

# Light & Sound Sensor



## User Manual

LSS-200



TD-001538-01-A1



## EXPLANATION OF TERMS AND SYMBOLS

The term "WARNING!" indicates instructions regarding personal safety. If the instructions are not followed the result may be bodily injury or death.

The term "CAUTION!" indicates instructions regarding possible damage to physical equipment. If these instructions are not followed, it may result in damage to the equipment that may not be covered under the warranty.

The term "IMPORTANT!" indicates instructions or information that are vital to the successful completion of the procedure.

The term "NOTE" is used to indicate additional useful information.



The intent of the lightning flash with arrowhead symbol in a triangle is to alert the user to the presence of un-insulated "dangerous" voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to humans.



The intent of the exclamation point within an equilateral triangle is to alert the user to the presence of important safety, and operating and maintenance instructions in this manual.



### IMPORTANT SAFETY INSTRUCTIONS



**WARNING!: TO PREVENT FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE. Elevated Operating Ambient - If installed in a closed or multi-unit rack assembly, the ambient operating temperature of the rack environment may be greater than room ambient. Consideration should be given to ensure that the maximum operating temperature range (0°C to 50°C (32°F to 122°F) is not exceeded. Reduced Air Flow – Installation of the equipment in a rack should be such that the amount of air flow required for safe operation of the equipment is not compromised.**

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. Do not submerge the apparatus in water or liquids.
7. Do not use any aerosol spray, cleaner, disinfectant or fumigant on, near or into the apparatus.
8. Clean only with a dry cloth.
9. Do not block any ventilation opening. Install in accordance with the manufacturer's instructions.
10. Keep all ventilation openings free of dust or other matter.
11. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
12. Only use attachments/accessories specified by the manufacturer.
13. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
14. Adhere to all applicable, local codes.
15. Consult a licensed, professional engineer when any doubt or questions arise regarding a physical equipment installation.

## Maintenance and Repair



**WARNING!: Advanced technology, e.g., the use of modern materials and powerful electronics, requires specially adapted maintenance and repair methods. To avoid a danger of subsequent damage to the apparatus, injuries to persons and/or the creation of additional safety hazards, all maintenance or repair work on the apparatus should be performed only by a QSC authorized service station or an authorized QSC International Distributor. QSC is not responsible for any injury, harm or related damages arising from any failure of the customer, owner or user of the apparatus to facilitate those repairs.**

## FCC Statement



**NOTE:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## RoHS STATEMENT

The QSC LSS-200 is in compliance with European Directive 2011/65/EU – Restriction of Hazardous Substances (RoHS2).

## Warranty

For a copy of the QSC Limited Warranty, visit the QSC website at [www.qsc.com](http://www.qsc.com)

# Contents

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<b>Maintenance and Repair</b> .....	<b>.ii</b>
<b>FCC Statement</b> .....	<b>iii</b>
<b>RoHS STATEMENT</b> .....	<b>iii</b>
<b>Warranty</b> .....	<b>iii</b>
<b>Installation</b> .....	<b>1</b>
<b>Intellectual Property</b> .....	<b>1</b>
<b>Introduction</b> .....	<b>1</b>
<b>Package Contents</b> .....	<b>1</b>
<b>Features</b> .....	<b>1</b>
<b>User Interface</b> .....	<b>3</b>
<b>Home Screen</b> .....	<b>3</b>
<b>Log</b> .....	<b>4</b>
<b>Audio Video Sync</b> .....	<b>5</b>
<b>Firmware Version</b> .....	<b>5</b>
<b>Configuration</b> .....	<b>5</b>
<b>Installation</b> .....	<b>10</b>
<b>NTP and Luminance Check</b> .....	<b>11</b>
<b>Writing Command Scripts</b> .....	<b>11</b>
<b>Script Test Run</b> .....	<b>12</b>
<b>Data Analysis</b> .....	<b>12</b>
<b>CSV Data Use</b> .....	<b>13</b>
<b>Multiple Logs on One Page</b> .....	<b>14</b>
<b>Multiple Auditorium Summary</b> .....	<b>15</b>
<b>Ethernet Device Discoverer iOS Version</b> .....	<b>16</b>
<b>Ethernet Device Discoverer Android Version</b> .....	<b>16</b>
<b>Ethernet Device TCP Based Operations</b> .....	<b>16</b>
<b>Dolby® CP850 Control</b> .....	<b>18</b>
<b>LSS-DB</b> .....	<b>20</b>
<b>Hidden Screens</b> .....	<b>20</b>
<b>View Configuration Data</b> .....	<b>20</b>
<b>Calibration Screens</b> .....	<b>20</b>
<b>Firmware Update</b> .....	<b>22</b>
<b>Restore Button</b> .....	<b>22</b>
<b>Useful Software</b> .....	<b>22</b>
<b>Ethernet Device Discoverer</b> .....	<b>23</b>
<b>LSS Database Software</b> .....	<b>23</b>
<b>LSS-200 Specifications</b> .....	<b>29</b>

# Installation

The LSS-200 should be configured prior to being installed. See [Configuration](#) for instructions on initial LSS-200 setup followed by the [Installation](#) instructions.

# Intellectual Property

The LSS-200 is manufactured under US Patent 8,836,910 . The firmware is copyright QSC, LLC.

# Introduction

The LSS-200 is designed for cinema auditorium quality control. It measures C-weighted sound pressure level (SPL) in dB, luminance in cd/m<sup>2</sup> and fL, chromaticity (x and y), correlated color temperature, and audio/video synchronization. The LSS-200 makes all of these measurements available on a web interface, through TCP commands over Ethernet, and by posting data to a remote web server for further analysis and display.

In a typical installation, the digital cinema server runs a test show each day. The show consists of one or more test compositions. A test composition contains a white flash sequence that identifies the test script the LSS-200 is to run, followed by the test content (screen image(s) and sound through each speaker). Several test compositions are available for different auditorium configurations. Each of these provide pink noise to each speaker in the auditorium. The LSS-200 measures the SPL from each speaker to detect changes in the system. The test compositions also include a white test pattern allowing the LSS-200 to measure peak luminance and chromaticity. Additional test compositions allow the testing of auditoriums using the Dolby® CP850 Atmos sound processor and audio/video sync. Captured measurements are limit checked, logged, and optionally posted to a remote web server for further analysis.




The LSS-200 contains an XYZ color sensor, not an image sensor. There is no possibility of the LSS-200 transmitting an image of the movie, so it does not present any security issues.

The LSS-200 is powered by Power Over Ethernet. A user-supplied PoE Ethernet switch or PoE injector (IEEE 802.3af class 1 or “passive 48V”) is used to power the unit. If desired, it may also be powered using a USB cable and power supply. Refer to [Appendix B](#) for power supply requirements.

The LSS-200 should be mounted on the rear wall of the auditorium. It is aimed towards the center of the screen using the internal LEDs. Before the first show or after the last show, a test show is run that projects a test pattern and sends pink noise to each speaker. The LSS-200 measures the color, luminance, SPL, and audio/video sync, depending upon which test shows are run. These measurements are used to identify lamps nearing end of life, misadjusted lamps, projector color problems, defective speakers, etc.

Since measurements vary in different positions in the room, the measurements from the LSS-200 should be compared with previous measurements to detect changes rather than interpreting the absolute values delivered by the LSS-200.

# Package Contents

	1 LSS-200		1 Mounting Bracket (2 pieces)		1 Safety and Regulatory Manual TD-001559-01
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# Features

- **Luminance Measurement** – Uses a precision detector with a photopic spectral response.
- **Chromaticity Measurement** – Uses a precision XYZ sensor and calculates calibrated XYZ, xy, and CCT.
- **SPL Measurement** – Uses a DSP generated C-weighting filter and RMS detector for accurate results regardless of signal waveform or crest factor. SPL measurement is averaged over 1.33 seconds to yield a stable reading with pink noise.
- **Audio/Video Synchronization** – Measures the delay between a light flash and sound beep reaching the LSS-200. Displays the offset in ms and frames at the LSS-200, at the screen, and at the SMPTE measurement location.
- **Temperature Measurement** – Includes an internal temperature sensor that can be used to approximate auditorium temperature and track changes.

- **Web Interface** – Displays live measured data along with user defined reference values. The web interface supports language translation tables based on the language requested by the browser. Currently the web interface supports English (en) and Chinese (zh).
- **Automatic Script Start** – Each test composition includes a white flash sequence that starts the appropriate measurement script in the LSS-200. As an alternative, scripts may be started with a command over TCP or by a contact closure. See [Appendix A – Red/Green or White Flash Script Start](#) for information on the flash sequence design. See [Appendix B – USB Power Interface and Contact Closure Script Start](#) for information on using contact closures to start scripts. See `lss.sys.script_run` in [Table 2 "LSS-200 TCP/Script Commands"](#) for information on starting a script with a TCP command.
- **TCP Command Interpreter** – Accepts commands over Ethernet to log data, send current measurement, start a measurement script, etc.
- **Command Scripting** – An unlimited number of user scripts (up to a total of 65,530 characters) may be defined. Scripting permits a sequence of measurements to be made automatically. Command scripts can send TCP commands to other devices. Command scripts can also put pink noise on individual speakers driven by a Dolby® CP850.
- **Logging with Limit Checking and Graph Generation** – The LSS-200 can capture measurements to a log. The log shows the measurement in red if it is outside user defined limits. The log can be downloaded as a CSV file for analysis in a spreadsheet. The LSS-200 generates graphs of logged data showing trends of the measured data along with limit lines.
- **Web Services Posting** – The LSS-200 can post log data to one or more HTTP or HTTPS servers. Log data is sent as XML for simple parsing into a database for report generation. The QSC provided LSS-DB can run on a user-provided server to gather information from a large number of LSS-200 devices and generate reports and alerts.
- **Power Over Ethernet** – The LSS-200 is powered by a PoE enabled Ethernet switch or a user supplied power injector. Use of PoE simplifies installation since fewer wires need to be run. The LSS-200 is an IEEE 802.3af class 1 powered device. It may be powered by “active” (power sources that use the PoE signature) or “passive” (power sources that do not use the standard PoE signature) 48V PoE injectors. The LSS-200 consumes less than 1.5W.
- **USB Power** – As an alternative, the LSS-200 can be powered by a USB power supply. See [Appendix B – USB Power Interface and Contact Closure Script Start](#) for information on using USB power.

# User Interface

The LSS-200 has an internal web server that provides the user interface. This section reviews the operational screens, while later sections review the configuration and calibration screens

## Home Screen

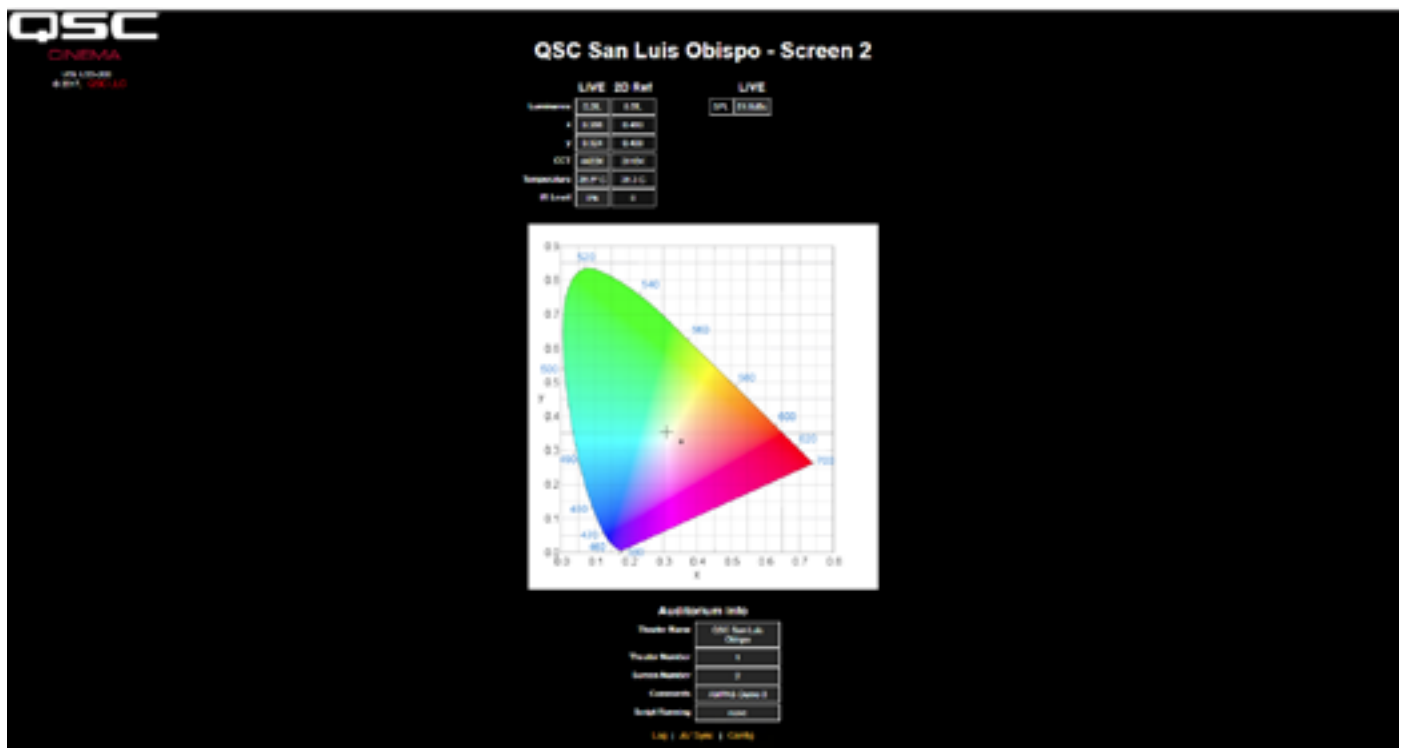
The LSS-200 home screen is shown in [Figure 1](#). This screen normally shows the luminance and chromaticity of the image currently projected on the screen plus the current SPL. The contents of the page are configurable as to what information is shown in the left table of light values. The right table shows the current C-weighted sound pressure level. Reference columns may be added to each table to make easy comparisons. Reference columns are added using the configuration screen. When the home screen includes light or sound reference columns, clicking on the header for that column copies the current values to the reference column.

The home screen also shows the current chromaticity on the CIE 1931 chromaticity space. The current chromaticity is shown as a small circle. Reference white, as specified by SMPTE ST 431-1 is shown by a small cross. The graph also shows the wavelength of a monochromatic light source that corresponds to the colors around the border.

The home page also includes information that identifies the auditorium the LSS-200 is placed in. This information is entered through the configuration screens during installation.

The LSS-200 uses automated scripts to perform measurements in synchronization with the playback of a test show. The home page shows which script, if any, is currently running. The first script is script number 0.

Finally, the home page has links to other pages where the log can be viewed, where audio/video synchronization can be viewed, and where the system can be configured.



— Figure 1 — LSS-200 Home Page

## Log

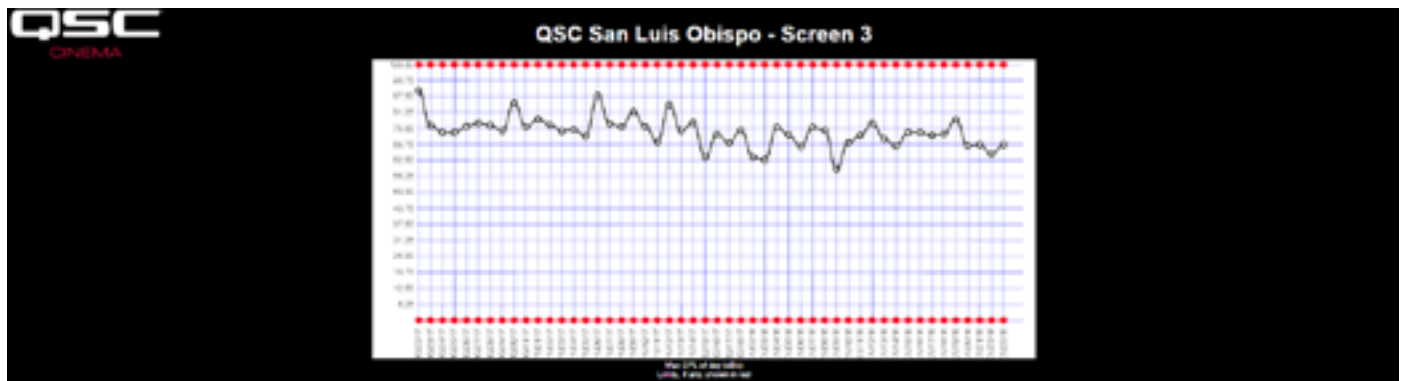
Figure 2 shows a portion of a log page from the LSS-200. Logs use UTC time internally. UTC time is converted to local time at the LSS-200 and local time at the user location when displaying logs. The time zone at the LSS-200 is entered on the configuration pages. The time zone at the user location is determined by the web browser referencing the operating system. The browser determines whether Daylight Saving Time (Summer Time) is in effect at the user location. This same determination is used to determine whether Daylight Saving Time is in effect at the LSS-200 location. The configuration page allows Daylight Saving Time to be disabled at the LSS-200 location if Daylight Saving Time is not observed at that location. Finally, you can click the time zone under “LSS Time” to toggle between standard and Daylight Saving Time.

Measurement descriptions are determined in the scripts that capture the measurements. In addition, the measurement capture commands allow minimum and maximum values to be specified for each measurement. Measurements that are outside these limits are shown in red.

Record Number	UTC Time	GUI Time Mountain Standard Time	LSS Time PST	Description	Measured Value
2436	Fri Jan 26 03:35:32 2018	Mon Jan 22 20:35:32 2018	Mon Jan 22 19:35:32 2018	Max SPL of day	64.5dB
2437	Fri Jan 26 04:50:59 2018	Thu Jan 25 21:50:59 2018	Thu Jan 25 20:50:59 2018	SPL, Silence	52.5dB
2438	Fri Jan 26 04:51:18 2018	Thu Jan 25 21:51:18 2018	Thu Jan 25 20:51:18 2018	SPL, Left Low	55.0dB
2439	Fri Jan 26 04:51:33 2018	Thu Jan 25 21:51:33 2018	Thu Jan 25 20:51:33 2018	SPL, Left Mid	54.0dB
2440	Fri Jan 26 04:51:48 2018	Thu Jan 25 21:51:48 2018	Thu Jan 25 20:51:48 2018	SPL, Left High	55.2dB
2441	Fri Jan 26 04:52:03 2018	Thu Jan 25 21:52:03 2018	Thu Jan 25 20:52:03 2018	SPL, Right Low	54.5dB
2442	Fri Jan 26 04:52:18 2018	Thu Jan 25 21:52:18 2018	Thu Jan 25 20:52:18 2018	SPL, Right Mid	55.1dB
2443	Fri Jan 26 04:52:33 2018	Thu Jan 25 21:52:33 2018	Thu Jan 25 20:52:33 2018	SPL, Right High	55.1dB
2444	Fri Jan 26 04:52:48 2018	Thu Jan 25 21:52:48 2018	Thu Jan 25 20:52:48 2018	SPL, Center Low	55.0dB
2445	Fri Jan 26 04:53:03 2018	Thu Jan 25 21:53:03 2018	Thu Jan 25 20:53:03 2018	SPL, Center Mid	55.0dB
2446	Fri Jan 26 04:53:18 2018	Thu Jan 25 21:53:18 2018	Thu Jan 25 20:53:18 2018	SPL, Center High	55.5dB
2447	Fri Jan 26 04:53:33 2018	Thu Jan 25 21:53:33 2018	Thu Jan 25 20:53:33 2018	SPL, LFE	55.2dB
2448	Fri Jan 26 04:53:48 2018	Thu Jan 25 21:53:48 2018	Thu Jan 25 20:53:48 2018	SPL, Lr	55.1dB
2449	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	SPL, Rr	55.2dB
2450	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	Luminance	0.210x
2451	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	Color r	0.36x
2452	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	Color g	0.30x
2453	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	Color Temperature	6.6e+3K
2454	Fri Jan 26 04:54:03 2018	Thu Jan 25 21:54:03 2018	Thu Jan 25 20:54:03 2018	BI Level	0.857%
2455	Fri Jan 26 05:26:34 2018	Thu Jan 25 22:26:34 2018	Thu Jan 25 21:26:34 2018	# Posted to <a href="http://radio.wolter.com/post.php">http://radio.wolter.com/post.php</a>	1.1e+09
2456	Fri Jan 26 05:26:34 2018	Thu Jan 25 22:26:34 2018	Thu Jan 25 21:26:34 2018	# Log post compression code	200
2457	Fri Jan 26 05:26:52 2018	Thu Jan 25 22:26:52 2018	Thu Jan 25 21:26:52 2018	Max SPL of day	68.7dB

— Figure 2 — LSS-200 Log

Clicking a measurement description brings up a graph of that measurement over time as shown in Figure 3. The minimum and maximum values specified in the script commands are plotted in red.



— Figure 3 — LSS-200 Graph



## Audio Video Sync

The LSS-200 can also measure the delay between a flash on the screen and a pop (one frame beep). This requires playing the AV Sync test content. The resulting page is shown in [Figure 4](#). The page shows how many milliseconds after the flash the pop arrives at the LSS (if the pop arrives before the flash, the delay is negative). Based on the distance from the LSS-200 to the screen (entered during system configuration), the LSS-200 also displays the sync delay at the screen and at the SMPTE reference point (2/3 of the way back in the auditorium). The sync delay is also displayed in frames based on a frame rate of 24 frames per second. Finally, the bottom of the screen shows the progress of the sync measurements. It includes the timer tick values when the flash and pop are detected and the calculated delay. The system is triggered by the flash. If no flash is detected, no action will be taken. If a flash is detected and no pop is detected before 1 second after the flash, the missing pop is reported. The measured delay can also be logged through a command script so changes in sync can be easily detected.



— Figure 4 — Audio Video Sync page

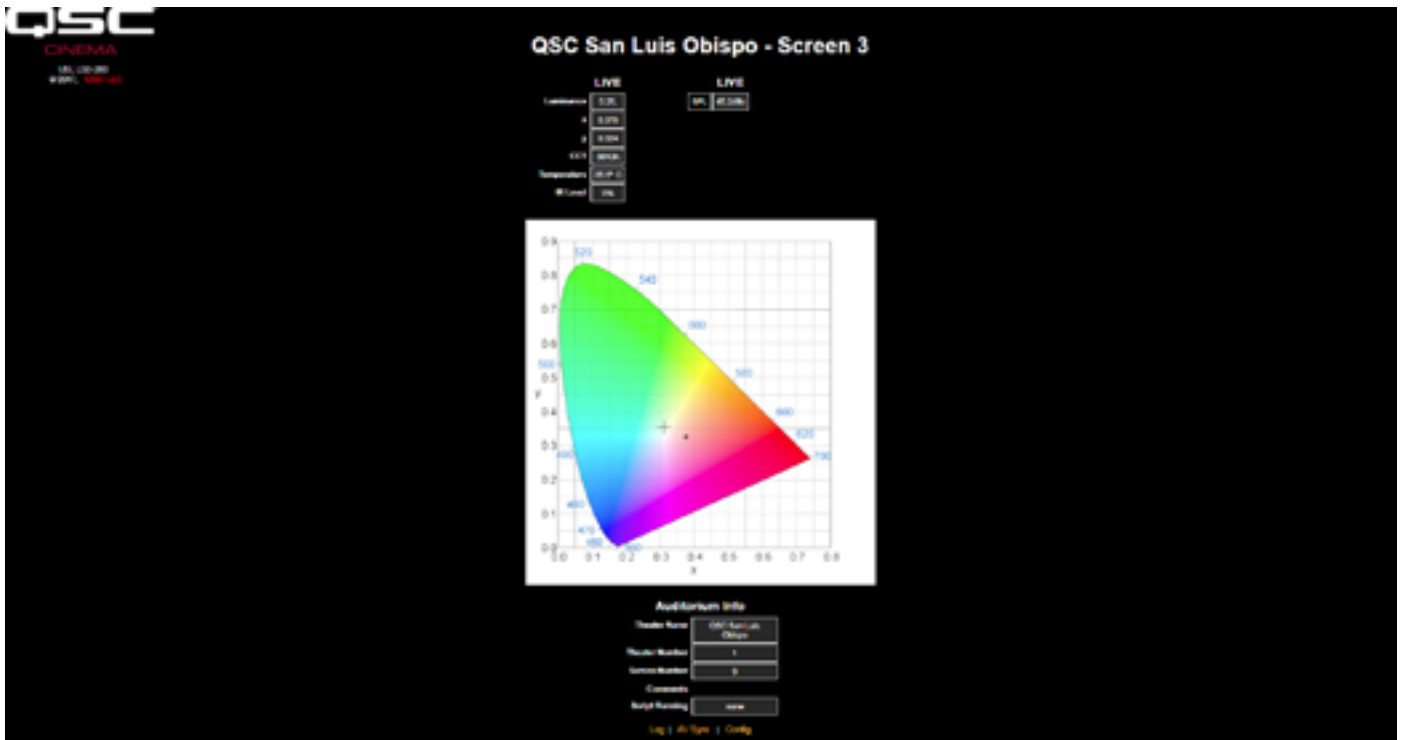
## Firmware Version

The LSS-200 is subject to constant improvement. Check <http://ftp.uslinc.com/?dir=ftp/Products/LSS-200>, or [qsc.com](http://qsc.com) for the latest firmware. Note that the latest firmware can be used in the LSS-100, the LSS-100P, and the LSS-200. See "Appendix D – LSS Models" on page 27 for a comparison of the various LSS models. See the "Firmware Update" on page 22 for instructions on updating the firmware.

## Configuration

It is a lot easier to do the initial configuration of the LSS-200 on a table or the floor of the projection booth instead of on top of a ladder.

1. Connect an Ethernet cable between the LSS-200 and a laptop computer. Connect a USB cable between the LSS-200 and the computer to supply power to the LSS-200.
2. The green LED next to the Ethernet connector on the LSS-200 will light dimly for 30 seconds, then light brightly. During this time, the LSS-200 is checking its backup copy of the system firmware. The green LED is lit whenever the LSS-200 is powered unless the flash memory chip is being accessed (such as during the firmware check, loading or saving of configuration information, etc.).
3. Open a web browser and type <http://169.254.1.6> in the address bar. (You can also use Ethernet Device Discoverer to find the IP address of the LSS-200.) On most laptops, this will bring up the home page of the LSS-200. If it does not, try changing the laptop's IP address to 169.254.1.123 with a subnet mask of 255.255.0.0. Most laptops have automatic crossover for Ethernet, but some older ones do not. If the LSS-200 home page is still not visible, try using an Ethernet crossover cable between the laptop and the LSS-200. The LSS-200 home page is shown below.



— Figure 5 — LSS-200 Home Page

- Click the “config” to go to the Configuration Page. The default username is “admin” and the default password is “ultra”. There are several configuration pages that are described below.



— Figure 6 — LSS-200 Web Display Configuration Page

5. The first configuration page, shown above, allows you to determine how the home page will appear. The Light Table section determines how the left side of the home page will appear (the side that is showing luminance, color, etc.). The home page can show up to 7 rows of light information. The source of that information is set by the first column of the light table. You can select U.S. or metric units for temperature and luminance. Select the data source for each line of the home page light display.
6. Set the name for each line of the home page light display. These may be in any language.
7. The light table of the home page supports a total of 7 data columns. The first column is always the current “live” measurement data. Additional columns hold reference measurements. Live data is copied to the reference measurement column by clicking on the header of the column on the home page. Define a name for each desired data columns. The first column is always labeled LIVE.
8. The right side of this configuration screen allows reference column names to be defined for the SPL measurement. These behave the same as the light reference measurements described in the previous step. Up to 14 SPL reference columns may be defined.
9. The LSS-200 determines the highest SPL it measured from midnight local time to midnight local time. The highest value is logged each night at midnight. You can set a limit for the maximum SPL on this page. If this value is exceeded, the maximum SPL of the day will be shown in red on the log.
10. The LSS-200 makes out of tolerance readings available to the QSC Ethernet Device Discoverer (see <http://ftp.uslinc.com/?dir=ftp/Products/EthernetDeviceDiscoverer> ). Ethernet Device Discoverer “discovers” QSC products on the network. In addition, it shows status messages from each device. If Ethernet Discoverer Log Review Days is set to 7 (as shown in [Figure 6](#)), Ethernet Device Discoverer will display any out of tolerance readings logged in the past 7 days.
11. Once this data has been entered, click the “Save User Data” button to save the settings to the LSS-200.
12. Click the “Auditorium Data” link at the top of the page.



— Figure 7 — LSS-200 Auditorium Data

13. Enter the theater name, theater number (large groups often identify a particular theater by number), and the screen or auditorium number. Note that the theater number and screen number must be numbers (not names). The “Organization Key” is used by the LSS Database software to identify multiple theaters as part of company or organization. A particular LSS-200 can be uniquely identified by the OrgKey, Theater Number, and Screen Number. The “Distance of LSS-200 to Screen” field is used when running the audio/video sync check to determine flash to pop timing at the LSS-200, at the screen, and at the SMPTE reference point. Additional information about the auditorium can be entered in the Comments field. These comments show up on the home page and are reported in the XML web services log data. Click the “Save Auditorium Data” button to save the data. Ignore the luminance scaling section for now.
14. Click the Web Configuration link at the top of the page.



— Figure 8 — LSS-200 Web Configuration

15. Enter the host name (NET BIOS host name), IP address, gateway, subnet mask, and DNS information. DNS is used if the NTP server or web services server (log posting in command scripts) is specified by a host name instead of an IP address. If IP addresses are used instead of host names, these fields can be left at 0.0.0.0. The default 8.8.8.8 is a DNS service provided by Google. After the network information has been entered, click the “Save Config” button to save the settings. Note that the new IP address takes effect immediately. The laptop will attempt to connect to the LSS-200 at the new IP address. The laptop network configuration may need to be changed to reach the LSS-200 at the new IP address.
16. Click the NTP Configuration link at the top of the page.



— Figure 9 — LSS-200 NTP Configuration

17. An NTP server is required for the LSS-200 logging. Most digital cinema servers have an NTP server in them, so the IP address of that server can be entered. If outgoing internet access is available, the default setting of pool.ntp.org can be used. The NTP server IP address can be entered as a dotted decimal IP address. If a DNS server was set up on the Web Configuration screen, a domain name (such as pool.ntp.org) can be used instead.
18. Set the time zone UTC offset. Offsets for U.S. time zones are shown in [Table 1](#). Note that fractions of an hour can be set (required for Venezuela, Afghanistan, India, Sri Lanka, Nepal, and other countries). Note that this is the offset for standard time, not advanced time, summer time, or daylight saving time. Additional time zone information is available at <http://www.timeanddate.com/library/abbreviations/timezones/> and [http://en.wikipedia.org/wiki/List\\_of\\_time\\_zones\\_by\\_UTC\\_offset](http://en.wikipedia.org/wiki/List_of_time_zones_by_UTC_offset).

— Table 1 — U.S. Time Zone Offsets

US Time Zone	UTC Offset	Standard Time Abbreviation	Daylight Saving Time Abbreviation
Hawaii-Aleutian	-10.0	HAST	HADT
Alaska	-9.0	AKST	AKDT
Pacific	-8.0	PST	PDT
Mountain	-7.0	MST	MDT
Central	-6.0	CST	CDT
Eastern	-5.0	EST	EDT

19. Enter the abbreviations for standard and advanced, summer, or daylight saving time. Select whether daylight saving (or similar) is observed at the location the LSS-200 is installed. This setting is not whether DST is currently being observed, but whether it is ever observed. For example, in the U.S., this would be set to “no” for Arizona and “yes” for California. The LSS-200 displayed logs will take this into consideration when displaying the time at the LSS-200.
20. Note that the bottom line of this page shows the last time the LSS-200 clock was updated from the NTP server. Since the LSS-200 does not have access to an NTP server when it is only connected to your laptop, this will indicate that the last update was never.
21. If a change of the administrator login is desired (the default username is “admin,” and the default password is “ultra”), click the link to the Admin Change page. Type the new admin username and password in the appropriate fields and press “Change Admin User Password.” Note that if the username or password is lost, they can be temporarily restored by pressing the restore button on the LSS-200 while the LSS-200 is powered up and operating. This restores the admin username, password, and default IP address.



— Figure 10 — Admin User Change page

## Installation

1. Use the supplied OmniMount 10.0 wall mount to attach the LSS-200 to the auditorium back wall.
  - a. Aim the lens and microphone towards the screen.
  - b. Thread the supplied nut onto the OmniMount threaded rod with the flat side of the nut towards the threaded end and away from the ball.
  - c. Thread the OmniMount threaded rod into the threaded hole on the LSS-200 turning the LSS-200 four turns, adjusting a fraction of a turn as required to point the LSS-200 towards the screen.
  - d. Tighten the nut on the threaded rod against the LSS-200 case to firmly mount the LSS-200 to the threaded rod.
2. If necessary, drill a hole between the booth and auditorium for the wiring. Since the LSS-200 uses Power Over Ethernet, only an Ethernet cable needs to be run. Connect the Ethernet cable between the LSS-200 and a user-supplied PoE Ethernet switch or PoE injector (IEEE 802.3af class 1 or “passive 48V”) to power the unit. If a PoE injector is used, connect another cable from the injector to the auditorium Ethernet switch. If desired, the LSS-200 may instead be powered using a USB cable and power supply (see [Appendix B – USB Power Interface and Contact Closure Script Start](#)).
3. Turn the LSS-200 LED switch to on and adjust the focus control until the red spots on the screen appear to be in focus. As the LSS-200 is adjusted out of focus, the hole in the middle of the spots fills in. When the LSS-200 is in focus, the hole in the center will be open and the edges sharp as shown in [Figure 11](#). Once focus is set, lock the lens position by tightening the thumb screw on the lens tube.
4. Project the test pattern on the screen. Suggested test content is the QSC LST-200 DCP. It is available from QSC on a USB flash drive or can be downloaded from <http://ftp.uslinc.com/?dir=ftp/Products/LSS-200/Software/TestContent>. Position the LED spots to be in the center of the test pattern area. Since the projector lamp is much more powerful than the LEDs in the LSS-200, it may be difficult to see the LED spots when the test pattern is on. A simple method of seeing where the LED spots are within the test pattern is to wave a hand through the projector beam, casting a shadow on the screen. As the shadow moves across the screen, the LED spots and their location within the test pattern will become visible. The LSS-200 sensor is positioned midway between the LEDs. Rotate the LSS-200 to align the spots horizontally within the test pattern. Place the center of the area between the spots in the center of the test pattern area. Lock the Omnimount position and turn off the LEDs.
5. The luminance and color (x, y) should agree with an accurate color meter. Spectrometer-based color meters are the most accurate. Note that luminance varies with measurement position due to the incident angle of the projector light with the screen and screen gain. Note that the LSS-200 is factory calibrated with a xenon-based projector. If another illumination source is used in the projector (such as laser or laser-phosphor), the LSS-200 will have to be calibrated in place using the procedure on page 20.
6. Turn on a pink noise source on one of the auditorium speakers (or play the test DCP which contains pink noise on each speaker in sequence). The SPL indicated by the LSS-200 should be close to that measured with an SPL meter. Again, due to system tolerances and variations in sound level throughout the auditorium, the numbers will not match precisely.



— Figure 11 — LSS-100 LED Focus and Aim

## NTP and Luminance Check

1. Go back to the NTP configuration page (shown in [Figure 9](#)) and ensure that the LSS-200 has received an NTP update.
2. If desired, the LSS-200 luminance measurement can be scaled to agree with a reference meter. The LSS-200 is factory calibrated, but, because it is not in the same location as a reference meter in the auditorium, it will probably read slightly different from the reference meter due to screen gain, elevation of the projector above the screen center, etc. Project the test pattern (ideally from the LST-200) and measure the luminance with the reference meter. While the test pattern is still present, key the measured luminance value into the appropriate box (cd/m<sup>2</sup> or fL) in the Luminance Scaling section of the Auditorium Data page (see [Figure 7](#)). Click the “Save Settings” button to scale the LSS-200 luminance measurement to match the reference meter. You can click the “Reset Luminance Scaling” button to return the LSS-200 to factory calibration.

## Writing Command Scripts

The LSS-200 script definition page includes default scripts. These can be copy and pasted into the script definition window. This section covers running the test DCP and configuring limits on the scripts.

1. Download the LSS-200 test content (LST-200) from <http://ftp.uslinc.com/?dir=ftp/Products/LSS-200/Software/TestContent>.
2. The LSS-200 test content includes “white flash script start” at the start of each composition. This flash sequence automatically starts the appropriate LSS-200 measurement script. The entire set of sample scripts on the script definition page should be copied to the top window on the script definition page. Note that the LSS-200 uses an XYZ color sensor instead of the RGB sensor used on the LSS-100 series. The XYZ sensor does not properly handle the previous red/green flash sequence. The new white flash sequence works on the LSS-100, LSS-100P, and LSS-200 with both xenon and laser-based projectors. Note that scripts may also be started with a TCP command (see Ethernet Device TCP Based Operations) or a contact closure (see [Appendix B – USB Power Interface and Contact Closure Script Start](#)).
3. Build a show with the appropriate test compositions. Add appropriate cues to the playlist to set the sound processor at reference level (0.0dB or 7.0) and take audio from the digital cinema server, turn on the projector lamp, open the dowsers, turn off the house lights, etc.
4. Click the “Command Scripts” link at the top of the configuration page. A page similar to [Figure 12](#) should appear. Lines starting with # are comments and are ignored. Blank lines separate scripts. The first script is script 0. There’s a blank line at the end of script 0. The next line is the start of script 1. Only insert one (not more) blank lines between scripts. There should be nothing on the blank lines between scripts (not even space characters). Fields are delimited with the pipe character (|). The various capture commands have these fields:
  - a. The command (“lss100.sys.capture\_spl”).
  - b. A user defined description of what is being measured (“Left Low”).
  - c. A minimum limit (“75”).
  - d. A maximum limit (“85”).
5. Note that at the bottom of the command scripts page (see [Figure 12](#) LSS-200 Command Script Page), there is a setting to select red/green flashes or white flashes for script starting. The default value is 1016 which causes the LSS-200 to respond to white flashes. A screen illuminated with more than about 2 fL is considered a binary 1. Less than 2 fL is considered a binary 0. A non-zero value causes the LSS-200 to respond to white flashes. The value establishes the threshold above which the LSS-200 recognizes the lighting of the screen as white. A value of 0 sets an LSS-100(P) to use red/green flashes and is included to allow existing test content to be used on LSS-100(P) units.
6. Run the test show. When it is complete, verify that data has been saved in the log. Print the log for reference in the next few steps.
7. Based on the test run of the show, adjust the minimum and maximum values for each measurement. The measured SPL values will vary as different bands and different speakers are run. We suggest setting limits 3 dB below and above the values measured on the test show. Failures in the audio equipment will result in values outside this range. Note that the limits set for luminance and chromaticity are based on SMPTE standards and should not require adjustment. Note that the description portion of each line of the script is user definable. Descriptions in other languages may be substituted, if desired. These descriptions will be used in the LSS-200 internal log, graphing, and web services (LSS-DB) reporting. If there are no limits on a measurement, leave the minimum and maximum out (end the line after the description). Internally and in web services reporting, a log record with no limits has its minimum set to -9e9 and its maximum set to +9e9. Note that the LSS-200 also generates “internal” log messages. These have a “#” as the first character of the description field to allow for easy sorting or filtering.
8. If web services LSS-DB reporting is desired, put the URL of the server in the lss.sys.log\_post line. For example, “lss.sys.log\_post|http://lssdb.uslinc.com/post.php” posts the log to the QSC LSS server. The URL can be either HTTP or HTTPS. A port number, username, and password may be included in the post URL. For example, http://user:pw@example.com:1234/path/filename. If posting to more than one server, include a wait between log posts to ensure the first log post is complete before the second is attempted. The LSS-200 can only post to one server at a time. A suggested wait command is “lss.sys.script\_wait|120”. The LSS-200 logs a hash of the URL on a successful log post. When another log post is executed, the LSS-200 searches back through the log for another log post with the matching URL. Log records from that point on are posted to the server. Each server receives all logs even if a post fails (they are picked up on the next post).



— Figure 12 — LSS-200 Command Script Page

9. Click the “Save Script” button to save the revised script(s).
10. Run the test show a couple times and review the log. It should appear similar to [Figure 2](#) but with the latest values not in red. Measured values that are not between the specified minimum and maximum are shown in red.
11. Click on a value in the log. A graph of the measured values (similar to [Figure 3](#) but with fewer values) should appear. If the test script has only run once, no graph will appear. At least two measurements are required to draw the graph.

## Script Test Run

The script test run buttons located on the Command Script Definition page allow the user to manually trigger LSS-200 Command Scripts without having to run the corresponding DCP show normally used. This may be useful when testing the “post to server” commands. Note that the LSS-200 home page shows the number of the currently running script (or “none” if one is not running).

## Data Analysis

The LSS-200 presents the captured data in a log (as shown in [Figure 2](#)) and a graph (as shown in [Figure 3](#)). Out of limit operation is easily identified in the log by a value being printed in red. The graphs show the measured values along with limit lines allowing easy detection of trends and out of limit operation. Ethernet Device Discoverer (<http://ftp.uslinc.com/?dir=ftp/Products/EthernetDeviceDiscoverer> ) can also be used to show out of tolerance operation within a theater.

Log data is also available as a Comma Separated Value file for analysis in a spreadsheet. Click the CSV link at the bottom of a log page to get the CSV log.

Log data can also be posted to a web server as XML for further analysis and consolidation with data from other sites.



## CSV Data Use

Click CSV to download the log as a comma separated value file for importing the data into a spreadsheet. A portion of a typical download is shown below.

Record Number	Time Stamp	LSS Time (PDT)	Excel Format	Description	Value	Units	min	max
0	1401461114		41789.32308	Silence	54.3	dBc	50	60
1	1401461144		41789.32343	SPL Left Low	87.1	dBc	82.7	88.7
2	1401461175		41789.32379	SPL Left Mid	73.9	dBc	70.5	76.5
3	1401461205		41789.32413	SPL Left High	76.4	dBc	73.9	79.9
4	1401461235		41789.32448	SPL Right Low	85.5	dBc	80.7	86.7
5	1401461265		41789.32483	SPL Right Mid	77.5	dBc	74.1	80.1
6	1401461295		41789.32517	SPL Right High	79.9	dBc	76.7	82.7
7	1401461325		41789.32552	SPL Center Low	81.1	dBc	77.4	83.4
8	1401461355		41789.32587	SPL Center Mid	73	dBc	70.8	76.8
9	1401461385		41789.32622	SPL Center High	75.1	dBc	73.9	79.9
10	1401461415		41789.32656	SPL LFE	85.1	dBc	80.8	86.8
11	1401461446		41789.32692	SPL Ls	83.4	dBc	80.9	86.9
12	1401461476		41789.32727	SPL Rs	84.7	dBc	81.3	87.3
13	1401461476		41789.32727	Luminance	9.21	fL	11	17
14	1401461476		41789.32727	Color x	0.312	x	0.308	0.32
15	1401461476		41789.32727	Color y	0.35	y	0.345	0.357
16	1401461476		41789.32727	IR Level	99.2	%	90	150
17	1401461479		41789.3273	Posted to <a href="http://lss.uslinc.com/xml/post.php">http://lss.uslinc.com/xml/post.php</a>	3.26E+03		-9.00E+09	9.00E+09

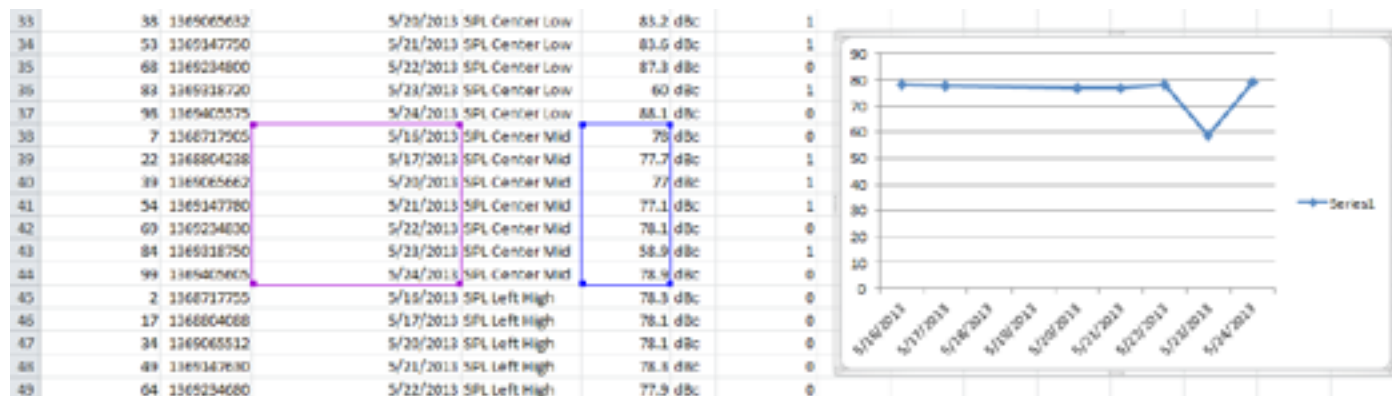
— Figure 13 — LSS-200 CVS Data

Change the format of column C (LSS Time) to date. The result is shown below:

Record Number	Time Stamp	LSS Time (PDT)	Excel Format	Description	Value	Units	min	max
0	1401461114	5/30/2014		Silence	54.3	dBc	50	60
1	1401461144	5/30/2014		SPL Left Low	87.1	dBc	82.7	88.7
2	1401461175	5/30/2014		SPL Left Mid	73.9	dBc	70.5	76.5
3	1401461205	5/30/2014		SPL Left High	76.4	dBc	73.9	79.9
4	1401461235	5/30/2014		SPL Right Low	85.5	dBc	80.7	86.7
5	1401461265	5/30/2014		SPL Right Mid	77.5	dBc	74.1	80.1
6	1401461295	5/30/2014		SPL Right High	79.9	dBc	76.7	82.7
7	1401461325	5/30/2014		SPL Center Low	81.1	dBc	77.4	83.4
8	1401461355	5/30/2014		SPL Center Mid	73	dBc	70.8	76.8
9	1401461385	5/30/2014		SPL Center High	75.1	dBc	73.9	79.9
10	1401461415	5/30/2014		SPL LFE	85.1	dBc	80.8	86.8
11	1401461446	5/30/2014		SPL Ls	83.4	dBc	80.9	86.9
12	1401461476	5/30/2014		SPL Rs	84.7	dBc	81.3	87.3
13	1401461476	5/30/2014		Luminance	9.21	fL	11	17
14	1401461476	5/30/2014		Color x	0.312	x	0.308	0.32
15	1401461476	5/30/2014		Color y	0.35	y	0.345	0.357
16	1401461476	5/30/2014		IR Level	99.2	%	90	150
17	1401461479	5/30/2014		Posted to <a href="http://lss.uslinc.com/xml/post.php">http://lss.uslinc.com/xml/post.php</a>	3.26E+03		-9.00E+09	9.00E+09

— Figure 14 — LSS-200 CSV with LSS Time Converted

Sort the spreadsheet on column D (description) to gather like readings together. Graphing or analysis can then be easily accomplished. The image below shows the generation of a plot of the SPL from the center channel mid-band measurements.



— Figure 15 — Graph Generation from LSS-200 CSV Data

## Multiple Logs on One Page

It may be desirable to have a single web page that includes the logs from multiple LSS-200 units (for example, all the auditoriums in a particular theater). This can be accomplished using HTML iframes (inline frames). Sample code to include multiple LSS-200 log pages is shown below. This code can be placed on the computer the browser is running on or on a local web server.

```
<html>
<head>
<title>Obispo LSS-200 Summary</title>
</head>
<body>
<h1 align="center">Obispo LSS-200 summary</title>
<iframe seamless frameborder="0" src="http://192.168.6.55/log.cgi?n=20&GuiTz=-
25200&GuiTzName=Pacific%20Standard%20Time&DST=1" width="100%" height="700"><br />
<iframe seamless frameborder="0" src="http://192.168.6.110/log.cgi?n=20&GuiTz=-
25200&GuiTzName=Pacific%20Standard%20Time&DST=1" width="100%" height="700"></iframe>
</body>
</html>
```

The iframe does a “client side include” of multiple web pages. The attributes of the iframe tag are described below.

The seamless and frameborder="0" attributes merge the fetched log pages into the resulting page with no frame borders so it appears to be one page.

The src attribute contains the URL of the log to be inserted at this point. It is simplest to connect to the LSS-200 home page, click log, then copy the resulting URL for use here with the changes listed below.

Delete the “rn=xx&” from the URL. rn holds the first record number to be displayed. The next part of the URL (“n=100”) indicates how many records will be shown. If rn is deleted, the LSS-200 shows the n most recent records. By deleting rn from the URL in the iframe, your page will always show the most recent log entries.

Change “n=100” to “n=20” or some other number indicating the number of log entries you want shown on this combined log page. If you do a daily log review, you may want to show three days worth of log entries to ensure data from weekends is reviewed.

GuiTz can generally remain unchanged. It is the offset in seconds from UTC where the browser is located. Similarly, the GuiTzName can remain unchanged. You may need to change DST between 1 and 0 depending on whether daylight saving time is currently in effect. You could build two pages (one for DST and one for standard time) or include the javascript at the top of the LSS-200 home page that determines whether DST is in effect at the GUI.

The width attribute is set to 100% so the iframe consumes 100% of the width of the browser window. The height is specified in pixels. If this is too small, scroll bars will appear on the resulting web page for each of the iframes. Making it too large results in empty space on the page. Experiment with this until you get the look you want for multiple logs on a single web page.

## Multiple Auditorium Summary

Another method of presenting multiple auditoriums on a single web page is to build a list of links to the auditoriums. The LSS-200 automatically supplies a link to a log that includes the theater name and the screen number. If there is an out of limits log entry in the log record range specified, the log link appears in red. You don't have to look at logs from auditoriums where all is well. Sample HTML is shown below.

```
<html>
  <head>
    <title>Obispo LSS-200 Summary</title>
  </head>
  <body>
    <h1 align="center">Obispo LSS-200 Summary</h1>
    <iframe seamless frameborder="0" src="http://192.168.6.55/loglink.cgi?n=20&GuiTZ=-25200&GuiTZName=Pacific%20Standard%20Time&DST=1" width="100%" height="50"></iframe><br />
    <iframe seamless frameborder="0" src="http://192.168.6.110/loglink.cgi?n=20&GuiTZ=-25200&GuiTZName=Pacific%20Standard%20Time&DST=1" width="100%" height="50"></iframe>
```

Most of the iframe attributes are similar to the previous example. As noted before, the lack of an `n` in the `src` attribute tells the LSS-200 to evaluate the last `n` records for an out of limit condition. In the examples above, a particular log link will be red if one of the last 20 records shows an out of limits condition.

Figure 16 shows how the HTML above appears in our test system:

## Ethernet Device Discoverer Windows Version

Ethernet Device Discoverer (<http://ftp.uslinc.com/?dir=ftp/Products/EthernetDeviceDiscoverer>) discovers QSC devices on a network. In addition, it shows the status of discovered LSS-200 devices. The LSS-200 status messages shows any out of tolerance measurements in the previous number of days where the number of days is set in the Web Display Configuration Page (Figure 6).



— Figure 16 — LSS-200 Multiple Auditorium Links

IP Address	Host Name	MAC Address	Serial #	Location	Screen	Model	Status
192.168.6.113	LSS-100	00-23-PC-06-0C-F5	3317	USL San Luis Obispo	1	LSS-100	SPL Silence high, SPL Left Low low, SPL Left Mid low, SPL Left High low, SPL Right Low low, SPL Right Mid low, SPL Right High low, SPL Center Low low, SPL Center Mid low, SPL Center High low, SPL LFE low, SPL Ls low, SPL Rs low, SPL Lrs low, SPL Rrs low, Luminance low, Color x high, Color y high, SPL Silence high, SPL Left Low low, SPL Left Mid low, SPL Left High low, SPL Right Low low, SPL Right Mid low, SPL Right High low, SPL Center Low low, SPL Center Mid low, SPL Center High low, SPL LFE low, SPL Ls low, SPL Rs low, SPL Lrs low, SPL Rrs low, Luminance low, Color
192.168.7.64	TH1_LSS-100P	00-23-PC-06-15-4F	5455	USL Test Screen 1	1	LSS-100	SPL Center Low low, SPL Center Mid low, SPL Center High low, SPL LFE low, SPL Ls low, SPL Rs low, SPL Lrs low, SPL Rrs low, Luminance low, Color x high, Color y high, SPL Silence high, SPL Left Low low, SPL Left Mid low, SPL Left High low, SPL Right Low low, SPL Right Mid low, SPL Right High low, SPL Center Low low, SPL Center Mid low, SPL Center High low, SPL LFE low, SPL Ls low, SPL Rs low, SPL Lrs low, SPL Rrs low, Luminance low, Color
192.168.7.40	TH1_JSD-60	00-23-PC-07-00-78	120	"" Factory Default ""	1	JSD-60	
192.168.7.63	TH1_CAPTIONS	00-23-PC-02-25-3F		UltraStereo	1	RC-28C	
192.168.6.57	HE-MONITOR	00-23-PC-08-09-79	123	Obispo	4	CM8E	
192.168.7.231	MP1-JSD-100	00-23-PC-05-12-FF	094863	USL San Luis Obispo	1		
192.168.7.232	JSD-100_MP-2	00-23-PC-05-25-18	086216	USL 3 Plus	2		
192.168.7.233	JSD-100_MP-3	00-23-PC-05-21-8D	08637	USL 3 Plus	3		

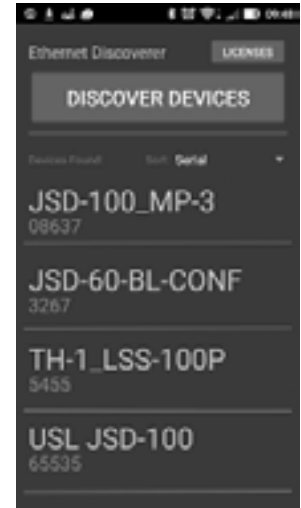
— Figure 17 — Windows version of Ethernet Device Discoverer showing LSS-200 status in red.

## Ethernet Device Discoverer iOS Version

An iOS version of Ethernet Device Discoverer is available at <https://itunes.apple.com/us/app/ethernet-discoverer/id1086192624?mt=8>. This application offers the same set of features as the Windows version but operates on iOS devices (iPhone, iPad, etc.). [Figure 18](#) shows the opening of the iOS version of Ethernet Device Discoverer.



— Figure 18 — Ethernet Device Discoverer iOS version



— Figure 19 — Ethernet Device Discoverer for Android

## Ethernet Device Discoverer Android Version

An Android version of Ethernet Device Discoverer is available at <https://play.google.com/store/apps/details?id=com.usl.discoverer&hl=en>.

## Ethernet Device TCP Based Operations

The LSS-200 uses TCP port 10001. It can accept 5 simultaneous TCP connections. Commands are lower case and terminated with a carriage return (0x0d). Parameters, if any, are separated by tab characters (0x09) or a pipe character (|). Responses are in ASCII and terminated with a carriage return. If multiple values are returned, they are separated with tab characters. In some cases, there may be a tab character after the last response and before the carriage return. The command is not echoed by the LSS-200.

LSS-200 commands can be tested using Tera Term, RealTerm (both listed below), or telnet on operating systems that include it (Windows XP, Linux, Mac OS). Since the LSS-200 does not echo commands or append line feed characters, Tera Term and similar programs should be set for local echo and CR+LF on receiving a carriage return. These options are in the Setup – Terminal menu on Tera Term.

The LSS-200 commands and typical responses are shown in [Table 2](#). Note that many of these commands are commonly used in scripts (described previously), and the `lss.sys.script_run` command can be used to start script execution.

The LSS-200 commands often include a minimum and maximum value. These values flag the reading as out of tolerance in the LSS-200 log, LSS-DB, and Ethernet Device Discoverer. These values are also shown on graphs generated by the LSS-200 and LSS-DB. The minimum and maximum may be omitted from the command if desired. The LSS-200 then sets the minimum to -9e9 and the maximum to 9e9. The parameter will then never be shown as out of tolerance and the limit lines will not be shown on graphs.

Commands start with “lss.sys.” The command prefix for the LSS-100(P) (`lss100.sys.`) is also supported in this firmware for those commands that are supported by the LSS-100(P).

— Table 2 — LSS-200 TCP/Script Commands

Command	Response	Description
<code>lss.sys.audio_sync_delay</code>	0.000000	Returns the last measured delay from screen flash to audio pop in ms. This is only valid when a flash/pop sync composition is playing.
<code>lss.sys.auditorium</code>	1	Returns the auditorium number entered on the configuration page.
<code>lss.sys.cct</code>	6255.250284	Returns the correlated color temperature in Kelvin.
<code>lss.sys.cdm2</code>	405.151492	Returns the luminance in candelas per square meter
<code>lss.sys.comments</code>	Conference Room	Returns the auditorium comments entered on the configuration page.
<code>lss.sys.ftl</code>	118.332596	Returns the measured luminance in foot-Lamberts
<code>lss.sys.spl</code>	83.239520	Returns the measured sound pressure level in dBc
<code>lss.sys.temperature</code>	29.2\t84.	Returns the internal temperature in degrees C and degrees F (separated by tab).
<code>lss.sys.theater_name</code>	QSC San Luis Obispo	Returns the theater name entered on the configuration page.
<code>lss.sys.theater_number</code>	1	Returns the theater number entered on the configuration page.
<code>lss.sys.ver</code>	K\t180126\t180109	Returns the circuit board version, the firmware version, and the bootloader versions, separated by tab.
<code>lss.sys.xy</code>	0.314743\t0.353419	Returns the chromaticity as x tab y.

Command	Response	Description
lss.sys.capture_audio_sync_delay Flash to Pop Delay 0 100	0.000000	Instructs the LSS-200 to capture the current sync delay (ms from flash to pop) to its log. The parameters are description, min, and max. Returns the latest delay measurement in ms. Note that this is the delay measured at the LSS-200 and is only valid during the playback of a flash/pop sync test.
lss.sys.capture_audio_sync_delay_at_screen Flash to Pop Delay at Screen 0 100	0.000000	Instructs the LSS-200 to capture the current sync delay (ms from flash to pop) to its log. The parameters are description, min, and max. Returns the latest delay measurement in ms. Note that this is the delay at the screen calculated based on the delay measured at the LSS-200 and the distance from the LSS-200 to the screen as entered during LSS-200 configuration. This is only valid during the playback of a flash/pop sync test.
lss.sys.capture_audio_sync_delay_at_smpte Flash to Pop Delay at SMPTE reference position 0 100	0.000000	Instructs the LSS-200 to capture the current sync delay (ms from flash to pop) to its log. The parameters are description, min, and max. Returns the latest delay measurement in ms. Note that this delay is at the SMPTE reference position (2/3 way from screen to LSS-200) based on the LSS-200 to screen distance entered during LSS-200 configuration. This is only valid during the playback of a flash/pop sync test.
lss.sys.capture_spl SPL Center Low 81.2 83.2	83.239520	Instructs the LSS-200 to capture the current SPL to its log. The parameters are description, min, and max. Returns the current SPL in dBc.
lss.sys.capture_fill Luminance 13 15	14.1234	Instructs the LSS-200 to capture the luminance (measured in fL) to its log. The parameters are description, min, and max.
lss.sys.capture_cdm2 Luminance 47 49	48.4321	Instructs the LSS-200 to capture the luminance (measured in cd/m <sup>2</sup> ) to its log. The parameters are description, min, and max.
lss.sys.capture_cct Color Temperature 6 100 6300	6262	Instructs the LSS-200 to capture the correlated color temperature in Kelvin to its log. The parameters are description, min, and max.
lss.sys.capture_temperature_c Temperature 20 40	25	Instructs the LSS-200 to capture its internal temperature in Celcius to its log. The parameters are description, min, and max.
lss.sys.capture_temperature_f Temperature 60 80	70	Instructs the LSS-200 to capture its internal temperature in Fahrenheit to its log. The parameters are description, min, and max.
lss.sys.capture_x Color 0.308 0.320	0.314	Instructs the LSS-200 to capture the color coordinate x. The parameters are description, Xmin, Xmax.
lss.sys.capture_y Color 0.345 0.357	0.351	Instructs the LSS-200 to capture the color coordinate y. The parameters are description, Ymin, Ymax.
lss.sys.cp850_test_start 0 192.168.1.146		Sends a command to a Dolby® CP850 to output a test signal to the specified speaker (0-63). The first parameter is the speaker number. The second parameter is the IP address of the CP850. The IP address is only required on the first test_start command sent to the CP850. If it is omitted, test_start commands will be sent to the same CP850.
lss.sys.cp_850_test_stop		Stops the test signal generation in the Dolby CP850 and returns it to normal operation.
lss.sys.log_post http://lssdb.uslinc.com/post.php lss.sys.log_post  http://user:pw@example.com:1234/path/filename		Posts logs in XML to the specified URL. The URL can be HTTP or HTTPS. The URL can include a username, password, and port number, if desired. Posts all log data since the last log post to this URL. If more than one post is included in a script, add a wait of 120 seconds between posts to allow time for the first to complete.
lss.sys.tcp_send_string address port string lss.sys.tcp_send_string 192.168.1.123 10001 ljsd60.sys.fader t700 r		Allows a user to have the LSS-200 relay a TCP string to another device. The first argument is the IP address to send the string to. The second argument is the port number. The third argument is the string to send. The string being sent can include control characters generated by an escape sequence. The sample sends a carriage return (r) at the end of the string. Permitted escape sequences are: \\ = backslash \t = tab \n = newline \r = carriage return \a = alarm (bell) \f = form feed \v = vertical tab \b = backspace
lss.sys.script_run 0		Runs the specified script. If no script number is specified, runs script 0 (the first one).
lss.sys.script_wait 30		Causes a script to wait the specified number of seconds before executing the next line. Waits between captures keeps the measurement capture synchronized with the test content.

## TCP\_Send Command Usage

The `tcp_send` command allows a user to have the LSS relay TCP strings to other devices by having the command embedded within a script. The usage of this command is shown below:

```
lss.sys.tcp_send_string|address|port|string
```

### Example:

```
lss.sys.tcp_send_string|192.168.1.123|10001|jssd60.sys.fader\t700\r
```

The example command tells a JSD-60 (located at 192.168.1.123, port 10001) to set its main fader to 7.00.

Allowed escape codes are:

```
\\ = backslash  
\t = tab  
\n = newline  
\r = carriage return  
\a = alarm (bell)  
\f = form feed  
\v = vertical tab  
\b = backspace
```

## Dolby® CP850 Control

The LSS-200 is capable of integration with a Dolby® CP850 Cinema Processor to check individual speakers in a Dolby ATMOS® installation.

The command below causes the LSS-200 to send a command to the CP850 at the specified address (192.168.1.146 in the example) to send pink noise to a specified speaker (speaker 0 in the example).

```
lss.sys.cp850_test_start|0|192.168.1.146
```

After a test start command has been sent to a specific CP850, additional `test_start` commands do not need to include the IP address. These commands will use the IP address of the last CP850.

The command below causes the LSS-200 to send a command to the CP850 stopping the test. The IP address specified in the last `cp850_test_start` is used.

```
lss.sys.cp_850_test_stop
```

A portion of a sample test script is shown below. A particular speaker is selected, the LSS-200 is given time for the SPL reading to stabilize, the reading captured, then the next speaker is selected.

```
# CP850 speakers are identified by index number (0-63)  
# Names may be substituted in measurement description.  
lss.sys.capture_sp1|SPL Silence|0|60  
lss.sys.script_wait|20  
lss.sys.capture_cdm2|Luminance|37.8|58.2  
lss.sys.capture_x|Color x|0.308|0.320  
lss.sys.capture_y|Color y|0.345|0.357  
lss.sys.capture_cct|Color Temperature|6016|6631  
lss.sys.cp850_test_start|0|192.168.7.60  
lss.sys.script_wait|5  
lss.sys.capture_sp1|SPL Atmos 0|80|90  
lss.sys.cp850_test_start|1  
lss.sys.script_wait|5  
lss.sys.capture_sp1|SPL Atmos 1|80|90  
lss.sys.cp850_test_start|2  
lss.sys.script_wait|5  
lss.sys.capture_sp1|SPL Atmos 2|80|90
```

## Log Post XML Format

Sample XML data posted to a web server is shown below. Note that the web server must accept chunked data as defined in RFC 2616 section 3.6.1. Note that DateTime is a Unix time stamp (seconds since January 1, 1970 UTC).

```
<?xml version="1.0" encoding="UTF-8"?>
<LssLogPost>
<Record>
<RecordNum>996</RecordNum>
<DateTime>1440661743</DateTime>
<Description>Posted to http://lssdb.uslinc.com/post.php</Description>
<Value>3.39e+03</Value>
<Units></Units>
<Minimum>-9e+09</Minimum>
<Maximum>9e+09</Maximum>
<OutsideLimits>0</OutsideLimits>
<SerialNumber>0157</SerialNumber>
<OrgKey>palm</OrgKey>
<TheaterName>Palm Theatre</TheaterName>
<TheaterNumber>1</TheaterNumber>
<AuditoriumNumber>1</AuditoriumNumber>
<Comments>HW Rev F</Comments>
<Firmware>150721</Firmware>
<Hardware>F</Hardware>
<IpAddress>192.168.1.153</IpAddress>
</Record>
<Record>
<RecordNum>997</RecordNum>
<DateTime>1440661743</DateTime>
<Description>Log post response code</Description>
<Value>200</Value>
<Units></Units>
<Minimum>0</Minimum>
<Maximum>399</Maximum>
<OutsideLimits>0</OutsideLimits>
<SerialNumber>0157</SerialNumber>
<OrgKey>palm</OrgKey>
<TheaterName>Palm Theatre</TheaterName>
<TheaterNumber>1</TheaterNumber>
<AuditoriumNumber>1</AuditoriumNumber>
<Comments>HW Rev F</Comments>
<Firmware>150721</Firmware>
<Hardware>F</Hardware>
<IpAddress>192.168.1.153</IpAddress>
</Record>
<Record>
<RecordNum>998</RecordNum>
<DateTime>1440661834</DateTime>
<Description>SPL Silence</Description>
<Value>56.4</Value>
<Units>dBc</Units>
<Minimum>40</Minimum>
<Maximum>60</Maximum>
<OutsideLimits>0</OutsideLimits>
<SerialNumber>0157</SerialNumber>
<OrgKey>palm</OrgKey>
<TheaterName>Palm Theatre</TheaterName>
<TheaterNumber>1</TheaterNumber>
<AuditoriumNumber>1</AuditoriumNumber>
<Comments>HW Rev F</Comments>
<Firmware>150721</Firmware>
<Hardware>F</Hardware>
<IpAddress>192.168.1.153</IpAddress>
</Record>
... (additional records)
</LssLogPost>
```

The web server can parse the XML to a database for further analysis and reporting. A simple PHP script that appends each new LSS-200 XML report to a file and mails each report is shown below. This is a good starting point to verify that things are working.

```
<?php
$postData=file_get_contents("php://input"); // get post data into a string
file_put_contents("/tmp/PostTest.txt",$postData,FILE_APPEND); // append post data to a file
// set up to mail data
$to='name@example.com';
$subject='LSS Post Data';
$headers= 'From: LSS@example.com';
mail($to, $subject, $postData, $headers);
?>
```

## LSS-DB

LSS-DB is a free database program designed for use with the LSS-200. It consists of PHP scripts and javascript to capture XML posts from LSS-200 units and present the data to users. LSS-DB is designed for use by theater chains or theater service companies that operate a Network Operations Center. LSS-DB separates data from LSS-200 units by OrgKey. Users are only allowed access to data with a corresponding OrgKey. A single service company can serve many different theater chains with one LSS-DB installation. An online demo can be viewed at <http://lssdb.uslinc.com>. LSS-DB can be downloaded from <http://ftp.uslinc.com/?dir=ftp/Products/LSS-DB>.



**NOTE:** \*This site is for demo purposes only. Data logged to this site is not guaranteed to be maintained or available and may be deleted at any time.

## Hidden Screens

The LSS-200 has a few hidden screens that are described below. One shows the configuration data for the unit. The other two allow for calibration (or mis-calibration) of the unit.

### View Configuration Data

The LSS-200 configuration is saved as text in a series of commands. These commands are sent through the same command interpreter as commands received over TCP or from a script. You can view this data at <http://xxx.xxx.xxx.xxx/ConfigFlash.html> (substituting the IP address of the LSS-200 for the xxx).

### Calibration Screens

These screens are supplied to allow for field calibration of the LSS-200. You should ONLY attempt this if you have accurate reference instrumentation. Light calibration is to be done with a projector having the same illumination source as will be used in operation. If a xenon projector is to be used, the LSS-200 must be calibrated with a xenon source (ideally the same projector). Luminance and color MUST be measured with a spectrometer-based instrument, such as the QSC PCA-100. Reference measurements should be made as close to the LSS-200 position as possible. Do not attempt calibration without the appropriate equipment.

Two calibration screens are available:

- <http://xxx.xxx.xx.xx/protect/cal.html> - Calibration using cd/m<sup>2</sup>.
- <http://xxx.xxx.xx.xx/protect/calf.html> - Calibration using fL.

These screens are similar. A portion of the cal.html screen is shown in [Figure 20](#).





— Figure 20 — LSS-200 Calibration Screen

Besides calibration, these screens includes factory configuration features and debug information.

The Copy PIC code to restore flash copies the currently loaded firmware to external flash as a backup. The number to the left of this button is a count of how many bytes disagree. We recommend not clicking this button in the field. Keeping the factory firmware as a backup allows you to go back to it should something go wrong.



**NOTE:** Copy PIC code to restore flash and Set Serial Number both copy the default script to configuration memory, replacing any custom script. Use of Copy PIC and Set Serial Number in the field is discouraged.

The Set Serial Number button is not normally used in the field. The MAC address of the LSS-200 is based on the serial number.

Use the procedure below to calibrate the light portion of the LSS-200:

1. Present the LSS-200 with total darkness. This can be accomplished by putting a lens cap over the lens or by dowsing the projector and removing power from any IR panels in the auditorium. Once the LSS-200 is presented with total darkness, click the “Save Dark Count” button. This sets a dark reference for the XYZ sensor.
2. Project a full-screen red test pattern on the screen. Measure the color (x,y) and luminance with the spectrometer-based reference meter. While the test pattern is still on the screen, key these values into the “measured x,” “measured y,” and “measured Y” (luminance) fields, then click “Save Red Data.”
3. Project a full-screen white test pattern on the screen. Measure the color (x,y) and luminance with the spectrometer-based reference meter. While the test pattern is still on the screen, key these values into the “measured x,” “measured y,” and “measured Y” (luminance) fields, then click “Save White Data.”
4. Project a full-screen blue test pattern on the screen. Measure the color (x,y) and luminance with the spectrometer-based reference meter. While the test pattern is still on the screen, key these values into the “measured x,” “measured y,” and “measured Y” (luminance) fields, then click “Save Blue Data.”
5. Click the “Calibrate Light Sensor” button.

To calibrate the SPL meter, place a sound level calibrator, such as the Reed SC-05 over the LSS-200 microphone. Set the sound calibrator to 94 dB. Key 94 into the Measured SPL field, then click the Calibrate Microphone button.

The remainder of the screen includes information to aid in the production test of the LSS-200. It can be ignored while doing field calibration of the LSS-200.

## Firmware Update

QSC may offer firmware updates to add features to the LSS-200. Firmware updates are delivered as a “hex” file. To install the update, click on “Update Firmware Page” on the “Configuration Page.” The firmware update page is shown in [Figure 21](#) - LSS-200 firmware update page. Note that some firmware updates may result in a change in log format. For this reason, this page includes a “Clear Log” button. This button can also be used to clear the log for other reasons.



— Figure 21 — LSS-200 firmware update page

Follow these step-by-step instructions to do a firmware update:

1. Use the browse button to select the hex file to be loaded into the LSS-200.
2. Press “Update Main Processor.” The green LED on the LSS-200 will flash as the new firmware is installed. After the new code is uploaded to the LSS-200, the browser will return a “Connection Reset” message. This happens when the LSS-200 reboots with the new firmware.

If a firmware update is interrupted, it is possible for the LSS-200 to cease operating. To restore the factory firmware (allowing another attempt at the update), hold down the restore button as power is applied to the LSS-200. If the button is held for about 1 second before and 1 second after power is applied, the factory firmware will be reloaded and system configuration will remain unchanged. The green LED flashes as the firmware is reloaded. Once the system is up and running, pressing the restore button will restore the default IP address (169.254.1.6).

## Restore Button

The restore button on the LSS-200 serves two purposes:

1. If the restore button is momentarily pressed while the LSS-200 is operating, the IP address is temporarily changed to its default IP address (169.254.1.6). In addition, the admin username and password will return to their default values (admin, ultra). These will remain in effect until the next power cycle. To maintain them through a power cycle, the settings need to be saved.
2. If the restore button is held down 1 second before applying power until 1 second after applying power, the factory firmware is reloaded. This can be used if a firmware update fails and leaves the system inoperable. The green LED will flash as the firmware is reloaded. No configuration is changed in this process. The unit will remain at the same IP address.

## Useful Software

Several programs are available on the QSC LSS website that should prove useful with the LSS-200.

— Table 3 — Useful Software

URL	Description
<a href="http://ftp.uslinc.com/?dir=ftp/Products/EthernetDeviceDiscoverer">http://ftp.uslinc.com/?dir=ftp/Products/EthernetDeviceDiscoverer</a>	Ethernet Discoverer - Finds QSC products on the network. Shows the MAC address, IP address, host name and other information. Clicking on a listing opens the home web page of the device. Also reports logged out of tolerance information from the LSS-200. Windows, Android, and iOS versions are available.
<a href="http://ftp.uslinc.com/ftp/MultiProduct/Realterm_2.0.0.57_setup.zip">http://ftp.uslinc.com/ftp/MultiProduct/Realterm_2.0.0.57_setup.zip</a>	Real Term – A terminal program that can be used to send commands and see responses over RS232 or TCP.
<a href="http://ftp.uslinc.com/MultiProduct/ttermp23.zip">http://ftp.uslinc.com/MultiProduct/ttermp23.zip</a>	Tera Term Pro – A terminal program that can be used to type commands to the LSS-200 and see responses.
<a href="http://ftp.uslinc.com/?dir=ftp/Products/LSS-200/Software/TestContent">http://ftp.uslinc.com/?dir=ftp/Products/LSS-200/Software/TestContent</a>	LST-200 Test DCP – Use this digital cinema content for the DCP-based operation of the LSS-200. This DCP is also available on a flash drive from QSC. Order part number LST-200.
<a href="http://ftp.uslinc.com/?dir=ftp/Products/LSS-DB">http://ftp.uslinc.com/?dir=ftp/Products/LSS-DB</a>	LSS-DB. A PHP/javascript application that reports on thousands of LSS-200 units.

## Ethernet Device Discoverer

The QSC Ethernet Device Discoverer is a helpful tool used to locate multiple LSS-200's and other QSC products on a network. For LSS-200's it also shows summaries and warning messages if any readings fall out of tolerance within a set number of days. The amount of days to look for out of tolerance conditions can be set on the main Configuration Page of each individual LSS-200. Since it is able to display multiple devices on a single page it may be the easiest way to get an overview of an entire multiplex of LSS-200s.

IP Address	Host Name	MAC Address	Serial #	Location	Screen	Model	Status
192.168.7.16	THQ-CAPTIONS	00-23-FC-02-10-CA					
192.168.7.232	JSD-100_MP-2	00-23-FC-05-20-10	000236	USL 3 Plex	2		
192.168.7.15	THQJSD-100	00-23-FC-05-10-86	000278	USL	2		
192.168.6.57	HH-CM-8E	00-23-FC-08-00-7B	123	Obitpo	13	CM-8E	
192.168.7.101	TH1_CM-8E#2	00-23-FC-08-05-A3	1440	USL	1	CM-8E	
192.168.7.100	TH1_CM-8E#1	00-23-FC-08-05-69	195	USL	1	CM-8E	
192.168.7.102	TH1_DAX-16	00-23-FC-0C-04-C3	1225	USL Conf Room	1	DAX-16	
192.168.7.29	TH1_FRC-29C	00-23-FC-02-E5-1D		USL_TH1	10	FRC-29C	
192.168.7.27	TH1_JSD-180	00-23-FC-05-12-C8	4824	USL Conference Room	1	JSD-180	
192.168.6.130	JSD-40	00-23-A3-07-01-90	400	Factory Default	1	JSD-40	
192.168.7.82	THQ_JSD-40	00-23-FC-07-00-63	99	USL JSD-40 Demo	2	JSD-40	
192.168.6.106	HH_LSS-100	00-23-FC-06-09-29	2345	USL San Luis Obispo	3	LSS-100	SPL Silence High SPL Left Low low SPL Left Mid low SPL Left High low SPL Right...

Selected Device Status  
 SPL Silence High SPL Left Low low SPL Left Mid low SPL Left High low SPL Right Low low SPL Right Mid low SPL Right High low SPL Center Low low SPL Center Mid low SPL Center High low  
 SPL LFE low SPL Ls low SPL Rs low Luminescence low Color x high Color y high

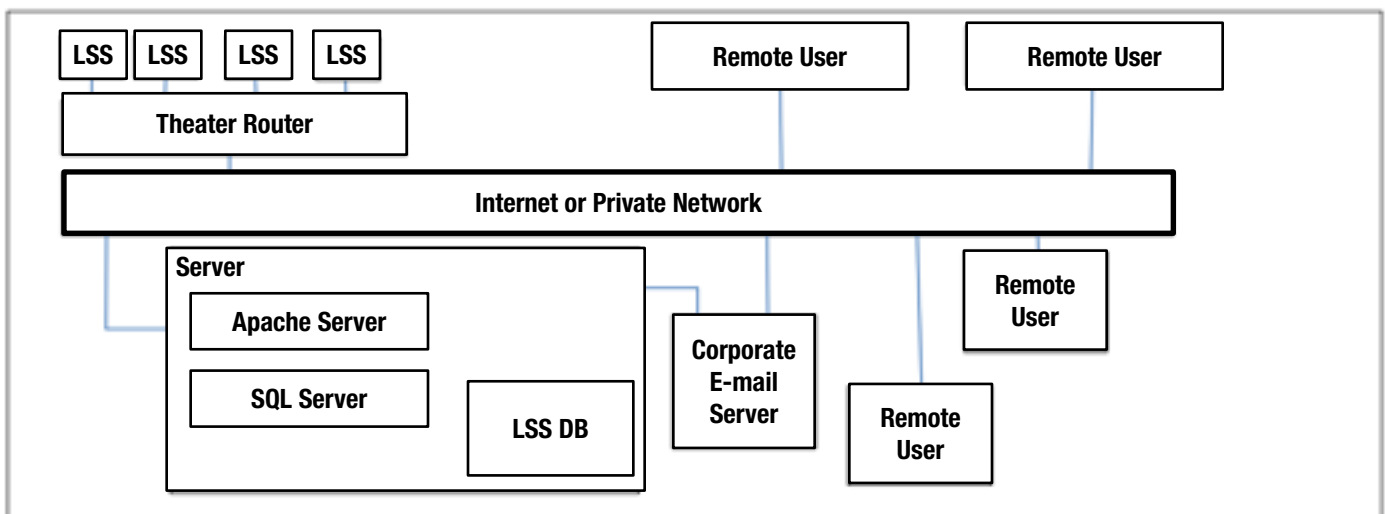
— Figure 22 — Ethernet Device Discoverer Overview

## LSS Database Software

The LSS Database (LSS-DB) is designed to provide a collection point for LSS-200 data transmitters and an observation platform for reviewing the results of the collected data.

Remote LSS-200 devices that have been installed in theaters will post the results of each test to a URL (Uniform Resource Locator) where the LSS-DB collects the data. The LSS Database provides a mechanism to collect the LSS-200 data and store it in a database. This operation is performed automatically and requires no intervention by the end user.

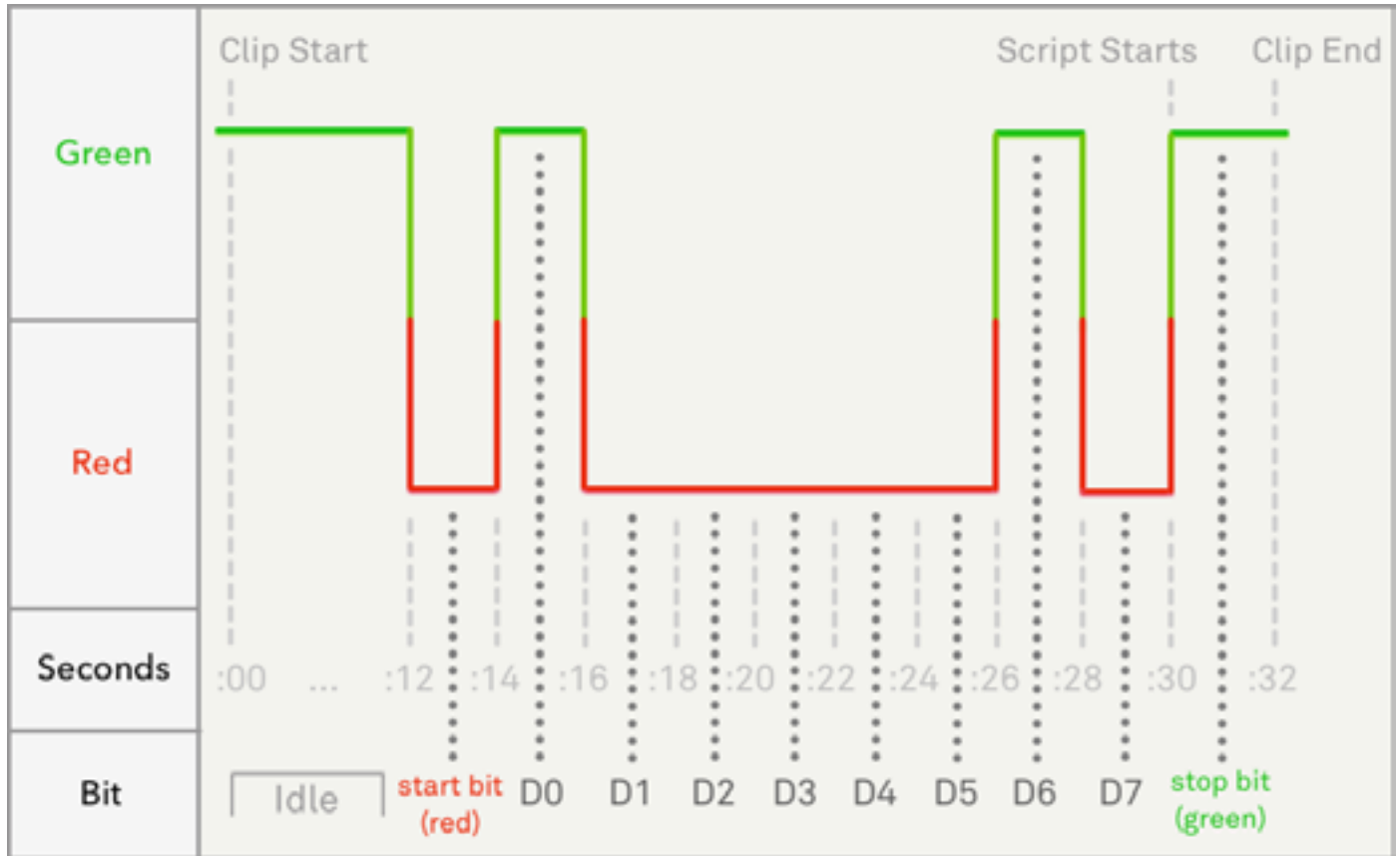
Visit the following URL for download and more info: <http://ftp.uslinc.com/?dir=ftp/Products/LSS-DB>



— Figure 23 — LSS Database Overview

# Appendix A – Red/Green or White Flash Script Start

LSS-200 installation is simplified by using a white flash sequence to start script execution. The LST-200 test content includes a white flash sequence in each test composition. These flash sequences start the appropriate script in the LSS-200. The flash sequence avoids the need to add a cue (send TCP string or provide contact closure) to start a script. The LSS-200 compares the sum of the XYZ sensors to a threshold value (set at the bottom of the script definition page). If the sensor sum is above this threshold, it is interpreted as a binary 1. Below this threshold is interpreted as a binary 0. The LSS-100(P) originally used red/green flashes, but, with the latest firmware, also now uses white flashes for improved operation with laser projectors. A single ASCII character is sent using a sequence of white and black images. The character is sent at 0.5 bits per second (2 seconds per bit). The character consists of a start bit (0), 8 data bits with the least significant bit sent first, then one stop bits (1). The most significant bit is 0. The script starts on the 0 to 1 transition between the most significant bit and the stop bit. Because of this, the script starts two seconds (one bit time) before the end of the clip. This two second difference needs to be taken into consideration when writing scripts. Bits are sampled in the middle of the bit time (based on the 1 to 0 transition of the beginning of the start bit). The letter 'A' starts script 0 (the first one).



— Figure 24 — Flash Script Start Timing

In [Figure 24](#), a binary 1 is shown as green and binary 0 as red. These colors were used in the LSS-100(P). With the LSS-200, a binary 1 is white, and a binary 0 is black.

# Appendix B – USB Power Interface and Contact Closure Script Start

---

Besides Power Over Ethernet, the LSS-200 can also be powered by a 5VDC power supply driving a mini-USB connector. A standard USB to mini-USB cable can be used. These can be used to power the LSS-200 and use contact closures to start scripts.

— Table 4 —  
Typical USB Cable Wire Colors

<b>Terminal</b>	<b>Wire Color</b>	<b>Wire Color</b>
+5V	Red	Red
D-	Blue	White
D+	Yellow	Green
Ground	Black	Black

To power the LSS-200 over USB, just use a standard mini-USB to standard USB cable to connect the LSS-200 to a USB power supply (often called a “charger”).

To use contact closure script start, momentarily (500 ms) short the D- wire to ground to start script 0. Momentarily short the D+ wire to ground to start script 1. Momentarily short both D- and D+ to ground to start script 2. Use of contact closure script start is now rarely used on the LSS-200. Instead, the white flash script start method is used.

## Appendix C – Language Support

---

The primary language of the LSS-200 is English. User defined fields on the home page and in scripts may be in any language. The configuration fields accept UTF-8 coding, allowing text of almost any language to be directly keyed in or pasted in.

Certain phrases and words are “hard coded” into the LSS-200 in English. The web interface replaces these phrases and words using javascript when the browser renders the web page. The replacement is based on a table located in the /translate directory. For example, /translate/zh.txt hold the translation table for Chinese. Additional translation tables will be added in the future. The LSS-200 sends the appropriate translation table based on the first language in the Accept-Language HTTP header.

## Appendix D – LSS Models

---

The LSS-200 is the latest product in the LSS series of products. All LSS products can be updated to the latest firmware. [Table 5](#) below lists the differences in the LSS models.

— Table 5 —  
Feature / Model Comparison

<b>Feature</b>	<b>LSS-100</b>	<b>LSS-100P</b>	<b>LSS-200</b>
Luminance Sensor	Calculated from RGB sensor	Separate photopic sensor	Calculated from XYZ sensor
Color Sensor	RGB	RGB	XYZ
SPL Measurement	Analog	DSP	DSP
Power	USB	POE or USB	POE or USB
Light Flash Script Start	Red/Green or White	Red/Green or White	White
Audio/Video Sync	no	no	yes
Dolby CP850 Control	yes, with latest firmware	yes, with latest firmware	yes

# Appendix E – Change Log

---

— Table 6 —  
User Manual Revisions

<b>Description</b>	<b>Date (YYMMDD)</b>
Original manual.	111107
Revisions for firmware and hardware changes.	120112
Revisions to accommodate hardware and firmware update.	120217
Editorial revisions	120501
Add documentation on DCP-based operation of the LSS-200.	130614
Add documentation on new hardware, scripting, etc.	140604
Added ToC, Support section, improved formatting.	140619
Added documentation for new features.	151015
Added documentation for new features.	160316
Updated CP850 control, added white flash detection, other minor updates	160927
Updated to LSS-200 and its new features	180130
Reformatted to QSC Format plus minor updates	180530



# LSS-200 Specifications

<b>Specification</b>	<b>Value</b>
Dimensions	51 mm x 85 mm x 165 mm
Weight	0.5 kg
Power	IEEE 802.3af class 1 Power over Ethernet Powered Device or USB 5V 1.5 W max
Accuracy (typical)	
Chromaticity	+/- .003 for x and y at SMPTE 431-1:2006 peak white (0.314, 0.351, 48 cd/m <sup>2</sup> ) with xenon-based projector
Luminance	+/- 2% at SMPTE 431-1:2006 peak white
Acceptance Angle	2.85 degrees
SPL	+/- 1 dB at 94 dB, 1 kHz
Communications	
Ethernet	10/100 Mbps
TCP Server	Supports 5 connections on port 10001
HTTP Server	4 sockets
Discovery	Supports QSC Ethernet Device Discoverer to find devices on the network
Default IP Address	169.254.1.6



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QSC proudly stands behind its products. We are ready to answer questions about the installation or operation of the LSS-200. The manual, application notes and other documents are available on our website.

File a support ticket electronically at: <https://www.qsc.com/cinema/contact-us/>

Please check the QSC website ([www.qsc.com](http://www.qsc.com)) for the latest software packages and updates for the LSS-200 product.

QSC is interested in your comments. Please feel free to contact us with any comments or suggestions.

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