SPLnet™

STUDIO TECHNOLOGIES INC.

SPLnet™ System

The SPLnet system from Studio Technologies provides a unique and powerful set of tools to measure, calculate, display, report, and respond to sound levels. The SPLnet system is ideally suited for entertainment-related and commercial measurement and level compliance applications. No matter whether used singly in a nightclub or performance space, or deployed in multiple locations in a concert arena or sports stadium, the same range of measurement resources are available. For example, in a concert venue the SPLnet's time-averaged (Leq) and percentile (Ln) measurement capabilities can be used to ensure that established maximum SPL levels are maintained. Level status information can be directly conveyed using the built-in LED indicator lights. Alternately, an operator can view real-time level data using an integrated Java™ applet. In a sports stadium application multiple applets can run on a single personal computer, providing a real-time view of the sound system's level at multiple points. This can be especially useful in situations where crowd size and weather conditions change over the course of an event.

SPLnet Model 100 Main Electronics Unit

An SPLnet system can serve as a "confidence monitor" for unattended locations or venues, revealing not only that a system is functioning, but is functioning at the proper audio level. Audio "hot spots" are excellent locations for SPLnet systems to be deployed, providing a real-time comparison to "front of house" levels. Industrial and governmental applications can take advantage of SPLnet systems for noise-compliance monitoring. With the system's SNMP network management support, deploying multiple units over a large physical area is simply not an issue. Using a database application and an SNMP Network Management System (NMS), data from multiple units can easily be stored and analyzed from a central location. This can be an important first step in ensuring compliance with facility safety policies or government-mandated exposure regulations.

Unlike conventional hand-held sound level meters, the SPLnet system is networked at its core—all measurement, status, and configuration data are accessed by way of an Ethernet interface. While applications exist for SPLnet systems to be used "stand alone," network access allows all of the unique capabilities to be realized. As an "internet appliance," the same capabilities are provided to all users, no matter where they are located—whether connected by way of a local area network or via the internet from literally anywhere in the world. Installations can easily be scaled from a single SPLnet system up to dozens, without the core set of resources changing. For example, a single personal computer can easily display eight applets simultaneously. And using the capabilities provided by SNMP a virtually unlimited number of SPLnet systems can be integrated.

Application Highlights:

- Useful in a broad range of entertainment, commercial, and industrial environments
- Provides "always on" SPL measurement
- Real-time monitoring using Java applet or SNMP
- Highly visible LEDs respond to level conditions
- Automatic alerting using SNMP traps, email, and SMS
- Measures SPL at one location or many
- Temperature and humidity measurement capable

Technical Highlights:

- Class 1 and 2 (Type 1 and 2) SPL meter capability
- Multiple time-averaged (Leq) measurements
- Real-time percentile (Ln) capability
- Programmable dual-color LED indicator array
- Web-page configuration
- Ethernet connected; Power-over-Ethernet powered
- SNMP support—Gets, GetNexts, Sets, and Traps
- Compact, wall-mounted electronics

A complete SPLnet system consists of a Model 100 main electronics unit and an associated MeasureSmart measurement microphone. Weighing less than one pound (0.45 kg), the Model 100 provides sophisticated analog and digital measurement circuitry in a compact aluminum enclosure. The unit is primarily intended for indoor wall-mounted applications. However, with the addition of an appropriate enclosure it can also find use in outdoor applications. Power for the Model 100 is provided by a Power-over-Ethernet (PoE)-enabled Ethernet port. In this way only a standard twisted-pair data connection is required between the Model 100 and a local area network.

MeasureSmart™ measurement microphones are intended exclusively for use with SPLnet systems. Each microphone contains a precision microphone capsule and related analog and digital support circuitry. They operate using constant current power and interconnect using coaxial cable and a BNC connector. Class 1 and class 2 MeasureSmart models are available to meet the needs of specific measurement applications. Upon system power-up or reset, the Model 100 communicates with the MeasureSmart mic to access its stored configuration and calibration data. This data is then used by the Model 100's digital signal processor and related circuitry to provide the best possible measurement performance.

The Model 100's sensor bus allows connection of optional temperature-only or temperature and humidity sensors. The data from these sensors can be viewed using a web browser or accessed remotely using SNMP.

In many cases the configuration and display software contained within the Model 100 will be sufficient for satisfactory operation. Managed network applications will typically use the unit's SNMP resources, however optional SPLcapture™ software is also available. It allows data from one or more SPLnet Model 100 units to be displayed and stored on standard personal computers. Focused on supporting live music events, SPLcapture has been field-proven at major international events.

Configuration

SPLnet is a fully "web-enabled" system. All configuration selections are made using a menu system accessible by way of a standard web browser. While simple to use, the menu system is normally accessed only by technicians, managers, or administrators, rather than by day-to-day users. Configuration choices include settings for measurement operation, visual indicators, SNMP parameters, email/SMS notification, device text names, and network settings. In addition, other menu choices allow portions of the unit's firmware to be remotely updated.

Measurement Capability

Using analog and digital circuitry, the Model 100 main electronics unit continually gathers and analyzes audio level data. The analog audio signal to be measured is first captured by the attached MeasureSmart microphone. The signal from the microphone enters the Model 100 where it is level adjusted and then converted, at 48,000 samples-per-second, to a 24-bit digital audio data stream. A high-performance digital signal processor (DSP) integrated circuit applies mathematical routines to the audio data to generate the SPL-related measurement values. Within the DSP software-implemented digital filters are used to create the available A and C frequency response weighting curves. Data "read" from the connected MeasureSmart microphone is used by the DSP to compensate for individual microphone performance.

Under software control the power and flexibility of the DSP "chip" is used to calculate the time-weighted, time-averaged, and percentile sound levels. Standard F (fast) and S (slow) time-weighted SPL (Lp) level data is continually derived. Ten time-averaged equivalent level (Leq) values are also calculated. Nine of the Leq values have fixed time intervals that range from 10 seconds to 24 hours. The tenth Leq provides a continuous time average. In addition, three percentile level (Ln) values are continually calculated, including L10, L90, and a user-selected value. These Ln values are calculated over one of five user-selectable times, ranging from 1 minute to 1 hour. In addition, Lmax and Lmin values are recognized and stored by the DSP.

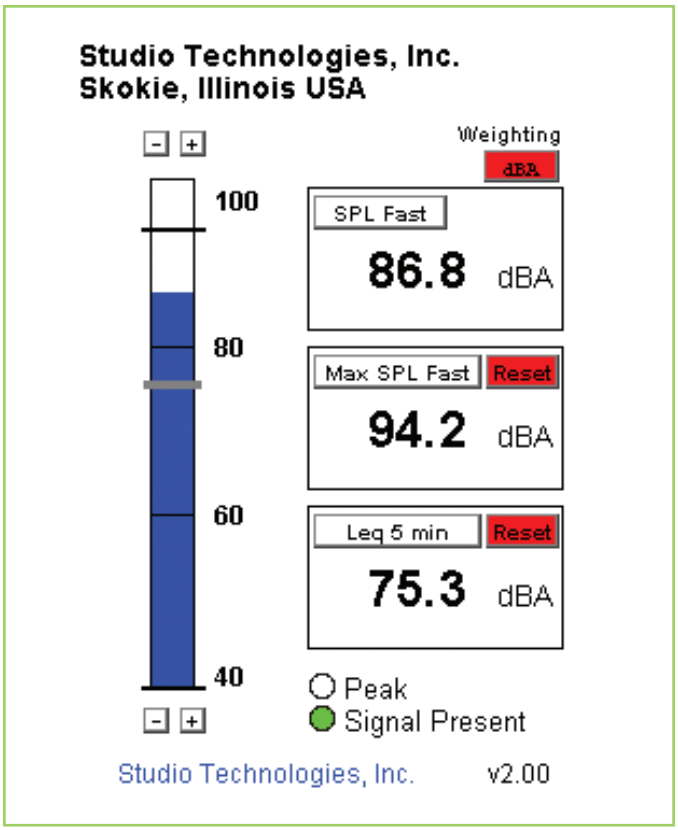
Measurement Accuracy

The Model 100 main electronics unit meets the requirements of both class 1 and class 2 sound level meters as detailed in the IEC 61672-1-2002 standard. While quite similar, a class 1 meter is required to measure over a wider frequency range, and be more accurate, than a class 2 meter. The overall performance of a specific SPLnet system will depend on the model of MeasureSmart measurement microphone that is connected.

Real-Time Display

A Java applet allows real-time display of the sound level data. An applet is a program written in the Java programming language that can be loaded onto a personal computer in a way similar to that of an HTML page. The applet is stored in the Model 100 and is accessible using a standard web browser. The applet allows real-time display of the fast or slow SPL value, a user-selected Leq or Ln value, and the minimum or maximum level value. Both bar graph and digital displays are provided for displaying the data. In addition to the level readings, the site name and location text is displayed along with the status of the Model 100's visual indicators. A personal computer can run multiple applets, allowing data from many SPLnet systems to be displayed simultaneously.

For devices that don't support the use of Java applets, the SPLnet system includes a text-only display method. This provides a simple "snap shot" display of all current level values. This method can prove useful with devices such as portable phones and PDAs that have limited graphics display capability.



Screen capture of Model 100's Java applet real-time display

Visual Alerting

Simple, yet flexible configuration parameters allow two SPL thresholds to be selected. These thresholds serve as the trigger sources for built-in visual indicators. An LED array, located just below the Model 100's front surface, creates a highly visible indication that the selected SPL thresholds have been reached. The array, which includes green and red LEDs, can be configured to serve the needs of specific applications, e.g., acting as signal present, peak, or excessive level indicators.

SNMP Support

The operating software within the Model 100 contains a simple network management protocol (SNMP) agent, compatible with v1 and v2c, allowing direct integration with network management systems. All measurement data can be polled, including current level, Leq, and Ln. In addition, selected parameters can be configured or reset using SNMP set commands. The Model 100's SNMP agent also includes the ability to automatically generate SNMP traps. Traps can be generated in response to signal levels, including peak, Leq, or Ln values.

Email/SMS Messaging

The Model 100's software resources include the ability to automatically send email or SMS messages. With a built-in simple mail transport protocol (SMTP) email client one or two recipients can receive messages in response to a specific trigger level being reached. The typical use of this feature is to allow management personnel to receive email or SMS messages in response to excessive level situations. The message content consists of the specific SPLnet system's name and location text, along with a separate configurable message and the associated trigger level value.

Time and Date Awareness

The Model 100 incorporates hardware and software resources to maintain an accurate time and date reference. This time and date information is used by the SNMP trap, email/SMS text messaging, and remote data logging functions. Using the simple network time protocol (SNTP), the reference time and date values are obtained from an internet-connected atomic clock server.

Sensor Bus

An optional sensor module can be plugged into to the sensor bus connector on the Model 100 main electronics unit. These compact sensor devices provide temperature-only or temperature and humidity measurements for the environment adjacent to where the SPL measurements are being made. Temperature, scalable in Celsius or Fahrenheit, and humidity readings can be provided for viewing or logging use.

System Power

For simple integration into local-area-network environments, the Model 100 and associated MeasureSmart microphone derive operating power from a Power-over-Ethernet (PoE) compatible Ethernet port. As an alternative, mid-span PoE power units allow power to be applied to the wiring associated with standard Ethernet ports. The Model 100 consumes less than 3 watts from the 48 volt nominal PoE power source. An on-board switch-mode power supply generates the required internal voltages. Initially covered under the IEEE® 802.3af standard, PoE has become ubiquitous for powering network peripherals. PoE-enabled Ethernet switches are readily available from many data equipment suppliers.

MeasureSmart Measurement Microphones

Several MeasureSmart measurement microphones are available from Studio Technologies. The Model 121 provides class 1 performance while the Model 122 supports class 2. Both are instrumentation-grade models with nickel diaphragms that allow measurement over the range of 35 to 130 dB SPL. MeasureSmart microphones follow the IEEE 1451.4 Transducer Electronic Data Sheet (TEDS) standard to store its performance capabilities in non-volatile memory. This includes its model and serial numbers, sensitivity, and date of calibration. This information can be viewed using a web browser or accessed using SNMP.

What does this capability mean for SPLnet users? With MeasureSmart microphones the Model 100 main electronics unit will automatically detect and "learn" how to best use the attached device. Display fields in the configuration menu can be used to confirm that the correct model of microphone has been attached. The applicable calibration data will automatically be incorporated into the DSP measurement functions.

There may be situations where the specific needs of an application can't be met by one of the available MeasureSmart microphones. To support these cases precision measurement microphones from other manufacturers can also be used. The Model 100's microphone input is "plug and play"-compatible with microphones that support constant-current (ICP®) power and TEDS V1.0 data.

SPLcapture Software

Installed on a Windows®-based personal computer, SPLcapture software is a powerful application designed expressly for acquiring, displaying, and storing SPLnet level data. One of SPLcapture's major strengths is its ability to support the needs of both operators—front-of-house mixers or balance engineers—and level compliance personnel at live music events. Multiple sessions of SPLcapture can be run on a single PC, allowing simultaneous access to multiple SPLnet units. Multiple PCs, all running SPLcapture software, can each access the same group of SPLnet units.

SPLnet Specifications

Model 100 Main Electronics Unit

Measurement Method: digital signal processing (DSP), input sample rate 48 kHz, bit depth 24

Measurement Range: 35 to 130 dB SPL (initial release)

Frequency Response: 20 to 60 Hz +0/–0.5 dB; 60 to 20 kHz +0/–0.1 dB

Frequency Weighting: A, C, and Z (unweighted), selectable

Time-Weighted Level (Lp) Measurements: F (fast, time constant 0.125 seconds) or S (slow, time constant 1 second)

Time-Averaged Level (Leq) Measurement Intervals: 9 fixed (10 seconds, 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 8 hours, 24 hours), 1 continuous, resettable

Percentile Level (Ln) Measurements: L10, L90, and one selectable value including L0 and L100

Percentile Level (Ln) Measurement Intervals: 1 minute, 5 minutes, 10 minutes, 30 minutes, or 1 hour, selectable, start time resettable

Microphone Input:
Compatibility: MeasureSmart measurement microphones from Studio Technologies
Connector: female, BNC
Power: 24 volts DC, 4 milliamperes, constant current, nominal
Data: Compatible with IEEE® 1451.4-2004 TEDS version 1.0, template 27

Applicable Measurement Standards:
Meets IEC 61672-1-2002 class 1 and 2 and ANSI S1.43-1997 Type 1 and 2 requirements with appropriate MeasureSmart measurement microphone connected; DIN 45657—March 2005 for percentile level measurements.

Sensor Bus:
Application: allows temperature-only or temperature and humidity modules to be connected.
Connector: 6-position modular (RJ11)
Compatibility: Dallas/Maxim 1-wire®

Ethernet Port:
Compatibility: 10BaseT and 100BaseTX, half- or full-duplex
Connector: RJ45

Configuration Network Parameters: IP address, subnet mask, gateway IP address, DNS server, SNTP server, TFTP server

Configuration SNMP Parameters: community names, trap receiver IP address

Time and Date (Real-Time Clock):
Adjustment Source: internet time server using simple network time protocol (SNTP)
Daylight Saving Adjustment: automatic, selectable
Accuracy: ±1 second (with SNTP updating); ±6 seconds per month (without SNTP updating)
Power Fail Backup: 48 hours, nominal

Real-Time Level Display:
Type: Java™ applet
Compatibility: Java Virtual Machine™ version 1.5 and later

SNMP Compatibility: v1 and v2c

Email/SMS Alerting:
Method: simple mail transport protocol (SMTP)

Visual Display: array of red and green LEDs, configurable triggering

DSP and Applet Firmware Update:
Method: trivial file transfer protocol (TFTP)

Powering:
Model 100 is a Power-over-Ethernet (PoE) powered device (PD) under the IEEE® 802.3af standard. Operating power is provided by a PoE-compatible Ethernet port.

Dimensions:
Height: 5.75 inches (14.6 cm)
Width (overall): 5.72 inches (14.5 cm)
Depth: 1.72 (4.4 cm)

Mounting: intended for wall mounting using four fasteners

Weight: 0.95 pounds (0.44 kg)

MeasureSmart™ Measurement Microphones

Designed for use with SPLnet products. Each unit contains microphone capsule along with supporting analog and digital circuitry. Interfaces with Model 100 main electronics unit using coaxial cable and BNC connector.

SPLcapture™ Software

Windows®-compatible application program designed to acquire, display, report, and store level data from one or more Model 100 units.

Features and specifications subject to change without notice.

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