

Audio Restoration Add-on On-line Help (Version 1.1)

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1 Introduction

1.1 Overview

Beginning with version 5.0, Total Recorder supports add-on programs. These add-ons can be used to process a sound stream or to monitor some sound characteristics. The features provided by the add-on depend upon the particular add-on. To learn more about add-ons, refer to the add-on's help file and add-on home page.



The Total Recorder Audio Restoration Add-on can be used to remove distortions such as clicks, crackles, and background noise, and provides high-quality restoration of audio recorded from LPs, tapes, microphones, etc.

The Audio Restoration Add-on Version 1.1 requires Total Recorder Version 7.0 or higher.

This add-on contains these three independent modules: Click Removal, Noise Removal, and Hiss Removal. Each module has its own algorithm.

WARNINGS

- *Use of the Audio Restoration functions requires an adequate level of skill and experience. It is recommended you carefully read the Help files to obtain the best quality audio with this add-on.*
- *When you apply Audio Restoration to a file being saved, it is not possible to revert the modifications afterwards. Therefore, it is strongly recommended you make a backup copy of the original recording before applying any Audio Restoration functions.*
- *It is not recommended you use any of the Audio Restoration functions during recording unless it is absolutely necessary. Instead, first record the sound without any modifications, and then apply Audio Restoration to the resulting file.*

Each module has two modes: active (audio stream passes through the module) and inactive (otherwise). If at least one module is in active mode, the Audio Restoration icon in Total Recorder's "Status" panel appears as . Inactive mode is indicated in the "Status" panel by the grayed out Audio Restoration icon as .

Using Audio Restoration

A typical scenario for using any of the audio restoration functions is when you have a file that contains unwanted distortions, such as clicks or noise.

To remove these distortions, take the following steps:

1. Make a backup copy of your file.
2. Open the file.
3. Turn on the audio restoration module to be applied during playback.
4. Listen to the resulting audio.
5. Determine and make the necessary settings.
6. When the results are acceptable, apply the module to the entire file and save it.

You can apply different Audio Restoration modules to an audio stream at the same time (during playback, recording, or when saving a file). If you wish to use more than one Audio Restoration modules

with the same recording, it is recommended you first apply the different modules to the entire file before you save it. After you have determined all of the necessary settings and made certain that the audio is modified as desired, you can save the resulting file.

If you apply more than one Audio Restoration module to a file, they must be applied in the following order:

7. Click Removal
8. Noise Removal
9. Hiss Removal.

Note that all Audio Restoration procedures (Hiss Removal, in particular) require extensive computations and may lead to gaps in the audio being played back. If such a problem occurs, you can backup your file, apply Audio Restoration procedures to the entire file, and then save the result. If you are not satisfied with the result, you can revert to the backup copy.

To find out more about specific Audio Restoration functions, select one of the following:

Click Removal

Noise Removal

Hiss Removal

1.2 Product Registration

After installing and verifying the add-on works properly, you should obtain a registration key from High Criteria. An unregistered add-on can be used as long as you want. However, it generates a 1-second noise every 1 minute.

To register the Total Recorder Audio Restoration Add-on:

1. Receive the registration key. Follow the instructions given on High Criteria Inc.'s web site at the following address: <http://www.totalrecorder.com/AddOnMain.htm>
2. In Total Recorder's main menu, select "Help" - "Add-on registration...". Type in the same name you used to obtain the registration key, and type your registration key.

2 Using Audio Restoration Add-on

2.1 Click Removal

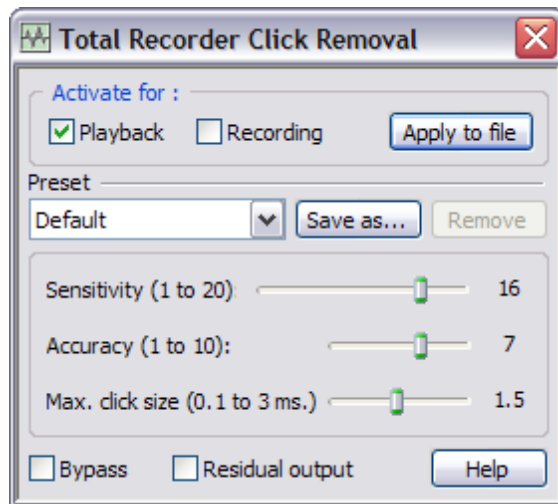
Total Recorder Click Removal is designed to remove and minimize short clicks and crackles that are often found in audio recordings made from LPs.

Note: The Click Removal module is not intended to remove long "scratch" noises. However, short scratches not exceeding 3 ms. in length can be removed.

Using Click Removal

To use Click Removal, take the following steps:

1. Select "Process" –> "Audio Restoration" –> "Click Removal". This opens the Total Recorder Click Removal dialog shown below.



2. Select “Playback” or “Recording” to indicate when Click Removal will be used.
3. From the “Preset” drop-down list, choose from the available presets for this module, or adjust the controls as desired. Normally, it is sufficient to use the “Default” preset to restore audio recorded from LPs. Optionally, you can save the current settings as a named preset.
4. Adjust the other settings on this dialog, as required.

Detailed information about each slider in the Click Removal dialog follows.

Sensitivity determines how sensitive the detection of clicks is. The higher this setting, the smaller the clicks that are detected. However, a higher “Sensitivity” value can lead to distortions. It is not advised to try to completely remove all clicks by setting the “Sensitivity” to the maximum possible value. It is usually preferred to leave some amount of clicks in a recording to avoid possible distortions. Normally, it is sufficient to set this value in the range from 12 to 16.

Accuracy determines the “fineness” of algorithm performance. The higher this setting, the more effective the algorithm is at smoothing clicks. However a higher “Accuracy” value causes more overhead on your system. In most cases, it is sufficient to set this value in the range from 6 to 8.

Max. click size determines the maximum size (in milliseconds) of a click that the Click Removal algorithm can remove. The higher this setting, the longer the clicks that can be removed. However, a higher “Max click size” value causes more overhead on your system. In most cases, it is sufficient to set this value in the range from 1.5 to 3.0 ms.

Applying Click Removal to an Entire File

To apply click removal to an entire file and save the changes, take the following steps:

1. Make a backup copy of the file.
2. Open the file.
3. From the Total Recorder Click Removal dialog, select “Playback”.
4. Listen to the file.
5. Adjust the settings on this dialog, as required.
6. Use the “Apply to file” button.

Adding a Preset

To add a preset, take the following steps:

1. Set the slider controls as required.
2. Click the "Save as" button.
3. Enter a name for the preset. You can use up to 99 characters.

The new preset is added to the Preset drop-down list.

Disabling Click Removal Temporarily

If you wish to temporarily disable Click Removal, select the "Bypass" check box. This function is useful when you need to compare the original sound with the modified sound during playback.

Listening to Audio Being Removed

If you wish to listen to only the audio being removed by the Click Removal algorithm, select the "Residual output" check box. This lets you monitor playback to make sure that the algorithm is performing as intended and it is not removing any audio that you would like to keep.

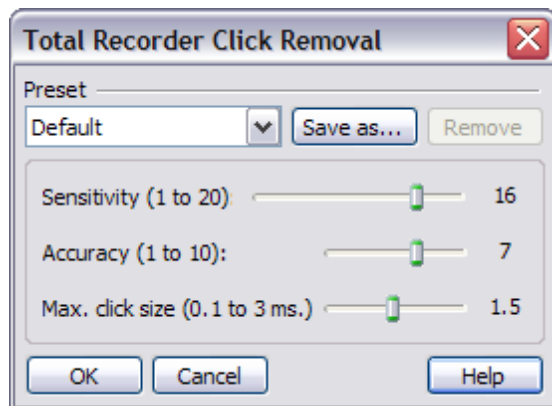
WARNING

- *When a file is being played back or recorded, it is not recommended you select/clear the "Playback" and "Recording" boxes, move the "Accuracy" and "Max. click size" sliders, or change presets. All these actions may result in sound distortion (e.g. clicks). Also, if the distortion occurs during recording, it cannot be removed later.*

Using Click Removal during Batch Processing (Professional and Developer Editions of Total Recorder only)

To use Click Removal during batch processing, take the following steps:

5. In Total Recorder's "Batch Processing Wizard – Choose Operations" dialog, select "Click Removal", and press the "Parameters..." button. This opens the Total Recorder Click Removal dialog for batch processing.



6. From the "Preset" drop-down list, choose a preset from the available list of presets for this module, or adjust the controls as desired. Normally, it is sufficient to use the "Default" preset to restore audio recorded from LPs. Optionally, you can save the current settings as a named preset.
7. Press "OK".

2.2 Noise Removal

Total Recorder Noise Removal is designed to minimize or fade stationary background noise with a constant level and frequency, such as tape or microphone hiss, powerline noise, drive motor hum, etc. The Noise Removal algorithm is not intended to remove non-stationary background noise, such as quiet background speech, sound of water, etc.

Noise Removal is effective only when a recording contains fragments of pure noise that require removal. Therefore, it is recommended to include at least several seconds of pure noise during recording (before the Noise Removal module is applied) so that it can be used as an example of noise to be removed. Start recording in advance and do not remove pauses between tracks. You can delete these unwanted silent parts later after applying the Noise Removal algorithm.

The most important step in the noise removal procedure is the capturing of a sample of pure noise (i.e. a noiseprint) that should be removed. This step greatly determines the quality of the Noise Removal algorithm.

Capturing a Noiseprint

There are two ways to capture a noiseprint:

- from the beginning of the file, for a certain length
- in a selected fragment of the file.

Use one of these methods based where the pure noise fragment occurs in your recording. For example, if a recording begins with a portion of pure noise, use the first method by setting the Capture duration value so it doesn't exceed the duration of the pure noise fragment. If the pure noise part is located in the middle of the recording, use the second method by first carefully selecting only this fragment of audio in Total Recorder.

It is not recommended you select a very long portion of pure noise. For reasonable performance of the Noise Removal algorithm, it is sufficient to select a fragment of a 0.5 - 2.0-second duration. More importantly is that the selected fragment contains only the noise that you wish to remove and nothing else. It should be noted, for example, that noise that is audible in the grooves that separate individual LP tracks is not normally the same as the noise that is present in the tracks, and therefore should not be used as an example of noise to be removed.

In "Recording" mode, a noiseprint can only be captured from the beginning of the file. It will be done automatically according to the "Capture duration" value each time a new file begins.

To capture a noiseprint, take the following steps:

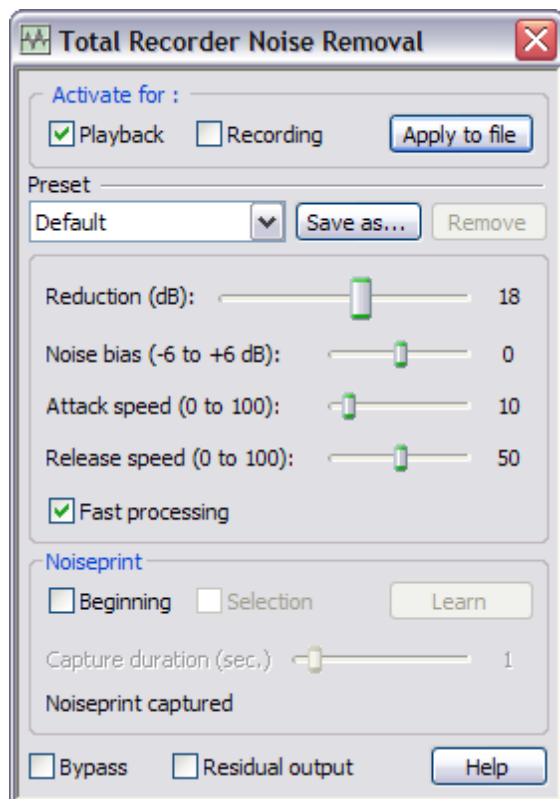
1. Listen to the recording first and determine where there is an example of pure noise you want to remove from the entire file. If this fragment is not at the beginning of the file, you need to select the fragment using the selection functionality in Total Recorder
2. On the Total Recorder Noise Removal dialog, select either the "Beginning" or "Selection" check box. This determines where the algorithm will get the noiseprint.
 - When the "Beginning" box is selected, you must correctly set the "Capture duration" slider.
 - To use the "Selection" box, carefully select a fragment of pure noise in advance.
3. Press the "Learn" button. This button is not accessible if no file is open or if "Recording" mode is selected. The algorithm captures the noiseprint, analyzes it, and saves it in memory.

If the noiseprint is captured correctly, the caption "Noiseprint captured" is displayed in the bottom part of the "Noiseprint" panel.

Using Noise Removal

To use Noise Removal, take the following steps:

1. Select “Process” –> “Audio Restoration” –> “Noise Removal”. This opens the Total Recorder Noise Removal dialog.



2. Select “Playback” or “Recording” to indicate when Noise Removal will be used.
3. Capture a noiseprint, if one has not been captured. For more information, refer to “Capturing a Noiseprint”. If you haven’t captured a noiseprint yet, the caption “No captured noiseprint!” is displayed in the bottom part of the “Noiseprint” panel.
4. From the “Preset” drop-down list, choose from the available presets for this module, or adjust the controls as desired. It is recommended to apply the “Default” preset as a starting point for audio restoration. Optionally, you can save the current settings as a named preset.
5. Adjust the other settings on this dialog, as required.

Detailed information about controls in the Noise Removal dialog follows.

Reduction determines the amount of noise being removed. The range is from 0.2 dB to 50 dB. The higher this setting, the more noise the algorithm will remove. However, a higher “Reduction” value will lead to distortion and an unwanted loss of high-frequency audio. In most cases, it is sufficient to set this value in the range from 12 to 24 dB. It should be stressed, however, that it is not advised to try to completely remove noise by setting the “Reduction” to the maximum possible value. It is usually preferred to leave some amount of noise in a recording to avoid possible distortions and preserve the natural and vivid sound of your recordings.

Other Noise Removal settings are considered advanced settings. You should only change the “Default” values of these settings if you are not satisfied with the performance of the algorithm or if it causes

distortions in the audio processed. Normally, such distortions have a “metallic” sound as if the audio is being played back inside a metal barrel.

Noise Bias determines an additional correction factor for a noiseprint. Setting this parameter to a smaller value may reduce possible distortions, but removes a lesser amount of noise. Setting it to a higher value causes more noise to be removed.

Attack speed and **Release speed** determine how quickly the algorithm reacts to changes in the sound level. The Attack speed determines how quickly the algorithm reacts to increases in the sound level. The Release speed determines how quickly the algorithm reacts to decreases in the sound level. Setting these parameters to smaller values leads to a more thorough removal of noise due to a lower number of “noise tails” that occur after sharp changes in sound levels. However, this leads to a greater risk of sound distortion.

Fast Processing causes the Noise Removal algorithm to process the data more quickly. In many cases, there will be no noticeable difference in the sound quality.

Applying Noise Removal to an Entire File

To apply noise removal to an entire file and save the changes, take the following steps:

1. Make a backup copy of the file.
2. Open the file.
3. From the Total Recorder Noise Removal dialog, select “Playback”.
4. Capture a noiseprint, if one has not been captured.
5. Listen to the file.
6. Adjust the settings on this dialog, as required.
7. Use the “Apply to file” button.

Adding a Preset

To add a preset, take the following steps:

1. Set the slider controls as required.
2. Click the “Save as” button.
3. Enter a name for the preset. You can use up to 99 characters.

The new preset is added to the Preset drop-down list.

Disabling Noise Removal Temporarily

If you wish to temporarily disable Noise Removal, select the “Bypass” check box. This function is useful when you need to compare the original sound with the modified sound during playback.

Listening to Audio Being Removed

If you wish to listen to only the audio being removed by the Noise Removal algorithm, select the “Residual output” check box.

WARNINGS

- *During the playback/recording processes, it is not recommended you select/clear the “Playback”, “Recording”, or Fast Processing check boxes, press the “Learn” button, or change presets. All these actions may result in sound distortion (e.g. clicks). Also, if the distortion occurs during*

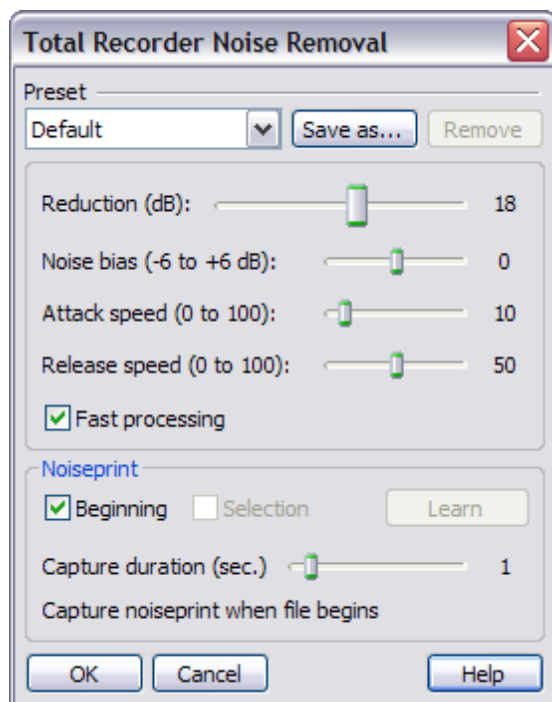
recording, it cannot be removed later.

- If you applied the Noise Removal algorithm to one file and then opened another file, the Noise Removal algorithm can be applied to this file as well if the caption “Noiseprint captured!” is displayed at the bottom of the dialog. However, in this case, the algorithm will remove noise from the file according to the noiseprint generated for the previous file. If you are certain that the new file contains the same noise as the previous one, you can proceed further. If not, you need to capture a new noiseprint for the new file. Applying the Noise Removal algorithm with an incorrect noiseprint may lead to serious audio distortions.

Using Noise Removal during Batch Processing (Professional and Developer Editions of Total Recorder only)

To use Noise Removal during batch processing:

1. In the “Batch Processing Wizard – Choose Operations” Total Recorder dialog, select “Noise Removal”, and press the “Parameters...” button. This opens the Total Recorder Noise Removal dialog for batch processing.



2. Set the “Capture duration” slider as desired. In batch processing, you can capture a noiseprint only from the beginning of the file. This will be done automatically according to the “Capture duration” value each time a new file begins. Note that the “Learn” button is not accessible during batch processing.
3. From the “Preset” drop-down list, choose from the available presets for this module, or adjust the controls as desired. It is recommended you apply the “Default” preset as a starting point for audio restoration. Optionally, you can save the current settings as a named preset.
4. Press “OK”.

2.3 Hiss Removal

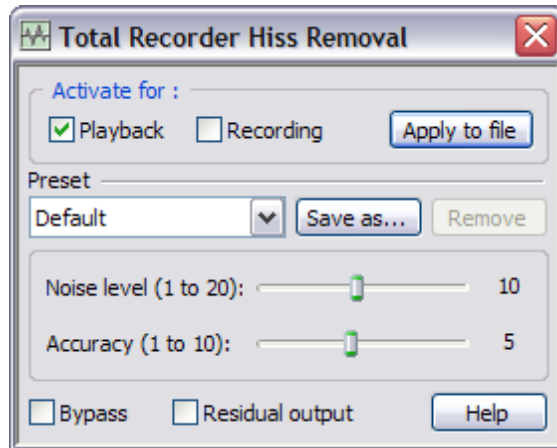
Total Recorder Hiss Removal is designed to remove and minimize background hiss that is typically found in tape, LP, and possibly microphone recordings. This algorithm does not require a sample of pure noise (noiseprint). You can use this module when your recording does not contain fragments of pure noise, or when the application of Noise Removal is not satisfactory.

The Hiss Removal algorithm is not intended to remove non-stationary background noise (e.g. quiet background speech, sound of water, etc.) or noise other than a typical hiss (e.g. powerline noise, drive motor hum of equipment, etc).

Using Hiss Removal

To use Hiss Removal, take the following steps:

1. Open the Total Recorder Hiss Removal dialog by selecting “Process” –> “Audio Restoration” –> “Hiss Removal”.



2. Select either “Playback” or “Recording” to indicate when Hiss Removal will be used.
3. From the “Preset” drop-down list, choose a preset from the available list of presets for this module, or adjust the controls as desired. It is recommended you apply the “Default” preset as a starting point for audio restoration. Optionally, you can save the current settings as a named preset.
4. Adjust the other settings on this dialog, as required.

Detailed information about each slider in the Hiss Removal dialog follows.

Noise level determines the amount of hiss being removed. The higher this setting, the more noise the algorithm will remove. However, a higher “Noise level” value will lead to distortion and an unwanted loss of high-frequency audio. In most cases, it is sufficient to set this value in the range from 8 to 16. It should be stressed, however, that it is not advised to try to completely remove the hiss by setting the “Noise level” to the maximum possible value. It is usually preferred to leave some amount of hiss in a recording to avoid possible distortion and to help preserve the natural and vivid sound of your recordings.

Accuracy determines the “fineness” of the algorithm's performance. With a higher “Accuracy” setting, the algorithm removes hiss more precisely and clearly. However, a higher “Accuracy” value will lead to a drastic increase in system overhead. Normally, it is sufficient to set this value in the range from 4 to 8.

Applying Hiss Removal to an Entire File

To apply hiss removal to an entire file and save the changes, take the following steps:

1. Make a backup copy of the file.
2. Open the file.
3. From the Total Recorder Hiss Removal dialog, select "Playback".
4. Listen to the file.
5. Adjust the settings on this dialog, as required.
6. Use the "Apply to file" button.

Adding a Preset

To add a preset, take the following steps:

1. Set the slider controls as required.
2. Click the "Save as" button.
3. Enter a name for the preset. You can use up to 99 characters.

The new preset is added to the Preset drop-down list.

Disabling Hiss Removal Temporarily

If you wish to temporarily disable Hiss Removal, select the "Bypass" check box. This function is useful when you need to compare the original sound with the modified sound during playback.

Listening to the Audio Being Removed

If you wish to listen to only the audio being removed by the Hiss Removal algorithm, select the "Residual output" check box.

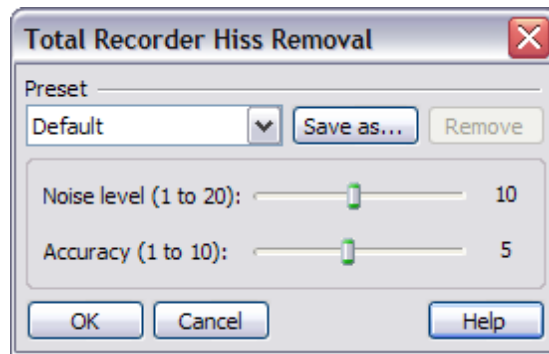
WARNING

- *During the playback/recording processes, it is not recommended you select/clear the "Playback" and "Recording" boxes, move the "Accuracy" slider, or change presets. All these actions may result in a sound distortion (e.g. clicks). Also, if these artifacts occur during recording, it will not be possible to get rid of them afterwards.*

Using Hiss Removal during Batch Processing (Professional and Developer Editions of Total Recorder only)

To use Hiss Removal during batch processing:

1. In the Total Recorder's "Batch Processing Wizard – Choose Operations" dialog, select "Hiss Removal", and press the "Parameters..." button. This opens the Total Recorder Hiss Removal dialog for batch processing.



2. From the "Preset" drop-down list, choose a preset from the available list of presets for this module, or adjust the controls as desired. It is recommended you apply the "Default" preset as a starting point for audio restoration. Optionally, you can save the current settings as a named preset.
3. Press "OK".

2.4 COM and Automation (Total Recorder Developer Editions only)

With Total Recorder Developer Edition, you can control add-ons using the COM and Automation technologies. The following properties and methods are available: AddonsCount, AddonName, AddonNumber, AddonParamsCount, AddonParamName, AddonParamNumber, AddonParamValue, AddonExecuteChanges. For detailed description of all properties and methods, refer to the Automation Online Help supplied with the Developer Edition of Total Recorder.

All parameters available with the Audio Restoration Add-on, Version 1.1, are listed in the table below:

| Number | Name |
|--------|--|
| 0 | Version number |
| 1 | Click Removal window is open/closed (0 or 1) |
| 2 | Noise Removal window is open/closed (0 or 1) |
| 3 | Hiss Removal window is open/closed (0 or 1) |
| 4 | Click Removal will be used for playback (0 or 1) |
| 5 | Click Removal will be used when recording (0 or 1) |
| 6 | Click Removal will be used when saving (0 or 1) |
| 7 | Click Removal Bypass mode is on/off (0 or 1) |
| 8 | Inversion of Click Removal process (0 or 1) |

| Number | Name |
|--------|--|
| 9 | Noise Removal will be used for playback (0 or 1) |
| 10 | Noise Removal will be used when recording (0 or 1) |
| 11 | Noise Removal will be used when saving (0 or 1) |
| 12 | Noise Removal Bypass mode is on/off (0 or 1) |
| 13 | Inversion of Noise Removal process (0 or 1) |
| 14 | Capture from beginning setting (Noise Removal) (0 or 1) |
| 15 | Capture from selection setting (Noise Removal) (0 or 1) |
| 16 | Hiss Removal will be used for playback (0 or 1) |
| 17 | Hiss Removal will be used when recording (0 or 1) |
| 18 | Hiss Removal will be used when saving (0 or 1) |
| 19 | Hiss Removal Bypass mode is on/off (0 or 1) |
| 20 | Inversion of Hiss Removal process (0 or 1) |
| 21 | Sensitivity setting (Click Removal) (from 1 to 20) |
| 22 | Accuracy setting (Click Removal) (from 1 to 10) |
| 23 | Max. click size setting (Click Removal) (from 0.1 to 3 ms.) |
| 24 | Reduction setting (Noise Removal) (from 0.2 to 50 dB) |
| 25 | Bias setting (Noise Removal) (from -6 to 6 dB) |
| 26 | Attack speed setting (Noise Removal) (from 0 to 100) |
| 27 | Release speed setting (Noise Removal) (from 0 to 100) |
| 28 | Fast processing setting (Noise Removal) (0 or 1) |
| 29 | Capture duration setting (Noise Removal) (from 0.1 to 10 sec.) |

| Number | Name |
|--------|--|
| 30 | Number of noiseprint captures (Noise Removal) (0 and more) |
| 31 | Noise level setting (Hiss Removal) (from 1 to 20) |
| 32 | Accuracy setting (Hiss Removal) (from 1 to 10) |

Notes

If some parameters are set incorrectly or an invalid combination chosen, then some parameters may not be changed.

The "Version number" parameter cannot be changed. This parameter has been converted from a DWORD type to a float type, where the high word corresponds to the high version number and the low word corresponds to the low number. Therefore, for Version 1.1, this parameter equals 65537.0.

For Noise Removal to function correctly during playback and when saving, you need to first capture a noiseprint by taking the following steps:

1. Select the capture method by setting either the 14 or 15 parameter to 1. Note that you can only set the 15 parameter to 1 if a file is open and it has a selected fragment of a non-zero length.
2. If you set parameter 14 (capture from beginning of file) to 1, then you need to specify a desired value for parameter 29 (capture duration).
3. Get the value of the 30 parameter and increment it by 1 or more.
4. Open file in Total Recorder, if one has not been opened.
5. Using the `AddonExecuteChanges` method, perform the entered changes.

In recording mode, capturing a noiseprint is always performed automatically each time a new file begins. The duration of the capture corresponds to the 29 parameter.

When changing the above parameters, note the following:

- Each module of this add-on can be in only one mode at a time (i.e. playback, recording, or saving). This means that only one parameter of (4, 5, 6), (9, 10, 11), or (16, 17, 18) can be set to 1.
- If any of the modules are in saving mode, only parameters 1-3 can be changed. You can change the other parameters only if you disable saving mode for the module.
- Saving mode cannot be disabled by setting parameter 6, 11, or 18 to 0. To disable saving mode, it is necessary to undo the changes (`Document.Undo` method), save the file (`Document.Save` or `Document.SaveAs` method), or close the file without saving (`Document.Close` method).
- Saving mode and Bypass mode cannot be on at the same time for any one of the modules. Saving mode for the Noise Removal module can only be turned on if a noiseprint has been captured.