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∑1

Surround Sound Panning System for ProTools® TDM Hardware

What is ∑1 (say : Sigma 1) ?

With the growing importance of multi-channel audio systems in cinema , theatre, music, theme parks ... ∑1 fills the gap of a ”spatial mixer” in the surround sound production chain, supporting any current surround sound format. With its possibilities and flexibility ∑1 is prepared for future multi-channel sound formats supporting up to 24 individual full bandwidth channels. ∑1 is also designed for science and research in multi-channel audio systems as used for example in Virtual Reality simulations.

The main goals during development were:

- to design a system to handle easily the huge amount of channels in a multi-channel audio production system
- graphical representation of the automatable movements of the sound sources including free placeable "virtual loudspeakers"
- no limitation of the system by committing to the current surround sound formats, combined with the highest flexibility to support any multi-channel sound format with up to 24 channels
- possibility of precise control over the sound distribution algorithm and access to all concerning parameters to provide any imaginable multi-channel panning law
- to use a worldwide proved and spread hardware platform including the use of all available TDM DSP-Plug-Ins to avoid confronting the user with another new and expensive hardware system
- combination of user experience, different sound distribution - and room simulation theories in one program

The result is an architecture that is unique to the digital audio world. ∑1 implements a graphical sequencer interface to record and play back "sound paths" in space, controlling all necessary level parameters for you, based on a 32x24 Matrix Mixer architecture with dynamic level automation in every crosspoint.
∑1 runs on the Digidesign® ProTools® III/PT24/PT24Mix hardware platform (PCI).
Using the ProTools® TDM hardware platform offers you first a professional digital audio system with all its capabilities and second, a totally new approach of a multi-channel sound distribution system with integrated features like the famous TDM Plug-Ins !
∑1 runs as a standalone DAE™-aware application (like Studio Vision, Logic Audio etc.) controlling the 32x24 Matrix Mixer, which expands your ProTools system from the disk-based recording system to a 768-channel dynamic matrix system.

What does ∑1 do with 768 audio-channels ?

Let's explain this regarding a 7.1 (L/LC/C/RC/R/RS/LS + Sub) Surround production:

If you have to realize a individual level distribution of one input source with a conventional mixing desk supporting 8 subgroups, you can do this by routing the input to all 8 subgroups and adjusting the level relations with the subgroup faders.
If you want to distribute now two or more input sources for independent placements in space, you have to move your distribution concept from the subgroups to the inputs: for every input source you need 8 input faders assigned in parallel and routed to the subgroups 1-8 to adjust different levels for every subgroup output.
The faders of the subgroups affect now the summation of all the input levels.
For each additional distributed input source you need 8 more input faders.
The whole amount of input channel is therefore determined by :

" Number of sources " x " Number of Surround Format outputs " = " Number of input channels "

This 7.1 Surround production example would need a mixing desk with at least 128 input channels for simultaneous access to16 sources.
In addition you would need at least a snapshot automation to control and edit all the level- and routing informations.
For simulating a moving source you even need a more sophisticated dynamic mixing desk automation for the level distribution, which still gives you a very abstract interface (a lot of faders !) for the movement definitions.
You can imagine, that a complex dynamic movement control of multiple sound sources would need a huge amount of time and equipment even with a high-end conventional mixing console.

∑1 provides you with a dynamic sound movement control for up to 32 sources distributed in up to 24 outputs with a specialized "roomoriented" user interface.
It is the first time that you are able to handle the simultaneous sound distribution of such a huge amount of channels in a creative, ergonomic and useful way.

"Roomoriented" User Interface

The main window of ∑1 displays a two dimensional view of the actual room situation.
Inside this window you handle the placement of the loudspeakers and the recording and editing of the spatial positions and movements of the sound sources.
The sound movements are recorded to timecode simply by moving the Mouse or using MIDI peripherals like Joystick, Dataglove etc. .
Also a PICT of the room situation can be put undernearth the surface for exact speaker positioning and movement creation.
In addition to the realtime recording ∑1 lets you calculate line- segments, circle-segments and randomized movements.
You are able to define movement offsets in time and space, copy existing movements to other channels or overlay them with a random function.

Concept of free defineable panning laws

The unique concept of free defineable panning laws between the individual speakers frees the user from the limitations given by the usual surround sound formats and their implementation in current mixing consoles.
For the first time ∑1 provides a creative tool for working with sound in space, no matter what multichannel-surround-format, leaving conventional mixing desk approaches for surround sound production far behind.

The Panning Laws (level distribution) are calculated by two parameters :

a) the distance between the mouseposition and the center of the speaker image on the screen
b) the angle of the mouse location related to the main direction of the speaker

The relation between these two parameters and the resulting output levels are free defineable with graphical table editing.
The level distribution values are calculated with a ramped 10 ms resolution.
The resulting control level areas of the speakers can be calculated and projected as colored level areas to the screen, which implements a totally new and precise graphical panning/volume control.

The Digidesign® TDM-Architecture

∑1 reads ProTools® Session files (Tracks and Volume automation data) which allows you to work with previously prepared time and volume structures of the individual tracks or external inputs (analog or digital).
All available TDM Plug-Ins can be inserted in the input and output channels (simultaneously visible), which gives unprecedented flexibility in assigning and moving sound effects in space including the simulation of virtual room situations.

Availability

∑1 Version 1.8 is available since end of December 2000.

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