabbitMQ Server Service	RabbitMQ management console - HTTP API client, management UI and rabbitmqadmin, with TLS (only if the management plug-in is enabled)
Quantum Vue Server	IIS	Quantum Vue Server	5672	TCP IPv4	Local RabbitMQ Server Service	Exchanges messages between Local Lutron Services and IIS for Quantum version 3.4.401 and above
Quantum Vue Server	IIS	Quantum Vue Server	5671	TCP IPv4	Local RabbitMQ Server Service	Exchanges messages between local Lutron services and IIS for Quantum version 3.4.399 and below.
Quantum Processor Network	Quantum Processor	Quantum Processor Network	2055–2184	UDP	Quantum Processor	Quantum processor to Quantum processors within a Quantum subsystem (1 port per subsystem).
Quantum Vue Server	Q-Design and LSM	Quantum Processor Network	51023	TCP	Quantum Processor	Quantum application server to Quantum processors **UNICAST OPTION** • TCP available only for Quantum servers hosting software version 3 0 and newer. • Only the master processor in each subsystem needs TCP/51023 open.
Quantum Vue Server	Q-Design and LSM	Quantum Processor Network	2055–2184	UDP	Quantum Processor	Quantum application server to Quantum processors **MULTICAST OPTION** (1 port per subsystem).

Network and IT Considerations *(continued)*

Ports (REQUIRED) *(continued)*

Source	Source Application	Destination	Port	Protocol	Destination Application	Description
Quantum Vue Server	IIS/Webpage	Quantum Vue Server	49152–65535	TCP	IIS	Quantum Vue webpage Source to destination TCP/443 (HTTPS) or TCP/80 (HTTP) • Available only for Quantum servers hosting software version 3.0 and newer. • Quantum version 3.0 through 3.3 defaults to port 80 but can be configured for port 443. • Quantum version 3 4 and later defaults to port 443.
Quantum Vue Server	Web Browser	Quantum Vue Server	443	HTTPS	IIS	Quantum Vue webpage • Available only for Quantum servers hosting software version 3.0 and newer. • Quantum version 3 4 and later defaults to port 443.
Quantum Vue Server	Web Browser	Quantum Vue Server	80	HTTP	IIS	Quantum Vue webpage • Quantum version 3.0 through 3.3 defaults to port 80 but can be configured for port 443.
Quantum Vue Server	LSM	Quantum Vue Server	7203 and 7303	TCP	LSM	Internal process communication within LSM UI.
Quantum Vue Server	LSM	Quantum Vue Server	36100–36130	TCP	Alert Service	Alert service Within LSM for versions 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	36200–36230	TCP	Alert Service	Alert service Within LSM for versions 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	36300–36330	TCP	Alert Service	Alert service Within LSM for versions 3.4 and above.
iPad/ Mobile Device	Q-Control+ App	Quantum Vue Server	5327	TCP	Quantum Application Server	Q-Control+ app to Quantum application server • Only required if the Quantum system is specified to use the Lutron Q-Control+ app.
iPad/ Mobile Device	Q-Control+ App	Quantum Vue Server	5443	TCP	Quantum Application Server	Q-Control+ TLS connection • Only required if the Quantum system is specified to use the Lutron Q-Control+ app.
Quantum Vue Server	LSM	Quantum Vue Server	36400–36430	TCP	LSM	LSM internal communication • For Quantum version 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	4444	TCP	LSM	LSM internal communication • For Quantum version 3.3 and below.
Quantum Vue Server	LSM	Quantum Vue Server	36500–36530	TCP	Gateway Service	Gateway Service within LSM for 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	36600–36630	TCP	Reporting Service	Reporting service within LSM for 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	36700–36730	TCP	Runtime Service	Runtime service within LSM for 3.4 and above.
Quantum Vue Server	LSM	Quantum Vue Server	5555	TCP	Alert Service	Alert service within LSM for versions 3.3 and below.
Quantum Vue Server	LSM	Quantum Vue Server	7204	TCP	Alert Service	Alert service within LSM for versions 3.3 and below.
Quantum Vue Server	LSM	Quantum Vue Server	7203	TCP	Gateway Service	Gateway service within LSM for 3.3 and below
Quantum Vue Server	LSM	Quantum Vue Server	9999	TCP	Reporting Service	Reporting service within LSM for 3.3 and below.
Quantum Vue Server	LSM	Quantum Vue Server	8888	TCP	Runtime Service	Runtime service within LSM and below.

Network and IT Considerations *(continued)*

Ports (OPTIONAL)

Quantum Processor Configuration and detection software

UDP/2647

- Only required while performing initial commissioning or maintenance

Quantum Processor BACnet/IP

UDP/47808

- Only required if the Quantum system is integrating with a BMS through BACnet/IP
- UDP Port 47808 may be **CHANGED** at the customer's discretion at any time during system startup by a field service engineer.

Q-Control+ App to Quantum Application Server

Source TCP/5443 and TCP/5327

- Only required if the Quantum system is specified to use the Lutron Q-Control+ App

Quantum Processor Telnet

Source TCP/23 (default)

- Only required if the Quantum system is integrating with AV equipment through Serial/IP
- This port is open by default in versions 3.3. and earlier
- This port is closed by default in Quantum version 3.4 and later and will only be open if Telnet integration is required
- The port number is also configurable if desired

Quantum Processor Additional Ports

Source TCP21 (FTP) and TCP80 (HTTP)

- These ports are open by default in versions 3.3. and earlier
- These ports are closed in Quantum version 3.4 and later

Hop Limit for Unmanaged Networks

The required hop limit of any data packet from a source processor to a destination processor/server within a single subsystem is 6. **Note:** This rule is only applicable when using an unmanaged network to interconnect the devices of a Quantum system and is required to ensure optimal performance.

Latency Requirements for Managed Networks

Note that for managed networks, the maximum latency between any 2 Quantum processors should be less than 10 ms. The maximum latency between the Quantum server and any processor is 10 ms.

Other Protocols Supported

IGMP – Quantum supports Versions 1, 2, and 3 for multicast communication within a subsystem. Any possible flooding of multicast traffic can be constrained to a set of interested ports by using IGMP snooping.

PIM – If Quantum processors within a subsystem are deployed on different subnets and need routing, PIM is supported in both sparse and dense modes. PIM is typically not required if the connections from the server to the processors is configured for Unicast.

Network and IT Considerations *(continued)*

Other Protocols Supported (continued)

BACnet/IP – BACnet is a communications protocol for building automation and control networks. It is defined in ASHRAE/ANSI standard 135. Below are details on how the Quantum system implements BACnet communications.

- BACnet communication is used to allow two-way communication between the Quantum system and a Building Management System (BMS) for control and monitoring of the system.
- The Quantum processors adhere to Annex J of the BACnet standard. Annex J defines BACnet/IP which uses BACnet communication over a TCP/IP network.
- The BMS communicates directly to the Quantum processors, not to the Quantum server.
- If the BMS is on a different subnet than the Quantum processors then BACnet/IP Broadcast Management Devices (BBMDs) can be used to allow the BMS to communicate across subnets.

Telnet – Telnet is an application layer protocol used to provide a bi-directional text-based communication between client and server devices. The Quantum processors will use this protocol over TCP/IP for two main instances:

1. Telnet may be used during system startup to run diagnostics and initiate firmware updates. Once system startup is complete, the Telnet port may be closed.
2. If there is an AV system (e.g. a touchscreen) integrating with the Quantum system, it may communicate to the Quantum processor over a Telnet session. By default, port 23 will be used but this can be changed at the customer's discretion. Alternatively, a Lutron QSE-CI-NWK-E can be added to the system for AV integration. This device provides either an RS232 or Telnet over Ethernet point of integration that is not required to be on the same network as the Quantum processors. For limitations, see the QSE-CI-NWK-E specification submittal (P/N 369373) at www.lutron.com.

Communication Speed and Bandwidth

100 BaseT – Is the maximum communication speed required for the Quantum processor and Quantum server communications.

1.88 MBPS – Worst case bandwidth in a fully loaded subsystem of 16 processors. Most subsystems include only 1 to 4 processors.

Wi-Fi

The Optional Q-Control+ app for *iPad* requires IEEE 802.11 wireless communication so that the *iPad* can communicate with the server. Quantum Vue, which is a web page hosted on the Quantum server in IIS can also be available over the wireless network if desired.

Server and Application Considerations

Microsoft® SQL & OS Required for Each Quantum Version

Reference below specification submittals based on server type or PC type on www.lutron.com

– High Reliability Server P/N 369594
– Standard Server P/N 369593 or Standard PC by Others P/N 369589
– Virtual Server by Others P/N 369592
– Laptop PC P/N 369384 or Laptop PC by Others P/N 369591
– Desktop PC P/N 369329 or Desktop PC by Others P/N 369590

Non-Dependent System Server

The Quantum processors can fully function without server connectivity. Loss of server connectivity does not affect timeclock events, lighting overrides, BACnet or Telnet integration, sensor control, or any other daily functionality. The Quantum server services two functions;

1. Enables End User UI – Provides the web server for Quantum 3.x and higher, provides the server for the thick client UI, provides the app server for the Q-Control+ App for adjustments and monitoring of the Quantum system.
2. Historical Data Collection – All energy management and asset management is stored on the SQL logging server for reporting.

SQL Server Database Usage

Application (Runtime Project) Database – Stores all of the configuration information for the system (areas, zones, programming, and other settings). A locally installed instance of SQL Server Express edition is best suited for this database and is automatically installed and configured during installation of Quantum on the server. Due to the operations performed (backup, restore, etc.) the Quantum software requires high-level permissions to this database. For this reason, remote SQL is not supported in the Quantum system.

Logging Database – Real-time database that stores system and user activity reported from the Quantum system. Used to generate historical activity reports in Q-Admin and Quantum Vue software.

Energy Database – Real-time database that stores energy consumption data for the lighting control system. Used to show energy reports in Quantum Vue. Data is recorded at an area level every time there is a change in the system.

SQL Instance Requirements

- Lutron requires a dedicated SQL instance for all installs for data integrity and reliability.
- A Quantum system does not support remote SQL. The SQL instance must be installed on the application server.
- System administrator privileges are required for Quantum software to access the SQL instance.
- Microsoft® SQL Server Express will be installed by default. Alternatively, full SQL can be installed if provided by the customer.

Server and Application Considerations *(continued)*

SQL Access

Lutron applications use “sa” user and “sysadmin” permission levels with SQL Server because the Quantum applications need backup, restore, create new, delete and modify permissions under normal use. The username and password can be changed but the privileges are required. Note that only SQL authentication is supported.

Windows® Services

The Lutron Services Manager is a Windows® service that runs on the Quantum server and provides status information about key Quantum applications and also ensures that they are running any time the machine is restarted. The Lutron Services Manager application coincides with the Lutron Service Manager service which should always be running on the server machine. It can be accessed using the small red “gears” icon in the system tray or from Services within the Windows® operating system.

Quantum applications in Lutron Service Manager includes:

- *Q-Runtime* – runs in the background and serves a number of purposes, among them it acts as a facilitator of system traffic.
- *Q-Reporting* – stores system data and logs it for the purpose of displaying energy savings, system events, or user activity.
- *Q-Gateway* – interfaces the Q-Control+ App and Quantum Vue with the Quantum server.
- *Q-Alerts* – monitors the system for certain events/triggers and raise awareness through visible changes in the Quantum software or through email messages.

Alerts can be emailed using SMTP server connection and port designation. SSL encryption and authentication can also be enabled.

Database Size

Typically, each database is capped at 10 GB when using SQL Server 2017 Express edition. If this database is deployed to a customer-supplied instance of SQL Server full edition on the application server, the 10 GB limit need not apply and the policy for data retention can be specified using Quantum configuration options.

Application (Runtime Project) Database – Does not grow appreciably post-deployment. Data modifications take place via software tools like Q-Admin and Quantum Vue where a facility manager can modify scheduled events and settings. Typical size is less than 100 MB but can reach ~250 MB for very large buildings or campuses.

Logging Database – Growth of the database varies based on the size of the facility, nature of devices used, and occupant activity. For example, occupancy sensors and daylight sensors tend to report larger volumes of data as compared to other devices. High occupancy facilities will see greater numbers of occupancy related events, etc. When using SQL Server 2017 Express edition, the database can store a minimum of 3 months of activity data. The database will delete the oldest information once it is close to being full.

Energy Database – When using SQL Server 2017 Express edition, the database can store up to 10 years of energy data for systems having ~2,000 areas or less (rooms). The data in the energy database aggregates automatically over time to save space. You will be able to view the data by day/week/month etc., but no longer by 15 minute to 1 hour intervals after a certain amount of time.

Server and Application Considerations *(continued)*

Active Directory

Individual user accounts can be setup and identified using AD. At setup, each user account can be setup with a direct application individual name and password or with authentication using Integrated Windows® Authentication (IWA). Active directory is not used for the application but for individual user accounts.

IIS

IIS is required to be installed on the Application server to host the Quantum Vue web page. Minimum version required is IIS 7.5. **A recommendation of installing all features listed for IIS is advised.** It is recommended that a website security certificate be purchased from a trusted certification authority and installed on the server to provide proper security for the Quantum Vue web page. **Note**: Lutron does not provide a security certificate for the Vue website.

DNS Host Names

When multiple Quantum (or Vive) systems are installed on the same server, each system's webpage requires a DNS host name for the system web page. If you have multiple systems, there may be multiple systems on the same server and/or there may be multiple servers.

DNS naming examples:

- Quantum System 1 - https://library.quantum.com
- Quantum System 2 – https://gymnasium.quantum.com
- Quantum System 3 – https://stadium.quantum.com
- Quantum System 4 – https://northofficebuilding.quantum.com
- Quantum System 5 – https://soutofficebuilding.quantum.com

TLS 1.2 Cipher Suites

Required Cipher Suites

- TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

Cipher Suites to be Disabled

- TLS_RSA_WITH_AES_128_CBC_SHA256
- TLS_RSA_WITH_AES_128_GCM_SHA256
- TLS_RSA_WITH_AES_256_GCM_SHA384
- TLS_RSA_WITH_RC4_128_SHA
- TLS_RSA_WITH_3DES_EDE_CBC_SHA
- TLS_RSA_WITH_AES_128_CBC_SHA
- TLS_RSA_WITH_AES_256_CBC_SHA
- TLS_ECDHE_ECDSA_WITH_RC4_128_SHA
- TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA
- TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA
- TLS_ECDHE_RSA_WITH_RC4_128_SHA
- TLS_ECDHE_RSA_WITH_3DES_EDE_CBC_SHA
- TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA
- TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA
- TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA
- TLS_RSA_WITH_NULL_SHA256
- TLS_RSA_WITH_NULL_SHA
- SSL_CK_RC4_128_WITH_MD5
- SSL_CK_DES_192_EDE3_CBC_WITH_MD5
- TLS_RSA_WITH_RC4_128_MD5

Server and Application Considerations *(continued)*

Multi-Instance Installation

Quantum versions up to 3.3 support a single instance of the software per machine. Quantum version 3.4 allows multiple instances of Quantum to be installed and run on the same machine in parallel. Up to 10 systems can be installed on a single machine. One and only one of the 10 systems can be a Lutron Vive system as well. The machine must be a server. Each server can be communicate with a maximum of 100 lutron controllers, including Quantum processors and Vive hubs.

Software Installation

- Software installation requires administrator privileges to install.
- Once installed, administrator privileges are not required for day to day operation.
- The Quantum software will run in the background even when there is no user logged into the server.
- Internet access is required during installation to download the necessary Lutron software and third-party software as needed.

Server and Application Considerations *(continued)*

IIS Features

This is a minimal list of features that MUST be installed. Table below:

Feature Name	Required	Comment
FTP Server		
FTP Extensibility	no	
FTP Service	no	
Web Management Tools		
IIS 6 Management Compatibility		
IIS 6 Management Console	no	Allows you to use existing IIS 6.0 APIs and scripts to manage this IIS 7.0 and above Web server.
IIS 6 Scripting Tools	no	Allows you to use existing IIS 6.0 APIs and scripts to manage this IIS 7.0 and above Web server.
IIS 6 WMI Compatibility	no	Allows you to use existing IIS 6.0 APIs and scripts to manage this IIS 7.0 and above Web server.
IIS Metabase and IIS 6 Configuration Compatibility	no	Allows you to use existing IIS 6.0 APIs and scripts to manage this IIS 7.0 and above Web server.
IIS Management Console	**yes**	Installs Web server Management Console which supports management of local and remote Web servers
IIS Management Scripts and tools	**yes**	Manages a local Web server with IIS configuration scripts.
IIS Management Services	**yes**	Allows this Web server to be managed remotely from another computer via the Web server Management Console.
World Wide Web Services		
Common HTTP Features		
Static Content	**yes**	Serves .htm, .html, and image files from a Web site.
Default Document	no	Allows you to specify a default file to be loaded when users do not specify a file in a request URL.
Directory Browsing	no	Allow clients to see the contents of a directory on your Web server.
HTTP Errors	no	Installs HTTP Error files. Allows you to customize the error messages returned to clients.
WebDav Publishing	no	
HTTP Redirection	no	Provides support to redirect client requests to a specific destination
Application Development Features		
ASP.NET	**yes**	Enables Web server to host ASP.NET applications.
.NET Extensibility	**yes**	Enables Web server to host .NET framework-managed module extensions.
ASP	no	Enables Web server to host Classic ASP applications.
CGI	no	Enables support for CGI executables.
ISAPI Extensions	**yes**	Allows ISAPI extensions to handle client requests.
ISAPI Filters	**yes**	Allows ISAPI filters to modify Web server behavior.
Server-Side Includes	no	Provides support for .stm, .shtm, and .shtml include files.

Server and Application Considerations *(continued)*

IIS Features *(continued)*

Feature Name	Required	Comment
Health and Diagnostics Features		
HTTP Logging	**yes**	Enables logging of Web site activity for this server.
Logging Tools	**yes**	Installs IIS logging tools and scripts.
Request Monitor	**yes**	Monitors server, site, and application health.
Tracing	**yes**	Enables tracing for ASP.NET applications and failed requests
Custom Logging	**yes**	Enables support for custom logging for Web servers, sites, and applications.
ODBC Logging	no	Enables support for logging to an ODBC-compliant database.
Security Features		
Basic Authentication	no	Requires a valid Windows® user name and password for connection.
Windows® Authentication	no	Authenticates clients by using NTLM or Kerberos®.
Digest Authentication	no	Authenticates clients by sending a password hash to a Windows® domain controller.
Client Certificate Mapping Authentication	no	Authenticates client certificates with Active Directory accounts.
IIS Client Certificate Mapping Authentication	no	Maps client certificates 1-to-1 or many-to-1 to a Windows® security identity.
URL Authorization	no	Authorizes client access to the URLs that comprise a Web application.
Request Filtering	**yes**	Configures rules to block selected client requests.
IP and Domain Restrictions	no	Allows or denies content access based on IP address or domain name.
Performance Features		
Static Content Compression	no	Compresses static content before returning it to a client.
Dynamic Content Compression	no	Compresses dynamic content before returning it to a client.

Server and Application Considerations *(continued)*

Browser UI (Quantum Vue)

The main UI into the Quantum system for software version 3.X and higher is Quantum Vue and is browser based. Below is the supported browsers for Quantum Vue.

Browser Options

Hardware	OS Version	Browser
iPad	*iOS 7.1* or later	*Safari*
PC	Windows® 10 or later	Google Chrome® version 26 or later
Windows® Surface	Windows® 10 or later	Google Chrome® version 26 or later

Q-Control+ for *iPad*

The Q-Control+ App is an optional UI for basic control and monitor functionality. This functionality is a subset of control that the Quantum Vue UI gives. A matrix of Quantum software version to corresponding Q-Control+ App version is listed below:

- *iOS* version 7.x or greater

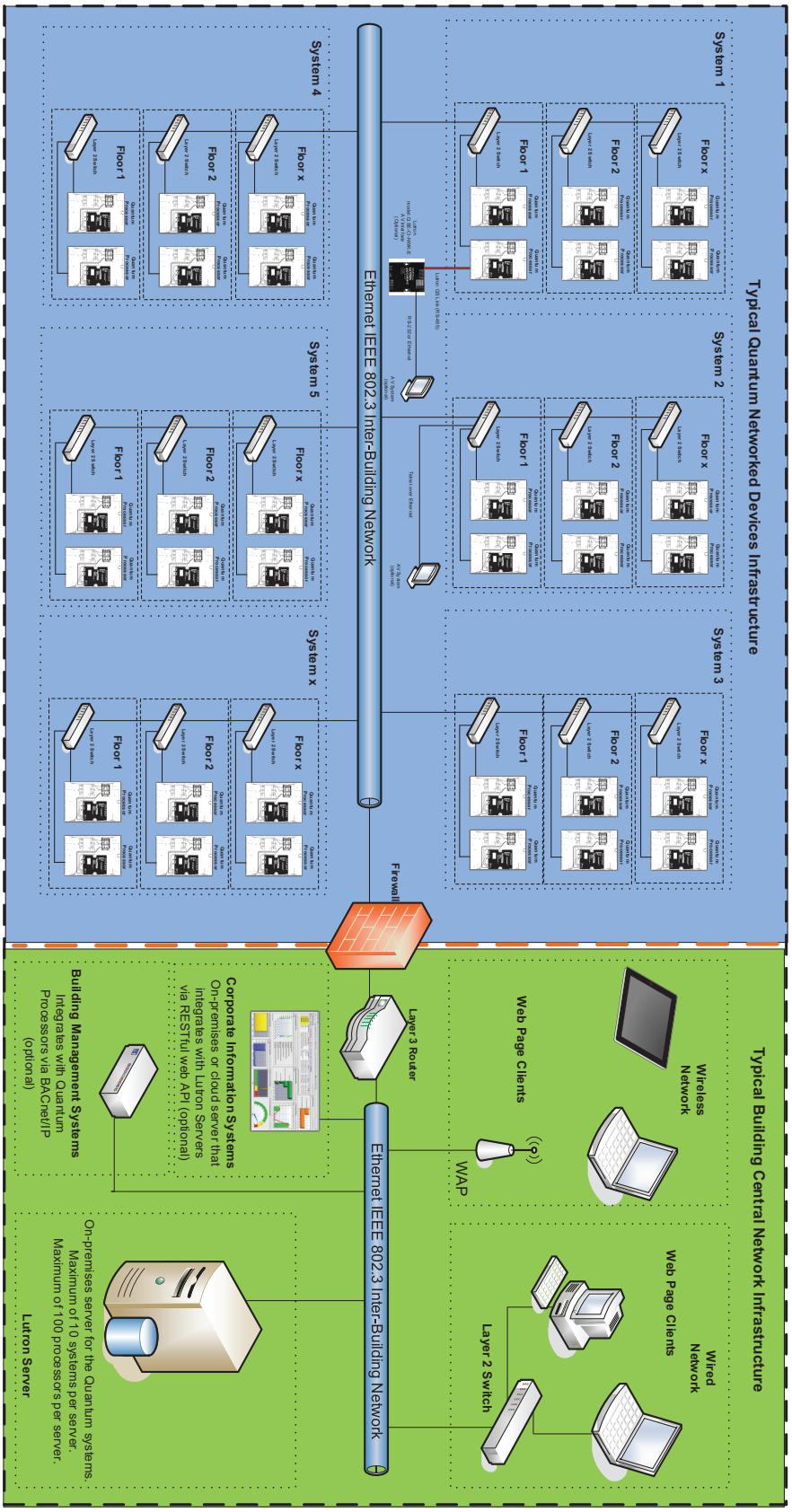
Quantum Version	*iOS* App Version
2.6	1.0/2.2/2.3
2.7	2.2/2.3
3.0	2.3
3.1	2.3
3.2	2.3
3.3	2.3
3.4	2.5

Q-Control+ can only communicate with one Quantum system per server. If Q-Control+ is required for multiple Quantum systems, each system must be installed on a separate server.

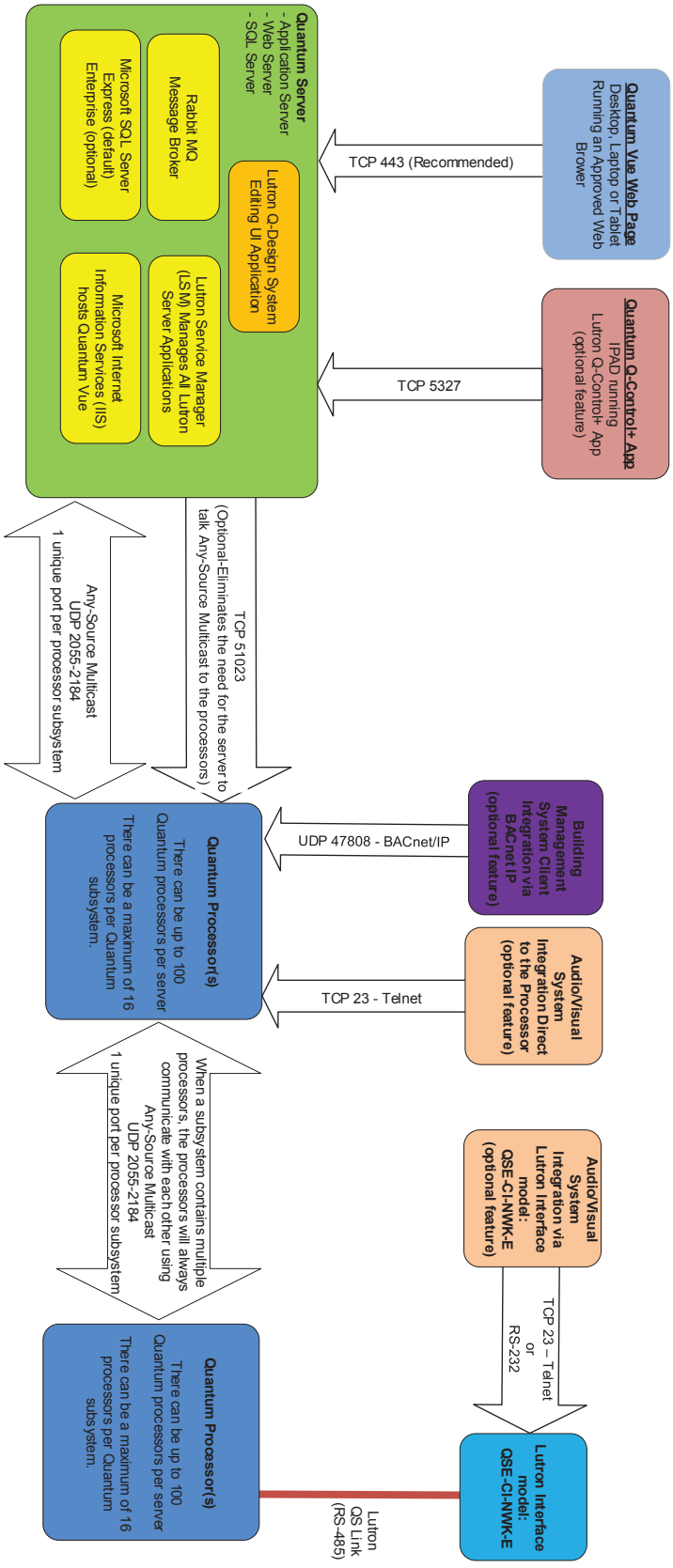
Software Maintenance

1. Each Quantum software version is designed and tested to work on specified Windows Operating System versions. See page 9 of this document for which versions of the Quantum software are compatible with each version of Windows and SQL.
2. Lutron recommends keeping the Windows Servers and PCs used with a Quantum system up to date on all Windows patches that have been recommended by the customer's IT department.
3. Lutron recommends installing, configuring and updating an anti-virus program, such as Symantec, on any Server or PC running the Quantum software.
4. Lutron recommends purchasing a Software Maintenance Agreement (SMA) offered by Lutron. A software maintenance agreement gives you access to updated builds (patches) of a specific version of Quantum software as well as access to new versions of Quantum software as they become available. Patches are released to fix software defects identified and incompatibilities found with Windows updates. New versions of Quantum software are released regularly to add support for newer versions of Windows Operating Systems and versions of Microsoft SQL Server as well as to add new features to the product. See the specification submittal for Lutron model number: LSC-SMA-SP (P/N 3601223) on www.lutron.com for details.

Typical System Network Diagram



Communication Port Diagram



Customer Assistance

If you have questions concerning the installation or operation of this product, call the Lutron Customer Assistance.

Please provide the exact model number when calling.
Model number can be found on the product packaging.
Example: SZ-CI-PRG

U.S.A., Canada, and the Caribbean: 1.844.LUTRON1
Other countries call: +1.610.282.3800
Fax: +1.610.282.1243

Visit us on the web at www.lutron.com

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