Technical Specifications

Analog Inputs

Connection	8 ch. on 25 pin female D-sub, compatible with TASCAM 8-female cables
Format	Balanced or Unbalanced
Input Impedance	1 MΩ, each side to ground
Maximum Input	+28 dBu
CMRR	>50 dB to 2 kHz, 10 Ω source imbalance
Response	+/- 0.1 dB, 20 Hz to 20 kHz
S/N	>105 dB, 20 Hz to 20 kHz
Crosstalk	>80 dB, 20 Hz to 20 kHz

Digital I/O

Connection	4 AES-3 inputs (8 ch.), 1 AES-3 output on one 15 pin high density female D-sub
Input Format	AES-3 120Ω Balanced or 75Ω Unbalanced
Sample Rate	32 kHz to 192 kHz, each AES-3 stream asynchronous to all others
Word Width	16 to 24 bit
Output Format	AES-3 75Ω Unbalanced
Cables	Unbalanced inputs use VGA to BNC cable, Balanced inputs use a custom DB15HD to 4 XLR / 1 BNC cable, not included

Digital Inputs

Connection	1 AES-3 input selected from 4 AES-3 inputs on one 15 pin high density female D-sub
Input Format	AES-3 120Ω Balanced or 75Ω Unbalanced
Sample Rate	32 kHz to 48 kHz
Word Width	16 bit
Cables	Unbalanced inputs use VGA to BNC cable, Balanced inputs use a custom DB15HD to 4 XLR cable, not included

Analysis

Surround Format	5.1, 5.1 + 2, 6.1, 6.1+1, 7.1
Metering Standards	VU, Nordic PPM, BBC PPM, EBU PPM, DIN PPM, proprietary 42, 70, 140 dB meters
Loudness	According to ITU-R BS.1770-1

LTC Input

Format	Balanced, AC coupled
Connection	1 on 25 pin female D-sub
Input Impedance	22 kΩ, each side to ground
Maximum Input	5Vpp

Auxiliary Inputs

Format	Unbalanced, ground referenced
Connection	6 on 25 pin female D-sub
Input Impedance	3 kΩ
Maximum Input	2.55VDC Protected – clamped at 3.3 VDC

Alarm Outputs

Connection	4 on 25 pin female D-sub
Format	Open collector, 24V/100mA max

Network

Ethernet	10 Base-T, RJ45 with status LEDs

Dimensions

Chassis	1.75” H (1U) x 17” W x 7” D (8.9 cm x 54.2 cm x 17.8 cm)

Power

Chassis	24V at 0.7 A max from external adaptor
Power adaptor	100V/120V/240V, 50/60 Hz, 18W

Ordering Information

The Sentinel network-enabled surround signal monitor consists of a mainframe and one or two input modules. Current input modules provide 8 balanced/unbalanced analog inputs or 8 channels of AES/EBU format signals.

Included Accessories

110/220V 50/60 Hz in-line power supply, printed manual.

Optional Accessories

HD15-FXLR Balanced AES-3 cable, terminates in 4 XLR, 1 BNC

HD15-BNC Unbalanced AES-3 cable, terminates in 5 BNC

DB25-FXLR Balanced analog in cable, terminates in 8 female XLR

DB25-AUX1 LTC In, Aux In, Alarm Out adapter

Intellectual Property Notice

About Qualis Audio

Qualis Audio was formed by Dr. Richard Cabot, formerly CTO of Audio Precision. The Sentinel is the result of his recent efforts developing algorithms for analyzing and processing surround program material.

Other products in development are targeted at content production, including the Auditor; a surround monitor controller designed for the film and broadcast post production industry.

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SENTINEL

Surround Audio Program Monitor

- Identifies level and loudness problems
  - Measures level on up to 8 channels
  - Simultaneously measures stereo and mono downmix levels of a surround program
  - Measures loudness to ITU-R BS.1770 (LeqLRB)
- Identifies program compatibility problems
  - Directly measures stereo & mono compatibility
  - Measures LFE bandwidth & phase compatibility
- Identifies signal chain problems
  - Dropout detection
  - Dead channel detection
  - Hum detection
  - Extracts digital audio metadata and compares:
    - to interface signal
    - to signal characteristics
    - across surround channels
- Easily understood display
  - Generates simple bargraph and text displays
  - All measurements displayed as good=green, marginal=yellow, bad=red
  - Network accessible with standard browsers
  - Generates user-defined alarms (local, remote and e-mail)
- Integrates easily into larger systems
  - Retains previous 24 hours of data for review or download to long term storage
  - Clock / calendar for time & date reference
  - LTC input for correlating results with program
  - Internal sensor reports rack temperature
  - 6 DC inputs for monitoring external parameters (line voltage, security, transmitter power, etc.)
  - Log file translator produces ASCII data for user developed post processing

The shift to surround-sound from stereo brings additional complexity in the audio monitoring and quality assurance functions. The growth associated with these changes has also forced many people unfamiliar with the subtleties of audio into roles where they are responsible for ensuring its quality.

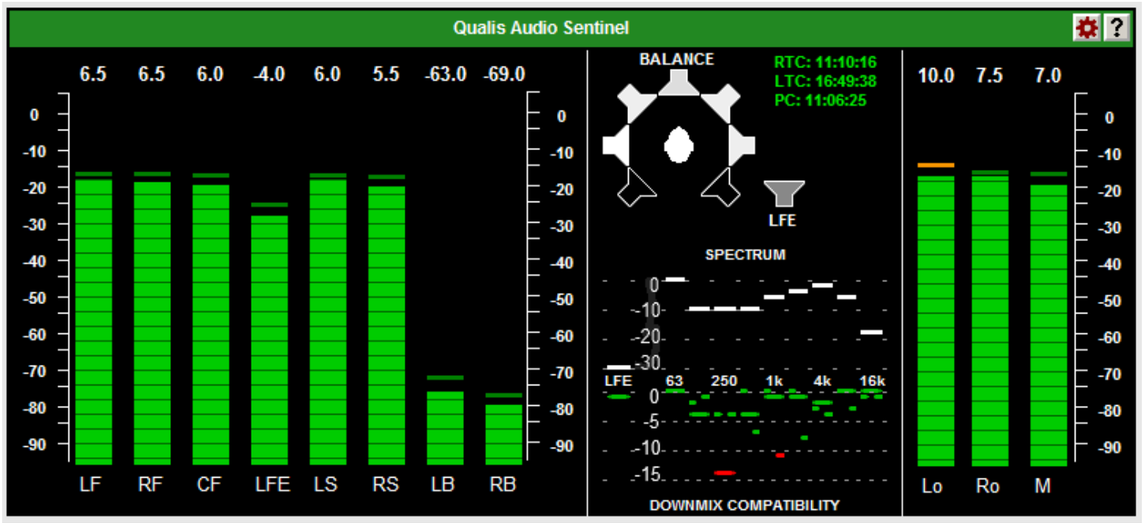
Simplistic multichannel audio level metering products are available from a wide range of manufacturers. Though important, managing signal levels is widely recognized to be only a small part of the task.

Numerous other problems can occur with an audio feed, discovery and correction of which traditionally necessitated continuous aural checks by skilled staff. Intermittent or dead channels, incorrect signal routing, channel reversal, hum, and many other conditions can result in severe dissatisfaction for listener, advertiser, sponsor and management.

The broadcast transition to digital audio has added additional potential for trouble involving incompatibilities in sample rates, word length, emphasis, metadata and more. Along with the shift to low bit-rate coding -with its sensitivity to signal clipping - and the increased dependence on metadata; the potential for audio errors reaching the listener is significantly increased.

The Qualis Audio SENTINEL was designed to address the compound needs of increased monitoring requirements, decreased personnel availability and shrinking budgets. It uses advanced signal processing algorithms to directly answer broadcast user’s fundamental questions, rather than merely displaying information requiring further analysis by experienced personnel. Coupled with a truly intuitive human interface and a hardware interface designed to fit into existing infrastructure, the SENTINEL allows significant reductions in operating costs while improving the quality of delivered audio.

The savings in personnel costs and lower error rates can be dramatic. The resulting return on investment can generally be measured in months or even weeks.

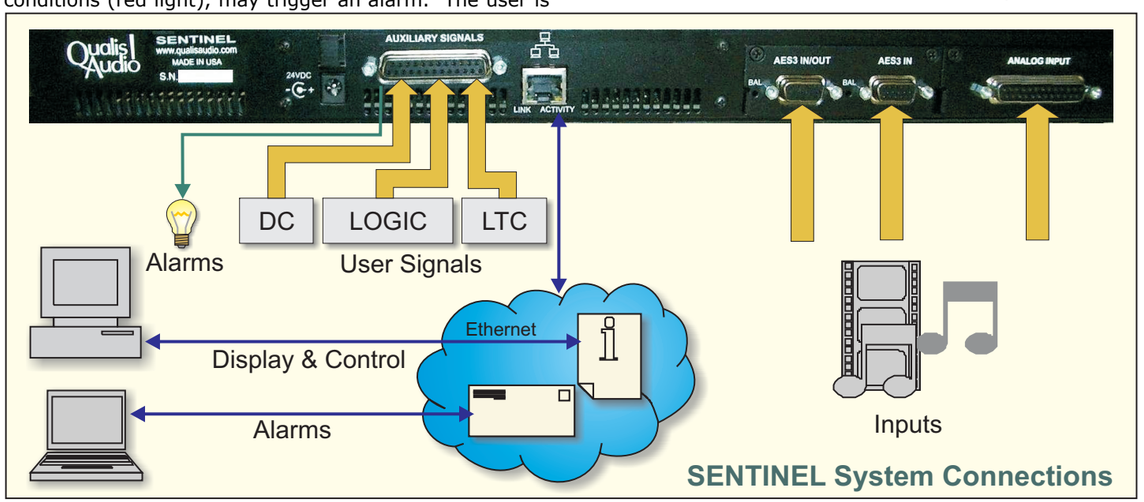


Stereo audio requires minimal out-of-phase content between channels to insure proper compatibility with monaural reproduction. Monitoring products for stereo audio often do this by using a Lissajous (X/Y scope) display of left vs. right with a correlation indicator that shows the ratio of in-phase to anti-phase content. Surround sound audio increases the complexity with the multiplied possibility for phase cancellations – all to be watched at once! The important question: "is any part of my program going to significantly change in level when reproduced in stereo or mono?" goes unanswered. Complex visual displays and additional correlation indicators – to handle up to 10 possible phase conflicts – make monitoring difficult even for personnel experienced with surround audio.

The Qualis Audio SENTINEL takes a different approach. It *directly* assesses stereo and mono compatibility of a surround mix. The measurements are converted to a simple green/yellow/red "stoplight" display. Error conditions (red light), may trigger an alarm. The user is freed from continuously watching and interpreting a screen, allowing more attention to other aspects of producing, evaluating or transmitting the program.

The DISPLAY (main) page of the SENTINEL is shown above. Standard digital and analog meter scales are user selected in the SETUP page. The bars at the left show channel levels using the selected metering standard with the maximum values represented by the horizontal line. The channels are downmixed to stereo and mono and their levels displayed on bars to the right. Above each bar is a numeric display of true peak amplitude, allowing precise metering of signals at or near clipping.

COMPATIBILITY - All input channels and the downmixes are analyzed in the frequency domain. The power of each component in the original signals is compared to its power in the downmixed signals. The results are grouped by octave band and summarized in the three COMPATIBILITY columns. If the power is lower in one or more downmixed signals there has been cancellation. Moderate reductions result in yellow indicators while severe reductions are shown in red. The frequency at which errors occur helps identify the material affected. Errors between 250Hz and 4kHz suggest dialog problems, below 250Hz generally impact special effects and those above 4kHz affect ambience.



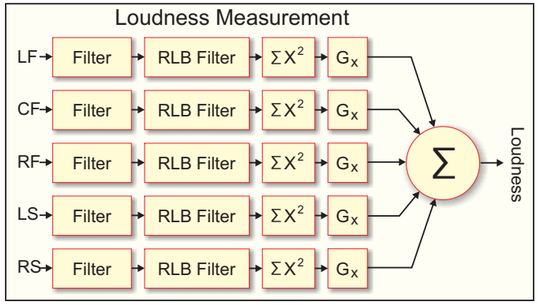
BALANCE - Graphical multichannel displays based on the Lissajous display concept are also used to infer level balance around the sound field. The SENTINEL BALANCE display supplies this same information in a more intuitive way. The fraction of program power contributed by each surround channel is computed and sets the brightness of the corresponding loudspeaker icon. For example a program with "phantom mono" shows equally bright left and right front speaker icons.

LOUDNESS - The SENTINEL continuously measures program loudness according to the recent ITU recommendation BS.1770-1 (see above right). The resulting dB LeqLRB (LKFS) reading may be used to monitor the measured loudness value for a program, compare it to the dialnorm value or be used to set the dialnorm value. The measured loudness is available via the SENTINEL display or may be accessed electronically from another computer. No separate specialized equipment is required for the measurement; no programming is required to access and use it.

CONNECTION - The figure at left illustrates the installation of the SENTINEL into a user's facility. Measurements made with the SENTINEL are available for display anywhere on any web browser with access to the network – no special cabling or computer required. Several SENTINELs can be connected to signals throughout the users facilities and the results viewed and compared from any location at any time. Gone is the need to travel to any specific point in the signal chain just to check operation. Attention and, more importantly, travel is only required if and when problems occur.

UNATTENDED OPERATION - Extensive alarm, notification and logging ability are key features of the SENTINEL. These make unattended monitoring practical, with complete confidence that problems will produce alarms, the alarms will be noticed and the details required for subsequent remedial action will be logged.

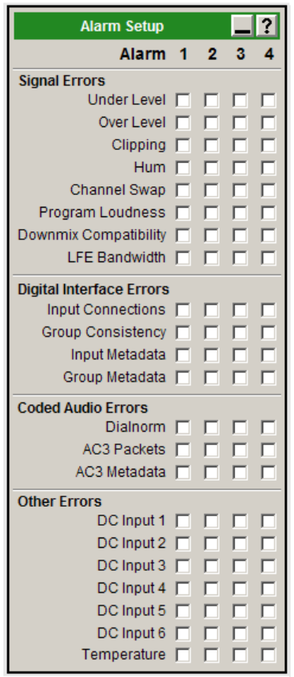
ALARMS – There are 8 alarms in the SENTINEL architecture (see right). Each of these can be independently defined by one or more error conditions. This enables notification of appropriate technical, program or management personnel for differing types of problems.



For example, technical personnel may be notified when signal loss occurs and program personnel notified when compatibility or loudness issues occur. An Alarm can cause any combination of contact closure, audible or visual indication and generated emails. Up to four email addresses may be entered into the SENTINEL and each may receive notification of any combination of Alarms.

LOGGING - Levels, loudness, compatibility, metadata and all other measurements and errors are logged in an internal memory. With all channels in use and all error checking enabled, the memory can handle more than 24 hours of data. To archive this data a simple script may be executed on a networked PC to download the log file at the end of each operating period. These daily logs may then be stored indefinitely.

TIME STAMPS - The SENTINEL includes a Linear Time Code input which can connect to a facility-wide time code signal. It also includes a highly accurate real time clock/calendar which time stamps all measurements and errors. This allows precise identification of events in both program position and time, greatly assisting diagnostic efforts.



AUXILIARY INPUTS - The SENTINEL includes 6 auxiliary DC inputs with a measurement range of 0 to 2.55V. The SENTINEL also continuously monitors its own temperature, generally only slightly above that of the rack in which it is mounted. These voltages can be assigned user defined labels and, along with temperature readings, are saved in the logs and can be shown on the Display page. Alarms can occur when any of these fall outside user-set minimum and maximum values.

The Qualis Audio Sentinel offers dramatic improvements in operational efficiency and significant reductions in error rates. The operational efficiencies lower audio QC cost while reduced error rates yield higher customer satisfaction.