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NUT

The Speech Processor application

Active audio

L'acoustique active

Contents

1 The Speech Processor application

The Speech Processor application is dedicated to multispeaker sound reinforcement (conferences, worship places, transports. . .)

It features original algorithms dedicated to the spoken voice:

- Automixer
- Compressor
- Speech conformer
- Feedback killer

The Speech Processor also includes standard functions (gain, routing, equalization, delay).

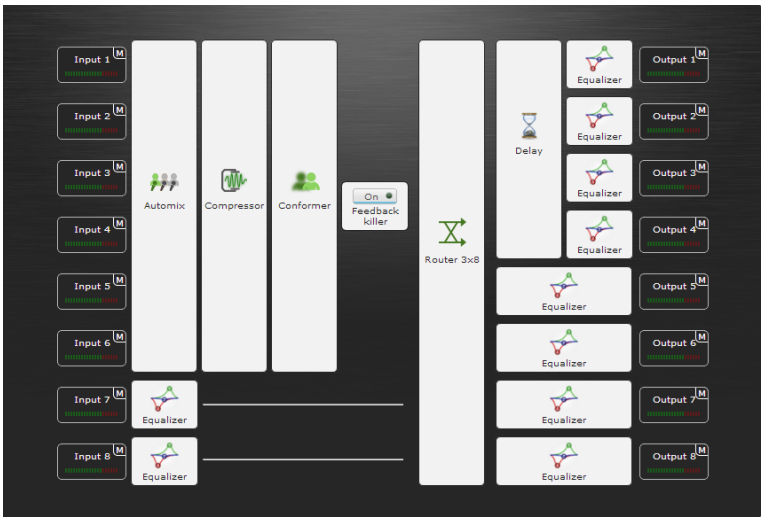

Figure 1: Synoptic of the Speech Processor application

The Speech Processor exists in several versions that differ in the configuartion of the eight inputs :

	Number of mic inputs	Number of line inputs
Speech Processor 80	8	0
Speech Processor 62	6	2
Speech Processor 44	4	4

1.1 Automixer

The Automixer algorithm is based on the gain sharing principle: it detects the active microphones (i.e. those in which speakers are talking), and apply to these mics a gain which depends inversely on the number of active microphones. This algorithm allows an extra 10.Log(number of microphones) dB gain. For example, for 8 microphones, it gives an extra margin of gain of 9 dB before the occurrence of a howling.

Of course, this algorithm finds its interest in the “live” applications, that is to say in which there is acoustic feedback from loudspeakers to microphones. However, nothing prevents using it for non-live applications (for example for transports).

1.2 Compressor

The compressor is a classical algorithm which enables to homogenize the levels for different speakers, or to smooth the level variations of one speaker.

1.3 Speech Conformer

Some people have a clear voice. Others have a dull and veiled voice, which may be difficult to understand, especially in a room with reverberation and background noises.

The Speech Conformer is an original algorithm dealing with this problem.

This is an adaptative algorithm which corrects, if necessary, the voices timbre (ie only for the voices that need it), to conform them to a target spectrum chosen by the user.

1.4 Feedback killer

This Feedback killer algorithm, dedicated exclusively to the spoken voice, saves about 3 to 4dB of gain margin (that is before the appearance of a howling). It doesn't affect the voice timbre and doesn't require any calibration.

It is of course dedicated to live situations.

2 Tuning the Speech Processor


The pink steps only apply in the case of live situations.

1. Set the dip switchs on the rear panel (phantom ON/OFF, level MIC/LIGNE).

Figure 2: NUT rear panel dip switchs

2. Adjust the microphones input gains so that the levels are aligned and close to 0dBu (green/orange limit on the input VUmeters) for a speaker with a « normal » voice.

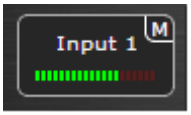

Figure 3: Level close 0dBu

3. Set the router.

Figure 4: Router setting example

4. Configure the EQ and output gains, together with the delays.

Figure 5: Example of output equalization

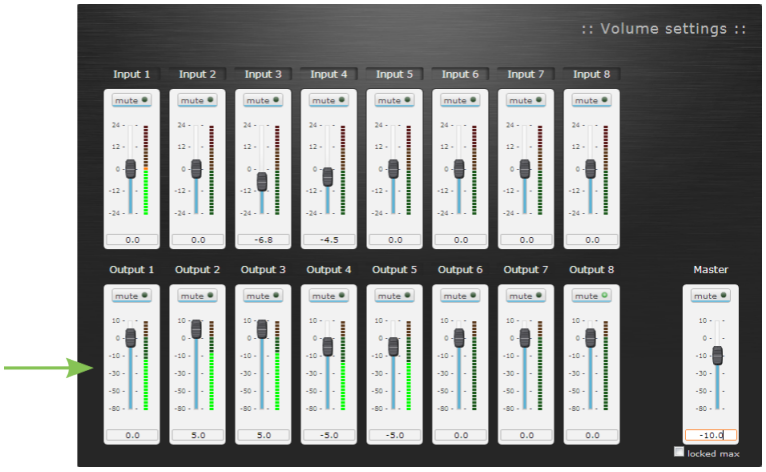

Figure 6: Setting the output gains for adjusting the sound coverage

Figure 7: Delays setting example

5. If the room is higly reverberant or if microphones are close to each other, select the « High selectivity » box on the Automixer page.

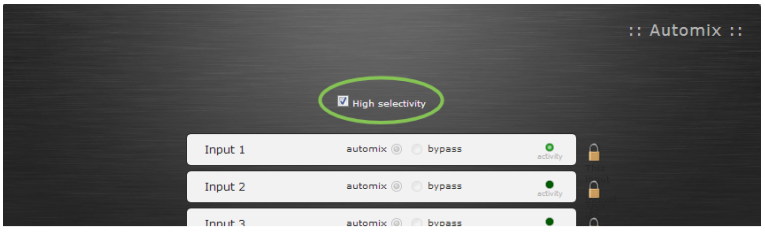

Figure 8: “High selectivity” box on the Automixer page

6. Turn the Conformer off and set the diffusion and the feedback killer equalization (cf sections 1.5 and 1.6 of the manual NUT - Tuning procedure for live PA systems).
7. Set the conformer :

- Adjust the Max Gains[1] in the three bands.

[1] The max gains are the maximum gains that the Conformer is authorised to apply for each of the 3 bands. The Conformer will reach this maximum gain only if the applied voice signal requires it.

Figure 9: Speech Conformer's Max gains

- Click on the « Test Feedback » button to see whether the conformer is likely to generate a howling with these Max Gains[2]. If yes, decrease the Max Gains or the inputs/outputs gains of the application.

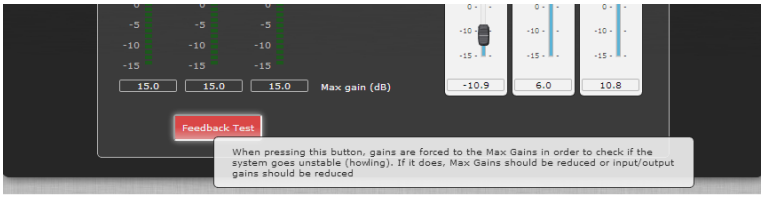

Figure 10: Speech Conformer Feedback Test button

- Make sure that the signal level is high enough so that the "Signal" led doesn't go off while the speaker speaks. (see figure 11)

- Make sure that the speaker triggers only its own microphone. To do so, the « Active mic » field should specify the microphone in which the speaker speaks. If it specifies « several » the Conformer's gains adaptation is frozen ("Adapatation" led off) (see figure 11). If many microphones are active, select the « High selectivity » box in the Automixer (see 5) and/or move the microphones away from each other.

- Select the desired target spectrum and validate by listenning to different voices.

[2] A limiter limits the signals amplitude in order to protect the loudspeakers (and ears of the user).

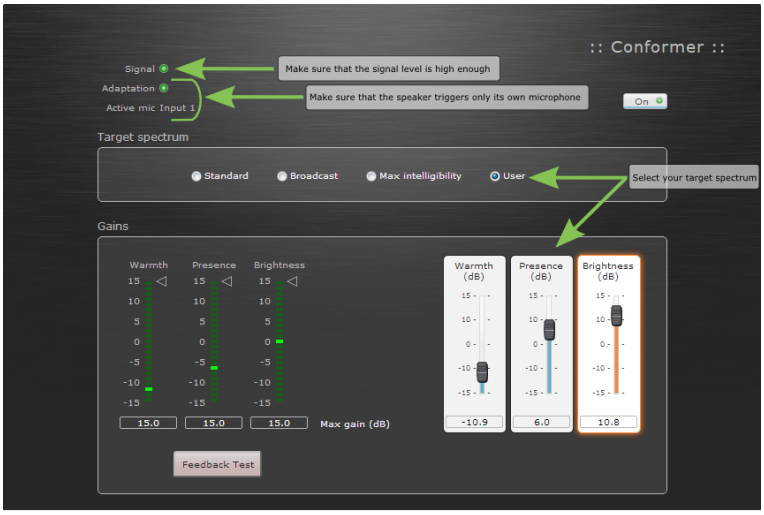

Figure 11: Speech Conformer block-function

3 Note on the background noise

The high-frequency background noise can be amplified by some of these algorithms:

- The compressor, because the shape of the characteristic (threshold, ratio) is usually associated with an output gain that increase background noise;
- The conformer, if it has to apply a large gain at high frequencies (band “brightness”) for the spectrum of a given voice to reach the target spectrum;
- The output equalizer, if the frequency response of the loudspeakers used requires increasing the response at high frequencies.

To minimize background noise:

- Use low noise microphones and preamps,
- Use the MIC sensitivity (NUT rear panel),
- Adjust the input gain so that the average level is close to 0dBu,
- Avoid compressing the signal too hard,
- Limit the Conformer Max Gain in the Brightness band,
- Avoid putting gain at high frequencies on the output EQ.

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