Rx Loudness Application Notes

Overview

In a world of thousands of television channels and hundreds of thousands of programs, films and live events, there is often a vast difference in audio volume and the level of the spoken voice. For many years the broadcast industry has been trying to standardize program volume and the level of the spoken voice with codes of practice covering dialogue norm to ensure that the spoken voice level is consistent across all programs, live events and advertising.
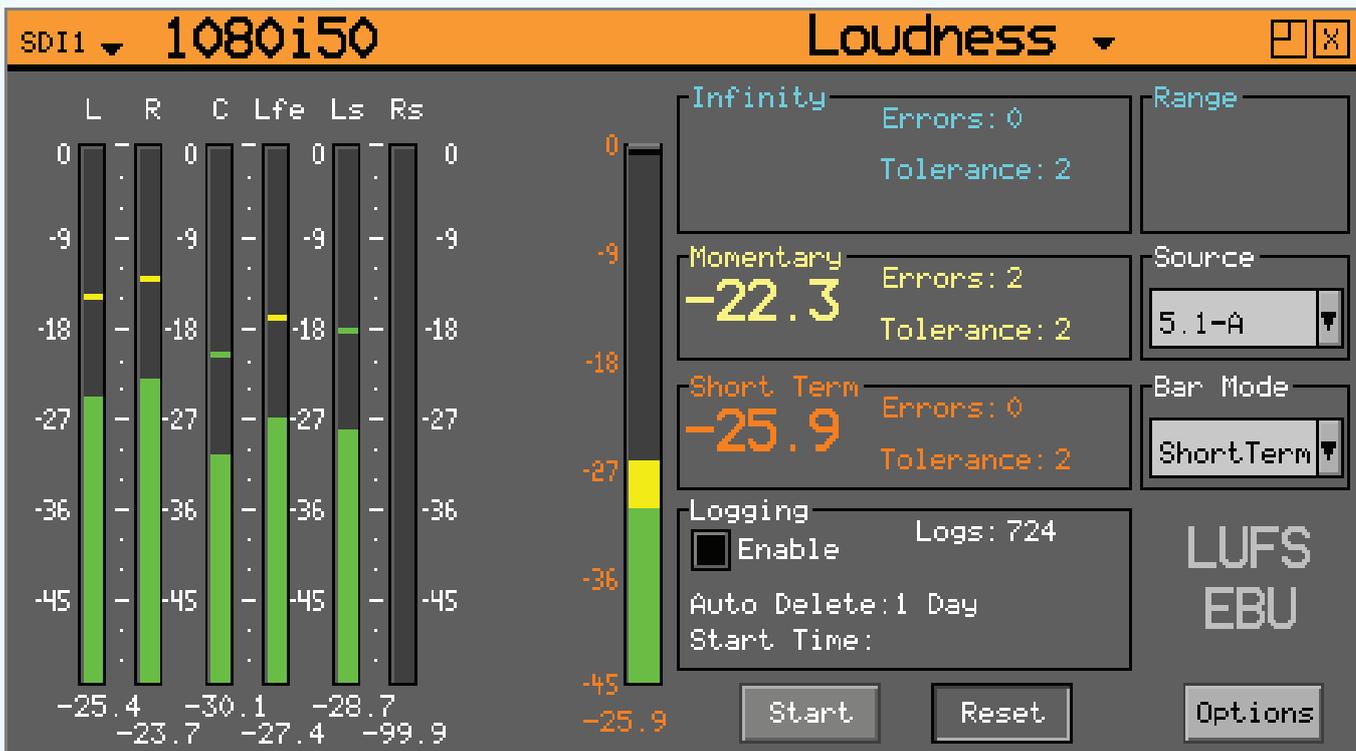
Unlike volume which is an instantaneous measurement, Loudness is a measurement of the average volume for the duration of the program. Typically 3 different averages are measured to take into account the wide diversity of programming and to ensure that program creativity is not stifled while ensuring that the viewer is not adversely affected.

In order to control the perceived loudness of one program against another (chat show, advert, film, etc), a number of organizations such as the ITU, EBU and ATSC have produced codes of practice to cover program loudness.

In the US the CALM Act has been passed which demands US broadcasters to comply with the ATSC A/85 standard and in Italy EBU R128 compliance is already law. Broadcasters in other European countries such as France, Germany, Switzerland, Austria, Norway and Spain aim to comply with EBU R128 for production, ingest and transmission.

Loudness is measured in accordance with ITU 1770-3, ATSC A/85 and EBU Recommendation 128 which define the measurement in terms of Loudness Units (LU), Loudness Units Full Scale (LUFS) and Loudness K-weighted Full Scale (LKFS) over Momentary (covering the shortest timescale of 400ms), Short Term (covering the intermediate timescale of 3 seconds) and Integrated (covering the duration of a program or segment) time periods.

PHABRIX Rx Loudness Instrument

Applications

Loudness Compliance

The primary application for the Loudness metering and logging is ensuring compliance to local Loudness requirements. Typically this is performed as part of a broadcasters Quality and Compliance processes.

Ingest

If program loudness is measured at ingest corrective action can be taken prior to broadcast. This is essential when broadcasters are obtaining programs material from all around the world and from countries with different loudness codes of practice.

Production

When producing program material for broadcasters with specific program loudness requirements it can be far more cost effective to deliver what is expected rather that having to re-work a program after it has be rejected on the grounds of incorrect program loudness.

Live Events

When transmitting or recording a live event it can be beneficial to monitor the average loudness while events are unfolding to ensure that program loudness limits are not unintentionally exceeded.

In many organisations the Rx series has been adopted as a Quality and Compliance tool as it covers all aspects of the program video, audio and metadata (including Dolby, Closed Caption, V-Chips, etc) that need to be correct to ensure that the consumer experience is a good one.

The loudness codes of practice in the US and Europe differ so the dialogue norm and loudness levels may differ. It is probably more cost effective to make adjustments at the point of ingest, but to do this there needs to be an accurate measurement of program loudness.

Where program material is being produced for a number of simultaneous broadcast customers in different parts of the world, it makes sense that the program loudness meets the requirements of all the customer rather than having to make different version for each customer.

This also has the benefit of ensuring that when the program is re-purposed for internet, DVD or film minimal rework is required.

The Rx Loudness tools allow threshold levels to be set for Momentary, Short Term and Integrated with on-screen warnings when any of these exceed the pre-defined tolerance levels.

Rx Loudness Tools

The tools provided in the "Loudness" window allow the loudness of the selected stereo audio pair, 5.1 surround or 7.1 surround audio group to be monitored and measured. The Rx system provides a single Loudness meter as standard and an additional 3 Loudness meters are available as an option (PHRXO-4LOU). The Loudness meters are accessed via the Analyser module menu on the HDMI® monitor output.

The Loudness display allows the required mode (Integrated, Momentary or Short Term) to be displayed as well as input type (SDI, Fibre or AES) and audio source to be selected.

The left hand part of the window displays the actual audio values of the select audio channels numerically and graphically. The scale of these meters is user selectable to match preferred practice.

The right hand part of the window provides the current Integrated, Momentary and Short Term loudness values, a loudness bar graphically displaying the selected loudness mode value, input and source selection and loudness logging controls.

Loudness Logging

If the "Enable" check box is selected in the "Logging" section, the system will log loudness continuously and save CSV files every 30 minutes (default setting).

As defined in the EBU Recommendation 128, the loudness meter provides the following functions:

> Start - starts the integrated loudness measurement.

> Pause - pauses the current integrated loudness logging process. Re-selecting this button will resume the loudness logging process from the point where it was paused.

> Reset clears the current integrated loudness session.

Loudness logs are stored automatically each time the defined duration is reached. This can be set between 1 minute and 3 hour intervals though 30 minute intervals is more practical.

The Loudness Logs are individual, time-stamped CSV (comma separated value) files which are stored in the "loudness" folder within the Rx operating system.

These logs can be copied onto a USB pen drive, if it inserted in to the front panel, from the loudness folder for analysis off-line.

Input Selection and Channel Mapping

The SDI input with the embedded audio channels to be monitored is selected using the "Input" drop-down list. The audio channels within the selected input are then selectable from the "Source" drop-down list. The loudness meter can display and log the loudness of stereo pairs (for example "G1-P1"), 5.1 or 7.1 surround sound audio channels.

The channel mapping for the 5.1 surround sound channels is defined in the "Surround Channel Setup" window. This allows the individual audio channels from the SDI inputs to be mapped to the L, R, C, Lfe, Ls, Rs, Bsl and Bsr.
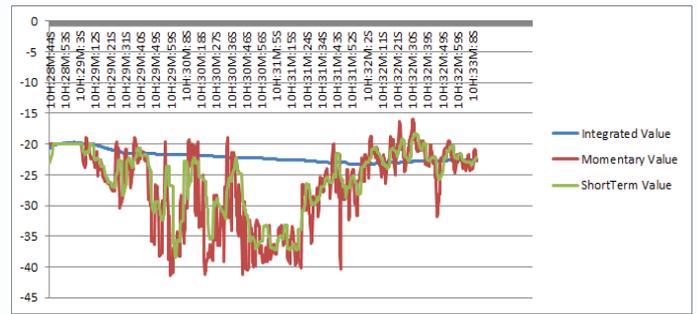

Options and Settings

The Options menu allows the selection of meter scale (LU, LUFS or LKFS), measurement standard (EBU or ITU) and Meter Range as well as user-defined threshold values for Integrated, Momentary and Short Term loudness. This menu also allows the manual or automatic deletion of Loudness log.

The mode drop down allows the selection of the displayed scale of LU (Loudness Unit), LUFS (Loudness Unit Full Scale) or LKFS (Loudness K-weighted Full Scale). These affect the loudness values measured. Note that LUFS and LKFS have a -23 dB weighting to standardise broadcast loudness measurement and prevent digital clipping. So if a -23 dB test tone is measured it will give 0 LU.
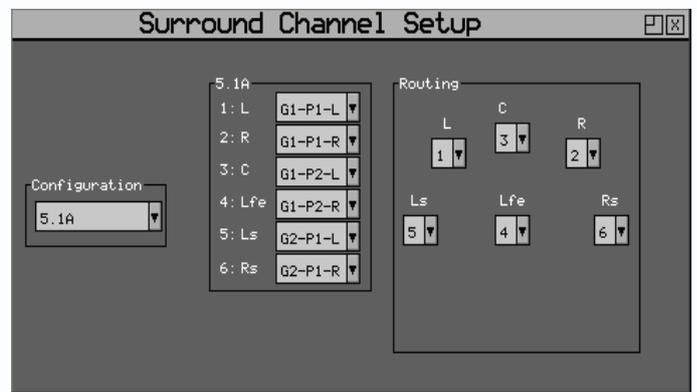
The Standard drop down menu allows the EBU RP128 or ITU 1770 loudness measurement standard to be selected. These affect the loudness values measured.

The Audio and dBFs drop downs in the Scales section allows the scale of the audio channel meters to be selected. The graticule of the Loudness meter is defined by the loudness mode selection.

The "Integrated", "Momentary" and "Short Term" threshold values define the level, above which, a loudness error is logged as exceeding the defined upper limits. The errors count is displayed on the Loudness window as well a being time-stamped in the log file.

Loudness logs that have been automatically saved can be deleted manually using the Delete and Delete all buttons. When continuously logging program loudness, the Auto Delete function can be used to delete log files older than 1 to 10 days.