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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 is obsolete 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.
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.
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: Multicast communication is still required for communication among the processors in a subsystem. The only way to completely eliminate all multicast from a Quantum system is to design the system so that there is only one processor in each subsystem.
Network and IT Considerations  (continued)

Ports (REQUIRED)

*Quantum processor to Quantum processors within a Quantum subsystem*
  UDP/2055 up to 2184 (1 per subsystem).

*Quantum Application Server to Quantum processors UNICAST OPTION*
  TCP/51023
  - TCP available only for Quantum servers hosting software version 3.0 and newer

*Quantum Application Server to Quantum processors MULTICAST OPTION*
  UDP/2055 up to 2184 (1 per subsystem).

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

*Quantum Vue Web Page*
  Source TCP/49152 - 65535 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
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 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**

<table>
<thead>
<tr>
<th>Software Version</th>
<th>Microsoft® SQL Version</th>
<th>Microsoft® OS Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantum 1.5 - 1.9</td>
<td>SQL 2005 Express (default)</td>
<td>Windows® XP Pro (32-bit)</td>
</tr>
<tr>
<td>Quantum 2.0 - 2.7</td>
<td>SQL 2005 Express (default)</td>
<td>Windows® XP Pro (32-bit)</td>
</tr>
<tr>
<td></td>
<td>SQL 2005 Full* (requires custom installation)</td>
<td>Windows® 7 Professional (32 or 64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2003 Server (32-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2008 R2 Server (64-bit)</td>
</tr>
<tr>
<td>Quantum 3.0 - 3.1</td>
<td>SQL 2012 Express (default)</td>
<td>Windows® 7 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td>SQL 2012 Full* (requires custom installation)</td>
<td>Windows® 8 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 8.1 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 10 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 10 Enterprise (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2008 R2 Server (64-bit)</td>
</tr>
<tr>
<td>Quantum 3.2</td>
<td>SQL 2012 Express (default)</td>
<td>Windows® 7 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td>SQL 2012 Full* (requires custom installation)</td>
<td>Windows® 2008 R2 Server (64-bit)</td>
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<tr>
<td></td>
<td></td>
<td>Windows® 8 Professional (64-bit)</td>
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<tr>
<td></td>
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<td>Windows® 8.1 Professional (64-bit)</td>
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<td>Windows® 10 Professional (64-bit)</td>
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<td>Windows® 10 Enterprise (64-bit)</td>
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<tr>
<td></td>
<td></td>
<td>Windows® 2012 R1 Server (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2012 R2 Server (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2016 Server (64-bit)</td>
</tr>
<tr>
<td>Quantum 3.4</td>
<td>SQL 2017 Express (default)</td>
<td>Windows® 10 Professional (64-bit)</td>
</tr>
<tr>
<td></td>
<td>SQL 2017 Full* (requires custom installation)</td>
<td>Windows® 2012 R1 Server (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2012 R2 Server (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2016 Server (64-bit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Windows® 2019 Server (64-bit)</td>
</tr>
</tbody>
</table>

* Configuring the Quantum system to use a full install of SQL server will require additional field service time as well as customer IT/DBA support. The SQL instance must be installed on the application server where the Quantum software is installed. Remote SQL is not supported.
**Server and Application Considerations (continued)**

**Hardware Requirements**

<table>
<thead>
<tr>
<th>Quantum Version</th>
<th>Laptop or Desktop</th>
<th>Physical Server</th>
<th>Virtual Server</th>
</tr>
</thead>
</table>
| **1.5-1.9**     | • Intel® Core i3 processor  
• Integrated Intel® HD Graphics or 256 MB dedicated graphics card  
• 1 GB RAM  
• 50 GB hard drive  
• Screen with minimum 1024 x 768 resolution  
• 10/100 MB wired Ethernet network interface | • Intel® Xeon® processor  
• Dedicated graphics card with 256 MB memory  
• 2 GB RAM  
• 80 GB hard drive  
• Screen with minimum 1024 x 768 resolution  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• Only needed if processors are not on the corporate network | • Intel® Xeon® processor  
• 2 GB RAM  
• 80 GB hard drive  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• One for communication to the Quantum processors  
• One for communication to other computers on the corporate network  
• Only needed if processors are not on the corporate network |

| **2.0-2.7**     | • Intel® Core i3 processor  
• Integrated Intel® HD Graphics or 256 MB dedicated graphics card  
• 2 GB RAM  
• 100 GB hard drive  
• Screen with minimum 1024 x 768 resolution  
• 10/100 MB wired Ethernet network interface | • Dual Core Intel® Xeon® processor  
• Dedicated graphics card with 256 MB memory  
• 4 GB RAM  
• 100 GB hard drive  
• Screen with minimum 1024 x 768 resolution  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• Only needed if processors are not on the corporate network | • Dual Core Intel® Xeon® processor  
• 4 GB RAM  
• 100 GB hard drive  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• One for communication to the Quantum processors  
• One for communication to other computers on the corporate network  
• Only needed if processors are not on the corporate network |
## Server and Application Considerations (continued)

### Hardware Requirements (continued)

<table>
<thead>
<tr>
<th>Quantum Version</th>
<th>Laptop or Desktop</th>
<th>Physical Server</th>
<th>Virtual Server</th>
</tr>
</thead>
</table>
| 3.0-3.3         | • Intel Core i3 processor  
• Integrated Intel HD Graphics or 256 MB dedicated graphics card  
• 4 GB RAM  
• 250 GB hard drive  
• Screen with minimum 1280 x 1024 resolution  
• 10/100 MB wired Ethernet network interface | • Quad Core Intel Xeon processor  
• Dedicated graphics card with 256 MB memory  
• 8 GB RAM  
• 250 GB hard drive  
• Screen with minimum 1280 x 1024 resolution  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• One for communication to the Quantum processors  
• One for communication to other computers on the corporate network  
• Only needed if processors are not on the corporate network | • Quad Core Intel Xeon processor  
• 8 GB RAM  
• 250 GB hard drive  
• Two (2) 10/100 MB wired Ethernet network interfaces  
• One for communication to the Quantum processors  
• One for communication to other computers on the corporate network  
• May be warranted if Quantum subsystem network is not accessible through a firewall from the corporate backbone |
| 3.4             | • Intel Core i7 (4 cores, 8 threads 2.5 GHz) or AMD equivalent  
• 16 GB RAM  
• 500 GB SSD hard drive  
• Screen with minimum 1280 x 1024 resolution  
• Minimum 100 MB wired Ethernet network interface | • Intel Xeon (4 cores, 8 threads 2.5 GHz) or AMD equivalent  
• 16 GB RAM  
• 500 GB SSD hard drive  
• Screen with minimum 1280 x 1024 resolution  
• Minimum 100 MB wired Ethernet network interface | • Intel Xeon (4 cores, 8 threads 2.5 GHz) or AMD equivalent with Multi-threading 8T enabled  
• 16 GB RAM  
• 500 GB SSD hard drive  
• Minimum 100 MB wired Ethernet network interface |
Server and Application Considerations (continued)

Software Required
- Microsoft® Internet Information Services (IIS) 7 or later for Quantum Vue
- Microsoft® .NET Framework 3.5
- Microsoft® .NET Framework 4.5 (Quantum 3.0 and 3.1)
- Microsoft® .NET Framework 4.6.1 (Quantum 3.2 and later)
- A web browser that supports HTML-5, the latest version of Google® Chrome® recommended

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).
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 recommend 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.

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

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 3rd party software as needed.
Server and Application Considerations (continued)

IIS Features

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

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

#### IIS Features (continued)

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

<table>
<thead>
<tr>
<th>Hardware</th>
<th>OS Version</th>
<th>Browser</th>
</tr>
</thead>
<tbody>
<tr>
<td>iPad</td>
<td>iOS 7.1 or later</td>
<td>Safari</td>
</tr>
<tr>
<td>PC</td>
<td>Windows 7 or later</td>
<td>Internet Explorer, Microsoft Edge, Google Chrome</td>
</tr>
<tr>
<td>Windows Surface</td>
<td>Windows 10 or later</td>
<td>Internet Explorer, Microsoft Edge, Google Chrome</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Quantum Version</th>
<th>iOS App Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.6</td>
<td>1.0/2.2/2.3</td>
</tr>
<tr>
<td>2.7</td>
<td>2.2/2.3</td>
</tr>
<tr>
<td>3.0</td>
<td>2.3</td>
</tr>
<tr>
<td>3.1</td>
<td>2.3</td>
</tr>
<tr>
<td>3.2</td>
<td>2.3</td>
</tr>
<tr>
<td>3.3</td>
<td>2.3</td>
</tr>
<tr>
<td>3.4</td>
<td>2.5</td>
</tr>
</tbody>
</table>

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

Quantum Processor(s)
There can be up to 100 Quantum processors per server
There can be a maximum of 16 processors per Quantum subsystem.

Quantum Server
- Web Server
- SQL Server
- RabbitMQ
- Lutron Q-Control+ App
- IPAD running Lutron Q-Control+ App (optional feature)
- Microsoft Internet Information Services (IIS)
- MS SQL Server
- Express (default)
- Enterprise (optional)

Lutron Service Manager (LSM) Manages All Lutron Server Applications

TCP 443 (Recommended)
TCP 5327
TCP 51023
UDP 47808 - BACnet/IP
TCP 23 - Telnet
TCP 23 - Telnet
RS-232
RS-485

Any-Source Multicast UDP 2055-2184 1 unique port per processor subsystem

Building Management System Client Integration via BACnet IP (optional feature)
Audio/Visual System Integration Direct to the Processor (optional feature)
Audio/Visual System Integration via Lutron Interface model: QSE-CI-NWK-E (optional feature)

Lutron QS Link (RS-485)
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: 1.800.523.9466
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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