

manuel

NUT

Tuning procedure for  
live PA systems



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## Foreword

This document describes the main steps for tuning a NUT audio processor used in a live PA system. In such a situation, microphones are in the same volume as loudspeakers. Hence they capture the sound from loudspeakers, so that there is a loudspeaker → microphone feedback which may cause howling of the system.

This is typically the case of worship spaces (churches, mosques, temples), conference rooms and amphitheaters, theaters, etc. This is not the case for transport spaces or shopping malls.

## Hardware required

- Pink noise generator (either an actual device, or a sound file stored on a CD or a USB key and played by a player)
- 1/3rd octave sound level meter

# 1 Steps of the tuning procedure

Before starting, make sure all connections are OK : microphones, processor(s), amplifier(s), loud-speaker(s), PC.

## 1.1 Configuring and assigning names to your NUT processor

Connect a PC to the USB or LAN port of the NUT processor and load the desired application.

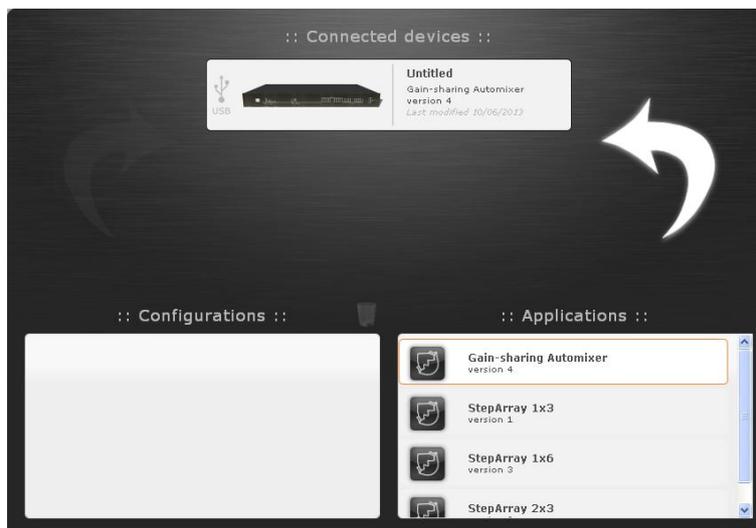


Figure 1: Load the chosen application

Assign a name to the configuration.



Figure 2: Name the configuration

Assign evocative names to the inputs and outputs.



Figure 3: Name the inputs and outputs in the Volume block-function

## 1.2 Adjusting the input gains of the microphones

Set the microphone input gains so that their sensitivities are aligned and that their level (input VUmeter) are close to 0dBV (limit green / orange) with a speaker having a “normal” voice.

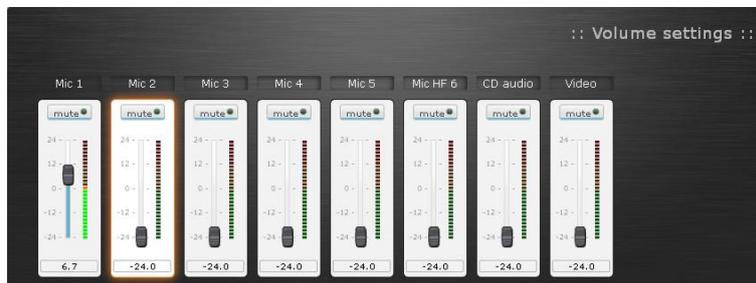


Figure 4: Adjust the input gains of the microphones in the Volume block-function



About the speaker – microphone distance : the amplitude of the direct sound captured by the microphone decreases as the speaker – mic distance increases, while the reverb sound is independent of this distance. Therefore, increasing the mic gain (to compensate for the loss of direct sound) results in a greater contribution of this mic to the loudspeaker-to-mics feedback. It is often the case of PZM microphones which are often used as altar microphones in churches.

## 1.3 Tuning the compressors

If needed, turn on and tune the input compressor(s) so that a voice louder than “normal” is compressed.



Figure 5: Compressor block-function interface

## 1.4 Adjusting the sound coverage

### 1.4.1 Tuning the diffusors

If StepArray columns are used, adjust their directivity in the StepArray block-function.

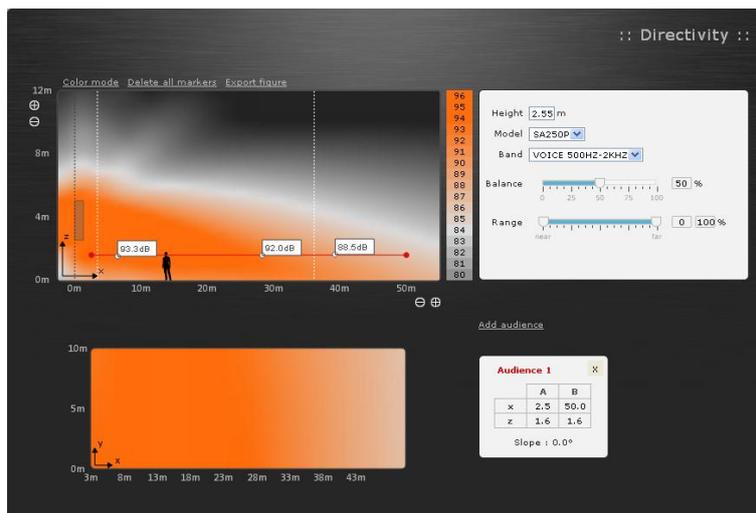


Figure 6: Adjust the directivity of StepArray columns in the StepArray block-function

If RayOn columns are used, set their equalization in the Equalizer block-function.



Figure 7: Set the equalization for Ray-On columns in the output equalizers

If another type of loudspeaker is used, set their equalization according to the recommendation of the manufacturer.

### 1.4.2 Setting the delays

Set the delays on the outputs if needed.

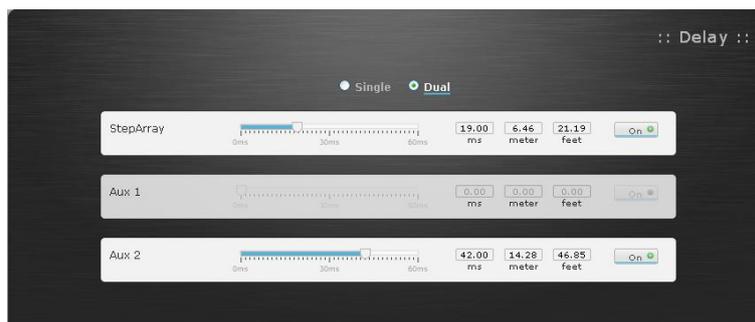


Figure 8: Adjust the output delays in the Delay block-function

### 1.4.3 Adjusting the sound coverage

Play an audio signal on a line input and set the output gains so that the sound coverage is correct everywhere in the listening area.



Figure 9: Adjust the sound coverage with the output gains in the Volume block-function

## 1.5 Equalizing diffusion

Mute the microphone inputs and play pink noise (line input) on the diffusion. With a sound level meter (SLM), measure the 1/3rd octave spectrum averaged over the listening area.

Set the output equalizers so that the 1/3rd octave spectrum is flat over the desired frequency range.



Figure 10: Equalize diffusion in the output equalizers

## 1.6 Equalizing loudspeakers → microphones feedback

Mute the microphone inputs, play pink noise (line input) on the diffusion, and measure the 1/3rd octave response spectrum averaged around the microphones.

Adjust the input equalizers so as to compensate for the measured spectrum (weighted by the microphone response if it is not flat).



Figure 11: Equalize loudspeakers -> microphones feedback in the output equalizers

The aim of this step is to reduce the gain at frequencies where feedback is high and could cause howling. The “gain margin” is thus increased, i.e. security before advent of howling is optimised ; or conversely the maximum sound level before howling may be increased.

One may go further by measuring with the SLM the frequency at which howling eventually occurs (by progressively and carefully increasing the master gain), and placing notch filters at this frequency.

### 1.7 Tuning the automix

Switch on the automix for the microphone channels (switch « automix / bypass »). Automix must be ON for all microphones that capture reverb (i.e. which are in the same room than loudspeakers).

Make sure that when one speaks in a microphone (at a “normal” level), the corresponding “activity” led is lit. If necessary, raise the microphone input gains (or the output gains of the compressors).

If the room is highly reverberant (a church for example), and/or microphones are closed to one another, check the box « High selectivity ».

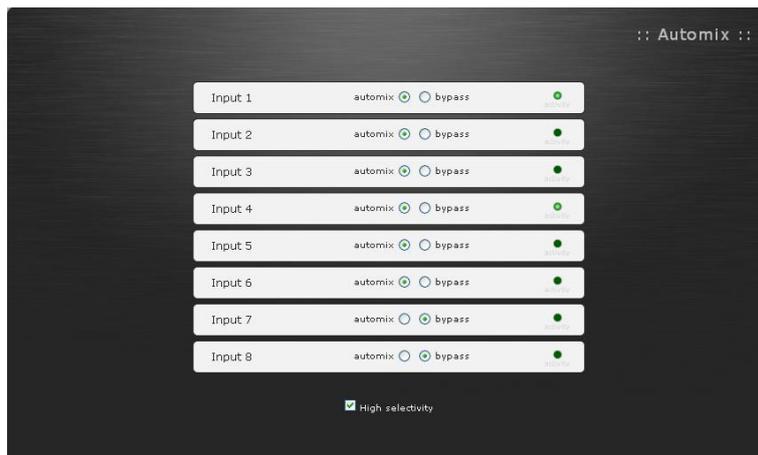


Figure 12: Automix adjustment interface

 The automixer affects each channel with a gain which depends on the number of activated microphones (i.e. mics in which a person is speaking). These channels must then be summed downstream the automixer.

## 1.8 Tuning the mixer

Set the gains of the matrix so that each source (mic or line) is routed to the desired output(s) with the correct level.



Figure 13: Mixer adjustment interface

## 1.9 Setting the master volume

Adjust the master volume slider so that the level of diffusion is correct, while keeping a gain margin of at least 3 dB, i.e. the master volume must be at least 3 dB below the value for which howling occurs.

Lock the max Master volume at the corresponding value by clicking on "locked".



Figure 14: Set the master gain in the Volume block-function

## 1.10 Setting the feedback killers

NUT feedback killers are exclusively dedicated to speech. They must be OFF when playing music (specially slowly modulated music such as organ and choir), and should be OFF on the line inputs.

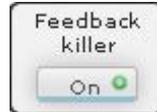


Figure 15: Set the feedback killer in the main synoptic

## 1.11 Listening tests

Carry on listening tests in all listening areas, with all microphones and sources. If needed, adjust the gains and equalization, while ensuring that the gain margin is still sufficient (see 1.2). The safest way to is to allow only reducing the gains, not increasing them.

## 1.12 Locking NUT

### 1.12.1 Locking NUT

It is highly recommended to lock NUT processors. Modifying parameters on a locked NUT is impossible, thus preventing mistakes.

Only preset recall, general mute and master volume functions are available on a locked NUT.



Figure 16: Lock configuration

### 1.12.2 Exporting settings

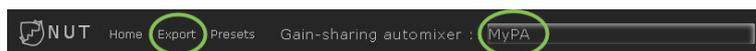


Figure 17: Export settings

Click on “Export” to generate a \*.nut file containing all current parameters. This file is placed in the Download folder with the name of the application (“MyPA” in the figure 17). If the file already exist, the name will be followed by “(1)”, then “(2)” etc.

## 1.13 Configuring presets

All parameters of all block-functions are saved when saving a preset.

All parameters are recalled using the Preset recall function which may be launched by a PC, a remote control NUT-RC, a smartphone, or a tablet.



Figure 18: Presets configuration with the Presets manager

## 1.14 Configuring the remote control NUT-RC

Note that the max volume corresponds to the locked value of the Master volume (see [1.12.1](#)).

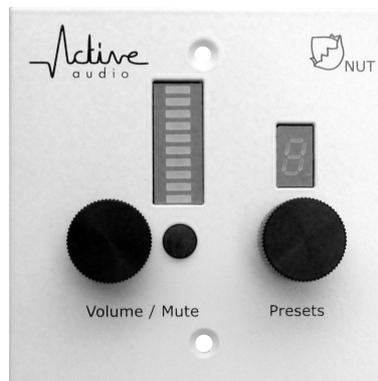


Figure 19: Front of the remote control NUT-RC

## 1.15 Managing a SUB

If a SUB is used, the crossover should be implemented with the output equalizers :

- With the mixer, route the mixing towards the desired outputs



Figure 20: Mixer configuration when using a subwoofer

- Configure a crossover filtering : low-pass on output SUB, high-pass on main output

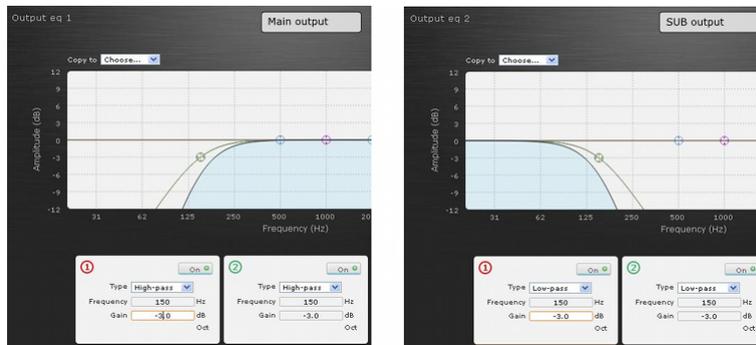


Figure 21: Output equalizer configuration for a crossover filtering

## 1.16 Dealing with stereo inputs

Diffusion of stereo signals is usually not relevant in churches or conference rooms. However, If one wishes to play stereo signals, the left and right channels must be treated as two mono signals.

## 2 Troubleshooting

In the table below, only trouble caused by bad tuning of NUT are considered.

Other problems such as wrong type of loudspeakers or microphones, wrong placement, problems in cables etc are not considered.

Symptom	Diagnostic	Solution
The sound wobbles when playing music	Feedback killers are ON on the line inputs	Turn Feedback killers OFF on line inputs (see <a href="#">1.10</a> )
	Microphones having Feedback killers ON pick up the sound coming from the diffusion of line inputs	Mute these microphones, or turn their Feedback killers OFF (and reduce their gain if needed) (see <a href="#">1.2</a> , <a href="#">1.10</a> )
The sound is coloured, system is too close to instability - howling	Too much loudspeakers → microphones feedback	Make sure the automix is ON for all microphones (see <a href="#">1.7</a> ) Make sure the loudspeakers → microphone feedback has been correctly equalized (see <a href="#">1.6</a> ) Turn ON the Feedback killers for all microphones (see <a href="#">1.10</a> ) Make sure there is no loudspeaker too close to a microphone Check if one particular mic is responsible for the problem. If so, move it or check its EQ (see <a href="#">1.6</a> ) or reduce its gain (see <a href="#">1.2</a> )
Too much noise on microphones	The compressor threshold is too low	Raise the threshold and reduce the compressor output gain (see <a href="#">1.3</a> )

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